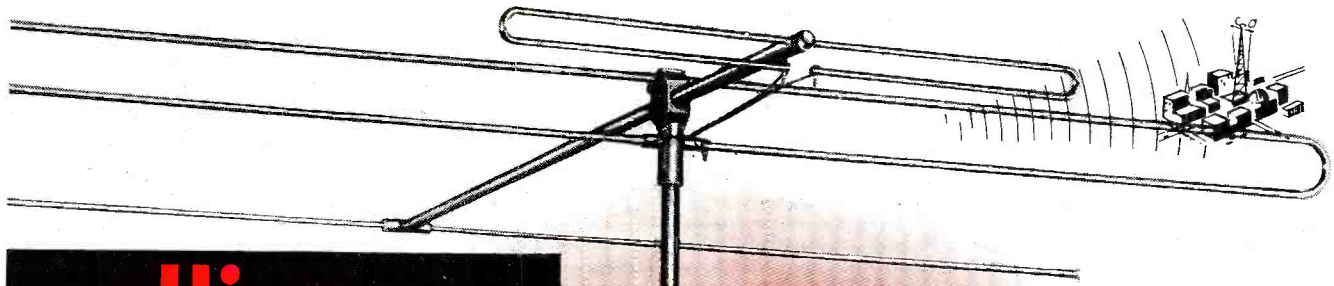
RADIO & TELEVISION NEWS

SEPTEMBER 1949

RADIO-ELECTRONIC ENGINEERING EDITION

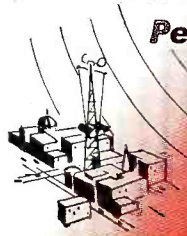
T. V. SERVICING WITH A SWEEP GENERATOR
PAGE 46

1949 U.S. TV YEAR



alliance
TENNA • ROTOR

For "Top"
TELEVISION
Performance!

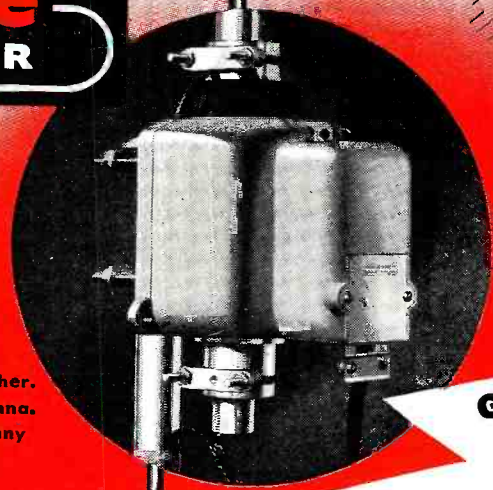


Operates in any weather.
Fits all types of antenna.
Motor will not cause any receiver distortion.

Approx. shipping weight 10 lbs.

Retails at **$39.95**

(Slightly higher west of Rockies)



GETS CLEARER PICTURES!

BRINGS IN THOSE OUT-OF-TOWN STATIONS!

ELIMINATES INTERFERENCE!

NEW DELUXE MODEL TENNA-ROTOR

Deluxe control case with indicator dial shows compass directions.

Overall dimensions of Rotor Unit
7¾" x 5¼" x 8"
Control Box 5" x 5"
Takes Max. Antenna Center Post O.D. 1⅜"

GREATEST DIRECTIONAL AID
For Maximum Signal Intensity!

Tenna-Rotor fits most manufactured 3-element 10-meter beams!

New Thrust Bearing Bracket—used with Tenna-Rotor is made especially for heavier 3-element 10-meter beams and stacked TV arrays. Supports direct vertical weights from 20 to 300 pounds!

Tenna-Rotor is easy and inexpensive to install—any antenna mast is quickly clamped into a rotating hollow shaft powered by fully enclosed, weather-proof, electric unit.

A new directional indicator control case as illustrated is now available and optional at slight extra cost.

Indicator dial shows *actual compass direction* in which the antenna is pointed at all times. Helps speed selection of desired antenna position—makes for greater convenience! The deluxe Tenna-Rotor (Model #DIR) costs only $10 more than standard model.

TENNA-ROTOR comes complete—ready to use! The Rotor is sturdy, water-tight, metal housed—a plastic control box five inches square plugs into any 60 cycle 110 volt circuit.

Simplify installations! Save Man-Hours on the Job—Eliminate Critical Antenna Orientation!

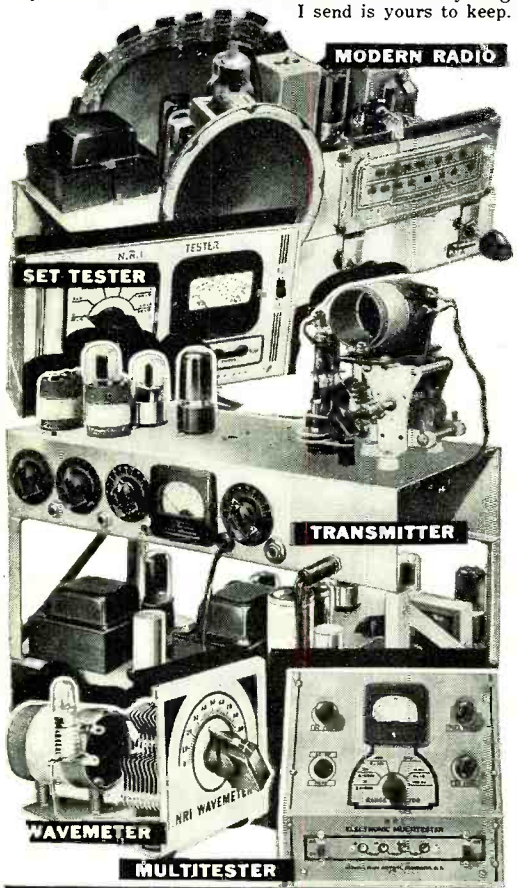
AMATEURS can use TENNA-ROTOR for both transmitting and receiving!

ALLIANCE MANUFACTURING COMPANY • ALLIANCE, OHIO
Export Department: 401 Broadway, New York 13, N. Y., U. S. A.

I Will Train You at Home for Good Jobs in RADIO-TELEVISION

I Send You Many KITS OF PARTS for practical experience

You conduct many tests and experiments with equipment built from materials I furnish. Some of the equipment from my Servicing Course and some from my Communications Course is shown below. Everything I send is yours to keep.



VETERANS GET THIS TRAINING WITHOUT COST UNDER G. I. BILL

America's Fastest Growing Industry Offers You GOOD PAY--SUCCESS

Want a good-pay job in the fast growing RADIO-TELEVISION Industry? Want a money-making Radio-Television shop of your own? Here's your opportunity. I've trained hundreds of men to be successful Technicians . . . MEN WITH NO PREVIOUS EXPERIENCE. My tested and proved train-at-home method makes learning easy. You learn Radio-Television principles from illustrated lessons. You get practical experience building, testing, experimenting with MANY KITS OF PARTS I send. All equipment yours to keep.

MAKE EXTRA MONEY IN SPARE TIME

The day you enroll, I start sending SPECIAL BOOKLETS that show you how to make $5, $10 a week or more EXTRA MONEY fixing neighbors' Radios in spare time while learning. From here, it's a short step to your own shop or a good-pay Radio-Television servicing job. Or be a licensed Radio-Television Operator or Technician.

TELEVISION OFFERS BRIGHT FUTURE

Today there are nearly 2700 Radio stations on the air—and within three years experts predict there will be over 1000 Television Stations. Then add developments in FM, Two-Way Radio, Police, Marine, Aviation and Microwave Relay Radio! Think what this means. New jobs, more jobs, good pay for qualified men.

ACTUAL LESSON FREE

Act now! Send for my FREE DOUBLE OFFER. Coupon entitles you to actual lesson, "GETTING ACQUAINTED WITH RECEIVER SERVICING." It shows you that learning at home is easy, practical. You also get my 64-page book, "HOW TO BE A SUCCESS IN RADIO-TELEVISION." It tells what my graduates are doing and earning. Send coupon in envelope or paste on penny postal. J. E. SMITH, President, Dept. 9JR, National Radio Institute, Pioneer Home Study Radio School, Washington 9, D. C.

I TRAINED THESE MEN

"I am operating my own Radio Sales and Service business. With FM and Television in the offing, we have a very profitable future." A. Patrick, Tampa, Fla.

"N.R.I. was my stepping stone from a few hundred to over $4,000 a year as a Radio Engineer. Make extra money servicing Radios." A. Michaels, Trenton, Ga.

"Before finishing course, I earned about $10 a week fixing Radios in spare time. Recommend N.R.I." — S. J. Petruff, Miami, Florida.

"My first job was obtained for me by your Graduate Service Dept. Am now Chief Engineer, Police Radio Station WQOX." T. S. Norton, Hamilton, Ohio.

"Am tied in with two Television outfits, and do warranty work for dealers. Use N.R.I. texts often." — Robert Dohman, New Prague, Minn.

"Four months after enrolling for N.R.I. course, was able to service Radios; averaged $10-$15 a week in spare time." — W. B. Weyde, Brooklyn, N. Y.

"N.R.I. helped me get position as Radio Mechanic with United Airlines. Have Radiotelephone 2nd Class License." — Lehman Hauger, San Bruno, California.

Good for Both—FREE

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

Mail me Sample Lesson and 64-page book about How to Win Success in Radio-Television—both FREE. (No salesman will call. Please write plainly.)

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

Address.....

City..... Zone..... State.....

☐ Check if Veteran — Approved Under G. I. Bill

COVER PHOTO. TV service technicians at the Patton Bros. (Benton Harbor, Michigan) firm use modern test equipment to speed up repairs and alignment. (Kodachrome by Deetjen Color Studio)

First in radio-television-electronics

Average Paid Circulation over 200,000

RADIO & TELEVISION NEWS

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DEPARTMENTS

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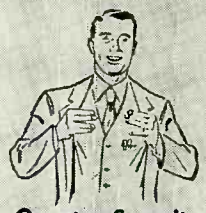
Which Do You Want?

Better Pay

A Nice Home

A New Car



Greater Security

Happy Vacations and Travel

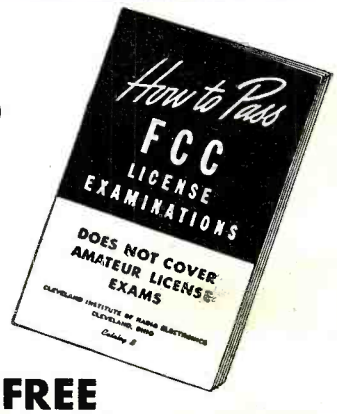
Get Your FCC Ticket
Jobs leading to
$3,000 to $7,500
(Average Pay Reported by FCC Nationwide Survey)
are opening up right now for FCC Licensed Radiomen.

I can train you to pass your FCC License Exams in a few short weeks if you've had any practical radio experience—amateur, Army, Navy, radio servicing or other. My time-proven plan can help put you, too, on the road to success.

Let me send you FREE the entire story
Just fill out the coupon and mail it. I will send you, free of charge, a copy of "How to Pass FCC License Exams," plus a sample FCC-type Exam, and the amazing new booklet, "Money Making FCC License Information."

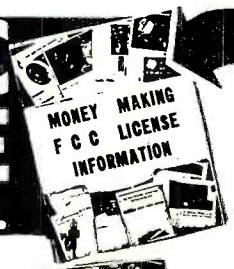
Edw. H. Guilford
Vice President

How to Pass FCC COMMERCIAL RADIO OPERATOR License Exams



FREE
Tells where to apply for and take FCC examinations, location of examining offices, scope of knowledge required, approved way to prepare for FCC examinations, positive method of checking your knowledge before taking the examinations.

Add Technical Training to Your Practical Experience & Get Your FCC COMMERCIAL RADIO OPERATOR LICENSE in a Few Short Weeks...



It's EASY if you use CIRE Simplified Training and Coaching AT HOME in SPARE TIME

Get your license easily and quickly and be ready for the jobs open to ticket holders which lead to $3000 to $7500 (average pay reported by FCC nationwide survey.) CIRE training is the only planned course of coaching and training that leads directly to an FCC License.

Your FCC ticket is always recognized in all radio fields as proof of your technical ability

Get This Amazing New Booklet

1. **Tells of Thousands of Brand-New, Better Paying Radio Jobs Now Open to FCC License Holders.**
2. **Tells How We Guarantee to Train and Coach You Until You Get Your FCC License.**
3. **Tells How Our Amazing JOB-*FINDING* Service Helps You Get the Better Pay Job Our Training Entitles You to Hold.**

Get All 3 FREE Send Coupon Now!

HERE'S PROOF THAT CIRE JOB-FINDING SERVICE GETS JOBS!

"Have accepted a position at KWAD in Wadena, Minn. I am indebted to CIRE, for I secured this position through the help of the CIRE Job-Finding Service. I had at least six other offers from stations receiving my employment application and CIRE reference. I am sincerely under obligation to you."
Student No. 2760 AT

"I am working at WRJM as a transmitter engineer, and received this position in response to one of the employment applications sent me upon completion of my course and the receiving of my Diploma. Received my 1st Class Radiotelephone license on March 2, 1949. I want to express my sincere appreciation to the staff of CIRE."
Student No. 2608 A2

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Desk RN-9 • 4900 Euclid Bldg. • Cleveland 3, Ohio
Approved for Veteran Training Under the "G.I. Bill of Rights"

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Desk RN-9, 4900 Euclid Bldg., Cleveland 3, Ohio
(Address to Desk No. to avoid delay)

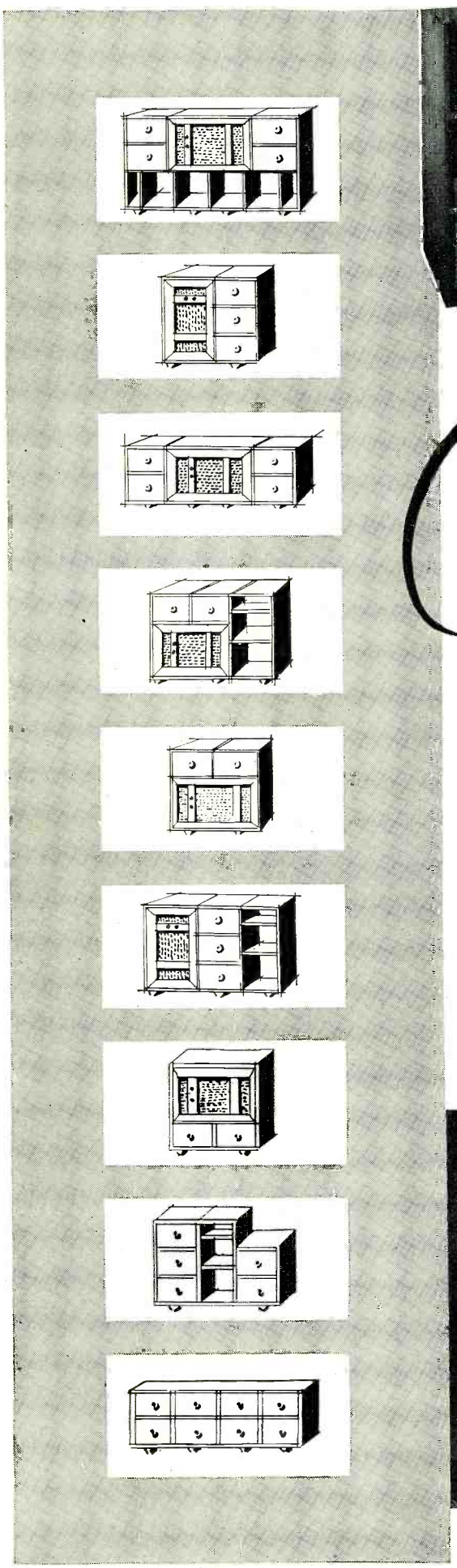
I want to know how I can get my FCC ticket in a few short weeks by training at home in spare time. Send me your amazing new FREE booklet "Money Making FCC License Information," as well as a FREE sample FCC-type exam and FREE booklet, "How to Pass FCC License Examinations" (does not cover exams for amateur License).

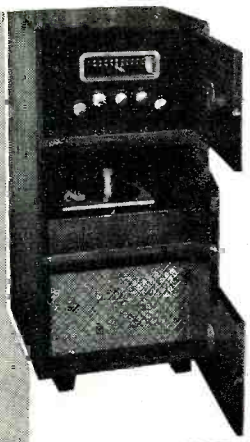
Name .....

Address .....

City ..... Zone..... State.....

☐ Veterans check for enrollment information under G.I. Bill
NO OBLIGATION—NO SALESMEN



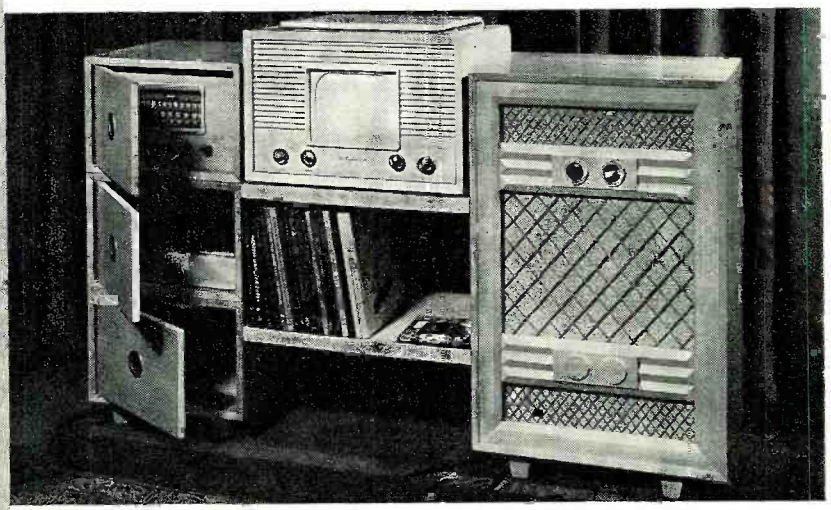


Jensen Customode

CUSTOMODE is the answer to the ever expanding requirements of audio-video equipment. Today you may install a tuner, an amplifier and a record changer with your loudspeaker. Tomorrow you can add a TV receiver, a pick-up for micro-groove records and a record cabinet. The illustrations show a few of the hundreds of possible arrangements for Home Entertainment Centers.

Designed by leading furniture stylists and acoustic engineers around a JENSEN 15-inch loudspeaker in a Bass Reflex Cabinet — the very ultimate in high-fidelity sound reproduction — CUSTOMODE is as functional as it is beautiful. Its "building block" versatility enables you to create your own layouts as you wish, when you wish.

Write today for literature and scale cut-outs. Jensen Manufacturing Company, Division of the Muter Company, 6617 South Laramie Avenue, Chicago 38, Illinois. In Canada: Copper Wire Products, Ltd., 351 Carlaw Ave., Toronto



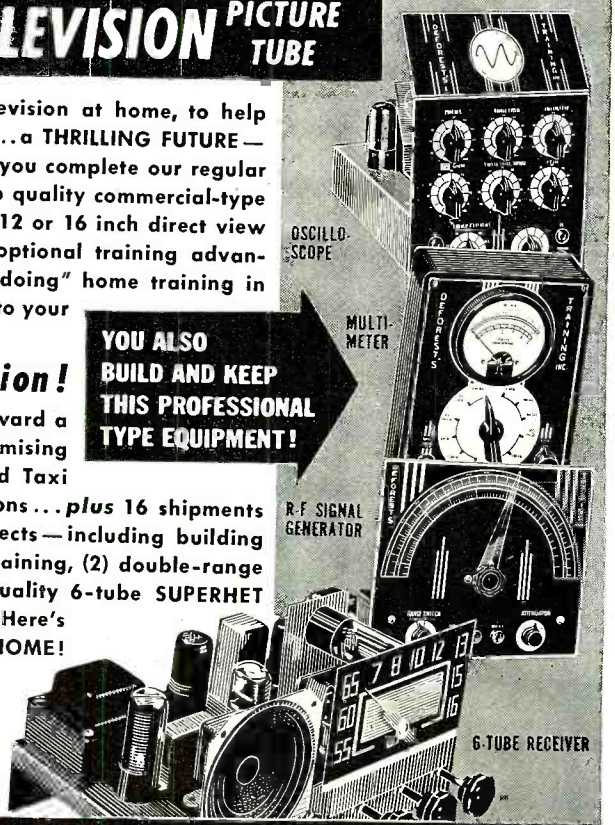
Shown above is Shelf which provides for inclusion of TV receiver or record albums in a CUSTOMODE ensemble.

SENSATIONAL New Training Offer!

NOW you build and keep a top quality TELEVISION RECEIVER to help you prepare for a real job in TELEVISION RADIO-ELECTRONICS

Choice of 10, 12 or 16 INCH TELEVISION PICTURE TUBE

Now you can get this amazingly practical aid for learning Television at home, to help you get started toward FASCINATING WORK... GOOD MONEY... a THRILLING FUTURE — in a real job, or your own sales and service business. • When you complete our regular home training — described below — you can build and keep a top quality commercial-type Television Receiver. Standardized chassis is adaptable for a 10, 12 or 16 inch direct view tube that gives big, bright, sharp, steady pictures. This is an optional training advantage — designed to provide the utmost in practical "learn-by-doing" home training in Television. Mail coupon for complete details. See why you owe it to your "Television Future" to enroll for DeForest's Training, Inc.



YOU ALSO BUILD AND KEEP THIS PROFESSIONAL TYPE EQUIPMENT!

Mail Coupon NOW for FREE Information!

See how D. T. I.'s amazingly effective methods help start you toward a GOOD JOB or your OWN BUSINESS in one of America's most promising fields — including Television, F. M. Radio, Aviation, Train, and Taxi Radio, Broadcast Radio, Industrial Electronics. Get modern lessons... *plus* 16 shipments of Radio-Electronic parts. Work over 300 experiments and projects — including building of (1) commercial-type OSCILLOSCOPE for practical T-V circuit training, (2) double-range R-F SIGNAL GENERATOR, (3) jewel-bearing MULTIMETER, (4) quality 6-tube SUPERHET RADIO. Then build and keep that big new Television Receiver. Here's EVERYTHING YOU NEED for real laboratory-type training... AT HOME!

Modern Chicago Laboratories

★ If you prefer, you can get ALL your preparation in our new, Chicago training laboratories . . . one of the finest of its kind. Ample instructors . . . modern equipment. Write for details!

Employment Service

★ When you complete your training, our effective Employment Service helps you get started toward a real future in Television — Radio — Electronics.

You also use HOME MOVIES! a D. T. I. Exclusive!

D. T. I. alone includes the modern, visual training aid . . . MOVIES . . . to help you learn faster, easier at home. See electrons on the march and other fascinating "hidden action" — a remarkable home training advantage that speeds your progress.

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Chicago 14, Illinois

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For the RECORD

BY THE EDITOR

TOO MUCH TELEVISION?

WE HAVE been running a lot of material on television the past few months in an effort to better serve those whose future bread and butter will depend a great deal upon their knowledge of television circuits.

Several readers have written letters of late, claiming we are devoting too much space to television. A few point out that television is still in its "infancy" and not yet on a par with radio.

Television is, to our way of thinking, no longer an infant. It has emerged from its swaddling clothes into the fastest growing industry of our time. No one can guess its future potentials.

Television, as an industry, is growing faster than did radio in its early commercial days. Almost daily come announcements of new models, new circuits, new antennas, and new techniques. The art of video is developing so fast that it now becomes a problem for many technicians to find time to keep up with the rapid tempo in areas now served. The FCC is now planning to add 42 new television channels in the ultra-high region. That means over 1700 additional video stations in 1179 areas, more than three times as many stations as were possible with initial allocations.

The FCC points out that there will some day be a total of about 2245 video transmitters in 1400 different communities. That's really important to technicians who are prepared to cash in on the new markets as they open up in their areas.

There are many technicians who are taking too much for granted when laying ground work for the future selling and maintenance of television. Television sets *are* complicated. They *do* require special trouble-shooting techniques and they *do* demand "know-how." That is why we run so many articles on all phases of television.

Technicians who have been in the television business for many months have discovered many short-cut methods for set adjustments. Passing along this information may save other technicians many a future headache. Television is a highly specialized subject and must be thoroughly learned if one is to be successful in the television business.

To those who might feel we are going overboard on television, may we again stress the necessity for studying the many components and analyzing the many video circuits found in present sets. Unfortunately, many manufacturers are too busy bringing out new models to concern themselves with providing complete data on their sets, and even if they do, many changes do not show in the literature or in their service sheets.

That's where "know-how" pays off. By knowing and understanding television circuits in general, it becomes a routine task for alert technicians to spot such discrepancies. We have seen many schematics which differ widely from the actual circuits found in specific models. The publishers of service manuals have found the same thing when preparing their own data. Unless the technician is familiar with video circuits in general, he will be unable to spot errors by the factory.

Another current television topic outside of the much publicized price-cutting war, is the practice on the part of certain companies of offering reduced rates for service. The dealer should remember that at the time he makes a sale, he is obligated to see that proper performance is rendered by the product. His obligation does not cease simply because he has turned the contract over to a service company. He should make certain that he has chosen his service representative wisely. He should check the reputation, financial standing, and distributor acceptance, as well as the length of time the company has been in business, before tying himself to any particular service company. He should also make sure that his service representative is not a sales competitor. Any service company operating as a subsidiary of a sales company is in business for the exclusive benefit of the parent sales company and should be avoided like the plague.

It is one thing for a dealer to cheat himself of a legitimate profit and then forget it, but it is another matter for a dealer to jeopardize his business future by dealing with a service contractor who offers to perform service for less than the established cost of the policy. Most factory-established rates can be justified by anyone willing to take the time to analyze all of the costs entering into installation and maintenance. Such an analysis will show that the possible profit in a TV service contract is invariably less than that of any other business. Why then should there be *reduced* rates for TV service?

We shall, therefore, continue to present timely articles on television. Sharing in importance with service techniques, etc., is the proper type of merchandising to employ. All of these considerations will add up to more money in the pockets of television service technicians..... ...O.R.

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196 VALUE-PACKED PAGES

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ALL THE LATEST RELEASES

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Here's the Buying Guide to everything in radio for everyone in radio! Preferred by expert service technicians, engineers, sound men, Amateurs, builders and experimenters—it's packed cover to cover with the world's largest selections of quality equipment at lowest money-saving prices. See the latest in TV and home radio receivers; radiophonos with new three-speed changers; new Sound Systems, P.A. equipment and high-fidelity sound components; recorders and accessories; full selections of newest Amateur receivers and station gear; test instruments; builders' kits; huge listings of parts, tubes, tools, books, diagrams.

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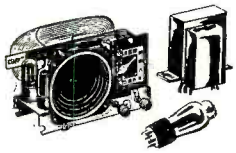
Radio's Most Complete Catalog
Use the coupon below—NOW!



WORLD'S LARGEST STOCKS

Everything in radio for everyone in radio! ALLIED's huge stocks are the world's largest, including complete lines of all leading makes of parts and equipment. Get everything you need from one dependable centralized source—ALLIED RADIO!

TELEVISION & HOME RADIOS

See ALLIED's outstanding selection of new Television sets, new table model radios, FM-AM combinations with new Three-Speed Automatic Changers. Save on these radio models—the choice of experts!

AMATEUR STATION GEAR

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NEW SOUND EQUIPMENT

Packaged, ready-to-use Sound Systems; amplifiers *guaranteed for one full year*; high-fidelity sound components; everything in speakers, mikes, P.A. accessories, intercom and recording equipment—ALLIED RADIO is headquarters for Soundmen!

Radio's Leading Buying Guide

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Chicago 7, Illinois

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

THE WORLD'S LARGEST RADIO SUPPLY HOUSE . . .

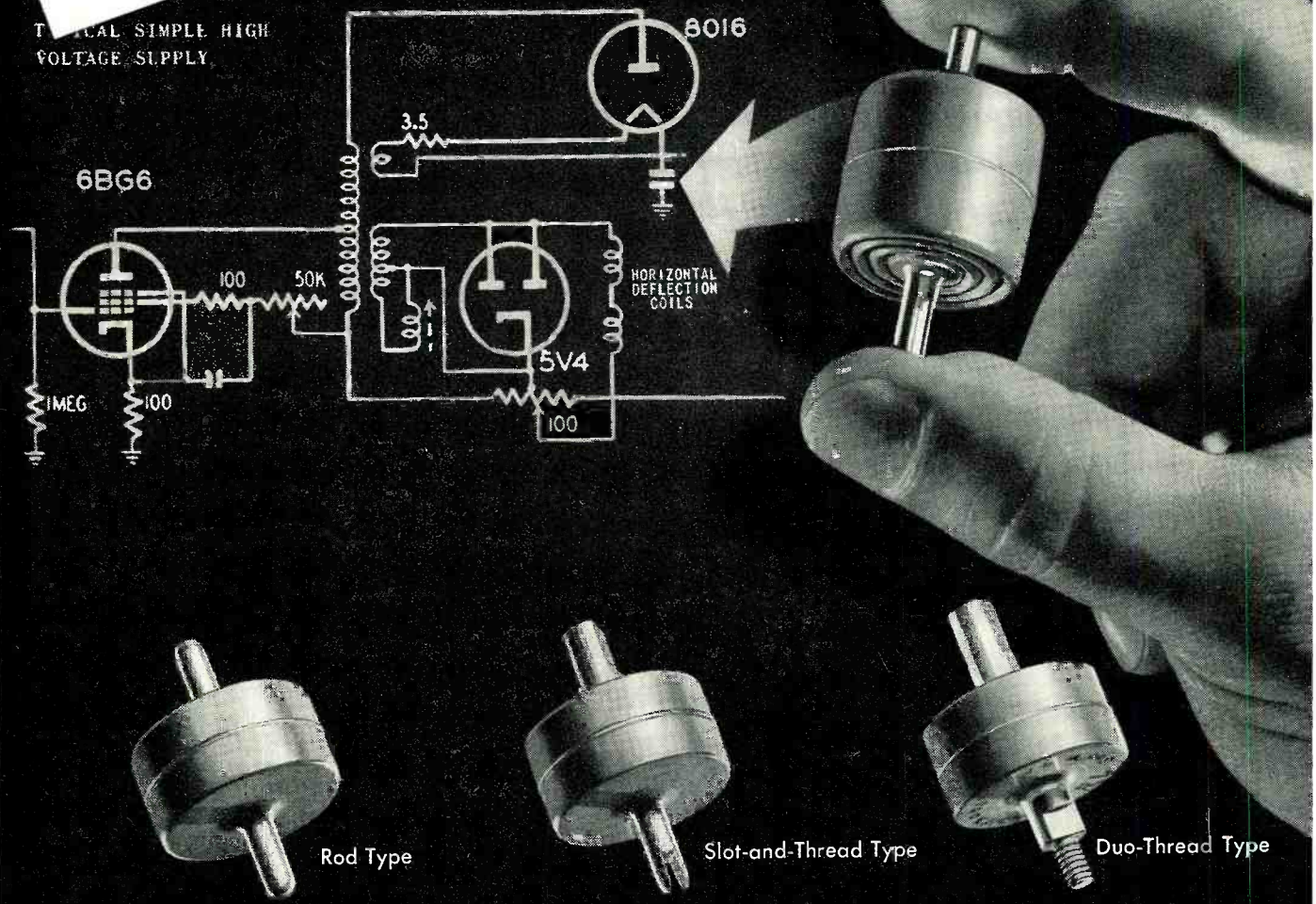
★ **ALLIED RADIO**

Everything in Radio and Electronics

Cen ralab Reports to

USE CRL HI-VO-KAPS

. . . They're Tops for TV Replacement



HERE'S WHY IT PAYS TO USE CRL *HI-VO-KAPS*

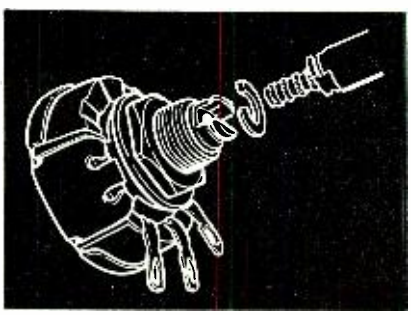
Centralab *Hi-Vo-Kaps* are high voltage capacitors. They are the *smallest* high voltage capacitors ever designed exclusively for television circuits. That's why you'll find them easier to install . . . find them taking up less space in the TV sets you service. Just as important is the flexibility *Hi-Vo-Kaps* give you. With three types of terminal connections to choose from, you can be sure of the right capacitor for virtually any high voltage or television application. What's more, *Hi-Vo-Kaps* are made of Centralab's original Ceramic-X to give you better performance . . . longer life. Get the complete story on Centralab high-quality *Hi-Vo-Kaps*. Call your CRL distributor today!

Service Engineers

Want to speed up service and repairs? Want to simplify inventory and draw more customers? One look at Centralab's line of service components gives you the key to these important service problems. Compare quality . . . compare performance . . . compare results, and you'll see why radio and television service engineers everywhere use CRL parts to increase the efficiency of their shops . . . why they are able to give their customers such fast, dependable service. Yes, new Centralab research and development points the way to easier, faster service and repair . . . improved customer satisfaction. For complete information on the Centralab line, get in touch with your Centralab Distributor.

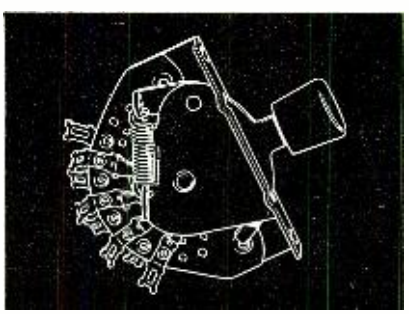
Centralab
CRL
®
Division of GLOBE-UNION INC. • Milwaukee

Ask Your Distributor for These CRL Parts



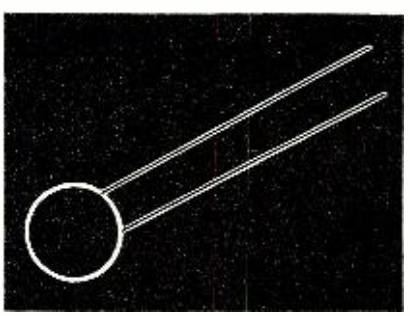
CONTROLS

MODEL "M" for voltage-divider, antenna shunt and "C" bias control, tone control, AF grid control. MODEL "1" for all miniature applications; rated at 1/10 watt, actually smaller than a dime. MODEL "R", wire wound, for voltage divider, antenna shunt, "C" bias, AF grid or tone control circuits.



SWITCHES

ROTARY for band change, meter, intercom circuits; made in ceramic and phenolic models. ROTARY SPRING RETURN for meter selection, intercom, phono-radio applications. MEDIUM DUTY for band changing in low power exciter-transmitters and receivers. LEVER ACTION for intercom, speaker, microphone and other applications.



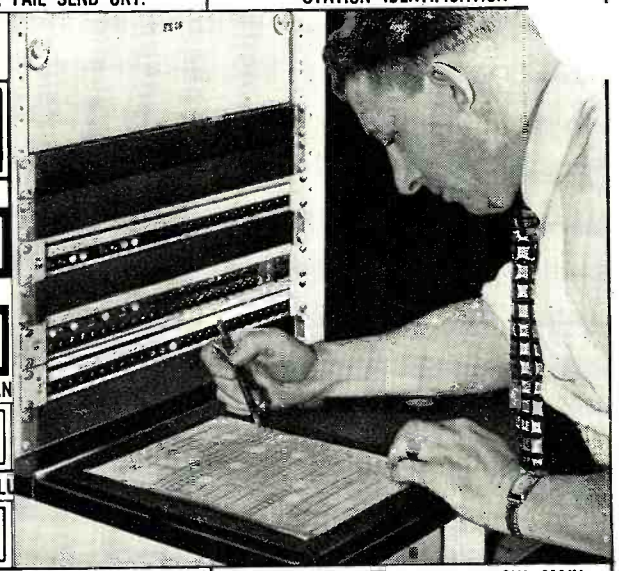
CAPACITORS

TC HI-KAPS for correcting temperature drift in TV, FM, AM, VFO circuits. BC and KOLORDISK HI-KAPS for by-pass and coupling applications in non-resonant, TV, AM, FM, AF, HF, VHF and UHF circuits. HI-VO-KAPS for TV power supplies. CERAMIC TRIMMERS for padder application in TV, AM, FM and HF circuits.

He can see a thousand miles

ALARM INDICATOR RECORD

TIME RECEIVED | A P | BY | TROUBLE FOUND | DATE OK | TIME | A P | BY

	SYNCHRONIZATION - START					CA FAIL SEND CKT.	STATION IDENTIFICATION						
1	ON	ON	OFF	ON	ON	CHAN. 1 SECT.							
	SYNCHRONIZATION - STOP												
2	ON	ON	OFF	ON	ON	FUEL GAS LOW							
	FUSES		24-VOLTS		ABS								
3	DISCH.	DIST.	H-L VOLT	REG. FAIL	24V 130V	48V							
	POWER CONTROL PANEL FAILURE												
4	201-202W	203-204W	205-206W	207-208W	201-202E	203-204E							
	ALT. CONT. BAY - NO VOLT. OUT.				NO VOLT. - TRAN								
5	201 202	203 204	205 206	207 208	201 202	203 204							
				RECTIFIER - INVERTER FAIL									
6	RECT. FAIL 24/130V	48 V H-L VOLT		NO. 1	NO. 2	NO. 3							
	64 KC PILOT ALARM AT NON-SW. MAIN								3096 (WKG. LINE) PILOT AT SW. MAIN				
7	201	202	203	204	205	206	207	208	201 203	205 207	202 204	206 208	
	2064 KC PILOT ALARM AT NON-SW. MAIN								3096 (SP. LINE) PILOT AT SW. MAIN				
8	201	202	203	204	205	206	207	208	201 203	205 207	202 204	206 208	
	3096 KC PILOT ALARM AT NON-SW. MAIN								SP. LINE FAIL AT SW. MAIN				
9	201	202	203	204	205	206	207	208	201 203	205 207	202 204	206 208	
	TOT. LINE FAIL AT SW. MAIN				AUTO. SWITCH AT SW. MAIN				AUTO. SW. LOCKED AT SW. MAIN				
10	201 203	205 207	202 204	206 208	201 203	205 207	202 204	206 208	201 203	205 207	202 204	206 208	

Carrying hundreds of telephone calls, coaxial cable runs through many lonely miles. Far from towns and people, master amplifying stations stand guard with a new automatic alarm system developed by Bell Telephone Laboratories.

At a city terminal, the man on duty makes a check by laying a transparent log sheet over a glass window, and dialing a master station hundreds of miles away. At once the station begins to give an account of itself, lighting lamps under the log sheet to report any abnormal operating condition before it becomes an emergency.

But when something happens that threatens serious trouble, the apparatus acts at once – maybe by switching in a spare coaxial – and calls a distant test board by ringing a bell. Sometimes he can take further steps by remote control; if not, he knows exactly how to brief the nearest repair crew.

With this new alarm system, maintenance men need not be stationed at isolated points, just waiting for something to happen. Instead, they live in their home communities. This makes for better work . . . and better telephone service.

BELL TELEPHONE LABORATORIES EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE.

Sensational TV News.

Sylvania Electric – For Years a Leading Manufacturer of Electronic Equipment – Has Now Developed a Television Receiver That Is Actually Years Ahead of Its Time!

For 25 years Sylvania Electric has been a pioneer in radio, radar and television. Such vital developments as the 6-volt car radio tube, the glass-to-metal seal and mass manufacture of sub-miniature tubes for wartime proximity fuses are the result of work by Sylvania's electronic engineers. What's more, these engineers have made such important contributions to *television* that, today, many of the nation's leading set manufacturers use Sylvania inventions!

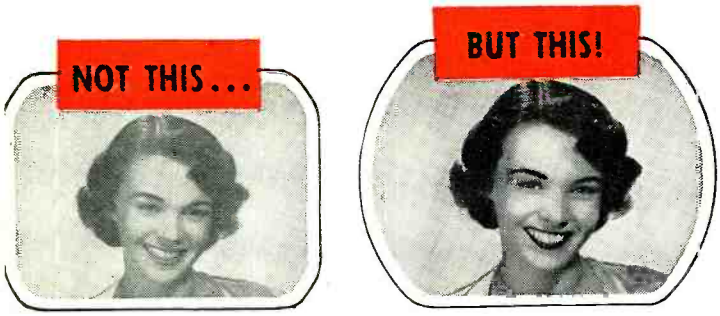
Sylvania waited to bring out its *own* television receiver until these engineers had developed the finest, *most advanced set* that could be made. Now that set is *here* – years ahead of its time, years ahead of any other make, *yet competitively priced!*

Read the amazing story of Sylvania's new television receiver on the next 2 pages...

HERE TODAY! Television that

SYLVANIA TELE

SEE the difference in SYLVANIA MOVIE CLEAR TELEVISION!



1. Sharper contrast! Finer detail! Sylvania's super-powered "Electron Gun" gives needle-point sharpness to picture-making beam. This finer, sharper beam makes blacks blacker, whites whiter, *brings out more detail more clearly!* Here, for the first time, is *movie-clear* television reproduction!

2. Steadier pictures! New Sylvania "Triple Lock" makes pictures stay put, stay rock-steady *even under adverse conditions!* Locked horizontally by new "Discriminator" circuit; locked vertically by "Blocking Oscillator"; locked in brightness by "Automatic Gain Compensator." Pictures never "tumble," never "drift," never fall out of synchronization, *never need adjusting!*

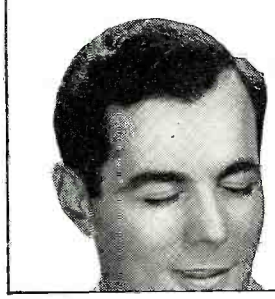
3. Minimum picture interference! Sylvania's shielded "Coaxial" lead-in eliminates "picture static" ordinarily picked up by conventional lead-ins.

HEAR the difference in SYLVANIA MOVIE CLEAR TELEVISION!

1. FM high-fidelity circuits with wide-range speaker and exclusive "Audio-Balanced" tone control!

2. "Intercarrier Sound" eliminates "howls," "microphonic noise," and "acoustic feedbacks"!

3. Sound locked in with picture! Sound automatically maintains its volume and quality no matter how often you switch channels!



Make the "Blindfold Test"—

Close your eyes and compare Sylvania FM sound with sound of any other fine television set!

Check these EXTRA SELLING FEATURES TOO!

✓ Easy, one-hand operation!

✓ Better reception in apartment houses!

✓ Better reception in "fringe" areas!

✓ Sensational new "Pay-back" Service Contract. Exclusive with Sylvania!

wasn't expected until 1952!

VISION MOVIE CLEAR*

10″ Mahogany Table Model (shown left)

also available

10″ Blonde Table Model

12½″ Mahogany Table Model

10″ Mahogany Console (shown right)

also available

12½″ Mahogany Console

16″ Mahogany Console

10″ Mahogany Console Combination (shown above)
12½″ Mahogany Console Combination also available

Big Picture, Direct View Television with Super-Powered "Long Distance" Chassis and FM Sound!

STYLED RIGHT for you and your customers! There's a model to please every customer, and every model's a fast-mover! Keeps your inventories low!

PRICED RIGHT for you and your customers! Low prices for big sales — high markup for big profits!

PLUS NEW "PAY-BACK" SERVICE CONTRACT — saves money for your customers! Sylvania Service Contract guarantees expert service by Sylvania-skilled technicians. And new "Pay-back" feature means *customers pay only for service they need!*

SYLVANIA MOVIE CLEAR TELEVISION

will be sold by huge, hard-hitting advertising campaigns aimed at your local customers! Get ready, get set for the biggest television sales and profits ever! Call your Sylvania Television distributor today!

*TRADE MARK

SYLVANIA TELEVISION

MOVIE CLEAR

TELEVISION—YEARS AHEAD OF ITS TIME!

Sylvania Television, 1280 Main St., Buffalo 7, N. Y.

Spot Radio News

★ *Presenting latest information on the Radio Industry.*

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

TV'S DYNAMIC EFFECT on the economy of the nation continued to be a roaring topic in the legislative halls of Washington during the early months of the summer, with the FCC's freeze order once again the accented problem. The situation was viewed with such alarm by members of the Television Broadcasters Association that Prexy Jack Poppele issued a seething statement, on behalf of the trade group, requesting immediate action on a partial lifting of the freeze. Poppele pointed out that . . . "the protracted character of the freeze has had an adverse effect on at least two segments of the industry, exclusive of the state of suspended animation in which hundreds of applicants for television stations find themselves. . . . Most seriously affected are the manufacturers of transmitters, who are unable to make any long-range plans with respect to production schedules. . . . Receiver manufacturers, too, are in a quandary attempting to project their operations over a span of six months, due to the imponderables of the stop order."

Poppele disclosed that a study of the present allocations chart revealed at least eleven market areas in the West with twenty-two channels which were sufficiently separated, co-channel-wise, to permit immediate action on applications pending in those sections: Amarillo, Texas (five channels); Denver, Colo. (one channel); El Paso, Texas (two channels); Sacramento, Calif. (three channels); Salt Lake City, Utah (one channel); Corpus Christi, Texas (three channels); San Diego, Calif. (two channels); San Francisco, Calif. (one channel); Seattle, Wash. (one channel); Stockton, Calif. (two channels); and Tacoma, Wash. (one channel).

The unfreeze would permit manufacturers of receivers to prepare plans for expanding operations, so that the new market areas could be assured of sufficient sets when the new stations go on the air in the unfrozen cities, cited Poppele. Distribution would also be improved, the TBA headman stated.

The significance of the TBA note propelled an unusually prompt reply from FCC, which indicated that an immediate specific-area unfreeze order could not be issued as such action would upset a country-wide plan now being processed. The government authorities revealed that undoubtedly by the time this column appears a revised national allocation plan will not only have been announced for hearing study, but the suggested changes in the western areas will appear to some extent, too.

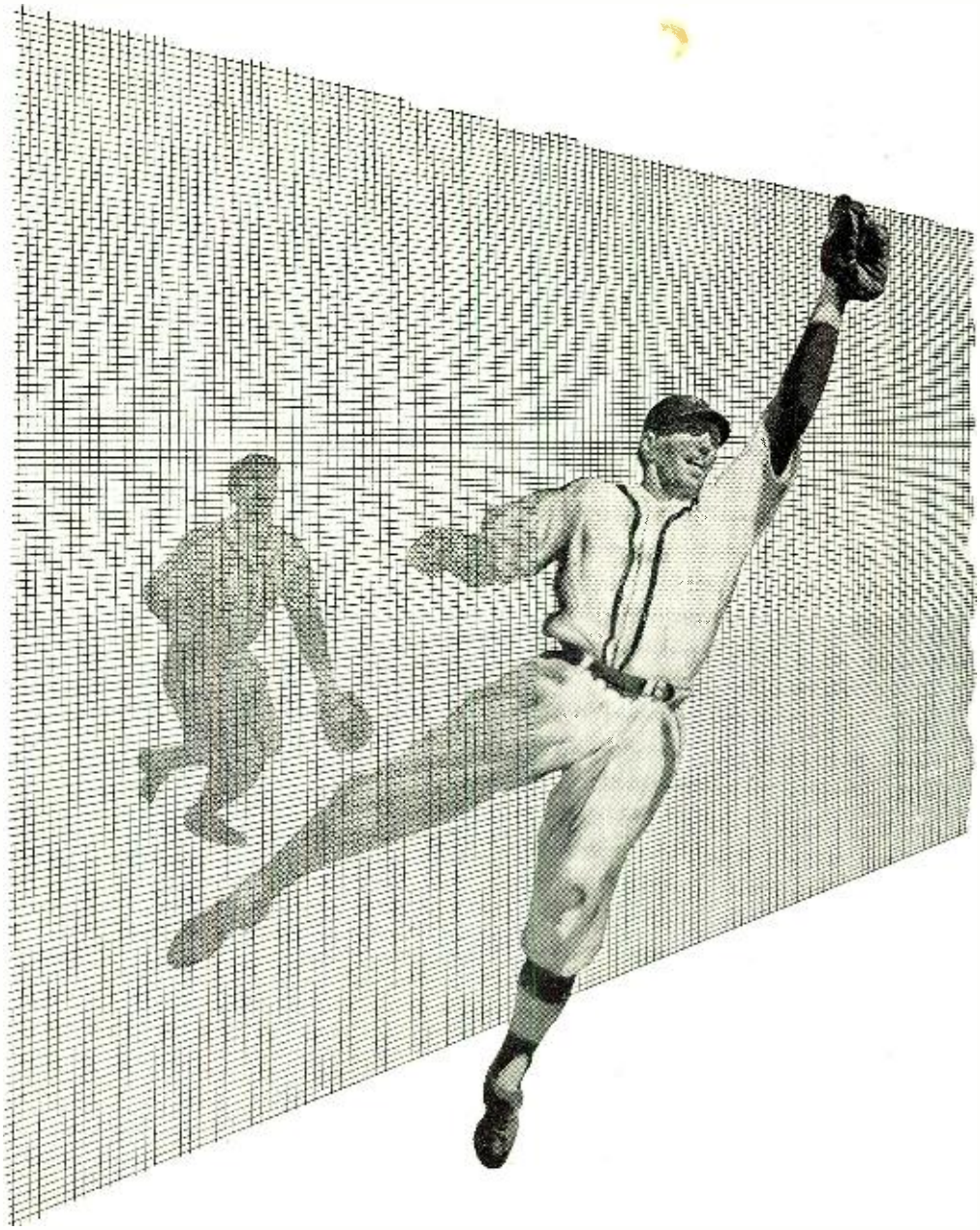
This frank disclosure by the boys in Washington, prompted by industry pressure, and particularly by their own time schedule set in the official announcement just before the summer began, indicated that early winter would probably see a complete lifting of the freeze and an orderly application of channels in the very-high and ultra-high bands.

IN A TALK at St. Andrews, New Brunswick, Canada, FCC Commissioner George E. Sterling stressed the potential power of TV and declared that the projected freeze lift and authorization of construction in the standard and higher bands will inaugurate a new era in the art . . . "destined to bring in its wake far-reaching changes in our social, educational, economic, and political customs."

Commenting on the color controversy, which was refired when the FCC mentioned its future possibilities in their recent allocation release, Sterling declared that he did not have the least idea when we'll have color. He emphasized that as a purchaser, he would not hesitate to buy a receiver now, because the government . . . "will not authorize color until color can be received satisfactorily on today's ordinary television receiver, with only relatively minor changes, or color pictures can be received in black and white on present-day receivers with perhaps no, or only minor, modifications."

COLOR TV and its possibilities prompted Senator Edwin C. Johnson to suggest an impartial probe by the National Bureau of Standards, with Dr. E. U. Condon, head of the bureau, selecting a committee of experts to make the study. The Senator stated that he wanted a comprehensive and unbiased report from an independent group, so that the public could be supplied, as soon as possible, with a true picture of what we have in color and can expect in the future.

At this writing, a committee of six is being considered with representa-



RCA Laboratories developed a copper mesh with 2,250,000 tiny openings to the square inch for the television camera "eye."

You get **finer television pictures** through this super-fine mesh

In RCA Image Orthicon television cameras you will find a super-fine copper mesh. Until a new technique for making such screen was discovered at RCA Laboratories, only coarse and irregular mesh—which obstructed 60% of the picture—was available.

Today, through RCA research, such mesh can be made with 1500 gossamer wires to the linear inch. An ordinary pinhead will cover about 7000 of its tiny openings.

By RCA's technique—now producing commercial quantities of 200- and 500-mesh screens—the mesh is so fine, so regular in structure, that it is invisible on home television receivers . . . and as much as 85% more television picture passes through.

You benefit—many times

This new type of super-fine wire mesh, and the technique for making it, like most major developments in all-electronic television, is another RCA Laboratories *first*. Leadership in science and engineering adds *value beyond price* to any product or service of RCA and RCA Victor.

* * *

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, and you are cordially invited. Radio Corporation of America, Radio City, N. Y. 20.

RADIO CORPORATION of AMERICA

World Leader in Radio—First in Television

tives of trade associations, government, industry, and the broadcasters, constituting the body. It is believed that some opinions of the group may be offered during the all-important very-high-ultra-high allocation sessions, so that the record will contain an official impartial version of the situation. These data, the legislators feel, will be very useful in preparing the channel assignments for upstairs television.

TV also became a page-one item in Washington and New York, when the FCC issued its test-pattern ruling forbidding the use of recordings with fixed patterns. According to the FCC interpretation, which prompted a storm of protests from telecasters, only a tone or series of tones can accompany a TV test or fixed pattern. The use of recordings or duplicates of AM or FM programs is a violation, they found, since such transmissions are actually separate broadcasts and not permissible according to present standards of operation.

The Washington boards buzzed all day and week, as TV-casters wired and phoned in their dissents, citing the hardships the ruling would inflict during the preliminary on-the-air setups and particularly during the late news telecasts, usually with fixed patterns, a procedure adopted to effect station economies and streamlined production. TBA, NAB and other trade groups telegraphed their criticisms of the ruling, NAB declaring that . . . "poor programming or greatly increased cost of operation" would result. TBA suggested that a formal conference be held so that the interpretation could be analyzed by all members of associations and industry.

From the FM interests, however, came a salvo of applause for the ruling, the FM association praising the ruling as . . . "the culmination of protests by aural broadcasters and the FMA launched more than a year ago." The "non-economical" use of the channels was the basis of FMA's protest to the FCC, they pointing out that "one-legged" television was a waste of frequencies.

WASHINGTON headquarters of the FMA, which fostered the test-pattern plan, is also quite active in other projects to accelerate interest in FM.

In testimony supporting the recently introduced McFarland Bill, prepared for presentation before the Senate Interstate and Foreign Commerce Committee, Leonard H. Marks, general counsel for the FMA, declared that the . . . "out-moded cumbersome procedure which must be followed under prevailing provisions of the FCC Act has retarded development of FM broadcasting." Passage of the proposed amendments introduced by Senator McFarland, would according to Marks, "streamline our government regulatory procedure to meet the jet propulsion of present day communications."

Marks pointed out that the present FCC legislation was . . . "written in the horse and buggy days of radio. . . . Since the time of the original FCC Act, the radio industry has progressed to the status which the authors of the Communications Act could never have imagined. The new services now available to the public have created new problems which must be solved by new procedures. . . . A dynamic, imaginative industry such as FM broadcasting will be considerably helped by the installation of the new procedures proposed by the McFarland Bill."

In a statement on a survey of FM station activities, FMA Prexy William A. Ware revealed that the "aggressive know-how of FM broadcasters" has boosted public acceptance of the medium during the past six months to its current high level. Ware pointed out that today there are 740 commercial stations out of an authorized 868 on the air, and there are five cities where FM outlets outnumber AM: Washington with nine FM against seven AM; Pittsburgh with nine FM against seven AM; Detroit with six FM against five AM; Columbus, Ohio, with five FM and four AM, and Miami with seven FM and six AM outlets.

The FMA survey disclosed that New York has twelve FM stations, Chicago fourteen, Los Angeles ten, New Orleans seven, Portland six, San Antonio six, Baltimore six, Boston six, Buffalo five, Cincinnati four, Providence five, Richmond five, Syracuse four, Philadelphia ten, San Francisco eight, Cleveland six, etc.

Commenting on the progress of FM, Ware said that . . . "FM broadcasters are meeting their obligation of providing the public with the finest in sound broadcasting."

THE FCC FILES revealed another milestone in FM progress a few weeks ago: The inauguration of a National Mobile Radio System, with a network in operation between Boston and New York permitting communication between the occupants of autos, trucks, buses, and other vehicles, and those in offices or homes. The system, which was originated during the spring in Washington, differs from the telephone company service, in that brief messages or conversation can be relayed back and forth through the intermediary of a station operator, who receives them by telephone from one end and then relays them by radio to the other or vice versa. Independent stations have been established in many cities, with clients including doctors, oxygen delivery and ambulance services, automobile towing and repair companies, trucking organizations, emergency repair services, etc.

Fixed stations are now in operation atop the Essex House in New York City and at White Plains, Rome, Utica, and Hempstead in New York State. There are also stations in Boston, Taunton, Springfield, and Pittsfield,

(*Continued on page* 116)

SEPTEMBER, 1949

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SEPTEMBER, 1949

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COVER PHOTO — Courtesy of Sylvania Electric Products Inc.

Postwar radar applications include exploration of the upper regions of the radio spectrum where microwaves are used for scientific gas analysis studies and for meteorological uses including automatic cloud height recording. Automatic transmit-receive switch is shown above hand of laboratory worker as she tests it in high frequency waveguide system at Sylvania Electric Products Inc., Electronics division, Boston, Mass.

A High Quality MICROWAVE RADIO LINK

By MARTIN SILVER
and JOSEPH RACKER
Federal Telecommunication Laboratories

Details of a commercial unit for use as studio-transmitter link in broadcasting or as a multichannel telephone link.

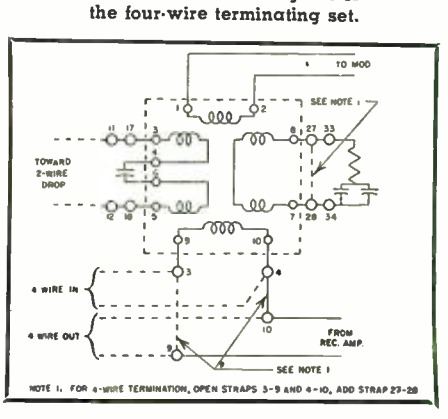
Fig. 1. The receiving antenna used in the New York to Mutley experiments. It is mounted near the bottom of the 75 foot FM broadcast antenna mast of experimental station W2XFZ.

MICROWAVE techniques have advanced to such a degree within the past few years that applications are no longer restricted to laboratory or military equipment but are now ready for full scale commercial service. The use of microwaves for relaying TV and FM program material has already received a considerable amount of publicity—not as well known, however, is its use in communications for both private industry and public telephone networks. In both of these latter applications, it has been found that the required facilities can be provided at lower initial and maintenance cost, and within a shorter period of time, than equivalent wire or cable lines providing the same service. Furthermore, as a result of the complete disruption of service in many localities, due to the uprooting of land lines in winter storms, the interest in radio links as a more reliable method of communications is now at a very high level.

The microwave radio link to be described in this article is designed for high quality broadband transmission and may be used either as a studio-to-transmitter link in the broadcast industry, or as a multichannel telephone link to provide communication facilities. Before delving into the details of the equipment, let us first consider the reasons for the use of microwave frequencies.

In addition to the fact that the crowded conditions of the lower frequency spectrum necessitated going to higher frequencies for new facilities, there are a number of intrinsic system characteristics that make microwave frequencies particularly adaptable to fixed point-to-point transmission of wide band modulation. These are: a) High antenna directivity, yielding line-of-sight transmission which assures more privacy (than lower frequencies) and permits operation of several radio channels on adjacent frequencies for maximum utilization of the r.f. band.

Fig. 2. Schematic diagram of the four-wire terminating set.



b) High antenna power gain, reducing transmitter output power requirements for a given coverage. c) Relatively large system bandwidth that can be accomplished at these frequencies, and d) Relative freedom of atmospheric noise existing at microwave frequencies.

To these system characteristics may be added the advantage of frequency modulation in its application to a high fidelity broadband communications system. Among these are: a) The use of high modulation indices affording improved output signal-to-noise ratios. b) Discrimination against low level interfering signals, and c) Simple methods of high linearity modulation and detection which are available.

When the link is used for studio-to-transmitter program transmission it is designed with a modulation bandwidth of 15 kilocycles, but with slight modification this bandwidth can be increased to 60 kilocycles to meet the requirements of multichannel telephone service. Radio links in their application to wire transmission systems fall into two general categories namely: a) As part of long line telephone systems in which the link is used only to span difficult terrain. b) As complete point-to-point links initiating and terminating directly in telephone and telegraph equipment. These two systems are illustrated in figures 1 and 2.

To obtain a multiplicity of voice channels—each falling within a 200 to 2700 cycle band—the frequency division system of multiplying is used. In this system each voice channel is identified with a sub-carrier frequency. For example, in the six carrier channels (and one voice to make a total of seven) system shown in Fig. 7, the sub-carrier frequencies are: 3.8 kc.; 7.2 kc.; 13.1 kc.; 16.5 kc.; 28.0 kc.; and 31.4 kc. Each

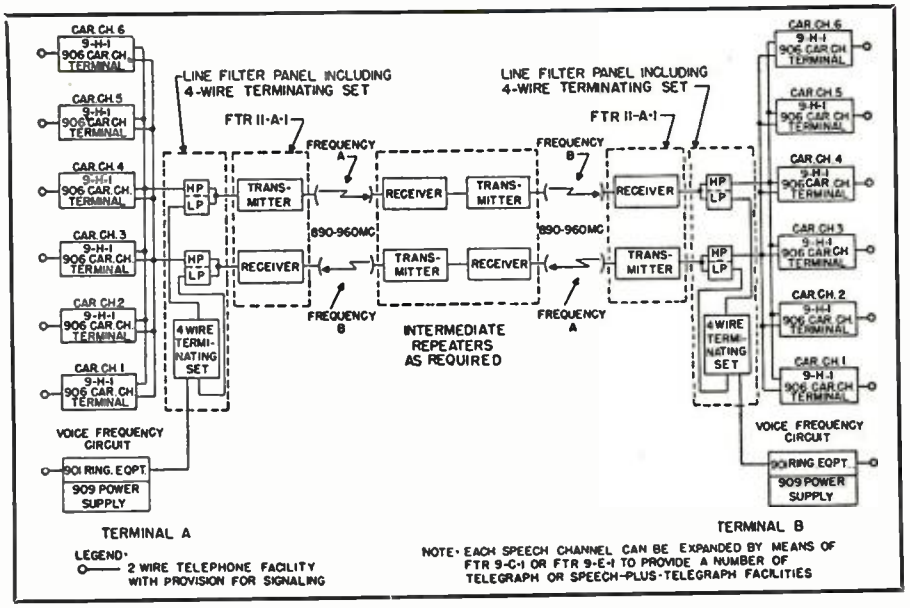


Fig. 3. Detailed block diagram of 7-channel two-way link system.

audio circuit modulates the sub-carrier identified with its channel. The modulated sub-carriers are then used to frequency modulate the r.f. carrier. At the receiver these channels are then separated by frequency selection and the sub-carrier filtered out, restoring the original signal.

For two-way conversations another identical link, operating at a different frequency, is used for the opposite direction—the two links comprising a 4-wire transmission system (a 4-wire system is defined as one whose transmitting and receiving paths are independent). Since these channels will usually be terminated in 2 wire telephone lines, i.e. transmitting and receiving paths transmitted over the same pair of wires, a 4-wire terminating set which matches the 2-wire system to the 4-wire one and vice versa is required at each terminal. Fig. 2 is a schematic diagram of such a 4-wire terminating set. Fig. 3 is a detailed block diagram of a 7 channel two-way radio link system with repeaters. Repeaters are required to extend the line of sight range of the equipment.

The radio link consists of a transmitter and receiver with associated parabolic antennas designed to operate in the 890 to 960 megacycle band, thus including the 940 to 952 mc. band authorized by the Federal Communications Commission for STL (studio-to-transmitter) applications and the 890-960 mc. band allotted for communication services. Development and test work on this equipment extending over a period of three years has confirmed the suitability of this band for reliable high fidelity transmission of program and communication material.

Fig. 6 is a block diagram of the transmitter. In this figure the essential components of the transmitter are shown, i.e. the directly modulated power oscillator, modulator unit, center frequency stabilization circuits, output matching transformer, frequency monitor, and associated power supplies.

The transmitter utilizes a *Sperry* type SRL-17 reflex klystron designed for operation in the 890 to 960 mc. band. Spurious radiation is minimized by the use of a single power oscillator output tube. Direct frequency modulation of the klystron oscillator is effected by operating on the repeller grid with the output of a two tube, three stage modulator at a level of approximately 20 volts. Over-all feedback is employed in this modulator for minimum distortion.

A simple reference type automatic frequency control circuit maintains transmitter frequency within .005 percent of its assigned frequency. In this system a portion of the klystron output is mixed with the output of a crystal oscillator frequency multiplier chain to produce a 30 mc. intermediate frequency. This 30 mc. intermediate frequency is then amplified and fed to a discriminator and the resulting zero center balanced direct voltage is used to control the klystron repeller voltage. Since the repeller voltage determines the klystron center frequency, and since the output of the discriminator is proportional to the deviation of the klystron from its assigned frequency (using the crystal oscillator as the standard), electronic tuning of the transmitter to its assigned frequency is thus effected. The necessary voltages for the beam, repeller and filament of the klystron as well as d.c. supply and filament power for all other tubes are supplied from the high voltage and d.c. supplies of a separate power supply unit.

A standard 10 dbm. input level preemphasized by a 85 microsecond preemphasis network modulates the transmitter to a maximum deviation of ± 200 kc. The preemphasis network is omitted when the unit is used for multichannel telephone communications, and is used only in STL applications.

Fig. 5 shows a three quarter front

Front view of the FTL-13-A broadband FM radio link operating in the 890-960 mc. band. Shown are the transmitter, receiver, and power supply units.

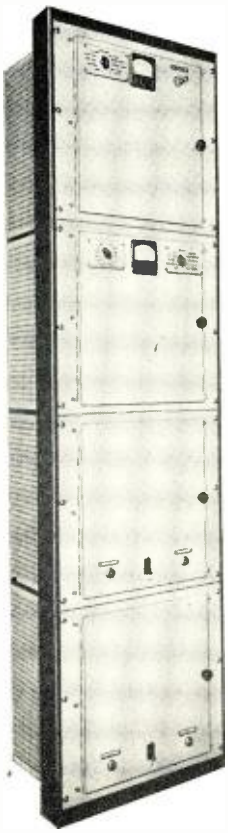
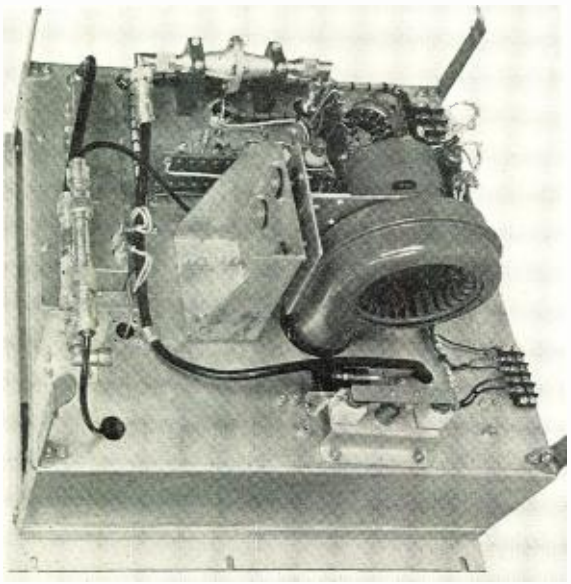


Fig. 4. Rear view of transmitter with the dust cover removed.



view of the transmitter r.f. chassis with door open and klystron shield cover removed. The chassis used in this equipment are of the vertical rack mounted type. The klystron frequency is continuously tunable over ± 5 mc. of the 920 to 960 mc. band by a single cavity control and is adjustable over the full 890 to 960 mc. band by a simple setting of the cavity and adjustment of the repeller voltage to any assigned frequency. The klystron tube is easily and quickly removed in case of failure and replaced with a pretuned unit in a matter of a few seconds.

A perforated sheet metal shield covering the klystron is required to prevent accidental contact with the klystron shell while the transmitter is in operation, since the klystron is operated with the cathode grounded and the shell at 1000 volts above ground. The entire klystron unit is securely fastened to the shock mount bracket by snap type holders that permit easy and rapid removal of the unit when necessary.

A two stub coaxial transformer is used to match the transmitter output circuit to the transmission line. Output frequency is monitored by a calibrated high Q resonant cavity and crystal rectifier circuit by interpolation between symmetrical readings about resonance to precisely determine frequency. Relative power output is monitored by the d.c. output of an r.f. sampling diode. A common microammeter associated with a selector switch provides monitor readings of all tube cathode currents, and voltage readings which are essential to the evaluation of transmitter performance and location of trouble. This "built-in" tube checker and monitor greatly simplifies the maintenance and service of the unit.

Fig. 4 shows a rear view of the chassis with dust cover removed. A perforated sheet metal dust cover slides over this assembly and snaps on the four holder arms seen in each corner of the chassis. A blower is provided for klystron cooling.

The transmitter output terminal is a type "N" coaxial fitting for connection to RG-8/U or RG-17/U solid dielectric cable or can act as an adapter to connect to a semi-rigid air dielectric transmission line. This feature is of great importance because it allows the use of a long antenna lead-in which means that the equipment can be placed in any convenient indoor location, rather than being restricted to a location close to the antennas.

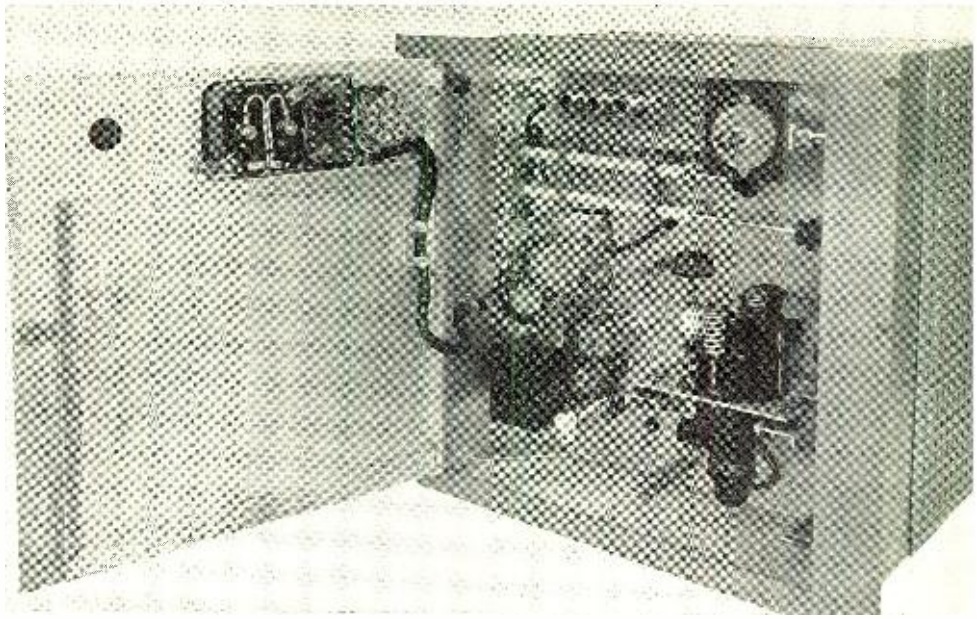


Fig. 5. Front view of transmitter with door open and klystron shield removed.

Receiver

The receiver is a single superheterodyne utilizing a reflex klystron local oscillator and a 30 mc. intermediate frequency. A block diagram of the receiver is shown in Fig. 8. As seen in this figure the receiver consists of a cavity preselector, matching transformer, line type crystal mixer, klystron local oscillator, 30 mc. i.f. with limiters and discriminators, automatic frequency control feedback circuits, audio section and power supplies. The local oscillator tube is, as in the transmitter, a type SRL-17 klystron but operated at a reduced beam voltage.

The incoming signal passes through a tunable resonant cavity preselector which reduces image and spurious signals. A single image gain of 80 db. is obtained. A stub tuner matches the cavity to the crystal mixer.

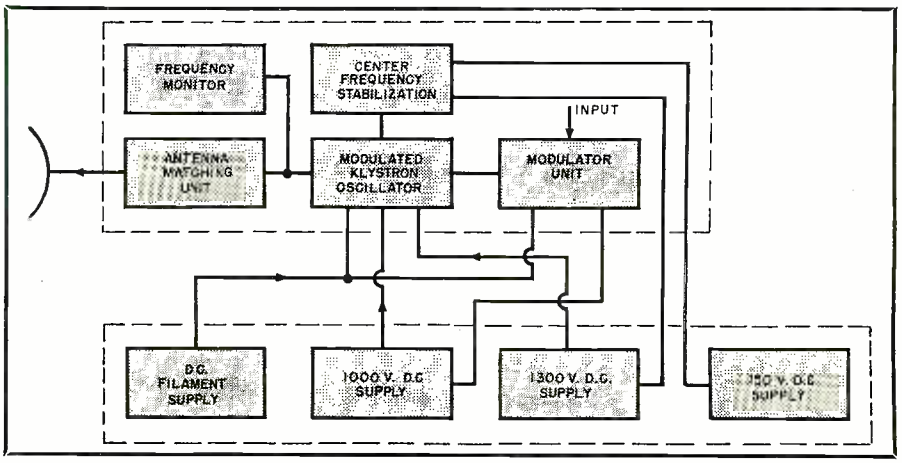
The klystron is tuned 30 mc. from the incoming signal. The i.f. is fed to the amplifier by a π-network which matches the mixer to the grid circuit. The i.f. amplifier uses 6AK5 stagger-tuned stages, giving a bandwidth of 2.5 mc. Two 6AK5 limiters follow. To reduce hum, decoupling filters are connected in the limiter plate circuits.

The first limiter feeds a balanced zero center type discriminator whose output is a polarized d.c. voltage used for automatic frequency control as well as to provide a driving circuit for the final limiter stage. This stage, in turn, drives a simple off-resonant type discriminator circuit for low distortion detection of the modulation. The balanced discriminator output is fed through a stabilized d.c. amplifier, the negative output voltage of which supplies klystron repeller voltage. The combined distortion of the off-resonant discriminator and its audio amplifier is better than 0.3 per-cent. Output level is the standard 10 dbm. ± 2 db. into a balanced 50, 250, or 600 ohm load. Operation of the system with a 65 db. signal-to-noise ratio is achieved with an r.f. signal input to the receiver of only 40 microvolts.

As in the transmitter, a single d.c. microammeter with two associated selector switches monitors all tube voltages and tube cathode currents for determination of tube operation as well as measuring crystal mixer current for a check of local oscillator injection and first limiter grid current for a measure of received signal level.

A squelch tube disables the receiver if the carrier goes off the air or if local trouble interrupts the signal. If r.f. signal is present at the sixth i.f. grid,

Fig. 6. Block diagram of transmitter.



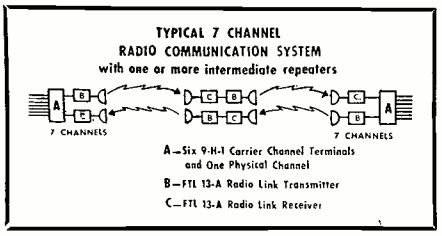


Fig. 7. Typical 7-channel point-to-point communications system utilizing FTL-13-A radio link and six FTR 9-H-1 carrier channels.

current flows to bias the squelch tube to cut-off. The contacts of a squelch relay are open. Under this condition, plate and screen supplies to the limiters are not interrupted. Operation of the limiters also turns on a pilot light. When the incoming r.f. is absent or below the predetermined level, the squelch tube conducts, operating the relay and disconnecting the limiters and pilot light.

A feature of the rack is the ready accessibility of all components for maintenance and servicing. All tube filaments are operated from the d.c. supply to assure low hum and noise levels. This supply as well as the B supply originates in the power supply unit.

Antenna

The same type of antenna is used at both terminals of the link and it consists of a reflector mounted in an aluminum parabola. The standard diameter of this parabola is six feet, but as will be indicated in a subsequent paragraph, four or ten foot parabolas may also be used depending upon the individual transmission paths. The gain of the six foot parabola, which is horizontally polarized, is 24 db. in the forward direction.

The minimum diameter of the parabolic reflector is determined by the required signal-to-noise ratio, transmission path length, and expected propagation variations. In general the system is designed to allow at least 20 db. fading over the transmission path. For maximum safety or for longer paths, a 10 foot reflector is used, while under some favorable conditions, 4 foot reflectors with a lower power gain may be satisfactory.

In determining the effect of adverse weather on transmission continuity, two factors must be considered. One is the effect, in terms of losses, of meteorological conditions on the propagation characteristics, and the other is the effect on the antenna system. Where the combination of these two losses does not exceed 20 db., a signal-to-noise ratio of at least 60 db. (without repeaters) is maintained. Where it exceeds 20 db. the signal-to-noise ratio drops below 60 db.

Under icing conditions, for example, there are a number of factors that introduce losses in the antenna system. However, under icing conditions, propagation characteristics at approximately 1000 megacycles are usually excellent. Hence, unless antenna icing introduces losses of the order of 20 db., high quality communications are maintained. Experience thus far indicates that this order of antenna icing is never reached. Consequently a transmission break would occur only if adverse icing conditions were combined with severe fading. Again this is a situation that is not usually encountered. For this reason, antenna deicing equipment is generally not necessary. However, if antenna deicing equipment is necessary, it is available in the form of heaters on the dipole assembly and on the back of the parabolic reflector.

At remote unattended repeater locations where a high degree of reliability is to be achieved, standby radio frequency equipment with automatic switchover in case of failure may be provided. Automatic switchover is accomplished by appropriate monitoring apparatus in the radio frequency output and associated equipment, which will energize a spare r.f. circuit in case of failure.

Side by Side Operation and Diversity Reception

Where the communications requirements of an individual application are not met with one link, a number of these links may be operated side by side. In this case all of the terminal and r.f. equipment except the antennas must be duplicated for each additional link. By means of filter networks and proper spacing of frequencies, it is possible to operate up to 6 links through each broadband receiving or transmitting antenna.

Where there is a possibility of fading over a given path, diversity reception is employed to assure a maximum of transmission continuity. Diversity reception consists of using two receivers and receiving antennas, the antennas being spaced sufficiently far apart to incur differences in signal strength. The receiver outputs are connected together and furnish a constant signal level.

Alarm Circuits

Alarm circuits are provided to adequately monitor all aspects of the microwave link. The alarm operates in the receiver when there is no pulse carrier. Failure within an individual channel circuit does not affect the other circuits and does not cause actuation of the alarm. The alarm, when actuated, operates lights and buzzers in the central office via telephone lines from the terminal site. It should be noted that failure of a transmitter at one location also causes the actuation of the receiver alarm at the other site. Since the operation of the receiving system can quickly be checked, the operating personnel are rapidly informed of the transmitter failure at the other end.

