RADIO & TELEVISION NEWS

MARCH
1949

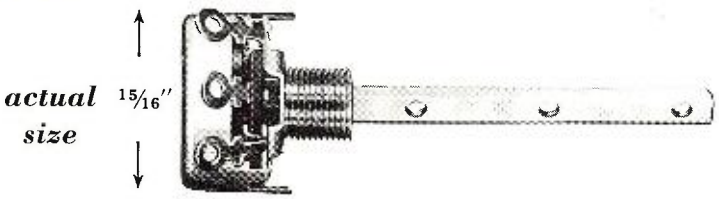
RADIO-ELECTRONIC ENGINEERING EDITION

DISH ANTENNA PICKS UP TELEVISION REMOTES

Page 38

You Asked For It...

HERE IT IS!



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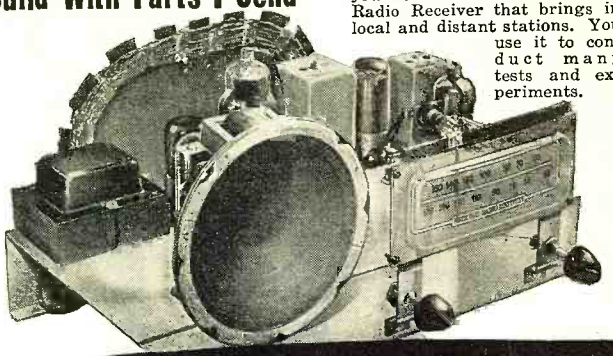
I Send You Parts To Build This Equipment

As part of my new Communications Course I send you parts to build your own Transmitter. Conduct actual procedure demanded of Broadcast Station Operators, practice many interesting experiments and tests, learn how to put a transmitter on the air.

You Practice Radio SERVICING

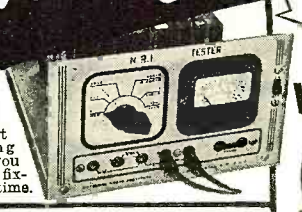
On This Modern Radio You Build With Parts I Send

As part of my Servicing Course, I send you the speaker, tubes, chassis, transformer, loop antenna, EVERYTHING you need to build this modern Radio Receiver that brings in local and distant stations. You use it to conduct many tests and experiments.



BE A RADIO TECHNICIAN

Learn Servicing or Communications



YOU BUILD this Tester as part of my Servicing Course. It soon helps you EARN EXTRA MONEY fixing neighbors' Radios in spare time.

Learn by Practicing in Spare Time with MANY KITS OF PARTS I Send

J. E. SMITH, President
National Radio Institute

Want a good-pay job in the fast-growing Radio and Television industries or to be boss of your own money-making Radio and Television shop? I've trained hundreds of men *with no previous experience* to be Radio technicians. I can do the same for you! Or now, for the first time, enroll in my *new* practical course in Radio—Television *Communications*—learn to be a Broadcasting and Communications technician. You learn Radio and Television principles from clear, illustrated lessons. You get practical Radio experience with MANY KITS OF PARTS I SEND in my train-at-home method. All equipment yours to keep.

MAKE EXTRA MONEY IN SPARE TIME

As part of my Radio Servicing Course, I send EXTRA MONEY booklets, starting the day you enroll. Use your know-how to make $5, $10 and more a week EXTRA MONEY fixing Radios in spare time while training. The next step is your own Radio shop or a good-pay Radio servicing job. Or, if you prefer, get into Government, Police, Aviation or Marine Radio, Broadcasting, Radio Manufacturing or Public Address Work.

BRIGHT FUTURE IN TELEVISION

Think of the present and future opportunities in the fast-growing Television field. New stations are going on the air every month. . . . Television manufacturers are producing over 100,000 sets a month. It's a fast-growing field and the man who knows Television will be in demand.

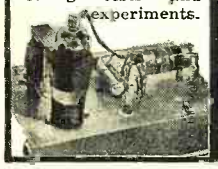
GET ACTUAL LESSON AND BOOK FREE

Send now for my special DOUBLE FREE OFFER. Get actual lesson on Radio Repairing short-cuts absolutely free. Also get 64-page book, "HOW TO BE A SUCCESS IN RADIO—TELEVISION—ELECTRONICS." See how quickly, easily you can start. J. E. SMITH, President, Dept. 9CR, National Radio Institute, *Pioneer Home Study Radio School,* Washington 9, D. C.

YOU BUILD this Power Pack as part of my new Communications Course. Use it to conduct fascinating experiments with frequency amplifiers and multipliers, buffer stages, etc.

YOU BUILD this Superheterodyne Receiver Circuit and conduct Frequency Modulation experiments and many other tests as part of my Servicing Course.

YOU BUILD this Signal Generator as part of my Servicing Course for more valuable experience. It provides amplitude-modulated signals for many interesting tests and experiments.

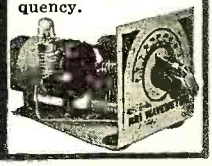


VETERANS

GET THIS TRAINING WITHOUT COST UNDER G. I. BILL

MAIL COUPON

YOU BUILD this Wavemeter as part of my new Communications Course. Use it with Oscillator you also build that furnishes basic power to transmitter and determines transmitter frequency.



I TRAINED THESE MEN AT HOME

Good Job In Radio Station

"Am Chief Engineer of Station WORD, in charge of four men. Owe all I know about Radio to NRI."—CLYDE J. BURDETTE, Spartanburg, South Carolina.

Makes Extra Cash In Spare Time

"Earned enough spare time cash to pay for my course by time I graduated. NRI training is tops!"—ALEXANDER KISH, Carteret, New Jersey.

Operates Own Radio Business

"Now have two Radio shops servicing about 200 sets a month. Have largest service establishment in Southeast Missouri." — ARLEY STUDYVIN, DeSoto, Mo.

MY COURSE INCLUDES TELEVISION

Good for Both—FREE

MR. J. E. SMITH, President, Dept. 9CR
National Radio Institute, Washington 9, D. C.

Mail me FREE Sample Lesson and 64-page book about how to win success in Radio and Television—Electronics. (No salesman will call. Please write plainly.)

Name..... Age.....

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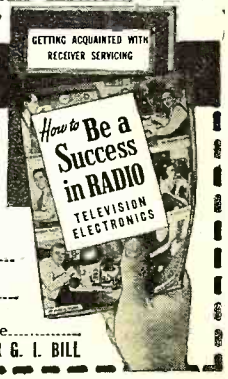

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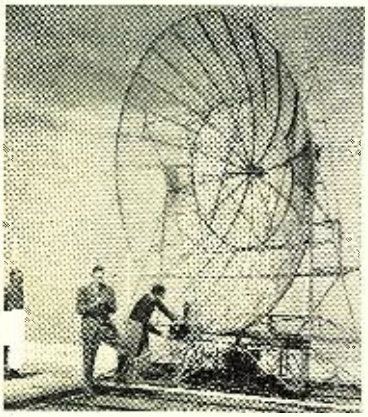

COVER PHOTO: Don Lee's 16 foot parabolic reflector (known as the "Mountain Shooter") located atop Mt. Lee, California, is believed to be TV's largest dish. (Cover photo by Mark Finley)

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CONTENTS — MARCH, 1949

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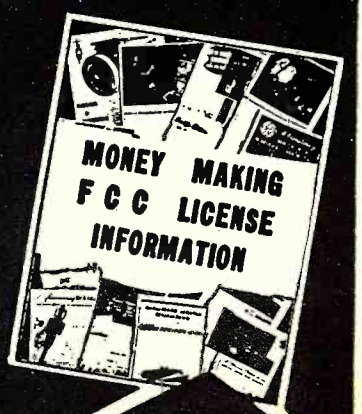
Want To Double Your Pay?

How To Pass FCC COMMERCIAL RADIO OPERATOR LICENSE EXAMINATIONS



GET THIS AMAZING NEW BOOKLET FREE!

1. Tells of thousands of brand-new, better-paying radio jobs now open to FCC License-Holders.
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6. Tells how we guarantee to train and coach you until you get your license.
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"I now hold ticket Number P-10-3787, and holding the license has helped me to obtain the type of job I've always dreamed of having. Yes, thanks to CIRE, I am now working for CAA as Radio Maintenance Technician, at a far better salary than I've ever had before. I am deeply grateful."
Student No. 3319N12

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Student No. 2355N12

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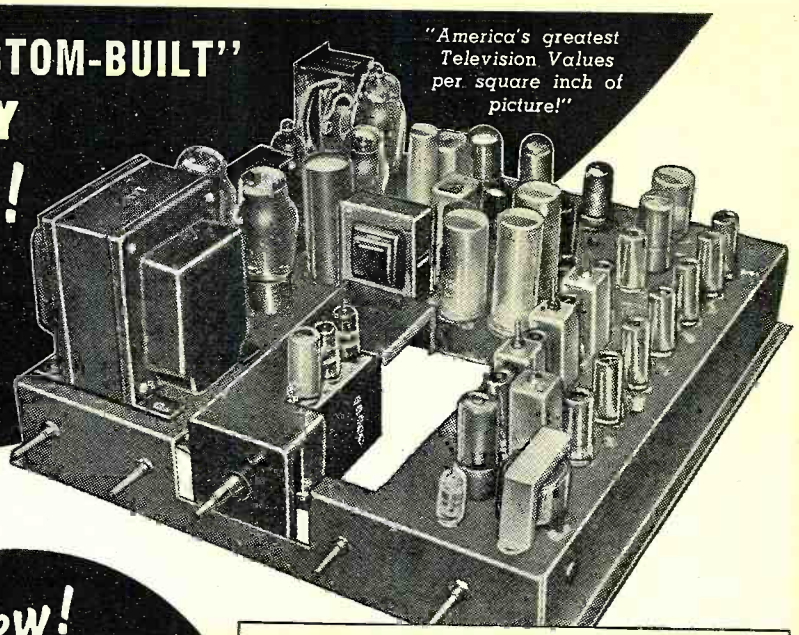

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213 SQUARE INCH PICTURE! Prewired Voltage Doubler 14KV power supply, Pre-wired "VIVIDeo" I.F. picture and sound strip (Pat. Pending). ALL channels TV plus ALL FM radio. Continuous tuning. DuMont Inputuner is Prewired. Delivered complete with all components and 30 RCA tubes plus 20-inch DuMont C.R. tube.

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29 tubes, including 13-tube "VIVIDeo" I.F. picture and sound strip (Pat. Pending). This portion completely wired, tested and aligned. Prewired, standard tuner ready to use. Handles ALL channels.

MODEL M-101S Less C.R. Tube **$169.50*** Dealer's net

CHAMPION MODEL

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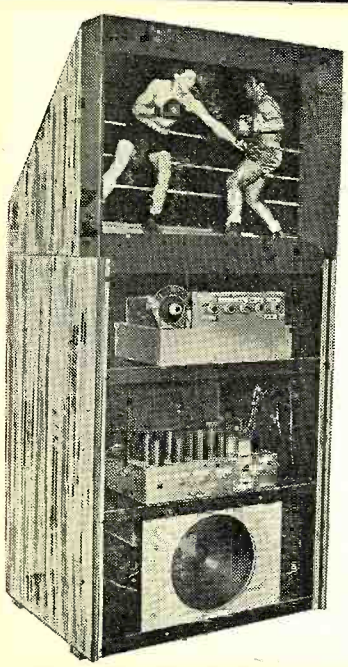
MODEL M-101C Less C.R. Tube **$209.50*** Dealer's net

Write for literature on our complete line of 10"-12"-15" standard and champion assemblies.

MODEL P-520 . . . 520 SQ. IN. PICTURE PROJECTION TELEVISION ASSEMBLY



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MODEL P-520 Dealer's net **$769.50***

MODEL P-520W Dealer's net **$895.00***

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For the RECORD

BY THE EDITOR

OUR $10,000.00 Contest is off to a good start, following our announcements in the January and February issues of this magazine. Actually, there are two separate and distinct contests: one designed specifically for *individual* hams to compete for worth-while merchandise awards, the other as an incentive for *ham clubs,* as a group, to lend their efforts to the training of many new licensees as club members during the remainder of the year. In order to make the awards more attractive, we are planning to make available a choice of transmitters, receivers, etc., to the principal prize winners. In this way it will be possible to acquire that "dream station."

Many ham clubs have facilities and space available for their own club stations. Usually these stations are made up from equipment no longer needed by individual members, and transmitters and receivers are usually donated by some member of the club. This contest will make it possible for these clubs to compete for up-to-the-minute equipment of prominent manufacturers.

It is important in the case of Club or Association participation for club secretaries to send in, as soon as possible, a complete list of their membership (explained within the rules of the contest on pages 52-53 of this issue). It is of equal importance for contestants to fill out their entry blanks and send them in as soon as they have begun the training of their prospects. This will prevent some other contestant from taking credit for the same trainee.

We have received several inquiries, following our announcements, from Youth organizations, Boy Scouts, and others, requesting licensed amateurs to take over a group of trainees.

There will be many similar requests. We will, wherever possible, refer these inquiries to as many ham clubs as may be within the area. It is then up to the clubs or even groups of individuals to decide who will receive credit for training the classes that may be set up for the teaching of amateur radio.

We will have reprints available on "The Beginning Amateur" upon request.

We think that the following best defines the purposes of our contest: "The object of this contest is to educate the youth of the nation in amateur radio; to encourage radio communications throughout the United States, particularly among civilians, both as a hobby and for the purpose of qualifying as finished radio operators those individuals who may be called upon to serve in times of emergency—and to create a public sentiment for the encouragement of radio communications practice, both as a hobby and as a necessary means of National Defense."

The amateur newcomers should, we feel, start the same as the present-day old-timers. As Chief of Naval Communications, Admiral Earl E. Stone so aptly put it in his Navy Day message to radio amateurs, "The enormous strides which have been made in the development of communication material—the development of various mechanical means of transmission and reception—have had a tendency to produce radio personnel who may be inclined to underestimate the importance of certain fundamentals. But the young amateur of today may fail to learn much that is fundamental if he passes up the opportunity to assemble his own equipment—not to mention the thrill that goes with building his own radio facilities. The newcomer in the amateur field will do well to follow in the footsteps of his older brother and learn by cutting and trying. The know-how which the amateur acquires by personally testing and experimenting is the priceless ingredient that makes the amateur a vitally important man in an emergency. Know-how, coupled with resourcefulness, has frequently meant success when success was urgently required."

The recent isolation of several towns due to heavy snows found amateur radio the only means of communication with the outside world, and it is very likely that more than one person owes his life to our hobby.

Many amateurs are being blamed by television set owners for interference which in most cases is due either to faulty transmissions or to automotive ignition noises and other interference. Even though most of the complaints are unfounded, the amateur is often damned without justification. It becomes increasingly important, therefore, to gather the respect of the public and to publicize the real story of amateur radio and what it means to our country.

We hope that our contest will in part fulfill that objective . . . O.R.

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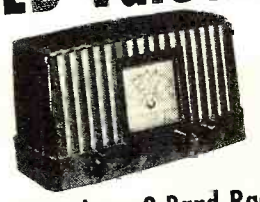

Echophone 3-Band Radio

A great buy! Covers 3 full bands: 535-1625 kc; 2200-7100 kc; 6900-22,000 kc. With electrical band-spread; Alnico PM speaker; built-in loop antenna. For 105-125 v. AC or DC. Beautiful walnut plastic cabinet, 8½ x 14 x 6½.

97-518. ONLY.... **$24.95**

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Knight LP Record Player

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ASK FOR THESE EYE-OPENING, EAR-CONVINCING PROOFS:

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- A standard replacement 4" speaker taking the output of a 25-watt amplifier.
- Comparison of the frequency response of various sized speakers.
- Comparison of the sensitivity according to magnet weight.
- Hear large speaker performance in small speakers.
- See a man standing on a speaker without damaging the all-weld frame.
- Also insist upon hearing the Variable Reluctance Cartridge playing a cracked record without reproducing the click, or a worn record without excessive needle scratch.
- Ask for the high fidelity performance demonstration of the Variable Reluctance Cartridge.

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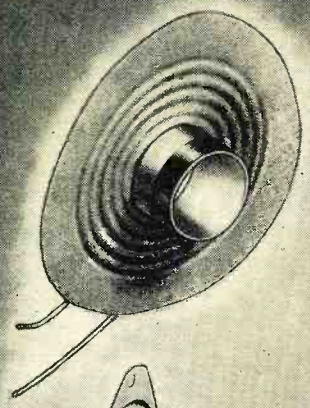
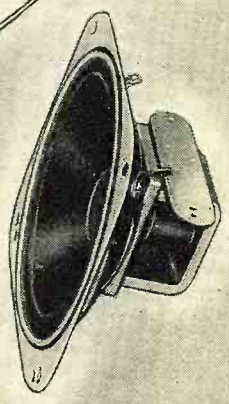
Every G-E speaker is equipped with the Aluminum Foil Base Voice Coil.

Every G-E speaker can handle plenty of power.

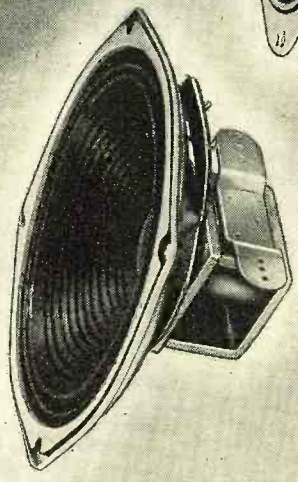
Every G-E speaker is designed to have the proper frequency response required for the job.



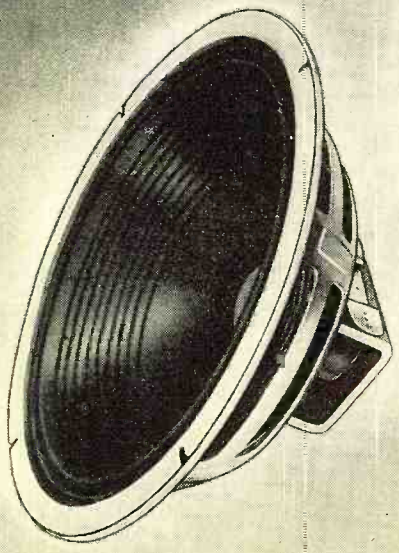
The inside story of G-E speaker superiority—the Aluminum Foil Base Voice Coil.



4" and 5½". For small set replacements, drive-in theaters, car radios, etc.



6" and 8". For larger set replacements, public address systems, car radios.



10" and 12". For public address systems, console radio replacement.

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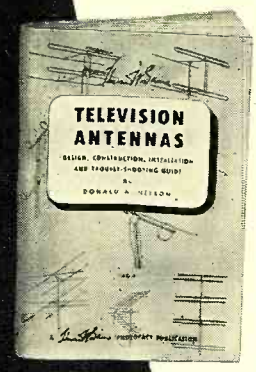

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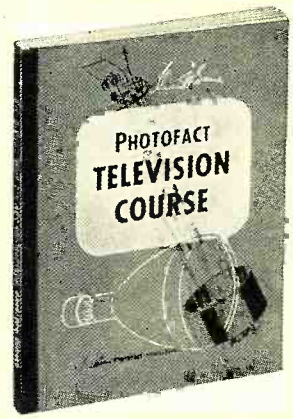
Now, you can own the *first* practical, down-to-earth guide to everything you need to know about Television antennas. Written by Donald A. Nelson; based on actual experience in the field, involving hundreds of installations made under all sorts of conditions. Shows you what type of antenna to select, how to install it, how to solve troubles. Gives you short-cuts that save time and help increase your installation profits. Chapters cover: receiving antenna principles; antenna construction; analysis of all types of commercial antennas on the market; complete antenna installation data (both outdoor and indoor, including apartment and multiple installations); installation problems and trouble-shooting ("ghosts," interference, etc.). Over 192 pages of easy-to-understand data; 124 clear illustrations. Handy pocket size. This is the book you need if you're *in* Television. Order from your Jobber today. *ONLY* **$1.25**



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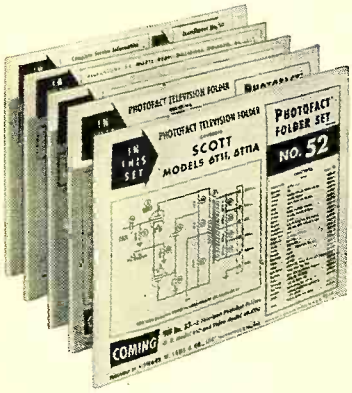

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HANDY, NEW ALL-PLASTIC CABINET WITH A SELECTED ASSORTMENT OF 125 "LITTLE DEVIL" RESISTORS

Molded of solid plastic, this rugged compact cabinet—9"x 4¾"x 5¼"—has 40 compartments factory packed with the "Little Devils" (from 10 ohms to 10 megohms) most frequently used. You find the *right* resistor... *fast.* Check inventory at a glance. And pay nothing extra for it—only regular price of resistors.

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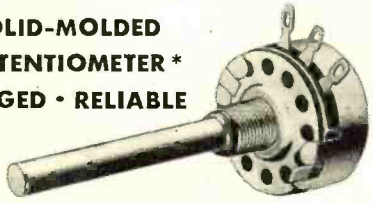

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Both color coded and individually marked for quick, sure identification, these sealed and insulated resistors are available in Standard RMA values. ½, 1, and 2 watts. Tol. ±10% and ±5%.

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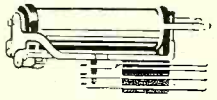
The following list represents only a tiny portion of our relay stock. Write or wire us for information on types not shown.

STANDARD DC TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-101	24V	1500.	DPST (NO)	Auto. Elec.	$1.35
R-102	24V	400.	SPDT	Auto. Elec.	1.10
R-103	24V	DUAL-1000	3PST (NO)	Auto. Elec.	1.35
R-105	24V	600.	3PST (NO)	Clare	1.20
R-106	24V	1300.	3PST (NC)	Clare	1.25
R-152	12V	50.	DPDT-SPST (NO)	Guardian	1.10
R-153	12V	200.	SPDT-SPST (NO)	Stromberg	1.25
R-154	12V	200.	SPST (NO)	Clare	1.20
R-155	12V	100.	SPST (4NO4NC)	Auto Elec.	1.15
R-158	6V	50	4PST (NO)	Stromberg	1.10
R-159	6V	50	DPST (NO)	Stromberg	1.10
R-160	6V	12	3PDT-3PST (NO)	Auto. Elec.	1.05
R-161	6V	10	3PST (2NC-1NO)	Auto. Elec.	.90
R-121	150V	5000.	2PST (NO) SPDT	Clare	1.65
R-123	150V	6300	SPST (NO)	Clare	1.75
R-602	150V	6500	3PST (NO)	Clare	1.75
R-515	24V	750	SPST (NO)	Clare	1.25
R-517	12V	250	DPST (NO)	Clare	1.20
R-519	250V	14000.	SPDT	Auto. Elec.	1.95
R-520	250V	14000	DPDT	R.B.M.	2.10
R-521	32V	1000.	DPDT	Kellogg	1.20
R-166	24V	DUAL-200.	DPDT-SPST (NO)	Stromberg	1.59
R-168	24V	DUAL-200.	4PST (NO)	Auto. Elec	1.20
H-240	250 350V	40000	DPST (NO)	Auto. Elec.	2.95
H-241	48V	650	SPDT-SPST (NO)	Clare	1.25

TYPE 18 DC TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-109	24-48V	4000.	SPDT	Auto. Elec.	$1.50
R-110	24-32V	3500	SPDT	Auto. Elec.	1.50
R-112	90-120V	6500	SPST (NC)	Auto. Elec.	1.75
R-114	24V	500	4PST (NO)	Auto. Elec.	1.30
R-603	24V	400	DPST (NO)	Auto. Elec.	1.25
H-238	24V	150	DPDT-SPST (NC)	R.B.M.	1.25
H-239	24V	180	DPST (NO)	Auto. Elec.	1.25



SEALED DC TELEPHONE RELAYS

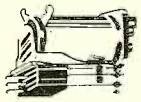
Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-125	24V	300.	DPDT	Clare	$2.75
R-126	90-120V	2000	DPDT	Clare	3.00
R-504	24-70V	2800	SPDT	GE-C103C25	3.00

V TYPE DC TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-164	24-32V	1000.	SPST (NO)	W. E.	$1.20
R-512	24-48V	3500	DPDT	W. E.	1.30
R-513	12-24V	300	DPDT-DPST (NC)	W. E.	1.20
R-514	4-6V	60	SPDT	W. E.	1.05
R-526	6V	35	DPDT-SPST (1NC-1NO)	W. E.	1.05

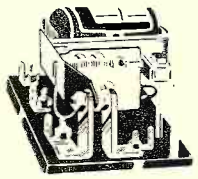
AC-STANDARD TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-212	90-135V	—	NONE	Clare	$0.95
R-213	5-8V	—	DPST (NO)	Clare	1.50
R-605	24V	—	3PST (NO)	Auto. Elec.	.95
R-606	24V	—	DPST (1NO-1NC)	Auto. Elec.	.95
R-607	24V	—	SPST (NO)	Auto. Elec.	.95



DIRECT CURRENT MIDGET RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-132	24V	300	DPDT	Clare	$1.20
R-133	24V	300	NONE	Clare	.60
R-134	24V	250	4PDT	Clare	1.20
R-135	24V	300	SPST (NC)	Clare	1.15
R-137	24V	300	SPDT	Clare	1.15
R-138	24V	300	4PST (NO)	Clare	1.15
R-139	24V	200	4PDT	Clare	1.15
R-140	24V	280	SPDT	R.B.M.	1.15
R-141	24V	280	3PST (NO)	R.B.M.	1.15
R-142	24V	400	DPDT	Allied Cont.	1.20
R-143	24V	280	SPST (NO)	R.B.M.	1.15
R-144	24V	250	SPST (NO)	Allied Cont.	1.15
R-145	24V	300	DPST (NO)	Allied Cont.	1.15
R-146	12V	126	DPST (1NO) (1NC)	Clare	1.10
R-147	9-14V	75	SPDT	Guardian	1.05
R-148	12V	100	DPDT-SPST (NC)	Price Bros.	1.10
R-149	6-8V	45	SPST (NC)	Clare	1.00
R-150	6V	30	SPST (NO)	E-Z Elec.	.95
R-522	2-6V	2.	SPST (NO)	R.B.M.	.65
R-523	90-125V	6500	DPDT	Clare	1.90
R-222	12V	100	DPST (NO)	P & B	.95
H-242	24-32V	300	DPDT	R.B.M.	1.20
H-243	24-32V	300	4PDT	R.B.M.	1.20



SENSITIVE DC RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-218	4-6V	1800.	SPDT	Kurman 220C	$1.95
R-220	75V	5000	SPDT	Allied Cont.	1.20
R-221	18-24V	5000	SPST (NO)	Allied Cont.	1.15
R-174	250V	5000	DPST (NO)	G.M.	1.85
R-175	350V	11000	DPDT-DPST (NO)	G.M.	2.95
R-176	24V	250	DPST (NO)	G.M.	1.50
R-177	24V	300	4PDT	G.M.	1.65
R-600	8-12V	5000	SPDT	S-Dunn-KS	2.10
R-507	24-48V	1000	SPDT-DPST (NC)	Guardian	1.15

TYPE BO DC RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-169	24V	250	SPST (NO)	Allied Cont.	$1.95
R-171	24V	230	DPDT	Allied Cont.	2.15
R-172	5-8V	30	DPDT-SPST (NO)	Allied Cont.	1.70
R-173	2-6V	5	SPST (NO)	Allied Cont.	1.25
R-529	24-48V	1000	DPDT	Allied Cont.	2.50

TYPE BJ DC RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-204	12V	65	DPST (NO)	Allied Cont.	$1.15
R-205	24V	260	DPDT	Allied Cont.	1.25
R-224	12V	75	SPST (NO)	Allied Cont.	1.15
H-237	27V	230	DPDT	Allied Cont.	1.25

HEAVY DUTY KEYING RELAYS

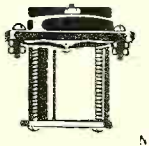
Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-248	28V DC	150.	SPST (NO) 10A.	Guard. 36471	$1.05
R-244	75V AC	265	SPST (NO) 20A.	Leach 1327	1.75
R-206	24V DC	150	5PDT-3 AMP.	P&B-KL	1.20
R-207	24V DC	210	4PDT-3 AMP.	P&B-KL	1.10
R-219	50V DC	1500	DPST (NO) 15A.	P&B-SP	1.25
R-217	115 AC	600	SPDT-10 AMP	St. Dunn 1XAX	2.25
R-525	24V DC	200	DPDT-10 AMP.	Guard. 34464	1.25
R-508	110 AC	600	SPDT-6 AMP.	Guard. 37189	1.95
R-506	24 V DC	300	DPST (NO) 6A.	—	.95
R-510	24 V DC	200	3PDT-10 AMP.	Guard. 516983	1.05
R-604	24 V DC	200	SPST (NO) 30A.	St. Dunn-B2A	1.25
H-608	115 AC	—	SPST (NO) 20A.	St. Dunn-1HXX	2.25
R-620	12V DC	35	3PST (NO) 10A.	Guard-BK2	1.05
R-223	28V DC	150	SPST (NO) 40A.	Price Bros.	1.35
H-230	12-24V DC	80.	DPST (NO) 10A.	—	1.20
H-231	24V	230.	DPST (NO) 5A.	R.B.M.	1.15

DC-TYPE 76 ROTARY RELAYS

Stock No	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-197	9-16V	70	DPDT	Price Bros.	$1.65
R-198	9-16V	125	6PST (3NO) (3NC) SPDT	Price Bros.	1.65
R-199	24-32V	250	SPDT-DPST (NC)	Price Bros.	1.65
R-200	24-32V	275	3PDT-SPST (NC)	Price Bros.	1.65
R-201	24-32V	250	DPST (NO) SPDT (NC) DPDT	Price Bros.	1.65
R-601	9-14V	60.	3PST (NO)	Price Bros.	1.65

DIRECT CURRENT KEYING RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-190	12V	65	DPDT 10 AMP	Advance Elec. Type 2000-A	$1.15
R-191	28V	125	DPDT 10 AMP	Guardian	1.20
R-192	12V	44	3PDT 10 AMP	Allied Cont. Type NB5	1.35
R-193	5-8V	11	DPDT 10 AMP SPST (NO)	Leach Type 1027	1.05
R-194	24V	265	DPST (NO) 10 AMP	Leach Type 1054SNW	1.25
R-195	6V	32	DPDT 3 AMP	G.E.Co.	1.15
R-196	12V	50	DPDT 10 AMP SPST (NC)	Guardian	1.15
R-242	24V	170	SPDT 2 AMP	Leach Type 1253DEW	1.25
H-236	5-8V	18.5	SPDT 10 AMP	Leach-BFM	1.05



CUTLER HAMMER HEAVY DUTY CONTACTORS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-178	24V DC	100	SPST (NO) 100A.	6141H34A	$3.65
R-179	6V DC	6.5	SPST (NO) 50A.	6041H83A	3.00
R-180	12V DC	25.	SPST (NO) 50A.	6041H308	3.25
R-181	24V DC	65	SPST (NO) 100A	6041H8B	3.85
H-232	24V	55.	SPST (NO) 50A.	Metal Cased	3.25
H-233	6V	15	SPST (NO) 50A.	Metal Cased	3.15
H-235	24V	70.	SPST (NO) 100A.	Type B6	3.85

DIRECT CURRENT AIRCRAFT CONTACTORS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-182	28V	80	SPST (NO) 25 A.	Guardian	$1.85
R-183	24V	60	SPST (NO) 50 A.	Allen Bradley Type B6A	2.75
R-184	28V	50	SPST (NO) 100A.	General Elec.	2.95
R-185	24V	100	SPST (NO) 50 A.	Leach 5055ECR	2.75
R-186	24V	132	SPST (NO) 50 A.	Leach 7220-3-243	3.50
R-187	24V	100	SPST (NO) 50 A.	Allen Bradley	2.95
R-188	24V	200	SPST (NO) 75 A.	Allied Cont.	2.95
H-234	14V	45	SPST (NO) 30 A.	—	1.65

ANTENNA CHANGEOVER RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-192	6-12V DC	44	2PDT 10 AMP	Allied-NB5	$1.35
R-231	12VDC	100.	DPDT 6 AMP	G. E.	1.95
R-256	24-32V OC	—	SPDT-DPST (NC) 1KW	Guardian	1.45
R-501	110 AC	4.	DPDT (1KW)	G. E.	2.45
R-503	12-32V DC	100	SPDT-5PST	G. E.-500 W.	1.95

COMBINATION PUSH BUTTON AND REMOTE RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
H-244	12-24 V DC	Dual-60	SPDT	CR2791-R106C8	$1.65

ADJUSTABLE TIME DELAY RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-246	115 AC		SPST (NO) or (NC) 10 AMPS	R. W. Cramer 1-120 Sec.	$8.95

DC MECHANICAL ACTION RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-245	12V	25.	4" Lever	G.M.	$0.95
R-527	6-12V	200.	2" Lever	—	.95

TYPE C.M.S. RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-511	24V DC	200	MICRO-SW. SPST (NO)	Clare	$2.45

DC CURRENT REGULATOR

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-509	6-12V DC	40	SPST (NC)	G. E.	$0.85

LATCH AND RESET RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-500	12V DC	10.	DPDT-10 AMP	St. Dunn-CX-3190B	$2.85

DC-ROTARY STEP RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-621	6-12V	30.	3 POLE 23 POSITION	W. E.	$10.95

DC-RACHET RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-230	5-8V	2.	SPDT-DPST (ND)	Guardian	$2.15

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Any ten relays listed (one of each type) with the exception of Stock Nos. R-621 and R-246—only $10.00.

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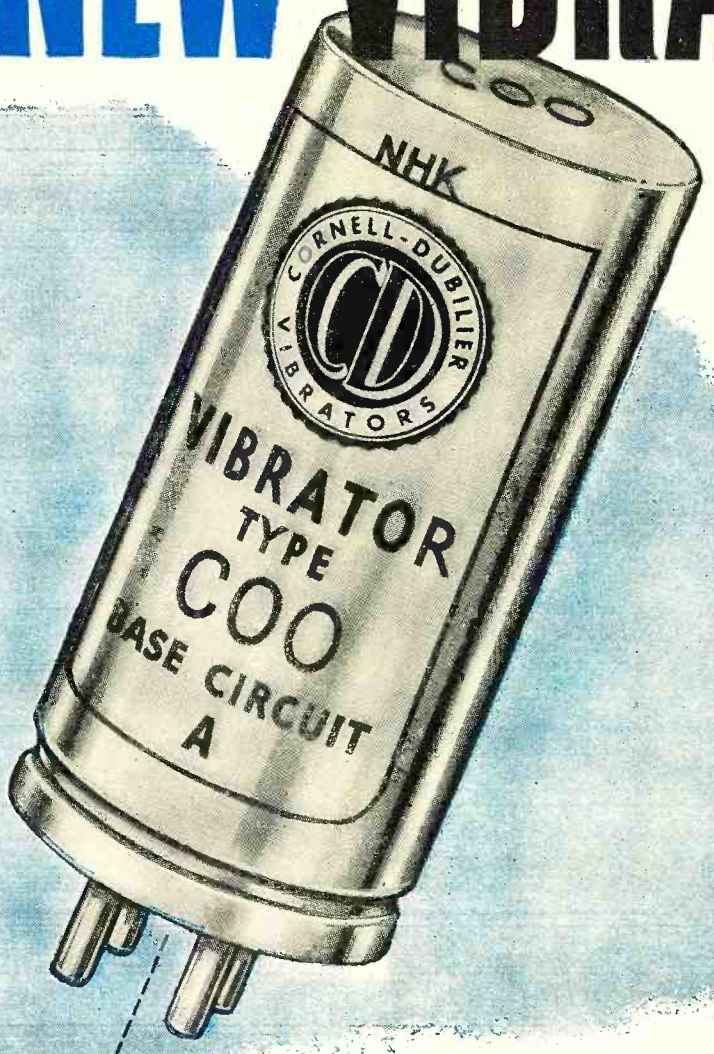

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- embodies latest developments plus C-D's famous built-in standard of quality
- designed by the nation's foremost vibrator engineers
- a complete line of replacements available

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By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

FCC's MOST IMPORTANT DOCUMENT of the year, their annual report to Congress, was an extremely impressive presentation, revealing unparalleled advancements in the art, with a future that was never brighter, even though many technical difficulties are still to be solved.

The report,[1] the fourteenth of its type, presented by FCC Chairman Wayne Coy, disclosed that there are now over 131,000 authorized radio stations of all types, not including mobile units, and over 635,000 authorizations on the FCC books, an increase of about 85,000 or more than three times the prewar amount. Broadcast authorizations jumped considerably, too, the total number in ten categories reaching close to 4000, of which over 3000 were for major broadcast outlets; more than 2000 for AM, over 1000 for FM and over 100 for TV. The four major networks expanded during '48, too, with *ABC* having 262 affiliates, *CBS* 172, *MBS* 506 and *NBC* 165.

The clear-channel problem, still around after several years of debate involving nearly 7000 pages of testimony and over 400 exhibits, is expected to be solved in '49 according to the FCC report, for presentation to the North American Regional Broadcasting Agreement Conference, which is scheduled to be held in September of '49. The FCC had hoped to reach a decision on this confusing puzzle in the early part of '48, but was thwarted by Congress who, through their Interstate and Foreign Commerce Committee, decided to review the situation. And to add further bewilderment to the scene, Senator Johnson introduced his bill which proposed to keep the power of standard broadcast stations to a 50 kw. maximum and provide for duplication of clear channels. The bill, a 1586-page affair, was not acted on by the Eighteth Congress and probably will not be by the present session, but the bill's presentation effects are still alive and Capitol Hill may be the scene of many debates on the subject before it is finally pigeon-holed.

TV was quite a featured topic in the report, too, the FCC reporting that applications for new TV stations for the year almost equaled the number for new AM facilities. At the close of '48, nine TV stations had been licensed, 102 construction permits were outstanding and 294 applications were pending. In addition, 21 stations were operating on an interim basis, providing a total of 30 stations bringing TV service to 17 cities and metropolitan districts.[2] Experimental TV and relaying facilities also increased substantially in '48, with 87 operating experimentally and 99 setting up remote pickup, studio-to-transmitter links, and intercity relays.

The gravest problem of TV, the lack of channels, precipitated a series of stormy sessions in Washington in '48, which resulted in the *freeze* statement of FCC Headman Coy. It was hoped that it would be possible to include some indication of the status of the freeze in the Congressional report, but the special engineering committees studying the reams of testimony and listening to additional comments by propagation experts, have not as yet been able to release a decision. There is a feeling though that the all-important freeze-allocation report will appear very soon.

The staggering amount of money spent for coax links was also disclosed in the FCC report; $170,000,000 for 7700 miles of cable, with many millions more to be spent in '49 for the wire links.

Safety and special radio services zoomed in '48, with nearly 11,000 new station authorizations. The largest increase appeared in the aeronautical field with 5000 stations being added, making a total of nearly 21,000. The marine services gained over 3000 stations, for a total of 15,000. More than 600 ship radar installations were made during last year, the report also pointed out. Police radio stations increased to over 4100, fire stations to nearly 100, forestry points to nearly 500 and special emergency to around 100. Railroads took to radio too, installing over 200 stations. The intercity bus and truck services added 24 stations to their system and the taxicabs joined the parade in a healthy way by operating nearly 3000 stations throughout the nation. Industry showed a keen respect for radio, too, in '48, adding some 3000 stations, the FCC report disclosed. Utilities in-

[1] For the year ending June, 1948 plus last minute highlight activities completed during the last six months of '48.

[2] Were we to include those stations now operating and listed in prior FCC reports, we would actually have 51 television stations operating in 31 service areas, as of January 1, 1949.

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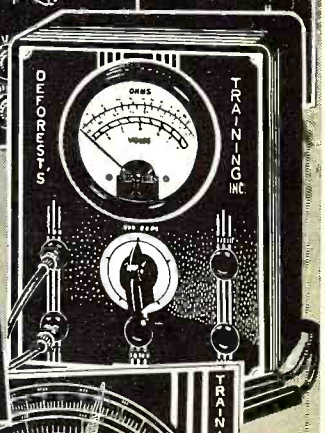

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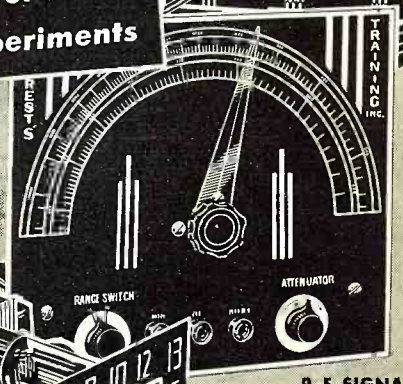

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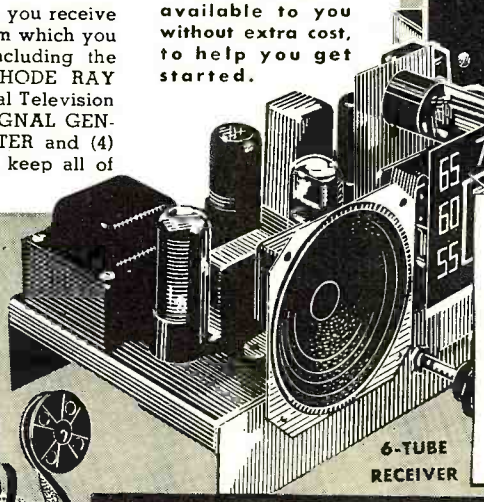

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stalled 1700 stations, petroleum pipe lines 400 units, lumber interests 32 and 750 others employed in the probing for oil, direction of movies, relaying press messages, began using radio, too.

A flood of applications for licenses in the safety and special service branches came to the FCC daily, according to the report, with many of the requests of unique nature . . . "from the cradle to the grave." For instance, one Texas applicant asked for a station license for his baby diaper pick-up and delivery service, while another, a cemetery operator in Chicago, wanted a mobile system to direct funeral corteges.

All operator license grant records were smashed last year, said the FCC review, with over 64,000 authorizations issued, bringing the total of operators in the country to over 500,000, of which 347,000 were commercial. Ham station operators jumped too, with nearly 78,000 now on the air. Civilian flyers also became quite radio minded, 80,000 receiving permits to operate their plane radiotelephone systems.

The import of interference was stressed in the FCC document, with a variety of types described. The field engineering and monitor service division of FCC, conducting thirty-three field offices and operating twenty-one monitoring stations, tracked down 153 illicit radio operators, and handled over 22,000 interference complaints. Some rather odd types of interference appeared during the calls. There were, for instance, troubles with drawbridges, industrial dryers, and even miniature aquariums.

The dominant role which the FCC members play in international affairs was also reviewed in the report. There were fifteen conferences all over the world covered by the FCC staffs. These included a session at Geneva to draft a new international frequency list for submission to a conference in Geneva in March, a meeting in Copenhagen to consider the needs of the maritime services in the 255 to 525 kc. bands, a safety-of-life-at-sea hearing in London, a series of meetings in Mexico City to study high frequency broadcasting, and other special hearings in Paris, Rio de Janeiro, etc.

In '49 the FCC will do quite a bit of globe trotting, too, appearing in The Hague, Paris, Oslo, Canada, and Montreal, to probe frequency control standards and evolve improved procedures for better national, continental and world broadcasting, and commercial communications.

TV SET PRODUCTION FIGURES continue to climb, and it now appears as if '49 will see a minimum of 2,000,000 receivers in operation. Since January, 1948, production has increased over 400 per-cent. A year ago, 30,000 sets were being made in one month. During the last month of the year, nearly 125,000 units were produced. Many manufacturers now predict that

(*Continued on page* 144)

MARCH, 1949

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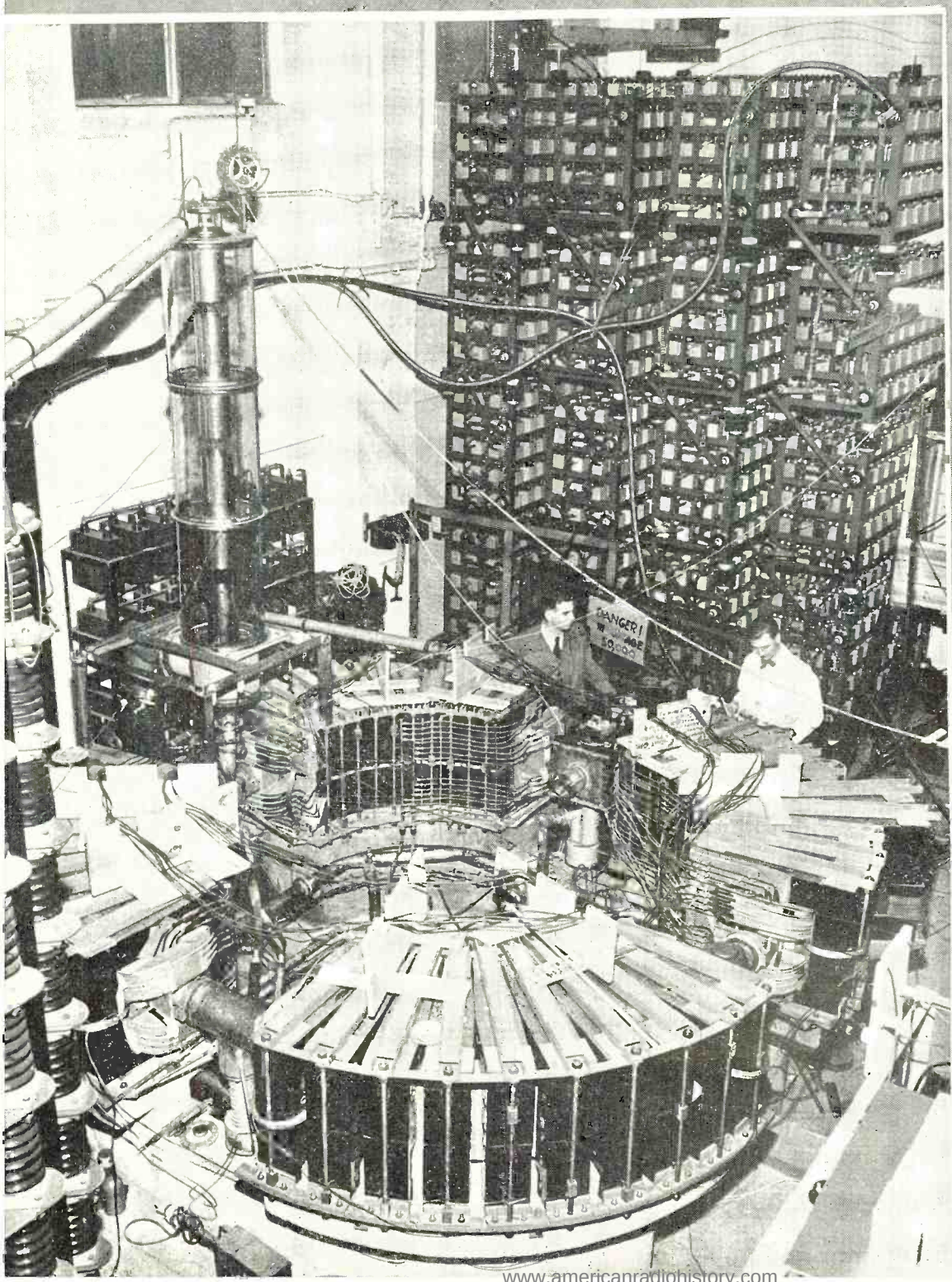

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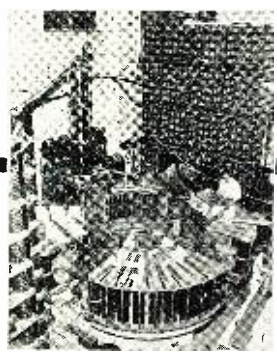

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VOLUME 12, NUMBER 3,

COVER PHOTO — By Acme

University of Michigan physicist Dr. H. R. Crane (left) and Dr. George Grover, a research associate, check the new 15-ton, 300 million electron-volt synchrotron. The "race track" machine will be used to split the nuclei of atoms for advanced atomic research.

ELECTRONIC COMPUTER APPLICATIONS

By DAVID FIDELMAN

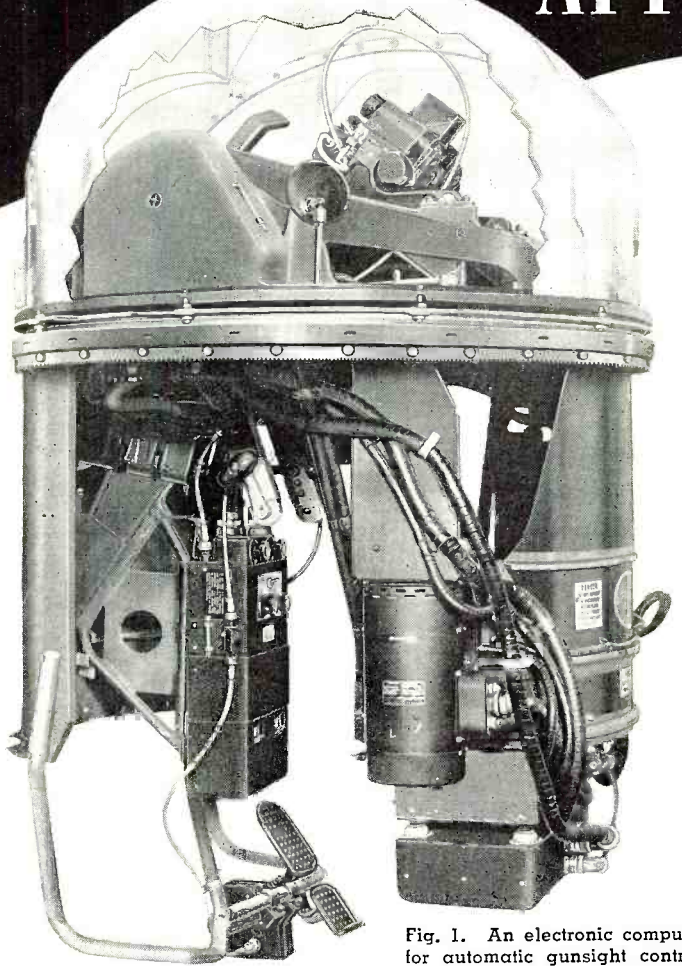


Fig. 1. An electronic computer for automatic gunsight control.

Part 1 of a two-part article describing how both digital and analogue computers are used in industrial processes.

THE development and introduction of electronic computing methods have had a very great effect upon the basic techniques of science and technology within the past few years. Through their use, it is possible to find exact solutions to problems and processes which previously could only be solved approximately, and in a large number of cases solutions are being found which would otherwise have been impossible.

The larger and more complex types of electronic digital computers are proving to be of major importance in solving the most difficult mathematical problems encountered in all phases of science, engineering, governmental, industrial and financial operations. Other types of computers are of value in the design of new devices and equipment and in setting up new plants, installations, processes and operations without the necessity of going through costly and time-consuming construction and trial-and-error experimentation. Smaller electronic analogue calculators are found to be of considerable value in scientific and engineering laboratories and offices in the solution of algebraic and differential equations which may not be of sufficient complexity to require the use of the large digital computers, but which are too difficult to solve manually. The calculators are being used in much the same manner as a slide-rule is used to simplify arithmetic computations.

In these applications the electronic equipment functions to deliver the mathematical answer to a specific mathematical equation which is delivered into the input of the unit. This is the usual purpose of a mathematical machine, and electronic computers have such applications in whatever field there are mathematical equations to be solved. However, electronic computing devices have other applications which are also of great importance, but which are not widely known or recognized as specific examples of the general theory of electronic computers. These applications occur in the field of automatic measurement and control, where electronic computers function as automatic control devices to regulate some process or function according to any preassigned relationship between a large number of dependent and independent variables. Previously, control operations of this type required human intelligence to correlate and establish the proper relationship between the different process variables. Now many such functions can be done automatically, resulting in faster operation and more accurate control by use of electronic computing devices.

Actually, electronic control systems have been in use in a number of such applications for some time. However, in the past, each application has been considered individually with no relation to other types of control systems. Thus each control system presented a completely new design problem. Consideration of electronic controls as applications of electronic computing methods results in a much more fundamental and, therefore, much more powerful viewpoint for both design and application engineers. This article will present the basic principles which govern the application of electronic computers to the field of automatic measurement and control and will describe a number of typical applications to illustrate the method of solution of specific problems which may arise.

Besides resulting in better control in existing applications, the wider use of electronic computing circuits will

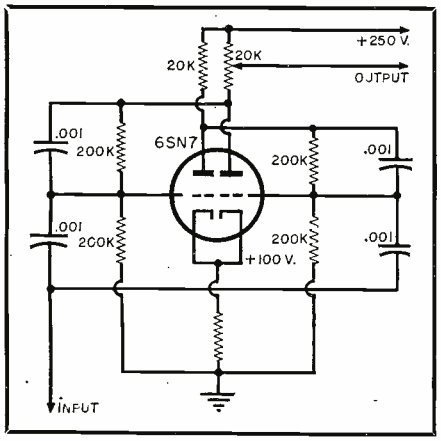


Fig. 2. Basic trigger circuit which may be used as the basis for digital computers and computing circuits.

make it possible to apply automatic control to applications which cannot now be controlled at all by present manual methods. Such applications include many industrial processes in which the relationships among the different process variables, and their influence upon the quality of the final product, are much too complex to be of any value without the use of electronic computers. The present practice in such processes is to determine the quality of the product by exhaustive and time-consuming analyses and tests before any changes can be made in the actual process conditions. Then when a change is made, the product must again be tested and analyzed completely to determine the effects of the change. This process must be repeated whenever there is any change in the process or in the quality of the product. However, if empirical relationships between all the measurable process conditions and product quality are first determined by test, they can then be set up in an electronic computer which can control the process automatically according to the required relationships. Then if any of the variables change from their optimum values during the course of the process, the effects of the change can be instantly determined and related to the change in the final product quality, and the required compensating adjustments can then be made either manually or automatically. Such controls can be used to regulate extremely complex processes automatically, resulting at the same time in greater uniformity of product quality and improved process operation. This type of automatic control by means of electronic computing devices is certain to have widespread applications in industrial process control in the future, and will have important effects upon manufacturing and production methods.

The basic setup for automatic control of processes by means of electronic computers is shown in the block diagram in Fig. 6. This basic setup is the fundamental method for control of any type of process or operation. The specific operating conditions of the process are determined by measuring any of the relevant variables, by any suitable means. The measured variables may include temperature, position, illumination, liquid level, number of items, or any other conditions which may be as-

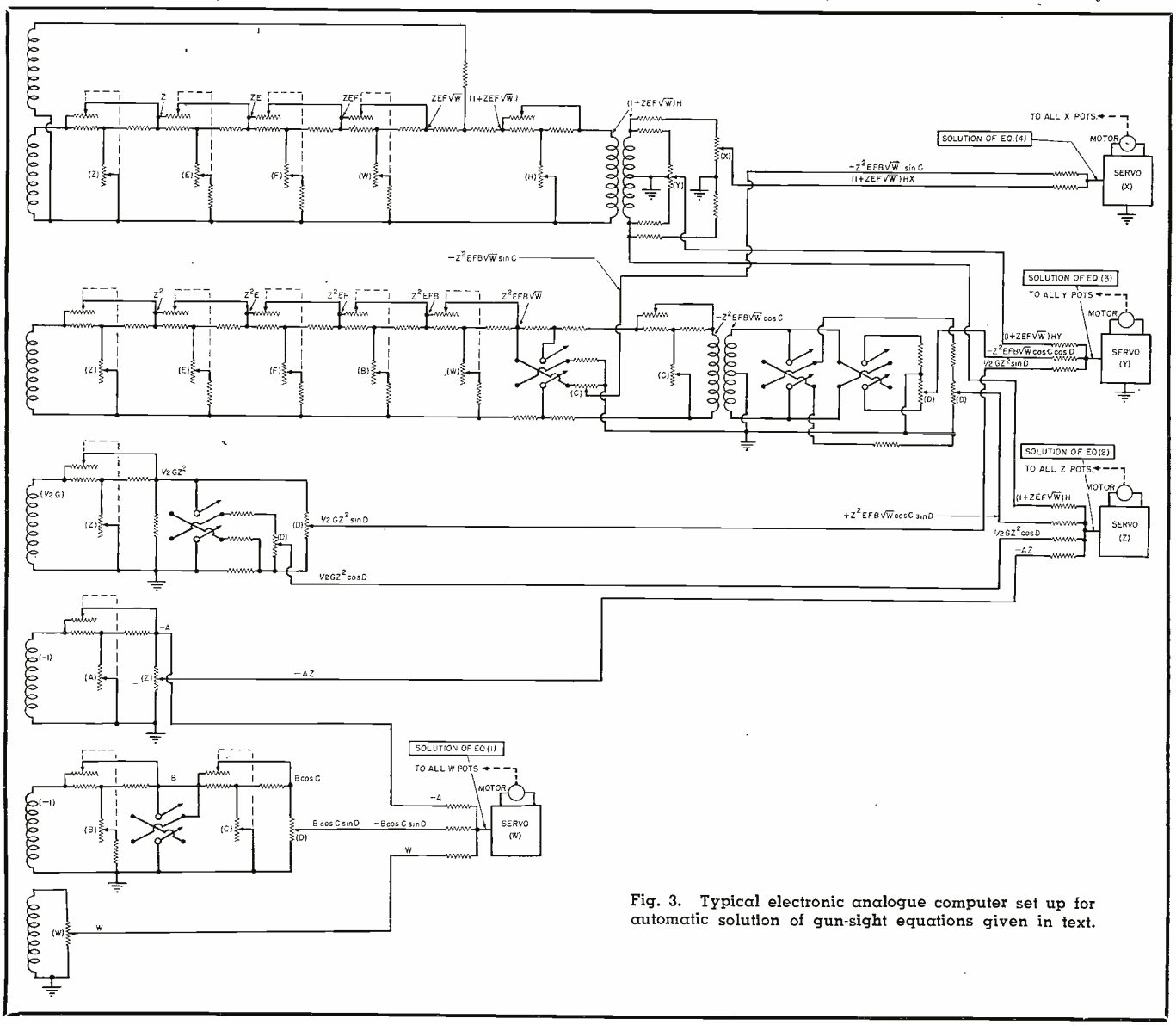


Fig. 3. Typical electronic analogue computer set up for automatic solution of gun-sight equations given in text.

sociated with the operation of the specific process. If the measuring device gives its reading in the proper electrical terms, then the output may be applied directly to the input of the electronic computing circuit. (Otherwise the measured value must be converted to some suitable electrical quantity.) Any electrical value may be used—generally voltage, frequency, and potentiometer shaft rotation are the variables which are most widely used in this type of application.

The computing circuit then determines whether the values of the input variables satisfy the required relationship for which it has been set up. If they do not, the necessary process conditions are adjusted in the required manner so that the equation is satisfied and equilibrium thereby attained. In many cases a feedback connection may also be established between the process controller and the computing circuit, in order to insure that the proper corrective action is being taken. Any change in the process due to any transient or non-uniform condition will be automatically compensated by the control system.

In order to perform the actual control function, the output (or outputs, depending upon the complexity of the process) of the computer are applied to a power amplifier which operates the actual control device. The control device, which controls the actual operation of the process, will in general be some form of electromechanical device —such as a relay, a motor, a solenoid-operated valve, or any other device which may be used to control the operation of the process equipment or the flow of materials.

Applications of Digital Computers

Both digital and analogue types of computers are used in automatic control applications. The fundamental digital counter is the simplest type of electronic computer and has had wide application in automatic control of industrial operations. In addition, the counter circuits may be provided with the proper sequencing and control circuits and combined to form more complete digital computer systems which are able to control complex sequences of operations. Such controls are of importance in any operations which make use of units, batches, or fixed quantities of any materials or items, and particularly where high speed and accuracy of operation are important. Various types of digital computers are now being used in the manufacture of zippers, control of tin plate processing, packaging of many different types of small items, and in many other industrial applications.

The basic circuit for electronic counting is the simple trigger circuit shown in Fig. 2. The operation of this circuit is well known. It may be used to develop either a decimal or a binary counting system, but generally for industrial and other control applications the decimal system is most useful.

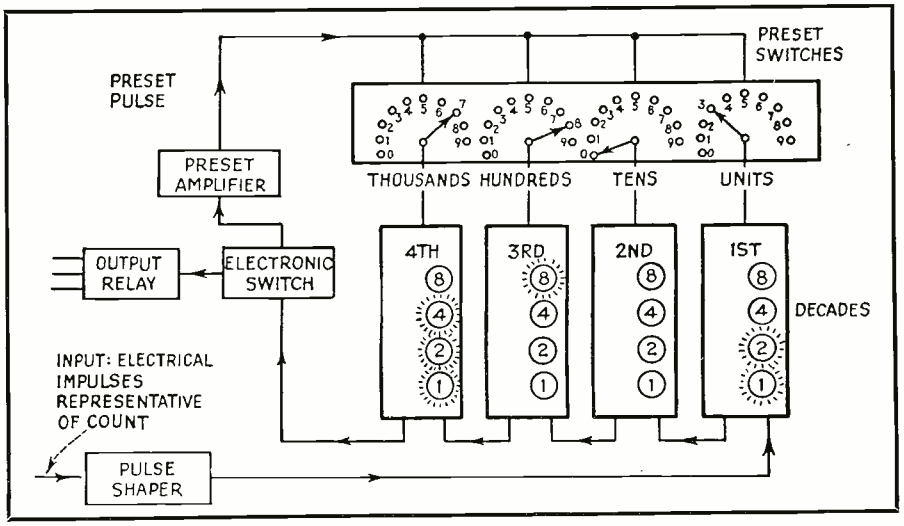
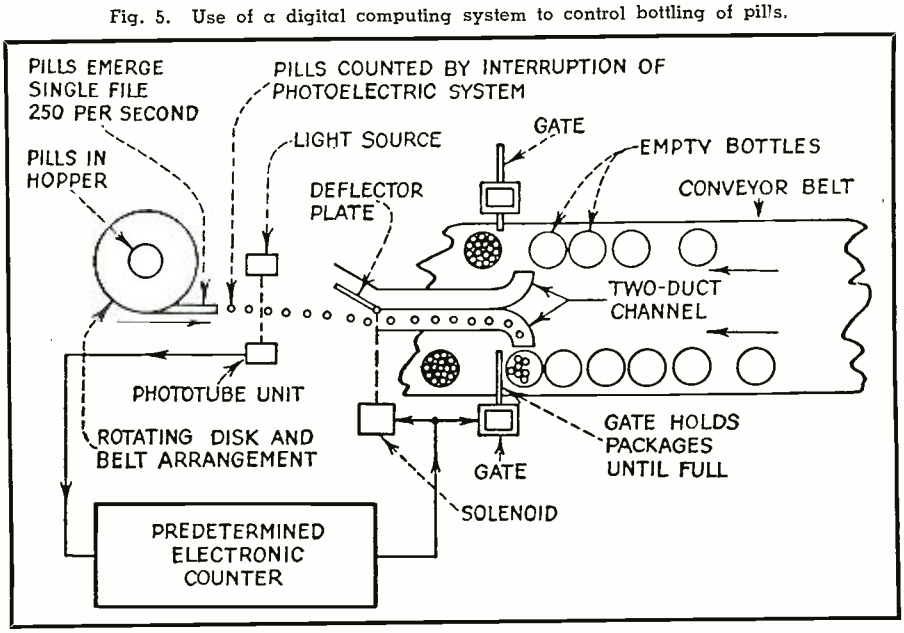


Fig. 4. Block diagram of a commercial preset digital counter capable of registering any number of input pulses from 0 to 10,000.

The type of electronic counter which is most generally used for controlling operations is the *preset* counter, which can be set to register a specific number of counts before initiating some action. The block diagram of a preset counter which is suitable for such applications is given in Fig. 4. The basis of the unit is a four-decade counter (i.e., a *digital computer*) which is capable of registering any number of input pulses from 0 to 10,000. The programming and sequencing controls consist of four switches (one for each counter decade) which may be set to cause an electronic switch to operate when a predetermined count is reached. The settings of the switches represent a preset initial count, so that the required number of pulses added to the initial count will equal a total of 10,000 and cause the electronic switch to operate the output relay. The counter controls may also be set so that the circuit may be reset to the zero count either automatically or manually, depending upon the particular application.

This type of counter can form the basis for circuits capable of more complex control operations. For example, by the addition of another set of preset switches, the counter can be made into a dual predetermined counter which can control two different operations that occur in sequence and recycle continuously. In multiple combinations, the counter circuits can control extremely complex sequences of operations. Digital electronic counters can be used to control any type of operation in which the process variables or products occur in fixed, regular amounts. Such applications include a large number of modern manufacturing, indus-

Fig. 5. Use of a digital computing system to control bottling of pills.



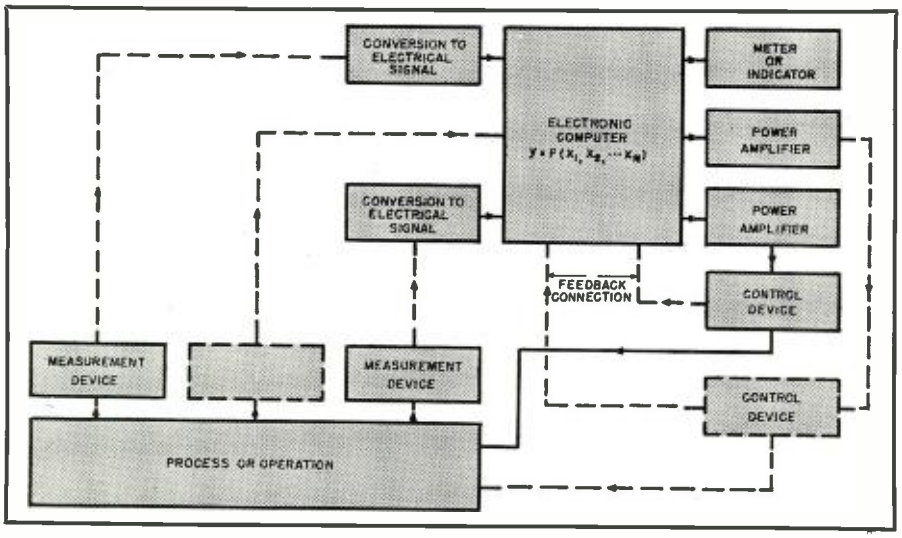


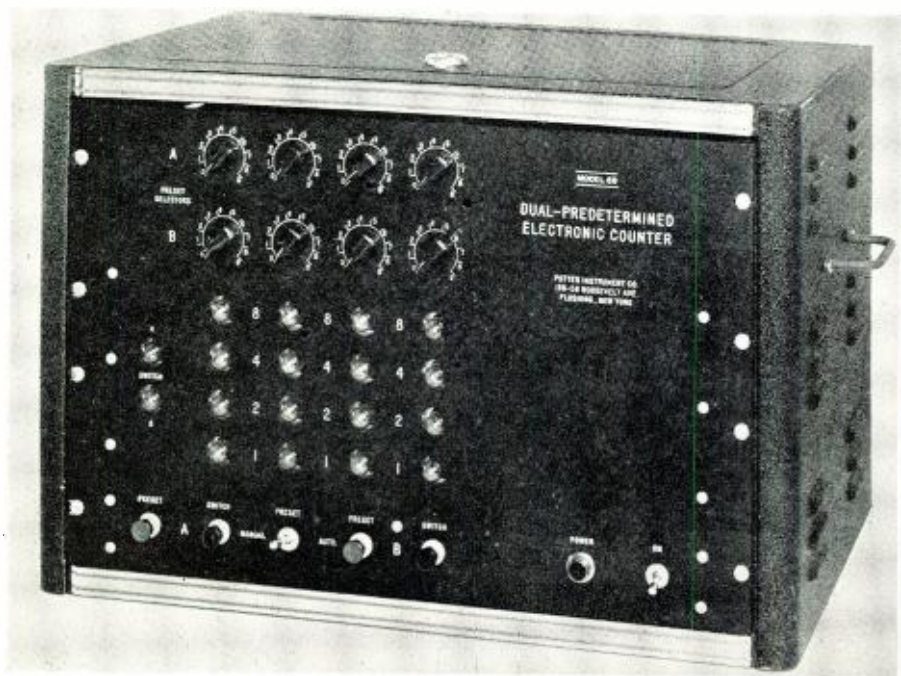
Fig. 6. Basic method for control of any process or operation by means of electronic computing devices.

trial and financial operations. The simplest applications of this type are counting, sorting and grouping for packaging any small or large items such as pills, buttons, screws, washers, caps, sheet steel, machined parts, and even liquids.

The manner in which such a counter would be used in a specific industrial application may be seen from Fig. 5, which illustrates the use of a predetermined counter to count a definite number of pills and accurately channel the quantities into two lines of bottles on a moving conveyor belt. The pills to be packaged are fed from a hopper to a rotating disc and belt arrangement which emits them in single file. Each pill, as it moves toward the bottle, interrupts a light beam, so that a pulse is applied to the counter for each pill that enters the bottle. When the required number of pills is in the bottle, the counter actuates a solenoid which moves a deflector plate and thereby channels the pills alternately through two duct channels; it also actuates two gates which control the motion of the bottles along the conveyor belt. When each bottle contains the required number of pills, the respective gate is opened and the bottle is permitted to continue along the conveyor. The use of the two-channel system in this case results in increased speed and simplicity of operation, since there is no need to interrupt the flow of pills while a full bottle is being removed for an empty one.

When used in conjunction with auxiliary equipment and proper sequencing and programming controls, the basic digital counter may also be used to provide a variety of other types of control functions besides the basic one of counting, but which are based upon the principle of counting. For example, by use of a crystal-controlled oscillator in conjunction with a counter to count the number of cycles, extremely accurate timing may be attained. This method may be used both to measure time intervals by counting the number of cycles during the elapsed time interval, and to generate precise time intervals by use of predetermined counters which will permit a preset number of cycles to register and then initiate some action.

Fig. 7. Dual (or two-sequence) preset electronic digital counter.



Digital counter devices also have wide applications where it is necessary to totalize the individual outputs of many sources occurring at random times. The electronic totalizing system using digital computers has already been applied to a pari-mutuel betting machine at a racetrack for recording the amount of money bet on each horse at the ticket machines. Since the equipment also converts the $2, $5, $10 and $50 bets into equivalent dollars and totalizes them, the equipment contains circuits for digital addition, multiplication and division and is, therefore, a complete digital computer system. Equipment of this type also finds application in many manufacturing processes where it is desirable to know the total output or the average rate for any one or more of several machines which are making the same product at varying rates. For example, this system can be used in newspaper and printing plants to provide a continuous count of the various press outputs. It can also be used to record total fluid output by totalizing the outputs of the individual flowmeters, and in power plants the total output from several generators may be obtained by totaling the readings of the individual wattmeters. Other applications of totalizing equipment are in photography and printing (where the total light in a picture controls the correct exposure time), and in many other industrial applications.

Applications of Analogue Computers

A still wider variety of industrial and other automatic control problems can be solved by the use of electronic analogue types of computer circuits. In such applications, a complex relationship between almost any number of dependent and independent variables can be established by means of the electronic analogue computer circuit. By the additional use of electrical servos and electromechanical devices to translate the electronically computed values into some mechanical form (such as shaft rotation, valve opening, etc.), the

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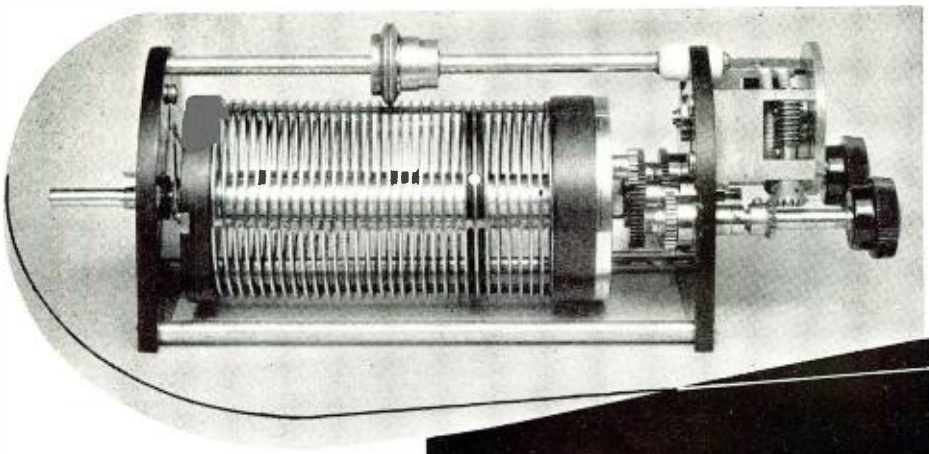


Fig. 1. Over-all view of the antenna coupler. Note the method of tapping to the outer coil, and the gears and knobs used in varying this tap.

COMPACT ANTENNA COUPLING DEVICE

By SIDNEY WALD

Advanced Development Engr., RCA Victor
Camden, New Jersey

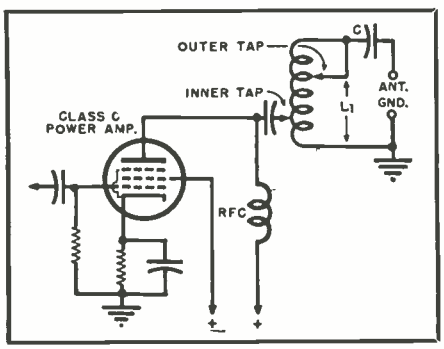
A device for quickly and easily adjusting the coupling between a transmitter and the antenna.

WHENEVER it becomes necessary to operate a multi-frequency transmitter into an antenna of fixed length, the problem of impedance matching arises. While suitable networks may be designed to operate at any given frequency, the situation becomes somewhat involved when the frequency varies over a wide range.

One method of antenna coupling which has appealed to many transmitter designers makes the antenna itself part of the power amplifier tank circuit. The proper value of plate load resistance is then secured by tapping into the appropriate impedance level. The simplest method of accomplishing this is shown schematically in Fig. 3. Here a continuous variable inductance L_1 is used to resonate the loop containing the antenna circuit while another tap on the same coil is joined to the plate of the power amplifier tube. Thus by simply setting two controls it is possible to cause a wide range of antenna impedances to appear at the plate circuit as a resistance of the proper value.

This circuit has been described by a number of writers[1] so no further discussion of its electrical aspects is necessary here. The greatest difficulty has been the design of the continuously variable inductance with two independent taps. The device described and illustrated in this article reduces the functions of loading and tuning a multi-frequency transmitter to more or less routine adjustments.

Fig. 3. Circuit of the coupler.



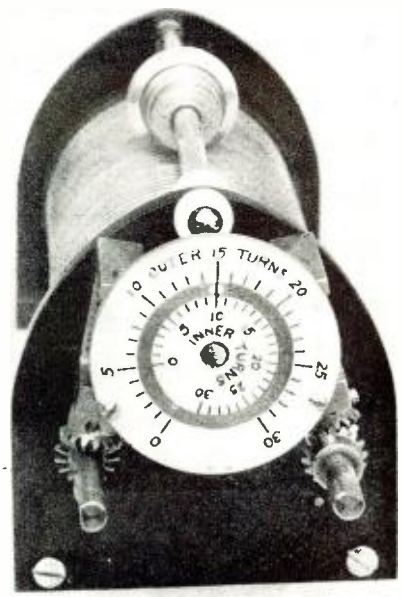
The coil assembly shown in Fig. 1 has an inductance of 25 microhenrys, and a Q of 250 at 3 megacycles. When the coil itself is rotated by turning the left knob (Fig. 2) the outer roller contact travels along the top support rod and varies the total inductance. This corresponds to L_1 in Fig. 3. Inside the coil is another contact assembly which may be adjusted by means of second knob. A dial counter assembly (Fig. 2) on the front end of the coil is used to indicate the positions of both inside and outside taps. The coil itself is made of edgewise wound copper ribbon separated by means of small bakelite spacers. These spacers are held in place by means of projections which fit into holes pre-drilled in the copper ribbon.

Fig. 1 shows the coil construction together with the central support rod. The rotating coil sub-assembly is self-supporting and contains the inner tap mechanism. The center shaft is solid and runs through the entire length of the coil. Two insulating end caps hold the ribbon assembly firmly in compression.

A bronze sleeve, running on the central support shaft rotates a thin insulating wheel on the periphery of which is machined a single thread of the same pitch as the ribbon coil. A spring loaded silver contact completes the electrical connection from the inner face of the coil to the central sleeve and shaft.

(*Continued on page* 30)

Fig. 2. Front view of the coupler, showing dial scales and adjusting gears.



An Unusual AUDIO AMPLIFIER

By JOHN D. GOODELL
and CURTIS W. FRITZE

The Minnesota Electronics Corp.

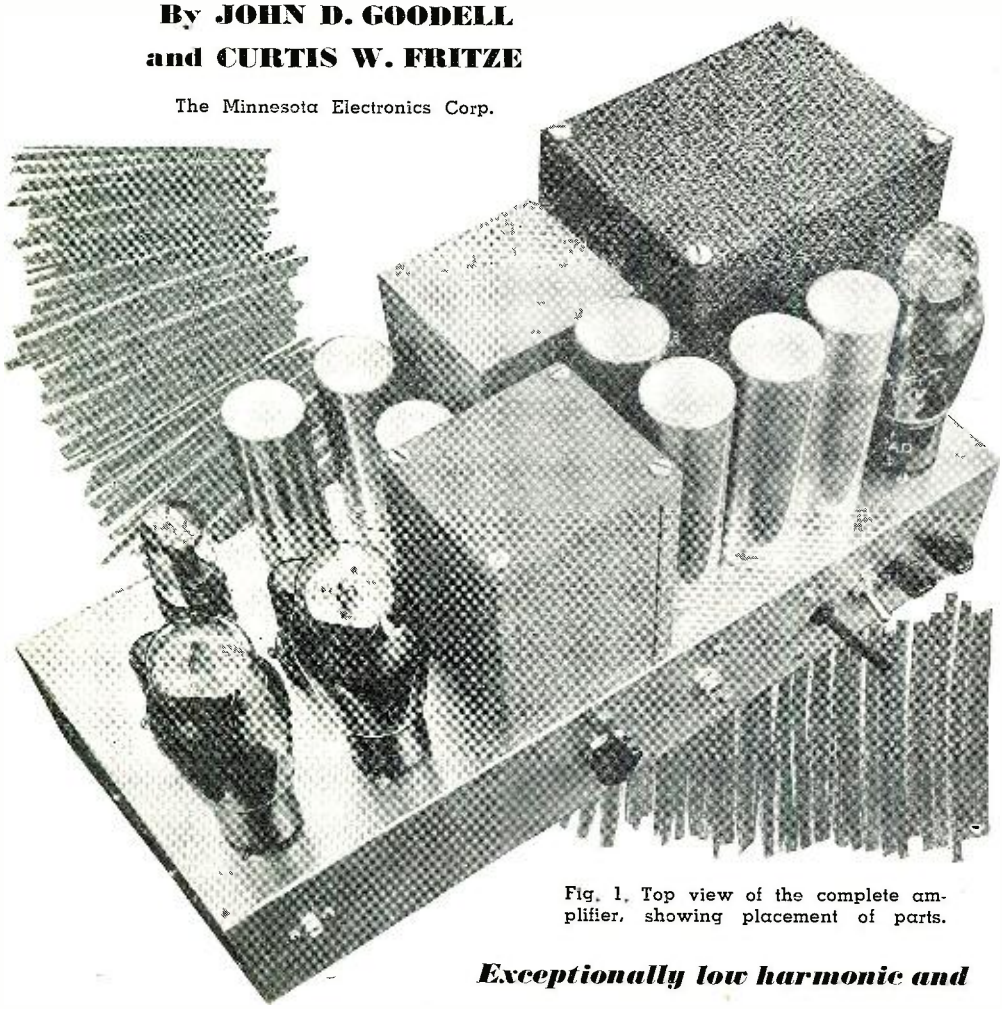


Fig. 1. Top view of the complete amplifier, showing placement of parts.

Exceptionally low harmonic and intermodulation distortion and wide frequency response characterize this unit.

THE controversy concerning triode versus beam power tetrode output tubes has probably been the subject of more discussion than any other single topic in the audio industry.

Since most people do not have the facilities for making their own choice, they are forced to depend on the recommendations of others who presumably have made controlled comparison tests. Whether an individual is purchasing an amplifier or building one, the investment is sufficiently large in time and/or money so that he would like to know in advance that his choice of output tubes is as close to ideal as possible. The amplifier design to be described was developed to eliminate this problem. This amplifier, as nearly as it has been possible to determine by laboratory measurements and listening tests, literally doesn't care whether triodes or beam-power tetrodes are inserted in the output sockets. Its characteristics, within the maximum output power set by the inherent design of the tube type used, are very much the same. The few instances in which this is not strictly true are indicated in later paragraphs. The owner of the amplifier may decide experimentally whether he prefers one tube type over the other and leave in the tubes he finds most satisfactory in the amplifier.

The first stage of this amplifier is a conventional triode voltage amplifier stage with the cathode bias resistor left unbypassed in order to obtain a convenient return point for the feedback voltage taken from the secondary of the output transformer. This feedback loop, which includes the entire amplifier from input to output, is intended principally to correct non-linearity in the output transformer and generally to compensate for phase shifts and attenuations in the input circuits. Note that the impedance-changing switch in the output circuit automatically adjusts the feedback resistor for optimum results at varying output impedances.

Obviously, if only the 500 ohm line is tapped to obtain feedback voltage, the amount of feedback obtained will depend on whether this impedance tap is loaded or not. In most instances, it is adequate to select a different resistor for feedback from the line impedances and the voice coil taps. However, with some output transformers, and in any design where the feedback quantity is critical, it is necessary to change the feedback resistor for each output impedance used. The point, of course, is that if the maximum feedback without instability is desired, and if it is connected to the 20 ohm tap and adjusted with this tap loaded, when the 10 ohm tap is used the amount of feedback will increase and instability may result.

The maximum amount of feedback that can be applied to any amplifier is a function not only of the frequency response range but of the shape of the attenuation curve at both ends of the spectrum. The criterion is that the phase shift shall be less than 180 degrees in the feedback loop with respect to the input signal at any frequency where the amplitude of the feedback component is unity or greater. Phase shift is related to attenuation. If the tail of the attenuation curve is too abrupt, causing an excessively rapid phase shift in the region just ahead of the frequency at which the amplitude falls below unity in the feedback circuit, the design will be unstable. Thus the amount of feedback it is possible to apply without instability and tendencies toward oscillation is related to the total pass band of the amplifier and the rate of attenuation at both ends of the pass band. In general, this means that for every 8-10 db. of feedback it is necessary to add a minimum of one to one and one-half octaves to the pass band. It becomes obvious that large amounts of feedback require control over a very wide response range. Three octaves above 250 cycles per second is only 2000 cycles per second, but three octaves above 20,000 cycles per second is 160,000 cycles per second—a radio frequency. Few designers realize the necessity of observing the characteristics of an audio amplifier in this region. On the other end of the spectrum the same comparison may be made. Three octaves below 250 cycles per second is only about 30 cycles per

second, while adding three octaves to a pass band that normally includes 50 cycles per second at the low end, without attenuation, means controlling the response down to 6 cycles per second —a low brain wave frequency.

The second stage of the amplifier is a split-load type of phase inverter with half the load impedance in the cathode circuit and half in the plate circuit. The only disadvantages in this design are: (a) that the maximum gain from the stage is always less than 2.0; (b) that raising the cathode so far above ground may introduce hum from the heaters (so that this phase inverter cannot normally be used satisfactorily in low level stages); and (c) that there is a difference between the shunting capacitance across the plate load and across the cathode load. Theoretically this difference in shunt capacitance may introduce a certain amount of unbalance between the two halves of the circuit at frequencies above approximately 6000 c.p.s. This, obviously, is particularly true if the value used for the load resistors is high. With low values of load resistors the effect is not sufficiently observable to warrant consideration, although it could be balanced out without great difficulty if required.

The intermodulation distortion in the cathode load is too low to measure accurately with available equipment, and at low levels of output signal requirements from this stage, intermodulation in the plate circuit is equally negligible. Where this type of phase inverter is required to furnish a very large signal, it is necessary to increase the plate voltage to the limits that the tube will stand if absolute minimum values of non-linear distortion are to be obtained in the plate circuit. In this amplifier, the signal required is relatively low under all conditions of operation and this consideration is not important.

One advantage of this type of phase inverter, in addition to its stability and freedom from distorton of all kinds, is the very high effective input impedance obtained. This may approach ten megohms with a one-megohm grid resistor and conditions where the gain is 1.8. Measurements to determine non-linearity with various values of cathode bias resistor showed very little change over the wide range of values from 1500 ohms to 10,000 ohms. The 2700 ohm resistor finally selected was chosen on the basis of maximum available output.

The third stage of the amplifier consists of two 6SJ7's, pentode connected as push-pull drivers. A small portion of the total load resistance for these tubes is inserted in the cathode circuit. This results in an increase of input impedance in the same manner as with the split-load phase inverter, although the magnitude of the effect is not so great.

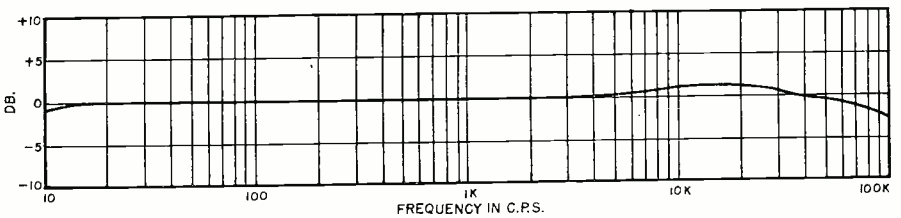


Fig. 2. Over-all frequency response of the amplifier. Note that the response is down only 3 db. at 100,000 cycles.

The output stage is first considered in terms of operation with 6L6 beam power tetrodes. The general circuit is conventional, but a feedback resistor is direct-coupled from the plate of each output tube to the cathode of the associated driver tube. This results in a voltage divider arrangement that applies a certain amount of fixed bias to the cathode circuit of the driver. The value of cathode bias resistor is chosen so that the combination of self bias and fixed bias from the voltage dividing network produces the correct operating point for the driver stage. This arrangement eliminates the need for a blocking condenser in this feedback loop so that no series reactance effects are encountered, and the feedback does not fall off even at very low frequencies, contributing considerably to the stability of the circuit in this region.

Where feedback is taken over one stage only, the danger of oscillation is essentially eliminated because the probability of excessive phase shift is removed. Over two stages, where there are no transformers involved and series reactances are eliminated from the feedback network, and the constants in the coupling networks are chosen with reasonable care, oscillation is not a serious problem. Thus, with this circuit, it is possible to introduce very large amounts of degenerative feedback, in an order of magnitude exceeding 30 decibels, with complete stability of operation.

The gain of the beam power tetrodes is such that a large feedback factor is obtained with the values chosen, and the gain of the driver stage is greatly reduced thereby. When triodes are used

Frequency	Response	Frequency	Response
18	0	10,000	+.8
30	0	12,000	+1.0
40	0	14,000	+1.0
60	0	16,000	+1.0
100	0	20,000	+1.2
200	0	25,000	+.75
400	0	30,000	+.5
600	0	50,000	0
1000	0	60,000	0
1500	0	70,000	—.8
2000	0	80,000	—1.0
3000	0	90,000	—2.0
4000	+.25 db.	100,000	—3.0
5000	+.4	200,000	—3.8
7000	+.6		

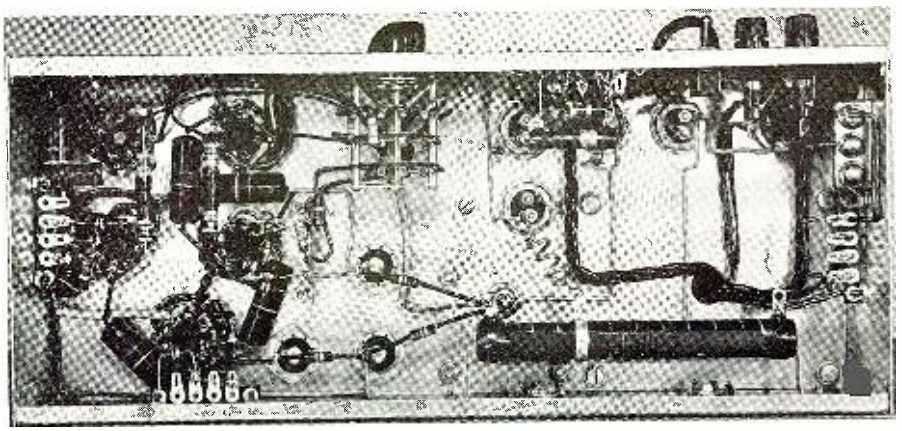
Table 1. Actual check-points used in preparing curve of Fig. 2.

in the output sockets, the much lower gain of the triodes greatly reduces the feedback factor and automatically increases the gain of the driver stage to provide sufficient input voltage to the grids of the triodes.

The filament center tap is returned to ground through a suitable bias resistor to provide the proper operating conditions for the triodes. When the beam power tetrodes are used, the current flow is through the cathode instead of the filaments, and the center tap return of the filaments has no effect on the operation of the circuit. The pin connections work out in such a manner as to make the 6L6 beam-power tetrodes and the 6B4 triodes interchangeable. The load resistance required for 6B4 triodes operating Class A, self-biased is 5000 ohms. The same load resistance is required for 6L6 beam-power tetrodes operating under self-biased, Class A conditions.

Experimentally it was determined that greater power with the same percentage of distortion was obtainable with the beam-power tetrodes operated

Fig. 3. Under-chassis view of the complete amplifier.



Fundamental	25	100	200	400	1000	2500	5000
2nd Harmonic	2.0	0.4	0.43	0.15	0.36	0.6	0.75
3rd Harmonic	1.3	0.23	0.2	0.18	0.16	0.15	0.14
4th Harmonic	0.4	0.06	0.05	0.06	0.08	0.08	*
5th Harmonic	0.2	0.05	0.02	0.02	0.02	0.01	*
Total	3.9	0.74	0.7	0.41	0.62	0.84	0.89+*

Table II. Actual measured harmonic content of amplifier at 5 watts output with either 6B4's or 6L6's. Asterisk indicates values not readable on equipment. Measurements made at 12 watts with 6L6's were identical or only slightly higher, never exceeding 1.5% except at 25 cycles, where readings were masked because of broad bandwidth of wave analyzer.

slightly in the direction of Class AB_1 with no measurable (instrument or listening) effect on the results. Consequently, although the normal requirement for optimum operation of 6L6's operated Class AB_1 is somewhat higher with regard to load impedance, the cathode bias resistor was increased beyond the value determined theoretically as being ideal.

In operation with either tube type, the intermodulation distortion at five watts measures less than 1 per-cent using 100 and 7000 cycles per second mixed 4:1. At ten watts for the triodes and 16 watts for the beam power tetrodes, this increases to 5 per-cent.

In the diagram shown in Fig. 4, it will be noted that one resistor—connected from the junction of the cathode bias and cathode load resistors in one of the 6SJ7's to one section of the output impedance switch—is marked, "*To be determined by I.M. meter.*" It is very difficult to obtain output transformers with absolutely perfect balance, particularly where multiple secondary taps are required. This resistor is inserted to compensate for whatever unbalance exists on various impedance taps. With the output transformer used in the circuit shown, it was found that balance was obtained with this resistor connected in the circuit when the 4, 6, 8 and 10 ohm taps were used, and with the resistor out of the circuit on the 20 ohm and 500 ohm taps. With other output transformers, it may be necessary to change the value of the resistor and connect it in or out of the circuit in various combinations for each impedance tap.

Any unbalance in the output circuits is strongly indicated by an increase of intermodulation distortion. This being the most sensitive measurement of nonlinearity, it is the easiest and most accurate method of determining the correct value for this resistor on each of the impedance taps. Experimental construction with a variety of output transformers indicates that even in very high-quality and high-priced output transformers appreciable unbalance

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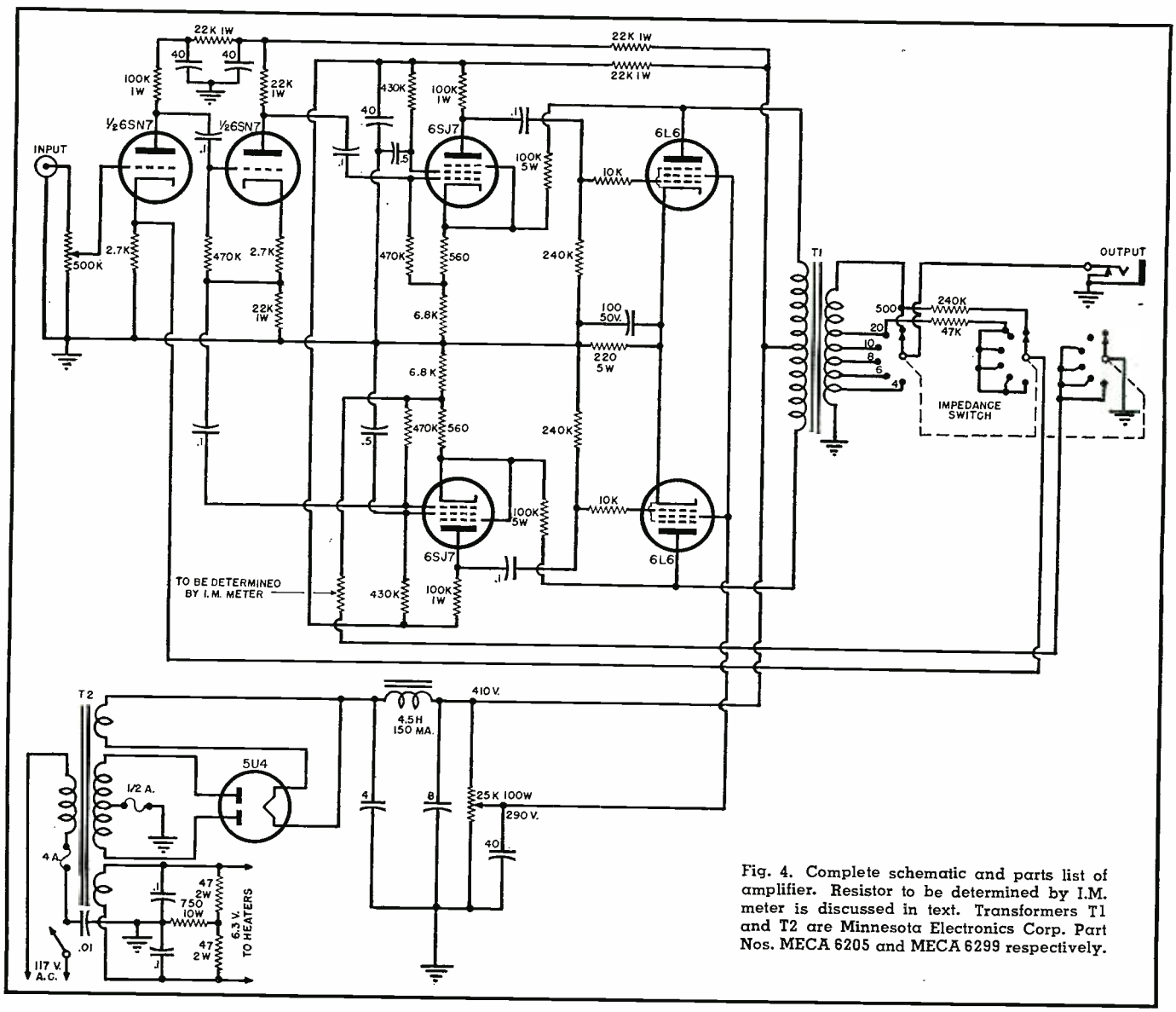


Fig. 4. Complete schematic and parts list of amplifier. Resistor to be determined by I.M. meter is discussed in text. Transformers T1 and T2 are Minnesota Electronics Corp. Part Nos. MECA 6205 and MECA 6299 respectively.

Fig. 1. A multi-frequency signal generator suitable for production line adjustment of stagger-tuned i.f.'s.

TELEVISION PRODUCTION LINE TESTING

Part 4 discusses sweep oscillators and marker generators for i.f. alignment.

By
M. S. KIVER

WE HAVE previously discussed sync generators, distribution amplifiers, bar and dot generators, and monitoring oscilloscopes. With the aid of these units, the complete sweep system and video-frequency amplifiers of any television receiver can be checked thoroughly. We come now to a consideration of the sound and video i.f. amplifiers and the important job of aligning these systems. The i.f. amplifiers are the backbone of every superheterodyne receiver and accurate testing methods are essential.

Television transmitting standards specify that the transfer characteristic of the transmitter shall follow the curve shown in Fig. 2A. The lower sideband shall be completely attenuated from its lowest frequency up to within 1.25 mc. of the carrier frequency. From approximately .5 mc. above the lower edge of the television channel to 4.0 mc. above the picture carrier frequency, the amplitude remains flat. The quiescent frequency of the frequency-modulated sound carrier is located .25 mc. below the upper edge of the channel. At the receiver, the frequency response characteristic must possess the form shown in Fig. 2B in order to offset the presence of the remnants of the lower sideband, those frequencies that extend 1.25 mc. below the carrier. Unless this is done, the output of the video detector will possess the shape shown in Fig. 2C, providing the lower video frequencies with 6 db. more voltage than the middle and upper video frequencies.

In superheterodyne receivers, the only system in use today in television receivers, the responsibility for determining the response characteristic of the set falls to the intermediate amplifiers. They must provide a frequency response which is as close to the so-called "ideal" curve of Fig. 2B as the design of the circuit will permit. If the set employs the conventional television system, then additional trap circuits will be found in the video i.f. system, and these must be aligned at the same time that the amplifiers are being adjusted. If the intercarrier television sound system is being used, no traps will be used in the circuit, but now special attention will have to be given the placement of the sound carrier along the i.f. response curve. With either system, following the video i.f. alignment, the sound system adjustment is undertaken.

Video i.f. systems fall into one (or possibly two) of the following categories:

1. Stagger-tuned
2. Transformer-coupled
3. Complex-coupled

The alignment procedures for Items 2 and 3 are similar, involving a stage-by-stage alignment followed by an over-all check to determine whether all stages are functioning properly as a group and, also, to note the effects of the trap circuits on the over-all response. Since each of the interstage coupling circuits in Systems 2 and 3 are bandpass networks, a sweep oscillator covering the entire video bandpass must be used. With stagger-tuned amplifiers, the alignment procedure is slightly different and somewhat simpler. First, each of the tuned circuits is peaked individually, after which an over-all response check is made to ascertain whether the proper characteristic has been achieved. Generally, some slight readjustments will be required during this over-all check.

The video bandpass extends for a maximum of 4.0 mc. If the conventional television system is being employed, the picture carrier, the video high-frequency 90 per-cent point, and each of the trap frequencies must be accurately located. If the intercarrier television sound system is used, the important alignment frequencies consist of the video carrier, the video high-frequency end point, and the exact location of the sound carrier. To accomplish identification easily and readily, marker pips or birdies are included with the sweep signal.

A multi-frequency signal generator which is ideal for the production line initial adjustment of stagger-tuned i.f. amplifiers is shown in Fig. 1. This instrument is a 10 frequency, 400-c.p.s. modulated, crystal-controlled oscillator. Crystals ranging from 17 to 40 mc. can be provided to the exact frequency specified. The crystals are arranged in a sequence specified by the customer. The frequency accuracy is better than .05

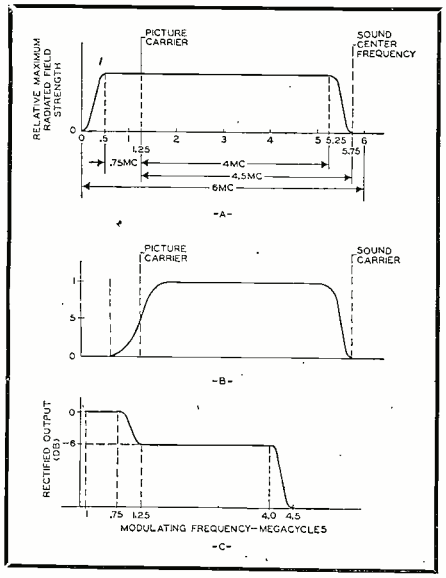


Fig. 2. (A) Television transmitter transfer characteristics. (B) Ideal receiver response. (C) Output of video second detector if receiver response characteristic is similar to the transmitter characteristic.

per-cent, and amplitude modulation is adjustable from zero to approximately 30 per-cent by an internal control. Frequency selection is instantly accomplished by means of a special, coin-silver contact rotary switch actuated by a heavy duty pulsing solenoid and front panel push button selector switch. The output signal is 0.5 volts across a 75-ohm terminated output cable 4 feet long, and this signal is capable of attenuation over a range of 1000 to 1.