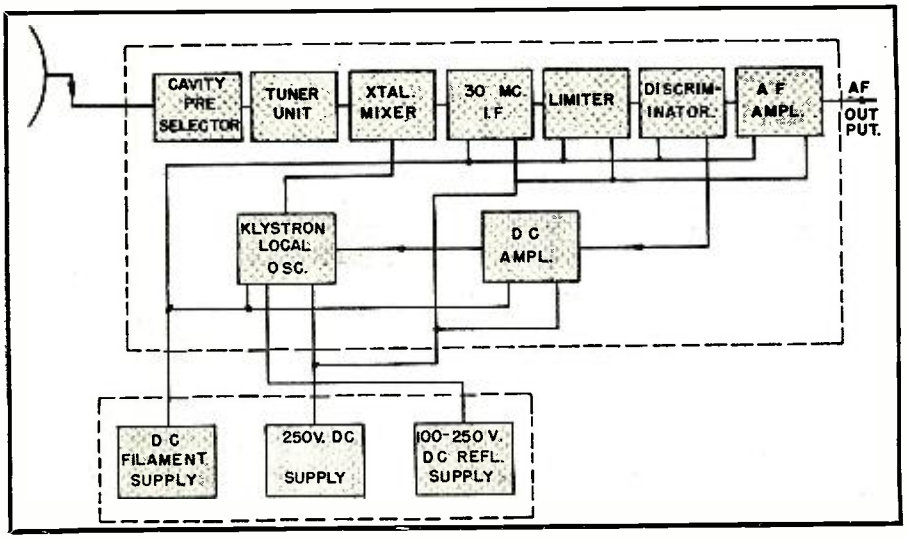
Propagation Tests

Propagation tests using this equipment have been conducted over a 12 mile path between New York City and Nutley, New Jersey and a 30 mile path between Telegraph Hill, N.J., and Nutley, N.J. Maximum fades of about 6 db. have been observed over the New York to Nutley link including seasonal variation. This transmission path was 16 per-cent over water. Recordings of field strengths over the 30 mile Telegraph Hill to Nutley path—30% water—yielded maximum fades of approximately 10 db. The conditions of these latter measurements were somewhat abnormal since the transmission path was barely line-of-sight and an airport was located directly in the beam.

Fig. 1 shows the picture of the receiving antenna used in the New York

(*Continued on page 29*)

Fig. 8. Block diagram of the microwave receiver.



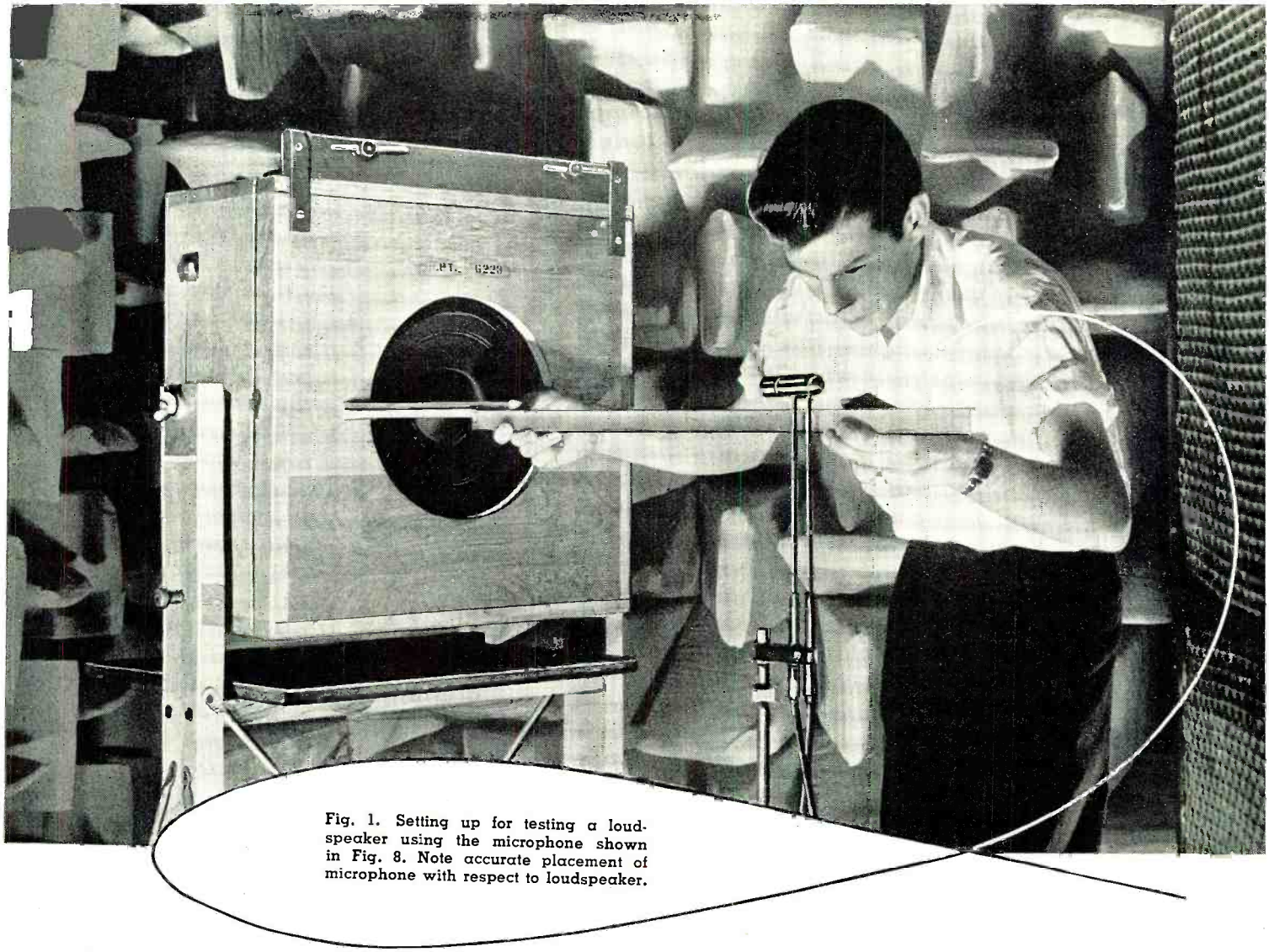


Fig. 1. Setting up for testing a loudspeaker using the microphone shown in Fig. 8. Note accurate placement of microphone with respect to loudspeaker.

Measurement of Quality in AUDIO REPRODUCTION

By DAVID FIDELMAN

Part 3 concludes this series of articles with a discussion of measurements on audio systems.

THE two previous parts of this series covered in detail the many various types of audio distortion. In connection with wow and flutter as discussed in Part 2, it has been empirically determined that the flutter index as defined is a measure of the relative perceptibility of frequency modulated tones.

Measurements on Audio Systems

When sound reproduction systems are tested for quality in actual practice, it is extremely important that such measurements be performed properly. Otherwise, the factors which are to be measured may be completely masked by errors due to the methods of measurement.

In all measurements the basic requirements are that the input signals have the correct form and be relatively free of distortion, that their characteristics be accurately known, and that the measuring equipment be sufficiently free of errors to permit measurement of the desired quantities. These considerations must be taken carefully into account in measuring quality in audio reproduction systems.

The functions of the various types of audio systems are summarized in Table I, which lists the general input and output signals of a complete audio system or section of an audio system. The complete system reproduces sound to sound, but sections of this system may reproduce sound to electrical signals or phonograph records, or reproduce records or electrical signals to sound. Therefore as test signals it may be necessary to produce standard sounds, electrical voltages, and calibrated records; and it must be possible also to perform accurate measurements upon these sounds, electrical voltages, and records. These basic considerations are summarized in Tables I and II, Part I.

The electrical signals can be tested most conveniently and with the greatest amount of precision, since instruments for generating and measuring electrical voltages have reached a high state of development. To measure the

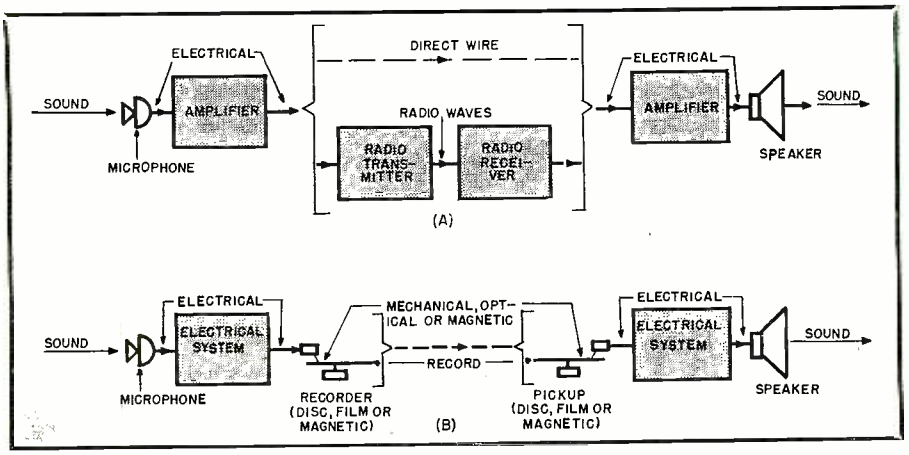


Table I. Summary of the various types of audio reproduction systems. (A) Purely electrical systems. (B) Reproduction systems involving recordings.

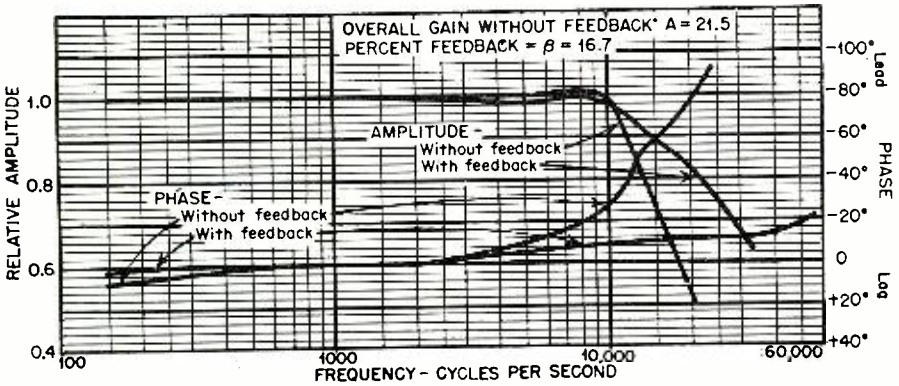
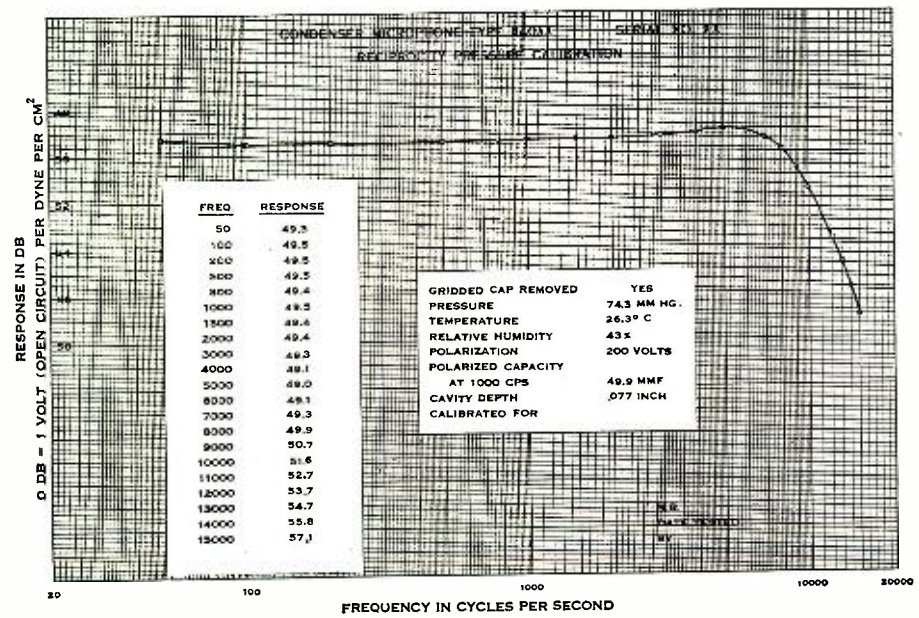


Fig. 2. Steady-state response measurements of an amplifier with and without feedback.

characteristics of components whose function is to reproduce electrical signals, the input voltage is supplied by an electrical signal generator, and the output measured by a voltmeter. The main precaution which must be taken in performing such measurements is that the input and output impedances should represent as closely as possible the impedances that the component will see in the system in which it will be used. The best method of accomplishing this is to terminate the unit in the actual output system with which it will be used, while applying the input signal from a generator of the proper impedance. The output may then be measured with a voltmeter of sufficiently high impedance that it will not appreciably affect the output.

Fig. 3. Typical frequency response calibration of condenser microphone of Fig. 8.



Greater difficulties are encountered when it is desired to test systems which include microphones or loudspeakers. Precise measurements of sound and the production of standard sound signals are more difficult than for electrical signals, and a more careful experimental technique is required. All such measurements must be performed in rooms or spaces which have been carefully planned to avoid acoustical resonances, or in such a manner as to avoid the production of resonances; and considerable attention must be given to the correct calibration and measurement of a standard of sound intensity and quality.

The most practical approach to acoustical measurements in the average laboratory is to use a calibrated standard microphone as the standard for all sound measurements. Such a microphone is one which has been calibrated against a primary standard sound source, and may be used as a secondary measurement standard. A calibrated microphone which has been widely used for this type of service is the condenser microphone shown in Fig. 8. This microphone is effectively a "point pickup", therefore does not appreciably disturb the sound field, and it has a frequency response (in combination with its companion preamplifier) as shown in Fig. 3.

The methods of measurement of acoustic devices with the aid of a calibrated microphone are illustrated diagrammatically in Fig. 5. Systems including a loudspeaker are tested by applying the input signal from the appropriate type of generator, and picking up the sound with the calibrated microphone and preamplifier. The electrical output from the microphone preamplifier is then tested for the desired characteristics in the normal manner by use of the measuring equipment which has already been described. Since the characteristics of the microphone are known, the characteristics of the reproducing system are readily determined.

The application of this method to the testing of a loudspeaker is illustrated in the photograph in Fig. 1. This shows the setting up of the loudspeaker in a "dead" room, and the accurate placement of the standard microphone (shown in Fig. 8) which picks up the sound for measurement by an automatic recording device. Fig. 4 shows an automatically recorded curve of the loudspeaker frequency response being measured in this manner.

When the system under test includes sound pickup by a microphone, it must be tested as shown in Fig. 5B. The test sound is produced by feeding the signal generator into a loudspeaker capable of reproducing the signal without excessive distortion. This sound is then

picked up by both the microphone under test and by the standard microphone. Comparison of the output of the two microphones then immediately gives the characteristics of the unit under test.

Systems which include mechanical and electromechanical methods of recording and reproduction—such as disc, film, and magnetic recording—also require special methods of measurement. (Of course, it is always possible merely to make a record from an applied electrical voltage, reproduce it and measure the resulting electrical voltage; but this procedure only gives information concerning the specific setup and does not tell anything about the individual units and their performance in more general systems.) To test the recorder and the reproducer individually, it is necessary to have a standard of some sort. This may be either a standard record, recorder or pickup, since any one may be used to calibrate the other two.

In certain measurements it may be necessary to use additional equipment (such as amplifiers, filters, etc.) which are not part of the reproducing system or of the measuring instruments. Any such equipment should always itself be tested first, since the errors in the test equipment necessarily set the limit of accuracy which can be attained in any measurement.

General

If the various factors which affect reproduction quality are measured accurately and evaluated properly, a very good indication will be obtained of how well the system will reproduce any physical sounds. As the techniques of sound reproduction and measurement improved, it was found that the relative importance of many of the distortions has been misjudged and needed revision. At the present time the relative values of the different distortions have been more accurately determined, and the information presented in this article represents the current status of audio fidelity evaluation. Audio reproduction systems tested and rated according to these principles will correspond closely with the preferences of the human ear —which is, after all, the final judge and has up to now been the determining factor in acoustical progress.

Fig. 4. Automatic recording of frequency response curve of speaker of Fig. 1.

The application of the principles described in this article has already changed some previous ideas concerning audio quality, particularly those concerning transient response. Some idea of their importance in actual practice may be obtained from consideration of their application in testing some specific audio systems. The results of measurements of a typical audio amplifier are shown in Figs. 2 & 7. These measurements were taken with and without inverse feedback, to test the quality of the amplifier and the difference with the feedback. The steady-state curves in (2) show that both the frequency and the phase response have been improved by the addition of the feedback. However, the square-wave response shown in (7) shows that the transient response has not been improved, and has actually become worse due to the increase in the damped high-frequency transient oscillation.

Such measurements are also of considerable importance in the testing of loudspeakers, and have considerably increased present knowledge of the factors which determine loudspeaker quality. For a long time steady-state response and distortion measurements were taken as the criterion of loud-

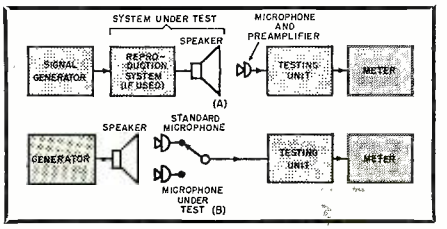


Fig. 5. Testing of reproduction systems involving direct sound pickup or reproduction. (A) Testing loudspeaker with standard calibrated microphone. (B) Testing sound pickup system by comparison with standard calibrated microphone.

speaker performance. However, although these measurements are valuable in determining the bad resonances of inferior loudspeakers, they do not give the complete picture of the quality of reproduction to be expected from the better grades. Loudspeakers with similar steady-state distortion characteristics and substantially flat frequency response often sound quite different to the ear in listening tests. Since the steady-state measurements take no account of the transient nature of natural sound, the tests are incomplete unless the transient response of the speakers has also been determined. This may be done by the method previously illustrated.

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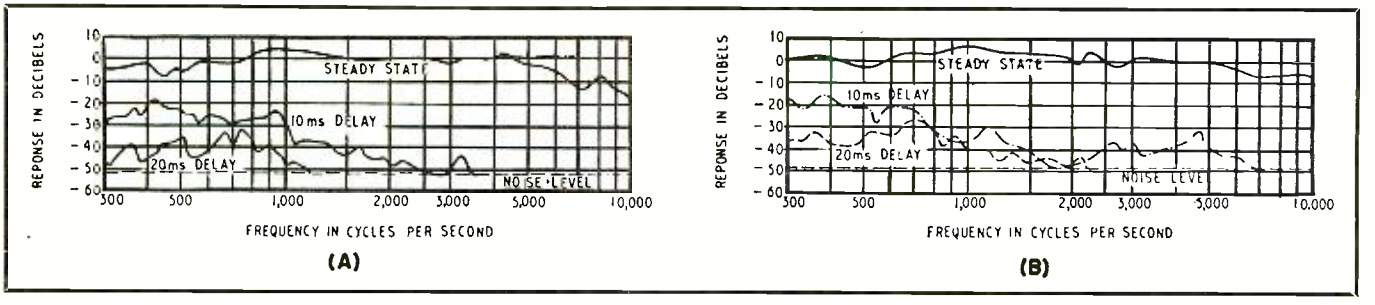
Fig. 6. Transient response measurements of two loudspeakers by the method of Fig. 5, Part 2.



Television

R. J. Trompeter, Supervisor, WKRC-TV, checking video amplifier stages in studio camera.

AS A RULE, no two television stations operate alike. Consequently, many of the problems which arise in programming and technical operations at one particular station may require a different and sometimes seemingly unorthodox approach from that used by another. This includes even the method with which equipment maintenance is carried out. A station employing a minimum of studio or field-type cameras, for example, may be faced with the necessity of using this equipment both at the studio and at a number of remote points, with a minimum of time allotted for transportation and equipment setup and adjustment. This of course requires a more rigorous maintenance schedule, plus a more clearly-defined system of emergency studio operation in the event of equipment failure.

Maintenance Notes

Routine maintenance depends largely on the specific type of equipment used and should follow the order recommended by the manufacturer, unless certain improvements or short-cuts can be adopted which expedite maintenance without sacrificing operating efficiency. In actual operation, there will be many, many failures whose symptoms or methods of servicing are not "in the books". It is here that the engineer is called upon to employ all the logic, circuit theory and practical experience at his command in the effort to find and correct the trouble in the least possible time. It is logical to assume that written accounts of symptoms and corrective measures employed will be invaluable in the future, not only to the maintenance engineer involved at the time, but to television students and to engineering personnel at other television stations.

The following maintenance notes were taken in part from the maintenance files of WKRC-TV. Although pertaining in some cases to *G-E* equipment (as noted in certain parenthesized references to tube types, condenser values, etc.), these notes are by no means isolated or limited in nature or application. In most cases the symptoms described herein will apply equally well to other types of video equipment, or will at least serve as a basis for logical analysis of circuit difficulties.

Oscillation (in Viewfinder only)—due in one case to a poor connection in the cable plug at the viewfinder end. One of the coaxial connectors was not making good contact at the plug. This trouble was corrected by building up the diameter of the coaxial plug tip slightly with solder. (Note: although this measure is not recommended as a permanent solution, it *did* suffice in this instance until further use resulted in more perfect seating of the plug fittings. The importance of perfect connections (and grounds) cannot be over-emphasized—make sure *all* terminations, cable connections and fittings are properly secured. This will save much time and "headaches" in tracing circuit difficulties).

Oscillation in Entire Camera Chain—(apparently caused by complete loss of driving control in the camera)—loss of drive in this case was traced to improper seating of a cable connector in the channel plug of the distribution amplifier. Driving pulses were going *to* the amplifier plug but were not making contact to the cable. (Note: when loss of sync, driving or blanking pulses is apparent, a stage-by-stage check with a video scope should be made, beginning at the load or termination point and working back toward the source until the normal pulse appears).

By JOHN B. LEDBETTER
Engineer, WKRC-TV, Cincinnati

Here is a collection of studio maintenance notes that will be of interest and value to all TV station engineers.

STUDIO MAINTENANCE

Heavy Oscillations in Camera Chain appearing on all monitor screens as a number of dark horizontal bars—(Fig. 2) in this case the trouble was due to an intermittent open in the heater transformer supplying the "Y" tubes. Resoldering the defective connection corrected the trouble.

Heavy Oscillation in Camera Chain, resulting in horizontal black and white shaded areas—check or replace the 6C4 vertical blocking oscillator tube in the Pickup Auxiliary unit.

Oscillation in Horizontal Circuit when cable delay is adjusted—due to a weak 6J6 cathode follower in the cable delay multivibrator circuit of the Pickup Auxiliary unit.

Retrace Lines in Viewfinder Only—burned-out or defective 1N34 blanking crystal in the viewfinder unit. This crystal is in the blanking input (6AS6 suppressor to ground); check also the 1N34 in the grid circuit of this stage.

Viewfinder Screen Dark—if the filament of the 8016 high-voltage rectifier is not lighted, check the 6J6 beat oscillator and horizontal discharge tube. This tube is part of the high-voltage interlock circuit; failure of horizontal deflecting voltages removes excitation from the 6J6 stage and subsequently from the 8016 to prevent damage to the 5FP4 cathode-ray viewing tube.

Pattern of White Dots out of sync, covering entire screen area of the Image Orth monitor (see Fig. 1B). Turning the high-voltage off and on caused the chain to operate normally for about an hour. At this time a *black* bar appeared on the camera viewfinder, accompanied by a *white* bar on the monitor screen. (The black bar on the viewfinder screen apparently represented the edge of the blanking pulse in the camera). The chain operated normally when the 6J6 vertical blanking pulse tube in the distribution amplifier and the 6C4 vertical oscillator tube in the camera pickup head were replaced.

No Vertical Deflection in Camera Chain Kinescope—due to an inoperative 6C4 vertical blocking oscillator. A voltage check showed only 90 volts on the plate of this tube; the trouble was caused by a shorted coupling condenser.

Intermittent Vertical Drive (vertical driving pulses occurring intermittently between frame lines)—due to loss of regulation in the +120-volt power supply circuit in the pickup auxiliary unit. This voltage operates the camera head video preamplifiers and is rather critical; when unregulated it can rise to as much as 200 volts. In the above case, the excessive unregulated voltage resulted in a shorted 100-μfd., 150-volt filter condenser in the camera head. Loss of regulation was due to three shorted 6AK5 regulator tubes. (Note: this particular V-R circuit employs three 6AK5 tubes as regulators. If one of these tubes burns out or is removed while the power is on, the grids of the remaining two are driven positive with subsequent damage to those tubes. If one tube is suspected, replace *all three* and check the removed tubes for shorts, poor emission, and leakage). Removal or replacement must be done with *power off!*

Lack of Vertical Hold on Camera Monitor and Master-Mixer Monitor screens (three pictures could be seen vertically, drifting *down* on one screen and *up* on the other. Pictures were normal on the viewfinder screen). Trouble was due to a burned-out 6AS6 vertical delay tube in the sync generator, which resulted in loss of vertical sync to the above units. Loss of sync can of course be due to a defective tube or component anywhere in the sync circuit; a common source of trouble is the 6SN7 sync amplifier in the studio pulse generator.

Very Poor Vertical Blanking Waveshape—the vertical blanking was checked with a scope from the sync generator through to the camera control unit. The waveform appeared normal all the way; after putting the scope test leads on the grid of the 6AS6 blanking insertion tube, the trouble cleared. Tapping or moving components did not cause the trouble to reappear. Later checks showed the tube to be intermittently defective.

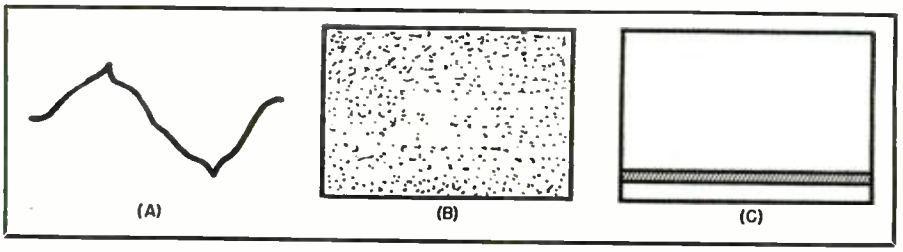
Distortion of Low-Frequency Pulses on Mixer-Monitor Scope—these pulses were normal on the grid of the 6AG7 video amplifier stage and on the plate with the other 6AG7 removed, but badly distorted with this tube in place. (These two tubes are in push-pull). Removal of a 0.1 μfd. low-frequency compensating condenser eliminated distortion but decreased the vertical trace amplitude on the scope. (This distortion also appeared on the screen of the Master monitor; its waveshape suggested that modulation of the blanking line with the picture envelope was taking place). Trouble was traced to defective 6AL5 clamp tubes.

Unbalanced Horizontal Shading on chain—bad ground connection on cathode condenser of the 6C4 cathode follower.

Horizontal Bar on Rasters of studio cameras, appearing about one inch above bottom of picture, Fig. 1C. (This normally is caused when the vertical driving pulses arrive at the camera much earlier than the *sync* pulses). Trouble in this case was due to a defective 6SN7 sync amplifier and 6SN7 60-cycle multivibrator in the studio pulse generator.

(*Continued on page* 30)

Fig. 1 (A) 60-cycle modulation waveform in video amplifier section. (B) Pattern of white dots out of sync covering entire screen area of monitor. (C) Horizontal bar on rasters of studio cameras, appearing about 1 inch above bottom of picture.



Measuring Dynamic Pressure and Displacement Electronically

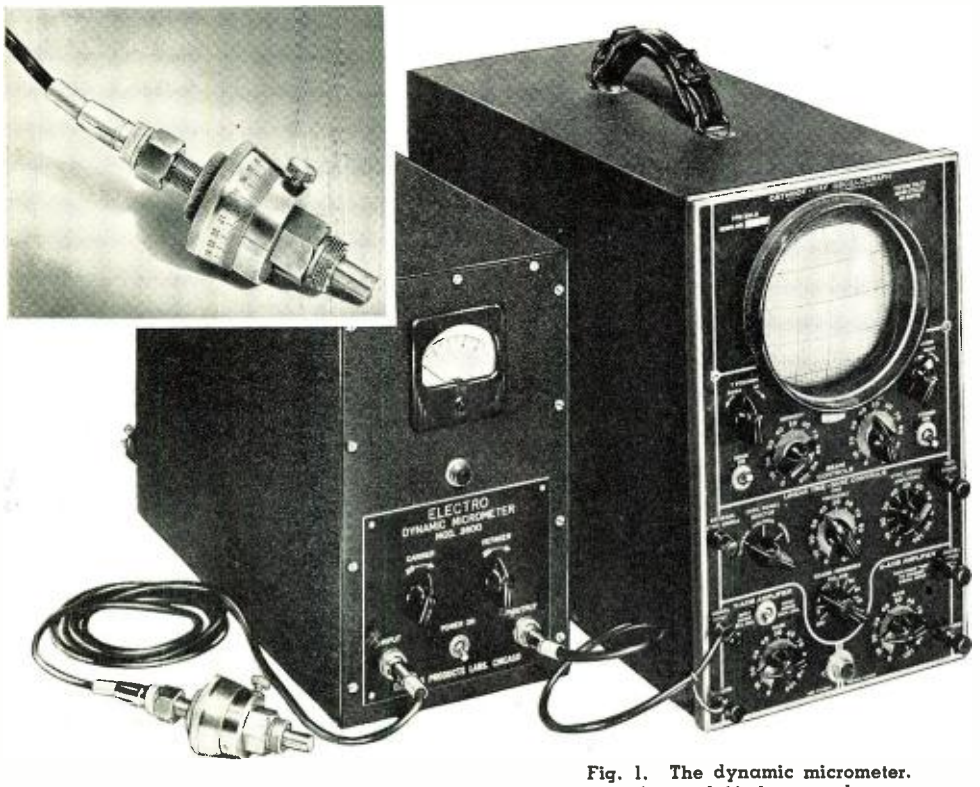


Fig. 1. The dynamic micrometer. Inset (upper left) shows a close-up of the micrometer sensing element.

By D. L. ELAM
Electro Products Labs., Inc.

Variable inductance and capacitance pickups are utilized in making dynamic measurements.

THE precise measurement of pressure and displacement, both static and dynamic, is one of the more recent contributions of electronics to the engineering sciences. The equipment and techniques were developed as a result of the need, for example, of determining accurately the pressure in the cylinder of an internal combustion engine at every instant during a complete cycle of dynamic operation.

There are various mechanical devices available for the measurement of both pressure and displacement, such as the micrometer and pressure gauge. However, there are many instances where such devices are entirely inadequate to give the desired information. In the measurement of pressure, it is many times necessary to have a device which will accurately follow and record, if necessary, extremely rapid changes. The same is true of displacement. Such requirements call for the use of a dynamic sensing unit.

There are two classifications of sensing units which will produce an output only during dynamic conditions. One of these is the rate of change type in which the output amplitude is dependent on the speed of displacement. The other produces an amplitude which is dependent on the amount of displacement and is independent of the speed of movement.

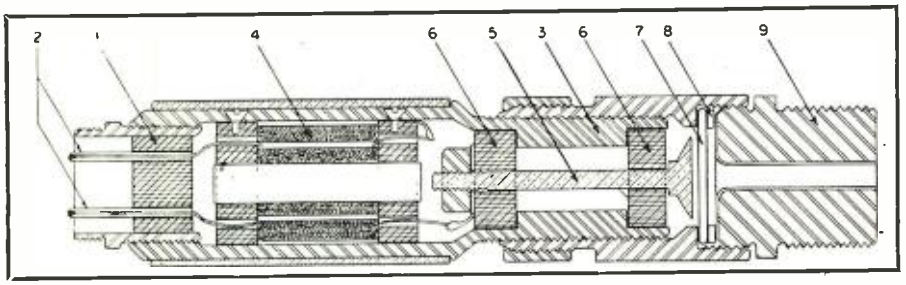
The rate of change sensing units operate on magnetic and magnetostriction principles. Both produce their signals by the action of a coil of wire in the presence of a changing magnetic field. The intensity of the field is made to vary in accordance with the pressure variations.

These are the most rugged and simplest to make of any of the pressure indicators. It is theoretically possible to integrate the response of a rate of change pickup so as to produce a pressure-time curve, but it is not practical. The rate of change type of sensing unit is very useful though, for many other purposes. When actuated by moving fins on a machine, it may be used for angular timing, synchronizing, or producing reference points to show angular position. When actuated by a diaphragm exposed to the explosions in an engine, it is very useful in measuring the level of detonation. The rate of change sensing units may be sensitive to vibration and care must be used to prevent signal output from this source.

The displacement type of dynamic sensing units consist of the piezoelectric crystal and d.c. excited capacitor pickups. Theoretically, each of these will produce a voltage change with a change of displacement and hold this voltage indefinitely. However, they both must be worked into a resistive load and therefore, the voltage will leak off. So in practice they will produce an output signal only while they are actuated dynamically. Since they must be worked into a resistive load, their low output when used with internal combustion engines at speeds below five or six hundred r.p.m. renders them impractical at these speeds.

The output signal from both of these

Fig. 2. Cut-away view of the pressuregraph pickup.



types is very small, necessitating amplifiers having tremendous gain. It is extremely difficult to build amplifiers which will give uniform performance over a frequency range from one or two c.p.s. to twenty or thirty thousand c.p.s. Such amplifiers must be perfect both as to amplitude and phase distortion over this whole range. Phase distortion can cause appreciable error when making time or angular position measurements. For instance, when we are using a pulse to indicate injection time or some other angular position, any phase delay introduced by the amplifier may cause an error by placing this pulse many degrees away from where it actually belongs.

Inductive Impedance Sensing Unit

Sensing units using impedance variations due to inductance changes have been used for observation of dynamic pressure variations. For this pickup, an inductance is mounted so that a moving steel diaphragm or a steel cylinder attached to a diaphragm is caused by pressure on the diaphragm to move in the magnetic field of the coil so as to produce a variation in the inductance of the coil. Since the coil is excited with a.c., the inductance change causes a variation in the voltage drop across the inductance which coincides with variations of pressure applied to the diaphragm. These pickups are also used with the Wheatstone bridge. Inductance bridges are a little more tricky to operate than resistance bridges, at the higher frequencies.

One of the instruments to be described in this paper is the Dynamic Micrometer. This device measures displacement of masses of both ferrous and non-ferrous metals. A constant current at a frequency of 50 kc. is fed to the induction coil. As the inductance of this coil varies, due to the movement of objects in its vicinity, the voltage drop across the coil varies accordingly. This voltage variation is amplified, rectified, and fed to a suitable meter.

Fig. 4 shows a circuit diagram of this unit. A 6J5 functions as a 50 kc. oscillator, controlled by the resonant circuit $L_1 - C_1$. This 50 kc. is fed, through suitable controls, to the connector marked "INPUT" and thence to the pickup coil. Because of the high resistance in this circuit, the current through the pickup coil is essentially constant, and variations in the inductance of the coil produce variations in voltage at the grid of one-half of a 6SN7. At this point, we have a modulated 50 kc. voltage. The modulated signal is amplified and fed to the 6H6 detector where the carrier is removed. Since the maximum modulation will not exceed 5%, the d.c. bias resulting from rectifying this signal is removed by applying a counter d.c. bias to the diode rectifier. The remaining signal is fed to the 6J6 vacuum tube voltmeter.

The sensing unit consists of many turns of fine wire wound on an iron core and located inside an iron tube, as close to the end as possible. This gives a magnetic field that is essentially parallel near the face. Any metal in the field will react by modifying the field. Ferrous material will increase the inductance, and with this increase of inductance there is an increase in impedance and an increase in the voltage drop across the sensing unit. Non-ferrous metals act as a shorting ring and decrease the inductance, thus decreasing the voltage drop. The dynamic micrometer will operate on either an increased or decreased voltage drop.

Operating the Dynamic Micrometer

The technique for using the Dynamic Micrometer is very simple. The sensing unit is brought to within a few thousandths of an inch of the moving surface to be measured but not close enough to touch it. The amplitude of the voltage corresponding to the maximum distance from the coil to the metal surface is noted on the oscilloscope screen. The micrometer screw is backed out, pulling the coil back until the voltage corresponding to the nearest approach of the metal is reduced to the previously noted amplitude for maximum distance. The change in the micrometer setting is read and is equal to the displacement of the moving surfaces.

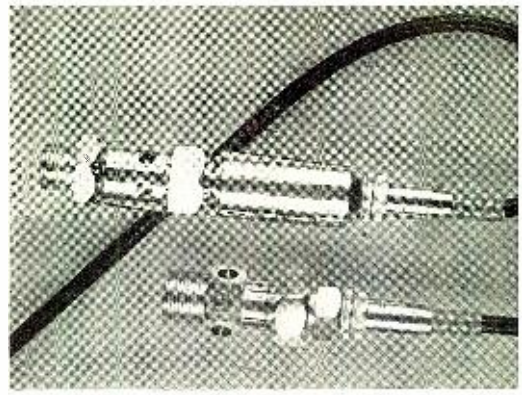
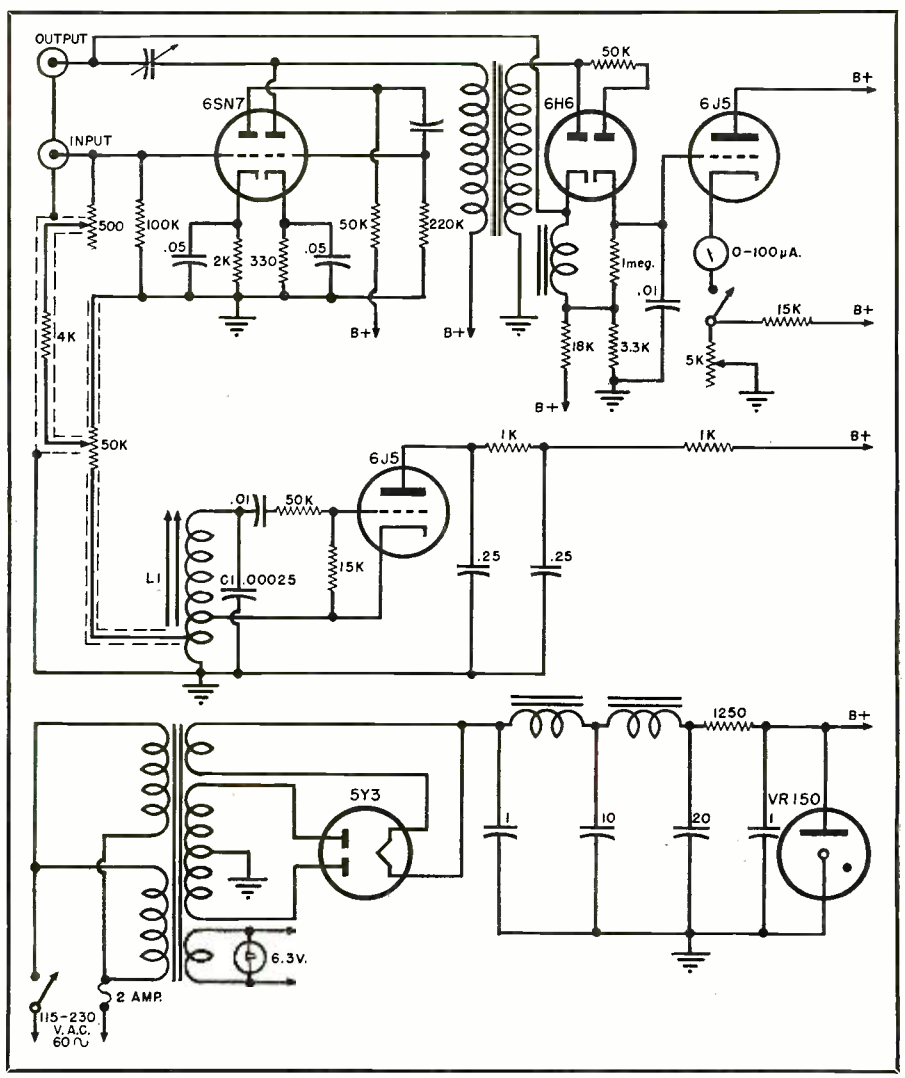


Fig. 3. (Top) Model 3709-A pickup with 18 mm. water cooled adapter. (Bottom) Model 3000-B detonation pickup with ⅞"—18 thread adapter.

Fig. 4. Circuit diagram of the dynamic micrometer.



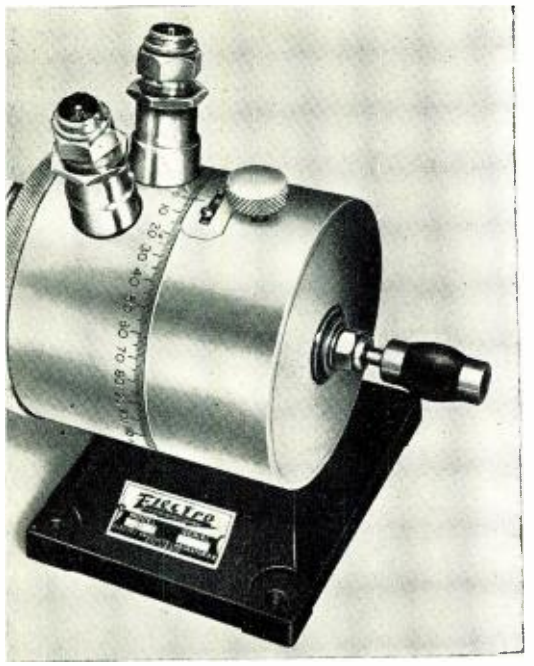


Fig. 5. Model 3850 angular sync.

The reading is made directly on the micrometer sleeve and is entirely mechanical. No elaborate calibrating of electronic components is necessary. We have been able to consistently make repeated measurements with variations of not more than a tenth of a thousandth of an inch. The device is sensitive only to displacement, therefore, the speed of the moving metal does not affect it. Measurements may be made with the metal stationary or at moving speeds corresponding to well over 200,000 r.p.m. The frequency response of the electronic components is not a factor in its operation since all amplifying is done at a single frequency. Furthermore, the electronic devices are only used to establish reference levels. The actual measuring is done on a conventional micrometer sleeve.

Fig. 1 shows the Dynamic Micrometer sensing unit mounted on a micrometer screw. The 2" diameter sleeve is calibrated in tenths of thousands of an inch.

Dynamic Pressure Measurement

Several different methods may be used for the dynamic measurement of pressure. These include the use of inductive and capacitive impedance sensing units, and capacitive reactance sensing units. After a great deal of study and development work, the capacitive impedance system was selected. A circuit diagram of this system is shown in Fig. 7.

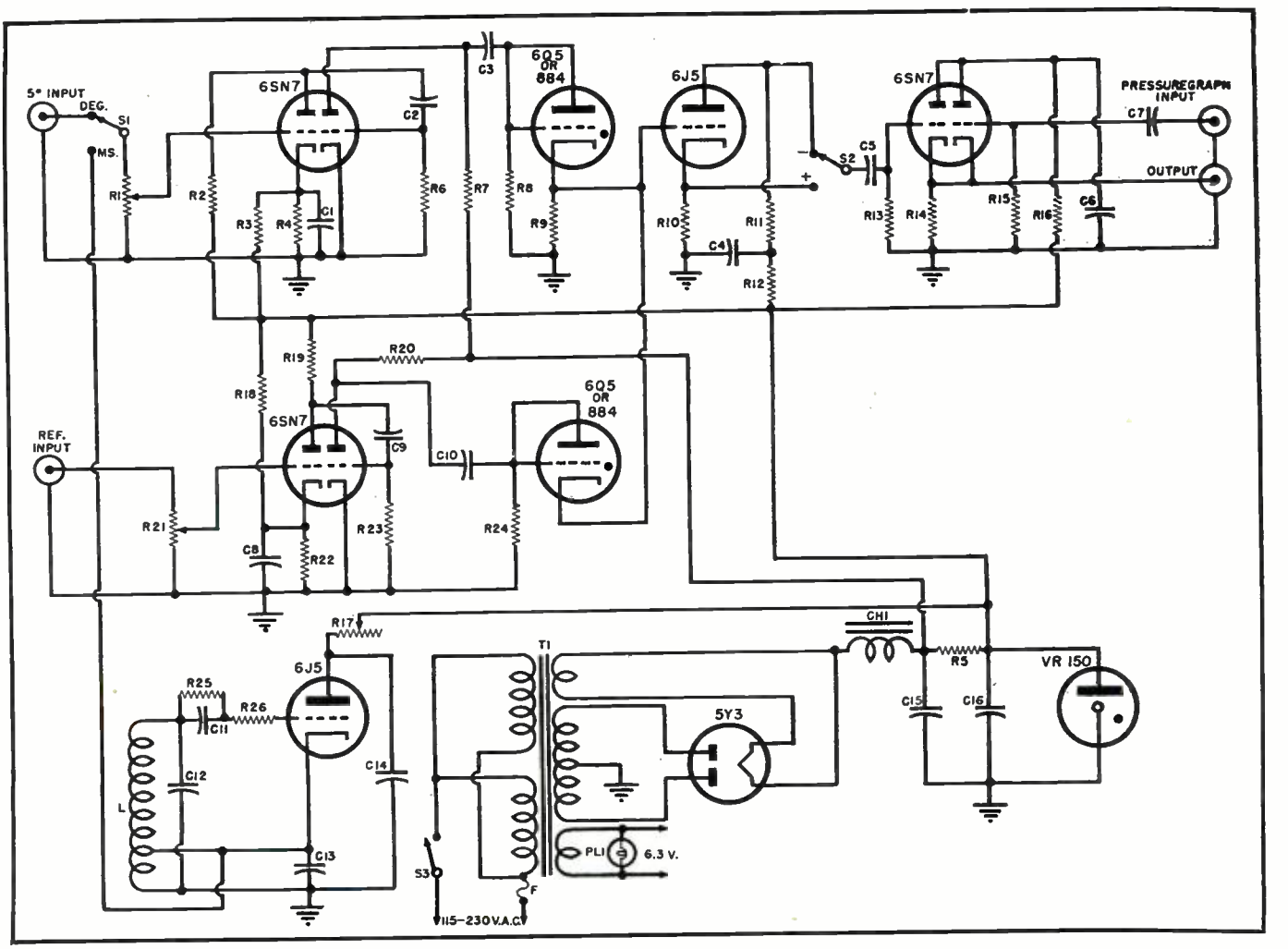
A 100 kc. carrier voltage is used, generated by a 6V6 tube in conjunction with the tuned circuit $L_1 - C_1$. Variations in the capacity of the sensing element, connected to the terminals marked "INPUT", modulate the 100 kc. carrier. This modulated carrier is rectified by the 6AL5 dual diode, and the intelligence impressed on the grid of a 6J5 cathode follower.

Since the amplifier works at only one frequency there is no possibility of error due to poor frequency response. With the exception of the oscillator, there are no tuned circuits. There is no critical tuning or close frequency control necessary. The 100,000 cycle oscillator tuning circuit consists of a powdered iron core coil tuned by fixed mica condensers. The oscillator frequency is set at the factory and no further adjustments are ever necessary. If the carrier frequency should drift a few thousand cycles one way or another it would not adversely affect the operation of the Pressuregraph.

For use in time and angular position studies, an integrating means is incorporated at the output of the Pressuregraph. This eliminates the 100 kc. carrier and provides a single line trace on the oscillogram. The integration is held to the lowest possible minimum so the

(*Continued on page* 30)

Fig. 6. Complete schematic diagram of the Electro synchro marker.



A Wide-Range PULSE SHAPER

By
LOUIS D. STEVENS, JR.
Div. of Electrical Engineering
University of California

This circuit will generate a single microsecond pulse manually, or may be triggered at rates up to 400 kc.

A CIRCUIT is described which will generate a single one microsecond pulse manually, or may be triggered with sine waves to produce pulses at repetition rates up to 400 kc. Square waves of the applied sine wave frequency may also be obtained from the circuit.

In testing electronic counters and other pulse circuits there often arises the need for a manually operated single-pulse generator. However, the single-pulse operation of such circuits is usually only desired in the very primitive stages of circuit development and a source of periodic pulses, variable in repetition rate over a considerable range is also needed. The circuit to be described satisfies both of the above requirements, giving a one microsecond pulse at any frequency from single-pulse to 400 kc.

Before consideration of the complete circuit, it would be more instructive to consider first the basic operation of the circuit which is actually the heart of the pulse shaper. The circuit in question is the little publicized Schmitt trigger circuit[1] which is shown in Fig. 1. This circuit is characterized by two critical voltage levels at the grid of V_1 which will be designated as $+e$ and $-e$. Suppose that the voltage at the grid of V_1 is less than $-e$. In this condition V_1 is cut off by the large cathode bias produced by the heavy conduction in V_2. As the voltage on the grid of V_1 is raised from $-e$ nothing occurs until the voltage on this grid becomes greater than $+e$. As soon as this happens, V_1 abruptly begins to conduct heavily and V_2 is quickly cut off. Subsequent raising of the grid voltage of V_1 does not alter the present state of the circuit. If the

1. *Schmitt, O. H., "A Thermionic Trigger," Journ. Sci. Inst., Vol. 15. pp. 24-26, January, 1938.*

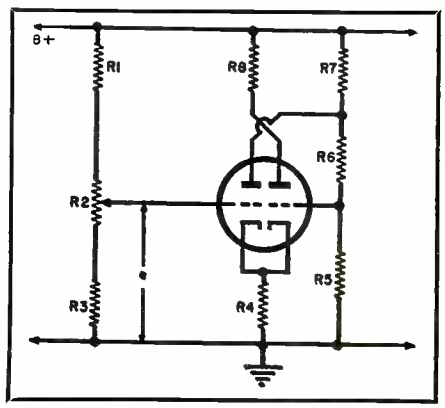


Fig. 1. Basic Schmitt trigger circuit. V_1 is the left half and V_2 is the right half of the dual triode.

grid voltage of V_1 is now lowered nothing occurs until it drops below $-e$ which is a few volts less than $+e$. This difference in the critical voltage at the grid of V_1 is known as the circuit hysteresis. However, when the voltage on the grid of V_1 drops below $-e$ the circuit abruptly reverts to its former state with V_1 cut off and V_2 conducting. The exchange of current between the tubes takes place with great rapidity and is independent, essentially, of the rate at which the critical voltages are crossed. As soon as one of the critical voltage levels is passed the circuit triggers on its own due to the closed regenerative loop which is formed from the plate of V_1 through V_2 as a cathode follower, to the cathode of V_1. This loop gain is much greater than unity when both tubes attempt to conduct at once.

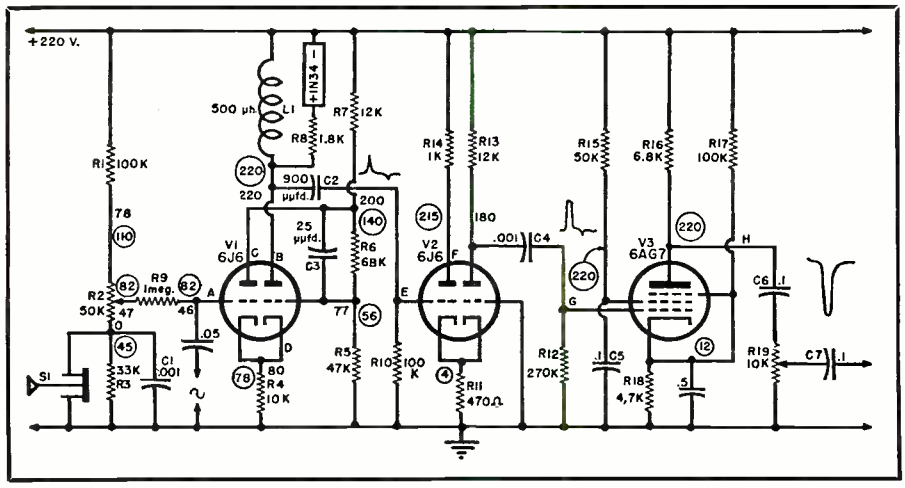
It should be noticed that the plate load of V_2 does not enter into the switching action of the circuit and may thus be made any type of load.

The complete circuit of the pulse shaper is shown in Fig. 2. A description of the operation of this circuit as a single-pulse generator will make clear its operation when sine waves are applied. The switch S_1 is a normally closed micro-switch and V_{1B} is normally conducting due to the setting of the grid control potentiometer R_2. When the switch S_1 is opened the grid of V_{1A} rises due to the added resistance R_3 in the voltage divider from grid to ground. Condenser C_3 will begin to charge and at the instant the voltage on the grid of V_{1A} passes + 73 volts the circuit triggers into its other state, where it remains as long as switch S_1 is opened. Before the switch was opened a large current was flowing through the inductance L_1. When the switch was opened the current suddenly stopped. The removal of the steady current causes the inductance and its distributed capacity to be shocked into oscillation at their resonant frequency. However, when the first positive cycle of the oscillation has been completed the 1N34 crystal diode will damp out any further oscillations.

A positive output pulse about 1 micro-

(*Continued on page 28*)

Fig. 2. Complete pulse shaper. Switch open voltages are in circles, switch closed voltages not enclosed. All voltages are with respect to ground. Subscripts A and B in text represent left and right portions respectively of V_1 and V_2.



PORTABLE GEIGER COUNTER for Drill Holes

Complete unit including cable drum and probe ready for use. Keiva Feldman holds the rubber coated probe.

By ARTHUR ROBERTS
Capital Press Service, Ottawa

Novel high voltage supply and probe design permits radioactivity measurements at depths to 1000 feet.

"OW can you tell what's down a hole without seein' a drill core?"

The hard-bitten old prospector spat and looked at the mining engineer and driller squatting beside him on the rock for confirmation of his skepticism.

A young Canadian scientist thrust the end of a cable into the newly drilled test hole and switched on the portable equipment he was testing.

The cable slid quickly through his fingers as it unwound from a drum and disappeared into the 1000 foot hole. Suddenly a small loudspeaker on the equipment started beeping a high musical note and the three old timers looked at each other incredulously.

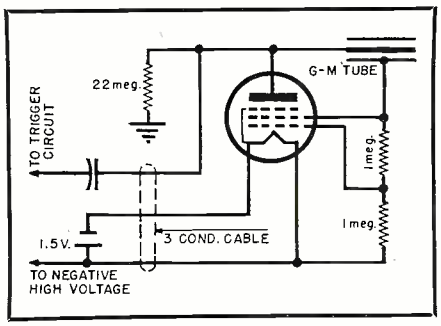
"That," said the young scientist, "is uranium about 250 feet down."

Last year at the *Eldorado Mines* in the Northwest Territories, Keiva Feldman, physicist at the National Research Council, Ottawa, tested this equipment which took him almost three years to perfect and added one more instrument to the rapidly growing list of tools used for probing the earth's crust for minerals.

The equipment is basically a Geiger counter, an instrument which has long been used for radiation detection. To date, however, such counters when used in mining and prospecting operations have been limited to surface use or down the mine shaft itself.

During the war when the urgency of finding new sources of uranium ores became acute, the Canadian government pressed for the development of an instrument for detecting radioactive ores down a diamond drill hole. Thousands of dollars were being spent on drilling operations from which valuable information was gathered from the drill cores. But frequently the drill cores crumbled when they encountered soft strata of rock resulting in the loss of information. Out of this problem came the development of the instrument described. The National Research Council tossed the problem into the laps of two of their physicists, Keiva Feldman and Mr. G. M. Wright early in 1945.

Fig. 1. Typical preamplifier circuit used with G-M tube in initial tests.



It was obvious from the start that a Geiger-Muller tube would have to be used but it was generally accepted that such a tube would not operate properly without a preamplifier at the end of a 10 foot cable let alone one a thousand feet long. The first prototype was designed with a preamplifier built into the probe but it frequently gave trouble and was difficult to repair in the field.

As a result the present model was built, in which the preamplifier was eliminated. The counter itself was designed for detecting gamma-rays in a diamond drill hole of a diameter not less than 1¼" to depths of 1000 feet. It consists of a battery operated electronic circuit with a G-M tube at the end of a cable and indicates the counting rate on a rate meter and a loudspeaker.

The chassis housing the electronic circuits is fastened to the side of the reel carrying the cable and rotates with it. The reel is mounted on a portable framework designed to be carried by two men.

Briefly, the circuit works as follows: Each "count" from the G-M tube, attenuated by the cable, is amplified and actuates a trigger circuit. The square pulse thus generated is modulated by a neon oscillator. This modulated pulse, amplified by the power amplifier, gives a note in the loudspeaker and a reading on the rate meter.

The G-M tube is of the single-ended, self-quenching type, requiring an operating voltage of about 1000 volts. When sufficient amplification is provided at the upper end of the cable, it is found

satisfactory to omit the preamplifier in the probe. This not only avoids possible trouble with the probe in the field but also simplifies its construction and enables it to be permanently sealed. It also eliminates practically all drain on the high voltage circuit, and makes possible the use of a cable having only two conductors of negligible current carrying capacity.

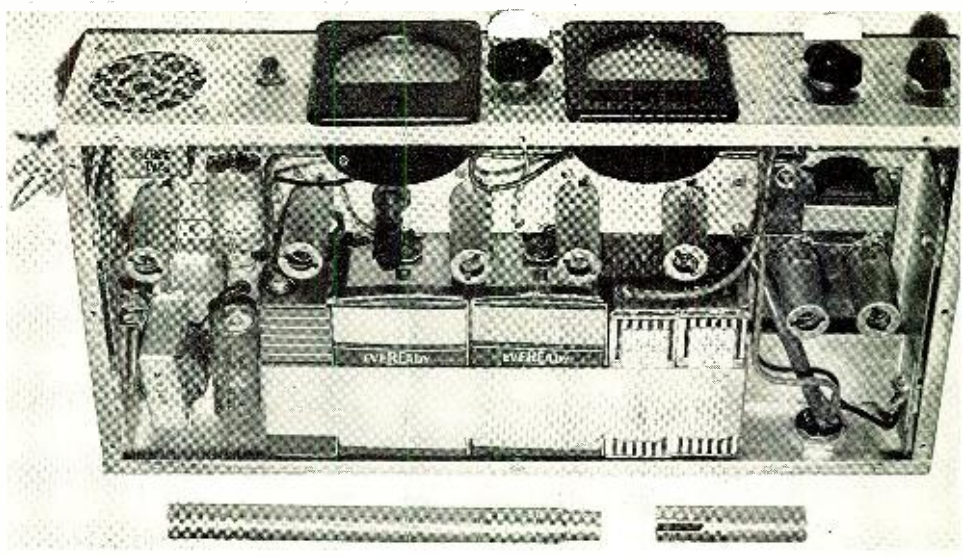
High Voltage Circuit

To build up a high voltage with a low current drain, a multivibrator is used with an inductive load in the plate of one tube and a rectifier through which the pulses induced in the inductance charge a condenser. Negative high voltage is used so the filaments can be near earth potential. Thus a single "A" battery can be used and the diode in one multivibrator tube can be used as the rectifier. In this way the charge produced in the condenser approaches the peak value of the pulses induced in the inductance.

The multivibrator has one voltage amplifier and one power amplifier type of tube with the inductance in the plate of the latter. A power amplifier is used to permit the use of low "B" battery voltages and the power requirements are reduced by using the screen grid rather than the plate for multivibrator action. Its frequency is about 40 oscillations per second.

The values of capacities and resistances to give the desired high voltage range depend chiefly on the type of inductance, on the particular tubes used, and on the "B" battery voltage. The inductance tried in this case was a 150 henry filter choke although in general audio plate reactor inductances are more efficient than filter chokes.

It was found that the grid and plate resistor values were not critical although it is advisable to choose a combination which is least sensitive to the tube characteristics and which keeps "B" battery current to a minimum.



A view of the electronic unit removed from the cable drum.

The variable resistance in the screen grid of V_1 (Fig. 1) is provided to adjust the high voltage to give a normal range from 800 to 1300 volts. Since the G-M tubes used have an operating range of 200 volts it is not difficult to adjust the high voltage to a suitable operating value.

An interesting aspect of this multivibrator circuit is that the high voltage decreases as the "B" voltage decreases but increases as the "A" voltage decreases. By choosing "A" and "B" batteries of appropriate capacities these effects may be made to compensate for each other.

Since considerable amplification of the G-M tube "counts" is necessary and because the capacitance of the cable feeds the ripple from the high voltage supply directly to the amplifier, it is necessary to add the two-stage filter. Care should be taken in wiring, to avoid placing input leads where they might pick up ripple from the high voltage circuit.

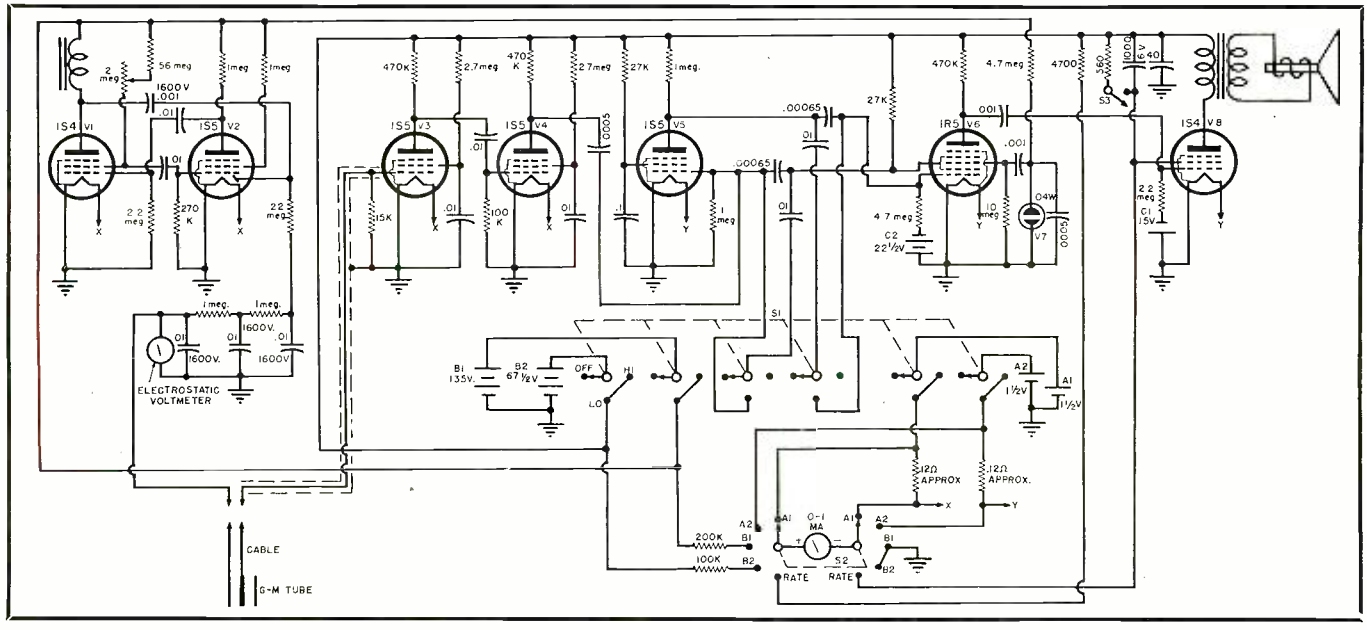
Amplifier and Trigger Circuit

The two-stage voltage amplifier (V_3 and V_4) has a gain of about 2500, and the grid resistor in the first stage serves as a load resistor for the G-M tube. With cables having an inter-conductor capacitance of up to .02 μfd. this resistance (15,000 ohms) gives pulses up to one-third of a millisecond long.

The trigger circuit (V_5 and V_6) is conventional except that the biased tube is a pentagrid converter V_6. Grid No. 3 of this tube is used as the input grid for the neon audio frequency oscillator V_7. During the conducting periods of V_6, that is, when a pulse trips the trigger circuit, the plate current of this tube is modulated at the audio frequency (about 1000 c.p.s.). Two sets of coupling constants in the trigger circuit, selected by the OFF-HI-LO switch, give conducting periods of either .25 or .001 seconds.

(*Continued on page* 21)

Fig. 2. Complete circuit diagram of the portable Geiger-Mueller counter for diamond drill holes.



CONDUCTIVITY MEASUREMENTS

By JOHN D. GOODELL and CURTIS W. FRITZE

The Minnesota Electronics Corp.

The conductivity of a solution, with suitable electronic controls, is used to keep the strength of the solution constant.

This small assembly line turns out approximately twenty complete units daily.

THERE are many fields of application for electronic devices in industry that have been explored but are far from fully exploited. Among these is the measurement of conductivity in solutions. Many chemical changes may be so directly related to electrical conductivity as to make this the perfect method for analysis, observation, and in many instances automatic continuous control of the characteristics of the solution. Typical of these applications is the control of detergents for large scale cleansing problems. In dairies this is a problem of no small importance. In all commercial dishwashing in restaurants, bars, hotels and hospitals it is imperative that the concentration of the detergent be controlled. This is important not only to make the use of the materials as economical as possible, but also to insure that the minimum concentration for satisfactory results is maintained. In many localities there are ordinances and laws requiring that concentrations be maintained within relatively close limits. Obviously, it is impractical to make a chemical analysis of the dish water as often as is necessary for optimum operation. It is also impractical to train dishwashing personnel to have the necessary knowledge and judgment to effectually control these conditions manually. The electronic control based on a continual measurement of conductivity is often the ideal solution. Manufacturing chemists, cosmetic plants, food canning industries and many others have need for controlling the characteristics of solutions during processing, and in many instances automatic monitoring is essential both for successful products and efficient operation.

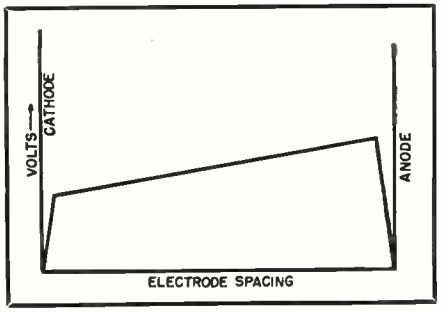
It is possible to measure the concentration of a specific ion in a solution by careful selection of the materials used for the electrodes and by bridge circuits designed for this limited laboratory type of work. In most applications it is necessary only to measure the total ion concentration of the solution. The conductivity of solutions (electrolytic conduction) is characterized by the actual physical transport of matter in the form of ions (charged atoms or groups of charged atoms) as opposed to conduction in metals via electron flow. This introduces typically chemical processes into the problem. For example, sodium chloride consists of positive sodium ions and negative chloride ions oriented alternately at the corners of cubes. When the crystals are dissolved in water the ions are separated in accordance with the chemical equation

$$NaCl \rightleftharpoons Na^{+} + Cl^{-}$$

Thus a molecule of sodium chloride splits into a positively charged ion of sodium with one less electron than normal and a negatively charged ion of chlorine with one extra electron added. Many other chemicals dissociate in a like manner, and even water will separate very slightly into hydrogen and hydroxyl ions so that even when it is chemically pure it is not a perfect insulator but will permit some conduction. Thus, conductivity may be shown to be directly related to the chemistry of many solutions and may be used as an accurate method of measurement and control.

There are many reasons why this type of conductivity may not be measured as a reciprocal of resistance with the conventional methods used for measurements of electron conduction in metals. Direct current cannot be used in most instances because of the transport of matter and because of the continually changing surface conditions on the electrodes. When two electrodes are initially placed in a solution and direct current is passed between them, the system is rapidly transformed from a simple conductivity cell consisting of three elements (the two electrodes and the solution) into a much more complex one. Furthermore, it will not be stable but will continually change in basic

Fig. 1. The distribution of potential in a conductivity cell.



character. As an example, when two electrodes are immersed in a dilute solution of sulphuric acid, direct current passing through the system polarizes the structures, i.e., a layer of hydrogen forms on one electrode and a layer of oxygen forms on the other. The cell now has five elements and a net e.m.f. appears that represents the energy required to decompose water into hydrogen and oxygen. This reaction, of course, results in the formation of an electrolytic capacitor. A very small current flows and the cell becomes a large electrolytic capacitor.

An important factor in considering the design of conductivity cells is the potential distribution between the electrodes. In the area immediately adjacent to the electrodes there will be a relatively large potential change, while in the large space between them the potential distribution will be almost exactly proportional to the distance. A typical potential distribution curve for electrolytic structures is shown in Fig. 1. Perhaps of greatest importance is the fact that the relatively large change in potential that occurs in the area immediately adjacent to each electrode will be intimately related to the material used for the electrodes. Hence, where greatly dissimilar materials are used for the two electrodes there will be a net e.m.f. between them at all times, even when they are disconnected from any exterior energy source. They form, effectively, a simple voltaic cell. This results from the transformation of chemical energy into electrical energy and introduces considerable complexity into the detailed theoretical considerations.

Conductivity in solutions, as in metals, changes with temperature. However, while the change in resistance in metals is directly proportional to temperature, it is inversely proportional to temperature in most solutions. In dishwashing applications and most chemical manufacturing processes the temperature of the solutions may vary enormously over the period during which conductivity is to be controlled. This factor must be considered in the design of any device requiring close tolerances and is often a factor that introduces serious errors when its importance is not fully recognized.

The most desirable metals for the electrodes in average applications are relatively inert metals, such as nickel and platinum, in order to minimize corrosion and similar difficulties. The physical design of the sensing probe must be such as to eliminate any possibility of crystals forming between the electrodes, and should also include a large enough sample of the material between the electrodes to eliminate the extent to which the abrupt changes at the electrode surfaces enter into the measure-

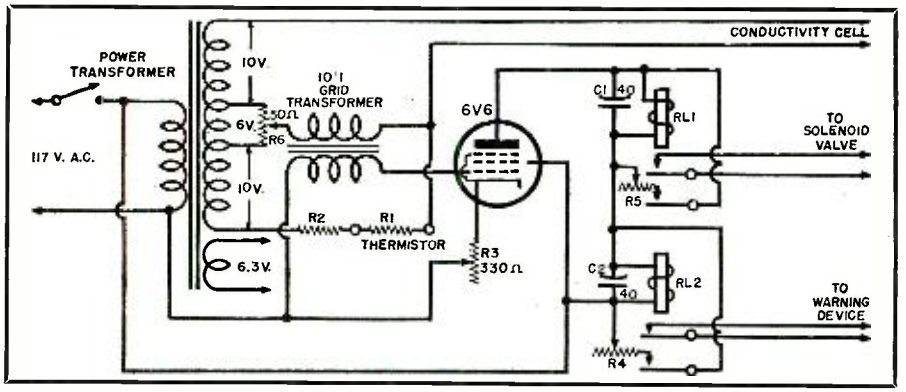


Fig. 2. Complete circuit diagram of the conductivity bridge.

ment percentage-wise. In general, the area of the electrodes will determine the cross section of the solution that enters into the measurement, thus controlling the average current flow. If one electrode is appreciably smaller than the other, the smaller one will be the controlling element and the larger one will be eliminated as an important variable so far as dirt and corrosion are concerned.

One typical approach to the design of a suitable sensing probe is shown in Fig. 3. The small electrode is a platinum of nickel rod and the larger electrode is in the form of a tube of a similar metal pressed over the rod and insulated from it. Hard plastic tubing or other suitable materials may be used as an insulator. It is important, obviously, that the manufacturing process for the cell be such as to insure a moisture-proof construction. The temperature compensating device may be housed somewhere within the tube or in a separate enclosure. Under some circumstances, where the temperature change may be anticipated in a portion of the tank remote from the cell location, it is worthwhile to place the temperature sensing element in a separate housing. Where the electrical connectors to the cell elements must be immersed in the solution it is important to consider the characteristics of the insulating ma-

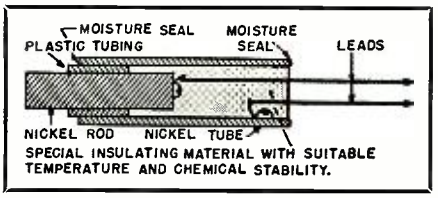
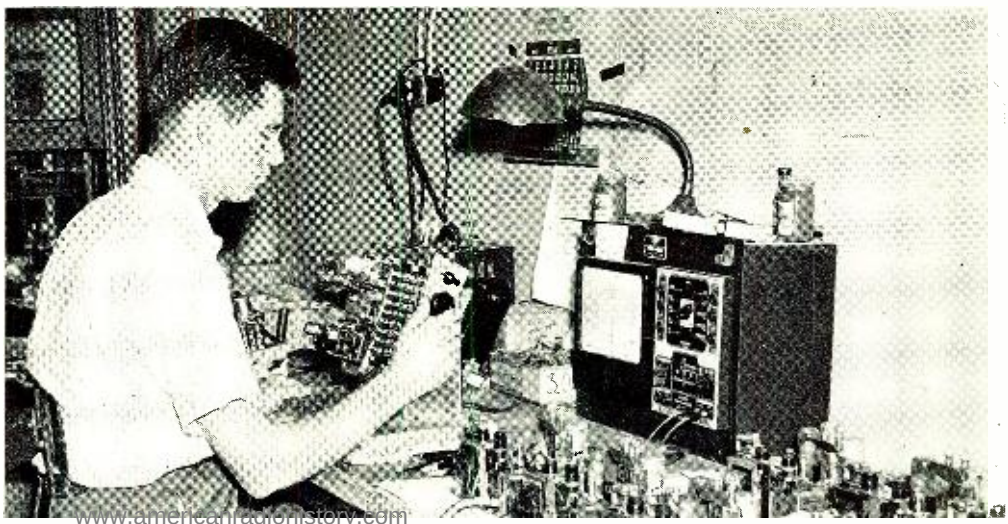


Fig. 3. Probe construction.

terial covering the wires in connection with high temperatures and the chemicals in the solution. Special rubber and synthetic compounds are often necessary in these applications.

There are many possible circuits for making these measurements but the practical method for the solution of most problems uses alternating current bridge circuits, such as those shown in Figs. 2 and 4. In Fig. 2 the secondary of the supply voltage transformer is tapped to provide two arms of the bridge. The conductivity cell is in one of the other arms, and the temperature compensating thermistor with a suitable resistor completes the circuit. The potentiometer connected across two taps on the secondary of the power transformer is for purposes of balancing the bridge for zero output in accordance with the conditions it is desirable to maintain in the solution, or to provide a zero setting on the meter if the device is used simply for observations. The primary of a high ratio step-up trans-

Production testing of the conductivity bridge circuits.



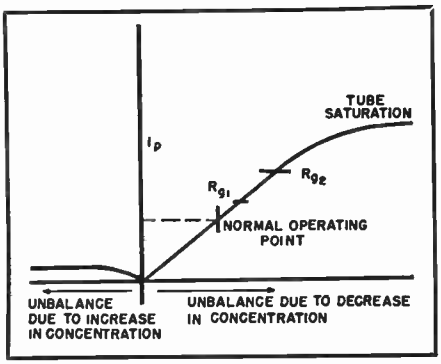


Fig. 4. Plate current of detecting tube.

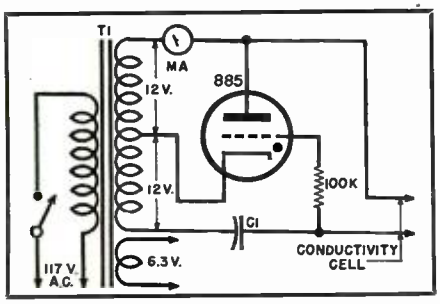


Fig. 5. Phase-sensitive conductivity bridge. C_1 is determined by the probe and solution characteristics. It may range from .001 to 10 mfd.

former applies any unbalanced voltage in the output of the bridge to the grid circuit of the control tube. As shown in Fig. 2, the plate circuit of the control tube is connected to operate various relays in accordance with the signal from the bridge. The sensitivity of this tube may be controlled to some degree by adjusting the potentiometer in the cathode circuit, which sets the static current flow with zero signal from the bridge.

It is essential that the circuit be so designed that it is phase sensitive as well as voltage sensitive. If there were no phase sensitivity the circuit would respond equally to changes in the conductivity on either side of the center. This would mean that if the relays were set to feed additional concentrate into the solution when a signal appears from the bridge, it would feed the concentrate as readily when the solution became too strong as when it became too weak. Phase sensitivity is obtained by applying the alternating supply to the plate circuit of the control tube as well as to the bridge.

The design procedure is as follows: With the conductivity cell immersed in a solution of the correct concentration, the value of R_1 plus R_2 must be adjusted in order to unbalance the bridge and cause the tube to conduct in accordance with the normal operating point as indicated in Fig. 4. Note that the phase of the plate supply voltage is connected so that it will be in phase with a signal caused by unbalance of the bridge in one direction and out of phase with the bridge output when it is unbalanced in the other direction. If this condition could be strictly maintained, the plate current of the tube would increase only when the bridge unbalanced as a result of a decrease in concentration of the solution. It is not practical to produce a device economically in which these phase relationships will be perfect. Thus it will be seen from Fig. 4 that if the bridge is operated exactly on the balance point there will be an increase in plate current regardless of the direction of unbalance.

The temperature compensating arm of the bridge is adjusted in the initial design so as to effectively bias the bridge circuit in the direction that represents a decrease of concentration in the solution. The tube then operates on a linear characteristic with respect to the signal from the bridge. The temperature compensating element itself is selected by inserting a rheostat in an experimental circuit. The temperature of the solution is then changed over the required range and the values plotted for the necessary settings of the rheostat in order to maintain constant current through the tube. This graph will show the characteristics required from the thermistor. A suitable fixed resistance may then be used to complete the arm.

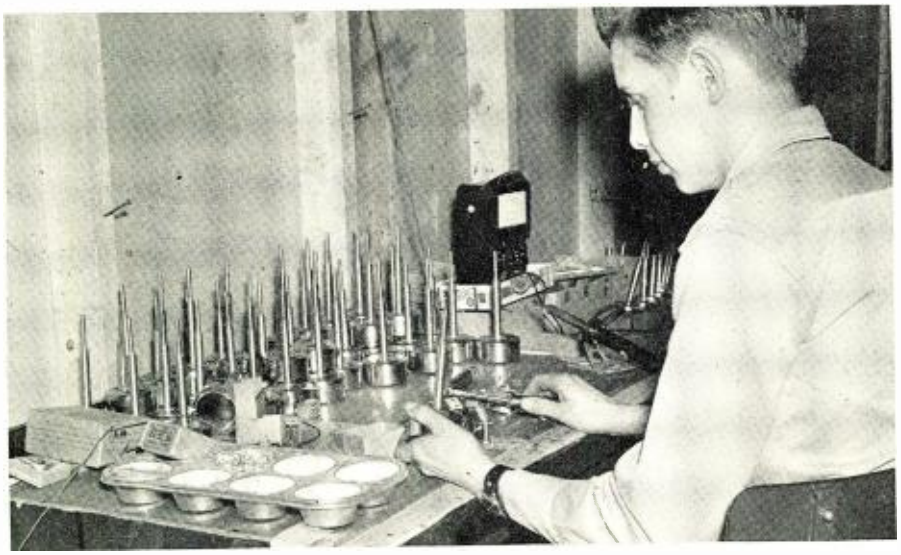
If this device is to be used simply for visual observation, a properly calibrated meter in the plate circuit is all that is needed. However, where the device is required to control the concentration of the solution, an adequate set of relays for performing these functions must be included. In the circuit shown in Fig. 2, relay No. 1 is used to actuate a solenoid valve that permits a suitable dispenser to pour concentrate into the solution, and relay No. 2 controls a signaling device to indicate an inadequate flow of concentrate to maintain proper operating conditions. This system will warn an operator when the dispensing device is empty. Resistors R_4 and R_5 are used to compensate for the pull-in and drop-out current differential characteristic of the relays. The signaling relay may, of course, be used to operate an audio or visual indication of the need for attention.

In the circuit shown in Fig. 5 a thyratron is used in such a manner that the current conducted is a function of the resistance of the conductivity cell. Considering the extreme conditions where the conductivity cell is a very high resistance, the phase of the voltage on the grid of the tube will be shifted 90 degrees with respect to the plate voltage. At the other extreme, where the conductivity cell is a short circuit, the grid and plate voltages will be in phase. The former condition will inhibit the flow of current, and maximum current will flow when the voltages are in phase. Actually, the variation in current flow will appear only between certain limited values of resistance for the conductivity cell. Over the range of operation in which there is a change in current for changes in resistance, the circuit has the advantage of great linearity. It is, however, important to regulate the line voltage and maintain it within close limits. Such regulation obviously is desirable in any device of this nature, but it is less important with the circuit shown in Fig. 2 than with the circuit shown in Fig. 4.

Where equipment of this kind is used for automatic control it is essential that the conditions of operation be studied in order to determine the necessity for protection against high temperatures, vibration and humidity. In the design of an individual unit it is often easier to over-compensate with safety factors

(*Continued on page* 31)

Final assembly of the conductivity cells.



Portable Counter

(*Continued from page* 17)

The resistance and capacitance in the coupling between the trigger circuit and the power amplifier V_8 are chosen to differentiate the negative pulses from the biased tube. The audio frequency modulation on each pulse that arrives at the grid of the power tube has therefore a positive as well as a negative portion. The tube can then be biased to cutoff, making it convenient to operate the rate meter in the screen circuit and the speaker in the plate circuit of this tube.

With the range switch in the normal LO position, each "count" from the G-M tube gives a shrill note about .25 seconds long in the speaker. The pitch of this note is such that it is not easily confused with other sounds in the area. The importance of this is realized when it is noted that during most of the time only the very low subsurface background activity is recorded. Under such conditions, the lowering of the probe is stopped to take rate meter readings at 5 and 10 foot intervals, but narrow occurrences between these points must not be missed.

The rate meter measures the averaged screen current in the power amplifier and has a time constant of about five seconds. A pushbutton switch S_3 is included to discharge the rate meter capacity quickly when desired. In the LO position the rate meter gives a full scale reading for about 200 counts per minute. In the HI position it has a full scale deflection of about 2000 counts per minute. At this rate the modulated pulses from the trigger circuit are then too short for the audio tone in the speaker to be recognized. However, the higher count rate partially compensates for this and a useful audible tone can be heard.

The rate meter is linear in each range. A decrease of 5 volts in the "B" voltage, results in a decrease in sensitivity of about 15%.

Switching, Metering and Batteries

Two 1.5 volt "A" batteries such as Eveready No. 742 are adequate for continuous operation for several hours at a time. Two separate "B" supplies made up of 67.5 volt batteries like the Eveready No. 467 are used to eliminate coupling between the input amplifier and the neon oscillator circuit.

The switch S_2 makes it possible to use the 0-1 ma. meter, which is normally in the rate meter circuit, for checking the "A" and "B" batteries. It was found useful to include an electrostatic voltmeter to provide a constant high voltage reading. The similarity of the results encountered between the low counting rates in some areas and the results in more active regions when the operating voltage is too low is otherwise a constant source of concern. It also simplifies the problems of diagnosing trouble with the probe hundreds of feet down a hole or the setting of the high voltage operating point where the temperature in a hole is widely different from that on the surface.

Probes

One of the main difficulties in making a probe for this purpose is to make it waterproof under a 1000 ft. head of water where the pressure approaches 500 lbs. per square inch. In the case of the glass-walled G-M tubes, the tube is placed in a brass cylinder of 1⅛" external diameter. Tubes with gland type seals were found unsatisfactory since under the necessary pressure the cable was deformed by the compressive gland. Probes filled with ceresin wax or oil were satisfactory but are difficult to assemble in the field when a tube must be replaced.

All-metal, single-ended G-M tubes coated with rubber promise to give better results. In making these probes a short length of cable is connected to the G-M tube. Rubber is then coated over the entire tube, connector and part of the cable to a diameter of one inch.

(*Continued on page* 28)

NEW PRODUCTS

GAMMA DETECTOR TUBE

An improved type of gamma ray detection tube which is only six inches long and two inches in diameter has

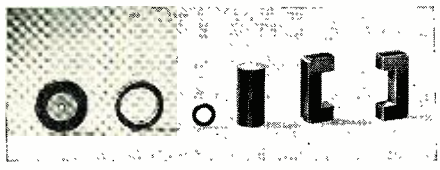
been announced by the Electronics Division, *Sylvania Electric Products Inc.*, 500 Fifth Avenue, New York 18, N. Y.

The GG306 gamma ray detector tube was developed in cooperation with leading medical authorities and is said to be five to six times more sensitive than standard tubes now used for tracing medicinal isotopes, analytical chemistry, search for radioactive ores, thickness gages, and geophysical studies.

The instrument operates at 960 volts, has an average Geiger threshold of 900 volts, provides 810 counts per minute from 5 micrograms of radium filtered through ⅛" of lead 12 inches from end, has a maximum recovery time of 800 microseconds, and a maximum dead time of 100 microseconds.

MAGNETIC CORES

A new ferro-magnetic material, Ferramics, which is said to offer many important advantages for core appli-



cations has been developed and produced by *General Ceramics & Steatite Corp.* of Keasbey, New Jersey.

Ferramics are suitable for all core applications and can be mass produced in most shapes and sizes to close tolerances. Shown are a group of five Ferramics parts illustrating ready adaptability to shape and size.

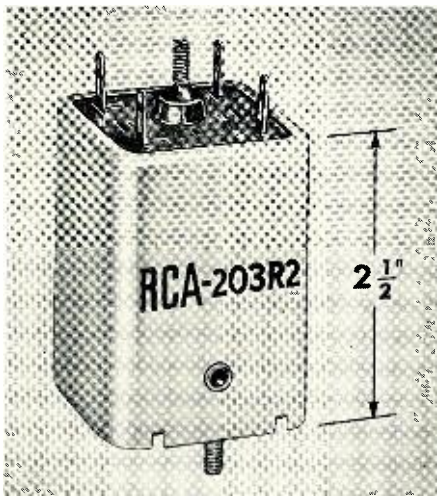
Readers are invited to request the new *General Ceramics* Bulletin No. 1 on Ferramics or submit specifications for recommendations.

RCA PRODUCTS

The tube Department, *Radio Corporation of America*, Harrison, N. J. recently announced three new products now available, including a 3" oscillograph tube, a video-circuit trap, and a horizontal-oscillator and sync-stabilizer coil.

The 3KP11 oscillograph tube is intended particularly for photographic recording of electrical phenomena. The blue radiation of its fluorescent screen is highly actinic and has sufficiently short persistence for moving-film recording without blurring, except where the film moves at high speed.

The video-circuit trap 203L5 is for use in the plate circuit of the 1st video



amplifier of television receivers to attenuate the 4.5 megacycle intercarrier beat frequency. The design utilizes a fixed, ceramic capacitor shunting a low-Q inductance tuned by an adjustable iron core.

For use in television receivers employing the medium-mu twin triode 6SN7-GT is the horizontal-oscillator and sync-stabilizer coil 203R2, shown. The unit is said to greatly improve the stability of the horizontal oscillator.

MODIFIED VOICEWRITER

Thomas A. Edison, Inc., West Orange, N. J. has announced a modification of their Disc Edison Voicewriter for combined use in dictation and telephone recording.

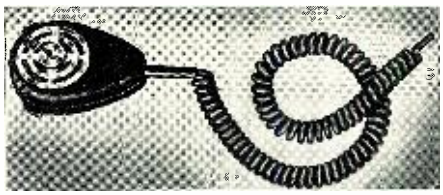
The model 88000 is similar in most respects to the regular Voicewriter, but contains a built-in selector switch for choice of either telephone or microphone recording. A signal light indicates the service selected.

The instrument comes equipped with an extension cord and special plug for connection to the telephone company's recorder connector. No other wiring or installation work is required.

Further information may be obtained by writing the Ediphone Division.

MOBILE MICROPHONE

Designed for use in police cars, taxis, locomotives and other mobile vehicles is the Mobile Mike developed by



Roanwell Corp., 662 Pacific St., Brooklyn, N. Y. which incorporates a choice of transmitter elements providing consistently superior modulation performance in the working range of 1000-3000 cycles.

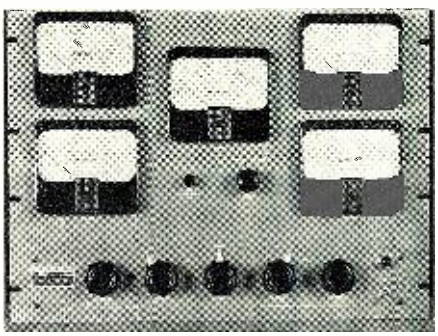
Designed to match 50-200 ohm circuits and to operate at 5-100 ma., according to circuit, this unit is produced in two models. Model 9900 has output level of 32 db below 1 volt for 10 bars. Model 9901 has output level of 25 db below 1 volt for 10 bars.

A special bulletin giving full details of the Mobile Mike may be obtained from the company.

PHASE METER

Clarke Instrument Corporation, 910 King St., Silver Spring, Maryland, recently announced its Model 108-C Phase Meter for accurately measuring the phase relations existing in directional antenna systems.

Provision is also made for remote monitoring of the amplitudes of the



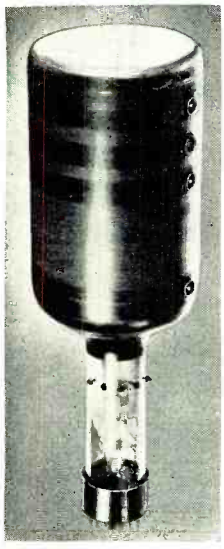
currents in the several elements of the array. Phase indication is clearly displayed on a meter marked in two-degree intervals.

Although normally supplied for oper-

ation in the standard broadcast band, Model 108-C is adaptable to other frequency ranges on special order.

CATHODE RAY TUBE

A multiple-intensifier-type cathode ray tube featuring a highly sensitive vertical-deflection system and known as Type 5XP is announced by *Allen B. Du Mont Laboratories, Inc.*, 1000 Main Ave., Clifton, N. J.



Potentials as low as 24 to 36 volts peak-to-peak are sufficient for one inch of vertical deflection on the screen. Because of this new deflection-plate design, the greater sensitivity of the tube is achieved with a plate-to-plate capacitance of only 1.7 $\mu\mu$fd.

At present the Type 5XP is available with a choice of phosphors including P1, P2, P4, P5, P7, P11 screens.

REGULATED POWER SUPPLY

Kepco Laboratories, Inc., 149-14 41st Ave., Flushing, N. Y., is offering immediate delivery on the new Model 245 power supply, regulated to within ½% for both load and input variations.

Specifications for the Model 245 for d.c. output are 200 to 450 volts at currents from 0 to 200 milliamperes, regulated; a.c. output is 6.3 volts at 6 amperes, unregulated.

The unit measures 8" high, 8" deep, 16" wide and weighs twenty pounds. A ground terminal connected to the chassis is mounted at the back.

DU MONT SPECIAL PRODUCTS

The Special Products Section of the Instrument Division of *Allen B. Du Mont Laboratories*, 1000 Main Avenue, Clifton, New Jersey will modify existing equipment or design wholly new equipment when available instruments cannot meet requirements of a highly specialized application.

(*Continued on page* 26)

SPECIAL ELEMENTS TO CORRECT TV DISTORTION

In a paper recently presented at a meeting of the American Physical Society held at the Massachusetts Institute of Technology, a new approach to the problem of correcting the distortion present in the larger sizes of television viewing tubes was described.

The new approach to the problem was presented by Dr. R. G. E. Hutter, Shirley W. Harrison and L. H. McKee of the Physics Laboratories of *Sylvania Electric Products Inc.*, Bayside, New York.

In their paper, presented by Dr. Hutter, they described how the introduction of special elements into the electron gun of television tubes permits good image quality from tubes much shorter than those now required for large direct-view images. The basic principle involved is the controlled predistortion of the electron beam so that the size and shape of the "spot" that traces the television image is the same on all parts of the picture screen.

VIRGIL H. DISNEY NAMED ARMOUR RESEARCH SUPERVISOR

The growth of electronics activities at Armour Research Foundation of Illinois Institute of Technology has necessitated a second electronics section and Dr. E. H. Schulz, chairman of the electrical engineering department, has announced that Virgil H. Disney will head that section.

James L. Murphy, supervisor of electronics activities at the Foundation since 1947, will continue as supervisor of one of the groups.

Mr. Disney was formerly an assistant section head in research at the airplane division of the *Curtiss-Wright Corporation*, Dayton, Ohio and was a project engineer for the *Sperry Gyroscope Company*, Great Neck, Long Island, N. Y.

DEVICE RECORDS ACCELERATION OF AIRPLANE

A. S. Iberall of the National Bureau of Standards has developed for the U. S. Air Force a novel type of accelerometer which gives both an instantaneous indication and record of the acceleration of an airplane in flight.

Immediate application of the new accelerometer is in the training of aviators for combat flying, where sharp turns must be made at high speeds. The device is compact, which permits mounting on an instrument panel, and spark recording is used to obtain a readily available record on a paper chart.

FIRE CONTROL SYSTEMS

An effective fire control system has three major components: (1) a sighting system for locating the direction of a target and for determining how far away it is, (2) a computing mechanism

for calculating where to point the guns so that the bullets will hit the target, and (3) a movable turret that mounts the guns and supplies them with ammunition. Such systems are now being manufactured by the Glenn L. Martin Co. Baltimore 3, Md.

The photograph shows a complete bench test setup for testing advanced fire control systems. When bench tests are completed and indicated adjustments made, the systems are given further tests in the field before being incorporated into a complete turret unit.

POSSIBLE USE OF GERMANIUM CRYSTALS

At a conference on Electron Tubes and Solid State Devices, sponsored by the IRE, at Princeton University recently, Rowland W. Haegele of the Physics Laboratories of *Sylvania Electric Products Inc.* revealed an expansion of the possibility of using germanium crystals in radio and television applications heretofore served almost exclusively by vacuum tubes. Mr. Haegele described the construction and experimental performance of germanium crystal tetrodes in mixer applications where he stated that the crystal tetrode offers certain advantages over germanium crystal diodes and triodes.

According to Mr. Haegele, the fact that the crystal tetrode has a conversion transconductance equal to that of ordinary vacuum tube mixers, but requires less power, is physically very small, and operates with input signals at least up to 200 megacycles, indicates interesting possibilities for commercial application.

EXAMINATION FOR ELECTRONIC SCIENTIST

Applications are now being accepted by the Board of U. S. Civil Service Examiners for the Potomac River Naval Command in Washington, D. C., for positions of electronic scientist in various Federal agencies in Washington, D.C., and in the states of Maryland, North Carolina, Virginia, and West Virginia.

To qualify, applicants must have completed a 4-year college course with major study in a field of physical science, mathematics, or engineering, or have had 4 years of scientific or technical experience in one of these fields.

Complete details on the requirements can be found in Announcement No. 4-34-4 (49) obtainable at any post office. Applications will be accepted until further notice and must be filed with the Executive Secretary, Board of U.S. Civil Service Examiners for Scientific and Technical Personnel of the Potomac River Naval Command, Building 37, Naval Research Laboratory, Washington 25, D. C.

AIEE ELECTS OFFICERS

At the annual meeting of the American Institute of Electrical Engineers held in Swampscott, Mass., James F. Fairman, Vice-President of the *Consolidated Edison Company of New York, Inc.*, was elected President.

Other officers elected were: Vice-Presidents, C. G. Veinott, Lima, Ohio; W. J. Seeley, Durham, N. C.; W. C. DuVall, Boulder, Colo.; Ralph A. Hopkins, Los Angeles, Calif.; A. H. Frampton, St. Catherines, Ont., Canada, —Directors E. W. Davis, Cambridge, Mass.; N. B. Hinson, Los Angeles, Calif.; H. J. Scholz, Birmingham, Ala. —Treasurer, W. I. Slichter, New York, N. Y.

"ELECTRONIC BRAIN" DEVELOPED

A machine which stores vast amounts of scientific information in its system, automatically "pores" over it, selects what is sought after by its operator and then hands him copies of what he wants, has been developed jointly by the U.S.

(*Continued on page* 29)

TECHNICAL BOOKS

"PHOTOELECTRICITY AND ITS APPLICATION," by V. K. Zworykin and E. G. Ramberg. Published by *John Wiley & Sons, Inc.*, 440 Fourth Ave., New York 16, N. Y. 494 pages $7.50.

The latest volume to replace the second edition of Zworykin-Wilson's "Photocells and Their Application" is this unified study of the whole field of photoelectricity. It presents practical reliable data on the properties, preparation and applications of photoelectric devices and because of the many develments in recent years, is about twice the size of the former book.

The first eleven chapters of the book deal with the principles and preparation of photosensitive devices and the remainder of the book with their application. The text is accompanied by circuit diagrams, graphs, halftones and line drawings which are practical rather than theoretical, thus allowing the reader to apply the material to specific uses. An arrangement which assures smooth continuity of the text is that of restricting formulas to footnotes. Those interested in supplementing their information on particular subjects will find reference material included.

Readers of the former book will find that this volume retains the original aim of presenting practical reliable data in a manner that makes it invaluable to engineers and students in the field.

"THE MATHEMATICS OF CIRCUIT ANALYSIS," by Ernst A. Guillemin. Published by *The Technology Press*, Massachusetts Institute of Technology and *John Wiley & Sons, Inc.*, 440 Fourth Avenue, New York 16, N. Y. 590 pages. $7.50.

Designed to supplement the usual undergraduate engineering mathematics curriculum and for use as a textbook in a course in higher mathematics for engineers, this volume contains a collection of a variety of principles and methods essential to a thorough understanding of electrical network theory.

Special treatment of the text is given in a complete assemblage of mathematical topics in the analysis and synthesis of electrical networks. For example, in the field of advanced algebra, the first four chapters covering the discussion of determinants and matrices is coupled with the geometrical interpretations provided by the subject of linear coordinate transformations and the closely related discussion of quadratic forms. Following at this point is the chapter on vector analysis containing considerably more detail than is usually found and of special concern to the engineer is the chapter on Fourier series and integrals.

Students and engineers will recognize this volume as a background of general understanding upon which to build the more formal rigorous treatment of mathematics.

"ELECTRON TUBES", Volumes I and II, Edited by Alfred N. Goldsmith, Arthur F. Van Dyck, Robert S. Burnap, Edward T. Dickey, and George M. K. Baker. Published by *RCA* Review, *Radio Corporation of America*, *RCA* Laboratories Division, Princeton, N. J. 475 pages. $2.50 each.

These volumes contain material written by *RCA* authors and originally published during the years 1935-1941 (Vol. I) and 1942-1948 (Vol. II). They are the ninth and tenth in the *RCA* Technical Book Series and are the first to be devoted exclusively to tubes. The papers are presented in four sections: general, transmitting, receiving, and special. As additional sources of references, the appendices contain a bibliography on vacuum tubes, thermionics, and related subjects and a reference list of Application Notes.

These volumes were published to serve scientists and engineers with a useful background text and basic reference source, and to aid in the development and advancement of radio and electronics.

"ELEMENTS OF SOUND RECORDING" by Dr. John G. Frayne and Dr. Halley Wolfe. Published by *John Wiley & Sons, Inc.*, 440 Fourth Ave., New York 16, N. Y. 700 pages. $8.50.

This up-to-date volume covers all phases of recording and discusses the underlying theory behind sound-on-film, disk, and magnetic recording. It is well-illustrated with 480 drawings and photographs and written in an easy to understand language.

Particular topics of practical concern such as noise reduction methods, the effects of speed variations on sound quality, microphones and their uses, acoustics of stages and theaters, various types of loudspeaker systems, 16-mm. and 35-mm. motion picture sound films, and stereophonic recording are also given thorough treatment.

Both authors have had wide experience in the field of sound recording and their book should be of special interest to designers, engineers, and technicians in the broadcasting, motion picture, phonograph, and television industries, although the principal emphasis throughout the book is on sound-on-film.

Personals

DR. DONALD L. BENEDICT has been appointed Assistant Chairman of the Department of Electrical Engineering of Stanford Research Institute. Prior to his new appointment, Dr. Benedict was a research fellow in electronics at Harvard University's Department of Engineering Science and Applied Physics. He is a member of the American Physical Society and the American Mathematical Society, and Sigma Xi fraternity.

WILLIAM DUBILIER, Technical Director and Founder of *Cornell-Dubilier Electric Corp.*, South Plainfield, N. J., has received two of the highest honors of France in recognition of his recent service to that country. One of the early pioneers in radio, Mr. Dubilier developed a submarine detector for the French government for use during World War II and just recently provided emergency relief for French power companies.

ELMER WILLIAM ENGSTROM, vice president in charge of research for *RCA*, received the honorary degree of Doctor of Science at the recent 117th Commencement of New York University. Mr. Engstrom received the degree for his personal contribution as a research engineer to radio and electronic development and the progress of television. He is a member and past president of the Princeton Chapter of Sigma Xi, science research honor society.

ROSS GESSFORD, has been appointed chief engineer for the Television Picture Tube Division of *Sylvania Electric Products Inc.*, Seneca Falls, N. Y. Mr. Gessford joined the engineering staff of *Sylvania's* Radio Division at Emporium, Pa., in 1937 and was formerly engineering specialist in cathode ray tubes. He attended George Washington University, the University of Maryland, University of Pittsburgh and is a senior member of the IRE.

W. H. LAMB will be general manager of the newly formed Television Picture Tube Division of *Sylvania Electric Products Inc.* with headquarters at Seneca Falls, New York. Mr. Lamb has been associated with the company's electron tube production since 1933. He received a B.S. degree in electrical engineering from Northwestern University and later attended Harvard Graduate School. He is a member of the Society for the Advancement of Science.

SIDNEY WALD, formerly Advanced Development Engineer, Aviation Equipment Engineering, *RCA Victor* Division, Camden, N. J., has joined *Bendix Radio Division*, Towson, Maryland as Principal Engineer for the Communications and Navigation division. Mr. Wald has done extensive development work in connection with aircraft communications and navigation equipment and components, and has had numerous articles on these subjects published.

New Products

(*Continued from page* 23)

An example of such a special instrument is a Four-Beam Cathode Ray Indicator capable of displaying simultaneously four related or unrelated, independent phenomena on a single cathode ray tube screen.

Details concerning the facilities of the Special Products Section may be obtained from the Instrument Division.

POWER SUPPLY

A compact, completely enclosed 30 kv. r.f. power supply suitable for application in dust precipitation, electrostatic painting and insulation breakdown testing as well as projection

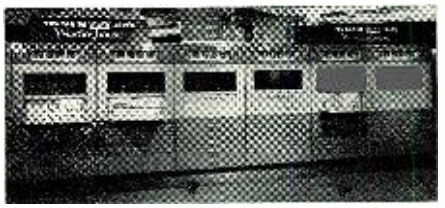
television is being manufactured and distributed by *Spellman Television Co., Inc.*, 13 West 24th Street, New York 11.

The voltage is variable from 15 kv. to 30 kv. through a control on the front panel. The high voltage unit includes a focus control and voltage tap variable from 4 kv. to 6 kv. for use with 5TP4 projection kinescope tube. The high voltage 30 kv.-6 kv. cables are 3 ft. 11 inches long and are of the safety type.

Also available are a 60 kv. r.f. power supply and a 30 kv. r.f. regulated power supply with regulation better than 1% at 1 milliampere load.

50-KW, AM TRANSMITTER

Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa., has an-



nounced the availability of a new high-level, amplitude-modulated standard broadcast transmitter with a nominal power output of 50 kw. The type 50-HG-2 transmitter, using twenty operat-

ing tubes of seven types, is a complete transmitting unit which can be used with any combination of studio equipment providing the required level of audio input.

Featured in the equipment of this transmitter is a complete supervisory control system, coordinated with a sequential interlock system and with an overload and safety protection system. It is designed to comply fully with FCC Rules and Regulations and Standards of Good Engineering Practice Concerning Standard Broadcast Stations. Further information may be obtained by writing the company.

GEIGER COUNTER

Nuclear Instrument and Chemical Corporation, 223 West Erie Street, Chicago 10, Illinois is adding a compact, two pound Geiger counter to its complete line of nuclear instruments and accessories.

Requiring only two 10c flashlight batteries for power the "Sniffer" is

economical to operate and is expected to replace expensive monitoring instruments in many cases where the location but not the exact strength of radiation must be determined.

The operating mechanism is a compact grouping of electronic parts, including two radio tubes, voltage regulator tubes, the special Geiger tube, and two flashlight batteries. The company guarantees repairs or parts replacement during the entire life of the instrument for a nominal charge.

SIGNAL APPARATUS

The *H. R. Kirkland Co.*, Morristown, New Jersey has announced a new line of "Super-Vise" lamp annunciators for application in power and industrial plants for the central supervision of all factors equipped with electrical contacts.

The Super-Vise annunciators can be furnished to perform any service that can be effected with a three-pole, double-throw contact arrangement on the relay, and a double-throw, double-pole toggle switch.

Audio Reproduction

(*Continued from page 9*)

The results obtained by measurement of the transient response in this manner are shown in Fig. 6, which shows the measured characteristics of two similar loudspeakers. Under steady-state conditions the two speakers seemed very much alike, but they sounded quite different to the ear. The high-frequency response of loudspeaker *A* was found to be a little irritating after long periods of listening (exhibiting a roughness normally associated with intermodulation, but the speaker was known to be free from this type of distortion); with loudspeaker *B*, this effect was not present. The transient response curves show that loudspeaker *A* has a longer decay time of residual vibrations than loudspeaker *B*, and that at some points the output actually rises with time (suggesting the transfer of energy from one vibrating element to another during the decay period.) Comparison between the aural effects and the results of the tests shows that the transient response gives a measure of quality of the system which cannot be obtained by steady-state measurements, and that the aural impressions were more related to the transient curves.

In radio broadcasting and in sound

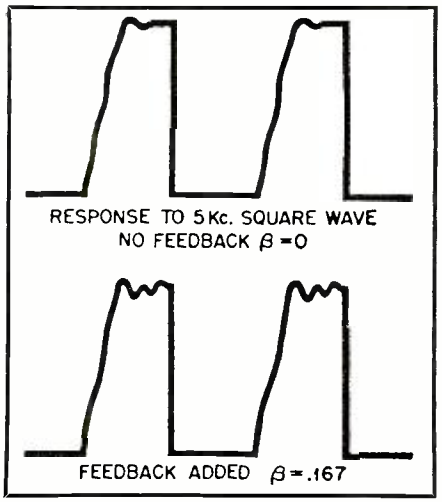


Fig. 7. Transient response measurements of an amplifier with and without feedback.

recording, peak-limiting amplifiers are often used to prevent very loud signals from affecting the operation of the system by causing overmodulation or overcutting. Until very recently the characteristics of peak-limiting amplifiers were specified in terms of steady-state measurements. However, most users of such equipment know from their own experience that the performance of limiting amplifiers under actual operating conditions frequently has little correla-

	Prefer 20-10,000 c/s	Prefer 60-8,000 c/s	Prefer 120-5000 c/s	No preference
Popular music (123 listeners)		33%	26%	41%
	39%	22%		39%
	33%		34%	33%
Classical music (105 listeners)		19%	38%	43%
	12%	67%		21%
	15%		58%	27%
Male speech (105 listeners)		52%	25%	23%
	21%	55%		24%
	24%		48%	28%
Mixed speech (123 listeners)		34%	34%	32%
	15%	64%		21%
	23%		45%	32%

(A)

	Prefer reproduced "live" music	Prefer reproduced transcribed music
Popular music	82%	18%
Classical music	67%	33%

(B)

	Prefer full range	Prefer 5-kc. cutoff
Popular music (1000 listeners)	69%	31%
Semi-classical music (200 listeners)	66%	34%

(C)

Table II. Comparison of listener preferences in the presence of different distortions. (A) Frequency range preference-reproduction from records and transcriptions. (B) Listener preference of transcribed vs. "live" music as reproduced by a good system. (C) Restricted frequency range-acoustical 5 kc. low pass filter, live music.

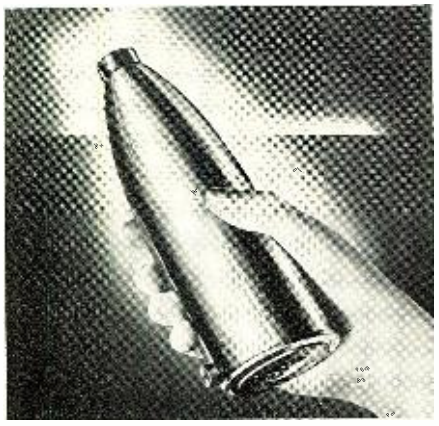


Fig. 8. Typical calibrated microphone mounted in case with its preamplifier.

tion with that indicated by steady-state measurements, and is much more dependent upon the transient characteristics. Limiting amplifiers which have similar steady-state characteristics are often found to perform quite differently for speech and music. Transient measurements such as those described in Part 2 must certainly be included in the testing of such equipment to specify their performance adequately.

This is the recommended method of testing the transient operation of peak-limiting amplifiers, and a few results of such measurements upon various commercial units are given in Fig. 9. The input signal consists of a sine wave whose amplitude is periodically changed between a higher and a lower level, and the resulting output of the amplifier observed upon the screen of an oscilloscope. The response of a number of different types of peak-limiting amplifiers to this input signal is shown in Fig. 9. The results of this measurement are in agreement with the aural impressions obtained with these amplifiers, and indicate the value of this method of testing.

These few examples have been described to illustrate the importance of proper measurement of quality in audio reproduction systems. If the factors which determine the quality of reproduction are taken properly into account and measured according to the methods described in this article, then the performance of the system can be completely described and its specification will have attained increased precision and accuracy.

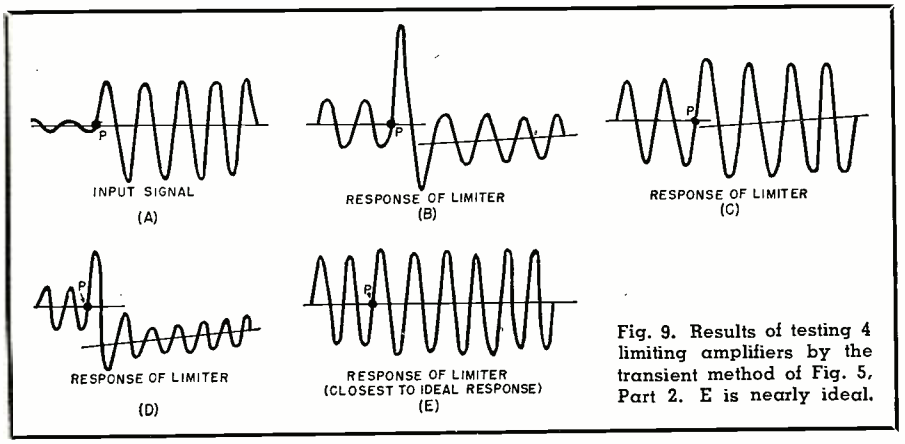


Fig. 9. Results of testing 4 limiting amplifiers by the transient method of Fig. 5, Part 2. E is nearly ideal.

Portable Counter

(*Continued from page* 18)

The end of the length of cable can easily be spliced to the main cable and sealed in the field without much trouble.

Although this instrument was primarily designed for the location of radioactive ores, it offers wide possibilities in the investigation of the slight residual activity present in virtually all minerals and provides a new and exciting field for geological research as changes in strata can be identified in this way.

The results of investigations of the feeble activity present in all normal mineral ore should be of the utmost importance to geologists, as this new geophysical technique offers a fresh angle of attack on many problems. Some of these, such as the confirmation of theories on the genetic relationship between rocks, the measurement of the gamma radiation from oil or rare mineral bearing deposits, the investigation of the potash content of rocks and as an aid to geographical mapping, will undoubtedly be advanced with this new technique.

Pulse Shaper

(*Continued from page* 15)

second wide at its base is obtained at the plate of V_{1B}. This pulse is amplified in the cathode coupled amplifier V_{2A}-V_{2B} which gives a positive output that is fed to the grid of the 6AG7 power amplifier V_3 which is normally cut off by the cathode bias bleeder $R_{17}R_{18}$. The positive pulse at the grid of V_3 drives it into conduction and gives a large negative output pulse. Since the pulse shaper was developed for use with a device which required a negative pulse no thought was given to obtaining a positive pulse output. However, this should be no problem should a positive pulse be desired.

It might be pointed out also that if positive pulses are desired the 6AG7 might be replaced by a triode and the output of the triode used to feed a cathode follower. However cathode followers and sharp falling negative pulses do not mix well. The power tube in the output was chosen since the circuit to be driven by the pulse shaper had a fairly large capacitive input impedance.

The operation of the circuit with sine waves applied to the input is similar to the single pulse operation, since the positive portions of the sine wave have the same effect as opening the switch, i.e., bringing the grid of V_1 out of cut-

off and triggering the circuit for the duration of the positive half cycle.

Waveforms at several points throughout the circuit are shown in Fig. 2. All waveforms were taken with operation at 100 kc. using a *Hewlett-Packard* 200A Oscillator as a signal source, and were displayed on a *Tektronix* 511A Syncroscope.

Microwave Link

(*Continued from page* 6)

to Nutley link experiments. This antenna was mounted near the bottom of the 75 foot FM broadcast antenna mast of the experimental broadcast station W2XFZ at the Nutley Laboratories. Transmission line feed to the antennas is by means of RG-8/U or RG-17/U solid dielectric cable for short lengths up to 50 feet, or by means of semi-flexible air dielectric transmission line for lengths from 50 to 250 feet.

The New York to Nutley link was used to supply program material to the experimental frequency modulation broadcast station W2XFZ located at *Federal Telecommunication Laboratories*. At all times usable program signals were received giving consistent over-all system signal-to-noise ratios of better than 65 db., and audio frequency distortion of less than 0.5 per-cent when used as a studio-to-transmitter link.

The link equipment used in these tests, while only of an experimental type, gave exceptionally reliable performance due to the basic simplicity of system design adopted. Still another relay type link system has been put into operation in a round-robin arrangement. Program material originating in the *Federal Telecommunication Laboratories* was broadcast via an STL to the *International Telephone and Telegraph* building in New York. Here it was demodulated and rerouted over a similar link equipment to the Nutley laboratories. Here again link system noise was approximately 65 db. below full modulation and audio distortion 0.5 per-cent.

Conclusion

Summarizing, the equipment described has been designed for and meets the requirements of commercial high fidelity program or broadband communication circuits, providing:

1. High fidelity, low distortion and noise. Measured characteristics are:
   a) Response—50 to 15,000 cycles for program transmission.
   200 to 60,000 cycles for multichannel telephone service.
   b) Distortion—0.5 per-cent for program transmission and such that it is capable of handling standard multichannel carrier telephone system with 60 db. or better interchannel crosstalk.
   c) Noise—Better than 65 db. below full modulation.
2. Reliable service, as proven through operation field tests, in freedom from interfering signals and anomalous propagation characteristics. Maximum signal fades of 6 db. for 12 miles over land and water path with less than optimum line of sight conditions, were measured.
3. Ease of installation, maintenance and operation as a result of the simple design adapted throughout.
4. Capability of handling broadband modulation to the limit of the design characteristics.

News Briefs

(*Continued from page* 24)

Department of Commerce and the U. S. Department of Agriculture.

Known as the Rapid Selector, the device was developed from principles originated before the war by Dr. Vannevar Bush, then at the Massachusetts Institute of Technology. The machine makes use of standard 35 mm. motion picture films on each reel of which can be stored the contents of almost 500,000 conventional library cards.

A report describing the Rapid Selector in detail is available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

LAMM TO HEAD GUIDED MISSILE ENGINEERING AT NBS

Ralph A. Lamm has been appointed Chief of the Missile Engineering Section of the National Bureau of Standards where he will direct guided missile engineering.

Mr. Lamm has done extensive work in the fields of radio engineering, radar system engineering, and guided missiles, particularly the "Bat" and "Pelican" projects. In recognition of his contributions to the war effort, Mr. Lamm has received the Presidential Certificate of Merit, Certificates from the Office of Scientific Research and Development, the U.S. Navy Bureau of Ordnance Merit Award, and the Department of Commerce Meritorious Service Award.

Mr. Lamm joined the staff of NBS in 1947. Prior to his appointment to the Bureau he served as a consultant to the Bureau of Ordnance, Department of the Navy.

NOVEL BUSINESS CARD GETS INQUIRIES

The *Midwest Electronic Laboratories* of Omaha, manufacturers of Geiger counters and electronic devices, recently tried an unusual method of getting its name across to the public.

A double panel "test card" was developed which had high-grade carnotite ore blended with other ores and impregnated in plastic to seal it to the card. The quantity of ore is carefully controlled and standardized to give 750 counts per minute on any of the company's units.

The company's advertising message is carried on the face of the card and the many inquiries have turned into profitable sales.

NEW LITERATURE

Reprint on Electrographic Printing

A new 4-page reprint titled "Testing Varnished Insulation" prepared by Dr. Max Kronstein, Myron M. Schacter and Marion M. Ward describes a new electrographic printing method suitable for testing both varnished paper and fabric.

Illustrations show results of tests and full explanation of developer solutions and other techniques employed in the new method are also included. Photograph of the laboratory apparatus is shown to aid others in duplicating the setup.

Copies of this reprint may be obtained by writing V. W. Palen, New York University College of Engineering, 181 Street and University Avenue, New York 53, N. Y. and enclosing 10c per copy to cover cost of handling and mailing.

Carrier Equipment Folder

Form 44P4 is a new folder now available from *Lenkurt Electric Co., Inc.*, 1115 County Road, San Carlos, California, covering radio and wire-line applications by *Lenkurt* Type 44 carrier equipment. This new folder shows how these units can be employed for voice, telegraph, telemetering and control installations as well as a wide variety of combinations of the four uses.

Several kinds of systems are illustrated photographically and diagrammed schematically. Also included is a tabulation which details the type of operation.

Measuring Pressure

(*Continued from page* 14)

fastest transients encountered in engine work are clearly visible.

In studies of dynamic pressures in the cylinder of a gasoline engine, some sort of synchronizing system was necessary.

Our first attempts to lock the Pressuregraph diagram on the oscillograph to the rotation of the engine made use of a voltage surge obtained from the engine ignition system. This method would start the sweep at the time of the spark and the pressure curve would appear in two parts, one at each end of the trace.

The next step was to make a pulse generator consisting of a rotating disc coupled to the engine crank shaft. A steel projection, or "fin" was mounted on the face of the disc and a magnetic rate of change pickup was mounted so as to be energized each time the steel "fin" passed the pickup. The pickup mounting permitted angular rotation of the pickup so as to control the angular position at which the pulse was produced. This permitted the starting of the scope sweep at any desired time during engine rotation. With this synchronizer we could pull any portion of the pressure curve to the center of the screen and hold it still for visual observation and photographing.

The Electro Syncromarker

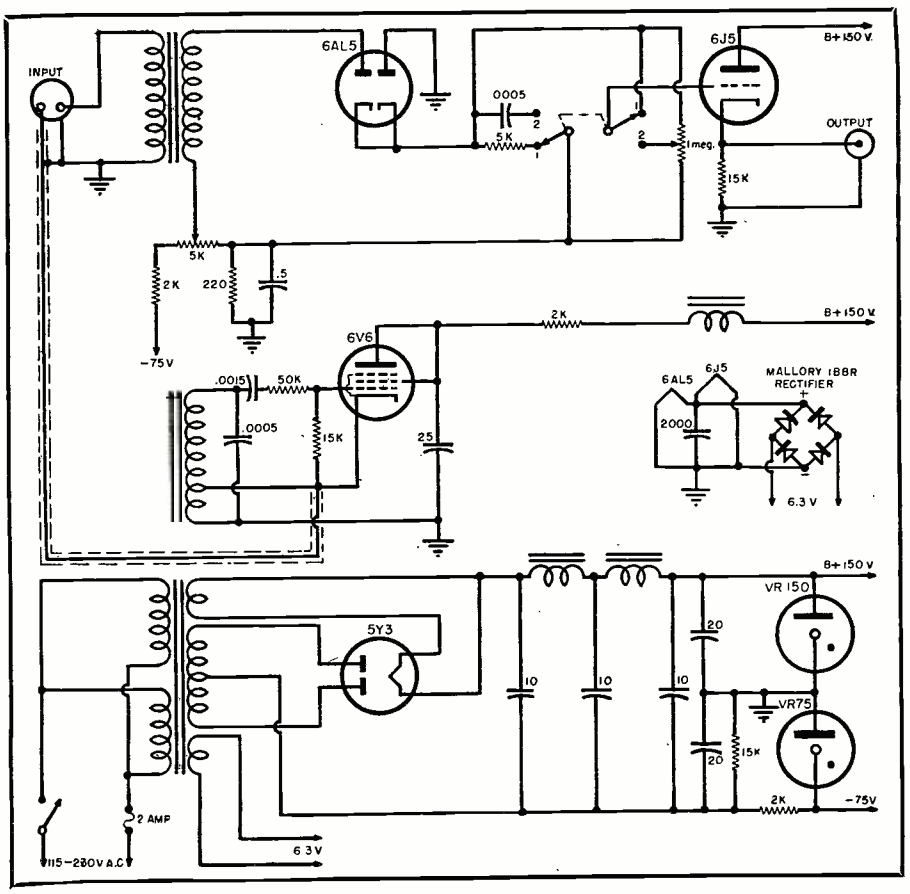
The synchronizer was later modified by substituting a 72-tooth gear for the rotating disc and adding two more pickups. One produces a pulse for each five degrees of angular rotation of the engine and the other produces a single pulse for each revolution. The single pulse was used as a reference point and the gear was usually coupled to the engine so this pulse appeared when the piston was at top center.

The pulses from these two pickups were amplified and shaped so they would appear on the oscilloscope as sharp vertical lines spaced across the screen. See Fig. 5. When superimposed on a pressure curve, we could locate the angular position of any part of the diagram with respect to top center. A one thousand cycle oscillator was built into the amplifier so we could supply 1/1000 second timing marks. The timing marks aid in the study of such phenomena as flame propagation and spark lag.

The Synchromarker is now supplied with provisions for rotating the reference marks around a scale calibrated in degrees. This feature makes it possible to shift the reference mark from one point to another in the pressuregram. The angular separation of two points can be read directly on the calibrated scale. In multicylinder engines, we can set the reference mark on top center for one cylinder and then shift it to top center for other cylinders, while the engine is running.

The above discussion has covered the development of electronic equipment for the dynamic measurement of pressure and displacement, and has included only one or two specific applications. Other applications are numerous, and are limited only by the imagination of the engineer.

Fig. 7. Circuit diagram of the Pressuregraph.



TV Studio Maintenance

(*Continued from page* 11)

Thin, Bright Horizontal Line (or Bar) at top or bottom of camera and control monitors—this is commonly due to crowding or compression of the horizontal sweep at the top and bottom of the raster. Proper adjustment of the horizontal sweep circuits should clear this trouble.

Displacement of Frame on camera control monitor (bottom of frame appearing about one inch above the bottom of screen)—60-cycle width control out of adjustment.

Displacement of Top Horizontal Portion of Picture in camera chain monitor (*tearing* across top part of screen)—due to a gassy 6J6 horizontal sweep discharge tube; may also be due to a defective 6J6 horizontal blocking oscillator.

Horizontal Displacement (or tearing) on Alternate Fields Only—(at the top 10 per-cent of picture area)—if removing the 6AL5 in the multivibrator circuit of the pickup auxiliary unit clears the trouble, look for improper delay adjustments in the auxiliary unit cable delay line and sync generator, or in the studio sync adaptor when this unit is used with the studio pulse generator. (Note: in the DuMont system, the horizontal driving pulses occur midway between horizontal sync pulses. This corresponds to the time phase normally used for the equalizing pulses. The horizontal driving pulses, in other words, are delayed by half a line. This allows use of cable lengths of up to 1,000 feet to be used on the camera. The amount of time delay for different lengths of cable is equalized by a variable multivibrator circuit in the pickup auxiliary unit.

Displacement of Raster on monitor kinescope in sawtooth fashion at the top 10 per cent of picture, on alternate fields only—see above.

Severe Ringing on Left Side of Picture—due to shorted 80 μfd. filter condenser in the camera pickup head. Also check the 6AS7 horizontal damper tube for emission, leakage, and short.

Flicker on Viewfinder and Monitor Control—bad 6C4 trigger tube in the pickup auxiliary unit.

Extreme Flicker in Camera and Monitors—check the video amplifier section of the camera for presence of a 60-cycle modulation waveform (see Fig. 1A). This trouble is commonly due to loss of regulation in the +120-volt section of the auxiliary unit power supply. Look for one or more shorted 6AK5 regulator tubes.

Poor Vertical Shading, normal on jarring of camera box—due in several cases to poor ground connections or cold-soldered joints at terminals. Check these in addition to tubes.

Poor Resolution or Poor Corner Shading—check the 2P23 Image Orthicon tube.

Waveshape Disintegration at output of camera Mixer-Monitor when load is connected, but normal waveshape without load—look for double-termination (75-ohm terminating resistor at both ends of a common line) or loose or improperly-fitting coaxial connectors. Double-termination commonly is the result of a mistake in wiring or inter-unit connections, or to applications of test equipment which terminate directly in 75 ohms.

No Blanking to Camera Chain—due in one case to defective "A" cable. Connections internally were very poorly soldered, and the blanking coaxial line had broken loose. Loss of blanking can of course be caused by any defective tube or part in the blanking generator circuit or power supply. The presence of blanking pulses in this instance can be checked rapidly with a scope.

Low Blanking, necessary to operate pedestal control on the camera monitor full on—due to a defective 6AS6 blanking insertion tube in the camera monitor.

Uncontrollable Blanking in Camera Chain, level excessive, exceeding the limits of the waveform monitor—also due to a defective 6AS6 blanking insertion tube.

Slope in Vertical Blanking, uneven beam response (top of picture degrades before the rest)—defective blanking crystal. This crystal (when normal) should show high resistance (on an ohmmeter) in one direction and *low* resistance when the test leads are reversed.

Loss of Video Gain, negative picture when the contrast control is decreased—caused by a bad ground connection to the cathode bypass condenser in the kinescope circuit of the 6AS6 video amplifier in the Mixer-Monitor unit.

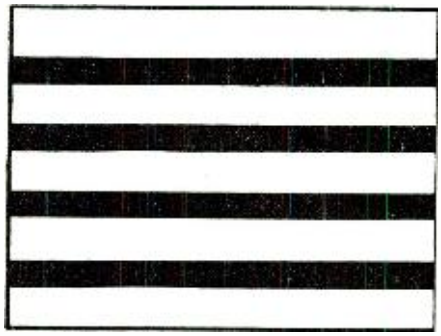


Fig. 2. Number of dark horizontal bars caused by heavy oscillations in the camera chain. In this case the trouble was due to a poor connection in a heater transformer. Resoldering the defective connection corrected the trouble.

Intermittent Drop in Master Monitor Output—output voltage (terminated in 75 ohms) intermittently dropped from normal (about 2 volts peak-to-peak) to about 0.5 volts peak-to-peak. Replacing weak 6AK5's in the video amplifier raised the level but did not entirely correct the trouble. Before the trouble could be localized, the output jumped to normal and no amount of tapping, vibrating leads, etc. could cause a re-occurrence. In this particular case, the trouble was not in the scope or kinescope video circuits, since the lead feed to these inputs was disconnected. The difficulty was finally traced to a defective cathode bypass condenser in the master monitor 6AS6 output stage.

Very Low Contrast in Master Monitor, picture practically impossible to detect—the peak-to-peak voltage at the output of the 6AG7 cathode follower stage (normally 17 volts) was only 5.5 volts. Operation returned to normal with replacement of the tube.

Horizontal Scan, Linearity, and Centering Unsatisfactory (on Master Monitor), alternate fields displaced about one inch down from the top of the screen—due to a defective 6J6 horizontal blocking oscillator.

Intermittent Video Output From Camera—in this case the output changed from normal picture to intermittent shots of the type which usually indicates lack of voltage on one of the 2P23 Orth electrodes. Trouble was due to a broken target lead at the terminal to the deflecting coil and annular socket assembly. (Note: another source of trouble can usually be traced to worn or defective insulation on the deflecting leads. This insulation becomes worn as the annular assembly is moved back and forth during focusing.)

Loss of Horizontal Sync (in viewfinder only)—look for a defective 6J6 horizontal blocking oscillator.

Picture Disintegration due to random clamping pulses—usually due to failure in the sync separator and horizontal blocking oscillator circuits. A defective tube or component will also result in failure of the *clamp* circuit.

Space limitations prevent a more detailed analysis of camera and studio equipment maintenance at this time. More articles on this subject may be forthcoming, however, if enough readers feel they are worthwhile.

Conductivity Meas.

(*Continued from page* 20)

than to analyze these details thoroughly. However, for large scale production purposes where the economy of optimum design is important, a careful survey is well worthwhile.

In many applications the installation will be made by relatively untrained personnel and service problems may also be handled by maintenance men with little or no knowledge of electronics. For this reason it is often worth the added cost to use plug-in components, capacitors, relays, etc., so as to facilitate the tracing and correction of minor troubles.

Equipment of this kind is typical of the increasing development of electronic methods for taking over low level decisions, decreasing the number of employees required and increasing the efficiency and accuracy with which many operations are performed. The new science of cybernetics, actually a combination of all the sciences, calls on the electronic engineer for development and research work to transform industrial operations increasingly in the direction of automatic controls. The machinery of industry now accomplishes the work necessary under the control of an operator. Electron tubes promise the elimination of the operator in more and more instances. Replacing the manual control of dishwashing techniques with an automatic dispenser of the cleansing agent may seem to be a small and unimportant accomplishment. Actually the proper washing of dishes in commercial installations is an important factor in the control of the spread of infectious disease. At any rate, it is one more link in the chain of electronic developments toward the completely automatic factory guided perhaps by a single individual at a central switchboard.

PHOTO CREDITS

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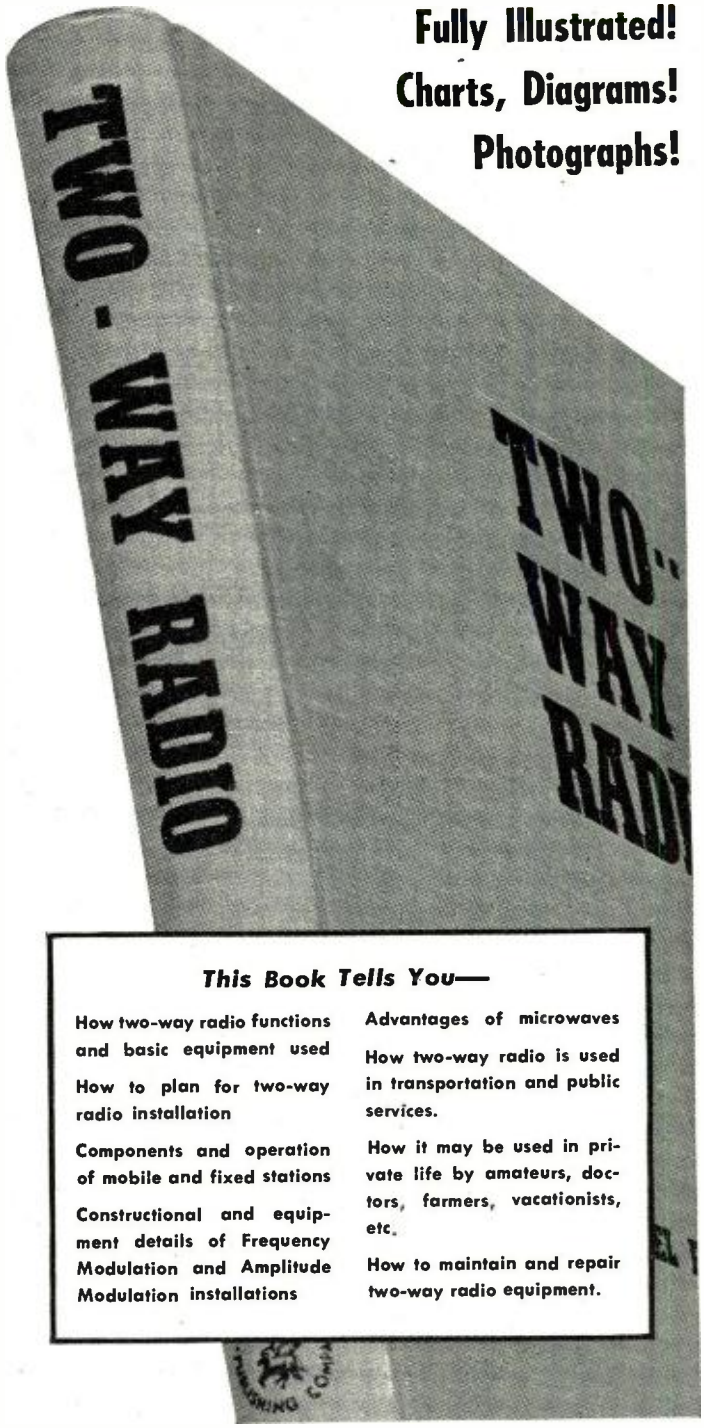

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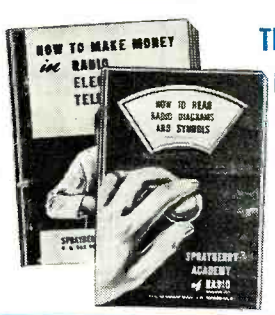

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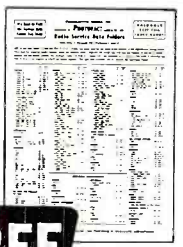

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Within the INDUSTRY

FRANK A. HINNERS will head the new program of the *Jewel Radio & Television Corp.* in that company's emergence into new fields as well as participate in its present operations.

Possessing much experience in the radio manufacturing industry, Mr. Hinners was former customer relations manager of *Teletone Radio Corp.*, vice-president of engineering at *Air King Products Co.*, and commercial engineer with *Servo Corp. of America.* His work in radio engineering in executive capacities dates to 1922, and to 1910 when he began his career.

* * *

ROLLA E. POWERS, consulting electrical engineer, has been added to the staff of *Ebasco Services Incorporated.* His previous association was with the *Stanolind Oil & Gas Company* as project engineer.

From 1923 to 1945, Mr. Powers was employed by *Westinghouse Electric.* Becoming district manager of the manufacturing and repair division at Chicago, 1938, he transferred to the Pacific Coast as manager in a similar capacity.

In 1943 he was loaned to the *Kellex Corporation* to act as a department head, designing, constructing and putting into operation the diffusion plant at Oak Ridge, Tenn. Subsequently he was assigned the duties of supervision of the design and construction of the oxygen plant and the purchase of equipment and material with *Stanolind.*

* * *

APEX ELECTRONIC SALES CORPORATION has been appointed by *Federal Television Corporation* of New York as national sales agency for its line of TV receivers.

Well known nationally as agent for leading lines of tele antennas, phonographs, and other related products, *Apex* is headed by Al Jacobs and Max Zimmer. *Federal Television Corporation* plans soon to announce their newest set, heretofore kept "under wraps."

* * *

AUSTIN C. LESCARBOURA completed his year's term as governor of the 174th district, Rotary International, which takes in Westchester County, Greater New York, Long Island, and Bermuda.

Mr. Lescarboura is a well-known radio journalist, publicist, and advertising man, who heads his own advertising agency at Croton-on-Hudson, N. Y. He has been a member of the Peekskill Rotary Club since 1926, and is a past secretary, past president, and past director. For over 20 years he has been active in Rotary circles.

* * *

DR. ALFRED OTTO C. NIER, the first man to isolate uranium 235, has become associated with *Minneapolis-Honeywell Regulator Company* on a consulting basis, it was recently announced, on a contract approved by the board of regents of the University of Minnesota, where he is a physics professor.

Mr. Nier is internationally known for his development of the mass spectrometer that first produced uranium 235. He is currently assisting the company in research work on mercury switches, including experiments on techniques of producing high quality gas for filling the switches, which are used in a wide range of industrial activities such as safety control instruments, automatic bomb sights for military aircraft, and dictating machines.

* * *

WILLIS E. PHILLIPS, named vice-president and general manager of the *Rauland Corporation* at 4245 N. Knox Ave., Chicago, was formerly assistant to the president, to which position he came from *Motorola.*

Mr. Phillips, a registered engineer, started his business career as chief engineer of WILL at Champaign-Urbana, the radio station of the university. Subsequent to his experience there, he has occupied executive engineering positions at *Bendix* and *Zenith* and with the broadcast equipment division of *Raytheon Manufacturing Company.*

He will continue his affiliation with the IRE and the Radio Engineers Club of Chicago.

* * *

DR. VLADIMIR K. ZWORYKIN, vice president and technical consultant of *RCA Laboratories Division* was presented recently with the Lamme Medal by the American Institute of Electrical Engineers.

Established in 1928 through a bequest of Benjamin Garver Lamme, chief engineer of the *Westinghouse Electric Co.*, the medal was given Dr. Zworykin for his outstanding contribution to the concept and design of electronic apparatus basic to modern television.

Dr. Zworykin is a graduate of the Institute of Technology at St. Peters-

burg and received a doctor of philosophy degree from the University of Pittsburgh in 1926. An honorary degree of doctor of science was conferred by Brooklyn Polytechnic Institute. A fellow of the A. I. E. E., he belongs to the Institute of Radio Engineers, Franklin Institute, Sigma Xi, and the American Association for the Advancement of Science, to name only a few of his memberships.

* * *

BELL TELEVISION, INC., has moved to larger quarters at 552 West 53rd Street, New York City, where it will occupy an entire floor. The company, engaged in the rental and installation of large-screen television for public places, was formerly at 147 West 42nd St., N.Y.C. . . . Consolidating the executive offices and warehouse under one roof, the **ATLANTIC BRASS & COPPER CO.** has announced the removal of its executive offices to 328 St. Marks Ave., Brooklyn 17, N. Y. . . . **VOICE AND VISION, INC.'s** president, Robert E. Samuelson, announces that the company has moved its offices and showrooms to new and larger quarters at 314 N. Michigan Avenue, Chicago, Ill. . . . Combining factory and showrooms, the new home of the **TRANS-VUE CORPORATION** will occupy an additional 12,000 square feet of space at 1139-41 South Wabash Avenue, Chicago, Ill. . . . To serve the District of Columbia and adjacent counties, a district sales office has been established by the **WESTON ELECTRICAL INSTRUMENT CORPORATION** of Newark at 6230 Third St., N. W., Washington, D. C., with its subsidiary the C. J. Tagliabue Corp.

* * *

CHARLES K. HORWITZ, following a short illness, recently passed away. He was associated with the *Insuline Corporation of America,* as assistant to the president.

During World War II, Mr. Horwitz was a major in the Army in charge of the personnel affairs division of the second service command and was instrumental in organizing the Army Emergency Relief Program. In charge of industrial relations for *Insuline,* he also assisted the sales department in its distributor relations.

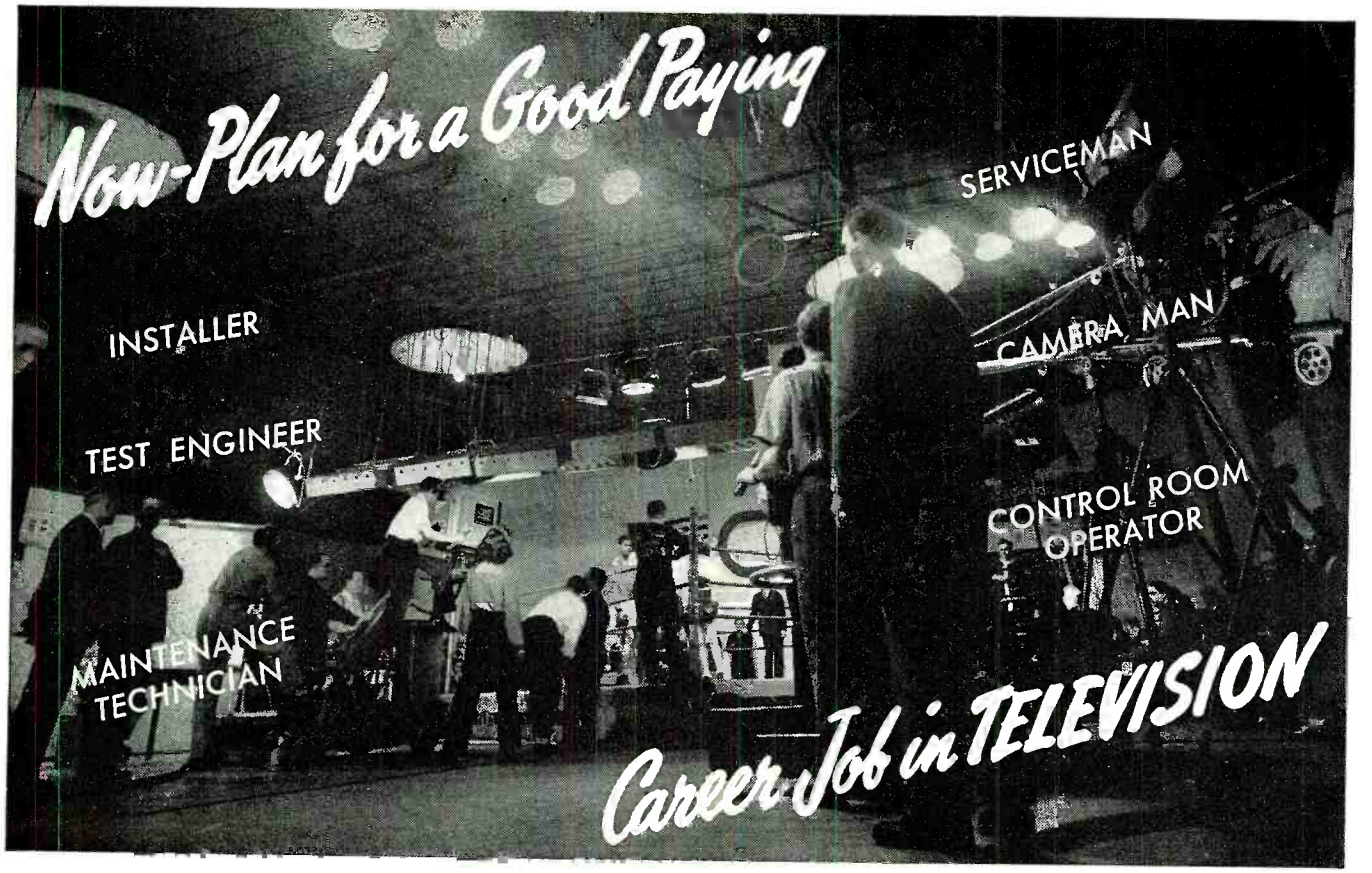
A member of many clubs and organizations, he will be missed by his associates and the friends he made in the course of his career.

* * *

JOSEPH H. McCONNELL was elected executive vice president of the *Radio Corporation of America* at the recent board of directors meeting. Previous to his appointment to this post, he served as vice-president in charge of *RCA,* a position he attained January 7, 1949. He has been associated with the corporation since 1941, when he joined the legal department.

A native of Davidson, N. C., Mr. McConnell was graduated from Davidson College in 1927, and in 1931, he received his law degree from the University of Virginia, subsequently prac-

(*Continued on page* 151)



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CREI can show you the way with convenient spare-time study at home that gives you the up-to-date technical background you *must have* for Television. CREI courses are designed to give you a thorough grounding in basic principles and take you step-by-step through the more advanced subjects of Television and its related fields. It must be remembered that all new electronic developments have their roots in past techniques. CREI training is basic and helpful in your daily work right from the start. You will learn about and understand such subjects as: Optics; Pulse Techniques; Deflection Circuits; RF, IF, AF and Video Amplifiers; FM; Receiving Antennas; Power Supplies; Cathode Ray, Iconoscope, Orthicon and Projection Tubes; UHF Techniques, Television Test Equipment, etc.

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Replacement Transformers

24 SERIES

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Servicemen are acclaiming Thordarson's new replacement transformers as tops in the field. Outstanding in quality and performance, these new Thordarson replacement transformers are very modestly priced! They are available as follows:

Thordarson "24" Series Service Line Tube to Voice Coil

Type No.	Case Style	Typical Applications	Pri. Imp.	Pri. M.A.	Max. Watts	Mtg. Centers	Dimensions W.	D.	H.	Weight	List Price
TS-24S48	BAH	Midget Replacement - 154,354, etc.	4-5000	10	1	1 3/4	2 1/8	1	1 3/16	1/8	$1.45
TS-24S49	BAH	Midget Replacement - 1C5GT, 1G5GT, 154, 354, etc.	7-8000	10	1	1 3/4	2 1/8	1	1 3/16	1/8	1.45
TS-24S50	BAH	2A3, 6A3, 6B4, 6W6, 7A5, 25AC5, 25B5, 25N6, 25L6, 35A5, 35L6, 35B5, 50B5, 50A5, 50L6, 70L7, 48, etc.	2000	55	5	2	2 3/8	1 1/4	1 3/8	1/2	1.35
TS-24S51	BAH	31, 43, 45, 50, 59, 71A, 3S4, 2B6, 6A5G, 6V6, 7C5, 12A5, 25A5, 25A6, 25A7, 35L6, etc.	5000	40	5	2	2 3/8	1 1/4	1 3/8	1/2	1.38
TS-24S52	BAH	20, 31, 33, 41, 42, 46, 47, 59, 89, 1C5, 1G5, 1Q5, 1S4, 2A5, 3Q5, 6A4, 6AC5, 6B5, 6F6, 6K6, 3S4, 6N6, 6V6, 7B5, etc.	7000 to 10000	30	5	2	2 3/8	1 1/4	1 3/8	1/2	1.30
TS-24S54	BAH	38, 85, 1D8, 1E7, 1F4, 1F5, 1J5, 1T5, 6F6, 6V7, 6Y7, etc.	15000 to 25000	10	5	2	2 3/8	1 1/4	1 3/8	1/2	1.48

Universal Service Replacement

Type No.	Case Style	Typical Applications	Pri. Imp.	Pri. M.A.	Sec. Imp.	Max. Watts	Mtg. Centers	Dimensions W.	D.	H.	Weight	List Price
TS-24S60	BHH	Single or push pull plates	4M, 7M 8M, 10M 14M, C.T.	35	.1 to 29 ohms	4	2	2 3/8	1 1/4	1 3/8	1/2	2.40
TS-24S61	BHH	Single or push pull plates	4M, 7M 8M, 10M 14M, C.T.	40	.1 to 29 ohms	8	2 3/8	2 7/8	1 1/2	1 5/8	1	2.70

Universal Matching-Line or Lines to Voice Coil

Type No.	Case Style	Primary Ohms	Secondary Ohms	Watts	Mtg. Center	Dimensions W.	D.	H.	Weight	List Price
TS-24S66	BHH	2000-1500-1000-500	3.2 to 4, 6 to 8	10	2 3/8	2 13/16	2	1 5/8	1	3.45
TS-24S62	BHH	3000-2500-2000 1500-1000-500	Pri. as 500, Sec. .06 to 8 Pri. as 1000, Sec. .12 to 16 etc.	10	2 15/16	3 3/8	2 1/2	3	2	5.75

Transformers Exact Popular Replacement "24R" Series

Type No.	Case Style	Pri. VA	Secondary A.C. Volts	No. 1 D.C.M.A.	Rect. Fil.	Fil. No. 2	Mtg. Centers	Dimensions W.	D.	H.	Weight	List Price
TS-24R00	AGF	50	240-0-240	40	5V-2A	6.3V.C.T.-2A	2 x 2 1/2	2 1/2	3	1 13/16	1 3/4	4.90
TS-24R00-U	GGV	50	240-0-240	40	5V-2A	6.3V.C.T.-2A	2 x 1 9/16	2 9/16	2 9/16	3 1/8	1 3/4	4.90
TS-24R01	AGF	56	325-0-325	40	5V-2A	6.3V.C.T.-2A	2 x 2 1/2	2 1/2	3	1 15/16	2 1/4	5.15
TS-24R01-U	GGV	56	325-0-325	40	5V-2A	6.3V.C.T.-2A	2 x 1 11/16	2 9/16	2 11/16	3 1/8	2 1/4	5.15
TS-24R02	AGF	70	350-0-350	70	5V-2A	6.3V.C.T.-2.5A	2 1/4 x 2 13/16	2 13/16	3 3/8	2 9/16	3 1/2	6.25
TS-24R02-U	GGV	70	350-0-350	70	5V-2A	6.3V.C.T.-2.5A	2 1/4 x 2 1/4	2 7/8	3 7/16	3 1/2	3 1/2	6.25
TS-24R04	AGF	83	350-0-350	90	5V-3A	6.3V.C.T.-3.5A	2 1/4 x 2 13/16	2 13/16	3 3/8	2 15/16	3 3/4	6.75
TS-24R04-U	GGV	83	350-0-350	90	5V-3A	6.3V.C.T.-3.5A	2 1/4 x 2 5/8	2 7/8	3 13/16	3 1/2	3 3/4	6.75
TS-24R05	AGF	135	350-0-350	120	5V-3A	6.3V.C.T.-4.7A	2 1/2 x 3 1/8	3 1/8	3 3/4	3	5	7.65
TS-24R05-U	GGV	135	350-0-350	120	5V-3A	6.3V.C.T.-4.7A	2 1/2 x 2 11/16	3 3/16	3 15/16	3 7/8	5	7.65
TS-24R06	AGF	154	375-0-375	150	5V-3A	6.3V.C.T.-4.7A	2 3/4 x 3 7/16	3 7/16	4 1/8	3 7/8	5 3/4	9.05
TS-24R06-U	GGV	154	375-0-375	150	5V-3A	6.3V.C.T.-4.7A	2 3/4 x 2 13/16	3 1/2	3 15/16	4 1/4	5 3/4	9.05
TS-24R07	AGF	200	400-0-400	200	5V-3A	6.3V.C.T.-5A	3 x 3 3/4	3 3/4	4 1/2	3 5/16	8 1/2	12.00
TS-24R07-U	GGV	200	400-0-400	200	5V-3A	6.3V.C.T.-5A	3 x 3 5/16	3 13/16	4 7/16	4 5/8	8 1/2	12.00

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LOOK . . . *You get the tape recorder and projector right at the start of your course!*

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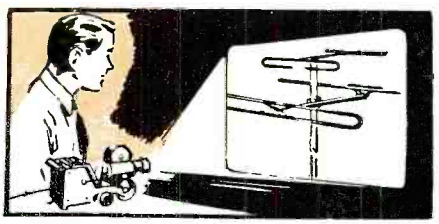
It's even better than the classroom, because you can *repeat* the instructor's lectures until they're thoroughly understood.



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Tell your instructor about anything that puzzles you and get his answers back pronto.

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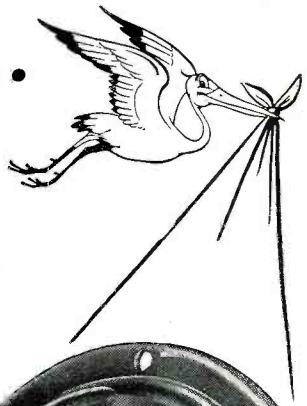

THERE'S always something new and better in the G-E Speaker Line—Now it's the G-E 5" Round —*specifically designed for service replacement!*

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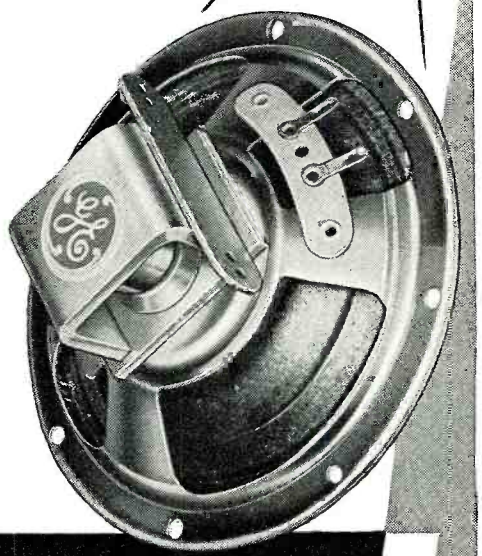
Naturally it has the quality you expect of a General Electric Speaker — sturdy all-weld construction, rock-steady G-E Alnico 5 magnet—plenty of power, sensitivity, fidelity! Give your customers the best—that G.E. gives you! See your G-E parts distributor and stock up today.



Of course it has the famous G-E Aluminum Foil Base Coil! Not subject to warping resulting from high humidity. Provides much higher power handling capacity. P. S. All G-E Speakers have this Metal Base Voice Coil—don't forget that!

FREE—with all 4", 5" and 5¼" G-E Speakers!

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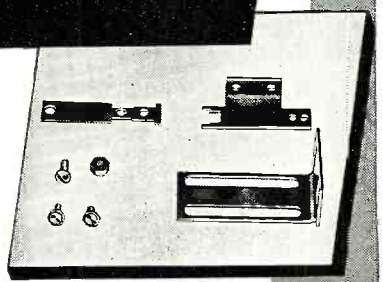
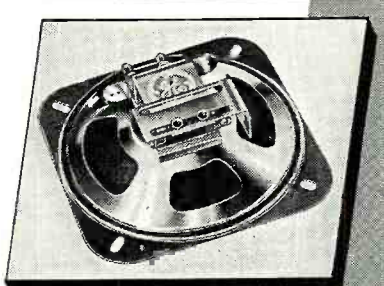
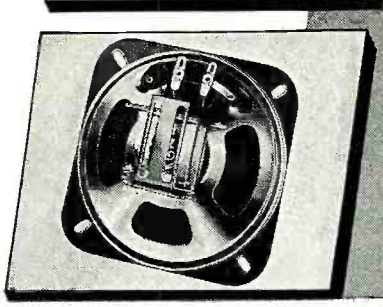


Save time, money and materials for the hard-working serviceman!

Well, now, here's the story. With the serviceman in mind, G. E. has cooked up these neat little mounting kits to save your temper and please your customers. They're adjustable—up, down or sideways, for simplified mounting of speakers in small working areas. Less work for you—and a cleaner job for that important fellow—your customer. The brackets are FREE with every 4", 5" and 5¼" G-E speaker you get from your G-E distributor or jobber. *General Electric Company, Parts Section, Electronics Park, Syracuse, New York.*

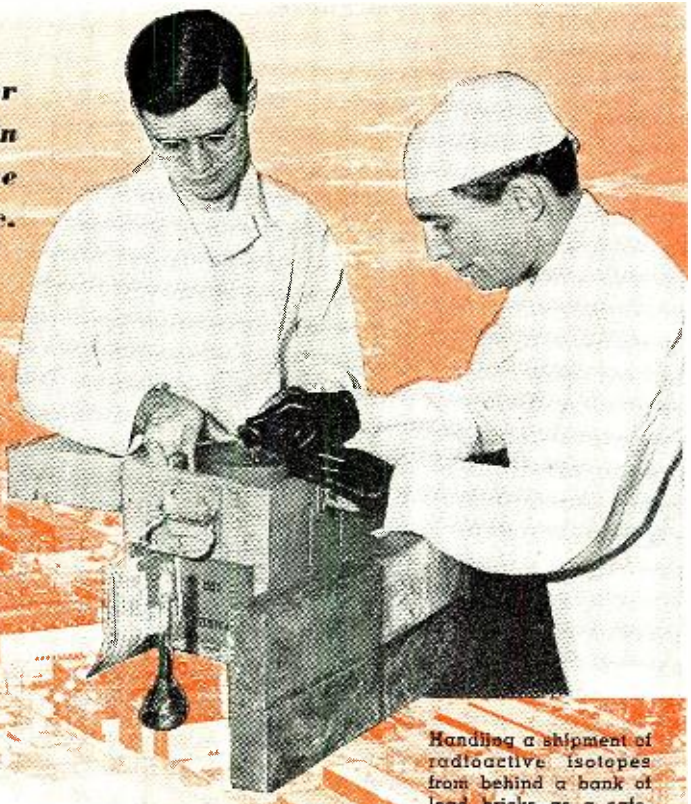




You can put your confidence in—

GENERAL ELECTRIC

There is just as much need for radio - electronic technicians in the nucleonic program as there is for physicists, chemists, etc.



RADIO-ELECTRONICS In The Atomic Energy Program

Handling a shipment of radioactive isotopes from behind a bank of lead bricks as a safeguard against exposure to radioactivity. Background shows birds-eye view of Y12 electromagnetic plant at Oak Ridge, Tennessee.

By
SAMUEL FREEDMAN,
W6YUQ
Developments Eng., DeMornay Budd, Inc.

THE multi-billion-dollar atomic energy program, first revealed in the form of the atom bomb in August, 1945, now provides astounding opportunities for radio and electronic personnel.

At the March, 1949, exhibition of the Institute of Radio Engineers, in the Grand Central Palace in New York City, a whole section was taken over by manufacturers of nucleonic instrumentation. These were principally comprised of a wide variety of Geiger-Mueller counters, or radioactivity detectors, of which a few are shown on the following pages. These instruments also included scaling equipment, ionization chambers, and high-sounding apparatus names, which, for the most part, turned out to be simple circuitry and tubes well within the realm of understanding of most of the readers of this magazine.

We are only at the beginning of a vast program that will become as great as the rest of radio and electronics. This must be so since radio-electronics-nucleonics are closely interrelated and overlap in their personnel qualifications to such an extent that they cannot be completely separated one from the other. The radio engineer, service technician, and installer belong in all three of these fields.

No single person can completely visualize the magnitude of the overall program. For the past two years, the author has been in frequent contact with extensive portions of this program's physical installations and has also provided cooperation on an industrial basis to many of its excellent personnel. If national security is a factor in any discussion of this subject, it may be said that our greatest protection lies in the fact that the atomic energy, or more correctly, the nucleonic program, requires laboratories, plants, quantity and high-calibre in personnel, and financial outlay, plus the national policy that exists only in the United States. This conclusion was reached after personal visits to the following major activities, which represent only a portion of the establishments and organizations devoted to the furtherance of nucleonic developments in this nation.

The Oak Ridge, Tennessee, installations include: (a) The gaseous diffusion plant, called K25; (b) The electromagnetic plant, called Y12; (c) The Oak Ridge National Laboratory, called X10; (d) The Oak Ridge Institute for Nuclear Studies; and (e) The NEPA plant, the initials meaning "nuclear energy for the propulsion of aircraft."