One such generator would be located at each test position devoted to the preliminary alignment of stagger-tuned coils. A loudspeaker or a meter connected at the output of the video-frequency amplifier system could serve as an indicator. The coils, including the trap circuits, could then be aligned in sequence, the only operation being to depress the proper push button and adjust the tuning slug for maximum output indication.

The schematic circuit of the generator, exclusive of the electronically regulated power supply, is shown in Fig. 3. V_{1A} is a phase-shift audio oscillator, operating at 400 cycles. The output is fed through the modulation control to an audio amplifier and modulator tube, V_{1B}. The crystal-controlled, cathode-coupled oscillator, V_2, receives its plate voltage through a choke coil common to V_{1B} and V_{2A}, thereby varying the plate voltage of V_{2A} at the 400-cycle rate and modulating the carrier. Feedback in the r.f. oscillator is achieved through C_1 and the crystal unit connecting the cathodes of each triode section of V_2. Each crystal functions here as a series resonant circuit, permitting oscillations only at its series resonant frequency. A tuned coil in the plate circuit of V_{2B} provides a sine wave output which is then made available at the output terminals after passage through an adjustable attenuator network.

An electronically controlled power supply assures complete freedom from line voltage fluctuations from 105 to 125 volts.

I. F. Sweep Generator

To check the over-all response of stagger-tuned amplifiers and the over-all and individual stage alignment of transformer and complex coupled i.f. systems, sweep generators are necessary. In choosing a sweep generator suitable for production line use, the following considerations must be kept in mind:

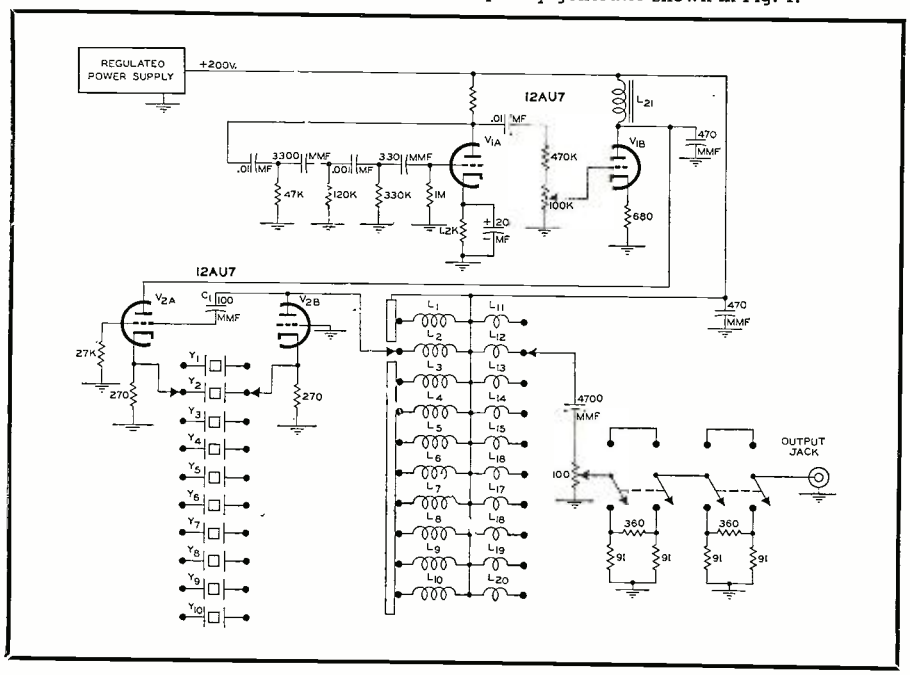
1) The instrument must be stable and simple to operate.
2) The bandwidth of the output signal should exceed the bandpass of the circuits to be tested by at least 30 per-cent.
3) Fixed markers should be clearly visible at those points of the response curve that it is desired to check.
4) A reference base line traced out on the oscilloscope is preferable. Further, the markers should extend down to this base line.

The last specifications may appear unnecessary to the man whose experience has been limited to engineering or servicing. However, a little time spent with the personnel employed at a line test position will soon indicate that any marker which is not clearly visible at all times soon results in incorrect alignments. This is especially applicable to markers which appear along the slopes of the response curve and at the bottoms of i.f. trap curves. The addition of the base line conveys to the alignment operator a better indication of the response curve.

A small sweep oscillator which is suitable for production and laboratory alignment of both the sound and video i.f. systems of television receivers is the unit shown in Fig. 4. The generator is a two-band, fundamental frequency oscillator capable of providing a frequency sweep of as much as 10 mc. on either band. The oscillator is frequency modulated at a 60-cycle rate by means of a special magnetically driven condenser. The output signal has a 50 per-cent duty cycle and the retrace period is used to provide a zero signal reference base line. The center frequency and the bandwidth of each band are adjusted at the factory, and anywhere from 0 to 25 per-cent of the center frequency throughout the range of 4.5 to 35 mc. is possible. Up to five pulse-type crystal generated markers having an accuracy of .05 per-cent can be obtained with each band. These markers are produced by an internal circuit arrangement that "keys" the output signal to zero level as the sweep oscillator passes each marker frequency. Thus, the marker pulse extends down to the base line and is always visible on the sharp slopes of response curves and at the bottoms of i.f. trap curves.

A block diagram of this sweep generator is shown in Fig. 5. The r.f. oscillator is a push-pull arrangement containing a separate set of coils for each band. A magnetically driven condenser is then switched across the coil of the band to be used. Adjustable condensers determine over what percentage

Fig. 3 Schematic diagram of multi-frequency generator shown in Fig. 1.



bandwidth the vibrating condenser will swing the oscillator. An alternate method of controlling this bandwidth could be achieved by controlling the driving voltage to the voice coil of the unit. This is not done here for two reasons. First, at very low drives, such as might be encountered in a narrow-band sound i.f. sweep, a slight microphonic tendency sometimes becomes noticeable. Second, it has been found that when the driving voltage is varied, the phase relationship between the movement of the voice coil and the driving voltage will vary, which would necessitate readjustment of certain phase-shifting networks.

At full driving voltage, which is about 3.5 volts, the vibrating condenser is capable of producing a plus or minus 25 per-cent frequency swing, under the conditions of stray circuit capacitance prevailing in this generator. It will be found that the frequency sweep is not completely linear in frequency with respect to either the vibrating condenser driving voltage or the sweep voltage furnished by the unit. However, this is not a disadvantage as crystal controlled markers appear at all the important frequencies. The oscillator is keyed "ON" by a square-wave voltage injected in the grid circuit during the interval when the vibrating condenser is causing its frequency to increase and keyed "OFF" while its frequency is decreasing. The r.f. output of the oscillator is fed through a link to the attenuator and crystal marker circuits.

Marker Generator. As the oscillator frequency sweeps through the resonant frequency of the crystal, it shock-excites the crystal, causing it to generate a chain of damped oscillations. As the bandwidth through which the oscillator is swept is reduced, the crystal becomes over-excited, as it takes longer for the oscillator to sweep through the resonance curve of the crystal, and thus the energy-time integral has a higher value. To correct this, damping resistors are placed across those crystals which are to be used to produce markers on low-sweep deviation bands. For the present purposes, it is necessary to select the first ring of these crystals, shape it into a pulse of the desired width, and then use this pulse to key the oscillator to zero output for a time corresponding to the width of the pulse. This is accomplished in its preliminary form by five separate sets of diodes and triodes, with an auxiliary pulse-shaping network between them. The five signals (or less, if fewer than five markers per band are ordered) are then all fed to one section of a dual triode which feeds the signal to an *R-C* cathode circuit having a short-time-constant charge, long-time-constant discharge, and then to the other half of the triode which has an adjustable bias applied to it to prevent certain low-amplitude signals which are present at the same time from feeding through. A diode is connected in parallel with the second half of the dual triode to prevent pulse overshoot on the rear half of the pulse and is provided with adjustable bias to control the voltage at which diode current flows.

It has been found by experience that there is a limit as regards the closeness of marker frequencies under certain conditions. In the case of a 20 to 30 mc. sweep it has been found impractical to space markers closer than 500 kc. Since such close spacing of markers is never required for the alignment of television receiver video i.f. amplifiers, this limitation is of no consequence. In the case of the sound i.f. alignment, markers are usually spaced either 50 kc. or 100 kc. apart, but the total bandwidth is usually only 250 to 500 kc. and for these bandwidths the 50 or 100 kilocycle spacing is entirely satisfactory.

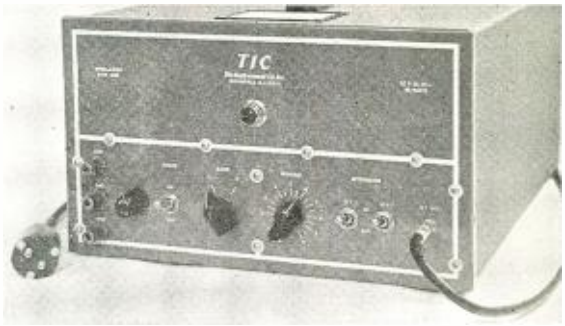


Fig. 4. A sweep oscillator covering the sound and video i.f. frequencies.

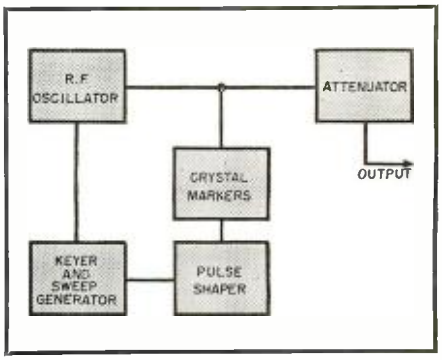
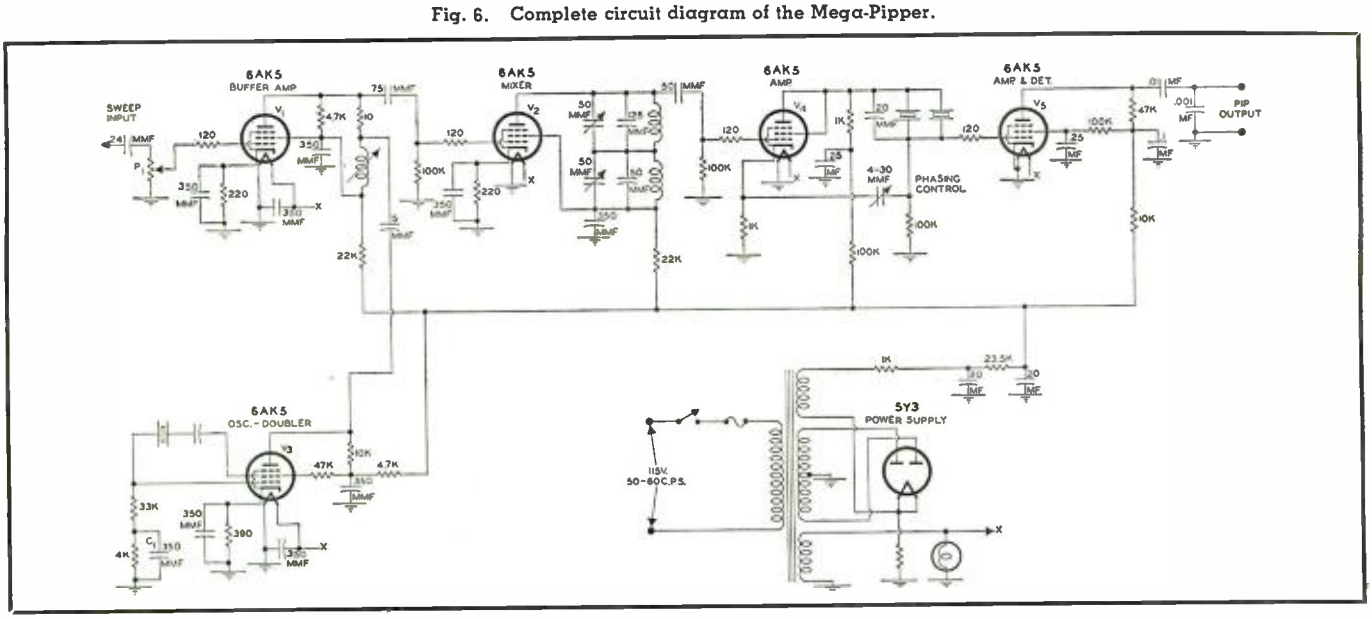


Fig. 5. Block diagram of i.f. sweep oscillator shown in Fig. 4.

Keying and Sweep Generator. The a.c. voltage from one side of the power transformer high voltage winding is fed through a phase-shifting network to provide a voltage which is 90 degrees out-of-phase with the motion of the vibrating condenser in the oscillator section. Sometimes, due to differences in the magnetic driver unit, the phase shift must be corrected by altering the components of the circuit. The voltage, after being limited in maximum value by a neon bulb, is applied to the grid of one-half of a 6J6, where it is limited to produce a square-wave of voltage at the plate. This voltage, along with the

(*Continued on page* 30)

Fig. 6. Complete circuit diagram of the Mega-Pipper.



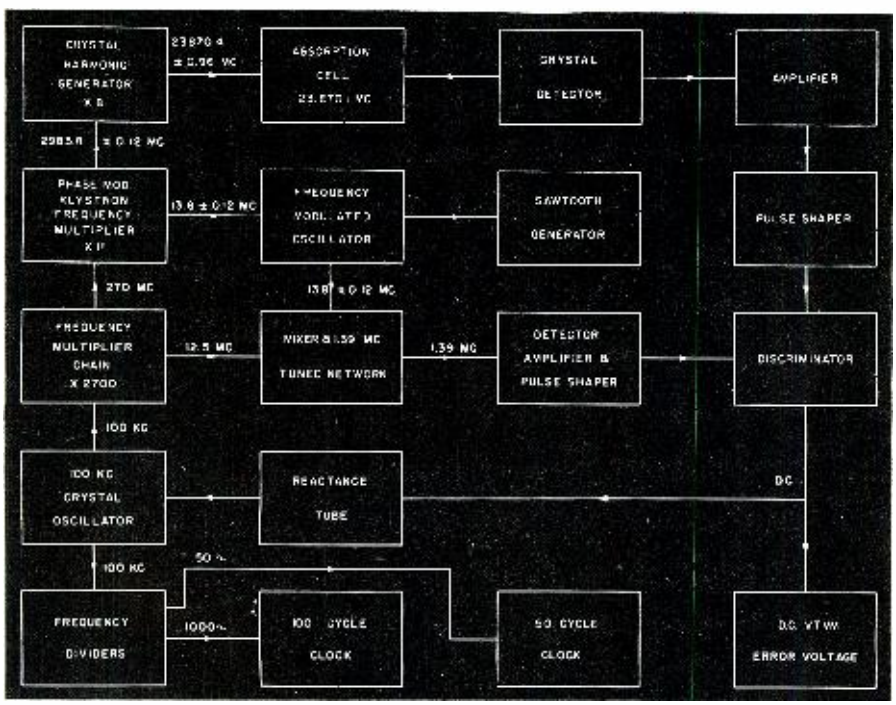
The ATOMIC CLOCK

A microwave absorption line of ammonia gas gives a new basic standard for frequency measurements.

A BASICALLY NEW, primary standard of frequency and time, invariant with age, has been developed at the National Bureau of Standards; an atomic clock based on a constant natural frequency associated with the vibration of the atoms in the ammonia molecule. Based on a principle developed by Dr. Harold Lyons of the Bureau's microwave research laboratory, the new clock promises to surpass by one or two orders of magnitude accuracy of the present primary standard, the rotating earth. Dr. Lyons was assisted in the design and construction of the clock by B. F. Husten, E. D. Heberling, and other members of his staff.

This is the first atomic clock ever built and is controlled by a constant frequency derived from a microwave absorption line of ammonia gas, providing a time constancy of one part in ten million. Theoretical considerations indicate a potential accuracy of one part in a billion or even ten billion, depending on the type of atomic system and spectrum line used.

Complete block diagram of the NBS atomic clock.



The improvements in frequency and time measurement offered by the atomic clock are of fundamental importance in many fields of science. An absolute time standard will be of special importance in astronomy, where present time standards leave much to be desired. The atomic clock and the method represent important tools of research and development in every technical field where precise measurements of time and frequency are crucial—for example, in long-range radio navigation systems, in the upper range of the microwave region where atomic systems can serve as electronic components, and in basic research in microwave spectroscopy and molecular structure.

The present time and frequency standards are based on astronomical determinations of the period of rotation of the earth. However, the earth is very gradually slowing in response to the forces of tidal friction in shallow seas. In addition, there are irregular variations—some of them rather sudden—in the period of rotation, the reasons for which are unknown. These two causes are responsible for changes in mean solar time and therefore in the frequency of any periodic or vibrating systems measured in terms of such time standards.

In recent years, vibrations of atoms in molecules—or what are more specifically termed spectrum lines originating in transitions between energy levels of these atomic systems—have been found in the microwave region of the radio spectrum. It has been possible to make very precise measurements of these lines by radio methods using all-electronic equipment of unprecedented sensitivity and resolution. When it became evident that such spectrum lines might eventually provide new primary frequency standards, scientists at the National Bureau of Standards began seeking a means of utilizing one of these lines to control an oscillator which in turn could be used to drive a clock. Because the resulting equipment, the atomic clock, is controlled by the invariable molecular system of ammonia gas, it is independent of astronomical determinations of time.

The National Bureau of Standards atomic clock consists essentially of a crystal oscillator, a frequency multiplier, a frequency discriminator, and a frequency divider, all housed in two vertical-type cabinet racks, on the top of which are mounted a special 50-cycle clock and a waveguide absorption cell. Ammonia gas under a pressure of 10 or 15 microns is maintained in this

(*Continued on page* 28)

Fig. 1. The new 12AY7 dual triode.

A Low-Noise INPUT TUBE

By C. R. KNIGHT and A. P. HAASE

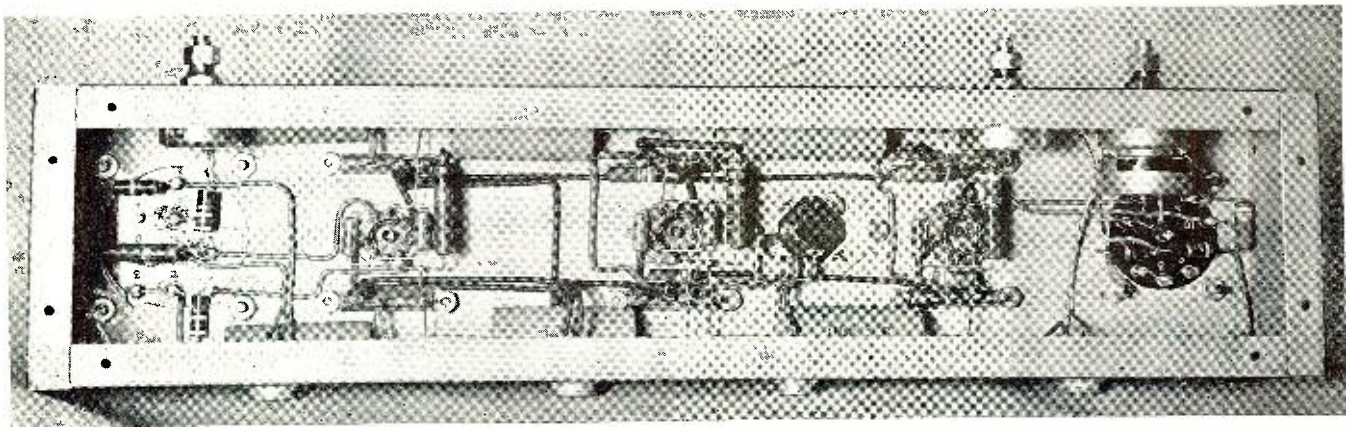
Tube Division, General Electric Co.

A new audio input tube having an excellent signal-to-noise ratio and low microphonics.

SHORTLY after the end of the war it became evident that in the expanding field of electronics more and more need would arise for a relatively inexpensive tube which could be used as an audio amplifier at very low signal levels. Such a tube should be capable of operation with alternating current on the heater near the theoretical noise level due to thermal agitation in the input circuit impedance. In addition, to be successful the tube must also have the lowest microphonic output practicable. At the inception of this development, to the best of our knowledge, a tube specifically designed for this purpose was not available, although some types selected from regular production had been made available commercially. It was our belief that a tube designed for this purpose could be manufactured at a much lower cost and would give considerably greater uniformity in performance than the selected type. Very early in the investigation it appeared that a miniature tube structure had inherent advantages from the standpoint of low microphonic output. Small size and consequent low mass of the electrode structures, the very short lead lengths within the tube which constitute the mounting pedestal, and the button stem structure which provides a wide base for the mounting pedestal all would offer great assistance in achieving the desired results. Since miniature tubes were rapidly gaining user popularity because of their small size and demonstrated superiority, the miniature envelope was the logical choice.

Since we desire to design a tube which, in addition to meeting the required noise objectives, would be as flexible as possible insofar as circuit applications were concerned, the relative advantages of triode versus pentode construction were given very careful consideration. A pentode appeared at first to have advantages from the standpoint both of voltage gain and of relative absence of Miller-effect capacitance. The triode offered the well-known advantage of low electronic noise and simple mechanical construction, which can be directly interpreted into lower mechanical noise. In addition, the triode has the advantage of having smaller practical control-grid-to-plate spacings than the pentode, thus making the former less susceptible to hum modulation due to the magnetron effect by stray magnetic fields. Inasmuch as the triode advantages were very fundamental from the standpoint of the objectives being sought, and the advantages of the pentode were primarily those of circuit convenience, the basic triode structure was selected. It was found that simple circuit means could be provided to overcome the Miller-effect capacitance of the triode and still maintain the low output capacitance of the triode. Also, by providing two triodes in one envelope and by connecting these two triode sections in cascade even greater voltage gain could be obtained in the double triode than in a single pentode. In addition, the double triode structure offered a great many advantages from the standpoint of circuit flexibility permitting conceivable combinations such as ordinary cascade amplifiers, bal-

Fig. 2. Bottom view of 3-stage balanced amplifier. Circuit diagram is shown in Fig. 10.



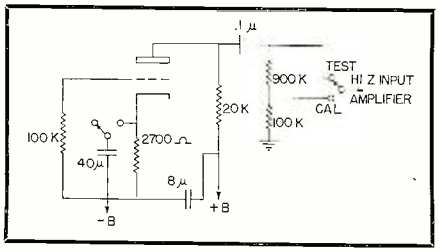


Fig. 3. Test circuit for the 12AY7.

Plate current	3.0 ma.
Amplification factor	40
Transconductance	1750 μmhos
Plate voltage	250 volts
Grid bias	—4 volts

Table I. Characteristics of the 12AY7.

anced amplifiers, and multi-channel amplifiers. An amplification factor was chosen which was high enough to provide a suitable voltage gain and low enough to provide a moderately large output voltage at low distortion and to allow the tube to be used with reasonable success in direct current amplifiers with as little dependence of plate current on contact potential as was practicable. Inasmuch as low noise was the primary concern and bandwidth of secondary importance, it was initially decided that the actual transconductance of the tube should be determined for optimum noise characteristics.

The actual design was then begun on the basis of these conclusions and objectives.

In designing the low-noise, low-microphonic tube it was necessary to consider the physical size of the electrodes from a mechanical as well as an electrical standpoint. In order to keep the energy in the mechanical system low despite the high acceleration associated with impact, it is necessary to keep the mass of the electrodes low. In addition, it is desirable to maintain high stiffness. A combination of low mass and high stiffness contributes to low storage of kinetic or potential energy with a given mechanical excitation and provides for rapid damping of natural oscillations of the electrodes. A third factor of importance is the interelectrode capacitance. In order to keep hum to a minimum, there must be low capacitance between the heater leads and grids of the tube. To minimize cross coupling between sections, it is desirable to keep plate-to-plate and plate-to-opposite-grid capacitance low.

These factors determined to some extent the structural design of the tube. In order to attain maximum support of the tube elements, it was decided to use double micas at both the top and bottom of the mount with the bottom micas spaced by a stud structure to separate points of support, thus providing more resistance to bending of the electrodes. The cathode hole in the mica is unique in that it does not, as is customary, provide a slot for a cathode connecting tab to slide through. The elimination of this slot allows full contact between the mica and the cathode sleeve and assures a good fit between the two parts. This is not normally the case since the cathode tab slot usually has rounded edges and is of such dimension that usually not more than ¾ of the cathode circumference is in contact with the mica. With this method of cathode mounting, the tab acts as a stop to prevent upward movement of the cathode when the tube is vibrated.

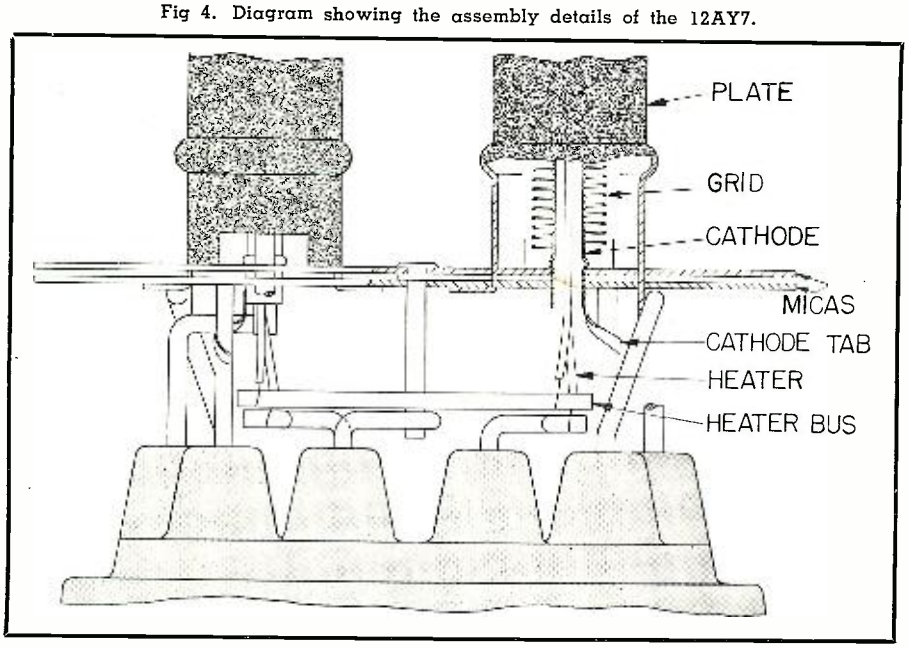
Particular attention has been given to the grid structure. In most instances the grid wires are fastened to the grid side rods by first notching the side rods, then laying the grid wire in the notch and finally peening the side rod to fasten the wire securely. In many tubes the notching is done over the full length of the grid side rods while peening is done only in the space in which the grid turns are located. This results in a grid leg with many burrs which act as cutting knives to ream out the hole provided for the grid. The 12AY7 utilizes a production method whereby the grid side rods are notched and peened only in the vicinity of the grid wires. This method not only provides a smooth grid leg which can easily be inserted into the mica hole but also maintains the accuracy of alignment and tightness inherent in the micas by eliminating the reaming associated with fully notched grid legs.

Fig. 4 shows the details of the mica assembly, cathode mounting, and plate and grid structures. The getter assembly has been mounted on a separate stake supported by the top micas to provide electrical isolation of the assembly from both sections. This mounting permits coupling from one section to another to be much lower than would be possible if the getter assembly were fastened to either of the plates. In addition, individual mounting of the getter assembly isolates it mechanically from the elements connected with the exterior circuit, thus making mechanical movement of the getter assembly a relatively unimportant item as far as microphonic response is concerned.

Particular consideration was given to the heater design in order to provide a minimum magnetic field in the region of the tube elements (particularly by the grid wires) and minimum capacity coupling to the elements. The heater is of the folded rather than the coiled type to facilitate easy mounting in the small diameter cathode used. Use of the miniature 9-pin button stem has reduced the leakage and capacitance effects sufficiently to keep hum voltages in the region of a few microvolts.

From the standpoint of electrical design, noise considerations dictate that the tube must operate in the emission-limited, rather than the temperature-limited, mode. However, in order that the number and intensity of hot spots which may develop along the coated length of the cathode be kept low, it was decided to keep the thermal excitation level low by running the cathode at a relatively low temperature. This is accomplished by using a fairly heavy cathode tab, by mounting the cathode sleeve tightly in the micas, and by distributing the heater over the full length of the cathode using 0.94 watt heaters in each section. The plate structure is made large enough to be cool in normal operation, thus minimizing noise effects from secondary electrons. Photoelectric

Fig 4. Diagram showing the assembly details of the 12AY7.



effects are reduced by the use of carbonized material in the plate structure.

The 12AY7 was tested in the circuit shown in Fig. 3 and has the following maximum noise specifications: hiss measured over a 13 kc. bandpass from 40 cycles, 8 microvolts; hum with an unbypassed cathode resistor measured over a 260 cycle bandpass from 40 cycles, 12 microvolts. In addition, tubes are tested in the quality control laboratory to maintain as low a microphonic level as is possible. The tube's electrical characteristics are as shown in Table 1. The amplification factor of the 12AY7 was determined by the application requirements as outlined earlier. Since mechanical considerations dictated the tube structure, choice of transconductance value was limited to a narrow range. Within this range a value was chosen which would give the best ratio of transconductance to plate current.

Although the limits indicated are the maximum noise values at which a tube is considered acceptable, the *General Electric Company* system of quality control assures continuing efforts to improve the product and maintain high-quality production. This AOQL system, as it is called, was adopted as a control on the factory production. It is used to maintain the median value of the characteristics of representative test lots within a given percentage of the bogie specifications of all characteristics. (See Figs. 6 & 7.) The system has been in operation for nearly a year and has proved to be very effective in improving the quality of production tubes and maintaining quality at a high level. Since this program will be in effect for this low-noise twin triode, it can be expected that the average noise characteristics will run considerably below the maximum allowable noise level given.

The development of a high-quality, low-noise audio amplifier is not merely a problem of tube design. This is particularly true when the input signal is of such a value that noise in the order of a few microvolts is important. It is very well known to those familiar with such design that circuit and chassis layout are of equal, if not greater, importance. Consideration must be given to: (1) magnetic hum pickup in the tube due to modulation of the electron stream and in the circuit leads caused by induction, (2) electrostatic pickup of hum and discharge noises, (3) ground loop pickup where signal voltage and either heater current or a.c. line current may pass through common ground conductors, (4) mechanical considerations directly associated with microphonics, (5) input-circuit noise and signal-to-noise ratio, and (6) feedback considerations.

To obtain the ultimate in low-noise

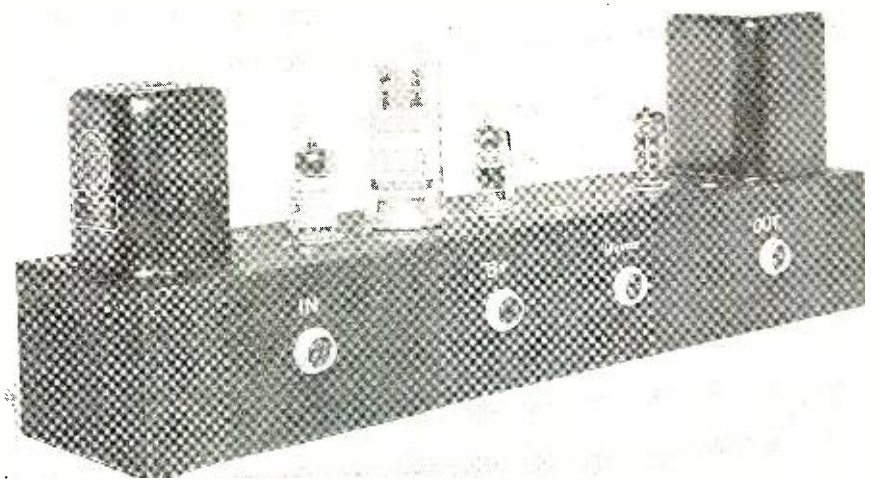


Fig. 5. Top view of experimental amplifier diagrammed in Fig. 10.

operation, it is always desirable to place the power supply on a separate chassis considerably removed from the amplifier and to supply the heaters with direct current. Often, however, from an economic and practical standpoint, these refinements cannot be justified. In this regard it is well to consider that when a tube like the 12AY7 is used in a typical circuit, the hum referred to the grid circuit, which can be produced by a field strength of 1 gauss, is in the neighborhood of 10 microvolts. Flux densities of 1 to 3 gauss are found quite frequently as far as 7 inches away from standard power transformers of the type generally used in radio and amplifier circuit work which have not been specifically designed with low-level audio amplifier use in mind.

With grid resistances as low as 30,000 ohms, approximately 4 microvolts of hum per volt of heater potential per micromicrofarad of heater-circuit-to-grid-circuit capacitance will appear at the grid. If the heater voltage is 6.3 volts, this means approximately 25 microvolts per micromicrofarad of coupling. Obviously, care in the relative location of grid and heater circuit wiring is essential, as well as proper shielding of both circuits.

Input circuit transformers must be of the hum-bucking type and should, of course, be magnetically shielded.

The field set up by the wires carrying the heater current is small—approximately 0.08 gauss at 1 inch from a wire carrying one ampere. The voltage drop along the heater mains is not negligible, however, being around 700 microvolts per inch per ampere for No. 18 wire. For this reason, ground loops where heater and grid-return circuits might conceivably go through a common conductor must be avoided. The heater circuit should be wired to all tube heater terminals and grounded at only one point, preferably through the heater transformer center tap or through a voltage divider potentiometer with the adjustable arm grounded.

Unfortunately, output from tubes caused by mechanical excitation is not

Fig. 6. Hum distribution curve.

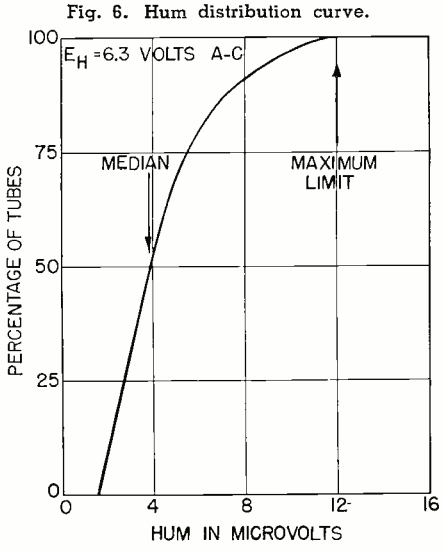
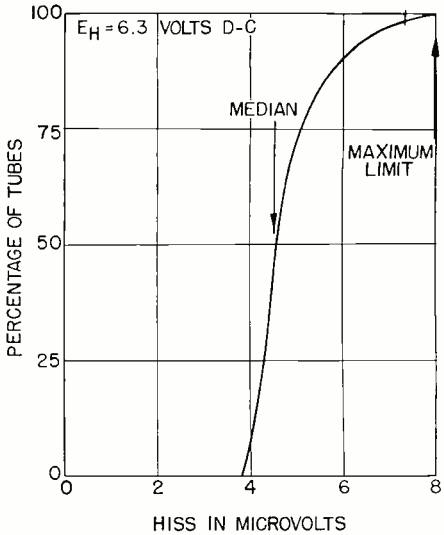


Fig. 7. Hiss distribution curve.



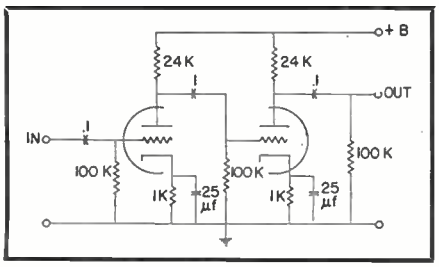


Fig. 8. 2-stage cascade amplifier using the type 12AY7 dual triode.

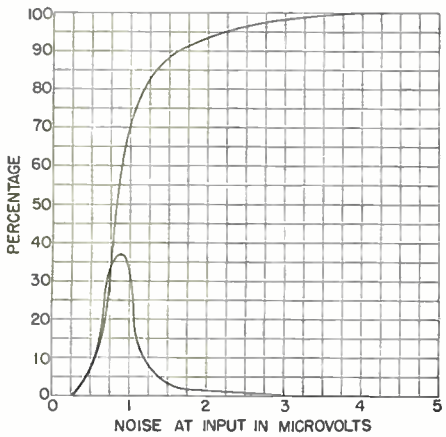


Fig. 9. Frequency distribution of combined hum and noise in balanced amplifier of Fig 10. Input, 600 ohms; bandwidth, 10 kc.

a thing which is either existent or non-existent. It is always a matter of degree. Consequently, it cannot be said that a particular vacuum tube is non-microphonic. The 12AY7 has been designed to have as low as practicable mechanical output. Our laboratory tests and those of others who have had samples of this tube indicate that this end certainly has been achieved. It should be remembered, however, that in high-gain amplifiers having considerable power output, all caution cannot be thrown to the winds. Loudspeakers should still be mounted as far as possible from the input stage and preferably in a separate cabinet. Mounting the tube socket on rubber grommets is quite inexpensive and is a fairly effective precaution.

Under the specification test conditions for the 12AY7, a maximum noise voltage due to shot-noise effects is 8 microvolts r.m.s. referred to the grid. This test is made with a 100,000-ohm grid resistance. The maximum hum voltage referred to the grid is approximately 8 microvolts when the cathode resistor is properly bypassed. This is a combined noise and hum maximum of approximately 11.2 microvolts r.m.s. Average tubes, of course, fall considerably below this value. Noise from carbon resistors carrying d.c. currents is also very important at low signal levels. In the balanced amplifier described later the noise level was increased 10 db. by substituting carbon resistors for the wire-wound cathode resistors ordinarily used. Tube sockets should make very firm contact to the base pins. Experience indicates that loose contacts can be a serious source of noise.

When triodes are to be used in a multi-stage amplifier incorporating overall feedback, difficulties may arise due to the Miller-effect capacitance, particularly when more than two stages are being employed. This difficulty was overcome by the use of a balanced amplifier system employing cross neutralization. This cross neutralization has been found to be non-critical, and the results obtained will be described a little later with performance details.

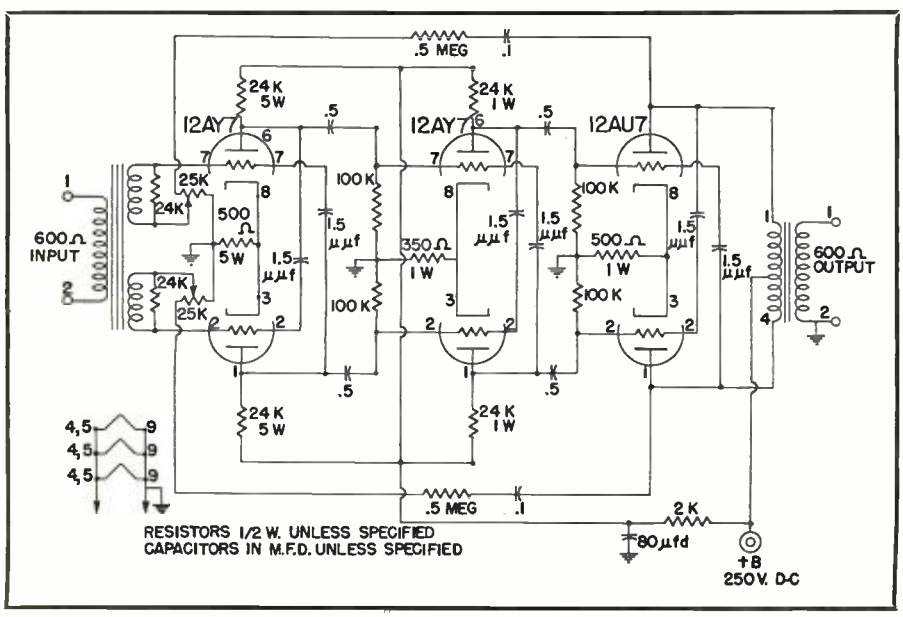
In order to evaluate the performance of the 12AY7, two amplifiers have been built up and fairly exhaustive tests made to determine the capabilities of the tube. The first was a very simple cascade amplifier employing the two triodes sections of one tube. A gain of 50 db. was realized, and the average noise and hum level referred to the input circuit grid was 11 microvolts. Fig. 8 shows the circuit diagram of this amplifier which is quite straightforward. While little has been done in this particular amplifier to correct for Miller-effect capacitance, the frequency response characteristics (flat within 1 db. from 90 to 11,000 cycles) are certainly suitable for a great many of the less critical applications. It was possible to obtain an output voltage of 15 volts for five per-cent distortion.

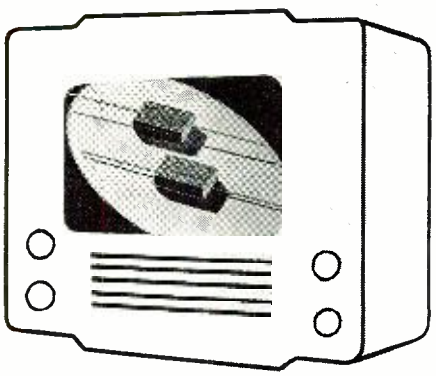
A balanced amplifier employing cross neutralization and inverse feedback was also constructed to obtain the utmost in performance from the tubes, both from the standpoint of noise and frequency response. Fig. 10 shows the circuit diagram of this amplifier. Note that negative feedback is provided over the entire three stages. A feedback of 17 db. could be inserted without any indications of instability. A top view of this amplifier chasis is shown in Fig. 5. It was deemed advisable to omit the power supply from this chassis although alternating current was used for the heaters. Fig. 2 shows the under side of the chassis where the input circuit and heater wiring as well as the cross-neutralizing capacitors are visible. The frequency response characteristic of the amplifier is remarkably flat from 30 cycles to 20,000 cycles. The cross neutralization, combined with the very low input and output capacitances of the triode, make this very flat frequency response possible. In addition, balanced amplifier design tends to reduce the noise level which may be caused by stray magnetic and electric fields. Fig. 9 shows the frequency distribution of combined hum and noise in this balanced amplifier, referred to the input circuit. The average noise as represented in the distribution curve represents a value which is 87 db. down from the +24 dbm. level. The designer's task in keeping distortion down is greatly assisted by this balanced amplifier design. The measured harmonic distortion at 50 cycles and 1,000 cycles was 0.55 per cent at 24 dbm. output into 600 ohms.

We believe that the objectives sought have been satisfactorily achieved in the 12AY7. The combined hum and noise voltages are only 7.6 db. above the theoretical on the poorest tubes, and only 2.2 db. on the average. Microphonics investigations have been very thorough in our laboratory as well as in the laboratories of some of our customers. The results indicate that the

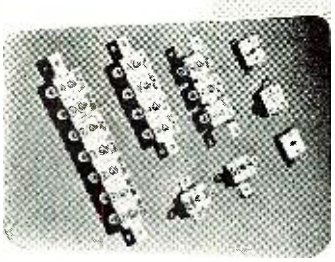
(*Continued on page* 31)

Fig. 10. Three stage balanced cross-neutralized microphone preamplifier using two 12AY7 tubes and one 12AU7 tube.





A GOOD TRADEMARK *is* BUT A REFLECTION OF *many* OTHERS



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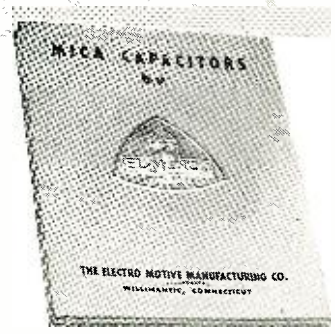

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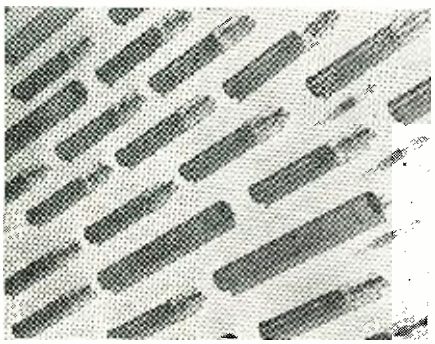
NEWS BRIEFS

NUCLEAR-RADIATION COUNTERS

The growing availability of man-made isotopes has created a need for nuclear-radiation counters for medical research, for tracer studies and for



process control in industry. Developments are now under way at *Westinghouse Electric Corporation*, 306 Fourth Ave., Pittsburgh 30, Pa., that will lead to mass production of the Geiger counter.

One of the representative types is a cylinder of chrome steel about an inch in diameter and six inches long. A critical feature of the tube is the gas within it, a controlled mixture of neon, argon, and an exact trace of chlorine, which has proved ideal.

New meters are also required and one now being manufactured has four scales of sensitivity, indicating intensities of radiation as to safe, mild, or hazardous. Radiac instruments, as this detection equipment is now called, will appear in various forms, from large units to outfits that a man can carry with ease. Use of the tiny high-voltage-batteries, tubes, and other components as developed for hearing aids, etc., permits the weight to be kept below ten pounds on portable units.

NEW VIDEO TUBE PLANT

National Union Radio Corporation, Orange, N. J., has acquired a new plant in Hatboro, Pa., for production of all types of cathode-ray tubes up to and including 20″ in diameter. The Hatboro plant is set on three acres and is completely equipped with power, sewer and gas services.

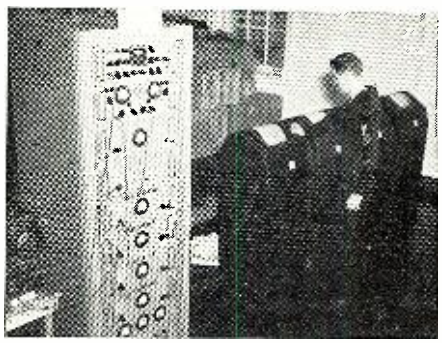
According to a company spokesman, the acquisition of this plant marks another step in the planned expansion program. When the unit is in full operation *National Union Radio Corporation* will produce a completely rounded line of tubes, including receiving tubes, television tubes, special purpose tubes and cathode ray tubes.

NEWS FROM THE INDUSTRY

Furst Electronics, manufacturers of specialized electronic laboratory instruments, is moving to enlarged quarters at 12 S. Jefferson St., Chicago 6 Illinois.

ELECTRONIC MULTIPLEX RECEIVER

The Navy department announces the development of an Electronic Time Division Multiplex receiver unit with attached battery of four teletype printers. This unit rearranges the output of two to four teletype machines so that the signals are simultaneously transmitted over a single radio channel by a single transmitter.



Since each teletype transmitter sends messages at speeds of 75 w. p. m. a total of 300 w. p. m. can be transmitted. The apparatus, divided into transmitting and receiving units, is calculated to make the best possible use of available radio frequency channels in military operations.

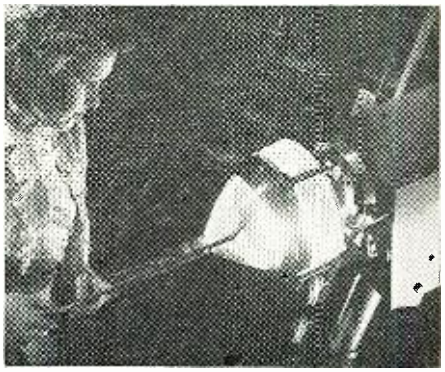
SCIENTIST TO HEAD NEW DIVISION

Dr. David Harker will head the new division in the *General Electric Research Laboratory*, the Crystallography Division. He received his Ph.D. in chemistry from the California Institute of Technology, and for five years taught at Johns Hopkins.

The work of the new division will center on problems of inter-atomic arrangement, particularly with respect to the structure of crystals. Such problems will entail use of electron and x-ray diffraction instruments and the electron microscope.

TV PRODUCTION

One of the operations in producing tubes for television is coating the inside



walls of the picture tubes with graphite, to improve screen contrast by absorbing reflected light. In the illustration, the operator uses an applicator easily adjusted for uniform coating, while the bulb is turned on a lathe. This is a scene at the *Sylvania Electric Products Inc.* plant at Emporium, Pa.

NEW SPRAGUE ELECTRIC PLANT

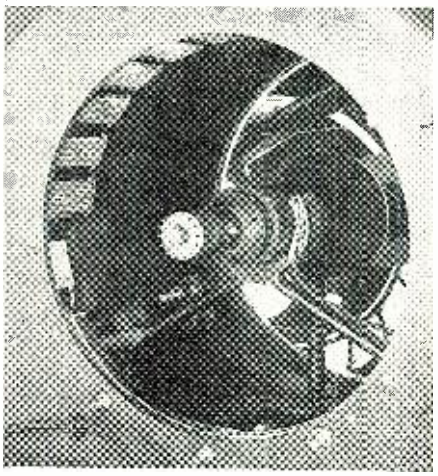
The *Herlec Corporation* of Milwaukee, manufacturers of ceramic condensers and "Bulplate" printed circuits, has been purchased by *Sprague Electric Company.*

At Nashau, N. H., a plant for manufacturing ceramic assemblies is being established, and manufacturing operations are being expanded at the Milwaukee plant, thus assuring two substantial sources of supply.

The Milwaukee operations will be under the continued direction of *Herlec* executives, including Milton Ehlers, Harry Rubenstein, and Thomas Hunter.

TELEVISION PROJECTOR

RCA's experimental large-screen television projector, which projects a



picture measuring six by eight feet, was demonstrated publicly at the Na-

tional Association of Broadcasters Convention in Atlantic City.

The developmental high intensity projection tube, shown in the center of the circular aperture, directs its brilliant image at a 30 inch spherical mirror, which is part of the reflective optical system and combines great magnifying power with minimum loss of light.

BROLLY IS CHIEF ENGINEER FOR TV ASSOCIATES

A. H. Brolly, veteran television engineer, has left WBKB, Chicago, to become chief engineer of *Television Associates, Inc.* of Chicago. Mr. Brolly has a B.S. degree from the University of California and an A.M. in communication engineering from Harvard. He has been associated in the past with *Federal Telegraph, Farnsworth Television, Inc.* and *Philco Corporation.*

NEW ATOMIC POWER DIVISION

Dr. William E. Shoupp, director of research, and Robert A. Bowman, manager of engineering, are the two key executives recently named to guide the work of the Westinghouse Electric Corporation's new Atomic Power Division.

Their work will include the construction and testing of an atomic power plant for the propulsion of naval vessels, at a remote location.

Dr. Shoupp has been until now manager of electronics and nuclear physics research, while Mr. Bowman was manager of condenser engineering at the company's Steam Division in South Philadelphia, Pa.

STRATOVISION

According to Westinghouse Electric Corporation and the Glenn L. Martin Company, co-developers of Stratovision, extensive tests over a three-year period show that it is a practical and useful method of expanding television service and provides a wide variety of functions in relaying television and other high-frequency communications.

The commercial development of Stratovision awaits the crystallization of public demand for the expanded services offered by airborne broadcasting. Although final tests are nearing completion, development of relaying and broadcasting equipment will continue.

These conclusions were based on flight tests conducted with a B-29 converted for airborne television broadcasting experiments.

NEW LITERATURE

Precision Resistors and Their Measurement, a booklet recently published by the National Bureau of Standards, deals with the characteristics of precision resistance apparatus and the Bureau's methods for measuring resistance. This pamphlet, NBS Circular 470, may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for 20 cents per copy.

Microwave Filter

A report on "Microwave Filter Theory and Design," PB 94664, is now available at $6.25 a copy in photostat and $2.50 in microfilm. Prepared by the Coles Signal Laboratory of the Army Signal Corps, the report covers the theory of waveguide filters and application of the theory to filter design. Orders should be addressed to the Library of Congress, Photoduplication Service, Publication Board Project, Washington 25, D. C., with remittance payable to the Librarian of Congress.

FM Telemetering Transmitters

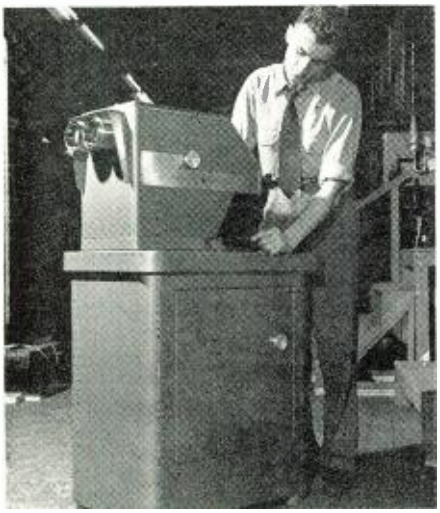
This 4-page folder of the New York University College of Engineering describes unique new equipment designs which have been developed as part of a special sponsored research project. It is amply illustrated and not only gives

(*Continued on page* 29)

NEW PRODUCTS

TV SLIDE PROJECTOR

The Transmitter Division of *General Electric's* Electronics Department at



Electronics Park, Syracuse, N. Y., has made a new slide projector available. For use in television stations to supply still projection facilities, the instrument will accept standard 3¼"x4¼" slides, cards and strips four inches wide of any length. Providing for dissolves between dual sections, the projector has dual lenses and may be ordered to operate with large or small iconoscopes or the image orthicon types of pickup cameras. Light intensity is between 10 and 15 foot candles.

Operating on 115 volts, 60 cycles, the projector is equipped with two opaque and two transparency lamps.

CRYSTAL ACCESSORY

Bliley Electric Company of Erie, Pennsylvania has recently announced the availability of a new crystal temperature stabilizer for modern military and commercial communications equipment.

Designated the type TCO-1, this miniaturized crystal oven is designed for use with *Bliley* type BH6 crystal units which mount in an internal socket. This compact combination will provide frequency stability down to ±.0001 per cent while crystal temperature is maintained within ±2 degrees C.

The standard unit is supplied for operation at 75 degrees C. ±2 degrees and is equipped with a 6.3 volt heater rated at 5.5 watts. Supplied with type BH6 crystal units at any specified frequency in the range from 1 to 100 mc., the TCO-1 oven introduces a new form factor in temperature stabilized crystals for high precision.

Full details on the type TCO-1 are available from *Bliley Electric Company*, Erie, Pennsylvania.

NEW STUD TERMINALS

The *Aerovox* stud terminals used in place of conventional rivet-type terminals for the dual leads have slashed the bulk of the company's new PRS midget-can dual-section electrolytic condensers to much less than previous sizes.

The new stud terminals to which the usual bare pigtails are positively crimped, have reduced terminal diameters without loss in mechanical strength or change in standard pigtail leads. According to *Aerovox*, constructional features make these new units equal or superior to their previous line of dual units.

Information about these new reduced-size dual electrolytic tubulars will be furnished by *Aerovox Corporation*, New Bedford, Massachusetts.

RAYTHEON ADDS NEW MODEL

Raytheon Mfg. Co., Waltham 54, Mass. announces the addition of a new model

to its VR-6000 catalog and custom engineered voltage stabilizer line. It is a hermetically sealed, frequency compensating model of 15 watts rating, for an input frequency range of 57 to 63 cycles, input voltage of 95 to 125 volts and output of 115 volts stabilized to plus or minus 1 per cent for both line and frequency regulation.

Oil filled for highest cooling efficiency, this stabilizer has been designed for maximum resistance to shock and vibration. A bulletin covering other characteristics may be had by writing the firm.

SCOPE KIT

Electronic Instrument Co., Inc. of Brooklyn, New York is currently offer-

ing a 5" oscilloscope in kit form to the service industry.

This instrument, which has been especially designed for AM, FM, and television receiver servicing, provides horizontal sweeps from 15 to 30,000 cycles. All controls are located on the front panel of the unit. The linear sweep uses an 884 gas triode. A graph screen is provided.

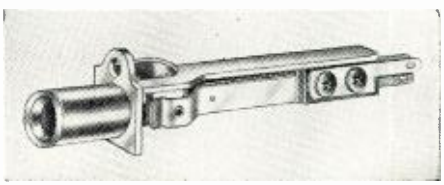
Frequency response of the horizontal and vertical amplifiers is from 50 cycles to 50 kc. The input impedance is 1 megohm and 50 $\mu\mu$fd. The scope uses two 6SJ7 tubes, two 5Y3's, one 884, and one 5BP1. Provision is made for external synchronization, test voltage, and intensity modulation.

Detailed instructions and a pictorial diagram are included with the kit. Literature on the *EICO* scope is available on request from *Electronic Instrument Co., Inc.*, 377 Blake Street, Brooklyn 12, New York.

ADC JACK

A new jack, designed for jack panels and other similar uses, is currently being marketed by *Audio Development Co.* of Minneapolis.

The frame of the new *ADC* jack is made of nickel-plated, heavy-gauge steel and die-formed and press-welded for utmost rigidity and dimensional accuracy. The brass sleeve is nickel plated. To meet high corrosion resistance requirements, silver alloy con-



tacts and nickel silver springs have been specified in this new unit.

Dimensions of the new jack are

standard and the new unit is interchangeable with any standard telephone-type jack using a ¼" plug.

For full details on this new item, write direct to *Audio Delevopment Co.*, 2833 Thirteenth Ave., So., Minneapolis 7, Minnesota.

PHONOGRAPH AMPLIFIER

The new Model P-10 phonograph amplifier being manufactured by *Newcomb Audio Products Co.* has been designed for the music lover with a limited budget.

Features of this amplifier include individual bass and treble tone controls, three inputs to permit connection to standard crystal pickups, long-playing crystal pickups, magnetic pickups, preamplifier output, AM, FM, or television without the necessity for special switching devices. In addition, the unit features a power socket especially designed to provide an easily accessible source of power for the connection of a *G.E.* or similar preamplifier for those wishing to use a variable reluctance type of pickup. All of the connections are clearly identified on the socket.

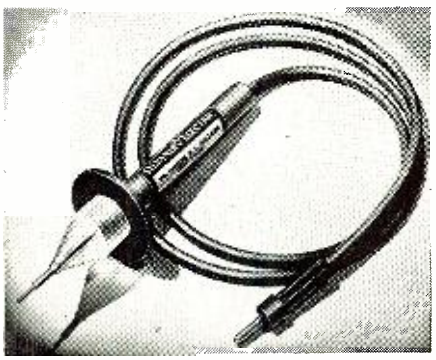
Information and literature on the P-10 amplifier may be obtained from

Newcomb Audio Products Co., 6824 Lexington Avenue, Hollywood 38, California.

POLYMETER MULTIPLIER

The Radio Tube Division of *Sylvania Electric Products Inc.*, 500 Fifth Avenue, New York 18, N. Y., has introduced a new d.c. voltage multiplier for use with the *Sylvania* "Polymeter."

The new multiplier extends the ap-

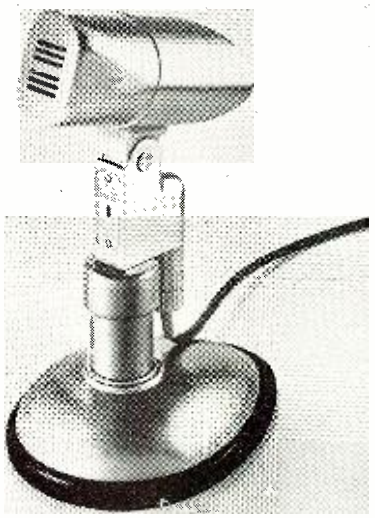


plications of the "Polymeter" to television high voltage supplies, transmitter plate circuits, experimental power supplies, industrial electronic equipment, electronic flash tube circuits, and many other high voltage d.c. circuits.

When used in place of the standard "Polymeter" low-voltage probe, it multiplies each of the present d.c. voltage ranges by a factor of 10.

MIKE DESK STAND

A new "shockproof" microphone desk stand, the Model 426, is the latest addi-



tion to the *Electro-Voice, Inc.* line of equipment.

The Model 426 combines modern streamlined "tear-drop" design with functional utility. It may be used on a desk or table for announcing, newscasting, amateur radio, etc. The newly-developed shock mount, with dual Lord shear-type mountings, is built into the base and provides double shock absorber action, prevents reproduction of external shocks and undesirable stand vibrations, and reduces sidesway of the microphone.

For further information write direct to *Electro-Voice, Inc.*, Buchanan, Mich.

NEW MOBILE UNIT

The Transmitter Division of the *General Electric Company* has announced production on a new single-unit mobile FM transmitter-receiver for communication in the 152-162 mc. band.

Designed for police departments, public utilities, taxi companies, and other agencies, the unit features high selectivity. The transmitter (Type FS-1-B) has a carrier frequency stability from minus 30 degrees to plus 60 degrees C. of better than ± .002 per-cent using a temperature controlled crystal. Its receiver selectivity is 60 kc. 50 db. down, for an adjacent channel and 120 kc., better than 85 db. down, for an alternate channel.

NEW TUBES

METAL CATHODE-RAY PICTURE TUBES

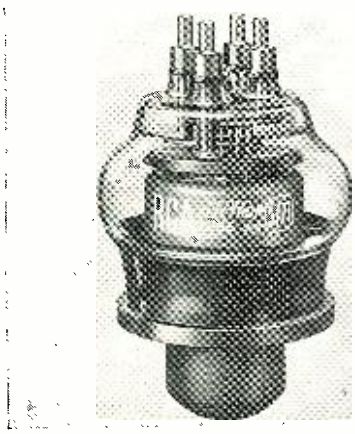
The *Allen B. Du Mont Laboratories, Inc.*, 515 Madison Avenue, New York 22, N. Y., recently introduced the tele-

vision industry's first line of metal cathode-ray picture tubes. Displayed were four new Du Mont receiver models, incorporating the new type tube, and a special table exhibit of 12" and 16" tubes.

The new tubes give the same performance as their glass counterparts, having the same electrical characteristics and the same over-all length. Production of these chrome steel alloy tubes has been undertaken in order to supplement the production of the glass blanks. Credited with the development of the tube are Stanley Koch, Robert Rutherford and Gerald Wright.

RCA TUBES

Type 5771. This is an improved version of the type 880 with thoriated-

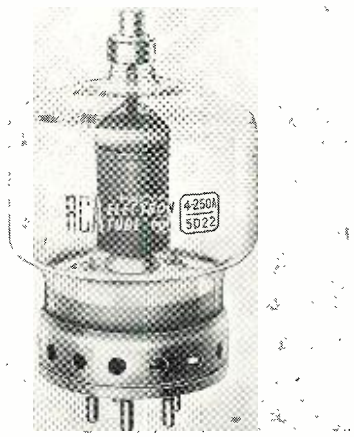


tungsten filament. It has a maximum plate dissipation of 22.5 kw.

The desirable features of the 880 have been augmented by four new features, providing high emission, increased strength, a self-supported filament structure for reliable service, and a maximum filament starting current 4.7 times higher than the operating current, to operate without a filament starter.

The 4-250A/5D22, a forced-air-cooled power tetrode, was recently added to the line of *RCA* power tubes. With a maximum plate dissipation of 250 watts, it is for use as an a.f. power amplifier and modulator, as well as an r.f. power amplifier and oscillator.

Compact in size, it has low grid-plate capacitance and requires low driving power. It may be operated with full ratings up to 75 mc. and with reduced ratings up to 120 mc. Further informa-



tion is available from the Tube Department, Harrison, New Jersey.

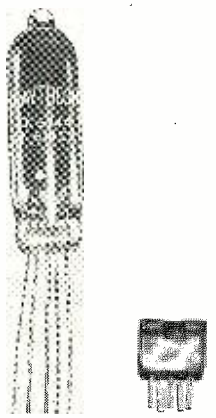
Type 5770 Power Triode. This tube has a maximum plate dissipation of 50 kw. It is a water and forced-air-cooled, grounded-grid type for industrial and broadcast service.

An improved version of 9C21, its added features include: a saving of 60 per-cent in filament power; a large, heavy-duty grid; operation with full ratings up to 20 mc.; strong, cylindrical copper grid support to protect against electron bombardment and radiated filament power.

Further information may be obtained from the Tube Department, *Radio Corporation of America,* Harrison, N. J.

SUBMINIATURE TRIODE

The Special Tube Section of *Raytheon Manufacturing Company,* Newton, Mass., announces the subminiature heater cathode triode type tube, CK5744/CK619CX. This is a high mu triode which is suitable for general purpose use and is also very satisfactory for use as a high frequency mixer



in superhet circuits when a separate oscillator is employed.

This tube is readily available from stock, according to the manufacturer, being backed by sizeable production facilities.

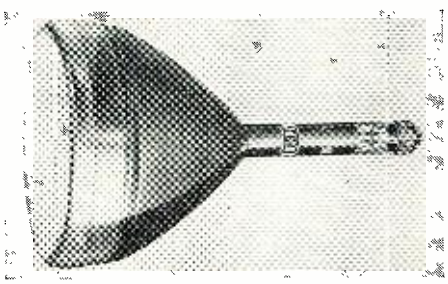
RCA TUBES

Type 5786 Power Triode. This tube, for industrial and broadcast service, will permit the use of a low-cost blower. It has a maximum plate dissipation of 600 watts.

Other features are internal heat shielding and reduced seal losses to give cooler operation at the highest frequencies, and a maximum filament starting current four times higher than the operating current to permit operation without a filament starter.

For further information, contact *RCA* Tube Dept., Harrison, N. J.

The 10KP7 is a 10 inch, direct view cathode-ray tube of the magnetic deflection and magnetic focus type, designed primarily for radar indicator service. The long persistence, cascade

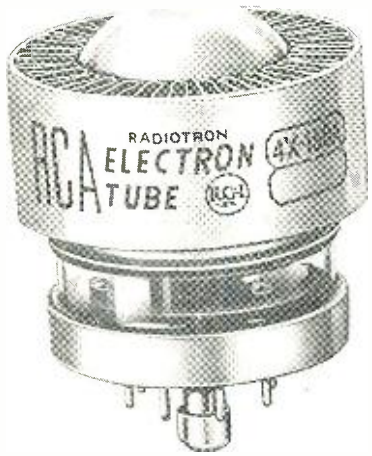


screen exhibits greenish-yellow phosphorescence which persists for several minutes under conditions of adequate excitation and low ambient light.

Featured in the 10KP7 is an electron gun which provides high effective reso-

lution even when the tube is operated with high beam current, as in pulse-modulated service. The face plate is almost flat and provides a large useful screen surface in relation to bulb diameter, facilitating the use of an external, transparent, calibrated scale. Contact the Tube Department of *RCA*, Harrison, N. J., for further details.

Power Tetrode. The 4X-150A is a forced-air-cooled power tetrode with a

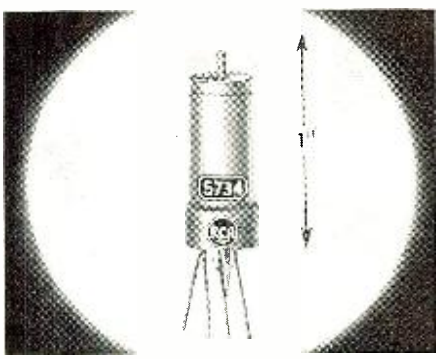


maximum plate dissipation of 150 watts. Very small and compact, it is intended for power amplifier or oscillator service at frequencies up to 500 mc.

It is useful as a wide-band amplifier in video applications. The terminal arrangement facilitates its use with tank circuits of the coaxial type.

Triode Transducer

Smaller in diameter than a cigarette and only half as long, the mechano-electronic triode transducer, *RCA*-5734, is intended for applications involving the measurement of mechanical vibration. It is constructed with a metal



envelope and weighs 1/16 ounce. Its moving element is designed to have low inertia, and there is a deflection sensitivity of 40 volts per degree deflection of its plate shaft. The part of the plate shaft inside the tube has a free cantilever resonance higher than 12,000 cycles per second, permitting measurements of vibration up to 12,000 cycles per second. The Tube Department of *RCA*, Harrison, N. J., is the manufacturer.

The new type 5762 has a maximum plate dissipation of 2.5 kilowatts and can be operated with full plate voltage and plate input up to 110 megacycles. It has a very efficient radiator, a feature of prime interest to industrial users, that permits use of an appreciably smaller blower than is normally used for tubes having its power-handling capability.

The thoriated-tungsten filament is economical in power consumption as compared with a pure tungsten filament and also provides a reserve of emission for long service.

Having a high ratio of permissible filament starting current to normal operating current, the 5762 can in general be used without a filament starter. Other features include complete shielding between filament leads and plate, low grid-plate capacitance, and high perveance.

Further information may be obtained from *RCA* Tube Division, Harrison, N. J.

RADIO TUBE WEIGHT CUT 50%

Westinghouse engineers have cut the weight of a giant radio broadcasting tube 56% by adapting an idea used for lightening warplane engines.

The success of aluminum cooling fins for aircraft engine cylinders suggested their tryout in the radiators of transmitting tubes. As a result, 25,000-watt tubes with laboratory-built aluminum radiators weigh only 98 pounds instead of the conventional 225-pound tubes with copper radiators.

A 59% weight reduction was achieved when the aluminum radiator was fitted to a 10,000-watt transmitting tube; the combined tube and radiator weight was cut from 44 to 18 pounds.

Lightweight radiators of aluminum cut shipping costs and permit tube installation in the close quarters of a radio transmitter by one man instead of two. Radiator appearance is improved because the fresh aluminum color is retained.

Aluminum tube radiators were made feasible by an aluminum-to-steel molecular bonding process developed after previous designs failed because the fast oxidizing rate of aluminum rendered its soldering directly to copper anode impractical.

TECHNICAL BOOKS

"PRINCIPLES OF MICROWAVE CIRCUITS", C. B. Montgomery, R. H. Dicke and E. M. Purcell. Published by McGraw-Hill Book Company, 330 West 42nd Street, New York 18, N. Y. 486 pages. $6.00.

The development of the impedance concept and its utilization through the theory of linear networks was an important step forward in the engineering application of low-frequency currents. This volume is devoted to an exposition of the impedance concept and to the equivalent circuits of microwave devices. The underlying principles of these equivalent circuits and the results that may be obtained by their use are emphasized.

Specific devices are not discussed except as illustrations of the general methods under consideration. (These devices and the details of the design procedure are treated in other volumes of this series.) The solutions of the boundary-value problems which give the susceptances of microwave-circuit elements are likewise omitted.

The publication of this volume was inspired by the tremendous research and effort that went into the development of radar and related techniques during World War II. This work resulted not only in hundreds of radar sets for military (and some for possible peacetime) use but also in a great body of information and new techniques in the electronics and high-frequency fields.

"MICROWAVES AND RADAR ELECTRONICS", Ernest C. Pollard and Julian M. Sturtevant. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 426 pages. $5.00.

A physicist and a chemist combine forces in this book to present the post-war developments and the peacetime applications of radar. After surveying the field and outlining the special knowledge of electricity and magnetism necessary to an understanding of microwaves, the authors discuss in detail the significance of microwave and radar electronics techniques in physical and chemical research.

The essential facts about microwave circuits are developed on the fundamental basis of electricity and magnetism, rather than from an extension of the theory of circuits with lumped parameters. Pulse circuits are considered as a unified subject, since the fundamental problems and basic methods of solving such problems accompany all types of pulse circuits.

The book is conclusively a post-war work and emphasis is placed on problems which have arisen since the end of the war.

"PRINCIPLES and METHODS of TELEMETERING", Perry A. Borden and Gustave M. Theynell. Reinhold Publishing Corp., 330 W. Forty-Second Street, New York 18, N. Y. 230 pages. $4.50.

Both the users and the manufacturers of telemetering apparatus have deplored the lack of a single modern book which discusses, from a consistent point of view and in perspective of past developments as modified by current advances, the essentials of telemetering equipment.

With the knowledge of this need the authors have obtained first-hand information by direct contact with responsible technical representatives of outstanding manufacturers, distributors, and users of this equipment. These representatives are engineers—not salesmen—so that the features of technical interest, rather than the "selling points" of each instrument are discussed.

If, in places, the work appears to lack balance, perhaps there has been too great a temptation to proportion the treatment of individual systems to the volume of material made available. Realizing that installation methods, adjustments, and operating procedures are best obtained from the instruction books and data sheets issued by the respective manufacturers, the authors have not thought it necessary to burden the present volume with such material.

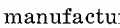
The book provides an analytical and descriptive treatment of a large variety of telemetering devices originating in almost as great a variety of sources.

"VELOCITY - MODULATED THERMIONIC TUBES", A. H. W. Beck. Published by Cambridge University Press and The Macmillan Company, 60 Fifth Avenue, New York, N. Y. 180 pages. $3.75.

The basic plan of this book is to give a general introduction to velocity-modulation tubes and their mode of operation in a pattern intelligible to anyone with a reasonably adequate knowledge of pre-1939 radio technique. The book is more of a personal account of a division of research which is still progressing rapidly than a formal textbook with full and critical documentation.

Mr. Beck, an expert on the war-time developments of his subject, builds up the theory from simple postulates by successive refinements so that physical facts dominate mathematical considerations, and a realistic picture of the way in which a physical theory is arrived at can be obtained.

The essential minimum of information on resonant cavities is included, and there is some information on heavy current electron beams. The major part of the work is, however, the general theory of the interchange of energy between field and beam with application to various type of V.M. tubes. The book is an addition to the new series, *Modern Radio Technique*, edited by Mr. J. A. Ratcliffe.



Computer Applications

(*Continued from page* 6)

computer can be made to control an extremely wide range of operations and processes.

The fundamental method of application of electronic analogue computers to automatic control problems will best be understood by consideration of a few specific applications which illustrate the fundamental methods which are involved. An outstanding example of the application of electronic computing methods to an extremely difficult and complex mathematical problem, in which the required results are very critical, is in the automatic electronic gunsight computers which were used to increase the accuracy of machine-gun fire from bombers during the war. The accuracy and reliability requirements of the computer in this case are much greater than in the average commercial application, since human lives are involved.

In the gun ballistic computer problem, the computer must continually solve the equations of motion of the projectile in terms of a number of independent variables which may remain constant, or change during the course of the calculation. The result is given in terms of two voltages (representing the lateral and vertical ballistic correction voltages), which are translated into the respective correction angles by position servos. In a typical case, the input variables are gun positions, azimuth and elevation, target range, aircraft true air speed, relative air density, the muzzle velocity of the type of ammunition used, and a factor called the ammunition constant. These variables may be denoted by the symbols:

A = projectile muzzle velocity
B = aircraft true air speed
C = gun azimuth
D = gun zenith
E = ammunition constant (for particular type used)
F = relative air density
G = gravitational acceleration
H = target range

and the results of the computation by:

X = lateral ballistic sight line correction

Fig. 8. Three-sequence preset electronic digital computer.

Y = vertical ballistic sight line correction

Z = computed time of flight of projectile to target

W = computed projectile initial true air speed

Then the lateral and vertical ballistic corrections are obtained from the following four equations:

$$W = A + B \cos C \sin D \quad \ldots\ldots\ldots \quad (1)$$

$$(1 + ZEF\sqrt{W})\ H + Z^2\ EFB\sqrt{W} \cos C \sin D + \tfrac{1}{2}\ GZ^2 \cos D - AZ = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

$$(1 + ZEF\sqrt{W})\ HY - Z^2\ EFB\sqrt{W} \cos C \cos D + \tfrac{1}{2}\ GZ^2 \sin D = 0. \quad (3)$$

$$(1 + ZEF\sqrt{W})\ HX - Z^2\ EFB\sqrt{W} \sin C = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

The manner in which the computer circuit is set up for the solution of these equations is illustrated in Fig. 3. The equations to be solved involve the functions of addition, subtraction, multiplication, division, trigonometric and functional transformations, but no differential or integral operations are required. Therefore, the calculations may readily be performed with alternating current as the function variable, using constant-impedance, bridged-T attenuators for multiplication and resistance mixing networks for addition. The mathematical relations at the various points of the circuit are indicated in the diagram. The input variables are set up adjusting the various attenuators to the proper values, and the solutions to the equations are automatically determined by the servo systems. The solutions of the simultaneous equations are obtained by setting up each equation to include the unknown quantities as if their values were known, with the servos controlling the actual setting of each of the unknown values. Then, when the complete solution for the four equations has been set up as indicated in Fig. 3, the servos automatically come into balance for zero voltage. Since the four sets of equations have been electrically interconnected, the system comes into balance only when all four equations are satisfied simultaneously.

In the actual operation of this gun-sight computer, the input variables A, B, E, F, and G are generally set into the circuit by setting the respective potentiometers to the proper value before the guns are used in actual combat, since their values are known in advance. The value of H, the target range, may be determined in any one of several ways and must be set in continuously during combat, since it is constantly changing. The remaining two variables C and D represent the line-of-sight position of the target, and are continuously and automatically determined during combat by sighting at the target. The resulting values of X and Y (which are continuously and automatically determined for any variations of the input variables) represent the required values for correct aiming of the guns, and direct the gun settings according to the settings of the servos. The electronic computer in this application was of great importance during the last war, and saved countless lives and aircraft by constantly extending the range and accuracy of defensive machine-gun fire.

Automatic Control of Industrial Processes

The basic principles and procedures which are used in the automatic gun-sight computer are exactly the same as those which are involved in the automatic control of industrial processes and operations. The basic problem is to determine which variables represent the operation of the process, and to derive a proper relationship between these variables and the quality of the final product. This is generally done empirically, and may either be known before the process equipment is set up, or while the process is being developed (either in the laboratory or in the pilot plant stage of development), or it may be done during the course of actual operation. Once the proper relationship is known, then it is a very simple matter to set up an electronic computer to control the process operation according to the prescribed relationship. In addition, if at any time it is necessary to change the mode of operation, the computer characteristics can readily be modified by very simple circuit changes to incorporate the desired changes in the process operation.

Part II, which will appear next month, continues with a discussion of Automatic Control, and covers the electronic calculation of controller response.

(To be continued)

Personals

F. R. BENEDICT is the new manager of the headquarters engineering departments of the *Westinghouse Electric Corporation.* A graduate of Tri-State College in 1928 with a B.S. degree in electrical engineering, he joined the *Westinghouse* student course that year. In 1938 he was made liaison engineer on the chief engineer's staff. He was made manager of the product analysis section and then manager of the industry engineering department in 1945.

DR. KARL KESSLER has been appointed to the staff of the Atomic and Molecular Physics Division, National Bureau of Standards. During the war, while at the University of Michigan, he served as consultant to the Philadelphia and Brooklyn Navy Yards and was also consultant on spectrography for a number of industrial concerns. Dr. Kessler is a member of the American Physical Society, Phi Beta Kappa and Sigma Xi.

ROBERT E. MOE, as new division engineer for electronic receiving tube product lines of *General Electric Company's* Tube Division, will be responsible for all receiving tube design and application, engineering, and standardizing activities. Mr. Moe is a senior member of the Institute of Radio Engineers and also affiliated with Tau Beta Pi and Eta Kappa Nu. A native of Appleton, Wisconsin, he graduated from the U. of Wisconsin with a B.S. in E. E.

GEORGE D. O'NEILL has been elected Fellow by the board of directors of the Institute of Radio Engineers. Assistant to the manager of research, *Sylvania Electric Products Inc.*, he began his engineering career with *Westinghouse Lamp Company* in 1925. In 1928 he joined the *Sylvania* engineering staff at Salem, Massachusetts. He will receive a fellowship award for his work in electron tube theory and design during the Institute's National Convention in 1949.

EMIL SCHAEFFER, new chief engineer of *Elizabeth Iron Works, Inc.,* Tower Division, will be in charge of the design and construction of that part of the company's structural steel fabrication activities. A graduate of Vienna Technical University, he held the position of chief engineer for the *Krupp Works* Dept. of Steel Construction for more than twenty years. From 1941 to 1946 in America, he designed radio towers and masts for the U. S. Army and Navy.

DR. GEORGE E. ZIEGLER will be the new Director of the Midwest Research Institute. During the past ten years, Dr. Ziegler has devoted much time to solving the problems of industry through the practical application of the fundamental sciences to the problems of industry. He received his Ph. D. from the U. of Chi. and is known for his experimental x-ray diffraction studies. He has been acting chief administrator of the Institute for six months.

The Atomic Clock

(*Continued from page* 14)

cell, a rectangular ½x¼-inch copper tube wound in a compact 30-foot spiral about the clock.

The new development uses an absorption frequency of ammonia to hold a microwave signal fixed. If the microwave output of a generator differs in frequency from the ammonia absorption line, then the control circuits generate an "error signal" which brings the microwave signal back to the frequency of the spectrum line. The oscillator generating the microwave signal is thus controlled, and the setting of the clock which it drives can be compared with a conventional astronomical clock.

The microwave signal is initiated by a 100-kilocycle quartz-crystal oscillator or any other oscillator which, for purposes of convenience and accuracy, is designed for a high degree of stability. By means of vacuum-tube circuits and silicon-crystal diodes, this frequency is multiplied to provide output signals throughout the microwave range. These signals are compared with the frequency of a microwave spectrum line, in this case of ammonia gas, by suitable control circuits, often called frequency discriminator or "servo" circuits. If the quartz-crystal oscillator drifts after the microwave signal at the upper end of the multiplier chain has been exactly tuned to the frequency of the spectrum line, the discriminator circuit generates an output signal which, through the proper control circuits, can be applied to the oscillator at the bottom of the multiplier chain to bring it back to the proper frequency. By means of a frequency divider, the 100 kilocycles may be reduced to any desired frequency for driving a clock; e.g. one thousand cycles or 50 cycles.

Frequency-discriminator or servomechanism control circuits for atomic clocks might be developed in many different forms. The electronic control circuit in the present atomic clock is one successful form of several being developed by NBS. It is now being refined to give even greater time-keeping accuracy.

The fundamental frequency signal generated by the 100-kilocycle oscillator is first multiplied up to 270 mc. by a frequency-multiplying chain using standard low-frequency tubes. In the next step, the multiplying chain is continued up to 2970 mc. by means of a frequency-multiplying klystron, which is also modulated by an FM oscillator generating a signal at 13.8 ± 0.12 mc. This makes the frequency-modulated output of the klystron 2983.8 ± 0.12 mc. After further amplification, the frequency-modulated signal is multiplied

in a silicon crystal rectifier to 23,870.4 ± 0.96 mc., and fed to the ammonia absorption cell. As the frequency of this modulated control signal sweeps across the absorption line frequency of the ammonia vapor, the signal reaching the silicon crystal detector at the end of the absorption cell dips because of the absorption, thus giving a negative output pulse.

A second pulse is generated when the output of the frequency-modulated oscillator at 13.8 ± 0.12 mc. is fed to a mixer (or radio receiver) into which is also fed a 12.5-mc. signal from the quartz-crystal multiplying chain. When the signal sweeps across the proper frequency to be tuned in (12.5 mc. plus the 1.39 mc. intermediate frequency of the receiver, or 13.89 mc.), an output pulse is generated. The time interval between the two pulses—that from the absorption cell, caused by the absorption line, and that from the receiver or mixer—is a measure of the degree to which the frequency-multiplying chain is tuned to the absorption line. The two pulses can therefore be made to control a discriminator circuit which will give zero output when the time interval is right (that is, when the circuit is tuned to the absorption line) and will generate a control signal when the time interval is wrong. If the quartz-crystal oscillator drifts in frequency to higher values, the time interval between the two pulses increases; for frequencies which are too low, the interval decreases. The control signals thus generated are fed to a reactance tube, which then forces the quartz-crystal circuit to oscillate at the correct frequency to tune to the absorption line. The quartz-crystal oscillator is thus locked to the ammonia line. Frequency dividers then divide the precise 100-kilocycle signal down to 50 cycles to drive an ordinary synchronous-motor clock, and also down to 1000 cycles to drive a special synchronous-motor clock, which is designed for exact adjustment and comparison with astronomical time to within 5/1000 of a second.

Control of the quartz-crystal circuit depends on the relative duration of the positive and negative portions of a square-wave signal generated by the discriminator. In the discriminator, the two pulses between which the time interval is to be measured turn a trigger circuit or square-wave generator on and off. When the time interval is correct, the on-off cycle generates no output signal from the positive and negative peak detectors driven by the square-wave signal. The detectors or rectifiers draw current on the positive and negative peaks of the square wave, but when the positive and negative portions of the square wave are of equal duration, they balance and give no direct current output. However, if the time interval between the two input driving pulses gets longer or shorter, the relative duration of the positive and negative parts of the square wave changes so that a resultant direct-current output is generated. This output is positive or negative, depending on the change in the time interval. Thus, no control voltage is generated when the quartz-crystal oscillator is on the proper frequency to agree, through the frequency-multiplying chain, with the ammonia line; but a positive or negative control voltage is produced for correcting the oscillator circuit when it drifts one way or the other from its proper value.

The atomic clock program is being carried on at the National Bureau of Standards along several different lines. Among these is a project being developed with the cooperation of the atomic beam laboratory of Columbia University which may result in greatly improved accuracy. In this method, quantum transitions in beams of atoms such as cesium will be used to establish frequency and time standards. The broadening of the lines by collisions and Doppler effect is largely eliminated in this method so that the potential accuracy is increased by a factor of 10 to 100 or more. Calculations show that an ultimate accuracy of one part in ten billion may be reached. The atomic beam is again used in conjunction with a quartz-crystal oscillator and frequency multiplier system, just as in the present method using an absorption cell.

The chemical analysis of many heavy molecules by means of a microwave spectroscope has been carried out by many investigators. This makes it highly desirable to place frequency standards on an atomic basis at an early date in order that better precision can be obtained in the measurement of molecular constants. More and more chemicals will be analyzed as the technique is pushed to higher and higher frequencies in the microwave region.

News Briefs

(*Continued from page* 21)

construction details but also explains care and adjustment of the apparatus. The price is 10 cents a copy, and may be ordered from V. W. Palen, Bureau of Public Information, Washington Square, New York 3, N. Y.

Inventions

A group of documents just released to the public contains descriptions of a number of inventions relating to the electrical and electronic fields.

Among these are two inventions making possible stable voltage control under wide variations of d.c. loads. Another is a satisfactory moisture-proofing compound for radio crystal holders. Also of particular interest are a special "antenna" device for transferring energy between coaxial cables and wave guides, highspeed keying devices for remote-control electronic systems, and an improved shielding system to protect cathode-ray tubes from stray electromagnetic fields.

Photostat and microfilm copies of the documents may be purchased from the Library of Congress, Photoduplication Service, Publication Board Project, Washington 25, D. C., with remittance payable to the Librarian of Congress.

Telemetering

The basic problems of designing telemetering systems are discussed in a report PB 93938, "Some Fundamental Aspects of Telemetering," price $10.00, or in microfilm for $3.50. This is an attempt to deal with inherent problems of telemetering as distinguished from incidental technical considerations of the equipment used. Errors of telemetering systems are also analyzed to determine relation to the type of system and their importance in any system. Address Library of Congress, Photoduplication Service, Publication Board Project, Washington 25, D. C., check or money order payable to Librarian of Congress.

Antenna Coupler

(*Continued from page 7*)

On one end of the inner driving sleeve is a spur gear, driven externally through an off-center pinion. Thus the inner contact is controlled through an epicyclic gear train. Another gear is pinned to the center shaft, rotating the coil assembly as a unit. A double thickness gear rolls on the central shaft and controls the motion of the inner contact through the epicyclic train already mentioned.

Television

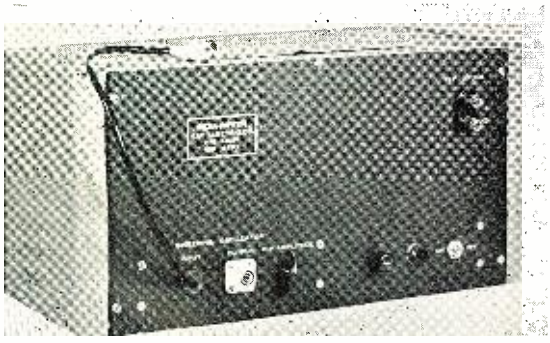
(*Continued from page 13*)

pulse marker voltage, is fed to the r.f. oscillator where it produces the gating action described before. The a.c. voltage across the neon bulb is also coupled to one section of a 12AU7, producing at the plate of the tube a square-wave voltage of the same phase as at the plate of the previously mentioned 6J6. This square-wave voltage is fed through an integrating network to produce a triangular shaped wave which is fed to the other half of the 12AU7, acting as a cathode follower. Thus the output of this tube provides a sweep voltage for the associated cathode-ray oscilloscope which is always in phase with the gating voltage and in phase with the frequency sweep when the phase-shifting network has been adjusted.

Power Supply. The power supply section of the instrument consists of a standard full-wave rectifier, with a single section condenser filter feeding a standard-type, degenerative voltage regulator circuit to maintain a supply potential of 250 volts for the rest of the instrument under all variations in line potential.

Attenuator System. The r.f. output of the oscillator is fed through a series resistor to a low-impedance potentiometer. The maximum voltage across the potentiometer is set at the factory to one volt and is adjustable, according to the zero resistance of the particular potentiometer, to less than 0.1 volt. This voltage is fed through two toggle-switch type attenuator sections, each having an attenuation of 10 to 1 or 20 db., and then to a miniature coaxial jack on the panel. The jack normally feeds a terminated 75-ohm cable, and the two attenuators are designed to show an impedance of 75 ohms when feeding a 75-ohm load, so that the impedance into which the potentiometer feeds its voltage is constant at all times. The attenuator is not a precision device, as only 5% resistors are used, and the linear panel scale provided does *not* give readings exactly proportional to output voltage.

Fig. 7. The Mega-Pipper.



Monitoring Signal. The r.f. output voltage at the panel coax jack is also fed to a 1N34 crystal detector, and the rectified voltage, after being filtered, is fed to a binding post on the panel marked "MON."

The production of marker pips can be made separate from the sweep generator. A suitable marker instrument is the Mega-Pipper shown in Fig. 7. A block diagram of the unit is shown in Fig. 8 and the actual schematic in Fig. 6. Examination of the block diagram reveals that the output of the Mega-Pipper is not fed into the i.f. system of the receiver, as is customary, but fed directly to the oscilloscope. In this way, the amplitude of the markers is unaffected by any adjustments in the receiver and consequently they are visible at all times. The frequencies spotted by the markers are those of the sound carrier, the picture carrier, and the adjacent channel traps. All these would be required in sets using the conventional television system. In the alignment of sets using the intercarrier system, adjacent channel traps are not ordinarily used, and the pips corresponding to these two frequencies would be disregarded.

In the schematic diagram, Fig. 6, the input signal fed to the buffer amplifier, V_1, is the same frequency-modulated output from the sweep generator that is applied to the i.f. amplifiers under test. This type of arrangement is necessary here in order that the marker output of the Mega-Pipper appear at the proper points along the oscilloscope pattern. The initial amplifier, V_1, is broadly tuned to cover the range of present RMA i.f. requirements and functions primarily to isolate the local oscillator from the television set under test. The local oscillator is crystal-controlled and is set at a frequency midway between those of the receiver picture and sound carrier i.f. values. This midpoint frequency will vary with the receiver. The oscillator is a crystal-controlled Pierce circuit with the crystal frequency one-half the actual output value desired. The second harmonic is then used in the mixer to produce the proper pip signals. For those who are unfamiliar with this circuit, the Pierce oscillator is equivalent to the widely used ultraudion with the crystal replacing the tuned circuit. Although its output is

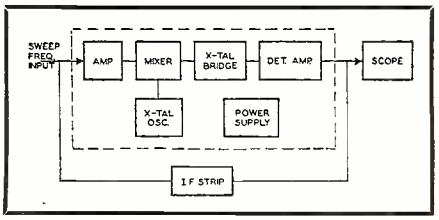


Fig. 8. Block diagram of the Mega-Pipper shown in Fig. 7.

generally small if taken directly from the crystal, it can be made greater at the second harmonic by using an electron-coupled arrangement such as shown here. C_1 is the feedback condenser, and its value will determine the amount of feedback.

The sweep signal from the external generator and the output of the local oscillator are heterodyned in the mixer, V_2, and then passed to a dual crystal bridge. This bridge, consisting of two *L-C* circuits tuned to the crystal frequencies, is resonant at 2.25 and 3.75 megacycles. With this arrangement the unit functions as a superheterodyne receiver with two intermediate frequencies, each having an image response. As the frequency of the input signal passes through each of the four desired frequencies, a sharp pip is obtained from the bridge circuits. The pips are then amplified and detected.

Four pips are obtained using only two crystals, because each crystal frequency (i.e., 2.25 mc. and 3.75 mc.) appears twice during the mixing operation. Thus, each appears once when the sweep frequency is above the local oscillator frequency, and each appears again when the sweep frequency is below the local oscillator frequency. As an illustration, let it be assumed that a sound carrier i.f. of 21.25 mc. is required. This will establish the picture carrier i.f. at 25.75 mc. and the adjacent channel traps at 19.75 and 27.25 mc. If these frequencies are plotted on a scale, then by using a mid-frequency of 23.5 mc. for the local oscillator, it will be seen that 21.25 mc. and 25.75 mc. are each 2.25 mc. distant from the oscillator frequency, while 19.75 mc. and 27.25 mc. are each 3.75 mc. distant from the same 23.5 mc. As the input signal sweeps through its range of frequencies, it will provide difference frequencies at the output of the mixer at values of 2.25 mc. and 3.75 mc. Since the various pips are all separated in time, they will appear at different points along the time base of the oscilloscope pattern. These will then be superimposed over the frequency response curve obtained independently from the i.f. system under test and act as markers. Whether or not a base line will appear on the scope screen will depend upon the design of the sweep generator.

Unusual Amplifier

(*Continued from page* 10)

and consequent non-linearity will often be observed. In some instances, the more elaborate transformer designs of very high cost have been found less satisfactory in measurements of intermodulation distortion than less complicated and less expensive designs. As almost all investigators of power amplifiers eventually conclude, the output transformer is probably the most important individual factor in obtaining the best possible results. Obviously the side of the driving stage that requires compensation by using this resistor to obtain satisfactory balance will vary with the characteristics of the output transformer.

This resistor, when connected in the circuit to ground, shunts the cathode load resistor on one of the push-pull driver tubes. This reduces the cathode load across which the feedback voltage is developed and lowers the percentage of feedback applied to this side of the push-pull circuits. Effectively this increases the gain of the associated circuit and, with proper adjustment, can be made to compensate almost perfectly for unbalance in the operation of the output transformer. Once adjusted, it does not need further attention.

Obviously in making this adjustment the output tubes and the push-pull driver tubes should be carefully selected for inherent balance in these stages so that the measurement will not be confused by unbalance in the tubes. All resistors in the push-pull stages, as well as the cathode and plate load resistors for the phase inverter, must be balanced with as much accuracy as possible. Any unbalance in these components will tend to increase the non-linear distortion appearing in the output.

After construction of the amplifier is complete, it is essential to check all of the voltage measurements in the balanced circuits to make certain that the components have not changed in value through excessive heat in soldering connections. In the effort to make short connections, which is indeed desirable, it is not uncommon to apply sufficient heat to change the value of a resistor appreciably and permanently. If the voltage measurements indicate such a change, the component must be replaced. However, once the stages are properly balanced, there appears to be relatively little danger of a change in values that will cause unbalance, except, of course, with components that are inherently defective in a way that shows up only under continuous operation. Otherwise, since all of the balanced components are operating under identical conditions, any change caused in them by heat or other factors will tend to be in the same direction and in the same order of magnitude.

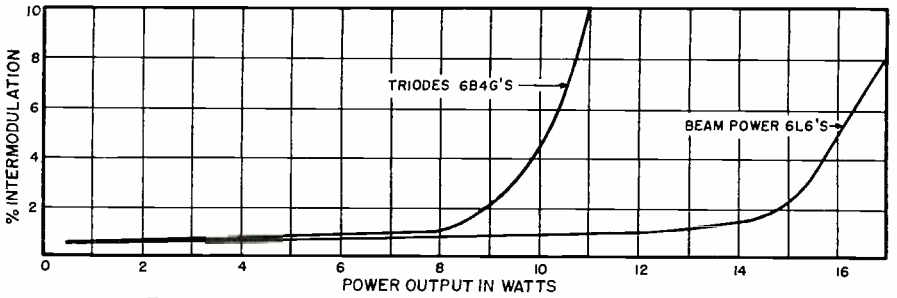


Fig. 5. Intermodulation distortion at various power levels.

After the circuits are properly balanced with regard to the output transformer and "mirrored" push-pull components, small changes, with age, in the characteristics of the tubes do not appear to make any appreciable difference in the results obtained.

Observation of the waveform in the grid circuit of the output tubes is interesting. As in all amplifiers where feedback is used, this waveform is very distorted even when the input and output waveforms from the entire amplifier are perfect sine waves. The reason, of course, is that this is the corrective waveform containing all of the inverse corrective distortion factors. When the output tubes are driven into square wave distortion, this intermediate waveform shows the extremely high peak in the center of the wave developed by the feedback voltage as the circuits "try" to correct the square wave and bring it back into sine waveform.

Fig. 3 shows the frequency response of the amplifier over the audio range. It is flat within a fraction of one decibel over a range that extends appreciably above and below the spectrum of normal hearing. In fact, it is down only one decibel at 10 c.p.s and down 4 decibels at 200,000 c.p.s.!

Neither the content of this article nor the design of this amplifier pretends to resolve the triode/beam power tetrode controversy. It does offer a means for the average person to conduct his own listening tests and reach his own conclusions without buying or building more than one amplifier. One distinct advantage in this regard is that the same components and the same circuits are used for both tube types, ruling out a number of variables that would otherwise exist. Obviously, to be fair, such tests must be conducted at power levels below the break-over point for the triode tubes. In almost all home installations and even in small auditoriums, the amplifier has adequate reserve power with either tube type provided that reasonably efficient loudspeaker systems are used.

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Low-Noise Tube

(*Continued from page* 18)

microphonic output of this tube is less than it is in other types tested which included many tubes which had been used specifically for this particular feature in the past. In addition to those performance features, we believe the design is one which can be manufactured at a good yield, thus insuring a uniform and a relatively low cost product.

The original intention was to provide a type which would be suitable for broadcast preamplifier work where a high degree of excellence, especially in the field of FM, is required. In addition, due to the attractive price and performance balance, the tube should be suitable in a great many other applications such as wire recorders and public address amplifiers where the low-noise and low-microphonic features are important. The 12AY7, although not intentionally designed for such service, has been used very successfully as a variable transconductance phase modulator tube for mobile radio equipment employing narrow band FM. In this application other tubes were quite unsuitable because of the noise modulation caused by mechanical shock and vibration. This type may also find considerable application in high-quality receivers where the newer low-level magnetic phonograph pickups are used. Also, it should provide a solution to the generally difficult problem of the low-level stages for electrocardiographs, electroencephalographs and other special instruments of a similar type.

The design and development of the tube described in this paper was carried out by Messrs. W. T. Millis and W. C. Louden of the *General Electric Company's* Tube Division. The authors wish to acknowledge the assistance of A. F. Dickerson and J. W. Macy, also of the Tube Division, in the design of the circuits discussed.