Besides the Oak Ridge activities, other laboratories throughout the country include the Los Alamos Scientific Laboratory at Los Alamos, New Mexico; the Brookhaven National Laboratory, Upton, Long Is.; the Argonne National Laboratory at Chicago; the University of California at Berkeley; the Ryan High-Voltage Laboratory, Palo Alto, California; the Atomic Energy Commission at Washington, D. C., plus its various area offices of directed operations; the Sandia Base, Albuquerque, New Mexico; and the hundreds of universities, colleges, and other institutions of higher learning that are devoting much study time and experimentation to the problems of nuclear fission.

Added to the work of these laboratories are the activities of many major industrial organizations, the most notable being *Carbon and Carbide Chemicals Corporation, General Electric Co., Westinghouse Electric,* among others.

These are all tremendous undertakings. At Oak Ridge, Tennessee, located eighteen miles from the city of Knoxville, near the Cumberland Mountains, the Great Smoky Mountain National Park, and the site of the Tennessee Valley Authority development is a reservation comprising 59,000 acres and extending into two counties. Employees, families, and the persons serving them make a total of about 36,000 people.

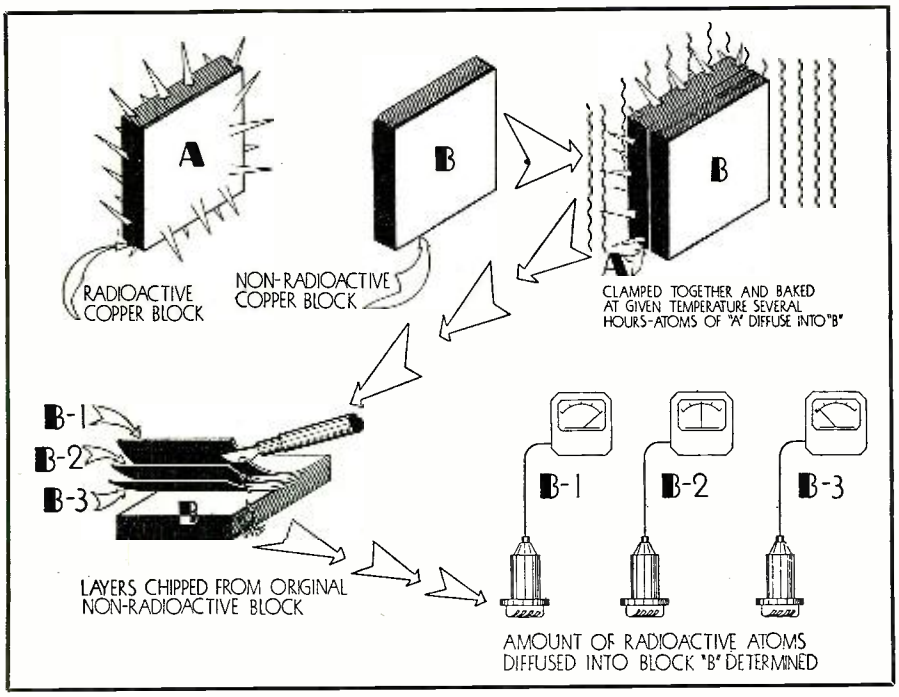


Fig. 1. Self-diffusion technique, imparting radioactivity to pieces of like materal, then measuring chips for presence of radioactivity with Geiger-Mueller detectors.

At Los Alamos, New Mexico, in breath-taking scenery at an elevation about 7400 feet above sea level, there lies 68,000 acres of canyon and mesa land. The laboratory is located about sixty miles northwest of Albuquerque and about thirty-five miles west of Santa Fe. Living in this vicinity are 8000 persons, people located there solely because of the atomic energy program. An investment of about $500,000,000 is represented by the project, which is operated under the auspices of the University of California as a contractor for the Atomic Energy Commission.

At Albuquerque, New Mexico, is the Sandia Base, located near the foot of the Sandia Mountains about five miles out of the city. Several thousand persons are engaged there in special applications and developments related to the nucleonic program.

The premises at Brookhaven National Laboratory include all of old Camp Upton of World War I fame, a vast establishment which is still undergoing heavy expansion. The work of more than fifty associated universities and colleges in northeastern United States is coordinated at this point.

The Argonne National Laboratory in and about the Chicago area is even larger and is a coordinating center for many Midwest universities and colleges headed by the University of Chicago.

At Schenectady, N. Y., on a several-thousand-acre tract, *General Electric* is building and operating the David Knolls Laboratory under sponsorship of the Atomic Energy Commission for the purpose of generating primary power for the creation of electricity. This firm also has a hand in the operation of the Hanford plant in the State of Washington for the production of plutonium or for utilization of the plutonium process.

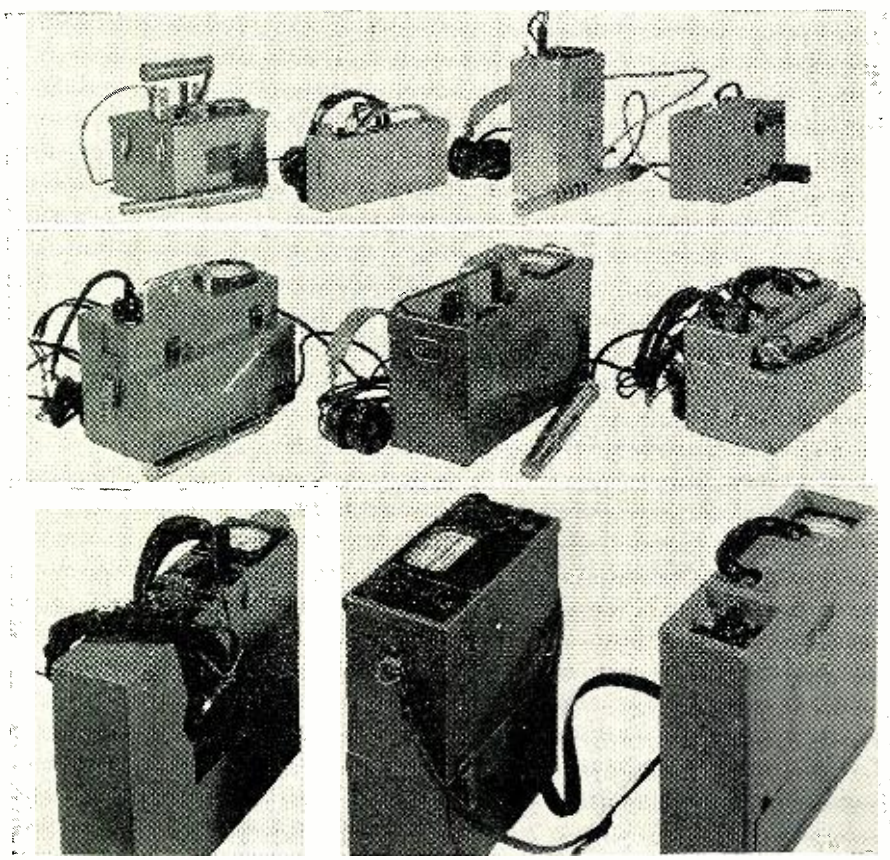
Westinghouse Electric is reported to be conducting work leading toward the use of nuclear energy for the propulsion of ships.

The atomic energy program continues to operate with Federal expenditures on the order of one billion dollars per year, four years after termination of World War II. Emphasis is increasingly being directed on applications in the fields of medicine, health, agriculture, and industry. One of the outstanding aims of the program is in connection with the production and distribution of radio-isotopes, and fantastic and unlimited are the possibilities and applications. To cite a recent example: When the microwave waveguide firm of *DeMornay Budd Inc.* encountered the problem of how to determine whether gold plating on waveguides was of uniform thickness, a professor at Columbia University suggested the adding of a small amount of radioactive gold in the plating solution. The idea then would be to measure the amount of radioactivity on the surfaces of the waveguide by means of a conventional Geiger-Mueller counter. Since radioactive gold has a half-life of 2½ days (it diminishes in radioactivity 50% during that time), it is necessary only to make the measurements at the same interval of time after plating for various samples.

It is also possible and feasible to determine the thickness and quality of concrete and many other materials by measurement of radioactivity in the radioactive material mixed in with such materials.

In the field of agriculture, plant growth studies can be made by radiochemical analysis of plants and soils to determine the extent of the root feeding zone and the relative avail-

Fig. 2. Some commercially-made Geiger-Mueller counters for measuring radioactivity.



ability of plant foods to sustain plants.

In the field of medicine, studies can be made of vulnerable parts of the human body in connection with such diseases as cancer and tumors, offering a measure of hope to people who would otherwise be in despair. Drinking a safe liquid that contains small amounts of radioactive material will trace the path of the liquid and permit a comparison between persons of normal health and those who are afflicted attaining a degree of accuracy in diagnosis that might otherwise baffle the medical profession. This is called "tracer" work.

A study of the role played by radio-electronics in the atomic energy program shows that there would be no such program without the extensive use of radio or electronic devices and techniques. There is just as much need for radio-electronic technicians as there is for physicists, chemists and members of the medical profession. The instrumentation branch of the Atomic Energy Commission is one part of it. To the extent of several million dollars a year the program has initiated and supported the development and production of Geiger-Mueller and ionization chamber types of survey instruments. It has also supported the development and production in industry of scaling equipment to permit higher counting rates in the presence of strong radioactivity. Such circuits have made possible a much more precise determination of radioactivity, regardless of magnitude, than the clicks or counts of a Geiger-Mueller device can make recognizable to the human ear and brain. For instance, it is now possible to record radioactivity by means of scaled-down circuits where the ratio is stepped down 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, or 4096 to 1, depending on selector switch setting.

In the laboratories are found fast transient cathode-ray oscilloscopes; microwave absorption sets in the new art of microwave spectroscopy for molecular analysis; waveguides energized by a series of high-power microwave tubes in combinations called microwave linear accelerators; and all

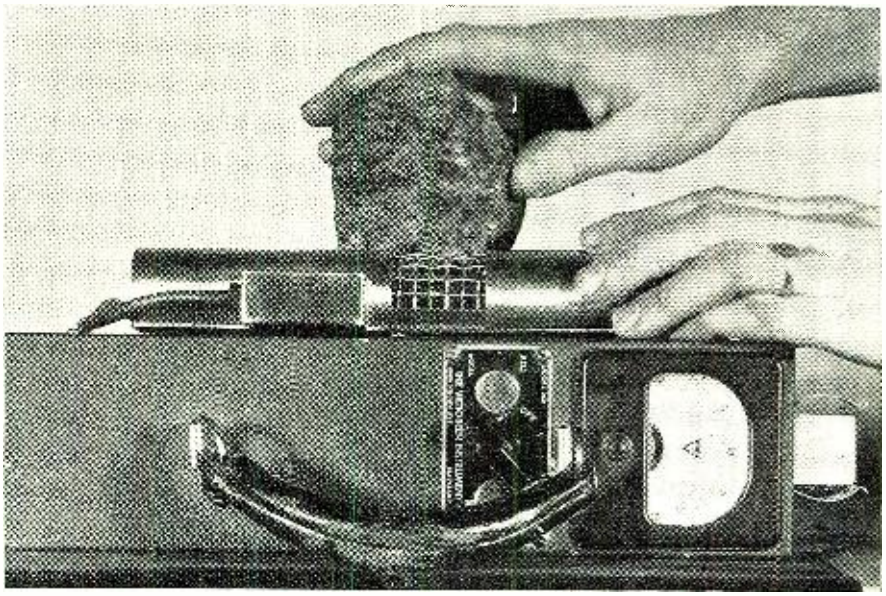


Fig. 3. Measuring mineral radioactivity. When screen mesh is exposed, beta, gamma, and higher radiations will be detected. When screen is shielded by metal slide, beta component will not be detected. It can be used in field exploration work.

kinds of circuitry and devices which operate much faster than human reaction time, and protect personnel by making it possible for them to work at safe distances from dangerous amounts of radioactivity.

Techniques developed in connection with radar for generating short pulses of tremendous peak power have many applications in the field of nucleonics. They require pulses much shorter than those used during World War II in connection with fast transient phenomena. They also require pulses of much greater peak power than were ever used in radar work for energizing microwave linear accelerators, in order to give matter an acceleration approaching that of light itself inside guides or cavities. In fact, it may make other techniques, including the cyclotron, van der Graff generator, or comparable devices, obsolete. At the Ryan High Voltage Laboratory, the author saw a new microwave linear accelerator using 5000-watt average power klystrons, with cavities replacing grids, used in a combination to develop over 1½ billion watts peak power on 2855 megacycles in a waveguide. The Atomic Energy Commission invites proposals from anyone for new applications of radio and electronics to facilitate nucleonic progress.

The field of nucleonics knows no bounds since it recognizes all matter, whether gaseous, liquid, solid, to be nothing more than quantitative arrangements of positive, negative, and neutral charges in atoms, which are, in turn, combined to form the molecules of matter. It requires unlimited development to construct or artificially create molecules now rare in nature, from those natural materials that are plentiful.

Although it is still very early to hazard such guesses or make such prophesies, it is believed that old age is caused by the cumulative effects of cellular destruction resulting from day-by-day exposure to ever-present radioactivity. No matter how slight, radioactivity may be detected virtually everywhere, including interstellar space, as it emanates from the sun. When science can find feasible forms

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Fig. 4. Passage of radioactive liquid through the digestive system, blood stream, and tissue lesions differentiates between various tumors, which are measured by radioactivity indicators.

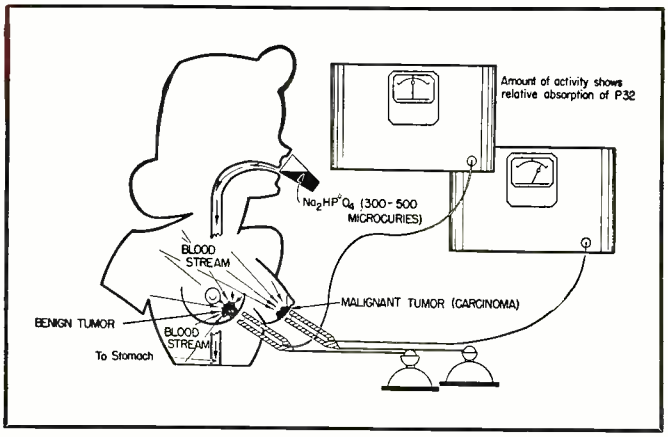
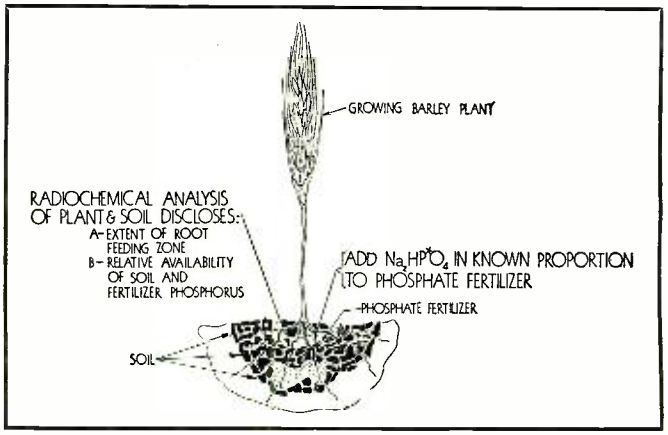


Fig. 5. Radioactive fertilizer permits many unusual studies of soil and plant growth, which will, in time, tend to revolutionize the current practices in the science of agriculture.



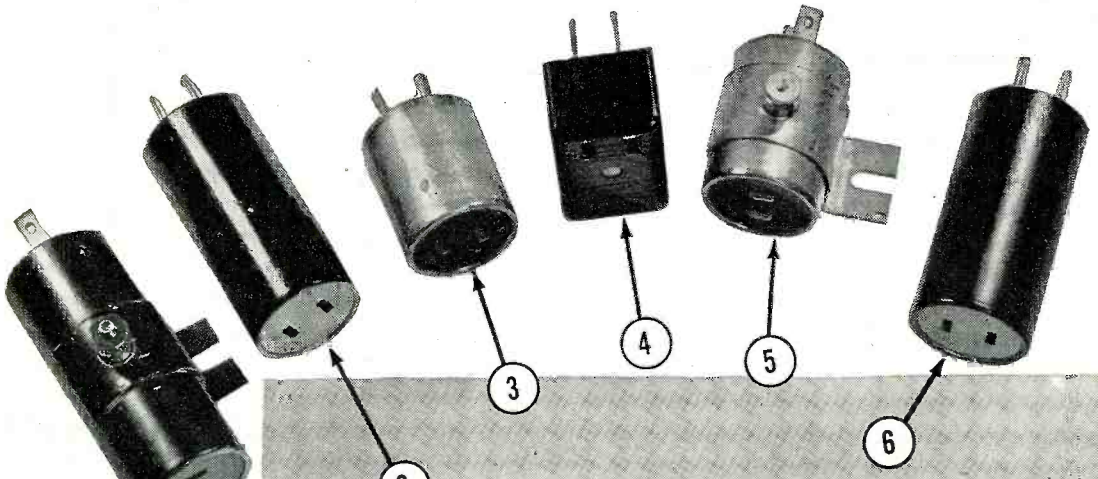


Fig. 1. Six plug-in type interference filters that were tested by the author. Nos. 1-6 tie in with the graphs shown in Figs. 3 and 4.

Household Radio Interference Elimination

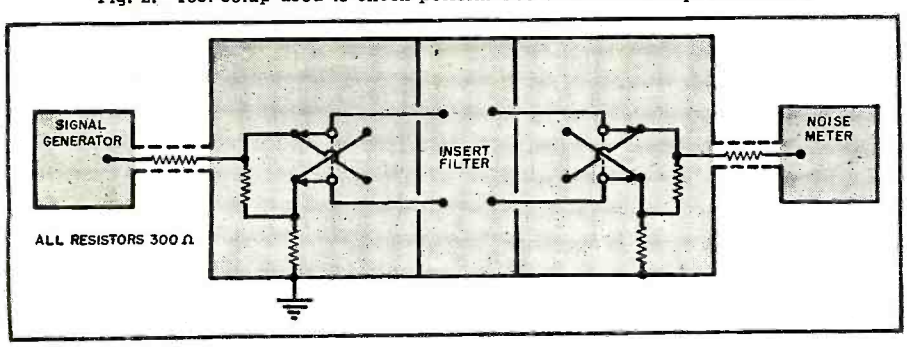
By JOHN W. TEEGARDEN

The over-all performance and limitations of several types of commercially built interference filters.

THE problem of radio noise interference has been with us since the beginning of radio reception. With the constant increase in frequency and the continuous improvement in the sensitivity of the receivers used, however, it has become of particular importance in the last ten years. Many commercial filters have been constructed and sold through regular trade outlets. Some of these filters attempt to reduce the interference produced by rotary or pulsing mechanisms, or to prevent that interference so produced from entering the back door of the radio set through the connection to the power line. In the past few months the writer has checked a considerable number of the standard plug-in type domestic filters with the results as shown in the accompanying graphs.

It is of primary importance to consider the fact that the ordinary American house wiring is different from anything else under the sun. Naturally, the electrical code calls for a single-circuit, 110-volt system to have one side connected to ground. It happens, however, that the grounded side is not at ground for radio frequencies. Thus, to approximate the situation encountered in the average home, we must consider that over the measured frequency range an average value of 300 ohms impedance exists between the ground wire and true earth ground. Likewise, for testing purposes, we will consider the wire-to-wire impedance and the impedance of the equipment that is permanently connected from wire to wire, and all other factors as indicating that a further 300 ohms impedance exists between the so-called "hot" wire and the so-called "ground" wire. With such impedance values existing, it often appears to the radio interference specialist that unconduited house wiring exists for the happiness, in theory, of the antenna engineer and constitutes a well designed network for better dissemination of interference.

Fig. 2. Test setup used to check performance of commercially built filters.



For a check of filter attenuation, construction of a completely shielded box with the matching network shown in Fig. 2 will give satisfactory indications of filter efficiency. The results obtained by pursuing this measuring technique will indicate immediately that the problems encountered in domestic filtering are much more difficult than those found in aircraft, automotive, or marine situations. In each of these instances, a fairly good ground exists, and there is but one "hot" wire about which to worry. To achieve a similar degree of attenuation in domestic filtering through the same technique requires definitely a two-circuit filter and, of even more importance, a ground reference point. The importance of this so-called ground reference point cannot be overemphasized. It may be the case, or the container, or the shell of the gadget creating the noise, or the receiver for which the attenuation is de-

manded. In each instance, an effort must be made to use either an absolute ground or an artificial ground as the reference point for the filter. The danger existing with artificial grounds is that the whole system may then begin to radiate and, thus, counteract all the beneficial effects of the filter.

We now arrive at the real determining factor which makes most domestic filtering so extremely difficult. Too much capacity from line to ground is a definite hazard, insofar as life insurance underwriting goes. Thus, we have a limiting factor, i.e., the safety requirement that a condenser from line to case must be small, not to exceed .1 μfd. Therefore, we have a further limiting factor—the amount of capacitance that can be used in a two-section pi-type filter; that is, the total, or lumped, capacitance to ground must not exceed .1 μfd. Attention is called to Fig. 4-7, which indicates a very satisfactory degree of attenuation but a filter which is definitely dangerous to "life, limb, or pursuit of happiness." [1] The filter shown in Fig. 3-1 is well within safety requirements and demonstrates increasing high-frequency attenuation. Its over-all attenuation is rather in the nature of that required by the average amateur and domestic radio equipment. Graphs shown in Figs. 4-2, 4-3, 4-4, and 3-6 have attenuation levels so low as to render them beyond consideration. The filter graphed in Fig. 4-7 was not photographed.

The true solution to radio interference is attacking the problem at the source, wherever it may be. In other words, where the noise source is external to the building in which the receiver is located, the filter should be installed at the point where the house wiring enters the building. That entails a more or less permanent filter installation and must also pre-suppose a permanent and code-approved ground connection from the filter and the unit filtered to a true earth ground, such as a cold water pipe.

In cases of noise originating within the building, the previous recommendation of attacking the problem at the source still holds. This means that the filter should be placed on the equipment which is the cause of the radio interference. It is the opinion of this writer that if satisfactory commercial filters are used, the installation will meet with Underwriters' approval. The foregoing applies principally to power equipment, such as motors, blowers, machine tools, razors, mixers, vacuum cleaners, etc.

Fluorescent lights, especially when one gets into the higher frequencies, entail additional problems. A filter of the type shown in Fig. 3-5, installed inside the light, will reduce

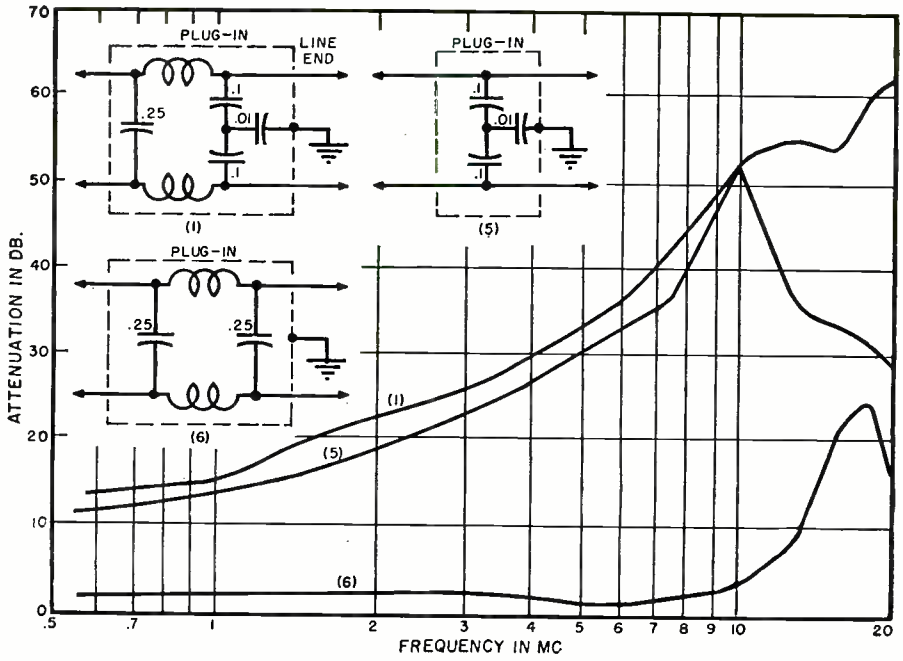


Fig. 3.

the feedback to the house wiring to a point where it is negligible through the range shown on the graph. However, the filter shown in Fig. 3-1 extends the range of usefulness far into the higher frequencies where FM and TV are received. Metallic screens over the fluorescent tube itself tend to reduce the radiation. For a light in proximity to a sensitive radio, there is almost no cure except to screen the tube and then ground the screen by returning a lead to the house conduit in case the wiring is in conduit. Very few situations will be encountered which are that severe.

A very recent article on "Television Master Antennas" in RADIO & TELEVISION NEWS, April, 1949, introduces the subject of multiple dwellings from the viewpoint of the antenna installation. The viewpoint of radio noise is also of prime importance in such a situation.

Just as the landlord is the determining factor in television antenna installation, he, and also his underwriters, must be considered in the installation of any interference filtering. Filtering of the incoming lines must be deemed a necessity. We cannot anticipate any lowering of the general nation-wide noise levels, but rather an increase. When the time comes that we in America have stringent Federal laws, such as those already existing in Canada, regulating the amount of radio interference which is permissible to be fed back into a power line, the general noise

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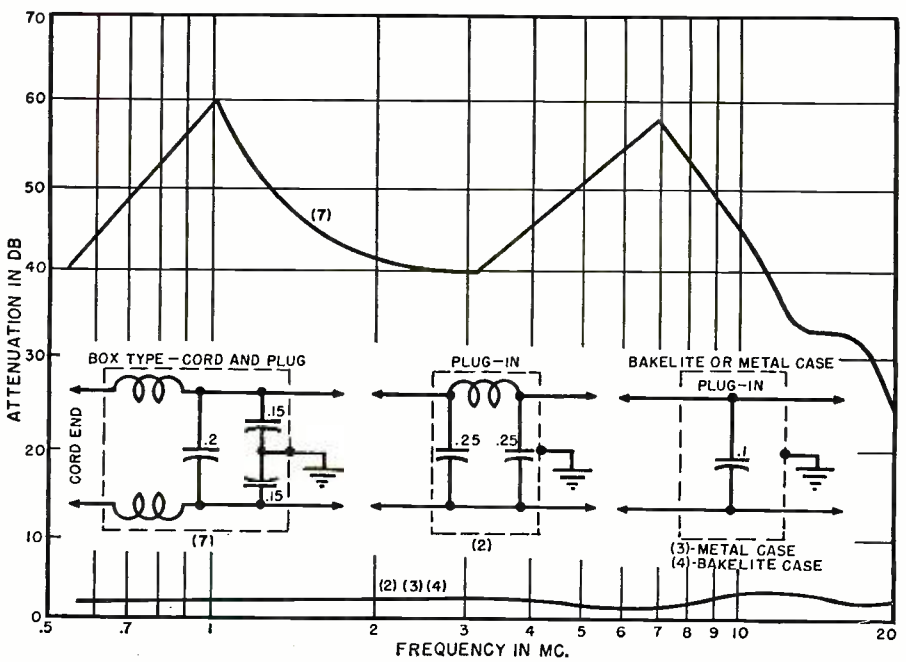
Fig. 4.



[1] See "Safety in Aircraft Electric Systems," by Morton H. Adolphe, and "Effects of Electricity on the Human Body," by W. B. Kouwenhoven, both appearing in the March, 1949, issue of the I.E.E. Journal.

IS YOUR *Profit* ON SALES A GOOD *Profit* ON BUSINESS INVESTMENT?

By
FRED MERISH

Do you know the net profit on your investment? In view of the present "buyer's market," it should be watched very carefully and is of utmost importance.

"HOW much profit did I make on sales?" Nine out of ten radio and television dealers ask this question when their operating figures are tabulated at the end of the year—and many otherwise capable businessmen are numbered in this nine out of ten.

They overlook the fact that the ultimate yardstick of profit is the return on their invested capital, which is the difference between the assets and the liabilities for a proprietorship, and the capital stock plus the surplus for a corporation. The net profit on sales is a secondary yardstick when considering the progress of a business over a period of years.

If you must invest a million dollars to make $100,000 sales and net a high percentage of profit on sales, say 20%, that's only $20,000 on a million-dollar investment, or two per-cent a year. A dealer can get more than twice this return on safe outside investments today with no managerial worries. He can go fishing and live the life of a country gentleman with no labor troubles and "overhead-aches." Whether you have a million dollars invested in a business or a much lesser amount, the same thing holds true. You should always keep an eye on the return on capital investment.

Table 1.

Sales	$50.000
Cost of goods sold	30.000
Margin on sales	$20.000
Overhead expense	16.000
Net profit on sales	$ 4.000—8%

Current assets	$10.000
Fixed assets	20.000
Total	$30.000
Current liabilities	$ 5.000
Net worth	25.000
Total	$30.000

Table 2.

The profit on sales, however, has been stressed so often in the past that most dealers think only of this return and ignore completely the return on their invested capital. This was always a good measurement of managerial "know-how," and since the war, its omission from business analysis is likely to do more harm than it did in the prewar period because profits have been higher, and the businessman should have increased his net worth proportionately. For example, suppose that Mr. Smith, a radio and television dealer, had a profit and loss statement in 1938 as shown in Table 1. Figures are merely illustrative and are not intended to represent the operating ratios of any dealer or group of dealers in this field. The figures are kept in the low brackets for easy assimilation.

Suppose Smith's balance sheet in condensed form for the same year (1938) was as shown in Table 2. Smith earned 8% on sales, or $4,000, which is 16% on $25,000 net worth. That was in 1938.

Since the war, Smith's business has increased in volume and he averaged $80,000 yearly sales and 8% net profit, or $6,400 yearly average. For the ten years intervening, these profits have increased his net worth $65,000. He has had no losses to charge to net worth, and so it has jumped from $25,000 to $90,000.

In 1948 he had an average year; he did $80,000 in sales, earned 8% in dollars on sales, or $6,400 net profit, which is 60% more net than he earned in 1938, when the net was $4,000. Inasmuch as he focuses all attention on the net profit on sales, he is satisfied.

Considering only the sales volume and the net profit on sales, this isn't a bad showing particularly in view of the fact that costs and taxes have increased heavily. But if Smith prepares a balance sheet (see Table 3) for 1948 and computes the 1948 net profit on net worth, he now earns less than 7.2% return on this capital investment, whereas he earned 16% in prewar days.

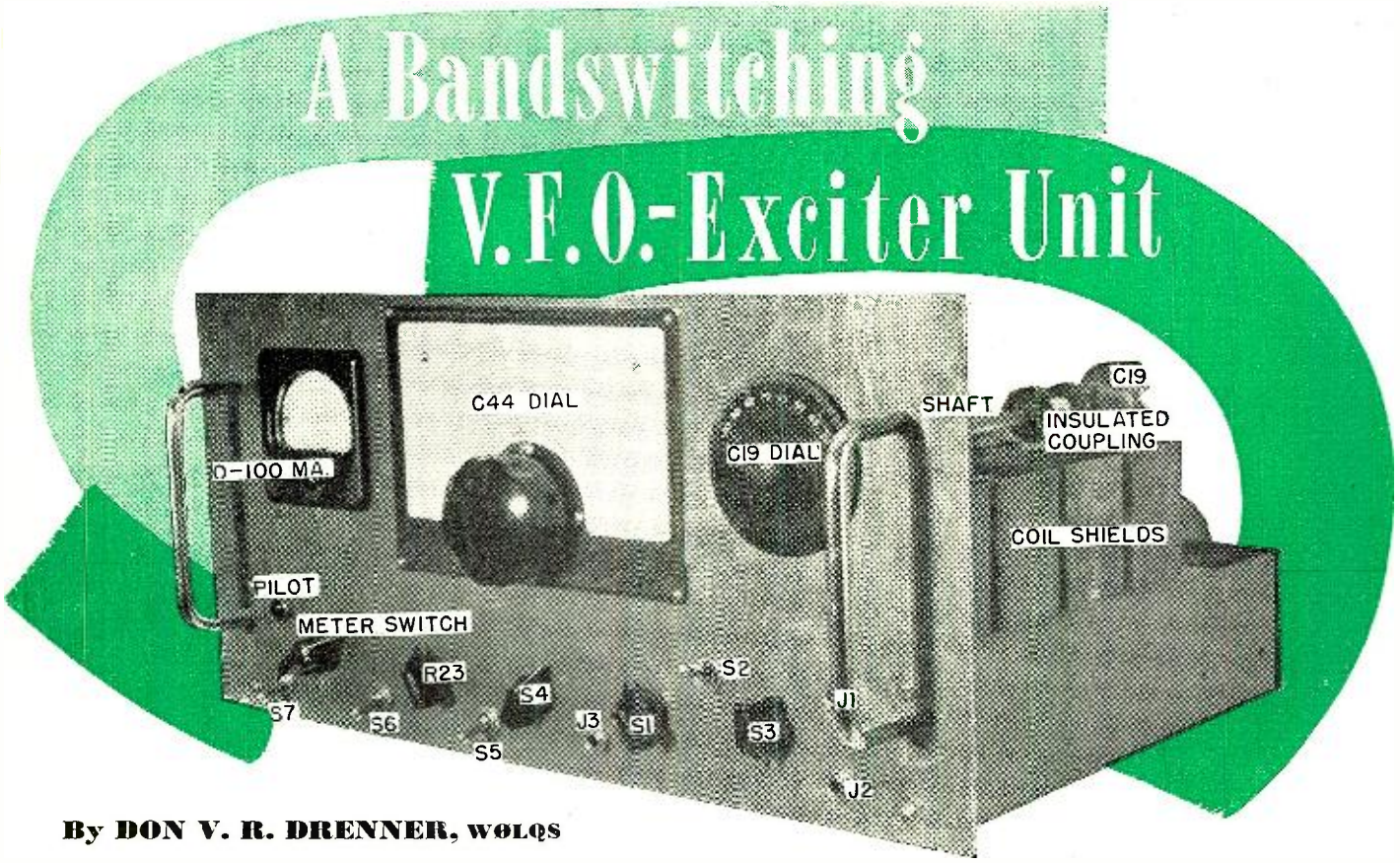
During the intervening years, he has more than doubled his cash in the bank, because he has been earning more money. Because prices have increased, the investments in inventory and accounts receivable have increased. He bought the building housing his store at an inflated price and installed a new store front and other merchandising equipment. He bought a new truck. These investments increased his fixed assets from $20,000 to $70,000. He has a lot more fixed capital to carry and a bigger capital investment, but he has cut the return on investment to less than half what it was in prewar days.

Current assets	$24.000
Fixed assets	70.000
Total	$94.000
Current liabilities	$ 4.000
Net worth	90.000
Total	$94.000

Table 3.

(*Continued on page* 136)

A Bandswitching V.F.O.-Exciter Unit



By DON V. R. DRENNER, W6LQS

Construction details on a v.f.o. exciter with output on the 10, 20, 40, and 80 meter ham bands.

Front view of the unit. The condenser, C_{10}, is used to resonate the 807 plate circuit.

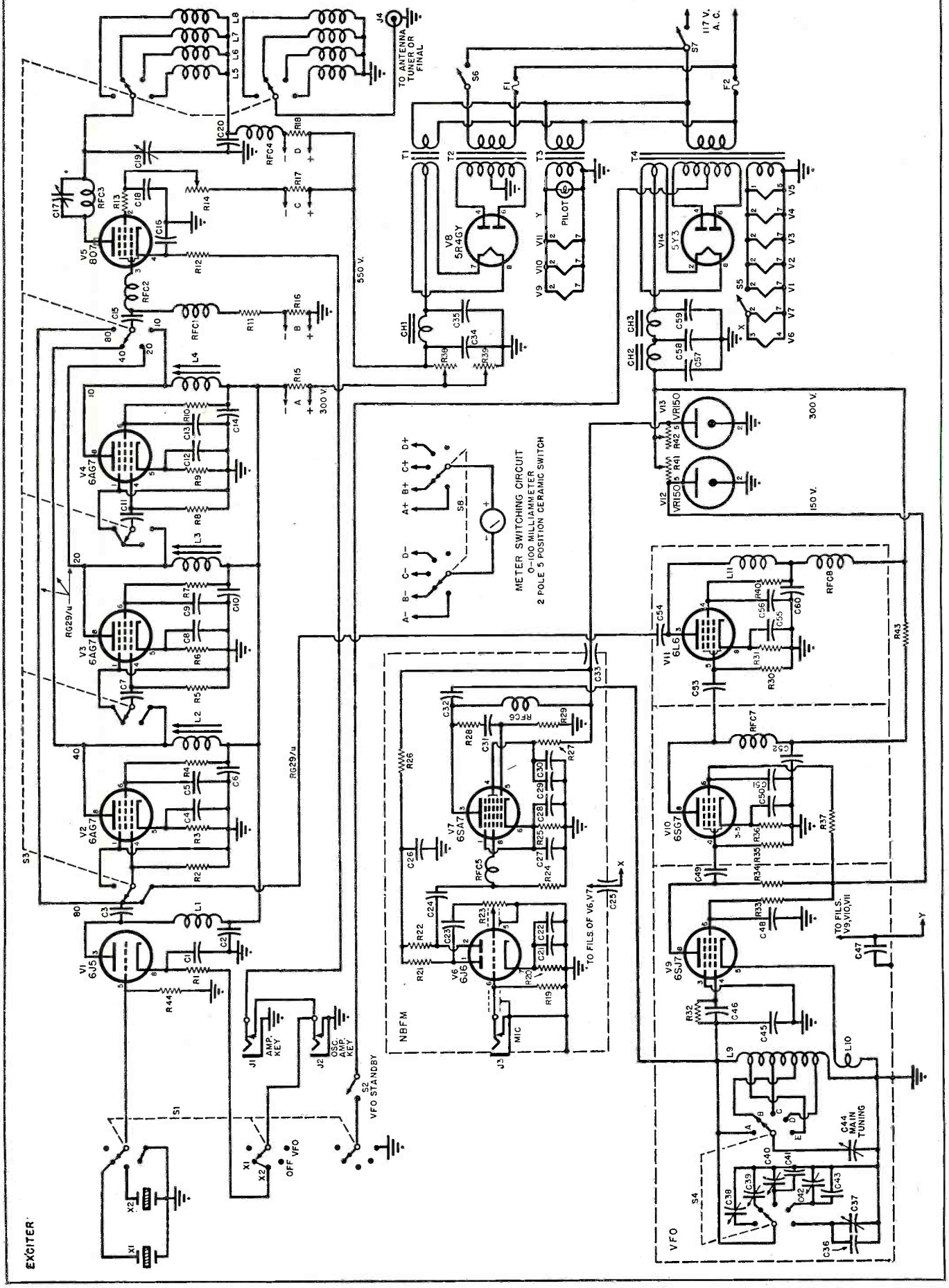
THE single-control bandswitching exciter unit of either home construction or commercial make is becoming more in evidence around ham shacks these days. Selecting a band, and working any frequency, either phone or c.w., certainly pays off in convenience and operating efficiency. This unit doesn't claim any great originality, being derived from various sources; but constructing, and making it work, offered some weekends of fun, and many a previously forgotten lesson was relearned!

The entire unit, v.f.o., NBFM, exciter, and associated power supplies, is mounted on a 13 x 17 x 3 chassis, with an 8¾ x 19 standard rack panel. The chromium-plated rack handles, obtained on the surplus market, "dresses up" the panel, and serves a utilitarian purpose as well since the unit takes on a little weight when completed. There's a lot of stuff on the chassis and under it; and one of the lessons which such compact construction teaches is that the judicious placement of parts and adequate shielding and bypassing are essential. Proper placement of components is important in order to provide for short leads in the two high-frequency stages. A lot of thought and reading went into the layout used here, and everything fits. Slight changes can, of course, be made to suit individual components.

The v.f.o. is conventional as to circuit, except for the novel bandspread feature for which Harms, W2JME, is responsible. Some juggling of taps and loading may be necessary in individual units, but the idea spreads all bands over the entire scale of the *National* Type ACN dial. The bandspread padders, which are connected across one pole of the 2-pole, 5-position bandspread switch, consist of a combination of variable and fixed condensers. The variables are the unique "Hi Q" *Philips* units made in Eindhoven, Holland, but available in this country. Their coaxial air dielectric type of construction makes them particularly suited for v.f.o.'s, and with the negative temperature coefficient *Ceramicons* indicated you'll have no "drift" troubles from that portion of the circuit. Once the band edges have been spotted with the variables, they can be locked with a spot of coil dope on the rotor screw and then left alone. The v.f.o. oscillator coil is wound on a ceramic form for further stability, and the wire stretched tightly as it is wound. The coil and bandswitch are mounted, along with all other components for the v.f.o. except the main tuning condenser, under the chassis in a shielded partition. This is located in a central position with respect to the exciter proper and the high voltage power supply, and is fitted with a removable bottom plate. A series of holes drilled along one end gives access to the "Hi Q" padders for adjustments. The various other components are mounted on convenient tie-strips. This leaves the shield removable after a couple of wires are unsoldered, a convenience when tinkering or getting at a part. The photo shows in some detail the construction, with the oscillator coil and bandswitch mounted on the front part of the shield. One of the most important lessons to remember in constructing the v.f.o. is that short leads with heavy wire are a must in order to achieve stability.

RFC_7 in the 6SG7 buffer plate circuit is mounted so that, in conjunction with a small aluminum baffle, no interaction will result on the grid coil of the 6SJ7 oscillator. The 6L6 output circuit is confined to the front portion of the v.f.o. shield can, with the plate coil in a small circular shield can on top of the chassis. An *RFC* could be used for the plate load of the output stage, or the untuned coil shown tuned by a brass slug, but adequate output over all bands results from the untuned coil, and it was left that way. The main tuning condenser for the v.f.o. is mounted on top of the chassis, and elevated by approximately 1" sleeves so that its shaft aligns with the ACN dial. The shield can around this condenser also encloses the oscillator and buffer tubes of the v.f.o., and is another must in order to keep the 807 output stage from reacting

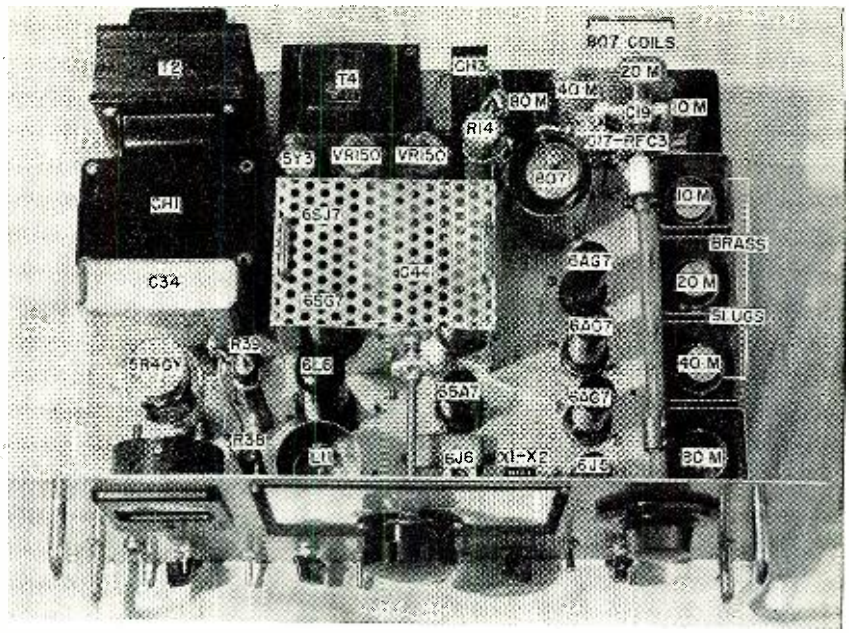
Schematic diagram of the complete unit. Full bandspread is available on all bands by means of separate padding condenser.



back on the v.f.o. grid circuit, since the two are fairly close, physically. Without the shield the 807 tank tends to "pull" the oscillator of the v.f.o., and a lot of spurious frequencies result, not to mention the erratic behavior of the 807 itself! The shield can is fitted with a perforated aluminum top to allow ventilation for the tubes, and a couple of small rack handles on each end of the top give the unit a slightly professional appearance.

The NBFM unit is also quite conventional, and utilizes one of the more simple reactance modulators to give direct FM. It occupies little space in the front portion of the v.f.o., a fact that requires some ingenuity in soldering! The shield between the v.f.o. 6L6 output stage and the FM unit is necessary to keep the r.f. where it belongs. In addition, the "B plus" and filament leads for the FM circuits are run through the shield in small 50 $\mu\mu$fd. feedthrough *Ceramicons*, the microphone jack is completely shielded, and all screen and cathode bypasses are shunted by mica condensers. The power supply requirements for the NBFM unit are quite modest, and a separate VR150 in the v.f.o. power supply gives a stabilized 150 volts. The voltage on the reactance modulator must be regulated or else the frequency of the v.f.o. will vary over too wide limits.

The exciter proper occupies the right 6" of chassis space, and comprises the 6J5 xtal stage, three 6AG7 broadbanded multipliers, and the 807 amplifier stage. Although the stability of the v.f.o. is excellent a xtal stage was indicated to allow for some spot frequency traffic work, and it was included with that in mind. The layout



Top view of the v.f.o.-exciter unit shows location of the major circuit components.

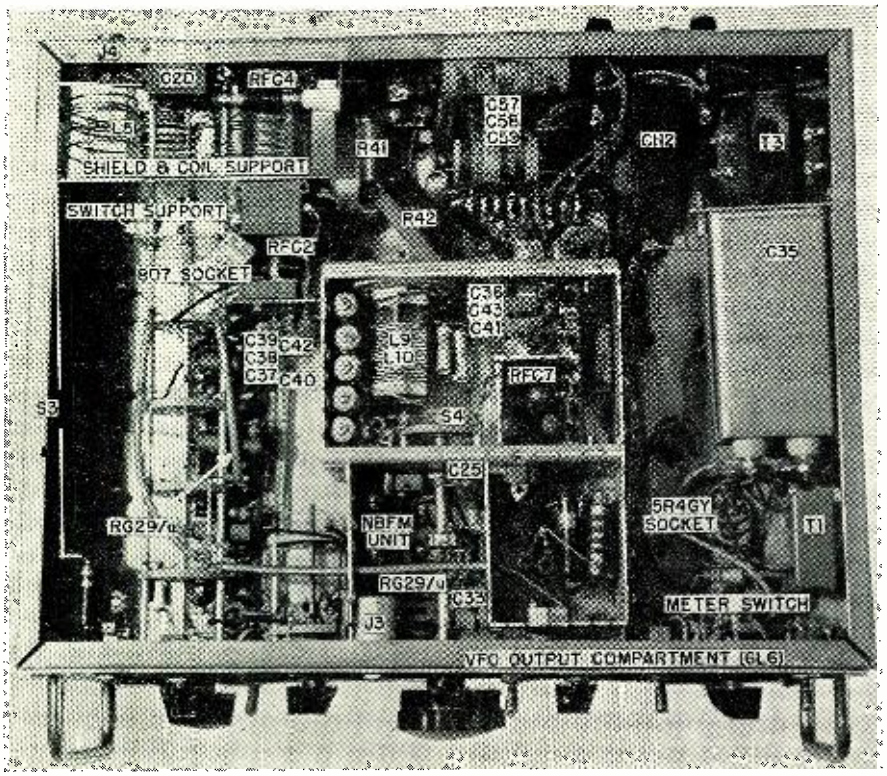
should be followed fairly closely, and construction and wiring done in sequence.

The biggest job is the bandswitch; but before assembling and installing the switch the chassis should be prepared by laying out and drilling the various socket holes, transformer mounting holes, and making the cutout for the 807 plate coil turret. This cut-out is 3" x 6" and is made at the extreme end of the chassis. The sockets for the exciter stages should now be mounted, the filament leads run, then the various bypass condensers and resistors installed *before* attempting to mount the bandswitch. This will save a lot of work, since there isn't much room under the switch wafers.

The bandswitch is made from *Centralab* parts, as follows: A K172 switch indexing assembly with 9" through-bolts, an extra pair of 6" through-bolts and detachable flat shaft, and an assortment of spacers K126 and 128. The switch wafers are type XX, 90 degree indexing ceramic wafers, single-pole, four-position. Four of these wafers are mounted on the 9" bolts and spaced with the 1" and 1½" spacers to position between the xtal socket and each multiplier stage socket. This puts the fourth wafer switch between

Complete parts list for the v.f.o.-exciter unit diagrammed on the opposite page.

R_1, R_3, R_6, R_9, R_{30}—270 ohm, 1 w. res.
R_2, R_5, R_8, R_{35}—100,000 ohm, ½ w. res.
R_4, R_7, R_{16}—10,000 ohm, 2 w. res.
R_{11}—12,000 ohm, 1 w. res.
R_{12}—100 ohm, 5 w. wirewound res.
R_{13}, R_{15}, R_{18}, R_{17}, R_{18}, R_{20}—47 ohm, 1 w. res.
R_{14}—60,000 ohm, 50 w. wirewound res. (with slider)
R_{19}—2.2 megohm, ½ w. res.
R_{21}, R_{22}, R_{30}, R_{31}—56,000 ohm, ½ w. res.
R_{23}—500,000 ohm pot.
R_{24}—470,000 ohm, ½ w. res.
R_{25}—680 ohm, ½ w. res.
R_{26}—2200 ohm, 1 w. res.
R_{27}—2700 ohm, ½ w. res.
R_{28}—47,000 ohm, ½ w. res.
R_{29}—220,000 ohm, ½ w. res.
R_{31}—400 ohm, 10 w. wirewound res.
R_{32}—330,000 ohm, ½ w. res.
R_{33}, R_{44}—10,000 ohm, ½ w. res.
R_{37}, R_{42}—2200 ohm, ½ w. res.
R_{38}—4000 ohm, 50 w. wirewound res. (with slider)
R_{39}—15,000 ohm, 25 w. wirewound res. (with slider)
R_{40}—25,000 ohm, 10 w. wirewound res.
R_{41}, R_{42}—5000 ohm, 50 w. wirewound res. (with slider)
C_1, C_2, C_4, C_5, C_6, C_8, C_9, C_{10}, C_{12}, C_{13}, C_{14}, C_{23}, C_{28}, C_{47}, C_{50}, C_{51}, C_{52}, C_{55}, C_{56}, C_{60}—.01 μfd., 400 v. paper cond.
C_3, C_7, C_{11}, C_{15}, C_{61}—100 $\mu\mu$fd., 500 v. mica cond.
C_{16}, C_{21}, C_{27}, C_{32}, C_{48}—.005 μfd., 500 v. mica cond.
C_{17}—3/30 $\mu\mu$fd. trimmer cond.
C_{18}—.002 μfd., 500 v. mica cond.
C_{19}—100 $\mu\mu$fd. var. cond.
C_{20}—.002 μfd., 1000 v. mica cond.
C_{22}—10 μfd., 25 elec. cond.
C_{24}, C_{29}, C_{31}—.001 μfd., 500 v. mica cond.
C_{25}, C_{33}—50 $\mu\mu$fd. Ceramicon feedthrough cond.
C_{26}, C_{30}—.1 μfd., 400 v. cond.
C_{34}—8 μfd., 1000 v. paper cond.
C_{35}—4 μfd., 1000 v. paper cond.
C_{36}—100 $\mu\mu$fd. negative coefficient Ceramicon cond.
C_{37}, C_{38}, C_{39}, C_{40}, C_{43}—3/30 $\mu\mu$fd. trimmer cond. (Philips "Hi-Q")
C_{41}—150 $\mu\mu$fd. negative coefficient Ceramicon cond.
C_{42}—160 $\mu\mu$fd. negative coefficient Ceramicon cond.
C_{44}—325 $\mu\mu$fd. var. cond. (Hammarlund MC-325M)
C_{45}—600 $\mu\mu$fd. negative coefficient cond. (three 200 $\mu\mu$fd. units in parallel)
C_{46}—33 $\mu\mu$fd. Ceramicon cond.
C_{49}, C_{53}—50 $\mu\mu$fd., 500 v. mica cond.
C_{57}, C_{58}, C_{59}—8 μfd., 450 v. elec. cond.
X_1, X_2—3500-4000 kc. crystal
S_1—3-pole, 5-pos. rotary sw.
S_2, S_5, S_6, S_7—S.p.s.t. toggle sw.
S_3—6-pole, 4-pos. rotary sw. (see text)
S_4—2-pole, 5-pos. rotary sw. (v.f.o.)
S_8—2-pole, 5-pos. ceramic rotary sw.
F_1, F_2—3 amp. fuse
CH_1—5-15 hy., 250 ma. swinging choke (Kenyon T-501)
CH_2, CH_3—15 hy., 75 ma. filter choke (Stancor C-1002)
L_1—55 t. #22 en. closewound on 1 5/16" dia. form
L_2—24 t. #22 en. closewound on 1 5/16" dia. form, tuned with 1" dia. brass slug
L_3—13 t. #20 en. closewound on 1 5/16" dia. form, tuned with 1" dia. brass slug (see text)
L_4—6 t. #18 en. spacewound on 1 5/16" dia. form, tuned with 1" dia. brass slug (see text)
L_5, L_6, L_7, L_8—Millen 4300 series coils for 3.5 mc., 7 mc., 14 mc., and 28 mc. band. Jackbars removed and coils mounted turret-fashion around bandswitch. Link on 7 mc. coil changed to 4 turns
L_9—22 t. #20 en. wound on 1½" dia. grooved ceramic form. Total coil used for 3.5-4 mc. range A; tap at 11 t. for 3.8-4 mc. range B; tap at 12 t. for 7-7.3 mc. range C; tap at 10 t. for 14-14.4 mc. range D; tap at 16½ t. for 28-30 mc. range E. All taps measured from bottom end of coil
L_{10}—6 t. #22 en. closewound at gnd. end of L_9
L_{11}—60 t. #24 en. closewound on 1 5/16" dia. form
T_1—Fil. trans. 5 v. @ 3 amps. (Thordarson T 21F03)
T_2—Plate trans. 540-0-540 v. @ 250 ma. (Surplus unit was used)
T_3—Fil. trans., 6.3 v. @ 3 amps. (Thordarson T 21F10)
T_4—Power trans., 350-0-350 v. @ 90 ma.; 6.3 v. @ 6.5 amps.; 5 v. @ 3 amps. (Stancor P6012)
RFC_1, RFC_4, RFC_5, RFC_6, RFC_7, RFC_8—2.5 mhy r.f. choke
RFC_2, RFC_3—See text
J_1, J_2, J_3—Closed circuit jack
J_4—Coaxial socket
Pilot—6.3 v. pilot lamp
1—0-100 ma. d.c. meter
V_1—6J5 tube
V_2, V_3, V_4—6AG7 tube
V_5—807 tube
V_6—6J6 tube
V_7—6SA7 tube
V_8—5R4GY tube
V_9—6SJ7 tube
V_{10}—6SG7 tube
V_{11}—6L6 tube
V_{12}, V_{13}—VR150 tube
V_{14}—5Y3 tube



Under chassis view. The oscillator and NBFM portions are enclosed in box shields.

the 10 meter multiplier and the 807 socket. The other two wafers are for the 807 plate coils, and are positioned at the rear, in the center of the cut-out space, on the extra 6" bolts. These two switch sections are joined by small aluminum sleeves ⅜" in diameter x 1" long, drilled and tapped for the bolts. These are 4-40 thread, and you'll need a small tap for this. Adjacent to the 807 socket is a bracket which supports the junction of the two through-bolts, against which the sleeves are tightened. The far ends of the 6" bolts go through the rear of the chassis and are locked by nuts run tight from each side. This results in a fairly long switch, but positions each wafer to permit short leads.

The shield which supports one end of the 807 plate coils extends the full width of the exciter portion of the chassis, and does not hold the band-switch. It provides isolation of the 807 coils that are positioned below the chassis top, and gives a nice support to one end of the coils by using small angle brackets bolted to the polystyrene strip. The other end of the coils, the "B plus" end, is strapped by a heavy bus and tied to RFC_4 and bypass condenser for support. The coils are arranged in turret fashion around the two rear bandswitch wafers, and can be installed quite easily. The 10 meter coil should be mounted and wired first, then the 80 meter coil, followed by the 20, and finally the 40 meter coil.

The 807 is shielded from the socket to the plate lead. This was accomplished by using sections of some old tube shields cut to fit the space under the chassis between the socket and the chassis lip. The socket is submounted 2¼". An additional shield with enough clearance for the bulb of the 807 is bolted to the top of the chassis. A few holes bored at random in the lower section of the shield provides ventilation. This shielding, with the addition of parasitic suppressors results in completely stable operation of the 807 on all bands.

The parasitic suppressors for the 807 consist of a small choke, RFC_2, in the grid lead, mounted right at the terminals. This choke consists of 10 turns of #22 en., ⅜" dia., self-supporting. Some experimenting with turns may be necessary in stubborn cases, but our own troubles cleared nicely with a choke of these dimensions. In the screen, a 47 ohm resistor is soldered right at the socket and takes care of troubles there. The plate suppressor, RFC_3, is wound with #16 tinned wire, ½" in dia., turns spaced the diameter of the wire. The coil is self-supporting, and the 3-30 $\mu\mu$fd. ceramic trimmer C_{17} is soldered across it. The whole thing is mounted on the 807 tank condenser, and the trimmer adjusted about half capacity.

The brass slugs used to tune some of the coils (see parts list for coil data) are not critical as to size. Any diameter from ¾" to a bit over 1" is OK. The ones used in this rig are 1" long, but this isn't important either, just so they fit inside the coil forms used without touching the leads fed down inside the forms. The slugs are drilled and tapped for the supporting bolts which mount in the center of the forms. Threaded brass rod of 8-32 size is recommended, and should extend about 1" above the top of the forms so the slugs can be screwed up and down for tuning. The bolts, and consequently the slugs, are insulated from the chassis and ground, i.e., they are left "floating," by reaming a hole in the chassis directly under the point where they come through the bottom of the coil forms.

Each coil in the exciter unit, including the xtal stage coil, is shielded by a square aluminum can, with an open top. Old 175 kc. i.f. transformer cans serve this purpose quite well. Despite the fact that each coil is at a different frequency, some troubles were encountered; shielding the coils cleared any tendency for the various stages to "take off" by themselves, a tendency aggravated by the high transconductance of the 6AG7's.

Before cementing the turns to the forms of any of the coils, line up the multiplier stages, using a wavemeter and flashlight bulb indicator. Some slight adjustments in the spacing of the turns of the 20 and 10 meter stages may be necessary, but the actual turns given in the coil table should be used if you want to hit the various bands.

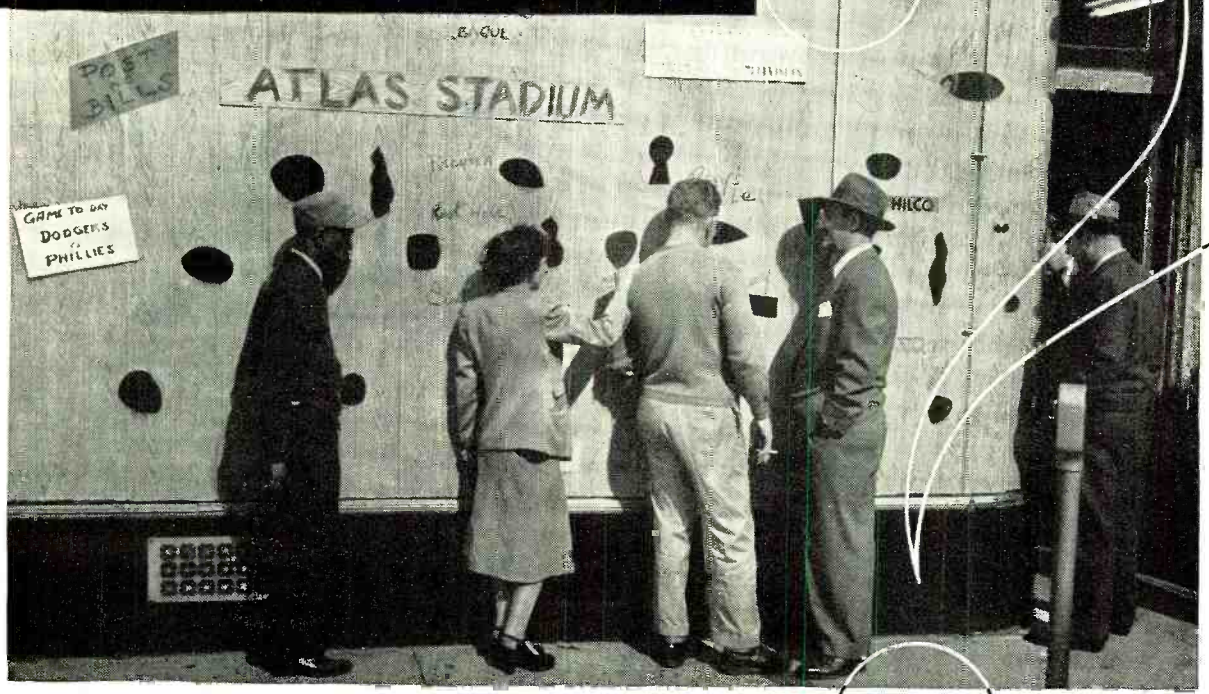
Testing and tuning is relatively simple, but as mentioned before a simple absorption wavemeter is absolutely essential. The v.f.o. output is always on 80 meters, and drives the 807 direct on that band with more than enough excitation. The "v.f.o.-xtal" switch can be set for either operation. In the v.f.o. position it connects the "B minus" to the v.f.o., disconnects the xtal stage cathode, and grounds the grid of that stage. In the xtal position it simply reverses the connections, as shown in the schematic.

On 40 the v.f.o., or xtal, drives the grid of the first 6AG7, and the grids of the other multipliers are grounded. The excitation should be set for the middle of the band, on the v.f.o., and the brass slug of the 40 meter coil should be run up and down the threaded rod until maximum brilliance is shown on the flashlight bulb indicator. Then check with the wavemeter to be sure you've got the 2nd harmonic! With the coils indicated no difficulty should be experienced.

For 20 meter operation, throw the bandswitch to that position and follow the same procedure as with the previous band. On 10 repeat the same adjustments. After each stage is aligned, the preceding stage should be retuned slightly. Both the 20 and 10 meter coils, L_3, L_4, require some adjustment of the turns spacing to get maximum output. In all cases tune the coils so that maximum drive results to the 807 grid, as indicated when the meter is switched to that circuit. As each stage is tuned the grid drive will drop slightly, but the result will be a series of "broadband" multipliers. A word of caution: the 807 just won't work properly unless the grid current is at least 2 ma. on all bands. This may require some tinkering with the

(*Continued on page* 165)

CURIOSITY Draws the Crowd



Spectators enjoying "today's game" through knotholes in the "stadium fence" show window of Atlas Appliance Co.

By DON BARRY

The talk of the town — this publicity stunt has increased television sales 33% since opening game.

A RECENT survey by *Sylvania Electric* showed that there are 4,600,000 families interested in buying television sets, and 2,700,000 of these indicate that they will *probably* buy this year. Allowing for the "dead-heads," 1,580,000 of the latter can be considered "good prospects." And you? Well—all you have to do is *sell* them.

And *sell them* is exactly what the *Atlas Appliance Co.* in East Orange, New Jersey, is doing by using an ingenious window display designed to attain other highly desirable results at the same time—with no additional bother whatsoever.

It seems that Mr. Herman Silberstein, owner of the store, located at 537 Main Street, had an extremely perplexing problem common to all television retailers throughout the country. Video fans were crowding inside the store to watch the programs, making it exceedingly difficult to get to and wait on properly those customers who were not discouraged, or trampled, by the legion of onlookers. Ray Ober, who operates a service station opposite the *Atlas* store, came up with the window decoration idea for the solution. The germ of the idea was then blown up until it reached its present peak of perfection. As can be seen from the illustration, it is an imitation ballpark fence around the imaginary "Atlas Stadium."

At first, Mr. Silberstein and Manager N. Leopold thought of many ways in which they could accomplish the desired effect before utilizing ordinary wallpaper, but all the other methods were ruled out because there was a curve in the window by the side entrance. Regular wallpaper having the appearance of vertical wooden boards was used and was applied to the glass with the standard paste used by the trade. Then, knotholes of many shapes and sizes were cut at varying levels in the "wall" to accommodate all comers, no matter how small or how tall. There is even a slit near the bottom of the window which is appropriately labeled "carriage trade." While I watched, a woman with two children in a stroller stopped to peer through one of the openings, and the tiny passengers, not to be outdone by mama, put their exclusive "peep-hole" to good use. Luckily, mama grabbed the stroller before it toppled over.

Writing on the fence was done with crayon and is typical of that found on any fence, anywhere, where a youngster discovers to his pleasure that both a fence and a writing instrument are available to him simultaneously. If you've ever seen a ballpark fence, you've seen the knotholes labeled; that is, the youths applied their names to the holes in hope of reserving them for their own personal use. Needless to say, these were not omitted on the *Atlas* "fence." Misspelled words and backward S's add even more to the realism of the masterpiece.

Seeing a specimen of the hieroglyphics on the fence, a young woman stopped in and, addressing Mr. Leopold, said proudly, "Don't you know how to spell 'Giants'?"

"Did you ever yet see a kid who didn't spell 'Giants' that way?" answered the amused manager, "It's always 'G-i-n-t-s.' And that's why it's spelled that way on our window."

Inside the fence, two television sets are rigged up so that all "peepers"

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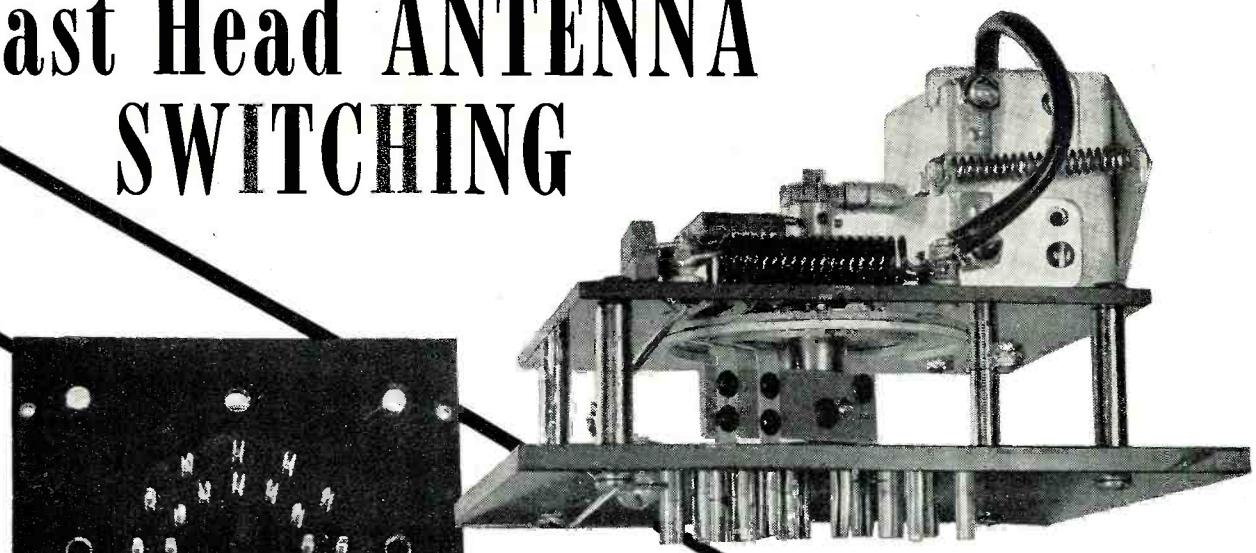
Mast Head ANTENNA SWITCHING



(Above) Antenna switch with cover removed. (Left) Bottom view of the switch showing the terminal arrangement for connecting as many as twelve 300-ohm transmission lines.

By DANA A. GRIFFIN
Communication Measurements Lab., Inc.

Any one of twelve antennas may be selected with this system by pressing a button at the receiver.

RECEPTION of television programs has created an enormous amount of interest in the subject of receiving antennas. This is due to two factors: First, the problem of securing sufficient signal strength in fringe areas; second, the problem of eliminating indirect path signals that cause ghosts. Usually the two difficulties do not occur together, but there is a considerable number of places where weak signals and ghosts are encountered as a two-fold problem on one or more channels. Obviously, the best answer to both problems is the use of a separate antenna on each channel that responds to one channel only. This will provide the greatest possible gain and the minimum amount of interference from man-made noises of all types. Lastly the ability to orient each antenna for a single station permits the ultimate in ghost reduction. In short, all compromises are eliminated with such a system.

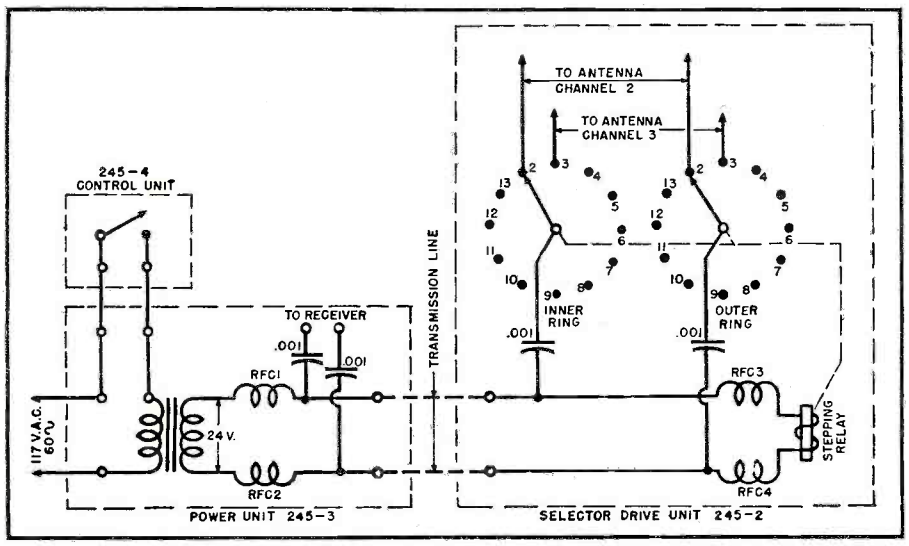
The desire to secure adequate signal strength over long distances has led to the use of multi-element Yagi-type antennas for single channels and the use of broadband stacked arrays. Another difficulty arises in receiving locations where the stations lie in different directions, or where multipath signals make it necessary to orient the antenna or antennas for the reception of each station. Two solutions of these problems have been available heretofore. One or two broadband antennas are rotated by means of a motor, or individual antennas for each channel are permanently oriented in the desired direction, and a multiplicity of transmission lines is brought down to a selecting switch at the receiver.

Both of these methods have decided disadvantages. In the case of the rotary antenna the process of orientation is slow. Furthermore, in inexperienced hands the antenna may not be oriented properly. Capacity coupling between the lines is a likely source of trouble where a multiplicity of transmission lines is brought down to the receiver. In addition, a large number of lines makes the installation unsightly and expensive.

The Select-O-Vision switching system was developed by engineers at *Communication Measurements Lab., Inc.,* to provide a better solution to the problem of securing adequate ghost-free signals regardless of location.

This system is based on the use of

Fig. 1. Circuit diagram of the complete switching system.



an antenna switch which is located on or near the antenna mast. The switch position is remotely controlled at the receiver by means of 60-cycle pulses which step the switch around to any one of twelve sets of contacts. This permits the use of twelve antennas. Each antenna can be tuned and oriented to do the best possible job on a given TV station or in a given direction. The chief novelty of the Select-O-Vision system is that no extra control cable is needed. The normal transmission line serves two purposes. It brings the signals down to the receiver and transmits the 60-cycle switch positioning pulses to the antenna switch.

The drawing in Fig. 2 illustrates a complete Select-O-Vision installation. Only three antennas are shown for the sake of simplicity. Additional antennas can be mounted on the same mast, or relatively short lengths of transmission line can be run from other masts to the mast-head switch. A single coaxial or twin-lead transmission line is brought down the side of the building and into the building through a window or other convenient means. This line connects to two terminals on the control box. A short piece of transmission line is connected between the other two terminals on the control box and the antenna terminals of the receiver.

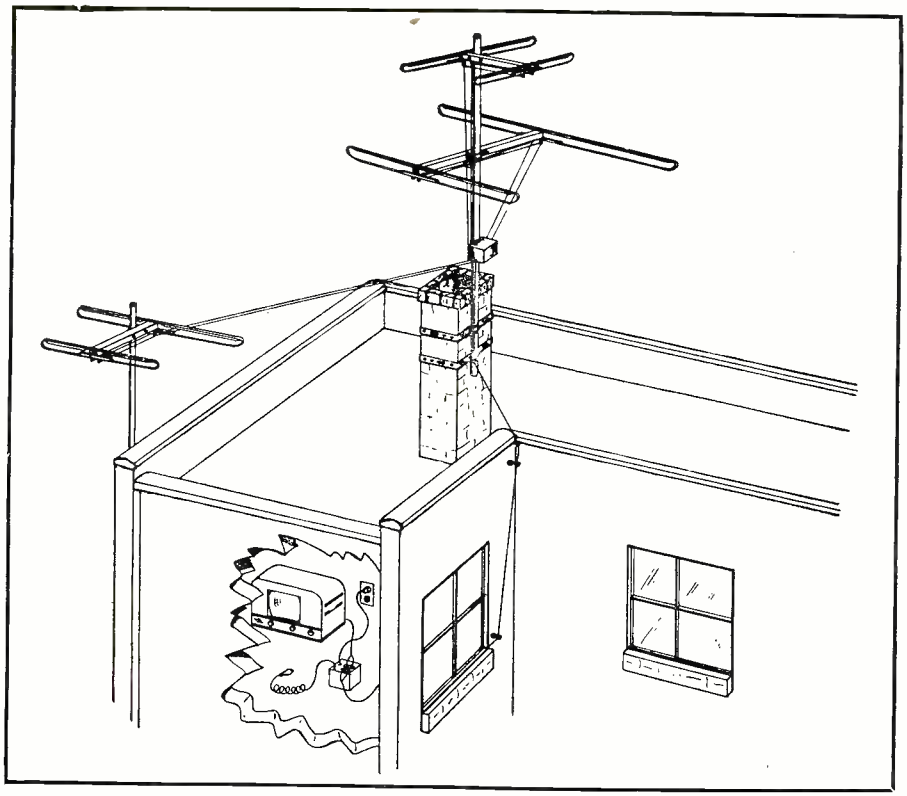


Fig. 2. Drawing of a complete Select-O-Vision installation.

Fig. 1 shows the schematic diagram of the Select-O-Vision switching system. The control box is connected to the 115 volt, 60-cycle line. The 24-volt secondary of the power transformer is connected to the transmission line through the isolating r.f. choke coils. The 24-volt, 60-cycle power is kept out of the input circuit of the television receiver by means of the blocking condensers. These condensers pass the signal with practically no loss, but offer a high impedance to the 24-volt output of the power transformer. Inasmuch as the primary of the power transformer is normally open, no current is drawn except when the control switch is closed to actuate the mast-head switch. For this reason, operating costs will not run over twenty-five cents a year. The control switch is a pendant type on a 6-foot flexible cord, permitting it to be placed at any position convenient to the set user.

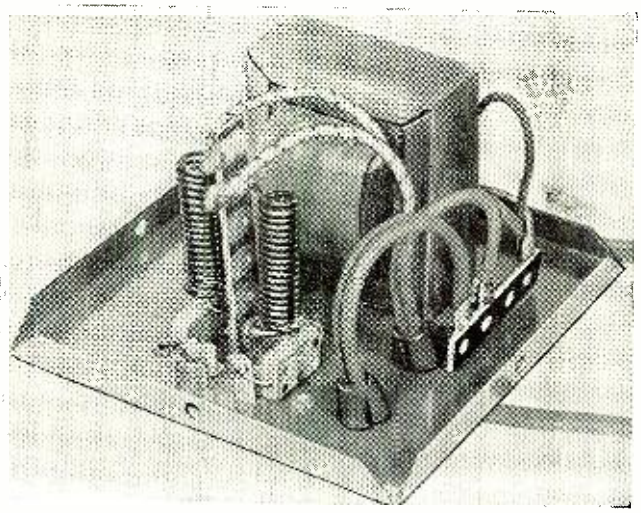
The 24-volt a.c. pulses are sent up the transmission line through r.f. isolating chokes to the winding of the stepper type relay. Every time the relay is closed, it operates a ratchet which, in turn, advances the rotary switch arm 30 degrees. The switch is a twelve-position, 2 pole unit employing a novel arrangement of slip rings and wide-spaced contacts to keep the line balanced and the losses low. Two blocking condensers are used to prevent the antenna from shorting the line from a 60-cycle standpoint. These condensers have a low reactance to the signal but a high reactance to 60 cycles, so that all of the latter current flows through the actuating relay winding.

Two of the photographs provide outside and inside views of the control box. This box should be located as close as possible to the receiver. The pendant switch can then be put within easy reach of the person operating the receiver, so that he can quickly shift antennas as he changes channels. No switch position indicator is provided, as the picture on the screen is the best possible indicator of antenna selection. This is particularly true with antennas designed to operate on a single

(*Continued on page* 157)

Outside view of control box showing the receiver and antenna terminal strips. The pendant switch ("control unit" of Fig. 1) is at the lower left of the picture.

Inside view of control box showing the r.f. chokes for isolating the incoming signal from the 24 v. secondary. The control box is labeled "power unit" in Fig. 1.



An Inexpensive PHOTOELECTRIC BURGLAR ALARM

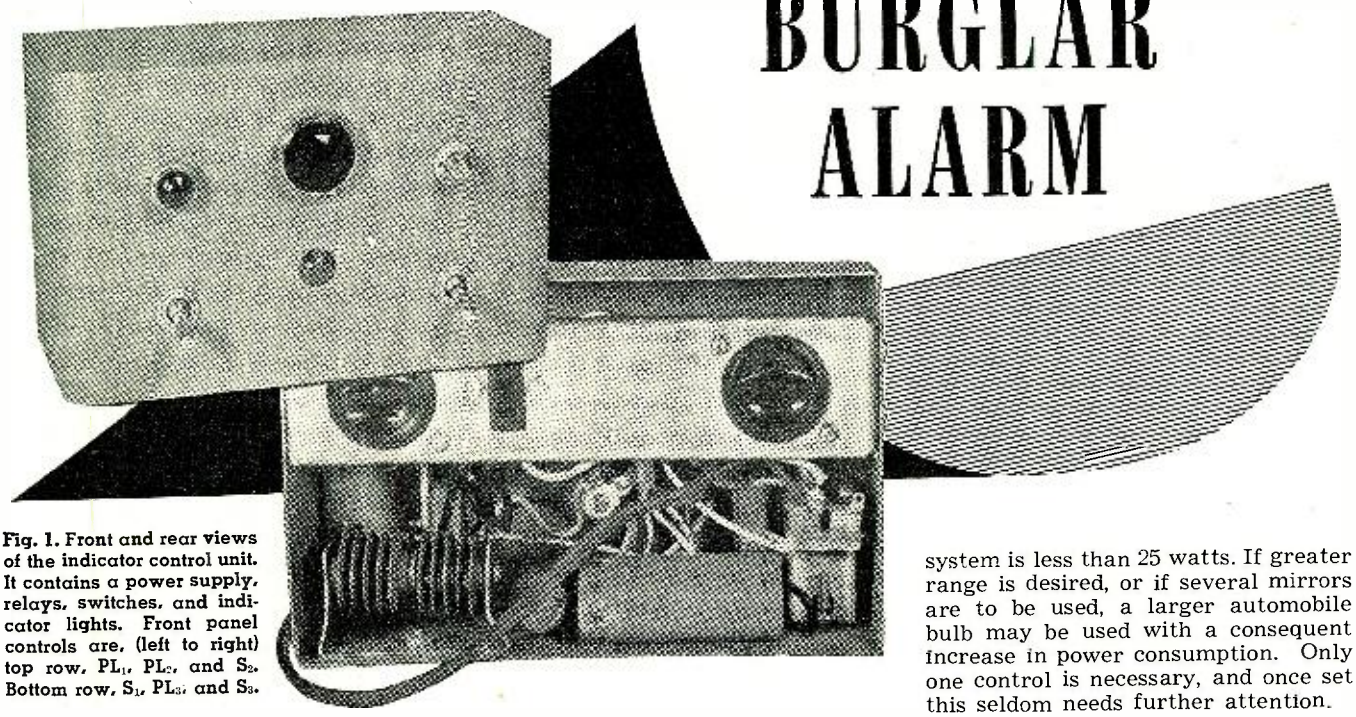


Fig. 1. Front and rear views of the indicator control unit. It contains a power supply, relays, switches, and indicator lights. Front panel controls are, (left to right) top row, PL_1, PL_2, and S_2. Bottom row, S_1, PL_3, and S_3.

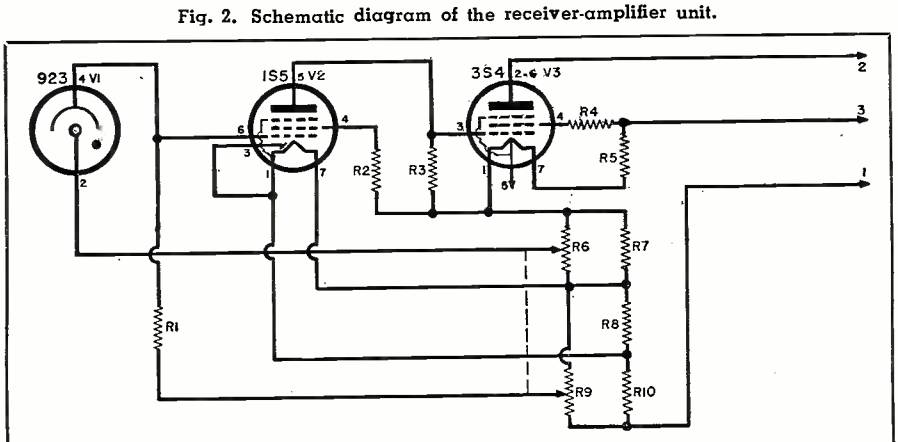
By CHARLES M. THORNE

Infrared filter provides black light operation in this easy-to-build photoelectric alarm system

A PHOTOELECTRIC device suitable for use as an effective burglar alarm requires a sensitivity much greater than is attainable in the conventional one-tube circuits. At the same time it should be economical to operate, simple to adjust, and as nearly foolproof as it can be made.

The effective range of the device described herein is limited only by the intensity of the light source. A two-candlepower, three-watt automobile instrument panel bulb, used in conjunction with a three-inch projection lens, gives a range of over 300 feet. The total power consumption of the system is less than 25 watts. If greater range is desired, or if several mirrors are to be used, a larger automobile bulb may be used with a consequent increase in power consumption. Only one control is necessary, and once set this seldom needs further attention.

Fig. 2. Schematic diagram of the receiver-amplifier unit.



R_1—10 to 100 megohm, ½ w. res. (See text)
R_2—3 megohm, ½ w. res.
R_3—1 megohm, ½ w. res.
R_4—33,000 ohm, ½ w. res.
R_5—1350 ohm, 5 w. res.
R_6, R_9—Dual pot. (IRC 3267 or equiv.) (See text)
R_7—1600 ohm, 5 w. res. (See text)
R_8—200 ohm, ½ w. res.
R_{10}—1800 ohm, 5 w. res.
V_1—923 phototube
V_2—1S5 tube
V_3—3S4 tube

Description

This alarm was constructed in three units to permit the utmost versatility. The indicator-control unit was built into an attractive, gray, wrinkle finished cabinet to be placed in a convenient location in the home. This unit contains the power supply, relays, switches, and indicator lights. The receiver-amplifier was built into a 3"x4"x5" utility cabinet which houses the condensing lens and phototube, the amplifier tubes, the bleeder resistors, and a sensitivity control. The third unit, the light source, contains the light, infrared filter, projection lens, and a filament transformer to supply six volts to the light. The instrument panel bulb (#55) would require only a half-ampere transformer. A 32-candlepower spotlight bulb would require a 4-ampere transformer.

Construction

Construction is not difficult since no special precautions are necessary. The tubes were mounted on a 3½"x3¼" sheet of metal, one side of which was bent over so that it could be bolted to the removable side of the cabinet. The metal need be only stiff enough to support the three tubes. A terminal board to hold the resistors and the sensitivity control was also mounted on the same panel. The phototube was mounted at the rear of the cabinet so that the condensing lens could be mounted directly to the cabinet, without requiring an extension. Parts were located in such a way that all light passing through the lens would reach the phototube.

Two *Amphenol* outlet sockets and a three-prong *Jones* socket were mounted on a strip across the back of the indicator unit. One outlet provides power to the light source when the system is turned on. The second is for an additional alarm such as a bell or buzzer, or for illuminating the yard by floodlights when an intruder interrupts the beam. A *Jones* plug, on the receiver-amplifier cable, plugs into the three prong socket.

Operation of the system is described as follows. Light striking the phototube causes a current to flow through R_1, (Fig. 2) overcoming the negative bias on V_2, and allowing that tube to conduct. Current flows through R_3, and biases V_3 so that the plate current is insufficient to close relay RL_1 (Fig. 3). When the light is interrupted, V_2 is cut off, removing the bias on V_3, and causing RL_1 to close. This relay energizes RL_2 (Fig. 3), which is wired to be self-locking, providing a continuous alarm until the reset button, S_2, is pushed. A warning light is also placed on a second set of contacts of RL_1 to indicate always when the beam is actually being interrupted.

To minimize any tendency of grid current, V_2 is operated at reduced filament voltage, permitting a grid leak of up to 100 megohms. The higher the value of this resistor, the greater will be the sensitivity. The dual potentiometer may be of any value from 50,000 ohms to one megohm. The "taper" of the two units must be identical, however.

The wiring should be carefully checked before any power is applied to the system. The pilot light will act as a fuse to protect the rectifiers but will probably not protect the tube filaments if the bleeder circuit is incorrectly wired. When the system is first turned on, the voltages should be checked to see that none of the tube ratings are exceeded. A voltage of 2.5 to 2.8 volts across the filament of the 3S4 will indicate that the bleeder current is correct. The bleeder current may be reduced by increasing R_7 up to 1800 ohms, or it may be increased by lowering this resistance to 1300 ohms. Any change, within these limits, will not appreciably alter the operation of the system.

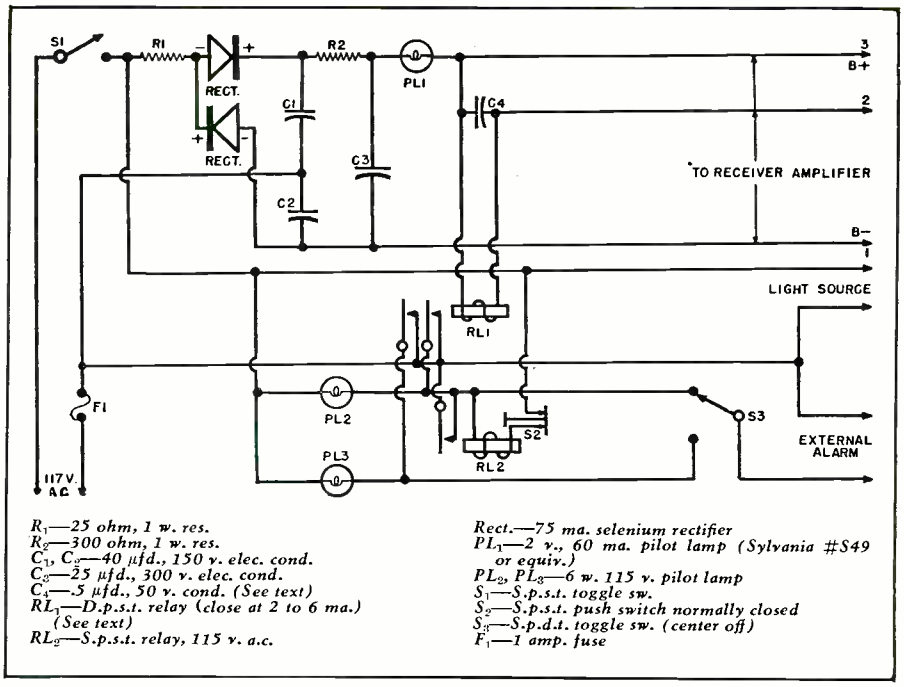
When testing the operation of the completed alarm, shield the phototube from all light and adjust the sensitivity control until relay RL_1 just closes. Aiming the phototube at a light should then cause RL_1 to open. Shielding the light from the phototube should cause RL_1 to close immediately. If there is excessive delay a smaller capacity of C_4 may be used. The purpose of this condenser is to prevent RL_1 from chattering, and its optimum value will depend on the resistance of RL_1 and the amount of "B+" ripple.

A diagram of the light source is shown in Fig. 4. A good-quality projection lens should be used and the light bulb carefully located at the focal point. This point can easily be determined by moving the light toward or away from the lens until an image of the filament is projected on an object about one hundred feet, or more, away. The infrared filter, if one is used, should be removable so that the light and the mirrors may be accurately aimed with white light.

High-quality polished mirrors must be used and kept clean if full advantage is to be obtained from the system. The receiver should be located in such a way that it cannot "see" the lights of passing automobiles, street lights, or other sources of unwanted light.

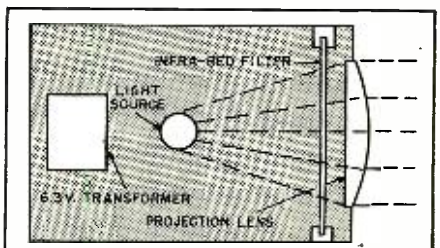
The reader is referred to the June, 1948, issue of RADIO NEWS for a general discussion of photoelectric devices and their applications. The system installed by the writer uses five mirrors to completely surround the house with an invisible beam.

—30—



R_1—25 ohm, 1 w. res.
R_2—300 ohm, 1 w. res.
C_1, C_2—40 μfd., 150 v. elec. cond.
C_3—25 μfd., 300 v. elec. cond.
C_4—.5 μfd., 50 v. cond. (See text)
RL_1—D.p.s.t. relay (close at 2 to 6 ma.) (See text)
RL_2—S.p.s.t. relay, 115 v. a.c.
Rect.—75 ma. selenium rectifier
PL_1—2 v., 60 ma. pilot lamp (Sylvania #S49 or equiv.)
PL_2, PL_3—6 w. 115 v. pilot lamp
S_1—S.p.s.t. toggle sw.
S_2—S.p.s.t. push switch normally closed
S_3—S.p.d.t. toggle sw. (center off)
F_1—1 amp. fuse

Fig. 3. Wiring diagram of the indicator-control assembly.



1—Filament trans. (See text)
1—2" dia. condensing lens, 3" focal length
1—3" dia. projection lens (perferably compound)

Fig. 4. Light source assembly. Unit contains the light, infrared filter, projection lens, and a filament transformer.

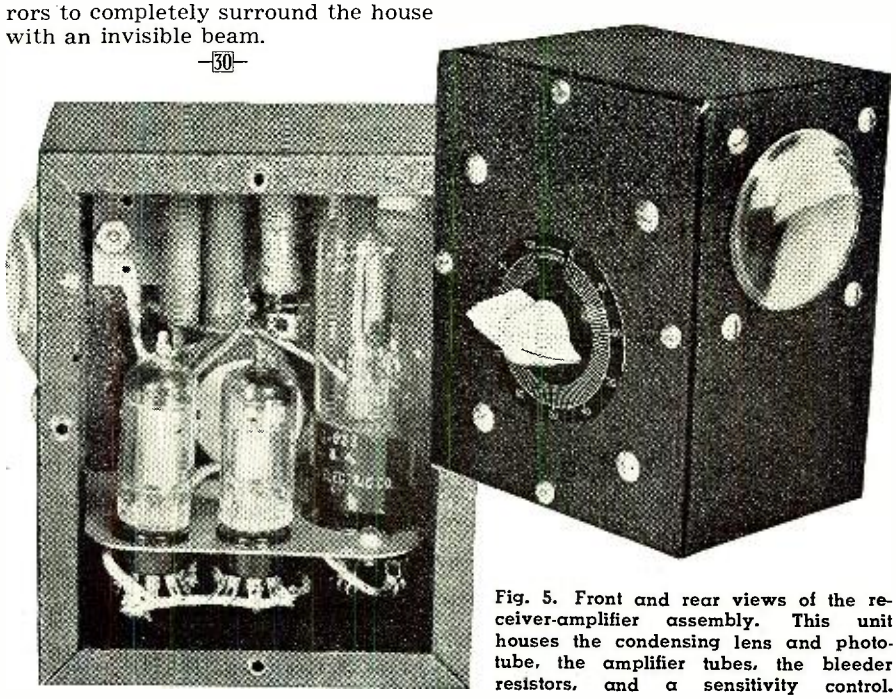


Fig. 5. Front and rear views of the receiver-amplifier assembly. This unit houses the condensing lens and phototube, the amplifier tubes, the bleeder resistors, and a sensitivity control.

SERVICING With a Sweep Generator

A conventional sweep generator suitable for visual alignment of AM, FM, and TV receivers.

By HOWARD E. ANTHONY
The Heath Company

Design characteristics desirable in a sweep generator and how such a generator may be used in TV servicing.

TELEVISION has hit us all with a terrific impact—barely two years ago it was still in the laboratories. Now over a million sets must be serviced, with probably two million more sets added this year. Obviously, TV servicing equipment is needed by every progressive service organization.

Let's consider the requirements. A television receiver consists of a tuner covering a spectrum ninety times as wide as the broadcast band, an FM sound superheterodyne receiver, an AM picture superheterodyne receiver, horizontal and vertical sweep circuits, and high and low voltage power supplies.

The i.f. sections must pass a bandwidth of 4½ mc., and the adjustment of this is today the service technician's most difficult job. This i.f. channel must amplify a bandwidth three times as wide as the entire broadcast band, and yet it must keep out frequencies on either side. Some form of visual alignment is a necessity, and the sweep frequency generator was developed for this purpose.

The balance of the TV receiver offers no difficult service problems and requires no special equipment (other than voltmeters capable of measuring the high voltages encountered). The r.f. and oscillator sections are best aligned on the actual stations wherever possible. Most service technicians are familiar with, and equipped for, FM servicing, and the power supply and multivibrator sections respond to normal voltage checking.

A sweep generator should cover the entire TV range of frequencies, have a sweep width of over 10 mc., have some means of identifying by marker any portion of the trace being viewed, and have a sufficient output to allow stage-by-stage alignment.

A first problem of the design of a sweep generator is covering the wide range required and, at the same time, sweeping the center frequency of this range sufficiently for observation of the response of any channel of the television receiver and providing also the same sweep width for the i.f. frequencies. Electronic sweep with a reactance tube is eliminated; first, because of its limited sweep width (about 4 mc. at i.f. frequencies) and, second, because of its lack of linearity.

Elimination of this method leaves only some form of mechanical sweep which can be capacitive or inductive. Capacitive sweep requires a considerable capacity range to obtain the required width and becomes extremely critical in adjustment and costly in construction. Thus, mechanical inductive sweep is the logical type. A simple application would be to place an aluminum cup on a speaker voice coil and mount the speaker so the cup is in the same plane and near the tank coil of the master variable oscillator. Applying 60-cycle a.c. current to the speaker voice coil forces the aluminum cup closer to and away from the tank coil at the 60-cycle frequency. As a greater voltage is applied, the cup travels farther each way. Thus the actual inductance of the coil is varied and with it the frequency. By calibrating the voltage applied to the voice coil in terms of sweep frequency width, a scale can be established.

In selecting mechanical inductive sweep, the choice of the master oscillator frequency is important, as it is not feasible to have more than one master oscillator coil and sweep speaker assembly. To cover the frequency range, it is obvious that a portion of the range must be covered by beat frequencies obtained by beating the master oscillator against a fixed oscillator and using the sum or difference frequencies. It is possible to select one master oscillator range and one fixed frequency by which, using both the sum and difference frequencies and the fundamental, the entire band is covered. This, however, results in such a confusing assortment of frequencies being present at the output that the average user is completely baffled as to which is the correct one. By properly selecting the variable and fixed oscillator frequencies, the equivalent of all fundamentals can be achieved. The master oscillator should be at the high end of the range, thus placing its harmonics far beyond the present TV band. The fixed oscillators are selected to allow only the difference frequencies to fall in the TV band and, thus, all except the desired frequencies are eliminated.

In the TV sweep generator shown, the master oscillator range is 165 mc. to 220 mc. Fixed oscillator frequencies are 165 mc. and 275 mc.; thus the difference frequency between 165 mc. fixed oscillator and 165—220 mc. variable oscillator is 0-55 mc., while the sum frequencies, 330 to 375 mc., are beyond the limits of the TV band.

Likewise the difference frequency between 275 mc. fixed and 165 to 220 mc. variable oscillators is 55 to 110 mc., while the sum frequencies are again beyond the present TV band. By controlling the fixed oscillators with a switch and switching only to the one in use, shutting off both when the master oscillator band is being used, the equivalent of band switching fundamentals is achieved.

Marker Identification

As the visual trace being observed on the oscilloscope is five or more megacycles wide, the actual location of the peaks of the several i.f. stages, as well as sound and picture carrier locations, is necessary. To establish these locations, some form of marker is required which can be moved through the trace at will and give the accurate location of all points in the trace. An additional oscillator can be used but with several disadvantages: One, the oscillator beats with the sweep master oscillator, causing confusing beats and false locations; two, the oscillator produces harmonics which give the same indication as the fundamentals and also produces beats; and three, the indication given by an oscillator is usually quite wide, resulting in uncertain locations.

One and five megacycle crystal oscillators have been used, but here again confusion reigns—the twentieth or more harmonic of one megacycle is extremely faint, and the uncertainty of a 5 mc. harmonic pip being the 20 or 25 mc. point usually takes unnecessary service time to definitely ascertain, and, in addition, this oscillator does not identify the peaks between.

The only logical and certain marker is the absorption type, which consists of a tuned circuit connected to the output of the sweep generator covering the range to be identified. A tuned circuit effectively absorbs the output of the generator at its resonant point, and causes a small "V" shaped pip to appear in the trace at the frequency removed. One main advantage of the absorption type is that it works only at the one fundamental frequency. Further, it removes a clean pointed pip indicating the exact frequency. By using a potentiometer in the primary of the tuned circuit, the amount of absorption, and thus the size of the pip, can be controlled. (See "Build This Absorption Type Marker" by Guy Dexter in the June 1949 issue of RADIO & TELEVISION NEWS.)

A marker indication is necessary primarily in the i.f. frequencies where the several stages must be identified, and thus it should cover 19 to 40 mc.

Because the gain of i.f. stages in TV is greatly reduced to widen the bandwidth, high output from a sweep generator is essential. In the unit shown, transmitting type triodes were used to obtain this output which is in excess of ½ volt on all ranges. High output, however, requires control necessitating a step type attenuator with a ten-thousand to one range.

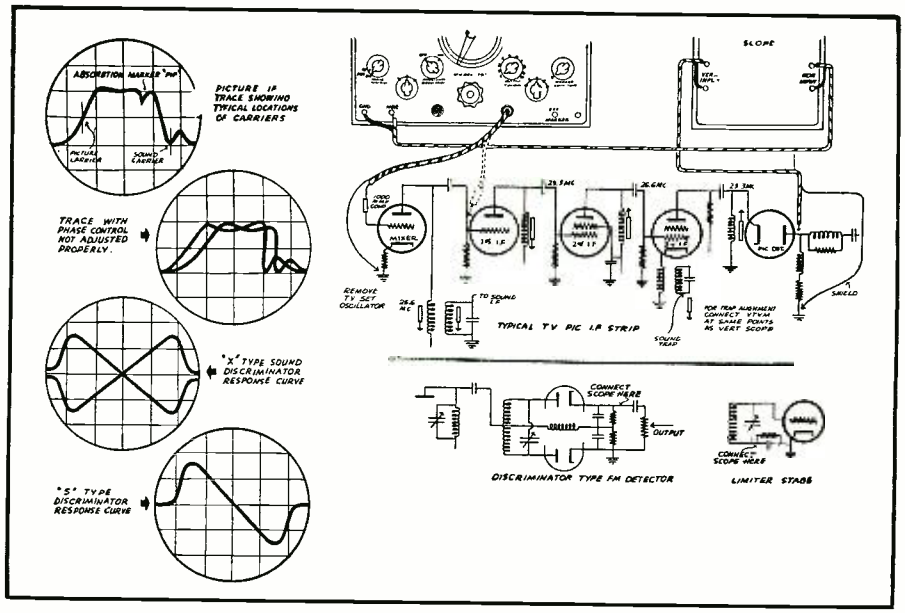


Fig. 1. A sketch showing a few of the many uses of a properly designed sweep generator when used in visual alignment techniques.

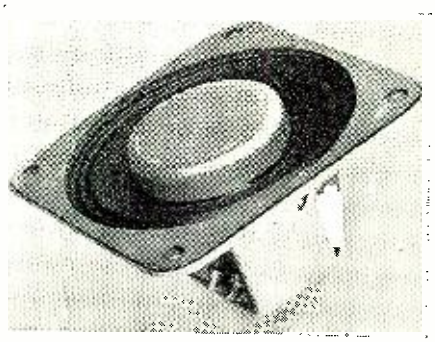
AM modulation is provided as a convenience in signal tracing television receivers and also in trap alignment. This AM is produced as 400-cycle sawtooth audio by a neon oscillator.

Sweep voltage for the horizontal amplifier is taken from the same point that supplies the internal sweep speaker and a conventional phase shifting network is provided.

Use of TV Sweep Generator

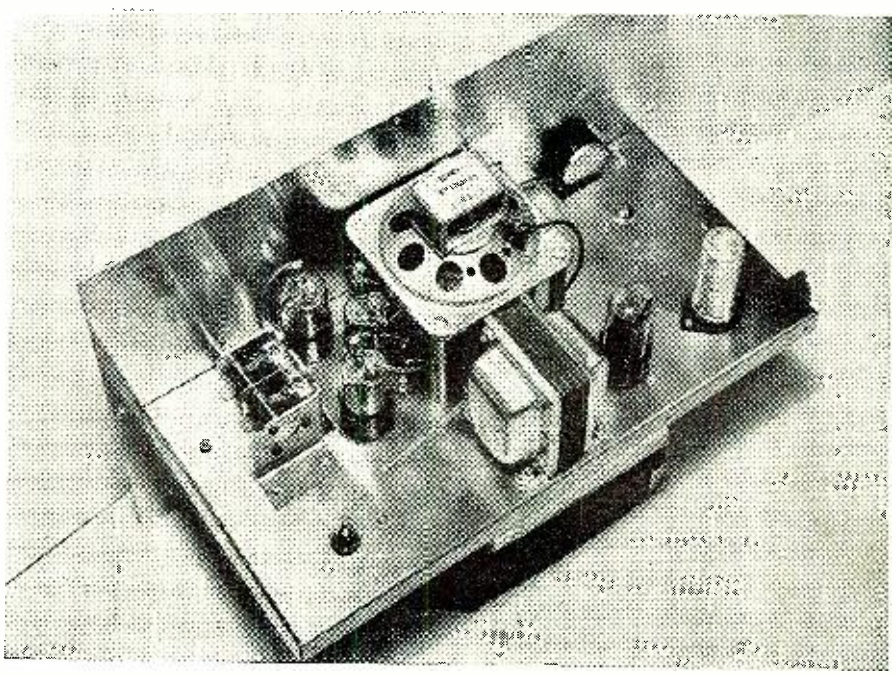
Connection between the sweep generator and the TV receiver should be made with shielded cable, with the shield grounded at each end. An additional short, flexible braid ground should be used between the chassis of the two instruments. Horizontal sweep voltage should likewise have a shield-

(*Continued on page* 152)



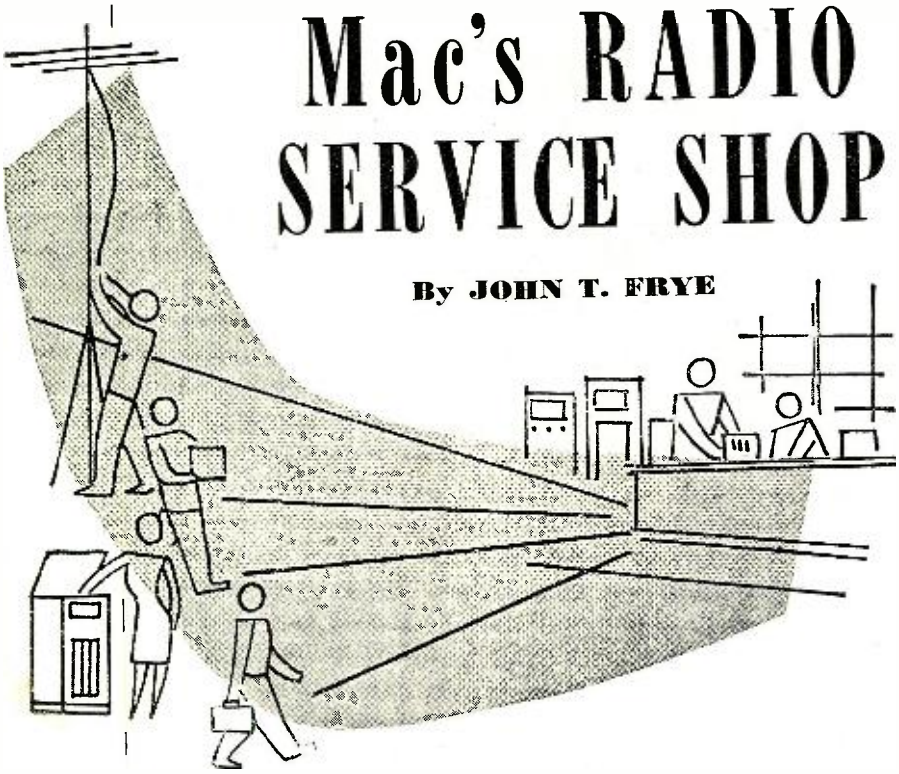
An aluminum cup driven by a loudspeaker at 60 cycles is used as a mechanical inductive sweep. This cup is located near the tank coil of the master variable oscillator. Thus, the actual inductance of this coil is varied and with it the frequency. Photo below shows position of speaker on chassis.

Top view of the chassis of the sweep generator shown on previous page.



Mac's RADIO SERVICE SHOP

By JOHN T. FRYE



BARNEY TALKS A.C.-D.C.

MAC peered through the open door of the service department and saw the lanky form of Barney, his apprentice, silhouetted against the bright September morning sunlight that was pouring through the front windows of the service shop.

"Oh, Mr. Gallagher," Mac called, "as soon as all of the pretty little high school girls have passed on their way to school, would it be too much to ask you to come back here and help me get out a batch of these a.c.-d.c. sets?"

Barney heaved a big sigh as he reluctantly turned away from the window.

"Only a man without the least shred of poetry in his soul could say a thing like that," he muttered bitterly. "To ask me to turn my thoughts away from—well, from what I was thinking about—to a consideration of a.c.-d.c. receivers is to suggest a transition from the sublime to the ridiculous."

"Spoken like a veteran service technician!" Mac applauded. "Cussing the a.c.-d.c. sets is the badge of the radio man who has really 'arrived.' It serves the same purpose as the complaint of the kid who has just returned from his first year away at college to the effect that the old home town is dead and ought to be buried. Sort of shows you are sophisticated, you know."

Barney looked sharply at his employer. "You trying to pull my leg?" he demanded suspiciously.

"Perish the thought!" Mac said blandly.

"Do *you* like a.c.-d.c. sets?" Barney wanted to know.

"Well, I like to eat; and so-called a.c.-d.c. receivers furnish me with a very sizable portion of my bread and butter."

"Why do you say 'so-called' a.c.-d.c. sets?"

"It was a poor choice of words. They *will* work on either 110 volts of alternating or direct current; but not many of them have an opportunity to function on d.c. The main idea in the original design of the circuit was to get rid of the power transformer and so reduce the bulk, weight, and cost, all in one fell swoop. It happens, though, that subtracting parts is not good sales psychology. The salesman likes to be able to tell the customer about the 'extra' features that have been added. That is why, instead of saying 'This receiver has no transformer,' he says, 'Now here is a receiver that will work on either alternating or direct current.'"

"Of course," Mac mused, "here in the United States, the likelihood that the ordinary individual would ever have occasion to plug his set into a 110 volt d.c. main is about as remote as that of his using his electric razor to take the fuzz off peaches; but the fact remains that it *could* be done."

"I notice that the sets we get in that use 25Z5's, etc., seem to have less tube trouble than the ones using either the 35Z5 or the 35W4 strings. Why is that? Can't we make tubes as good now as we used to make them?"

"I'm glad you noticed that," Mac said. "It is encouraging to know there are rare occasions when an object does not have to be edible or wear skirts to attract your attention. In the first place, you must know that it is the heavy first surge of current that flows through a cold filament that does the most damage. When the filament is cold, its resistance is only a fraction of what it is when the tube is at its proper operating temperature. The heavy current that flows when the set is first turned on and the magnetic fields accompanying such currents cause the loops of the filament to writhe inside the cathode sleeve and produce fractures of the filament wire."

"Yeah, but the 25Z5 draws 300 mils of filament current, while the 35Z5 and the 35W4 only take 150 mils," Barney pointed out. "It looks like the 25Z5 filament would be the one doing the most wriggling."

"Quite true, but remember the heavy-current type always uses a resistor in series with the filament string to make up for the difference between the total tube voltages and the line voltage. Sometimes this resistor is in the line cord; sometimes it is in the form of a ballast tube inside the set; but it always serves to remove the shock of that first current surge from the tubes. When the set is first turned on, most of the voltage appears across this resistor; then, as the tube filaments gradually warm up and increase their resistance, the voltage division gradually shifts to the proper proportion between the line resistor and the filament string."

"Which is better: the line cord resistor or the ballast tube?"

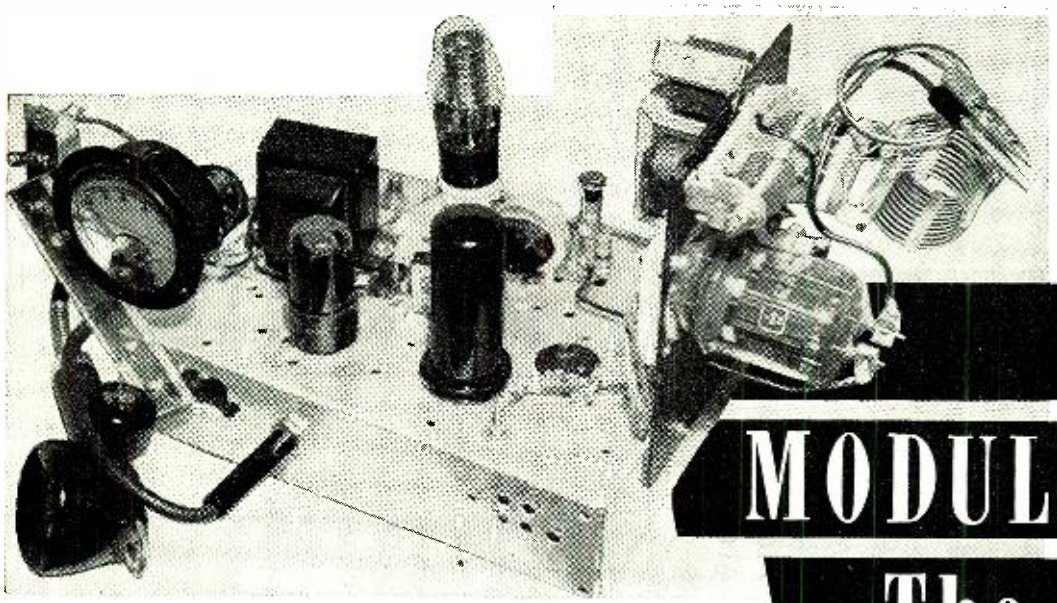
"Each has its advantages. The line cord resistor serves to put the heat dissipated by the voltage dropping resistor outside the cabinet, and this increases the life of the filter condensers and other units adversely affected by heat. On the other hand, the line cord will not take too much abuse without the resistance element breaking. What is more, we always have the amateur 'fixer' who decides he does not need all of that long line cord on his receiver and proceeds to cut off two or three feet of it; and then he wonders why his tubes burn out so quickly. While the ballast tube releases all of its heat inside the cabinet, it is usually a better deal if the set is to be carried about much or plugged in and out quite often."

"Would you say the fact that no series resistor is used with the 150 mil type of tube accounts for their shorter life?"

"Not altogether. These tubes are an improvement over the former types in the particular respect that they have more efficient filaments. Since they draw only half as much current, and since the wattage consumption is equal to the product of the voltage and the current, a string of 150-mil tubes will twirl the watt-hour-meter only half as fast as a 300-mil string. On the other hand, the filaments of such tubes are smaller, or at least more fragile, and they are subject to filament failures more often than the older tubes.

"But you are the fellow who is knocking the a.c.-d.c. receivers," Mac broke off. "What else is wrong with them outside of the fact that they help us sell a lot of tubes?"

(*Continued on page* 156)



Experimental setup used to test the possibility of internal modulation of the 829-B tube. Across the front are the meter, 6SN7 speech tube, and the 6L6 oscillator. In back of the 6SN7 is the audio transformer. The iron core filter chokes are mounted on the back of the vertical panel.

SELF MODULATING The 829-B

By OTTO L. WOOLLEY, W8SGG

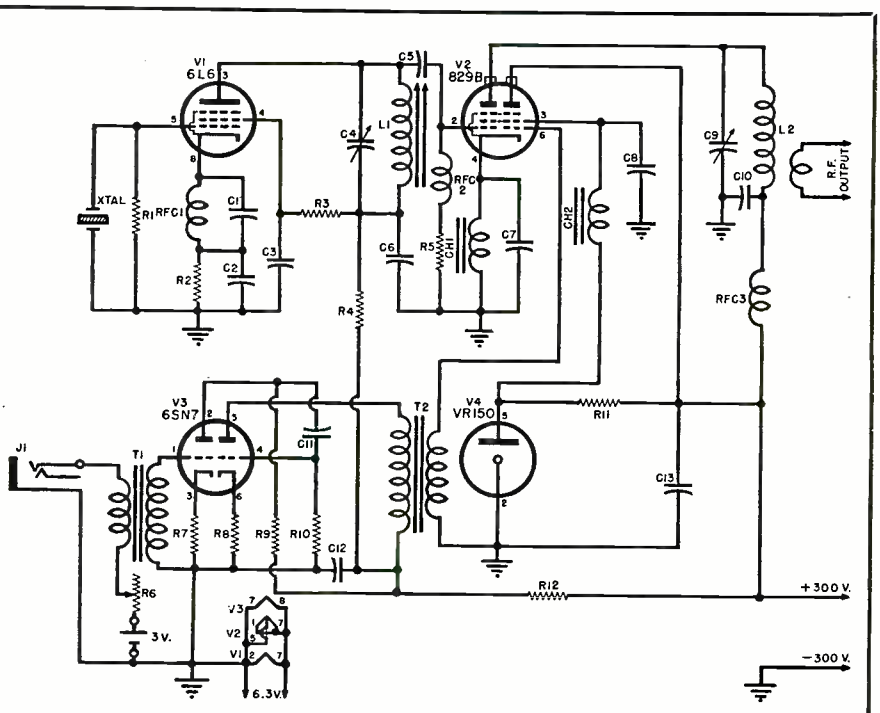
A novel method of using a single 829-B as an r.f. amplifier and modulator. The common cathode and screen are modulated.

AMONG the other popular tubes on the surplus market is the 829-B twin tetrode. In reviewing the specifications and performance data for this tube, the question arises as to the possibility of self modulation through the common cathode and screen circuits, by operating one-half of the tube as a conventional "Class C" r.f. amplifier and operating the second portion as a power audio stage.

The diagram shown herewith is a circuit used to investigate the aforementioned possibility in actual practice. Modulation is possible with this setup. The circuit constants shown are not to be considered optimum in any case, but are the result of construction with parts on hand. However, the circuit as shown has been used a few times for local 10-meter roundtables, and the reports have been better than anticipated, considering the strictly experimental construction.

As the diagram shows, a 6SN7 is used as a cascade amplifier—transformer coupled to one 829-B grid as an audio power stage. A T-17-B carbon microphone was used in the interest of simplified speech section construction. In the r.f. portion, a 6L6 doubles a 40-meter crystal to give 20-meter drive to the 829-B. Doubling is also done in the final stage to eliminate any self-oscillation tendencies that might give rise to misleading

(*Continued on page 98*)

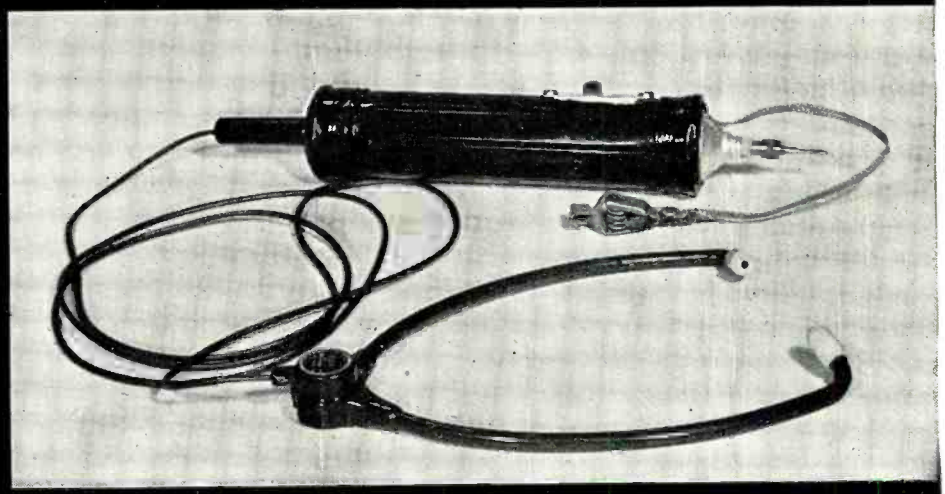


Circuit diagram used to check the performance of the 829-B as a self-modulating tube. One-half of the tube is used as a conventional "Class C" r.f. amplifier and the other half as a power audio stage.

R_1—100,000 ohm, ½ w. res.
R_2—220 ohm, 10 w. wirewound res.
R_3—27,000 ohm, 2 w. res.
R_4—500 ohm, 1 w. res.
R_5—15,000 ohm, 2 w. res.
R_6—1000 ohm, wirewound pot.
R_7, R_8—1500 ohm, ½ w. res.
R_9—270,000 ohm, ½ w. res.
R_{10}—470,000 ohm, ½ w. res.
R_{11}—2000 ohm, 20 w. wirewound res.
R_{12}—2500 ohm, 10 w. wirewound res.
C_1—100 μμfd. midget mica cond.
C_2, C_3—.002 μfd. @ 400 v. cond.
C_4—50 μμfd. midget var. cond.
C_5—150 μμfd. midget mica cond.
C_6—.005 μfd., @ 400 v. cond.
C_7, C_8, C_{10}—.001 μfd. @ 400 v. cond.
C_9—35 μμfd. var. cond., double spaced
C_{11}, C_{12}—.01 μfd. @ 400 v. cond.
C_{13}—.02 μfd. @ 400 v. cond.
L_1—12 t. #22 en. closewound on ½" dia. slug-tuned form
L_2—B & W 75 w., 10-meter coil, end link
RFC_1, RFC_2, RFC_3—2.5 mhy. r.f. choke
CH_1—150 ma., 350 ohm filter choke (see text)
CH_2—40 ma., midget filter choke
T_1—Single button mic.-to-grid trans.
T_2—Interstage trans., 3 to 1 ratio.
Xtal—7.0 mc. band crystal to quadruple to 28 mc. phone band
J_1—2-circuit mike jack
One—3 v. "A" battery
V_1—6L6 tube
V_2—829B tube
V_3—6SN7 tube
V_4—VR150 tube

A Pocket Signal Tracer

By
J. L. BARBER



THIS little instrument is just the size of an ordinary flashlight, - - but it will follow a signal all the way through the r.f., i.f. and a.f. sections of a standard broadcast receiver. It is sensitive enough to pick up a signal from a local broadcasting station without the benefit of any other attachments, and yet it requires no batteries or other source of power. It can be carried in the pocket as readily as a physician's stethoscope and since it does not need any outside source of power, it is immediately available for use under any circumstances.

It can be constructed by anyone with average ingenuity and requires the purchase of very few parts. A flashlight, similar to the one pictured, a slide switch, a crystal diode, a small condenser, and an alligator clip just about completes the list of components. It does require a good high impedance set of phones or a sensitive microammeter, or both, for satisfactory operation.

To start with, procure a flashlight of the type issued to Navy personnel. It should have straight sides for easy assembling, and it is important that it be made of material that can be worked without too much trouble. It does not have to be metal, but the one in the picture was metal with a threaded cap on each end. All the "insides" should be removed and then the switch is carefully taken off. The hole left by the removal of the switch should be enlarged to accommodate the slide switch. If a small enough switch can be obtained, it may not be necessary to enlarge this hole. In making the instrument in the picture, the switch was purchased in a surplus store and it happened to be quite large. This switch may be attached with screws or sheet metal screws but in either case it will look better if a nickel or black plate is used.

Although the parts list calls for single-pole, double-throw switch with neutral position, this is not easily obtained. If, however, one of the well-known *Stackpole* switches is used, the neutral position can be improvised. The top is removed, the steel ball taken out, and the top replaced. The switch will not snap into position with this ball removed, and all that remains to be done is to mark the point at which the switch is in neutral position.

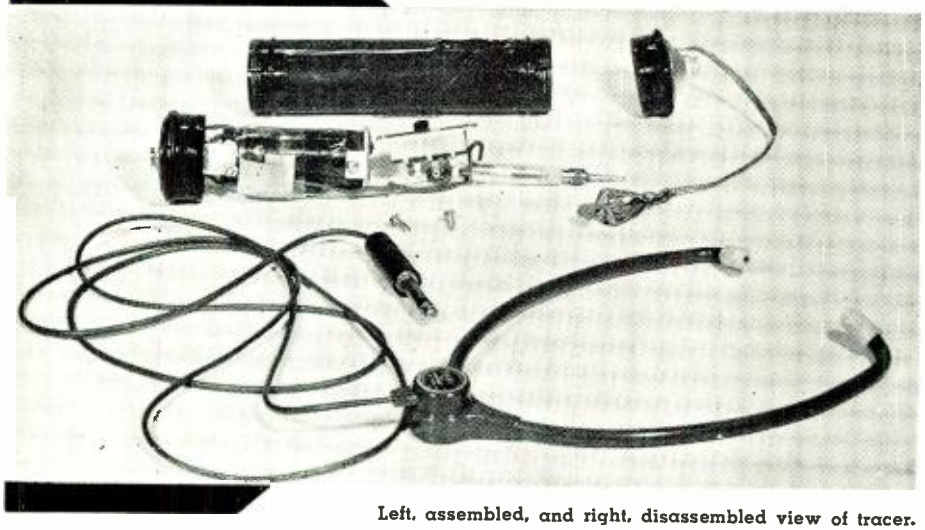
Next, a piece of tubing (bakelite, plastic, or paper) two inches long by 1 inch in diameter is wound with 90 to 100 turns of Number 30 enameled wire. About 15 turns of the same wire is wound close to one end of the larger winding or over one end with Scotch Tape insulating the first winding from the second. This coil is intended to tune to a local broadcast station. The coil specified tuned to the 1400 kc. region but if your closest station is not in this region, the coil will have to be varied accordingly.

The next item is the small variable condenser, C_1. The one used in the circuit was sold in army surplus stores for less than ten cents. It is marked ARC 10543, but it is not necessary to use one of these. One of the small trimmer condensers, made by the *F. W. Sickles Co.*, can be used. It will not slip inside the case but will have to be mounted on the end. Since it is not necessary to tune this circuit regularly, a padder condenser may be used. When a padder is used more experimentation may be necessary to get the circuit to tune in the right range, however, it should not be a serious handicap.

A piece of aluminum or brass strip 1/16" thick by ⅝" wide by 2" long is bent at right angles at a point ¾" from one end. At a point ⅜" from the end of the ¾" leg, drill a hole ⅜" in diameter. About ⅛" from the end of the long leg, drill two holes to clear 6-32 screws. This angle is the bracket that mounts the coil form to the end of the case where the jack is located. A similar hole must be drilled in the blank end of the flashlight case. This allows the phone jack to go through both the angle and the head piece, fastening them together. The long end of the angle with the two holes should be cambered slightly to fit securely against the curve of the bakelite form. Two matching holes are drilled through the bakelite in such a way that when the three pieces are assembled, the bakelite form will extend centrally into the flashlight case when the end piece is screwed in place. The condenser is attached to the opposite end of the coil form. If the builders plan to use a condenser mounted outside the case, some consideration should be given to the over-all length of the assembly relative to the length of the flashlight case. It should be remembered at this point that the phone jack, the coil form, and the condenser all have to go between the back end of the case and the slide switch. If necessary, the length of the coil form may be cut down, but if a padder or the specified variable condenser is used it will slip inside the case and the dimensions can be held for most standard straight-sided flashlights.

The condenser shown was attached with one "hook screw" which hooked into the side of the coil form and extended through the condenser mounting plate. On the other side an angle clip was screwed to the side of the

This handy test instrument can be used for signal tracing in the r.f., i.f., and a.f. sections of any AM receiver.



Left, assembled, and right, disassembled view of tracer.

coil form and extended over the condenser mounting plate in such a way that it was held securely. It is not important how the mounting is made but it is important that it be held rigidly.

Next, the reflector is fitted into its holding ring but in the reverse position that it has in a flashlight. This usually requires a ring to take up the space normally occupied by the edge of the lens. This ring may be made of any material. It may be a regular spacing ring or washer or it may be something soldered to the edge of the reflector. (This would be on the under side of the rim as the reflector normally is positioned in the flashlight.) In the instrument as constructed, a narrow piece of *Belden* woven wire ribbon was soldered to the rim. A piece of tinned *Belden* ribbon also makes an excellent lead for the ground clip. One end of a piece about five inches long is soldered to the side of the reflector and the other end is spread and soldered in the spread position. It may then be drilled for the screw of an ordinary clip or an alligator clip, if preferred.

A piece of bakelite ⅜" diameter and about 1½" long is squared on the ends and the outside of one end is tapered slightly. This taper is so small that care should be taken so that the tube does not fit too loosely in the socket of the reflector. It can be done with a file and only sufficient bakelite should be removed to allow the end of the tube to be wrung into the lamp socket of the reflector. The fit of this tube in the socket is important because of the method of assembly which will be described later. When it is firmly in place, it should project outside the reflector socket about ⅛" to ¼". An all metal phone tip plug, of the solderless variety, is inserted in the tapered end of the tube. If the tube has ¼" diameter hole, this can be accomplished without too much trouble but the phone tips have a slight knurl and it is wise to run a drill into the end of the tubing to be sure the hole is up to size. It is also a good idea to warm the tube before pressing the tip into place. This fit is permanent as the tip does not need to be withdrawn.

With the coil unit mounted on the end of the flashlight case by means of the jack and with the condenser and phone tip in place, it is time to start making the electrical connections. The wiring diagram should be self-explanatory and while there is nothing critical about it, the usual precautions followed in wiring radios should be remembered. Don't use more wire than is necessary, don't use anything but rosin flux, don't get too much solder on any joint, and avoid cold soldered joints.

Place the 500 $\mu\mu$fd. condenser inside the ⅜" tube and slip the pigtail through the phone tip. Draw it down into the tip as close as possible, and wind one turn around the back of the thread, cut off the excess, and put on the cap. This tip unit and the slide switch are attached to the rest of the apparatus only by the wires which connect them. Leave two to three inches of slack in the wire between the tip assembly and the slide switch for later assembly purposes. In the instrument built by the author, the crystal diode was taped to the side of the coil tube. It probably would have been better if it had been along side of the slide switch.

With all the parts assembled as illustrated, the unit should be tested and tuned before being put into the case, as there is no way of tuning it after it is enclosed. Attach an antenna to the tip and a good ground to the metal frame. With the slide switch in position No. 1, tune in a local station. If there is no station close by, a good outdoor antenna may be required. When working in the i.f. section, move the slide to the neutral position, and when in the audio, move it all the way forward to position No. 2. If a signal generator is available, no antenna will be necessary.

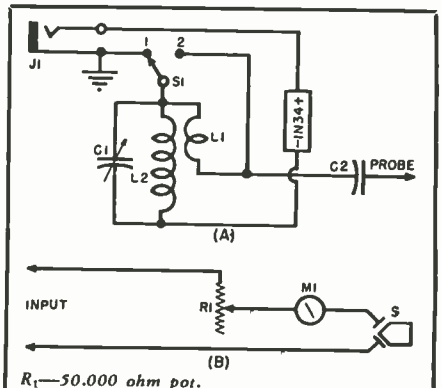
A word about inserting the unit in the case is necessary at this point. The assembly, complete as shown in the picture, is dropped through the case until the end with the jack reaches the end of the barrel. The whole thing is then carefully rotated inside the barrel until the end of the flashlight case is screwed up tight. Next, the slide switch is worked through the hole in the side and screwed down fast. The reflector is then slipped over the tip end and the holding ring passed over one reflector and screwed tight. Grasp the tip itself and pull it through the socket hole in the reflector working it fast by twisting it slightly while drawing it through.

When tuning the device before putting it in the case, some means should be used to avoid body pickup. This can be done by holding it with a piece of bakelite or other similar material. If it is desired to use the instrument for making indicating measurements of the signal, a good meter will be necessary. It should not be greater than one milliampere full-scale, but for really satisfactory results, a 0-50 or 0-100 microammeter should be used.

The meter should be mounted in a case with a variable resistance to keep the meter on scale. When using the more sensitive meters, extreme care must be exercised to avoid damaging the meter. A good idea is to add a push-button circuit to the meter

(*Continued on page* 163)

Fig. 1. (A) Complete circuit of the signal tracer. (B) Suggested circuit for using meter in place of phones.



R_1—50,000 ohm pot.
C_1—15-50 $\mu\mu$fd. var. cond.
C_2—500 $\mu\mu$fd. ceramic cond.
L_1—15 t. #30 en. wound over one end of L_2
L_2—100 t. #30 en. wound on plastic, bakelite, or paper form 1" dia., 2" long
S—Normally open push-button sw. (H & H No. 3392)
S_1—S.p.d.t. slide sw. (with neutral pos.)
J_1—Open circuit phone jack
M_1—0-50 microammeter
1—1N34 crystal diode

Sweep Generator Adjustment of Transmission Lines and Antennas

By JOHN A. CORNELL
RCA Service Company, Inc.

Accurate impedance matching, resulting in improved performance, is assured with this new technique.

SWEEP generators, employed by most radio and television service technicians almost exclusively for the visual alignment of wideband amplifiers found in FM and television receivers, can be employed in a great variety of other interesting and useful applications. This article will describe some of the not-so-well-known applications in the field of antennas and transmission lines in the hope that the principles will be of interest to radio men and, in particular, to television service technicians.

In addition to their more conventional applications, sweep generators may be used to check transmission lines for flaws, to measure standing-wave ratios, to adjust antennas and matching stubs for proper impedance match, and to determine whether or not a television receiver is properly matched to its transmission line. The methods used to accomplish these things with a sweep generator are amazingly simple and time-saving. Before a few particular applications are considered, a brief discussion of the theory behind the procedures to be described will be given.

Fig. 1 shows a long coaxial transmission line, such as might be used to connect a television receiver to its antenna. The sweep generator is connected to one end of the line through a small carbon resistor, as shown in the drawing. The resistor should have a resistance of around one hundred ohms, and its leads must be kept short.

A crystal detector is connected to the junction of the resistor and the line, and the output of the detector is fed to the vertical amplifier of the cathode-ray oscilloscope. A diode detector, such as a 6AL5, could be used in place of the crystal, or if the oscilloscope is equipped with a crystal (or a diode) probe, the probe can be connected to the transmission line. Into the horizontal amplifier of the scope is fed the time-base voltage output of the sweep generator, usually a 60-cycle sine wave. The generator is set to sweep a band of frequencies about six megacycles wide with a center frequency somewhere above fifty megacycles, and the oscilloscope controls are adjusted to give a trace of convenient size. Now, if the other end of the transmission line is open circuited (and let's assume that it is) a pattern similar to that of Fig. 2A will appear on the scope.

To see how this pattern is obtained, let's return to the transmission line again, remembering that its far end is open-circuited. The line will present, at its sending or near end, an impedance which is a function of the length of the line and the instantaneous frequency of the sweep generator. For instance, a frequency which would make the line an integral number of half-waves long would cause the sending end of the line to look like an open circuit (assuming the line has negligible losses) to the sweep generator. A frequency which would make the line an odd number of quarter-waves long would cause the sending end of the line to act like a short circuit. Other frequencies would cause the line to present intermediate values of impedance to the sweep generator.

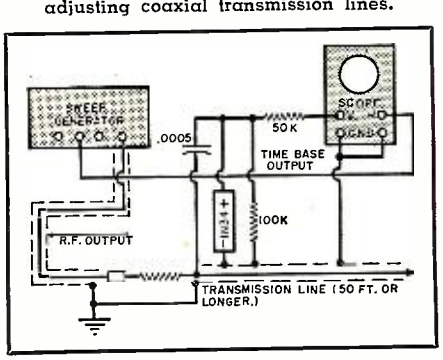
When the line is fed a signal the frequency of which is continually swept over a wide band, the sending-end impedance varies in accordance with the voltage used to frequency-modulate the oscillator in the sweep generator. If the output of the sweep generator is reasonably flat over the swept band, as it should be if it is a good one, then the r.f. voltage at the sending end of the line will vary in the same way that the impedance of the line varies. The varying r.f. voltage is detected by the 1N34 and fed to the oscilloscope, where it is displayed as a wavy line. This trace is usually called a standing-wave pattern, since it can be used to determine the standing-wave ratio on the transmission line. The longer the transmission line, the more the variations, or cycles, in the trace.

Some sweep generators are equipped with a blanking switch which cuts off the oscillator during the time it would normally sweep from the high frequency to the low frequency. If the blanking switch is turned on, then a reference baseline, representing zero r.f. voltage at the input to the transmission line, will appear on the oscilloscope pattern. This is shown in Fig. 2B and is very useful because it permits evaluation of the losses on the line. The higher the line losses, the greater the spacing between the baseline and the negative excursion of the trace. If the line has zero losses then the negative excursion will coincide with the baseline.

A transmission line which has a flaw, such as a partially open shield, or a bad pinch, will cause a discontinuity to appear on the scope pattern, as shown in Fig. 2C. We have then one application—that of checking transmission lines for flaws or irregularities. If the line is coax, it makes no difference whether it is on a roll or already installed; it can be checked by using this method. This method of checking lines will show flaws that no ohmmeter could find, but which could still prevent the reception of good television pictures.

Now, let's go back to Fig. 1 to find out what will happen if we connect various impedances across the far end of the transmission line. Suppose that a pure resistance equal to the surge impedance of the line is connected across the far end. The sending end of the line will present to the sweep generator only a constant resistance equal to its surge impedance, regardless of the frequency. In this case, the voltage at the input to the line will remain constant as the sweep generator sweeps through its band of frequencies, the rectified voltage fed to the scope will contain no varying component, and the trace on the scope will be a straight line (or two parallel lines, if the sweep generator blanking switch is turned on). Commercially

Fig. 1. Circuit for basic test setup for adjusting coaxial transmission lines.



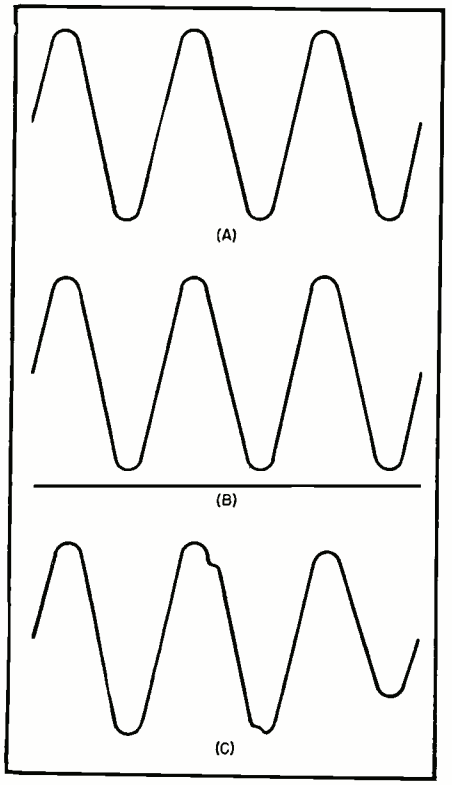


Fig. 2. Patterns observed when line is incorrectly terminated. (A) Phasing adjustment on sweep generator correctly set. (B) Sweep generator blanked during return sweep. (C) Pattern resulting when there is a fault on the line.

available transmission lines are not perfect, and it will generally be impossible to get an absolutely straight-line trace on the scope (although, if the sweep generator output is low, or the scope does not have much gain, the line may look straight). When the line is properly terminated, however, the trace will be most nearly straight.

If different values of resistance are connected across the far end of the line, we will see our wavy pattern on the scope again, but the waves will not be as deep as they would be if the far end were completely open or short-circuited. The depth of the waves, then, is an indication of the degree of match or mismatch of the line; the flatter the pattern on the scope, the more nearly is the line matched, and vice versa. This fact can be used to match a television antenna or a receiver to the transmission line, and it's a very simple thing to do.

Let's consider a particular application, one which illustrates very nicely the value of this method of checking and adjusting transmission lines for proper match. Suppose a television receiver has been installed in some location remote from a television transmitter—a location where the field strength is low and where every little bit of energy the antenna can abstract from the space surrounding it is needed. A location like this would, of course, call for a directive array. Directive arrays are relatively narrow-band antennas, and the more directive the array, the more difficult and critical is the problem of matching the array to the antenna. In order that the array may transfer a maximum amount of power to the line, and ultimately to the television receiver, it must match the line; that is, its radiation resistance must be matched, through the use of stubs, quarter-wave transformers, or other means, to the surge impedance of the transmission line. The sweep generator can be used to obtain this match in a manner that will amaze you with its simplicity and accuracy.

Let's assume that the antenna has been properly positioned for maximum signal pickup and a minimum of reflections, and that the transmission line has been installed and is ready to connect to the receiver. Just hook the scope, the sweep generator, and the detector to the line as shown in Fig. 1. Set the sweep generator to sweep the television channel it is desired to receive. If the scope pattern is fairly flat, the antenna and the line are reasonably matched, but if the trace looks like Fig. 2A, some means must be employed to match more perfectly the antenna to the line. Again, the degree of mismatch will determine the depth of the waves on the trace, and the length of the line will determine the number of waves. If the line is short, less than one wave may appear on the scope.

Now, the idea is to adjust the matching elements, the lengths of the antenna elements, and the element spacings, until the pattern on the scope is as flat as possible. This will take two men: one to make the antenna adjustments and one to watch the pattern on the scope. In general, it will be impossible to match the antenna and the line completely over the wide band of frequencies occupied by a television station, and the scope pattern never will be absolutely flat. When the trace is as flat as it is possible to get it, however, the line and the antenna are most nearly matched, and the antenna will deliver a maximum amount of power to the line.

This article will not discuss the various ways of matching antennas, for that is not its purpose. It is intended only to describe a simple means of indicating instantaneously the effects of the matching adjustments over a wide band of frequencies. That phase which deals with the matching methods themselves has been covered in other articles and need not be repeated.

Any discontinuity on the line, such as a faulty lightning arrestor or a bad pinch, will cause a discontinuity in the pattern, as shown in Fig. 2C, and should be corrected. Some lightning arrestors, while not actually defective, will cause the discontinuity mentioned. These should be replaced with a type which will not alter the transmission line characteristics.

The method proposed can also be used to check the degree of match between the television receiver and the transmission line. Just connect the line to the receiver, and the necessary test equipment to the other end of the line. If this is impracticable, then a roll of the same type of coax as used in the transmission line can be used. The receiver is tuned to each channel in turn, and the sweep generator is set to sweep each corresponding channel. The scope pattern will show the degree of match offered by the input of the receiver to the line for each station. A bad case of line reflection caused by receiver mismatch can be definitely located this way.

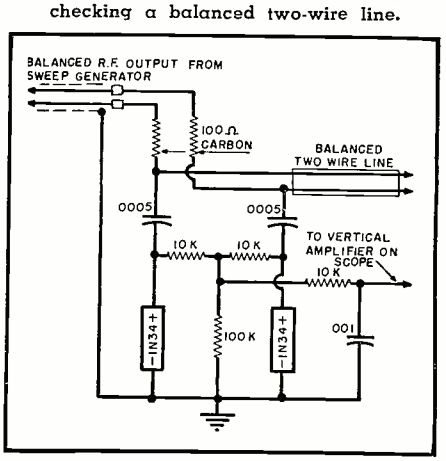
Once the cause of a reflection is determined as caused by a line mismatch, the receiver input circuit can be adjusted to provide the proper match for the line, or, if this is not physically possible, a stub can be used to match the receiver to the line. The effects of adjustments on the receiver input circuit, or on stub length, can be seen on the scope as they are made. As was the case in antenna adjustment, the idea is to get the flattest trace possible. In general, stubs at the receiver end of the line should be avoided, because, while they may effect a match for one channel, they will seriously destroy the match on one or more other channels. Of course, if only one station is available anyway, a stub can be used at the receiver end of the line. Also, one of the commercially available line-matching devices, which can be adjusted for each channel, may be used. In this case, the sweep generator will show conclusively the merit of such a device.

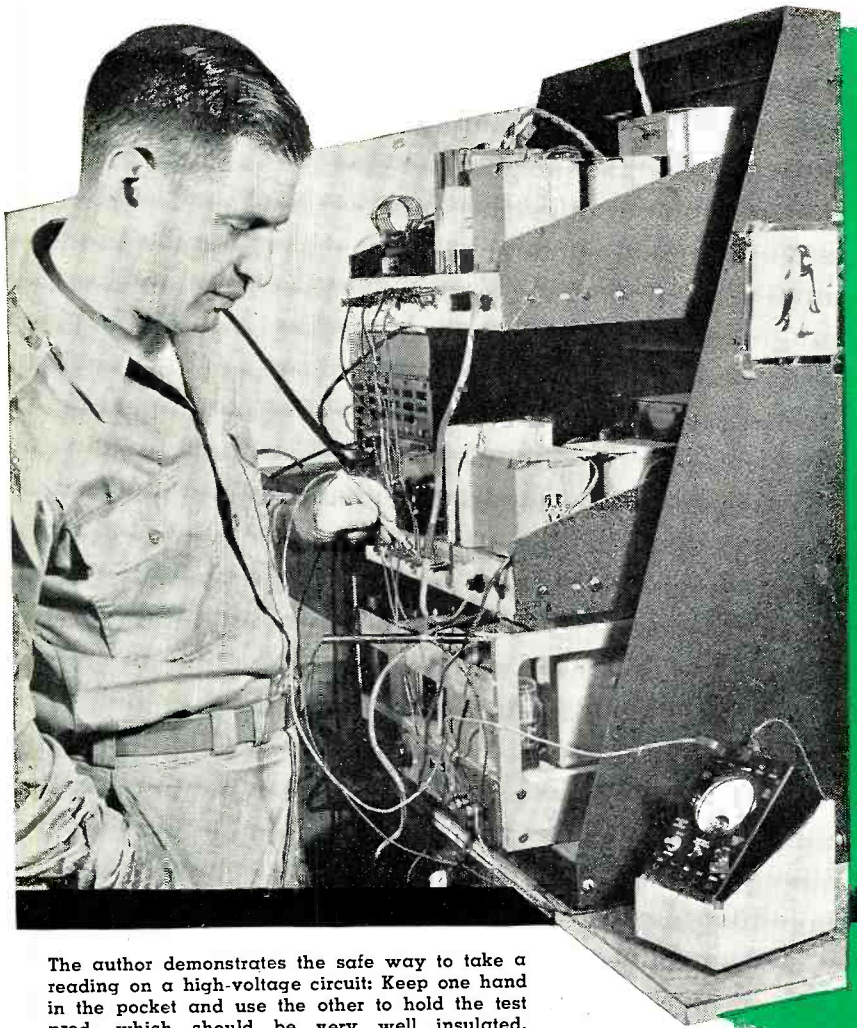
In order to check balanced two-wire lines, a sweep generator with balanced output and a balanced detector must be used. The circuit is shown in Fig. 3, and the results obtained are the same as would be obtained with coaxial cable. However, the two-wire line cannot be rolled up or doubled back on itself, or the indication on the scope will be incorrect.

Now for some precautions to exercise when employing the foregoing procedures. In the first place, if the output of the sweep generator has several spurious frequencies, it will sometimes be impossible to produce a straight-line trace on the scope, even though the transmission line is correctly terminated. Those sweep gen-

(*Continued on page* 109)

Fig. 3. Test setup which is useful for checking a balanced two-wire line.





The author demonstrates the safe way to take a reading on a high-voltage circuit: Keep one hand in the pocket and use the other to hold the test prod, which should be very well insulated.

The BEGINNING AMATEUR

By
ROBERT HERTZBERG,
W2DJJ

Part 8. Test equipment for the ham shack—your investment need not be too great. There are many test operations that can be performed equally as well with lower-priced instruments.

ONCE you get beyond the construction of extremely simple transmitters such as the one described in Part 5 of this series of articles (June, 1949, issue of RADIO AND TELEVISION NEWS), you begin to appreciate the need for meters of various kinds. A single, inexpensive milliammeter enables you to tune up the rig and to get it on the air, but all it tells you is how much current the oscillator tube is taking. If another ham asks you, "How much power are you using?" you can't answer him because you must know the plate voltage as well as the plate current to determine the input power. Multiplying the current in amperes (not milliamperes) by the voltage gives the power in watts, in case you have forgotten Ohm's law.

The servicing of receivers and transmitters in an intelligent manner is almost impossible without some form of test equipment. Although no instrument can take the place of common sense, the use of such equipment will enable you to quickly localize the trouble, eliminating "cut and try."

Suppose your receiver or transmitter suddenly stops working. The trouble may be nothing more serious than a burned-out tube, but you can't check the filament just by looking at it; with metal envelope tubes you can't see anything. However, if you have an ohmmeter you can make a continuity test on the filament in about three seconds.

After a new receiver or transmitter is finished and is working properly, a smart ham will check the voltages and currents in all conveniently accessible parts of the circuit and record them carefully. Then, if trouble develops some time in the future, he can take another set of readings, compare them with the original values, and determine very quickly the location of the fault.

Experienced hams and other radio workers take test equipment so much for granted that they are likely to say, "Why all this sales talk? How can a guy get along *without* good meters?" The point is that many beginners overlook test equipment until they find themselves with a dead rig and no method of trouble-shooting.

Fortunately, a fine collection of meters at reasonable cost is available on the market today. If you own no testers of any kind (other than the milliammeter recommended for the simple transmitter), certainly your basic purchase should be a combination volt-ohm-milliammeter. This is by far the most common and versa tile piece of test equipment in use by hams, service technicians, and radio engineers the world over. In its usual form, it consists of a single meter, which carries a wide range of volt-

EDITOR'S NOTE: *It is impossible to illustrate on these pages all the various types of test equipment on the market today. There are hundreds of different types and makes, all relatively similar in design. The higher priced units obviously have additional features and provide greater stability and accuracy. Before making any decision as to a particular type or manufacture, it is advisable to check all the advertisements appearing in this and other issues.*

age, current, and resistance values on a multiple scale. The meter itself is a very low range milliammeter and is made to read in terms of volts, amperes and ohms by means of resistors connected with it in series or shunt. The desired scale is selected by a rotary switch in some models and by a series of pin jacks in others.

The meter movement is a direct-current device. Most of the popular multi-testers, however, contain small rectifiers which permit measurement of alternating currents as well.

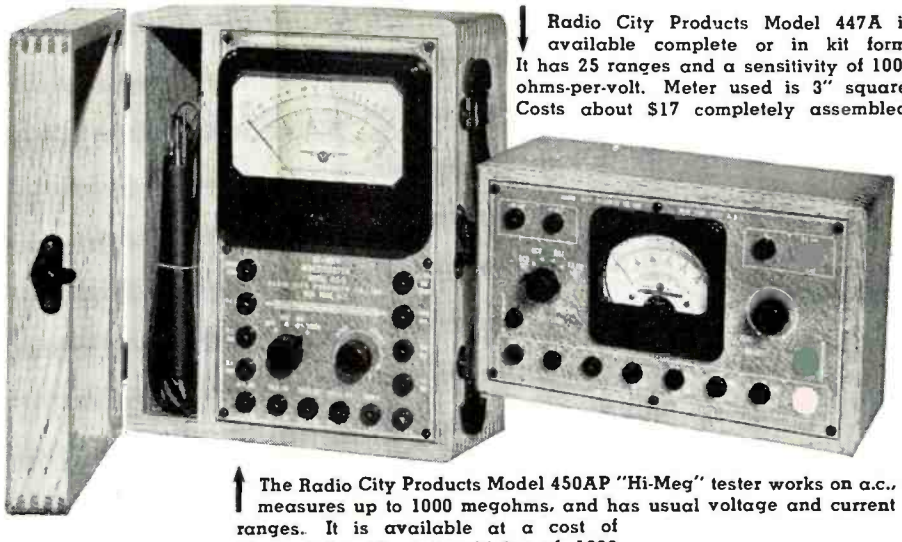
For resistance measurement a source of low voltage d.c. is required. In practically all testers this is furnished by a couple of flashlight batteries concealed inside the cases.

The price range of these popular multi-testers is almost as wide as their technical capabilities. You can get a small pocket-size job for as little as ten dollars, and you can pay about seventy dollars for a deluxe model. Two major factors determine the cost: the size of the meter proper and its "sensitivity." The less costly units use two-inch diameter meters on which the scales admittedly are a bit crowded and difficult to read. As the price goes up, the meters become bigger and the scales are more spread out; the limit of size for portable meters is about 6 inches.

The "sensitivity" of a meter is the measure of current through it that gives full-scale deflection. The less current required, the less disturbance the meter introduces in the circuit to which it is connected. When a meter is used as an ammeter or milliammeter, its resistance is very low, and since it is connected in series with the other circuit elements, its presence causes no trouble. However, a meter used as a voltmeter is always connected across ("shunt" or "parallel") a circuit element. Its effective resistance must be very high compared with that of the circuit, so that it will take very little current from it. The sensitivity of a voltmeter in this respect is expressed in terms of "ohms per volt," and the minimum for purposes of radio is generally recognized as 1000 ohms-per-volt. A meter of this sensitivity thus presents an effective resistance of 500,000 ohms if its scale reads 0-500 volts. Much higher sensitivities in multi-testers are available; 20,000 ohms-per-volt is not unusual.

A multi-tester is a lifetime investment. Receivers and transmitters change, but volts, amperes and ohms are no different now than they were a hundred years ago. Get the best meter you can afford, and you'll always be glad of your purchase. Incidentally, the tester is by no means limited to radio. With it, you can quickly locate opens and shorts in household electrical appliances, such as lamps, toasters, vacuum cleaners, mixers, fans, etc. Many a ham is practically pushed into a profitable side business as the neighborhood "electrical expert" simply because he possesses this magical little gadget.

A word of caution: Most multi-



Radio City Products Model 447A is available complete or in kit form. It has 25 ranges and a sensitivity of 1000 ohms-per-volt. Meter used is 3" square. Costs about $17 completely assembled.

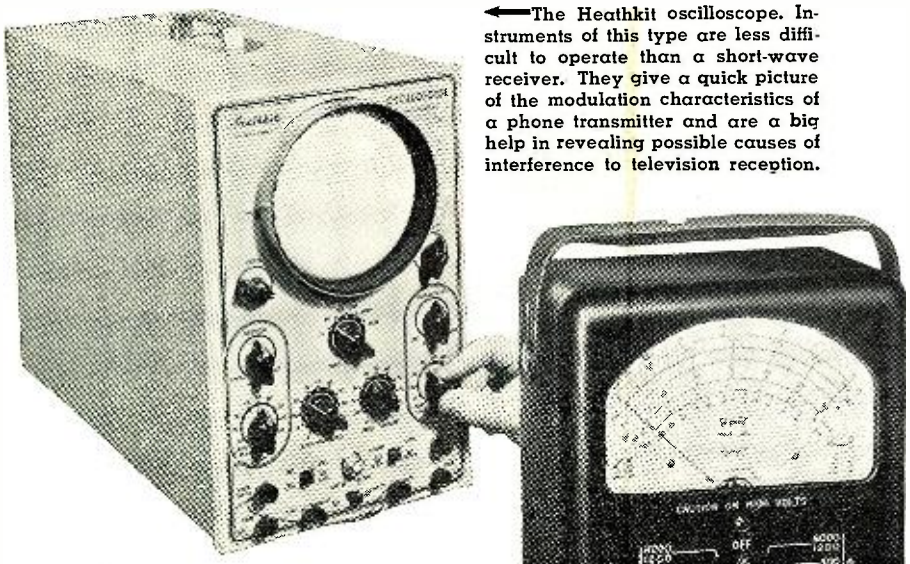
The Radio City Products Model 450AP "Hi-Meg" tester works on a.c., measures up to 1000 megohms, and has usual voltage and current ranges. It is available at a cost of about $25 with a sensitivity of 1000 ohms-per-volt, and $32.50 with a sensitivity of 20,000 ohms-per-volt.

This pocket-size multimeter, the Simpson Model 240, uses a 3" meter, has a sensitivity of 1000 ohms-per-volt, and has 14 ranges. With a high-voltage range of 3000 volts, is well suited for checking transmitter power supplies. Price, about $22.

The four-inch meter dominates the case of the Hickok Model 435 volt-ohm-milliammeter, with 35 ranges, a sensitivity of 20,000 ohms-per-volt, and d.c. and a.c. power supplies. Price of unit is about $38.

★

In the Simpson "Roto Ranger," the proper meter scale automatically comes into view as the range selector switch is turned. This feature facilitates rapid reading of the meter needle. Sensitivity is 20,000 ohms-per-volt, and 25 voltage, current, and resistance ranges are available. Meter is 5½" in size. Price is approximately $70.



←The Heathkit oscilloscope. Instruments of this type are less difficult to operate than a short-wave receiver. They give a quick picture of the modulation characteristics of a phone transmitter and are a big help in revealing possible causes of interference to television reception.

With 21 ranges, the Triplett Model 630 volt-ohm-milliammeter is unusually useful. Sensitivity on d.c. voltage scales is 20,000 ohms-per-volt. Ranges are selected by rotary switch. Meter itself is 5½ in. in size in a black molded case, and the price is approximately $37. →

testers are very susceptible to accidental damage because it is very easy to forget to turn the selector switch to the desired function. If you want to check power line voltage, for instance, and have the switch on the 0-120 milliampere position, you'll probably hear a quick *"ffftt"* as you plug in the test leads. That sound represents your investment going up in smoke, literally. Sure, the meter can be repaired, but it will cost money.

A second type of multi-tester deserves mention because it is especially suitable for television testing as well as for all ordinary applications, and many hams are finding it a lot of fun to assemble their own TV kits. This is the vacuum-tube type. It costs more than the other kind, but it also does more. Its big advantage is its extremely high input resistance on *all* voltage ranges: about ten or eleven million ohms. This means that the meter can be connected to very sensitive parts of a circuit (the grid of oscillator tubes for instance) without affecting the operation. A conventional 1000 ohm-per-volt meter set to the 0–5 v. scale has an effective resistance of only 5000 ohms, which is a dead short circuit as far as a critical circuit is concerned.

Vacuum tube meters use four or five tubes, generally require a.c. power, and cost between $75 and $125. With accessory equipment, they are capable of direct measurement of radio-frequency circuits, something that has not been possible with conventional meters.

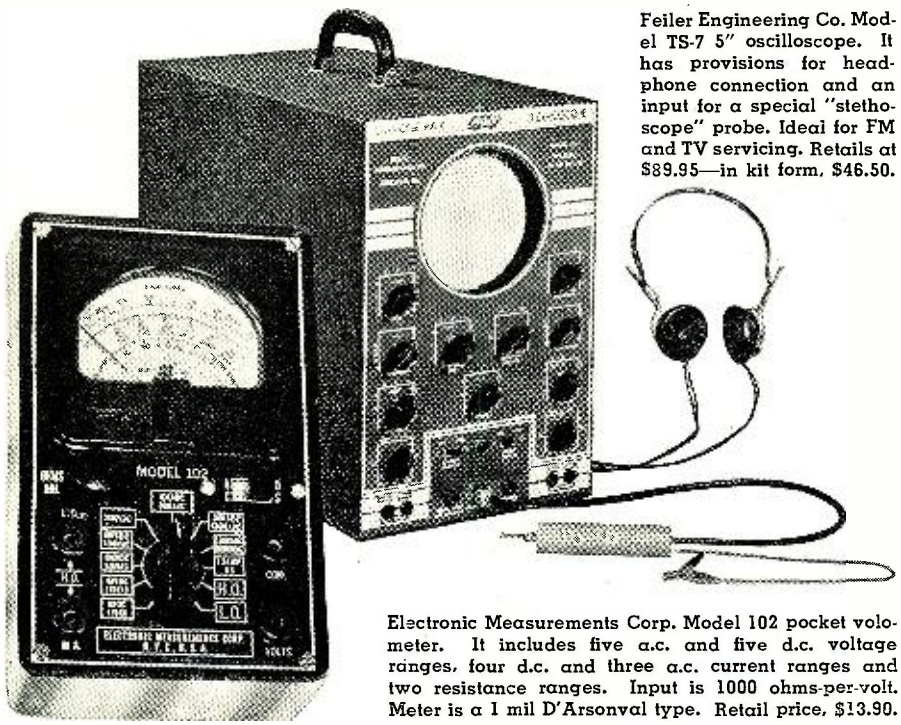
Apparently taking their cue from the television kit people, some meter firms are now offering excellent test equipment in knockdown form for easy home assembly. By eliminating the expensive labor element, they are able to establish very low prices on meters that are normally expected to be "expensive," I was startled to read of a complete vacuum tube voltmeter kit, for instance, that cost only $25 . . . $24.95, to be exact. Since I own a factory-made v.t. job that cost exactly one hundred dollars more than that, I decided to investigate. I obtained a kit and put it through the works; I am now both surprised and pleased to report that it really is excellent. Even granting that the meter face is a bit smaller and the r.f. range less extensive, the $25 unit performs admirably. If I didn't have the $125 model I'd be perfectly happy with this home-assembled meter.