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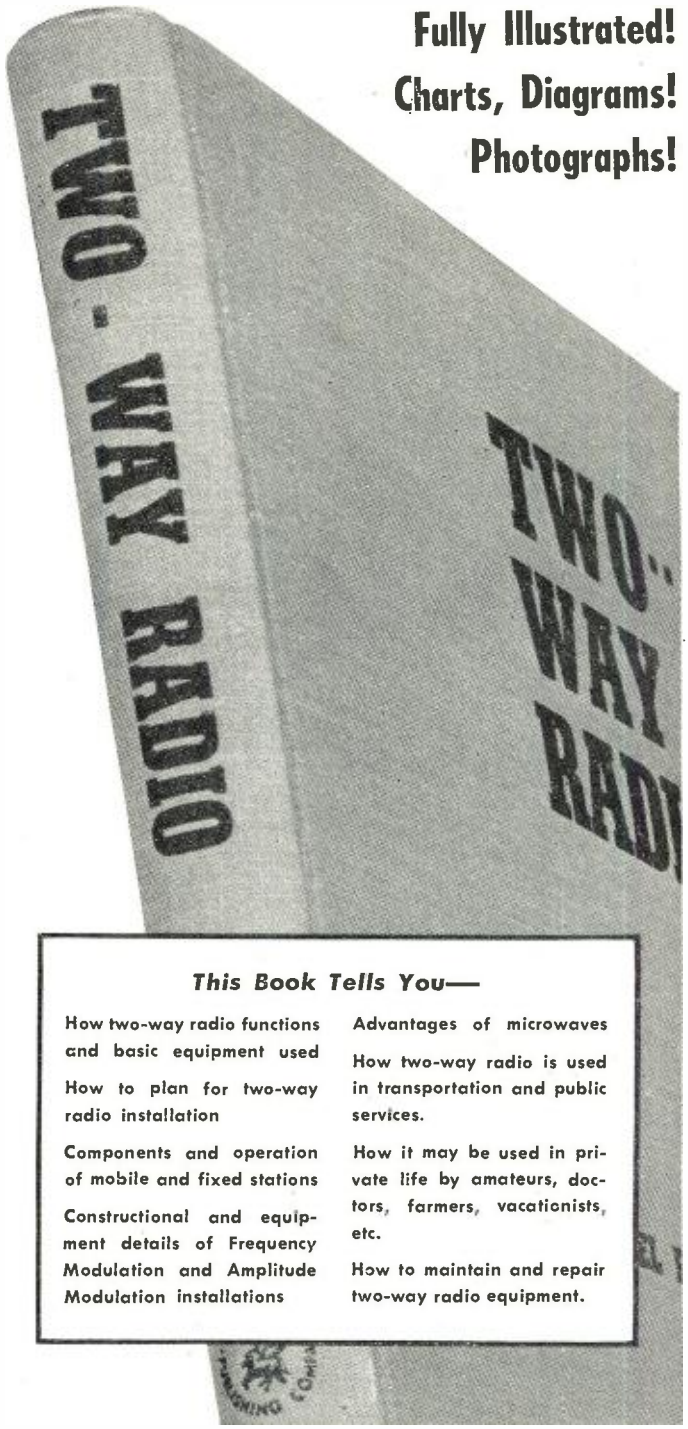

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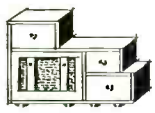

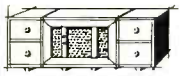

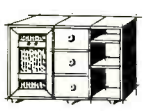

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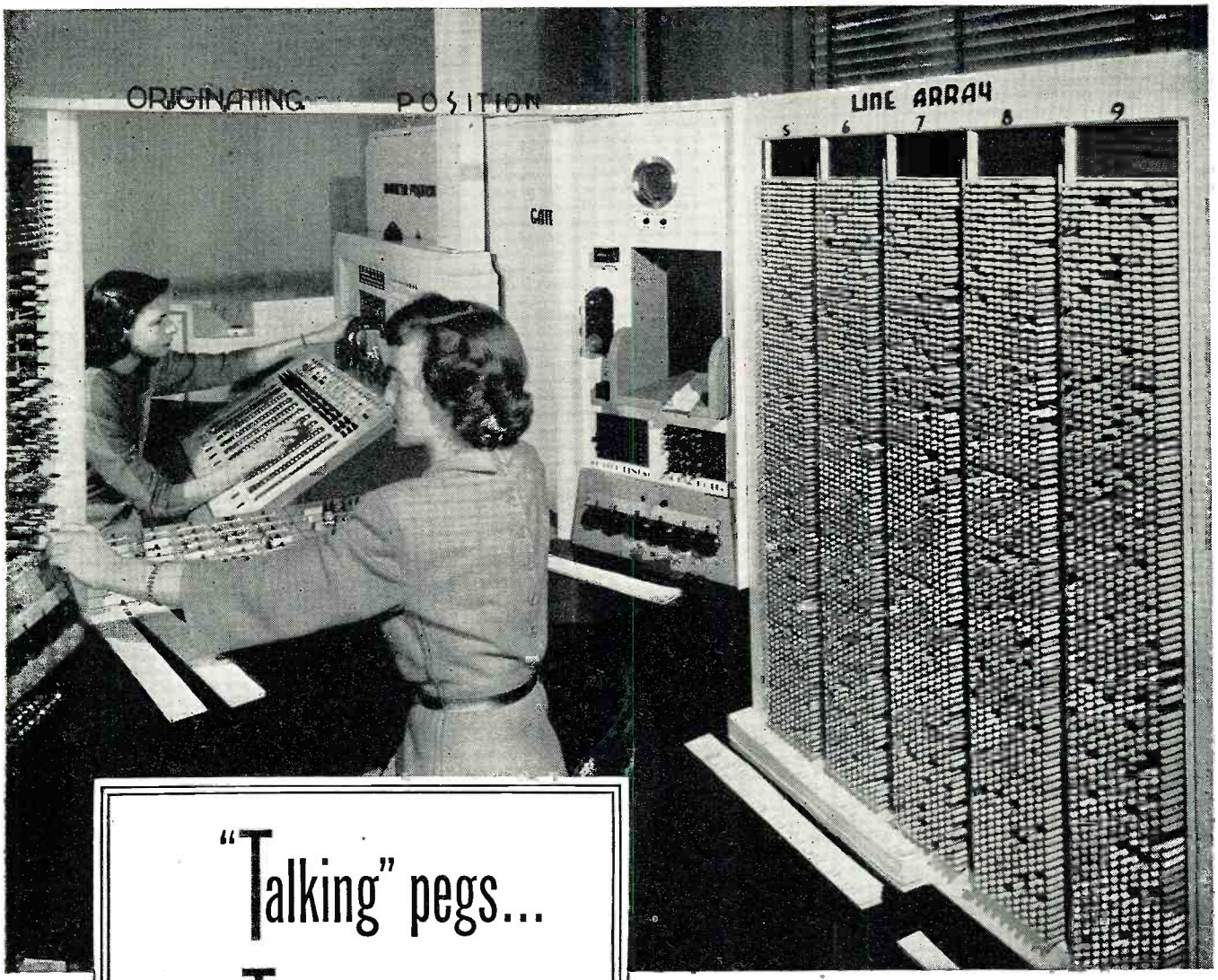

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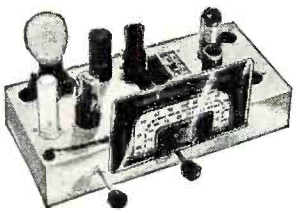

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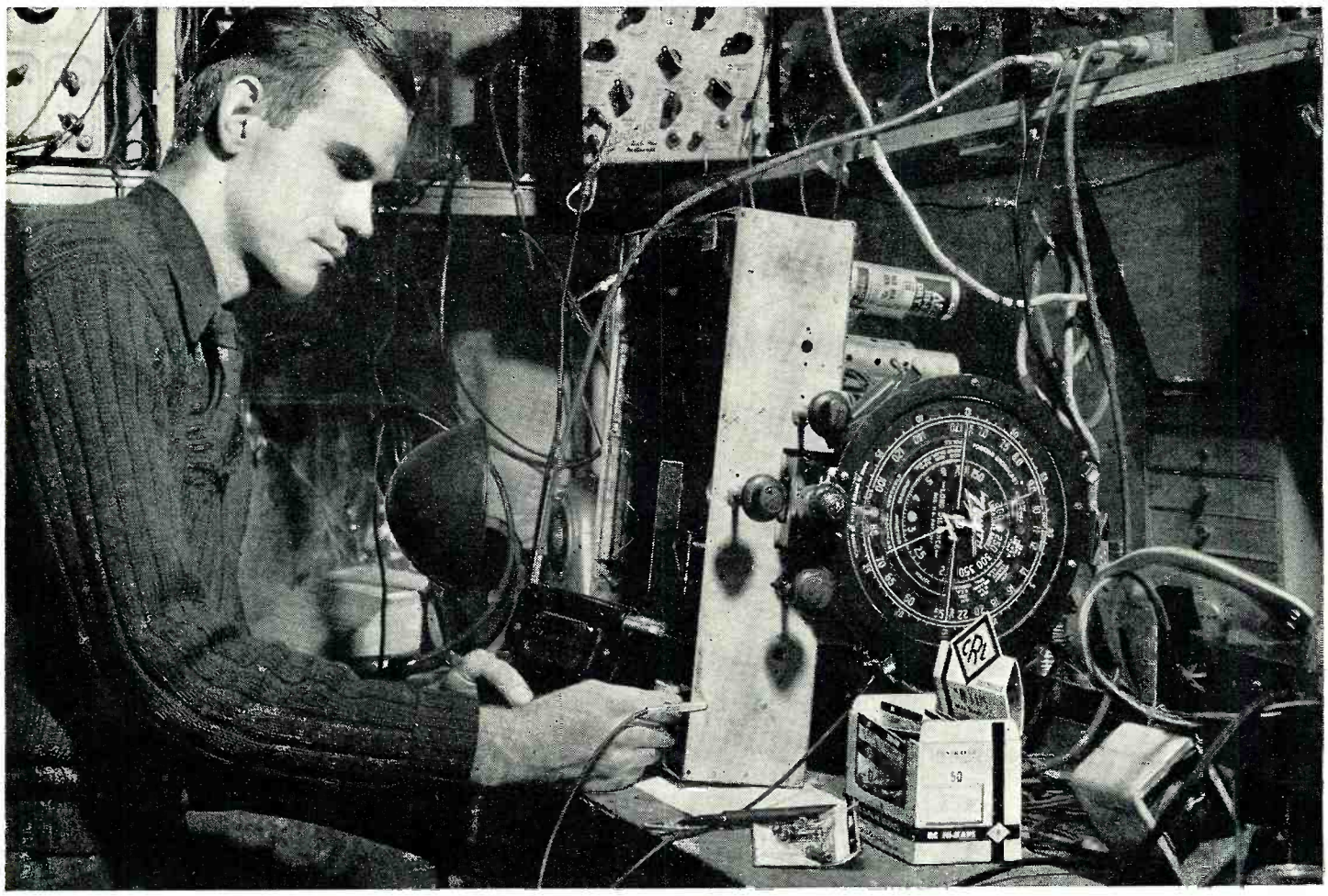

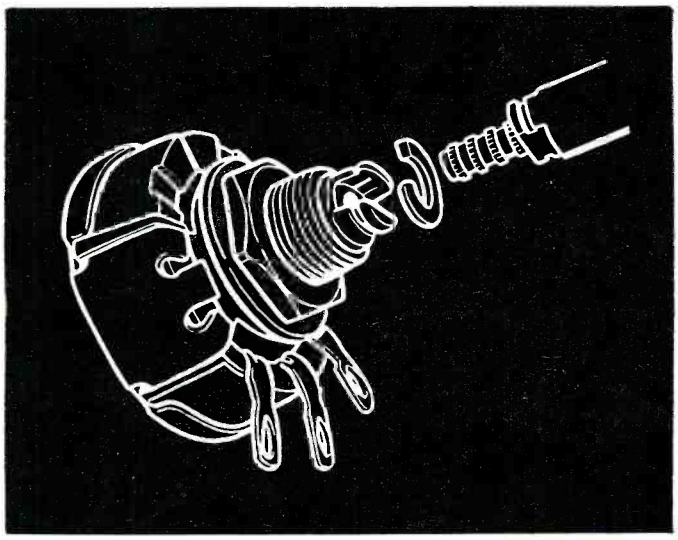

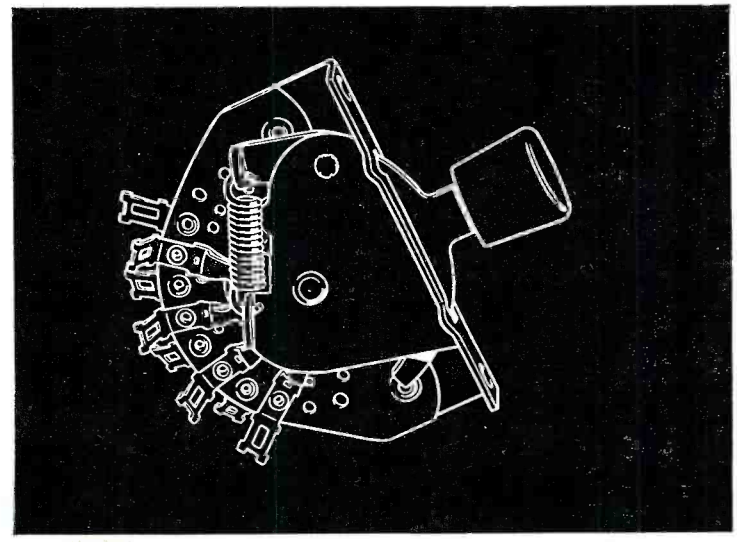

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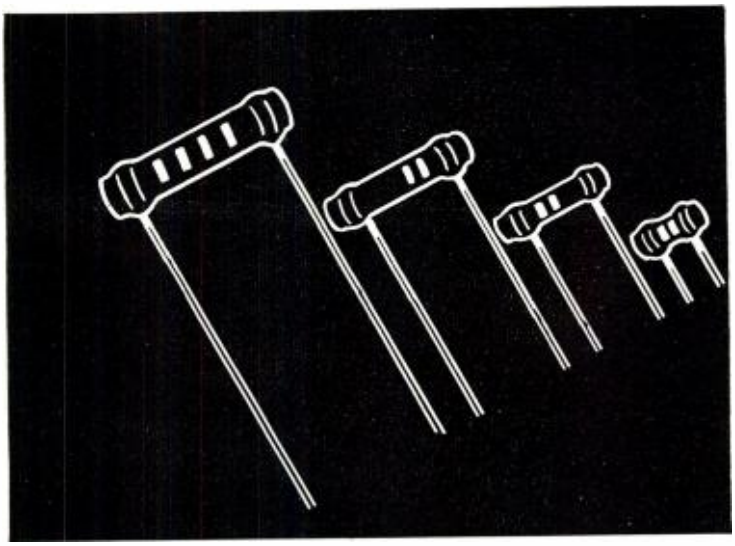
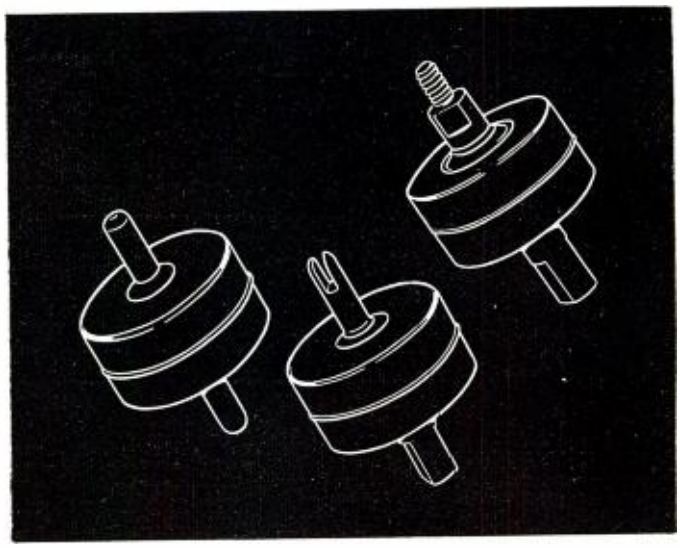
Your reputation as a serviceman is determined to a large extent in the living rooms of your customers. That's why it's important to know that the replacement parts you use provide the kind of service your customers want. You can be sure they will if they're Centralab—the components that take guesswork out of radio and television repair. That's the word of successful servicemen everywhere who report that quality CRL parts provide finer performance, extra dependability, longer life. What's more, Centralab parts are easy to stock, easy to identify and easy to use. Get the complete story from your CRL distributor today.

Donald Armstrong, serviceman at Konig's Radio Service, Milwaukee, Wisconsin installs CRL *Hi-Kap* Capacitors in a radio receiver. Says Armstrong, "Our shop is located in a fine neighborhood and the number one consideration of our customers is dependable performance. That's why we use Centralab parts exclusively."

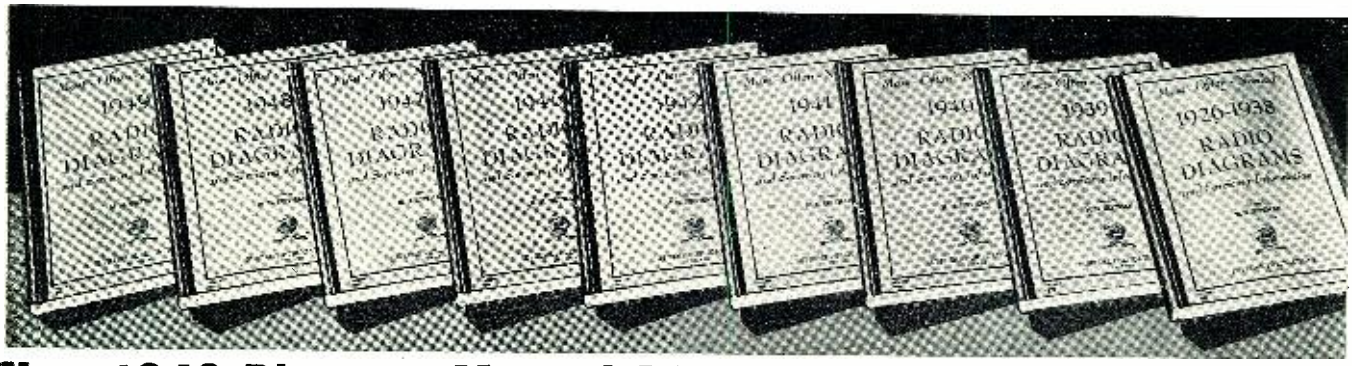
Centralab
CRL
Division of GLOBE-UNION INC., Milwaukee



"Hi-Kaps": CRL line of ceramic By-pass and Coupling Capacitors gives you ceramic dependability and permanence at a new low price! Packaged in a convenient envelope of five, *Hi-Kaps* are clean, easy to stock and handle. Wide range from .000050 to .010000 mfd. Rating — 600 WVDC, 1000 V. flash tested. Ask your Centralab Distributor for all the facts.



"Hi-Vo-Kaps": Just out! Centralab's new high voltage capacitors for television and high voltage applications. Made of Ceramic-X, *Hi-Vo-Kaps* combine high voltage and small size to give you convenient, dependable performance, 10,000 WVDC flash. 20,000 VDC. Capacity — 500 mmf. See your CRL Distributor, or write direct.



New 1949 Diagram Manual Added to Supreme Publications

INCLUDES ALL POPULAR 1949 SETS

Use this new manual to repair quickly all modern 1949 radio receivers. In this big, single volume, you have clearly printed, large schematic diagrams, needed alignment data, replacement parts lists, voltage values, and information on stage gain, location of trimmers, and dial stringing for almost all recently released sets. A worthy companion to the 8 previous volumes used by over 123,000 shrewd radio servicemen. Like the previous volumes illustrated above, it sells at a give-away price and gives you a whole year of radio diagrams for a couple of dollars total cost — nothing else to buy the rest of the year, nothing else to pay. Giant size: 8½ x 11 inches. Includes complete index. Manual style binding. Available at your jobber, or send coupon, price only..... **$2.50**

Models Made by:

R.C.A., Zenith, Philco, Sears, Fada, Emerson, Belmont, Detrola Radio, Majestic, United Motors, Westinghouse, Admiral, Arvin, Stewart-Warner, Delco, Stromberg-Carlson, Western Auto, Wards, Sparton, Crosley, Motorola, Gamble, G.E., and many others.

AMAZING BARGAIN IN SERVICE DATA

Compiled by M.N.Beitman, radio engineer, teacher, author & serviceman.

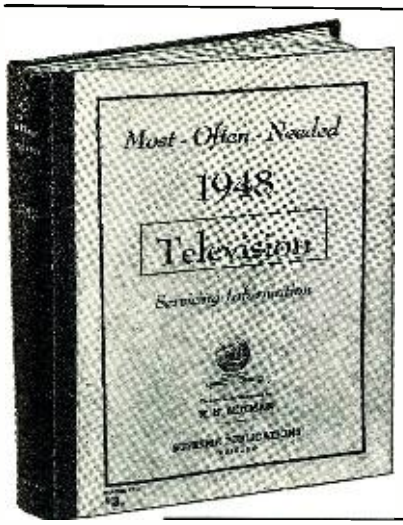
Here is your low-priced, money-saving source of radio diagrams and service information for all popular sets. Above is a photograph of these giant-size manuals—available to radio servicemen at only $2 for most volumes. Let these easy-to-use manuals guide you to quick fault-finding and simplified repair of any radio. Eliminate guess-work, cut hour-wasting jobs to pleasant moments. For 16 years, radio servicemen expected and received remarkable values in **Supreme Publications** service manuals. Yes, these manuals are still only $2 each, and only $2.50 for the new 1949 manual and the extra large 1926-38 volume. Biggest bargain in service manuals. Only a publisher who sold over a million manuals can offer such values based on tremendous volume-sales. **No-risk** examination granted to servicemen.

RADIO SERVICING COURSE-BOOK

Here is your practical radio course of 22 easy-to-follow lessons. Review fundamentals, learn new servicing tricks, all about signal tracing, use of oscilloscope, recording, P.A., test equipment, and T-V. Just like a $100.00 correspondence course. Every topic of radio servicing. With self testing questions and index. Large size: 8½ x 11 in. Price by mail or at your jobber, only..... **$2.50**

FIND ALL RADIO FAULTS DOUBLE-QUICK

You can speed-up and simplify radio repairs with **Supreme Publications** manuals. Service all radios faster, better, easier, save time and money, use these **most-often-needed** diagram manuals to get ahead, earn more per hour. These manuals cover every popular radio of all makes, from old timers to new 1949 sets. Clearly printed circuits, parts lists, alignment data, and helpful service hints are the facts you need to be more expert in radio servicing. Save hours each day, every day, begin to earn more by making repairs in minutes instead of hours. Let these inexpensive manuals give you needed diagrams for 80% of all sets. These manuals pay for themselves with time saved on a couple of jobs, after that you use them FREE. There are nine volumes in all as illustrated above. Each manual is 8½ x 11 inches, sturdy manual style binding, average manual has 194 pages of diagrams and practical service data. Use coupon below to order on trial.

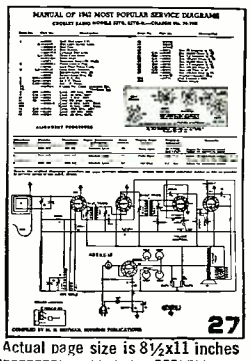


New 1948 T-V Manual

New, giant volume of television factory data covers every popular make. Gives description of circuits, pages of test patterns, response curves, alignment facts, oscilloscope waveforms, voltage charts, service hints, many diagrams in the form of double-spread blueprints, test points, everything to bring you up to date and make you expert in T-V repairs. Large size: 8½x11", manual style binding, flexible covers, price only **$3**

SENSATIONAL LOW PRICE

Be money ahead with SUPREME manuals. For the remarkable bargain price (only $2 for most volumes) you are assured of having in your shop and on the job, needed diagrams and other essential repair data on 4 out of 5 sets you will ever service. There is no need to spend large sums for bulky, space-wasting manuals of other publishers, or to buy additional drawings every few weeks; be wise, use **SUPREME Manuals** to get the most in diagrams for the smallest cost. Check manuals wanted below.



Actual page size is 8½x11 inches

1947 F.M. and Television Manual

Manual of instructions for trouble-shooting, repairing, and alignment of all popular 1947 F.M. and Television sets. Covers every popular make; includes F.M. tuners, AM-FM combinations, and all types of T-V receivers. This is the material you need to adjust and fix any modern F.M. and T-V set. Data on 192 large pages, 8½x11". Sturdy, manual style binding. Your price, only..... **$2**

Supreme Publications

Sold At All Leading Radio Jobbers

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SUPREME PUBLICATIONS, 3727 W. 13th St., Chicago 23, ILL.

Ship the following manuals: (Satisfaction guaranteed or money back)

- ☐ 1949 Manual, only $2.50
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- ☐ 1947
- ☐ 1946
- ☐ 1942
- ☐ 1941
- ☐ 1940
- ☐ 1939
- ☐ 1926-1938 @ $2.50

PRICED AT ONLY **$2** EACH

- ☐ Radio Servicing Course-Book.....$2.50
- ☐ New 1948 Television Servicing Manual.. 3.00
- ☐ 1947 F.M. and Television Manual..... 2.00

☐ I am enclosing $....., send postpaid.

☐ Send C.O.D. I am enclosing $..... deposit.

Name: .....

Address: .....

CHICAGO... The Engineer's Transformer

HIGH Q CHOKES
for Dynamic Noise Suppression Circuits

Two precision-built chokes with inductance values of .8 and 2.4 henrys respectively—accurate to within ± 5% with up to 15 ma d-c. Units have a minimum Q of 20. Exceptionally compact, 1 11/16" x 2 3/8" x 1 7/16".

Write for literature

No.	Inductance	List
NSI-1	.8 h	$10.00
NSI-2	2.4 h	10.00

Famous "Sealed in Steel" New Equipment Line

Chicago Transformer's New Equipment Line offers transformer engineering *ahead* of the trends in circuit design. It's the Transformer Line preferred by experts in the P.A., ham, communication and experimental fields, and by broadcast stations and manufacturers.

Check these features—*drawn steel cases* to provide compact, streamlined mounting; *conservative ratings* that meet all RMA and FCC recommendations; *precision characteristics* for stable, uniformly excellent performance—these, and many others. Check the prices—and you'll learn how little more these advanced units cost over conventional transformers.

Typical of the New Equipment Line are the outstanding audio transformers listed below. Get full details on the complete line—write for descriptive catalog today.

No. BO-6
List Price $23.00

Response within .2db, 30 to 20,000 cycles
New Full Frequency Range Output Transformer

No. BO-6. For use in high fidelity amplifiers. Couples push-pull 6L6's (7500 ohms, C-T) to 6/8 or 16/20-ohm voice coil. Center-tapped tertiary winding provides 15% inverse feedback to reduce harmonic distortion to a minimum. In drawn steel case, 4 5/16" x 3 7/8" x 3 11/16", with mounting studs and pin-type terminals.

There's a CHICAGO OUTPUT TRANSFORMER For Every Full Frequency Use

Cat. No.	Application	Impedance	Max. Power	List
BO-1	Single Plate to Line	Pri.—15,000 ohms at 0 to 10 ma d-c *Sec.—600/150 ohms CT	+20 dbm	$13.00
BO-2	P.P. Plates to Line	*Pri.—20,000 ohms CT *Sec.—600/150 ohms CT	+30 dbm	19.00
BO-3	P.P. Plates to Line	Pri.—5,000 ohms CT *Sec.—600/150 ohms CT	+40 dbm	17.00
‡BO-4	P.P. Plates to Line	Pri.—7,500 ohms CT *Sec.—600/150 ohms CT	+43 dbm	18.00
BO-5	P.P. Plates to Line	Pri.—10,000 ohms CT *Sec.—600/150 ohms CT; 16/8/4 ohms	+37 dbm	24.00

‡Tertiary winding provides 15% inverse feedback. *Split and balanced windings.

Television Transformers *to fit today's leading TV circuits*

Because Chicago Transformer is the largest single supplier of transformers to the Television industry, you gain the advantages of "Original Equipment" components when you buy Chicago TV Transformers. Available now, the three units described here are part of a complete new line, soon to be announced.

Vertical Blocking Oscillator Transformer No. TBO-1. 60-cycle unit for creating the vertical sweep "saw-tooth" voltages required in conventional circuits.

Pri. Inductance: 1.15 hy ± 20% at 3 v., 1000 cycles
Pri. Leakage Inductance: 8 mh + 25%, −15%
Ratio, Primary to Secondary: 1 to 4.2

Exact equivalent to R. C. A. Part No. 208T2. List Price, **$3.10**

TV Power Transformer No. TP-365. Designed to supply 405 volts d-c with two 5U4G's to an 80 mfd condenser input. Copper shorting band around core reduces external magnetic field; cuts image distortion to a minimum.

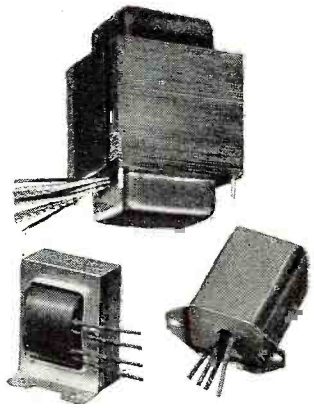
Pri.: 115 v., 60 cycles
H.V. Sec.: 362-0-362 v., a-c, .295 amps d-c
Fil. No. 1: 12.6 v., 5 amps, C-T
Fil. No. 2: 5 v., 2 amps
Fil. No. 3: 5 v., 6 amps

Exact equivalent to R. C. A. Part No. 201T6. List Price, **$26.00**

Vertical Scanning Output Transformer No. TSO-1. Couples vertical output tubes to picture tube deflection yoke.

Pri. Impedance: 19,000 ohms at 30 v., 60 cycles, 13 ma d-c
Ratio, Primary to Secondary: 10 to 1

Exact equivalent to R. C. A. Part No. 204T2. List Price, **$5.90**



Write for Descriptive Literature

CHICAGO TRANSFORMER
TRADE MARK REG.

CHICAGO TRANSFORMER

DIVISION OF ESSEX WIRE CORPORATION

3501 ADDISON STREET • CHICAGO 18, ILLINOIS

Millions of nationally-known receivers produced annually are equipped with Chicago Transformers

Within the INDUSTRY

ARTHUR E. AKEROYD was one of two men named as representatives for the new replacement line of transformers recently introduced by *Chicago Transformer Division* of *Essex Wire Corporation.*

From his Boston office Mr. Akeroyd will cover the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

The second appointment named James J. Backer of Seattle, Washington to represent the company in the four states of the Pacific Northwest and in the territory of Alaska.

Mr. Backer who maintains offices in Seattle, Washington, has been a sales representative to the jobber and industrial trades for 22 years.

* * *

SPRAGUE ELECTRIC COMPANY of North Adams, Massachusetts has purchased the *Herlec Corporation* of Milwaukee, manufacturers of ceramic condensers and "Bulplate" printed circuits.

A *Sprague* plant for manufacturing ceramic assemblies is already being established at Nashua, New Hampshire. Manufacturing operations are being expanded at the Milwaukee plant, thus assuring two substantial sources of supply. Milwaukee operations will be under the continued direction of *Herlec* executives.

* * *

NATIONAL UNION RADIO CORPORATION has purchased a plant in Hatboro, Pennsylvania, for the production of all types of cathode-ray tubes up to and including 20" in diameter.

The company will spend a million and a half dollars for the installation of machinery and equipment for the production of these tubes. When the new unit is in full production the company will turn out a complete line of tubes including receiving tubes, television tubes, special purpose tubes, and cathode-ray tubes.

* * *

ELMER H. WAVERING is the new vice-president of Product Design for *Motorola, Inc.* of Chicago.

Mr. Wavering, who joined the company in 1930 as an engineer, will be responsible for consumer product engineering including home radios, auto radios, television sets, and car heaters.

In a second appointment Walter H. Stellner was named vice-president of merchandising and will handle all merchandising, including sales, advertising, market research, and service.

When *Motorola* entered the home radio field in 1937 Mr. Stellner was named advertising manager for the Home Radio Division. A year later he was appointed product manager of that division and in 1942 headed the company's Washington, D.C. office.

* * *

ALLEN B. DU MONT LABORATORIES, INC. has purchased the former *Wright Aeronautical Plant* in East Paterson, New Jersey.

This new installation will be used for television receiver assembly, general offices, and engineering laboratories, and will enable the *Du Mont* organization to expand its activities and operations.

The plant consists of a modern one story structure having a total floor area of 500,000 square feet, on a site of 58 acres, with railroad siding facilities available. The plant was built in 1942.

* * *

PHILIP DIAMOND has been named to the post of application engineer at *International Rectifier Corporation* of Los Angeles.

Mr. Diamond who received his electrical engineering degree from CCNY served as a second engineer in the U.S. Merchant Marine while simultaneously holding the commission of Lieut. (jg) with the U.S. Marine Corps. He was subsequently employed as an electrical engineer with the *Stone & Webster Engineering Corporation* on the recently completed 50 to 60 cycle frequency change project of the *Southern California Edison* system.

* * *

PAUL HETENYI is the newly appointed consulting engineer for *Aerovox Corporation* of New Bedford, Mass., and will handle matters of engineering, production, and application of the company's products.

For the past twenty-five years, Mr. Hetenyi has been identified with the condenser industry, being the founder of the *Solar* organization. He resigned as president several months ago.

A graduate engineer, trained here and abroad, his earlier activities were with *Kleinschmidt Electric* in New York, and with *Westinghouse Electric* in Pittsburgh.

* * *

SAM INSULL, JR., a vice-president of *Stewart-Warner Corporation,* has been designated head of the newly created *Stewart-Warner Electric Division.*

This becomes Division Five in the organization. Each group of product

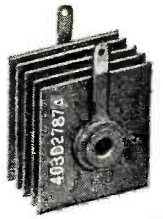
Bias Supply
20 V 75 MA

B+ Supply Radio
130 V 75 MA

B+ Supply Preamplifier
130 V 50 MA

Trickle Charge Assembled
18 V 700 MA

B+ Supply Radio
130 V 100 MA



B+ Supply Radio-TV
130 V 150 MA

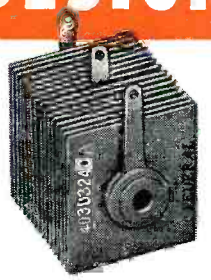
FEDERAL Miniature Selenium Rectifiers have opened the way to NEW CONCEPTS OF DESIGN

B+ Supply Television
130 V 200 MA

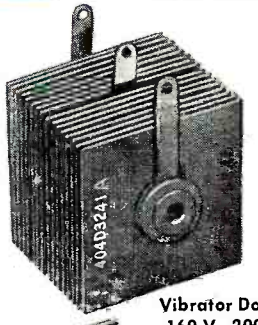
B+ Supply Television
130 V 250 MA

Vibrator 160 V.
160 V 100 MA

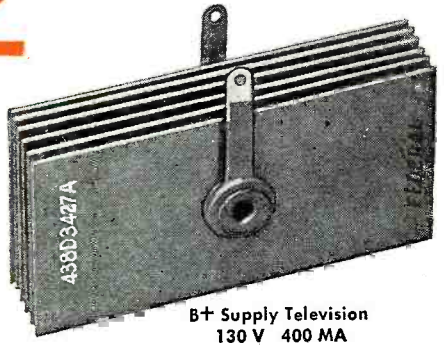
Vibrator Doubler
160 V 75 MA



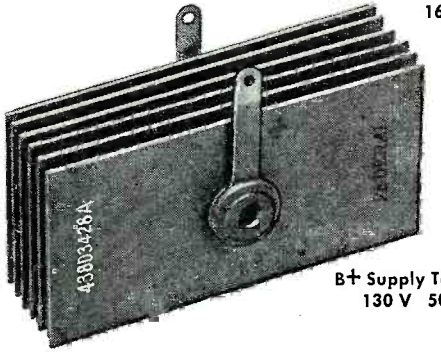
Vibrator Doubler
160 V 100 MA



Vibrator Doubler
160 V 200 MA



B+ Supply Television
130 V 400 MA



B+ Supply Television
130 V 500 MA

The Federal Miniature Selenium Rectifier has firmly established its position as a versatile new source of DC power in electrical and electronic design.

From a "Federal First" in 1946—when the nation's leading radio set manufacturers were quick to adopt it as a rectifier tube replacement—the field of application of Federal's Miniature Selenium Rectifier has expanded to a point where radio rectifier tube replacement is but one of an almost limitless variety of uses.

Today there are millions of Federal "Miniatures" in use not only in radio sets but in television, electric shavers, electronic musical instruments, intercommunication systems, mobile radio and many special applications.

Now Federal offers a line of 18 different "Miniatures"—and still more are in development. It is our policy to work directly with you in specifying the right Federal Miniature Selenium Rectifier to meet your requirements. If there's not a Federal "Miniature" to handle your particular job, there can be. For information, write to Department F459.

FTR
An IT&T Associate

KEEPING FEDERAL YEARS AHEAD... is IT&T's world-wide research and engineering organization, of which the Federal Telecommunication Laboratories, Nutley, N. J., is a unit.

Federal Telephone and Radio Corporation

SELENIUM and INTELIN DIVISION, 900 Passaic Ave., East Newark, New Jersey

In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp. 67 Broad St., N. Y.

lines has been segregated into a distinct and independent division.

Mr. Insull joined the company in January, 1947, as assistant to the president and was made a vice-president eleven months later.

* * *

C. PHILIP GALLOWAY is the new sales manager of the *L. S. Brach Manufacturing Corp.* He was, previous to his appointment, associated with the *Stewart - Warner Corporation* of Chicago and the *Frederick Hart Company* of Poughkeepsie.

On taking over his new duties, Mr. Galloway announced that the following manufacturing representatives would handle the *Brach* line of FM and TV antennas: E. W. Oszman of Minneapolis; *J. J. McBride Sales Company* of Chicago; J. A. McCaffrey of Detroit; Joseph Clancy of Fort Wayne; and *Winfield-Pressinger Associates* of Washington, D. C.

* * *

FRANK LESTER heads the engineering staff of the *Insuline Corporation of America* and will direct the activities governing development and improvement of all radio, electronic, and television units.

Mr. Lester is widely known in the amateur and industrial radio field, having operated as W2AMJ for the past 25 years. He has also written many technical articles for publications in the radio field.

Prior to joining *Insuline Corporation,* he was chief engineer for *Electronic Corp. of America* and *Radio Wire & Television Inc.*

* * *

W. J. BARRON has been appointed general sales manager of the *Merit Coil & Transformer Corp.* Previously serving during the latter part of 1948 as jobber sales manager, Mr. Barron will succeed John I. Crockett, who is moving to Dallas, Texas.

For 12 years prior to joining *Merit,* he was associated with the *Burgess Battery Corp.* Widely acquainted in the radio and industrial transformer fields, Mr. Barron brings to his new post a broad experience.

* * *

SIDNEY L. CHERTOK, well-known in the electronic and radio industry, has joined the application engineering staff of *Sprague Electric Company,* North Adams, Mass.

He will also serve as sales promotion manager of the jobbers distributing organization for *Sprague* condensers, resistors, and other products.

Formerly, Mr. Chertok was sales promotion manager of *Solar Manufacturing Corp.;* previous to that he

(*Continued on page* 129)

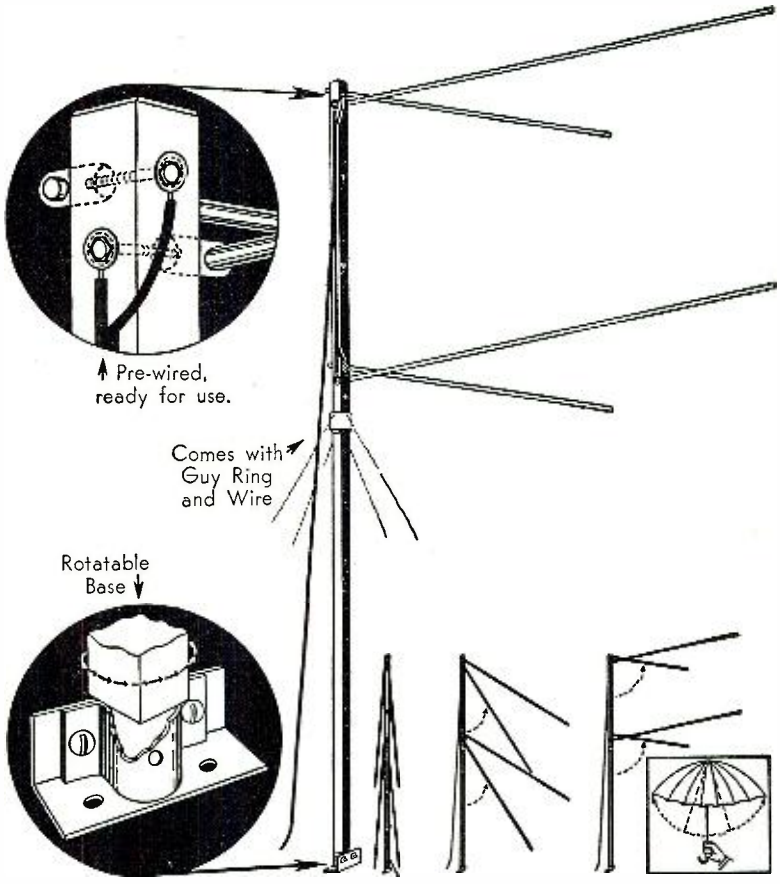
NOW...A Revolutionary Pre-Assembled, Pre-Wired TV ANTENNA

that gives Superior Performance on ALL CHANNELS---

...yet COSTS YOU ONLY ½ the price of equivalent antennas!

TRANSVISION Flip-Up

... the new TV Antenna that gives you more value for your money because—



- It's **PRE-ASSEMBLED,** ready for use. Just "*flip-up*" (like an umbrella) and *install.*
- **PRE-WIRED**—just connect your lead-in to the two terminals.
- **RECEIVES ALL CHANNELS**
- **ALL-DIRECTIONAL;** can be oriented for the weakest station in an area with assurance that all other channels will be brought in equally well.
- **EXTREMELY SENSITIVE.** *Unusual high gain on upper channels.* Ideal for fringe areas.
- **PRICE: $6.95 NET**

Completely assembled with rotatable base, 7-ft. mast, guy ring and guy wire.

Additional 7-ft. masts, to build antenna up to 19 ft., at small extra cost.

SAVES TIME, LABOR! Note how *EASY* it is to install the "*Flip-Up.*" It comes to you compact, folded like an umbrella. *You open it*—like an umbrella, *and install.*

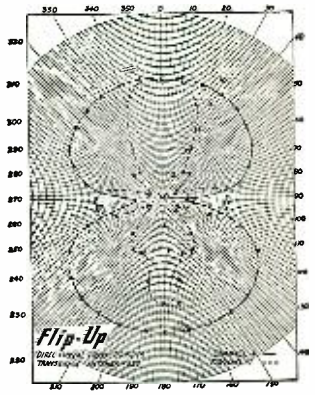
ADDITIONAL Superior Features of the "Flip-Up" Antenna:—

- *Upper and lower bands completely wired.* Eliminates need for two separate antenna installations for the high and low TV bands; therefore, *no coupling losses.*

RUGGED CONSTRUCTION: Mast of the antenna has been designed of *non-conducting* material which prevents possible grounding and reduction of signal strength. It has *unusually high mechanical strength* and is extremely rigid when installed.

- *Guy ring and guy wires* provided for added rigidity.
- *Additional 7-ft extension masts* can be furnished to increase height to total of 19 ft.

—and REMEMBER, *"Flip-Up" COSTS ABOUT ½* the price of equivalent antennas!



Superior Performance of the Transvision "Flip-Up" TV Antenna.

This chart shows the directional characteristics of the "Flip-Up"—or the relative strength of signals received at different incident angles. The two channels used, 4 and 11, represent the centers of the low and high frequency bands respectively.

The SIGNIFICANT FEATURES are:

Wide Angle Reception at Low Frequencies; High Sensitivity at High and Low Frequencies; All-Directional.

All Transvision Prices are fair traded; subject to change without notice. Prices 5% higher west of the Mississippi.

TRANSVISION, INC., Dept. RN, **NEW ROCHELLE, N. Y.**

IN CALIF.: TRANSVISION OF CALIFORNIA, 8572 SANTA MONICA BLVD., HOLLYWOOD 46

Ask to see the new "Flip-Up" Antenna at Your Transvision Outlet!

TRANSVISION

PRESENTS THE NEW
MODEL 12CL TV-FM KIT

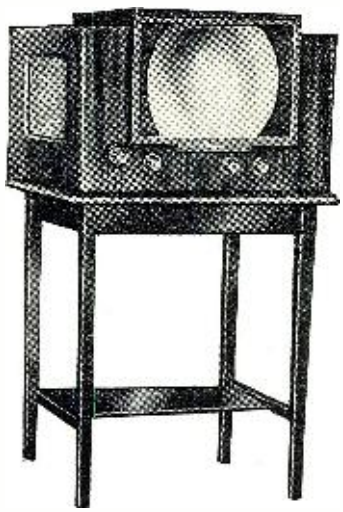
Brings the biggest and best in television within the reach of everyone.

- Features 12½" tube with fitted **All-Angle Lens**, giving **over 200 sq. inch picture** which is visible from **anyplace** in a room.
- Gives ideal long-range reception with **CONTINUOUS TUNING** on ALL CHANNELS. Has DeLuxe TV-FM Inputuner.
- **COMPLETE** with Cabinet, Lens, Roto-Table, Antenna, Lead-in Wire.
- **A BIG PROFIT-MAKER for service dealers.** This kit is TOPS—ideal for homes, clubs, taverns, and other commercial installations.

• • • • •

EASY TO ASSEMBLE . . .
NO TECHNICAL KNOWLEDGE REQUIRED

Transvision's simple step-by-step Instruction Sheet makes assembling a TV Kit a pleasure. Each kit comes **complete with all-channel double-folded dipole antenna and 60 ft. of lead-in wire.** ***Nothing else to buy!***



MODEL 12CL TV-FM KIT

$399.00 NET

Includes Cabinet, Lens, Table, Antenna

Here's amazing
GIGANTIC VALUE!
OVER
200
SQ. IN. PICTURE
VISIBLE from ALL ANGLES
With FM RADIO
Has DeLuxe TV-FM Inputuner

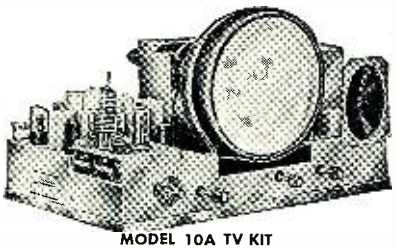
(Picture bigger than a tabloid newspaper page) **IMAGE IS EQUAL** to that of a 20" tube—even sharper and clearer—visible from all angles.

• • • •

EQUIVALENT OF $1000.00 SETS!

Price of the new 12CL electromagnetic kit includes these outstanding features:

- **12½" picture tube** with special fitted **All-Angle Lens** and **color kit.**
- Beautiful select-grain **cabinet** and **roto-table.**
- DeLuxe Continuous TV-FM Inputuner.
- **New all-channel hi-gain** antenna and 60 feet of lead-in wire.
  Nothing else to buy.



MODEL 10A TV KIT

NEW 10" TV KIT at amazingly LOW PRICE!

The **new** Transvision **Model 10A** electromagnetic TV Kit gives a bright, stable 52 sq. in. picture. Has 10" picture tube, and **CONTINUOUS TUNING** on **all 12 channels.** Its high sensitivity makes for improved long distance reception; especially good on high channels. Complete with all-channel double-folded dipole antenna and 60 ft. of lead-in wire.

MODEL 10A TV KIT, less cabinet .....**Net $199.00**

MODEL 12A TV KIT, same as above, but has a 12" picture tube .....**Net $263.00**

NEW STREAMLINED CABINETS

for Transvision Model 10A or 12A TV Kit. Made of select grain walnut with beautiful rubbed finish. Fully drilled, ready for installation of assembled receiver. Choice of finishes:

Walnut Cabinet for 10A or 12A (Specify) .....**Net $44.95**
Mahogany and Blonde slightly higher.

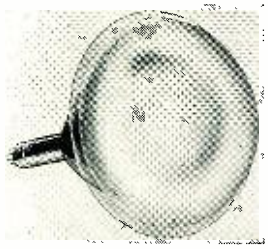
"CUSTOM-ART" Television Cabinets
Made to Order . . . Radiomen, Dealers—

Here is a beautiful line of exclusive, **custom-built cabinets,** designed and completely built in our factory, and finished to your customers' specifications . . . at very reasonable prices. Shown here is Transvision's "Modern Comprehensive" which has provision for TV/FM/AM, Record Changer, Album Shelf, Bar, and Concealed Wine Cellar. For further details on the complete line, **write for FOLDER No. D-1.**

TRANSVISION Complete Line of TELEVISION COMPONENTS

Essential units for building a quality television set . . . Transvision makes available a **complete line** of high quality parts competitively priced. Included in this line are **Filter Chokes,** all types of **Transformers, Focus Coils, Deflection Yokes, Coils**—and of course major units such as **Picture Tubes, Antennas, Lenses,** etc., etc.

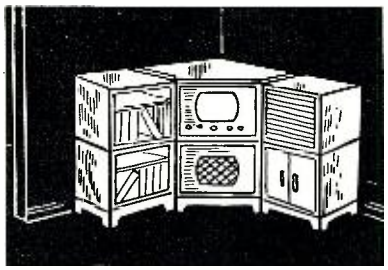
WRITE FOR COMPONENTS FOLDER P-1



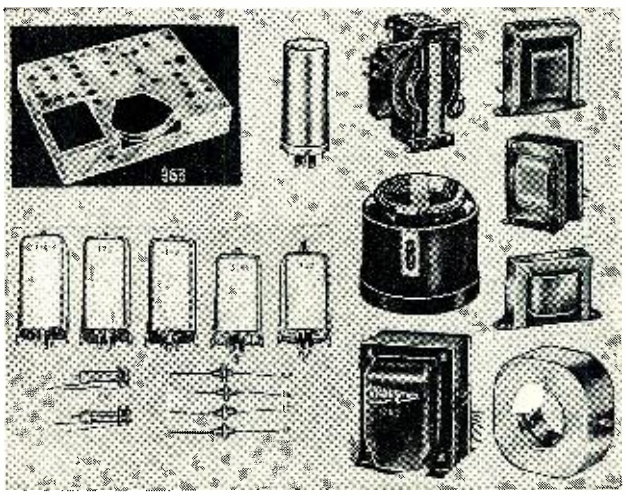
TRANSVISION ALL-ANGLE LENSES for ALL TV SETS. Give picture sizes up to 150 sq. in. **Exclusive patented feature makes image visible from wide angle.** Lenses come with adapter for installation on ANY 7" or 10" picture tube, and with color kits. **All-Angle Lens** for 7" tubes (gives 75 sq. in. picture), **Net $21.95. All-Angle Lens** for 10" tubes (gives 150 sq. in. picture), **Net $32.50.**

ASSEMBLE Your Own CABINETS

Transvision's "MODULAR" Cabinets come in knock-down, unpainted units, offering an unlimited range of combinations, including even a bar. Finish them off to suit your taste and need.



Corner piece, **shown above, has room for TV, Phono, Record Storage,** and open **Book Case. COMPLETE.....Net $84.00**
For other units and prices, write for "Modular" Catalog.



GET into the TELEVISION BUSINESS in a BIG WAY

Radiomen, Servicemen, Dealers . . . Transvision offers you, through your jobber, a 3-point **Dealer Plan** for making big money in television: (1) Sell **TV sets constructed by you from Transvision Kits.** (2) Sell exclusive **Custom-Built Jobs** with beautiful "Custom-Art" Cabinets. (3) Sell **"packaged" Transvision TV Products,** including Kits, Components, and Accessories. For FULL DETAILS about this amazing plan, **WRITE FOR FOLDER No. D-1,** or ask your jobber.

FREE 162 p. TELEVISION COURSE with purchase of any Transvision TV Kit . . . You don't need this course to assemble a Transvision Kit, because the job is easy enough and our instruction sheet is simple and clear. BUT, if you want a **good introduction to television fundamentals** as a basis for further study, the **Transvision Television Home-Study Course** is ideal. Remember, you pay nothing extra for this course. Ask your jobber.

All Transvision Prices are fair traded; subject to change without notice. Prices 5% higher west of the Mississippi.

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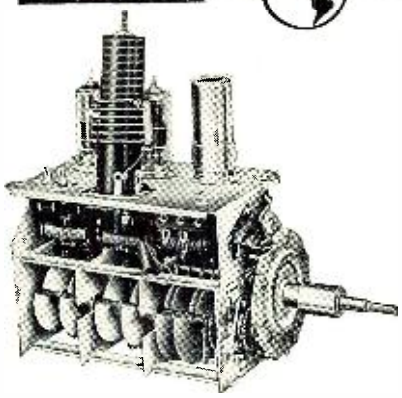
TRANSVISION New TV INSTRUMENTS

TUNERS, BOOSTER, and ACCESSORIES

For Every Television Installation Requirement



NEW 12-Channel TV Tuner

CONTINUOUS TUNING

Model CT-1 (part #653), for TV channels 2 to 13, is notable for its high gain, sensitivity, excellent image rejection ratio, and **CONTINUOUS TUNING** feature. May be used with any 7", 10", 12" or 15" kit.

Model CT-1 TV Tuner . . . . . **Net $32.50**

Model TT-2 (part #301-1 or #301-2) covers **all TV channels, also FM band** (88-108 mc.). Available for 7", 10", 12", or 15" kits. Specify tube size.

Model TT-2 TV/FM Tuner . . . . . **Net $44.95**

TRANSVISION ALL-CHANNEL TELEVISION BOOSTER

CONTINUOUS TUNING

To **assure television reception in weak signal areas,** or areas which are out of range of certain broadcasting stations, Transvision engineers have designed this new booster It **increases signal strength on all television channels.** Tunes all television channels **continuously.** Can be used with any type of television receiver. Unusually high gain in upper television channels.

Model B-1 . . . . . **List $44.95**

TRANSVISION'S NEW REMOTE CONTROL UNIT KIT—for use with ANY TELEVISION SET

OPERATES ANY TELEVISION SET from a DISTANCE up to 50 feet.

Now you can sit back in your easy chair, a comfortable distance away, and operate your TV set. This new **Transvision REMOTE CONTROL UNIT** turns **ANY SET on, tunes in stations, controls contrast** and **brightness, turns set off.** Especially ideal for commercial installations where the TV set is inaccessible.

TUNER UNIT is a high gain, all-channel, **CONTINUOUS TUNING UNIT** (about 50 microvolt sensitivity). **Supplied in KIT form** . . . easy to assemble in about an hour.

Model TRCU Remote Control Unit Kit with 25-ft. cable . . . . . **Net $69.00**

Also available without cabinet . . . . . **Net 65.00**

TRANSVISION FIELD STRENGTH METER

Saves ½ the cost of TV installations

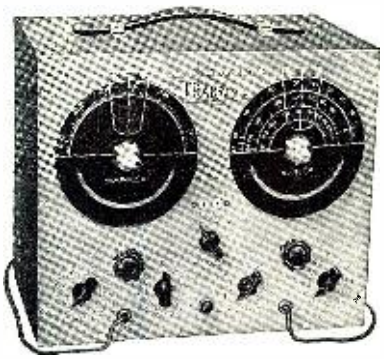
Improves Installations: Saves ½ the Work! Has numerous features and advantages, including —(1) Measures actual picture signal strength . (2) Permits actual picture signal measurements without the use of a complete television set (3) Antenna orientation can be done exactly (4) Measures losses or gain of various antenna and lead-in combinations . . . (5) Useful for checking receiver re-radiation (local oscillator) (6) **12 CHANNEL SELECTOR**. . . (7) Amplitudes of interfering signals can be checked . . (8) Weighs only 5 lbs. . . . **(9) Individually calibrated . . .** (10) Housed in attractive metal

carrying case (11) Initial cost of this unit is covered after only 3 or 4 installations . . . (12) Operates on 110V, 60 Cycles AC.

Model FSM-1, complete with tubes . . **Net $99.50**

TRANSVISION TELEVISION and FM SWEEP SIGNAL GENERATOR

Complete frequency coverage from 0-227 MC with no band switching. . . . Sweep width from 0-12 MC completely variable. . . . Accurately calibrated built-in marker generator.



OUTSTANDING FEATURES: (1) Frequency range from 0-227 MC . . . (2) Dial calibrated in frequency . . . (3) Sweep width from 0-12 MC completely variable . . . (4) Self-contained markers readable directly on the dial to .5% or better. (No external generator required to provide the marker signals) . . . (5) Crystal controlled output makes possible any crystal controlled frequency from 5-230 MC . . . (6) Plenty of voltage output—permits stage-by-stage alignment . . . (7) Output impedance 5-125 ohms . . . (8) Directly calibrated markers, 20-30 MC for trap, sound and video IF alignment . . . (9) RF for alignment of traps for IF channels when a DC voltmeter is used as the indicating medium . . . (10) Unmodulated RF signal to provide marker pips simultaneously with the main variable oscillator . . . (11) Markers can be controlled as to output strength in the pip oscillator . . . (12) Power supply completely shielded and filtered to prevent leakage . . . (13) All active tubes are the new modern miniature type . . . (14) Phasing control incorporated in the generator . . . (15) Operates on 110V, 60 Cycles, AC.

Model SG . . . . . **Net $99.50**

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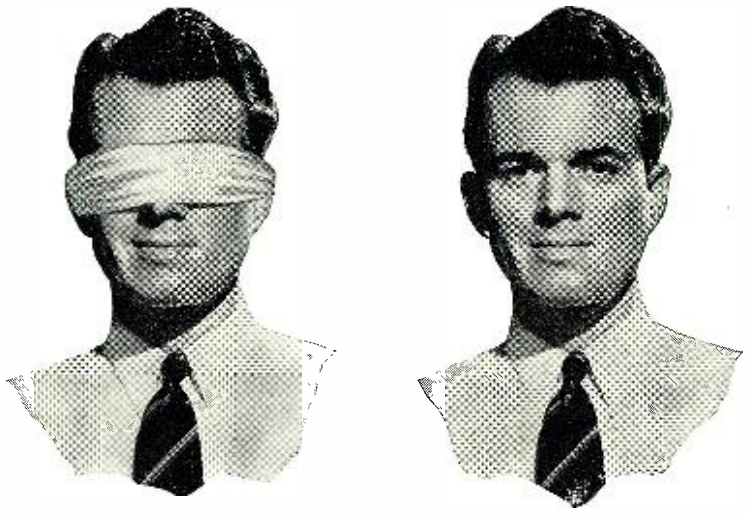

Who Will Get the Better Job?

The Radioman Who Looks Ahead Will Get Ahead

Don't play blind man's bluff with your future! Are you, like many other professional radiomen, so wrapped up in your present routine work that you are losing sight of where you will be tomorrow?

Look at the successful radioman. You'll find that he's the fellow who looked and *planned* ahead. Today, as a member of the great radio-electronic-television industry, you have opportunities that few men ever enjoyed in the past. Your future success can be assured by the plans *you* make *today*.

The radio industry is expanding so fast, that it is doubtful any radioman can truthfully say he has kept pace with all the major developments. Thousands of new men have joined the ranks of the radio industry creating new competition for you. New developments create demands for more advanced technical ability. You can't afford to be a "pre-war model". You must "re-tool" your technical knowledge in order to keep pace.

Look ahead and start now to increase your technical ability with the thorough, practical technical training for which thousands of professional radiomen have enrolled with CREI since 1927. This is a real, honest-to-goodness practical course in radio-electronics and television engineering that leads to better jobs, and security in the knowledge that you are capable of coping with tough problems.

CREI courses are still available at pre-inflation prices and today give you *more thorough instruction service* per dollar than ever before—on convenient terms. It costs you nothing to read the interesting facts. Write today.

VETERANS! CREI TRAINING AVAILABLE UNDER G. I. BILL

If you have had professional or amateur radio experience and want to make more money, let us prove to you we have the training you need to qualify for a better radio job. To help us answer intelligently your inquiry—*please state briefly your background of experience, education and present position.*

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Gentlemen: Please send your free booklet, "Your Future in the New World of Electronics," together with full details of your home-study training. I am attaching a brief resume of my experience, education and present position.
Check field of greatest interest:

☐ PRACTICAL RADIO-ELECTRONICS ☐ PRACTICAL TELEVISION
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☐ I AM ENTITLED TO TRAINING UNDER G. I. BILL.

Mercury, "messenger of the gods," was slow compared with Ultrafax—which moves at the speed of light.

This messenger *delivers a million words a minute*

Recently, at the Library of Congress, a distinguished audience saw documents flashed across Washington by a new means of communication . . . and reproduced *in facsimile.*

This was Ultrafax in action—a superfast television communications system developed at RCA Laboratories. Reproductions of *any* mail—personal, business, or military . . . including police descriptions, fingerprints, bank drafts, government records—can travel at 186,000 miles a second!

Material to be sent is placed before an RCA "flying spot" scanner, and transmitted by ultra-high frequency radio signals. Miles away the pictures appear on a picture tube and are photographed. Negatives are ready for printing or projection in 40 seconds.

Eventually, when Ultrafax comes into commercial use, a complete Sunday paper—every word, every picture—may cross America in 60 seconds . . . a letter in the twinkling of an eye.

Science at work . . .

Ultrafax is but *one* of scores of major achievements pioneered at RCA Laboratories. This leadership in science and engineering adds *value beyond price* to any product or service of RCA and RCA Victor.

• • •

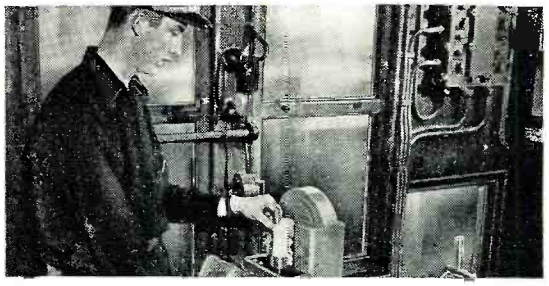
Examples of the newest developments in radio, television, and electronics may be seen in action *at RCA Exhibition Hall, 36 West 49th Street, N. Y. Admission is free. Radio Corporation of America, Radio City, N. Y. 20.*

RADIO CORPORATION of AMERICA

World Leader in Radio — First in Television

RADIO-TELEFAX UNITS WITH SYLVANIA TUBES

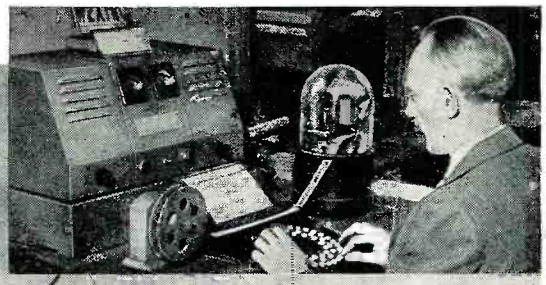
SPREAD THE NEWS OF INCOMING SHIPS!



Pilot boat Captain sending written message of arrival of the big ship through Link unit equipped with Sylvania tubes, and in short order . . .

★ ★ ★

. . . message arrives in Western Union Marine News room as facsimile reproduction, then is transmitted by an operator and simultaneously appears on tickers at offices of newspapers, customs, postal and immigration authorities, taxi, steamship companies and many others.



Link radio equipment used in Western Union Marine Reporting Service

RADIO-TELEFAX, a new type of telegraph communication, reports ship arrivals as part of Western Union's Marine Reporting Service.

Out at sea, the captain of the New York Pilot Boat spots incoming liners, writes a message such as "SS QUEEN ELIZABETH INCOMING AT 1644" on a telegraph blank and inserts it in an automatic Telefax transmitter. The unit then transmits it to Western Union over a VHF radio channel. It arrives as a *facsimile* of the sent message!

And inside this Link equipment, rugged Sylvania tubes, operating smoothly, do their part in this important marine reporting service. Find out more about the complete Sylvania line of Radio Tubes . . . see your Sylvania Distributor or write Radio Tube Division, Emporium, Pa.

SYLVANIA ELECTRIC

RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS

The antennas on this "Constellation" are dwarfed by the plane itself. Shown in the picture are: A, the 77 ft. "V" to outboard stabilizers; B, ILS antenna; C, pitot (air speed indicator) masts which support ends of DF sense antennas; and D, v.h.f. stub.

AIRLINE RADIO

Today's "Colossus of the Sky" is a fabulous mobile radio station equipped with all types of safety and communications devices

By ROBERT HERTZBERG

AN EARTHBOUND radioman who has the chance to visit the front cabin of a modern four-engine airliner is in for a big surprise. He knows of course that all commercial planes carry radio communication and navigation equipment, but he is totally unprepared for the impressive array of heavily-laden racks and tables he finds crammed into the forward section of the ship. He quickly realizes that aeronautical radio is big stuff. Literally, it is; the total weight of a typical radio installation is 800 pounds and its cost is $17,500.

I underwent this interesting experience recently at LaGuardia Field, New York, when I was shown through a "Constellation" used by *American Overseas Airlines* on its popular New York-to-London route. After I counted up eleven different receivers, three transmitters, and a few incidental items, I remarked to my guide, Frank Keplinger, assistant superintendent of communications equipment of the line, that keeping all this gear in working order must be a job all by itself.

"Come and see for yourself," he answered. He then led me through a series of beautifully equipped shops containing more and better test instruments and facilities than are found in many radio factories. At LaGuardia alone fifty-one service technicians are kept busy at a wide variety of jobs ranging from simple tube testing up through crystal grinding and calibration and major revamping of whole transmitters and receivers.

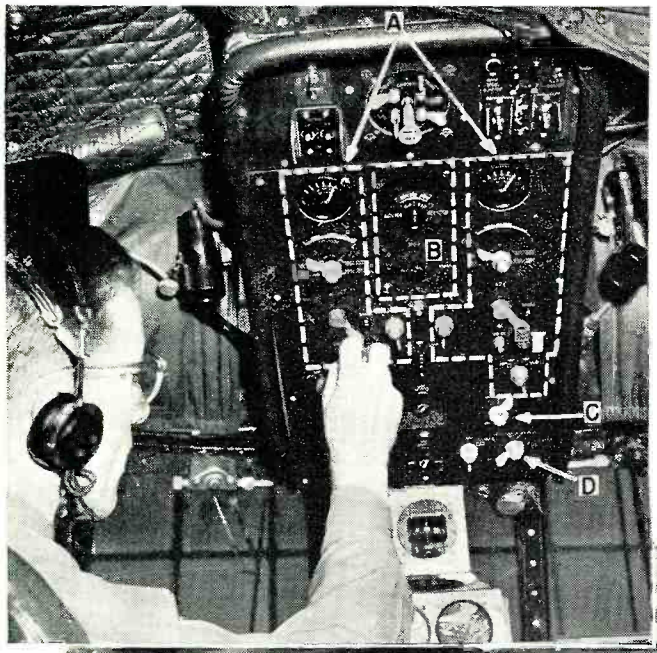
"Six months after we get a piece of equipment the manufacturer might not recognize it," remarked Mr. Keplinger. "We have special problems to meet and we don't hesitate to change things to make them perform to our requirements."

In addition to the big crew at LaGuardia, the line has shops in Boston, Newark, Chicago, Dallas, Fort Worth, Tulsa, Los Angeles, and Ardmore, Oklahoma, and employs a total of about 160 men. Their job is to keep the airborne radio in top-notch working order so that the ships can fly, and fly safely. No ship leaves the ground unless the radio is checked off as "OK."

On domestic flights, planes do not carry a radio operator. The pilot and co-pilot handle all communication on voice, the distances involved being short and ground stations numerous. However, the overseas planes do have a full-fledged radioman, holding a second-class radio-telegraph license as a minimum. He wears the traditional insignia of a brass pounder, three jagged sparks, although he has to know much more than was ever required of a shipboard "sparks."

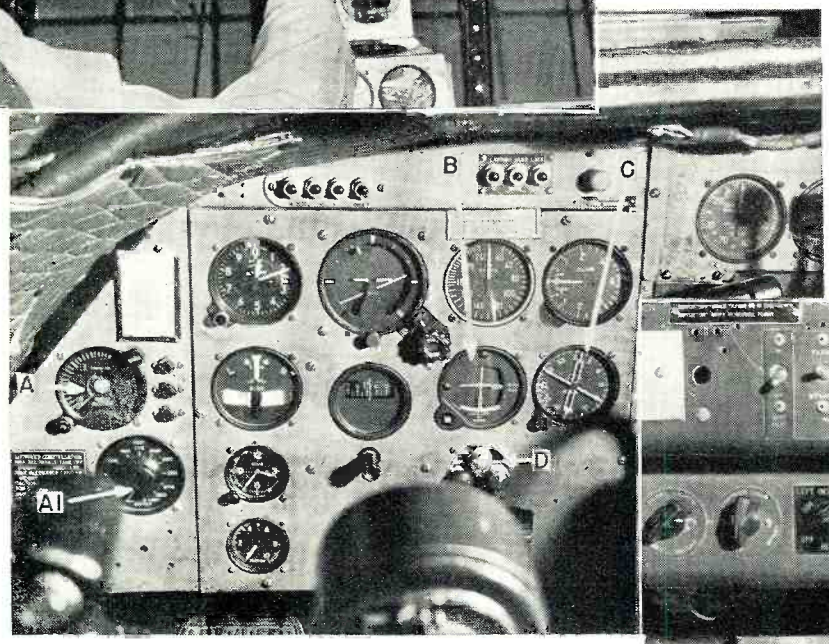
The pictures that appear with this article, taken exclusively for RADIO & TELEVISION NEWS, give some idea of the extent of the radio-electronic installation in an overseas "Connie." Some of the units to be mentioned do not appear in the photos because they were inaccessible to the camera.

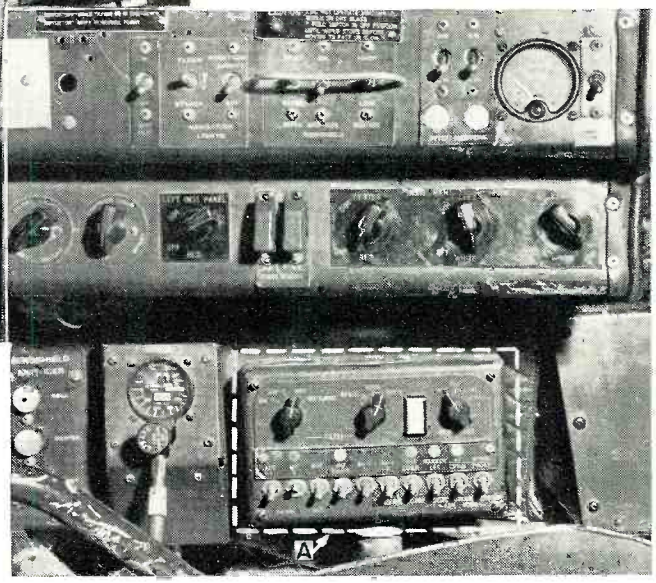
The two basic pieces of equipment are duplicate *Collins* 17H-2 transmitters, better known as the AN/ART-13. When a few of these appeared on the surplus market they were quickly gobbled up. Two frequency ranges are covered: 2000 to 18,000 kilocycles, with a choice of ten preset channels available through a motor driven selector, and 200 to 1500 kilocycles, manually tuned. One set is standby for the other. Either the pilot or the radio operator can take over the active transmitter. The former uses only voice, while the latter uses either voice or c.w. Of course, c.w. is favored for the long over-water jumps, when the



← Large overhead panel accessible to pilot or co-pilot holds following controls: A—duplicate ADF control; B—MDF controls; C—band selector for HF receivers; D—ILS and glide-path receiver controls.

↓ This is what the pilot sees in front of him. The equipment comprises: A—low range radio altimeter; A1—altimeter limit switch; B—ILS indicator; C—ADF Dual azimuth indicator; D—marker beacon lights.





Switch box → next to the pilot's seat enables him to select any radio facilities on the plane. A similar box is on the right side, next to the co-pilot's seat.

plane works commercial shore stations on either side of the Atlantic. These transmitters are rated at 100 watts output.

In the radio operator's tight little compartment just behind the pilot's seat, there are two manually tuned general utility communications receivers, the *Bendix* RA-1B units. These cover 150 to 15,000 kilocycles in six bands. One can be set to a station on one continent and the other to a station on another continent, so the operator can catch signals both coming and going!

For medium high-frequency communication, the pilot has his own receiver, a *Western Electric* 29-A. This is a ten-channel, preset crystal-controlled job, which he uses for voice reception only, in the band from 2870 to 8965 kilocycles. The set itself is in the radio shack, and he selects frequencies by means of a remote-control switch on a panel over his head in the cockpit. The operator can listen on this receiver but he cannot tune it.

For general voice communication within about 50 miles of a ground station, both the pilot and the radio operator can switch on a *Western Electric* AN/ARC-1, a very high frequency (v.h.f.) combination transmitter and receiver allowing a choice of ten dual channels in the 110-156 megacycle band. The transmitter is of the AM type and has an output of 8 watts; the receiver is a superhet. The same crystals are used for both transmitting and receiving. The pilot uses this rig mainly for landing and take-off communication with the control tower of an airport.

The radio navigational aids on a big plane are numerous and tricky. The overseas ships carry a navigator as a regular member of the crew, and he has a private little cubicle between the transmitter rack and the radio compartment. His main source of information is an *RCA* AN/APN-9 Loran receiver, working on the 1900 kilocycle band. This contains a three-inch scope with magnifier and is very popular because of its accuracy. For altitude measurements, he depends on an *RCA* AVQ-9 radio altimeter. This is virtually a small radar set. It sends a 440 megacycle pulse downward from the plane, picks it up on its bounce from the ground, and measures the time required. The indicator is the face of a cathode-ray tube, suitably calibrated to translate time into feet. This altimeter is a high-range unit, giving measurements up to about ten miles. For close work, the pilot has a separate altimeter of his own, the *RCA* AVQ-6. This is calibrated in the low ranges of 0 to 400 and 0 to 4000 feet, and the indicator is a meter on his instrument panel up front.

Three radio compasses are available in addition to the Loran. The first is a *Bendix* MN-26K, a manual direction finder (MDF) with a manually rotatable loop. This is used for getting positions from land or ship stations between 200 and 1750 kilocycles. It can be controlled by either the pilot or the radio operator. The other two are identical *Bendix* MN-62A automatic direction finders (ADF), working into common indicators on the pilot's and navigator's instrument panels. The controls for this ADF system are on a control panel in the ceiling of the cockpit, centered over the pilot's and co-pilot's seats.

Also for the pilot's use, as aids in making landings, are the following:

(1) A *Bendix* Marker Receiver MN-53A, working on 75 megacycles. This operates three little lights on the pilot's panel and indicates boundary markers and route check points. It also feeds an audio signal to the pilot's phones.

(2) ILS (Instrument Landing System) Localizer Receiver BC-733D, to be replaced by the *Collins* 51-R. This responds to a two-tone modulated sig-

nal squirted up from the ground on 108.3 or 110.3 megacycles, and enables the pilot to check his lateral position. The indicator is a meter on the cockpit panel.

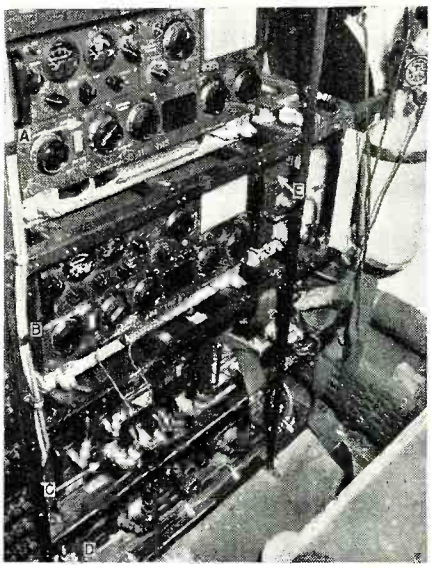
(3) A Type R-89B Glide Path Receiver, tuning to 332.6 or 335 megacycles. Registering on a cross-pointer meter, this signal enables the pilot to bring his plane down on a definite glide path to meet the runway even though he can't see it.

As might be expected, the outside of the plane is festooned with antennas. The biggest one is a 77-foot long "V", running from a short mast over the cockpit to the two outboard stabilizers. This is used for all low and medium high-frequency work, with suitable antenna matching networks and loading coils. The v.h.f. antenna is a quarter-wave stub (about 26 inches long) mounted in front of the nose wheel and pointing downward. Several short wire antennas on the belly of the ship are "sense" aerials for the DF systems. The loops for the latter are enclosed in plastic blisters to minimize their wind resistance. Dipoles for the ILS and glide path receivers are on the top of the cockpit.

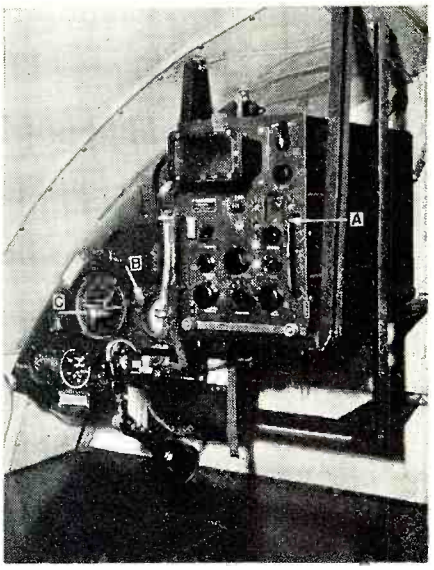
Primary supply for all radio equipment is 28 volts d.c. from the plane's power system. This consists of a relatively small storage battery of only 34 ampere-hours' capacity floating across four paralleled 28 volt, 300 ampere generators, one driven by each engine. The radio load is about 90 amperes. All plate supply is furnished by dynamotors.

An elaborate wiring system connects switch boxes in the pilot's, co-pilot's, navigator's and radio operator's positions, and permits a ready interchange of audio signals representing the various communication and DF facilities on board the plane. The radio operator himself wears a pair of split headphones and can mix the output of nine receivers and the intercom. The latter, using a separate little amplifier, has six stations: the four mentioned plus the flight engineer and the stewardess. It's very useful for ordering hot coffee out over the Atlantic!

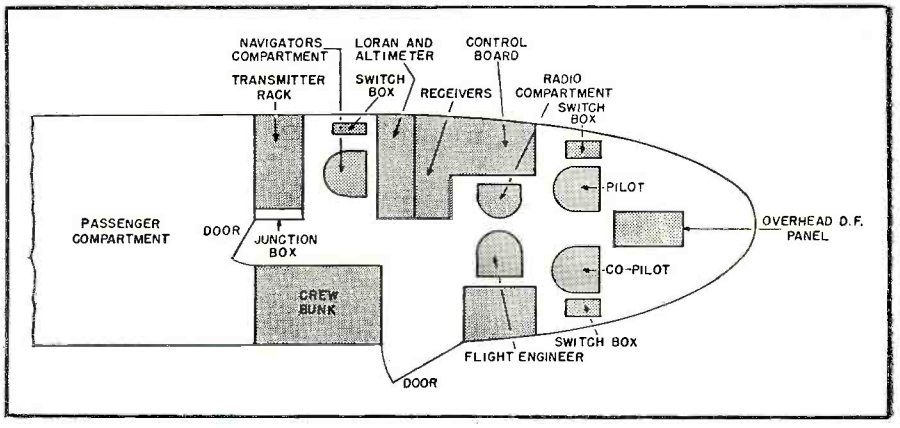
(*Continued on page* 161)



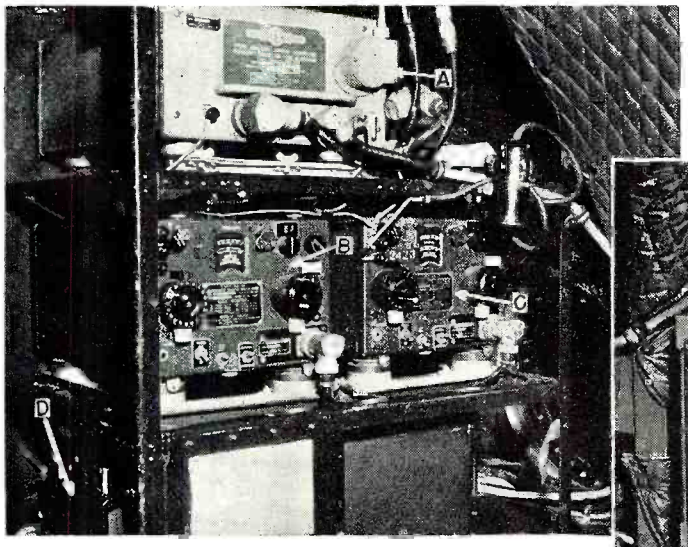
The main equipment rack behind the navigator's position. A and B—ART-13 transmitters; C—low-range radio altimeter; D—ADF equipment; E—glide-path receiver.



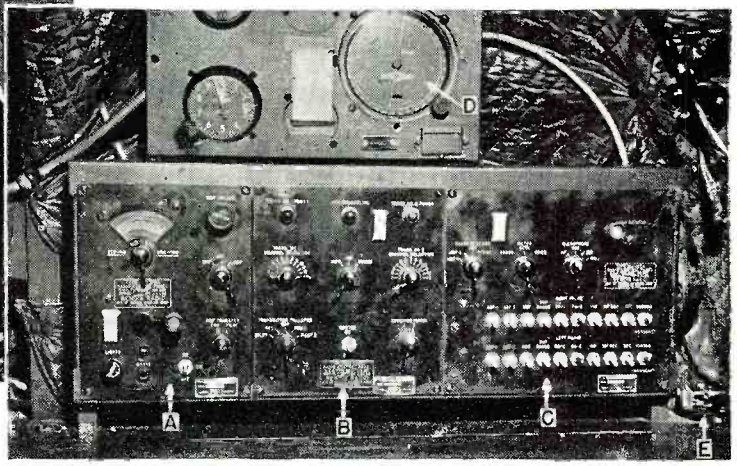
Inside the navigator's compartment: A—Loran receiver; B—high-range radio altimeter indicator; C—ADF dual azimuth indicator (identical with pilot's meter).



Layout of the front section of an American Overseas Airlines' "Constellation."



The radio operator's table. A—MDF control; B—transmitter control panel; C—audio control panel; D—MDF azimuth indicator; E—telegraph key.



← The left hand section of the radio operator's compartment, showing part of a typical radio installation which weighs up to 800 lbs. and costs as much as $17,500. A—MDF receiver; B and C—manually tuned communications receivers; D—pilot's ten-channel h.f. receiver, used for medium high-frequency communication (Western Electric 29A).

Television's LARGEST

This 16 foot parabolic reflector is located on top of the Mt. Lee television studio. It is used for pick-up of signals from remote locations and is the largest such unit being employed in video work.

By HARRY R. LUBCKE
Technical Director of Television
Don Lee Television System

The author, a well-known figure in the video industry, has been Director of Television for the Don Lee Broadcasting System since 1930. He is a member of several professional radio and television societies and author of a number of technical articles dealing with television. He received his Bachelor of Science degree from the University of California at Berkeley in 1929 and did graduate work at the University of California. He received citations from both the Army and Navy for his wartime developments in the field of airborne and other vitally-needed equipment.

DON LEE, on the West Coast, operates one of the most unique television set-ups in the United States. The station, KTSL (W6XAO), went on the air December 3, 1931, on a one-hour-a-day, six-days-a-week schedule. The station transmitted on 44½ mc.

From its modest beginning on the eighth floor of the Don Lee Building at 7th and Bixel Streets, the station has grown to its new present site on Mt. Lee—the first structure in the world erected exclusively for telecasting. Erected just before World War II, the new facilities are complete even to a swimming pool!

One of the unique features of this station, which serves the Hollywood and San Fernando Valley area, is the use of a 16 foot parabolic reflector mounted atop the Don Lee studio building. This unit, shown on this month's cover of RADIO & TELEVISION NEWS, is used to pick up signals from remote locations. It is the largest parabolic reflector used for television operations in the country.

It was constructed for and first used on January 1, 1948, for the Don Lee pickup of the "Tournament of Roses" parade from Pasadena, California, twelve miles east of the base transmitter. To offset the effects of a 200-foot mountain range in the "line of sight," this giant antenna was used in conjunction with a 9-foot diameter dish at Pasadena to insure a perfect transmission.

Known familiarly to Don Lee video engineers as "The Mountain Shooter," this parabolic reflector operates on a 100-foot track. This particular installation permits the antenna to be used to pick up programs from the San Fernando Valley to the north as well as from Hollywood, which lies to the south of the station. Overturn is prevented during high winds by a special track construction which prevents uplift as well as acting as a bearing surface. Full adjustment as to azimuth and elevation can be made. These adjustments are accomplished by means of a large electric rotary control which is actuated from the control booth in the building. This allows accurate beaming of the reflector while monitoring the studio control screen during tests preceding the regular program.

"The Mountain Shooter" is constructed entirely of metal. The ribs are of welded aluminum while the base and mesh are of steel. The device weighs more than a ton and has a total height of 20 feet and a width of 16 feet. The focal length is 4 feet. The folded dipole and reflector are positioned at the focus.

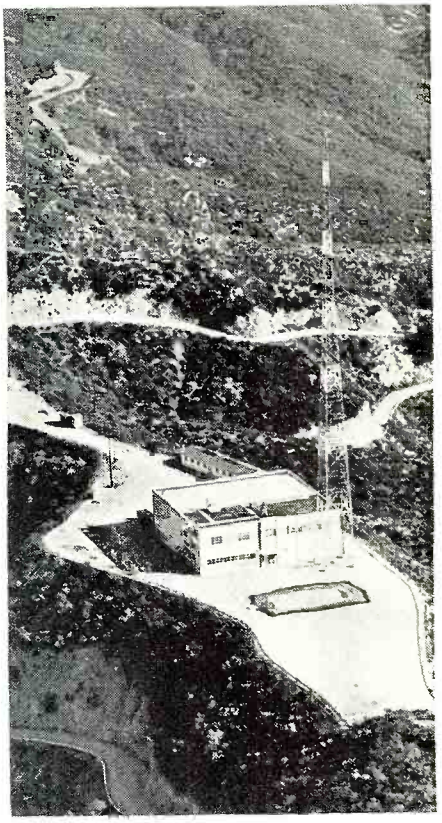
In the photograph appearing at the top left-hand corner of page 38, Bill C. Ames, the designer and builder of the parabolic reflector, is shown check-

Left to right: John Barnett, asst. conductor of Los Angeles Philharmonic; Carleton Winckler, Don Lee's TV coordinator; Gil Wyland, engineer; and Stuart Phelps, director of special events, monitor a screening of the Philharmonic concerts which were done as a remote pickup over Don Lee's KTSL.

Don Lee's 16-foot dish is used to pick up remote transmissions despite the intervening mountains.

PARABOLIC ANTENNA

A television studio in Don Lee's new $3,000,000 building in Hollywood. The "Music Hall," a variety show, is telecast every Tuesday evening from this studio, before an audience of 350. Note positioning of the video cameras.



Over-all view of the Mt. Lee studio. The parabolic reflector had not been installed at the time this photograph was taken.

ing standing wave ratios with a "Megasweep" oscillator which supplies an r.f. signal of rapidly and widely varying frequencies. On top of the oscillator is a vacuum tube voltmeter which is used to measure the voltage on the quarter-wave stub which may be seen in the antenna line (in front of the "Megasweep" oscillator). The author records this data while Larry Rohrer, who did the machine work on the reflector, watches the operation.

Because of its giant size, the antenna system has an excellent signal-to-noise ratio, the signal gain being 20 db. over that of a conventional dipole. With an antenna of this gain outside interference is unknown. The beam width to the half-power point is 5 degrees in azimuth, 3 degrees in tilt.

The antenna has been used daily since its construction to pick up program material in Hollywood and its environs. One of the most interesting programs, from a technical standpoint, was a telecast of a symphony performance from the Philharmonic Auditorium in downtown Los Angeles. In order to avoid buildings in the signal path it was necessary to erect a transmitting antenna several hundred feet from the auditorium and run coaxial cables from the program site to the transmitting antenna.

Prior to the use of the "dish," diathermy harmonics and communications harmonics were occasionally recognizable in the background of the video transmissions. Since the installation of the parabolic antenna system, this interference has been removed.

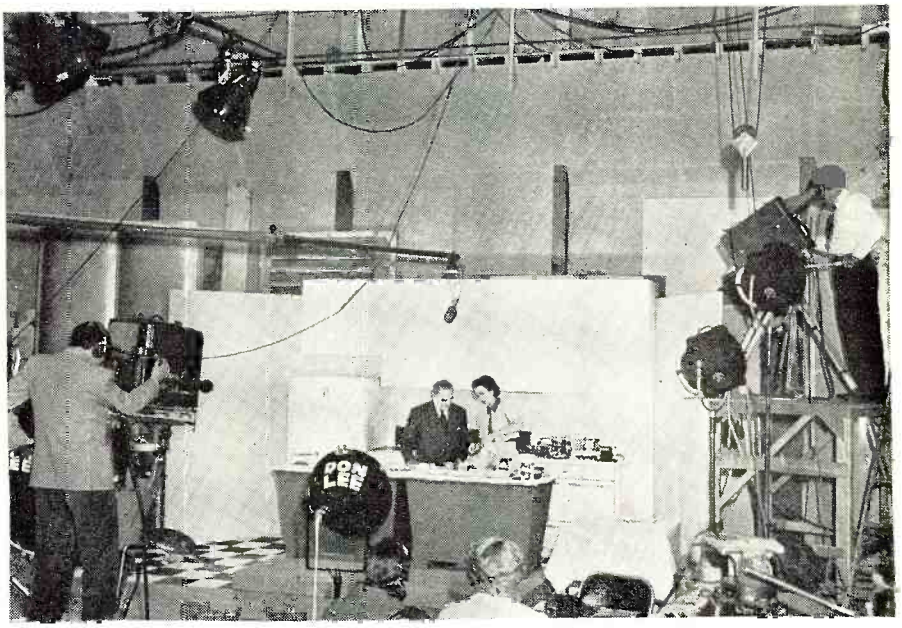
The studio-transmitter building at Mt. Lee is a 100 square foot stucco structure with soldered-seam copper interlining under the cemented floor, between the side walls, and under the roof. This technique was employed to exclude outside radio frequency interference which might disturb the television pictures.

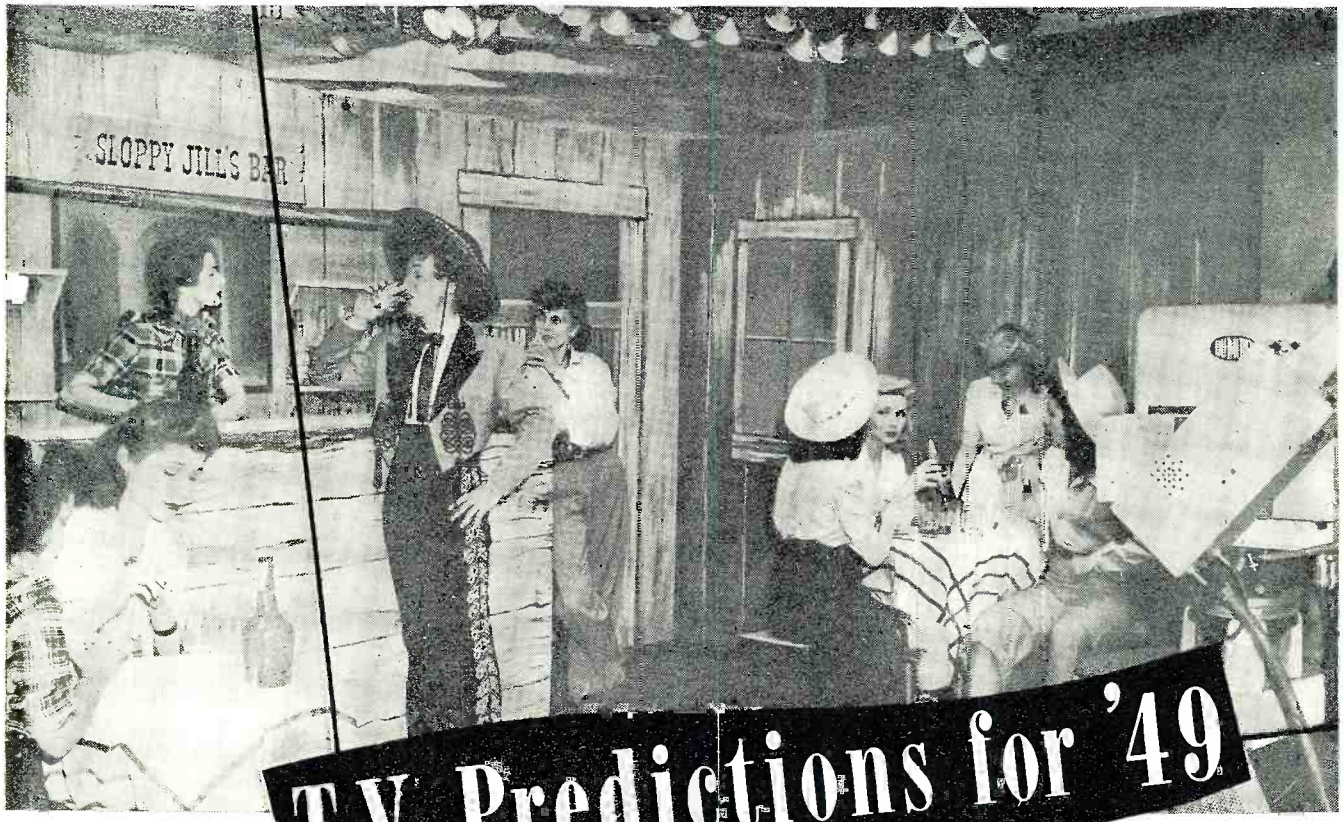
The building has complete sponsor viewing facilities, a special transmitter room, and a uniquely designed transcription and film projection room. A performers' makeup room, scenery storage docks, a machine shop, and a suite of executive offices are also housed at Mt. Lee. The main studio measures 60 by 100 feet and is the largest ever built for television. As many as 25 scenery trucks can move onto the main stage floor.

The large stage is fitted with 20 microphone outlets. Catwalks around all sides and across the middle of the

(*Continued on page* 116)

Prudence Penny, home economics expert, receives a visit from Walter Kingsford, stage and screen actor, on her television show over TV station KTSL.





TV Predictions for '49

By DR. ALLEN B. DU MONT
Pres., Allen B. Du Mont Laboratories, Inc.

The television industry is ready to take its place as a "billionaire" industry, says this TV pioneer.

TELEVISION moves ahead even faster in 1949, for it starts out with terrific momentum. Witness the 51 stations, as of January 1st of this year, already serving 31 marketing areas, to be joined shortly by upwards of 74 new stations. In addition to 77 construction permits soon to be converted into TV stations, there are 310 applications waiting to be processed with the raising of the present "freeze" order whereby the industry takes inventory of present and future needs, and gives due consideration to u.h.f. possibilities quite in addition to present v.h.f. channels. Meanwhile, coaxial and radio relay networks spread out to a goodly third of our country—the eastern and northern states and again along the Pacific coast.

There are well over a million TV sets in use, with more being produced at a rate in excess of 130,000 monthly, for at least 2,750,000 TV sets in use by the end of 1949. Topping it all, television becomes real "show business" and that means irresistible entertainment for every man, woman, and child. What with the boom business in sets, tubes, antennas and accessories, in transmitting equipment, in programming and operational activities, in network facilities and other TV aspects, the young industry now takes its rightful place among the "billionaire" industries. Definitely, the Television Age is here.

Aside from television's spectacular growth in 1949, the outstanding development must be the lifting of the "freeze" and the early exploitation of the u.h.f. frequencies. True, there will be many technical angles to be worked out, especially in actual practice. But u.h.f. means the opening up of many more TV channels which in turn means TV stations for the smaller cities, towns, villages, and rural areas. Also, it can mean two or three stations in every section of the country for an adequate choice of competing programs.

The u.h.f. channels to be opened up are quite in addition to present v.h.f. stations and receivers. In fact, it seems now as though the densely populated areas will continue to be served by v.h.f. transmitters tuned in by present types of receivers, while the smaller cities, towns, villages, and wide open spaces will be served by u.h.f. transmitters calling for new types of receivers. For u.h.f. signals introduce many new problems which will be worked out as such channels are opened up. New TV receivers capable of handling those signals will become available in the u.h.f. service areas. Entirely new types of receiving antennas will be required, along with special coaxial cable downleads.

Economic considerations may dictate that receivers be limited to either v.h.f. or u.h.f. programs only, although *Du Mont* engineers already have a new continuous-tuning technique that can take care of both the u.h.f. and v.h.f. bands. It may even be found necessary in some installations requiring very long downleads, to place the r.f. head at the antenna itself, so critical are the ultra-high-frequency signals. Whatever technical developments may be required are more than justified by the increased "elbow room" to be gained in the very crowded ether.

As for TV reception generally, it seems that direct-viewing reception continues as the popular choice because of its brighter, more detailed, and all-around more pleasing images. The 12", 15" and 20" picture tubes will be the popular sizes in 1949, with production advances and economies per-

(*Continued on page* 92)

The "NEW LOOK" In Popular Records

By
TOM GOOTÉE

Closeup of the new RCA record player and its 45 r.p.m. record. The 7" vinyl plastic record has 1½ inch center hole.

RCA's 45 r.p.m. system combines a compact record player with 7" plastic discs to provide a small phono unit for use in new or existing equipment.

A NEW and important trend toward high fidelity and the distortion-free reproduction of recorded music and entertainment in the home is indicated by the radically new system of 45 r.p.m. records and matched record players developed by the *RCA Victor Division* of *Radio Corporation of America.*

Establishing new standards of size and speed as well as improved fidelity, the 45 r.p.m. system is designed to provide mechanical simplicity, small size, light weight, and lowered costs.

The Records

The new 45 r.p.m. records are wafer-thin, non-breakable discs of the vinyl plastic, which is known commercially as *Vinylite.* All records are of uniform size—slightly less than seven inches in diameter. All of the records have a large center spindle hole which measures one and one-half inches in diameter.

The playing surface on each side of a record is confined to a single band, about one inch in width (maximum), which represents a maximum of 275 grooves. This band represents a playing time of about five minutes. A three-minute record would have a narrower band of grooves and correspondingly fewer grooves.

Between the band, or playing surface, and the large spindle hole is a slightly raised collar which carries the record label. The primary purpose of this raised circular area is to prevent any contact between the playing surfaces of proximate records when they are stacked together. In this way, scratches due to friction with other records is effectively minimized.

The *Vinylite* used in the records is a hard and durable material and stands considerable abuse. Essentially a vinyl-acetate resin, *Vinylite* is molded with heat and pressure like other synthetic resins. *Vinylite* is unaffected by water, oil, gasoline, acids, or alkalies. It is thermoplastic, but no appreciable change in shape can be detected when the record is subjected to normal heat. The material can be produced in a variety of colors and because of its high refractive index the colors are brilliant and clear.

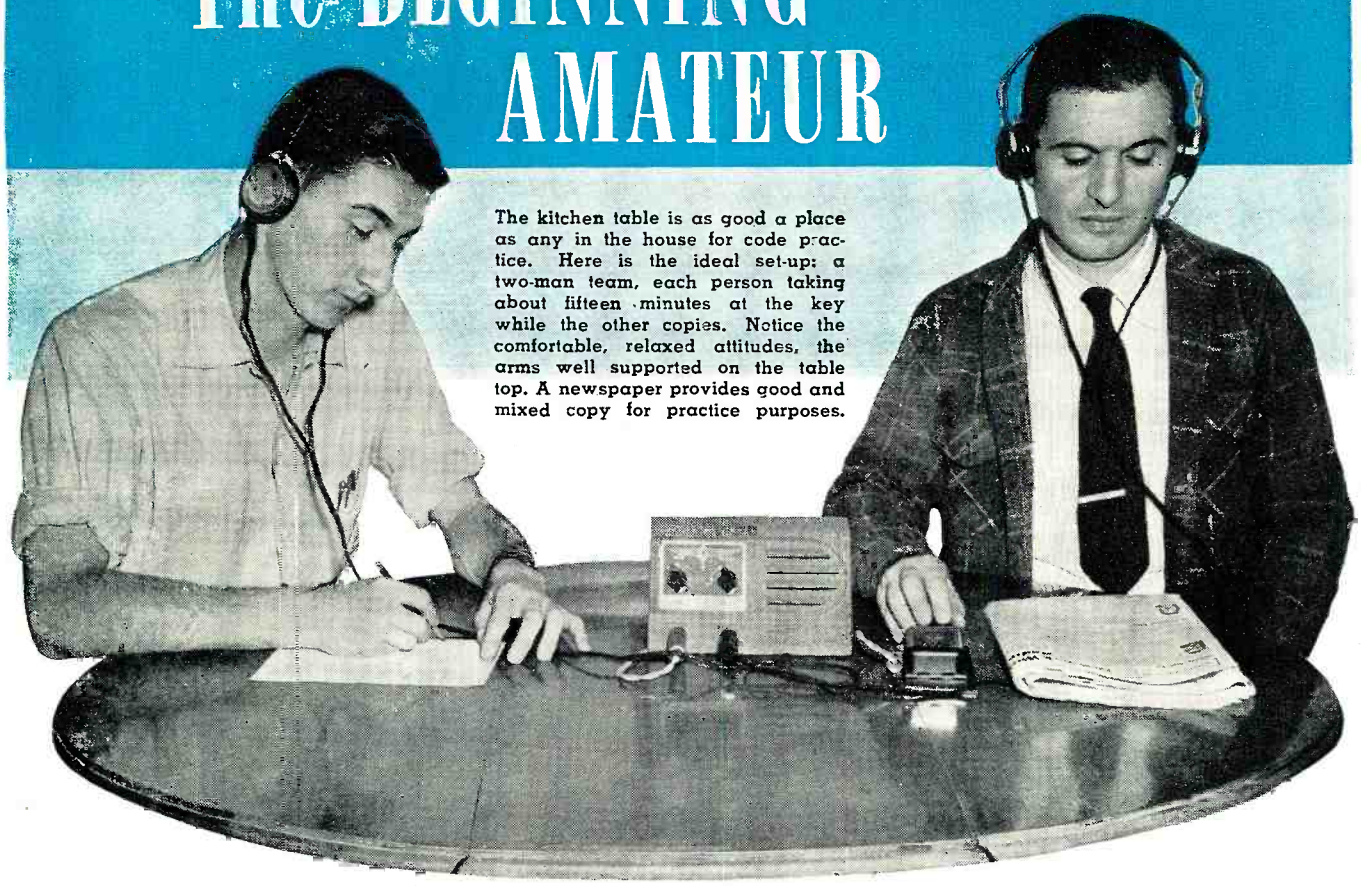
Illustrative of the relatively small size of these new records is the fact that a stack of 1000 discs can be housed in an ordinary console cabinet. Thus the problem of record storage in the

(*Continued on page* 98)

Comparison in size between the 78 r.p.m. and the new 45 r.p.m. discs. The new 7" vinyl record plays 5 min., 15 sec. per side.

Over-all view of the record player in operation. The new unit can be used with any type of available audio system.

The BEGINNING AMATEUR



The kitchen table is as good a place as any in the house for code practice. Here is the ideal set-up: a two-man team, each person taking about fifteen minutes at the key while the other copies. Notice the comfortable, relaxed attitudes, the arms well supported on the table top. A newspaper provides good and mixed copy for practice purposes.

Part 2. Learn code the painless way. This tested method has worked for thousands of radio amateurs.

By
ROBERT HERTZBERG
W2DJJ

YOU must be able to send and receive in the radio code at the rate of thirteen words-per-minute in order to qualify for an amateur operator's license. Your "ham ticket," once earned, gives you free and permanent passage through a lifetime of radio enjoyment. Make up your mind that you want to learn the code and that you will learn it, and you *will* learn it in a surprisingly short time. A firm determination is half the battle.

Who said learning the code was a battle? It can't be very difficult if several hundred thousand hams, over a period of years, have mastered it so thoroughly that they consider it almost a second language.

The radio code, known officially as the "Continental Code," consists of combinations of short and long noises usually referred to as dots and dashes because that's the only way of representing them in print. A more correct vocal approach is to call the sounds *dits* and *dahs*. Whether the noises are of low pitch and rather rough sounding, or of high pitch and rather musical sounding, their only important characteristic is their relative length and mutual spacing. A single short *dit* represents the letter *E*. A single dash or *dah*, approximately three times the duration of a dit, is the letter *T*. A single *dit*, followed by a single *dah* after a silent interval equal to the time of a dit itself, gives the letter *A*. Two quick *dits* make the letter *I*, two quick *dahs* make the letter *M*. To keep the *dits* and *dahs* of individual letters from piling into each other, a blank period equivalent to the duration of three *dits* is allowed *between* letters. Between whole words, the interval is increased to a five-*dit* silence. The actual length of the *dits* and *dahs* is not important as long as the *dits* are unmistakably short and the *dahs* unmistakably longer.

The complete code, arranged alphabetically and also rearranged into convenient groups for study purposes, is shown in Table 1. This is the *only* dot-and-dash code used in radio work the world over. Don't confuse it with the "Morse Code," which was named after the inventor of the telegraph and which was used for many years on the land-line telegraph circuits of the United States. "Morse" was designed to fit the requirements of a clicking telegraph sounder. It has more *dit* characters, and some of them have spacing within themselves. For instance, the Morse letter *C* is *dit dit space dit*. With the advent of teletype machines, the Morse Code and the telegraph sounder have pretty much disappeared. The present code is called "Continental" because it was first used on the telegraph lines on the continent of Europe. It was adopted for radio communication, through international agreement, because it was better suited to the sustained signals of radio transmitters than was American Morse.

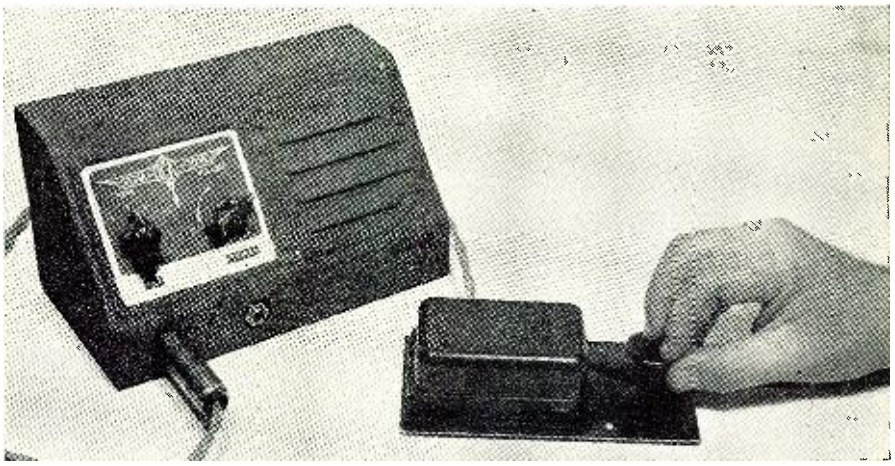
Also, don't confuse "radio code" with "code messages." A "code message" is a form of secret communication between two or more persons who know through careful prearrangement certain private meanings given to apparently innocent words or phrases. A message might read, "Oceans of love and best wishes for a pleasant journey," but to the recipient it might mean, "Your competitor is on the same boat and is trying to land an order from your customer". Contrary to the fond belief of many writers of spy stories, there is no way of "breaking a code"; you either know the arbitrary

meanings of the words or phrases or you don't, and there's no way of guessing at them. What these writers usually have in mind when they say "code" is properly known as "cipher." A ciphered message is one in which the letters of the original clear text have been rearranged or replaced by other letters, the result being pure hash as far as the uninitiated are concerned. A lot of traffic of this kind can be heard on a short-wave receiver. If you copy it carefully, you'll get something like *"xcvbt qwert ghtyu polut,"* and so on interminably. It's deadly stuff to write down and not very good code practice because you really don't know whether you're getting it correctly or not.

The very first step in learning the code is of course to memorize the *dit* and *dah* combinations. If you start with *A* and try to work through to *Z* you'll have a headache after the first attempt. A much better idea is to tackle the four groups as they are shown in the chart, one at a time. Take Group One, which contains only *dit* and *dah* characters. How did you memorize short poems for recitation in class, or the conjugations of those French verbs? Just repetition, that's all. Look at the letter *E* and to yourself say *"Dit."* Look at *I* and mutter *"Dit dit"*; at *M*, say *"Dah dah,"* and be careful no one hears you, or you'll be suspected of succumbing to baby talk. Allow about fifteen minutes for the very first self-taught lesson. After you look at the letter *S* and reel off *"Dit dit dit"* without thinking, you are ready to make a code practice set and get going seriously.

There are several excellent code practice devices on the market; some of them are shown in the photographs so that you will at least recognize them if you look for them in any of the standard radio catalogues. However, for less than a dollar you can make a perfectly good unit that will serve very nicely as a starter. This unit consists of a war surplus radio key (about 40 cents), a common household door buzzer (about 45 cents) and two flashlight cells, assembled and wired as shown. The key is so called because it opens and closes the attached circuit when its knob is manipulated. The spacing of the contacts and the spring tension applied to the lever are both adjustable. The contacts should be about 1/32 inch apart. The buzzer will sound somewhat raucous. You can improve its tone considerably by stuffing a tiny wad of paper in its armature, which is the short springlike arm next to the magnet coil.

Working entirely alone, many hams have taught themselves the code. However, it's a much, much easier undertaking if two people, or more, start together. They can check each other's mistakes and in general accelerate each other's progress. Father-and-son teams are good. Many a dad starts with his son just to help him out, and ends up by becoming a rabid ham himself. That's fine, because he'll spend the heavy money for the equipment!



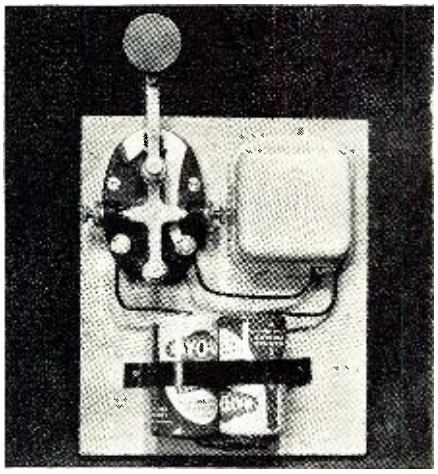
The proper way to use the key is the easy way. The thumb should be against the edge of the knob with the first two fingers resting lightly on top. The knob is pressed rather than tapped. The unit on the left is a commercial code practice oscillator with a self-contained loudspeaker. The unit will work on any house power line.

You are bound to fumble a bit the first time you touch the key. Just relax and take it easy. Initially, try making series of uniform dots representing the letters *E, I, S* and *H,* in Group One of the chart. Then try dashes. Your partner will tell you if the characters sound all right. Let him try. After about ten minutes, immediately begin to send words and see how the other lad understands them. The process of writing down the words on paper is called "copying"; the art of sending by means of the key is commonly called "brass pounding", because early keys were massive chunks of brass. A "brass pounder," it follows, is a radio operator.

A learner is greatly encouraged when he finds that he is able to make sense out of the *dits* and *dahs*. Therefore, compile simple words and sentences, using only the letters of Group One, and watch how quickly both of you improve. Here are a few suggestions for "copy" to transmit:

"He is Tom." "She is his sis." "Tessie

(*Continued on page* 141)



The simplest of all code practice equipment consists of a key, a household buzzer, and two flashlight cells wired in series. The wooden baseboard is about 5½ by 6½ inches. The key and buzzer are fastened down with small wood screws, the batteries by a clamp cut from a tin can, with screws through the ends. No diagram is necessary as all of the wiring is visible.

Code practice records provide one method for improving speed and accuracy. This Linguaphone International Morse (Continental) Code set is one of several available.

A Compact Home-Built STROBOSCOPE

By
LYMAN E. GREENLEE

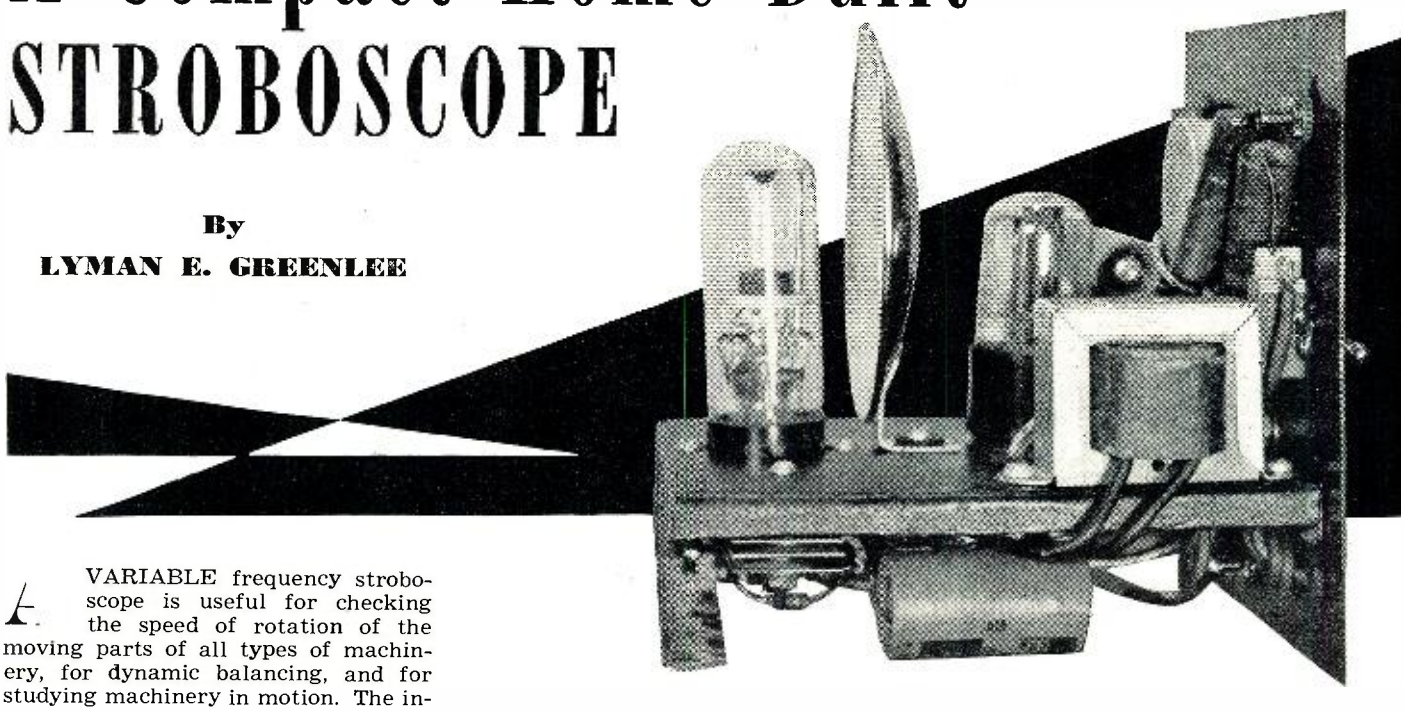


Fig. 1. Side view of unit showing mounting of reflector.

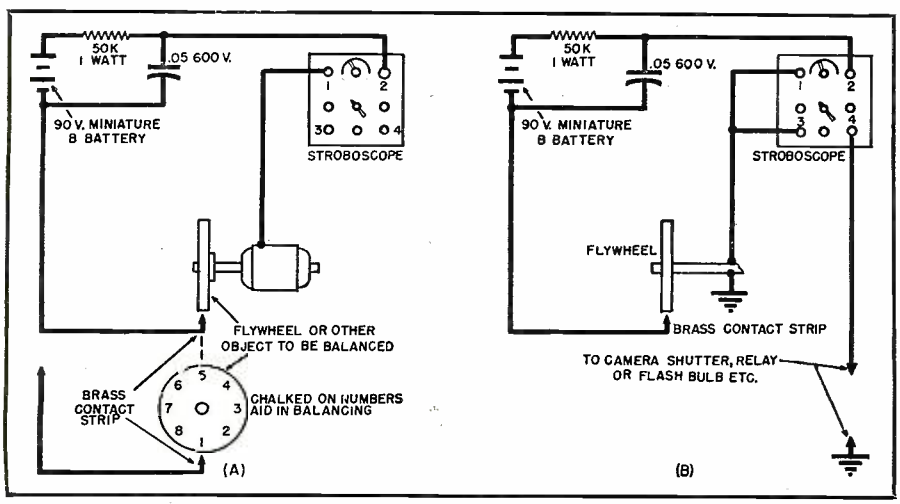
This easily-built unit may be used for checking the rotational speeds up to 30,000 revolutions-per-minute.

A VARIABLE frequency stroboscope is useful for checking the speed of rotation of the moving parts of all types of machinery, for dynamic balancing, and for studying machinery in motion. The instrument described is easy to build and its cost is much less than for a comparable piece of commercially-built equipment. In addition, several features are included which are not usually found in the manufactured instruments.

The stroboscopic light is produced by a *Sylvania* Type 1D21 *Strobotron.* The *Strobotron* is a special neon light capable of maintaining a high current instantaneous peak discharge at frequencies up to 240 c.p.s. The frequency range is sufficient to permit speed checks up to 30,000 r.p.m. with a high degree of accuracy. All the working parts are assembled in a stock metal cabinet 6" x 6" x 6" and the completed light weighs 5 pounds. The small size and light weight is obtained by using two selenium rectifiers in a voltage doubler circuit in place of a regular transformer power supply.

A type 6N7G radio tube is used as a low frequency pulse generator (Fig. 3.) to cover all frequencies from approximately 10 to 300 c.p.s. in two ranges. Pulses from the 6N7G oscillator are fed to the control grid of the 1D21 through a .0005 μfd. coupling condenser. These pulses cause the *Strobotron* to fire at a rate determined by the 6N7G plate-to-grid coupling condensers and the setting of the 50,000 ohm potentiometer used as variable frequency control. A triple-pole, triple-throw switch is used as range selector, and in the third position, either 60-cycle line frequency or an external source may be used to fire the tube. An output transformer is connected in series with the cathode of the *Strobotron,* and a high voltage pulse is thus available for applications such as triggering speed flash tubes for photography, etc.

Fig. 2. (A) Simple arrangement for triggering the light for dynamic balancing. (B) Suggested circuit whereby output pulses may be used to actuate a relay.



Construction Details

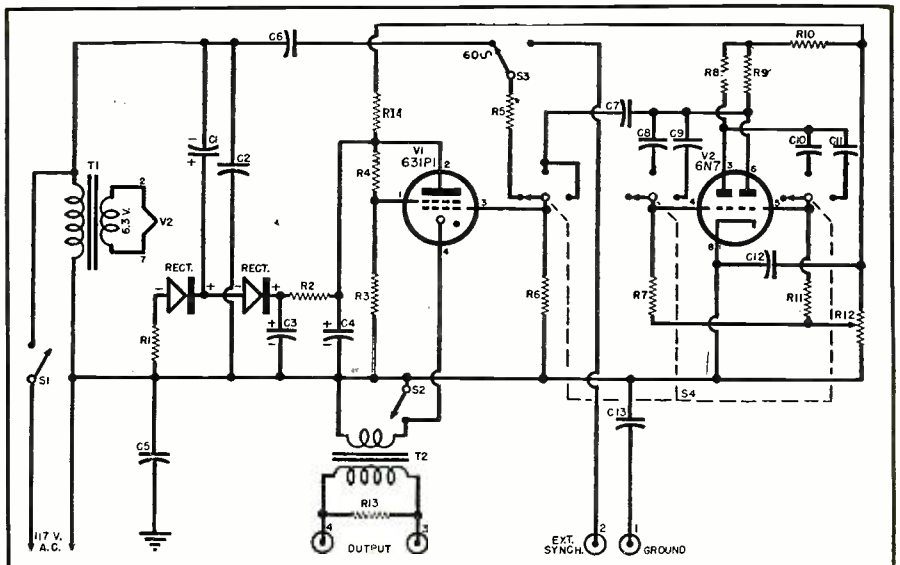
Make the chassis out of a piece of 18 or 20 gauge sheet steel or aluminum. Cut to size, drill and tap holes, and fold in a vise. Socket holes may be cut out with a hammer and cold chisel, and finished with a file. The stock metal box is available already finished and assembled. Drill the control panel making allowances if other than specified parts are used. No dimensions for the front panel are given as this will have to be cut to fit whatever type of escutcheon plate and dial the constructor is able to obtain from a junked radio. A suitable handle may be obtained from the local hardware store. Felt feet should be added to prevent the light from marring finished surfaces. The photographs will give a good idea as to the proper parts arrangement and assembly. There is plenty of room for all the parts, but

the chassis is a close fit in the cabinet, and therefore parts must be mounted so that they do not interfere with its insertion and removal.

The wiring is simple and should be made as direct as possible, using a good grade of radio pushback wire. Solder all connections with rosin solder. The 3000 ohm wirewound resistor must be mounted so that the heat generated will not affect other parts. Values of resistors and condensers are not critical with the exception of the four condensers coupling the grids and plates of the 6N7G. The values of these condensers should be matched on a capacity bridge. Any radio parts jobber can easily match pairs from an assortment of condensers. For example, select a handful of condensers rated .02 μfd., and pick out two which check exactly the same on the bridge, without regard to whether either one is exactly .02 μfd. Select a matched pair close to .005 μfd. the same way. By picking through a couple of dozen condensers, two can be selected that are very close to the required value.

A piece of lucite or similar plastic should be used as a lens to prevent damage to bulb and reflector. Some constructors may prefer to use glass. In use, the light may be held close to rapidly moving machinery and there is always the possibility that chips, oil, and dirt may fly off, so the lens should be heavy enough to withstand rough usage.

After assembling and wiring of the chassis, tubes should be inserted in their respective sockets and the unit plugged into the a.c. power line and checked for operation before it is finally installed in the case. The *Strobotron* should start to flash as soon as the 6N7G tube has warmed up. The maximum or minimum frequency rate may vary somewhat due to differences in parts used, but the low frequency should be about 10 c.p.s. and the high about 300 c.p.s. maximum. Since 300 c.p.s. is beyond the normal operating range of the tube, the highest frequency setting may cause the tube to sputter and miss out part of the time. If a slower timing cycle is desired, the .005 μfd. condensers may be changed to a matched pair of .05 μfd. units. However, the values given in the diagram will cover most applications unless extremely slow motion is to be studied.



R_1—50 ohm, 2 w. res.
R_2—3000 ohm, 10 w. wirewound res.
R_3, R_{10}—50,000 ohm, 1 w. res.
R_4—100,000 ohm, 1 w. res.
R_5, R_{13}—10,000 ohm, 1 w. res.
R_6, R_7, R_{11}—1 megohm, ½ w. res.
R_8, R_9—150,000 ohm, 1 w. res.
R_{12}—50,000 ohm, wirewound pot. (Mallory #M50MP)
R_{14}—5000 ohm, 1 w. res.
C_1—16 μfd., 350 v. elec. cond.
C_2, C_3, C_9, C_{11}—.02 μfd., 600 v. cond. (two should be matched, see text)
C_3—8 μfd., 350 v. elec. cond.
C_4, C_{12}—4 μfd., 350 v. elec. cond.
C_5, C_{13}—.05 μfd., 600 v. cond.
C_7—500 μμfd. mica cond.
C_8, C_{10}—.005 μfd., 600 v. cond. (should be matched, see text)
T_1—Fil. trans. 6.3 v. @ 1 amp.
T_2—Output trans. single plate (7000 to 10,000 ohms) to v.c. (Stancor #A3822)
S_1, S_2—S.p.s.t. toggle sw.
S_3—S.p.d.t. toggle sw.
S_4—3-pole, 3-pos. rotary sw.
Rect.—75 ma. selenium rectifier

V_1—631P1 stroboscope tube (Sylvania 1D21 Strobotron)
V_2—6N7G tube
Other parts required:
1—6" x 6" x 6" metal cabinet
1—8½" x 5¾" x 18 or 20 gauge piece of sheet steel for chassis
1—Handle for cabinet
1—Reflector from Univex flash camera or equivalent
1—Escutcheon plate from old radio dial (approx. 3" dia.)
4—Felt feet with 6-32 machine screws in head
1—Piece of lucite for circle 3" dia. (to fit escutcheon plate)
1—4 prong wafer socket
1—Octal socket
1—Gordon handwheel with 270 deg. scale
4—Wiring ties
1—Bar knob for switch
1—Line cord and plug
3—⅜" rubber grommets
4—Pin jacks
Wire, solder, 6-32 and 8-32 screws, etc., as required

Fig. 3. Circuit diagram and parts list for building the compact stroboscope.

In case the *Strobotron* fails to flash properly, check all wiring and also check the voltage across the 8 and 4 μfd. condensers, which should be about 250 volts when the tube is not flashing. Note that the circuit is grounded to the case through an .05 μfd. condenser. In no case should any part

(*Continued on page* 102)

Fig. 4. Rear view of stroboscope showing the control panel.

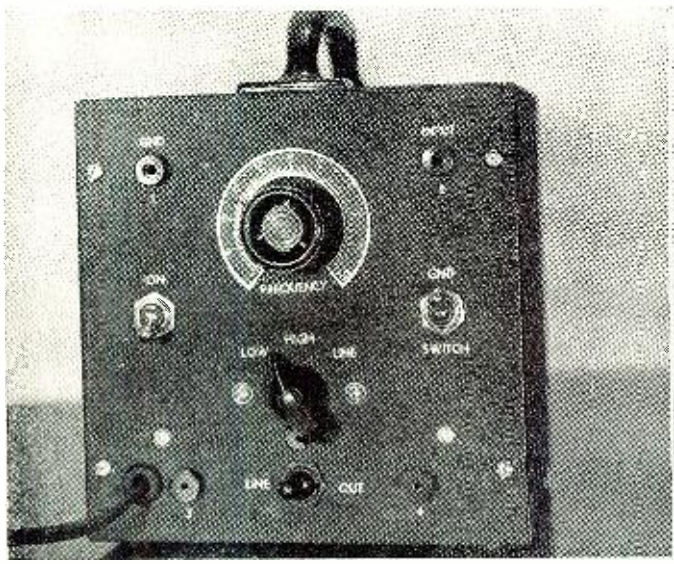
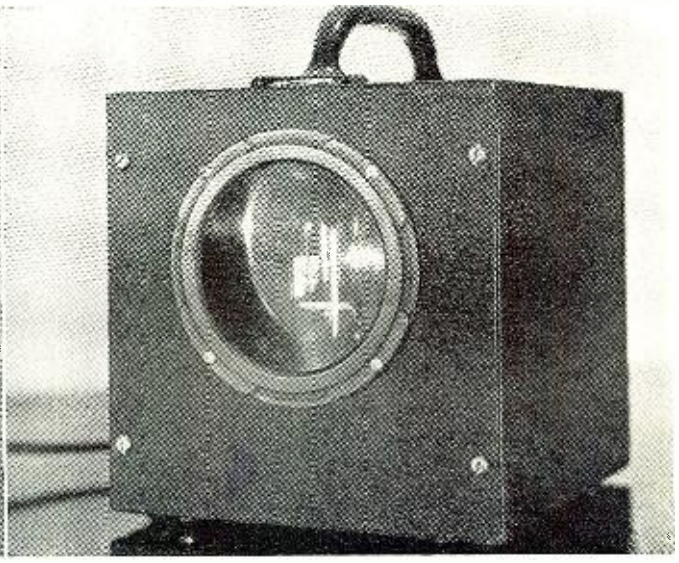
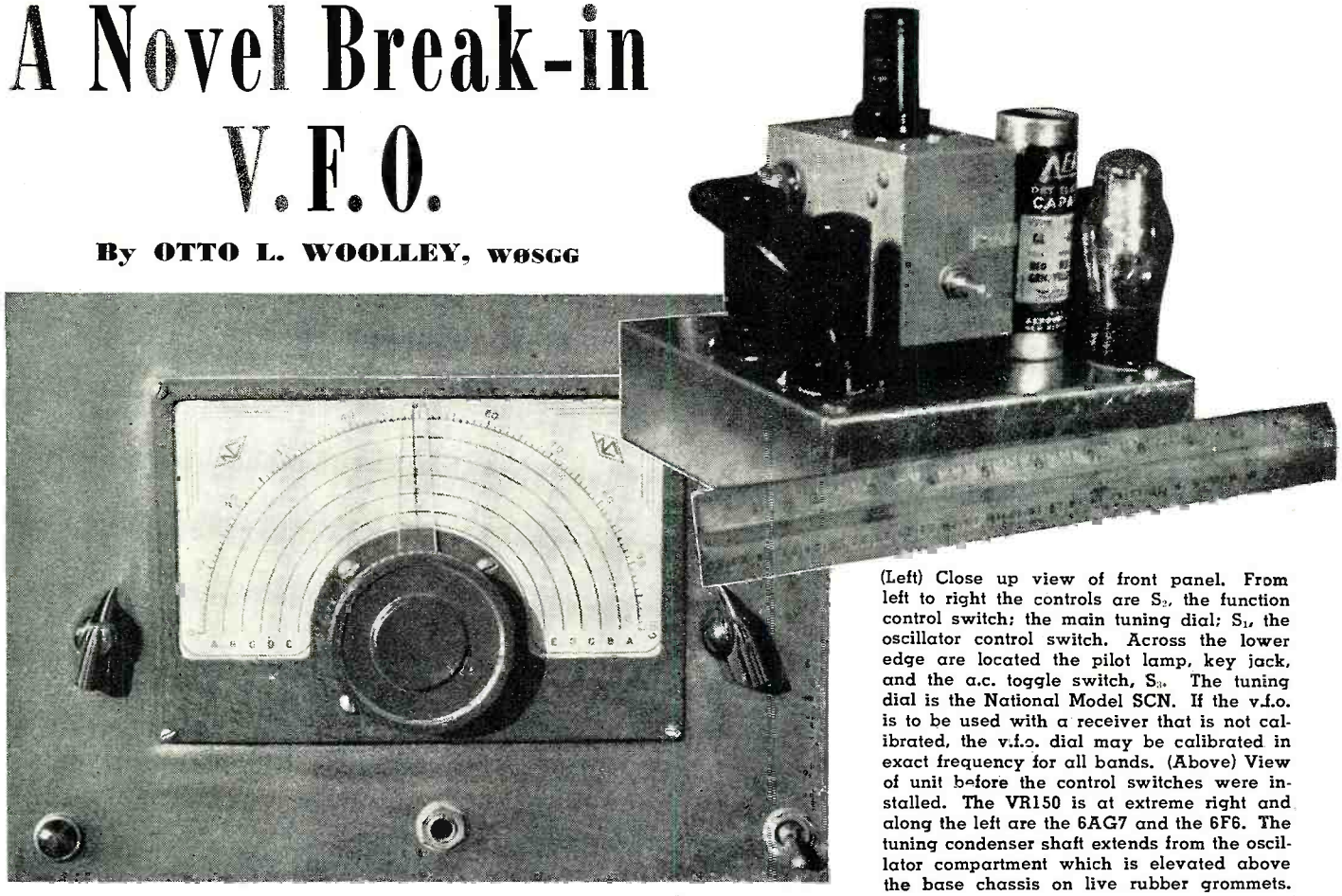


Fig. 5. Front view of the adjustable frequency stroboscope.



A Novel Break-in V.F.O.

By OTTO L. WOOLLEY, WØSGG



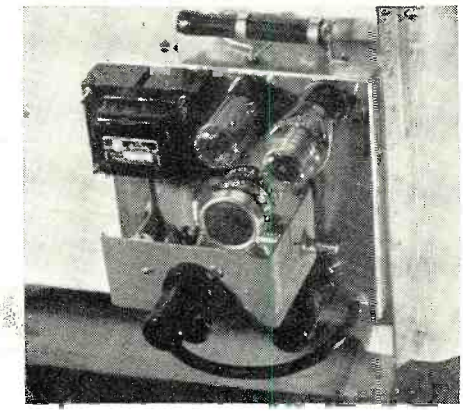
(Left) Close up view of front panel. From left to right the controls are S_2, the function control switch; the main tuning dial; S_1, the oscillator control switch. Across the lower edge are located the pilot lamp, key jack, and the a.c. toggle switch, S_3. The tuning dial is the National Model SCN. If the v.f.o. is to be used with a receiver that is not calibrated, the v.f.o. dial may be calibrated in exact frequency for all bands. (Above) View of unit before the control switches were installed. The VR150 is at extreme right and along the left are the 6AG7 and the 6F6. The tuning condenser shaft extends from the oscillator compartment which is elevated above the base chassis on live rubber grommets.

An unusual v.f.o. featuring break-in operation on the transmitter frequency by thoroughly shielding the oscillator section.

THIS v.f.o. is the result of a considerable amount of work done to secure a unit that would fill the requirements for a compact, completely self-contained variable master oscillator for amateur work; providing break-in on the operating frequency, good keying characteristics, and sufficient output to drive any ordinary crystal oscillator tube or doubler stage. A "must" was that some means be provided to spot the oscillator frequency in the receiver with no possibility of putting a signal on the air during the tuning of the v.f.o.

To permit break-in on the operating frequency a keyed oscillator was tried in various forms but after some work the idea was abandoned and it was decided to use a well shielded, continuously running oscillator, at low input and lightly coupled to the following stages. In practice this arrangement worked out very well. The 6SS7 tube was chosen for the oscillator tube. This tube is very similar to the 6SK7 in most characteristics with the important exception that the filament current is only .15 amp. as compared to the .3 amp. for the 6SK7. This represents a very worthwhile reduction in oscillator tube temperature and subsequent drift from the heating of other oscillator components. The oscillator operates at 75 volts on the plate and screen and the combined currents are only 7 ma. At this low input the stability of the oscillator section is excellent. The entire oscillator unit is built into a cast metal "jack box" secured on the surplus market. The box measures about 2" by 3½" by 4¼" and originally contained a five position switch,

Top view of the v.f.o. with the oscillator box cover removed. Power supply is shown along the top side of chassis with the large resistor mounted on the outside.



volume control, and two jacks. All parts are removed from the box as received and discarded, including the cover. A new cover is folded from sheet aluminum and should be firm enough to form a good shield and be mechanically solid.

The oscillator operates on 160 meters into the 6AG7 class A amplifier which is untuned and has an r.f.c. in the plate circuit. The 6F6 output tube doubles the frequency to 80 meters in the broadly resonant output tank coil. In this unit the range covers 3500 to 3650 kc., with a small overlap at each end. This range may be shifted by use of the bandset condenser C_2 or it may be expanded by increasing the inductance L_1 or the capacity of C_3, or both. The range above was chosen at this station to permit working the low end of 80 and still have as much bandspread as possible on the higher frequency bands without resorting to bandswitching. Zero temperature coefficient fixed condensers are used to pad the oscillator circuit and there is a total of 850 $\mu\mu$fd. of fixed capacity across the oscillator coil. The coil consists of 20 turns of #22 enameled wire, closewound on a 1" diameter form, tapped 5 turns from the ground end. This coil should be wound as tightly as possible and then very thoroughly doped to assure freedom from frequency shift. A ceramic form is ideal but it is doubtful that one will be readily available and a good solid mica phenolic form may be used instead. To

further insure stability all parts must be very solidly mounted and all joints mechanically sound and carefully soldered. Three holes are drilled in the bottom of the oscillator box to pass 6-32 machine screws which are passed through ⅜" high rubber grommets which shock mount the oscillator compartment against vibration. The base chassis is 7" x 7" x 2" and the parts layout may be determined from the photos.

A *Jones* socket and plug (coaxial type) is used to connect the cable to the oscillator compartment. This short section of coaxial line is then run up to the front corner of the chassis where it is dropped down through to connect to the coupling condenser of the 6AG7 grid. An ordinary brass panel bearing makes a convenient way to pass the coax through the chassis. The shield is cut back on the cable and soldered to the outer side of the bearing. The center of the coax is passed through the hole in the panel bearing and the retain-nut is tightened on the portion of the bearing protruding through the bottom of the chassis. This makes a practical and solid fastening and is very compact.

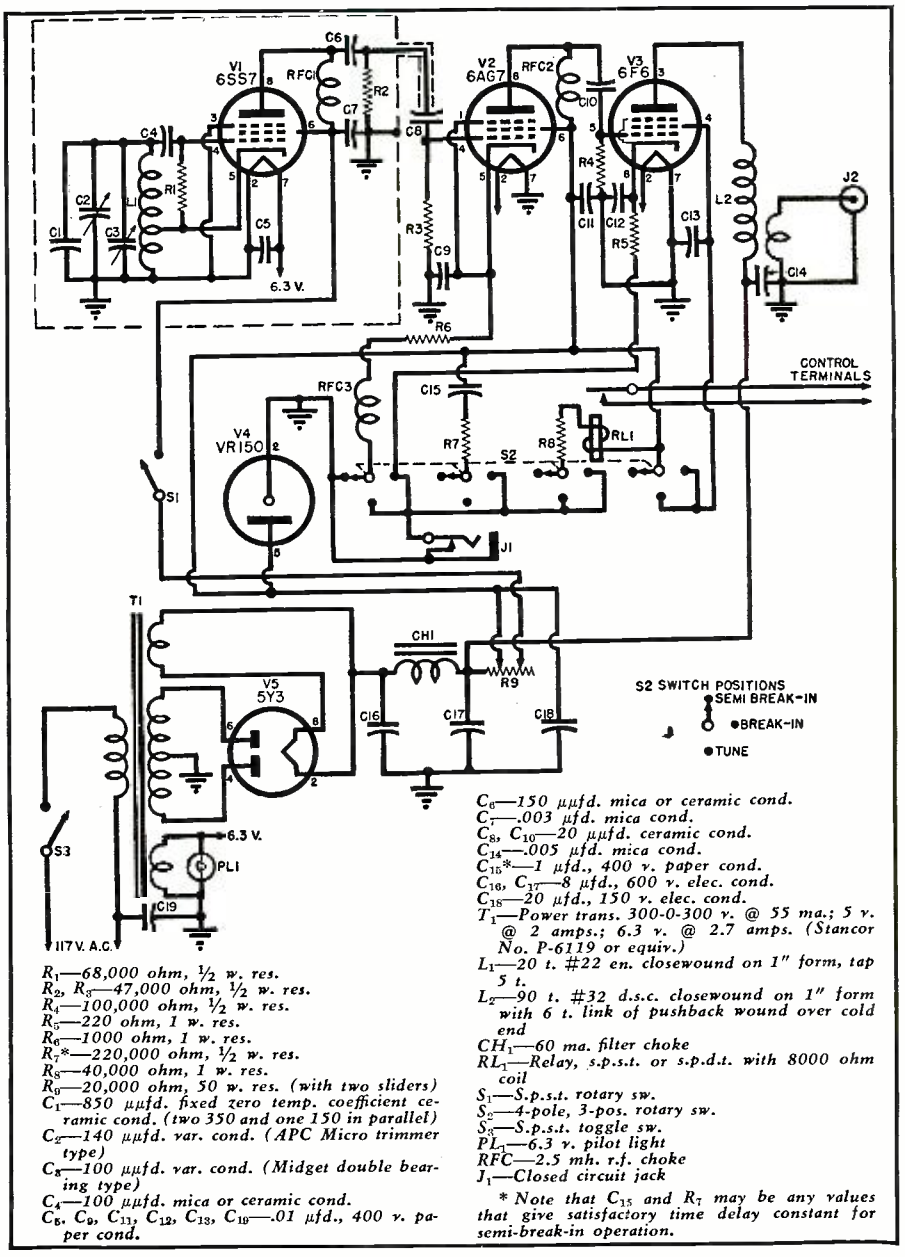
Keying is accomplished in the cathodes of both amplifier tubes. This keeps the key-up residual signal at a minimum. A simple shield is bent to enclose the output stage and minimize any r.f. feedback through the power supply which might roughen up the note. The output tank coil consists of 90 turns of #32 d.s.c. wire closewound on a 1" form. The pickup link is 6 turns of #20 hookup wound over the cold end and connected to the output connector on the rear of the chassis. It is important that coax be used to feed the transmitter and that the lead in the transmitter itself be as short as is practical in order to hold down any signal that may be present with the key up. This is of importance only when working a station on the same frequency, but that is often necessary and is mandatory for networking. which comprises a good deal of amateur activities.

The control circuit switch provides three positions as follows:

1. *Tune:* In this position the cathode of the 6AG7 is closed, the 6F6 cathode is open and the relay is disabled, placing the station in the "receive" position. The screen voltage of the 6F6 is also removed. It is now possible to listen to the v.f.o. in the receiver and tune to any desired spot in the band without putting any signal on the air whatsoever.

2. *Break-in:* This position puts both amplifier cathodes across the key, applies voltage to the 6F6 screen and to the relay. The relay will now follow the key and may be used to control the station equipment for complete break-in. One of the easiest ways to work in this fashion is to use a separate receiving antenna and let the v.f.o. control circuit take the receiver off the air.

(*Continued on page* 105)

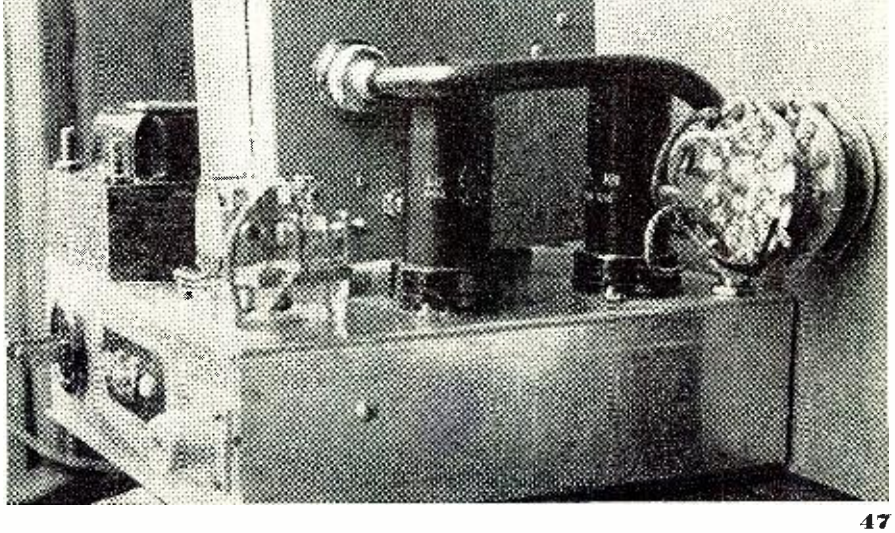


R_1—68,000 ohm, ½ w. res.
R_2, R_3—47,000 ohm, ½ w. res.
R_4—100,000 ohm, ½ w. res.
R_5—220 ohm, 1 w. res.
R_6—1000 ohm, 1 w. res.
R_7*—220,000 ohm, ½ w. res.
R_8—40,000 ohm, 1 w. res.
R_9—20,000 ohm, 50 w. res. (with two sliders)
C_1—850 μμfd. fixed zero temp. coefficient ceramic cond. (two 350 and one 150 in parallel)
C_2—140 μμfd. var. cond. (APC Micro trimmer type)
C_3—100 μμfd. var. cond. (Midget double bearing type)
C_4—100 μμfd. mica or ceramic cond.
C_5, C_9, C_{11}, C_{12}, C_{13}, C_{19}—.01 μfd., 400 v. paper cond.
C_6—150 μμfd. mica or ceramic cond.
C_7—.003 μfd. mica cond.
C_8, C_{10}—20 μμfd. ceramic cond.
C_{14}—.005 μfd. mica cond.
C_{15}*—1 μfd., 400 v. paper cond.
C_{16}, C_{17}—8 μfd., 600 v. elec. cond.
C_{18}—20 μfd., 150 v. elec. cond.
T_1—Power trans. 300-0-300 v. @ 55 ma.; 5 v. @ 2 amps.; 6.3 v. @ 2.7 amps. (Stancor No. P-6119 or equiv.)
L_1—20 t. #22 en. closewound on 1" form, tap 5 t.
L_2—90 t. #32 d.s.c. closewound on 1" form with 6 t. link of pushback wound over cold end
CH_1—60 ma. filter choke
RL_1—Relay, s.p.s.t. or s.p.d.t. with 8000 ohm coil
S_1—S.p.s.t. rotary sw.
S_2—4-pole, 3-pos. rotary sw.
S_3—S.p.s.t. toggle sw.
PL_1—6.3 v. pilot light
RFC—2.5 mh. r.f. choke
J_1—Closed circuit jack

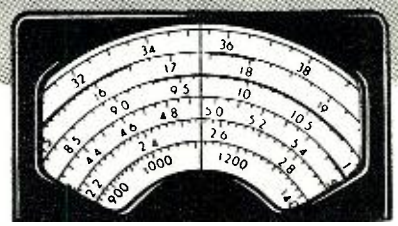
* Note that C_{15} and R_7 may be any values that give satisfactory time delay constant for semi-break-in operation.

Fig. 1. Circuit diagram and parts list covering the break-in v.f.o. unit.

Rear-side view of the v.f.o. The main control switch is shown at the far right with the break-in control relay on the rear corner of the chassis. Across the back is the a.c. connector, relay control terminal strip, and coaxial output fitting. The bandset adjustment screw is behind the 6F6.



International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

JUST like a watchful sentinel, knowing his peaceful mission and conscious of his quiet force, stands *Radio-Andorra*.

It is with pleasure this month that we salute *Radio-Andorra,* claimant to the title, *"the most popular broadcasting station in Europe."* (Thanks go to D. W. McPheeters, Louisiana, for assistance in translating much of the following material.)

Radio-Andorra is located in the main valley of the Principality of Andorra, between the towns of Encamp and las Escaldes, about 2 kilometers from Encamp. It overlooks the main highway connecting France and Spain. It is here that the valleys of Ordino and Andorra dominate the Valira, still bordered by stones dragged along by floods.

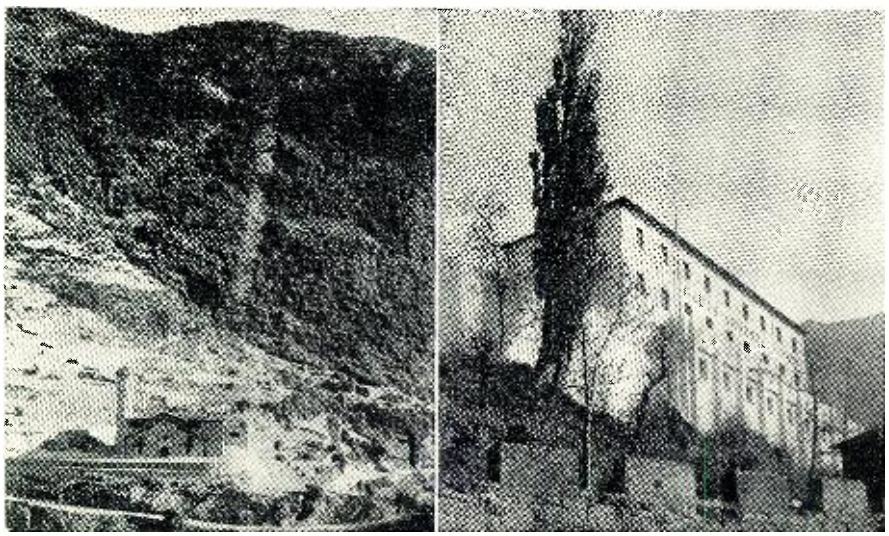
On the Pena de les Anelletes stand the studios of *Radio-Andorra*. The building is of smart line and bright color. Gathered around it are all the administrative services for the programs, publicity, patrons, propaganda, and also broadcasting and telephone technicians. On the four main floors where all the numerous departments are situated, there is a center of bustling activity that works day and night with the greatest discipline, to maintain the name of *Radio-Andorra*.

The concession granted to an old Andorran family in 1935 to build *Radio-Andorra* grew into this fine installation, in spite of countless obstacles, in spite of snow, in spite of arduous problems of transportation and the proper use of materials. Instead of the smooth and lonely rock of Pug d'Encamp, rended by dynamite, little by little the walls of a great construction came out of the earth. It was truly an example of Modern Times conquering the Middle-Ages. Here Andorrans fight tenaciously against nature, where the river Valira meanders forth into Spain providing the energy for hydro-electric power stations. This broadcasting station, in its picturesque frame, presents medieval style in splendid contrast with the achievements of the modern technique which the station employs.

Altitude of the station is 890 meters. But the antenna masts are set up at 1640 meters, in a splendid background, near the shore of Lake Engolasters Discreetly lodged between pines and silver-trees, are the antennas of *Radio-Andorra*. The antennas are supported by two 125 meter towers, with the studios being connected by a feeder of more than 850 meters in length.

This is the first time a radio-electric installation of this type has been effected. It was necessary to overcome numerous technical difficulties in order to match the antenna with the station itself because of the distance of about a half mile and a difference in altitude of 650 meters.

(Left) Transmitter building of Radio Andorra, located 900 meters above sea level. A feeder line carries the program from the transmitter to the antennas which rise 1650 meters above sea level. (Right) The famous studio terrace at Radio Andorra.



But thanks to the arrangements made and the location of the antenna, the active range of the 60,000 watt medium-wave station is excellent and permits particularly easy and powerful reception in all of Europe and North Africa. On short-waves, with a power of 25,000 watts, the concerts of *Radio-Andorra* are easily heard in the United States and Canada, Australia, New Zealand, French Indo-China, Scandinavia, South Africa, South America, and so on. (Station officials speak in terms of *"mountains of mail."*)

The frequencies used simultaneously are: medium-wave 704 kc. (426.10 m.); and short-wave 5.980 mc. (50.16 m.) and 9.330 mc. (32.15 m.); *the latter is believed to be inactive at this time.*

The main building—specially planned and constructed to meet the exacting requirements of a radio-electric center—is built entirely of granite. It consists of a ground floor, completely accessible with large doors, which houses a machine room embracing the power input box and relays, the output circuits, the lighting transformers, and the installation of water pumps to provide the necessary water circulation for high-power tubes; a distribution room which holds all electric and water mains (these go from the input sources to the transmitters and to various control panels); a large workshop with machine-tools and power lathes, to permit the making of all mechanical and electrical repairs on the spot; a garage; the main entrance of the transmitter room, and quarters for the guard.

The first floor houses the transmitter rooms and related units—a huge transmitter room approximately 39 by 12 meters where is gathered the actual transmission apparatus: the standard broadcast transmitter S.F.R. with power of 60 kw. carrier—425 meters during the day and 274 meters at night —and the short-wave transmitter S.F.R. A rectifier room continues this arrangement at the same width and approximately 10 meters long, where are located the high voltage rectifiers necessary for feeding the power triode tubes of the transmitters, as well as the filter units located between the rectifiers and the transmitter; the power, 350 kw., is supplied by the Andorran Center of the FHASA, at 5000 volts a.c., and is then transformed into

(*Continued on page* 118)

A Phone-C.W. TRANSMITTER in Miniature

By
RAY D. ZIMMERMAN, W3KOY

Fig. 1. Over-all view of rig. In front are (from left to right): buffer coil, 80 m. tank coil, 6 m. tank coil, and 20 m. tank coil.

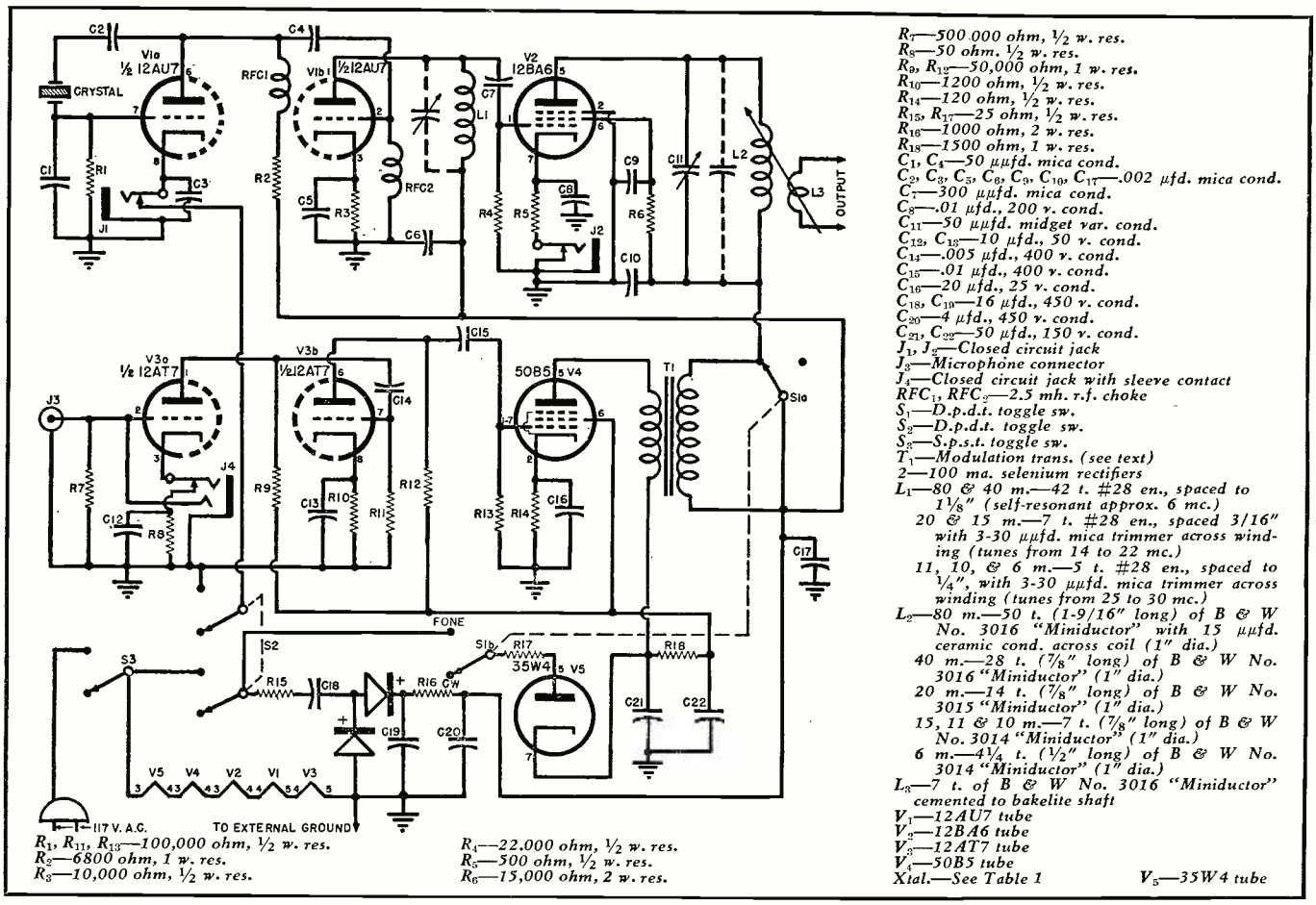
Employing readily available parts, this compact transmitter will serve nicely as a standby rig.

ACTUAL tests have shown that an operator will usually notice little or no increase in the strength of a received signal when the power at the transmitter is increased to three times its original level. Furthermore, the power must often be increased considerably above this ratio to produce a marked increase in signal strength. This leads to the interesting conclusion that a transmitter running three to four watts input will perform very nearly—if not equally—as well as a ten to fifteen watt transmitter.

Since many successful transmitters operate with a power input of only ten to fifteen watts, the transmitter to be described was designed to operate with a nominal power input to the final amplifier of three and one-half watts. In the interest of versatility, the following features were incorporated: (1) Operation on all bands 80 to 6 meters inclusive; (2) phone or c. w. at the flick of a switch; (3) provision for the use of either a carbon or a crystal microphone; and (4) operation from 117 volt a.c. power. These features make the unit useful as a standby rig at the home station in addition to its utility in portable work. Moreover, the low power drain of the unit (approximately 30 watts) allows operation from a 6 volt battery when used in conjunction with a 6 volt d.c. to 117 volt a.c. inverter. Through the use of plug-in coils, miniature tubes, and transformerless type power supply construction, the size of the unit was held to a bare minimum. Its slight bulk (4" x 5" x 8") will fit into almost any suitcase or blend unobtrusively with home furnishings.

The r.f. line-up begins with a Pierce crystal oscillator in one-half of a 12AU7 dual triode. The other half of the 12AU7 is used as a buffer or frequency multiplier depending on the output frequency desired. In the plate circuit of the buffer/multiplier stage, three plug-in coils serve for operation on all bands. One coil, self-resonant at approximately 6 mc., functions as an untuned plate load on 80 and 40 meters, and the other two coils are tuned by mica trimmers to the frequencies listed in the tuning chart. In this manner, sufficient output is obtained to allow straight-through operation of the 12BA6 final amplifier on all bands except 6 meters. For 6 meter output, the 12BA6 doubles from the 25 mc. region. Miniature plug-in coils in the 12BA6 plate circuit provide efficient multi-band operation and, at the same time, keep the over-all size of the rig at a minimum. The output is taken from these coils through a swinging link arrangement which is excellent for coupling to an untuned transmission line. If a zepp or other tuned antenna system is to be used, an external antenna tuner should, of course, be employed.

Keying is accomplished in the cathode of the crystal oscillator where a jack has been provided for this purpose. It may be noted that the shorting contact on the key jack connects to ground through a section of the plate voltage switch (S_2) rather than directly to ground. The purpose of this is to cause the carrier to leave the air immediately when the plate voltage is cut off after a phone transmission. The current drain on the power supply for the r.f. section is not sufficient to cause an immediate discharge of the filter condensers when the plate supply is turned off, and for this reason, the oscillator would continue to run for a few seconds if the cathode circuit were not interrupted. This, of course, would interfere with reception on the operating frequency. Although keying is crisp and clean in the oscillator cathode, the rig can be keyed in the final cathode circuit if desired; however, the jack in this circuit was provided primarily for metering the final cathode current during tuning operations.



R_1, R_{11}, R_{13}—100,000 ohm, ½ w. res.
R_2—6800 ohm, 1 w. res.
R_3—10,000 ohm, ½ w. res.
R_4—22,000 ohm, ½ w. res.
R_5—300 ohm, ½ w. res.
R_6—15,000 ohm, 2 w. res.
R_7—500,000 ohm, ½ w. res.
R_8—50 ohm, ½ w. res.
R_9, R_{12}—50,000 ohm, 1 w. res.
R_{10}—1200 ohm, ½ w. res.
R_{14}—120 ohm, ½ w. res.
R_{15}, R_{17}—25 ohm, ½ w. res.
R_{16}—1000 ohm, 2 w. res.
R_{18}—1500 ohm, 1 w. res.
C_1, C_4—50 μμfd. mica cond.
C_2, C_3, C_5, C_6, C_9, C_{10}, C_{17}—.002 μfd. mica cond.
C_7—300 μμfd. mica cond.
C_8—.01 μfd., 200 v. cond.
C_{11}—50 μμfd. midget var. cond.
C_{12}, C_{19}—10 μfd., 50 v. cond.
C_{14}—.005 μfd., 400 v. cond.
C_{15}—.01 μfd., 400 v. cond.
C_{16}—20 μfd., 25 v. cond.
C_{18}, C_{19}—16 μfd., 450 v. cond.
C_{20}—4 μfd., 450 v. cond.
C_{21}, C_{22}—50 μfd., 150 v. cond.
J_1, J_2—Closed circuit jack
J_3—Microphone connector
J_4—Closed circuit jack with sleeve contact
RFC_1, RFC_2—2.5 mh. r.f. choke
S_1—D.p.d.t. toggle sw.
S_2—D.p.d.t. toggle sw.
S_3—S.p.s.t. toggle sw.
T_1—Modulation trans. (see text)
2—100 ma. selenium rectifiers
L_1—80 & 40 m.—42 t. #28 en., spaced to 1⅛" (self-resonant approx. 6 mc.)
20 & 15 m.—7 t. #28 en., spaced 3/16" with 3-30 μμfd. mica trimmer across winding (tunes from 14 to 22 mc.)
11, 10, & 6 m.—5 t. #28 en., spaced to ¼", with 3-30 μμfd. mica trimmer across winding (tunes from 25 to 30 mc.)
L_2—80 m.—50 t. (1-9/16" long) of B & W No. 3016 "Miniductor" with 15 μμfd. ceramic cond. across coil (1" dia.)
40 m.—28 t. (⅞" long) of B & W No. 3016 "Miniductor" (1" dia.)
20 m.—14 t. (⅞" long) of B & W No. 3015 "Miniductor" (1" dia.)
15, 11 & 10 m.—7 t. (⅞" long) of B & W No. 3014 "Miniductor" (1" dia.)
6 m.—4¼ t. (½" long) of B & W No. 3014 "Miniductor" (1" dia.)
L_3—7 t. of B & W No. 3016 "Miniductor" cemented to bakelite shaft
V_1—12AU7 tube
V_2—12BA6 tube
V_3—12AT7 tube
V_4—50B5 tube
Xtal.—See Table 1
V_5—35W4 tube

Fig. 2. Circuit diagram of transmitter. See text for power line connection data.

The audio section of the transmitter consists of a 12AT7 dual triode speech amplifier and a 50B5 beam power modulator. The input stage in one-half of the 12AT7 features a unique system designed to permit the use of either a carbon or a high impedance microphone such as the crystal or dynamic types. A standard microphone connector (J_3) serves as a receptacle for a high impedance microphone, while a closed-circuit jack equipped with a sleeve contact (J_4) accommodates a standard (surplus PL-55 or similar type) carbon microphone plug.

When a high impedance microphone is used, the circuit functions as an ordinary resistance-coupled speech amplifier; however, the circuit changes when a carbon microphone is used. Inserting the carbon microphone plug into J_4 connects the microphone into the cathode circuit of the tube and causes the grid of the tube to be shorted to ground through the sleeve contact. The carbon microphone then functions as a varying cathode resistance which causes the bias on the tube to vary slightly with the speech. This, in turn, causes a low audio voltage to be developed across the plate load resistor (R_9). The circuit constants are such that the voltage developed across R_9, when a carbon microphone is used, is approximately equal to that developed when a crystal microphone of average output is used. This voltage is amplified by the second half of the 12AT7 and applied to the grid of the 50B5. In the interest of compact construction, an audio gain control was not incorporated; 100 per-cent modulation results when the voice is held to a normal speaking level. Since 1.9 watts of audio power can be obtained from a 50B5 operating into a 2500 ohm load, plenty of power is available for 100 per-cent voice modulation of the 12BA6. In fact, some mismatch can be tolerated in the modulation transformer. For a perfect match, the transformer should be designed to reflect 2500 ohms into the primary when the secondary load is 16,000 ohms; however, the transformer used in the rig built by the writer most certainly does not have this characteristic. It was chosen from the junk box because of its small size and ability to handle the required 50 milliamperes in the primary winding and 15 milliamperes in the secondary winding. Its turns ratio is approximately 1:4 which is quite a deviation from the correct turns ratio of 1:2.5. Despite this fact, the speech quality of the modulation is excellent, and the rig can easily be modulated 100 per-cent.

Table 1. Tuning chart for the various amateur bands covered by the transmitter.

BAND	CRYSTAL	L_1	L_2
80	3.5 to 4.0 mc.	80 & 40	80
40	3.5 to 3.65 mc. 7.0 to 7.3 mc.	80 & 40	40
20	7.0 to 7.2 mc. 3.5 to 3.6 mc.	20 & 15 (tuned to 20)	20
15	7.0 to 7.166 mc.	20 & 15 (tuned to 15)	15, 11 & 10
11	6.79 to 6.857 mc. 9.054 to 9.143 mc.	11, 10 & 6 (tuned to 11)	15, 11 & 10
10	7.0 to 7.4 mc.	11, 10 & 6 (tuned to 10)	15, 11 & 10
6	8.33 to 9.0 mc.	11, 10 & 6 (tuned to 25 mc.)	6

The power supply for the audio section is a half-wave system using a 35W4 rectifier, while a voltage doubler using selenium rectifiers supplies approximately 250 volts to the r.f. section. The shock hazard that usually accompanies transformerless power supplies has been eliminated by taking advantage of the fact that one side of the outside power line is grounded. One of the wires in the transmitter's power cord is not connected in any way; to serve in place of the unconnected wire, *the chassis itself must be connected to a good external ground.* Then, when the power plug is correctly oriented in the 117 volt receptacle, the line voltage will be applied to the transmitter. If the power plug is incorrectly inserted into the receptacle, no voltage will be applied, and it will be necessary to reverse the plug. Since the chassis is connected directly to ground, the unit is as safe to operate as one containing a conventional power supply using a transformer. It should be emphasized, however, that the chassis must be connected to a *good* external ground, and that this ground connection must be made *before* the power plug is inserted into the receptacle. The heaters in the tubes are connected in series across the 117 volt line to eliminate the need for a filament transformer. It should be noted that the wiring sequence of the heaters with respect to ground is rather important; the heaters in the circuits most sensitive to a.c. hum must be closest to ground potential. If the tubes are wired as shown, no hum troubles will be experienced.

A total of three switches controls the rig. S_3 is a line switch, which may be considered unnecessary in portable applications. However, the convenience gained by its incorporation more than compensates for its low cost. S_2 controls the modulator plate supply as well as the plate supply for the r.f. circuits and, in addition, interrupts the cathode circuit of the oscillator as explained previously. S_1 is the phone—c.w. switch. When it is thrown to the c.w. position, it shorts the secondary winding of the modulation transformer and cuts off the modulator plate voltage simultaneously. The locations of these switches as well as the associated operating controls are shown in Fig. 1. On the lower left corner of the front panel, the carbon microphone jack is located, and just above this jack is the crystal microphone connector. The oscillator cathode jack is located between the carbon microphone jack and the crystal, and just above is the amplifier cathode jack. The knob on the lower right controls the final plate tuning, while the knob above it controls the loading. The output terminals are located above and to the left of the loading control.

The transmitter is housed in a small case which measures 5" high x 8" wide x 4" deep. The case did not have a hinged top, so some alterations were necessary to provide access to the inside. Accordingly, the bottom of the case was cut out and mounted on hinges, and the front panel was secured to the hinged bottom. As shown in Fig. 3, this allows the case to swing back, exposing the entire chassis and facilitating coil changes and adjustments. A thumbscrew holds the front panel to the top of the case when the case is closed.

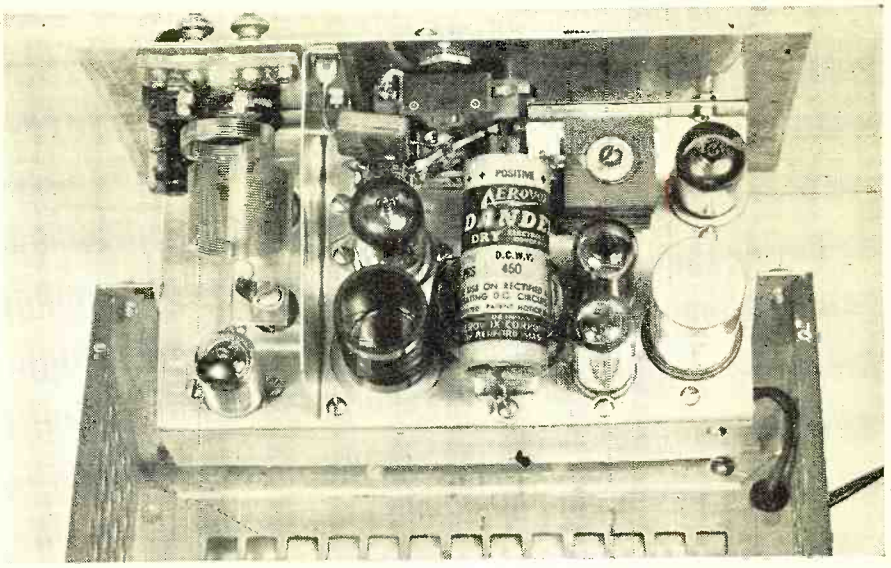


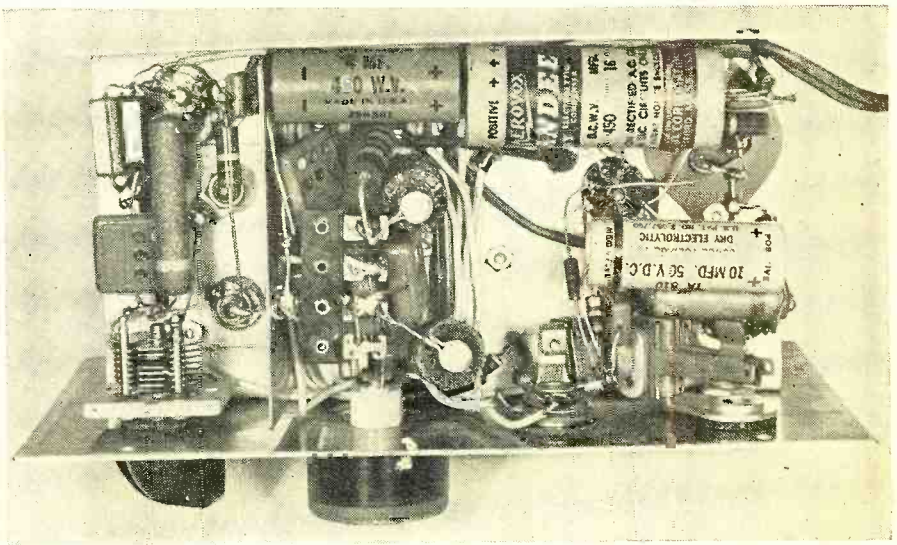
Fig. 3. Top view of transmitter with case swung back. The 12BA6, its tank coil, and the swinging link are to the left of the shield. Just to the right of the shield is the 12AU7 and its plate coil. The large condenser is C_{19}, and under it is the modulation transformer. To the right are the selenium rectifiers, the 50B5, and the 35W4. On the extreme right are the 12AT7 and the filter can, C_{16}, C_{21}, C_{22}.

The construction of the plug-in coils is shown in Fig. 1. The buffer/multiplier coils (L_1) are wound on 1" diameter coil forms. A metal bracket supports the trimmer condenser on the top of each of the two tuned coils. The tank coils for the final amplifier (L_2) consist of lengths of *B & W "Miniductor"* cemented to ⅝" x 1½" blocks of polystyrene. Banana plugs are mounted on the polystyrene bases. These coils plug into a receptacle consisting of a 1" x 2" block of polystyrene equipped with banana jacks. The receptacle is mounted on the underside of the chassis, and the tops of the jacks protrude through holes drilled in the chassis. Arranged in relation to the low potential end of the tank coil, the swinging link coupling system consists of 7 turns of *B & W* No. 3016 cemented to a bakelite shaft which protrudes through a panel bearing in the front panel. A knob on the end of the shaft controls the antenna loading.

All in all, the construction of the rig is not a difficult task. The chassis and the two shield plates are made of light gauge aluminum which is very easy to handle. There is plenty of room to mount the components provided that a little care is exercised in their positioning. The locations of the components are shown in the illustrations, and while strict adherence to this layout is not necessary, it does represent a method of achieving a

(*Continued on page* 110)

Fig. 4. Under chassis view. The shield isolates the final amplifier from the rest of the transmitter circuits. The chassis is 3¾"x6¾"x1¼".



HAMS: Here are the revised and Complete Rules for the

$10,000.00 NEW HAM CONTEST

LICENSED AMATEURS AND HAM CLUBS TO BE REWARDED FOR THEIR EFFORTS IN SECURING NEW LICENSEES

126 Merchandise Awards for Licensed Hams, and Ham Clubs, Training New Licensees During 1949.

★ ***Separate merchandise awards for individual winners.***
★ ***Separate awards for Ham Clubs.***
★ ***No limit on the number of entries.***
★ ***Prize winners will be announced in the February 1950 issue.***
★ ***Prizes will be listed in an early issue of RADIO & TELEVISION NEWS.***

RULES OF CONTEST

(1) Contest is open to licensed amateurs and their clubs only and is restricted territorially to the United States, its possessions, and Canada. Licensed status to be determined by licensees published in the Winter issue of the 1948-49 Radio Amateur Callbook. Employees of the Ziff-Davis Publishing Company, their representatives, or their families are not eligible as participants.

(2) All entries to this contest must be made on official entry blanks, available from Contest Editor, RADIO & TELEVISION NEWS, 185 No. Wabash Avenue, Chicago 1, Illinois, or at your dealer.

(3) Two sets of awards will be given: Individual and Club or Association. Awards to individuals will be made on a point system, to be determined as follows:

For the training and bringing to operator and station licensed status of any new amateur, 1 point for the individual trainer, who for his own protection should enter his "prospective ham or trainee" promptly.

Notification of the complet on of training and the securance of license for any new licensee must be made by the trainer of that person and sent by him to RADIO & TELEVISION NEWS.

Final determination as to the official licensed status of all new licensees will be checked with the Spring 1950 edition of the Radio Amateur Callbook, but all entries must be postmarked not later than midnight December 31, 1949.

INDIVIDUAL AWARDS

1st Prize. To the individual responsible for the successful licensing of the largest number of new amateurs, a complete ham station worth $1,500.00.
2nd Prize. To the individual responsible for the second largest number of new licensed amateurs, a complete ham station worth $750.00.
3rd Prize. A $300.00 transmitter or receiver.
Runner-up Awards. Ten $100.00 receivers.
Consolation Awards. Fifty merchandise awards of a value not less than $30.00 each.

In case of ties the judges will select the winners from the best letters of 100 words or less, submitted by tied contestants on the subject of "Amateur Radio's Greatest Need for Its Future Security Is ....."

CLUB AND ASSOCIATION AWARDS

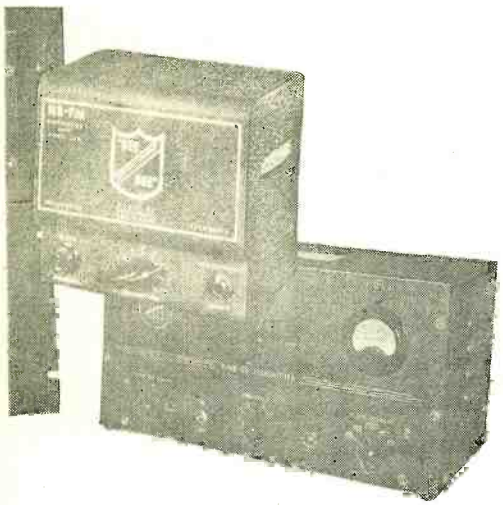
1st Prize. To the amateur radio club or association adding the largest percentage of newly licensed members during the contest period, as a result of the Club's training program, a $1,500.00 ham station. In determining percentage of membership increase, accurate numerical status of "licensed hams" membership as of January 1, 1949 will be sworn and attested to by club or association secretary, who will also list call letters of all members. All statements must be postmarked not later than March 31, 1949 to be eligible in this contest. Club secretary must also submit a complete list of newly licensed members, postmarked not ater than midnight December 31, 1949.

2nd Prize. To the amateur radio club or association adding the second largest percentage of newly licensed members during the contest period, as a result of the Club's training program, a $750.00 ham station.

3rd Prize. A $300.00 transmitter or receiver.
Runner-up Awards. Ten $100.00 receivers.
Consolation Awards. Fifty merchandise awards of a value not less than $30.00 each.

In case of ties the judges will select the winners from the best letters of 100 words or less, submitted by the club or association secretary, on the subject of "Amateur Radio's Greatest Need for Its Future Security s....."

(All values based on manufacturers amateur net prices)



JUDGES

OLIVER READ.....W9ETI, Editor of Radio & Television News

RAY FRANK.....W9JU, Associate Editor of Radio & Television News

CHARLES STIMPSON W9TRD, Publisher of Radio Amateur Callbook

FRED SCHNELL.....W9UZ, National Service Mgr., Motorola Communications Equipment Division

ENTRY BLANK

Please enter (myself) (club) in the $10,000.00 RADIO & TELEVISION NEWS "NEW HAM" Contest for 1949.

Name of Contestant (Trainer).....Call.....

Address.....

City..... Zone.....

State.....

(I am)
(We are) training the following individuals to obtain their amateur license during the 1949 contest period:

(I will)
(We will) (before midnight December 31, 1949) submit call letters and date of issuance of license of trainees.

Name of Trainee.....

Address.....

City..... Zone.....

State .....

(Add additional names and addresses on an attached sheet.)

NEW FOCUSING ARRANGEMENT IMPROVES TV KITS

By MARTIN MULLIN

Performance of Transvision's 12 inch video receiver was improved to some extent by changing focus coil circuit using a separate power supply. This conversion can also be applied to other magnetically deflected TV sets.

STANDARD focusing procedure in present-day television receivers using magnetically deflected picture tubes involves the use of a special focusing coil which is placed behind the deflection coils and which fits around the neck of the picture tube. A d.c. current taken from the receiver power supply is passed through the coil which is designed to create a flat, circular magnetic field. This brings the electron beam to a sharp point at the light-producing phosphor on the front of the tube. Under ideal conditions, the scanning lines that make up the picture can be seen upon close examination.

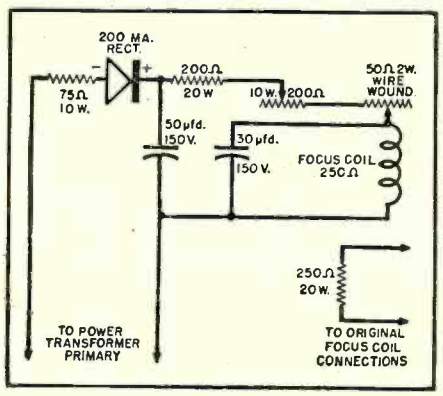
The d.c. current for the focusing coil is almost invariably secured from a resistance network placed between the negative center tap of the power transformer and the common return bus or chassis. A network of shunts and a rheostat provide sufficient variation in the coil current to permit close adjustment to allow for variables present in the electrical components and the picture tubes. The focusing coil usually requires only about 110 to 160 mils, which is actually a small fraction of the total current delivered by the power supply in the most elaborate receivers.

The picture gain control in most television receivers is arranged to vary the bias on several of the i.f. tubes by applying a negative voltage derived from the power supply or even by varying the cathode resistance of several picture i.f. tubes. Since the focusing coil is part of a shunt network, the effect on the focus control setting is not usually troublesome, in spite of the fact that the i.f. tube current drain (and total d.c. current delivered by the power supply) varies with the bias applied to the i.f. tubes.

The magnetically deflected sets constructed from *Transvision* kits use a different method of securing the focusing coil current. The focus coil is placed in the "B plus" supply which feeds a portion of the receiver that includes the sound channels and the picture i.f. tubes. In fact, the coil is not shunted at all, and since the picture i.f. tubes use a good portion of the current, the sharpness of focus is at the mercy of the contrast control setting. In these sets, focusing is accomplished by varying the resistance in the cathode of the audio output power tube. In practice, it develops that a well focused picture on a strong local station becomes quite fuzzy when the picture gain control is advanced to receive a more distant station. This, of course, will not be found objectionable when all stations received are approximately the same strength.

In order to avoid the effects of this condition without overloading the power supply or upsetting the electrical balance of the receiver, a 12" *Transvision* receiver was equipped with separate power supply for the focusing coil as shown in the schematic diagram. The focusing coil has a resistance of 250 ohms and was replaced by a 20 watt wirewound resistor having the same resistance. No increase in hum was noticed on an oscilloscope or in the picture or sound.

Schematic diagram shows revisions made in focus coil circuit used in TV receivers employing magnetically deflected CR tubes.



A Navy surplus aluminum aircraft interphone junction box, 5"x5½"x2" deep, was secured and all resistors except the 75 ohm unit were mounted in it. Several ⅝" holes were drilled in each end to provide air circulation. The 50 ohm, 2 watt wirewound potentiometer was placed to one side of the box, well away from the larger resistors. Its shaft protrudes for vernier adjustment. The slider on the semivariable resistor is set approximately, and the potentiometer is adjusted until all trace lines are perfectly clear and well defined over the entire raster.

The 200 mil selenium rectifier, the filter condenser, the 75 ohm resistor, and a two-lug terminal board are mounted on a light angle bracket such as is sold in the dime store for repairing furniture. The junction box is bolted vertically to the back apron of the chassis behind the video detector, one of the mounting bolts also being used to secure the angle bracket inside the back apron. Since the box is mounted with the ⅝" holes in the top and bottom, it receives a clear updraft of air and does not heat up too much. The filter condenser is mounted under the chassis and is thus protected from the heat generated.

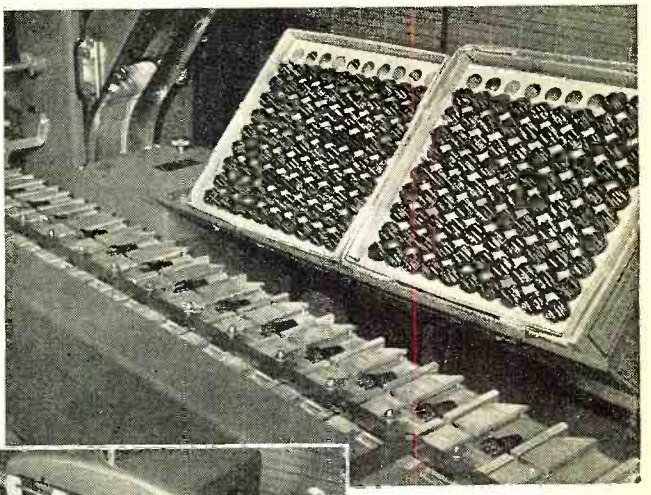
Results are most gratifying and the focus setting is absolutely constant and completely independent of the setting of all controls. The raster is clear and bright, and all trace lines are visible over the entire raster.

While the above modification was made in a 12" *Transvision* kit, the same procedure can be followed to improve any similar receiver. It has particular value with respect to 15" and 12" sizes, these larger tubes being more difficult to focus accurately. The resistance values may be different, but they can easily be figured. The resistor which is substituted for the focus coil must have the same value as the d.c. resistance of the coil, with a suitable wattage rating. The resistors in the new circuit must be chosen to give adequate control of focus coil current.

—30—

Automatic Machine Packs Tubes Into Individual Cartons

An ingenious machine, in operation at G.E.'s Owensboro plant, speeds tube packaging and portends lower prices.



AN AUTOMATIC cartoning machine that packs electronic tubes into individual cartons is now in operation at *General Electric's* Owensboro, Kentucky tube warehouse.

The automatic cartoner feeds flat folding cartons from a magazine, then makes up the carton, inserts a tube, closes the top and bottom tuck-in flaps, and finally imprints the tube type designation on the top panel of each carton. The machine handles 160 cartons a minute.

The machine uses a special folding carton with an inner platform which forms an integral part of the one-piece reverse-tuck carton. This construction eliminates the necessity for additional wrappers or die-cut devices to cushion tubes.

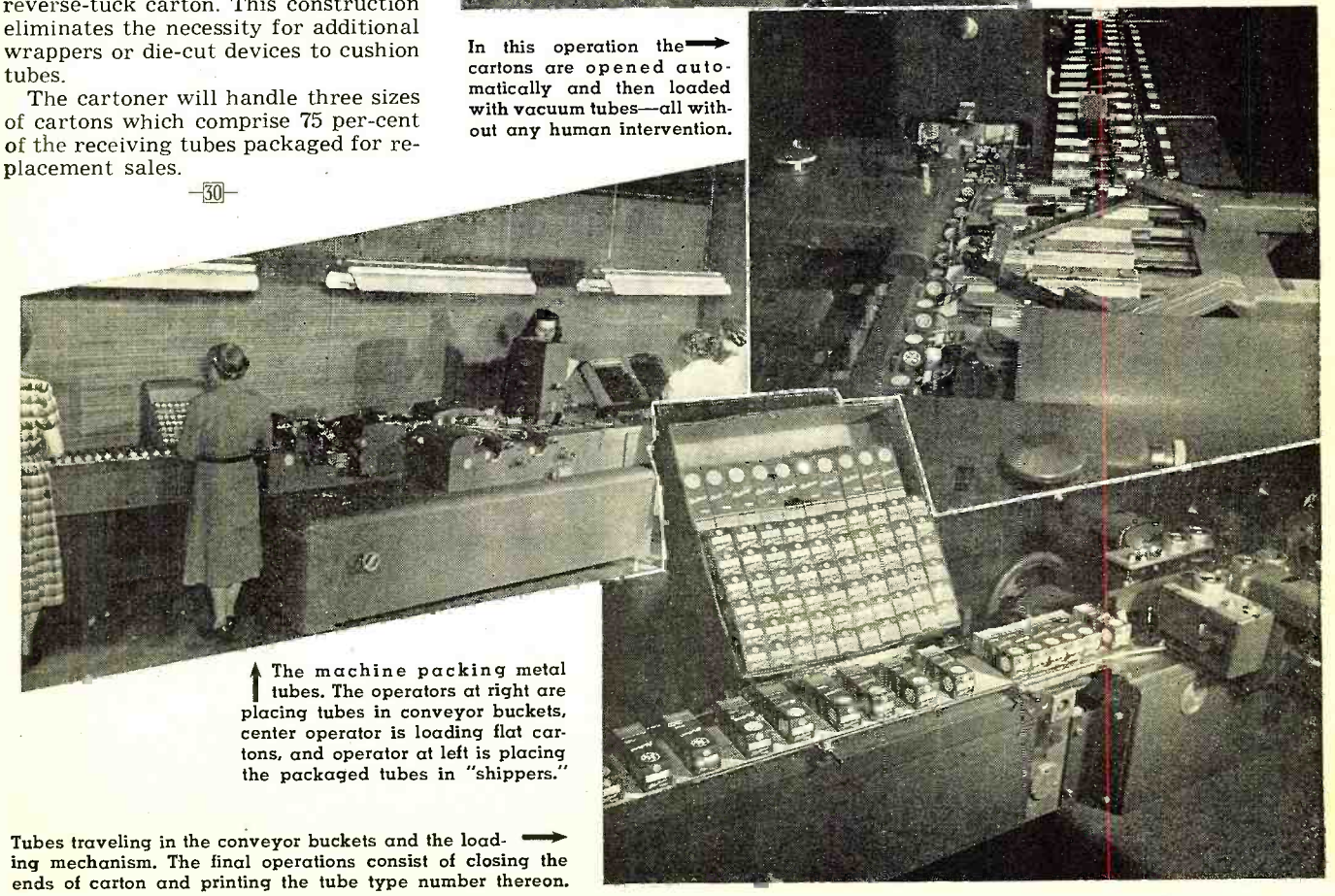
The cartoner will handle three sizes of cartons which comprise 75 per-cent of the receiving tubes packaged for replacement sales.

—30—

↑ Tubes in loading buckets with flat folding cartons stacked in the magazine to be seen at the top-left.

← Closeup view shows the packed and printed cartons on the offtake conveyor of the automatic tube-packing machine being used by General Electric Company.

In this operation the → cartons are opened automatically and then loaded with vacuum tubes—all without any human intervention.



↑ The machine packing metal tubes. The operators at right are placing tubes in conveyor buckets, center operator is loading flat cartons, and operator at left is placing the packaged tubes in "shippers."

Tubes traveling in the conveyor buckets and the loading mechanism. The final operations consist of closing the ends of carton and printing the tube type number thereon. →

Build CUSTOMER CONFIDENCE

By
HERBERT S. LAUFMAN
Hopwood, Laufman, Fomund & Cross

Providing suitable settings for the display of television receivers is a powerful sales stimulus. This Admiral video display is an effective "silent salesman."

The confidence of your customers is what keeps you in business. It must be carefully fostered.

WITH the thousands of television sets being installed in American homes each month a degree of conflict has arisen as to how such installations are to be handled and serviced. Should the manufacturer, distributor, retailer, or the neighborhood retailer-serviceman assume the responsibility for the proper operation and installation of the video set?

A good case can be made for any one of the previously mentioned groups to handle television installation, but it should be pointed out that the neighborhood technician, once he relinquishes his hold on his service business, is practically eliminating himself from the industry scene.

The point has been made that the average neighborhood technician is not in a position to handle such servicing and installation jobs. This might have been true in the earliest stages of video's phenomenal growth but today the picture has changed. Now the average man who takes on television work has spent many hours studying the subject and has acquired a familiarity with the medium which permits him to handle most of the servicing requirements. In the event he is called upon to handle some phase of television work with which he is not fully familiar or before he is technically qualified, he usually calls upon an independent television specialist to perform this work in his name. In this way he is able to offer his customers the best possible service and installation work without jeopardizing his position.

It is in the servicing and installation field that the dissatisfaction among dealers has become most apparent. Many neighborhood dealers and repairmen depend upon servicing for the greater part of their revenue. They feel that manufacturers who employ their own servicing departments or contract work out to independent servicing organizations are taking the bread out of the mouths of the men who have contributed much to the development of the industry.

Servicing, whether it be of radios, appliances, or television sets, not only helps the smaller retailer to stay in business but tends to help him build up a clientele to whom he can sell merchandise. It is an acknowledged fact that the good neighborhood dealer can often do a better and more personalized selling job than some of the larger retail outlets. As one local retailer expressed it, "Why does the manufacturer bite the hand that feeds him? The manufacturer can gain nothing from employing or contracting service and installation personnel and the local man has a great deal to lose."

It must be remembered, however, that manufacturers are genuinely interested in satisfying their customers and protecting their good reputation with the public. They also realize that they owe much to the neighborhood dealer. To date, some manufacturers have undertaken the installation and servicing of their television receivers simply to insure top quality work. Most neighborhood servicemen, once they acquire the proper knowledge of their subject, are capable of turning out work which would satisfy even the most demanding customer. Each serviceman has the problem of convincing the manufacturer that he is in a position to handle the installation and servicing of the television sets he sells.

Even if the serviceman is not equipped to handle this work himself, by engaging an independent organization to perform the work in his name, the customer will still continue to associate the retailer's name with service work to be done.

In this way the manufacturer will be assured that his sets are being installed and serviced properly, the distributor will profit from the increased traffic engendered by a growing customer respect for the product and the local retailer will gain a customer and make a fair profit.

There is still another problem that seems to be confronting the television industry with repercussions which will reach all merchandising levels. This is the matter of price cutting.

Quantity discounts are being scrutinized with an eye to limiting them to

retailers who sell sets at list price only. The feeling is growing that the dealer working on a normal discount is handicapped by the merchant who marks his sets below the market price but recoups his losses by securing a quantity discount from the manufacturer. The cooperative efforts of the manufacturer, distributor, and dealer will be needed in order to give all radio retailers the same break.

Customer Confidence

In addition to all the sales promotion techniques outlined in the article "TV Promotion" appearing in the January issue, the dealer has an important job on his hands in building and maintaining customer confidence.

Since television sets require a much more elaborate installation than other types of receivers an added charge is made for these services. To customers who have been used to buying a receiver and then just "plugging it in," these charges may seem both high and unnecessary.

The large number of tubes used in television receivers as compared with broadcast radio receivers raises the odds of tube loss to a much higher proportion. By pointing out these things to the customer he is inclined to feel that the serviceman is doing him a favor in making the policy available which creates added customer confidence in the serviceman.

As far as the charges made for installation are concerned these can usually be fully and completely justified providing the serviceman will take the time to explain the need to the customer.

One of the best ways of graphically illustrating the differences between AM and television broadcasting is by means of a promotional piece developed expressly for the purpose. For as little as ten dollars, a folder which diagrams the coaxial and microwave techniques can be prepared. Included in this booklet should be "before" and "after" pictures of the images received on the television screens under imwere back from scout camp he could install the television set without all this trouble. It will benefit all concerned if the need for skilled, trained personnel is emphasized. An understanding of what is involved in television is the first step in the right direction.

Indoor Installations

Often servicemen are questioned regarding the feasibility of indoor antenna installations. The query usually arises in the case of tenants whose landlords have either forbidden or put a premium on rooftop installations. Robert English, radio engineer for *Admiral Radio Corporation,* stated recently that this type of installation may be used efficiently when conditions prevent outside antenna structures.

According to Mr. English, first class reception will be hampered by the presence of excessive metal within the building and sometimes by electrical devices such as razors or vacuum cleaners. For the apartment dweller,

With network television spreading rapidly, it will be easier to sell prospective customers on the entertainment value of television rather than its novelty role.

One of the television sales lounges that are being established throughout the country to sell the customer on television rather than specific brands of receivers.

It is up to the serviceman to explain fully the reasons why (1) expert and specialized installation is necessary, and (2) why there is an added charge. Few laymen understand the essential differences in the operating principles of sets at television frequencies. A simple "brush-off" or jumbled explanation about coaxial cables or dipole antennas is not sufficient to stave off later complaints when the bill is presented or when the customer is discussing the matter with his friends and neighbors. For this reason a simple but complete explanation of television installation requirements must be given in order to build customer confidence and insure repeat business.

The "service guarantee" which is offered with most television receivers can, of course, be sold when the customer realizes just what the replacement of component parts would cost if he failed to have this protection. He can be shown that replacement of the kinescope alone can sometimes cost more than the entire "owner's policy."

proper and proper installation conditions. An explanation of line-of-sight transmission and the peculiarities of high frequency signals will go a long way toward eliminating the problem of "Why do I need this fancy antenna when my friend who lives about a mile from here has a plain antenna?"

The need for coaxial cable is taken for granted by someone who is familiar with FM and television techniques but the average housewife just can't understand why the wire she uses to hang "Uncle Henry's" picture won't work especially when it performed nobly when she used it on her kitchen radio!

The entire situation offers the dealer a wonderful opportunity to build confidence, gain respect for a job well done, and help the public realize that the service rendered is a procedure requiring a high degree of skill and that the serviceman is progressive and up-to-date on matters in his field.

Often, but quite erroneously, the customer feels that if only little Willie

this indoor antenna can take the form of under-the-carpet stripping or a small dipole placed within the room.

Where a serviceman makes an indoor antenna installation he would be well advised if he explains to the customer the difficulties involved in securing peak reception.

Installation Problems

Where installation difficulties arise, or threaten, the serviceman can avoid a lot of trouble with the customer if he will carefully explain the problem to the customer either in advance or as the situation arises.

The customer should be made to realize the importance of right antenna height, correct distance from electric signs and fluorescent installations, the problems which arise when the location is near x-ray equipment and diathermy machines.

Most servicemen are fully aware of the problems presented by the proximity of large metallic and concrete

(*Continued on page* 107)

Mac's Radio Service Shop

By JOHN T. FRYE

TENDERLOIN AND TAXES

"MAKE way! Make way!" Miss Perkins called as she marched into the service department holding a large paper bag at arm's length in front of her.

Barney, the student serviceman of Mac's Radio Service Shop, looked up from the dial cord he was restringing to see Mac himself, a big grin spread across his face, following right behind her and carrying three bottled *Cokes*.

"Hey! What *is* this?" Barney asked.

"It's a party!" Miss Perkins announced gaily. "A party to celebrate the mailing of our income tax report!"

While Mac removed the bottle caps with his trusty battery pliers, Miss Perkins passed around the huge, circular tenderloin sandwiches she had in the sack. Then she perched herself on the high stool where she could keep an eye on the front door, and Mac and Barney leaned comfortably back against the bench.

"Say, Mac," Barney said a few minutes later, when he had reduced his sandwich to a half-moon, "I have helped my uncle, who is a fireman, make out his income tax report; but I am wondering what is the difference in reporting on a business like this."

Mac studied critically the amount of *Coke* left in his bottle as he slowly answered, "Well, the big difference lies in the percentage of money taken in that you get to keep. In your uncle's case, almost all of his salary was 'take home' pay; and most of it was subject to tax. In the case of a business, the only part of the money taken in that the operator can keep is the net profit, and that is what he is expected to pay taxes on."

"How do you know what *is* profit?"

"*Form 1040, Schedule C, Page 2—Profit (or Loss) From Business or Profession,*" Miss Perkins said in a singsong voice as though she were reading words branded on her memory.

"That's right," Mac said with a chuckle. "*Schedule C* is arranged for determining the net profit of a business. We start by setting down our *'Total Receipts,'* which is the complete 'take' of our business from every source, including appliances and parts sold and charges for service—in short, the grand total of everything rung up on the cash register."

"To figure our profit on merchandise sold," he went on, "we must know how much we actually sold during the year and what it cost us. That is where the inventory comes in. First we put down the dollars and cents value of our *'Inventory at the Beginning of the Year'* on the articles we have for sale. To that we add the value of the *'Merchandise Bought for Sale'* during the year."

"And then you subtract your closing inventory!" Barney interrupted.

"Not quite yet," Mac said. "There are some other factors that should be added to the cost of the goods we sell. For example, you will recall that we sold several TV and FM antennas on an 'installed' basis. I paid Jim Winemiller, the telephone lineman, to do the dangerous climbing for us. The money I paid him is added to the costs of goods sold under *'Labor,'* as is any other amount paid for labor that actually adds to the cost of the things we sell. Along the same line, we add the cost of such things as wrapping paper, string, cartons, etc., that we use directly in selling merchandise. These are listed as *'Materials and Supplies.'*"

"And then," Miss Perkins broke in, "there are other miscellaneous costs added to that of goods sold—things like freight-in, drayage, and demurrage on the articles we buy to sell. All of these items that add *directly* to the cost of goods sold are lumped under the general heading *'Other Costs.'*"

"So," Mac said, picking up the ball again, "if, to the value of what we had for sale at the beginning of the year, we add the value of what we bought to sell during the year and all of these other closely-connected costs, we have but to subtract our *'Inventory at the End of the Year'* to know our *'Net Cost of Goods Sold.'* This, subtracted from our total receipts, gives us our *'Gross Profit.'*"

"About these inventories," Barney said, "how do you figure the value of the tubes, condensers, and so on?"

"Either *'C,'* or *'C* or *M,'*" Miss Perkins said dreamily.

Mac anticipated the question telegraphed by Barney's arched eyebrows: "She means with either the 'cost' system, in which you put down the actual cost price of the article, or the 'cost or market' system, which means that you put down the price you would pay for the thing if you bought it at inventory time. You can choose either system you wish, but once chosen, it must be stuck to until you get permission from the Tax Commissioner to change it. We use the 'cost' system here."

"Are there other expenses you can deduct?"

"Well I should hope!" Mac said fervently. "You can deduct practically all of the money you have to spend in your business to make money. *Schedule C* lists these under *'Other Business Deductions.'* The very first item takes care of you and Miss Perkins. It is called *'Salaries and Wages'* and includes all money paid out to 'help' that was not listed under the 'labor' item of 'costs of goods sold.'"

"Boss, anytime you want to increase this deduction, it is all right with me," Barney generously offered.

"Thank you, Red; I'll remember that!" Mac promised with a grin. "Another item is *'Interest on Business Indebtedness.'* Here we put down such things as interest on a mortgage on the place of business, interest on a business loan, or interest on installments on a business truck or service equipment or office furniture."

"But to claim one of these interest deductions, it must be listed separately from the amount of the payment," Miss Perkins interjected. "Otherwise, it is figured as part of the cost price."

"*'Taxes'* paid in connection with the business may also be deducted," Mac continued. "That takes in real estate and personal property taxes on the business, Social Security taxes, state and federal unemployment taxes, gross income and use taxes, store license, business car license, and stamp taxes."

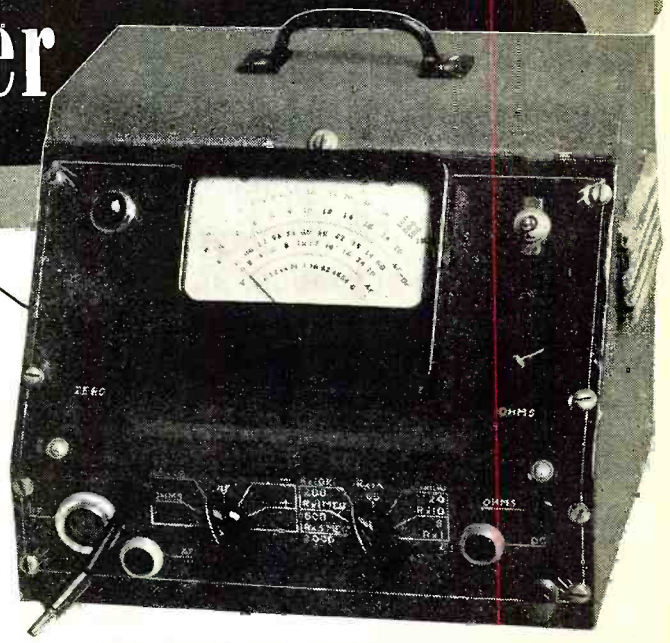
"It is kind of nice of Uncle Sam not to make you pay taxes on taxes," Barney observed.

(*Continued on page* 80)

An Electronic Volt-Ohmmeter

By WILBUR FLAHERTY

This easy-to-build test instrument has an input impedance of 23 megohms on d.c., 2.2 megohms on low-range a.c., and 18 megohms on the high-range a.c.



Front view of meter showing layout of meter scales. Plug P_1 is at lower left near 4-prong r.f. connector.

THE electronic volt-ohmmeter to be described is of the type commonly called the "push-pull" or cathode-coupled voltmeter. It employs large degeneration for stability and also a VR-150 tube for additional stability. The fundamental circuit is shown in Fig. 1.

The power supply is represented by two batteries in series, and grounded at the center point. The cathodes of the two voltmeter tubes are connected together and thence through R_{35} to the —75 volts of the "B" or power supply. The lower end "Y" of R_{35} is at —75 volts with respect to ground. The *IR* drop through R_{35} is sufficient to place the cathode end "X" approximately plus three volts above ground. Thus one-half of the "B" supply is used for degeneration in the cathode circuit and the other half is used to power the plate circuit.

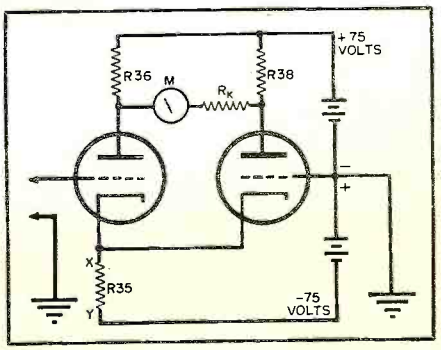
The gain of the circuit is low due to the large degeneration; and because of the circuit constants chosen, the maximum overload current through the meter is held to twice the full scale current. The meter *M* in series with the calibrating resistor R_k in Fig. 1 simply functions as a 5000 ohms/volt voltmeter to measure the difference in potential between the plates of the two triodes.