What about the signal generators, tube testers, analyzers, and other test equipment shown in the radio catalogues? This is strictly professional service stuff, of no immediate value to a "beginner." It's nice to have, but certainly not essential. To supplement the general-utility multi-tester, I recommend something else: a cathode-ray oscilloscope. Like the multi-tester, this instrument is extremely versatile, having many applications in both receiving and transmitting work. For adjusting the modulation of a phone transmitter, for example, it is without equal. As an educational instrument it is superb, giving as it does an animated representation of electric waves and currents.

Many people have the idea that a scope is a complicated and expensive device. Actually, it's easier to put together and use than many receivers. To prove this point, I obtained a kit for a five-inch size 'scope (cost: less than forty dollars for everything, including all tubes and even wire), turned it over to a nineteen-year-old college freshman with only a scanty knowledge of radio and told him to make it work. Three hours after supper, he called me and fairly shouted over the phone, "It works fine. Now for the first time I understand what a.c. is!" Because it looks like a television set (and in fact the cathode-ray tube is the heart of TV), that 'scope is busy almost every night.

The illustrations accompanying this article show some representative test instruments suitable for amateur work. Many others are available; but before you make a choice, compare characteristics and prices carefully.

(To be continued)



Feiler Engineering Co. Model TS-7 5" oscilloscope. It has provisions for headphone connection and an input for a special "stethoscope" probe. Ideal for FM and TV servicing. Retails at $89.95—in kit form, $46.50.

Electronic Measurements Corp. Model 102 pocket volometer. It includes five a.c. and five d.c. voltage ranges, four d.c. and three a.c. current ranges and two resistance ranges. Input is 1000 ohms-per-volt. Meter is a 1 mil D'Arsonval type. Retail price, $13.90.

SHIELDING AGAINST TVI

On top of the relay racks may be seen several breadboard units that have been properly shielded. All r.f. units in the cabinets have been shielded similarly to the 829 unit described in the article.

Many transmitters and other units including commonly used test equipment cause TV interference. One of the best insurances against it is to shield all r.f. circuits.

By

P. S. RAND, W1DBM

ONE of the best insurances against TVI is the proper shielding of the various r.f. chassis in a transmitter. It has often been recommended, but very little has been specifically said about it. A good many of the usual TVI preventives are not completely effective unless coupled with adequate shielding.

In combating TVI, one of the first things to do is to determine whether the interference is being radiated via your transmitting antenna or via your rig itself. The best way to do this is to disconnect your transmitting antenna and substitute a dummy load consisting of electric light bulbs of sufficient wattage. If this step clears up the TVI, it is safe to assume your shielding is adequate, and it is only necessary to filter your feeders and perhaps use plate traps in your final (see *CQ*[1] and *QST*[2] for proper meth-

1—"CQ"—April, 1949.
2—"QST"—May and December, 1948, February, 1949.

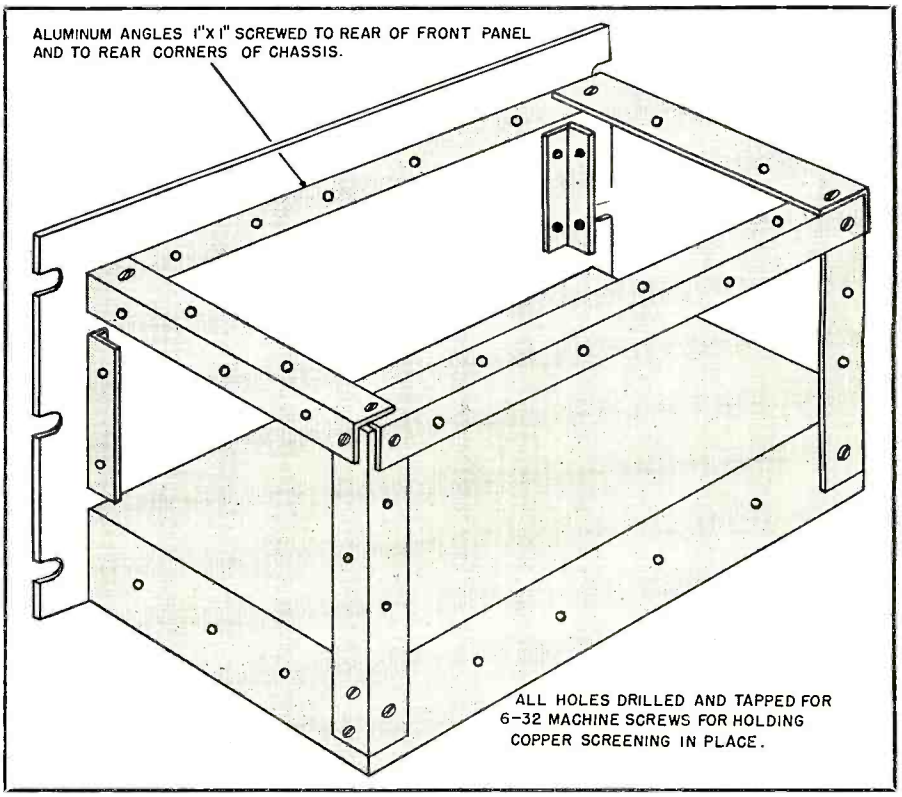
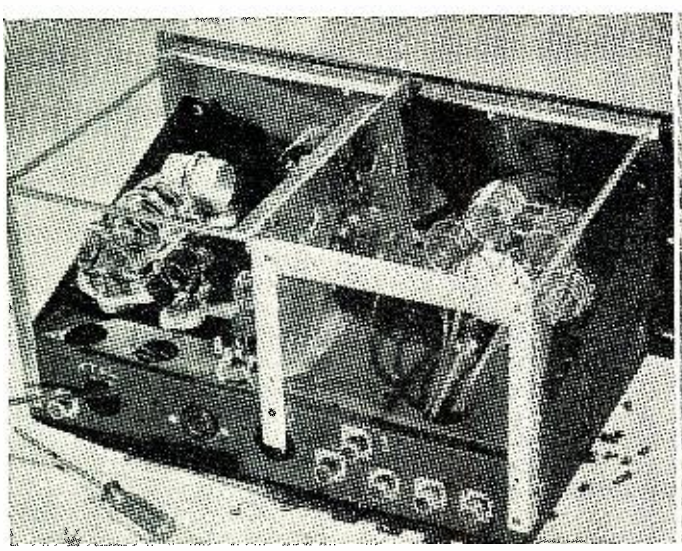
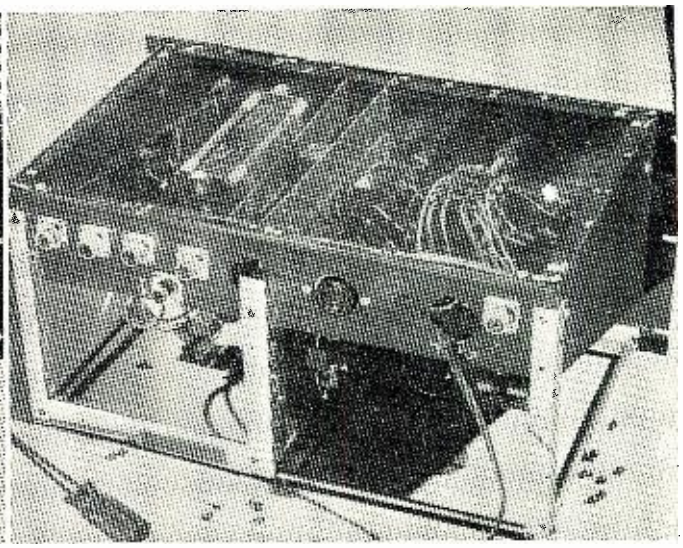


Fig. 1. Installation of framework to support copper screening on a standard 17 x 13 x 3 inch chassis with an 8¾ by 19-inch panel.



Details of aluminum angle framework and scrap odds and ends that are used to shield an 829 bandswitch amplifier.



Shielding the bottom of the chassis is not difficult. Simply tin the edges and bolt the screening to the chassis flanges.

ods.) However, if your transmitter working into a dummy load still causes TVI, you probably had better do some shielding in addition.

Let us consider for a moment that we are designing a signal generator for use in lining up and checking a receiver for sensitivity. The requirements then will be for an oscillator operating at a few watts that will have an output controllable for say one microvolt to one volt. Now it is obvious that if we build this unit up "breadboard," style the direct radiation from the coils, condensers, tubes, wiring, etc., will be so strong that our output may exceed the maximum level we wish, to say nothing of the minimum. In order to make this signal generator of any use, we must therefore pay particular attention to the shielding of the entire oscillator circuit, even going to the extreme of double or triple shielding. We must also see to it that all the wires entering this shielded compartment are sufficiently well filtered that they cannot conduct any of the r.f. signal outside the shielded area. The fact that all signal generators on the market utilize this principle shows it can be done, and we only have to borrow some of this technique and apply it to our own transmitters, the main difference being that we are shielding against harmonics and other spurious radiations rather than against the desired signal. The desired signal, of course, is taken out via the antenna connections on the transmitter and fed to the antenna through a suitable antenna coupler, never directly.

A properly designed and operating transmitter never suffers from the addition of shielding. The only case where shielding might upset a rig is when the transmitter owes its stability to a combination of coupling and miscellaneous feedback that all just happens to cancel out. When proper shielding is added in this case, it removes some of this unintentional coupling and then the original trouble shows up. Let me say that shielding has always improved the operation of any transmitter that I have worked on.

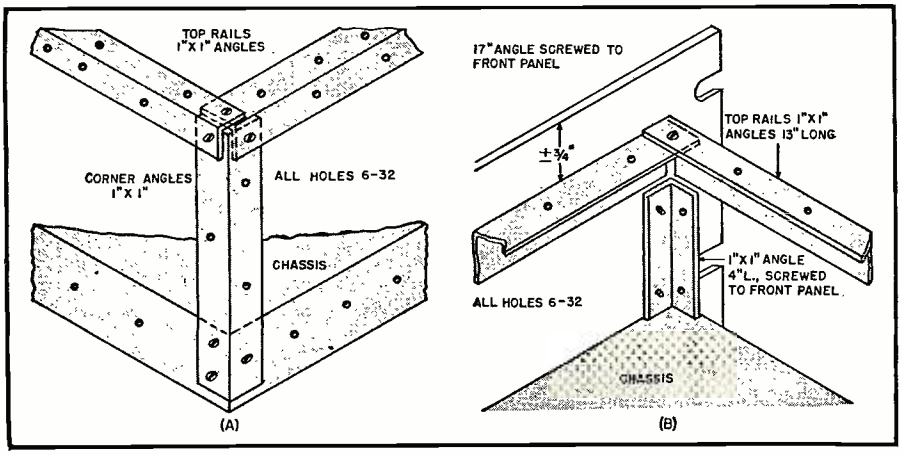
The purpose of this article is to describe a method of shielding that is not only very effective, but easy to install on any type of gear with a minimum of cost and a minimum of tools. We will divide the description into three parts: (1) Shielding units already in an enclosed relay rack cabinet. (2) Shielding units in an open type relay rack. (3) Shielding "breadboard" type of construction. (4) Use of a shielded room.

Enclosed Cabinet Type

Many amateurs, including myself, prefer to mount their equipment in an enclosed relay rack with the equipment built up on standard chassis attached to nineteen inch relay rack panels. All wiring comes in the rear edge of the chassis through suitable cable connectors. It is generally thought that such a cabinet constitutes a good job of shielding. However, such is not the case. An enclosed cabinet is far better than an open relay rack and in some cases provides just enough shielding to do the job. In many cases, however, additional shielding is necessary, as there are just too many louvres, cracks between panels, and too much paint between joints, to say nothing of the space around the back door. Luckily, two poor jobs of shielding are better than one good job, so all we have to do is to put some copper screens around each chassis. After the chassis is put back in the cabinet, the result is a good job of shielding.

Fig. 1 shows the installation of a framework of aluminum angles over which the copper screening is bent and screwed down. The dimensions shown are for a standard 17x13x3 inch chassis with an 8¾x19 inch relay rack panel. Any size angle may be used; however, something between one-half to one inch to a side is most convenient. This may be purchased from a sheet metal supply house or may be folded up out of 2 inches of aluminum strips. Your local plumber or tinsmith should be able to do this for you. If aluminum is used it should be about 1/16 inch thick so that it can be tapped for 6–32 machine screws for assembling; however, you may also use sheet galvanized iron or sheet copper, either of which can be purchased at your local tinsmith and also cut and

Fig. 2. (A) Assembly details of top rear corner and (B) top front corner.



bent to form the angles. In the case of galvanized iron or copper, it may be soldered together or assembled with machine screws and nuts as this material is too thin for tapping. Flat strips of brass may be used in place of the angles if they are easier to obtain. These should be from 3/16 to 1/8 inch thick and 3/4 to 1 inch wide for rigidity. Also the dimensions should be altered to fit the particular chassis and panel size used.

Fig. 2A shows the assembly detail of a top-rear corner of the frame while Fig. 2B shows the top-front corner.

The easiest way to start is to remove the chassis from the relay rack and fit the top rail on the rear of the front panel. This should be the same length as the chassis. In the case described this is seventeen inches. Make any notches in it necessary to clear meters, switches, etc., and then drill about four holes through the panel and angle with a #36 drill. The holes in the angle should be tapped with a #6–32 tap while the holes in the panel are enlarged with a #26 drill for clearance. This angle is then screwed in place. Two short four-inch angles are next mounted vertically in a similar fashion on each side of the panel directly under the top rail. These may be omitted if your front panel uses chassis supporting brackets, inasmuch as the purpose of these short angles is to give support to the screening at this point and the brackets may be used for this purpose.

Next mount the two eight-inch angles on the two rear corners, being sure that they are of proper length to conform to the height of the top rail already mounted on the rear of the front panel. These are held in place by three 6–32 machine screws in the corners of the chassis. Now after drilling and tapping appropriate holes for 6–32 screws, mount the rear seventeen-inch top rail. This is held in place with one screw at each end. The two side rails are now put in place with one 6–32 at the front end and two 6–32 screws at the rear, one on top and one on the side.

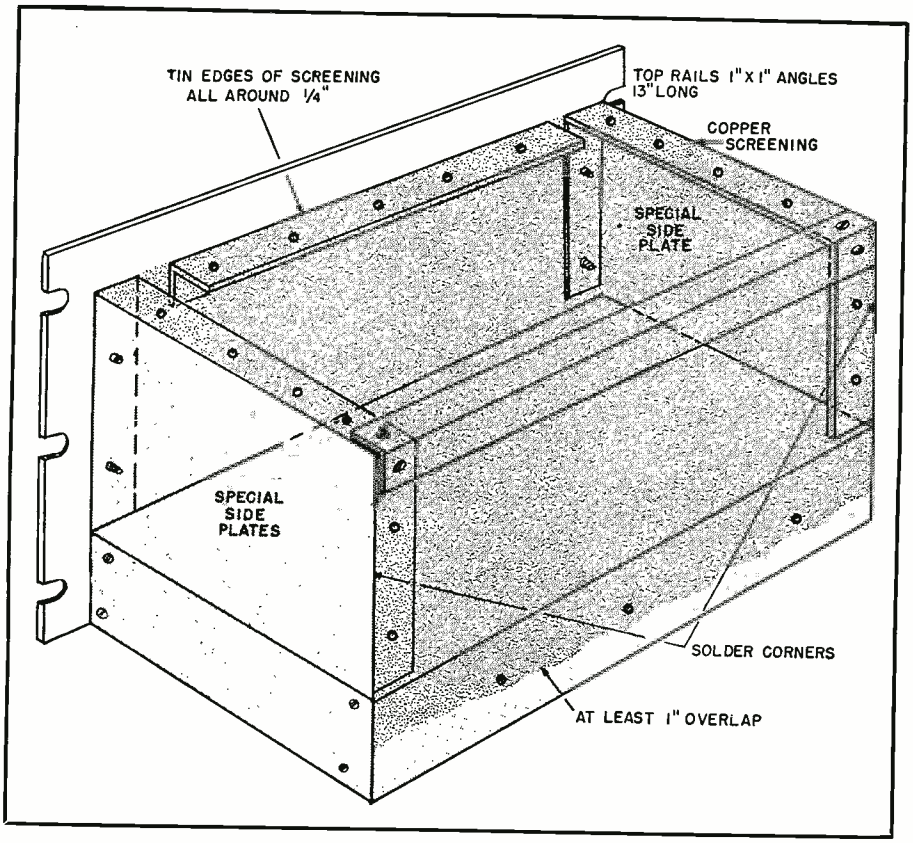


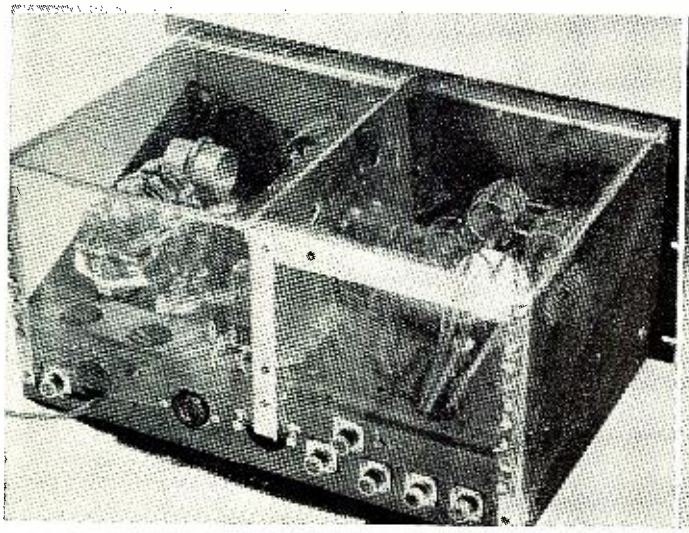
Fig. 3. If chassis supporting brackets are not used special side plates made of aluminum can be used. Copper screening would then be necessary only for top and back.

The copper screening (ordinary window screening purchased at the local hardware store) will be held in place by 6–32 screws, and it is now necessary to mark both the angles and the chassis at not over three-inch intervals so that the frame may be disassembled, drilled, and tapped. It should be pointed out that beeswax rubbed on the 6–32 tap as a lubricant before tapping the aluminum will insure a nice job of tapping. In tapping the steel chassis the tap should be lubricated with oil and care should be taken not to break it as this can be done very easily.

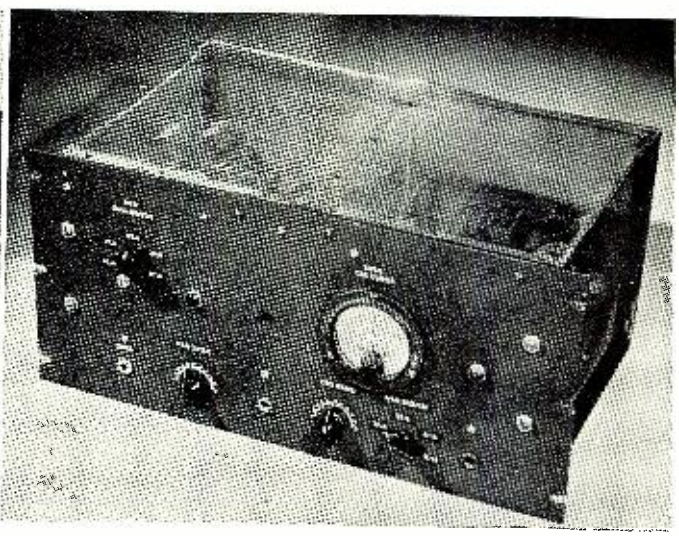
Fig. 3 shows an alternate method of building a frame. This consists of making two end plates 13x8 inches out of 1/16 inch sheet aluminum with a 1/2 inch lip folded over on three sides. This foldover is cut away at the bottom on both the front and rear to clear the chassis. The frame is completed with one sixteen-inch long angle screwed to the top rear corners of the side plates. Copper screening is then necessary only on the top and rear.

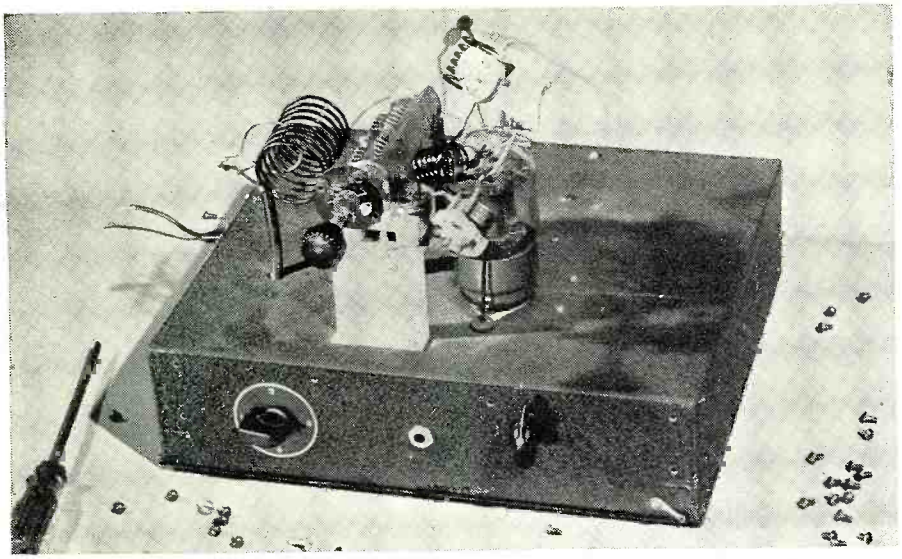
In applying the copper screening, a pattern is first made out of heavy

If chassis supporting brackets are used screen must cover top, back, and sides. See Fig. 3 for alternate method using end plates.



Front view of the 829 bandswitch amplifier. It is completely shielded for TV interference and is ready to go back into rack.





This is a 28 mc. 815 "breadboard" type with 56 mc. plate traps installed.

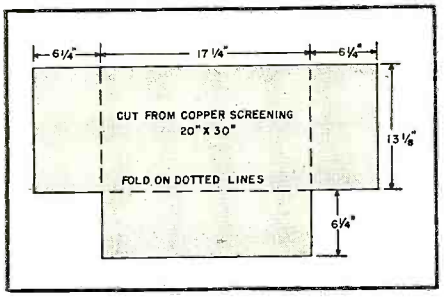


Fig. 4. Details for cutting wire screening.

brown wrapping paper by folding or wrapping the paper around the frame in the position to be occupied by the screening. The paper is then cut out with a pair of scissors, and when you are satisfied that it is a good fit, it is flattened out and laid over the screening as a guide in cutting the screening. Be sure to allow enough leeway so that the screening will overlap all joints by at least one inch. This is important as a good overlap, especially on the chassis, is insurance of a good job of shielding. The screening should be soldered together down the two back corners, and it is wise to tin all the edges so that it won't unravel as well as to bond it together.

After cutting and folding the screening to shape (see Fig. 4) it is slid over the framework, and the holes for the 6–32 screws are carefully put in by pushing a sharp pointed instrument such as a scriber or center punch through the mesh. The wires are separated easily without breaking to a large enough size to clear the 6–32 screws. Trap doors or other access doors for the purpose of changing coils or tubes may be installed in the top or rear; however, it is strongly urged that unless these are securely fastened on with screws every two inches, an overlap of three inches all the way around should be provided. See Fig. 5 for an explanation.

After screwing on the screening, our shielding is now complete except for a bottom pan. This may be a standard chassis bottom pan, but if so, it should have a few extra screws put in to make it good and tight. If there are any components that generate heat under the chassis, this bottom pan may be made from screening as this will allow plenty of ventilation. Be sure to tin all of the edges with solder.

The unit may now be returned to the relay rack cabinet and the next unit removed for treatment.

Most open relay racks consist of two vertical angle or channel irons drilled and tapped to fit panel notchings, tied together at the top and firmly bolted to a heavy base. To this rack are bolted standard nineteen-inch metal panels with their respective chassis sticking out the rear in the open. If this is the type of rig you have, the first thing to do is remove the r.f. units and shield them individually as described in the preceding section. Occasionally you run into the use of *Masonite* panels in which case it will also be necessary to remove the front panel and back it up with a thin sheet of copper or copper screening. Be sure this is bonded to the rest of the shielding.

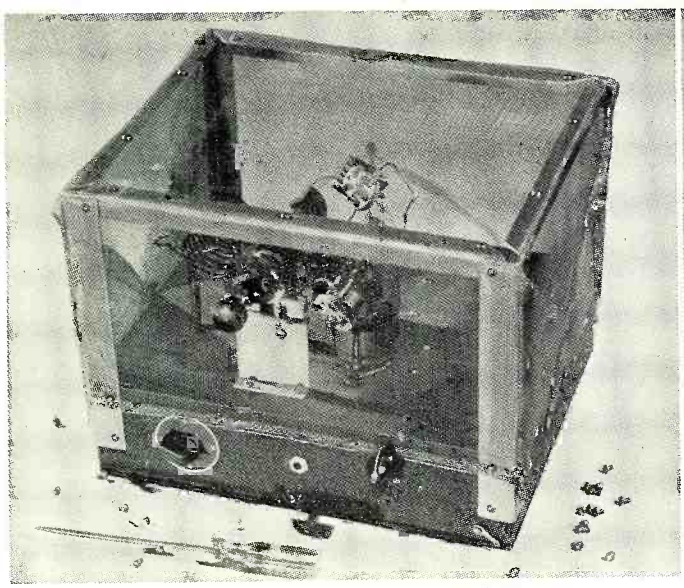
Before proceeding any farther, test the rig for TVI, and if you find that more shielding is necessary, build yourself a framework out of wood or angle-iron as shown in Fig. 6. Copper screening should then be tacked onto this frame. Be sure to put an access door in the rear and bond all the screening to the relay rack and a good ground. Don't forget to cover the top and bottom as well as the sides. You are now the owner of an inexpensive yet very effective enclosed relay rack cabinet.

Breadboard Construction

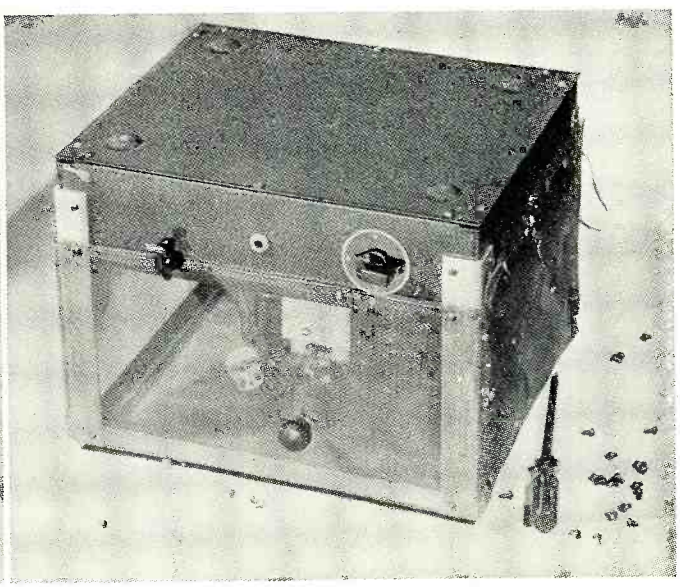
This type of construction consists of grouping together various units whose

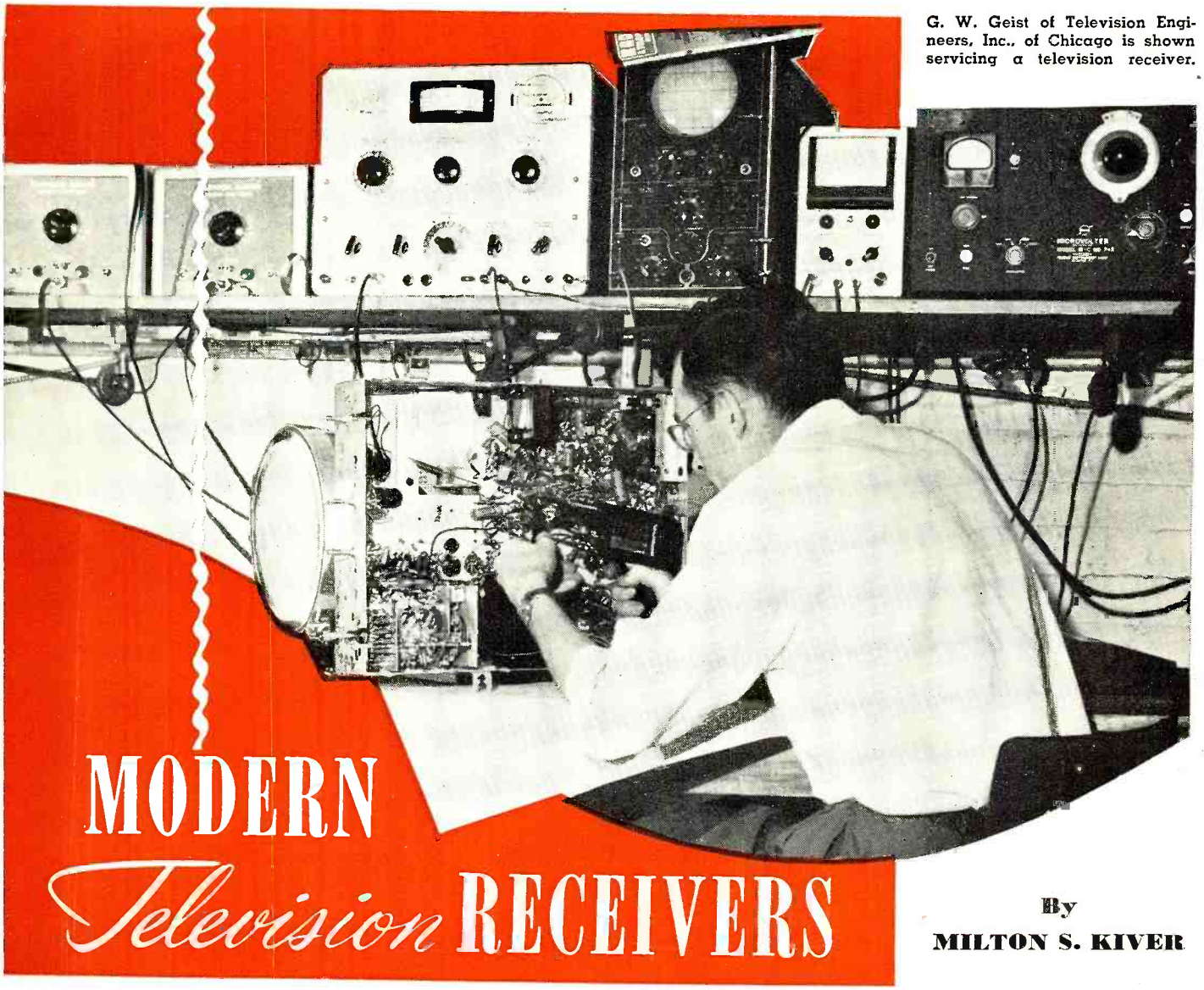
(*Continued on page* 106)

The 815 properly shielded with angles and copper screening.



A solid bottom pan can be used in place of the wire screen.





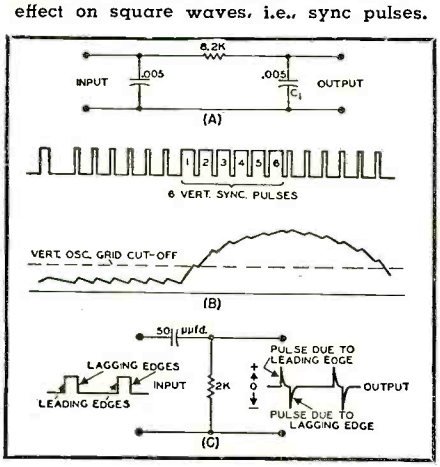
G. W. Geist of Television Engineers, Inc., of Chicago is shown servicing a television receiver.

MODERN *Television* RECEIVERS

By
MILTON S. KIVER

Part 18. Introduction to vertical sweep systems in modern television receivers. Included is a discussion of the best servicing procedure to follow.

Fig. 1. (A) Typical integrating network. (B) Output of the integrating network, appearing across C_1, during the vertical sync interval. (C) Differentiating network and its effect on square waves, i.e., sync pulses.



MORE troubles arise in the deflection systems of television receivers than in any other section of the set. Therefore, it behooves the television service technician to know not only how these systems work, but what to expect of them when some component fails. This latter point is seldom stressed in discussions of television receivers, and yet it is most important. You must know what to expect of a circuit when it fails before you can state with complete confidence that you know how that circuit works. Merely to be able to follow electrons around a circuit is not enough for successful servicing.

We have seen that the vertical and horizontal sync pulses at the output of the sync separator (or sync clipper) are directed by differentiating and integrating filters to the proper sweep system. Preceding the vertical sweep system is the integrating network, Fig. 1A, and its purpose is to permit a voltage to develop across the output condenser (C_1) only when the vertical sync pulses are active. This, of course, occurs every 1/60 of a second. The filter has a relatively long time constant which means that the condenser will charge and discharge slowly and will not respond to rapid fluctuations in voltage. Thus, when a horizontal pulse arrives at the input to this filter, its leading edge starts a slow flow of current through the resistor, and the condenser begins to charge. However, the charging process is slow, and before any appreciable amount of voltage has developed in the filter, the lagging edge of the wave arrives, reverses the current flow, and brings the condenser voltage back to its previous value. Very little change has occurred during this short time interval, and the vertical synchronizing oscillator is designed so that it does not respond to these small fluctuations.

The building up of the voltage across C_1 begins when the serrated vertical pulses are reached. Even though the series of six vertical pulses have

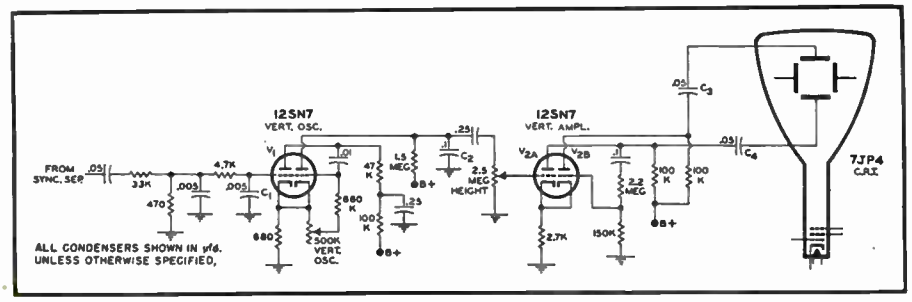


Fig. 2. A widely-used vertical sweep system.

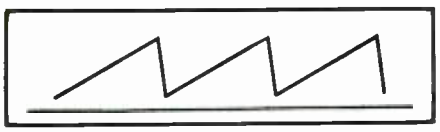


Fig. 3. The waveform of the voltage developed across C_2 of Fig. 2.

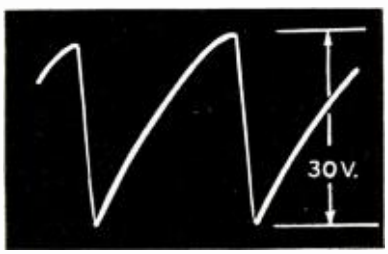


Fig. 4. The proper method of presenting a saw-tooth wave, with its amplitude indicated, in the receiver service manual.

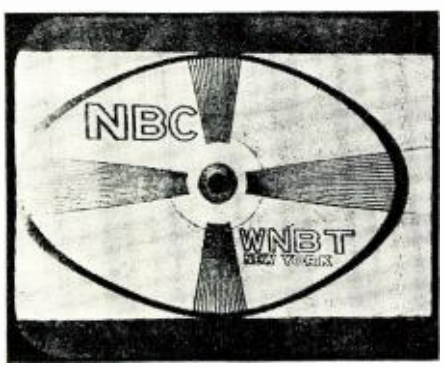
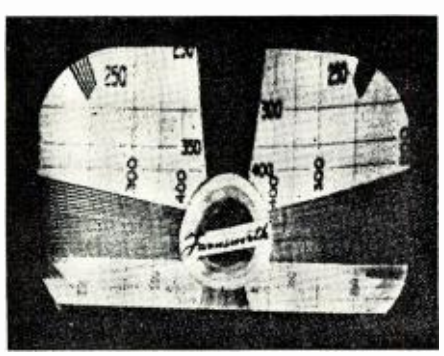


Fig. 5. Image possessing insufficient height.

Fig. 6. Non-linear saw-tooth wave. The effect of this type of deflection wave on an image is shown in Fig. 7.

Fig. 7. Vertical non-linearity.



notches between them, the voltage remains above the reference line for a relatively long time. During this interval, the charge across the condenser rises until it is sufficiently strong to trigger the vertical oscillator and initiate a new cycle. (See Fig. 1B.)

Now, let us look to the horizontal system. The differentiating filter preceding it (Fig. 1C) has a short time constant. At the application of the leading edge of a square sync pulse, a momentary flow of current passes through the resistor to charge the condenser fully to the value of the applied voltage. Once the full value is reached, nothing further occurs all along the flat portion of the pulse, because a condenser (and hence, a condenser and resistor in series) reacts only to changing voltages, not to steady voltages. The voltage along the flat top of the pulse is steady. At the lagging edge of the pulse, where the voltage drops suddenly, another momentary flow of current takes place, this time in the opposite direction, discharging the condenser. The result of the application of the square wave synchronizing pulse to the input of the filter is the output wave indicated in Fig. 1C. Each incoming sync pulse produces two sharp pulses of voltage at the output of the filter. For control of the sweep oscillator, only the leading pulse is required.

If the leading pulse is negative at the output of the filter (obtained by feeding in negative sync pulses at the filter input), it may be reversed by passage through an amplifier. Blocking oscillators, for example, require positive triggering pulses. In any event, whether the leading pulse is positive or negative, this pulse only is effective in triggering the sweep oscillator. The oscillators used, either the blocking or multivibrator types, respond to the first pulse, becoming insensitive immediately thereafter to other pulses that do not occur at the proper point in the oscillator frequency interval. Note that positive and negative pips are obtained at the output of the differentiating filter, even when the vertical pulses are active. In this way, the horizontal sweep oscillators are kept in synchronization during this period. (For a more detailed discussion of blocking and multivibrator sweep oscillators, consult the references at the end of this article).

We come now to the deflection system itself, and as a start we will begin with the vertical system. Perhaps one of the simplest vertical systems in use is that found in *Hallicrafters* television receivers, Models T-54 and 505. (See Fig. 2.) The incoming sync pulses are fed through a low-pass filter (integrating network) to a cathode-coupled multivibrator, V_1. This multivibrator is a self-oscillatory circuit, with its design constants adjusted to operate at or near 60 cycles. The incoming vertical sync pulses then lock-in the oscillator at precisely 60 cycles. Should the multivibrator natural frequency wander far enough away from 60 cycles to prevent a lock-in with the sync pulses, there is a hold control available, rotation of which will bring the multivibrator frequency back to 60 cycles again. (Actually, when the multivibrator is locked-in by the sync pulses, its operating frequency is slightly less than 60 cycles. This, however, is of academic interest only.)

The circuit oscillates in such a manner that the right-hand triode section of V_1 is kept cut off for approximately 16,000 microseconds out of each 16,666 microsecond vertical interval. For the remaining 666 microseconds, it is driven sharply into conduction, while the other triode section of V_1 is cut off. During this time, whatever voltage has been built up across C_2 discharges rapidly through the triode that is now conducting. This discharge of C_2 represents the vertical retrace period, when the electron beam is brought rapidly back from the bottom of the image to the top. When the beam is back at the top of the screen, the right-hand triode section of V_1 starts to conduct. In the long interval that follows, C_2 commences to charge, doing this because one plate is connected to "B +" (through a resistor), and the other plate is grounded. If left alone long enough, the voltage across C_2 would equal that of applied "B +." As it is, the right-hand triode section of V_1 conducts before this happens and discharges whatever accumulation of voltage has developed across C_2 in the period when this tube was non-conductive.

In this circuit C_2 performs a very important function. The voltage variations which are developed here possess the form shown in Fig. 3. The voltage rises linearly as long as the right-hand triode section of V_1 is not conducting, and drops sharply when this triode does conduct. The rising voltage represents the deflection voltage which, when applied to the vertical deflection plates of the 7JP4 cathode-ray tube, forces the beam to move gradually from the top of the screen to the bottom. The sudden drop in the saw-tooth waveform represents the rapid reversal of the deflection voltage, bringing the beam back to the top of the screen again. Across C_2, then, we obtain our driving voltage for the vertical section of the image, and any total or partial failure of this condenser to develop the proper voltage will affect the image ver-

tically. How these will affect the image will be indicated presently.

We are concerned here with two quantities, namely, waveform and amplitude. Both must be right if the proper image is to appear on the screen. Thus, consider C_2. The proper voltage waveform that should develop across this condenser is a linear saw-tooth wave. Its peak-to-peak spread or amplitude will depend upon the design of the circuit. This will differ with each television receiver model and will be included in the service manual if the waveforms are also given. One is seldom present without the other and they are shown as illustrated in Fig. 4. If neither is given, and, unfortunately, this is true in many of the poorly compiled instruction sheets that pass for service manuals, then the service technician will be forced to depend upon waveform alone. Fortunately, many of the deflection circuits are similar, and the same waveform will be found in a goodly number of sets. By observing the waveform in these circuits and comparing their amplitude with comparable sets where the amplitude is known, it is possible to determine roughly if the circuit is functioning properly.

Getting back to the saw-tooth wave shown in Fig. 3, suppose it possesses the proper waveshape but insufficient amplitude. How will this affect the image? The answer is shown in Fig. 5. The image will be evenly spaced from top to bottom (or vertically), but only part of the screen will be covered by the image. To correct this condition, try adjusting the height control. In Fig. 2, this height control functions in a manner similar to a volume control in an audio amplifier. By altering the position of the center arm of the potentiometer, we can use part or all of the saw-tooth voltage developed across C_2. If, by taking all of the voltage developed across C_2, we are still unable to cause the image to fill out the screen vertically, then change V_1 and/or V_2; V_2 is the vertical amplifier.

If the defect still persists, measure the voltages at both tubes and compare them with the values quoted by the manufacturer. Resistances in the circuit do change values, and generally the result is an increase in resistance. If the plate voltage is low, do not assume that the fault lies in the power supply. It has been the author's experience that quite frequently a rise in plate load resistance is responsible for the decrease in plate voltage. Measuring the power supply voltage will indicate whether or not this unit is at fault. As a further check, turn the set power off and measure the plate load resistance. If it differs more than 15 per-cent from the specified value, replace it.

Another common defect in the voltage developed across C_2 occurs when the waveshape assumes the form shown in Fig. 6. Note that the wave levels off after it has attained a certain amplitude. We say that the wave

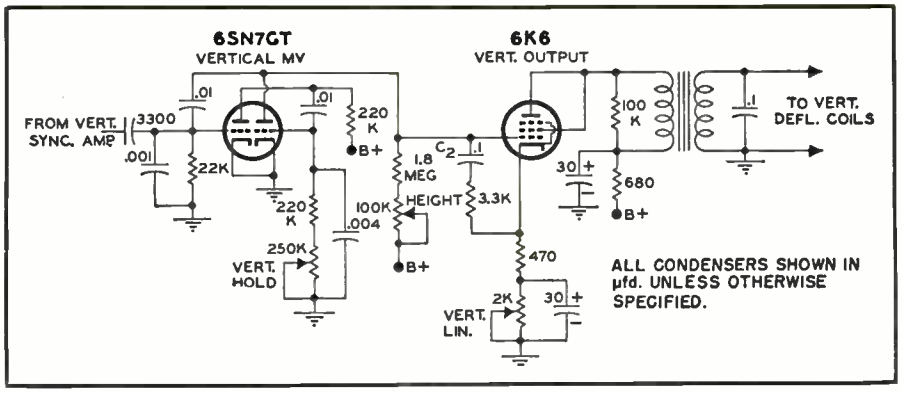


Fig. 8. A vertical deflection system feeding a set of deflection coils.

is non-linear. Now let us see how it will affect the image. As long as the saw-tooth wave rises at a steady (or linear) rate, the scanning beam in the cathode-ray tube travels downward at an even rate, and the image will be properly traced out. However, the wave shown in Fig. 6 does not rise at an even rate. Instead, it slows down after starting off linearly. The electron scanning beam in the cathode-ray tube will do the same thing. It will start traveling downward at the proper rate of speed and then slowly decrease its speed. The image signals, in the meantime, continue to arrive at the same steady pace. The result: The image will be crowded together at the bottom, as shown in Fig. 7. The image is now said to possess non-linearity.

What are the causes of this condition? Low "B +" voltage, bad tubes, and altered component values, precisely the same causes encountered for reduced amplitude; and, in many cases, a distorted waveform is accompanied by lowered amplitudes. The procedure, then, is to check the waveform first and then its amplitude.

In the circuit shown in Fig. 2, non-linearity must be due to one of the three items just mentioned. In some circuits, however, there is available a linearity control. This should be adjusted first when the image appears non-linear. Only after it has been found that the control is unable to correct the defect is the systematic approach outlined above begun.

The circuit of Fig. 2 is straightforward, involving a cathode-coupled multivibrator, a charge and discharge condenser C_2 and a push-pull output amplifier. The saw-tooth wave developed across C_2 is amplified by V_{2A} and V_{2B} and then transferred to the vertical deflection plates of the 7JP4

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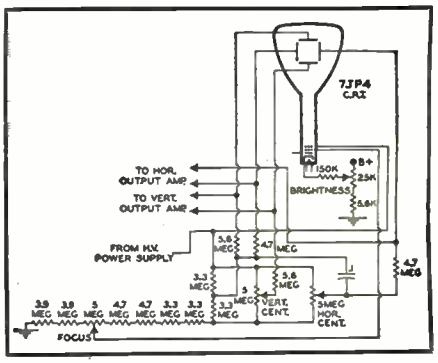


Fig. 9. Method of applying the high accelerating voltage to the image tube and also providing beam centering adjustments.

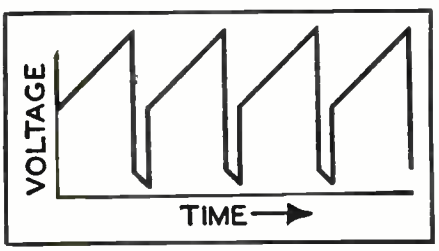
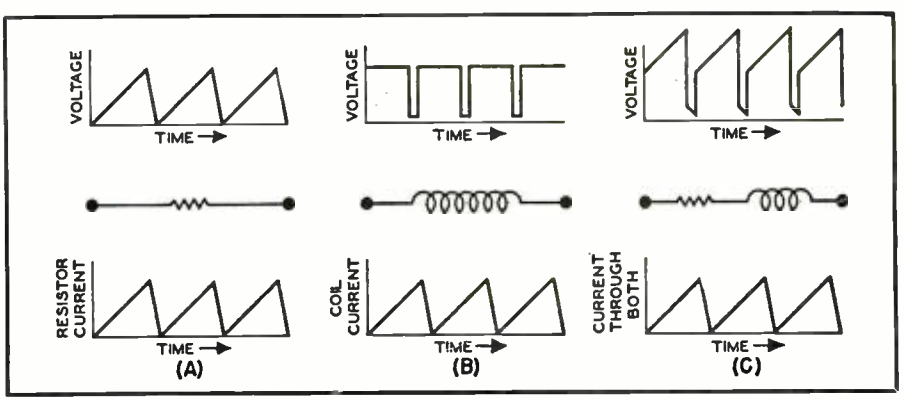


Fig. 10. The proper deflection voltage to use with deflection coils.

Fig. 11. By applying the voltage shown above each electrical component, the saw-tooth waves shown underneath are obtained.



Build This Experimente.'s POWER SUPPLY

By
RUFUS P. TURNER
K6AI

Fig. 1. The d.c. voltage control knob is in the center. Insulated binding posts on the right allow easy access to variable d.c. voltage and to a selection of low a.c. voltages.

Constructional details of an inexpensive power supply which furnishes continuously variable d.c. output and twelve easily selected, low a.c. voltages.

EVERY experimenter needs a variable-voltage bench power supply. A permanent unit of this sort is invaluable for powering developmental models of receivers, small transmitters, test instruments, and miscellaneous electronic gear. A line-operated power supply always is ready for use, while standby batteries may be found to have deteriorated from use or disuse when they are needed urgently. While most experimenters, both professional and amateur, readily acknowledge the usefulness of a variable-voltage bench power supply, others have not constructed these units because the tendency is to associate smooth output voltage variation with relatively expensive Variac control.

In developing the power supply described in this article, the author has aimed to produce a simple unit having wide versatility. The subject supply delivers filtered d.c. continuously variable from 58 to 305 volts at 100 milliamperes. The maximum voltage drops approximately to 250 volts when the output current drain reaches 150 milliamperes. In addition, 12 low a.c. output voltages are available for filament heating and sundry other test or control purposes. The unit may be built with surplus parts.

How the Unit Works

An *electronic variable resistor* is connected in the positive high-voltage output leg of the otherwise conventional power supply to vary the output voltage. This simple electronic rheostat consists basically of a triode tube with its plate connected to the output of the power supply filter and its cathode becoming the d.c. output voltage terminal. The internal plate-cathode path of the tube, when electrons are flowing across, acts as a resistance, the ohmic value of which is determined by the amount of bias applied to the control grid. The bias is derived from a potentiometer connected across the d.c. output, and this potentiometer thus acts as the single output voltage control.

In practice, few small-sized triodes will pass safely the full d.c. output current of a power supply in this fashion; and such triodes are relatively expensive. In order to achieve the desired results without damaging the rheostat tube, two or more triodes often are connected in parallel for larger current handling ability. Two triode-connected 6L6 control tubes are wired in parallel in the power supply described here. These tubes may be bought on the surplus market at present for less than one dollar each, and they are adaptable excellently to this application.

Two center-tapped filament transformers (one 6.3 volts and the other 2½ volts) are provided in the power supply. All six secondary leads from these transformers are brought out to binding posts. A variety of a.c. voltages may be obtained by using these transformers separately and by connecting their full or half secondaries in series (See Table 1).

Fig. 2 is the complete circuit schematic of the power supply.

Power transformer T_1 furnishes all voltages required by the rectifier and

Table 1. Showing a.c. output voltages.

A.C. Voltage	How Obtained
0.65	Connect one-half of 6.3 v. winding and full 2½ v. winding in series BUCKING.
1.25	Use one-half of 2½ v. winding.
1.90	Connect one-half of 6.3 v. winding and one-half of 2½ v. winding in series BUCKING.
*2.50	Use full 2½ v. winding. Center tap available.
3.15	Use one-half of 6.3 v. winding.
3.80	Connect full 6.3 v. winding and full 2½ v. winding in series BUCKING.
4.40	Connect one-half of 6.3 v. winding and one-half of 2½ v. winding in series ADDING.
5.05	Connect full 6.3 v. winding and one-half of 2½ v. winding in series BUCKING.
5.65	Connect full 2½ v. winding and one-half of 6.3 v. winding in series ADDING.
*6.30	Use full 6.3 v. winding. Center tap available.
7.55	Connect full 6.3 v. winding and one-half of 2½ v. winding in series ADDING.
8.80	Connect full 6.3 v. winding and full 2½ v. winding in series ADDING.

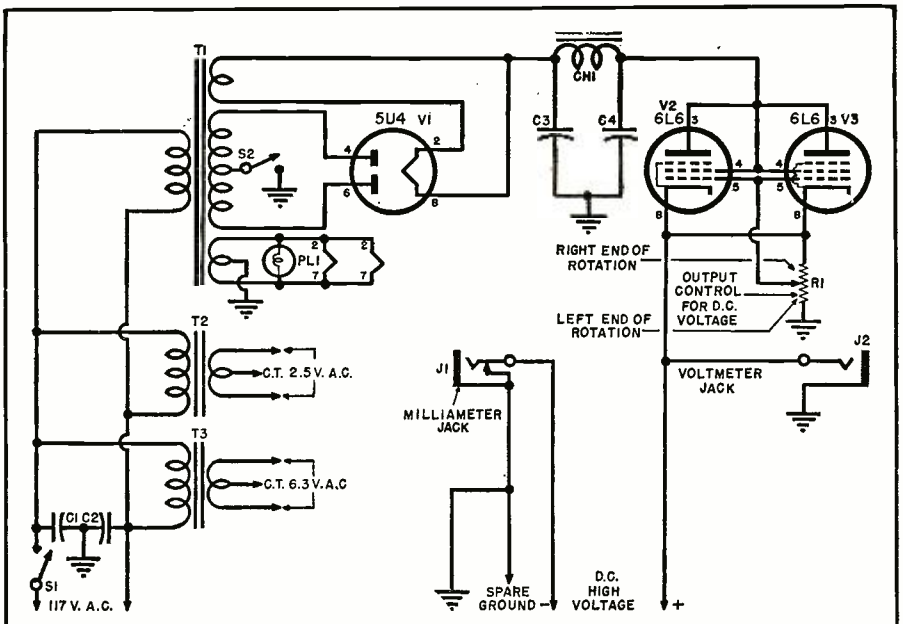
* Common filament or heater voltages.

control tubes. The 5U4-G rectifier is a high-current glass-octal type which operates with an abundant safety factor at the current rating of this power supply. Other rectifier tubes, such as the Types 5X4 and 5Z3 can be used with equal efficiency. However, Types 5Y3 and 80 are not recommended unless the output current is held to a maximum value of 125 milliamperes, and Type 83 (because of its mercury vapor) is not entirely satisfactory in some applications requiring complete freedom from hash.

The positive d.c. output from filter choke CH_1 is applied directly to the 6L6 plates and screens which have been connected in parallel. The 6.3-volt filament winding of transformer T_1 supplies the 6L6 heaters and pilot lamp PL_1. The center tap of this 6.3 volt winding is grounded to prevent any possible hum modulation of the d.c. output. The 6L6 cathodes in parallel present d.c. output voltage to voltage control potentiometer R_1, voltmeter jack J_2, and the "+" high voltage d.c. output terminal.

The d.c. output voltage control, R_1, is a 75,000-ohm wirewound potentiometer of the larger-size volume control type. A carbon or composition control must not be employed in this position. This potentiometer permits smooth variation of the 6L6 control grid bias voltage and, in turn, the d.c. output voltage at the "+" high voltage terminal post. Potentiometer R_1 operates in this circuit position without heating; and, in addition to its intended function, it acts also as a bleeder resistor to discharge the filter condensers (C_3, C_4) when the power supply is off.

Switch S_2 permits interruption of the d.c. output voltage without switching off the a.c. voltages delivered by the filament transformers, T_2 and T_3. Switch S_1 is the power-line "On-Off" switch which places the entire unit in or out of operation.



R_1—75,000 ohm wirewound pot.
C_1, C_2—.1 μfd., 400 v. cond.
C_3, C_4—Dual 8 μfd., 450 v. elec. cond.
CH_1—8 hy., 180 ma. filter choke (Thermador 7A0819)
J_1—Miniature closed-circuit phone jack
J_2—Miniature open-circuit phone jack
PL_1—6.3 v. pilot lamp
S_1, S_2—S.p.s.t. toggle sw.
T_1—Power trans.: 350-0-350 v. @ 150 ma.; 5 v. @ 3 amp.; 6.3 v. @ 4.5 amp. center-tapped (Thordarson T-70R62)
T_2—Filament trans.: 2.5 v. @ 5 amp. center-tapped (Thordarson T-21F00)
T_3—Filament trans. 6.3 v. @ 3 amp. center-tapped (Peerless 304-FD)
V_1—5U4 tube
V_2, V_3—6L6 tube

Fig. 2. Complete wiring diagram of the experimenter's low-cost power supply.

A self-contained output voltmeter and milliammeter were not included in the power supply, since it was decided that all experimenters already have these two instruments in some form, and inclusion would result in unnecessary duplication. Instead, a voltmeter jack (J_2) and a milliammeter jack (J_1) are provided for plugging in the instruments when readings are desired. In order to prevent grounding the positive output line when the meter plug is withdrawn, J_2 must be an open circuit jack. On the other hand, J_1 must be a closed circuit jack to permit interruption of the negative high-voltage line for insertion of the milliammeter, while restoring the line when the meter plug is withdrawn.

Several careful considerations resulted in choice of the two transformers, T_2 and T_3, instead of some sort of continuously variable circuit to supply low a.c. voltages. A continuously variable autotransformer, such as the Variac, is the most satisfactory and foolproof device for variation of the a.c. voltage; but it is expensive and bulky. A wide range of a.c. voltages ordinarily will not be needed in most

(*Continued on page* 86)

Fig. 3. Under-chassis view. Both filament transformers are mounted below the deck. Wiring does not have to be cabled or isolated as in other electronic equipment.

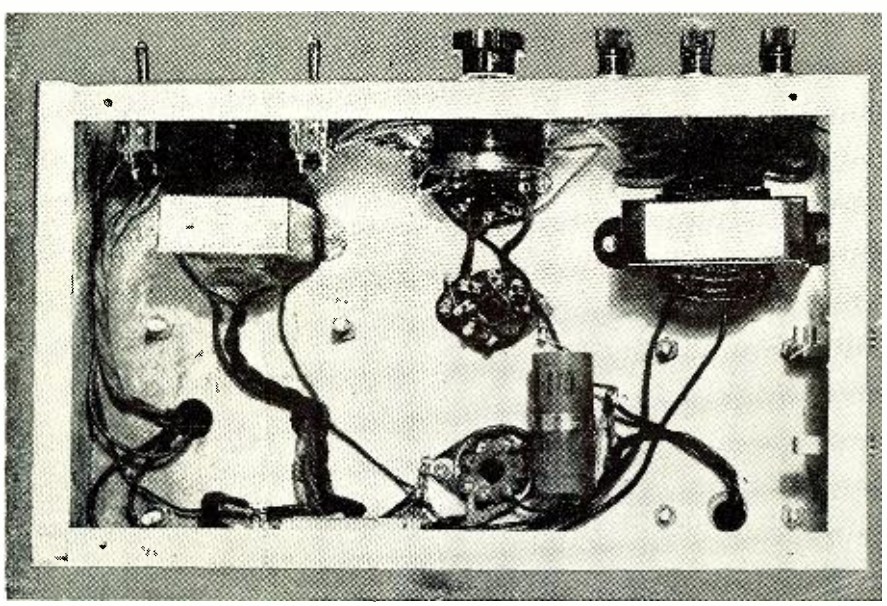
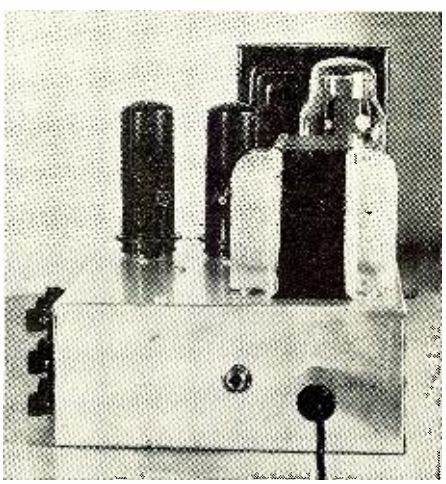
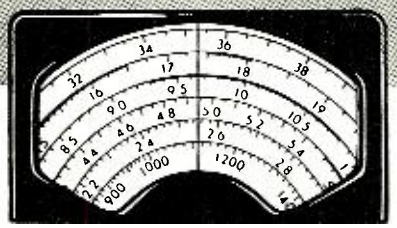


Fig. 4. The two meter jacks are mounted through this end of the chassis. The voltmeter plug, for reading d.c. output voltage, is shown inserted into its jack.



International SHORT-WAVE



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

IT IS a pleasure this month to dedicate the *ISW Department* to radio broadcasting in Norway, *"The Land of the Midnight Sun."* Thanks go to Arne Halvorsen, Oslo, who furnished us this information:

All Norwegian broadcasting is operated by the State company, *Norsk Rikskringskasting.* There are four stations in the long-wave band, thirteen medium-wave stations, and four short-wave stations—serving a total of 650,000 registered listeners in Norway, each of whom pays an annual fee of 20 krone (approximately $4.10 or one pound sterling).

In addition to broadcasts for home consumption, short-wave programs are arranged especially for the Antarctic whaling fleet, Norwegian ships, and other Norwegians abroad. This series of Norwegian short-wave transmissions was inaugurated January 3, 1948, by King Haakon.

Norwegian Home Service broadcasts are of an informative and educational nature rather than pure entertainment. Commercial advertising and "soap operas" are unheard of in Norway!

Short-wave broadcasts are radiated over the short-wave transmitters at Fredrikstad. The new installation consists of a 100 kw. *General Electric* transmitter and two 8 kw. *Westinghouse* transmitters.

The short-wave broadcasts are opened by a signature tune, a melody built around the oldest Halling written down (Halling is a Norwegian folk dance). The announcement is: "This is the Norwegian State Broadcasting with its short-wave service for Norwegians abroad. We are calling on the following frequencies. . . . This special transmission takes place every day . . . between . . . and . . . o'clock GMT. In these broadcasts, we will usually bring news from Norway and other items of particular interest for Norwegians abroad. We also will include a concert of Norwegian music of various kinds towards the end of these transmissions and this music will be introduced in *English* as well as in Norwegian. Today, you will hear . . . and it will be heard in approximately . . . minutes. We are always grateful for reports on the broadcasts and our mailing address is The Norwegian State Broadcasting, Oslo, Norway."

N.R.K. now has a *new* QSL card.

Summer short-wave schedules of *Radio Norway* are listed:

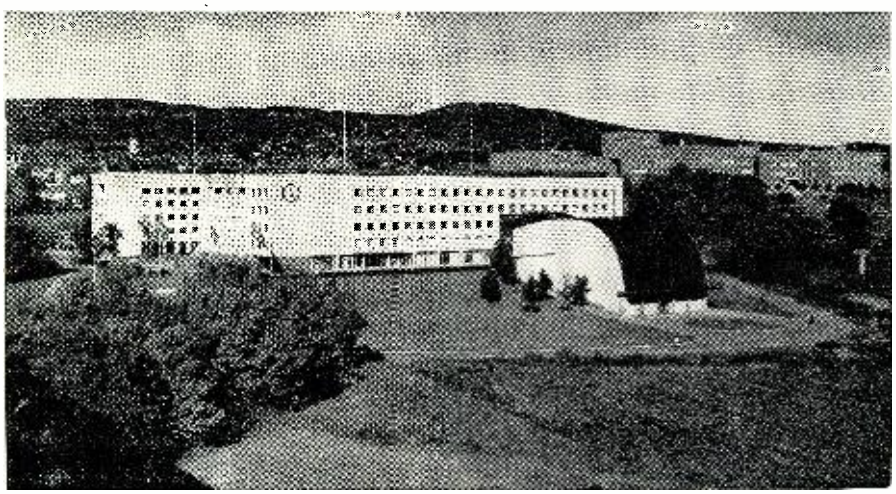
Norwegians abroad—2000-2100, LKV, 15.170, LKQ, 11.735, LLG, 9.645, beamed to North American waters, North Atlantic. *Home Service and Norwegians Abroad*—0130-0230 (Sundays 0255-0715), LLP, 21.670, LLN, 17.825, LKV, 15.170, LLK, 11.850, beamed to African waters, South Atlantic. *Norwegians Abroad*—0600-0630, LLP, 21.670, LLN, 17.825, LKV, 15.170, LLK, 11.850 (schedule lists this weekdays *only*), beamed to Far East. *Norwegians Abroad*—0800-0830, LLP, 21.670, LLN, 17.825, LKV, 15.170, LLK, 11.850, beamed to North Atlantic and Indian Ocean. *Home Service*—1230-1340 (Sundays 1000-1340), LLP, 21.670, LLN, 17.825, LKV, 15.170, LLG, 9.610, beamed to African waters and South Atlantic. *Norwegians Abroad*—1400-1500, LLP, 21.670, LIN, 17.825, LKV, 15.170, LKQ, 11.735, LLG, 9.645, beamed to African waters and South Atlantic. *Home Service*—1500-1700, LLP, 21.670, LLN, 17.825, LKV, 15.170, LLG, 9.610, beamed to African waters and South Atlantic. *Norwegians Abroad*—1800-1900, LKV, 15.170, LKQ, 11.735, LLG, 9.645, beamed to South America. *Home Service*—0130-0230 (Sundays 0255-0715), LKJ, 9.540; 0520-0740, LKJ, 9.540; 1100-1700 (Sundays 1000-1700), LKJ, 6.130, beamed to North Atlantic Sea.

And so it is our best wishes for the future go to *Radio Norway* . . . in *"The Land of the Midnight Sun!"*

* * *

(Note: Unless otherwise indicated, all time 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.)

Broadcasting House, Oslo, Norway. From the "land of the midnight sun" short-wave programs are radiated daily for Norwegians abroad from this beautiful modern structure.



DX Broadcasts

Contributors to the DX program (Wednesdays around 2115 on 9.767) from Leopoldville, Belgian Congo, are receiving this letter:

"Thanks to your personal contribution, our special weekly program dedicated to DX-ers has grown to a world-wide success, and we therefore take this opportunity to express our appreciation on behalf of our large radio-fans family. The information, experience, and knowledge which our DX friends in all parts of the world gain by listening to the Wednesday feature of OTC, is, by their own acknowledgment, most invaluable, and many an old hand, and certainly most newcomers, have increased their listening-radius and their contacts by taking down the items you so helpfully send us. And by helping us, you surely contribute to a great extent in spreading friendship and mutual understanding, both of which are the aims of our International Goodwill Station. On behalf of all OTC-friends, we thank you sincerely." Signed L. Le Roye, Director.

* * *

Regarding VED

Harris, Calif., has received this information on VED, the short-wave

(*Continued on page* 124)

The Television RECEIVING ANTENNA

By B. V. K. FRENCH
Exec. Staff, Howard W. Sams & Co., Inc.

Part 2. Covering various types of antenna construction, transmission lines, and the problems of fringe-area reception.

IN PART ONE of this series, published in last month's issue, we covered such topics as wave polarization, wave paths between transmitter and receiver, line-of-sight transmission, television channel wavelengths, bandwidth and antenna problems, multiple-path transmission ghosts, reflections in lead-in line, half-wave dipole antennas, and the folded dipole.

The folded dipole covered did not take into consideration the addition of reflectors. Now, if a second half-wave dipole is placed parallel to and closer than a half-wavelength from the receiving dipole, the magnetic and electrostatic fields of this element will modify the directional pattern of the receiving dipole and also increase its effectiveness or gain, compared with the performance of the dipole alone. When such a "parasitic" element is placed behind the receiving dipole, i.e., on the side away from the transmitter, it is known as a "reflector" element. If, on the other hand, it is placed on the side of the dipole toward the transmitter, it is known as a "director." When employed as a reflector the element is made approximately 5% longer than the receiving antenna, and when employed as a director it is made about 4% shorter than the receiving dipole.

This is equivalent to saying that the reflector is tuned to a frequency somewhat lower than the operating frequency and that the director is tuned to a slightly higher frequency. Fig. 10A shows the arrangement of the dipole with a director and a reflector. The effect of the spacing of these elements on the power gain of the dipole antenna is shown in Fig. 10B.

Fig. 10C compares the directional pattern and gain of the dipole alone, with a dipole using either a reflector or a director and also with a dipole using both a reflector and a director. It will be seen that the gain in the desired direction (toward the transmitter) is increased by these additional elements, and the directional pattern is made sharper so that stations at other points of the compass are not received with the same strength. For this reason, arrays of this type are beneficial in increasing the pickup from the desired station and, at the same time, suppressing reflection paths which would produce ghosts.

These multiple element arrays are sometimes called "Yagi," since a Japanese by that name first proposed their use as directional antennas.

Arrays with directors and reflectors, while constituting an improvement over the dipole from the standpoint of pattern and gain, will not accept as wide a frequency band as the simple dipole or folded dipole. It is often necessary to erect a number of these antennas tuned to various stations in the band. Fig. 10D illustrates a dipole with reflector, while Fig. 10E shows two sets of arrays on a single pole. The lower array is used for the low band of television frequencies, i.e., channels two through six, and the upper array of smaller size is used for channels seven through thirteen.

If increased gain and directivity are required, additional director elements can be added, and arrays with as many as five elements are often employed for the reception of a single station, when the receiving location is at the edge or fringe of the service area. Several such arrays will be illustrated when we discuss fringe reception. When five elements are used (a reflector and three directors added to the dipole) the antenna will accept only a single channel, and may not

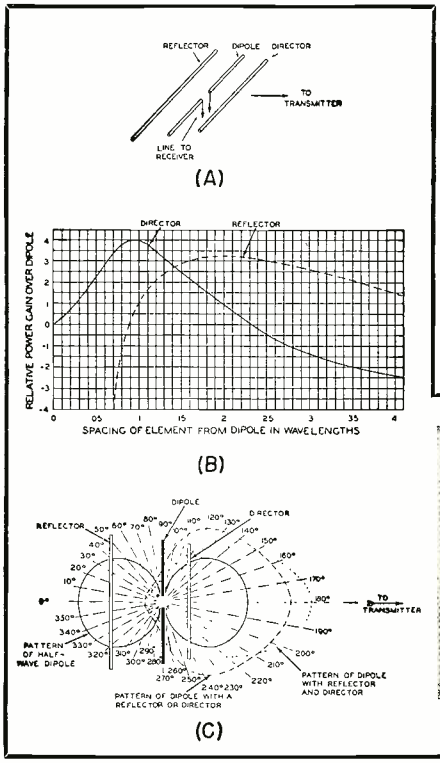


Fig. 10. (A) Dipole with director and reflector. (B) Effect of director and reflector spacing on gain of parasitic array. (C) Typical reception patterns of a dipole with director and reflector elements singly or in combination. (D) Dipole with reflector. (E) Dipole arrays with directors and reflectors separate for each band.

EQUATIONS FOR DIPOLE ANTENNA ARRAY DIMENSIONS

Length of Dipole Element in Feet = $\frac{468}{\text{Frequency (Megacycles)}}$

Length of Reflector Element in Feet = $\frac{492}{\text{Frequency (Megacycles)}}$

Spacing of Reflector Element in Feet = (.15 wavelength) $\frac{148}{\text{Frequency (Megacycles)}}$

Length of Director Element in Feet = $\frac{450}{\text{Frequency (Megacycles)}}$

Spacing of Director Element in Feet = (.1 wavelength) $\frac{98}{\text{Frequency (Megacycles)}}$

DIMENSIONS FOR DIPOLE ELEMENTS

Channel Number	Channel Freq.Mc.	Dipole Length	Reflector Length	Spacing of Reflector	Director Length	Spacing of Director
2	54-60	8ft. 5-5/8in.	8ft. 10-7/8in.	2ft. 8-1/8in.	8ft. 1-3/4in.	1ft. 9-3/8in.
3	60-66	7ft. 7-3/4in.	8ft. 3/8in.	2ft. 3-3/4in.	7ft. 4-1/4in.	1ft. 7-1/4in.
4	66-72	6ft. 11-1/2in.	7ft. 3-7/8in.	2ft. 2-5/8in.	6ft. 8-3/8in.	1ft. 5-1/2in.
5	76-82	6ft. 3/4in.	6ft. 4-1/2in.	1ft. 11in.	5ft. 10in.	1ft. 1-1/2in.
6	82-88	5ft. 7-1/2in.	5ft. 10-5/8in.	1ft. 9-1/4in.	5ft. 4-7/8in.	1ft. 3-1/8in.
7	174-180	2ft. 8in.	2ft. 9-5/8in.	10-1/8in.	4ft. 6-3/4in.	6-3/4in.
8	180-186	2ft. 6in.	2ft. 8-1/2in.	9-3/4in.	2ft. 5-3/4in.	6-1/2in.
9	186-192	2ft. 9-3/4in.	2ft. 7-1/2in.	9-1/2in.	2ft. 4-3/4in.	6-1/4in.
10	192-198	2ft. 5in.	2ft. 6-1/2in.	9-1/4in.	2ft. 4in.	6-1/8in.
11	198-204	2ft. 4-1/8in.	2ft. 5-5/8in.	8-7/8in.	2ft. 3-1/8in.	5-7/8in.
12	204-210	2ft. 2-3/4in.	2ft. 4-3/4in.	8-5/8in.	2ft. 2-1/4in.	5-3/4in.
13	210-216	2ft. 2-5/8in.	2ft. 4in.	8-3/8in.	2ft. 1-1/2in.	5-5/8in.

Table 1. Equations for the dimensions of practical dipole array.

Number of Elements	Power Gain (Compared to Dipole)	Front-to-Back Reception Ratio
2	2.5	10/1 to 30/1
3	3.6	30/1 to 300/1
4	5.0	100/1 to 1000/1

Table 2.

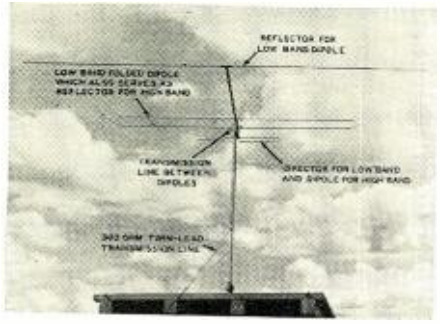


Fig. 11. Antenna array of folded dipoles for reception on both bands.

adequately cover the entire six megacycle band required for the channel.

Table 1 shows in tabular form the formulas for the length of dipole elements and the optimum spacing of these elements for each channel.

Table 2 shows the effect on the power gain of the array, as compared with the half-wave dipole used alone, and the ratio of forward reception to that of the reverse side of the antenna. These figures depend upon the care with which the system is adjusted. This is especially true with respect to the front-to-back ratio, in which the highest values are obtained only at the frequency to which the system is tuned.

The Broadband Problem

The half-wave dipole and arrays employing half-wave elements are most efficient at the frequency for which they have been cut. Satisfactory performance is obtained with such antennas when only one station serves the area, or when relatively high signal strength exists for several stations in the same television band. When reception of stations in both the low band (54 mc. to 88 mc.) and the high band (174 mc. to 216 mc.) is required, antenna structures of wider frequency response are necessary.

The folded dipole exhibits the broadest frequency response of any of the types of television antennas discussed to this point. Fig. 11 shows a combination of folded dipoles which provides reception in both bands as well as directional discrimination.

In the low-frequency band, this antenna acts as a three-element array in which the larger folded dipole is the receiving antenna, backed by a reflector, and the smaller folded dipole is properly positioned to act as a director. In the high-frequency band, the small folded dipole functions as the antenna and the large dipole behind it acts as a reflector. The two dipoles are connected to each other at their center (high current) points, by the proper length of twin-lead transmission line, so that a transition of operation occurs between the two bands. An additional feature of this array, as determined by the size of the elements and their spacing, is a low efficiency in the gap between the two television bands. This gap contains the FM broadcast stations (88 mc. to 108 mc.), which constitute a possible source of television interference.

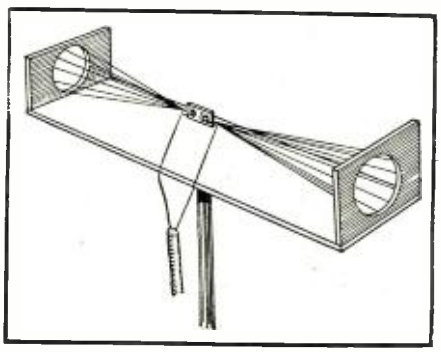
In the following text, means for increasing the bandwidth, other than by use of the folded dipole, are described and illustrated.

A Large Diameter Dipole. A dipole whose diameter is increased with respect to its length has a wider frequency response than the thin rod type. If the dipole is made in the form of a large cylinder, i.e., three to six inches in diameter, its "Q" will be decreased and its response to frequency broadened. Such a cylinder would be awkward to install and would possess a large surface which would easily be damaged by wind. An equivalent of the cylinder can be obtained by constructing a cage of wires with their ends connected to rings.

A Dipole in the Form of a Cone. The cage construction can further be modified to the form of two cones whose apexes meet at the lead-in or feed point. Fig. 12 shows such an antenna.

A Modified "Cage" or "Cone." Sev-

Fig. 12. The "cage" antenna, a variation of the dipole for wide-band reception.



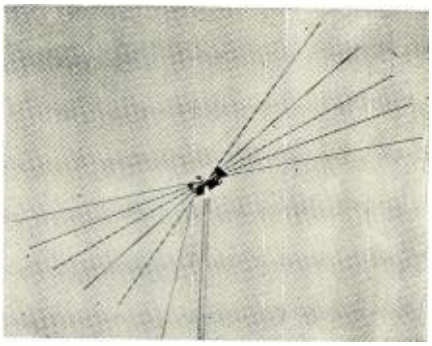


Fig. 13. Broadband response obtained by a "fan" of dipole elements.

eral dipoles arranged in the form of a fan, and with varying element lengths, will provide a pattern similar to the simple half-wave dipole, but will have broad frequency response characteristics. Fig. 13 shows a commerical form of such an antenna, known as the "di-fan."

A Non-Parallel Dipole. The "V" type antenna, in its simplest form, consists of a dipole whose elements are not in a straight line, but are positioned at an angle of less than 180 degrees (in other words, "V" shaped). The effect of moving the dipole elements from a straight line is to broaden the band and still retain the directional pattern. Fig. 14A shows the

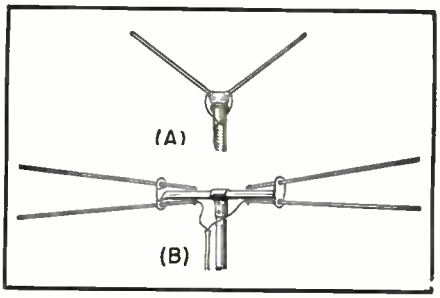


Fig. 14. The "V" and "double-V" variations of the dipole antenna.

"V" antenna in its simplest form. Fig. 14B shows a modification of the "V" antenna known as the "Double-V" which, due to the parallel operation of the dipoles, shows an increased impedance and matches a 300-ohm transmission line.

Special Dual Element Combinations. Dipole combinations, in which the high-frequency element is a physical extension of the low-frequency element, can be made to exhibit wide frequency response. Many variations of this type of construction are appearing on the market, a number of which are illustrated in Figs. 15A, B, and C. Such antenna structures can also be used with reflector elements, as shown in Fig. 15C. Their characteristics include wide band response, desirable directional patterns, and attenuation of the FM region. Certain of these antennas use balancing transformers, consisting of short lengths of coaxial cable, which aid in matching the transmission line.

Any type of antenna can be used in

a "stacked" arrangement in which a second identical antenna is erected directly above the first and in the same vertical plane. The antennas are positioned at a critical spacing (usually a half-wavelength), which provides in-phase operation to a common transmission line. The advantages of vertical stacking are twofold.

1. Additional gain is obtained due to the contribution of the added antenna.

2. Some vertical directivity is contributed by the mutual interaction of the antennas which discriminates against a reflected wave from the ground and confines the reception to the direct or sky wave. Fig. 16 illustrates several versions of vertically stacked arrays.

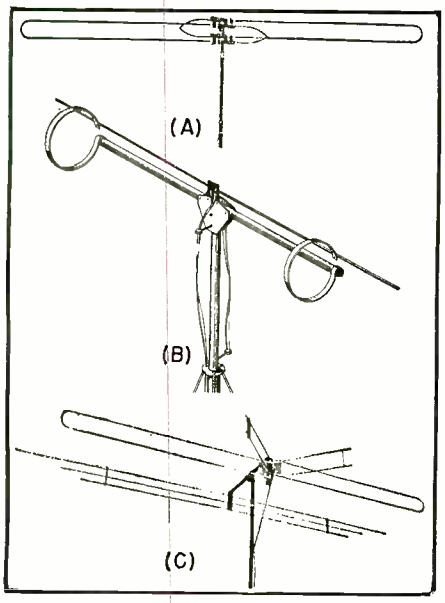


Fig. 15. Three different types of dual-element, wide-band television antennas.

Rotatable Antennas

From the discussion of multiple path reception difficulties, it is evident that a highly desirable feature for a television antenna would be the ability to rotate it to different positions as conditions might require. Fig. 17 shows a remotely controlled, motor driven antenna which accomplishes this result. It consists of two half-wave dipoles positioned at right angles to one another. The longer dipole is cut for the average frequency of the low frequency band, while the shorter dipole is tuned to the average frequency of the high band. A motor, housed within the antenna structure, allows rotation of the structure for optimum reception. Motion is accomplished by a control box located at the receiver. Slip-ring construction allows the antenna to be continuously rotated. On alternate 180 degree positions, the mechanism at the base of the antenna automatically switches from one band of TV frequencies to the other.

Other types of rotators are available which provide remote indication of the antenna position. With these devices the user may "log" the best position of the antenna for any given station, and subsequently return the antenna to the proper position.

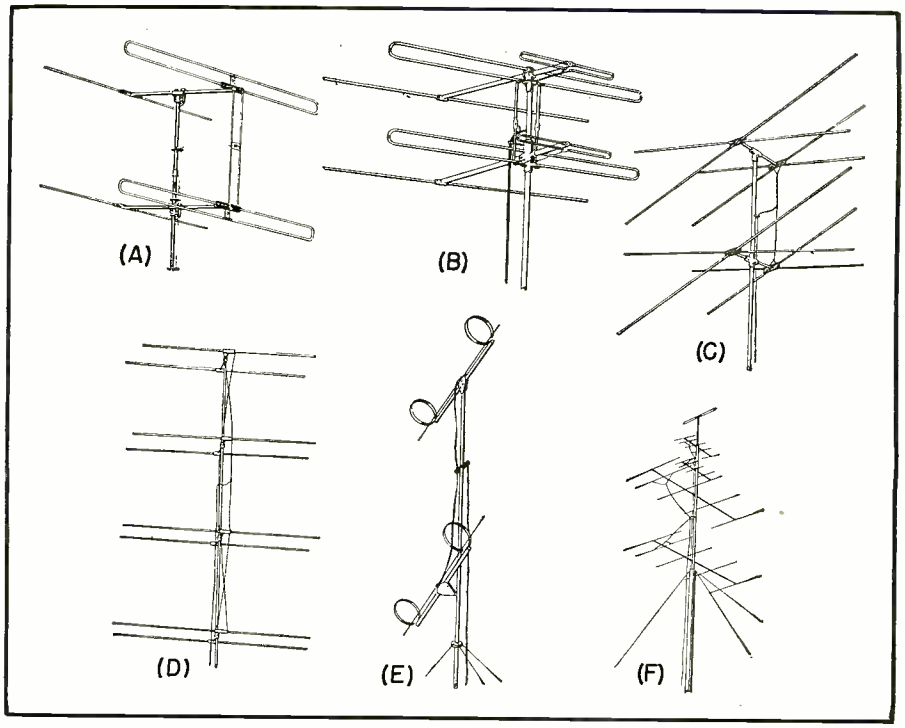


Fig. 16. Several types of commercially available stacked arrays that provide a higher gain and an improved directional pattern.

The Corner Reflector Antenna

Fig. 18 shows an antenna structure which is of interest because it has a very high "front-to-back" ratio and greatly increases the pickup of the dipole.

Its size, weight, and cost are justified in locations of low signal strength, high noise level, and excessive interference.

This type of antenna was originally introduced for use in the frequency range known as u.h.f. (ultra high frequencies), extending from 300 mc. to 3000 mc. In this range, the corner reflector is usually made as a solid sheet of metal, since the dimensions of the dipole and the reflector are conveniently small.

When applied to the v.h.f. television region, a solid metal reflector would be exceedingly massive and easily damaged by high winds. It has been found that the solid sheet can be replaced by a "grid" of rods made longer than the dipole element, and spaced closer than .1 wavelength, as shown in Fig. 18A.

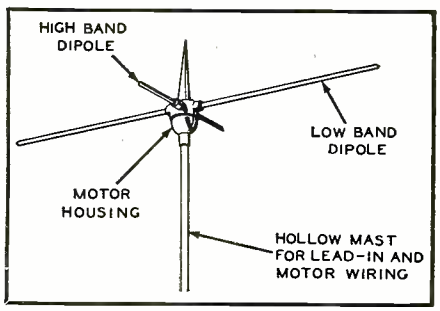
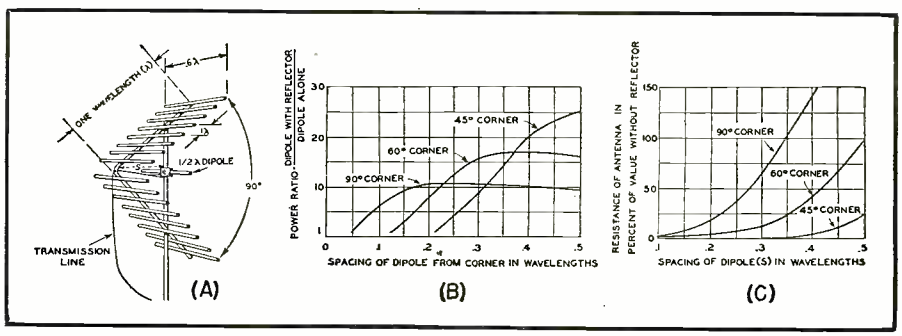


Fig. 17. Motor-driven antenna.

Fig. 18B shows the gain or ratio of power received with the reflector, to power received with the dipole alone —for various spacings of the dipole from the corner, and for corner angles of 90 degrees, 60 degrees, and 45 degrees. Fig. 18C illustrates the in-

Fig. 18. (A) The corner reflector antenna. (B) Effect of corner angle and dipole position on gain of corner reflector. (C) Effect of corner angle and spacing on dipole resistance.



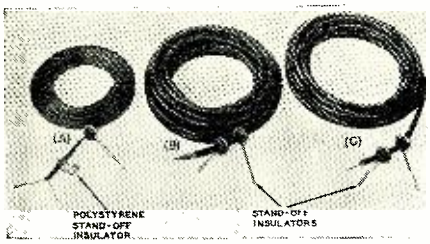


Fig. 19. Television transmission lines. (A) Twin-lead parallel line. (B) Coaxial cable. (C) Tubular twin-lead parallel line.

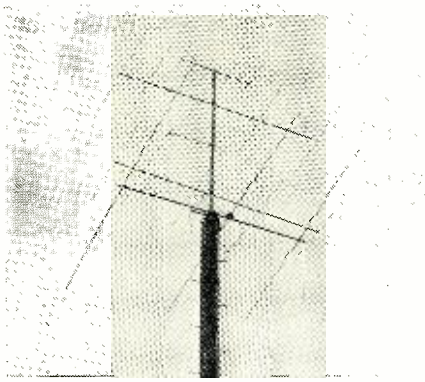


Fig. 20. Multi-element "Yagi" antennas.

fluence of the corner reflector on the impedance of the antenna. This has been expressed in percentage change of dipole impedance since the corner reflector can be used with any type of dipole.

The high power gains shown in Fig. 18B, for 60° and 45° corner angles, can be realized only if the sides are made several wavelengths in extent. The reception pattern (directional characteristic) becomes progressively sharper as the corner angle is reduced.

For these reasons, the 90° type is the most practical for the v.h.f. channels. A spacing (S of Fig. 18A) of .35 wavelengths is a satisfactory value. The rods used for the reflector may be replaced by a screen of woven wire (chicken wire) supported by a suitable frame of wood or metal.

Types of Transmission Lines

In our discussion of ghosts produced by reflections in lead-ins or transmission lines, we have indicated that maximum power transfer and freedom from reflections occur when the transmission line has a characteristic impedance which exactly matches both the antenna resistance and the input resistance of the radio receiver. It is important that the power developed in the antenna structure be transferred to the grid of the first radio frequency amplifier tube with as little loss as possible in order to override noise and produce high-contrast, steady pictures. To accomplish this, four types of lead-ins or transmission lines have been used extensively. These are: The twisted pair line, the two-wire parallel line, the coaxial or concentric cable, the shielded two-wire parallel line.

Each of these types exhibits its own particular characteristics of impedance range possibilities and loss or attenuation per-foot.

Twisted Pair Line

This type of transmission line is similar to twisted lamp cord but is made of higher grade insulation and weatherproof covering. It is the most economical type of lead-in, but possesses several disadvantages. Its impedance is normally in the range of 100 to 300 ohms, depending upon the size of wire used and the thickness of the insulation. The losses are fairly high and the line is subject to deterioration by weather and dirt. Its use has been supplanted, in most instances, by more efficient types of lines.

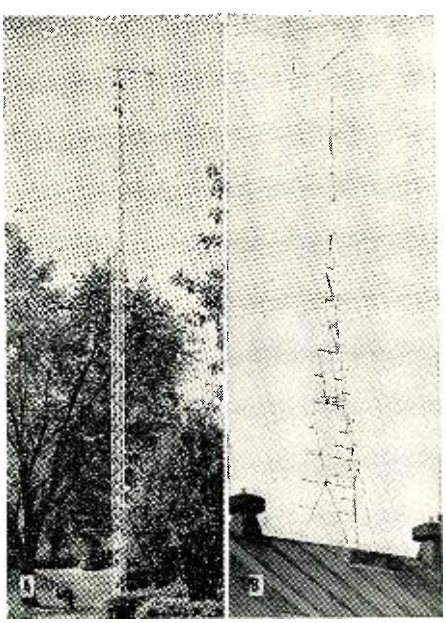
Two-Wire Parallel Line

The most popular type of television lead-in consists of two stranded wires molded parallel to each other, at a uniform spacing, in a flat strip of insulating material. This low-loss material, a plastic known as polyethylene, has excellent radio frequency properties including high resistivity, low water absorption and low dielectric constant. It is commercially available in impedances of 75, 150, and 300 ohms, which provide a match for any of the types of antennas discussed. Parallel wire lead-in is available in both clear and brown colored plastic. Each type is equally efficient. The color has been added, in the case of the brown cable, to mask a slight color change which appears with aging of the transparent cable. Fig. 19A shows this type of parallel lead-in cable together with two different types of stand-off insulators.

Both types of insulators are used to support the cable away from the buildings and to keep it from twisting. The only disadvantage in the use of parallel lead-in cable is the fact that it is not shielded and, therefore, can pick up man-made noises from electric equipment and particularly automobile ignition.

A recently introduced variation of this type of parallel line consists of two wires which are molded diametrically opposite one another in the side walls of a hollow plastic tube. The advantages of this construction are: (1) the leakage path has been increased, (2) the dielectric between the wires is substantially in the air and, (3) the spacing between the wires (the diameter of the tube) can be smaller for a given characteristic impedance than the width of comparable ribbon-type. Its construction decreases the loss per foot and improves the performance, especially in wet weather. Fig. 19C shows such a tubular two-wire line together with the stand-off insulators designed to support it.

Fig. 21. Special high-tower assemblies for fringe area television reception.



Coaxial or Concentric Cable

Coaxial cable as used for television lead-ins consists of a flexible conductor molded in the center or axis of a solid polyethylene cylinder. This cylinder is surrounded by a copper braided outer conductor, and the entire cable is covered by a weatherproof vinylite sheath. The outer conductor is grounded at the receiver and acts as a shield for the inner conductor. Coaxial cable has the properties of very low loss per foot and freedom from noise pickup. It is made in characteristic impedances of from 50 to 150 ohms.

The impedance is determined by the ratio of the diameter of the outer conductor to the diameter of the inner conductor and, for this reason, impedances higher than 150 ohms would require either a large outer diameter or an extremely small and weak inner conductor. Fig. 19B shows a sample of coaxial cable with the various layers cut back to show the construction. The coaxial cable is an unbalanced type of line, and if the receiver is designed for a balanced input with a grounded center tap, it may be necessary to remove the ground connection before connecting the cable.

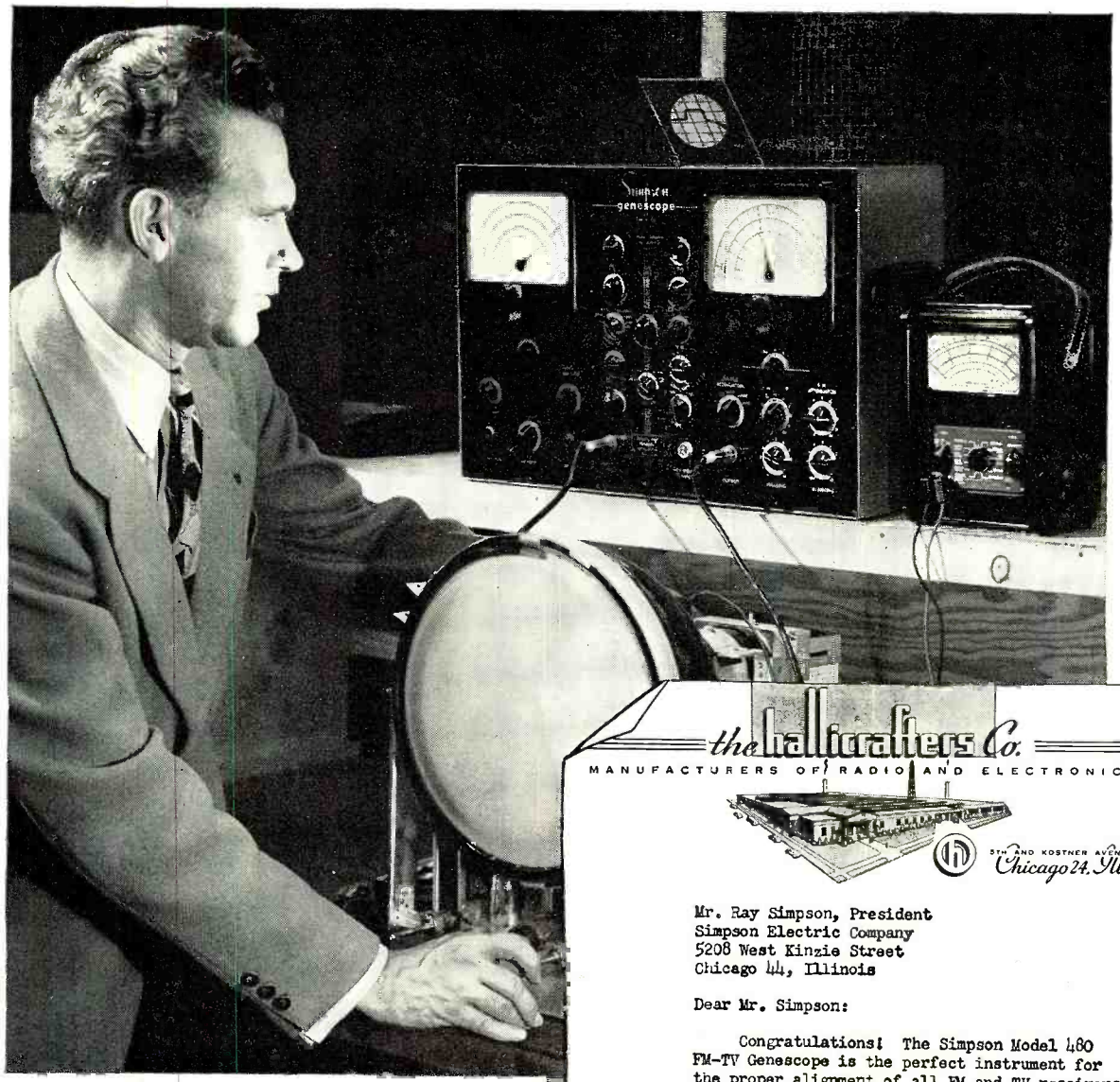
Shielded Parallel Line

This type of construction is similar to the coaxial cable except that two conductors, equally spaced from the center, are molded in the solid dielectric. Such a line is balanced since the outer conductor is merely a shield and can be connected to ground, while the two inner conductors can be connected to the balanced input of the receiver and to the dipole. The losses per-foot are higher than coaxial cable of the same impedance and the impedances, commercially available, are from 40 to 300 ohms. It is especially valuable for short transmission lines in unusually noisy locations.

Reception in Fringe Areas

The service area of the television transmitter is normally considered to

(*Continued on page* 159)



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DO YOU KNOW?

By DAVID SCOTT

85. What is meant by negative polarity?

A. *By negative polarity is meant that as the amplitude of the signal increases, the corresponding brilliance in the reproduced picture decreases. If polarity is not observed, reversal in tone values takes place.*

86. What, if any, is the advantage of negative polarity?

A. *The advantage of negative polarity is that if there is an increase in signal level due to interference, the picture is broken by black lines or dots which are less conspicuous than if they were white, as would be the case in positive polarity.*

87. For what purposes are the various portions of the amplitude of the video signal used?

A. *The lower 75-80 per-cent of the amplitude of the signal is devoted to picture intelligence. The upper 20-25 per-cent is devoted to sync and blanking signals and is known as the infra-black region.*

88. What is the purpose of the blanking signal?

A. *The blanking signal imposes a high amplitude voltage on the signal circuit so that the retrace of the scanning beam is forced into the infra-black region, and, hence, no trace appears on the screen during this time.*

89. Define and explain the d.c. component of a TV signal.

A. *The d.c. component is the over-all value of the camera signal averaged over the whole frame scanning interval. By adding to the d.c. factor, the a.c. component is unchanged but is displaced upward and the picture due to negative transmission becomes darker. By subtracting from the d.c. component, the picture becomes lighter due to downward displacement; changing the d.c. component varies the brightness.*

90. What are the waveform requirements of the a.c. component?

A. *Perfect transmission requires that the amplitude, frequency, and phase response curves be as flat as possible.*

91. What is the frequency range of the video signal?

A. *The frequency range of a video signal lies between 30-4,000,000 cycles, or higher.*

92. What are some of the causes of distortion in a video amplifier?

A. *Video amplifiers may have distortions due to: 1. Non-ideal amplitude and phase response characteristics; 2. Masking voltages; 3. Counter-distortions inserted to compensate shortcomings in the picture.*

93. What are some of the causes of masking voltages?

A. *(a) Natural masking voltages are: 1. Thermal agitation in resistors; 2. Shot effect in electron emission; 3. Natural atmospheric disturbances. (b) Man-made masking voltages are: 1. Automobile ignitions; 2. High-frequency generators; 3. Diathermy machines.*

94. What is thermal agitation and how may its effects be minimized?

A. *Thermal agitation arises from the random motions of electrons in resistors. Since one of the factors governing thermal agitation effects is the frequency range of the circuit, preamplifiers are designed to have a bandpass no wider than necessary.*

95. What is shot effect?

A. *Shot effect in electron emission is the random effect of individual electrons causing little pulses of current which excite the transmission circuits over their entire frequency range.*

96. What is the effect of shot effect on the TV picture?

A. *If the shot effect is high enough, the picture may have a shimmery, mottled appearance.*

97. What ratio of signal voltage to shot effect is necessary for satisfactory pictures?

A. *A peak picture voltage of at least 20:1 is necessary to give satisfactory pictures, though lower ratios may in many cases still produce intelligibility.*

98. Why are intentional distortions introduced into a TV picture?

A. *Since subject brightness and reproduction brightness is described by a logarithmic curve, occasional intentional distortions are necessary to enhance the realistic effect. Intentional distortions may also be introduced to compensate equipment shortcomings.*

99. What four elements of capacity must be considered when designing high-frequency video amplifiers?

A. *In high-frequency amplifiers, these elements of capacitance must be considered: 1. Stray capacitance of wiring and coupling elements; 2. Output capacitance of preceding tube; 3. Input capacitance of following tube; 4. Grid-to-plate capacitance of following tube, plus its gain.*

100. What are the advantages of series peaking?

A. *It achieves higher gain and a more linear phase response.*

(To be continued)

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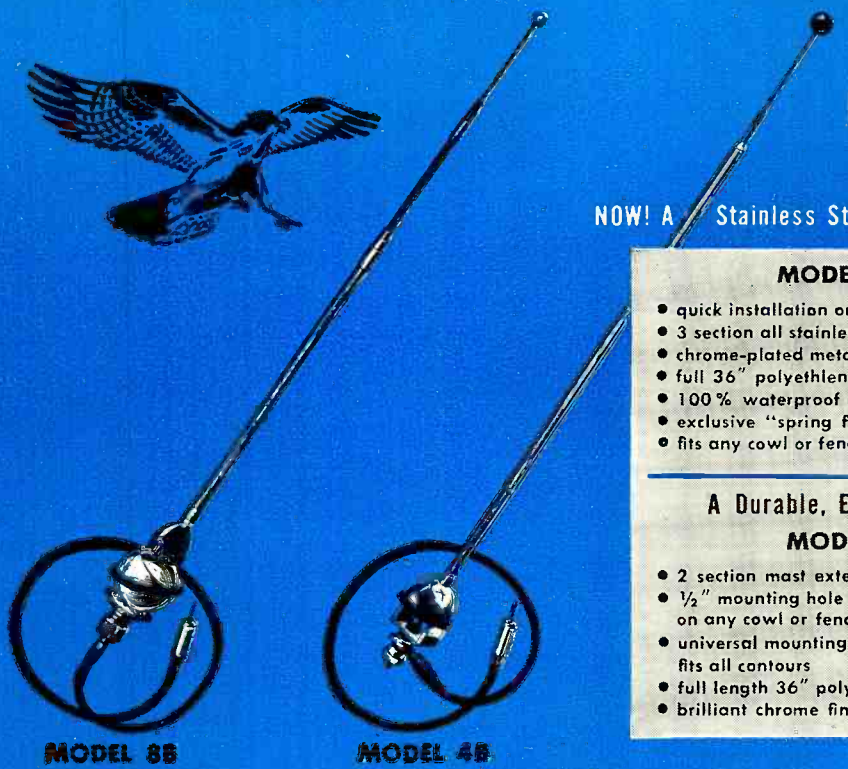

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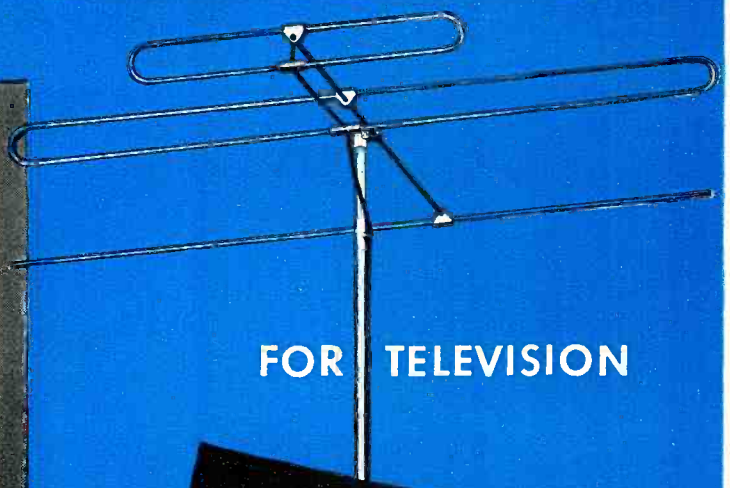

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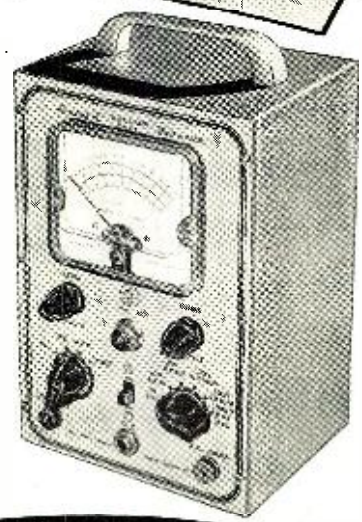

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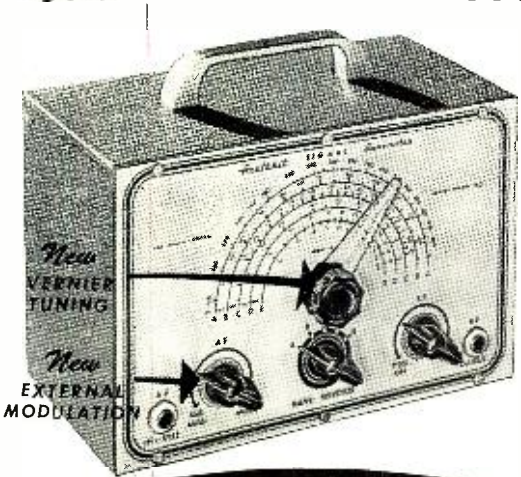

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New Heathkit
IMPEDANCE BRIDGE KIT

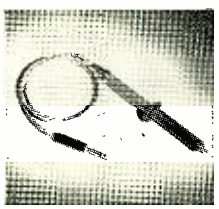
A LABORATORY INSTRUMENT NOW WITHIN THE PRICE RANGE OF ALL

Measures Inductance from 10 microhenries to 100 henries capacitance from .00001 MFD to 1000 MFD. Resistance from .01 ohms to 10 megohms. Dissipation factor from .001 to 1. "Q" from 1 to 1000.

Ideal for schools, laboratories, service shops, serious experimenters.

An impedance bridge for everyone — the most useful instrument of all, which heretofore has been out of the price range of serious experimentors and service shops. Now at the lowest price possible. All highest quality parts General Radio main calibrated control. General Radio 1000 cycle hummer. Mallory ceramic switches with 60 degree indexing — 200 micro-amp zero center galvanometer — ½ of 1% ceramic non-inductive decade resistors. Professional type binding posts with standard ¾" centers. Beautiful birch cabinet Directly calibrated "Q" and dissipation factor scales. Ready calibrated capacity and inductance standards of *Silver* Mica, accurate to ½ of 1% and with dissipation factors of less than 30 parts in one million. Provisions on panel for external generator and detector. Measure all your unknowns the way laboratories do — with a bridge for accuracy and speed.

Internal 6 volt battery for resistance and hummer operation. Circuit utilizes Wheatstone, Hay and Maxwell circuits for different measurements. Supplied complete with every quality part — all calibrations completed and instruction manual for assembly and use. Deliveries are limited. Shipping weight, approximately 15 lbs.

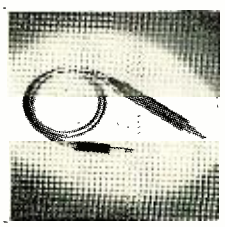


10,000V. H.V. TEST PROBE KIT

No. 310. Extends range of any 11 megohm VTVM to 3,000 and 10,000 Volt ranges. A necessity for television. Shipping Wt., 1 pound. **$4.50**

R.F. CRYSTAL TEST PROBE KIT

No. 309. Kit to assemble. R.F. probe extends VTVM range to 100 Mc. Complete with 1N34 crystal. Ship. Wt., 1 lb. **$6.50**



New Heathkit
TOOL KIT

Now a complete tool kit to assemble your Heathkit. Consists of Krauter diagonal cutters and pointed nose assembly pliers, Xcelite screwdriver, 60 Watt 110V. soldering iron and supply of solder. Shipping Wt., 2 lbs. Complete kit $5.95

New Heathkit
TELEVISION ALIGNMENT GENERATOR KIT

$39.50

Nothing ELSE TO BUY

Everything you want in a television alignment generator. A wide band sweep generator covering all FM and TV frequencies 0 - 110 and 165 to 220 Megacycles, a marker indicator covering 19 to 43 Megacycles, AM modulation for RF alignment — variable calibrated sweep width 0 - 30 Mc. — mechanical driven inductive sweep. Husky 110V. 60 cycle power transformer operated — step type output attenuator with 10,000 to 1 range — high output on all ranges — band switching for each range — vernier driven main calibrated dial with over 45 inches of calibration — vernier driven calibrated indicator marker tuning. Large grey crackle cabinet 16⅛" x 10⅜" x 7-3/16". Phase control for single trace adjustment. Uses four high frequency triodes plus 5Y3 rectifier — split stator tuning condensers for greater efficiency and accuracy at high frequencies — this Heathkit is complete and adequate for every alignment need and is supplied with every part — cabinet — calibrated panel — all coils and condensers wound, calibrated and adjusted. Tubes, transformer, test leads — every part with instruction manual for assembly and use. Actually three instruments in one — TV sweep generator — TV AM generator and TV marker indicator. Also covers FM band.

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Heathkit
TUBE CHECKER KIT

Features

1. Measures each element individually
2. Has gear driven roller chart
3. Has lever switching for speed
4. Complete range of filament voltages
5. Checks every tube element
6. Uses latest type lever switches
7. Uses beautiful shatterproof full view meter
8. Large size 11" x 14" x 4" complete
9. Checks new 9 pin miniatures

Check the features and you will realize that this Heathkit has all the features you want. Speed — simplicity — beauty — protection against obsolescence. The most modern type of tester — measures each element — beautiful Bad-Good scale, high quality meter — the best of parts — rugged oversize 110V. 60 cycle power transformer — finest of Mallory switches — Centralab controls — quality wood cabinet — complete set of sockets for all type tubes including blank spare for future types — fast action gear driven roller chart uses brass gears to quickly locate and set up any type tube. Simplified switching cuts necessary time to minimum and saves valuable service time. Short and open element check. No matter what arrangement of tube elements, the Heathkit flexible switching arrangement easily handles it. Order your Heathkit Tube Checker today. See for yourself that Heath again saves you ⅔ and yet retains all the quality — this tube checker will pay for itself in a few weeks — better build it now.

Complete with detail instructions — all parts — cabinet — roller chart — ready to wire up and operate. Shipping Wt., 15 lbs.

Only $29.50

Nothing ELSE TO BUY

Heathkit
SINE AND SQUARE WAVE AUDIO GENERATOR KIT

Nothing ELSE TO BUY

$34.50

Experimenters and servicemen working with a square wave for the first time invariably wonder why it was not introduced before. The characteristics of an amplifier can be determined in seconds compared to several hours of tedious plotting using older methods. Stage by stage, amplifier testing is as easy as signal tracing. The low distortion (less than 1%) and linear output (± one db.) make this Heathkit equal or superior to factory built equipment selling for three or four times its price. The circuit is the popular RC tuning circuit using a four gang variable condenser. Three ranges 20-200, 200-2,000, 2,000-20,000 cycles are provided by selector switch. Either sine or square waves instantly available at slide switch. All components are of highest quality, cased 110V. 60 cycle power transformer. Mallory F.P. filter condensers, 5 tubes, calibrated 2 color panel, grey crackle aluminum cabinet. The detailed instructions make assembly an interesting and instructive few hours. Shipping Wt., 13 lbs.

New Heathkit
BATTERY ELIMINATOR KIT

Nothing ELSE TO BUY

$22.50

Now a bench 6 Volt power supply kit for all auto radio testing. Supplies 5 - 7½ Volts at 10 Amperes continuous or 15 Amperes intermittent. A well filtered rugged power supply uses heavy duty selenium rectifier, choke input filter with 4,000 MFD of electrolytic filter. 0 - 15 Volt meter indicates output. Output variable in eight steps. Excellent for demonstrating auto radios. Ideal for servicing — can be lowered to find sticky vibrators or stepped up to equivalent of generator overload — easily constructed in less than two hours. Complete in every respect. Shipping Wt., 18 lbs.

NEW Heathkit
SIGNAL TRACER AND UNIVERSAL TEST SPEAKER KIT

Nothing ELSE TO BUY

$19.50

The popular Heathkit signal tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker —locates intermittents—defective parts quicker—saves valuable service time—gives greater income per service hour. Works equally well on broadcast — FM or TV receivers. The test speaker has assortment of switching ranges to match push pull or single output impedance. Also test microphones, pickups — PA systems — comes complete — cabinet — 110V. 60 cycle power transformer — tubes, test probe, all parts and detailed instructions for assembly and use. Shipping Wt., 8 lbs.

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Heathkit
ELECTRONIC SWITCH KIT

DOUBLES THE UTILITY OF ANY SCOPE

$34.50

Nothing ELSE TO BUY

An electronic switch used with any oscilloscope provides two separately controllable traces on the screen. Each trace is controlled independently and the position of the traces may be varied. The input and output traces of an amplifier may be observed one beside the other or one directly over the other illustrating perfectly any change occurring in the amplifier. Distortion — phase shift and other defects show up instantly, 110V. 60 cycle transformer operated. Uses 5 tubes (1 6X5, 2 6SN7's, 2 6SJ7's). Has individual gain controls, positioning control and coarse and fine sweeping rate controls. The cabinet and panel match all other Heathkits. Every part supplied including detailed instructions for assembly and use. Shipping Wt., 11 lbs.

New Heathkit
FM TUNER KIT

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 — 110V. 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 lbs.

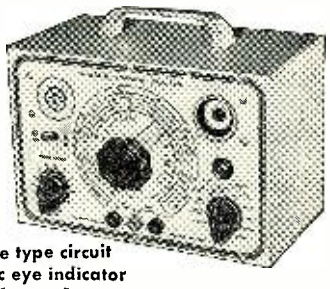
CABINET EXTRA

$14.75

Beautiful mahogany cabinet for FM Tuner (shown above) extra $3.75

Heathkit
CONDENSER CHECKER KIT

$19.50



Features

- Power factor scale
- Measures resistance
- Measures leakage
- Checks paper-mica-electrolytics
- Bridge type circuit
- Magic eye indicator
- 110 V. transformer operated
- All scales on panel

Checks all types of condensers, paper-mica-electrolytic-ceramic over a range of .00001 MFD to 1000 MFD. All on readable scales that are read direct from the panel. NO CHARTS OR MULTIPLIERS NECESSARY. A condenser checker anyone can read without a college education. A leakage test and polarizing voltage for 20 to 500 volts provided. Measures power factor of electrolytics between 0% and 50%. 110V. 60 cycle transformer operated complete with rectifier and magic eye tubes, cabinet, calibrated panel, test leads and all other parts. Clear detailed instructions for assembly and use. Why guess at the quality and capacity of a condenser when you can know for less than a twenty dollar bill. Shipping Wt., 7 lbs.

Heathkit
3-TUBE ALL WAVE RADIO KIT

$8.75

CABINET EXTRA

An ideal way to learn radio. This kit is complete ready to assemble, with tubes and all other parts. Operates from 110V AC. Simple, clear detailed instructions make this a good radio training course. Covers regular broadcasts and short wave bands. Plug-in coils. Regenerative circuit. Operates loud speaker. Shipping Wt., 3 lbs.

HS30 Headphones per set.....$1.00
2½" Permanent Magnet Loudspeaker..... 1.95
Mahogany Cabinet..... 2.95

Heathkit
HIGH FIDELITY AMPLIFIER KIT

Nothing ELSE TO BUY

$14.95

Build this high fidelity amplifier and save two-thirds of the cost. 110V. 60 cy. transformer operated. Push pull output using 1619 tubes (military type 6L6's), two amplifier stages using a dual triode (6SL7), as a phase inverter give this amplifier a linear reproduction equal to amplifiers selling for ten times this price. Every part supplied; punched and formed chassis, transformers (including quality output to 3-8 ohm voice coil), tubes, controls, and complete instructions. Add postage for 20 lbs.

12" PM Speakers for above....$6.95

Mahogany Speaker Cabinet, 14½" x 14½" x 8".....$8.75

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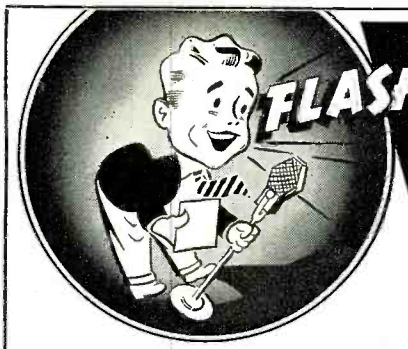

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PE101C BC645 POWER SUPPLY
NO. 273. Complete power supply for BC 645. Operates from 12 or 24 Volts. Supplies both AC and DC required. Shipping Wgt. 13 lbs. Each **$3.95**

DM 35 12 VOLT DYNAMOTOR
NO. 274. New input 12 Volt at 18.7 Amperes. Supplies 675V at 275 MA or ½ above voltage from 6 volts. Excellent for auto use. Shipping Wgt. 11 lbs. Each **$7.50**

HOME WORKSHOP GRINDER KIT
NO. 230. Easily assembled 110V AC or DC ball bearing fully enclosed motor from Army surplus dynamotor. Purchaser to make simple changes and shaft extensions, detailed instructions and all parts supplied. Motor approximately 5,000 R.P.M. Ideal for tool-post grinder, flexible shaft tool, model drill press, saw. Shipping Weight 6 lbs. **$3.95**

COLLINS AUTOTUNE CONTROL HEAD
NO. 278. Brand new controls used on the ART/13, 100 Watt, Transmitter. Types 7, 8, 10, and 11 available. Get a spare while available as new cost is over $22.00 each. Shipping Wgt. 3 lbs. Price any type (mention when ordering). Each **$4.50**

300 MA SELENIUM RECTIFIERS
NO. 209. Rated 300 MA at 36 Volts, complete with mounting brackets. Shipping Wgt. 1 lb. 3 FOR $1.00

1N90 FEED THROUGH INSULATOR
NO. 276. Heavy duty feed through, 2" diameter 4" long, complete with brass hardware and gasket. Shipping Wgt. 2 lbs. 2 FOR **$1.00**

1N86 STRAIN INSULATOR
NO. 277. Husky army type 1¼" diameter, 5¼" long. Brown porcelain. Shipping Wgt. 4 lbs. 4 FOR **$1.00**

G.E. BC 306 ANTENNA
TUNING UNIT
NO. 231. Matches any aerial to 150 Watt transmitter, used on BC 375. Brand new. Add postage for 20 lbs. **$2.95**

G. E. 1,000 VOLT 350 MA
DYNAMOTOR

NO. 213. An ideal dynamotor for mobile operation in taxicabs, police cars, sound systems and amateur stations. Supplies above voltage from 12 Volts or 500V. at 350 MA from 6 Volts. Complete with starting relay, and fuses. New. Our Dynamotor A. Shipping Weight 72 lbs. **$5.95**

POWER TRANSFORMER *Specials*

NO. 226. Primary 117V. 60 cycle. Secondaries supply 746 V.CT at 220 MA, 6.3V. at 4.5 A., and 5V. at 4A. Will handle 13 tube radio receivers. Supply is limited, order early. Shipping Weight 11 lbs. each.
$3.95 . . 3 for $9.95

T32 TABLE MICROPHONE
NO. 210. One of the Army's best. Built by Kellogg, ideal for factory call system, public address, amateur use. Brand new in original cartons. Add postage for 5 lbs. **$2.95**

MINIATURE ELECTRIC MOTOR

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**

OUTPUT TRANSFORMER

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

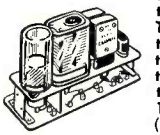
No. 744. Carbon microphone input transformer and output to headphone transformer, all in one case, excellent for building your own. Shipping Wt. 1 lb. **4 for $1.00**

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**

METER SPECIAL

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

OUTPUT and MODULATION TRANSFORMER

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

HOW TO ORDER • • • GIVE PART NUMBER AND DESCRIPTION . . . ADD POSTAGE FOR WEIGHT SHOWN. NO ORDERS UNDER $2.00 . . . WE WILL SHIP C.O.D.

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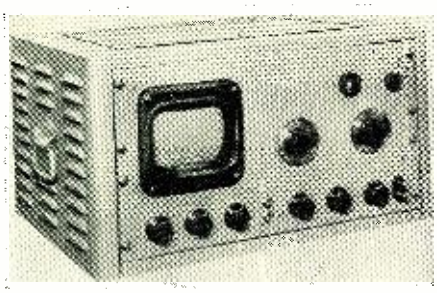
What's New in Radio

NEW PANORAMIC SYSTEM

Available in an instrument called the Panoramic Ultrasonic Analyzer, Model SB-7, manufactured by the *Panoramic Radio Products, Inc.,* 10



South Second Avenue, Mount Vernon, N. Y., is a system which is said to revolutionize the technique of ultrasonic spectrum analysis.

Although it is designed for use in development laboratories, the instrument is simple to operate and reduces the analysis of ultrasonics to the simplest, fastest, and most direct procedures. Indications are obtainable for signals between 2 kc. and 300 kc. in the form of vertical deflections distributed across a cathode-ray tube screen.

In applications to frequency investigations, panoramic instruments have become more and more important in the communications fields, particularly in view of the instrument's elimination of point by point frequency checks.

UNIVERSAL IMPEDANCE BRIDGE

Brown Electro-Measurement Corporation, formerly *Brown Engineering Company,* 4635-37 S. E. Hawthorne Blvd., Portland 15, Oregon, announces a new universal impedance bridge, small and light in weight, the Model 250-A.

This bridge can measure resistance,

capacitance, and inductance over the following ranges: Resistance, 1 milliohm to 1 megohm; capacitance, 1 $\mu\mu$fd. to 100 μfd.; inductance, 1 μhy. to 100 hy. It is enclosed in a 9½ by 10½ inch cast aluminum cabinet and is powered by four replaceable flashlight cells.

High accuracy is provided by utilizing .1 per-cent precision wirewound resistors in the bridge arms, and a directly calibrated slidewire consisting of .1 per-cent precision decade with a coaxially mounted rheostat for interpolation within the decade steps. The net weight is approximately 20 pounds.

BASE LOADED MOBILE ANTENNA

A new mobile antenna specially designed for 75-meter amateur mobile operation is being manufactured by *Premax Products,* Niagara Falls, New York, and is said to step up efficiency over the conventional whip on the average of 6 db.

This base loaded antenna will resonate anywhere between 3800 to 4000

kc. and may be adjusted by shorting out top turns of the special loading coil.

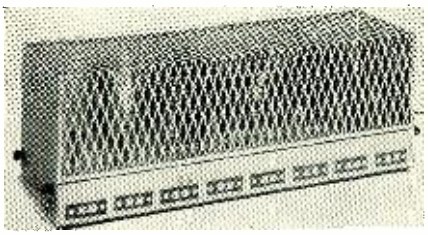
W2TBD states he has satisfactorily worked stations 250 miles and more distant on the 75-meter band in midsummer. Winter transmissions should exceed 500 miles.

TV DISTRIBUTION SYSTEM

Suitable for use either by television dealers or small apartment house or multiple dwelling owners is the new TVD-8 television distribution system announced by the *Electro Engineering and Mfg. Co.,* 627 West Alexandria, Detroit 1, Michigan.

It is a compact unit using eight 6J6 tubes in a circuit arranged to provide balanced 300-ohm input and output facilities, and it operates from a 115 volt, 60-cycle supply line. The TVD-8 may be used on channels 2 to 13 inclusive, and is built for continuous duty service.

No adjustable resistance networks or switches are required for the operation of the TV receivers from the TVD-8, and from one to eight sets may be used with each unit. Floor salesmen



may show pictures transmitted from several stations to different customers at the same time, eliminating waiting time for the prospect besides the unsatisfactory images caused by coupling between receivers.

MIDGET-CAN CONDENSERS

Measuring only 13/16 inches in diameter by 1½ inches long, the "Dandee" Type PRS midget-can electrolytic condensers are being produced in smaller sizes by *Aerovox Corporation.*

These smaller metal-can electrolytics come in single-section ratings from 25-700 d.c.w., 4 to 100 μfd., and again from 25 to 450 volts d.c.w., 8-8 to 100-100 μfd. dual-section units. Higher capacitance, low-voltage units are available in voltage ratings from 6 to 25 d.c.w., 100 to 2000 μfd.

The trend toward still more compact radio-electronic assemblies and recent refinements in the manufacture of these condensers resulted in the production of the "Dandee" electrolytics by the New Bedford, Mass., firm.

CROWN ANTENNA ROTATOR

One of the outstanding features of the *Crown* antenna rotators is the rotator control which is equipped with dial indication, eliminating guess work as to where the antenna is pointing. The easy-to-read illuminated dial is calibrated with compass points and numbers so that the antenna position is always known, and it lights only

when the button is pressed to operate.

The antenna drive unit is designed to carry the entire weight and to rotate the antenna and antenna mast. It is thus possible to mount the an-

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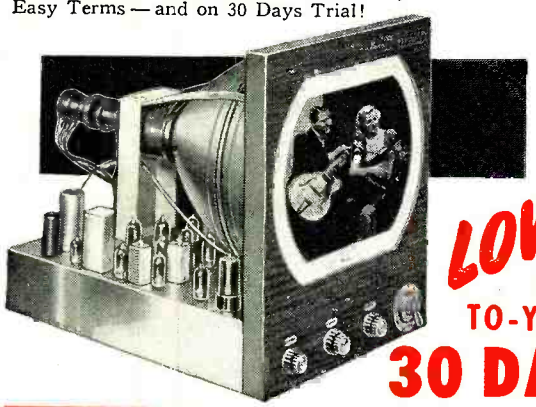
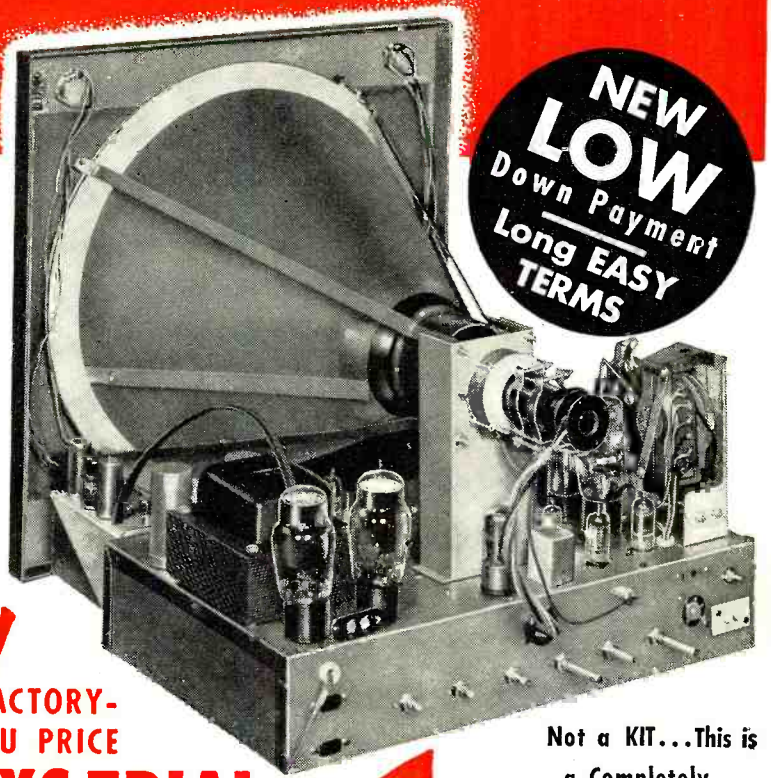
New GIANT 16" PICTURE TUBE

Here is Television at its finest! . . . brought to you by Midwest, for 30 years a leader in the field of radio and electronics. Immense 151-square-inch screen on new 16" metal-glass tube . . . clear, steady, bright pictures . . . Synchronized sound and picture that a child can tune in perfectly . . . Highest quality FM sound . . . Big 12" Electro-Dynamic Panasonic Speaker. Available in beautiful Consoles or in complete chassis as illustrated (not a kit, but a complete Television receiver ready to plug in and play) to place in your own cabinet. And you can buy Midwest Television at Low Factory Prices, with Low Down Payment and Long Easy Terms — and on 30 Days Trial!





NEW LOW Down Payment Long EASY TERMS

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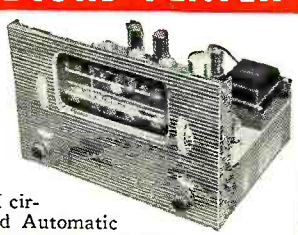
. . . also a Magnificent Line of NEW 1950

MIDWEST RADIOS

featuring the latest Improved FM Circuit and the New 3-SPEED RECORD PLAYER



Powerful new 1950 Series 16 and Series 12 AM-FM Radio in complete chassis. Also beautiful new Console models including the magnificent Symphony Grand Radio-Phonograph with latest FM circuit and new 3-Speed Automatic Record Player. New portable and Table Models also available.

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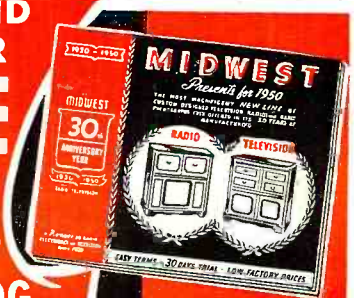

• Write in Name and Address (Please Print) on Coupon or 1c Postcard. •

MIDWEST RADIO & TELEVISION CORP.
Dept. X372, 909 Broadway, Cincinnati 2, Ohio
Please send me your new FREE 1950 Catalog.

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tenna drive unit at the base of the antenna mast.

Both of the units are manufactured by the *Crown Controls Company, Inc.*, 124 S. Washington St., New Bremen, Ohio.

ALLIED 20-WATT AMPLIFIER

A new, improved model of the "Knight" 20-watt high-fidelity amplifier is being produced by *Allied Radio*, featuring wide-range response (plus

or minus 1 db., 20-20,000 c.p.s.), with less than 2 per-cent distortion at full output.

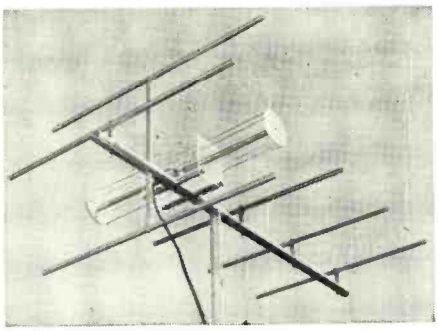
As a recording amplifier, it can be used from a mike, radio, or records. An exclusive feature is the output for direct connection to any crystal recording head. The unit has separate bass and treble tone controls, 5 output impedance taps (4, 8, 16, 250, and 500 ohms), and a tapped power transformer for optimum operation from 117-volt or 130-volt a.c. lines.

Allied Radio Corporation, 833 W. Jackson Blvd., Chicago 7, Ill., supplies the unit complete with all connectors, tubes, and instructions.

CAPITAL TELETENNA

Formerly available to commercial users only, the Teletennas manufactured by *Capital Electronics Company*, 120 East McCarty Street, Jefferson City, Missouri, are now being made for jobbers and dealers.

All of the Teletennas are furnished with 24-inch mast for mounting. They are easily assembled in a short time with pliers and a screwdriver. Radiation impedance is matched by a



folded cage signal trap to the surge impedance of standard 300-ohm transmission line. Being cut to channel and correctly spaced, it is assured of maximum efficiency for highest gain.

The Teletenna 7-element beams are specifically engineered for fringe

(*Continued on page* 149)

McGEE HAS DELCO VIBRATORS for BUICK SETS $1.95

ST. GEORGE WIRE RECORDING MECHANISM $22.95

St. George wire recorder mechanisms. Brand new, complete wire recording and playback mechanism. (Also plays 78 RPM records when crystal pick-up is installed.) Records and plays back up to 1 hour on standard Webster wire. Furnished with diagram for 3-tube converter (adapts radio or amplifier for wire recording). X-93 St. George mechanism, weight 15 lbs. Requires 9x18x3½" space. Net, $22.95. Crystal pick-up for playing and recording phono records. $1.95 extra. Webster wire, 1 hour, $3.25; 30 min., $1.95; 15 min., $1.30. Crystal mike and desk stand, $4.95 extra.

WIRE RECORDER CONVERTER $12.95

With this 3-tube converter you can adapt the St. George Airking, or Webster Chicago wire recorder mechanism to any radio or P. A. system. Only 3 connections necessary. Just plug in to the phono input of your amplifier and connect to plate of output tube. All-metal chassis construction, gain for mike, 3 position switch for quickly changing from record to play-back. Priced ready wired and tested with instructions and tube 12AT7 pre-amplifier; 6AQ5 Oscillator erase; 6X4 rectifier. Stock No. RR-Y, net, $12.95.

TAPE RECORDER 1 HOUR MECHANISM TWIN CHANNELS SPECIAL $59.95

Our leader tape recorder mechanism—Size 10½x8x135/8x7-5/16, weight 16 lbs. Tape speed full 7½ feet per second—two sound channels. One hour with 7" reel, 30 minutes with 5" reel. Bias frequency to erase 50K.C. Twin erase heads, one recording head. Response flat from 60 to 8,000 cps. Non-slip and Wow-less drive. Made for high fidelity recording and play-back on tape. Furnished complete with suggested diagram and erase coil. Model TP4-Y Tape recorder mechanism, sale price, $59.95. Recording Tape 7" Reel, $2.50.

RECORD PLAYER KITS $9.95 AND UP

Capitol Portable Case

Deluxe Portable Record Player Kit housed in the attractive Capitol case. Includes all parts and easy to follow diagram. Has 4" Heavy Duty PM Speaker, 78 RPM Phono Motor. All necessary parts to build a 70L7 type Amplifier. Weight 14 lbs. Model CK-1. Net $9.95.

WIRE RECORDER and 18-WATT P.A. SYSTEM

SALE PRICE **$69.95**

Three **years of wire** recording experience has lead us to the development of this combination wire recorder and public address system. Housed in an attractive portable case with hinged lid on the recorder compartment. Beautiful streamlined plastic grill. Storage compartment in back panel for mike and accessories. Size 21½x14x14. A full 18 watt HI FI amplifier with P.P. 6V6 tubes in output stage and separate 6AQ5 eraser circuit. This new super erase circuit eliminates all the bugs in wire recording. 12-inch Alnico V. P.M. speaker. Extension speaker jack. Mike input, tone control. Equipped with the St. George wire recorder playback mechanism that has 78 rpm turntable and General Electric Variable reluctance pick up. You can record or play phono records. Record from mike. The play-back quality is tops. Plenty of volume and good fidelity. This is also a top wire recorder. Unit is completely assembled and ready to operate. Furnished with 15 minute spool of Webster recording wire. Extra recording wire, 15 min., $1.30; 30 min., $1.95; hour, $2.25. **Model GE-16** Portable public address system and wire recorder shipping weight 38 lbs. Net, $69.95. Crystal Mike and Desk Stand, $4.95 extra.

MUSICAL P.A. 34-WATT $54.95

McGee's wide range musical P.A. amplifier, $54.95. Powerful 34 watt, wide range amplifier, housed in an attractive leatherette covered cabinet, with tri-color plastic front. 12" super heavy-duty Oxford curvelenier cone. 22 oz. Alnico V PM speaker. This speaker is used by others only on their highest priced amplifiers. Response from 40 to 17,000 cps. 3 inputs, 2 for musical instruments or mike, one for crystal pick-up. Tone compensation for G.E. variable reluctance pick-up. Push-pull 6L6 output tubes, twin tone controls and inverse feedback. This amplifier may be used for two instruments or two mikes. It is the most versatile amplifier that we know of. Stock No. MM-35, complete ready to operate. Weight 26 lbs. Net price, $54.95. 12" extension speaker in plastic grill, leatherette covered case, with Oxford hi-fi PM speaker, $19.00 extra.

20-WATT MUSICAL PA $34.95

Stock No. MM-20, 20 watt musical, P.A. system with inputs for crystal or dynamic mikes or instrument pick-ups and G.E. variable reluctance or crystal phono pick-up, heavy duty high fidelity intervound Stancor output transformer matches one or two PM speakers, tone control. Response from 50 to 12,000 cps. 12" heavy duty PM speaker. Housed in the same attractive plastic grill case as the MM-35. Stock No. MM-20, ready to operate. Weight 22 lbs. Net price, $34.95.

McGEE HAS THE SPEAKERS

Following speakers listed are latest production NO-Factory throwouts made by the largest factory who furnish the original equipment to America's biggest 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. Aln. 5 Mag., Square	1.49
6" PM 2.15 Oz. Aln. 5 Mag. Square	1.98
6" PM 3.16 Oz. Aln. 5 Mag., Square	2.49
6½" PM 1.5 Oz. Aln. 5 Mag., Round	1.69
4x6" PM 1.5 Oz. Alnico 5 Magnet	1.49
10" PM 4.64 Oz. Mag.	3.98

MAGNAVOX

6" Square 4 OHM. Field	$1.49
6½" Round 4 OHM. FIELD	1.49
6x9" Auto Speaker 4 OHM. Field	1.98
7" Motola-Philco. Field	2.49
8" Motola-Philco. Field	2.49

UTAH

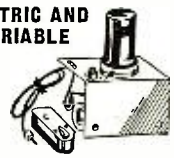
G.E. RPX010 V.R. CART. $2.95

G.E. RPX010, with permanent needle. $2.95 each; 10 for $24.95.

Kit of parts to build 6SC7 type preamplifier, $2.49 extra.

A lucky purchase by us enables this terrific General Electric cartridge value.

GENERAL ELECTRIC AND WEBSTER VARIABLE RELUCTANCE



New Webster cartridge with removable permanent needle. Response is second to none. Offered with pre-amplifier (6sc7) ready wired and tested. A scoop at $5.95 complete.

Webster MI-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 RPX-040 or PRX-041 cartridge. Net $7.95

Webster N-7, same as L-40, L-70 $1.19

Astatic MLP-1, with needle 1.19

Astatic MLP-2, with needle 1.95

Astatic QT3-M, with needle 3.29

Astatic NJ-1, with needle 3.29

Astatic L-72 or Webster Equal 1.79

Astatic L-40 or Webster Equal 1.79

Astatic L-70 or Webster Equal 1.79

Take 10% off on 10-lot assortment.

STOCK UP ON DELCO

McGee offers you the biggest vibrator scoop of all times. Delco dumps 30,000 auto set vibrators. We pass on to you our terrific bargain. You save over half off of regular dealers' net. Remember, there are a lot of war surplus vibrators floating around; however, most of them are 12-volt and will not work correctly in auto sets. The vibrators we are offering are all genuine Delco.

Buick vibrator Delco No. 5050050, replaces Mallory 716 (popular model with handle on top). Can size 2x3½". McGee's price, $1.95. 10 for $17.95.

Standard 4-prong, 1½" can, short enough for Chrysler, Plymouth sets. 8-point, heavy duty. Replaces Mallory 294. Regular dealers' net, $2.62. McGee's price, $1.29: 10 for $11.90.

Odd 4-prong, 1½" can Delco 1301, replaces Mallory 852. Popular GM car sets. Regular $2.46. McGee's price, $1.49; 10 for $12.95.

Chevrolet vibrator, Delco No. 8622, replaces Mallory 273D. Can size 2x4½". A sync with buffers. Odd 5-prong. McGee's price, $1.95.

Delco No. 8611, replaces Mallory 245A. A standard 5-prong sync, no buffers. Can size 2x3½". McGee's price, $1.95.

Delco 8612, replaces Mallory 271HD. Offers 5-prong sync, no buffers. Can size 1½x3¼". McGee's price, $1.49.

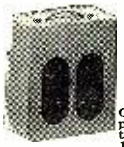
Delco 8637, replaces Mallory 954. Standard 6-prong sync, no buffers. 1½x3⅛" can. McGee's price, $1.49.

Delco 8610, replaces Mallory 245, 1½x3¼" can. 5-prong sync, no buffers. McGee's price, $1.49.

DELCO VIB UNITS

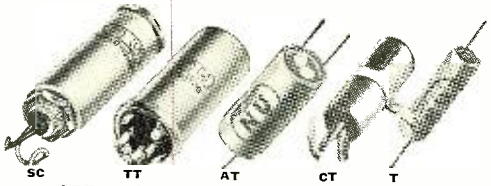
Delco sync vibrator unit, with buffer condensers attached. This same unit used in all sync vibrators, regardless of case size. If buffers are not needed, simply clip off. You save up to $4.00 by replacing the unit in your old vibrator can. $1.09 each: 10 for $9.95.

Delco 8 point, heavy duty, non-sync replacement vibrator unit. The best non-sync unit known today. For regular and heavy duty replacement use. Small in size. Fits them all. Net 99c each. 10 for $8.95.



18-WATT AMP KIT FOR INSTRUMENTS MIKES OR PICKUP $14.95

General purpose portable amplifier kit, housed in an attractive portable case, with 10" speaker. Two inputs for instruments or mike, one phono input. Variable tone control. Kit is complete with diagrams and photos and tubes: 2—12AX7, 6X4, 2—6AQ5. AC transformer type. Stock No. MM-18RC, weight 20 lbs. Net $14.95. Crystal mike and desk stand, $4.95 extra.



SC TT AT CT T

NATIONAL UNION CLOSE-OUT SALE

ORDER $100.00 WORTH—TAKE 10% OFF ON N.U. COND.

TYPE "AT" N.U. TUBULAR ELEC. ALUMINUM WITH SEALED ENDS

National Union Type AT Electrolytics. Housed in sealed metal tubes in spun-end cardboard sleeves. Bare wire leads. Standard package of 10 condensers. Save over half. This is your every day need in condensers. One-year guarantee.

National Union Aluminum Tubulars, with paper insulating sleeves. Type AT

10 MFD. 25v.	.15c	24 MFD. 150v.	.30c	4 MFD. 450v.	.20c
25 MFD. 25v.	.20c	50 MFD. 150v.	.35c	8 MFD. 450v.	.30c
100 MFD. 25v.	.25c	80 MFD. 150v.	.35c	16 MFD. 450v.	.40c
8 MFD. 150v.	.15c	8x8	450v. .40c	30 MFD. 450v.	.50c
16 MFD. 150v.	.25c	16x16	450v. .50c	8x8	150v. .20c
20-20 150v.	.30c				
40-20 150v.	.35c				
50-30 150v.	.50c				
80-40 150v.	.60c				
20-20 450v.	.60c				

NATIONAL UNION ALUMINUM CAN "TWIST TAB" TYPE TT

National Union Type TT Electrolytic Condensers. Aluminum can F.P. type Twist Tab mounting common negative grounded to can. Individually cartoned in green N.U. boxes. Each condenser supplied with 1 bakelite insulating plate and 1 metal grounding plate. Save over half on these. All sizes and one-year guarantee.

100 MFD	25v. .19c	20-20 MFD	150v. .30c	40-40, 150v, 25 MFD	25v. .40c
500 MFD	25v. .19c	40-20 MFD	150v. .35c	40-40-20 MFD	150v. .60c
10 MFD	450v. .25c	40-40 MFD	150v. .40c	40-40-40 MFD	150v. .60c
20 MFD	450v. .30c	50-50 MFD	150v. .50c	80-40, 150v, 25 MFD	25v. .60c
30 MFD	450v. .40c	80-40 MFD	150v. .60c	10-10, 450v, 20 MFD	25v. .50c
40 MFD	450v. .50c	10-10 MFD	450v. .40c	10-10-10, 450v, 20-25v	.70c
80 MFD	450v. .60c	16-16 MFD	450v. .45c	10-10-10-10, 450v	.70c
		40-40 MFD	450v. .60c		
		20-20-20	450v. .65c		
		20-20, 150v, 100 MFD	25v. .45c		

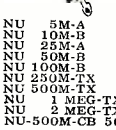
N.U. THREAD MOUNT ALUMINUM CAN TYPE SC

National Union Type SC-SCN-SCS Upright Aluminum Can Condensers. With pal nut mounting. Flexible insulated leads. Individually cartoned in green N.U. boxes. Save over half on this. One-year guarantee.

4 MFD	450v. .25c	8 MFD	600v. .60c
8 MFD	450v. .30c	16 MFD	600v. .80c
16 MFD	450v. .35c	8 MFD	525v. .50c
40 MFD	450v. .50c	8x8	450v. .50c
4 MFD	600v. .35c	16x16	450v. .60c
		20x20	450v. .70c

100-600V. BY PASSES, $6.95 MAKE YOUR OWN ASSORTMENT

T .0001, T .00025, T .0005, T 001. T .002, T.005, T .006—5c Each.
T .02, T .03, T .04—6c Each.
T .05—7c Each; T .1—8c Each.
T .25—10½c Each; T .5—15c Each.



N.U. CONTROLS 100 FOR $29.25

Individually cartoned volume controls, all have off-on switch attached.

NU	5M-A	5,000 OHM	24c
NU	10M-B	10,000 OHM	24c
NU	25M-A	25,000 OHM	24c
NU	50M-B	50,000 OHM	29c
NU	100M-B	100,000 OHM	29c
NU	250M-TX	250,000 OHM Tapped	29c
NU	500M-TX	500,000 OHM Tapped	39c
NU	MEG-TX	1 MEG OHM Tapped	39c
NU	2 MEG-TX	2 MEG OHM Tapped	39c
NU-500M-CB		500,000 OHM	39c

100 National Union Controls $29.95. Assorted as follows: 25 of the 1st 3 Types. 25 of the 2nd 3 Types. and 50 of the last 4 Types.

100 RADIO TUBES $29.95

250,000 Tubes for fast sale. Tremendous value. Tubes up to $3.00 list. 100 Cartoned and branded Hyvac Miniature Tubes for $29.95. Over a million sold. Guaranteed full replacement. 34c Each in smaller quantities.

1R5	12BE6	12AU6	6SU7	12S8			
1T4	12ATG	12BF6	6AQ5	9001			
1U5	35W4	6BA6	6AQ6	9002	6BA7		
3A4	35B5	6BE6	6C4	6BH6	6BJ6		
1S5	50B5	6AT6	6X4	117Z3	35C5		
3V4	12AT7	6AL5	6W4	19T8			
3Q4	12AU7	6AQ5	6G5	6BJ6			
3S4	12AX7	6BF6	6AU6	6AT6			
12BA6	12BA7	6AU7	6BG6				

$29.95 for 100

34c each

Popular GT Tubes, individually cartoned and branded Hyvacs. $35.00 per hundred. 39c Each in smaller quantities.

6V6	6X5	6SK7	12SF7	12SN7	32L7	
6SN7	6SD7	6SQ7	6J5	12BF7		
6C5	5Y3	25L6	6SJ7	6SJ7		
6P5	6K7	70L7	12SJ7	35Z5		
12A8	5Y3	1B4	6SF5			
6S8	6K6	12K8	80			
12S8	6SA7	12A6				

39c each

100 for $35.00

HYVAC 6AK5 6SN7 6J6 59c EACH

STANDARD BRAND TUBES CARTONED and UNCARTONED 49c

0Z4G	1G6	5V4	6F7	6SA7	6T7	7B8	7S7	12F5	12SQ7	26	43
1A4	1H6	5Y3	6H6	6SC7	6V6	7C4	7V7	12H6	12SR7	27	45Z5
1A6	1J6	6A3	6J5	6SD7	6X5	7C5	7Y4	12J5	12Z3	30	50B5
1B4	1L4	6AB7	6J7	6SF5	6Y6	7C6	7Z4	12K8	14A7	32	56
1B5	1R5	6AC7	6K5	6SF7	6Z7	7C7	10Y	12Q7	14B6	33	57
1C6	1S5	6AG7	6K6	6SG7	6ZY5	7E5	12A6	12SC7	14C7	34	58
1C7	1T4	6B8	6K7	6SH7	7A4	7E7	12A8	12SF5	14H7	35	70L7
1D5	1V	6C4	6K7	6SJ7	7A5	7F7	12AH7	12SF7	14Q7	35W4	75
1D7	2A5	6C5	6L5	6SK7	7A6	7H7	12AT6	12SG7	14R7	35Y4	76
1D8	2A6	6C6	6L7	6SL7	7A7	7L7	12BA6	12SH7	19	35Z4	77
1F4	2A7	6D6	6N7	6SQ7	7B4	7N7	12BD6	12SJ7	25L6	35Z5	78
1F5	3S4	6D8	6R7	6SR7	7B5	7Q7	12BE6	12SL7	25Z5	38	80
1G4	5T4	6F5	6S7	6SS7	7B6	7R7	12C8	12SN7	25Z6	39	

NAME BRAND 1½ VOLT LOCTALS, ETC.

1LN5	1LD5	1LH4	1LC6	1LA6	1LB4	
1LC5	1LG5	3LF4	1LE3	1LA4	—	69c
1A7	1H5	1A5	1N5	3Q5	1T5	
1Q5	1P5	1C5	1G4	1G6	117Z6	69c
35A5	50A5 69c Each.					

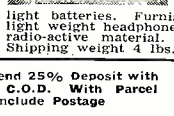
10 for $6.50

Standard Brand Tubes, fully guaranteed. New and perfect.

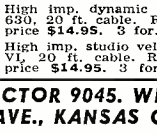
12SA7 .....59c 12SK7 .....59c
35L6 .....59c 50L6 .....59c

10 of any of these for $5.50

NUCLEAR "SNIFFER" GEIGER Counter $54.50



Nuclear "Sniffer," made by a leading manufacturer of nuclear instruments for locating radio-active materials. This small Geiger counter weighs only 2 lbs., powered by 2 standard flashlight batteries. Furnished complete with light weight headphones ready to sniff out radio-active material. Stock No. ATO-1. Shipping weight 4 lbs. Net, $54.50.



$9.95 605 $14.95 630 $14.95 VI

PHILCO MIKE SALE BRAND NEW WITH 20 FT. OF CABLE

High imp. dynamic mike made for Philco 605, 20 ft. cable. Reg. $26.00 list. Sale price $9.95. 3 for.....$26.95

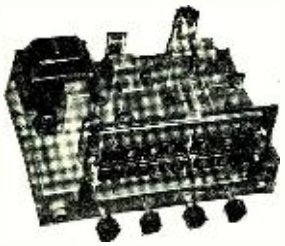
High imp. dynamic mike made for Philco 630, 20 ft. cable. Reg. $36.50 list. Sale price $14.95. 3 for.....$41.95

High imp. studio velocity. Made for Philco VI, 20 ft. cable. Reg. $40.00 list. Sale price $14.95. 3 for.....$41.95

McGEE RADIO COMPANY

Prices F.O.B. K.C. Send 25% Deposit with Order, Balance sent C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI



hallicrafters

MODEL S-56 $110.00 VALUE FM/AM CHASSIS $59.95

11-TUBE S-56 $59.95 ● PUSH PULL WIDE RANGE AUDIO ● AUTOMATIC FREQUENCY CONTROL ON F.M.

Model S-56 Hallicrafters, high fidelity, 11 tube AM-FM radio receiver chassis for broadcast and FM 88 to 108 mc. Automatic frequency control on FM, holds the receiver in perfect tune. Phono connection on rear of chassis. Full range tone control with base boost. Push-pull 6K6 tubes in audio system. Frequency response essentially flat, from 50 to 14,000 CPS. Wide vision accurately calibrated slide rule dial, with pre-selection on broadcast band. Output transformer matches 500 ohm line. 4 antenna terminals; two for AM and two for FM. This is the finest type home radio that we know of today. Better get your order in early. Designed to be used in commercial radios selling in the **$400.00** to **$600.00** class. The regular dealers net on this chassis is **$110.00**. However, a lucky purchase enables us to offer these brand new, factory cartoned S-56 Hallicrafter chassis, complete with tubes and operation instructions, at only **$59.95**, less speaker. Speaker matching transformer 500 ohm to voice coil **$2.50** extra. Chassis size 12¾"x10"x7¾". Weight 25 lbs. Brand new factory cartoned. Buy your S-56's with a wide range PM speaker. Pick your combination from the prices listed below and save.

S-56 WITH 12" 21 OZ P.M. $74.95

Hallicrafters S-56 chassis with tubes, 500 ohm to speaker matching transformer and our model A-50 super heavy duty 12-inch 21-oz. Alnico V PM speaker (regular $50.00 list). This gives you the complete radio for custom installations. Shipping weight 38 lbs. Stock No. S-56A50: A-50 Speaker S-56 and transformer all for **$74.95**. **G.I.** Dual Speed Changer. **Stock No. GI-73: $17.95.**

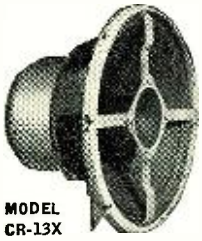
S-56 WITH 12" COAXIAL P.M. $71.95

Hallicrafters S-56 chassis with tubes, 500 ohm to speaker matching transformer and our model CR-13X 12-inch coaxial PM wide range speaker. This gives you a complete radio for custom installations. Shipping weight 33 lbs. Stock No. S-56CR13X: CR-13X speaker S-56 and transformer all for **$71.95**. **G.I.** Dual Speed Changer. **Stock No. GI-73: $17.95.**

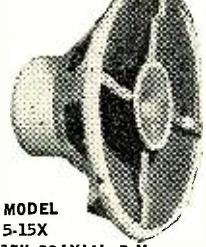
S-56 WITH 15" JENSEN P.M. $79.95

Hallicrafters S-56 chassis with tubes, 500 ohm to speaker matching transformer and model A-15 PM Jensen 15-inch 6-lb. magnet speaker. This gives you a complete radio for custom installations. Shipping weight 47 lbs. Stock No. S-56A15PM: Jensen Speaker S-56 and transformer all for **$79.95**. **G.I.** Dual Speed Changer. **Stock No. GI-73: $17.95.**

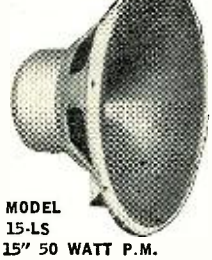
NATIONALLY FAMOUS 12" COAXIAL P. M. SPEAKER $12.95



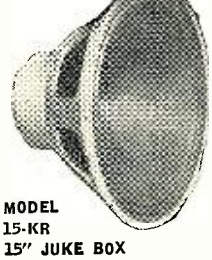
MODEL CR-13X
12" COAXIAL P.M.
$12.95



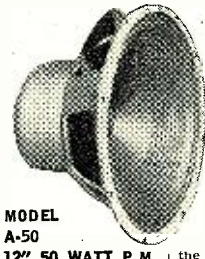
MODEL 5-15X
15" COAXIAL P.M.
$24.95



MODEL 15-LS
15" 50 WATT P.M.
$16.95



MODEL 15-KR
15" JUKE BOX
$9.95



MODEL A-50
12" 50 WATT P.M.
$14.95

OUTPUT TRANSFORMER HIGH FIDELITY 20—20,000 C.P.S. SCOOP PRICE

$6.95 EACH

6600 OHMS PLATE TO PLATE

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 AB, to 4-8-15-250 and 500 ohm; with 10% feedback winding. Housed in a compound filled case: 3⅞x4½x3". Actual net weight, 6 lbs. 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. 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**

DELUXE 12" COAXIAL MODEL CR-13X $12.95

- **RESPONSE 40 TO 17,000 C.P.S.**
- **FINE CONSTRUCTION**
- **GREY FINISH** ● **REGULAR $32.50 LIST**

Newly designed by one of America's finest speaker builders. Made for FM and AM high fidelity radios and record players. This speaker is incorporated in radios of the 500 dollar bracket. It has an especially designed 12" 6.8 oz. Alnico V Magnet PM for the low range Woofer and a coaxially built in 3" Alnico V tweeter for the extended high range. The high pass filter is concealed under the pot cover. Just hook to any 8 Ohm output transformer. Will work 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. Wide range response 40 to 17,000 Cycles. This speaker should sell for $35.00. Why buy any ordinary speaker when we offer a 12" Coaxial PM for only $12.95. Shipping weight 8 lbs. **Model CR-13X, $12.95.** Two for **$24.95**

STANDARD 12" COAXIAL P.M. CN-12X $10.95

Standard Model 12" Coaxial PM Model CN-12X. Same as model CR-13X except 4.64 oz. Mag. in woofer response 50 to 17,000 CPS. Will handle 12 Watts Output. Shipping weight 7 lbs. **Stock No. CN-12X, $10.95.** Two for **$20.95**

15" "KING COAX" P.M. SPEAKER $24.95
"IT WOOFS AS IT TWEETS"

The King Coax. A 21.5 oz. 15 inch Alnico V PM speaker with a built-in high frequency tweeter. Will respond to from 40 to 17,000 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. This speaker has a retail list of over $60.00. We offer you our 5-15X 15 inch coax for only **$24.95.** Shipping weight 16 lbs.