In the designing of this voltmeter it was desired to make it as flexible as possible in function and range, and to achieve a low degree of circuit loading, good stability and accuracy. The a.f. and d.c. voltage ranges increase approximately in multiples of three; namely: 2 v., 6 v., 20 v., 60 v., 200 v., 600 v., and 2000 v.; r.f. voltage ranges are 2 v., 6 v., 20 v., 60 v., 200 v. The lowest readable a.c. is 100 millivolts and the lowest readable d.c. is 2 millivolts. With this range of voltages it usually is possible to select a range which will give a reading near or slightly above the center of the meter scale. The scale is a conventional zero-left scale. A zero-center scale was not used, chiefly for two reasons, less crowding of scale divisions, and the advantage of a separate full-scale calibration for plus and minus voltages, the latter making for greater independence from changes of tube characteristics as tubes age or are changed. When zero center readings are wanted, the zero-adjust R_{37} (Fig. 2) can be turned far enough to bring the meter to near mid-scale.

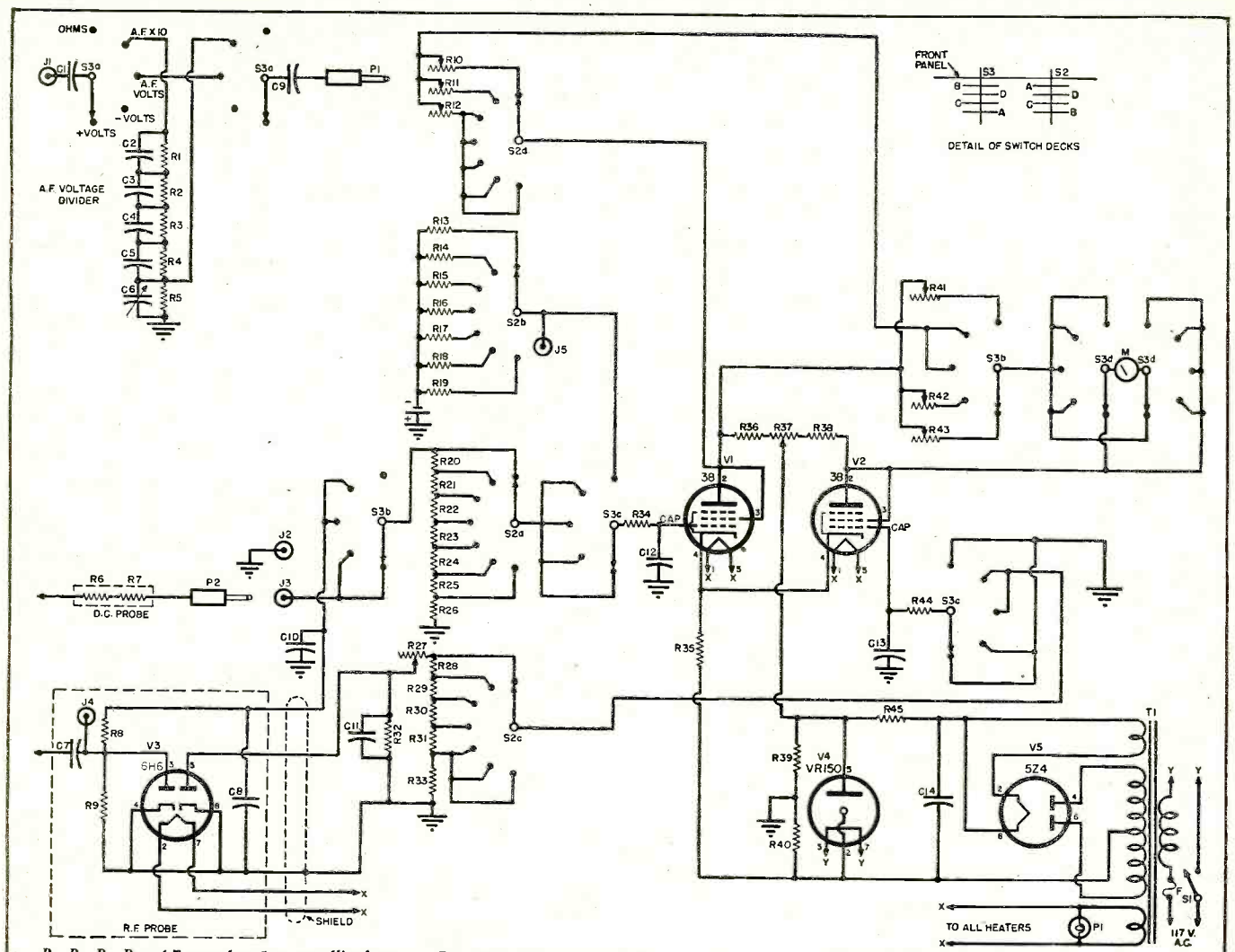
The ohmmeter ranges are conventional except that an extra-high range up to 5000 megohms is provided. If steatite switches are not used, this range may be in error under conditions of high humidity. At all normal room temperatures and humidity this range is reliable. The ohmmeter ranges are *R* x 1 (0 to 1000), x 10, x 100, x 1000, x 10,000, x 1 megohm, x 5 megohm. Note that a one cell battery of 1.5 volts is used for resistance measurements, and that a negative voltage is used. The ohms adjust (full scale) rheostat is R_{41}, located on the right hand side of the meter panel. The zero adjust R_{37} covers all functions and is located on the left hand side of the meter panel.

For r.f. voltage readings an external probe is used. In the circuit diagram (Fig. 2) the r.f. probe is enclosed in the dotted rectangle. The probe is connected through a four conductor shielded cable, the shield acting as ground conductor and being grounded to the PC4F connector in the usual manner. The cable connects to the chassis by means of the *Amphenol* PC4F connector assembly. For low frequency voltages P_1 connects into J_1 on the probe, an operation which connects the voltage divider network to the input of the probe. For r.f. and a.f. up to 200 volts, set the function switch S_1 to *"A.F. VOLTS."* For a.f. above 200 volts, set switch to *"A.F. x 10."* In this latter position the voltage divider network permits readings up to 2000 volts. This method of extending the range was used in an earlier v.t.v.m. built by the author and described in RADIO NEWS.* For these readings a separate a.f. probe or test lead is used

Fig. 1. Basic diagram of volt-ohmmeter. Complete schematic is shown on following page.



*Flaherty, Wilbur; "Serviceman's VTVM-Capacity-Ohm Meter," RADIO NEWS, November, 1944, page 48.



R_1, R_2, R_3, R_4—4.7 megohm, 1 w. metallized res.
R_5—50 megohm, 1 w. res. ± 2%
R_6, R_7—4 megohm, ½ w. metallized res.
R_8—2 megohm, ½ w. metallized res.
R_9, R_{32}—20 megohm, ½ w. high frequency res.
R_{10}, R_{11}, R_{12}, R_{41}, R_{42}, R_{43}—15,000 ohm wirewound pot.
R_{13}—10 ohm, ½ w. wirewound res. ± 2%
R_{14}—100 ohm, ½ w. res. ± 2%
R_{15}—1000 ohm, ½ w. res. ± 2%
R_{16}—10,000 ohm, ½ w. res. ± 2%
R_{17}—100,000 ohm, ½ w. res. ± 2%
R_{18}—10 megohm, ½ w. res. ± 2%
R_{19}—50 megohm, ½ w. res. ± 2%
R_{20}—10 megohm, 1 w. res. ± 1% (See text)
R_{21}—3.5 megohm, 1 w. res. ± 1%
R_{22}—1 megohm, ½ w. res. ± 1%
R_{23}—350,000 ohm, ½ w. res. ± 1%
R_{24}—100,000 ohm, ½ w. res. ± 1%
R_{25}—35,000 ohm, ½ w. res. ± 1%
R_{26}—15,000 ohm, ½ w. res. ± 1%
R_{27}—9 megohm vol. control
R_{28}—10 megohm, ½ w. res. ± 5%
R_{29}—3.5 megohm, ½ w.res. ± 5%
R_{30}—1 megohm, ½ w. res. ± 5%
R_{31}—350,000 ohm, ½ w. res. ± 5%
R_{33}—150,000 ohm, ½ w. res. ± 5%
R_{34}, R_{44}—3 megohm, ½ w. res.
R_{35}—50,000 ohm, 5 w. wirewound res.
R_{36}, R_{38}—70,000 ohm, 1 w. res.
R_{37}—10,000 ohm wirewound pot.
R_{39}, R_{40}—12,000 ohm, 1 w. wirewound res.
R_{45}—12,000 ohm, 20 w. wirewound res.
C_1—.1 μfd., 2000 v. paper cond., oil filled
C_2, C_3, C_4, C_5—100 μμfd. mica cond.
C_6—50-200 μμfd. trimmer cond.
C_7—.02 μfd. mica cond.
C_8—500 μμfd. mica cond.
C_9—.25 μfd., 400 v. cond.
C_{10}, C_{11}—.01 μfd., 400 v. cond.
C_{12}—.02 μfd., 1000 v. mica cond.
C_{13}—.02 μfd., 400 v. cond.
C_{14}—16 μfd., 450 v. elec. cond.
F—Line fuse, 1 amp.
J_1, J_3—Amphenol 80M single-pole connector
J_2—Pin jack or binding post
J_4—Short banana jack
J_5—Amphenol pin jack
P_1, P_2—Short banana plug
PL—Panel lamp, 6.3 v.
S_1—S.p.s.t. toggle sw.
S_2—4-gang, 4-p. 7-pos. non-shorting sw. (Centralab #1429 or steatite)
S_3—4-gang, 8-p. 5-pos. non-shorting sw. (Centralab #1431 or steatite)
T_1—Power trans. 300-0-300 v. @ 40 ma., 5 v. @ 3 amp., 6.3 v. @ 1.2 amp.
M—0-200 microampere d.c. meter
V_1, V_2—38 tube
V_3—6H6 (metal) tube
V_4—VR-150 tube
V_5—5Z4 tube

Fig. 2. Complete schematic diagram and parts list for the all-electronic volt-ohmmeter test unit.

and plugged into J_1 on lower left hand side of panel near the PC4F connector. This a.f. probe is a single-conductor, low-capacity shielded cable capable of carrying 200 volts r.m.s. If the builder does not intend using the instrument for r.f. measurements, the r.f. probe can be left out altogether during construction of the instrument, and V_3 can be mounted on the chassis, and the divider network connected through S_{3a} and C_9 directly to the socket of V_3. A 6H6 tube was used for V_3 because nothing else was available at the time. Some of the newer high frequency diodes would be superior. For minimum r.f. loading it is recommended that a single h.f. diode be used in the probe, and the balancing diode be mounted on the chassis. The balancing diode feeds through to V_2 and balances out the contact potential from the voltmeter diode which feeds through to V_1. R_{27} is adjusted to balance the contact potential of the two halves of the 6H6 so that the meter reads zero when switched to the "*A.F VOLTS*" position.

The d.c. probe contains two 4 megohm resistors, R_6 and R_7, in the tip for isolation. It is made up of the same type cable as used for the a.f. probe, and plugs into J_3 on the lower right hand side of the panel.

A few words about the place of V_4 in the circuit may be in order. A push-pull degenerative voltmeter is customarily considered stable enough without the use of such a tube. This is true when considering only the stability at zero on the meter scale. However, when a voltage is applied that gives a full scale deflection of the meter, and then the 117 volt line voltage is varied, a large degree of error can result. For this reason a VR-150 tube was used for regulation and the meter is unaffected by line voltage variations, both at zero and at full scale readings. This helps maintain accuracy of readings and calibration under varying conditions and over a long period of time.

V_1 and V_2 are type 38 pentodes con-

nected as triodes—screens tied to the plates. 38's were selected because they have extremely low grid current and reverse grid current and their cathode emission holds quite constant with changes in voltage. A pair should be selected for matched emission to achieve best results. This can be done, as follows, in a tube checker; give the heater ample time to warm up at 6.3 volts and make a routine tube test and write down the reading of the meter on the tube checker. Then turn the heater voltage switch to 5 volts and write down the meter reading after the tube has had ample time to readjust to the lower heater voltage. Check a number of 38's this way and select the pair whose readings most nearly coincide.

The power supply is conventional with the exception of the bleeder resistors, R_{39} and R_{40} whose midpoint is grounded, thus giving two voltages, plus 75 and minus 75, with respect to ground as shown in Fig. 1.

Range switch S_2 is a 4 deck, 7-position non-shorting switch. Deck A carries the input d.c. voltage divider made up of resistors R_{20} to R_{26}. Deck B carries the ohmmeter resistors R_{13} to R_{19}. Deck C carries the resistors R_{28} to R_{33} which furnish balancing potential to V_2. Deck D connects to the calibrating rheostats R_{10} to R_{12} which are used to calibrate the 2, 6, and 20 volt a.c. ranges. These are necessary for greatest accuracy on the lower a.c. ranges because of the curvature of the diode characteristics. Fig. 2 shows the placement of the various decks of S_2 and S_3 relative to each other and the front panel.

S_3, the function switch, is a 4 deck, 8 pole switch, non-shorting. There are two poles, 5 positions on each deck. Deck A switches the a.f. network in or out of the diode input. One half of Deck B selects either the d.c. input from J_3 or the rectified a.c. from the diode. The other half of Deck B switches in the various calibrating rheostats as the function switch is set on *"OHMS," "A.F. VOLTS,"* etc. One half of Deck C switches the input grid of V_1 to either the *"OHMS"* section or to S_{2a} and the d.c. range divider R_{20} to R_{26}. The other half of Deck C connects the input grid of V_2 to ground or balancing potential as required. Deck D is simply a reversing switch which connects the proper polarity to the meter. As can be seen from the photographs, S_2 has a one-inch spacing between decks A and D, and one-half inch spacing for the rest. S_3 has one inch spacing between Decks A and C one one-half inch spacing between the rest. These spacings are for the purpose of separating points of high voltage from the other decks. All wiring carrying high voltage, such as that from J_3 to S_{3b} and J_1 to S_{3a}, should be done with a suitable high voltage hook-up wire.

The accuracy of the instrument will depend to a large extent on the accuracy of resistors R_{20} to R_{26} for the voltage ranges, and on R_{13} to R_{19} for the *"OHMS"* ranges. The resistors R_{20} to R_{26} are made up of matched pairs (a pair in series) of *IRC* metallized resistors to an accuracy of 1%. These matched pairs are expensive items when purchased in small quantities. An alternative is to borrow a supply of the desired ranges, measure them on an accurate bridge and obtain pairs matched to 1%. Also, there are some excellent wirewound precision resistors on the market today at a price lower than factory matched pairs of resistors. Lately, dealers in war surplus equipment have been advertising precision wirewound and metallized resistors that would be suitable for this voltmeter. In any case the use of wirewound or metallized resistors is recommended for R_{20} to R_{26} because of the lower voltage coefficient of these types. If wirewound bobbin types are used they may be mounted on an insulating strip and leads run to the appropriate lugs on the range switch. Pigtail resistors, either wirewound or metallized, may be supported directly on the switch lugs, though care should be used to prevent any grounds or shorts. Remember that on the highest d.c. range R_{26} will have approximately 1000 volts across it; so whatever is used for R_{26} must be capable of withstanding that voltage.

The group R_{13} to R_{19} comprises the comparison resistors of the ohmmeter section. Inasmuch as only 1.5 volts is used as the *"OHMS"* biasing voltage, carbon resistors can be used. 2% carbon resistors were used with the exception of R_{13} which is wirewound.

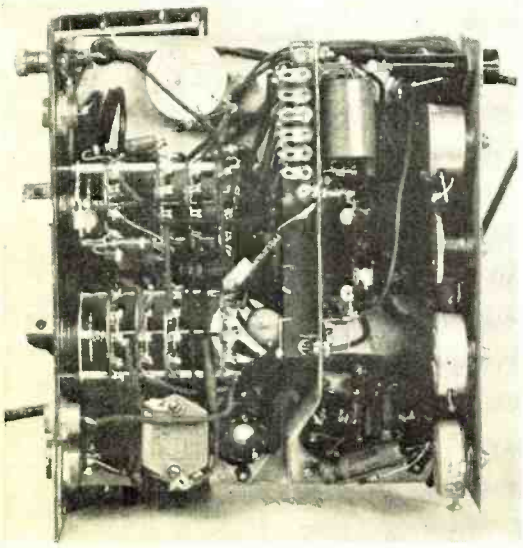
Carbon or metallized 5% resistors are sufficient for R_{28} to R_{33} since only the contact potential of the 6H6 section is impressed across this series.

Full scale accuracy of the various ranges is assured by the calibrating rheostats R_{10}, R_{11}, and R_{12}, and R_{41}, R_{42}, and R_{43}. As the circuit diagram shows, R_{43} is switched in series with the meter when the switches are set for *"PLUS VOLTS."* To set for full scale on this function, R_{37} is adjusted for zero reading and then an accurate two volts positive is applied through the d.c. probe, with the range switch on the two volt setting and the function switch set on *"PLUS VOLTS."* R_{43} is then adjusted until the meter reads full scale. The function switch is then set at *"MINUS VOLTS"* and the above procedure followed with an accurate two volts negative applied to the d.c. probe. R_{42} is adjusted until the meter again reads full scale.

Now that the negative range has been set for full scale, turn the function switch to *"OHMS,"* set the range switch to *"Rx1"* and adjust R_{41} until the meter deflects to the same point as for full scale d.c. volts. You are now prepared to calibrate the division

(*Continued on page* 153)

Under chassis view showing barrier for shielding and mounting parts. The terminal strip at right carrying the "Ohms" resistors has been impregnated with coil dope to reduce leakage.



Rear view showing R_{13} and C_6 mounted on transformer shield. The VR-150 and 5Z4 tubes are at the left and the 38's at the right. A spare socket is located near the 38's. The r.f. probe is at right of chassis while the calibrating rheostats may be seen mounted on back of the instrument chassis.

FACSIMILE TRANSMISSION OF NEWSPAPERS

By FRED GROSSMAN

Home facsimile receiver. Two controls are needed: an "on-off" switch, and gain control. Meter shows proper setting of gain control.

Although facsimile progress has been relatively slow, it is gradually gaining public recognition.

FACSIMILE, radio's "aged infant" may be able to grow into childhood as a result of a recent successful demonstration of multiplexing —the simultaneous transmission of FM and facsimile. An FCC decision in May of last year allowed multiplexing providing no degradation of the FM signal below 10,000 cycles occurred (RADIO & TELEVISION NEWS, Aug. 1948). The facsimile program would be transmitted in the remaining portion of the bandwidth. Recently, however, a multiplex system was demonstrated which allowed simultaneous transmission of a full fidelity program (up to 15,000 cycles) and a facsimile program.

Meanwhile, progress is being made in the extension of facsimile service. *The Philadelphia Inquirer, Miami Herald,* and the University of Missouri School of Journalism are broadcasting facsimile regularly. A score of newspapers have sent out sample pages and some, notably, *The New York Times* and *Chicago Tribune* have conducted extensive demonstrations.

About six firms are engaged in the limited production of facsimile transmitters and receivers. The principle of operation is similar in all the sets designed for home use. Operation of a typical facsimile system is described below.

The copy to be transmitted is placed on a revolving cylinder. A small, sharp spot of light from an exciter lamp is focused on the copy. The reflected ray is picked up by a phototube and converted to a voltage impulse whose magnitude varies directly with the intensity of the reflected ray. The impulses, about 105 to the linear inch, amplitude-modulate a 10 kc. subcarrier, and thence are fed to an FM transmitter.

In facsimile devices for the home, the signals are picked up by an FM receiver and sent to the facsimile recorder from the discriminator output of the radio. After amplification and rectification, the pulses are fed to the drum mechanism consisting of a printer blade, the sensitized paper, and a revolving helix. The pulses arrive at the printer blade, pass through the moistened sensitized paper to the helix. The helix makes one complete revolution per line. As the electric current passes through the coated paper, the paper becomes blackened in proportion to the amplitude of the current. In one system, the moistened paper is then passed over a heater strip. Besides drying the paper, the ironing process increases the clarity of the printing and makes the paper crisp and easy to handle. The machine can produce four 8½" x 11" pages in a quarter-hour. It has been estimated that between luncheon and dinner, an average-length novel can be transmitted.

A printer being designed by *Finch Telecommunications* uses ordinary bond paper instead of moistened, coated paper. Replacing the printer bar and helix is a voice coil to which a "pencil" is attached. The blackness of the impression is determined by the amplitude of the current actuating the voice coil, pressing the "pencil" against the bond paper. By using four "pencils": one black, one yellow, one red, and one blue, *Finch* has succeeded in transmitting colored pictures. The speed of this type of recording is decreased in proportion to the number of "pencils" employed.

Fig. 1A shows a simplified block diagram of a facsimile transmitter. The cathode follower and limiter are connected directly to the same plate supply and feed the modulator stage. The grid of the limiter is grounded, and its cathode bias is adjustable in steps to compensate for the tone scale of the copy to be transmitted. When the output from the phototube is maximum (when the white portions of the copy are scanned), the modulator input is zero. A minimum output from the phototube (during scanning of the

black portions of the copy) yields a maximum voltage from the cathode-follower-limiter. This inversion is necessary because, in the recorder, maximum pulses blacken the sensitized paper and minimum pulses yield white images.

The *limiter line amplifier* has two inputs. Signals applied to one input are amplified linearly. Signals applied to the other input are amplified with a limiting characteristic. Both signals feed a common output. The limiter is useful in compensating for photographs and other types of copy possessing comparatively limited contrast.

The *pulse generator* shown in Fig. 1B is a vital circuit, performing several functions. It transmits the page-separation signals (Fig. 2A), phases the transmitter and receiver drums, and identifies the station. The scanning unit consists of a revolving drum (360 r.p.m.) bearing the station call-letters, an exciter lamp, phototube, and a slotted disc. The circuit is so arranged that light falling on the phototube keys the 10 kc. oscillator off. The oscillator is triggered when the light is blocked from the phototube. At the conclusion of each line, the transmitter is blanked out, and the 10 kc. oscillator is triggered, sending a phasing pulse from the pulse generator to the transmitter drum. If the transmitter and pulse generator drums are not phased, this pulse actuates a relay, interrupting power to the transmitter drum motor and momentarily decreasing its speed. The relay will trip at the conclusion of each line until the transmitter drum is in-phase with the pulse generator drum. Once the two drums are phased, the pulse cannot actuate the relay.

At the end of each page, the pulse generator transmits a black strip, a half-inch thick and 8½ inches wide, bearing the station call-letters. This page-separation signal serves as an identifying signal and a framing pulse. This pulse lasts for almost a complete revolution of the pulse generator drum, except for a 15 degree "no signal" period.

The recorder phasing mechanism consists of a relay in series with the output tube and a commutator attached to the recorder drum (Fig. 2B). The commutator makes contact with its brush for only six degrees of a revolution. Assume that the equipment has been turned on just as the identification signal is being transmitted. Assume also that the recorder motor is not in-phase with the transmitter motor, so that a situation such as is shown in Fig. 2C exists. The commutator segment contacts its brush as the black (or maximum) pulse is transmitted by the pulse generator, closing the circuit to the relay, thus causing the relay to trip and momentarily opening the motor circuit. This decreases the motor speed momentarily. The relay continues to operate six times a second, slowing the motor until the commutator closes during a "no signal" period as shown in Fig. 2D. During this "no signal" period, although the commutator closes the circuit, the relay does not operate because no voltage pulse is supplied by the transmitter. Since the relay cannot trip, the motor continues to run and is now in-phase with the transmitter drum. Thereafter, the commutator contacts its brush only during the "no signal" period, and the relay is not tripped. In actual practice, the broadcast station transmits several page-separation signals at the beginning of each transmission to phase all the recorders in the area. The page-separation signal corresponds to the test-pattern of the television station.

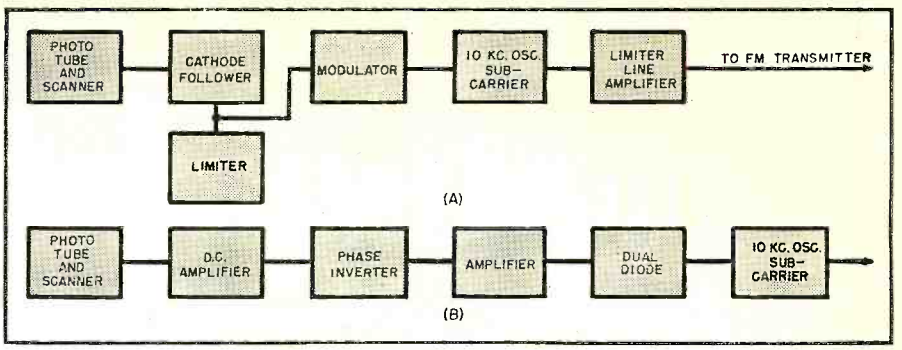


Fig. 1 (A) Simplified block diagram of facsimile transmitter, and (B) pulse generator.

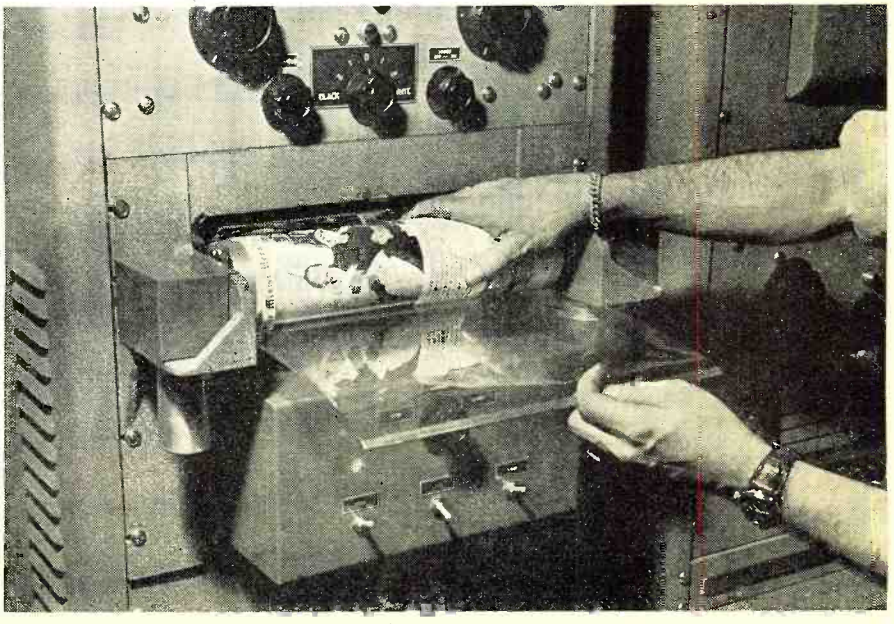
The condenser C_1 (Fig. 2B), parallel with the relay coil, is used to lengthen the pulse to allow the relay time to act.

The transmitter and recorder drums employ synchronous motors. Normally, 60 cycle power keeps both motors turning at the same speed. In home facsimile machines this "60 cycle synchronization" is the most practical system. It is more economical than the self-synchronizing circuits employed in some portable devices. In these systems, a tuning-fork oscillator is used to generate an audio signal. This signal is used to lock in a multivibrator which supplies the pulsating current to synchronize a small synchronous motor. In such a system, an oscillator-multivibrator is incorporated in both transmitter and receiver. Synchronization depends upon precision engineering of the circuits. The frequency of the unit at the transmitter must correspond to the frequency of the unit at the receiver if the two drums are to be synchronized. As a result, the self-synchronized system is more costly and not applicable to home receivers where low cost will be an important factor in gaining public acceptance.

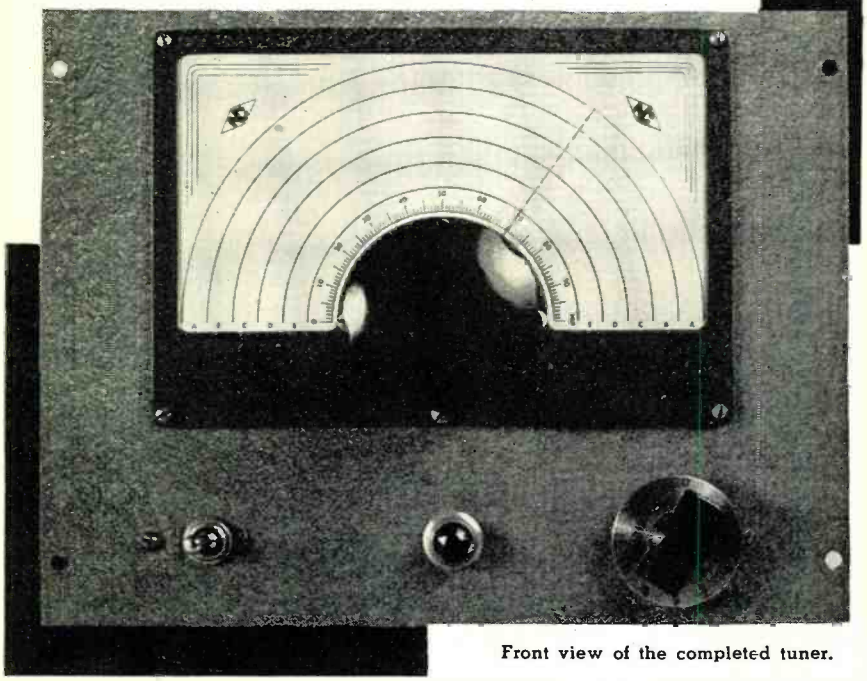
How much will facsimile cost? Estimates vary, but it is believed that mass production methods can bring the price of a recorder below $100. At present, *General Electric* has produced a combination facsimile—SW-FM-AM-receiver which is in the high-priced console class. The facsimile unit of the receiver consists of a nine-tube detector-amplifier with its own power supply, plus the associated mechanical equipment. It occupies the space normally taken by the phonograph. When

(*Continued on page* 151)

Transmitter drum being loaded. The "black-white" switch just above the drum is used to control the density. Light copy may be darkened by setting the control on one of the "black" positions. Equipment is similar to that installed at WAAT-FM.



Home-Built HIGH FIDELITY AM TUNER



Front view of the completed tuner.

By LOUIS J. FRENKEL, JR., W9GUP

This fine-performing tuner can be constructed easily in three hours by the average radioman.

'T'S A funny thing about this radio game. The major radio stations spend good Yankee dollars for the finest high-fidelity audio equipment obtainable. They lease the best high fidelity lines from studio to transmitter. The broadcasters do their part by presenting us with quality audio.

At this point, we come along and undo all of their efforts. Back about the time Don Ameche was "inventing" the telephone, the wireless was beginning to press the front pages for news. The early methods of demodulation and detection were extremely crude. This brings me to the point of this article. With all due respect to the umpteen tube superheterodyne, the critter has some definite shortcomings. In the early days of frequency allocations, broadcast stations were few and far between. The picture quickly changed. An evolution which opened an entirely new industry followed. Today, everyone takes radio for granted. Twenty-four hours a day a variety of programs are available at a twist of a dial.

This increase in activity and occupancy of the broadcast band fathered a receiver with increased selectivity. This receiver is the superheterodyne you use daily. Now selectivity is a nice thing, but the bandpass of a superhet is limited. Let's reduce this high sounding term to an understandable level. We can adjust a garden hose to give either a narrow stream of water, or a broad spray merely by twisting the nozzle. The superhet represents the narrow stream, the tuned radio frequency, TRF, receiver represents the broad spray.

The very nature of the superhet limits its bandpass. Many good engineering books explain the "why" to a fare-thee-well. What then of this TRF as a, excuse the expression, "broad" receiver?

Glad you asked me that question. I have here such a receiver. Do you like to hear the "S's" and "C's," etc. come out nice and crisp? Do you like to hear the "gutty" sound of strings, the woods and reeds come out third dimensionally? Are you a high fidelity hound; do you like to have "presence" to your audio? Perhaps this little tuner will serve as a starting point.

This is a TRF tuner, complete with power supply, ready to hook up to the phonograph input jack of your present receiver. Naturally, its use with a high fidelity amplifier is recommended. A hi-fi system is only as strong as its weakest link. A high grade speaker is a requisite.

This is not a "screw A in hole B" article. The actual mechanical construction is left to the individual constructor. The only recommendation for the constructor is that the unit be built on a metal chassis and be completely enclosed in a suitable metal cabinet so that adequate shielding is supplied. There are only three controls on the front panel, the "On-Off" switch, the main tuning dial, and the detector gain control. The back drop of the chassis contains the antenna input terminals, and the output terminals to the audio amplifier. Shield braid microphone cable will serve to connect the tuner to the amplifier. An outside antenna is necessary, the longer the better. I'm using my ten meter beam with this receiver and it works fine. However, any piece of wire inhaling ether in the out-of-doors will do the trick.

The thing that started me on this project was a review in available texts of the many methods of demodulation currently in use. I think it might be a good idea for all of us to blow the dust off some of these tomes, as there is lots of food for thought in them. It was through this rather abstract literary wandering that an idea began to take shape. Listed are the familiar types of detection and demodulation employed.

1. Diode detectors (simplest detector employing either a vacuum tube or a galena, silicon, or germanium crystals)
2. Grid leak detectors
3. Plate detectors
4. Regenerative detectors
5. Superregenerative detectors
6. Infinite impedance detectors

An hour spent in reviewing the theory and operation will refresh your memory as to the relative advantages and limitations of each of these various detector circuits. It is the last of the group, the infinite impedance detector, in which we are interested.

The infinite impedance detector was chosen as the "heart" of the tuner. It is the detector that largely determines the amount of linearity and distortion appearing in the final output. With this in mind, let's find out something of the characteristics of the infinite impedance detector. One disadvantage of the popular diode detector is that it loads the circuit to which it is connected. The infinite impedance detector eliminates this problem. It gives less distortion because the grid is

never driven positive. That is, no grid current is drawn. Good linearity is provided along with high signal handling capabilities. All of this supplies us with better fidelity than the diode. The only disadvantage from this type of detector is its inability to supply a.v.c. voltage without additional circuits. However, in this tuner I have found no evidence of blasting or distortion that would indicate the need for any type of a.v.c. circuit. Remember this is a hi-fi tuner, not a DX man's receiver. We are concerned with strong local broadcast stations that are capable of pushing the microvolts into the tuner. We want high fidelity, not Timbuktu. Don't worry about the lack of a.v.c.—you won't need it!

Now you know that the infinite impedance detector is the key to the success of this little unit. All we have to do is add an r.f. and a first audio stage and we are in business. It is just that simple. For the owners with *Rolls-Royce* ideas, two r.f. stages can be incorporated but mine works fine with one. The second r.f. stage may be necessary in some areas where a lot of stations are operating in the same service area. This extra r.f. stage will then give the selectivity needed to separate two stations of approximately the same power operating on adjacent channels. Should a second stage be deemed necessary, a duplication of the single stage is all that is required. For the present, it's assumed one r.f. stage will suffice.

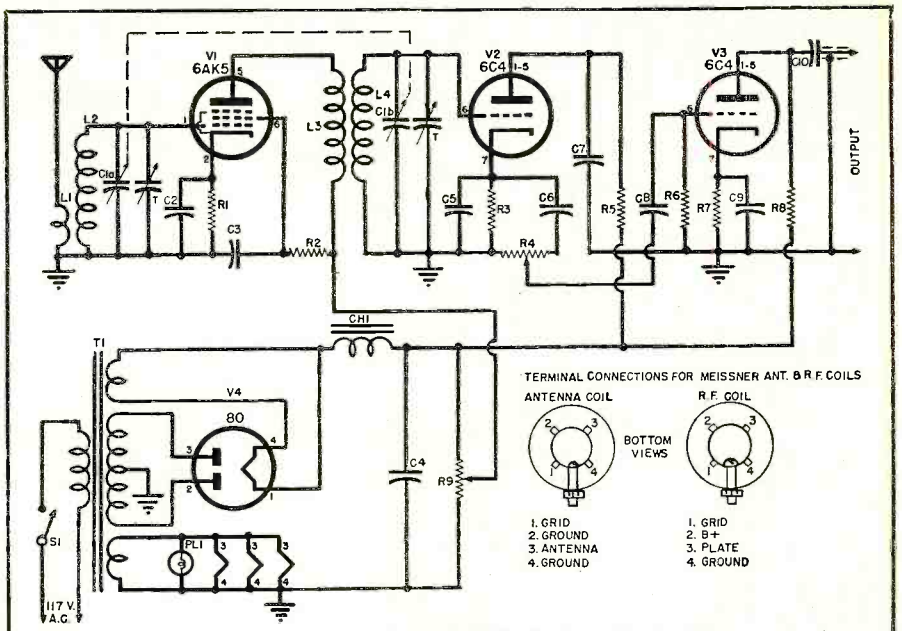
The r.f. and first audio stages are run wide open. The only gain control necessary is provided in the detector output. The gain control of the detector is usually run wide open, the actual output level being controlled by the gain control of the audio system employed.

Miniature type, high-frequency tubes are used in the tuner. They were chosen because they are available at low cost on the surplus market, and because they possess desirable electrical characteristics. The high gain obtainable from the 6AK5 is well-known.

The 6AK5 is a natural for ultra-high frequency application, but why not use it on the standard broadcast band? This I did and with surprising results. It's a "hot" little bottle. The choice of the 6C4 for detector and audio stage proved to be a happy one.

It may seem like gilding the lily a bit to use high grade ceramic sockets and tube shields on a broadcast tuner, but the final results fully justified the expenditure. No trouble with hum or microphonics was encountered. Hum level is below audibility, and with no modulation there is velvet silence. The unit is simple to build. Three hours after starting the project, I had an antenna going in one end and music coming out the other end. If you are fortunate enough to have access to a signal generator, alignment is conventional for TRF receivers. Not owning such a device, I lined the tuner up with my "bare hands" so to speak. This is not recommended for the uninitiated. Actually the only adjustments to be made are the two padder screws built

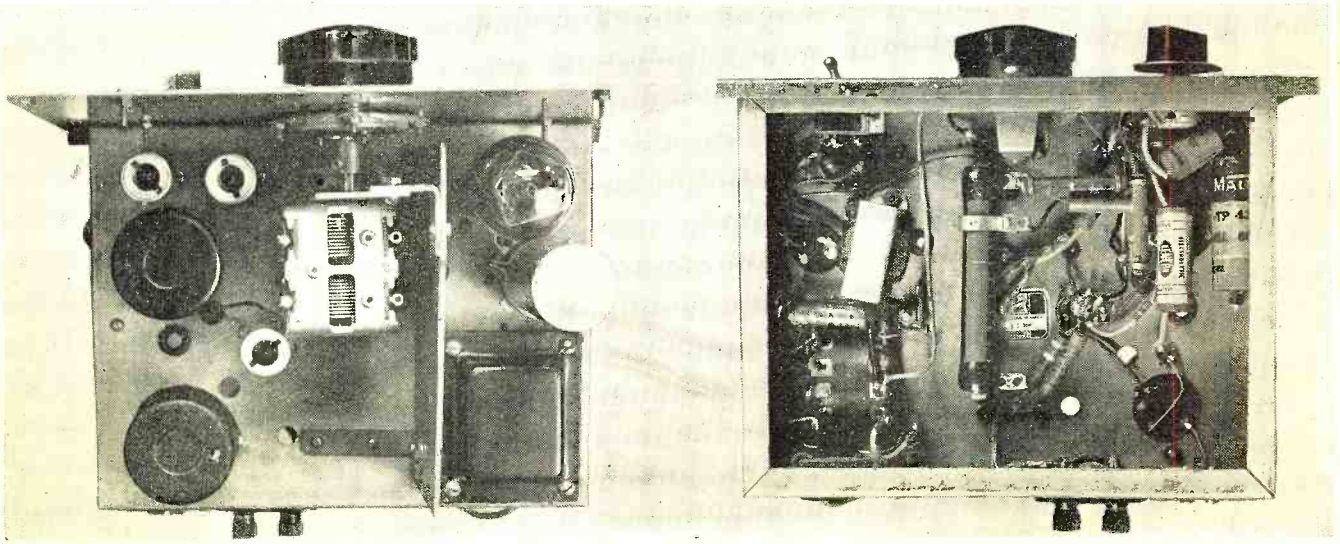
(*Continued on page* 140)



R_1—180 ohm, 1 w. res.
R_2—27,000 ohm, ½ w. res.
R_3—.15 megohm, ½ w. res.
R_4—.25 megohm vol. control
R_5—27,000 ohm, 2 w. res.
R_6—100,000 ohm, ½ w. res.
R_7—1500 ohm, ½ w. res.
R_8—250,000 ohm, ½ w. res.
R_9—15,000 ohm, 50 w. wirewound bleeder res. (with tap)
C_{1a}, C_{1b}—Midget 2-gang var. cond. 365 μμfd. per sec., with built-in compression mica padders
C_2, C_3, C_8, C_{10}—.01 μfd., 400 v. paper cond.
C_4—25 μfd., 300 v. elec. cond.
C_5—250 μμfd. mica cond.
C_6—.1 μfd., 400 v. paper cond.
C_7—.5 μfd., 600 v. paper cond.
C_9—25 μfd., 25 v. elec. cond.
L_1, L_2—Ant. coil (Meissner #14-1004)
L_3, L_4—R.f. coil (Meissner #14-1005)
CH_1—50 ma., 8 hy., midget filter choke
T_1—Power trans. 325-0-325 v. @ 50 ma.; 5 v. @ 2 amps.; 6.3 v. @ 2 amps.
S_1—S.p.s.t. toggle sw.
PL_1—6.3 v. pilot lamp

Circuit diagram and parts list for the high fidelity AM tuner unit.

(Left) Top chassis view of tuner showing shield location. (Right) Under chassis view.



MODERN TELEVISION RECEIVERS

By MILTON S. KIVER

The Philco Model 1240 TV receiver (above) and one of the new Farnsworth table model receivers (right).

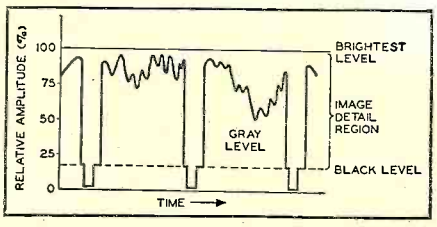
Part 12. A discussion of d.c. restorers used in television receivers, covering why they are needed and how they function.

IN CONSIDERING the video-frequency amplifier stages of a television receiver, it was briefly noted that some form of d.c. restoration was required in most sets before the video signal was suitable for application to the cathode-ray tube. D.c. restoration is a problem which is peculiar to television and in order to understand why we need it, we must understand the composition of a video signal.

Several lines of a typical video signal are shown in Fig. 1. Between every two successive synchronizing and blanking pulses, we have the camera signal variations, ranging from white (at the most positive value) to black at the level of the blanking pulse. These signals are shown in the positive picture phase form. When applied to a cathode-ray tube, each different value of video voltage produces a different spot intensity on the cathode-ray tube screen and from all these light gradations we obtain the image.

Suppose, now, we take a video signal and, while maintaining the same camera signal variations, we first move these variations closer to the blanking pulse level (Fig. 3A) and then shift the same variations as far away as possible from the blanking pulses (Fig. 3B). What would be the visual result in each instance? Since the blanking level represents the point at which the cathode-ray tube beam is supposed to cut off, moving the video signal closer to this level means that the overall background of the image will become darker. On the other hand, when the video signal variations are farther away from the blanking level, the background of the image will become brighter. Note, however, that because the video signal variations are identical in each instance, the same scene is obtained. The only thing we have altered by shifting the relative position of the video signal is the background brightness. In the first instance it is dark, whereas in the second illustration it becomes bright. We can simulate the same conditions in a room by increasing or decreasing the intensity of the electric lights. This change does not affect the objects in the room themselves, but merely the over-all brightness of the scene.

Fig. 1. Several lines of a video signal possessing proper polarity for application to the television receiver's cathode-ray tube.



To distinguish between the camera signal variations themselves and the average distance of these variations from the blanking level, it has become standard to call the latter the d.c. component and the former the a.c. component of the video signal. The average level of the signal can be altered by the insertion of a d.c. voltage, thereby raising or lowering the average level of the video signal and changing the background brightness of the image.

At the transmitter, the level of the blanking pulses is established as the dark level, at which point the electron beam in the receiver cathode-ray tube is cut off and the screen, for that point, is dark. When the a.c. video signal variations obtained from the camera tube are combined with this blanking voltage and the sync pulses, we have a complete video signal. At any point along the program line, the distance between the average level of the a.c. video signal and the blanking level may be varied (through insertion of a d.c. voltage) to produce the desired shading or background brightness as dictated by the program director. Note that since the d.c. voltage moves the video signal variations closer to or farther away from the blanking level, we are using this level

as a reference. Therefore, the level of the blanking pulses must remain fixed, and the signal is transmitted with this relationship maintained.

The video signal, at the second detector output in the receiver, contains the full video signal as shown in Fig. 1. The blanking pulse of each line is aligned to the same level. However, when the signal is passed through *RC* coupled video-frequency amplifiers, the blanking pulses of the various lines are no longer lined up because the coupling condensers cause the video signal to possess equal positive and negative areas about the zero axis.

This situation has been encountered by the serviceman, although in slightly different form. Suppose we take three 60 cycle a.c. voltages and three d.c. voltages and combine them to form the signals indicated in Fig. 2A. (Voltages of this type are frequently found in power supplies where the a.c. wave represents the ripple or hum voltage).

For the sake of this discussion, we have provided enough d.c. voltage so that the positive peaks of all three waves reach the same level. Now, let us pass these voltages through a condenser. The result is shown in Fig. 2B. By removing the d.c. voltages, each wave has as much area above the axis as below and because of this, the positive peaks of the waves are no longer at the same level.

Let us look at the equivalent situation in a television system. In Fig. 2C there is shown three video signals taken at different moments from a television broadcast and representing three lines. One line is essentially white, one is gray, and one is dark or black. As they come out of the video second detector, all of the blanking voltages are aligned to the same level. After passing these three signals through a coupling condenser, the signals possess the form indicated in Fig. 2D. For each signal, the area above the axis is equal to the area below the axis. But because of this, the blanking voltages of the signals are no longer at the same level. In this condition, we say that the d.c. component of the video signal is missing. The question now is: "What effect will this variation in blanking level have on the image produced on the screen?"

Each blanking pulse represents the dark level of each line. Since all lines in an image should have the same reference (or black) level, all blanking pulses should have the same voltage value. This was true of the video signal when it left the transmitter and it was true in the receiver just before we passed the detected video signal through a coupling condenser in the video-frequency amplifier system. After passage through this condenser, the blanking pulse levels were no longer aligned to the same level. If now we apply these three video signals to a cathode-ray tube, here is what happens.

When the first signal, corresponding to a white line, reaches the cathode-ray tube grid, we manually adjust the brightness control (which controls the bias for the image tube) to the point where the blanking pulse level just drives the tube into cut-off. Thus, as long as this signal remains, the negative voltages of the blanking pulse, added to the negative bias set by the brightness control, will just darken the screen at the blanking pulse level.

If now the next video signal comes to the cathode-ray tube, we see that its blanking pulse level is not at the same negative potential as the level of the previous video signal. Hence, here, the beam will not cut off at the blanking pulse and the beam retrace will

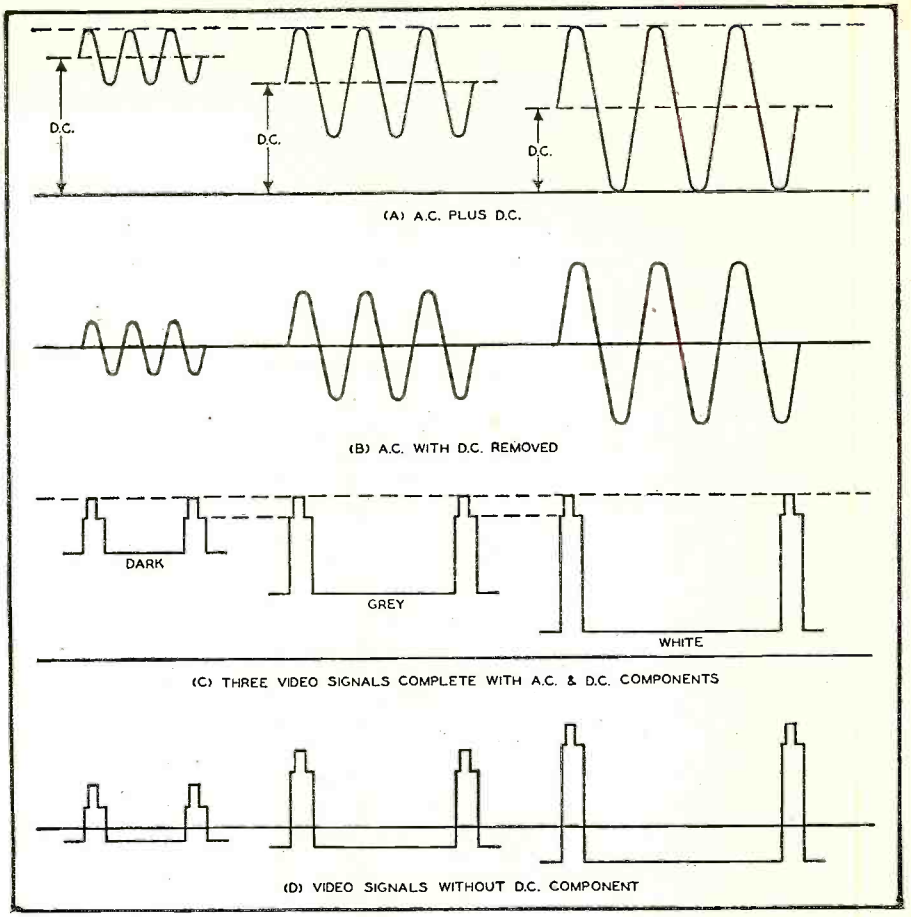


Fig. 2. Comparison of video signals and a.c. voltages with and without their d.c. components.

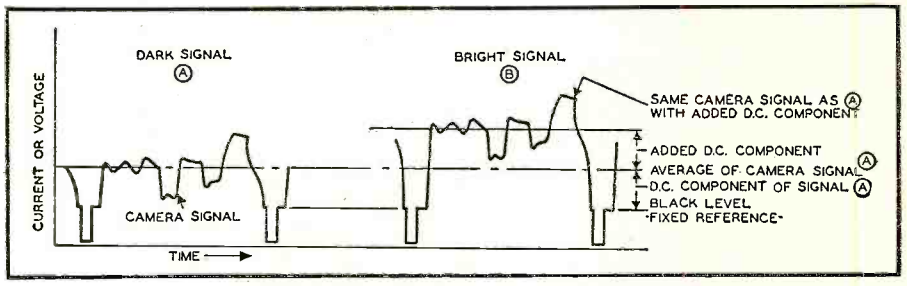
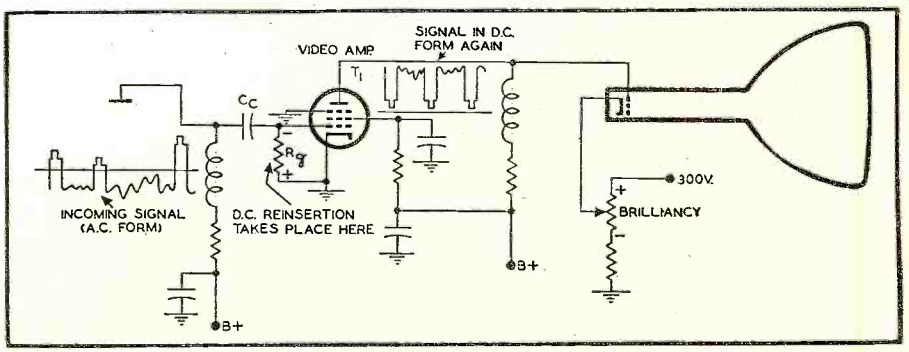


Fig. 3. Identical video signals possessing different values of d.c. components.

Fig. 4. The grid-leak bias method of d.c. restoration.



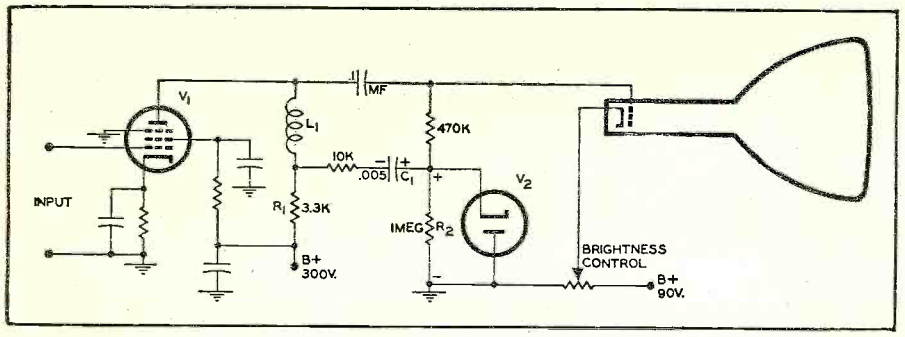


Fig. 5. The diode method of d.c. restoration.

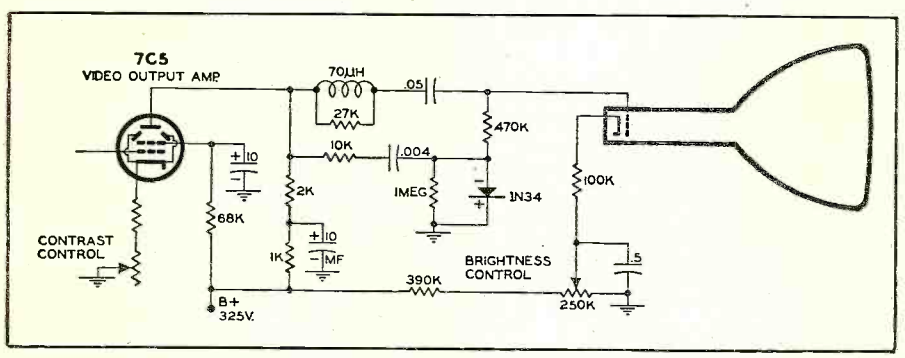


Fig. 6. Substitution of a germanium crystal, 1N34, in place of a diode tube.

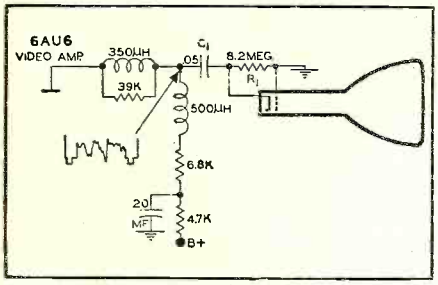


Fig. 7. The application of the grid-leak bias method of d.c. restoration directly at the image tube.

be visible. We could produce the proper cut-off conditions by increasing the negative bias on the image tube but this is impractical for several reasons. First, in any changing scene, the background shading changes too rapidly to be manually adjusted by the viewer. As a result, if the brightness control is set for a very bright picture, we will see the retrace lines when a darker picture arrives. Conversely, if the brightness control is set for a darker image, then when a lighter image is viewed, part of the detail will be lost because of the greater cathode-ray tube grid bias.

Finally, the situation is even further aggravated when a dark video signal arrives. Now, we require an even greater negative bias and when the brightness control is set correctly for this signal, it is much too negative for both the two previous signals. If either of these two other signals is viewed with the bias set for this last signal, the image will appear too dark. On the other hand, when it is correctly set for a white picture, a black picture will appear too light, with even the retrace lines visible. The only solution to this state of affairs is to return all blanking voltages to the same level again, just as we found it in the incoming signal. *This, then, is the function of the d.c. restorer in the receiver.*

To understand why d.c. restoration is possible, it is necessary to know that removing the d.c. component from a video signal does not change its shape, but merely its reference level. This is evident when Fig. 2C and 2D are compared. The same variations in the a.c. components occur and the relationship of the a.c. signal to the blanking and synchronizing pulses remains the same, with or without the d.c. component.

Now, to reinsert the d.c. component, we require a variable bias which will change in such a manner that all pulses will be brought to one common level. It means that if a video signal in its a.c. form is applied to the input of a tube where the process of d.c. restoration is to occur, a variable bias developed here will return all blanking and sync pulses to the same level again in the output circuit of the tube.

There are two general methods for reinserting the d.c. component: grid-leak bias and the diode method, although as we shall see, there are many variations of these basic systems.

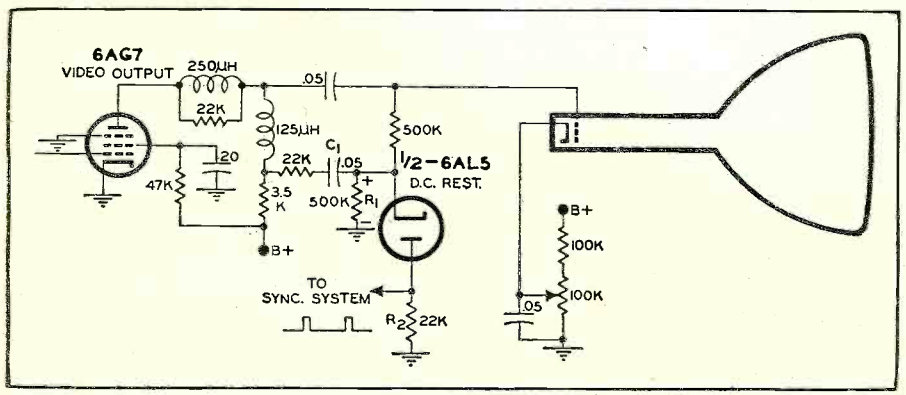
Grid-Leak Bias Method

This is the simplest of the d.c. restoration methods and is illustrated in Fig. 4. Here the final video amplifier is operating at zero fixed bias when no signal is applied to the grid. When a signal arrives, grid current will flow at the positive peaks of the applied voltage, charging up condenser C_c. During the interval when the video signal is active, and the signal voltages are negative, the charge on C_c partially discharges through R_g, developing a negative biasing voltage with the polarity indicated. The voltage across R_g is the operating grid bias and, in effect, acts in series with the a.c. video signal applied to the tube. Since the current flowing in the grid resistor depends on the extent the applied a.c. signal is driven positive, it is evident that the grid current will vary from pulse to pulse. A large positive voltage (corresponding to a bright line) will produce a large biasing voltage across R_g and this will tend to reduce the plate current flow. On the other hand, a small positive pulse, such as we obtain for a dark line, produces only a small biasing voltage across R_g. This automatic variation in bias results in a uniform plate current for each pulse (blanking and synchronizing), thereby aligning them to the same level.

In practice it is seldom necessary to change the bias for each horizontal sync pulse and the values for C_c and R_g are so chosen that the bias voltage lasts for about 10 lines. Thus, RC is equal to or greater than $10T$ where T is the time of one horizontal line (approximately 64 microseconds).

Once the video signal is returned to its proper form, it is fed directly to the grid of the cathode-ray tube. There are no intervening coupling condensers to remove the d.c. component. This direct connection between the plate of the video frequency amplifier output tube and the grid of the cathode-ray

Fig. 8. Circuit of Fig. 5 modified to provide sync pulses to the set's sweep system.



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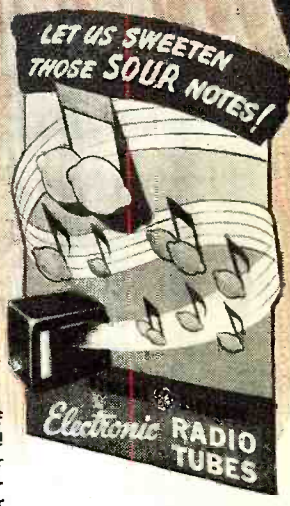

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tube places a fairly high positive voltage on the image tube grid. Since the tube operates normally with negative bias, a higher positive voltage is required on the cathode of the image tube. See Fig. 4. A potentiometer in the cathode circuit permits the viewer to adjust the bias so that the blanking pulses just cut off the electron beam. When the d.c. restoration circuit is functioning properly, the screen will be black with no signal coming in.

A disadvantage of this type of d.c. restoration circuit is the fact that the "B+" potentials on the screen grid and plate must be reduced in order that excessive current does not flow when no signal is being received. This reduces the over-all gain available from this stage. Secondly, it is quite important that the screen-grid voltage be well regulated, otherwise the d.c. restoring action is impaired.

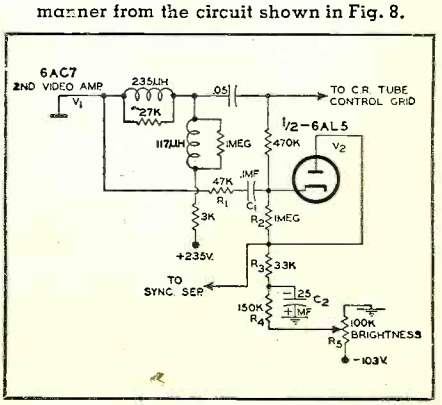
Belmont (Models 21A21, 22A21), *General Electric* (Model 810), *Tele-King* (Model 2315), *RCA* (Models 621TS and 721TS), and *Stromberg-Carlson* (Model TV10) all use the grid-leak bias method of d.c. reinsertion.

One manufacturer, *Motorola*, in Model VT-71, applies the grid-leak bias method directly to the cathode-ray tube. See Fig. 7. The signal is fed to the cathode through C_1. The grid is grounded directly and when the cathode is driven negative (by the blanking and sync pulse voltages) we are, in effect, causing the grid to become positive with respect to the cathode. Grid current flows at this point, charging C_1 to the peak value of the negative portion of the incoming signal. When the cathode is positive (or the grid negative), C_1 discharges, placing a bias voltage across R_1 which represents the d.c. restoration voltage. This bias alters the potential between grid and cathode in such a manner as to have the beam cut off with each blanking pulse.

Diode Reinsertion Circuit

The second system widely employed for reinserting the d.c. component is shown in Fig. 5. The video signal appearing across R_1 is transferred via the 10,000 ohm resistor and the .005 μfd. coupling condenser to V_2, where the d.c. reinsertion voltage is devel-

Fig. 9. A diode d.c. restorer and clipper functioning in a slightly different manner from the circuit shown in Fig. 8.



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7E6	5X4G	6H6GT	9T8	2050	46
7E5	5Y3GT	6J5GT	10	2051	47
7C4	5Y4G	6J7GT	12A8GT	24A	50
14X7	5Z3	6K6GT	12A6	25L6GT	50B5
1A5GT	6A7	6K7GT	12A7	25Z5	50L6GT
1A7GT	6AC5GT	6P5GT	12AT6	25Z6GT	56
1B4	6A3	6Q7	12AU6	26	57
1C4	6A8GT	6Q6GT	12C8	27	58
1H5GT	6AJ5	6R7	12BA6	30	70L7GT
1L4	6AL5	6S8GT	12BE6	31	71A
1N5GT	6AQ5	6SA7GT	12F5	32L7GT	75
1P5	6AQ6	6SC7GT	12H6	35	76
1Q5	6AT6	6SD7GT	12J5	35/51	78
1R4	6AU6	6SF5GT	12J7GT	35B5	80
1R5	6B6	6SF7	12K7GT	35C5	81
1S4	6B7	6SG7GT	12K8G	35L6GT	83
1S5	6BA6	6SH7	12Q7GT	35W4	84/6Z4
1T4	6BE6	6SJ7GT	12S8	35Z4GT	85
1U4	6BH6	6SK7GT	12SA7GT	35Z5GT	112A
1V	6BJ6	6SL7GT	12SH7GT	37	89
2A3	6C4	6SN7GT	12SG7	37A	117L7GT
2A5	6C5GT	6SQ7GT	12SJ7GT	38	117P7GT
2A7	6C6	6SR7GT	12SK7GT	39	117Z3
2B7	6C8G	6TB	12SN7GT	39/44	182B
3A4	6D6	6U7GT	12SQ7GT	40	183
3Q4	6F5G	6V6GT	12SR7	41	482B
				42	483

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5" Alnico 5 Magnet	Lots of 10, ea. 95c
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50-50 mfd, 150V	ea. 49c
20 mfd, 150V	ea. 25c
40 mfd, 150V	ea. 29c
8 mfd, 450V	ea. 21c
8-8 mfd, 450V	ea. 43c
10-10 mfd, 450V	ea. 43c
20-20 mfd, 450V	ea. 39c
25 mfd. 25V	ea. 17c

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For: 50L6, 50B5, 50A5, 50C6, 32L7, 70L7, 26A7, 6W6, 28D7, 70A7, 1276, 6A5, 6B4, 25C6, 7C5, 2A3, 6A3, 6Y6, 25B6, 25L6, 6L6 ..... each 39c

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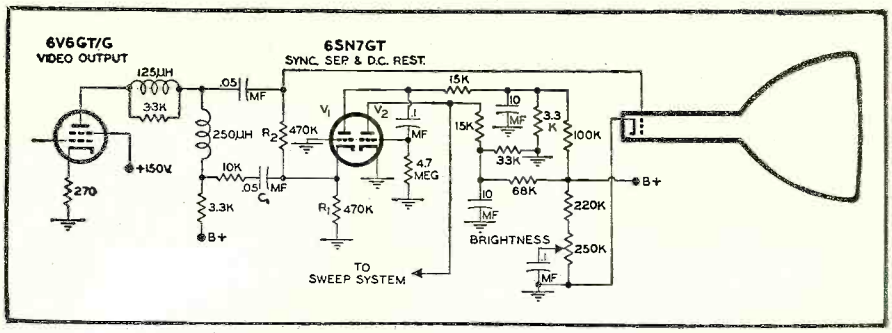


Fig. 10. Another circuit arrangement of d.c. restoration and clipping. See text.

oped. The operation of this circuit is as follows:

When the signal reaches this portion of the circuit, it is in the positive picture phase. Consequently, the blanking and synchronizing pulses possess the most negative potentials. For the diode to respond to these pulses, it must be inverted, as shown. When a negative pulse reaches the diode, the cathode becomes negative with respect to the plate and the tube conducts. Current will surge from the cathode of the diode to its plate, to ground, up through V_1, L_1, and back to cathode of V_2 through the 10,000 ohm resistor and C_1. This current, in flowing through C_1, will charge this condenser to the peak value of the voltage across R_1. The polarity of C_1, when it is charged, is such that the condenser plate connected to the diode cathode becomes positive with respect to the other plate. At the conclusion of the pulse, the diode becomes non-conductive, and C_1 begins to discharge. The path of discharge is from the negative plate of C_1, through the 10,000 ohm and 3300 ohm resistors, down through the power supply, to ground and from ground up through R_2 to the positive plate of C_1. Since electrons flow up through R_2, the bottom end of this resistor becomes negative with respect to its top end. If the values of R_2, C_1 and the rest of the resistances in this discharge path are properly chosen, the biasing voltage developed across R_2 will remain steady for a period equal to several lines. The biasing voltage is provided a direct path to the grid of the cathode-ray tube through the 470,000 ohm resistor. In this way it combines with the video signal and restores the missing d.c. component. A brightness control is still needed to establish the negative bias for the image tube. The 0.1 μfd. coupling condenser from the plate of V_1 to the grid of the image tube blocks the "B+" voltage from the diode and grid of the cathode-ray tube and does not interfere with the d.c. reinsertion voltage developed by the diode. *Farnsworth* (Model GV-260), *General Electric* (Model 802), *Industrial Television* and *Philco* (Models 48-1000, 1050, 2500 and 49-1075, 1240, 1275) employ this method of d.c. reinsertion.

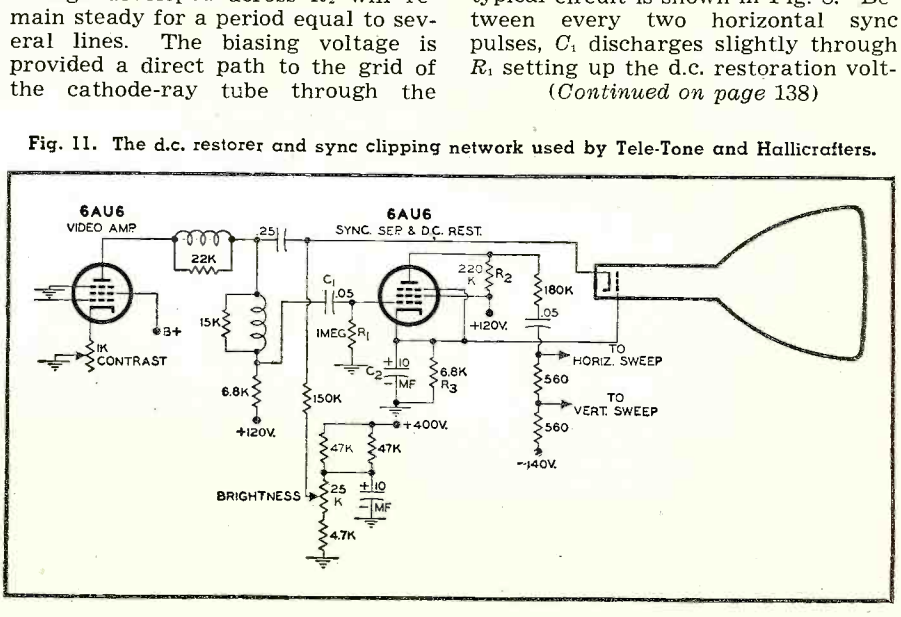
In some sets, tubes other than diodes are used, but in all cases, the tube elements are tied together in such a manner as to form the equivalent of a diode.

A circuit that is equivalent to Fig. 5 is shown in Fig. 6. Instead of using a diode tube for the d.c. reinsertion, a 1N34 crystal is substituted. Since crystals and diodes function in the same manner, the entire previous discussion can be applied here. *Philco*, in the first sets of Model 48-1000 and in Model 48-1001, uses such crystals.

The same diode restorer, in addition, can be utilized to function as a clipper circuit to separate the sync pulses from the rest of the video signal and then transfer these pulses to the horizontal and vertical sweep systems. A typical circuit is shown in Fig. 8. Between every two horizontal sync pulses, C_1 discharges slightly through R_1 setting up the d.c. restoration volt-

(*Continued on page* 138)

Fig. 11. The d.c. restorer and sync clipping network used by Tele-Tone and Hallicrafters.



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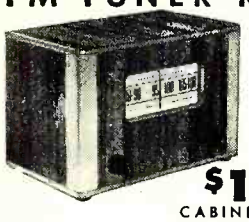

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A truly fine FM Tuner with the coils ready wound, all alignment completed — all that is necessary is wiring and it's ready to play — uses super regenerative circuit — 110 V. 60 cycle transformer operated — two gang tuning condenser — slide rule calibrated dial — two tubes — complete instructions including pictorial enable even beginners to build successfully. Shipping Wt. 4 pounds.

Beautiful mahogany cabinet for FM Tuner (shown above) extra **$3.75**

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2. Has gear driven roller chart.
3. Has lever switching for speed.
4. Complete range of filament voltages.
5. Checks every tube element.
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7. Uses beautiful shatterproof full view meter.
8. Large size 11"x14"x4" complete.

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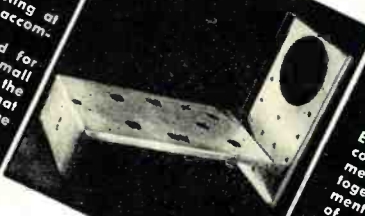

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Everyone is pleased at the thorough instructions covering the assembly of each Heathkit instrument. Every detail of the assembly is covered, together with sections on the use of the instrument and trouble shooting instructions in case of difficulty. Actual photos of the assembled instrument enable fast and accurate assembly. clear schematics and pictorial diagrams of the confusing parts such as rotary switches enable the wiring to be completed quickly.

Heathkit SIGNAL GENERATOR KIT . . .

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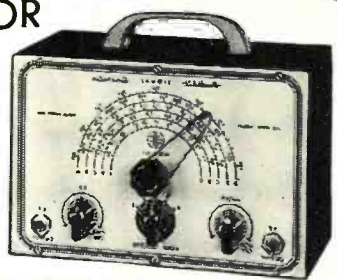

Every shop needs a good signal generator. The Heathkit fulfills every servicing need, fundamentals from 150 Kc to 30 megacycles with strong harmonics over 100 megacycles covering the new television and FM bands. 110V 60 cycle transformer operated power supply.

400 cycle audio available for modulation or audio testing. Uses 6SN7 as RF oscillator and audio amplifier. Complete kit has every part necessary and detailed blueprints and instructions enable the builder to assemble it in a few hours. Large easy to read calibration. Convenient size 9" x 6" x 4¾". Shipping weight 4½ lbs.

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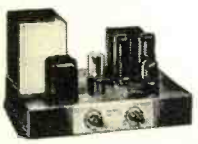

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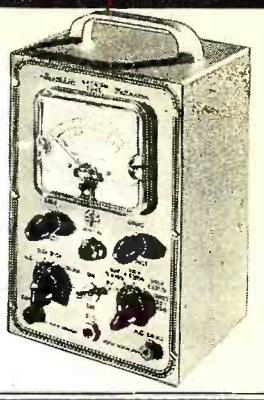

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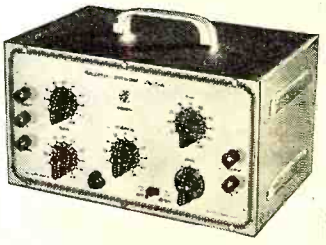

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New 1948

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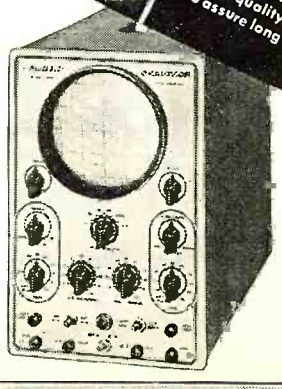

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NO. 211. Tiny Delco motor only 1" x 1¼"x2" 10,000 RPM. Operates from 6 to 24 V. Excellent for models. Add postage for 1 lb. **$2.95**

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NO. 227. Push pull 6V6's to 6 - 8 ohm voice coil excellent characteristics. **3 for $1.95**

RCA SATURABLE REACTOR TRANSFORMER

NO. 246. New RCA No. CKV30531 AC current 750 MA DC current 2 Amperes. Rated 1.75 henries. Shipping wgt. 4 lbs. Each **$1.00**

12.6V POWER TRANSFORMER

NO. 247. New cased 110 V 60 cy. Power Transformer. Supplies 440V Ct. at 60 MA, 6.3V at 2A. and 12.6V at 1 Amp. Excellent for military sets. Shipping Wght. 6 lbs. Each. **$1.95**

RCA INPUT TRANSFORMER

NO. 248. Heavy duty RCA No CKV-30529. Input has primaries 600 to 200 and 25 ohms secondary 250,000 ohms C.T. Shipping Wgt. 2 lbs. Each **$1.00**

FEDERAL POWER TRANSFORMER

NO. 252. New cased 110V 60 cy. Power Transformer. Supplies 480V CT at 50 MA and 6.3 V at 2.1 Amps. A beautiful transformer. Shipping Wgt. 4 lbs. Each **$1.50**

MILITARY POWER TRANSFORMERS

NO. 229. Convert your military receivers without rewiring the filament. "A" type supplies 500 VCT at 50 MA, 5V. at 2A. and 24V. at ½ A. "B" type supplies 500 VCT at 50 MA, 5V. at 2A. and 12V. at 1 Amp. State whether A or B type desired. Shipping Weight 4 lbs. **$2.95**

WALKIE TALKIE TRANSFORMER

No. 744. Carbon microphone input transformer and output to headphone transformer, all in one case, excellent for building your own. Shipping Wt. 1 lb. 4 for $1.00

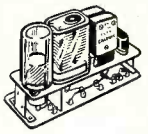
LOW PASS FILTER UNIT

No. 637. 3000 cycle cutoff consists of 3 inductances and 4 capacitors in network, 500 ohms in and out. Excellent for clipping all frequencies above 3000 cycles. Drawn steel case, shipping Wt. 5 lbs. $2.50

FM PUSH BUTTON TUNER

NO. 224. Brand new ten push button tuning assembly from Army FM receiver. Contains 4 gang 100 MMF silver plated tuning condenser. Add postage for 10 lbs. **$2.50** EACH

BC 746 TUNING UNIT



NO. 257. Plug in transmitter tuning unit from army Walkie Talkie. Contains antenna and tank coils, tuning condenser, transmitting and receiving crystals. Ideal transmitter foundation. Shipping Wgt. 1 lb. Each **$1.00**
(Same as above except transmitter crystal in 80 meter amateur band $2.50 each)

T30 THROAT MICROPHONE

NO. 258. Makes excellent contact microphone for musical instrument or vibration pick-up. Shipping Wgt. 1 lb. $1.00 each
Extension cord with switch for above $ .50 each

BC731 CONTROL BOX

with Weston Model 476 AC Voltmeter

NO. 208. Excellent buy in motor control box. Size 8"x10"x5½". Contains Weston 0-150V. AC 3½" voltmeter, motor starting switch, 28 fuses all 30 Amp 110V. and 8 fuse holders. Fuses and holders alone worth the price. Shipping Weight 18 lbs. **$7.95**

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NO. 237. Brand new DeJur Model 312 0-800 M.A. D.C. Square 3" 0-10 M.A. basic meter with built in shunt. Probably the best buy ever offered in a surplus meter. Shipping Weight 1 lb. **$2.95**

HEARING AID HEADPHONES

NO. 216. The Army's best — eliminate flat ears and outside noise. Complete with transformer for conversion from low to high impedance. With cord and plug complete.
Add postage for 1 lb. **$1.00**

BC 451 CONTROL BOX

NO. 236. Control box for 274N transmitters. Contains proper cw-voice switch, 4 channel switch, power switch, mike jack and telegraph key.
Add postage for 2 lbs. $1.95

100 MA FILTER CHOKE

No. 641. Heavy 1.5 henry choke in drawn steel case, 50 ohm resistance, conservatively rated at 100 MA. Shipping Wt. 1 lb. 50c

FILAMENT TRANSFORMER

No. 922. 220V. 60 cy. primary supplies 12.6V. at 3.5 Amps, 15.6V at 1 Amp. Supplies 6.3 at 3.5 Amps and 7.8V. at 1. Amp from 110V. Shipping Wt. 8 lbs. $1.50

PANEL METER

Burlington O-300 VAC Meter

No. 290. Model 32XA 3½" round AC Voltmeter 0-300 VAC full scale. Scale also calibrated 0-600V. Bakelite case. A beautiful meter in original carton. Shipping Wt. $3.95

DRIVER TRANSFORMER

No. 651. Couples 3000 ohm plate to push pull parallel grids hermetically sealed. Ship. Wt. 1 lb. $1.00

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No. 745. Companion transformer to above driver. A push pull output, 3000 ohms to 3.2 ohm voice coil, or to 1250 ohms at 80 MA. A high quality cased unit. Shipping Wt. 2 pounds. $1.00

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AN INEXPENSIVE LOW-PASS FILTER FOR RECORD REPRODUCTION

By HARRY D. ZINK
The Antenna Research Laboratory, Inc.

WITH the advent of greatly improved phonograph pickups and high frequency speakers, great emphasis is being placed on reproducing all of the high frequencies that can be obtained from records without noise and distortion. The *Scott* noise suppressor apparently represents the ultimate in accomplishing this objective. Experiments with this circuit have shown it to be a far from easy task to secure proper operation with the information now published. For the audio enthusiast who does not have either the time, patience, or finances to buy and measure chokes and adjust the noise suppressor, the inexpensive filter proposed will give an effective compromise.

When possible circuit combinations for the noise suppressor were being investigated, the filter circuit shown in Fig. 1 was discovered. Choke CH_1 is a UTC R-55. This is an inexpensive, low current a.c.-d.c. choke. Choke CH_2 is a Thordarson T-20C58. This is an inexpensive audio choke. The fixed condensers are postage stamp micas and the ganged variable condensers are ordinary 0-365 $\mu\mu$fd. broadcast tuning condensers. A shifting of the cut-off frequency from 4000 to 6000 cycles may be accomplished by adjusting the variable condensers. As is shown, a d.p.d.t. switch may be arranged to remove the filter completely from the circuit if desired.

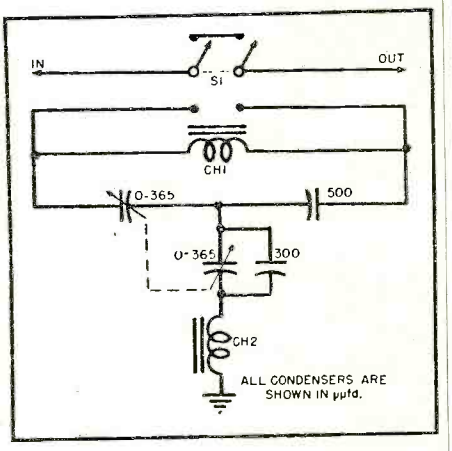


Fig. 1.

It is unlikely that suitable results would be obtained if substitutions were made in the chokes used since many unspecified qualities of these chokes enter into the proper operation of the filter. In assembling the filter it must be noted that the ground of the variable condensers is not grounded in this application and therefore must be insulated from any chassis on which it is mounted.

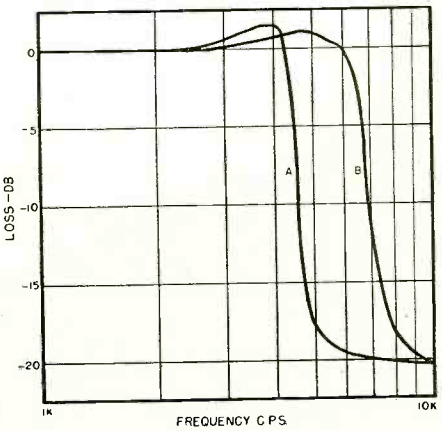
It will be observed that the general configuration of this filter is of the band elimination type. This consists of a parallel resonant circuit in series with the line and a series resonant circuit in shunt with the line. On further investigation of this filter it will be noted that it can be considered as a Bridged-T network. It will be remembered that a network of this type can be made to have a very sharp cut-off characteristic because of the neutralizing of the shunt arm resistance by the bridging resistance[1]. This effect was observed in this case, for when the components were connected in any other configuration, the cutoff was much less sharp. The choke used as the bridging inductance is self resonant at about 7000 cycles. The condensers added in parallel bring this resonance to between 4000 and 6000 cycles depending on the tuning of the variable condenser. The series resonant shunt arm is resonated at about 9000 cycles when the variable condenser capacity is maximum. This keeps the response down up to the limit of audibility.

Response curves on the filter were taken in two ways: one was by point-by-point plotting with an audio oscillator and vacuum tube voltmeter, the other was by observing the pattern on a scope when a sweep frequency record was played through the phonograph system. The second method tested the filter as it was to be used, while the first method tested it isolated from other circuits. The results obtained by both methods were essentially in agreement. The curves with the variable condensers at maximum (B) and minimum (A) capacity are shown in Fig. 2. It can be seen that the sharp cut-off allows all of the sound to be heard in the region of greatest importance. The action of this filter is considerably superior to that of an ordinary condenser filter for reducing undesirable high frequency noise.

In the author's application, the filter was connected to the output of the preamplifier for a *G.E.* pickup. During the course of experimentation the input impedance shunting the filter was varied from 30,000 ohms to 100,000 ohms with no apparent effect on the filter action. The output of the filter was connected to the high impedance input of an amplifier. This impedance was of the order of 1 megohm. Lowering the impedance shunting the output of the filter will tend to decrease the sharpness of cut-off while decreasing the impedance shunting the input will tend to increase the peak that occurs just before cut-off.

Listening tests using a *G.E.* pickup equalized flat and a two way speaker system proved indeed gratifying.—30—

Fig. 2.



[1] Kauke, J. E.: "A 10 kc. Suppressor," RADIO NEWS, March, 1947.

WIDE RANGE AMPLIFIER Increases Sensitivity of V. T. Voltmeter

By RUFUS P. TURNER, K6AI

A video-type amplifier of simple design for boosting the sensitivity of an a.c. vacuum-tube voltmeter.

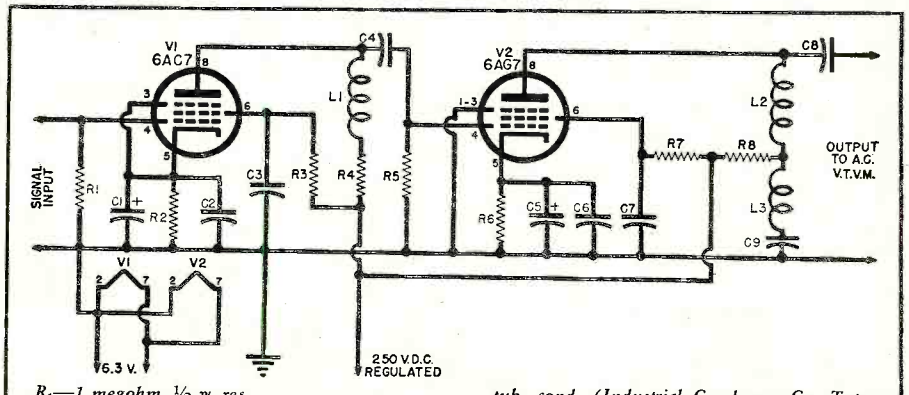
THE sensitivity of an a.c. vacuum-tube voltmeter can be increased by placing a voltage amplifier ahead of the instrument. The increased sensitivity is useful in many tests where small signals are encountered. However, a meter amplifier must have flat response over a wide frequency range.

The circuit shown in Fig. 1 is a video-type amplifier built especially for use ahead of a v.t. voltmeter. It has an over-all gain of 85 and is flat within 1½ db. from 60 cycles to 2 megacycles. With this amplifier in operation ahead of the instrument, the 0-3-volt a.c. scale of the v.t. voltmeter (the author used a *Sylvania* Type 134 Polymeter) becomes 0-35.3 millivolts—approximately 1.17 mv. per scale division.

The 250-volt d.c. power supply for the amplifier plates and screens must be well filtered and voltage-regulated. It may be built on the same chassis with the amplifier, if desired. If the v.t. voltmeter has a condenser-isolated input circuit or probe, condenser C_8 may be omitted from the amplifier circuit. No input gain control has been provided, and construction of an input attenuator, which would be accurate over the wide frequency range, is a rather complicated job. Also, no input condenser has been included, for the reason that such a capacitance, together with resistor R_1, would affect the frequency response of the amplifier. Omission of this coupling condenser is entirely satisfactory unless the circuit under test delivers a d.c. component. When d.c. is present, the operator should use the largest obtainable *non-inductive* input condenser.

In checking the amplifier for voltage gain, the reader should apply an accurately-known a.c. voltage (for example, ½ or 1 volt r.m.s.) to the input terminals and measure the voltage at the output terminals with the v.t. voltmeter which is to be used with the amplifier. The gain is determined by dividing the a.c. output voltage by the a.c. input voltage. Any voltage reading obtained on the meter scale when the amplifier later is used for measurements must be divided by this gain figure.

Fig. 1.



R_1—*1 megohm, ½ w. res.*
R_2—*160 ohm, 1 w. (150 and 10 ohms in series) res.*
R_3—*60,000 ohm, 1 w. res.*
R_4—*1250 ohm, 1 w. res.*
R_5—*250,000 ohm, ½ w. res.*
R_6—*65 ohm, 2 w. (50 and 15 ohms in series) res.*
R_7—*25,000 ohm, 1 w. res.*
R_8—*3500 ohm, 10 w. non-inductive res. (Sprague 10K)*
C_1, C_5—*10 μfd., 25 v. midget tub. elec. cond.*
C_2, C_3, C_4, C_6, C_8—*.1 μfd., 400 v. non-inductive tub. cond. (Industrial Condenser Co. Type PT173)*
C_7—*.5 μfd., 400 v. non-inductive tub. cond. (Industrial Condenser Co. Type PT175)*
C_9—*6 μfd., 400 v. non-inductive, oil-filled cond. (Aerovox Type 30)*
L_1—*25 μh., 34 t. #29 en. wire on 1" dia. form. Spaced to winding length of 11/16"*
L_2—*72 μh., 54 t. #29 en. wire closewound on 1" dia. form*
L_3—*48 μh., 42 t. #29 en. wire closewound on 1" dia. form*

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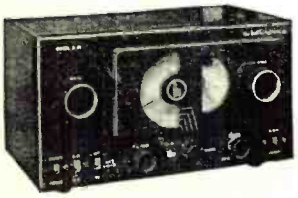
In a spectacular promotion aimed at making world-renowned Hallicrafters equipment available to more and more operators, Walter Ashe is stepping up his "Surprise" Trade-In Allowances on your used, factory-built communication equipment. Take advantage of the tremendous savings made possible by Walter Ashe's bigger-than-ever allowances. Get your trade-in deal working today and experience the thrill of owning "The Radio Man's Radio." Wire, write, phone or use the handy coupon below!



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Hallicrafters most versatile receiver. For Ham or SWL. Covers 540 Kc. to 32 Mc. 5 tubes plus rectifier. Internal speaker. Shpg. Wt. 13½ lbs. **$49.95**

Model SX-62 Receiver

SWL version of the SX-42. Continuous coverage 540 Kc. to 110 Mc. Each band separately illuminated. 15 tubes plus rectifier. Shpg. Wt. 68 lbs. **$269.50**

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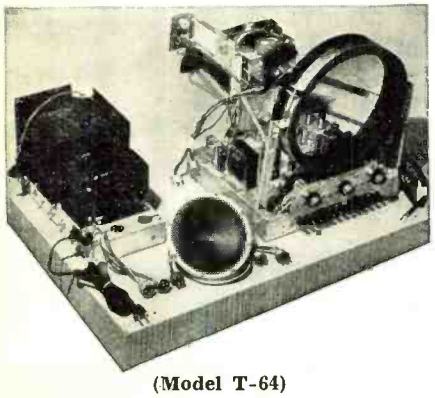

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Model R-42 Speaker for SX-42, SX-62 Bass Reflex. **$34.50**
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Non-inductive condensers are used in each circuit position except C_1 and C_5 which are electrolytics. The coils, L_1, L_2, and L_3, are simple and may be wound according to directions given in the coil table, Fig. 1. After winding the original coils, the author checked them with a *Boonton* 160-A *"Q"*-Meter for *"Q"* and distributed capacitance, with the following results: L_1; *"Q"* 162.4, C_d 2 $\mu\mu$fd. L_2; *"Q"* 103, C_d 3 $\mu\mu$fd. L_3; *"Q"* 115, C_d 2.8 $\mu\mu$fd.

—30—

Mac's Service Shop

(*Continued from page 58*)

"Yes; isn't it?" Mac agreed. "You are also permitted to deduct any losses suffered to business property that are not compensated for by insurance. The loss may occur by theft, fire, freezing, loss in transit, collision, etc. You cannot claim such a loss on merchandise purchased for resale, for that would be reflected in your closing inventory; but a casualty to business equipment, like the time our truck was banged up, is deductible. I had 'fifty-dollar-deductible' insurance; so, while the cost of repairing the truck was $150, all I can deduct is $50, for that is all the accident cost me.

"We report on a 'cash' basis; so we cannot deduct anything for bad debts. There is no reason why we should, for the debt is not reported as 'income' until the money is actually taken in. On the 'accrual' basis, the selling price is listed as income at the time of sale, and deductions may be made for bad debts at the time they are written off.

"There are other things we buy that last more than one year, and we cannot deduct their total cost all at once," Mac went on, warming to his subject. "We recover the cost of these by deducting a certain percentage of the cost each year. For example, we figure the truck will last five years; so we deduct 20% of its cost price as *'Depreciation'* each year. Other rates of depreciation are: office furniture, 10%; testing equipment, 20%; service manuals, 20%; tools, 20%; brick building, 2%; frame building, 3%.

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Mac stopped for breath, and Miss Perkins smoothly continued: "Technical radio magazines and journals, experimental expenses, accident insur-

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Model 247 comes complete with new speed-read chart. Comes housed in handsome, hand-rubbed oak cabinet sloped for bench use. A slip-on portable hinged cover is indicated for outside use. Size: 10¾"x8¾" x5¾". ONLY.....

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Features:

★ A newly designed element selector switch reduces the possibility of obsolescence to an absolute minimum.

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★ The Model 247 provides a super-sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals.

★ One of the most important improvements, we believe, is the fact that the 4-position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

THE MODEL 88—*A COMBINATION*

SIGNAL GENERATOR and SIGNAL TRACER

SIGNAL GENERATOR SPECIFICATIONS:

• Frequency Range: 150 Kilocycles to 50 Megacycles • The R.F. Signal Frequency is kept completely constant at all out-put levels. • Modulation is accomplished by Grid-blocking action which is equally effective for alignment of amplitude and frequency modulation as well as for television receivers. • R.F. obtainable separately or modulated by Audio Frequency.

SIGNAL TRACER SPECIFICATIONS:

• Uses the new Sylvania 1N34 Germanium crystal Diode which combined with a resistance-capacity network provides a frequency range of 300 cycles to 50 Megacycles.

The Model 88 comes complete with all test leads and operating instructions. ONLY . . . **28.85** net

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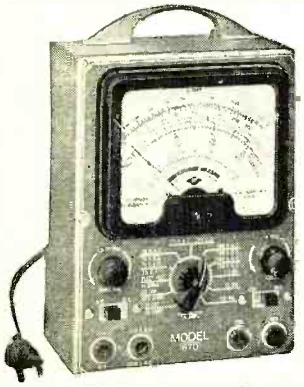

D.C. VOLTS: 0 to 7.5/15/75/150/750/1500/7500. **A.C. VOLTS:** 0 to 15/30/150/300/1500/3000 Volts. **OUTPUT VOLTS:** 0 to 15/30/150/300/1500/3000. **D.C. CURRENT:** 0 to 1.5/15/150 Ma.; 0 to 1.5 Amps. **RESISTANCE:** 0 to 500/100,000 ohms, 0 to 10 Megohms. **CAPACITY:** .001 to .2 Mfd., .1 to 4 Mfd. (Quality test for electrolytics). **REACTANCE:** 700 to 27,000 Ohms; 13,000 Ohms to 3 Megohms.

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The model 670 comes housed in a rugged, Crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3". **28.40** net

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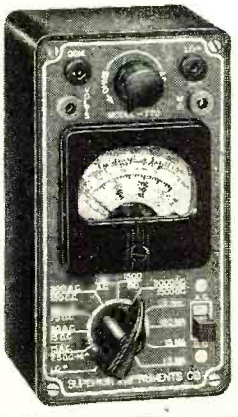

(Sensitivity: 1000 ohms per volt)

FEATURES:

Compact—measures 3⅛" x 5⅞" x 2¼". Uses latest design 2% accurate 1 Mil. D'Arsonval type meter. Same zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V.O.M. in this price range. Housed in round-cornered, molded case. Beautiful black etched panel. Depressed letters filled with permanent white, insures long-life even with constant use.

6 A.C. VOLTAGE RANGES: 0-15/30/150/300/1500/3000 volts.

6 D.C. VOLTAGE RANGES: 0-7½/15/75/150/750/1500 volts.

4 D.C. CURRENT RANGES: 0-1½/15/150 Ma., 0-1½ Amps.

2 RESISTANCE RANGES: 0-500 ohms. 0-1 Megohm.

The Model 770 comes complete with self contained batteries, test leads and all operating instructions **13.90** net

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ance premiums; professional fees for legal advice or income tax service; travel expenses for business trips; dues to professional societies and trade associations; cost of installing new equipment or a new system."

"That should be enough to give you an idea of what kind of deductions you can take," Mac said. "The main idea to keep in mind is that the Treasury Department does not expect you to pay taxes on the money you have to spend to make money. If we have a sinking fund to take care of emergencies, we can deduct the amount we put into it under *'Amortization of Emergency Facilities';* but we have to explain this in an attached statement.

"Finally, we add up all of these business deductions and include the net costs of goods sold. This total, deducted from our total receipts, gives us our *'Net Profit.'* If we have no *'Capital Gains or Losses'* or no *'Income from Partnerships, Estates, Trusts, and Other Sources,'* our *'Net Profit'* is the figure we write in as *Item 5, Page 1.* The remainder of the report is handled just as was your uncle's—and don't ask me to explain *'Capital Gains* or *Losses'* to you, for we do not have time. You take home that Income Tax Guide on Miss Perkins' desk and read up on the subject for yourself."

"Is that where you got all this info?"

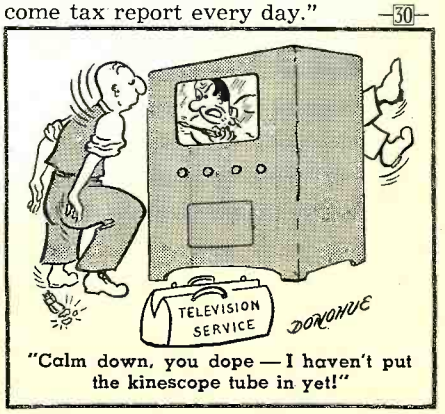
"Part of it. We also have a booklet called *'Your Federal Income Tax'* that can be had for a quarter from the Superintendent of Documents at Washington. A chat with the Collector now and then helped clear up other points."

"Is making out a report such a terrible chore as the radio comedians would have us believe?"

"Not if (a) you are not trying to cheat, and (b) you keep your books all year with the idea of making out your report, as Miss Perkins does. She keeps these separate items that we have mentioned in such a way that we can tell in a few passes of the adding machine exactly how much is represented by each—and what is more, she has all of the bills carefully filed to prove every deduction we claim."

Barney swallowed the last bite of his sandwich and drained the last drop from his bottle of *Coke.*

"Personally," he remarked, "I wouldn't mind if you mailed an income tax report every day." —30—



"Calm down, you dope — I haven't put the kinescope tube in yet!"

ANOTHER McGEE SCOOP

NEW $110.00 VALUE **HALLICRAFTERS** 11-TUBE **S-56 CUSTOM AM/FM CHASSIS** SALE PRICE **$59.50**

AUTOMATIC FREQUENCY CONTROL ON F.M.

HALLICRAFTER FM/AM custom radio receiver chassis. Regular $110.00 net price. A sleek, new precision-engineered chassis designed to meet the popular demand for a medium priced chassis with top performance characteristics. This outstanding value offers high quality performance comparable to that found in console models in the $400.00 to $600.00 price range. Some of the special features of this chassis are, automatic frequency control which assures clearest possible reception of FM stations by eliminating the human error in tuning; as stations are approached, this circuit "takes over" electronically, and holds the station in perfect tune: Full range tone control: Phonograph attachment on rear of chassis; wide vision dial accurately calibrated in MC: New type high efficiency miniature tubes. This radio has ten tubes, plus rectifier. Frequency range 540 to 1700 kc and 88 to 108 mc. Audio response 50 to 14,000 cycles. 7 watt output. Power 105-125 volts 50-60 cycles AC. Provide ventilation to dissipate 90 watts of heat. Output transformer matches 500 to 600 ohm line. Four antenna terminals; two for AM and two for FM. Model S-56. Weight 25 lbs. Net **$59.50.**

11-TUBE FM/AM Model S-56—$59.50

8-TUBE FM/AM Model S-59—$39.95

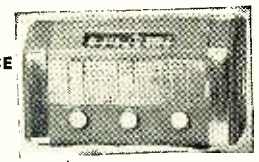
Transformer 500 ohm line to 3.2 or 6.8 ohm voice coil (necessary to match S-56 or S-59 to PM speaker). Net price **$2.50.** Recommended for either S-56 or S-59. Stock No. CR-13X.

S-59 HALLICRAFTERS FM/AM moderately priced radio receiver. Another new, excellently engineered chassis for installation whenever both quality of performance and low cost are to be considered. Easily comparable in operating characteristics and tone to consoles in the $300.00 class. Especially suited to applications where distortion-free reception is desired with full room volume for moderately sized rooms. The outstanding features of the S-59 chassis are: full range tone control, phonograph input jack on rear for connecting any standard record changer or player, wide vision slide rule dial is accurately calibrated in mc. New type high efficiency miniature tubes for greater sensitivity. This radio has 7 tubes plus rectifier. Frequency range 540 to 1700 kc and 88 to 108 mc. Audio response 60 to 14,000 cycles (plus or minus 3db.). 4 watt output. Power 105-125 volts, 50-60 cycles AC. Provide ventilation for 60 watts of heat. Output transformer matches 500 to 600 ohm line. Has four antenna terminals; two for AM and two for FM. Model S-59, weight 16 lbs. Net **$39.95.**

SCOOP SALE ON RADIO CHASSIS; 6 TUBES, 3-WAY $14.95

Chassis Model S19-A. A deluxe broadcast 3-way; 110 volt. AC or DC or battery pack radio chassis, complete with 6 tubes, 6" slide rule dial and 6" PM speaker. Size 12 x 6 x 7 inches. Made by a No. 1 manufacturer for a top mail order house. Has tuned RF stage; giving high sensitivity and selectivity. A $25.00 value for only.. **$14.95**

RCA COIN OPERATED RADIOS—SALE PRICE $39.95



Sets are for 1 hour play for 25c: $39.95 each, Lots of 10 $34.95. Phone Victor 9045 for 100 lot price.

DEALERS and RADIOMEN SAVE OVER ½ ON NATIONALLY ADVERTISED CONDENSERS

TUBULARS CAN TYPES BY-PASSES

BY PASSES TYPE TP

600 V. Tubulars

Type TP, wax filled paper tubular by-pass condensers. 1948 production; offered you at over half off of regular dealers' net price. Buy 100 assorted of these and save.

600 VOLT

.003, .004, .006, .02, .03, .04, .06. All 600 volt. 8c each.

100 FOR $6.95

1000 VOLT

.001, .005, .006, .01, .05. All 1000 volt. 10c each.

100 FOR $7.95

1600 VOLT FOR BUFFERS

.002, .02, .03, .04. All 1600 volt.

15c EACH—10 FOR $1.29

TUBULAR ELECTROLYTICS TYPE TC-TCD

Tubular Electrolytics, in aluminum tubes, with paper insulating sleeves. All are late 1948 production. Take an extra 10% off, on prices listed below, if ordered in assortments of 100.

16 mfd 150 volt cond.	$0.24
60 mfd 150 volt cond.	.29
30 mfd 450v cond.	.49
10 mfd 500v cond.	.39
20-20 mfd 150v cond.	.39
30-30 mfd 150v cond.	.44
40-40 mfd 150v cond.	.49
10-10 250v cond.	.29
20-20 250v cond.	.34
20-20 350v cond.	.34
8- 8 450v cond.	.49
16-16 450v cond.	.54
20-20 450v cond.	.59

ELECTROLYTICS TYPE 2N-3N

Electrolytics, in paper tubes, with two metal tabs for uprite or under chassis mounting. Take an extra 10% off on 100 assorted.

20-20 mfd 150 volt cond.	$0.39
30-30 mfd 150 volt cond.	.44
40-40 mfd 150 volt cond.	.49
16-16 mfd 450 volt cond.	.59
8- 8 mfd 450 volt cond.	.49
8-8-8 mfd 450 volt cond.	.69
30-30 150 volt 20-25 volt	.54
8- 8 450 volt 20-25 volt	.54
8- 8 450 volt 10-10 25 volt	.59
8 mfd 450 volt	.29
16 mfd 450 volt	.39
20 mfd 450 volt	.44
30 mfd 450 volt	.49

SCREW MOUNTING UPRITE ALUMINUM CANS TYPE RS-RM

Electrolytics in uprite aluminum cans. Standard screw mounting. All late 1948 stock. Take an extra 10% off, on prices listed below; if ordered in assortments of 100.

8 mfd 450v cond (screw mtg.)	$0.49
12 mfd 450v cond (screw mtg.)	.54
30 mfd 450v cond (screw mtg.)	.59
8-8 mfd 450v cond (screw mtg.)	.59

STANDARD BRAND ELECTROLYTICS

Twist Mounting Small Aluminum Cans

We made a lucky purchase of 25,000 small aluminum can (twist mounting) FP type electrolytic condensers. All are 1" and 1⅜" x 2" and 3" height. Same type used in original equipment, by manufacturers. All carry a one-year guarantee to you. Priced at up to 70% off regular dealers' net. Order a good supply now.

40 x 20 150 volt Alum. can	$.39
40 x 40 150 volt Alum. can	.49
40 x 40 150v, 20 25v Alum. can	.49
40 x 20 x 20 150v Alum. can	.59
25 x 25 mfd 25 volt Alum. can	.19
50 x 30 150v, 20 mfd 50v, 100 10v Alum.	.59
40 x 40 150v, 40 x 40 25v Alum. can	.59
40 x 20 150v, 200 mfd 6 volt Alum. can	.59
10 mfd. 450v Alum. can	.29
20 mfd. 450v Alum. can	.39
40 mfd. 450v Alum. can	.49
10 x 10 x 10 mfd 450v Alum. can	.49
10 x 10 mfd 450v Alum. can	.49
30 x 15 x 10 450v Alum. can	.69
40 x 40 450v, 25 mfd 25v Alum. can	.69
20 x 20 mfd 450v, 25 mfd 25v Alum. can	.59
15 x 10 mfd 350v, 25 mfd 25v Alum. can	.49
30 x 15 mfd 350v, 20 mfd 25v Alum. can	.49

BUY VIBRATORS FROM McGEE FOR LESS

Standard size 4 prong, 6 volt vibrator. Made and branded by the Number One builder of auto set vibrators. Regular non-sync type, but has 8 points for heavy duty use. Buy these vibrators with confidence. These vibrators are tops. Scoop price **$1.29** each; 10 for..... **$11.95**

Every Vibrator Guaranteed Best Values in U. S.

Replacement sync vibrator unit	$0.99
Standard 5 prong sync vibrator	1.49
6 prong reversible sync vibrator	1.99
7 prong reversible sync vibrator	1.99
7 prong, 2 volt G.E. vibrator	1.99
4 prong, off-set Delco vibrator	1.49
5 prong sync vibrator	1.49
4 prong vibrator for Ford	1.49

SAVE OVER HALF on VOLUME CONTROLS

Regular manufacturers type with 2½" shaft that is split and knurled. These controls fit 90% of all radio sets.

500,000 ohm with SPST switch	39c	10 for $3.50
500,000 ohm with DPST switch	39c	10 for 3.50
1 megohm midget with SPST switch	39c	10 for 3.50
500,000 ohm less switch	29c	10 for 2.50
1 megohm midget, less switch	29c	10 for 2.50

Regular 3" shaft jobbers stock controls at scoop prices.

5,000 ohm with DPST switch for battery radio sets and portable..... 49c ea., 10 for 4.50
1 megohm tapper, with SPST switch. 49c ea., 10 for 4.50

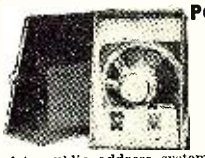
WET ELECTROLYTICS

Screw Mounting Wet Electrolytics. Latest 1948 production. Use wets when you want a filter for those tough jobs

8 mfd 500 volt wet	$0.78
16 mfd 500 volt wet	1.15
20 mfd 500 volt wet	1.23
8 mfd 600 volt wet	1.23
16 mfd 600 volt wet	1.64

WORLD'S BEST MIKE VALUES

33X Crystal Mike with 20 Ft. Cable, worth ½ more.	$10.95
33D Dynamic Mike with 20 Ft. Cable. Scoop Price.	12.95
Top quality Xtal mike & stand—recording type	4.95
Crystal hand mike for the service bench	2.98



PORTABLE P.A. $39.95

18 watt complete portable public address system. Has inputs for a crystal or dynamic mike and phono pick-up. Has push-pull 7C5 tubes in output. Attractive leatherette covered split type case. Priced complete with two 10" PM speakers. This is a complete public address system wired ready to play. Stock No. RC-18. Net **$39.95.** Priced complete with crystal mike and desk stand.

BW-3L—$26.95E-25—$24.95

15" THEATRE TWIN SPEAKER $26.95

Our sound laboratory has assembled this fine speaker combination. A super heavy duty 15" Cinaudagraph Alnico V PM and a University Laboratories trumpet type high frequency tweeter. Ready cut plywood baffle and cut to fit grill cloth are furnished. All you do is bolt the speaker to the baffle and connect in the 1 mfd. high pass filter. This combination will take 35 watts of audio and frequency response 40 to 10,000 cps. A speaker combination of theatre quality. Stock No. BW-3L. Net price **$26.95.** (If a baffle cabinet is desired, order the E-25 listed below.)

University Laboratories high frequency tweeter trumpet with connecting instructions. Same as used in above theatre speaker combination. Net **$11.76.**

Walnut floor type speaker baffle. Size 12x22x26 inches. will accommodate either a 12" or 15" speaker. Fully lined with celotex. Air relief cutouts in corners of grill. Weight 35 lbs. Stock No. E-25. Net price **$24.95.**

1949 MODEL—MIKE-BROADCASTER ONLY $7.95

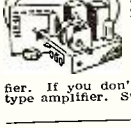
Broadcasts 800 to 1500 KC from either a phonograph pick-up or a crystal or dynamic mike. Makes any radio receiver a P.A. system, record player or recording amplifier. Gives broadcast quality. Has fader control from mike to record, simulating a regu-broadcast station. This is a powerful model; using 2—35B5, 12SJ7, 35W4 tubes. Priced with tubes and connecting instructions. Work on 110 volts AC-DC. Crystal mike and desk stand $4.95 extra. Model DE-5 truly a de-luxe mike-phono oscillator.

DE-2X Phonograph Oscillator. Broadcasts from 800 to 1500 KC gain for any crystal pick-ups. A new, powerful circuit has variable gain control. Priced complete with 2 tubes and connecting instructions. Net **$3.95**

AUTO PILOT, $1.00

CIT—Auto pilot amplifier salvage scoop. Has 6 high resistance relays. Weight 12 lbs. Scoop price **$1.00** each.

SUPERHET BROADCAST TUNER $7.95



Broadcast superhet tuner for connection to any phono amplifier or P. A. system. Built on a small compact chassis with dial plate and tuning knob furnished. Requires only three connections to amplifier. Uses three miniature tubes. Loop antenna and instructions are included. Specify when ordering, whether tuner is to be used on AC-DC or AC type amplifier. If you don't specify we will ship tuner for AC type amplifier. Stock No. PAT-3. Net Price.... **$7.95**

8-Watt Amplifier with P.P. 50B5 $9.95

4 tube, plus rectifier, AC-DC amplifier. Push-pull 50B5 output tubes, with 12SJ7 (Gain for mike or G.E. variable reluctance pick-up), 12SL7 (Gain for conventional crystal pick-up) and phase inverter. This is a nice small audio amplifier, with tone and fader control, plus inverse feedback. Furnished wired and tested, complete with tubes. 8 watts output. Ready to play. Weight 6 lbs. Model TM-5. Net price **$9.95.**

Crystal mike and desk stand **$4.95** extra. 8" PM speaker **$2.95** extra. G.E. variable reluctance pick-up cartridge **$5.85** extra.

Brand New BC-458 5.3 to 7.1 mc Transmitter, with tubes **$5.95.**

Used modulator BC-456, with tubes & dynamotor. Weight 18 lbs., **$2.95.**

Antenna current meter for BC-458 command transmitter, each **$1.95.**

ARC-4 Transmitter-receiver, used, good condition, with tubes. Wt. 30 lbs. **$12.95.**

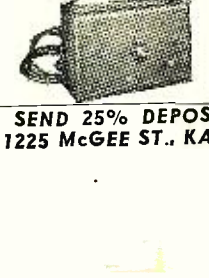
APN-1 Transreceiver only, with tubes, good condition. Weight 25 lbs. **$9.95.**

HS-30 Army "plugin your ears" headphones, with 8000 ohm trans., very tiny. Scoop price **$1.79.**

SCR-518 Radio Altimeter, New Factory Cartoned Weight 140 lbs. **$24.95.**

BC-733-D Localizer receiver, with 10 tubes, good condition. Wt. 20 lbs. **$6.95.**

APS-15 Radar Range Scope with 45 tubes 7-6L6 etc. 5" Scope Tube with electromagnetic deflection. Weight 65 lbs. Scoop price **$29.95.**



Brand New

ELECTRONIC MEGAPHONE SCOOP PRICE $34.95

Only 109 of these Brand New Electronic Megaphones to sell. You may see these listed at a lower price, but ours are new and guaranteed to work. Amplifier straps on shoulder, then just hold megaphone and speak into mike, mounted on rear of projector. Pull switch to turn on dry battery operated amplifier. Requires 2—67½ B and 5 flash lite cells.

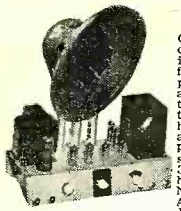
McGEE RADIO COMPANY

ORDER FROM THIS AD PRICES F.O.B. K. C.

SEND 25% DEPOSIT—BALANCE C.O.D.

1225 McGEE ST., KANSAS CITY, MISSOURI

COMPLETE THEATRE QUALITY AUDIO AMPLIFIER KIT RESPONSE 20 TO 20,000 CYCLES ONLY $24.95

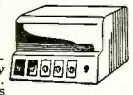


McGee's Theatre Quality AMPLIFIER KIT $24.95

Our sales and engineering department realizing that not everyone can afford a $100.00 audio amplifier, has designed a Theatre quality, 15 watt True-Fidelity Amplifier kit. Response essentially flat, from 20 to 20,000 cycles. It contains every part, tubes and ready punched chassis. Has input for a crystal or dynamic microphone and gain and tone compensation for the new G.E. Variable Reluctance pickup, as well as the conventional crystal pickups. A 3 step tone switch for tone equalization. This kit has a 34 watt Merit high fidelity, wax impregnated output transformer, with 4, 8, 16 and 500 ohm taps. The chassis is of heavy treated metal, ready Punched; approximately 5x11 inches. The quality of all parts is second to none. Priced complete with tubes as follows: 12AX7, 3—6C4, 2—6AQ5, and 5Y3. This is the best amplifier kit we know how to produce and we have made thousands. Kit Model ME-15R. Net price, $24.95.

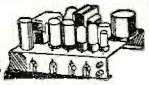
Altec Model 903-B 15-inch coaxial pm speaker pictured above Me-15R kit. Net, $63.00 extra. Our leader 12-inch coaxial pm model CR-13X. $12.95 extra.

DELUXE 30-WATT AMP. KIT, $29.95



Kit model RA-30. A complete 30 watt high fidelity Push pull 6L6 amplifier. Ready punched chassis with cover to match. Beautiful opalescent finish. Input for two mikes and crystal pick up. Perfect for the new GE VR Cartridge. Twin tone controls bass and treble. Inverse feed back. Heavy duty output trans for 4, 8, 16 and 500 ohm. Everything furnished including diagram and tubes 2—6S37, 2—7N7, 2—6L6, 5V4. Worth twice our price. Build an amp you will be proud of. Kit model RA-30. Net $29.95. Furnished with a merit impregnated and shielded wide range output transformer with 4, 8, 16, 250 and 500 ohm secondary $5.00 extra.

20-WATT AMP. KIT, $17.95



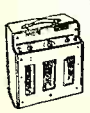
Build this 20 watt utility 110 volt AC 20 Watt power amplifier. Ready punched chassis, size 12 x 6 x 2½ inches. Has two input circuits, one mike and one phono. Mike stage has 135 DB gain for crystal or dynamic mike. Has bass and treble control. Designed for use with PM speakers; has 8-16 ohm output transformer. All parts and easy-to-follow diagram furnished, including tubes: 2—7N7, 6S37, 2—6L6GA, 5Z3. Kit Model 20-LX. Net $17.95.

JUKE BOX AMP. KIT, $24.95

Juke Box amplifier kit. Model KV 7. All the necessary parts and tubes to build a juke box type amplifier. Has push pull 6L6 tubes in the output. Proper tone control circuits. Super heavy duty power trans, choke and output trans. Everything furnished including tubes, diagram and photo, inputs for mike variable reluctance pick or crystal pickup. Delivers 25 watts of power. Scoop price, $24.95.

6-110 VOLT POWER SUPPLY KIT, $14.95

New utility power supply kit, works on either a 6 volt storage battery or 110 volts AC. Furnishes power for a 25 watt amplifier and will run a turntable from a storage battery. Kit 6-110 KR complete with diagram $14.95. 6-110 volt 60 cycle vibrator only $1.98. Thermador 6-110 power transformer $5.95.

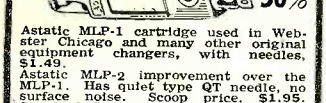


$59.50 VALUE MUSICAL AMP. $24.95

8 watt Musical Amplifier. 4 tube AC transformer type. Proper gain for all instrument pickups. Housed in leatherette case with built-in 8" speaker. Gain and tone controls. Made by a large manufacturer, to sell for $59.50. Stock No. XR-3. Weight 25 lbs. Net Price $24.95.

DeLuxe Musical Amp., $39.95

30 Watt musical amplifier with 12 inch speaker, a $75.00 value. Has the same appearance as the musical amp above; however, it is our deluxe model with two 6L6 output tubes. Inputs for mike and instrument pick-up. The last word in musical amps. Stock No. MM-30X. Net $39.95.



SAVE 50%

Astatic MLP-1 cartridge used in Webster Chicago and many other original equipment changers, with needles, $1.49.

Astatic MLP-2 improvement over the MLP-1. Has quiet type QT needle, no surface noise. Scoop price, $1.95. Standard L-40, L-26, cartridges, old standbys, thousands in use. Complete with rest clip. Each, $1.79; 10 for $15.00.

Astatic L-70, L-75, cartridges or equal. Each, $1.79; 10 for $15.00.

Astatic L-72A or equal 3½ volt output, used in one lung record players, etc. Also where tone networks are used, $1.79; 10 for $15.00.

Shure 1-volt cart. Light weight. $1.79; 10 for $15.00.

NJ-Nylon cartridge with permanent, but changeable needle, $3.29.

RCA magic-tone cell, with permanent sapphire needle. Modernization kit replaces 95% of old cartridges in RCA radio phonographs, built during 1938 and later. 4 page instruction book included. A scoop at only $1.95.

Astatic QT 3-M cartridge with silent needle response to 10,000 CPS. Reg. $8.40 List. Scoop price, $3.29.

Complete arm with 3½ V. cartridge, $2.29.

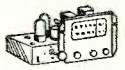
Complete arm with 1 V. cartridge, $2.29.

LP micro-groove arm with needle, $3.95.

12-WATT AMP. KIT, $10.95

KIT MODEL AC-12. 12 watt amplifier kit. Ideal for high quality record player as well as public address or recording amplifier. Matched component parts, ready punched chassis pan. One control fades from phono to microphone. Gain enough for crystal or dynamic microphone. 100 mil power transformer, for 110 volt AC 60 cycle operation. Priced complete with tubes: 2—6V6, 6SN7, 6SH7 and rectifier. Diagrams and photos furnished. Kit AC-12. Net $10.95. 12" Alnico 5 PM speaker extra; crystal microphone and desk stand $4.95 extra.

The above AC-12 amplifier wired and tested ready to operate net $14.95. Specify Stock No. AC-1125. 12-inch Alnico V PM speaker $5.95 extra. Crystal mike and desk stand $4.95.



8-TUBE 2-BAND RADIO KIT $16.95

Kit model ABK-7. A complete kit of parts and tubes to build an 8 tube quality radio chassis for custom installations. Size 4x7½x7 with 6" slide rule dial. Made from basic Detrola components. Has 6" illuminated slide rule dial and 3 gang tuning condenser. R.F. stage on both broadcast and shortwave. Receives 550 to 1650 kc and 6 to 18 mc; foreign shortwave. Complete with heavy duty 8" speaker. Includes all parts, ready punched chassis and tubes: 2—6SD7, 6SA7, 6SQ7, 6J5, and 2—25L6 in Push pull; 25Z6 rectifier. Photo of chassis wired and instructions are furnished. This kit has not only top selectivity and sensitivity, but high fidelity audio; with continuously variable tone control. A real McGee value, priced at only $16.95. Weight 16 lbs.

Kit model AC-AK6. Same chassis and frequency coverage as above model ABK-7; except has 6 tubes with single 6V6 output tubes and 90 mil power transformer. Everything else is the same. It is designed for those who prefer a straight AC transformer type radio. A complete kit; everything is furnished including tubes and diagram, with instructions. Net price $16.95. Weight 15 lbs.

Kit model DBK-8. A basic kit, same as the ABK-7 pictured above, but only the basic parts are furnished. No tubes or speaker are included. You get the diagram, dial, ready punched chassis, all coils, tuning condenser, band switch and loop antenna. Sale price $6.95. Weight 7 lbs.

GAROD PERSONAL RADIO KIT, $14.95

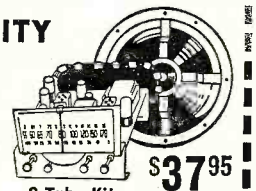
Size 6½ x 3¼ x 4⅛—Weight 3½ Lbs.
Simple Assembly and Wiring Instructions

This kit is ready for immediate delivery. The same nationally known factory that manufactures tens of thousands of this radio, is line producing this radio kit for us. Every part, from the cabinet down to the last resistor, is matched. The chassis is ready punched; all you do, is mount the parts and wire. This radio kit will assemble into a beautiful personal radio for you, just the same as it does for the factory. We furnish you a diagram, photograph of the completed chassis and full assembly instructions so that those with a minimum knowledge of radio may wire this kit. The beautiful case is made of metal with plastic hinged lid and snap-on back. The lucite face of the receiver has an inlaid gold design. The circuit is the conventional two gang superhet type, with A.V.C. Receives the broadcast band 540 to 1650 KC. Uses miniature tubes: 1R5 converter, 1S5 detector A.V.C., 1T4 amplifier and 3S4 power amplifier. Alnico V PM speaker. The loop antenna is built in the lid. Radio comes on automatically when lid opens. Operates on self-contained batteries. Priced complete with tubes and 67½ volt "B" battery and flash cell (Not AC-DC). Nothing else to buy.

Model X-45, Price $14.95. Include Postage for 6 lbs.
Scoop Model X-45 Personal Portable Kit Wired and Tested With Batteries. Net $17.95

BUILD THIS

8-TUBE HI FIDELITY RADIO AND AMPLIFIER



8-Tube Kit $37.95

● 8-INCH SLIDE RULE DIAL ● RECEIVES BROADCAST and 19 to 49 METERS ● PUSH PULL OUTPUT TUBES ● BASS BOOST TONE CONTROL ● EVERYTHING FURNISHED ● CHASSIS SIZE 9½ x 11 x 8" HIGH ● BEST RADIO KIT VALUE IN THE WORLD

Here is something new in radio. A real 15 watt power amplifier with bass and treble controls. Has extra gain stage for crystal or dynamic mikes. And on the same chassis, a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SR7, 6SN7, 6SJ7, two 6V6 and 5Y3. No cabinet. Extra care in designing the power supply section assures low hum level, making this unit ideal for recording as well as P.A. use. We furnish everything as well as schematic diagram and photos of the completed chassis. Weight 26 lbs.

PRK-24. Radio-Amp. Kit with 12" P.M. speaker. With tubes.....Net $29.95

CPR-15. Exactly the same kit as the PRK-24 kit, except it is furnished with a 12" Cinaudagraph wide range speaker. (Has built-in high frequency tweeter.) This is our finest kit.....Net $37.95

100 CARTONED AND GUARANTEED RADIO TUBES for only $35.00

Popular GT tubes. All individually cartoned and branded Hy-Vac. Guaranteed best quality. Full replacement. These tubes meet the ever-growing need for low-cost service replacement and counter sales. Over 800,000 sold. A scoop item for the service dealer.

39c EACH IN SMALLER QUANTITIES

117P7GT	3V4	6SD7GT	12BE6	3S4	6SF5	19T8	6DJ6
32L7GT	6C5	6SK7GT	35W4	1B4	6BA6	.....	6AG6
12A8GT	6K7GT	6SN7GT	35B5	12K8	6BE6	12S8	.....
12K7GT	6A8GT	6SQ7GT	50B5	12A6	6AT6	6AL5	12AU6
25Z6GT	5Y3GT	25L6GT	1T4	12SF7	6X4	6C4	12AU7
6A7	6K6GT	7017GT	1L4	6F5	6BJ6	6AU7	12AT7
47	6Q7GT	117L7GT	1U4	6J5	6AK5	12BF6	12SN7
12F5GT	6V6GT	117Z3	1R5	6SJ7	6BH6	12BF7	6SL7
6S8GT	6X5GT	12AT6	1S5	12SJ7	80	12AX7	.....
6P5GT	6SA7GT	12BA6	3Q4	6AJ5	.....	6BF6	

75% OF THE TUBES YOU USE, 49c EACH, GUARANTEED NAME BRANDS CARTONED AND UNCARTONED

12AH7	6C5	6SC7	6SR7	12SG7	6R7	35Z5 GT	6K5 GT
27	6H6	6SF7	6V6 GT	12SH7	6L7	35W4	6A3
26	6J5	6SQ7	6X5 GT	12SJ7	7Z4	50B5	483
78	6K7	6SH7	6AB7	12SA7	12SQ7	2525	2051
76	9001	6SJ7	12AT6	12SL7	12SR7	2526	25Z5
3S4	9002	6SK7	12BA6	12SC7	50L6	6D6	6R4
5U4G	9003	6SL7	12BE6	1T4	12SK7	6C6	6C4
5Y3G	1625	6SG7	12H6	1R5	25L6 GT	6J7	78
6AC7	6SA7	6SN7	12J5 GT	1S5	35L6 GT	77	.....
35Y4	14Q7	7E5	7H7	7B6	7F7	7C5	7Y4
14A7	14B6	7E7	7C7	7A7	7N7	7Z4	

Sylvania or Equal. 1LN5, 1LD5, 1LH4, 1LC6, 1LA6, 1LB4, 1LC5, 1LG5, 3LF4, @ 59c; 10 for $5.50.

Name Brand, 1st Line. 1A7, 1H5, 1A5, 1N5, 3Q5, @ 59c. 50A5 or 35A5 or 0Z4, 69c.

New Metal WAA 6L6 (Rusty). Each, 49c; 10 for $4.50.

6L6G or Metal. Reg. stock, @ $1.09.

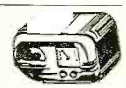
WALNUT ARM CHAIR CABINET, $29.95

WILL HOUSE CRP-15 KIT

Beautifully made walnut armchair cabinet. Outside dimensions 24" high, 16½" deep and 27" wide. Ample room for radio receiver 14" long 9" high, and 10" deep. Will hold a changer up to 14" square. Will accommodate speaker up to 12". Has record album storage compartment. Hinged lid covers changer compartment. Cabinet AR-15. Net price $29.95. General Instrument changer $14.95, extra. Armchair cabinet in blonde finish. Net price $34.95.

4-TUBE T.R.F. KIT

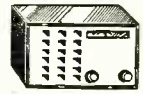
BARGAIN SPECIAL $6.95



4 tube AC-DC, TRF radio kit. Ideal for students and beginners. Every part furnished to build this kit, including tubes, diagrams and photos. Has Alnico V PM speaker and tubes 12SK7, 12SJ7, 12S5 and 35W4. Plastic cabinet with airplane dial. Receives broadcast 550 to 1600 KC. This is the easiest type of radio to build. Kit Model TF-4. Weight 6 lbs. Net $6.95.

DELUXE 5-TUBE AC-DC KIT

OUR LEADER $9.95



Made from Detrola Components

A full size 5 tube superhet radio kit housed in a 13 inch wood cabinet with full plastic front. Lighted slide rule dial. Incorporates a standard 2 gang superhet circuit. Loop antenna, ready punched chassis, etc. This is another one of our line production radio kits. Every part is furnished including tubes, 12BE6, 12BA6, 12AT6, 50B5, 35W4. Diagrams, photos, and instructions are included. 5" dynamic speaker. Receives broadcast 550 to 1650 kc. Weight 9 lbs. Kit model TF-6C. Net $9.95.

GAROD DELUXE 5-Tube Kit $12.95

This is our latest and finest AC-DC radio kit. Receives Broadcast, 540 to 1650 KC. Has full length illuminated slide rule dial. Choice of Ivory or Walnut plastic cabinet. Full high efficiency 2 gang superhet circuit, with loop antenna. Ready punched chassis, full 5" PM speaker. Every part fits. Everything furnished, including tubes. 12SA7, 14A7, 12SQ7, 35Z5 and 50L6. This kit will go together just like it would on the production line. Diagram, photos and instructions are furnished. Shipping weight 9 lbs. Kit model XA-49. Net $12.95.

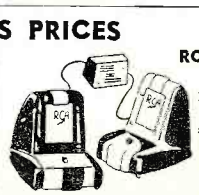
SALE! INTERCOMS AT RIDICULOUS PRICES

McGRADE $11.95

McGrade Intercom. Master and sub-station, housed in small matching walnut plastic cabinets, 5½x7x3½ inches. Sloping front for desk or wall installations. Furnished with 50 feet of interconnecting wire. Sub-station may be used up to 1000 feet from master station. These units are new and factory cartoned. Complete with tubes. Made to retail at $29.95. A lucky purchase enables us to offer these to you for only $11.95. Include postage for 8 lbs. Stock No. MG-2S.

Complete Intercom SCOOP PRICE $14.95

The nicest Inter-com you have ever seen. Made by a top quality manufacturer. A complete two-station unit with 50 feet of connecting wire. Sub-station and Master are black plastic case size 8 x 6 x 5 inches. Made to sell for $25.00. Stock No. DG-29. Sale Price $14.95.



RCA INTERCOM $19.95

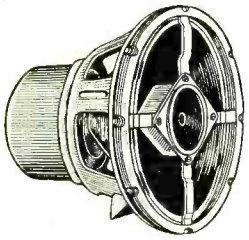
RCA two-station Inter-com. It has amplifier made separate to reduce size of the stations. Housed in plastic case, trimmed with chrome. Low distortion insures natural voice reproduction. Ease of installation makes this unit ideal for home, office or store use. Complete with amplifier, two stations and 100 ft. wire. $19.95.

McGEE RADIO COMPANY

ORDER FROM THIS AD PRICES F.O.B. K. C.

SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

12 INCH $27.50 LIST COAXIAL P.M. SPEAKER $10.95



TWO NATIONALLY FAMOUS 12" COAXIAL P.M. VALUES

★ BRAND NEW ★ FACTORY CARTONED ★ BUILT IN MATCHING NETWORK

Designed by one of America's finest speaker builders. Made for FM high fidelity radios, record players and P.A. systems. This speaker is incorporated in radios selling in the $500.00 bracket. It has an especially designed 12" 4.64 oz. Alnico V Magnet PM for the low range and a co-axially built-in 3" Alnico V tweeter. The high pass filter is concealed under the pot cover. Just hook to any 8 ohm output transformer (will hook in place of any home radio speaker, as most speakers have an 8 ohm voice coil). Only 2 wires to connect, will handle 18 watts peak. Frequency response, 50 to 15,000 CPS. This co-axial PM speaker should sell for $35.00. Why buy an ordinary speaker, when we offer you the speaker of the future; for only $10.95?

Stock No. CN-12X—Weight 8 lbs. **$10.95**, 2 for **$20.95**.

DELUXE 12 INCH COAXIAL P.M. $12.95

12" co-axial No. CR-13X. The same basic design as the model CN-12X, described above, but furnished with 6.8 oz. magnet in the 12" woofer. Frequency response, 40 to 15,000 CPS. Has more mellow tone than CN-12X. Weight 9 lbs.

Model CR-13X **$12.95**, 2 for **$24.95**.

$60.00 LIST 15" COAXIAL $24.95

★CURVED MOLDED CONE ★21.5 OZ. MAGNET
★OUR FINEST SPEAKER

THE KING COAX. A 21.5 oz. 15 inch Alnico V PM speaker with a built-in high frequency tweeter. Will respond to from 50 to 15,000 cycles. This is a ruggedly built speaker with a curvelenier one piece molded cone. Built-in high pass filter. Just hook to any 8 ohm output. Built by the maker of our ever popular 12 inch coax model CR-13X. Weight 22 lbs. This speaker has a retail list of over $60.00. We offer you our 5-15x15-inch coax for only **$24.95.**

RADIO REPLACEMENT SPEAKERS

Following Speakers listed are latest production No-Factory throwouts made by the largest factory who furnish the original equipment to America's largest Radio Factory. Every speaker guaranteed.

3" PM 1 Oz. Alnico 5 Magnet	$0.99
4" PM 1 Oz. Alnico 5 Magnet	.99
4" PM 1½ Oz. Alnico 5 Magnet	1.19
5" PM 1 Oz. Alnico 5 Magnet	.99
5" PM 1½ Oz. Alnico 5 Magnet	1.19
6" PM 1½ Oz. Alnico 5 Mag., Square	1.49
6" PM 2.15 Oz. Alnico 5 Mag., Square	1.98
6" PM 3.16 Oz. Alnico 5 Mag., Square	2.49
6½" PM 1.5 Oz. Alnico 5 Mag., Round	1.69
4x6" PM 1.5 Oz. Alnico 5 Magnet	1.49
6x9" PM 3.16 Oz. Alnico 5 Magnet	2.98
7" PM 3.16 Oz. Alnico 5 Magnet	2.98
8" PM 3.16 Oz. Alnico 5 Magnet	2.98
10" PM 4.64 Oz. Alnico 5 Magnet	3.98

Hot Buys in PM's—With Trans.

4" PM 1 Oz. Alnico 5 2500 ohm Trans.	$1.49
4" PM 1 Oz. Alnico 5 10M ohm Trans.	1.49
5" PM 1 Oz. Alnico 5 2500 ohm Trans.	1.69
5" PM 1 Oz. Alnico 5 10M ohm Trans.	1.69
5½" PM 1 Oz. Alnico 5 2500 ohm Trans.	1.89
6" PM 1.5 Oz. Alnico 5 2500 ohm Trans.	1.99
6" PM 1.5 Oz. Alnico 5 7000 ohm Trans.	1.99
6" PM 2.15 Oz. Alnico 5 7000 ohm Trans.	2.49
6" PM 3.16 Oz. Alnico 5 10M ohm Trans.	2.98

Hot Buys in Field Spkrs. With Trans.

5" PM 450 ohm Utah—2500 ohm Trans.	$1.98
5" PM 450 ohm Utah—7000 ohm Trans.	1.98
6" PM 1500 ohm Utah—7000 ohm Trans.	2.29
8" PM 450 ohm Utah—7000 ohm Trans.	2.98
8" PM 1000 ohm Utah—Less Trans.	2.49
10" PM 1000 ohm Utah—Less Trans.	3.98
12" PM 450 ohm Utah RCA, Less Trans.	4.98
12" PM 1000 ohm Magnavox, Less Trans.	4.98

Famous Magnavox Speakers

6" Auto Spkr—4 ohm	$2.49
7" Auto Spkr—4 ohm	2.98
8" Auto Spkr—4 ohm	2.98
5" 8 Oz. Alnico 3 PM	1.79
8" 12 Oz. Alnico 3 PM	3.98
10" 21 Oz. Alnico 3 PM	4.98
12" 21 Oz. Alnico 3 PM	5.98

REGULAR $35.00 LIST JUKE BOX SPEAKER

15 INCH ALNICO V MAGNET $9.95

HAS NEW MOLDED CONE

A carload purchase, from a number one builder of fine PM speakers, enables us to offer this regular $35.00 list 15" speaker for only $9.95. New one piece molded cone, with 8 ohm voice coil. 12 oz. Alnico V magnet, will take 18 watts average audio and 25 watts peak. If you want a speaker to woof out the low notes, buy this model. This is without a doubt the most speaker for the money that is available today. Include postage for 11 lbs. Stock No. 15-KR. Net price **$9.95.**

50 WATT 15 INCH P.M. SPEAKER $16.95

Model 15-LS—The KING of all juke box speakers. Frequency response as low as 30 cycles. Will take 50 watts peak audio and 35 watts average, with ease. The most efficiently designed built today. 5 watts input to this speaker will give twice the air movement of an ordinary speaker. Has 1½" 8 ohm voice coil and molded one piece curved cone. Designed to retail for $50.00. Include postage for 18 lbs. Stock No. 15-LS. Net price **$16.95, 2 for $32.95.**

50 WATT 12 INCH P.M. SPEAKER $14.95

Model A-50—12", 50 watt super heavy duty permanent magnet speaker. Has 1½" 8 ohm treated voice coil and one piece molded cone. Heavy half inch machined pot, with bolt secured 21 oz. Alnico V magnet. Frame is of heavy construction with metal pot cover. Finished in silver-grey enamel. This speaker is the best value possible today. Efficiency is two to three times that of ordinary speakers. Especially recommended for all public address systems and high quality home audio systems. Will handle 35 watts with ease and 50 watts peak for short lengths of time. Its retail value is $50.00. But, by our large purchase, we are able to offer it to you for only $14.95. Do not confuse this speaker with surplus merchandise. This is the latest production. Model A-50. Weight 15 lbs. Net **$14.95, 2 for $29.00.**

OUTPUT TRANSFORMER HIGH FIDELITY 20—20,000 C.P.S. SCOOP PRICE $6.95 EACH

Why pay $20.00 or $30.00 for an output. Supreme quality and high fidelity output transformer. Designed to match push-pull plates (2—6L6, 2—6V6, or 2—6AQ5) class AB1 to 4-8-15-250 and 500 ohm; with 10% feedback winding. Housed in a compound filled case; 3⅞ x 4½ x 3". Actual net weight, 6 lbs. High quality, low hysteresis loss core. If you want the best quality from your audio system; order this transformer. Response essentially flat from 20 to 20,000 cycles. We have tried several high fidelity outputs in our lab and find this to be the best value. There is certainly no reason to pay $20.00 to $30.00 for an output; when we offer this one for $6.95. Even though your amplifier only puts out 10 or 15 watts; this 34 watt job is what you should have. Connecting instructions are furnished. Stock No. A-403, shipping weight 8 lbs. Net price **$6.95.**

$100 Value Wire Recorder Complete Only $69.50

Makes and plays back through its own amplifier and speaker a 1 hour, 30 minute, or 15 minute Wire Recording. Made to retail for $100.00 by Air King. Portable with blue leatherette carrying case, weight of 24 lbs. 1 hour spools of wire $3.25, 30 minute spools for $1.95, 15 minute spools $1.30. Complete ready to operate. Stock No. A-725..... **$69.50**

Deluxe Model Air King Model A-750—Similar to above. Only heavier construction and records directly from 78 RPM phono records or mike to wire, weight 35 lbs. Net..... **$92.50**

PORTABLE WIRE RECORDER WITH 12 WATT P.A. SYSTEM $69.95

Why Not Record a Full Church Service and Replay for Shut Ins

Portable Wire Recorder Model GN-11

Has ready wired and tested 5 tube AC type amplifier with push-pull 6V6 tubes. Built-in eraser circuit. Input for crystal mike or phono pick-up. Diagrams show how you can record from any radio receiver. 3 position switch enables you to quickly change from record to playback or conventional P. A. system. This amp delivers 12 watts of good clean audio. Here is what you get: Webster 79 recording mechanism, with 15 minute spool of wire, attractive leatherette covered case, 6" heavy duty PM speaker and wired and tested 12 watt AC wire recording amplifier. All you do is mount the amp, recording mechanism and speaker. Simple instructions furnished. Portable Recorder Model GN-11. Net **$69.95.** Crystal mike **$4.95** extra.

Deluxe Portable Wire Recorder Model GN-12. Has same features as the model GN-11, as well as a larger split type leatherette covered case and a heavy duty 10 inch PM speaker. Deluxe Portable Wire Recorder Model GN-12. Net **$79.95.** Crystal Mike **$4.95** extra.

Recording Wire, 15 minute spool **$1.30.** 30 minute spool **$1.95,** 1 hour spool **$3.25.**

Either the GN-11 or the GN-12 wire recorder listed above may be had with the Webster wire recording mechanism or the AIR KING type wire recording mechanism which will record from a phono record. Specify when ordering which mechanism you want.

12" 15 WATT P.M. SPEAKER 5 for $22.50

Nationally known 12" 6.8 oz. Alnico V PM. with 1" 8 ohm voice coil. Will take 15 watts. Grey finish. Our leading 12" speaker. Stock No. CH-12. Net **$4.95.** 5 for **$22.50**

12 12 Oz. Mag. Will Take 20 Watts $8.95

Super heavy duty 12" 12½ oz. Alnico V magnet PM with 1¼" with 8 ohm voice coil. This speaker is equal to 60 oz. of old type magnet. Will take 25 watt peak. Stock No. CH-13—**$8.95**; two for **$17.00.**

SALE! RECORD PLAYERS—AUTOMATICS—LONG PLAYING AND STANDARD

Children's Player Kit $7.95

New, children's electronic player. Offered in kit form. Includes all material necessary. Attractive red plywood cabinet, self-starting phono motor and crystal pick-up, 4x6" PM speaker and parts to build 70L7 amplifier. Diagram included. Stock No. LJ-1. Net Price **$7.95**

LJ-1 $7.95

CAPITOL PORTABLE CASE CK-1 AND CC-8

ECONOMY PORTABLE PLAYER KIT $9.95

Portable Player Kit Scoop $9.95

Deluxe portable electronic record player kit in deluxe capitol case. Includes all parts and easy to wire diagram. Comes complete with grey leatherette portable carrying case self-starting phono motor, pickup, 5" PM speaker and all necessary parts to build 70L7 amplifier. Stock No. CK-1. Net Price **$9.95.**

Record Player $14.95

Complete record player. Component parts shipped separately. Amplifier is ready wired and tested. Amplifier has four tubes, 12SQ7, 2—117Z3, 50L6. All parts are included, self-starting phono motor, crystal pickup, 5" heavy duty PM speaker and amplifier, with tone and volume control. Deluxe capitol heavy wooden case is covered with brown leatherette and has chrome fittings and speaker grill. Stock No. CC-8. Net price **$14.95.** Model—LP-CC8—same as above only Dual speed with 2 pickups. **$19.95.**

Super Portable Player With A.C. Amp. $19.95

Super deluxe record player with push pull 7C5 AC type amplifier and 6" inch speaker. All you do is mount amp. in the case. Case is of the accepted type. This player should sell for $35.00. Stock No. DL-3. Net **$19.95**

Offered with Stewart-Warner automatic changer. Stock No. ARO-4. Net **$27.95**

G.I. RM-4 $5.95

General Industries RM-4 heavy duty phono motor with T.T. 78 RPM. Scoop price..... **$5.95**

Deluxe quality 78 RPM phono motor with T.T.... ..... **$2.95**

Dual speed phono motor 33⅓ or 78. Reg $11.00 list, scoop price **$4.95**

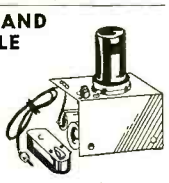
REPLACEMENT MOTOR $1.29

Scoop-Replacement phono motor fits 90% of all changers. A scoop at only..... **$1.29** each

Our Leader Magnetic Tape Recorder $250 List—Net $149.50

Magnetic tape recorder of nationally known manufacturer, complete ready to operate. Has AC transformer type amplifier for recording and playback. Housed in an attractive leatherette case, with microphone. Makes a 30 minute recording from standard magnetic tape. Made to sell for $250.00 list. McGee's scoop price **$149.50.** Circular sent on request.

GENERAL ELECTRIC AND WEBSTER VARIABLE RELUCTANCE



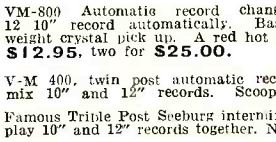
New Webster cartridge with removable permanent needle. Response is second to none. Offered with preamplifier (6sc7) ready wired and tested. A scoop at $5.95 complete.

Webster M1-VR cartridge only, net **$4.41**

New General Electric V. R. cartridge No. RPX-040, with removable needle. Net **$5.85**

General Electric V. R. cartridge RPX-041, for micro-groove records. Net **$5.85**

Our 6sc7 type pre-amplifier with either PRX-040 or PRX-041 cartridge. Net..... **$7.95**



SALE RECORD CHANGERS $12.95 UP

Latest Aero Changer, made for Stewart-Warner. Equipped with the popular Webster high list bouncing pickup cartridge. With permanent OT Needle. Plays 10 12" or 12 10" records automatically. Base size 12x13". Scoop price **$12.95.** 2 for **$25.00.**

General Instrument automatic changer. Base size 10½x12". Plays 10 12" or 12 10" records automatically. A real value at only **$14.95** each.

Farnsworth, 2 post automatic changer; complete with new variable reluctance cartridge. Net price, each **$19.95.**

VM-800 Automatic record changer. Plays 10 12" or 12 10" record automatically. Base size 13½x14. Light weight crystal pick up. A red hot scoop in a changer. Net **$12.95,** two for **$25.00.**

V-M 400, twin post automatic record changer, will intermix 10" and 12" records. Scoop price, each **$19.95.**

Famous Trible Post Seeburg intermix automatic changer, will play 10" and 12" records together. Net price, each **$29.95.**

Leatherette covered bases designed to fit any of the above changers **$1.95** extra. Specify type of changer when ordering base.

Webster 156 changer. Equipped with variable reluctance cartridge. Brand new, but have been removed from new radios to be replaced with twin speed changers. Show slight mounting marks. Guaranteed perfect. Net price **$22.95.**

DUAL SPEED AUTOMATIC CHANGERS

Webster-Chicago Model 256, dual speed; for the regular and microgroove records. Base size 14x14". New "Tilt-O-Matic" cartridge. Net price **$33.91.** Webster-Chicago standard model 246, dual speed automatic changer for the microgroove, or standard records. Base size 12x13½". Net price **$29.25.**

McGEE RADIO COMPANY

ORDER FROM THIS AD
PRICES F.O.B. K.C.

SEND 25% DEPOSIT — BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

A LOCAL/DX ANTENNA for the 7mc. Band

By WOODROW SMITH, W6BCX
Author, "Antenna Manual"

Controllable vertical directivity permits low angle radiation for DX or ground wave, high angle for the short hops.

WITHOUT a doubt the amateur band most popular with the beginner for "day in and day out" c.w. work is the 7 mc. band. It also is a favorite of many of the old timers. By picking the time of day it usually is possible to work over distances ranging from the next town to the Antipodes, provided a reasonable amount of power *and the proper antenna* are employed. Naturally, power helps, but the characteristics of the antenna are just as important.

For general rag chewing and traffic work out to distances of a few hundred miles, a "high angle" radiator will give the best results. A horizontal half-wave radiator from 25 to 40 feet above ground is hard to beat for this type of work. The horizontal directivity is not pronounced at the higher angles, and no particular care need be taken with orientation.

This type of antenna with one type of feed or another is widely used on 40 meters, and the user ordinarily is quite happy with the results for distances out to a few hundred miles. But often he complains that he can't raise half the DX that some fellow up the street is able to hook with a harmonic operated horizontal wire, or maybe a half-wave horizontal radiator between two 70 foot sticks, or perhaps a slanting or vertical half wave, or some other *low angle* radiator.

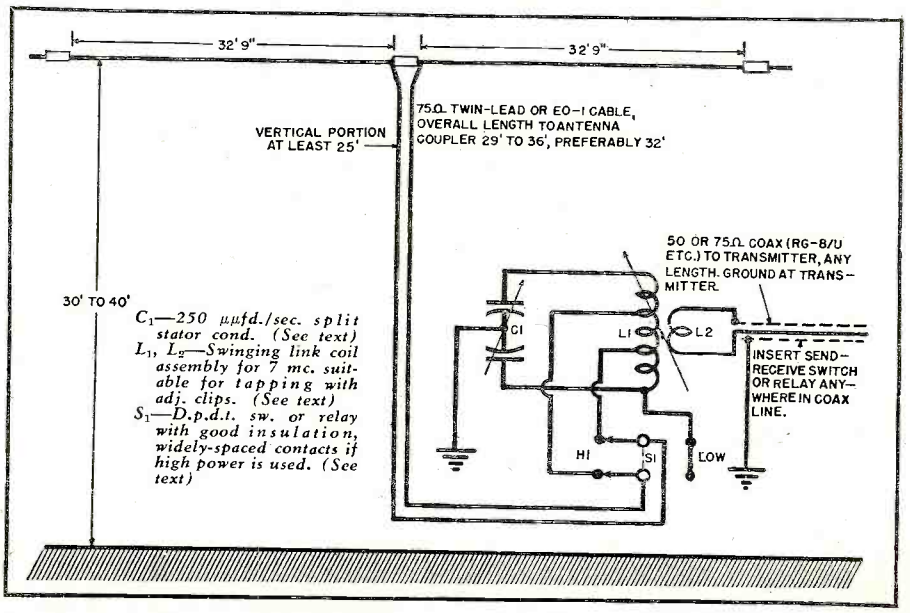
From the foregoing it is apparent that the ideal single antenna for *general purpose* work on 40 meters would be an omnidirectional antenna with *controllable vertical directivity*, to allow the operator a choice of high angle radiation for short haul stuff, or low angle radiation for DX, whichever happens to work better under the particular ionosphere conditions for intermediate distances.

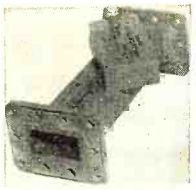
An antenna meeting these requirements is the "HI-LO" antenna system illustrated in Fig. 1. Fig. 2 illustrates how the mode of operation is changed by means of the "HI-LO" switch. This antenna does not require objectionably high poles, is not critical as to orientation, and will fit on a city lot.

Varying the Vertical Angle

With the "local-DX" or "vertical angle" selector switch or relay thrown to the "HI" position (high angle radia-

Fig. 1. Schematic of "HI-LOW" antenna, giving choice of high angle or low angle radiation. It is substantially non-directional unless the pattern is distorted unduly by surrounding objects. The specified limits for pole height assume that the transmitter is located on first floor. With second floor locations, pole heights must be increased.





10 CENTIMETER

WAVEGUIDE DIRECTIONAL COUPLER, 27 db. Navy type CABV-47AAN, with 4 in. slotted section as shown $42.50

SQ. FLANGE TO RD CHOKE ADAPTER, 18 in. long OA 1½ in. x 3 in. guide, type "N" output and sampling probe..$32.00

"S" BAND CRYSTAL MOUNT, gold plated, with 2 type "N" connectors.....$12.50

MAGNETRON TO WAVEGUIDE coupler with 721-A duplexer cavity, gold plated.....$45.00

10 CM WAVEGUIDE SWITCHING UNIT, switches 1 input to any of 3 outputs. Standard 1½" x 3" guide with square flanges. Complete with 115 vac or dc arranged switching motor. Mfg. Raytheon. New and complete $150.00

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10CM. McNALLY CAVITY Type SG.....$3.50

WAVEGUIDE SECTION, MC 445A, rt. angle bend, 5¼" ft. OA, 8" slotted section.....$21.00

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TS115/APS-2F 10 CM ANTENNA in lucite ball, with type "N" fitting $4.50

OAJ NAVY TYPE CYT66ADL, ANTENNA, in lucite ball, with Sperry fitting.....$4.50

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SLOTTED SECTION, 10 ft. L. 4" Slot.....$8.50

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(STD. 1" x ½" GUIDE UNLESS OTHERWISE SPECIFIED)

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CU 106 APS—33 Directional coupler, 25 db.....$15.00

APS-10 TR/ATR duplexer section with additional iris flange $10.00

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18" FLEXIBLE SECTION.....$17.50

"E" or "H" PLANE BEND.....$12.50

BULKHEAD FEED THRU.....$15.00

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ROTARY JOINT with slotted section and type "N" output pickup $17.50

WAVEGUIDE SECTION, 12" long choke to cover, 45 deg. twist & 2½" radius, 90 deg. bend.....$5.00

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WAVEGUIDE SECTIONS 2½ ft. long, silver plated, with choke flange $5.75

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ROTARY JOINT, choke to choke, with deck mtg. $17.50

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724-A TR tube (41-TR1).....$2.50

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1.25 CENTIMETER

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TBK-19 (new)
RC-145 (new)
RC-148 (new)

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DYNAMOTORS

Type	Input Volts	Input Amps	Output Volts	Output Amps	Radio SET	Price*
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						14.00LN
PE 73C	28	19	1000	.350	BC 375	24.50N
DM 21	14	3.3	235	.090	BC 312	3.45N
DM 21CX	28	1.6	235	.090	BC 312	3.45N
DM 25	12	2.3	250	.050	BC 367	2.49LN
DM 28R	28	1.25	275	.070	BC 348	8.75N
DM 33A	28	7	510	.250	BC 456	5.50
DM 42	14	46	515	.110	SCR 506	6.50LN
			1030	.050		
			2/8			
PE 55	12	25	500	.400	SCR 245	5.25LN
PE 86	28	1.25	250	.060	RC 36	3.55
PE 101C	13/26	12.6/ 6.3	400 800	.135 .020	SCR 515	5.25N
			9 AC	1.12		
BD AR 93	28	3.25	375	.150		4.95N
23350	27	1.75	285	.075	APN-1	3.50N
35X045B	28	1.2	250	.060		3.50N
ZA .0515	12/24	4/2	500	.050		3.95N
B-19 pack	12	9.4	275	.110	Mark 11	9.95N
			500	.050		
D-104	12		225	.100		14.95N
			400	.200		
DA-3A*	28	10	300	.260	SCR 522	8.95N
			150	.010		
			14.5	5		
#5053	28	1.4	250	.060	APN-1	3.95N
DA-7A	26.5		1100	.400	TA-2J	25.00N
CWD-21AAX	13	12.6	400	.135		17.50N
	26	6.3	800	.020		
			9	1.12		
PE 94	28	10	300	.260	SCR	15.00
			150	.010	522	
			14.5	5		

*For PE 94: Less Filters & Relay
N—New LN—Like New

PE 73 CM Replacement Dynamotors, Less Filter Box. New..$12.50

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GN 35: 350V, 60MA, 8V, 2.5A. New, w/cranks.....$12.50
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Homedell male to type "N" male adapter $1.25
D-166366 Baby "N" Adapter Cable Ass'y, Type "N" Male to Type "N" Female 85
Adapter Cable Ass'y, Sperry Male to Type "N" Male 2.25
Connector, #49579 for RG 18/U.....2.25
.....1.80

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RG 23/U, twin coax. 125 ohm imp. armored .....50/ft.
RG28/U. 50 ohm imp. pulse cable. Corona min. starting voltage 17 KV .....50/ft.
RG 35/U, 70 ohm imp. armored .....50/ft.
RG 57/U. 95 ohm imp. twin coax.....35/ft.

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2J22	3267-3333 mc.	265 KW.	$25.00
2J26	2992-3019 mc.	275 KW.	$25.00
2J27	2965-2992 mc.	275 KW.	$25.00
2J32	2780-2820 mc.	285 KW.	$25.00
2J38 Pkg.	3249-3263 mc.	5 KW.	$35.00
2J39 Pkg.	3267-3333 mc.	87 KW.	$35.00
2J40	9305-9325 mc.	10 KW.	$65.00
2J49	9000-9160 mc.	58 KW.	$85.00
2J55 Pkg.	9345-9405 mc.	50 KW.	$35.00
2J61	3000-3100 mc.	35 KW.	$65.00
2J62	2914-3010 mc.	35 KW.	$65.00
3J31	24,000 mc.	50 KW.	$55.00
5J30			$39.50
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720BY	2800 mc.	1000 KW.	$50.00
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725-A	9345-9405 mc.	50 KW.	$25.00
730-A	9345-9405 mc.	50 KW.	$25.00
Klystrons:	723A/B $12.50; 707B W/Cavity		$20.00
	417A $25.00	2K41	$65.00

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GAUSS	POLE DIAM.	SPACING	PRICE
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1500	1⅞ in.	1½ in.	$12.50
D161392*	1⅝ in.	1 5/16 in.	$12.50

*Mfr's Number

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tion), the antenna functions as a conventional half-wave doublet in conjunction with a link-coupled antenna coupler. As noted previously it will not exhibit pronounced horizontal directivity at vertical angles above 45 degrees or so, except in locations where surrounding objects are such as to have an appreciable effect upon the directivity pattern.

With the switch thrown to the "LO" position, the two conductors of the feed line are connected together and the *feed line becomes the effective radiator*. There will be some radiation from the horizontal portion of the antenna, but most of it will be from the feed line, or rather what *was* the feed line. In effect, the antenna now is basically an *inverted* "ground plane vertical," voltage fed at the "hot" end of the vertical radiator rather than in the conventional fashion.

Inverting the antenna so that the ground plane is above the radiator produces two desirable effects. It increases the vertical directivity slightly, concentrating a greater portion of the radiated power at low vertical angles, and reducing earth losses.

Results

The difference in signal strength between the two modes of operation (horizontal Hertz or inverted ground plane) is surprisingly pronounced at short distances and for distances over 1500 or 2000 miles, and will be quite noticeable most of the time for intermediate distances. The greatest difference in signal reports will be observed when the station being worked is using an antenna having a vertical directivity pattern favorable to the distance being worked.

Usually the most desirable switch position for *transmission* can be determined by comparing the other fellow's signal strength between the two positions while using the "HI-LO" antenna for *reception*. However, the correlation is not 100 per-cent.

A simple procedure to follow it this: For DX *transmission* always use the "LO" position of the switch. For short distance sky-wave *transmission* always use the "HI" position of the switch. For short distance ground-wave *transmission* use the "LO" position of the switch.

For reception, use whichever position provides the best signal. If the switch is accessible from the operating position, or especially if a relay is used in conjunction with a toggle switch, the operator has available a form of manual "diversity reception." This is a desirable feature in combatting certain types of fading and in fighting QRM. This requires keeping one hand on the switch, but it sometimes permits practically solid copy under QRM or fading conditions which would otherwise cause a large portion of the transmissions to be lost.

Construction

The direction in which the horizontal "flat top" runs is not important. However, it is desirable that the antenna

be so located that it is possible to drop the feed line as vertically as possible to the antenna coupler. The latter may be placed on the wall near the lead-in insulator, regardless of where the transmitter is located in the room, because the coax line may be run any length, and because the antenna coupler need not be retuned for moderate changes in frequency. It is not essential that the whole length of twin-lead or EO-1 cable be kept vertical, but the top 25 feet should be kept as nearly vertical as possible.

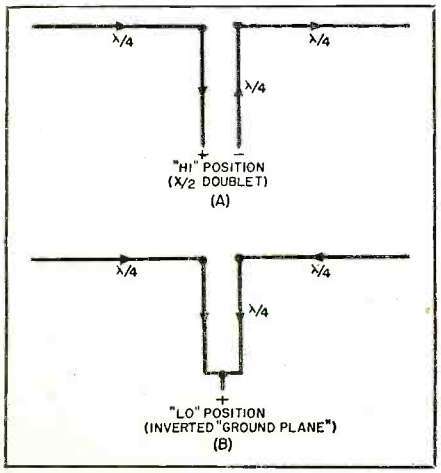
Where the rig is located on the first floor, a height of 30 to 40 feet will be satisfactory for the horizontal "flat top." If the rig is located on the second floor, correspondingly higher poles are required.

It should be kept in mind that with the switch in the "LO" position the lower portion of the twin-lead radiator is "hot" with r.f. voltage during transmission. To minimize losses and to avoid the possibility of flashover when much power is used, the lead-in insulator should be of good quality and be provided with a leakage path of at least a couple of inches. If a bowl type lead-in insulator of the type which mounts by means of a metal slip-on flange is employed, the twin-lead can be run through the hole without breaking the twin-lead.

If it is necessary to pull the line away from the house in order to keep the top portion vertical or to keep it from rubbing against the edge of the roof, use heavy twine, rather than wire.

Receiving-type 75 ohm twin-lead is satisfactory for transmitter powers up to 150 watts or so. The attenuation of this type of line is very low at 7 mc., and is but a small fraction of 1 db. for the length required. So there is no point in using the transmitting type twin-lead for powers of 150 watts or less. For higher powers either transmitting-type 75 ohm twin-lead or EO-1 cable may be used.

Fig. 2. Illustrating how the mode of operation is switched from half-wave doublet to inverted ground-plane antenna. The phase relationships are indicated by means of arrows which represent the instantaneous direction of current flow. The current loops are represented by the large dots.



A link coupled antenna coupler is employed for both positions of the "HI-LO" switch. This assures satisfactory reduction of harmonic radiation.

The split stator condenser, C_1, should have approximately the same spacing as the final amplifier tank condenser, assuming that the spacing of the latter is appropriate to the power employed, and should be of 250 $\mu\mu$fd. per section. The coil combination L_1, L_2 is a 7 mc. swinging link coil, with sufficient turn spacing to permit clipping on to a turn without shorting against adjacent turns. Clips should be used which have a good "bite" if the coil uses enameled wire.

The number of turns should be such that condenser C_1 hits resonance at about 80 per-cent of maximum capacity. Usually this will require pruning of turns, which of course should be done on each end to keep the coil symmetrical. The coil will be husky enough for the job if the wire size and insulation are comparable to those used in the final amplifier tank coil. The antenna coupler coil need not be made plug-in unless the same coupler is to be used on other bands with other antennas.

If high power is used, a relay rather than a switch is preferable at S_1, in order to preclude the possibility of r.f. burns to the operator. However, in the "LO" position there is considerable r.f. voltage at this point, and a relay with excellent insulation and the greatest available contact spacing is necessary at S_1 for transmitter input powers exceeding 500 watts.

Tuning Up

It will be assumed that the reader is familiar with the basic functioning and adjustment procedure of a link-coupled universal antenna coupler. If not, he is referred to one of the several books available which treat the subject in detail.

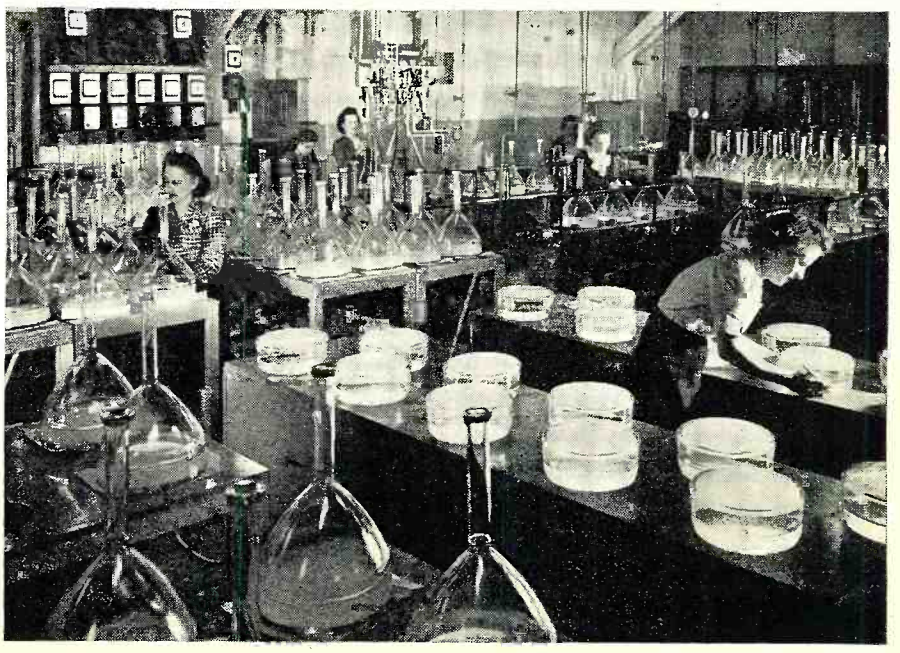
The antenna is first tuned up with the switch or relay in the "LO" position. The coupling between L_1 and L_2 is adjusted to reflect the proper resistive load at the transmitter end of the coax line when C_1 is resonated. The switch then is thrown to "HI," with the adjustable taps tentatively placed one or two turns each side of center. The taps are gradually moved in or out a fraction of a turn at a time (an equal distance from the center of the coil) until the same loading is obtained as before, without readjustment of C_1 or the coupling betwen L_1 and L_2. It then is possible to switch from "HI" to "LO" without appreciable effect upon the loading.

The transmitter frequency may be varied plus or minus 75 kc. without further adjustment of the coupler. Variations in loading can be taken care of by adjustment of the coupling at the transmitter end of the coax line. If it is not possible to compensate for the loading variation over this range by adjustment of the coupling at the transmitter end of the coax, then the coupling between L_1 and L_2, and the position of the taps on L_1, are not correct.

Should a "pencil-test" indicate the presence of much r.f. voltage on the stator of C_1 (considering the amount of power employed), the rotor should be grounded via heavy wire to a water pipe, ground rod, or other suitable ground. The current flowing in this ground lead will be small, and a low resistance ground connection is not required.

-30-

First step in the preparation of television tube bulbs is the dispensing of a measured amount of fluorescent screen material in solution which is allowed to settle. The solution is then poured off leaving the screen material on the tube face which is dried with warm circulated air and carefully examined for blemishes in a specially lighted inspection rack. Sylvania's TV tube plant is the locale of this picture.



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.25mfd.	600v	.35	2mfd.	2000v	1.75
.5mfd.	600v	.35	4mfd.	2000v	3.75
1mfd.	600v	.35	15mfd.	2000v	4.95
2mfd.	600v	.35	4mfd.	2500v	3.98
4mfd.	600v	.60	2mfd.	2500v	2.49
8mfd.	600v	1.10	.1mfd.	2500v	1.25
10mfd.	600v	1.15	.25mfd.	2500v	1.45
3x.1mfd.	1000v	.45	.5mfd.	2500v	1.75
.25mfd.	1000v	.45	.05mfd.	3000v	1.95
1mfd.	1000v	.60	.1mfd.	3000v	2.25
2mfd.	1000v	.70	.25mfd.	3000v	2.65
4mfd.	1000v	.90	1mfd.	3000v	3.50
8mfd.	1000v	1.95	12mfd.	3000v	6.95
10mfd.	1000v	2.10	2mfd.	4000v	5.95
15mfd.	1000v	2.25	1mfd.	5000v	4.95
20mfd.	1000v	2.95	.1mfd.	7000v	2.95
24mfd.	1500v	6.95	3mfd.	4000v	6.95
.1mfd.	1750v	.89	2mfd.	3000v	3.45
.1mfd.	2000v	.95	2x.1mfd.	7000v	3.25
.25mfd.	2000v	1.05	.02mfd.	12000v	9.95
.5mfd.	2000v	1.15	.02mfd.	20000v	11.95

HIGH CAPACITY CONDENSERS

10,000 mfd.—25 WVDC	$6.95
2x3500 mfd.—25 WVDC	3.45
2500 mfd.—3 VDC	.39
3000 mfd.—25 WVDC	2.49
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1000 mfd.—15 WVDC	.99
200 mfd.—35 VDC	.59
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4000 mfd.—18 WVDC	1.95
4000 mfd.—25 WVDC	2.95
4000 mfd.—30 WVDC	3.25

FILTER CHOKES
HI-VOLTAGE INSULATION

8 hy @ 550 ma....	$7.95	325 hy @ 3 ma....	$3.45
8 hy @ 300 ma....	3.95	1 hy @ 800 ma....	14.99
25 hy @ 160 ma...	3.49	10 hy @ 250 ma...	2.45
12 hy @ 050 ma...	2.25	10 hy @ 200 ma...	1.98
30 hy @ 70 ma....	1.39	10/20 @ 85 ma....	1.59
.05 hy @ 15 amps..	7.95	15 hy @ 125 ma...	1.49
.1 hy @ 5 amps....	6.95	15 hy @ 100 ma...	1.39
4 hy @ 600 ma....	5.95	3 hy @ 50 ma.....	.29
200 hy @ 10 ma...	3.49	30 hy Dual @ 20 ma.	1.49
600 hy @ 3 ma....	3.49	8/30 hy @ 250 ma..	3.50
.065 hy @ 2.5A....	2.49	10 hy @ 100 ma...	1.29

RADIO TUBES
NEW! STANDARD BRANDS!

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1B29	.89	801A	.49	1S4	.69
1N21	.59	802	2.95	1S5	.59
1N23	.59	803	3.75	1T4	.59
1N34	1.59	805	3.95	3Q4	.59
1P24	.89	807	1.19	3Q5	.69
2AP1	2.39	808	1.95	3S4	.59
2C22	.19	809	1.98	5Y4GT	.49
2C26	.29	810	4.89	6A7	.59
2C40	.74	811	1.49	6A8GT	.59
2C44	.69	812	1.39	6AG5	.89
2C46	3.75	813	5.25	6AG7	.98
2D21	1.19	814	2.75	6B4G	.95
2J21	12.45	815	1.45	6BG6G	1.49
2J22	12.95	816	1.10	6C6	.49
2J26	9.95	826	.49	6D6	.49
2J31	11.49	829B	2.89	6F5GT	.49
2J32	14.75	832A	2.49	6F6GT	.49
2J36	24.95	833A	29.50	6F8G	.59
2J37	18.95	836	.79	6H6GT	.39
2J38	14.75	837	1.19	6J5GT	.42
2J39	18.95	838	2.95	6J5	.55
2J40	18.95	841	.50	6J7GT	.55
2J46	18.95	843	.39	6K6GT	.49
2J49	26.95	845	3.29	6K7GT	.55
2J51	69.50	851	12.95	6L6G	.95
2J54B	18.95	860	1.98	6L6	1.23
2J55	18.95	861	11.95	6L7	.79
2K25	24.95	865	.79	6Q7GT	.55
2K28	6.95	866A	.98	6SA7GT	.49
2V3G	.79	866JR	1.10	6SC7	.55
2X2	.27	869B	18.75	6SF5GT	.59
3AP1	2.39	874	.69	6SH7	.49
3BP1	1.39	876	.39	6SJ7GT	.49
3B22	.59	878	1.29	6SK7GT	.49
3B24	1.29	884	.99	6SL7GT	.59
3B26	.89	885	.78	6SN7GT	.59
3CP1	2.95	902P1	5.95	6SQ7GT	.49
3C22	19.95	905	4.95	6V6GT	.59
3C23	2.49	923	.69	6X5GT	.69
3C24	.29	954	.24	7A8	.69
3C30	.59	955	.35	7B7	.69
3C31	1.49	956	.45	7C5	.59
3DP1	2.25	957	.24	7C6	.69
3D21A	1.50	958	.35	7F7	.49
3E29	3.39	1611	.98	7Y4	.49
4B24	2.25	1613	.58	12A8GT	.63
4E27	12.95	1616	.75	12AT6	.49
5AP4	4.75	1619	.21	12AU6	.75
5BP1	1.49	1622	1.59	12BA6	.59
5BP4	2.45	1624	.85	12BE6	.59
5CP1	1.98	1625	.29	12J5GT	.49
5D21	18.95	1626	.25	12J7GT	.49
5FP7	.85	1629	.29	12K7GT	.49
5JP1	11.95	1630	1.98	12Q7GT	.59
5J29	18.95	1638	.49	12SA7GT	.49
5J30	18.95	1654	1.98	12SF5GT	.49
5LP1	11.95	1851	.69	12SF7GT	.59
5R4GY	.89	2050	.68	12SJ7GT	.49
5T4	.69	2051	.45	12SK7GT	.49
5U4G	.45	8005	1.98	12SQ7GT	.49
5V4	.72	8011	.65	12SR7GT	.49
5X4	.59	8012	1.39	14A7	.69
5Y3	.35	8013	.89	14B6	.69
5Z3	.55	8014	3.98	14Q7	.69
5Z4	.79	8016	1.39	24A	.49
6AB7	.85	8020	.89	25L6GT	.59
6AC7	.59	8025	3.45	25Z5	.47
6AK5	.89	9001	.39	25Z6GT	.45
6AL5	.59	9002	.35	26	.45
6C4	.25	9003	.35	27	.49
6D4	1.29	9004	.29	30 Spec	.39
6J4	5.49	9005	.39	32L7GT	1.19
636	.89	9006	.29	35/51	.59
6Q5G	1.25	CK1005	.29	35A5	.59
7EP4	17.95	CK1006	.69	35L6GT	.49
10Y	.19	CK1090	1.49	35W4	.39
12A6	.25	EF50	.50	35Y4	.69
12DP7	13.95	F123A	8.95	35Z3	.57
12GP7	12.95	F127A	17.50	35Z5	.49
15E	.89	F128A	39.50	36	.79
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100TH	9.95	FG105	8.75	43	.52
211	.49	FG238B	29.50	45	.52
227A	3.75	GL146	7.95	47	.74
231D	1.49	GL605	39.50	50A5	.89
249C	.75	GL697	29.50	50B5	.59
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316A	.35	ML101	39.50	59	.95
327A	4.95	ML502	39.50	70L7GT	1.29
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371B	.99	VR105	.65	76	.49
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531	2.50	VU111	.49	80	.45
559	.75	0Z4	.59	81	1.55
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705A	1.65	1A7GT	.59	83	.89
706CY	18.95	1H5GT	.54	83V	.89
714AY	5.95	1N5GT	.59	84	.59
715B	9.95	1LA4	.95	89	.69
715C	18.95	1LA6	.95	117L7GT	1.15
717A	.59	1LB4	.95	117P7GT	1.15
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723A/B	12.95	1LD5	.95	117Z6GT	.69
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350-0-350v @ 35 ma.....	1.25
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150-0-150 @ 80 ma.; 150 @ 40 ma.; 6.3v @ 3.5A; 6.3v @ 1A.....	1.98
150v @ 55A; 150v @ 2.13A; 5v @ 5A...	3.95
120-0-120v @ 50 ma.....	.98
80-0-80v @ 225 ma.; 5v @ 2A; 5v @ 4A.	3.95
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3x18v @ 2A.....	3.95
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All Prices Subject To Change Without Notice

All merchandise guaranteed. Mail orders promptly filled. All prices F.O.B. New York City. Send money order or check. Shipping charges sent C.O.D. Minimum order $5.00. 20% Deposit required with all orders.

RADIO HAM SHACK Inc.
189 GREENWICH STREET . NEW YORK, N. Y.

TV Predictions

(*Continued from page 40*)

mitting large-tube sets to come within reach of the average household budget.

One thing is certain: *No obsolescence of present TV receivers is yet in sight.* Existing operation standards have been set for years to come. Also, notable refinements in transmitting equipment and operation during the past year have proved that current receivers are capable of still greater pictorial quality.

While practical progress has been scored in the metal type tube during recent months, I believe the glass type will still constitute the bulk of the picture tubes used during the next year at least. Recent developments in metal tubes came about mainly because of serious glass shortages. In fact, the greatest bottleneck in TV receiver production has been in the limited supply of glass blanks, but with the recent expansion and greater mechanization in glass production, this critical shortage is rapidly disappearing.

While coaxial cable and radio relay networks serve to bring the program facilities of our leading entertainment centers to scattered telecasting stations, and at the same time provide the commercial sponsor with a numerous audience worthy of national advertising appropriations, many programs are being recorded on film for telecasting at any time and place. Marked progress made in "Teletranscriptions," or the filming of TV programs directly from the monitor screen, will contribute much to 1949 telecasting variety especially among smaller and more isolated stations.

The close partnership between television and movie media, increasingly apparent this year, will become still closer during 1949. Because of the time difference between actual event and favorite looking-in hours, or again in the matter of the news locale being beyond the reach of TV pickup facilities, the filming of TV news events becomes generally accepted practice in the field.

Most TV transmitting facilities already include film processing equipment whereby film can be developed, reversed, fixed, rinsed, and dried, all in a matter of minutes since time is of the very essence in most news programs.

Air transport of timely films can bring overseas news events to American homes in minimum time. Television news coverage during 1949 will spread out to the entire world. I see no diminution of the film presentation but rather a still more effective use of this companion medium in TV programs.

Another phase of the television-movie partnership is at the theater level. *Eastman Kodak* and *Du Mont* engineers have evolved a practical means whereby televised news events

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B. Utah9318 H'Blk Osc Xfmr H'sld . . .98
C. UTC88662 V'BlckgOsc Xfmr H'sld . . .98
D. Erie HiV Cndsr 500mmf/10KV .40
D. Jeffers HiV Cndsr500mmf/20KV .75
E. Yoke MagnDeflec sim RCA201D1 . . . 4.59
F. FocusCoil forMagnFocKinescps 3.95
G. HiV Flybak H'OutXFMRsim RCA211T1 . . . 5.49
Ion-Trap Magnet RCA203D1 . . . 2.98
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FEATURING Herm Sld W.E. USN oil filled XFMR Inputs 105/115/125VAC 50-425 cps Outputs H.V. & 600VCT or 300VCT/375MA & 6.3V/10A, 5V/8A, 2.5V/3A, 5V/3A. H.V. ins exc for 630TS to 16" CR 10000V & 300VDC & ALL Filaments Supply Kit. Above Xfmr & 3B24 Doubler-Rect. & 5U4G rect. & ALL cndsrs, sockets, choke & data $29.95

SPECIAL . . . . . 5000V 300VDC & ALL Filaments KIT, Same Xfmr plus 5U4G & 3B24 rect., condsrs, choke, sckts, data $21.95

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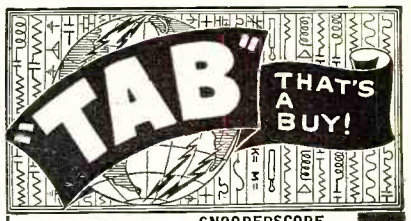

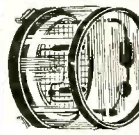

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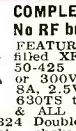

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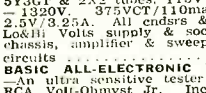

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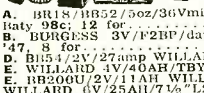

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or sports coming over direct coaxial cable or over the air can be filmed directly off a special cathode-ray tube, processed, dried, and readied for projection by standard theater equipment all in the matter of minutes if not seconds. TV economics, particularly in the matter of prohibitively-priced sporting events, may yet introduce the box office method of collecting maximum revenues, in which case one or more theaters may be joined together by wired television or special radio relay. Something along this line may appear in 1949.

But, by and large, TV programs will continue on both sustaining and sponsored bases. We have witnessed the commercial pattern of telecasting during the past year. The economic cycle of good programs, justifying the buying of TV receivers by the public, which receivers in growing numbers justify still better programs, and such better programs sell still more TV sets, has at last been completed. As a result we enter the new year with an array of outstanding television presentations.

Over and above the many and varied entertainment programs, I anticipate still greater emphasis on the educational potentialities of television. This seems to be a logical outcome of daytime programming. Instead of being limited to a few evening hours, as has been the general rule until now, we enter 1949 with daytime schedules such as that of station WABD in New York with its 80 hours weekly. Thus telecasting is no longer confined to an audience that wants to be entertained at the end of a long day, but rather can appeal to children, to young people, to the women folk, and even to students with programs of genuine educational content. I make bold to predict that even as early as 1949 we may see the beginnings of educational television worked into our school and college life.

Finally, the non-telecasting applications of television are yet to be touched upon. The "seeing at a distance" technique offers many challenging possibilities in everyday life: bank personnel checking signatures over intra-television installation; prison guards possessed of additional eyes with which to watch all sides and corners of their institution; inter-city sales meetings and demonstrations over leased circuits; the training of scattered groups from a central lecture platform; intra-store television—these are but samples of the tremendous potentialities of TV.

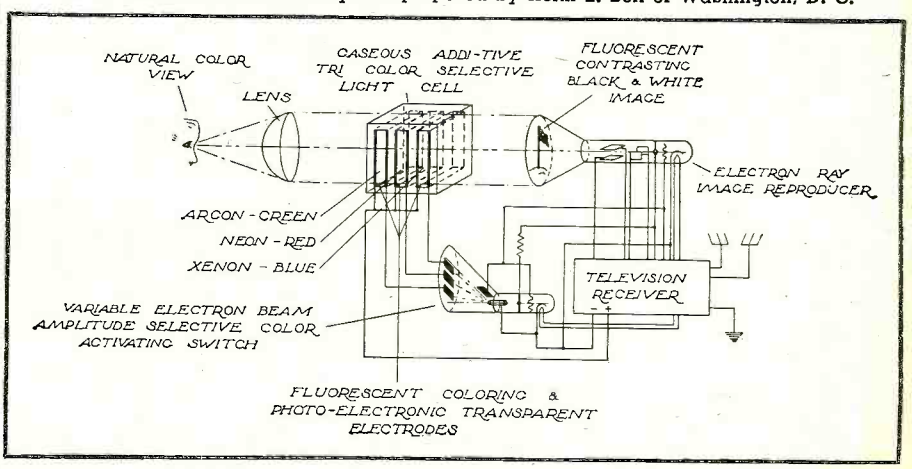
Much of our American living is undergoing modifications because of this newly opened "window on the world." We are setting aside many hours of leisure time in order to see things all about us via the television screen. And it all adds up to this in 1949: A still more learned, broader-minded, more interprising people is in the making, thanks to the impact of practical television. —30—

NATURAL COLOR TELEVISION SYSTEM

BY ALBERT WEINSTEIN

A NOVEL system for the achievement of color television has been proposed by inventor Keith L. Bell, of Washington, D. C., in patent application No. 48079. The intriguing idea, yet to be actually demonstrated, involves no change in present black-and-white transmitting equipment—and only relatively minor changes in present television receivers. Mr. Bell's theory and explanation of the system's operation is basically as follows: (1) Each primary color has its own characteristic range of signal amplitude as it passes through the receiver. (2) A tri-color selective light cell is placed between the eye and the picture tube. This cell comprises three layers of transparent, sealed envelopes. One contains argon gas for green, the second neon for red, the third xenon for blue. One side of each envelope is photoelectric in nature; the other side of each is fluorescent. (3) When a portion of the incoming signal, characteristic of a particular color, is represented in black and white on the face of the kinescope, an amplitude selective switch simultaneously activates the proper layer of the tri-color selective light cell, causing it to fluoresce so as to make the monochrome picture appear properly colored. —30—

The natural color television system proposed by Keith L. Bell of Washington, D. C.



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316A	.69
322A	8.95
327A	4.95
331A	5.95
338A	4.95
350A/B	2.95
354C/D	19.95
368AS	4.95
371A/B	.89
393A	7.95
394A	4.50
417A	24.95
434A	3.95
446A/B	1.95
450TH	24.95
464A	7.50
527	12.95
531	24.50
575A	14.95
701A	4.95
703A	4.95
705A	2.95
706CY	18.95
707A/B	24.95
708A	7.95
710A	2.95
713A	1.65
714AY	6.95
715A/B	9.95
715C	24.95
717A	.99
720DY	34.95
721A/B	4.35
723AB	7.95
724A/B	4.95
725A	24.95
726A	23.50
750TL	49.50
800	2.25
801A	.98
802	2.95
803	8.95
804	12.95
805	5.95
807	1.25
808	1.89
809	2.95
810	7.95
811	2.45
812	2.95
812H	6.90
813	8.95
814	3.95
815	2.95
816	1.19
826	.69
828	6.95
829A/B	7.95
829B/3E29	4.95
830	2.95
830B	5.25
832/A	4.95
833A	34.50
834	5.95
836	1.15
837	2.50
838	3.95
841	.69
843	.69
845	4.95
845W	5.95
849A	60.00
849H	60.00
851	75.00
860	3.00
861	49.95
864	.69
865	2.98
866A	.99
868	1.95
869B	75.00
872A	2.95
874	2.49
876	.39
878	2.49
884	1.49
885	.98

Type	Price
891	$110.00
902P1	7.95
904	9.95
905	11.95
913	7.95
920	2.95
923	.98
925	1.40
929	1.25
930	1.10
931A	4.95
954	.75
955	.75
956	.75
957	.75
958A	.75
1608	4.95
1611	.98
1613	.75
1614	1.75
1616	1.39
1619	.75
1621	1.98
1622	1.75
1624	1.75
1625	.49
1626	.49
1628	4.95
1629	.69
1631	1.50
1633	1.65
1634	.79
1635	1.10
1636	5.95
1638	.98
1641	.79
1642	.98
1644	1.49
1654	1.98
1851	1.25
1852	1.06
1853	1.06
1960	.95
2050	1.19
2051	.98
5514	4.95
5516	5.95
5562	10.00
7193	.39
8003	5.95
8005	4.95
8011	2.95
8012	4.95
8013A	2.95
8014A	24.95
8016	1.49
8020	3.95
8025	7.95
C5B	12.95
C6J	12.95
CEQ72	1.95
CK1005	.39
CK1006	.69
CK1090	4.95
EF50	.79
EL1C	4.95
EL3C	4.95
EL225	1.95
F123A	12.95
F660	150.00
FG17	3.25
FG27A	9.95
FG33	8.95
FG67	12.95
FG81A	6.95
FG105	19.95
FG172A	32.50
FG235	59.50
FG238B	160.00
GL146	11.00
GL530	49.50
GL559	5.35
GL697	150.00
HF100	3.95
HF210	17.95
HY65	2.49
HY69	2.49
HY75	1.25
HY615	1.25
HYE1148	.48
KU610	9.95
ML101	150.00
RK21	3.95
RK22	4.95
RK25	2.95
RK33	.89
RK34	.59
RK59	3.95
RK60	.79
RK65	24.95
RK72	1.95
RK73	3.95
RX120	10.00
SD809	4.95
TZ40	2.95

Type	Price
UH50	$ 5.95
V70D	6.95
VR75	.98
VR78	.75
VR90	.75
VR91	1.49
VR105	.75
VR150	.98
VT127A	3.00
VU111	1.19
WL460	14.95
WL468	14.95
WL532A	4.95
WL562	150.00
WL616	105.00
Z225	1.95
ZB120	6.95
ZP477/12DP8	14.95
0A2	1.65
0A3/VR75	.98
0A4G	1.06
0B2	2.05
0B3/VR90	.75
0C3/VR105	.75
0D3/VR150	.75
OY4	.88
0Z4	.88
OZ4G	.88
01A	.50
1A3	.72
1A4	1.28
1A4P	1.56
1A5GT	.72
1A6	1.28
1A7GT	.80
1B3GT	1.49
1B4	1.56
1B5/25S	1.28
1B7GT	1.06
1C5GT	.88
1C6	1.28
1C7G	1.28
1D5GP	1.55
1D7G	1.28
1D8GT	1.56
1E5GT	1.38
1E7G	1.56
1F4	1.06
1F5G	1.06
1F6	1.56
1F7G	1.56
1G4GT	1.06
1G6GT	1.06
1H4G	.88
1H5GT	.66
1F 6G	1.28
1F6GT	1.28
1J6GT	1.28
1L4	.80
1LA4	1.06
1LA6	1.06
1LB4	1.06
1LC5	1.06
1LC6	1.06
1LD5	1.06
1LE3	1.06
1LG5	1.06
1LH4	1.06
1LN5	1.06
1N5GT	.80
1P5GT	1.06
1Q5GT	1.06
1R4	1.06
1R5	.80
1S4	.96
1S5	.72
1T4	.80
1T5GT	1.06
1U4	.80
1U5	.72
1V	.88
2A3	1.28
2A4G	1.98
2A5	.88
2A6	1.06
2A7	1.06
2B7	.88
2E5	.88
2V3G	1.98
2X2A	1.25
3A4	.39
3A8GT	1.98
3B7	.36
3D6	.36
3Q4	.88
3Q5GT	.96
3S4	.80
3V4	.80
5AZ4	.50
5R4GY	1.15
5T4	1.28
5U4G	.60
5V4G	.96
5W4	1.06
5W4GT	.66

Type	Price
5X4G	$ 0.72
5Y3GT	.42
5Y4G	.60
5Z3	.72
5Z4	1.06
6A3	1.28
6A6	1.06
6A7	.80
6A8	.80
6A8GT	.80
6AB5/6N5	.88
6AB7/1853	1.06
6AC5GT	1.16
6AC7/1852	1.16
6AD6	.88
6AD7G	1.28
6AF6	1.25
6AG5	1.06
6AG7	1.28
6AH6	1.56
6AJ5	.99
6AK5	1.56
6AK6	.96
6AL5	.80
6AL7GT	1.06
6AQ5	.80
6AQ6	.72
6AQ7GT	.88
6AR5	.66
6AS7G	4.95
6AT6	.60
6AU6	.80
6AV6	.60
6B4G	1.28
6B5	1.56
6B6G	.88
6B7	1.28
6B8	1.28
6B8G	1.28
6BA6	.80
6BE6	.72
6BG6G	1.92
6BH6	.80
6BJ6	.80
6C4	.39
6C5	.66
6C5GT	.66
6C6	.80
6C7	1.28
6C8G	1.28
6D6	.66
6D8G	1.28
6E5	.85
6E6	1.06
6F5	.66
6F5GT	.66
6F6	.80
6F6GT	.66
6F7	1.06
6F8G	1.28
6G6G	1.06
6H6	.60
6H6GT	.60
6J5	.54
6J5GT	.54
6J6	1.16
6J7	.80
6J7GT	.80
6J8G	1.28
6K5GT	.96
6K6GT	.60
6K7	.66
6K7GT	.66
6K8	.96
6K8GT	.96
6L5G	1.06
6L6	1.42
6L6G	1.16
6L6GA	1.16
6L7	.96
6L7G	1.16
6N6G	1.56
6N7	.96
6N7GT	.96
6P5GT	.96
6Q6G/6T7G	1.06
6Q7	.80
6Q7GT	.72
6R7	1.06
6R7GT	1.06
6S7	1.28
6S8GT	1.06
6SA7	.66
6SA7GT	.66
6SB7Y	.88
6SC7	.72
6SD7GT	.49
6SF5	.66
6SF5GT	.72
6SF7	.80
6SG7	.80
6SH7	.39
6SJ7	.66
6SJ7GT	.66

Type	Price
6SK7	$ 0.66
6SK7GT	.66
6SL7GT	.96
6SN7GT	.88
6SQ7	.60
6SQ7GT	.60
6SR7	.72
6SR7GT	.72
6SS7	.66
6ST7	.88
6SV7	.88
6T7G	1.24
6U5/6G5	.72
6U6GT	.72
6U7G	.72
6V6	1.28
6V6GT	.80
6W7G	.88
6X4	.60
6X5GT	.66
6Y6G	.90
6Y7G	.88
6Z7G	1.28
6ZY5G	.88
7A4/XXL	.72
7A5	.72
7A6	.72
7A7	.72
7A8	.72
7AD7	1.06
7AF7	.72
7AG7	.88
7AH7	.88
7B4	.72
7B5	.72
7B6	.72
7B7	.72
7B8	.72
7C4/1203A	.39
7C5	.72
7C6	.72
7C7	.72
7E5/1201	1.06
7E6	.72
7E7	.88
7F7	.88
7F8	1.06
7G7/1232	1.06
7H7	.80
7J7	1.06
7K7	1.06
7L7	.88
7N7	.88
7Q7	.72
7R7	.88
7S7	1.06
7V7	1.06
7W7	1.06
7Y7/XXFM	1.06
7Y4	.72
7Z4	.72
10	.69
12A	.60
12A6	.39
12A6GT	.39
12A7	1.28
12A8GT	.80
12AH7GT	.88
12AL5	.80
12AT6	.60
12AT7	1.06
12AU6	.80
12AU7	.96
12BA6	.72
12BE6	.72
12C8	.69
12F5GT	.72
12H6	.39
12J5GT	.39
12J7G	.80
12J7GT	.80
12K7GT	.66
12K8	.88
12K8GT	.96
12Q7GT	.72
12SA7	.66
12SA7GT	.66
12SC7	.72
12SE5	.80
12SE5GT	.80
12SE7	.80
12SE7GT	.80
12SG7	.72
12SH7	.39
12SJ7	.66
12SJ7GT	.66
12SK7	.66
12SK7GT	.66
12SL7GT	.88
12SN7GT	.80
12SQ7	.60
12SQ7GT	.60
12SR7	.39
12SR7GT	.39

Type	Price
12X3	$ 0.98
12Z3	.88
14A7/12B7	.88
14AF7/XXD	.88
14B6	.88
14B8	.88
14C5	.88
14C7	.88
14E6	.72
14E7	.88
14F7	.88
14F8	1.06
14H7	.88
14J7	1.06
14N7	1.06
14Q7	.88
14R7	.88
14S7	1.06
14W7	1.06
14X7	1.06
14X4	.88
19	1.28
19T8	1.06
22	1.28
24A	.88
25A6	1.06
25A6G	1.06
25AC5GT	1.16
25L6GT	.66
25Y5	1.16
25Z5	.60
25Z6GT	.60
26	.72
27	.60
28D7	.39
30	.39
31	.39
32	1.28
32L7GT	1.28
33	.39
34	.39
35/51	.80
35A5	.72
35B5	.80
35L6GT	.66
35W4	.46
35Y4	.72
35Z3	.72
35Z4GT	.60
35Z5GT	.50
36	.39
37	.39
38	.39
39/44	.39
41	.66
42	.66
43	.66
45	.66
45Z3	.60
45Z5GT	.72
46	1.06
47	.96
49	.88
50	1.56
50A5	.88
50B5	.66
50L6GT	.66
50Y6GT	.72
53	1.06
56	.72
57	.80
58	.80
59	1.06
70L7GT	1.56
71A	.80
75	.66
76	.66
77	.66
78	.66
79	.88
80	.46
81	1.56
82	1.06
83	1.06
83V	1.28
84/6Z4	.72
85	.88
89	.72
89Y	.39
117L7GT	1.56
117M7GT	1.56
117N7GT	1.56
117P7GT	1.56
117Z3	.60
117Z4GT	1.16
117Z6GT	.96
FM-1000	1.28
UX120	1.38
UX200	1.28
9001	.89
9002	.39
9003	.69
9004	.49
9005	.98
9006	.49

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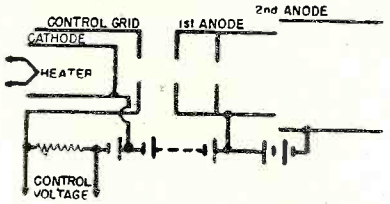
DO YOU KNOW?

By DAVID SCOTT

40. Describe the cathode of an electron gun.

A. *The cathode is a nickel cap over a nickel sleeve. The heater is an insulated tungsten wire operating at about eleven hundred degrees K. The cathode cap is covered with a mixture of barium and strontium oxide which can emit electrons at a rate in excess of 100 ma. per square centimeter.*

41. Draw a simple schematic of an electron gun.



42. Describe the first anode of an electron gun.

A. *The first anode is a cylindrical sleeve containing several apertures spaced at intervals on the axis of the system. These apertures confine the beam still more than when it left the grid.*

43. Describe the second anode of an electron gun.

A. *The second anode usually takes the form of a conducting coating on the inside of the glass tube. The second anode has a larger diameter than the first anode and is placed so that its edge just overlaps the edge of the first anode. The second anode is at a higher potential than the first anode.*

44. Of what does the first electron lens consist?

A. *The first electron lens consists of the cathode surface, control grid, and the first aperture in the first anode.*

45. What is the function of the first electron lens?

A. *The dimensions and voltages of the first lens cause the electrons to form a crossover or focus slightly in front of the cathode. The area of this crossover is smaller than the area as emitted from the cathode and hence is more easily focused toward the scanned surface by the second lens.*

46. Of what does the second electron lens consist?

A. *The second lens is the region where the edges of the first and second anodes meet.*

47. What is the function of the second electron lens?

A. *Due to the difference of potential between the first and second anodes, the electrons are deflected toward the axis of the system. When the voltages are properly chosen the electrons are directed so that they meet the axis at its intersection with the plane of the scanned surface. The focusing action is the result of the ratio of the diameter of the cylindrical electrodes and the ratio of the potenials to the electrodes. The ratio of the second anode voltage to the first anode voltage is usually 5:1.*

48. What is the function of the control grid?

A. *The control grid in an iconoscope is used to fix the beam current at the value that produces an optimum ratio of usable to spurious signal under given conditions of light. In a receiver, the grid receives the signal that controls the brilliance of the picture elements. It must, therefore, be capable of responding to voltages at the rate of $8x10^6$ per second, corresponding to a frequency of $4x10^6$ c.p.s. The power density, from which the light is produced, should vary in proportion to the control grid voltage.*

49. What is meant by electrostatic deflection?

A. *Electrostatic deflection is accomplished by applying voltages to deflecting plates.*

50. What is meant by magnetic deflection?

A. *Magnetic deflection is accomplished through the creation of fields of force by passing currents through strategically located coils of wire.*

51. How may deflection cause defocusing?

A. *Defocusing from deflection may result because the beam when in focus on the axis may be out of focus on the edges of the tube. In the iconoscope a beam with a long narrow point is used so the entire surface can be scanned without spreading. In receiving tubes the surface is curved to make all points of the screen equidistant from the axis.*

52. What may be the result of non-uniformity of the deflecting field?

A. *Non-uniformity of the deflecting field will cause defocusing. Hence the plates or coils must be placed to produce as uniform a field as possible.*

53. What is the ion spot?

A. *The ion spot is the result of negative ions (heavy particles) not being deflected, and thus bombarding the center of the fluorescent screen, producing a spot or blemish.*

(To be continued)

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TU-9	2.25
TU-10	2.25
TU-26	2.25

BC-454—3-6 mc Receiver $6.95
BC-455—6-9 mc Receiver 6.95
Modification data to 20 & 10 meters Conversion Book.

ART-13 Collins Transmitter

New Condition	$200.00
DY-12 Dynamotor	40.00
Control Box	4.50

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Famous Army Air Force and ground Transmitter. Made by G.E. Transmitter and 5 tuning units, antenna tuning unit, dynamotor. Price each **$49.50**
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BC-458—5-7 mc Transmitter ... 7.95
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Permanent Magnet

4"	$ 1.60
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15" Cinaudagraph—12500 ohm field coil 12 ohm voice coil—15 watts—normal. Price each. **$24.50**

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225-250-275-300 volts at 100 Ma. New in Original Cartons **$15.00**

Intercoms—New
Utiliphone ... 1 Master ... 1 Station. 100 feet connecting wire. Ready to plug in 110 Volts AC **$14.95**

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.05 Mfd.	600 Volts	$0.15
.10 Mfd.	350 Volts	.69
.15 Mfd.	150 Volts	.60
16 x 16	450 Volts	1.20
20	250 Volts	.69
40	150 Volts	.75
50	150 Volts	.69
150	25 Volts	.54
200	10 Volts	.45
8 x 8 Can.	Electrolytic	1.50

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For Frequency Modulation. Broadcast Band with 100 feet 300 ohm lead-in and mounting pole. Price each **$2.95**

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ANB-H 1 Headphones ..... .21

HS-33 ANB H 1 low impedance phones ..... .49
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I-82-A Selsyn Indicator 3.25
Or Both for 11.50

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12A6	69c	OD3-/VF150	75c
12SR7	69c	12SA7	69c
12K8	69c	77	59c
12SK7	69c	78	59c
12SF7	69c	89	59c
1625	89c	38322	$1.19
1626	79c	1235-GT	69c
1629	89c		

Tubes: (Loose, Unpackaged).

6SJ7	39c	6K8	39c
6SJ7-Y	39c	10-Y	39c
211	49c		

Potentiometers

1 meg. with dual switch, AC DC replacement part	54c
Dual 25,000, 2000	44c
500 M with switch	44c
20,000	30c

Crystals—CR-1 Holder
6450 KC, 7010 KC, 7120 KC, 7300 KC, 7620 KC, 8007.69 KC, 8155.71 KC, 8297.14 KC. Ea. 50c; 3 for $1.25

Code Keys
J47 J37 Handkeys 69c

Output Universal
Push-pull output 6V6, 6K6, 6F6, 6L6, etc. To Voice Coil **$1.30**

Heavy Duty R.F. Switch
Rotary Type—3 Sect. 1st Sect. 1 pole 3 position. 2nd Sect. 1 pole 4 position. 3rd Sect. 1 pole 2 position. Ceramic insulation. Size—5.38"x2.75"x2.75". Price each **$2.89**

Knobs for local tuning of your SCR-274-N Receivers. 50c ea.; 3 for $1.25

SCR-274-N Racks and Mounts. Dual trans. Rack & Mount $2.25. Triple Rec. Mount and Rack $2.75

Dual 8 Pin Male **Jones Plug** 20c
Cable and Spline Gear on end 5c

Test Instruments
Simpson Model No. 443 0-2.5 volt. 10 volt, 100 volt, 250 volt, 500 volt, 1000 volt DC 0-10 mc 0-1 ma, 5 ma, 25 ma, 100 ma. Price **$24.50**

Phone Cords ... Extension. Rubber Covered, with PL-55 one end and JK-26 one end 25c

Condensers ... Variable Padders. Mica. Miscellaneous values from 3 mmfd to 260 mmfd. Single units.. 10c Dual units... 20c Triple units... 30c

Transmitting Tubes

304-TL'S	$2.95

"Special"
2 305-TL Tubes
1 10 V 15 Amp Transformer for Filaments. Both for $14.95

Resistors ... ¼, ½, 1 Watt in Value from 22 ohms to 10 meg.
¼ watt ..... 5c ½ watt 7c
1 watt 9c

Aircraft Signal Lights. 28 V DC. Spot can be seen up to 5-8 miles. Price **$6.50**

Small Signal Light. M308-B. Use as a trouble light on car with 6 volt bulbs 35c; 2 for 59c

Mica Broadcasting Type Transmitting Capacitor
Type G1 by Sangamo. Cap. 00024 Mmfd. Working voltage 6000 V. Size 3"x3"x 2⅝". Price each **$4.90**

Setchell Carlson Receivers 200-400 kc. New. Price each **$8.50**

BC-348 Receiver — Shock Mount. Rack and Power Plug, ea. **75c**

ANB—H1 Headphone Unit 21c
Standoff Insulators ¾x¾x2 **Hi.** .. 10c
PL-68 Mic Plug 15c
JK-26 ..... 15c
Knobs ¼" Shaft 5c

TRANSFORMERS
For converting SCR-274-N to 115 Volts AC.

No. 1 Power Transformer. Pri—115v 60 cycle; sec—500 CT .06 Amp. Price only $3.90

No. 2 Filament Transformer. Pri—115v 60 cycle; Sec. 1—14v 7½ amp.; sec. 2 14v 7½ amp. Series 28v 7½ V; Parallel 14V 15 amp. Price only $4.50

No. 3 Filament XMFR. Pri—115v 60 cycle; Sec. 24v 2 amp. Price only $2.25

BC-1206-A Detrola. Used ... $2.95
50 mmfd Vacuum Condensers, 50KV 1 amp can be used for final tank padding 1.50
Fan Belt. Fits V-8 ..... .48

Shock Mounts for SCR-274-N. BC-348 and BC-375-E. Each.. 75c
PL-55 (Short) Plug. New 17c
JK-26 Plug. New 18c

DYNAMOTORS
Below is listed the types of dynamotors we carry in stock. Many of them may be operated at half-voltage input with one-half output.

	INPUT	OUTPUT	PRICE
DM-32	28v DC	250v 60 MA	$ 2.95
DM-33	28v DC	525v 250 MA	1.35
DM-35	12v DC	625v 225 MA	12.50
DM-37	28v DC	625v 225 MA	3.50
DM-34	12v DC	230v 80 MA	9.95
PE-73	28v DC	For BC-375-E	17.25
DM-53-A	28v DC	For AN/ARN-5	12.50
PE-94-C	28v DC	For SCR-522	12.50
PE-98-A, B, C.	12v DC	For SCR-522	15.50
PE-86	28v DC	250v 60 MA	12.50
DM-24	14v DC	220v 70 MA	3.50
DY-20	14v DC	28v 1.5 Amp	12.50
GE-5D2INJ3A Inverter	28v DC	115v 400 cy. 500 V.A.	35.00
MG-149-F Inverter	28v DC	115v 400 cy. 500 V.A.	42.50

"SPECIAL" DYNAMOTOR "SPECIAL"
6v DC Input 4 to 5 amperes 260v output 60 to 70 MA. Just the item for that Mobile receiver supply BC-454, BC-455, etc. New Price **$7.95**

SAVE C.O.D. CHARGES by remitting in full or 25% deposit. We ship transportation charges collect.

R&M RADIO COMPANY
1426 N. QUINCY ST. DEPT. RN 39 ARLINGTON, VIRGINIA

"New Look" (*Continued from page 41*)

average home is considerably alleviated.

The heart of the new 45 r.p.m. system is a simple and unique type of automatic record changer developed exclusively for use with the new 45 r.p.m. records. Housed in a small plastic case is a single-speed motor which drives the turntable. The shaft of this motor is precision-built to insure constant running speed and the elimination of turntable "wow."

The turntable is mounted on top of the plastic case. The feature of this turntable most likely to interest the radioman is the large, red plastic-capped center spindle which houses the fast-dropping changer mechanism. As many as eight of the 45 r.p.m. records may be stacked on the center spindle. The action of the drop mechanism is normally automatic but can be accomplished manually by means of a small touch-button. Metal fins emerge from narrow horizontal slots in the spindle to hold the upper portion of the stack while latch-type projections below the record recede to drop the bottom record.

This record-changing mechanism is exceptionally fast. Immediately upon completion of a record, the tone arm swings out, the next record drops in place, and the tone arm settles into the first groove, all in the time required for the turntable to complete one revolution. In other words, the actual time between the conclusion of one record and the start of the next record is about 1/45 minute. The action of the turntable and drop mechanism is noiseless, and even the drop of each record is scarcely audible.

The tone arm, which is located on top of the plastic case, contains a "Silent Sapphire" permanent point pickup. The stylus has a 1 mil. radius (45 degree included angle). A tracking pressure of only 5 grams is exerted on the playing surface of the record.

The pickup and the record have a matched frequency response which results in improved fidelity (a flat response characteristic). With a low voltage output, the frequency range of the pickup, and therefore the entire system, extends as high as 8000 cycles.

During the brief period of the change cycle when the tone arm is in motion, a muting switch opens the circuit automatically so that no voltage leaves the changer.

The record changer has only two simple adjustments—small screws—which can easily be reached from the top of the instrument. One is a height adjustment for the tone arm while the other is a landing adjustment to make certain that the pickup settles into the first groove of each record.

The automatic changer (without amplifier) is expected to retail for around $10.00 net, thus bringing the cost of such an instrument well within the range of the most modest budget.

Because of the small physical size of the record player, it can be installed in existing phonographs. The output of the unit can be fed into any amplifying system.

Formal announcement of the new 45 r.p.m. system is the culmination of nearly a decade of research and development on the problem by *RCA*.

The majority of the problems encountered arose from a lack of standardization in the industry, particularly in the records themselves, in the matter of thickness, diameter, groove depth, and other dimensions and record characteristics.

According to the company, the new record meets the requirements of all types of recorded material whether it be popular, folk, semi-classical, or classical.

The Future

Since many customers are reeling from the multiplicity of records and recording systems now being offered, it might be well to dwell briefly on the future of the art as it affects the consumer.

Columbia Records plans to continue releasing its 33⅓ r.p.m. long-playing Microgroove records in three sizes; the 12″ record which runs an uninterrupted period of about 25 minutes; the 10″ size which provides approximately 15 minutes of program material; and the 7″ plastic record which runs about 7 or 8 minutes. Classical and popular works from their 78 r.p.m. catalogue are to be re-recorded for issuance on the 33⅓ r.p.m. discs.

Present plans by *RCA* call for the creation of an extensive catalogue of the 45 r.p.m. records in order to stimulate sales among all classes of record buyers. Classical records of the "Red Seal" series are to be released on the 7″ *Vinylite* disc as well as many old and all new recordings in the "Black Label" series. Records sold under the "Bluebird" label will be issued on the new 45 r.p.m. discs in addition to a new series of records for children. These latter two will appear later in the year.

Because there are, at present, 16 million record players which are equipped to handle only 78 r.p.m. records in the hands of the public, *RCA* plans to continue the release of 78 r.p.m. discs in addition to the new 45 r.p.m. units.

RCA has completed arrangements with *Decca Records* and *Capitol Records* to issue releases on the 7″ *Vinylite* 45 r.p.m. discs. In addition, to expedite production on the automatic changer, the company has released blueprints and specifications to all interested manufacturers on a royalty-free basis. Thousands of these changers are now in production and will be sold individually or as part of radio-phonograph combinations. *Admiral, Crosley, Emerson, Stewart-Warner,* and others, are planning to incorporate the new changer in their fall and winter lines of combination instruments.

—30—

MARS Station of the Month

WILLIAM Four King Queen William (W4KQW), with Master Sergeant Reynold A. Champagne at the key, Keesler Air Force Base, Biloxi, Mississippi, was named the "MARS Station of the Month" by Major Rawleigh H. Ralls, Chief, MARS, USAF.

The laurels go to "Ray" for his sweet fist and clean-cut, all-around operation. He operates in the Training Command nets on 3497.5 as AF4KQW one evening a week but his enthusiasm for both brass pounding and phone operation is limited only by free time for his duties and the XYL's tolerance. She's the silent partner.

Ray considers himself more or less a newcomer to the amateur ranks, having gotten his first ticket in 1937 as W2KUV; he was an active participant in the East New York State net of AARS from 1938 to 1941. He still proudly exhibits the AARS certificate as one of his most coveted pieces of wallpaper.

His wrist action, which works smoothly up to 50 w.p.m. was acquired as a code instructor in various Signal Corps communications schools from 1927 to 1941. He can satisfy any of the swifts or he can slow it down to 13 for those who are not so apt at code.

Ray divides his time equally between 20 and 40-meter c.w. and 10 meter phone and enjoys a local rag-chew as well as a bit of elusive DX. He has reached the half-way mark to DXCC honors working 45 of the countries on only 40 watts. His log books show 2000 odd QSO's since November 1945 and he has lost count of them from 1937 to 1941.

The operating position at W4KQW consists of a *National* 240-D receiver with an *RME* v.h.f. 152 converter. The xmitter is of home-grown variety with 100 watts going into an 829-B final driven by a *Meissner* "Signal Shifter." For phone operation Ray uses two 6L6's for class AB2 modulation and gets plenty of fox baker reports. In his odd moments he is putting together a six-meter rig to go on the air this spring.

In addition to filling a full eight-hour day as electronics instructor at the Air Forces Radar School, working his regular MARS schedule, Ray is also president of the Keesler AFB Radio Club which boasts more than 50 members and a myriad of activities. He is, indeed, entitled to a salute as one of the outstanding amateurs of the Training Command.

Captain E. L. Nielsen, Chief, MARS, Army will designate the "MARS Station of the Month" for April. —30—

M/Sgt. Reynold A. Champagne, W4KQW, at the key. His station at Keesler Air Force Base, Biloxi, was named "MARS Station of the Month" by Major Rawleigh H. Ralls, Chief, MARS, USAF.

SPECIAL SURPLUS BROADCAST OF OUR SUPER SPECIALS!!!

B.C. 688A RECEIVER
Part of SCR518 hi. alt. altimeter. Freq. 515MC. Complete w/ 11 tubes. **$14.95**

PE112A POWER SUPPLY. Part of SCR518 hi. alt. altimeter. Dynamotor rating 27V @ 6A output 18VAC @ 2-2A, 300 VDC @ 200MA.....$10.95
IFF TRANSMITTER ASB-7A. Freq. 500 MC. uses two 15E Tubes.....$12.95
ASB-6 Rectifier Power Unit for ASB-7A Trans......10.95
YJ RADIO EQUIPMENT. Two channel, automatic responding radar beacon or racon. For shore installation. Automatically transmits coded sigs. in reply to interrogating sigs. from craft equipped with radar or IFF Equipment. Replies to interrogating sigs. in the (A) Band 176 MC and (B) Band 515 MC. Consists of: Rectifier power units: A and B Band transpondors, transmitter and receiver units, complete w/30 tubes. 115V 60 cy. 36" L., 18" H., 17" W. 270 lbs. L.N.....$80.00
DIAL ASSEMBLY. Calibrated dial, two bands 250-610KC and 610-1500 KCS. Each band a vernier scale —0-1000—is shown, 7½" W., 10" H., 4" D.....$1.00
RAYTHEON DEFLECTION COILS. U8820 for 5FP7 CRT Metal Cased.....$1.85
REMOTE CONTROL RM-29A. Telephone units. No external power necessary. Good to 50 miles. Self contained magneto rings other station.....$12.95 per pair
BATTERY CHARGING PANEL. Mfd by Price Bros. Two 3PDT Trumbull knife switches MTD on 10x8x¾ Bakelite panel, wired up to 10 heavy duty metal conn.$3.50
WET STORAGE BATTERIES. Searchlight type 4 volt 80 Amp. Hour.....$10.65
Dewar 8V 15AH w/electrolyte and filler syringe. Can be used as 4 individual 2V Batteries.....$8.00
Willard 2V @ 20AH used in G. E. portable radio LB530 $2.50 ea.; 6 or more.....10/ 20.00
(All batteries shipped dry) Case lots of 36 $1.50 ea.
W E HEADSET 716B. Single phone 600 ohms imp.$2.00
ASE RADAR RANGE INDICATOR. Type 1 using 5BP1 CRT, metal shielded controls for gain, brilliancy, focus, sync., vert. and horiz. Uses four 6AC7's and Two 6116's. Excellent possibilities. Scope.....$12.95

MILLIAMMETERS

SIMPSON NO. 29 METER. 150-0-150 MADC 4" sq. Panel mtg. Cat. No.....$3.35
BUTTON CONDENSERS. 2000 MMF or 500 MMF, your choice.....10 for $1.00
ANSO ANTENNA. ¼ Wave length trans. receiving 500 MC 5" Blade Type.....75c
Mtg. in Isolante form.

150-0-150 MA DC. Accuracy ½ of 1%. Scale length 4½", Wt. 3½ lbs. 6" x 2½"x4⅛". L. N. Your choice....$2.50

1% PRECISION RESISTORS

Ohm	W	Price	Ohm	W	Price	Ohm	W	Price
1	½	22c	45.1	½	15c	50K	½	25c
2	½	22c	56.7	½	15c	60K	½	25c
14.25	½	15c	228	½	22c	*110K	½	30c
17.9	½	15c	*2500	½	25c	600K	½	40c
22.5	½	15c	7000	½	30c	1 MEG	½	75c
28.5	½	15c	10K	½	30c	1 MEG	½	50c
35.7	½	15c	*15K	½	30c			

MOTORS, GENERATORS AND SYNCHRO'S

Ford Instrument Synchro Generator, 7G, MK111 Mod. 3 115/90 Volts 60 Cy.....$16.50
Arma Corp. Synchro Differential Generator, Type 5 DG MK4 Mod. 1 90/90 60 Cy.....7.95
Diehl Synchro Transmitter, Type C78414 115 Volts 60 Cy.....4.35
G. E. Synchro Motor, Type 5F, MK4 Mod. 3 115/90 Volts 60 Cy.....37.50
Sperry Gyroscope Voltage Receiver, 76166, 115 Volts 400 Cy.....4.35
Delco Synchro Transmitter, C79331, Type 1-4, 115 Volts 60 Cy.....4.35
Western Electric Motor, KS8624, 20 VAC, 200 Cps, 2 ph, 9000 RPM.....4.95
Oster Shunt Motor, Type E-7-5, 27½ Volts DC 1/20 HP 3650 RPM.....7.50
Oster Series Motor, Type C-2BF-1A, 27.5 Volts DC, 1/100 HP 7000 RPM.....2.50
Universal Electric Shunt Motor, KS5603L02, 28 Volts, .6 Amps, 5000 RPM.....2.00
Elinco AC Generator, Type F-16 2 phase, 1.3 Volts per 100 RPM.....7.95
G. E. Permanent Magnet Generator, 5BY9 #8, 140 Volts DC, .025 Amps, 1800 RPM.....5.50
Emerson Electric Motor, Style 1610212, 24 Volts 160 oz/ft 27 Amps, 100 RPM.....8.95
G. E. Motor, Type BC 115 VDC 1/6 HP 1725 RPM Hour Wound Rebuilt.....7.50
G. E. Motor Series, Mod. 5PS56HC18. 60 VDC 1/20 HP, 1.4 A. 5500 RPM.....2.85
G. E. Motor, 230 Volts DC. 6.75 HP. 1100 RPM flange mounting.....$0.00
General Industries Phono Motor, 23200, 115 VAC, 60 cy. 0.5 A. 80 RPM.....3.75
General Industries Phono Motor, 23200, 115/220 VAC. 60 cycle. 0.5 Amps. 80 RPM.....4.00
Universal Elec. Co., 115 VDC 500 RPM, 12A.....4.50
EMC 110 VAC 60 cy. 1/40 HP 1725 RPM L.N..4.50
EMC 110 VAC/DC 1/20 HP 200 RPM.....8.50
EMC 28 VDC .6A 1 RPM.....4.85
G. E. 27 VDC .5A 250 RPM 80 oz. in Torque L.N.....2.50
G. E. 115 VDC 1/30 HP 1750 RPM shunt.....4.00
Electric Spec. AC motor BF51R 440/3/60 cy., 2.5 HP 1750 RPM. Self braking.....28.50
Barber Coleman Servo Motor, YLC 2189, 24VDC 1.0A 100 lbs. Torque 1.5 RPM.....6.95
White Rogers Servo MTR 6904X-27 Type 3 24VDC 1.18, 150 in. lbs. 2½ RPM.....8.95
White Rogers Model 6905X-46 Type 3 24VDC. .65A, 50 in. lbs. Torque, ½ RPM.....7.95
Oster 6VDC 1.8A 5000 RPM 6 oz./in. torque w/Torrington #1½ blower, 50 CFM.....4.50
Oster 27VDC, 1/100 HP 7000 RPM w/L-R #2 blower 50 CFM.....2.50
*5% Tolerance.

MAGNETRON AND KLYSTRON TUBES

2J26	$10.00	714 AY	$ 8.50
2J27	10.00	720 AY	25.00
2J31	15.00	720 GY	25.00
2J34	25.00	728 AY	25.00
2J40	25.00	728 BY	25.00
2J48	35.00	728 CY	25.00
5J23	35.00	728 DY	25.00
5J29	35.00	728 EY	25.00
700 A	15.00	728 FY	25.00
700 B	15.00	728 GY	25.00
700 C	15.00	725 A	25.00
700 D	15.00	723 AB	12.50
706 BY	35.00	417 A	9.00

CHOKES AND TRANSFORMERS

Raytheon S. M. Chokes. UX7776. 1.28 Henries 130 MA 57 ohms.....$ 1.00
Raytheon S. M. Choke, &X8675. 15 Henries 28MA 1050 ohms.....50
Raytheon S. M. Choke, UX9116. .03 Henries 2A (Rectifier Choke).....2.25
Raytheon Choke Assembly, CRP30509. 1.8 Henries 0.384A.....1.50
Raytheon Dual Choke. WX5146. 1.5 Henries 400 MA 1.5 Henries @ 400 MA.....1.75
Raytheon S. M. Choke. (Rectifier) UX9114A. 0.100 Henries 1.4 Amps.....2.00
G. E. #7385576. 87.9 Henries @ .0672 Amps. 7.5 KV DC Test Volts.....10.00
Amertran, 20 Henries @ 45 MA.....75
Sprague, 15-E4-91-400-50P.....4.95
Fast, 15-E5-1.33-700-50P2T (Z1743).....3.00
Raytheon, UX7361A, blocking oscillator, 3 windings, 2-3 micro seconds, peak pulse 300-400. Repetition rate up to 4000 Cy.....1.00
Raytheon, Input, UX9216A, Pri. 10,000 ohms impd. Sec. 2x 25,000 ohms.....1.00
Raytheon Sweep, UX8725A. Pri #1 1600-0-1600 turns. Sec. #2 800-0-800 turns. Sec. #3 & #4 1600 turns.....1.00
Raytheon, Auto, UX7548, Pri. 26V Sec. 10.8V 400-800 cy.....1.00
Raytheon, Interstage, UX7587C. Pri. #1 & #2 15,000 ohms impd. Sec. 67,500 ohms.....1.00
Raytheon, Phasing, UX8724. Pri. 115 VAC, 60 cy. Sec. 15V 0.5MA.....1.00
Raytheon, Interstage, UX8442, Pri. Minus 40V Sec. plus 40V.....1.00
Raytheon AC-RC UX7358, Pri. 115 VAC 400 Cy. Sec. 6500V. .005A.....1.00
Raytheon, Filament, UX8486A. Pri. 115 VAC 400 Cy. Sec. 5V @ 5A, 13500 WVT.....1.00
Raytheon, Output, UX7489A. Pri. 3600 Ohms. Sec. 720 Ohms.....1.00
Raytheon Plate & Fil, UX8547. Pri. 115V 400 Cy. Sec. 1000V 25MA. Sec. #2 6.15 V 0.7A. #3 2.5 Volts @ 5 Amps. 3 KV Test.....1.00
Raytheon Pulse Transformer WX5137. Pri. 4 KV, 1 MU. Sec. 16 KV 16 Amps. Fil. Trans. Pri. 115V 60 Cy.....2.00
Raytheon Fil. Type U-8370 Pri-220/440 60 Cy. Sec. #1, #2, #3-2.5 Volts @ 5 Amps. Sec. #4 2.5 Volts @ 15 Amps, 3 KV Test.....6.50
Raytheon Dist Type CRP-30382. Pri. 220/440 V 1.71 A. Sec. 145 V @ 6.53 A. 4000 V.T.....14.50
Raytheon Fil. U-5083 Pri: 220/440 V 60 Cy. Sec. 5 Volt @ 30 Amps. 1780 test Volts.....10.95

TRANSFORMERS

Thordarson (70R82) 350-0-350 sec.; 115 V 60 cy; 145 Mils: 5V @ 3A; 6.3 VCT @ 4.5A.....$ 4.25
Jefferson Fil. 115 V 60 cy; 20 Volts 10A.....3.95
Power, Thordarson (92R21) Sec. 380-0-380 Volts @ 200 MA; 5 V @ 3A; 6.3 VCT @ 5A.....4.95
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Power, 430 VCT 145 MA; 6.3 V 5A; 5V 3A.....3.50
Open Core Power, 18 V @ 6A.....2.95
Power, 1600 VCT 70 MA; 5V 2 A; 6.3 V 2A.....2.50
Audio-Output-Pri. 5000 Ohms Sec. 16 Ohms Hermsealed.....95
Mike Trans-Pri. 150 Ohms Sec. S. Grid. Ratio 20:1. "UTC".....85
Mike Trans-Pri. 35 Ohms Sec. 600/200 Ohms.....75
Input—Ration 1:2 Freq. Resp. 500-15,000 within 3 Db.....60
Audio-Federal "Ouncer" Pri. 8000 Ohms Sec. 600 Ohms.....60
Mike Trans-"Ouncer" Pri. 300 Ohms. Sec. .25 Meg.....50
Output Trans. BC 221, 125 Ohms.....35
Elec. Spec. Autotrans 21P1. Output 2.3 Amps. 6 @ .002 A.; 5V @ 3A. 6.3 V .6 A.....
Raytheon Fil. CRP30452. Output 7.5 V @ 2.5A; 10VCT @ 6.5 Amps., 20 V @ 13 Amps.....4.95
Raytheon Fil. U8964, Sec. 2.9 V @ .19 A.....1.95
Raytheon Plate and Fil. U8848. Output 600 VCT @ .135 A.; 6.3 V @ 5 A.; 5 VCT @ 3 A.....3.75
Raytheon G. P. U8844A outputs #1 and #2200 V @ .35 A.; Output: #3 and #4, 20 V @ .01 A. Sub Sig. Co. Plate U7412, Sec. #1 and #2, 300 Volts @ .5 Amps.....3.50
Raytheon Plate and Fil. U3508A., Outputs 640V @ 80 MA; 6.3 V @ 3.2 A.; 5V @ 3 A.....7.95
Raytheon Plate and Fil. U8824. Outputs 770 V @ .07 A.; 5V @ 3A. 5V @ 6A.; 2.5V @ 10A.....3.00
Raytheon Plate and Fil. U7420. Sec. 225 V @ 180 MILS.....3.95
Plate and Fil. U8379. Outputs 750 VCT @ .113 A.; 6.3 V @ 5 A.; 5 V @ 3 A.....2.25
Raytheon Plate and Fil. U3508A Sec. 640V @ 80 Ma.; 6.3 V @ 3.2A.; 5 V @ 3A.....3.95
Raytheon Plate and Fil. Type U8824. Sec: 770 V @ 7 A.; 5 V @ 3 A.; 5 V @ 6 A.; 2.5 V @ 10 A.....3.00

AMERTRAN HEAVY DUTY TRANSFORMERS. Pri 115/230 VAC 60cy. Sec. 4730/2365. KVA 1.66 RMS 12 KV Wgt. 50 lbs. 11"x11"x9". New.....$27.50

All items new except items notated LN (meaning like new). If not rated, 25% with order, balance C.O.D., F.O.B. Boston. Let us quote on your requirements. Write for our Catalog. Minimum orders $3.00.

TRANSTATS

Amertran Voltage Regulator 11.5 KVA 50/60 cy. Commutator range 0-115 V. Max. Amps. 100. Reconnection diagram available for 230 V. 50 A oper. Brand New.....$100.00
Transtat—115 VAC 60 Cy. 25 KVA @ 217 A 103-126 V by Amertran.....9.45
Transtat—115 VAC 400 Cy. .5 KVA 5.5 A 92-115 V by Amertran.....2.50

COMMAND SET EQUIVALENT

BC 430. Excellent VFO using 2 Type 45's and 2 Type 10 tubes, 40 Watts CW with one coil. (Coil Ranges: 2-2.5, 2.5-3.2, 3-3.6-4.5, 4-4.8, 6-7.3, and 7.3-9 MC.....Your choice $ 6.95

AUTOSYNS, INVERTERS AND DYNAMOTORS

PE 206-Inverter, input 27 Volts DC, output 80 Volts, 800 Cycle 500 VA.....$10.00
PE 218 Inverter, input 27 Volts DC, output 115 Volts, 400 Cycles, 1500 VA Rebuilt, L.N.....15.00
G. E. Dynamotor, 5D48B8A input 14 V. D. C. output 1000 V. at 350 Ma. with filter.....5.00
MG-132A Inverter, input 11.5 V DC, output 140 V AC, 1.2 Amps. 350 cy. 1800 RPM 100% PF.....19.95
AY—1 Autosyn indicator 26 V 400 Cy 400 AY—2 14 Trans. Autosyn 26 V 400 Cy new/calibration chart.....10.95
AY—20 26 V Trans. Autosyn 26 V 400 Cy.....6.50

B. C.—604 F. M. TRANSMITTER

Wide or narrow-band FM. 30 watt power output. Excellent possibility for ten or eleven meter exciter. Range 20-27.9 MC. Working space permits modification. Complete with tubes but less power supply and xtls.....$11.50
L.N.
"TELEVISION" GUY WIRE—1/16" Dia. Galv. Perf. Steel. Excellent elasticity. Rust proof. Ideal for television antenna installations. 1000 ft. rolls...$3.00/M
WESTERN ELECTRIC PRECISION CRYSTALS—40 Meter Band 7270 KC 95c ea. 2 for.....$1.75
BATTERY CHARGERS—Input 115 V 60 cy., Output 7.5 Volts @ 6 A. Portable Insulated leads. Each...$8.25
INTERCOM SETS—Two way system for YR shack and home. Battery operated. Complete w/wire, per set.$9.95
"BEAM INDICATOR" SELSYNS—GE model 2J1G1. Operates from 57.5/57.5 volts 400 cycles w/wiring diagram for 110 V 60 CY. $2.50 pair. Also available GE Model 2J1F1 115/87.5 Volts 400 CY. Pair.....$3.00
ANTENNA CHANGE OVER SWITCH—SPDT, knife operated. Heavy duty. Isolantite insulation. Each.....25c
HEINEMAN CIRCUIT BREAKERS—24 VDC @ .220 AMPS, SPST 95c ea.; 0311 M-10, 24 VDC @ 10 A. SPST $1.45. 0322M-10 24 VDC @ 15 AMPS. DPDT.....$2.25
SOLDERING IRONS—JACKSON "STANDARD" No. 323. Removable tip 150 Watt 115 VAC/DC $2.95. General Electric Model 1-79 115 VAC/DC 250 Watt. Removable tip. Heavy duty.....$7.50
CARBON PILE VOLTAGE REGULATORS—BENDIX/ ECLIPSE TYPE 956 Model 1 Style A, 13 Volts..$1.25
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PANEL LAMPS—#44 and #47 @ 55c per carton 10; #51 at 45c per carton 10.
NEON LAMPS—NE 45 @ 20c each; NE 48 @ 15c ea.; NE 32 @ 25c ea.; NE 2 @ 8c ea.; cartons of 10 only. 110 V PILOT BULBS 656, DC BAY. 18c 10/ 1.25
CATHODE RAY TUBES—5BP1 @ $3.00; 5 BP4 @ $4.95; 5 CP1 @ $3.50; 3 EP1 @ $2.95; 5FP7 @$2.00
TV SCREEN (Frosted Glass) 25½x25½x3/16....$3.00
SHEET ALUMINUM 1/8"x24"x27" @.....$2.00
WEST WATT HOUR METERS
Type CS, 240V/60cy/1ph 15 Amp., 3 Wire....$12.50
Type CS, 120V/60cy/1ph 15 Amp., 2 Wire.....9.50
Type CA, 120V/60cy/1ph 15 Amp., 2 Wire.....9.50
METAL BOXES—
23½"x21"x18" (Clean) @.....$8.45
10"x12"x38" (With compartments).....$2.50
10"x15"x30" (With partitions).....$2.50
12½"x12½"x9" (Clean).....$2.50
10"x10"x12" (with hinged door).....85c
HARDWARE BY THE POUND—Our assortment of screws, nuts, washers, cable clamps, lugs, spacers, springs, etc. 10 lbs. assortment.....$5.00
25 lbs. assortment.....$10.00
SOCKETS—
OCTAL TUBE—Either in red or blue bakelite. MTD in metal plate. Each.....10c
MINIATURE—"POLY" with metal flange. 10 for..$1.25
MAGIC EYE—with 8" of wire attached. Each.....25c
AMPHENOL—4 and 5 prong steatite sockets W/out MTG rings 6c ea.; 10 for.....50c
TRANSMITTING—Heavy Duty 8 prong isolantite, ea..15c
10/$1.25; 4 or 5 prong. Each.....12c
"CINCH" OCTAL ISOLANTITE WITH MTG PLATE 15c; 10 for.....$1.25
HOT SPECIALS—CONDENSERS—
2x50 MFD @ 150 WVDC TUBULAR GUDEMAN @ 50c
40 MFD. @ 200 WVDC TUBULAR GUDEMAN @ 35c
16 MFD. @ 150 WVDC TUBULAR GUDEMAN @ 25c
.1 MFD. @ 600 WVDC TUBULAR AEROVOX @ ea. 15c
.25 MFD. @ 600 WVDC AEROVOX OIL IMPREG TUBULAR CAW 481074 17c ea.; 10 for.....$1.50
Same as above but 400 volt 15c ea. 10 for.....$1.35
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DELUXE STREAMLINED CABINET RACKS—chrome decorated. Hinged door on top and back catches. Fits standard 19" panels. Black crackled. 28½" H., 15" deep. Panel space 26¼" (LN) $15.00.....2/ $27.00
CABINET—STREAMLINED. Black crackled. Hinged cover on top. Uses standard 10" panel. 21½" L. 15" D. 11" H. Ideal for low power transmitter. Receiver or P. A. System. Price @.....$7.50
MCELROY TAPE PULLER TP890-B. Speeds from 0-1100 R.P.M. Can be obtained by knob pointer. Used to track standard ¾" paper tape. Also winds tape on standard 16MM 400 foot motion picture reels. 115/1/60. 10¾" x 11¾ x 7½. Price.....$16.00
TOWNE NAME PLATES #671 1¾" x 2¼". Graduated from "0-10". Black background. 10c.....15/$1.00
DAVEN SOUND ATTENUATORS TYPE—350 A 30/30 ohms. 2DB attenuation. Will dissipate 10 W. Linear Ladder network.....$2.50

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Compact Stroboscope

(*Continued from page* 45)

of the wiring be connected directly to the case because of the danger of a short circuit through the power line. The shorting switch across the primary of the output transformer should be kept closed at all times unless the secondary of the transformer is connected to a suitable load. The high voltage surges developed under open circuit conditions may cause the transformer to break down internally. As an added protection against voltage breakdown of this transformer, it is well to dip it in an insulating varnish and either bake in an oven or dry over a hot air register.

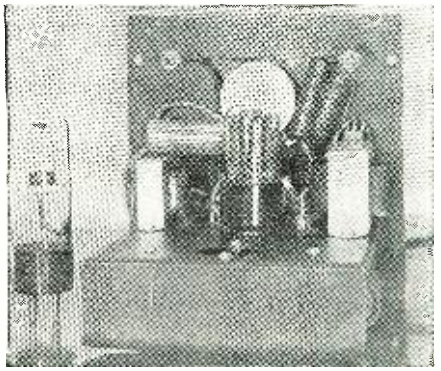
The *Strobotron* and reflector must be inserted after the chassis is fastened in place in the cabinet. This can be accomplished without difficulty by tightening the screw that holds the reflector with a stub screwdriver while the reflector is twisted to one side. The reflector can then be twisted back into the correct position after the mounting screw is tight, and the 1D21 (631P1) tube can then be inserted in its socket. The reflector was removed from a *Univex* flash outfit and is ready for use by bending the mounting to the correct shape. A similar reflector could be formed out of sheet aluminum in case the constructor does not have a flash unit to dismantle.

Uses

If the strobe light is focused on a piece of moving machinery and the frequency control properly adjusted, the moving part will appear to stand still. This is an optical illusion which is caused by the fact that the tube flashes momentarily to catch the moving part in the same position each time. A slight frequency adjustment will make the moving part appear to rotate very slowly either forward or backwards, depending on whether the flashes are faster or slower than the speed of rotation. Many fascinating experiments are possible and an irregular movement or vibration in high speed machinery can be apparently slowed down for easy visual inspection.

If a simple switch is arranged to trip

Fig. 6. Front view of chassis. The Sylvania Strobotron is shown at the left of unit.



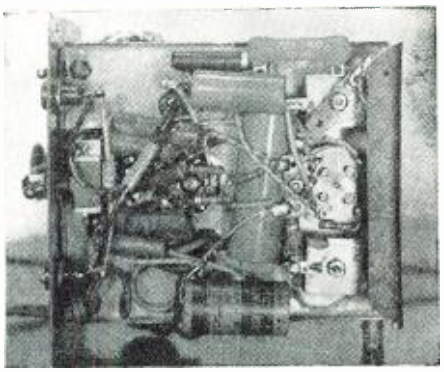


Fig. 7. Bottom view of stroboscope chassis.

from the shake when a shaft or flywheel is out of balance, (see Fig. 2A) this switch can be used with a small hearing aid battery, a resistor and condenser, to trigger the light for dynamic balancing. The tripping switch may be a simple finger of sheet brass. The circuit is so sensitive that a slight momentary contact is sufficient to trip the light. A 90 volt battery is recommended to aid in overcoming high contact resistance. The principle is similar to that used in wheel balancing outfits found in garages, etc. A series of numbers marked with chalk around the edge of the wheel or shaft being balanced will assist in locating the points where weights must be applied; this will be opposite the point stopped by the light. Automobile wheels can be balanced without removing them from the car by using a slightly different set-up. An electric motor must be used to drive the wheel at high speed through a friction pulley. The switch used for tripping the light can be made up from a *Microswitch* with an extension arm, and it should be arranged to trip through vibration of the car axle which must be free to vibrate with the wheel being balanced. A bumper type jack will raise the car and allow the axle to float freely. The switch must be clamped to a rigid support with the arm touching the axle so that the slightest vibration is sufficient to actuate it. Numbers chalked around the outer edge of the tire will assist in locating the correct places for balancing weights. This method has the advantage of allowing for unbalance in axles and bearings which is not taken into account if wheels are removed from the car. It is of course necessary to clean out all loose mud and gravel from the tread before attempting to balance a wheel and tire. In balancing a flywheel or other object as shown in Fig. 2A, it is desirable to drive the flywheel with a small motor which may be placed on a sponge rubber pad to allow the whole assembly to vibrate freely, the motor being fastened tightly enough to prevent its being thrown completely out of position.

Calibration of Light

Calibration in r.p.m. to make a direct reading portable tachometer is possible, and various check points can be easily located by observing shafts

turning at known speeds. Usually it is convenient to either watch a set screw or make a chalk mark somewhere on the gear or shaft under observation. An ordinary metal turning lathe offers a large selection of gear ratios suitable for calibration purposes. At 60 c.p.s. (power line frequency) a shaft must be turning 3600 r.p.m. to synchronize with the light. At 1800 r.p.m. there will be two flashes of light per revolution, at 1200 r.p.m., three flashes, and at 900 r.p.m., four flashes, etc. This fact is useful in checking speeds because when several flashes of light occur per revolution, each one will reveal the set screw or chalk mark in a different position, and by counting the number of positions we can determine the number of flashes per revolution. At higher speeds, the shaft may make two or more revolutions for each flash of light and this fact must be taken into consideration, otherwise it is possible to make an error in calculating the correct speed. A simple check is to speed up the frequency of the light and check for points of synchronization as each point will represent a fundamental or harmonic of the correct speed frequency.

The most convenient method of calibrating the light is to use a variable speed (a.c.-d.c.) motor driving a direct reading tachometer as with this set-up the entire speed range can be calibrated directly in r.p.m. in a very few minutes. A direct reading scale can be made up and pasted on the instrument, or a graph made up and a curve drawn. If only a few points can be located, the calibration curve will allow intermediate points to be interpolated. No calibration is needed unless the light is to be used in checking speed of rotation. Fundamental speed range is from 600 r.p.m. to 14,400 r.p.m. which is sufficient for most applications, and by using harmonics (counting multiple responses) the range is extended to cover from 60 r.p.m. to 30,000 r.p.m.

Pulse Output

A novel use of the 1D21 (631P1) tube is as a pulse generator. High voltage pulses are available from the secondary of the output transformer. These pulses are strong enough to ignite gunpowder, fire a gas engine, etc. (The *Stancor* output transformer can be replaced with a model airplane ignition coil if higher voltage pulses are wanted.) An electronic ignition system can be hooked up experimentally by feeding pulses from the timing circuit to the *Strobotron* and taking the ignition voltage from the secondary of the output coil.

Ignition timing can be checked by triggering the light with pulses from the ignition circuit. The higher intensity of the *Strobotron* makes it superior for observation purposes to an ordinary neon bulb. Many other applications of the light will undoubtedly occur to various users.

Output pulses can be used to actuate a relay or trigger a flashbulb (speedlight) for taking a picture at a particular point in the rotation of a moving object. A suggested diagram is shown in Fig. 2B. The input current required to trip the *Strobotron* is very small (touching the grid of the tube with the finger will initiate a discharge) but the output pulse is strong enough to trip a camera shutter or fire a flashbulb, speedlight, etc. —30—

READING TUBE NUMBERS

By JOHN W. MUMMA

ALTHOUGH I have been reading RADIO & TELEVISION NEWS for some time now, I have yet to see any mention made of a little trick that an old-timer in the radio servicing business told me about. It concerns the elusive type designations on glass tubes.

We all know about breathing on a tube to bring the numbers into view, but how many of us have tried to cause moisture to condense on a hot or even warm tube?

The trick I have in mind is to rub the tube in your hair, thereby taking advantage of an ever-available supply of light oil which will, when rubbed slightly, cause the numbers to reappear in the same manner as when the breath is used.

This trick has worked time and again for me, bringing out the numbers on either a hot or a cold tube. —30—

AMPLIFIER FOR SOUND ON FILM CONVERSION

By R. L. NEWLAND

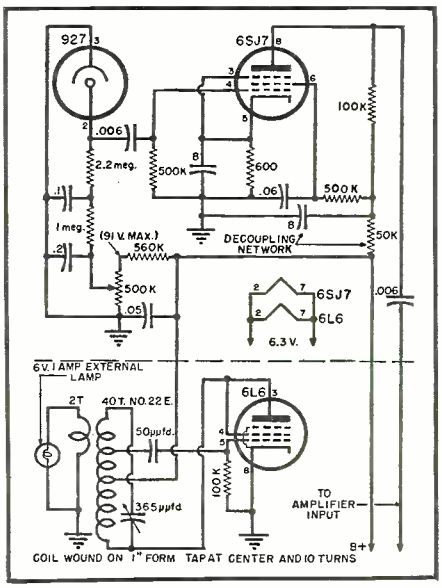
THE diagram accompanying this item is the last of several circuits tried for adapting any existing sound amplifier for sound-on-film conversion.

The 6SJ7 should be fully shielded, and I found that winding the tube itself with solder and then taping and varnishing contributed substantially to the good performance of the circuit.

The oscillator may be of any conventional type providing it is capable of delivering its required load.

This system works very well and at present is being used with a Vallette 16 mm. machine. —30—

Circuit for adapting any sound amplifier for sound-on-film conversion.



Break-in V.F.O.

(*Continued from page 47*)

3. *Semi-break-in:* This position is the same as No. 2 except that a time delay combination of a 1 μfd. condenser and a 220,000 ohm resistor in series is switched in parallel with the relay coil. This holds the relay in at normal keying speeds but will allow it to open again when the key is raised momentarily or between words. In noisy locations this type of break-in is especially suitable, and it seems to be the type of break-in used by more and more hams every day.

The relay used should be a sensitive type with an 8000 ohm coil or some value near that figure. Adjustable contact spacing is advantageous and the contacts should be set as close as is practical. A simple crystal diode noise clipper is very useful in the headphone circuit to wipe out the remaining bit of thump that may be present.

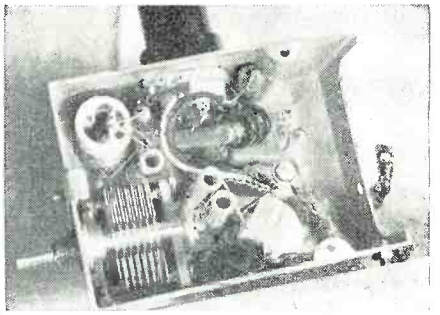
Other switches are provided to cut off the oscillator and, of course, the 117 volt a.c. supply.

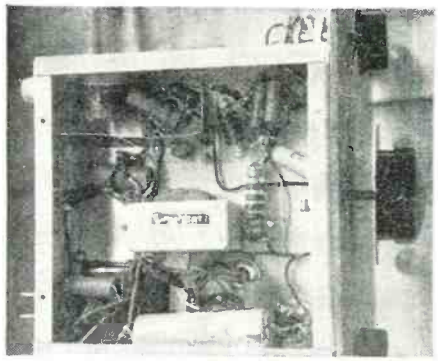
Across the rear of the chassis are the 117 volt supply plug, the break-in control terminal strip, and the coaxial output fitting.

No report less than T9 has been received with this v.f.o. and practically all are T9X. Some operators may prefer the keying change afforded by omitting the r.f.c. in the 6AG7 cathode circuit. However, with the components as shown we have had no reports of clicks even with a heavily biased final stage in the transmitter. Of course, the compromise between hard keying and the point where soft keying becomes hard to read at usable speeds is necessarily determined by considerations pertinent to each particular installation.

Coupling the v.f.o. to the transmitter may be accomplished in most cases by fitting an old crystal holder to the end of the coaxial cable and plugging it into the ex-crystal socket. With crystal circuits using a tuned cathode circuit it will be necessary to short out the

Oscillator box with cover removed. The tuning condenser is at lower left with coil above it, the bandset condenser is lower center. The zero temperature coefficient padders along with the bypass condensers are grouped around the tube socket. The power supply leads are brought out through the bottom near the rear. The grounding cable for box is shown at the rear of the compartment.





Underside view of base chassis. The power supply components are along bottom with filter choke in the center. The 6AG7 tube is at top right with its bypass condensers mounted across the socket to shield plate and grid. The output coil is in upper left hand corner and the shield for output stage is plainly shown. The large condenser at bottom is the 1 μfd. delay condenser. Beneath it is the 20 μfd., 150 v. filter condenser which is mounted directly on the socket of the VR150 tube.

tuned inductance for best results. In the Pierce type oscillator it may be best to bypass the oscillator stage and feed the v.f.o. into the next stage.

An alternative method is shown in Fig. 2 for coupling into the cathode of the crystal stage. This type coupling often gives increased output and also may cure oscillation grief that is present when the tube is working straight-through.

The stability of the unit in all respects is very good. Solid construction eliminates variations from vibration, and voltage regulation holds the oscillator steady. Frequency changes due to temperature variations will be slight if careful choice is made of components for the frequency determining elements. Actually it is not hard to construct a v.f.o. with stability comparable to most communications receivers in general ham use. A moment's reflec-

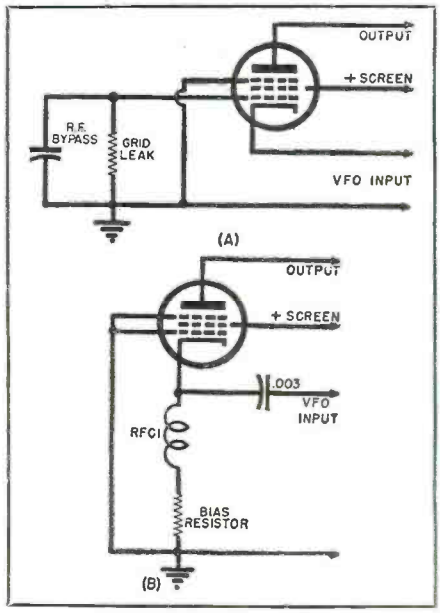


Fig. 2. Alternative v.f.o. coupling to the transmitter. A well screened pentode is recommended and conventional circuit values may be used in hooking up the unit.

tion of the complex problems that confront the receiver designer make it apparent that building a v.f.o. as stable as our receivers is a project well within the capabilities of the serious amateur.

Thoroughly filtered d.c. contributes to the purity of the note. A total of 36 μfd. and 15 hy. inductance plus the resistance of R_9 supply really pure d.c. to the oscillator and all critical voltage points.

The final output can be increased by elevating the voltage on the screen of the 6F6 output tube. However the unit as shown delivers about two watts of r.f. which is ample for most applications.

The newcomer to ham radio who has never used v.f.o. or break-in will find in this device the key to real operating pleasure, and the seasoned old timer will appreciate the businesslike utility of this compact, efficient unit. —30—

Customer Confidence
(*Continued from page 57*)

structures and if the new television home is near a large office building, hotel, or factory, the new owner should be shown how the presence of such structures affects television reception before the proper adjustments are made. This explanation can also assist in explaining to him why reception on one channel may be less desirable than that on another channel.

Such a "demonstration" will also serve to justify such specialized installation charges as may be required. When the customer understands that ghost images, low signal strength, various picture aberrations, etc., require different installation techniques he is more likely to pay such charges ungrudgingly.

Often the serviceman-retailer is asked, either in the course of selling the receiver or during installation, "When are we going to have network programs on television?" The answer is, of course, that there are network programs in operation now.

The Midwestern television net started operating commercially on September 20th. Chicago, Milwaukee, St. Louis, Detroit, Cleveland, Toledo, and Buffalo were joined via coaxial cables and microwave relays.

The rapidly expanding programming is of importance to dealers as it provides a wider market and larger audience, which in turn will attract more sponsors, which will result in better programs, and ultimately create a new and bigger demand for sets.

In the East, television network programming is old stuff. Boston, Schenectady, Providence, New Haven, New York, Philadelphia, Baltimore, Washington, and Richmond have been linked for some time and enjoy a regular interchange of programs.

Since the *Bell System* facilities are still limited, a somewhat unusual situation has arisen. Competitive networks are often in the position of vy-

ing for the same network facilities as well as the same station outlets. To insure a fair opportunity to all interested parties, a system of allocations has been established whereby each net or station may bid for the time segments during which it wishes to operate on a network basis. The allocations are then made according to the bids and the station or network is required to purchase this time. In the event that the station or network later wishes to relinquish this time, the period is made available to any other telecaster willing to buy it.

At the present time, network facilities are far from cheap. In Chicago, stations desiring network hookups eight hours a day will have to pay 35 dollars per airline mile per month. Two dollars per month per mile is the fee for each additional consecutive hour. Thus, a telecast from New York to Chicago would be billed on the basis of 975 miles. Despite the cost more and more network time is being purchased and as facilities grow this trend will tend to increase.

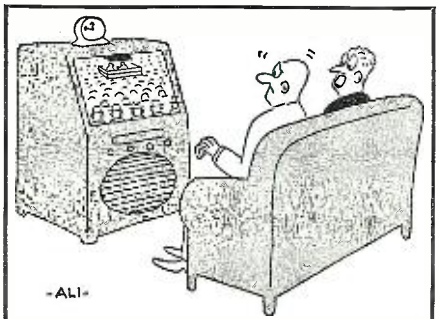
To date only "one-way" service is available on a single cable. Thus, a double cable is necessary to allow any two or more stations to transmit and receive each other's programs. In the case of the new Midwest network, WBEN Buffalo will be able to receive programs from Chicago but cannot transmit back because at the present there is only a single cable in operation and that is going east.

Early in January facilities were completed which include 5000 miles of intercity television networks linking fifteen cities from the East Coast to the Mississippi. Persons living in the eastern half of the United States will no longer be deprived of watching a World Series no matter where it is played.

Coaxial cable facilities for television require that repeater stations be established approximately every eight miles. The coaxial facilities are used for both telephone and television.

Daily, new and exciting things are happening in the television industry. Close to 1,000,000 sets were sold in 1948 and each set involves original installation plus upkeep and repair. Television is a wonderful shot in the arm for the serviceman providing he is prepared to do his part by preparing himself adequately.

—30—



"I know these are lousy fight seats, Joe, but I only could get a cheap TV set."

Miniature Transmitter

(*Continued from page 51*)

compact transmitter. Incidentally, the method used in marking the aluminum front panel may be of interest. Rectangular spaces were laid out with Scotch tape, and black enamel was brushed into the enclosed areas. After the enamel had dried, the tape was removed, and *Millen* white decals were applied on top of the enamel.

Tuning the transmitter is simplicity in itself. Select the combination of crystal and coils indicated on the tuning chart for the desired band, and insert them into their sockets. For operation on 80 and 40 meters, the buffer/multiplier coil is untuned, and it is necessary to adjust only the final plate tuning and the antenna loading. These operations are accomplished in exactly the same manner as in tuning a conventional full-sized rig; tune the final to resonance as indicated by a dip in cathode current, adjust the antenna loading for maximum output, and then recheck the final tuning. An accurate wavemeter should be used to make certain that the final is tuned to the correct frequency rather than to an out-of-the-band harmonic of the crystal. Metering is accomplished by inserting a plug, connected to a 0-25 milliampere meter, into the 12BA6 cathode jack (J_2). If output is desired on 20, 15, 11, 10, or 6 meters, the buffer/multiplier coil must be tuned to the band indicated on the tuning chart. This can best be accomplished by using the receiver, in addition to the meter, to determine resonance. Tune the receiver to the frequency of the buffer/multiplier coil, and with the r.f. gain turned down, the audio gain turned up, and the b.f.o. operative, adjust the trimmer on the top of the coil until the signal in the receiver and the reading on the 12BA6 cathode meter reach a peak simultaneously (the final plate tuning condenser should be set off resonance during this operation). The final plate tuning and the antenna loading should then be adjusted in the normal manner. On 6 meters, the dip in cathode current at resonance is not very pronounced, and the final tuning is quite critical; however, no trouble should be experienced if reasonable care is exercised. After the foregoing operations have been completed, all that remains is to plug a microphone or key into the correct jack, set the phone-c.w. switch, and you are on the air.

A general idea of what might be expected in the way of results can be gleaned from the contacts established with the rig in conjunction with a mediocre 80 meter zepp at the home location. Although time was not available to try the rig under ideal conditions, approximately ten different states were worked on 40 meter c.w. The best 40 meter DX was approximately 1000 miles into Kansas during crowded evening conditions. On 75 meter phone, the rig worked out approximately 100 miles, also under crowded evening conditions. Although the antenna is very inefficient on 20 meters, the signal from the little rig was RST 359 in Florida on a congested frequency. As far as the higher frequencies are concerned, just enough time was spent one evening on 10 meter phone to work 14 miles on the ground wave, and since the only active 6 meter amateur in the area lives next door to me, the best distance worked on 6 meters was approximately 100 feet. However, under favorable conditions, the transmitter should be capable of excellent results on this band as well as the others.

-30-

One of the better-known Canadian "hams" is Jibby whose boss Wilf Moorhouse operates as VE7US. The station that Jibby guards is a 500 watt maximum on phone all bands with PP810's in the final. PP811 modulators are driven by a limiting amplifier of VE7US's own design. The station is at Penticton, B.C.

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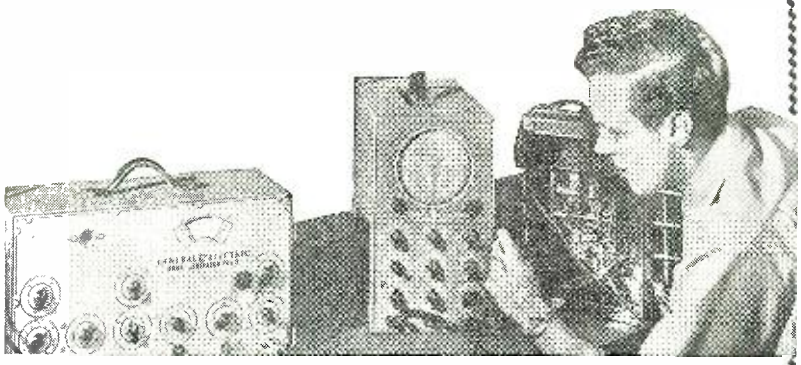

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What's New in Radio

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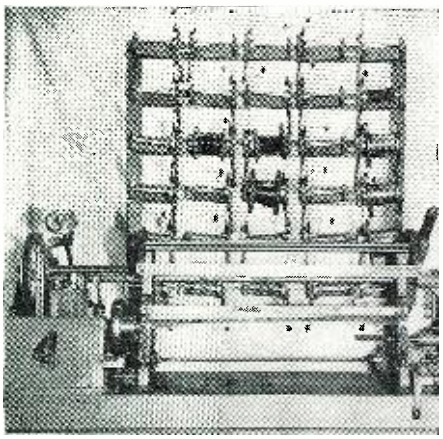
La Cesa Engineering Corporation of Chicago has recently introduced a multiple coil winding machine which is capable of handling up to 30 coils at once.

The new machine will take wire from sizes 14 to 44 and can wind coils



as large as 9" in diameter. The unit, which measures 26" in length, is equipped with knives to cut paper, a rack to mark coils, and a variable speed motor with rheostat. The carriage is operated by an a.c. solenoid, thus eliminating the necessity for a rectifier.

The forward-stepped and tilted rack keeps all tensions closer to the operator and prevents tangling, according to the manufacturer. Changing from one job to another can be accomplished in from 7 to 11 minutes.

For full details on this new multiple coil winding machine, address *La Cesa Engineering Corporation,* 5910-12 West Division Street, Chicago 51, Illinois.

NEW MOBILE FM UNIT

The Transmitter Division of the *General Electric Company* has announced production on a new single-unit mobile FM transmitter-receiver for communication in the 152-162 mc. band.

Designed for police departments, public untilities, taxi companies, and other agencies, the unit features high selectivity. The transmitter (Type ES-1-B) has a carrier frequency stability from minus 30 degrees to plus 60 degrees C of better than ±.002 per cent using a temperature controlled crystal. Its receiver selectivity is 60 kc. 50 db. down, for an adjacent channel and 120 kc., better than 85 db. down, for an alternate channel.

Operating off 6.3 volts d.c., the ES-1-B furnishes transmitter power of 20 watts.

Special features include quick-heater tubes in the transmitter; positive action relays in all control circuits; and jacks to measure directly all important receiver and transmitter circuits.

The unit measures 8" high, 8" wide, and 26" long. It weighs 46 pounds.

Additional data on the new 152-162 mc. equipment is available from the Transmitter Division, *General Electric Company,* Electronics Park, Syracuse, New York.

DISPLAY TUBE TESTER

Designed as a tube merchandiser to let customers see for themselves the condition of their tubes, the new Model 533 DM Display Tube Tester being marketed by *The Hickok Electrical Instrument Company* has several unusual features.

A big, 9-inch illuminated scale reads "Replace," "Doubtful," and "Good" so that the customer can easily interpret the actual test of his tubes. The Model 533 DM is precision built and incorporates the *Hickok* Dynamic Mutual Conductance Circuit. Complete flexibility has been provided in selector switches to take care of unusual base pin connections. The unit tests all present-day tubes and has provision for new tube designs to prevent early obsolescence.

The instrument uses rectified current to energize plates and grids, using two rectifiers. The meter shows micromho ranges of 0-3000, 0-6000, 0-15,-000 for the technician. A roll chart in the panel makes tube data easily and quickly available. A gas test provision quickly determines gassy tubes. The unit tests diodes separately with

low voltage to prevent paralysis of the elements.

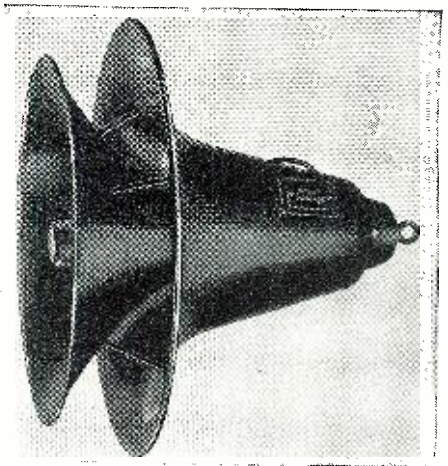
The manufacturer, *The Hickok Electrical Instrument Company,* 10524 Dupont Avenue, Cleveland 8, Ohio, will supply full details on request.

"HYPEX" PROJECTOR

Jensen Manufacturing Company of Chicago has just added the Model VR-241 ST-789 "Hypex" projector to its line.

The "Hypex" flare formula, which gives greatly improved acoustical performance particularly at the lower frequencies, according to the company, is incorporated in the design of this new model. The new unit is intended for installations where coverage of relatively large areas and suspension from the ceiling are desired.

The developed acoustic path length is 54 inches and the useful frequency response ranges from 140 to 6000 c.p.s. The voice coil impedance is 16 ohms, and the power rating is 25 watts maximum speech and music signal input.



The driver unit, an integral part of the assembly, has a phenolic diaphragm and Alnico 5 magnet and is completely enclosed yet can be removed and replaced if required. The connecting cable is passed through a rubber grommet into a terminal box and the leads attached to the screw terminals.

For further information on the new "Hypex" unit, write *Jensen Manufacturing Company,* 6601 S. Laramie Avenue, Chicago 38, Illinois.

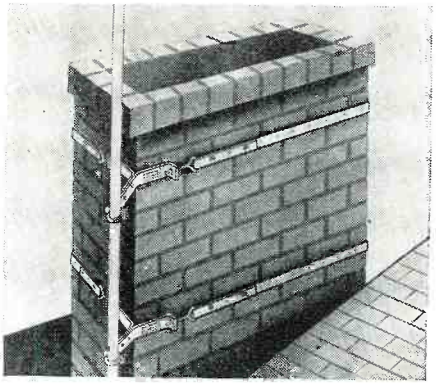
DUO-MOUNT ANTENNA BASE

South River Metal Products Company, Inc. has announced the availability of the "Duo-Mount" antenna base, designed specifically to be used in inexpensive antenna installations.

According to the company, the new base can be installed with only the use of pliers and a screwdriver. No special tools are required, nor is it necessary to drill surrounding concrete or brick or make any other structural changes in the building.

The base is made of strong alloy steel and features a riveted construction. The specially designed "U" bolt has a complete thread, and when the mast is inserted, gripping teeth corrugated into the steel prevent the mast from turning in high winds. The entire unit is finished in a dipped, corrosive-resistant aluminum paint.

The mount is fastened on any chimney, pole or similarly shaped extension by means of the straps. Any size tube, from ⅝" to 1½" o.d. or



any size pipe from ⅜" to 1", can be accommodated.

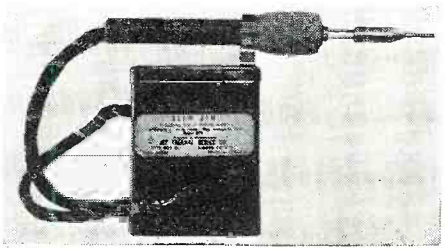
For additional information, inquiries may be addressed to *South River Metal Products Company, Inc.*, South River, New Jersey.

"SLIM JIM"

Jet Thermal Device Co. of Brooklyn is now marketing its "Slim Jim" soldering iron which is said to incorporate several new features.

The unit is approximately 9" long and weighs only 3 ounces. It is an all-purpose iron suitable for various radio and electrical applications. A new development is the interchangeable "Thermo-Cell" cartridge heads which permit greater flexibility of operation from precision soldering on voice coils to heavy duty work on chassis.

The replaceable thermo cartridges permit the iron to be converted to any desired wattage. The unit will operate from an ordinary storage battery, less transformer, making it suitable for



use in the field. It will, of course, operate normally on a.c. or d.c. low-voltage current.

Special non-oxidizing soldering tips, which are said to outlast many ordinary copper tips, will not freeze in the barrel and can be removed easily after many hours of use.

Further information is available from *Jet Thermal Device Co.*, 2873 86th Street, Brooklyn, New York.

NEW RESISTOR

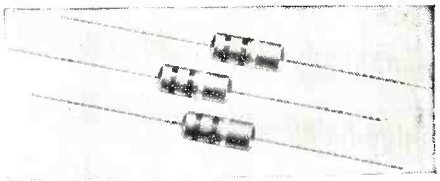
A new resistor for high-voltage applications is being manufactured by *International Resistance Company* of Philadelphia.

Designated the type BTAV, this new unit is a variation of the company's well-known Advanced BT with fea-

tures that enable it to operate continuously at much higher voltages than the maximum rated voltage of the standard BT resistor, and to withstand surges up to 6000 volts.

As a discharge resistor across a condenser in fluorescent "Quick Start" ballasts, in television bleeder circuits, and as a meter multiplier, this unit is particularly adaptable.

In construction, the BTAV type is much the same as the Advanced BT, except that the internal part of the lead wires is shorter, leaving a wide air gap between the lead ends. This reduces the power handling capacity



somewhat below that of the standard unit, but permits it to operate continuously at potentials up to 2000 volts.

Full details on the new BTAV may be secured by writing *International Resistance Company,* Philadelphia, Pa.

MATCHING TRANSFORMER

The broadband impedance matching transformer for use at frequencies between 50 and 225 mc. manufactured by *The Workshop Associates, Incorporated,* consists of a r.f. transformer with a specially designed polyiron core, mounted in a small aluminum container.

At one end is mounted a standard miniature connector for attachment to a 72 ohm unbalanced coaxial line. Out of the side, a 6 inch piece of 300 ohm balanced line is provided, permitting matching of the 72 ohm unbalanced coaxial line to the 300 ohm bal-

anced line. A solderless W50 RG-59/U cable connector is supplied with the transformer.

The Workshop Associates, Incorporated, 66 Needham Street, Newton Highlands, Mass., will supply further information on this item.

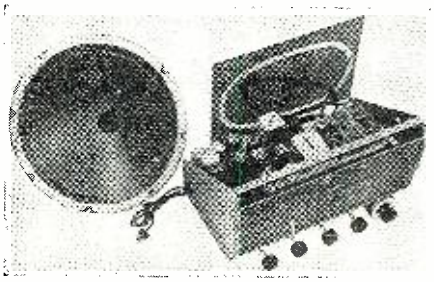
AM-FM CHASSIS

Espey Manufacturing Co., Inc., of New York has introduced the new Model 511 AM-FM receiver chassis for custom installation applications.

Incorporating the latest engineering features, the FM circuit includes a tuned r.f. amplifier stage, two stages of high-gain i.f. amplification, and an advanced design ratio detector circuit which provides low noise level between stations and freedom from AM interference, according to the company.

The AM circuit includes a tuned r.f. amplifier. The unit will cover the AM band from 535 to 1720 kc. and the FM band from 88 to 108 mc.

The Model 511 is supplied ready to operate, complete with tubes, antennas, speaker, and hardware for mounting in a table cabinet or console. The chassis measures 13½"x8½"x10" and weighs 16½ pounds.



Espey Manufacturing Co., Inc., 528 East 72nd Street, New York 21, New York has further details and literature available on this unit.

SIGNAL BOOSTERS

The new signal boosters introduced by *Regency Division, Idea, Inc.,* have an amplifier circuit which is fully neutralized so that the units may be cascaded without fear of oscillation.

These signal boosters are designed so that either 300 ohm parallel-line or coaxial cable may be used.

These signal boosters are available for the 10 meter, 6 meter, and 2 meter amateur bands; the television models are available for the low frequency band (Channels 2-6) and the high frequency band (Channels 7-13).

For complete information on these signal boosters, write to *Regency Division, Idea, Inc.,* 4125 E. 10th St., Indianapolis 1, Indiana. —30—

SERVICEMEN'S ASSOCIATION NEWS

THE William Penn Hotel, Harrisburg, Pa., was the scene on January 16 of the first monthly meeting in 1949 of the Federation of Radio Servicemen's Association of Pennsylvania. David Krantz of Philadelphia was re-elected chairman, while Robert Riedy of Bethlehem was chosen vice-chairman, and John Rader of Reading was re-elected secretary-treasurer.

The Federation awarded the Plaque for Outstanding Service to the Radio Service Industry in 1948 to *Philco Corporation* on February 13. The award was in recognition of the benefits derived from the excellent course in Television which was made available to all Association members.

The Philadelphia Radio Servicemen's Association held a meeting on January 18 in studios of KYW for the purpose of choosing 1949 officers and new members for the board of directors. David Krantz was voted in as president; his fellow officers will be Richard G. Devaney, vice-president; Frank P. Gerhard, recording secretary; John Zagury, corresponding secretary; and Stanley Myers, treasurer and editor.

The board of directors of the Philadelphia Association includes Larry Oebbeke, Paul Lau, Gail Woodward, George Greenberg, and Stanley Winiarski. —30—

Parabolic Antenna

(*Continued from page 39*)

stage allow optimum placement of the necessary illuminating elements. Upwards of one hundred lamps of the motion picture and theatrical type are often used to light as many as six sets at once. Remote control switches, operated by push-buttons in the monitor rooms, control the banks of lights.

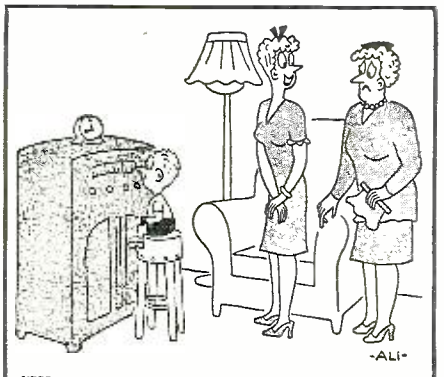
The physical facilities of the station include four studio image orthicon cameras, four remote cameras, two film projectors complete with synchronizing generators, distribution amplifiers, monitors, and an impressive assortment of auxiliary equipment.

The television sight and sound transmitters occupy a room 45 feet square on the second floor of the building. Monitor facilities for checking the carrier frequencies of the transmitters, the modulation of the transmitters, and the outgoing signal and waveform are continuously available. A coaxial cable patch bay, one of the first in the country, is used for changing signal connections throughout the building as may be required.

The control room windows are equipped with green shades so that the lighting in the control room can be adjusted to a comfortable level. The control room-to-studio windows are double and are slanted for maximum sound insulation and glare filtering.

The station transmits on Channel 2 (54-60 mc. band) on a regular schedule every day of the year. Both live and film program material is carried. The station transmits on a visual frequency of 55.25 mc. and an aural frequency of 59.75 mc. The waves are horizontally polarized and best results are obtained by placing the conductors of the receiving antenna horizontally.

"The Mountain Shooter" is destined to play an even greater role in the intricate Don Lee video network upon the completion of a new transmitter being built atop Mt. Wilson at a cost of more than $1,000,000. When this transmitter goes into operation, the network will include the Mutual-Don Lee $3,000,000 studios at 1313 N. Vine Street, Hollywood, the present extensive Mt. Lee site, and remote pickup facilities. —30—



"We pay him the difference we save in electricity for snapping off commercials."

International Short-Wave

(*Continued from page 48*)

direct current of 16,000 volts; a motor room, communicating easily with the other rooms, where are located the various groups of converters necessary for supplying transmitters; adjoining rooms house studios, salons, modulation (control) office, engineers' quarters, and so on.

The construction of *Radio-Andorra* was begun in the middle of 1937. The installation was a particularly difficult one because of the two heights that had to be bridged, one of 890 meters and the other of 1640 meters.

During the winters of 1937-1938, the work was hampered by a thick blanket of snow which covers the ground for six months of the year. Furthermore, it was necessary to cut down part of the forest which is located on the mountain slope, so the feeder and its masts could have a clear passage.

Station *Radio-Andorra* was completed in July 1939, and on August 7 the first broadcast was radiated. Transmissions were interrupted for some months because of an accident to the equipment incident to the European War. Transmissions were resumed on April 27, 1940, on a regular basis. (They now take place daily at 1200-1430* and 1900-0100 Andorran time 0600-0930 and 1300-1900 EST.) Announcements are made in Spanish and French as *"Aqui, Radio-Andorra!"* and *"Ici, Radio-Andorra!"*, respectively. Programs are half in Spanish and half in French.

The station welcomes reception reports and will verify from Radio-Andorra, Roc de los Anelletes, Andorra la Vieja, Principality of Andorra, Europe.

Andorra is situated almost on the southern Spanish slope of the Pyrenees, between 42.45 degrees North latitude and 5.29 degrees East longitude of the Madrid meridian. Its boundaries are France to the East, North, and North-East; Spain to the West and South.

The country is an autonomous republic, founded during the Thirteenth Century. Since then on it has been under the protection of the Bishop of Seo de Urgel and the Earl of Foix, but the rights of the Earl of Foix have been transmitted to the Chief of the French State. Andorra was granted a constitution as a republic by Napoleon in 1806. It pays an annual tribute of 960 francs to France, and 460 pesetas to the Bishop of Seo de Urgel.

Andorra has an area of 485 sq. kms. (191 square miles), and its population, according to the official census of 1937, numbered 6231 inhabitants, scattered

* (Note: Unless otherwise indicated, all time herein is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

in six villages. It is a mountainous region which forms part of the Pyrenees. Its altitude varies from 880 to 3000 meters, Soldeu being the highest village (1825 m.) and San Julian de Loria the lowest (839 m.).

From the political point of view, Andorra is a Republic under the leadership of the two Co-princes—the Bishop of Seo de Urgel and the Chief of the French State. The Government is elected by general suffrage. The rights of the two Co-princes are alike and they legislate by common agreement. It is they, who in 1938 confirmed and approved the concession made to *Radio-Andorra.*

As we take our leave of *Radio-Andorra,* it is with this bit of description from the material furnished us by the station:

"In an angle of the building of *Radio-Andorra,* which harmonizes perfectly with the attractive landscape of the nearby mountains, the sentry-box with its loopholes reminiscent of the Thirteenth Century is lodged in a suitable site, and seems to protect the secrets of the valleys against the onslaught of new Saracen invasions. But although the building looks like one of those pleasant castles which characterized the Middle-Ages, it never prepares within its walls cauldrons of hot oil to pour over the heads of possible assailants . . . but under the Christian Cross — symbol of peace and love amongst men, which overlooks the sentry-box—*Radio-Andorra,* the most popular broadcasting station in Europe, invariably broadcasts its gay, yet dynamic concerts, trying to awake in the soul thousands of motives to force all human beings to unite in an atmosphere of kindness and without any misgivings. Amidst a majestic isolation, lies the slope of Andorra, mysterious mountains and valleys, whose bright legend reminds us of Charlemagne and the Middle-Ages. It is from this spot that daily to the world flashes out the familiar call, *'Aqui, Radio-Andorra!'* "

* * *

Standard Frequency

Through the courtesy of the *Universal Radio DX Club,* we present the following data on standard frequency transmissions, as compiled by Mike Fern, Hawaii, for the current s.w. log issued by *URDXC:*

WWV, 2.5, Beltsville, Md., 700 watts, 1900-0900 (1 and 440 c.p.s.); JJY, 4.0, Kemigawa, Japan, 2 kw., continuously (1000 only); WWV, 5.0, Beltsville, Md., 8 kw., continuously (1 and 440); WWVH, 5.0, Puuene, Hawaii, 2 kw., 2354-0035 and every 2 hours thereafter (1000 only); WWV, 10.0, Beltsville, Md., 9 kw., continuously (440 and 4000); WWVH, Puuene, Hawaii, 400 watts, continuously (440 and 4000); WWV, 15.0, Beltsville, Md., 9 kw., continuously (440 and 4000); WWVH, 15.0, Puuene, Hawaii, 400 watts, continuously (440 and 4000); WWV, 20.0, Beltsville, Mr., 8½ kw., continuously (440 and 4000); WWV, 25.0, Beltsville, Md., 100 watts, continuously (440 and 4000); WWV, 30.0, Beltsville, Md., 100

watts, continuously (1 and 440); and WWV, 35.0, Beltsville, Md., 100 watts, continously (1). WWV and WWVH give two time services—a tick every second (omitting the 59th second in each minute), and a break in audio modulation for one minute in each five. The *beginning* of this break is the accurate time signal. The call and GMT time are given in code during pauses. WWVH closes down briefly each day to check its standards against those of WWV. WWV is accurate to less than one part in 50 million; WWVH, to one part in 10 million. JJY sends steady 1000-cycle tone for 4 minutes, starting on the hour and 10th minutes), its call, and the number of minutes past the hour during the fifth minute, then sends one dot each second (omitting the 59th second in each minute) for five minutes; its accuracy is 3 parts in 10 million (audio and radio frequencies), and 0.03 seconds (time).

* * *

DX Sessions

Radio Sweden, Stockholm, will celebrate the 20th anniversary of the International Short Wave Club, of 100, Adams Gardens Estate, London S. E. 16, England (formerly of America), in a 30-minute broadcast on April 23 at 0230 on 6.065, 9.535, and repeated 1630 on 10.780, 15.155, and 2030 on 6.065, 9.535. Arthur E. Bear, secretary of ISWC, will be presented by transcription to give a history of the club and to comment on the possibilities of such broadcasts for international goodwill and friendship. There also will be messages from DX-ers in various parts of the world, including your ISW Dept. editor. The program will be directed by Arne Skoog, Stockholm, who is chairman of the International League of Short Wave Editors.

According to present plans, the BBC, London, will dedicate a half-hour program to the ISWC in October.

Current schedule for "Sweden Calling DX-ers!" is Saturdays 0215-0230, 6.065, 9.535; 1015-1030, 10.780, 15.155; and 2015-2030, 6.065, 9.535. (Skoog, Sweden)

* * *

Hse

The International League of Short Wave Editors for 1949 is composed of these directors:

Europe—Arne Skoog, chairman, Ridvagen 14, Danderyd, Sweden.

America—Wm. Howe (inactive at present due to studies), 3940 Second St. S. W., Washington, D. C.; Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia.

Australia—Rex G. Gillett, 170, Churchill Road, Prospect, South Australia.

New Zealand—Arthur T. Cushen, 212, Earn Street, Invercargill, New Zealand.

Africa—Ernest H. Stephan, "Louvain," Bell Road, Claremont, C. P., South Africa.

* * *

Club Notes

England—Departments of the British Short Wave League are: Headquarters, 145, Uxendon Hill, Wembley Park, Middlesex; Hon. General Secretary (to whom all general correspondence such as applications and renewals should be sent), A. W. H. Wennell, headquarters; Hon. Manager, W. H. C. Jennings; Hon. Editor, N. A. Phelps; "Review" Despatch, P. R. Vasey; scribes, to whom all news and

Kalman A. Leichtman, the first U. S. Merchant Marine radio officer to be licensed by the U. S. Coast Guard, is shown receiving his certificate from Capt. Herbert A. Daub, Master of the U. S. Army Transport "E. B. Alexander" aboard which he is serving. This Coast Guard certificate for the first time gives radio officers actual status as ship line-officers. Mr. Leichtman formerly served as a radio officer in the Normandy campaign, in southern France, and in the Okinawa campaign in the Pacific.

reports for publication in *Short Wave Review* for the appropriate bands, should be sent include—10 meters, C. S. S. Lyon, 15 Ullet Road, Liverpool, 17, Lancs.; 20 meters, N. A. Phelps, 17, Leaside Mansions, Fortis Green, London N. 10; 40 meters, John L. Hall, 2, Coombe Court, St. Peters Road, Croydon, Surrey; 80 meters, C. S. S. Lyon (same as for 10 meters); and short-wave broadcast stations, R. V. Aldridge, "Aprillis," New Road, Amersham, Bucks. In charge of the technical section are D. W. Poulston, T. Vallard, M. Coombe, T. H. Carter, M. Bamford, J. H. D. Down, H. Staniforth, E. M. Barlow, R. White, others; translation service is in charge of W. F. Morris (Dutch), N. A. Phelps (French), D. H. G. Tyrrell-Lewis (German), W. A. Welsman (Spanish). Other officials include E. J. Logan, L. J. LeBreton, A. Ward, L. S. Adams, C. G. Bagley, J. Fost, F. Furlonger, others.

United States—One of the best s.w. logs I have yet seen has just been issued by the *Universal Radio DX Club;* it was compiled by Mike Fern, Hawaii, and is up-to-date and highly accurate; the next issue will come out in about five months. Anyone wishing details as to membership in and services provided by this club should write *direct* to the club president, Charles Norton, 7507 Holly Street, Oakland 3, California; a dime should be inclosed to cover cost of sending a sample of the club's publication.

The *Short Wave Listeners Registry* has separated itself from the Hobby Exchange. The latter is now issuing a separate bulletin called "International Hobby Registry." Current officials of the SWLR are Glen Jensen, president; Russ Bearinger, first vice-president; Mrs. Arthur McArthur, second vice-president; Steve Sidor, secretary; Bill Cooley, publicity director; Bill Camp, editor, and Bob Camp (W3NJL), radio editor. Address of club headquarters is 1042 Water Street, Moosic 7, Pennsylvania.

* * *

Verification Data

The Ponta Delgada, Azores, stations CSX2 and CS9MB verified by letter, stated they are local outlets for *Emissora Nacional de Radiodifusao.* (Driver, Ohio)

QRA of Leipzig is Mitteldeutcher-Rundfunk, Sender-Leipzig, Springerstrasse 20/24, Leipzig N. 22, Germany. (Dallmeier, N. Y.)

Reports for the new VLI stations in Sydney should be addressed VLI, Australian Broadcasting Commission, Box 487, G.P.O., Sydney, New South Wales, Australia. (Cushen, N. Z.)

R. N. Joyce, Forces Broadcasting Station, Lakatamia, Cyprus, says that he is "receiving an average of twelve reports from Sweden to one from other parts of the world." (Skoog, Sweden)

Address of PCJ is now P.O. Box 137, Hilversum, Holland.

Pearce, England, has received this data from the British Far Eastern Broadcasting Service, Singapore, Ma-

laya—"Technical reports, which give details of how our transmissions are received, are very much appreciated here. A report of reception covering a period long enough to indicate that it is not merely freak reception or deterioration will always receive a personal reply. Now that we are part of the British Broadcasting Corporation, we regret, however, that we have to inform you that it is not the Corporation's practice to verify reception reports which require details of transmitted program matter."

Radio Indonesia, Batavia, notified Pearce, England, that lack of personnel caused delay in answering mail but as of November 1, 1948, all reports and letters were being promptly handled.

JJOY, Greece, verified by airmail from The District Engineer, Grecian District, Corps of Engineers, Athens, Greece; stated is not connected in any way with the Armed Forces Network. (Pearce, England)

KZOK-KZPI, Manila, wants reports to Philippines Broadcasting Corporation, 4th Floor Ramon Foces Buildings, Soler and Calero Streets, Manila, Philippines. (Cushen, N. Z.)

HC2AK, 4.650, verified through letter from Guayaquil Radio Club, Casilla 784, Guayaquil, Ecuador; said it cannot send out verification direct because it is a commercial broadcasting station. (Cushen, N. Z.)

XLRA, 168 Victory Street, Hankow, China, asks for further reports. (Cushen, N. Z.)

QRA for ZOY, Accra, is Broadcasting Department, P.O. Box 250, Accra, Gold Coast, Africa. (Hankins, Pa.)

* * *

This Month's Schedules

Afghanistan—In a letter from The General Direction of Broadcasting, Afghanistan, it was said—"We have no short-wave transmitter, and we generally broadcast our program at 0830-1100 in this season in Pashto and Persian languages on 674 kc. (445.1 m.), with 20 kw. power in the antenna. We start with a flute signal, calling Radio Afghanistan, Kabul, giving talks, music, and finish with the National Anthem." (Block, Belgium)

Anglo-Egyptian Sudan—Radio Omdurman is still wandering around the 31-m. band in its daily 2315-2345 transmission in Arabic; varies 9.520 to 9.750. Pearce, England, also reports it on 9.750 with Arabic program 1400-1430.

Antarctica—Villela, Brazil, sends along this data—*British*—GCQ, 8.760, London, has been heard in contact on phone and c.w. with GFLF, 8.790, on the ship *"John Bisco"* during the annual relief trip to the British Antarctica bases of the Falkland Islands Dependencies Survey; station at headquarters base, GNME5, Marguerite Bay, has been heard to announce available channels as 7.600, 8.000, 8.800, 9.000, 9.400, 9.480, 12.600, 12.800, 17.600; heard in contact with GCQ on 9.400 and testing on 17.600 (1500-1600); GNME5 announced maximum power

250 watts on c.w. and 60 watts on phone; GFLF uses an American Navy transmitter (probably TBE CFN 52267), running only 30 watts on phone. GCQ announces power of 40 kw. GFLF has been heard on c.w. in contact with VPC, Falklands, using 8.350 at 1945. *Chilean*—CCW1, base of O'Higgins, has been using phone regularly to RAC7, 15.750 (approx.), Santiago, CCW1 being on approx. 16.650 (varies), at 0700 and 1600; also heard calling CCV7, 13.500, Santiago, at 1630. *Argentinian*—LOCI, aboard a ship of the Argentina naval fleet in the Antarctic, was heard contacting LQX, Antarctic base of Melchior, on 12.330 at 0820, on phone and c.w. LQX answered on 8.550 on phone; scheduled QSO on phone at 0905 with LOCI to use 4.650, 8.550, or 12.330, and LQX to try 4.650 or 8.550.

Australia—A *new* relay short-wave station of the Australian Broadcasting Commission is now operating from Sydney, New South Wales; takes relays from Home Service (National Network) of ABC, using non-directional antennas to areas of New South Wales where regular service does not reach, particularly along the seacoast. Schedule is Saturdays 1545-1730 on VL12, 6.090; Saturdays 1745-0315 (Sun.) on VL13, 9.500; Sundays 0330-0830 on 6.090; Sundays to Fridays inclusive, 1500-1745 on 6.090, and 1800-0315 on 9.500; Saturdays 0330-0900 on 6.090, and week days 0330-0830 on 6.090. (Radio Australia) The 6.090 channel is a fair to good signal here in West Virginia early mornings; has BBC news 0800 followed by domestic news and weather report for Sydney-Hobart area.

VLC, 15.20, has been replaced by VLC9, 17.84, in parallel with VLB8, 11.76, VLB2, 9.65, 1200-1315, for German language program to Europe.

After some difficulty *Radio Australia* seems to have found a satisfactory channel for its 1643-1815 East Coast of North America beam; now uses VLA5, 15.23, which is an additional frequency available to VLA5 which call sign is also allotted 15.32. Other stations used in this transmission are 1643-1815, VLB11, 15.16 (to Forces in Japan and Asia); 1655-1815, VLC9, 17.84 (to South America), and 1710-1815, VLG8, 9.68 (to British Isles-Europe); VLC9 continues through from the British Isles-Europe beam of 1500-1655.

I have just been informed by *Radio Australia* that in addition to 15.20, the 15.22 channel is available to VLA6 and VLB6.

Azores—CSX2, 4.845, Ponta Delgada, is scheduled 1700-1900, signs off with "A Portugesa;" has heavy QRM and CWQRM; the 11.090 outlet (CS9MB) is the better of the two, scheduled 1500-1600. (Driver, Ohio)

Barbados—VPO11, 11.475, Bridgetown, has been heard around 1700 with special tests for the Caribbean Press Association; announced frequencies of VPO11, 11.475, VPO16, 5.725, and VPO15, 5.040. (Bellington, N. Y.)

Belgian Congo—Leopoldville's OTC2, 9.767, is one of the best Africans, putting in a good signal all over the British Isles, reports Patrick, England; *English* transmissions are (for Britain and British Colonies in Africa) 1430-1530 and (for America) 2100-2300. Balbi, Calif., reminds that this station has a DX session on Wednesdays 2115.

Winkler, Michigan, reports OQ2RC, 6.010, Leopoldville, can be heard 1200-1300, and that OTM2, 9.380, can be heard 1100-1500; Rosenauer, Calif., has heard OTM2 from sign-on at 1100 to 1230 fade-out. Gimby, Sweden, reports *Radio Congolia*, 9.210, Leopoldville also, at 1215-1330.

Brazil—ZYK2, 6.085, has a Mailbag Program on Sundays 2145-2200. (Peterson, Sweden) PRL-7, 9.720, Rio de Janeiro, signs on 0750, off 2230 (some days may run a little later), good signal from 2100. (McPheeters, La.)

British Guiana—ZFY, 5.985, Georgetown, has been heard in Britain this winter. (Patrick) Schedule now appears to be 0545-0745, 0945-1145, 1445-2015 (Sundays 0745-0945). (URDXC)

British Honduras—ZIK-2, 10.598, Belize, recently has been heard around 1305-1333 (newscast); previously was heard at 1330. (Ferguson, N. C.) Gives local time as 1½ hr. *ahead* of EST. (Stark, Texas)

British Somaliland—Radio Somali, VQ6MI, 7.125, Hargheisa, has discontinued its *English* broadcasts, now in Somali on weekdays 0830-0940. (Bluman, Nor. Afr., via ISWC)

Bulgaria—Radio Sofia has been heard in Alabama on approximately 7.671 at 2250 with interval of 5 notes repeated 5 or 6 times; announces at 2300 as "Radio Sofia," then has news in Bulgarian; news repeated 0000; remainder of program mostly music, and sign-off is 0300 with march song. (Hagen) Has *English* session ending 1540. (Swedish DX broadcast) According to QSL card, this channel went into effect December 18, 1948; *English* scheduled daily 1530, 1650. (Pearce, England)

Burma—Rangoon, 6.035, heard in California, 0930-1015 sign-off; news 1000; fair level. (Rosenauer)

Canada—Patrick, England, reports good signal from CHNX, 6.130, Halifax, Nova Scotia, from 1815 onward. Since this station just recently returned to the air and is eager to receive reception reports, Patrick has arranged to send them a report monthly so they'll know how they are being received in Britain. He says there is a special Mailbag Program Saturdays 1830.

VE9AI, 9.54, Edmonton, Alberta, heard 2130. (Stein, Calif.)

Cape Verde Island—Praia's CR4AA is now on 5.895, reported logged in England 1800. (Harrison, England)

Ceylon—Announcement of Colombo's former *Radio SEAC* is now "This is the Forces Broadcasting Service of Radio Ceylon." (N. Z. DX Times)

Chile—CE622, 6.220, Santiago, heard signing off 2310 in *English*, asked for reports to Casilla 2626. (Stark, Texas)

CE920, 9.200, Puntarenas, heard signing on 1900, through bad CWQRM. (Jeffrey, Ontario) Heard signing off 2200. (Driver, Ohio)

China—Winkler, Michigan, reports XORA, Shanghai, back on 11.690 to 1000.

XGOA's 5.985 channel is heard in Toronto, Ontario, at around 0520. (Bromley) Other frequencies have been poor in the East lately, best seems to be XGOA on 15.105, 2100-2255, news 2115, 2230.

Latest XGOA schedules for overseas service are to North America, 2100-2300, 15.105; to Australasia, 0500-0550, 9.730; to Mongolia, Tibet, Japan, and Pacific Islands, 0500-0830, 9.730; to India, South Africa, Europe, 0800-0830 on 9.730, 5.985, 660 kc., at 0830-0900 on 9.730 *only,* at 0900-0915 on 9.730, 5.985, 660 kc., and at 0915-1015 on 9.730 *only;* news 2115, 2230, 0520, 0900.

XGOY, Chungking, has moved its 41-m. outlet from 7.153 to about 7.100. (Balbi, Dilg, Calif.) Is still operating on 15.172 early mornings, news 0700. Some days has fair signal here in West Virginia.

ZBW-3, 9.525, Hong Kong, is heard in Britain to 1015 sign-off with "God Save the King." (Pearce)

XMNG, 7.340, Nanking, is heard in Sweden with good strength to closedown 1010; news 1000. (Petersson)

XLRA, 11.500, Hankow, gives schedule of 1800-1915, 0500-100. (N.Z. DX Times)

A *new* Chinese reported on 9.500 is XAET, heard at 0630 when takes a long relay from XNCR (Communist-controlled). (Sanderson, Hutchins, Australia, via Radio Australia) XAET was first reported on 12.700.

Colombia—HJAP, Cartagena, *Radio Colonial,* is back on old frequency 4.925; closes 0100. (Petersson, Sweden)

Costa Rica—TIPG, 9.615, San Jose, heard with good level to 2215. (McPheeters, La.)

Cyprus—The Near East Broadcasting Station is heard on 6.135, 6.170, 9.650 at 2300-0130, all-Arabic programs. (Hagen, Ala.) The 11.720 channel is heard in Australia 0800 with news in Arabic. (Radio Australia) Heard in

(*Continued on page* 131)

AFCA NEWS

AFCA's National Meeting

This year's annual meeting, sponsored jointly by the Navy Department and AFCA's Washington Chapter, will be held in Washington, D. C., March 28th and 29th. The meetings in 1947 and 1948 were held at Fort Monmouth, N. J., and Wright Field, Ohio, and were sponsored, respectively, by the Signal Corps and Air Force. Secretary of the Navy Sullivan, in correspondence with the Association's President David Sarnoff, selected Washington as the location because of the proximity of the Naval Research Laboratories, Naval Gun Factory and the practicability of bringing Naval vessels, on which communications play so important a part, into the Washington Navy Yard near the Anacostia Naval Air Station.

The Navy is planning an outstanding exhibition and demonstration and the Association expects the largest attendance it has yet had. Only AFCA members will be permitted to attend the two-day meeting. The first day will include meetings and a luncheon, at which the chiefs of communications in the Army, Navy and Air Force will be the principal speakers, and the banquet, at which Admiral Denfeld, Chief of Naval Operations, and Senator Tydings and Representative Vinson of the Armed Services Committees of Congress will deliver addresses. The schedule for visits to Naval activities and demonstrations on the second day, March 29th, will not be announced until the afternoon of the first day.

The Shoreham Hotel will be AFCA headquarters at which the first day's meetings and the banquet will be held. All members of record of March 15, 1949, will be eligible to attend.

AFCA NEWS

Executive Committee Meeting

Vice-President A. W. Marriner presided at the regular quarterly meeting of the Executive Committee, held at AFCA National Headquarters in Washington on December 14th. The agenda included a discussion of the slate of new officers and directors to be voted on by the Council in May, and a review of the financial condition of the Association which has shown considerable improvement during the year.

Technical Schools Study

Mr. E. H. Rietzke, of the *Capitol Radio Engineering Institute,* and a life member of AFCA, is serving as chairman of a special committee on technical schools. The committee is studying the use of these schools during World War II with a view to recommending for consideration by the Army, Navy and Air Force improvements in the procedure followed at that time, should the services again decide to supplement their own schools by the use of selected private technical schools.

AFCA CHAPTER NOTES

Atlanta

Some 150 members and guests attended the December 1st meeting at the Officer's Club, Fort McPherson. Among those present were: Maj. Gen. Leland S. Hobbs, Deputy Commanding General, Third Army; Capt. W. A. Brooks, Senior Naval Officer Present Atlanta Area; Lt. Col. George H. Kneen, Commanding Officer, Marietta Air Force Base; and Mr. Hal S. Dumas, Sr., President, *Southern Bell Telephone & Telegraph Co.* The principal address was delivered by Rear Admiral Earl E. Stone, Chief of Naval Communications.

Baltimore

The *Bendix Radio Corporation* was host to the Baltimore Chapter at its meeting on November 17th. Following dinner and a speech by Mr. John W. Hammond, Manager of Communication Radio Sales, the members were taken on a tour of the various manufacturing activities of the *Bendix* plant.

Cleveland

Chapter members met on November 11th to hear Lt. Col. W. M. Healey, Division Outside Plant Maintenance Supervisor of the Long Lines Dept., *AT&T Co.,* discuss the coaxial cable and its possible use in television networks.

The December meeting was addressed by Mr. Frank E. Roush of the Air Materiel Command, Wright-Patterson Air Base. His subject, "Program Procedures," was most interesting from the standpoint of manufacturers who had handled contracts with the Armed Forces.

Decatur

On November 22nd, the chapter was the guest of Mr. Merrill Lindsay for a tour of his radio station WSOY in Decatur. The tour covered the entire station, from basement to the transmitter tower, and was of extreme interest to the members.

Officers were elected for 1949 as follows: President—George V. Miller; 1st Vice-Pres.—Louis L. Thomas; 2nd Vice-Pres.—Glenn S. Cox; Secretary—Doris E. Short; Treasurer—Edward J. McCarthy.

Fort Monmouth

A joint meeting of the Fort Monmouth Chapter and the Monmouth County Subsection of IRE was held on

November 18th. An audience of 300 heard Dr. J. W. McCrae, Director of Electronic and Television Research for *Bell Laboratories,* deliver a lecture on "Transistors."

Kentucky

On November 19th, the Kentucky Chapter met at Fort Knox as guests of Col. C. A. Carlsten, Director of the Communications Dept. of the Armored School. After luncheon at the Club Cafeteria, the members were taken on a bus tour of the Post. They were conducted through the Armored Field Forces Board No. 2 by Maj. S. A. Miller, the Signal member of the Board, and at the Academic group were welcomed by Brig. Gen. Bruce C. Clarke, Assistant Commandant of the Armored School. After inspecting the Weapons Dept., Command and Staff Dept. and Automotive Dept., the group returned to the Club Cafeteria for dinner. A business meeting was held in Rowe Hall and was followed by a tour of the Communications Dept. and the Patton Museum.

The December meeting was held on the 17th at the Jefferson Davis Inn, Lexington. Professor Louis A. Pardue, of the Physics Dept. of the University of Kentucky, discussed "Atomic Energy" in an interesting and easy to understand manner.

Louisiana

The petition for charter for the Louisiana Chapter was approved by National Headquarters on January 3rd. Rear Admiral Earl E. Stone, Chief of Naval Communications, has accepted an invitation to be guest of honor at the first formal meeting of the chapter in March. He will make the presentation of the charter at a banquet at which ranking Army, Navy and Air Forces officers in the New Orleans area will be among the honor guests. Chapter Secretary Bruce Hay, of the *Southern Bell,* is in charge of arrangements.

New York

The Board of Directors of the New York Chapter met on November 16th in the Seventh Regiment Armory. Committee chairmen were appointed as follows: Armed Forces — Capt. David R. Hull; Financial—Comdr. W. L. Peel; Industrial Relations—Dr. Orestes Caldwell; Liaison—Mr. George W. Bailey; Meetings—Capt. W. G. H. Finch; Membership—Mr. Lee L. Glezen; Publicity—Lt. Col. Ralph G. Edwards; Reserve Affairs—Lt. Col. James A. Mylod. After discussion of the proposed functions of the Industrial Relations Committee, it was unanimously agreed that the chapter could best assist Industry and the Armed Forces towards solution of mutual problems by acting in a liaison capacity between them. The varied civilian and military contacts in the communications and photographic fields available to the chapter will provide effective channels through which representatives of Industry and the Armed Forces may be assisted in obtaining the most direct contacts with one another.

The regular meeting of the New York Chapter was held on December 15th at the Seventh Regiment Armory. The program featured an interesting demonstration by engineers of the *New York Telephone Company* on "High Waves of Communications." Mr. Leslie R. Blasius, Service Engineer, used small scale replicas of the transmitter receiver stations that are now operating on seven hilltops between New York and Boston and are being constructed to link Chicago and New York with a microwave relay system. This system is designed, through the use of various frequencies, to carry television network programs and hundreds of simultaneous long distance calls. The demonstration included the actual transmission of speech and music over a microwave beam.

Pittsburgh

On November 9th, the regular meeting of the chapter was devoted to Problem No. 1, "The Conversion of Industry from Peacetime Operation to Wartime Controls," submitted by the AFCA National Advisory Committee. The discussions were led by Mr. Robert R. Ridley, Manager of Orders, *Copperweld Steel Co.*, and Mr. Ralph W. Will, Manager of Radio Sales, *Hamburg Bros.*

The *Copperweld Steel Company*, Glassport, was host to the chapter at its December 14th meeting. After dinner in the company's cafeteria, the members were welcomed by *Copperweld* officials and given a brief description of the plant layout, manufacturing processes, and quality control methods. Following this, the gathering was divided into small groups, each under the guidance of an engineer, and viewed each phase of the manufacturing operations from raw materials to finished products.

Richmond

The December meeting of the chapter was held on the 7th at the John Marshall Hotel. The program featured two speakers from Camp Lee: Maj. R. C. Hummell, Signal Officer, who gave a short talk on Army communications; and Lt. Col. John A. Spencer, Executive Officer, Quartermaster Training, whose subject was "The Use of Photography in Visual Education."

Sacramento

The November 3rd meeting, held in the Sacramento Signal Depot, was attended by 82 members and guests. The official guests of the evening were members of the Sacramento Signal Depot Radio Club. Lt. Col. F. C. Butler, new Commanding Officer of the Depot, welcomed the members to the Post. The activities of the Radio Club were described by Mr. Xelis W. Godfrey, its President. After seeing two Army films—"Tale of Two Cities" and "The Atomic Bomb"—the group heard Dr. Otto J. M. Smith speak on "Russia's Bomb."

Seattle

A dinner meeting was held on November 30th at American Legion Post #1. The feature of the evening was a talk and demonstration on Loran receivers by Messrs. Thompson and Wakefield of the *Sperry Gyroscope Company*.

Southern California

Chapter members met on November 18th at KMPC Studios, Los Angeles, to hear Arthur C. Hohmann, Deputy Chief of Police of Los Angeles, speak on "Local Preparations for an International Conflict." Kenneth B. Lambert of MGM was elected Secretary-Treasurer of the chapter.

Washington, D. C.

The first fall meeting of the Washington Chapter took place on November 16th at Fort Lesley J. McNair. The feature of the evening, following a buffet supper and a business meeting, was a discussion and demonstration of the new "Transistor" by Dr. J. W. McRae, Director of Electronic and Television Research for the *Bell Telephone Laboratories*. —30—

Lafayette-Concord Radio has gone all-out for the music lover, radio engineer, ham, and professional musician at their New York store. This array of sound equipment includes 10 tuners, 45 amplifiers, 21 speakers, and 10 types of record players from which the customer can make his selection. Through this selector, customers may choose standard units which range in total cost for the assembly from $65 to $780, exclusive of cabinet. The company reports enthusiastic public acceptance of the selector.

Within the Industry

(*Continued from page 28*)

was staff engineer of the American Standards Association, New York City, and associate radio engineer at the Signal Corps Laboratories, Fort Monmouth, N. J.

* * *

GEORGE F. DEVINE, formerly commercial engineer for the Specialty Division of *General Electric's* Electronics Department at Syracuse, N. Y., has been made assistant to the manager of sales of the division.

Mr. Devine has been employed by *General Electric* since 1935. During the war, he was assigned to naval ordnance projects by the Receiver Division, and in December 1945 received the Naval Ordnance Development Award for his work on anti-submarine electronic devices.

* * *

VIDEO CORPORATION OF AMERICA, manufacturers of table and console television sets, has named six new distributors for the company's new line of video receivers.

The new appointments are: *Milmar Sales Co.,* Chicago, Illinois; *H. A. Gilliam Co.,* Houston, Texas; *Stan-Burn Radio Electronics,* Brooklyn, N. Y.; *Regal Radio, Inc.,* New York, N. Y.; *L. Zelkin,* Beverly Hills, California; and *Commercial Television Corp.,* Pittsburgh, Pa.

The receivers made by *Video Corporation* include 7", 10" and 12" table models and a 12" consolette. AM and FM radio will be featured as well as a club line for commercial use.

* * *

STANLEY A. MORROW will succeed John S. Garceau as advertising and sales promotion manager of the *Farnsworth Television & Radio Corporation.*

Mr. Morrow joined the *Farnsworth* organization in 1944. His 25-year background in advertising activities embraces posts held with nationally-known agencies, manufacturers, and retailers. Prior to service in World War II, Mr. Morrow was advertising manager for the *Cable Piano Company* of Chicago.

* * *

PALMER M. CRAIG, chief engineer of *Philco Corporation's* radio division, has been appointed director of engineering of the electronics division.

Mr. Craig has been with *Philco Corporation* for 15 years and served as chief engineer in charge of radar and military radio development during the war.

Together with Mr. Craig, six chief

engineers responsible for major product development have been chosen for major posts in the division.

* * *

TERRY P. CUNNINGHAM, formerly advertising manager of the Radio Tube, Electronics, and International Divisions, has been appointed director of advertising and sales promotion for *Sylvania Electric Products Inc.* He will have charge of advertising and sales promotion for the Lighting Fixture, Lamp, Radio Tube, and Electronics Divisions and the *Wabash Corporation.*

Sixteen years prior to joining the company, he specialized in radio advertising and merchandising campaigns for leading radio set and parts manufacturers in Chicago and Milwaukee advertising agencies and as the head of his own agency.

* * *

GENERAL ELECTRIC COMPANY is erecting an ultra-modern, five-story brick and steel building at Lynn, Mass., which will house a completely equipped electrical measurements laboratory.

It is designed to provide the best possible facilities for research and development in the field of electrical measurements for the Meter and Instrument Divisions of the company.

The laboratory will occupy the largest amount of the building's 142,000 square feet of floor space, but the structure will also include offices, exhibit rooms and conference rooms for the administrative and sales personnel. —30—

Scott Radio Laboratories, Inc., recently introduced a phonograph unit which is capable of handling 78, 45, and 33⅓ r.p.m. records. The new player features two pickup arms, one for conventional records and the other for the two speeds used for the long playing records. A single arm can handle the two slow speeds because grooves on both types are the same size and the same needle pressure is required. Conventional records will play automatically and new records will be played manually.

International Short-Wave

(*Continued from page* 125)

England 1930 with Arabic on 6.135, 6.790, 9.650, but 6.170 is jammed; signs off 1515 after news in Arabic. (Pearce)

The Forces Broadcasting Station, 7.220, has test transmissions each Saturday 1700-1900, asks for reports. (Berglund, Sweden) Remainder of schedule is 2330-0130 and 0430-1600 weekdays (2330-1600 Sundays).

Denmark—Direct from I. Rosenkier, chief of the short-wave department of the *Danish Radio,* I learn that the periods to North America on 9.520 continue at 1900-2030, 2130-2300, 2300-0030; first hour is with Danish announcements, remainder with *English* announcements. "We have had many difficulties with our channel," says Mr. Rosenkier, "because several other stations had placed their programs quite near us. We hope it shall be better in 1949."

Dominican Republic—Former *"La Voz del Yuna"* is now operating under new slogan, *"La Voz Dominicana."* (McPheeters, La.)

Ecuador—HCIAB, 6.210, *La Voz de la Democracia,* Quito, parallels HCIAB, 1280 kc.; station says is affiliated with BBC; schedule given as national and international news (presumably Spanish) 0630-0900, commercial programs 1130-1630, 1730-2330; asked for reports. (McPheeters, La.)

Egypt—According to *Cairo Calling,* SUX operates on 7.867 daily with Arabic programs 1330-1600; "also on 10.055 for Friday programs."

El Salvador—Rosenauer, Calif., has received an interesting letter (Spanish) from *"Radio Programas de El Salvador,"* network comprised of YSR, *"La Voz de El Salvador,"* San Salvador, 6.265, scheduled 1200-0000; YSF, *"Radio Vanguardia,"* San Salvador, 9.250, scheduled 0800-1000, 1900-2300; YSHQ, *"La Voz del Progreso,"* San Miquel, 6.500, scheduled 1100-1400, 1800-2300; YSA, *"Radio Cultura,"* Santa Ana, 9.490, not on the air at time of writing but expected to begin operations early in 1949. Advised that they acknowledge all reports and requested reports on future transmissions. A personal letter also was received from Arnulfo Ernesto Martinez, accountant for the network, who said he would like to correspond with young people of both sexes. He is much interested in happenings outside of his country and wishes to exchange books and photographs; his QRA is 8a Avenue Norte 8, Altos, San Salvador, El Salvador.

Finland—Helsinki's new transmitter on 15.190 has been utilizing only 85 kw. of its 100 kw. capacity, but as soon as new aerials are erected will use the full 100 kw.; regular transmissions in the 31-m. band (9.500) are scheduled to begin early this year, may be in progress by this time. (Major, W. Australia) The 15.190 outlet is scheduled to North America 0700-0715 (news), 0725-0800, 1145-1200 (may run to 1245

at least some days), 1600-1700, 2200-0000. Station officials have informed me the new transmitter is a class B job of British manufacture, that the antenna is a three-stack dipole, and that location is Pori.

French Indo-China—Radio Dalat informs Sanderson, Australia, it is currently operating on 6.180 daily 1800-2000, 0830-0930; had been using 4 kw., but since July—due to difficulties with transmitter—has utilized only 240 watts, hopes to resume 4 kw. operation in the near future.

M. Jean Pipon, head of the English Dept. of *Radio Saigon,* airmails me that the station still operates on 11.78, 6.165, 1050 kc., and that daily *English* periods are now 1830-1845, 1930-2000, 0415-0530, 0830-0930. Full schedules are promised next month. Stark, Texas, McPheeters, La., and myself have been hearing a French-speaking station on 11.78 around 1830-1930 (through terrific CWQRM) that may be Saigon.

Gold Coast—Accra is reported testing recently on 15.435 at 0400-0430. Also reported on 4.915 occasionally at 1045-1300. (Radio Australia)

Greece—Call-sign of the American station in Athens in JJOY, *not* KJOY. (Morgan, Pa.) Still operates *Fridays only* on 8.000 at 1330-1430. (Swedish DX Broadcast) This *"American Hour"* consists of 15 minutes of news, 45 minutes of music; power is 375 watts. (Pearce, England)

Cairo Calling lists *Radio Athens* with daily programs on 7.300 at 1130-1145 news in *English,* 1145-1200 news in French, 1200-1210 news in Turkish; on 15.345 with transmission for U.S.A. 1730-1830; on 6.177 at 0015-0030 news in Greek, 1240-1250 news in Arabic, 1250-1300 news in Russian, 1300-1310 news in Rumanian, 1310-1320 news in Yugoslavian, 1320-1330 news in Bulgarian, 1330-1340 news in Albanian, 1415-1630 relay of Athens Program; announcement given as "Edho Athinai."

Radio Athens is still being heard from 0030 on 9.607, with slightly improved signal; *no English.* (Fargo, Ga.) Probably runs to 0300.

Haiti—HHCP, Cap-Haitian, has increased power somewhat; HHYM expects to have verification cards soon. (Kary, Pa.)

Holland—PCJ, Hilversum, currently is using 21.48, 17.775, 15.22, 6.025 for Indonesia, the Far East, Australia, New Zealand; 11.73, 9.59, 6.025 for Great Britain, Continental Europe, South and Central Africa; 11.73, 9.59, 6.025 for the West Indies, U.S.A., Canada. *English* transmissions of *Radio Nederland Wereldomroep PCJ* can be heard at 1800-1900 Batavia time in Indonesia and the Far East; 2000-2100 Australian Eastern Standard Time in Australia; 2200-2300 New Zealand Time in New Zealand; 1730-1830 GMT in Europe; 1930-2030 South African Time in Africa; 2300-0000 Surinam Time in the West Indies; 2200-2300 Curacao Time on the Netherlands Antilles; 1830-1930 PST, 1930-2030 MST,

2030-2130 CST, 2130-2230 EST, and 2230-2330 AST in the U. S. and Canada. The *"Happy Station Programs"* produced and presented by Eddie Startz, are scheduled Wednesdays, Sundays at 1030-1200, 1600-1730, 1830-2000 EST (if the latter is not heard 1830-2000, try old time of 2200-2330 EST); and on Tuesdays 0330-0430 EST. PCJ also transmits in Spanish for Spain and Latin America twice daily—1730-1830 and 2100-2128, 11.73, 9.59, 6.025; *this is not heard on Sundays.* Dutch programs are beamed to Indonesia and the Far East at 2100-2300 Batavia Time on 21.48, 17.775, 15.22, 6.025 (and at 2130-2200 Batavia Time daily, a program in Bahasa Indonesia is transmitted from the 15.22 outlet); to Europe and Africa at 2030-2300 South African Time (1830-2100 GMT or 1330-1600 EST) on 11.73, 9.59, 6.025; and to the West Indies at 2000-2230 Surinam Time (1900-2130 Curacao Time) on 11.73, 9.59, 6.025. Communications about all PCJ broadcasts will be welcomed by Radio Nederland Wereldomroep PCJ, P. O. Box 137, Hilversum, The Netherlands (Holland); a monthly program sheet (*English*-Spanish texts) is now being issued free of charge, on request.

Iceland—TFJ, 12.175, Reykjavik, opens 1115 with call repeated twice in the *Sunday only* transmission, then all talk in Icelandic to 1145 closedown. (Pearce, England)

India—VUD11, 11.79, heard in parallel with 15.16 with news 2130, signs off 2230, but back on at 2245 when soon fades out on West Coast. (Balbi)

VU7MC, 6.026, Akash-Vani, Mysore, is scheduled 2030-2240, 0330-0540, 0700-1140. (Harrison, England)

Indonesia—Raymond Block, Belgium, has sent us these Indonesian schedules taken from *Radio Gids,* published in Batavia:

Radio Indonesia, Batavia — Dutch programs on 10.365, 4.865, 2.602, 1700-1900, 2300-0130, 0400-1000, news 0445. World program, *English* broadcast for Australia-Malaya, New Zealand on 15.150, 7.271, 0600-0700, news 0600. Dutch program for Netherlands on 19.350, 15.150, 1130-1200; Forces program on 10.365, 4.865, 2.602, 1800-1900, 2045-2215, 2300-0000, 0910-1000. French broadcast for Fr. Indo-China on 15.150, 7.271, 1000-1100, also on 11.770V. French broadcast for Arabic countries on 17.630, 1130-1200. Arabic broadcast for Arabic countries on 19.350, 15.150, 1230-1300. *Fridays only,* special programs for Flemish listeners in Belgium (in Flemish) on 19.350, 15.150, 1145-1200, given by Joop Van den Broeck.

Radio Bandoeng—Dutch program on 3.024, 1730-1900, 2300-0145, 0430-1000; Forces program on 3.024, 0830-1000; Indonesian program on 6.170, 4.950, 1800-1930, 2300-0000, 0430-0930.

Radio Makassar, Celebes—Dutch program on 9.550, 1800-1900; on 9.550, 5.030, 0000-0130; on 11.080, 0500-0700; on 9.550, 0700-1000; Forces program on 11.080, 0500,0700; Indonesian program on 9.550, 5.030, 1700-1758, 2200-

0000, 0400-0630; on 5.030 *only*, 1800-1900, 0700-1000.

Radio Medan—Dutch program on 7.210, 1727-1845, 2300-0100, 0630-0900; Indonesian program on 7.210, 2230-2300, 0330-0630.

Radio Soerabaja—Dutch program on 4.840, 3.240, 1730-1900, 2230-0145, 0400-1000; Forces program (no frequencies listed), 0500-0600, 0830-0930; Indonesian program on 7.295, 4.370, 1725-1900, 2300-0100, 0400-0930.

Radio Manado—Dutch program on 9.804, 0530-0700 (for the Forces); Indonesian program on 9.804, 0500-0530.

Radio Palembang—Dutch program on 4.855, 0430-0600, 0630-0900; Indonesian program same frequency, 0600-0630.

Radio Padang—Dutch program on 3.270, 2300-0100, 0400-0900 (for the Forces); Indonesian program on 3.270, 0300-0400.

Radio Semarang—Dutch program on 11.034, 2.510, 2100-2200, 0600-1000; Indonesian program same frequencies, 2200-2300, 0400-0600.

Radio Garoet—Dutch program on 2.808, for the Forces, 0430-0900.

Radio Pontianak—Dutch and Indonesian programs on 8.090, 0625-0730.

Radio Djakarta — Indonesian program on 11.770V, 7.271, 4.910, 2.240, 1700-1900, 2300-0130, and 0330-1000 (except 7.271).

(*NOTE:* These frequencies were converted from meters and in some cases may be approximate.—K.R.B.)

Stark, Texas, has recently heard Pontianak on 8.090, signing off 0830 to 0840; signature is some sort of anthem.

Iran—EQB, 6.155, Teheran, is heard 2130-2330 with native-type program. (Hagen, Ala.)

Israel—O. Wilker, engineer in charge of studios at "Kol Israel" Broadcasting Station, informs me that "*The Voice of Israel*," Tel Aviv, now operates on 6.280 at 2345-0100, 0430-0745, 1015-1530, and has an *English* news bulletin twice daily—0700, 1500.

Jamaica—ZQI, Kingston, dropped its 6.070 channel because the fading zone had fallen within a radius of three to five miles of the station, thus affecting adversely for 80 per-cent of listeners; this frequency is registered with BBC, but ZQI has permission to use it until next fall, so it may be tried again around May-August of this year. (Kary, Pa.)

Japan—The service to repatriation camps in China is still being carried on 15.225, 15.235, and can be heard in Michigan around 1900-1930 with fair level; JVW, 15.225, is the slightly better of the two; JKF, 9.655, can be heard around 0000, but is quite weak; JKE-2, 4.860, is fair at 0800 relaying AFRS programs. (Becker)

Kenya Colony—Australians report the Forces Broadcasting Station, Mombassa, at good strength around 1000, giving local time as 6:15 p.m.; is now on 7.220, evidently moved from 7.215 where was first reported.

Korea—Pearce, England, received schedules from HLKA, 7.935, Seoul, as daily 2100-0000, 0330,0830 (this period is being heard by Pearce, however, *from* 0300), 1630-1830; power listed 5 kw.

Lebanon—Radio Beirut is reported on approximately 8.020 at 0000-0115. (Hagen, Ala.) *English* period is at 1500-1600 daily. (Pearce, England)

Luxembourg—Current schedules of *Radio Luxembourg* are 0600-0800 on 15.350. and 1130-1700 on 6.090. (Patrick, England)

Madagascar—Tananarive has been logged in Australia on 12.125—but this may be a harmonic of 6.065. (Radio Australia) The 6.065 outlet has been heard by Rosenauer, Calif., from tuning 0930 to shortly after 1100 (fade-out); concert music 0930-1045, then short commentary in French, followed by program of popular music to fade-out. Reports frequency seems closer 6.070 than listed 6.065. Identifies as "*Ici Radio Tananarive.*"

Malaya—The British Far Eastern Broadcasting Searvice, Singapore, has moved its 25-m. outlet from 11.850 to 11.880, probably to avoid QRM from Delhi. (Radio Australia) *Radio Malaya's* 7.220 channel has been heard with news 0900, still on 1000. (Balbi, Calif.)

Monaco—Radio Monte Carlo has been heard in England on its *new* frequency of approximately 9.475 at 0600-0800 during its dance time session, all-French. (Patrick) Simpson, Australia, has heard Monte Carlo on 17.780 daily from 0800; has been heard 1400 on 9.500 by Simpson and by Cushen, New Zealand; Cushan also reports it on 11.800 from 0100 but with bad interference from BBC to 0245; on Sundays carries "Bringing Christ to the Nations" (in *English*) 0300-0330; appears to be parallel with its old transmitter 6.035.

The 6.035 channel is heard in Alabama at 0100-0330. (Hagen) Heard in New York in clear around 2200. (Osterman)

Mozambique—CR7BE, Lourenco Marques, is still heard on about 9.708, with *English* session opening 0000. Announces "Lourenco Marques in the 31-meter band for happy listening." (Hankins, Pa.) Portuguese program heard daily around 1430 on 4.825, and at same time on approx. 4.920 (varies to 4.930) has sponsored program in *English*. (Pearce, England) The approximate 9.708 channel is heard in Michigan to 0830, weak signal, with American dance music. (Becker)

New Zealand—ZL3, 11.78, Wellington, appears to be testing around 2330-0115 or 0130 in addition to regular daily transmission 0200-0400 (latter also carried on ZL4, 15.28). (Rehrer, Indiana, Balbi, Calif.)

Norway—Olso's nightly program for listeners abroad 2000-2100 is being heard currently on 9.61 (8 kw.), 11.735 (100 kw.), 11.850 (8 kw.). (Harris, Mass., Wooley, N. J., Worris, N. Y., others)

Pakistan—Fern, Hawaii, has notified URDXC that *Radio Pakistan* is now definitely on (measured) 6.075;

station on (measured) 6.229 heard to sign-off 1115 or 1125 is now believed to be at Jammu, Kashmir, Fern states.

Panama—HP5B, 6.030, Panama City, heard signing off 2230 and announcing sign-on of 0630; announces "Radio Miramar." (McPheeters, La.)

Peru—OAX-4Z, 5.889, Lima, heard evenings to 2330 sign-off, fair to good signal. (McPheeters, La.) Officials of OAX6B, 6.038, Arequipa, have informed Pearce, England, that present power of 300 watts is expected to be increased soon.

Philippines—KZPI, Manila, has increased power of its s.w. outlet on 9.500 to 1 kw., and its medium-wave outlet (800 kc.) to 10 kw. The 9.500 channel has been heard 0930-1000 with musical programs and announcements in *English*, fair level. (Rosenauer, Calif.) KZRC, 6.135, Cebu City, *"The Voice of Cebu."* heard well 0900-1000. (Brain, Idaho)

Portugal—Lisbon's 15.100 outlet appears to have irregular schedule; heard by Pearce, England, signing off 1145, another day 1245.

Portuguese India—*Radio Goa*, 7.225, heard in New Zealand at fair strength to 1000. (Cushen) Scheduled in native languages weekdays, in Portuguese on Sundays.

South Africa—Cape Town's approximate 5.880 has been weaker lately around 2355. ZRB, 9.110, Pretoria, is heard erratically, best around 0015. (Bromley, Ontario)

Surinam—OZX5, 15.405, Paramaribo, is heard around 1830 relaying a PCJ broadcast. (Jeffrey, Ontario)

Sweden—*"Radio Sweden, the Swedish Broadcasting Corporation"* is the slogan now being used by Stockholm. (Skoog)

Radio Sweden has added these weekly special programs—Sundays, friendship program for youth (*English*); Mondays, program in Esperanto; Thursdays, program for Swedish missionaries abroad (Swedish); Fridays, press review for Swedes abroad (Swedish, later also in *English*). Each of these programs is transmitted three times on the same schedule and frequencies as used for "Sweden Calling DX-ers!"—that is, Saturdays for DX sessions and other days just mentioned for additional special programs—at 0215-0230, 6.065, 9.535, 1015-1030, 10.780, 15.155, and 2015-2030, 6.065, 9.535. These programs replaced the daily program for listeners abroad at 0900-1000; the nightly broadcast 1900-2000 remains on 6.065, 9.535. (Skoog)

Turkey—Although the *English* news is scheduled daily 1245 from TAP, 9.465, Ankara, it has been heard at 1235 and sometimes as early as 1230, reports Orr, Ohio. Alfred, Ontario, sends us these current schedules for TAP—newscasts as follows, Urdu 1100; Persian 1115; Arabic 1130; Turkish 1200; *English* 1245; French 1300; Greek 1330; Rumanian 1345; Serbo-Croat 1400; Bulgarian 1415; German 1430; Hungarian 1445; Mailbag (*English*) Sundays 1630; special broadcast for *English*-speaking listeners (beamed

to England) Mondays, Thursdays 1630; special broadcasts (*English*) for U.S.A. fortnightly on Tuesdays 1800.

U.S.S.R.—RV15, 8.820, Khabarovsk, is heard in Ontario around 0605 in Russian. (Bromley)

New frequencies used in Home Service include 9.83, 9.74, heard late evenings and early mornings, irregularly. (Balbi, Calif.)

Current North American schedules listed by Soviet Embassy are 0745-0815, 6.05, 7.36, 9.54, 9.56, 9.60, 11.72, 11.87, 11.96; 1820-1930, 7.29, 7.36, 11.72, 11.89, 13.71, 15.23; 2100-2215, 7.29, 7.36, 9.60, 9.72, 11.72, 11.87, 11.88, 13.71, 15.23.

Vatican—HVJ, 9.640, heard 0945-1030, news 1000. (Rosenauer, Balbi, Calif.)

Yugoslavia—Radio Belgrade, 6.107, now heard with second transmission of the day (*English*) from 1700; announces first *English* period for 1215. (Pearce, England) Heard afternoons in Michigan with some heterodyne on top, fair level. (Becker)

* * *

Last Minute Tips

Pearce, England, has heard *Radio Monte Carlo's new* transmitter on approximately 9.495 ending transmission at 0300, then after interval had classical music from 0310; severe QRM after 0345 when OIX2, Lahti, Finland, signed on its 9.500 outlet; also heard from 0900 to 1030. This channel has been heard at 0200 by Bellington, N. Y. Petersson, Sweden, flashes us that the 6.035 channel more recently has been heard also at 2200-2300; formerly, first transmission began 0100. He reports the 9.495 channel at 0730-1215.

Osterman, N. Y., reports a Hawaiian station with call which sounded KRGE (?) heard 2330-0010 when was lost in heavy QRM; frequency was 9.530 and had local news 2330, then recordings.

KZPI, 9.500, Manila, is scheduled 1630-1205, power 1 kw.; KZOK, 9.690, Manila, 1630-1205, power 250 watts; KZBU, 6.100, Cebu City, 1630-1205, power 250 watts; programs of KZOK are in *English,* Tagalog, and Chinese (latter since 80 per-cent of retail trade of Philippines is controlled by Chinese). KZPI advises that every station in the Islands is a clear channel one and that they have excellent DX response. (Rosenauer, Calif.)

ZNT18, 19.210, Amman, Transjordan, heard testing 0945; is Cable and Wireless station. (Harrison, England)

X9BGC, Mexican-American Hoof and Mouth Disease Control Commission, has been heard testing hourly; heard on 5.869 at 0805, announced tests on 5.8, 4.2; said next test 0900 on 8.2, 7.6. (Stark, Texas)

Cushen, N. Z., reports PLB7, 11.080, Batavia, has been heard in relay with YDC, 15.150, and YDB3, 7.270, 0600-0700 with *English* session. A further *new* station reported by Cushen is Manado in the Celebes, heard 0500-0900 on 9.804. DeSouza, Singapore, reports that many low-powered Indonesians are heard but do not seem to be on a fixed schedule. Two that do

have regular broadcasts are *Radio Republic Indonesia* on 9.028 and a Batavia outlet on 11.915—at 0400-1030 and with French language broadcasts the last half hour on each channel. (Radio Australia)

Batavia, Java, expects to have its *new* 100 kw. transmitter in operation in July. (Cushen, N. Z.)

Bangkok, Siam, on about 6.010, has had improved signal lately on West Coast, signs off around 1000, all-native. (Anderson, Calif.)

The BBC is now using GSY, 6.040 at 1430-1730 for "Voice of America" relay; also GSA, 6.060 at 2330-2345, 1045-1730, with relay of European Service. (Cushen, N. Z.)

Here are late tips from Leven, Brazil—*Radio El Mundo* and *Radio Belgrano,* Argentina, are still the same high level; *Radio Splendid* generally is poor. LR-4, 990 kc., LRS, 9.320, are in parallel 0800-2200, audible in Brazil from 1700 to sign-off; LRS-1, 6.065, same schedule, audible after 1900; LRS-2, 11.840, has bad interference from CXA-19, 11.835, Montevideo; latter has very strong signals afternoons, is in parallel with CX-14, 810 kc., scheduled 0600-2200 with 5 kw.; HCJB, 17.890, Quito, Ecuador, appears to be on to Europe Tuesdays through Fridays at 1200-1400 or later in *English,* French, Swedish, Spanish; on Sundays 1700-1730 an English program called *"Brazil Calling"* has been heard from ZYK-2, 6.085, and ZIK-3, 9.565, announcements and texts read by a woman in *English,* and a man announces in Portuguese; this station wants reception reports to Radio Jornal Do Comercio, Recife, Pernambuco, Brazil. Mr. Leven comments that "it is interesting to note that northern Brazilian stations have programs especially prepared for foreign listeners, without commercial announcements, while Rio de Janeiro and Sao Paulo stations—bigger and more powerful—do not even make occasional announcements in languages other than Portuguese."

Ken Dobson, England, informs me that the projected Fernando Poo station in Spanish Guinea is expected to begin transmission early this year. *"La Sociedad de Radiodifusion Intercontinental"* has a 200 kw. s.w. transmitter under construction there, to be the most powerful *"commercial"* broadcasting station in the world. *Radio Atlantica* is to have an initial record library of 55,000 recordings and its programs will be in six languages (*English,* Spanish, French, Portuguese, German, Italian). Frequencies are expected to be 17.6, 11.6, 8.8, and *probable* schedule listed by Dobson is 0600-0800 for Europe, 0900-1200 for Africa, 1200-1300 for North America, 1300-1400 for South America, 1400-0000 for Europe, 1900-2200 for North America, 2200-0100 for South America. Dobson also advised that *Radio Nacional de Espana* in Cuenca, Spain, 7.100, has been closed down *temporarily,* and that various 100 kw. s.w. transmitters are under construction in Spain, further details promised as available.

Late tips from Peddle, Newfoundland, include CR6RL, 8.090, Luanada, Angola, 1330-1600; PJC1, 2.315, Curacao, surprisingly good to 2130 sign-off; Rabat, 6.005, French Morocco, heard 1530-1630; HVJ, 5.971, Vatican City, excellent 1400-1500; Monte Carlo heard on 9.495 in parallel with 6.035.

Radio Malaya schedules were extended early this year, now runs 0430-1030; 0530-1030 is in *English* on one network (believed Blue Network); Red Network carries various native languages; Singapore frequencies of *Radio Malaya* include 7.220, 6.135, 4.965, 4.825, 4.780; Kuala Lumpur operates on 6.025. (Radio Australia) On the morning this was compiled I heard a station on approximately 6.025 at 0630 which is possibly Kuala Lumpur; noise was high but signal good; woman gave news followed by market reports; man announced at 0645.

Carl-Eric Petersson, Sweden, says *"Radio Difusoras Amazonas"* is a *new* transmitter at Manaos, Brazil, operating on 4.950, heard to 2250 in Portuguese.

* * *

Acknowledgement

Thanks for the FB cooperation, fellows! Reports are always welcome at 948 Stewartstown Road, Morgantown, West Virginia. —K.R.B.

—30—

Television Receivers

(*Continued from page 72*)

age here. Upon the arrival of a sync pulse, a short flow of current takes place through the tube and R_2 since this latter resistor is in series with the tube. These pips of current then represent the sync pulses as they appear only when the peak pulses are present across the circuit. *Rembrandt* receivers, Models 80, 130, and 1950, possess this type of circuit.

There are variations of the foregoing diode restorer and clipper circuit which accomplish the same job but function slightly differently. Consider, for example, the circuit shown in Fig. 9.

V_2, the diode d.c. restorer, receives the video signal from the plate of V_1 through R_1 and C_1. Because of the manner in which it is connected, V_2 will conduct only for the negative sync pulses of the video signal, charging C_1 in the manner already described. The d.c. restorer biasing voltage is then developed across R_2 and fed through a 470,000 ohm resistor to the control grid of the image tube. Thus far the circuit is concerned with the d.c. restoration. The voltage from this network that is applied to the sweep system of the receiver is obtained from R_3.

When the positive half of the video signal is applied to V_2, this tube does not conduct since its plate is negative with respect to its cathode. This positive voltage, which contains essentially the picture information and not the sync pulses, is divided between R_1 (47,000 ohms), R_2 (1 megohm), and R_3 (33,000 ohms). Since it is the voltage across R_3 which is sent to the sweep system, only 33/1080ths of the total applied voltage goes to the sweep system. This ratio, it is seen, is quite small and thus not much picture detail voltage is fed to the sweep system.

On the negative half of the video signal, when the sync pulses are active, V_2 conducts, shunting out R_2. Now, the total applied video voltage is divided between R_1 and R_3 and the sweep system receives 33/80ths of the applied voltage. This means that approximately 14 times more sync voltage is transferred to the sweep system than picture voltage. Due to the presence of some picture voltage, further separation is usually found in these systems. *Admiral* (Model 30A1), *Crosley* (Model 307-Ta), *DeWald, Fada, Motorola* (Model VK-101), *RCA* (Models 630TS, 8TS30, 641TV, 648-PTK), and *United States Television* (Models T10823 and T15823) use this system.

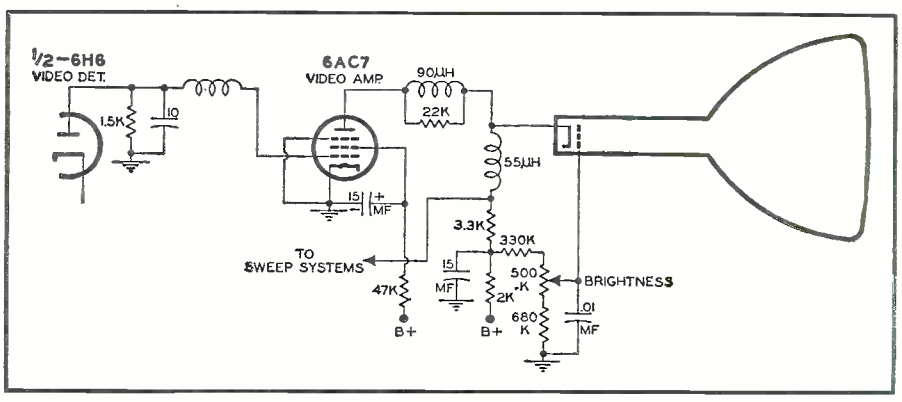
Another novel arrangement employing a triode (½ 6SN7) as a d.c. restorer and clipper is shown in Fig. 10. The d.c. restoring operation is similar to that of Fig. 5 except that the control grid and cathode of the ½ 6SN7 triode are being employed here as a diode. When this simulated diode conducts, C_1 is charged to the peak of the applied sync voltage and, on discharge, develops the d.c. restoration bias across R_1. This d.c. bias is then fed through R_2 to the grid of the cathode-ray tube in the same manner previously described for a diode. This, then, represents the d.c. restoration portion of the circuit.

Now, current flows from cathode to grid of V_1 at each sync pulse. Some of the electrons will hit the grid and flow in this circuit. Most of the current, however, will flow toward the positive plate of this triode, and develop a pulse of voltage across the load resistor. Thus, the sync pulses appear in the plate circuit. They are passed on to V_2, amplified, and then fed to the sweep system of the receiver. *Andrea* and *Emerson* (Model 545) television receivers have this type of circuit.

The final d.c. restoration system found in some current television receivers is shown in Fig. 11. Here the tube employed is a pentode and the circuit functions somewhat differently from any of the previous arrangements.

The pentode tube contains a high value resistor in its cathode circuit which will bias the tube near cut-off. If the applied video signal is in the negative picture phase, i.e., with the sync pulses most positive, then current will flow through the tube only at these moments, effectively clipping off all of the video signal and permitting only the sync pulses to appear in the plate circuit of the tube. These sync pulses are then fed to the vertical and horizontal sweep sections of the receiver.

Fig. 12. A video amplifier system requiring no d.c. restorer.



The d.c. restoration voltage is obtained from across the bypassed cathode resistor. It will be found that if a large plate load resistor and a fairly large cathode resistor, bypassed, is used with a sharp cut-off pentode, such as the 6AU6, then the d.c. voltage developed across the cathode resistor will be a function of the average value of the applied signal. Thus, with a white picture, the cathode voltage will be large whereas with a black picture, it will be small. This is precisely the same voltage variation provided by the other d.c. restorers.

Note again that in order for this circuit to function, the video signal applied to the grid must be in the negative picture phase, i.e., with the sync pulses most positive. In this receiver this is possible because the video signal from the final video-frequency amplifier is fed to the cathode of the image tube. *Tele-Tone* and *Hallicrafters* use this method of securing d.c. restoration and sync clipping.

It is possible to construct a television receiver requiring no d.c. restoration. This can be done if there are no coupling condensers between the video second detector and the cathode-ray tube. *General Electric,* in some of their sets, use the circuit shown in Fig. 12. The video-frequency amplifier in this instance is really a d.c. amplifier and passes the signal it receives from the video second detector directly to the cathode of the image tube without any intervening condensers.

(To be continued)

SERVICE HINT

BY FRANK EVANS, W6WXD

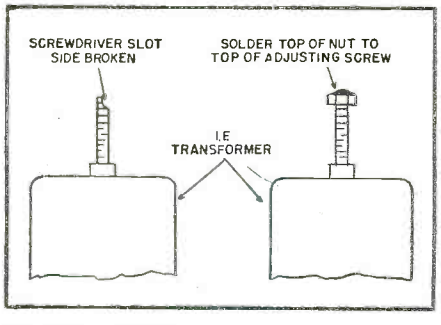
HERE is a helpful tip for repairing broken adjustment screws of iron-core i.f. and detector transformers.

If the adjustment screwdriver slot of one of the powdered iron core i.f. or detector transformers is sheared or broken off, here is a repair that makes it better than when new.

Thread a nut, preferably brass, onto the adjustment screw. Solder the top of the nut to the top of the adjusting screw. The nut should be of correct outside diameter to accommodate the socket of your alignment tool.

Some patience may be necessary to start the nut over the damaged threads on the end of the adjusting screw, but this repair saves removing the transformer from the set. In addition, the alignment tool socket will not slip from the adjustment as will a screwdriver alignment tool. —30—

Method for salvaging i.f. transformers.



AM Tuner

(*Continued from page 65*)

into the main tuning condenser. The trick is to adjust the r.f. and detector circuits below the point where they "pull." Your neighborhood radio serviceman can perform this simple job of alignment if you find this necessary. His fee should be nominal. Don't be frightened by this alignment business, it's quite simple.

A glance at the schematic will show that the power supply is straightforward. More filtering may be employed although it is unnecessary. To secure low hum level it is important to wire the filament circuit as shown. Ground one side directly at the socket and at the transformer. A "hot" wire is then run from the high side of the filament winding to the "hot" side of the tube's filament directly at the socket.

Standard, readily-available parts are used throughout. It will be seen that a metal shield is used topside to isolate the power supply from the tuner proper. No similar precaution is observed underneath the chassis. Choice of the dial and hardware is left to the individual builder.

Standard wiring procedure is followed. No. 18 pushback (solid) is used with standard color coding. Resistors and condensers are wired in point-to-point fashion. A shield braid cable runs from the first audio output to the output terminals of the tuner. Ground the shield braid. Wire the filament circuit first and check for proper operation. Wire the power supply next. Start with the 6AK5 r.f. stage and work "backwards", completing each circuit as you go. Complete the detector and first audio stages next. Before you know it the unit is finished. Use shielded antenna and r.f. coils. If possible, use the *Meissner* coils specified. The midget 365 $\mu\mu$fd. variable, complete with compression padders, is a standard stock item at the big radio supply houses. Ask for a TRF type. They have them listed that way.

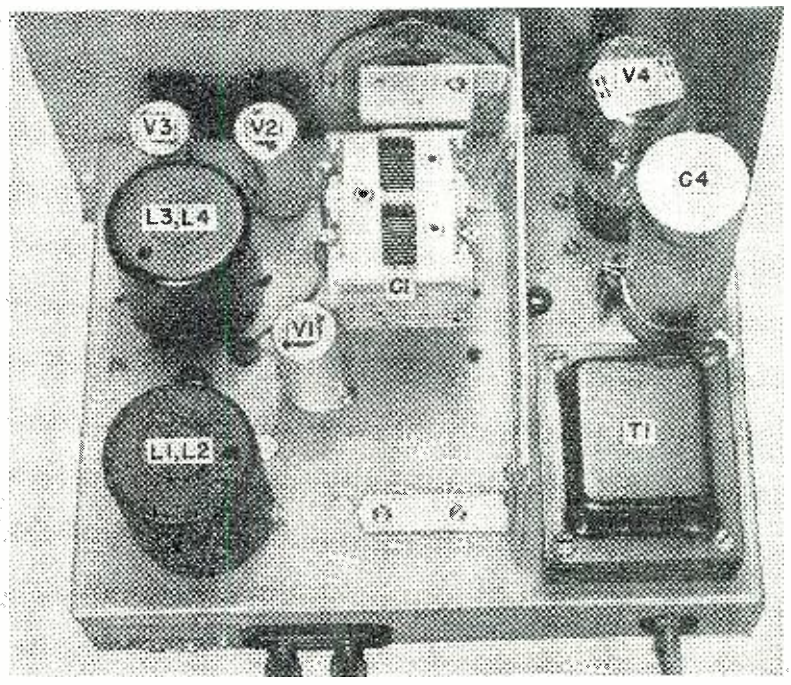
The tap on the bleeder is adjusted using a 1000 ohms-per-volt d.c. voltmeter. The reading is taken from the tap to ground. The 6AK5 voltage is taken off the tap adjustment for about 180 volts for the plate of the 6AK5. The screen voltage ratio will automatically adjust itself through the series screen resistor. The voltage for the 6C4 detector and 6C4 first audio stages is taken directly off the high side of the bleeder through the respective series resistors. Voltages are not critical as long as 180 volts max. for the 6AK5 and 250 volts max. for the detector and first audio stage are not exceeded.

The little device is simple and straightforward, and further elaboration seems unnecessary. A word about the tuner's performance may be in order. Remember this unit is capable of providing higher fidelity than you have been used to hearing. Don't be disappointed when a station plays cheap, scratchy commercial records or transcriptions and the results are unsatisfactory. Just tune to a good "live" show. What was acceptable as good music on your superhet will be rejected on your tuner. You'll have to re-educate your ear!

Assuming that a good amplifier and bass reflex or other speaker system is used, a new listening experience is in store for you. Music takes on a third dimension. I may seem a bit over-enthusiastic, perhaps, but you be the judge.

—30—

Top chassis view of tuner showing location of the most important components.



Beginning Amateur

(*Continued from page 43*)

is his mom." "He shoots." "It's Moses." "Hi Toots." "Moths meet some time."

For the first evening, limit yourself to about half an hour. The next day, memorize the characters of Group Two, and then try them on the buzzer, with your partner assisting. I can pretty much guarantee that he will copy *E T* the first time you send *dit dah* for *A!* With the Group Two letters you begin to appreciate the need for accurate spacing. Hesitate just a little during a *D*, for instance, and the other operator will write down *T I*. Again, take it easy. Beginners since the days of Marconi have had a tendency to rush their sending. And don't think for a moment that it's easier to send than to receive; one's ability can only keep pace with the other.

With five more consonants and one more vowel available in Group Two, you can make up longer words. Write out several in advance, and make them common words or groups that will be recognized instantly if copied correctly.

"Look, I'm getting it OK," will be the happy comment of each partner as the practice team exchanges the key every five minutes or so. Nothing makes for success like success.

Watch the other chap as you send, and try to adjust your speed to his speed of response. The instant he writes down a letter, send the next one.

How long it will take you to get up to five or eight or ten or thirteen words a minute (counting five characters per word), depends entirely on how much *steady* time you put in. Fifteen to thirty minutes every evening for two weeks should have you up to about seven w.p.m. and progressing rapidly. Large doses of practice days or weeks apart won't be nearly so effective. No tricky "system" is a substitute for practice, and more practice and more practice.

Note from the code chart that the numerals are the only characters that seem to have any sense to them. Tackle them after you have memorized the entire alphabet thoroughly, and then mix numbers and words. Excellent copy for practice purposes will be found in stock market reports, farm produce price listings, etc., in any newspaper.

Of the punctuation marks, the period and the comma are rarely used in ham work, and only occasionally even in commercial messages. Actually, these marks are not usually needed to complete the sense of a message; where they are important, they are invariably spelled out as words to avoid any misunderstanding. The question mark is also used to have the meaning "repeat." If you know that you have sent a false character, send a string of eight or more *E's* as the "error" signal and start the entire

word from the beginning. The double dash is used formally in separating parts of a message, and informally among hams as a sort of time-stalling signal; while thinking of something to say, you can send *dah dit dit dit dah's* to show that you are still alive. The "wait" signal is very useful. It is not copied, any more than the error signal is. The fraction bar has probably only one use in amateur practice: to indicate temporary operation in an area away from the home location of a station. For instance, a fourth district station with the call W4ABC, temporarily in Boston, would identify itself as W4ABC/1.

The "invitation to transmit" signal

The Continental Code. Four groupings have been established to facilitate code practice.

A • —	J • — — —	S • • •
B — • • •	K — • —	T —
C — • — •	L • — • •	U • • —
D — • •	M — —	V • • • —
E •	N — •	W • — —
F • • — •	O — — —	X — • • —
G — — •	P • — — •	Y — • — —
H • • • •	Q — — • —	Z — — • •
I • •	R • — •	

BY GROUPS

GROUP ONE:	GROUP TWO:	GROUP THREE:
E •	A • —	R • — •
I • •	W • — —	F • • — •
S • • •	J • — — —	L • — • •
H • • • •	N — •	U • • —
T —	D — • •	V • • • —
M — —	B — • • •	
O — — —		

GROUP FOUR:

K — • —	Q — — • —
X — • • —	G — — •
C — • — •	Z — — • •
Y — • — —	P • — — •

NUMERALS

1 • — — — —	6 — • • • •
2 • • — — —	7 — — • • •
3 • • • — —	8 — — — • •
4 • • • • —	9 — — — — •
5 • • • • •	0 — — — — —

PUNCTUATION

Period • — • — • —	Error • • • • • • • •
Comma — — • • — —	Double Dash — • • • —
Question Mark • • — — • •	Fraction Bar — • • — •
Wait • — • • •	End of Message (AR) • — • — •
Invitation to Transmit — • —	End of Work (SK) • • • — • —

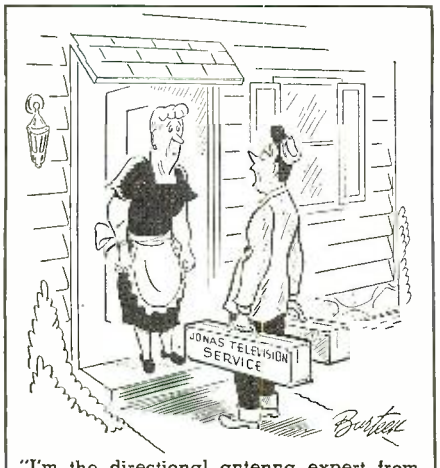
looks like the letter *K*, and it is. There is an improper and altogether unnecessary carryover of *K* to voice operation. Many hams say "*K*" when they should say "go ahead." Not shown under "Punctuation" but very important in all communication is the letter *R*, having the meaning "received." It is the complete signal of acknowledgment.

There is some slight confusion among hams at the present time in regard to the various ending signals *K*, *AR* and *SK*. Don't worry about them right now, but concentrate instead on developing efficiency with the thirty-six basic characters. By the time you get on the air with a transmitter of your own there may be some changes in the rules anyway!

The buzzer set mentioned earlier in this article is minimum basic equipment for the beginning ham. For those who can afford to spend a few dollars, tone oscillators that work off the house power line are available for around $12 or $13. For the isolated individual who must work at the code alone, there is assistance in the form of a set of special phonograph records containing practice transmissions; these cost about $9. A small automatic, motor-driven keyer, using a perforated tape, can be had for $20.

There are thousands of stations on the air at all hours of the day and night, transmitting at various speeds up to several hundred words a minute; listening to the slower ones is certainly good practice. However, only a very few of these stations can be heard on an ordinary "all-wave" family type receiver, because it lacks a circuit accessory called a "beat frequency oscillator." In next month's installment of this series the construction of a simple but effective receiver will be described. This will enable you to eavesdrop to your heart's content on the ham bands and to build up receiving speed. However, you must continue with your own little key and buzzer outfit (or separate tone oscillator) to develop your sending skill, or, as hams call it, your "fist." Practice and more practice does the trick.

(To be continued)



"I'm the directional antenna expert from Jonas. Can you tell me which way is North?"

Spot Radio News

(*Continued from page* 18)

they'll be delivering up to 100,000 units a month. As picture tubes become more readily available, these figures will really race on.

There'll certainly be plenty of television sets out in the field in the next year or two!

THE TV FREEZE, a much-debated topic these days, was applauded by Dr. Ray H. Manson, *Stromberg-Carlson* prexy, recently during his annual message to the Rochester Engineering Society. He declared that the freeze was a good thing for industry, since it checked the headlong rush of television expansion, permitting a thorough planning of telecasting and more time for perfecting receiver designs.

IN ANOTHER VIEW on the freeze, David Sarnoff, *RCA* chairman of the board, said that the recently announced TV carrier sync system, proposed by R. D. Kell at the December FCC hearings in Washington, offered an effective solution to the problem of channel scarcity. He pointed out that the sync method was working out very well between the *NBC* stations in New York and Washington, offering interference-free service to those in the fringe areas. Mr. Sarnoff declared that the use of the sync idea permits a closer spacing of television stations on the same channels, and enlarges the service area of television stations.

THE TREND TO new, unusual applications of AM and FM facilities continues, with interurban trolleys now a member of the two-way fraternity. Employing a wired-radio system, in which a frequency-modulated carrier is fed into the trolley power system at 100 kilocycles, reliable two-way operation has been reported by the *Pittsburgh Railways Company* on their Pittsburgh and Washington, Pa., runs. The system permits the trolley operator to report his position and receive his orders in a few seconds without leaving the car, the former practice which resulted in time losses of seven to ten minutes.

Besides a speaker, the equipment consists of a junction and meter box and transceiver, mounted in a shock-mounted steel case, weighing about forty pounds.

The results have been so promising that the railway officials have ordered new trolleys, now under construction, wired to accommodate the radio setups.

The transit radio system, another of the recent FM application trends featuring the use of FM receivers, is also on its way to substantial success, with thousands of riders in Cincinnati, St. Louis, and Houston enjoying the music-while-you-ride service. Advertisers have found the idea so effective, particularly at choice hours, that a series

of time and rate standards had to be prepared. Two rates have been established, for rush hour and shopping hours, predicated on 1000 riders; seventy-five cents for rush hours and one dollar for shopping hours. It is expected that a fifty-word message will be the limit for announcements and about twenty-five seconds for transcribed sales talks.

There's quite a story behind the birth of transit radio, how it was adopted and is used today. The idea was first tried in Cincinnati in 1936 by a streetcar company with AM equipment. The experiments proved that AM would not work too well because of the static and other noise problems. In addition the receivers did not seem able to withstand shock. The receivers were also of the tunable type and passengers often found themselves debating what programs should be tuned in. In April 1947, a small group of FM operators originated the plan of transit radio with FM and brought the matter to the attention of a group of bankers in Cincinnati. A month later, a company was organized, with one particular thought in mind, the development of a special receiver which would work and work well.

By October first, the receiver, a thirteen-tube, crystal-controlled, shockproof unit, had been designed and, for test purposes, fifteen prototypes built. The first tests were made on three buses and one trolley of the *Cincinnati Street Railway Company.* About a month later another model was installed in a bus of the *Green Line,* a company operating from Northern Kentucky into Cincinnati. After three months of tests and public-opinion balloting, it was found that not only did the sets stand up but there was almost unanimous approval of the music-while-you-ride idea. Soon after, tests were run off in Houston, Wilkes-Barre, Washington, Philadelphia, Seattle, Indianapolis, and other cities, with equally favorable results.

The receiver has many unusual features, such as "on-off" and voice-emphasis circuits. Both are operated from the transmitter by supersonic tone. There is a two-fold purpose for the "on-off" circuit. It provides a method of preventing unpleasant noise from coming through the speaker system when the station is off the air, and it also gives the station a necessary means of cutting away from programs unsuitable for bus reception; political announcements, rural programs, etc., which are essential in the broadcasters' well-rounded daily service. The voice-emphasis circuit is activated by the announcer's microphone. When the microphone is open, the volume on the receiver is raised an adjustable amount varying from zero to 12 decibels. This type of amplification was found necessary after many tests, which revealed that the volume for music could be kept low for pleasant listening, but voice announcements had to be stepped up to become fully

audible. During the summer months when windows of most of the buses and trolleys are kept open, it was found that a least a 10 db. rise was necessary for complete intelligibility. In the winter, a 6 db. signal was found sufficient.

Transit radio now has hit its stride and is destined to become one of the most significant fields for FM broadcasting.

THE PETROLEUM INDUSTRY, which has found radio so essential, and presented so engrossing a case for more frequencies at the recent hearings in Washington, through the American Petroleum Institute offices, reviewed at the sessions how completely necessary radio has become to our daily way of life. The institute's reps showed how vital petroleum cannot be drilled without a radio communications system in operation. Petroleum is usually sought and found in areas remote from existing communication facilities and where the construction of telephone or telegraph lines would be impractical, the oil specialists noted. Such areas include marsh and swamp inland areas in the southern part of the country, off-shore locations on the Continental Shelf and rugged mountain terrain in the western portion of the nation. During drilling operations, it is imperative that continuous communications be maintained between the well site, field headquarters and mobile units to provide close supervision of this extremely hazardous operation, the FCC was told. Fire, explosion, well blowouts, accidents, equipment failures, and other emergencies require immediate coordinate action by special agencies including medical, fire-fighting, special mud conditioning, and well-cementing services. In addition, the witnesses testified, supervision of the drilling operations requires adequate communication facilities for transmission of communications essential to the successful completion of the well.

The 152 to 162 mc. channels are also necessary for roving pipe line repair crews, it was learned, as well as patrol groups who use planes. It was also revealed that radar is an important factor in the industry, the scope equipment being used at fixed and portable locations for navigation and protection of vessels.

Describing the extent of radio applications, the institute's witnesses said that in the Texas and Louisiana areas, where approximately two-thirds of the oil-production activity is centered, there are 105 station licensees, which operate a total of 2706 transmitters on 60 channels.

NEW WORDS AND NEW DEFINITIONS appear in an *NBC* TV glossary of terms now used in telecasting.

We find such new words as *womp*, which means a sudden flare-up of brightness in the picture. *Woof* is another newcomer, which is telephone slang used by TV engineers to signify

okay and goodbye. The word *busy* has taken on a new meaning, too, for now it seems to describe a setting or background that is too elaborate and obscures the movement of actors or detracts from the logical center of interest on a scene. *Free perspective* has a new definition too, now; the deliberate falsification of normal perspective in a painting or construction of television settings to achieve an apparent greater depth or distance. *Freeze it* has an interesting meaning according to the *NBC* booklet; it's used to indicate that set designs and arrangements or positions of furnishings are approved and should be executed as planned. According to the new TV talk compilation, *getaway* is now an offstage means of descent from a raised flooring area within a set. It's also a passageway behind the settings provided as a means of unobserved access to other settings or locations within the studio.

High hat is not a topper in TV talk, but a camera mount for use on a table top, and *inky* is an incandescent lamp. And *noodle* is not something to eat, but the playing of a few bars of background music, usually in an improvised style behind the titles of scenes. The art is known as *noodling.* By the way, *stretch* now means a stall for time!

PROGRESS ACHIEVED during the year in the laboratory and field by industry and the universities, will be thoroughly reviewed at the annual IRE convention which will be held in New York City during the first week in March. There'll be over 100 papers on all phases of the art covering antennas, microwaves, oscillography, tube design, nucleonics, instruments, components and materials, navigation aids, wave propagation, relay systems, electronic computers, television, audio facilities, etc. It will be quite a meeting, lasting four days, and providing an encyclopedic study of the advancements in radio and electronics which have become the servant of mankind.

.....L.W.

DELAWARE HAMS MEET

THE DELAWARE Valley Radio Association of Trenton, New Jersey will sponsor its Fifth Annual Old Timer's Nite and banquet on Saturday, April 9th.

The affair will be held in the Grand Ball Room of the Hotel Stacy-Trent, West State and Willow Streets in downtown Trenton. A turkey dinner will be served at 6:30 p.m.

Guest speakers will include old timers in the wireless field and men who have served many years in all branches of the radio field. W2ZI's collection of early wireless instruments will be on display. Door prizes will be awarded, with a special prize going to the "Grand OM" whose radio experiences date back to the earliest days of wireless.

Reservations should be made before April 1st with Ed G. Baser, W2ZI, general chairman, 315 Beechwood Avenue, Trenton 8, New Jersey. The tickets are $5.00 per person up to April 1st with late comers paying $6.00 for tickets purchased at the door. —30—

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

TV EQUIPMENT

The new catalogue just issued by *Roger Television, Inc.* contains many items of interest to the television serviceman and video set owner.

Included in this 4-page booklet are new products designed to help solve TV installation problems, i.e., the company's "Yagi-Beam" television booster antenna, a pinpointing tele-booster array, mast swivel, self-supporting mast base, line stand-off, duplex outlet, the "Tel-Adjust," self-supporting masts for fringe areas, interference eliminator, "Tele-Pad," "Tele-Power," and fixed attenuator.

A copy of this Catalogue No. 49-1 will be sent free of charge. Address your requests to *Roger Television, Inc.*, 366 Madison Ave., New York 17, New York.

MIDGET RELAYS

A new catalogue, designed to simplify the selection and use of midget relays for almost any application, has just been issued by *Struthers-Dunn, Inc.* of Philadelphia.

In concise, easily-understood form, it contains complete information on hundreds of the company's midget industrial control relays with the exact contact arrangement, mounting details, and construction required for each application. It also explains the many physical and electrical features that are available to adapt standard relays to special conditions. Several recently developed midget types, including a small *UL*-approved relay with 15 ampere (115 v., a.c.) contacts, are listed for the first time.

A copy of the new bulletin (No. 2100) will be sent on request. Write direct to *Struthers-Dunn, Inc.*, 150 N. 13th Street, Philadelphia 7, Pa.

PROJECTION TV DATA

Television Assembly Company, in response to requests from servicemen and students, is currently making its instruction manuals, covering the Model P-520 projection television assembly, available to the public.

This large book of 93 pages, plus schematic inserts, covers in minute detail every operation for assembling this projection television unit as well as a complete description of the various ways of securing maximum efficiency from the set.

The instruction manual was prepared by *John F. Rider Laboratories* in collaboration with Gerard R. Francoeur, the company's chief engineer.

While the manual is provided at no cost with each Model P-520, it will be supplied at a cost of $2.50 to others requesting it. Send your order and payment to *Television Assembly Company*, 540 Bushwick Avenue, Brooklyn 6, New York.

RECORDER BOOKLET

The Engineering Department of *Amplifier Corp. of America* has just published a 12-page booklet entitled "99 Questions Most Often Asked About Magnetape Twin-Trax Recorders" which it is distributing free of charge.

Compiled from an analysis of over 5000 letters received by the engineering department of the company, the booklet lists everyday questions and their answers on the performance, construction, specifications, etc. of the company's newly developed series of "Twin-Trax" dual-channel magnetic tape recorders.

The booklet is intended to provide information on "Twin-Trax" recording which is not normally covered in sales literature, but which has proven vital to the individual interested in magnetic tape recording.

A copy of the publication will be sent free on request. Address the "Twin-Trax" Division, *Amplifier Corp. of America*, 398-2 Broadway, New York 13, New York.

PRINTED CIRCUITS

Microcircuits Company of New Buffalo, Michigan is currently offering an 8-page booklet, "Design & Repair of Printed Circuits," written by Robert F. Bradley.

The booklet discusses such subjects as equipment, circuit layout, use of the paints, base material, surface treatment, tube and component mounting, crossovers, calculating resistors, calculating condensers and inductances, and circuit repair.

A table for computing resistor sizes and wattage ratings for any resistance value is a valuable addition to the text.

For details on how to secure a copy of this booklet, write to *Microcircuits Company*, New Buffalo, Michigan.

SIMPSON INSTRUMENTS

Simpson Electric Company of Chicago now has available a data sheet covering its line of test equipment which is available on request.

Included are descriptive material and specifications on the company's Model 260 v.o.m., Model 266 v.t.v.m., Model 555 tube tester, the Model 445 tube and set tester, the Model 330 mutual conductance tube tester, Model 415-A signal generator, the Model 335 plate conductance tube tester, the Model 340 signal generator, the Model 221 v.o.m.,

and a whole line of portable test instruments.

A copy of this data sheet is available from *Simpson Electric Company,* 5200-5218 West Kinzie Street, Chicago 44, Illinois. Further details on any or all of the individual instruments listed are also available.

TURNTABLE DATA

The November issue of the *"Western Electric* Oscillator" carries an article of interest to station engineers and recording enthusiasts.

Entitled "Program Quality Depends on Turntable Precision," this article discusses such problems as what to look for and how to select a turntable. The author, J. G. Lawrence of the *Western Electric Company's* Radio Division, outlines in considerable detail a fresh approach to the problem of turntable driving mechanism design.

In addition to the article on turntables, a considerable portion of the issue is devoted to unusual sound installations.

For a copy of this issue, write to *Western Electric Company, Inc.,* 195 Broadway, New York 7, New York. Ask for No. 12 issue of the *"Western Electric* Oscillator."

MEISSNER CATALOGUE

Of interest to a large segment of the radio industry is the announcement that *Meissner Mfg. Division* of *Maguire Industries, Inc.* has just issued a new general catalogue covering the company's line of precision-built products.

This new catalogue, the first the company has issued in some time, covers television receivers, TV components, AM-FM tuners, test equipment, kits, recorders, receivers, and various radio components.

Copies of Catalogue 48B are currently available on request. Write direct to *Meissner Mfg. Division, Maguire Industries, Inc.,* Mt. Carmel, Illinois.

REFERENCE CHART

A handy reference chart for easily determining the actual picture size of all cathode-ray tubes has been produced by *International Television Corporation.*

The screen size of their own "Embassy" projection model, 2¼' by 3', is indicated by the over-all size of the chart.

Those connected with the television industry may obtain one of these "Vari-Scope Guides" by writing to *International Television Corporation,* 745 Fifth Avenue, New York City.

RCA SALES AID

The new, giant-size wall chart just announced by the Home Instrument advertising department shows seven current models of *RCA Victor* television receivers in full color.

The chart is designed as an attention-compelling window and interior display piece. Photographs representing the wide range of television programming are incorporated into the

chart; the pictures of the various instruments show them open to display their entertainment services, and closed to exhibit their styling. The chart, together with a distinctive-looking oak frame designed for it, is available to dealers through *RCA Victor* distributors in television areas.

COMAR CATALOGUE

The new, loose-leaf catalogue illustrating *Comar* relays, transformers, coils, terminals, etc., which has just been released, will be available without cost or obligation to those who inquire on company letterhead.

Write *Comar Electric Company*, 2701 Belmont Ave., Chicago 18, Illinois.

TELEVISION FOLDER

Transvision, Inc. has prepared a new "Television Components Folder No. P-1," which describes basic essential units for building a quality television receiver.

Succinctly written and clearly illustrated with photographs and schematic diagrams. 19 television parts are analyzed according to function, general use considerations, ratings, and connections.

Copies of this folder may be obtained by writing *Transvision, Inc.*, 460 North Avenue, New Rochelle, N. Y.

DESCRIPTIVE BOOKLET

Raytheon Manufacturing Co. has compiled a bulletin, "Socket and Mounting Notes for *Raytheon* Flat Press Subminiature Tubes," which will be distributed to engineers using these tubes in the design of electronic equipment.

These notes give very complete information on mechanical applications, including details of subminiature tube sockets and methods of connecting to the tube, shielding it, and potting it in plastic.

For copies of this publication address *Raytheon Manufacturing Co.*, 60 East 42nd Street, New York 17, N. Y.

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The grand prize winner in Hytron's servicemen's tool contest is Harry L. Smith of Long Island City, New York, who became eligible for the big money by virtue of his winning the May contest. Contestants were asked to submit suggestions, photographs, or sketches of useful, practical, durable, and easy-to-manufacture service tools which could be used in the radio shop. Mr. Smith receives $400 in U. S. Savings Bonds from Bruce A. Coffin, president of Hytron Radio & Electronics Corporation while Everett Boise, Hytron's commercial engineer in the New York area, watches the proceedings.

Facsimile

(*Continued from page* 63)

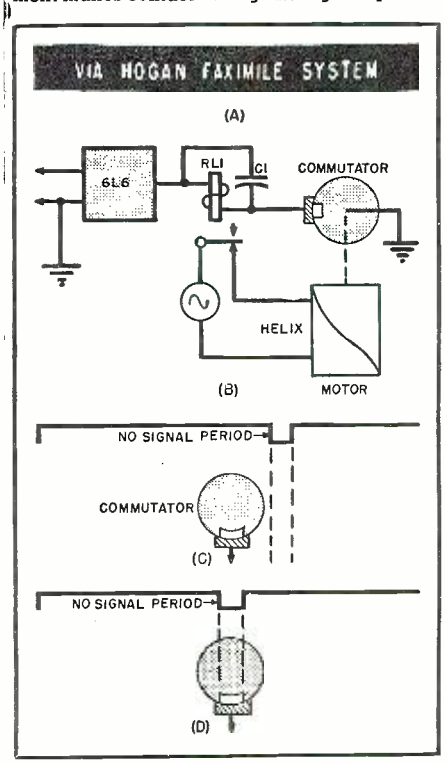
simplified for mass production, a facsimile recorder and an automatic changer will probably cost about the same and customers may have a choice between them.

One brand of sensitized paper used at present costs $3.85 per 400 foot roll, a one-month supply under normal conditions. It is anticipated that mass production will bring the cost down to a dollar a roll. To preserve the moisture content of the paper, it is packed in a moisture-retaining can. In the receiver, the paper is stored in a small humidor.

The printer blade gradually wears away as metal from the blade is transferred to the sensitized paper during the electrolytic marking process. Cost of a new blade is negligible, and the replacement can be performed by the set owner. It is common, in good recording, to change the blade every time a new roll of paper is installed. In this way, no blade problems are ever encountered. One proposal currently being considered calls for packing a new printer blade with each roll of sensitized paper.

In appearance, facsimile pages resemble photo-offset printing. Pictures reproduce with better quality than the

Fig. 2. (A) Page separation signal. This signal is sent out by the pulse generator and serves the dual purpose of identifying the station and phasing the recorder. (B) Diagram of recorder phasing circuit. (C) Time relation between frame pulse and commutator when recorder is not phased. (D) Time relation between frame pulse and commutator when recorder is phased. Note that commutator segment makes contact during "no signal" period.



average newspaper cut. Printed matter, although quite readable, does not approach type-printing in clarity. This problem is being solved by the development of clearer type-faces and more sprightly makeup.

The biggest problem facing fax manufacturers is gaining public acceptance. Even when convinced that facsimile newspapers are clear and readable, the public is inclined to ask: "So what? It's a fine gadget, but why buy one when very satisfactory newspapers can be purchased at the newsstand?" This problem is being resolved by *Newspaper Publishers' Faximile Service,* an organization affiliated with *Radio Inventions, Inc.* and broadcasters interested in the field. Recently, *The Philadelphia Inquirer* ran a demonstration of multiplexing to which publishers and the trade press were invited. A full-fidelity FM program was broadcast by WFIL simultaneous with a fax-cast. An FM-facsimile receiver, tuned to WFIL was set up in the room and the guests could hear the program and watch the *Inquirer's* facsimile edition at the same time. In an adjoining room. an ordinary FM set was placed to demonstrate that no filter was necessary to prevent interference between fax and FM.

Details of the multiplexing unit are not yet available. Basically it is a filter and amplifier. One unit is required at the transmitter and another at the fax receiver. FM sets without facsimile do not require the multiplex unit.

The Inquirer sends out an eight-page edition weekly. An average edition includes three pages of general news, a page of movie and theater news, a radio-television page, women's features and—two pages of comic strips! For about 10 months, *The Inquirer* has included paid advertisements in their editions.

The Miami Herald sends out five editions daily through its FM outlet WQAM. Four four-page issues and an eight-page edition are transmitted. To acquaint the public with facsimile, *The Herald* rents facsimile receivers to hotels for $85 a month. At this writing, the newspaper is in the process of actually installing some 45 receivers.

A smaller problem is the one of cutting the pages. As the equipment is now set up, the paper rolls out of the recorder continuously. A cutter blade, actuated by an audio tone from the transmitter could cut the pages into 8½" x 11" sheets.

Many broadcasters are interested in facsimile and the future may witness close cooperation between radio and the new art. For instance, as the *"Magic Chef"* extols the virtues of a new pastry, the recipe for same could be transmitted by facsimile, saving the housewife the bother of searching for pencil and paper and eliminating the possibility of error in taking down the formula.

Sporting events offer facsimile a unique chance to make a name for itself. At the conclusion of a baseball game, facsimile stations could send out a photographic recap of the event. Pictures of photofinish horse-races, transmitted a few seconds before the official decision, would give the facsimile set owner a "scoop."

REFERENCE

1 Two motors rotating at the same speed are synchronized but not necessarily in-phase. Phasing refers to a definite angular relationship between the motors. The transmitter and recorder motors may be said to be in-phase when their drums start and finish each line simultaneously. The phasing pulse is sometimes called a "framing" or "centering" pulse.

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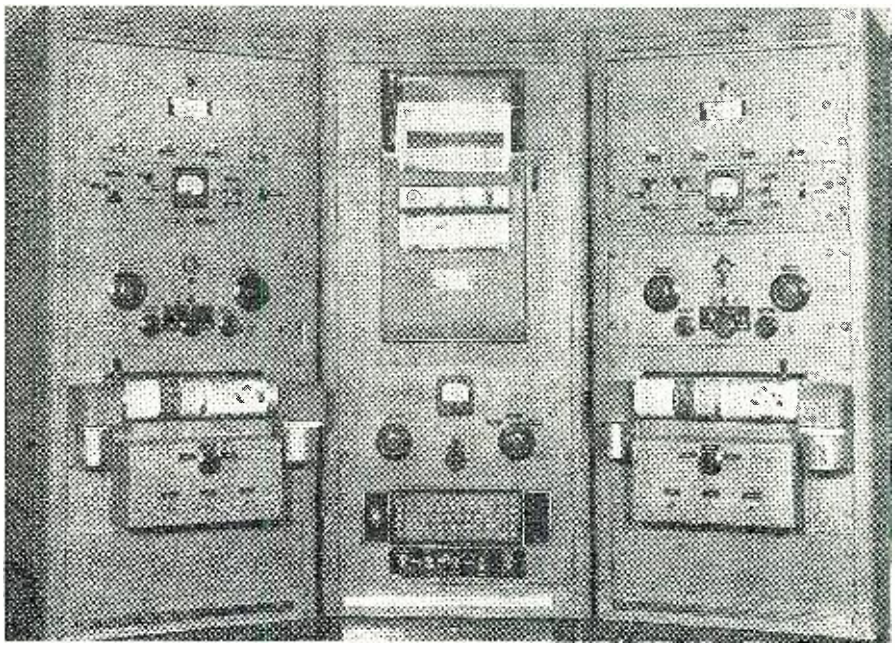
A facsimile transmitter and monitor designed for broadcast station use. The cabinets to the left and right of the center panel house the scanner units. Directly above the scanner units are the scanner amplifiers. The center panel contains the monitor recorder. Note the facsimile receiver at the bottom of the recorder unit.



Electronic Volt-Ohmmeter

(*Continued from page 61*)

lines and the various scales for the new meter dial. This can be most conveniently and accurately done by photographically reducing a large meter scale. First photograph the present 200 microampere meter and enlarge it about three times. When the enlargement is finished tack it down on the center bottom edge of a 16 x 20 inch sheet of white, matte surfaced drawing paper on a flat board or surface. From the end radials on the enlargement draw extensions up to the top of the 16 x 20 paper and lay off the three arcs for the various scales. The top arc is for *"OHMS";* the next one down is for *"A.C."* and *"D.C. VOLTS,"* 0 to 2 and 0 to 6 range; the lowest arc is for *"A.C."* only, 0 to 2 and 0 to 6 volts. When measuring a.f. or r.f. volts up to 6 volts the lowest arc is used. Anything over 6 volts, whether a.c. or d.c., is read off the center a.c. and d.c. scale. A separate scale is used for low a.c. voltages because of non-linearity of the diode characteristics at low voltages.

With the three arcs laid out, the builder can now begin marking out the various scale divisions or calibrations. Set function switch to *"OHMS,"* set zero adjust and connect a known accurate resistance between J_2 and J_5. Observe the reading on the 200 microampere scale of the meter, and lay a straightedge over the corresponding place on the enlarged picture of the scale. The straightedge goes through two points—one corresponding to the pivots of the meter; and the other is the observed reading on the 200 microampere scale. Mark off a short line where the straightedge intersects the *"OHMS"* arc. Proceed with different values of resistors until the *"OHMS"* scale is calibrated. Needless to say, the accuracy of the ohmmeter will depend largely on the accuracy of the standards and the care with which the readings are transferred to the 16 x 20 drawing. A decade box is ideal as it gives a wide range of accurate resistance values. The layout of the *"OHMS"* scale will be similar to that of an ordinary ohmmeter; the 10 ohm point will be approximately at midscale.

The 2 and 6 volt d.c. scales are laid out in similar fashion by switching to *"PLUS VOLTS"* and applying known d.c. voltages between the d.c. probe and J_2. A battery in series with a low resistance wirewound rheostat and a high resistance wirewound potentiometer is used for the d.c. voltage source. An accurate low range d.c. moving coil voltmeter is connected across the d.c. probe and J_2 for the d.c. readings. The low resistance rheostat serves as a fine control of the calibrating voltage.

For the 2 and 6 volt a.c. ranges a stable source of a.c. is necessary, and the fine and coarse potentiometers are

used as before. The low range d.c. voltmeter is replaced by an accurate a.c. meter of low range connected between the r.f. probe and J_2. It is recommended that the a.c. source be 60 cycles since most a.c. meters are subject to considerable error as the frequency rises. If 60 cycle current is used it should be fed into the probe through an 0.5 μfd. paper condenser connected to J_4.

When the a.c. source is connected as above, set the function switch to *"A.F. VOLTS"* and the range switch to 20 volts. Apply an a.c. signal of exactly 20 volts and adjust R_{12} until the meter reads full scale. Then switch to the 6 volt range, apply exactly 6 volts to the probe and adjust R_{11} until the meter reads full scale. Then switch to the 2 volt range, apply 2 volts and adjust R_{10} until the meter reads full scale. This completes the full scale calibration of the a.c. ranges, and you can now mark off the intermediate scale values by applying various a.c. voltages until the full 2 and 6 volt arcs are divided as was done for *"OHMS"* and *"PLUS VOLTS."* When the large 16 x 20 drawing is inked and lettered with India ink it can be reduced photographically. A camera with a ground-glass back is necessary so that the new scale will be the proper size for the meter movement. The size can be checked by measuring the chord across the arc of the original 200 microampere scale, and then adjusting the camera until corresponding points on the ground-glass image are of the same dimensions. The photographic negative so obtained will be used for making a contact print on smooth matte surfaced white contact paper of contrasty grade. The resultant print is then trimmed and cemented over the original dial scale on the meter movement. This method of making meter scales can be adapted to almost any type of meter or dial for most any type of instrument. If an extra touch is desired, the 16 x 20 drawing can be inked in with colored inks and the color reduction made by some one of the new color processes now available to amateur photographers. If you do use the color method it would be well to cultivate the friendship of an amateur photo fiend.

A somewhat similar process is used for marking the front panel of the instrument case. A full scale drawing of the desired panel was made on matte surfaced white drawing paper and inked in with India ink. A full scale, or one-to-one ratio, photostat was made from this drawing and cemented on the front panel of the instrument. This gives a black panel with white markings for the ranges and functions. The photostat should be first given several coats of clear lacquer, and when dry cemented on with a good grade of cement. This method of panel lettering is economical, flexible, and at the same time accurate.

In the mechanical layout of the voltmeter some shielding is advisable and

the photographs show how it was done. A shield of 16 or 20 gauge iron goes around the power transformer on two sides, with ventilating holes along the bottom edges of the shield. R_{45} is mounted on this shield above the transformer. This resistor is the only one that runs warm and this position places it high up where its warmth will not affect any of the other parts. C_6 is also mounted on this shield so that it can be easily adjusted. Underneath the chassis a barrier of similar metal runs transversely, separating the a.c. wiring from the rest of the wiring. On the back side of the barrier are mounted C_{14}, R_{36}, R_{38}, R_{39} and R_{40}. On the front side of the barrier is mounted the divider network C_2, C_3, C_4, C_5, R_1, R_2, R_3, R_4, and R_5 and the ohmmeter resistors R_{13} to R_{19} (if these resistors are not mounted on S_{2b}). This arrangement shields all the high range resistors and low level circuits from the transformer and high voltage fields. The calibrating rheostats R_{10} to R_{12}, and R_{41} to R_{43} are mounted on back side of chassis. and are provided with screwdriver slots on their shafts for adjustment. The chassis base, also of 20 gauge iron, is formed as an open end channel and bolted to the sloping front panel of the cabinet. The cabinet used by the author was an 8 x 8 x 10 inch sloping front cabinet. This was the only thing available and it led to close fitting to get everything in. The builder is advised to use the next larger size.

C_6 is adjusted as follows: set function switch to *"A.F.x10"* and range switch to 2 volts. Plug P_1 into J_4 on the probe, and apply 20 volts at about 10,000 cycles to the a.f. probe in J_1. Then adjust C_6 until the meter reads full scale two volts on the 2 volt a.c. scale. This sets the divider network so that it will divide the input voltage by 10, thus multiplying the meter reading and switch setting by 10 up to a maximum of 2000 volts r.m.s. Sometimes it is necessary to take a measurement of a.c. when a large d.c. potential is present, as for example across the filter condenser in a power supply where the ripple voltage might be only 50 volts and the d.c. component 4000 volts. In this case a .5 or 1 μfd., 5000 volt condenser should be connected between J_1 and the point where voltage is measured, showing all due respect for the high voltage present. —30—

"It's that nosey Mrs. Ipswitch, next door!"

Technical BOOKS

"RADIO OPERATING QUESTIONS AND ANSWERS" (9th Edition) by Arthur R. Nilson and J. L. Hornung. Published by *McGraw-Hill Book Company, Inc.,* New York. 517 pages, Price $3.60.

By now this text should be so familiar to radio operators and prospective licensees as to need no review. Long considered the "bible" in the field, this newest edition does include several additions to previous text material which are worth noting.

This 9th edition includes an "addenda" section which has been designed to cover the new supplementary elements recently released by the FCC for the radio-television license examinations for the broadcast service.

The "addenda" deals with those questions recently added by the FCC to elements 2, 3, and 4. This material was added by the FCC to increase the scope of the radio broadcast operator's examination to include AM, FM, and television, plus special antenna systems required for these services.

The book is divided into six elements corresponding to the FCC examinations. Basic radio laws, basic theory and practice, advanced radiotelephony, radiotelegraph, and advanced radiotelegraphy are covered.

Persons preparing for licensing exams will do well to have a copy of this study manual handy.

* * *

"HANDBOOK OF RADIO PRODUCTION" by Erik Barnouw. Published by *Little, Brown & Company,* Boston. 324 pages. Price $4.50.

This concise handbook should be of interest to all persons in the broadcast end of radio; studio engineers, sound men, announcers, actors, and directors. The author has devoted a chapter to the equipment used in broadcasting (exclusive of the transmitters) and has explained, in a thoroughly understandable fashion, the purpose and limitations of each piece of studio equipment.

Another chapter deals with the personnel in radio, and the duties and responsibilities of each. The second part of the text is devoted to actual production techniques and the problems involved in putting a program on the air.

For the newcomer in the radio broadcasting field as well as the old-timer who wishes to brush-up on his technique this book is especially helpful. The material has been presented in such a way that the personnel of small, independent stations, as well as the larger network outlets, can gain the data necessary for doing a good job.

* * *

"PUBLIC ADDRESS EQUIPMENT MANUAL" by John F. Rider. Published by *John F. Rider Publisher, Inc.,* New York. 2000 pages. Price $17.64.

This monumental text is devoted entirely to audio amplification systems. Schematic diagrams and service notes are provided for audio amplifiers manufactured from 1938 to date.

Data on response curves, preamplifiers, equalizers, mixer circuits, tone compensation, and volume expansion and compression circuits has been included.

A separate volume entitled "How It Works" and containing a complete index, accompanies the p.a. manual. This book covers basic audio amplifier considerations, input systems, mixer circuits, tone compensation and coupling, volume expansion and compression, push-pull circuits, inverse feedback, and the output transformer and speaker system. The text is liberally supplied with schematic diagrams to illustrate the subject matter.

So complete is this book that it would be hard to imagine how any serviceman who does audio amplifier servicing could get along without this latest *Rider* Manual. —30—

CR TUBE SALES UP

REFLECTING the record-breaking television receiver production of the latter part of 1948, sales of cathode-ray tubes to set manufacturers rose sharply in the third quarter of 1948 over the second quarter, according to statistics released by the Radio Manufacturers Association.

Third quarter sales of cathode-ray tubes to equipment manufacturers totaled 306,502 valued at $7,529,531 compared with 267,763 units valued at $6,021,878 in the second quarter of 1948. All third quarter sales, including replacements, U. S. government agencies, and exports, totaled 327,044 units.

During the first nine months of 1948 cathode-ray tube sales to receiver manufacturers totaled 732,971 units valued at $17,779,749 as compared with sales during the entire year of 1947 of 255,035 units with a value of $7,218,358. —30—

ERRATA

An error occurred in the "solution" given on page 55 of the December issue. In the article entitled "Converting d.c. Relays," the current through the coil should have been stated as 60 ma. rather than 4.7 ma. The current was calculated on the basis of the old voltage of 12 v. rather than on the basis of 150 v.

* * *

The price quoted for volume control R-1 on page 43 of the article "Latest in Triode High Fidelity Amplifiers" published in the February 1949 issue was in error. Price should have been quoted as $17.50. Price of $11.50 shown was for a similar volume control without base compensation.

* * *

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RADIO Engineering Broadcasting, Aviation and Police Radio, Servicing, Marine Operating and Electronics taught thoroughly. Expenses low. Write for catalog. Valparaiso Technical Institute, Dept. N.. Valparaiso. Ind.

SALE

WEBSTER Model 78 Wire Recorder. Used less than 50 hours. Plus 30 spools ½ hr. wire. Guaranteed perfect. $100. J. Chiorazzi, 228 W. College Ave., State College, Pa.

BC-348-P, 110 VAC, with Noise Limiter, Thor 10 meter and Broadcast Converter. Schematics for all. $99.50. Irving Baer, 1294 Medford, Topeka, Kan.

HICKOK radio test equipment; Model 203 Electronic VOM, 532P Tube Tester, 191X Microvolt Signal Generator. Rider Manuals 6-14. Good condition. Bargain. Richard Fruechte, Lansing, Ia.

HALLICRAFTERS SX42. Perfect condition, $175. Joseph Fitzgerald, Hendric Ave., Riverside, Conn.

DUMONT 224 Hi-Fidelity Oscillograph. Perfect condition. $170. F.O.B. Brooklyn. Landy, 1796 Pitkin Ave., Brooklyn, N. Y.

BC-348-P NEW. Will sell for best offer. P. Halmbacher, 1208 Grant St., Waukesha, Wis.

NEW Bridge type Dry Rectifier units. Input max. 12 VAC, output max. 8 VDC, 100A $12.50; input max. 18 VAC, output max. 14 VDC, 100A $18.50; input max. 48 VAC, output max. 38 VDC, 100A $37.00. Starkweather, Ottawa, Kan.

BARGAINS: New and reconditioned Hallicrafters, National, Collins, Hammarlund, RME, Meissner, other receivers, tuner, television receivers, transmitters, amplifiers, speakers, etc. Lowest wholesale prices. Terms. Shipped on trial. Liberal trade-in allowances. Write. Henry Radio, Butler, Mo., and 11240 W. Olympic, Los Angeles, Calif.

2-VOLT Storage battery & home charger for portables, etc. Both only $4.95; guaranteed. Special quantity prices available. Modelectric Products, Asbury Pk., N. J.

GRILL Cloth, Celanese, light and dark pieces. 1000 square inches for $1 bill. Write for list of lowest priced national brand parts in nation. Bursma Radio. Route 5, Grand Rapids. Mich.

LOWEST Prices. Radio Tubes, parts. Bargain lists, 3c. Potter, 1314 McGee, Kansas City 6, Mo.

HEARING Aids. Zeniths, others. All used but working. Make miniature transmitters or receivers. Complete with cords, ear piece, $20 ea. Shelby Instrument, 321 W. 7th, Long Beach, Calif.

12B8 & 25B8 TUBES. Adapter unit using 2 miniature tubes (6AT6 & 6BA6 for 12B8, and 12AT6 & 12BA6 for 25B8). Takes less space than original tube, nothing else to buy, just plug in and it works. Money-back guarantee. 12B8 or 25B8 unit complete: $2.49 each, 10 units for $22.50. Send 25% deposit, balance C.O.D. Write for free parts catalog. Commercial Radio, 36 Brattle St., Boston, Mass.

VACUUM tube voltmeter, 6v input B supply, 60c selsyns, Aluminum call letter plates, FM-TV servicing aid. Write Hawkins Radio Co., 621 E. 31st St., Kansas City 3, Mo.

LIGHT Plant Universal Model 6000 M, 110 volts DC 6. KW. Good running condition, $250.00. Miller Watkins, 1056 Murfreesboro Rd., Nashville, Tenn.

COAXIAL Cable. Identical characteristics as RG-58/U. Send dime for 3 foot sample: 300 ohm Twin-Lead $1.75 per 100 feet. Harry H. Van Dick, Box 236, Little Falls, N. J.

SX-43. Like new, $145. Harry Meiss, 1111 Egan Court, Cincinnati, Ohio.

ALUMINUM tubing, angles, channels and pipe. Write for list. Willard Radcliff, Fostoria, Ohio.

TELEVISION, radio, tubes, parts. Send for free bargain list. Hallmark, 592 Communipaw Ave., Jersey City, N. J.

SURPLUS Parts Bargains: Looking for some special item? Radio parts and equipment bargains as offered by leading U.S. and Canadian dealers are listed and cross indexed in the files of: Surplus Directory Service, 366 Madison, New York, N. Y.

POLYSTYRENE coil dope, cement for polystyrene parts and moisture proofing, pint $1.00. Toggle switches, H & H arrow 3 amp DPDT, ball handle, stem length ½", 4 for $1.00, 9 for $2.00. Free "Shorty" tapered polystyrene alignment tool blank with each order. All items postpaid in U. S. Kissel Electric Products, 431-N Sherman, Galion, Ohio.

CONDENSER Bargain. 50 assorted Paper Condensers $2.45, 50 assorted Mica Condensers $2.45 (regularly $12.50 each assortment). Both assortments $4.50. All new and size marked. Special prices for quantity users. Sorry, no C.O.D. Telectrad, 3232 Broadway, New York 27, N. Y.

RADIO Diagrams AM, 30c; SW, FM or combined, 60c; Television $1.00; Service information $1.00 add'l. State manufacturer and model number. Kramer's Radio Service, 36 Columbus Ave., New York 23, N. Y.

RECORD Changer parts for leading makes of changers. We invite mail orders! Ship everywhere. Friends, Wholesale Distributors, 106 N. 6th St., Philadelphia 6, Pa.

SURPLUS rotary selector switches 10 for $1.00; Triple section condensers 2-.8-.3 @ 200V DC 10 for $1.00. Witzel, 181 Cobb Terrace, Rochester 10, N. Y.

HOTTEST surplus list in the country. Electronics-Hydraulics, Aircraft-Gadgets. Dick Rose, Everett, Wash.

CONDENSER Bargain. 50 assorted Paper Condensers, $2.45, 50 assorted Mica Condensers, $2.45 (regularly $12.50 each assortment). Both assortments $4.50. All new and size marked. Special prices for quantity users. Sorry, no C.O.D. Telectrad, 3232 Broadway, New York 27, N. Y.

TWO 1846 Inconoscopes, used, good condition, one mount and two coil assemblies included. Best offer. A. Edwards, 624 18th St., CHA-3, Honolulu, Hawaii.

WRITE Dept. RN18 for our free wholesale list of Radio parts & accessories. R. C. Radio Parts & Distributing Co., 731 Central Ave., Kansas City 6, Kan.

WANTED

FELLAS! Got any radio parts you're not using? Such as recvrs., complete xmitters, test equipment, parts, etc. Why not sell them to us? This may be your chance to get some needed cash. Don't delay, send for our catalog listing the gear we are now buying. Kindly remit quarter (refundable) to cover cost of handling and mailing. Your copy is waiting, may we serve you? Radio Exchange, Box 215, Bayonne, N. J.

MANUFACTURERS, Wholesalers, Dealers. A service to save you Time and Money. Locating your hard-to-find items and selling your "non-moveable" surplus. Write on company stationery. Tell us your needs. Sell us your surplus. Electronic Surplus Brokers, 3232 Broadway, New York 27, N. Y.

TRC1 EQUIPMENT T14 Transmitters, R19 Receivers, AM & Amplifiers, PP13 Power Units. Box 476, % Radio & Television News, 185 N. Wabash Ave., Chicago 1, Ill.

WANTED: A Theremin (an Electronic Musical Instrument) or information on the coil winding data of the tone, volume and oscillator coils. R. J. Weidman, 101-39 118th St., Richmond Hill 19, N. Y.

WANT to buy a few BC-654 Transmitter-receiver sets or complete SCR-284A sets. Must be new or good clean-used condition. Write giving condition of set or sets available with listing of components and price asked. W. H. Gilman, 2144 S. Kedzie Ave., Chicago 23, Ill. Phone BIshop 7-6340.

SITUATIONS WANTED

SELECTED group of men, graduates of well-known trade school, desire employment in Radio Field. Will travel anywhere. Qualified in radio servicing, installation, test instruments, circuit operation, etc. Contact Placement Dept., Eastern Technical School, 888 Purchase Street, New Bedford, Mass.

HELP WANTED

OPENINGS! Broadcast-TV (1st fone lic.); Design, Sales, Crystal, Research, Tube Development, Recording, EEs, Electronic Technicians, Engineers, today consult: RRR-Radio-TV Employment Bureau, Box 413, Philadelphia, Pa.

INSTRUCTORS in Electronics and Radio. Prefer former Navy Radio Technician instructors willing to locate in the Detroit, Mich., area. Write to Box 452, % Radio & Television News, 185 N. Wabash, Chicago, Ill.

SALESMEN to sell Nationally Advertised Brand Radio Tubes to Dealers and Servicemen at liberal discounts. Good commissions paid. Box 480, % Radio & Television News, 185 N. Wabash Ave., Chicago 1, Ill.

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USED Correspondence Courses and Educational Books bought, sold, rented. Catalog free. Educational Exchange, Summerville, Ga.

USED Correspondence courses and books bought, sold, rented and exchanged. Catalog free. Lee Mountain, Pisgah, Alabama.

AMATEUR radio licenses. Complete code and theory preparation for passing amateur radio examinations. Home study courses. American Radio Institute, 101 West 63rd St., New York 23, N. Y.

PATENT ATTORNEYS

LANCASTER, Allwine & Rommel, Registered Patent Attorneys. Patent practice before U.S. Patent office. Validity and Infringement investigations and opinions. Booklet and form "Evidence of Conception" forwarded upon request. Suite 414, 815 15th St., N.W., Washington 5, D. C.

MISCELLANEOUS

ENTHUSIASTS! Britain's foremost radio monthly. Practical Wireless, keeps you up-to-date with latest radio news and events. Covers entire British and European radio-television developments. Authoritative constructional data; television and electronic features, discussion columns, news on International Radio Trade developments, etc. For annual subscription mailed direct to your address from London send only $2.00 to George Newnes, Ltd. (PW.39) 342 Madison Ave., New York 17, N. Y.

OREGON only. Our Radiotelegraph Code Practice Machines, model RCM-1, now available on monthly rental basis. Tapes designed for FCC preparation, Advanced, Beginners. Oswego 2-5011 or write Ultradyne Electronics, Oswego, Ore.

PHONOGRAPH records cheap. Catalogue free. Paramount, BN-313 E. Market, Wilkes-Barre, Pa.

PANAMA picture postcards, six, one a month with correspondence. Send $1 to P. Hawkins, Apartado 3124, Panama, Republic de Panama.

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INDEX OF Advertisers

MARCH 1949

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

Airline Radio

(*Continued from page 37*)

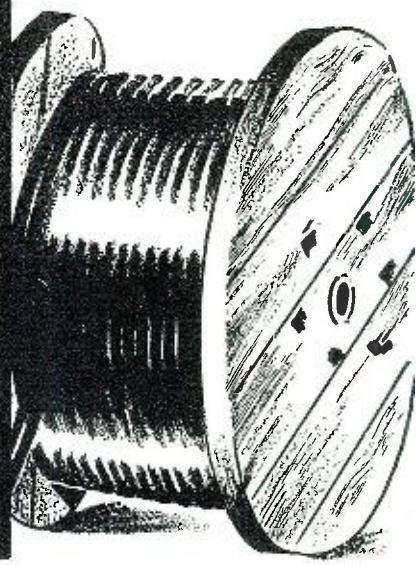
A typical flight of an *American Overseas* flagship from New York to London includes stops at Gander, Newfoundland, and Shannon, Ireland. With his passengers strapped in and the plane ready to go, the pilot cuts in the *Western Electric* AN/ARC-1 v.h.f set and gets clearance from the LaGuardia control operator for take-off. About ten or fifteen miles out (which means only about five minutes to a 300-mile-per-hour "Constellation"!), the pilot switches to the ART-13 transmitter and his 29-A receiver, selects an "en route" frequency, which might be 5672.5 or 3432.5 kilocycles, and contacts, as necessary, New York, Boston, Moncton, New Brunswick, and Gander. He is still using voice, and his transmissions are mainly brief position reports. Approaching Gander, he goes back to v.h.f., gets landing instructions from the tower and comes in. Take-off duplicates the LaGuardia operation. Once Gander is cleared, the radio operator, until now a silent observer, takes over on c.w. Using the plane's assigned call, KHGCP, to pick a real one, he works Gander, VOAC, until the plane is about half way over the ocean. Then he shifts to Shannon, whose call is EIP. This communication is likely to be on 6577, 11,319 or 3285 kilocycles. Meanwhile, the navigator and the pilots have been using the navigational equipment. Near Shannon, the pilot takes over radio control by switching on the v.h.f. set and he goes into and out of Shannon as he did at Gander and New York. On the relatively short hop from Shannon to London, "sparks" goes back to work on c.w., contacting London, MVA, on the medium frequencies. Outside of London, the pilot resumes the v.h.f. channel for voice communication with the ground control tower.

A fairly recent innovation in international air travel is the handling of "public correspondence," or third-party traffic, from the plane's passengers. At the present time this service is limited to outgoing messages only, between Gander and Shannon. For the most part they consist of notifications to friends of expected time of arrival. —30—

"It's really a television antenna in disguise—the wife and I like to have our evenings to ourselves!"

COAX CABLE

TREMENDOUS VALUES IN GUARANTEED COAXIAL CABLE • ANTENNA WIRE MICROPHONE AND HIGH VOLTAGE CABLE



COAX CABLE

RG-7/U	97.5 ohms impedance; outside diameter .370"; black vinyl jacket; polyethylene insulation. On original manufacturer's reels of 2040 feet	$37.50/M
	100 ft. coils	.04/ft.
RG-29/U	53.5 ohms impedance; outside diameter .184"; black vinyl jacket. Packaged on 4000 ft. reels	27.50/M
	1000 ft. reels	32.00/M
	100 ft. coils	.035/ft.
RG-29/U-W	Same characteristics as RG-29/U except cotton braided covering. Per 1000 feet	25.00/M
	100 ft. coils	.03/ft.
	RG-29/U is ideal for television to eliminate lead-in pick up of local interference. RG-29/U is similar to RG-58/U.	
RG-57/U	2 conductor Coax. 95 ohms; Kilowatt Rating. Any length	.18/ft.
RG-8/U	Limited quantity	40.00/M

LOW LOSS BEADED COAX CABLE, 72 ohms impedance.

	Type 72-12 — for ultra high frequency, with black vinyl covering supplied in any length desired	.11/ft.
	Type 72-12-W — Same as above except varnish cambric covering supplied on 60 ft. coils, only	.07/ft.

OTHER WIRE AVAILABLE FROM WELLS

PWD-20-2	Plastic coated assault wire two-conductor twisted Type W-130. Available on 1000 to 2500 ft. steel reels, individually boxed	7.00/M
PWD-20-3	3000 ft. payout reels (packed two reels per box)	6.50/M
PWD-20-10	10,000 ft. steel reels	6.25/M
AWT-18-1	Army Field Wire, Type W-110B. Two conductor, stranded, rubber covered, weather proof. 1000 ft. reels	10.00/M
AWT-18-10	Army Field Wire, Type W-110B. Two conductor, stranded, rubber covered, weather proof. ½ mile steel reels	9.50/M
AWT-18-20	Army Field Wire, Type W-110B. Two conductor, stranded, rubber covered, weather proof. 1 mile steel reels	9.00/M
KW-3	Flexible Phosphor Bronze No. 18 bare aerial wire 300 ft. spool	1.00/Sp.
KW-10	Flexible Phosphor Bronze No. 18 bare aerial wire 1000 ft. coil	3.00/M
AJ-18	Aerial Wire, No. 18, Copperweld, solid — on 3000 ft. reels, only	4.00/M
SWB-20	Single conductor No. 20, shielded, over-all braid, 1000 ft. reels	15.00/M
SC-20-1	Single conductor, ANJC-48, No. 20, stranded, glass braid, lacquered 1000 volt insulation, 2000 ft. reels	10.00/M
SC-20-3	Single conductor No. 20 glass braid, lacquered, 3000 volt insulation for Transmitters, 1000 ft. coils	12.00/M
MW-1	Shielded, single conductor microphone cable, rubber covered, extra flexible, inter-conductor stranded silver wire, 500 ft. coils	12.50/coil

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JOBBERS: REGULAR DISTRIBUTOR'S ARRANGEMENT APPLIES • ORDER FROM THIS AD.

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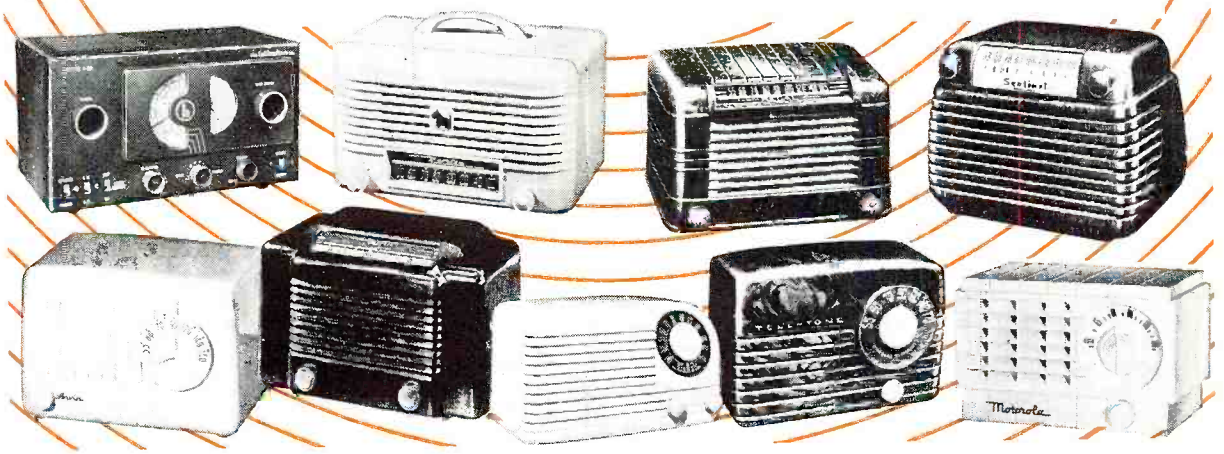
The ALL-AMERICAN FIVE and HYTRON go together

Build a better mouse trap and the word gets around—but fast. Same with Hytron a-c/d-c tubes. Many years of experience. Many millions of tubes. Constant engineering co-operation with dozens of prominent radio set manufacturers. All help make Hytron a-c/d-c tubes better. Make it natural to think of Hytron when you think of the All-American Five.

The lowly a-c/d-c tubes must pack a heck of a lot of performance—at a price. Hytron tubes do. They offer the special advantage of being built to the strictest requirements of leaders in the small set field. GT or miniature—you, too, will find Hytron a-c/d-c tubes your best choice.



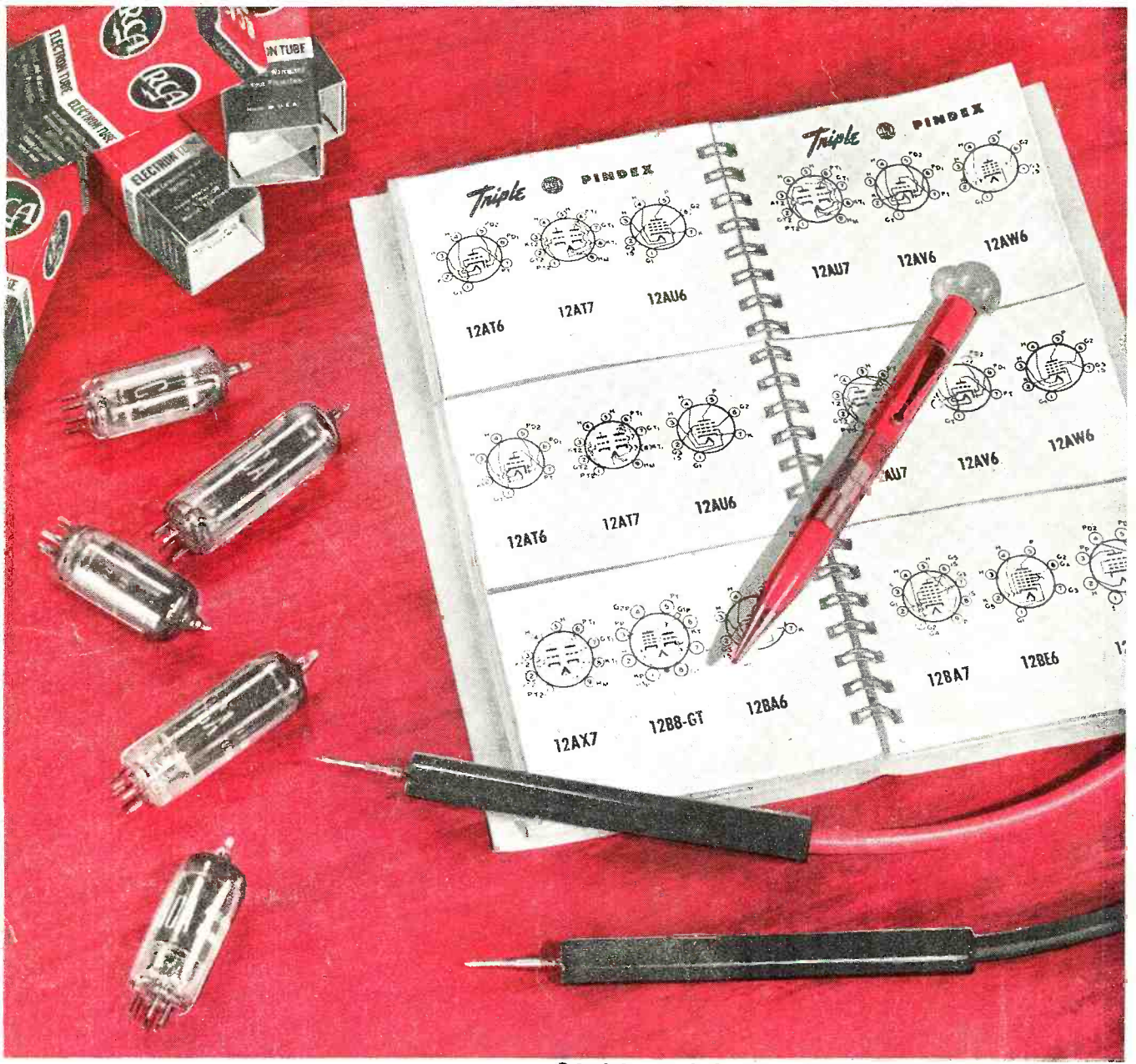
SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921.

HYTRON

RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS

HYTRON RADIO TUBES



RCA helps you all the way . . . with the best in business and sales aids.

There's *more* business in RCA miniatures

FEATURE FOR FEATURE, RCA miniatures have electrical and mechanical characteristics that set them apart from other tubes. That's why more RCA miniatures are used in FM and TV receivers *where it's the tube that counts.*

This extra quality cuts down costly service call backs . . . builds customer confidence—brings you *more business.*

When you push RCA tubes you're selling the brand that holds top customer acceptance. So . . . *push RCA tubes and watch your business grow!*

Sign Up! **for more profits**

RCA's famous "Fire Ball" fluorescent sign out front will bring in more customers. Sign up for yours today.

ALWAYS KEEP IN TOUCH WITH YOUR RCA TUBE DISTRIBUTOR.

TUBE DEPARTMENT

RADIO CORPORATION of AMERICA

HARRISON, N. J.