15" DELUXE 50-WATT P.M. SPEAKER $16.95
WITH WIDE RANGE MOLDED CONE

Model 15-LS. 15" 21½ oz. Alnico V Magnet PM Speaker. Will take 35 watts with ease. Thousands of dollars were spent in building the fine tools to produce this speaker. The 8 ohm voice coil is 1½" in diameter and has been heat treated and plastic coated. Constructed to eliminate loose voice coils, wires and warpt fine speakers. Made by a renowned Builder of fine speakers. Truly the King of juke box speakers. Shipping weight 14 lbs. Net Price **$16.95.** Two for **$32.95**

15" JUKE BOX P.M. SPEAKER $9.95

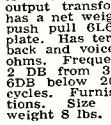
Model 15-KR—Pre-War or Post-War. You never bought a speaker like this for such a scoop price. Made by a nationally known builder of fine speakers. A full 15" 12½ oz. Alnico V magnet speaker of juke box quality. Has standard 8 ohm voice coil. Will take up to 18 watts average or 25 watts peak. Here is a speaker that will bring out those low notes. Latest 1948 production; not line through-outs. Every speaker is guaranteed new and perfect. We may not be able to continue this offer for long, so place your order now. Stock No. 15-KR. INCLUDE POSTAGE. Wt. 10 lbs. A **$35.00** value for only **$9.95**

50-WATT 12" SUPER HEAVY DUTY P.M. $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 speaker. Especially recommended for all public address systems and high quality home audio systems. Will handle 35 watts with ease and 50 watts peak or 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. Shipping weight 13 lbs. Net **$14.95**, 2 for **$29.00**

40-Watt CAPEHART Wide Range Output Trans. $7.95

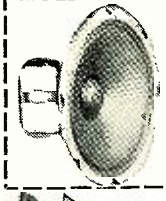
Built for Capehart for this finest combination, 40 watt capacity all windings interwound to increase high frequency response and decrease capacity losses. High inductance in coils makes for best efficiency at low audio frequency. This high fidelity output transformer is fully shielded and has a net weight of 6 lbs. Made to match push pull 6L6 tubes 5,000 ohm plate to plate. Has tertiary winding for 10% feed back and voice coil windings of 4 and 8 ohms. Frequency response plus or minus 2 DB from 30 to 12,000 cycles. Down 6DB below 20 cycles and above 15,000 cycles. Furnished with connecting instructions. Size 3½x4x4⅜ tall. Shipping weight 8 lbs. Stock No. SX-55 net **$7.95.**



CONSOLE BASS REFLEX SPEAKER BAFFLE $19.95

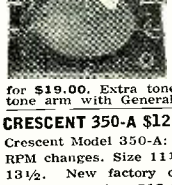
6 Cubic Foot Utility Base Reflex Speaker Baffle. Size 32x22x16. Heavy construction with curved pleasing lines. **Celotex** lining assures non-rattle reproduction. Brown leatherette covered. Chrome front trim. Specify when ordering whether for use with a 12" or 15" speaker. Weight 40 lbs. This is an ideal baffle for our deluxe Coaxial model CR-13X. Baffle Stock No. NA-12 Net **$19.95.** CR-13X 12" Coaxial PM Speaker and NA-12 Baffle both for **$29.95.** You will be pleased with the fine tone of this combination.

CURVILINEAR "WIDE RANGE SPEAKER LINE"
MOLDED HIGH FIDELITY CONES — 6", 8" AND 12" SIZES



Designed to meet the ever-growing demand for finer reproduction of sound. Wide range 6 and 8 inch models offered for the first time. These speakers feature heavier moving parts assembly. One piece molded high fidelity curvelenier cones with 45 M.M. reinforcing dust buttons. This reinforcement adds to high frequency response and overall speaker efficiency. Cone movement is piston-like with more unified action. All models have 1" diameter 8 ohm voice coils, with 6.8 oz. Alnico V magnets. Even ordinary radios will sound better with these speakers. **Model 6L-1.** Wide range 6½" PM 12 Watt. Shipping weight 4 lbs., response 90 to 12,000 CPS, **$4.95.** **Model 8L-1.** Wide range 8" PM 12 Watt. Shipping weight 5 lbs., response 70 to 12,000 CPS, **$5.95.** **Model 12L-1.** Wide range 12" PM 12 Watt. Shipping weight 7 lbs., response 50 to 12,000 CPS, **$7.95.**

CAPEHART CHANGER SCOOP $9.95



While 500 famous Capehart, 2-post automatic record changers last, we offer them to you for only $9.95. Plays standard 78 RPM records automatically, either 12—10" or 10—12". These changers are sets to be replaced with two-speed changers. They may require minor adjustment. This super heavy duty changer is equipped with a new type high fidelity, true-timbre, transparent cartridge, with permanent needle. Requires same gain as the G.E. Variable reluctance cartridge. Base size 14¼x14¼". Stock No. 71-WL: With connecting instructions. Weight 23 lbs. Net Price, **$9.95** each; 2 for **$19.00.** Extra tone arm with Astatic MLP-1 cartridge and needle, **$1.00** extra. Extra tone arm with General Electric RPX-010 variable reluctance cartridge, **$2.95** extra.

CRESCENT 350-A $12.95

Crescent Model 350-A: 78 RPM changes. Size 11½x13½. New factory cartoned. Net price, **$12.95**; 2 for **$25.00.** Leatherette base, **$1.95** extra.

Aero-Stewart Warner $12.95

Aero-Stewart Warner, 78 RPM changer. Size 12x13", with permanent needle. New factory cartoned. Net price, **$12.95**; 2 for **$25.00.** Leatherette base, **$1.95** extra.

VM-406: Tri-O-Matic Changer. Base size 12½x13-13/16". Plays all records automatically. 33⅓, 45, and 78 RPM. Net, **$33.23.**

VM-406GE: Same as 406 but has G.E. variable reluctance cartridge. Net, **$37.15.**

35-WATT 12" CURVILINEAR CONE PM-SPEAKER

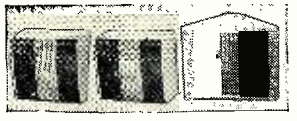
10.95 TWO FOR **19.95**

Why pay $25.00 **or $30.00 for a 12" PM** speaker? Our **engineering lab has dubbed** this speaker the "Jumbo 12." Made expressly for us by a nationally-known manufacturer, to list for $50.00. Heavy duty 12", 22-oz. Alnico V ring magnet, with molded curvelenier wide range cone and 1½", 8 ohm voice-coil. It will take 35 watts. Even if your amplifier is only 6 or 8 watts, it will sound better if you buy a good speaker, like this one. The curvelenier moldcd cone gives good low and high frequency response. (40 to 14,000 cps.) Remember, this speaker is equal to $50.00 list speakers: Stock No. 12-XMS: Weight 12 lbs. Net, **$10.95**; 2 for **$19.95.**

G.I. DUAL SPEED CHANGER WHEN PURCHASED WITH S-56 OR S-59 $17.95

General Instrument Dual speed automatic record changer plays 10—12" or 12—10" 33⅓ or 78 RPM records automatically. Latest model with astatic reversible cartridge and Permanent needle. While our stock lasts we offer this changer, Stock No. GI-73 for only **$17.95** when purchased with S-56 or S-59 Hallicrafters or **$19.95** when purchased by itself. Weight 11 lbs.

PLASTIC GRILL SPEAKER BAFFLES



Juke-box operators, Sound men, here is the prettiest line of speaker baffles you have ever seen. Tri-color curved plastic grills. Good plywood construction, with matched leatherette-covered sides.

12 IN. WALL BAFFLE $3.95

12" slanting wall baffle, with curved plastic grill. Stock No. 12-R: **$3.95.** Buy 4 for only **$14.95.**

8-10 IN. WALL BAFFLE $2.95

8" or 10" Flat mounting wall baffle, with plastic grill. Will hold either 8" or 10" speaker. Stock No. 8R: Your cost, **$2.95** each; 4 for **$10.95.**

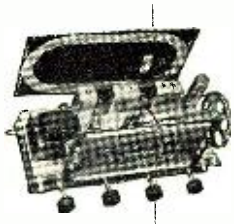
12 IN. CORNER BAFFLE $3.49

Unique design 12" corner mounting baffle. Mounts snugly into corner, giving best sound distribution. Plastic front. Stock No. 12-C: Your cost, **$3.49** ea.; 4 for **$12.95.**

McGEE RADIO COMPANY

Prices F.O.B. K.C. Send 25% Deposit with Order, Balance C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI



S-59 8-TUBE FM/AM CHASSIS $32.95

8 TUBE S-59 AM/FM HALLICRAFTERS-CHASSIS $32.95

REGULAR $50.00 DEALERS NET

PUSH-PULL WIDE RANGE AUDIO

WHY BUY AN ORDINARY RADIO

WHEN YOU CAN BUY A HALLICRAFTERS S-59

Model S-59 Hallicrafters, high fidelity, 8 tube FM/AM chassis, for custom installations. Receives broadcast 540 to 1700 KC and FM—88 to 108 Mc. Size 12½x7½x9". An excellently engineered chassis, with accurately calibrated slide rule dial. Variable tone control and 60 to 14,000 cps, wide range audio. (Push-pull 6K6) 8 ohm output transformer will match most PM speakers. No special output transformer required. Loop antenna built on, for broadcast reception. This is without a doubt the most radio chassis value we have ever been able to offer. Better rush your order in now. We have them. Heavy duty 6x9" PM speaker, for use with the blond console, pictured on the right. $2.95 extra.

S-59 8 tube FM/AM chassis, with tubes. Wt. 16 lbs.....Net **$32.95**

S-59 8 tube FM/AM chassis, with tubes and regular $12.95 12" coaxial PM speaker. Clt-13X. Wt. 24 lbs. Net **$42.95**

IDEAL FOR S-59

CABINET FOR S-59 $19.95

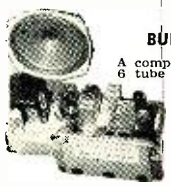
Beautiful blond console cabinet. Size 17 x 21 x 33" high. This cabinet was intended for use on a nationally known $129.00 radio-phono combination. The lower half of the cabinet is divided for albums. The upper half has a hinged lid, which covers the radio and changer. Radio panel is 8 x 15" and may be ordered ready cut for Hallicrafters S-59 or with a blank panel for installing your own chassis. Changer panel is blank, will hold a changer up to 12x15". Cabinet will hold a 6" or a 6 x 9" speaker. Shipping wt. 40 lbs. Stock No. JB-4 blond cabinet, ready cut for the S-59 Hallicrafters. (Will not hold S-56) **$19.95**

6 x 9" 4.64 Alnico V PM speaker..**$2.95** extra
Stock No. JB-5X same but blank radio panel **$19.95**
Stock No. B-1000 cabinet just as we bought them. You re-do the radio and changer area to suit your own need. Changer area is now 15 x 15" and radio area 5 x 15 x 11½". Stock No. B-1000. Shipping weight 40 lbs. **$14.95**

6-TUBE AC 2 BAND RADIO KIT $9.95

BIGGEST RADIO KIT VALUE IN U. S.

BUILD A RADIO WITH MATCHED "DETROLA" PARTS



A complete kit of parts, tubes and ready punched chassis to build a fine 6 tube power transformer type radio chassis. (No cabinet.) We furnish every piece as well as a printed diagram and photograph. Chassis size 14 x 7½ x 7. Receives standard broadcast and 6 to 18 MC foreign short wave. 3 gang tuning condenser used on both bands. 90 mil power transformer 6v6 output tube. This kit is made up of parts intended for use in a high quality Detrola radio. Has full lighted slide rule dial. Everything goes together just like a factory built radio. Priced complete with 6 tubes. Kit model 6-ACX. Less speaker. Weight 16 lbs. Net **$9.95.**

CHOICE OF EITHER 8 OR 10 INCH DYNAMIC SPEAKER **$1.99** EXTRA

MCGEE'S NEW FM-AM-PA KIT $39.95

12 Tube Kit Model PRK-51. This is the most elaborate radio, P.A. kit that our engineering department could design. Here are its features: Receives broadcast, 550 to 1650 kc and FM, 88 to 108 mc (3 gang tuning on FM.) The audio system is wide range, 40 to 17,000 cps.. 5 lb. interwound high fidelity output matches 8 ohm speaker. Twin tone controls, (base and treble boost). Phonograph inputs for standard crystal or General Electric variable reluctance. Mike input for crystal or dynamic mike. This radio may be used for an 18 watt P.A. system, a recording amplifier, or for a high fidelity T.V. sound system. Chassis size, 15½ x 7½ x 7½". Ready punched. Everything furnished with the kit, including tubes: 6AG5, 6SB7Y, 2—6BA6, 6AT6, 6H6, 6BE6, 2—12AT7, 2—6V6 and 5Y3. The FM RF section is ready wired (coils and sockets), to make this kit easier for you to build. 6" slide rule dial. Complete kit model PRK-51, with photos and instructions, **$39.95.** Speaker recommended, Oxford 12", 22 oz. PM, curved cone and 1½" voice coil. Model 12-XMS **$10.00** extra.

$6.95

New 3-Way PORTABLE RADIO KIT *ONLY* $12.95

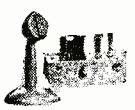
Sensational new 3-way portable radio kit. 4 tubes plus rectifier. Housed in an all aluminum, leatherette covered case made by Farnsworth, with loop antenna built-in. Size 5x9x6". Build yourself a professional looking radio with this kit. Every piece furnished including tubes: 1R5, 1T4, 1S5, and 3V4, as well as easy-to-follow diagram and photo. This set will make a full two gang superhet, that looks like a $40.00 radio. We should ask $17.00 for this kit. Stock No. FP-4X, complete kit less batteries, weight 8 lbs. Net price **$12.95.** Kit of batteries, 67½ volt "B" and "A". **$2.25** extra.

Kit Model TF-4 **$6.95**

4-TUBE RADIO KIT $6.95

Complete Radio Kit Model TF-4. A 4 Tube AC-DC Broadcast, TRF Receiver. Ideal for the beginner. 2 Gang Condenser. Ready punched chassis. Alnico V PM Speaker Airplane Dial. Plastic cabinet. Diagram photos and special pictorial diagram for beginners. This is the simplest type radio to wire. Price includes every part and tubes. 12SK7, 12SJ7, 50B5 and 35W4. Kit Model TF-4. Weight 6 lbs. Net **$6.95.**

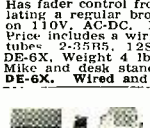
Kit Model X-45 **$12.95**



Kit Model DE-6X **$5.95**

Complete Personal Portable Radio Kit Model X-45. Made from genuine Garod factory-matched parts. A complete kit to build a broadcast battery operated 4 tube receiver. Small in size 6½x3¼x4½". Weight 3½ lbs. 2 Gang Superhet circuit set comes on when lid opens. "Rugged metal case with colored plastic front and back. Loop antenna in lid. Furnished with diagram and photos, tubes and 67½ B-Battery. Will go together like a factory built radio Shipping weight 6 lbs. 8 Tube. # X-45 **$12.95.** Wired and tested **$17.95.**

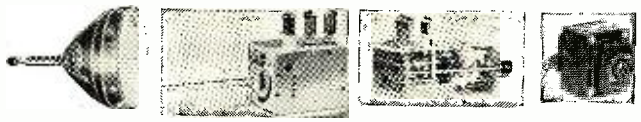
Complete Mike Broadcaster Kit Model DE-6X. Broadcasts 800 to 1500 KC from either a phonograph pick up or mike. Makes any radio receiver a P.A. system or recording amplifier. Broadcast tone quality. Has fader control from mike to record simulating a regular broadcast stations. Works on 110V. AC-DC. Ready punched chassis. Price includes a wiring diagram, photos and tubes 2-35B5, 12SJ7, 35W4. Kit Model DE-6X. Weight 4 lbs. Net **$5.95.** Crystal Mike and desk stand **$4.95** extra. **DE-6X. Wired and tested, $8.95.**



34-WATT WIDE RANGE AMP-KIT $29.95

It's the newest thing in audio amplifiers. McGee's wide range, 34 watt amplifier kit with inputs for crystal or dynamic mikes and any crystal phono cartridge, as well as the new G.E. variable reluctance cartridge. Output transformer is wax impregnated, weighs 6 lbs. Voice coil taps 4-8-15-250 and 500 ohms. Push-pull 6L6 output tubes. Separate electronic base and treble boost. Inverse feedback. Input tube filament is DC heated to reduce hum level to nil. Frequency response from 20 to 20,000 cps. Easy to follow diagram and photos for easy assembly of this kit. Ready punched chassis. Every part furnished, including tubes: 2—6L6, 5V4, 3—12AX7. Shipping weight 18 lbs. Stock No. XX-34 net **$29.95.** Custom wired and tested, net **$39.95.**

BUY YOUR TELEVISION MATERIAL FROM McGEE FOR LESS



(A) Sale Picture Tubes | (B) Sarkes Tarzian Front End $9.95 | (C) G.I. Front End $7.95 | (D) T.V. Power Trans. $2.95

(A) 10BP4.....$19.95 12LP4 .....$32.95

Save $27.00 on a 12" picture tube. McGee offers a real hot deal on T.V. picture tubes. Manufacturer makes this statement about these tubes. These tubes, although well within our manufacturing tolerance, are not quite good enough to bear our brand name. We here at McGee fail to see any difference in these and other tubes. They carry the standard factory T.V. tube guarantee. 10BP4 T.V. tube.....**$19.95**
12LP4 T.V. picture tube.....**32.95**
TUBE SOCKETS FOR EITHER TUBE 49c EACH.

(B) SARKES TARZIAN 13-CHANNEL T.V. FRONT END...$9.95

SARKES-TARZIAN, 13 channel tuner for Television receiver. This 3 tube front end is all wired, including tube sockets. The same T.V. front end as used by several nationally known manufacturers. Built in fine frequency trimmer. Offered with printed schematic diagram. Priced complete with 3 tubes, 6C4 osc., 6AG5 mixer, and 6BH6 RF amplifier. This unit is worth twice our price. All wired, output is to be fed into your video channel. It can be mounted and used with the Farnsworth GVZ-60 chassis, advertised to the left. Weight 2 lbs. Stock No. SK-T3. Net price, Sarkes-Tarzian, 13 channel tuner, with 3 tubes.....**$9.95**

(C) G.I. 13-CHANNEL T.V. FRONT END.....$7.95

13 Channel Television Front End. Permability tuner, with 13 position switch. Built in oscillator trimmer. Priced complete with tubes; 6C4 and 2—6AG5. This T.V. front end may be used with our Farnsworth GVZ-60 chassis. Output feeds to video channel. Stock No. MAB-13 T.V. front end with tubes..... **$7.95**
We have a few of these tuners, that have the fine tuning osc. trimmer missing. Otherwise, need repair and may have broken coil form. **$1.95**
No. MA-13XT. Less tubes.....

(D) T.V. POWER TRANSFORMER.....$2.95

GVZ-60 Power Transformer, C-94230Z. A 135 ma. tapped 110 volt primary. Supplies plate voltage and filament for part of Farnsworth T.V. chassis. 375 volts D.C. 6.3 and 5 volt filament. Adjustable voltage. Size, 3¼ x 3¾ x 5½" high. Shipping weight, 7 lbs. Scoop price. GVZ-60 T.V. Power Transformer..... **$2.95**

JEFFERSON T.V. PWR. TRAN (not pictured)

T.V. Power Transformer, similar to R.C.A. 290 ma. 110 volts. 60 cycle. 760 volts D.C., filaments 5 volts at 3 amps., 5 volts at 3 amps. and 6.3 volts at 8 amps. Trans. size 3¾ x 4½ x 5¼". Shipping weight, 12 lbs. **$6.95**
Stock No. MB-4F. Net price.....

Television Vertical Deflection Output transformer. Shipping weight 2 lbs. Stock No VD-500D. Net price.....	Television Focus Coil. Top quality for 10 or 12" tubes. Similar to R.C.A. No. 202D1. Net price.....	Horizontal Oscillator Transformer. Stock No. H-MA. Net price..	Electro "Magnetic" Ion Trap
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Farnsworth Television Chassis Model GVZ60 partially built up Chassis Size 12 x 17. Has 16 Tube sockets and over 150 small parts (Resister and Ceramic Condensers) no coils or Transformers or tuning unit. Sweep and sync circuits are all partially wired up. This T.V. Chassis is ideal for the student and experimenter. Learn T.V. by building your own set using this chassis to start from. Furnished with a 1948 regular $3.00 Supreme Publications Television Manual, which has a complete schematic of this chassis as well as 9 pages of service information.
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Gives you a clear, complete understanding of T.V. principles, operation and practice. Covers: Beam Formation and Control; Beam Deflection Systems; Beam Modulation and Synchronization. Full analysis of the Cathode Ray tube, voltage supplies, control functions, antenna circuits, RF and IF systems, AGC, video amplification, contrast, etc. 216 pages: 8½ x 11", profusely illustrated; sturdily bound. **Only**.....**$3.00**
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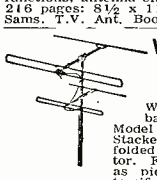

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MODEL TVH-9

Ward $26.50 list, all band T.V. antenna Model TVH-9. (Pictured), Stacked high and low band folded dipole with reflector. Furnished with mast as pictured. This is a terrific antenna buy. The regular dealers net was over $15.00. Buy them now at McGee for only.....**$6.49**

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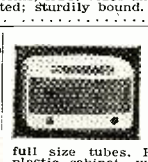
Ward TVA-94. Folded dipole, with 5 ft. mast. Shipped less 300 ohm line. The regular net on this antenna is $6.36. McGee's hot weather price.....**$2.49**



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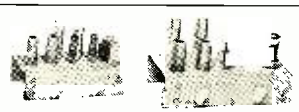

TM-4—5 WATT KIT $6.95 | **TM-8—8 WATT KIT $8.95**

Kit Model TM-4. 5 Watt Amplifier Kit. Ideal for beginner construction. Has features of higher priced amplifiers. Inputs for phono pick up or mike. Compensation for the G.E. Variable Reluctance pick up. Push-pull output gives good tone quality. Output to 8 ohm Voice Coil. Variable tone control and fader control. Ready punched chassis. This makes a top quality AC-DC Audio Amplifier. Priced complete with tubes, diagram and photos. 2—50B5, 2—12AX7, plus selenium rectifier. Weight 3 lbs. Stock No. TM-4, **$6.95.** Crystal mike and utility desk stand $4.95 extra. TM-4 custom wired and tested $3.00 extra.

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TM-12—12 WATT KIT $10.95 | **TM-20—20 WATT KIT $15.95**

Kit Model TM-12. 12 Watt Amplifier Kit. Ideal for a high quality record player as a P.A. System or recording amplifier. Matched component parts ready punched chassis. One control fades from phono to mike. Input compensation for Variable Reluctance pick up. Output matches 8 ohm Voice Coil. 100 Mill Power Transformer. Complete with tubes, diagram and photos. 2—6V6, 2—12AX7 and rectifier. Variable tone control. Model TM-12. Weight 10 lbs. Net **$10.95.** Crystal utility mike and desk stand $4.95 extra. TM-12 custom wired and tested $4.00 extra.

Kit Model TM-20. A high quality 20 Watt Audio Amplifier with 135 Mill Power Transformer and push-pull 6L6's. Inputs for mike or phono pickup. Compensation for G.E. Variable Reluctance pick up. Tone and fader controls. Has heavy duty universal output transformer to match 8 ohm P.M. Speaker. Ready punched chassis. Price includes tubes, diagram and photos. 2—6L6, 2—7N7, 7Z4. Frequency response 50 to 8000 Cps. Kit Model TM-20. Weight 20 lbs. **Net $15.95.** TM-20 custom wired and tested $5.00 extra.

SUPER DELUXE 30-WATT AMP. KIT $19.95

A complete kit of parts to build a 30 watt public address amplifier. Ready punched chassis with cover. 160 mill power transformer for 110 watt AC. Inputs for two mikes and crystal or G-E variable reluctance phono-pick up. Base boost tone control, heavy duty shielded output transformer matches 4 or 8 ohm voice coils. In verse feed back. Everything furnished including easy to follow diagram and tubes; 2-6SJ7, 2-7N7, 2-6L6, 5V4. This kit makes a ready saleable amplifier, of commercial quality and appearance. Kit TM-30 weight 25 lbs. Net, **$19.95.**
With 34 watt wide range high fidelity (20 to 20,000 cps) compound filled output transformer with windings 4-8-16-250-500 ohm add **$5.00.**

Power Supply

(*Continued from page 65*)

experimental radio work, the greatest need for such voltages being for tube filament heating. A tap switch is not so desirable, because the high currents usually drawn by tube filaments and other devices likely to be operated on low a.c. voltages call for rather heavy switch contacts and accordingly large switch size. The two-transformer scheme shown in Fig. 2 supplies the two tube heater voltages (2½ v. and 6.3 v.) most often used. And various external series connections of the six a.c. output terminals will provide an additional 10 useful voltages. (See Table 1). In addition to this, an individual builder may, if he desires, bring the 6.3 volts from transformer T_1 (supplying the 6L6 tube heaters) out to another set of binding posts. This second 6.3-volt source then may be connected in series in a number of ways with the other six a.c. output terminals to provide even more a.c. voltage values.

One binding post in the high voltage d.c. trio is a spare ground connection (connected to chassis). This terminal will be found useful in bonding the power supply to the chassis of any device to which power is delivered. It is handy also for grounding the power supply chassis to earth and for a variety of other uses involving a quick connection to the power supply chassis.

The line bypass condensers, C_1 and C_2, minimize noise and interference arriving via the a.c. power line and reduce the tendency for hum to be transmitted to oscillator and high-gain amplifier circuits which may be operated from the power supply.

Construction

The unit is built on a heavy steel chassis, 12" long, 7" wide, and 3" high. Power transformer T_1, choke CH_1, and all three tubes are mounted on top of the chassis, while transformers T_2 and T_3 are mounted "below deck." The power transformer and filter choke have their cores at right angles to each other to prevent magnetic interaction. Use of an upright-type power transformer and filter choke with pigtail leads removes the necessity for making large, rectangular cutouts for these components. Only medium-sized holes are required to clear the leads.

The output terminals are fully-insulated binding posts mounted with sufficient spacing to enable free manipulation with the fingers.

Fasten all iron-core components solidly to the chassis to prevent vibration. The power transformer (T_1) should be secured with size ¼–20 bolts, choke CH_1 with 10–32 screws, and transformers T_2 and T_3 with 8–32 screws.

Fasten jacks J_1 and J_2 directly in contact with the chassis without insulating washers. Make all connections to the chassis solid. For this purpose, use tinned soldering lugs held tightly with 6–32 screws. If a painted chassis is used, be sure to scrape the paint completely from around any point to which a chassis connection is to be made.

Pull the a.c. line cord through a grommet-lined clearance hole in the rear of the chassis. Tie a tight knot in this cord just inside the chassis to prevent its later pulling loose. Solder the two ends of this cord to a 2-lug insulated terminal strip mounted under chassis near the grommet-lined hole, and make all other internal power line connections to this strip.

The meter jacks, J_1 and J_2, are mounted on the right-hand side of the chassis where they will be readily accessible while at the same time out of the way of connections and controls. The filament transformers should be mounted close enough to the output binding posts so that their secondary leads can be run directly to these posts without splicing. Use good solid, insulated hookup wire for all necessary wiring in all parts of the unit. Cabled wiring may be employed if the reader prefers, but careful isolation and shielding, so important in amplifiers and other electronic apparatus, is not necessary in this power supply.

The author did not choose to enclose his own power supply, shown here, in a cabinet. However, any metal housing of the proper dimensions may be employed, provided sufficient louvres or holes are provided for free circulation of air around the hot tubes.

Testing and Use

After completing the assembly, check all wiring carefully before undertaking any tests.

(1) Set switches S_1 and S_2 to their "Off" position.
(2) Set potentiometer R_1 to its extreme left-hand position.
(3) Insert power plug into a.c. outlet.
(4) Throw switch S_1 to its "On" position and allow about two minutes for the 6L6 tubes to reach operating temperature.
(5) Plug a high-resistance d.c. voltmeter (set to its 0-500-volt range) into jack J_2.
(6) Throw switch S_2 to its "On" position.
(7) Slowly turn potentiometer R_1 to the right, noting that the voltmeter reading rises in accordance. If the voltmeter reading *decreases* as potentiometer R_1 is advanced, interchange the two outside connections of the potentiometer.
(8) Throw switch S_2 to its "Off" position, and check the voltage at the six output terminals of transformers T_2 and T_3 by means of an a.c. voltmeter set to its 0–10-volt range.
(9) When using the power supply, make connections with insulated wire or cable to the "+" or "—"

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Chairman Wayne Coy of the FCC estimates there will be 400 TV stations on the air within two years—and 1,000 in eight or nine years. David Sarnoff, chairman of the board of RCA, predicts about 18 million TV sets will be in use by the end of 1953. FM figures are equally impressive, with about 4,000,000 more radios with FM forecast in 1949. There can be no doubt about the importance of, and the need for, experienced TV-FM servicemen. Are *you* going to be qualified for the increased earnings that lie ahead?

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high-voltage d.c. terminal posts, and plug a 0-150 ma. d.c. meter (depending upon the expected current drain through the load) into jack J_1. Whenever load conditions cause the d.c. output voltage to drop, as indicated by the voltmeter, simply reset potentiometer R_1 to restore the voltage to the desired value.

(10) To obtain the various a.c. output voltages listed in Table 1, make short jumper connections between appropriate a.c. output binding posts, using heavy wire.

CAUTION: All power supplies are dangerous. The unit described in this article is no exception, although its maximum output voltage is about 300 volts. Use every precaution to avoid electric shock. In designing the unit, the author has made use of insulated binding posts and grounded meter jacks and has kept all exposed contacts and wiring below the chassis. Do not alter the construction in such a manner as to make this serviceable equipment a hazard to your life. —30—

RADIO ASSN.'S GOOD NEIGHBOR POLICY

THE flood that inundated a good part of Garland, Texas, last June gave the Dallas Radio Sales & Service Association an opportunity to play the part of "good neighbor."

On the evening of June 13, senior member of the Association H. H. Hirsch and his wife were forced to flee the torrent which overflowed Duck Creek in Garland. Returning, they found the stock ruined, with radio sets and test equipment now worthless. Friends rallied to his assistance and after a thorough scrubbing, the shop was supplied with new TV sets from the *Motorola* Distributors and testing equipment borrowed from Association members. But that does not finish the story.

At the next regular meeting, the members decided to give Hirsch a surprise parts and tube shower to help him really get started. Before the committee, consisting of Johnny Anderson, Theo Kramolis, and Egon Pflughaupt were through, over $800 worth of new soldering irons, batteries, tubes, speakers, i.f. transformers, antennas, and r.f. coils, etc., had been gathered.

Enticing Mr. Hirsch out for some cokes, the volunteers unloaded the complete new stock. When the couple returned, they could not believe their eyes.

E. Pflughaupt, vice-president of the Dallas Radio Sales & Service Association explained away the kindnesses with the statement that "the Association members believe in helping our neighbors." —30—

"Can't you do anything for him, Doctor? He keeps chewing up records and mumbling '78 . . . 33⅓ . . . 45 . . . 33⅓ . . . 78 r.p.m.!' "

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1T4 1U4 3A4 3Q4 3V4 6S8GT 01A
4A6G 6A3 6C4 6F8GT 6SD7GT 10 12A
14X7 39/44 47 50 71A 112A 182B

FREE! $20.00 List Value Cornell-Dubilier, Mallory, Aerovox, Sprague, Solar. Filter Condensers—ten fast moving filters FREE with each 100 tubes.

183 25S 25Z6GT 482B 483 1A4 1A4P
1A6 1B5 1D5GT 1D7 1D8GT 1F4
1F5G 1G4GT 1G6GT 1H4G 1H6GT 1J6G

29c ea.

39c ea.

1C5 1C6 1L4 1R5 1S4 1S5 2A5 2A7 3Q5GT 3S4 5U4G 5W4GT 5X4G
5Y3GT 5Y4G 5Z3 6AC4 6AC5 6AC5GT 6AG5 6AK5 6AL5 6AL6 6AQ5 6AT6 6AU6 6A7 6A8G 6A8GT 6B6 6BA6 6BD6
6BE6 6BH6 6BJ6 6C5 6C8G 6D6 6F5GT 6F6GT 6G6 6H6 6H6GT 6J5 6J5GT 6J6 6J7G 6J7GT 6K6GT 6K7GT 6K8GT
6Q7 6Q7GT 6P5GT 6SA7GT 6SC7GT 6SG7 6SG7GT 6SH7 6SJ7 6SJ7GT 6SL7GT 6SK7GT 6SN7GT 6SQ7GT 6SR7 6U6G 6U6GT 6U7G 6U7GT
6V6GT 6X4 6X5GT 6Z4 12A8GT 12AT6 12AU6 12AU7 12AX7 12BA7 12BA6 12BE6 12F5GT 12H6 12J5GT 12J7GT 12K7GT 12K8GT 12S8GT
12SA7GT 12SF5 12SF7 12SG7 12SH7GT 12SJ7 12SJ7GT 12SK7GT 12SN7GT 12SQ7GT 12SR7GT 2050 2051 24A 25L6GT 25X6 25Z5 30 31 32
33 34 35 35B5 35C5 35W4 35Z3 35Z4GT 35Z5GT 36 37 38 39 41 42 43 45 46 50A5 50B5

39c ea.

50Y6 51 56 57 58 75 76 77 78 80 84/6Z4 85 — 89

49c ea.

OZ4 1A5GT 1A7GT 1C7G 1H5GT 1LA4
1LE3 1N5GT 1P5GT 1Q5GT 1T5GT 1V 1C5GT 2A3 2B7 2C34
2E24 5V4 5Z4 6AC7 6AV6 6B4G 6B8 6C6 6D8 6D8G
6F5 6F8G 6K7G 606 6R7 6SF5GT 6T7G 6T8 6U7 6W7G
6Y6G 6Z7G 7A4 7A7 7B6 7E5 7E6 7E7 7F7 7G7
7H7 7J7 7L7 7N7 7Q7 7S7 7T7 7W7 12A7 12AT7
12C8 12J5 12Q7GT 12Z3 14N7 19T8 20 32L7GT 35/51 35L6GT

49c ea.

36 40 50L6GT 89 117Z3 VR150 XXL/7A4

59c ea.

1B3 1AD5 1LA6
1LB4 1LC5 1LC6
1LH4 1LN5 2V3G
3LF4 6B7 6BG6G
6J8G 6L6G
6L6 6S7G
6U5 70L7GT
81 117Z6GT

59c ea.

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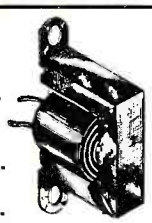

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12"	4.95	5.95

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100 Condensers ass't. in package **$5.95**

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.002 mfd. 600 V. ea. 6c
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.01 ea. 7c
.02 ea. 7c
.05 ea. 8c
.1 ea. 9c

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20—450 V ea. 39c
30—450 V ea. 49c
30—450 V with 20—20—25V ea. 29c
8—8—450 V ea. 39c
10-10—450 V ea. 43c
20-20—450 V ea. 49c

150 Working Volts
15-15—150 V ea. 29c
20-20—150 V ea. 29c
20-20-20—150 V ea. 39c
30-30—150 V ea. 39c
40-20—150 V ea. 39c
40-30—150 V-30-20-25 V ea. 39c
40-40—150 V ea. 39c
40-40—150 V-25-25V ea. 39c
50-30—150 V ea. 39c
50-50—150 V ea. 39c
60-60—150 V ea. 39c
15—150 V ea. 21c
16—150 V ea. 23c
20—150 V ea. 25c
30—150 V ea. 29c
40—150 V ea. 29c

25 Working Volts
10—25 V ea. 16c
20—25 V ea. 16c
25—25 V ea. 16c
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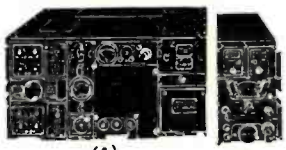
Medium frequency. (40 to 400 mcs.) Butterfly condenser. Assembly will take any acorn tube. A fine foundation unit for the high frequency transmitter hound.

CAT. NO. N-127
YOUR COST **$4.95**

SCR 506-A TRANSMITTER AND RECEIVER



(A) (B)

(B) RECEIVER BC 652-A

BC-652-A is an eleven tube superhet. receiver with a frequency range of 2,000 to 6,000 kc. (75-80 mtr. ham bands), crystal frequency standard and 12 V. dynamotor DM-40-A on two separate chassis combined in one case. Tube line-up consists of 12SG7—R.F., 12K8Y—converter, 12SK7—1st I.F., 12C8—2nd I.F. and noise limiter, 12SK7—3rd I.F., 12K8Y—B.F.O., 12SK7—1st audio, 6Y6G—2nd audio, 6K8—crystal oscillator, 6SC7—20kc. multivibrator, and 6SC7—100 kc. multivibrator. Sensitivity is 1 microvolt or greater. Front panel contains all controls and is ribbed for protection against damage. Unit requires absolutely no conversion other than addition of proper power supply. Brand new in original overseas shipping crates.

CAT. NO.
YOUR COST **$39.95**

(A) TRANSMITTER BC653-A

BC-653-A is a 7-tube, variable frequency transmitter with range of 2,000 to 4,500 kc., modulator, voltage regulator and DM-42-A dynamotor. all self contained in one case. Tube line-up consists of 1613 master oscillator, 807 buffer, two parallel 814 power amplifier, 1613 modulator and two 03C-105 voltage regulators. Power input;—100 watts C.W. and 25 watts phone. Principal feature is the speed with which any of five pre-set frequency channels can be selected from the front panel. BC-653-A transmitter, brand new with all tubes and 12 V. dynamotor, packed in original, unopened crates.

CAT. NO. N-177
YOUR COST **$150.00**

RCA TV YOKE MOUNTING HOOD TYPE 201x1

Hood holds deflection yoke 201D1 or 201D3. Improved rubber bumper provides safe support for picture tube. Spring contacts provide a ground for the coating on outside of the kinescope.

CAT. NO. N-121
YOUR COST **$1.65**

FM WAVE TRAPS

A wonderful device with many applications.
1—Unexcelled in matching high and low frequency TV antennas.
2—Very desirable in eliminating FM sound bars in TV pictures.
3—Perfect for eliminating amateur interference (shock excitation in TV receivers).
4—Most useful in building that new 2 meter converter and dozens of other uses too numerous to mention.

Trap consists of two slug-tuned silverized coils and two ceramic condensers. Mounted on a cadmium plated bracket, conveniently drilled and ready for mounting.

CAT. NO. N-128 **$.39** each 3 for **$1.00**

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SEE US AT THE SHOW!

TRANSFORMERS

POWER TRANSFORMERS ALL 117V. 60 CYCLE PRI.

T-47177	40VDC @ 250 ma. 5V @ 3A. 1600 V. ins. herm. sealed	$2.49
SP-105	725-0-725V. @ 60 ma., 5V @ 3A. 6.3V. @ 1.2A	2.95
511-T2	350V CT @ 150 ma. 6.3V @ 6A herm. sealed	2.10
475-T301	245-0-245 @ 70 ma., 6.3V @ 6.2A. 1600V. ins. herm. sealed	2.75
466-T1R	110-0-110 @ 225 ma., 5V @ 3A herm. sealed	3.25
PC-110	600V.C.T. @ 125 ma. 6.3V @ 3.8A. 5V. @ 3A. 1600V. ins. herm. sealed	2.85

PLATE TRANSFORMERS

T-47168	540-0-540V. @ 650 ma. Herm. sealed	9.95
475-T302	2350-0-2350V. @ 300 ma.	23.50
69125	2100V.C.T. @ 500 ma	17.95

FILAMENT TRANSFORMERS

T-47164	6.4V. @ 8A, 1600V. ins. herm. sealed	2.49
T-47167	5V. @ 9A. 3500V. ins. herm. sealed	2.75
SP-100	24V. @ 10A	4.95
D161917	6.3V. @ 3A, 2.5V. @ 2A., herm. sealed	1.95
510-T4	6.4V. @ 10A., 6.3V. @ 5A., 1200V ins. herm. sealed	2.95
475-T201	5V.C.T. @ 15A., 1600V. ins. herm. sealed	4.25
510-T2	Bridge transformer 2.5V. @ 5A. 2.5V. @ 5A., 2.5V. @ 10A. herm. sealed	3.95

CHOKES — REACTORS

	Cap.	Current	Res.	Insul.	
L-143	1.72	4A.		10,000V.	$12.00
L-554	20	125ma.	300		* 4.95
475-CH301	3.8	75ma.	160	1600V.	* 4.15
475-CH302	10	300ma.	100	7500V.	* 5.25
14010	15	200ma.	150	2000V.	* 5.25
15406	12	225ma.	200		* 5.25
510-X2	15	200ma.	145		5.25
S-16886	2.5-24	50/400ma.	53	10,000V.	8.95
S-16885	.875	125ma.	250	1,600V.	8.95
RC-72	15	400ma	45	10,000V.	*4.15
L-218	45	90			2.75
T-46256A	12	210ma.			5.25

*Herm. sealed

SPLIT-STATOR XMTR CONDENSER

Hammerlund 35 mmfd per section split-stater variable transmitting condenser. Steatite mounting base. variable soldering lug-contacts. Special shield between sections. ¼" shaft.

CAT. NO. N-126
A REAL BUY AT ..... **$.89**

PATCH CORD

Don't be caught short! Niagara's shelves are bursting with U. S. Navy 2-conductor neoprene jacketed headset extension cords 5 feet long, equipped with PL55 plug and JK26 Jack. Fully moisture and fungus proofed. In original overseas pack.

CAT. NO. N-115
YOUR COST ..... **$.69**

CRYSTAL HOLDER ADAPTER

Adapts holders to existing crystal sockets. Polystyrene block with lo-loss pins on bottom. Phosphor bronze contacts take ½" pin spaced crystals (ft 243) on top. Bottom fits standard ¾" crystal sockets or 5 prong tube socket.

CAT NO. N-118
YOUR COST ..... **$.34**

ANTENNA CHANGE-OVER RELAY

Made by Automttic Elec. Mfg. Co. for the discriminating ham requiring a fine, mycalex insulated 115V. A.C. 60 cycle antenna relay. Will handle up to 1 kw. Contact rating .5 amp. @ 2000 Volts. Measures 2¼x3¾x1½" high. Supplied with rubber mounts.

CAT. NO. N-139
YOUR COST **$4.80**

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No.		
415	55 Watts	$1.17
416	60 "	1.27
417	100 "	2.37
418	130 "	2.97

ORANGE LABEL
Mechanic or professional

No.		
62	60 Watts	$2.37
63	100 "	2.97
64	130 "	3.57
65	200 "	4.17
67	300 "	4.77
69	500 "	5.37

RED LABEL
Industrial

No.		
38	100 Watts	$3.57
58	200 "	4.77
78	300 "	5.37
98	550 "	5.97

B & W "CC-50" CO-AX CONNECTOR

Efficient, waterproof coax cable connector and center insulator. Aluminum casting with steatite insulation. Weighs 12 ounces assembled, will withstand 500 lb. pull, complete with weather-proof cement, ⅝" O.D. rubber tubing all necessary screws. CAT. NO. N-101. YOUR COST.. **$5.00**

AMPHENOL FEMALE RECEPTACLE

Female receptacle with removable mounting plate and spring retainer Ring. type 61-F1. CAT. NO. N-123.
SPECIAL.....each **$ .19**

50 MMFD TUNING CONDENSER WITH MOUNTING BRACKET

TVI got you licked? Don't give up O.M.! Operate, but co-operate by installing this 50 mmfd. ceramic mounted, tuning condenser as part of the plate circuit, series tuned trap. Drilled and tapped bracket provided for convenience in mounting.
CAT. NO. N-119.
YOUR COST EACH..... **$ .39**
3 For $1.00

BC 312 1ST. DETECTOR TRANSFORMER

1st detector assembly for BC312 receiver, mfgd. by RCA, contains 5 mica condensers, 3 ½w. resistors, 3 tie strips, transformer coils on ½ coil form all fully encased in 2⅝x1⅝x3⅝" high-aluminum shield can. 5 RMA color coded pigtail leads. Makes perfect foundation unit for the receiver building enthusiast. Brand new in original cartons. CAT. NO. N-129.
YOUR COST..... **$1.98**

OVERLOAD RELAY

Westinghouse overload relay. Adjustable from 250 ma. to 1 amp. D.C. Manual reset, heavy construction, coil and contacts fully enclosed in ¼" glass shield. WORTH PLENTY.
CAT. NO. N-122.
YOUR COST..... **$12.95**

4 P.D.T. LOCKING SLIDE SWITCH

Just the thing for Xmitr band switching. Four pole, double throw, locking slide switch. By releasing locking knob, all contacts are automatically opened thereby avoiding possible short circuit within switch. Retightening knob again makes contact and locks switch in either of two, four circuit positions.
CAT. NO. N-112.
YOUR COST..... **$1.49**

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The tubes listed below are guaranteed to be lower in price than any advertised listing of standard, branded, new tubes appearing within the last 30 days. We will meet or better any prices proven to be lower. (Proof of lower prices must be submitted.)

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10% off on quantity of 100 or more.

(may be mixed)

29 Cents Each

2C22	12A6	28D8	38
3A4	12A6GT	30	39/44
3B7	12H6	31	89Y
3D6	12J5GT	33	CK1005
6C4	12SH7	34	7193
6SH7	12SR7	36	9002
7C4	12SR7GT	37	

27 Cents Each

23D4	1626	5AZ4
45 SPEC	HYE1148	6SD7GT
1625	01A	9004
	9006	

55 Cents Each

1H5GT	6SA7GT	12SK7GT
5W4GT	6SJ7	25L6GT
6AR5	6SJ7GT	78
6C5	6SK7	35L6GT
6C5GT	6SK7GT	41
6D6	6SS7	42
6F5	12K7GT	43
6F5GT	12SA7	45
6F6GT	12SA7GT	50B5
6K7	12SJ7	50L6GT
6K7GT	12ST7GT	75
6SA7	12SK7	77

FLASH!
11 meter band has been changed from 27160-27430 to 26960-27230 KC.

6 HOT SPECIALS

OSCILLOSCOPE

Telemark No. 450A

The Telemark No. 450A oscilloscope has been developed to fill the requirements of a general purpose instrument. The vertical and horizontal amplifiers were made identical, of good sensitivity and wide band-width, in order to allow its use in television servicing, laboratory and production testing. It is capable of studying pulses and square waves as high as one megacycle.

This scope is a low priced portable unit utilizing a 5 inch tube. It embodies features previously found only in high priced instruments.

1—Decade type frequency compensated attenuators.
2—Continuously variable low impedance gain controls.
3—Push-Pull deflection amplifiers.
4—Maximum deflection amplitude is 1½ times the screen diameter.
5—Internal sync. signals of either polarity available.
6—Z-axis imput (intensity modulation) available on the front panel.
7—Calibrated 60 cycle test voltage available on the front panel.

The scope is housed in a sturdy steel case, blue-grey hammertone finish, contrasted with a light grey aluminum panel having raised black characters. Chassis, brackets and braces are cadmium plated steel, complete wired and tested with all tubes and Full instructions.
CAT. NO. N-145
YOUR COST..... **$99.50**

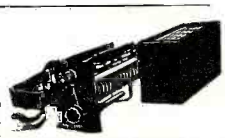
ALL BAND ANTENNA TUNER SWITCH

Heavy duty tap switch from high powered, all-band antenna tuner. Six tap positions plus antenna disconnect-dummy load switch. Heavy copper taps and phospher bronze wiper contacts. Spring snap action permits arc-less band switching with antenna loaded. May also be used as primary tap switch for high powered finals. Mounted on cloth laminated, heat resistant, plastic board. Measures 3½x5".
CAT. NO. N-114
YOUR COST..... **$2.49**

CERAMIC DPDT SWITCH

A simple item made beautifully by its careful construction. Especially useful where high frequency, low loss is an important consideration such as in high to low frequency TV antenna changeover networks. A lucky buy, at a scoop of a price makes them available to you for the SPECIAL PRICE of—each:
CAT. NO. N-137
YOUR COST..... **$ .45**
3 for $1.25

A-27 PHANTOM ANTENNA



Popularly used by thousands of hams on 75-80 meters. Unit consists of a sturdy steatite mounted variable condenser and two high current plaque resistors. Framed calibration chart is mounted on enclosing case. Brand new and complete.
CAT. NO. N-195
YOUR COST..... **$2.49**

NATIONAL 450-550 KC I.F. TRANSFORMER

Niagara does it again! Genuine National 450-550 KC I.F. transformers. Ideal for ham, experimenter or serviceman. Unit consists of air padder condensers isolated from each other by an internal aluminum shield. Litz wound coils on moisture proofed ceramic base. Fully enclosed in shield can 4½x2⅜x2" Fungus proofed and anti-corrosion treated.
CAT. NO. N-130
SPECIALLY PRICED AT..... **$1.49**
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KEYING RELAY

DPDT high speed keying relay. 300 ohm coil, in grey vacuum sealed metal shield, mounted on octal base. Will follow 100 words per minute. Made by BETT & BETT. Brand new in original boxes.
CAT. NO. N-201
YOUR COST..... **$2.00**

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Technical BOOKS

"A BUSINESS OF MY OWN" by Arthur E. Morgan. Published by *Community Service, Inc.,* Yellow Springs, Ohio. Price $1.00. 185 pages.

It is the opinion of the National Resources Planning Board that if America is to maintain full employment, expansion of services must play a large part in the reconversion process. This statement, included in the section of the book devoted to service occupations and the possibilities open to businessmen engaged primarily in these categories of activity, perhaps explains in part why the larger portion of this manual is devoted to information on these pursuits.

The personality characteristics, abilities, educational requirements, etc., necessary for the many different types of service occupations listed are interestingly presented. Included also are scores of suggestions as to what businesses are needed most, those in which future development is most probable, and where the ambitious will find the greatest scope.

The first part of the book is devoted in general to small enterprise, with a discussion of business ethics, the question of competition, and suggestions on capital requirements. Helpful hints on finding the right business, taking into consideration personal interest, adaptability, and temperament, and problems of distribution and advertising are set forth here. The latter part is given to small industries, agriculture, and a brief explanation of cooperative enterprise.

Seven full pages, with complete bibliography and listing of other sources of information are included, so that the beginner may continue his research on those portions of the text that apply to his particular case.

* * *

"THE CATHODE-RAY OSCILLOSCOPE" by George Zwick. Gernsback Library No. 40, published by *Radcraft Publications, Inc.,* New York. 112 pages. Price 75 cents.

As is well known, the cathode-ray tube, the modern-day electronic marvel, is an exceedingly versatile instrument, with many applications beyond the field of radio. This handbook, however, is devoted to the use of the tube in the operation of the measuring instrument called the oscilloscope and is intended to be of assistance to the ham, service technician, or radio hobbyist.

The first part of the text begins with the simple techniques of the measurement of a.c. current and continues with a description and general study of the cathode-ray tube, the sweep systems for pattern tracing in the cathode-ray tube, and a preliminary study of the complete oscilloscope.

The last two chapters are devoted to the practical aspects of the oscilloscope in the alignment of intermediate-frequency amplifiers, bandpass or flat-topping alignment in receivers, alignment of television i.f. channels, to list only a few of the many uses, and to the measurement techniques of the scope, together with the advantages it possesses in the tracing, location, and analysis of circuit hum.

Readers who will benefit the most are those who have some knowledge of radio fundamentals, although the handbook does not contain complicated mathematical explanations and deals in clear, simple explanations.

* * *

"RADIO AND TELEVISION MATHEMATICS" by Bernhard Fischer, Ph. D. Published by *The MacMillan Company,* New York. 484 pages. Price, $6.00.

Arranged in four separate sections, under electronic headings, such as circuit components, direct-current circuits, amplifiers, transmitters, receivers, power supplies, etc., this handbook gives the solutions to almost 400 problems typical of those encountered in the construction, operation, and servicing of radios, television, and other electronic equipment.

Section three devotes a considerable amount of space to the tools used in working radio and electronic mathematical problems, the j-operator, polar vectors, the slide rule, etc., and the fourth and last section contains many electronic formulas and tables.

The system used in this book is conducive to quickly and thoroughly digesting the techniques of solving these problems, whether the reader is a student, or using the book for purposes of review. The problem is first stated, then the steps necessary to solve it are given, and finally the answer is shown. A working knowledge of algebra and trigonometry is a prerequisite to understanding the material.

For those engaged in the construction, operation, and servicing of radios, television, and other equipment, for teachers, students, or amateurs, this handbook will be an extremely useful reference and textbook.

* * *

"EMPLOYMENT OUTLOOK IN RADIO AND TELEVISION BROADCASTING OCCUPATIONS" by Bureau of Labor Statistics, *U. S. Department of Labor.* Bulletin No. 958, Occupational Outlook Series. 70 pages. Price 30 cents.

The job outlook for all radio and television employees from program workers, professionals, and clerical employees to technical and commercial personnel is the subject of this book, compiled from individual reports from 40 states. These reports are given in detail for the states individually, and maps also are included on nine sections of the country.

Designed to help the thousands of young people attracted by the greatly expanding and dynamic industry, statistics on the numbers of people at work in the industry, occupations

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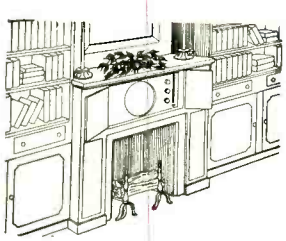
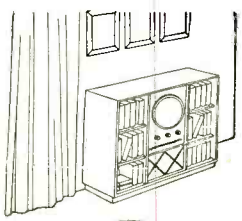
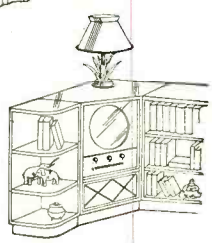
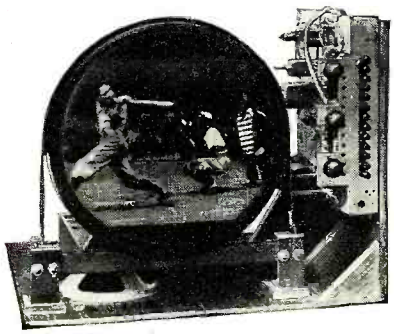








MODEL T-69
15" Custom TV Chassis
COMPLETE WITH PICTURE TUBE

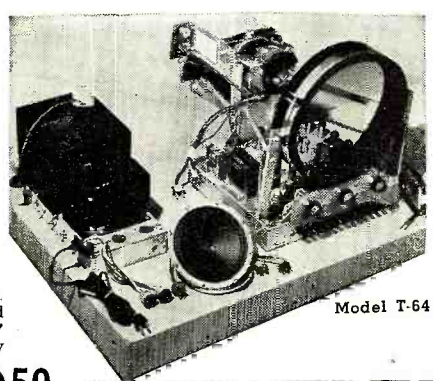
Now you can have big picture television at a real saving in price plus the convenience of a custom installation to exactly suit your own requirements. 130 sq. in. picture on 15" direct view tube. All channel push button tunning. 8" PM speaker. Mounted on reinforced wood frame ready to be slipped in cabinet, wall installation, etc. Dimensions 19½" high x 23" wide x 24¼" deep. Factory wired and tested. 19 tubes plus picture tube and 3 rectifiers. Complete with 15AP4 picture tube. Shpg. wt. 80 lbs.

$259.50

MODEL 513
10" Plastic Cabinet

New 10" table model in modern plastic cabinet. 56 sq. in. picture with rounded sides utilizing full width of TV tube. 19 tubes plus 3 rectifiers and picture tube.
Shpg. Wt. 98 lbs.

Only **$199.50**



Model T-64

MODEL T-64
12" Custom TV Chassis
COMPLETE WITH PICTURE TUBE

Plan your own TV installation and pay no more for big picture 12" direct view custom chassis than you would for a regular 7" set. 84 sq. in. picture plus dual-focus giving a big 95 sq. in. round picture all at a flick of a switch. All channel push button tuning. Mounted on reinforced wood frame. Dimensions 13" wide x 17¾" high x 20" deep. Factory wired and tested. 19 tubes plus picture tube and 3 rectifiers. Complete with 12LP4 picture tube. Shpg. wt. 66 lbs.

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available, training needed, the availability of jobs, job prospects years from now in this field, all of these and more questions are answered in the report. Charts, graphs, and maps in addition to the text provide overall pictures of the industry prospects, and no one who is interested in work of this sort could fail to be properly directed and assisted by such information.

* * *

"DIRECT CURRENT FUNDAMENTALS" Joseph J. De France. Published by *Prentice-Hall, Inc.,* New York. 270 pages. Price $4.30.

Anyone with a knowledge of physics will be able to understand this book, and more advanced students will profit from it as a review of fundamentals. Written for the purpose of training electronic technicians, the text benefits from the author's experience in teaching radio and electrical engineering at the *RCA Institute* and New York City College, which enables him to assist the student in comprehending the material.

Two special features especially useful to a clear understanding are the different types of arrows used to designate current distribution among the branches of parallel and series-parallel circuits, even in the more complex problems, and specially designed graphs. Since it was impossible to duplicate fine subdivisions of graph paper in the text, spacing between coordinates was made an integral number of 1/16 of an inch, and a standard ruler can be used for interpolations of units of 1/32 of an inch.

In the rapidly advancing electronic industry, radio and TV technicians need not find themselves limited by inadequate knowledge of d.c., as with a book such as this, they may continue to study and apply their present knowledge to new developments.

* * *

"HOW TO SERVICE RADIOS WITH AN OSCILLOSCOPE" published by *Sylvania Electric Products, Inc.,* New York 18, N. Y. 71 pages. Price $1.00.

The compilers of this handbook did not intend to write an engineering manual but to explain in a practical manner the operation and applications of the cathode-ray oscilloscope for the benefit of radio and audio amplifier service technicians.

In the chapter on voltage measurement, the workings of the oscilloscope are fully explained by means of the voltage measurement principle, explanations of d.c. voltage measurement, a.c. measurement, sensitivity of the oscilloscope as a voltmeter, calibration of the oscilloscope as a voltmeter, and calibration of direct input, to mention only a few of the sections in this chapter.

Uses of the oscilloscope in receiver alignment, trouble-shooting, in amplifier testing, transmitter testing, and miscellaneous applications are given in detail. Uninvolved terms, drawings, schematics, and photographs explain

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The New Model TV-20 A COMBINATION **20,000** OHMS PER VOLT **MULTI-METER and TELEVISION KILOVOLTMETER**

ADDED FEATURE
Includes an Ultra High Frequency Voltmeter Probe with a frequency range up to 1,000 MEGACYCLES. When plugged into the Model TV-20, the V. H. Probe converts the unit into a Negative Peak-Reading H. F. Voltmeter.

The Model TV-20 operates on self-contained batteries. Comes housed in beautiful hand-rubbed oak cabinet complete with portable cover, Built-In High Voltage Probe, H. F. Probe, Test Leads and all operating instructions.

$39.95 NET

9 D. C. VOLTAGE RANGES: (At 20,000 ohms per Volt) 0-2.5/10/50/100/250/500/1,000/5,000/50,000 Volts

8 A. C. VOLTAGE RANGES: (At 1,000 ohms per Volt) 0-2.5/10/50/100/250/500/1,000/5,000 Volts

5 D. C. CURRENT RANGES 0-50 Microamperes (.5/50/500 Milliamperes 0-5 Amperes

4 RESISTANCE RANGES: 0-2,000/20,000 ohms 0-2/20 Megohms

7 D. B. RANGES: (All D. B. ranges based on ODb = 1 Mv. into a 600 ohm line)

− 4 to + 10 db
+ 8 to + 22 db
+ 22 to + 36 db
+ 28 to + 42 db
+ 36 to + 50 db
+ 42 to + 56 db
+ 48 to + 62 db

7 OUTPUT VOLTAGE RANGES: 0 to 2.5/10/50/100/250/500/1,000 Volts

THE NEW MODEL TV-10

TUBE TESTER

The Model TV-10 operates on 105-130 Volt 60 cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

$39.50 NET

SPECIFICATIONS:

Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing-aid, Thyratron, Miniatures, Sub-Miniatures, Novals, etc. Will also test Pilot Lights.

Tests by the well-established emission method for tube quality, directly read on the scale of the meter.

Tests for "shorts" and "leakages" up to 5 Megohms.

Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-10 as any of the pins may be placed in the neutral position when necessary.

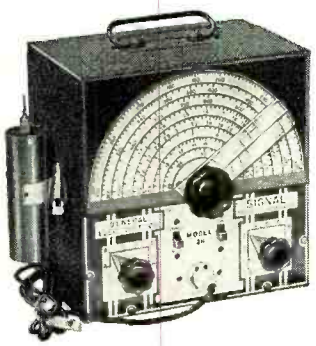
The Model TV-10 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.

Free-moving built-in roll chart provides complete data for all tubes.

Newly designed Line Voltage Control compensates for variation of any line voltage between 105 Volts and 130 Volts.

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 output 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 the Audio Frequency.

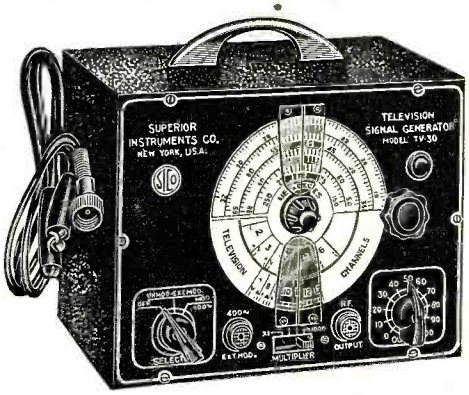
Signal Tracer Specifications:

*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**

The New Model TV-30

TELEVISION SIGNAL GENERATOR



Enables alignment of television I. F. and FRONT ENDS without the use of an oscilloscope.

SPECIFICATIONS

Frequency Range: 4 Bands—No switching

18— 32 Mc.
35— 65 Mc.
54— 98 Mc.
150—250 Mc.

Audio Modulating Frequency: 400 cycles (Sine Wave)
Attenuator: 4 position, ladder type with constant impedance control for fine adjustment.

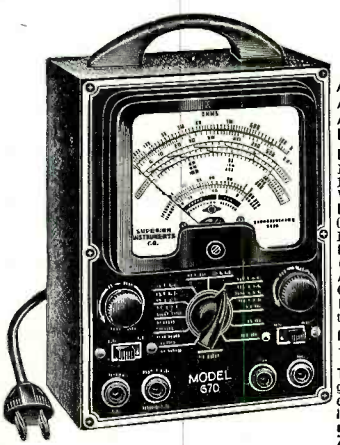
Model TV-30 comes complete with shielded co-axial lead and all operating instructions.

$29.95 NET

Tubes Used:
6C4 as Cathode follower and modulated buffer.
6C4 as R.F. Oscillator.
6SN7 as Audio Oscillator and power rectifier.

THE NEW MODEL 670

SUPER METER



A Combination VOLT-OHM-MILLIAMMETER plus CAPACITY REACTANCE, INDUCTANCE and DECIBEL MEASUREMENTS.

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. **INDUCTANCE:** 1.75 to 70 Henries; 35 to 8,000 Henries.

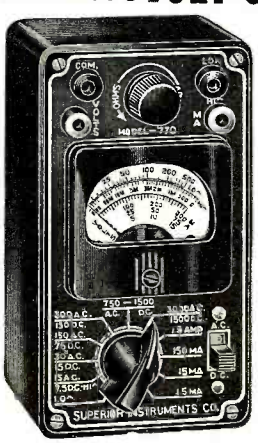
DECIBELS: −10 to +18, +10 to +38, +30 to +58.

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

THE NEW MODEL 770 *An Accurate Pocket Size* **VOLT-OHM MILLIAMMETER**

(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.

Specifications: 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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GENERAL ELECTRONIC DISTRIBUTING CO.

DEPT. RN-9, 98 PARK PLACE, NEW YORK 7, N. Y.

all of the steps to follow in using this instrument to service all types of AM and FM radios, audio amplifiers, and transmitters.

* * *

"TELEVISION ANTENNAS" by Donald A. Nelson. Published by *Howard W. Sams & Co., Inc.*, Indianapolis, Indiana. 190 pages. Price $1.25.

Actual field experience has been successfully incorporated into this book, which is called a design, construction, and trouble-shooting guide for the service technician in selecting and installing television antennas.

Containing over 120 drawings to illustrate the text, the five chapters cover the principles of receiving antennas, their construction, installation, and trouble-shooting. Problems of ghost signals and TVI from electrical units are fully covered. with hints on how to identify interference sources. Also included is a reference table of commercial antennas by manufacturer, model, and description, and a discussion of the more representative types.

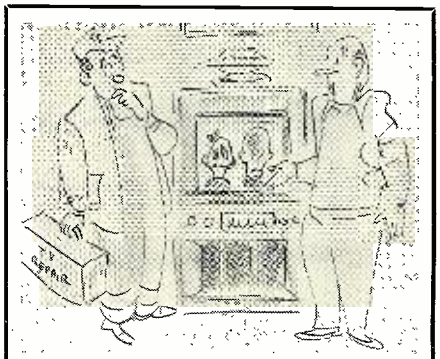
Brief notes in the construction chapter are devoted to such things as tools, supplies, and construction materials needed by the installer; as well as information on straight dipoles, folded dipoles, two-and-three-element parasitics, etc. Tables for dimensions and spacings, together with the book's convenient size, make it an extremely valuable reference work to have along on all such jobs. —30—

QUICK REPAIR OF TUBE SOCKETS

IN REPAIRING mobile communications receivers employing miniature tubes, the fault, in many cases, can be traced to a loose tube socket; due to vibration, the metal grips expand and cause poor contact. No doubt this trouble occurs occasionally in TV receivers.

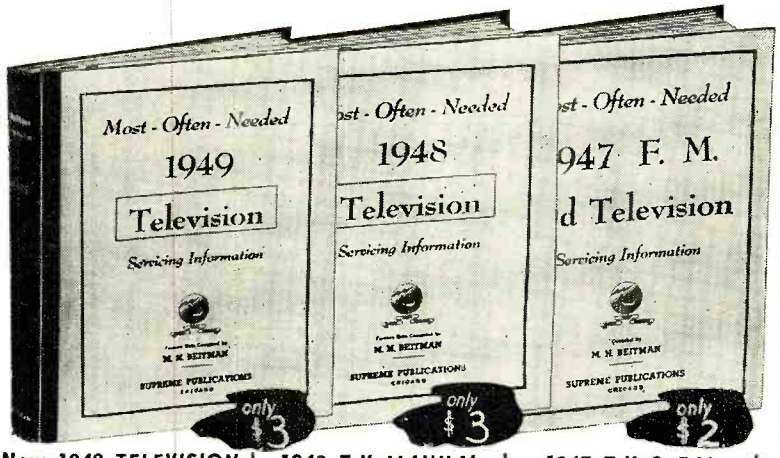
Rather than replace the socket, it is a very simple trick to repair it. A dentist's pick is an excellent tool, being very slender but extremely rugged, although the enterprising could make one by grinding a piece of tough steel to shape.

With the pick, it is possible to go behind the metal grip of the socket and bend it slightly toward the center. This operation is performed on all the metal grips of the offending socket. It is a simple correction but will be found effective. . . . . D.R.R.



"Since I reversed our electrical current, all we get is the backs of the performers!"

Amazing SUPREME Values in New TELEVISION Manuals



All three giant Television Manuals shown at the left are available to you for only $8, total cost, nothing else for you to pay, nothing else to buy, and we will even prepay the shipping charges. (Or you can buy these manuals separately at only $3, $3, and $2.) Take advantage of this amazing *Supreme* offering to step into Television at a tremendous saving. For over 16 years, radio servicemen expected and received remarkable values in *Supreme Publications* service manuals. And now, the three-volume Television and F.M. series beats all previous bargains. Only a publisher who sold over one million of various radio manuals can offer such bargain prices based on stupendous volume-sales.

New 1949 TELEVISION

Use this new giant handbook of television servicing as your guide to quick fault finding and repair of any modern T-V set. Easy-to-understand description of circuits, pages of test patterns, response curves, alignment facts, waveforms, voltage charts, service hints, hundreds of diagrams many in the form of giant double-spread blueprints. Here you have approved factory data on every popular T-V set. Large size: 8½x11". 192 pages + 9 blueprints 11x15", manual style. Amazing **Supreme value for only $3.**

1948 T-V MANUAL

In this mammoth volume you have practical factory service data on all popular 1948 T-V sets of all makes. Let this manual show you how to make needed tests, guide you in carrying out adjustments, point to probable trouble spots, indicate location of all parts, trimmers, and controls. Includes hundreds of charts, waveforms, photographs, and many large 11x16" blueprints. Use coupon below to order; your special price only **$3.**

1947 T-V & F.M.

Here is your manual of instructions for trouble-shooting, repairing, and alignment of all popular 1947 F.M. and TELEVISION sets. The F.M. data covers tuners, AM-FM combinations, and all other types of F.M. circuits. Most complete information on various methods of F.M. alignment. A great deal of material on popular T-V sets including RCA 630-TS. Data on 192 large pages, 8½x11 inches. Sturdy manual-style binding. Price only **$2.**

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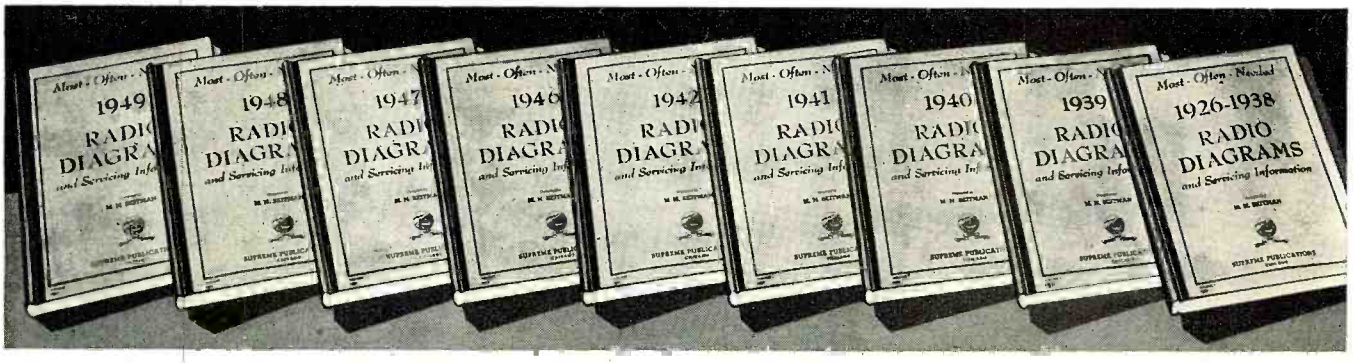
Use these timely television manuals as your guide to quick fault finding and repair of any television set. Eliminates guesswork—tells you just where to look and what to do. Cuts hour-wasting jobs to pleasant moments. Use test patterns for quick adjustment, or look up probable cause of trouble in the pages of hints after simply observing fault in video picture. No equipment needed with these tests. Or use your voltmeter and compare values with many voltage charts included. With an oscilloscope you can get waveforms similar to hundreds illustrated using test points suggested and in a flash locate what used-to-be a hard-to-find fault. These manuals will give you the know-how of a television expert and will repay for themselves with time saved on the first TV job. Order at our risk for a 10-day trial. Use coupon below.



NEW 1949 DIAGRAM MANUAL

Use this newest SUPREME radio 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 128,000 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: 8½x11 inches. Includes index. Manual style binding. Available at your jobber, or send coupon, price only **$2.50.**

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

AMAZING SUPREME BARGAIN IN DIAGRAMS AND SERVICE DATA

Here is your low-priced, money-saving source of radio diagrams and service data 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 guesswork, cut hour-wasting jobs to pleasant moments. 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. There are nine volumes in all as illustrated above. Each manual is 8½x11 inches, sturdy manual style binding, average manual has 194 pages of diagrams and practical service data. Use coupon below to order on 10-day no-risk trial or see these manuals at your jobber.

Record Changers
Post-War Manual

Service expertly all modern (1945-1948) record changers. Includes every popular make. Just follow simplified factory instructions to make needed adjustments and all repairs. Hundreds of photographs and exploded views. Large size: 8½"x11 inches. 144 fact-filled pages. Available at your radio jobber, or sent postpaid, price only..... **$1.50**

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Here is your practical radio course of 22 easy-to-follow lessons. Review fundamentals, learn new servicing tricks, all about signal tracing, oscilloscopes, recording, P.A., test equipment, and T-V. Just like a $100.00 correspondence course. Everything in radio servicing. With self-testing questions and index. Large size: 8½x11". Price postpaid, only **$2.50**

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The 829-B

(*Continued from page 49*)

conclusions during experimentation.

At 300 volts, it is possible to easily load the r.f. section to 30 or 35 ma. This represents an input in the neighborhood of 10 watts, and all work has been done at this load figure.

The first setup tried obtained the screen voltage from a series resistance without stabilization. Application of modulation resulted in a screen voltage drop due to the increase in current through R_{11}. This caused the final amplifier output to drop off sharply. After installing a VR-150 to hold the screen voltage at a steady value, the output remained fairly constant with modulation. A very definite modulation increase resulted with the insertion of the iron core choke CH_2 in the screen lead.

No attempt has been made to run the audio side of the final at any rating where the grid draws current. If the final is operated at higher voltages and increased input, it may be necessary to drive the audio grid into the grid current region.

The inductance used at CH_1 has a d.c. resistance of 350 ohms. Quite likely this is considerably more resistance than is needed at this point, and variations of this inductance should be made until the best operating value for a given set of conditions is determined. At the stated input of 10 watts a grid drive of 5 ma. seemed to give the best results. It is not necessary to drop the drive to a low figure for successful modulation. Various sizes were tried for the grid leak R_5, and 15,000 to 20,000 ohms is apparently about the proper value.

The cathodes of the speech section are not bypassed, because the gain is sufficient with the present setup. Bypassing was tried at one point, but the resulting bass boost added nothing to the intelligibility. The gain control in the microphone circuit consists of a 1000-ohm variable resistor (potentiometer) in series with the microphone battery. If desired, a volume control may be inserted in the grid circuit of the second section of the 6SN7 in the conventional manner.

Thoroughly exploring the possibilities of this circuit should prove interesting to the experimentally inclined amateur. As mentioned before, what has been done here is only a scratch on the surface, and it is hoped that the future will see some interesting and practical applications of the idea, particularly for compact, lightweight, or mobile use.

While all the tests mentioned were conducted using an 829-B, the 832-A would appear to offer the same possibilities for a lower powered rig suitable for mobile work. The only changes necessary would be the application of proper voltages.

—30—

BRILLIANCY DECREASE IN 7" TV RECEIVERS

By MATTHEW MANDL
Temple University

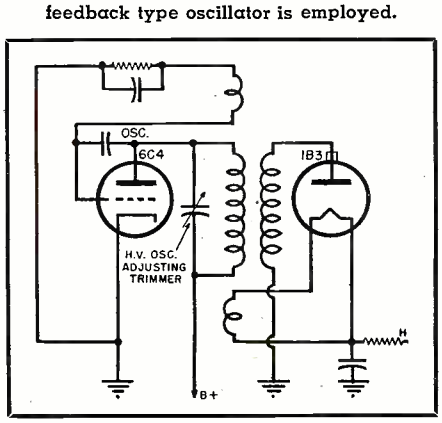
TELEVISION receivers with 7-inch tubes commonly employ an r.f. power supply to furnish the necessary high voltage for the second anode of the picture tube. Fig. 1 illustrates a typical oscillator of this type, using the inductively coupled feedback principle, where a part of the tank circuit potential is fed back to the grid to sustain oscillation. Two secondary transformer windings are coupled to the tank circuit, one a step-down for filament voltage on the 1B3/8016 rectifier tube, and the other winding a step-up for the high voltage.

The oscillator circuit functions most efficiently at the resonant frequency for which it was designed. When it is operating off resonance the r.f. potential across the plate tank circuit decreases. This means, of course, a resultant decrease in the rectified high voltage to the picture tube. Picture brilliancy, in consequence, will be down. This condition is further aggravated because of the correspondingly lower filament potential on the 1B3 tube.

Manufacturers make provisions to permit the oscillator to be tuned in order to bring it back to proper operating frequency. A small trimmer-type condenser in the high voltage compartment is tuned with a neutralizing stick until picture brilliancy returns to normal. A small hole is provided in the top of the high voltage power supply housing for ease of adjustment. The brightness control should be set at minimum when making the tuning adjustment. Do not use a metallic screwdriver.

Occasionally a 10-inch tube receiver utilizes the same r.f. oscillator principle for obtaining high voltage (*Belmont* Model 22AX22 with electrostatically deflected picture tube). Brilliancy decrease again may be due to an off-resonance condition of the oscillator. Receivers using the inductive kick-back type of power supply cannot be tuned in this manner, and a decrease of picture brilliancy usually means faulty circuit components or tubes. —30—

Fig. 1. Conventional high-voltage television power supply for receivers using 7-inch picture tubes. A feedback type oscillator is employed.



Curiosity Draws Crowd

(*Continued from page* 41)

may view the screens without dislocating their necks or otherwise suffering discomfort. Over these come the games as indicated by the blackboard atop one of the cabinets, which announces, for example, "Today's Game — Brooklyn vs. Giants — 2:30 p.m."

You've heard before how stopping pedestrians would help your business. Well, here is proof. "Since the beginning of the baseball season on April 18th, when the window was set up, sales have gone up, roughly *one-third,*" says Mr. Leopold.

And here's one for Ripley: The entire cost of the project was only $4.00. That's right, only $4.00; and besides the one-third increase in sales, the plan cleared the store of non-buying "telefans," filled it with purchase minded customers, and made the Atlas store the talk of the town, giving it more publicity than can be imagined—much less described. Ad-wise, the whole idea is perfect.

From early in the morning 'til late at night, everyone passing stops, without fail, to peer through a hole at his own particular level. It is much like the temptation to touch paint proclaimed "wet" by a sign: a passerby cannot help but steal a glimpse. Observed from across the street, the display taught an important lesson in psychology. Not one person out of approximately twenty-five observed at one period was able to walk by it.

Even the mere presence of the crowd gets the best of their curiosity.

In all their dealings, Mr. Silberstein and Mr. Leopold show remarkable sales-sense. In one instance, Mr. Leopold was asked, "Why waste your time on those kids?" while he was talking to and explaining the merchandise to some teen-age boys.

"They're just as important as any adult customer," he replied. And the proof came when one of the boys came back a second time for more information, and then a third time, bringing his parents. The result was a $670 sale of a TV set. Now is it "wasting time on those kids"? Another interesting item to note is that, according to an *NBC* survey, teen-agers between 13 and 19 have a potential buying power of more than eight billion dollars.

As you know, television is the fastest growing industry in the nation. A year ago there were 200,000 sets with an approximate audience of 1,000,000 people. Now, there are 1,900,000 sets and an audience of about 7,000,000 people. In that same period of time, the number of TV stations jumped from 16 to 75. At present, there are 42 construction permits for stations and 342 applications pending before the FCC, and by the end of 1953, a television set output of 5,000,000 per year is expected. It's a wide open field, so *sell,* brother, *sell!* —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.

CONRAC CUSTOMER BOOKLET

Conrac, Inc., Glendora, California, is making available to its dealers and distributors a folder called "Television by Conrac," which describes the features of the custom installed or cabinet enclosed receivers of the company, for the benefit of dealers' customers.

Other features described in this folder, which has room for carrying the dealer's name and address, include the "conradial" selector. Photographs show the simplicity of the receiver circuits, and the appearance of the components when mounted in cabinets, or in the wall.

SIMPLI-FLEX CATALOGUE

The *Radiart Corporation,* Cleveland 2, Ohio, recently purchased by *Cornell-Dubilier Electric Corporation,* has made available a new 8-page catalogue in color describing the Simpli-Flex TV and FM antennas, as well as a line of accessories.

Types covered in the booklet include the "81" series, folded dipole bi-directional antennas and TV and FM reflector kits; "82" series, folded dipoles with reflectors for TV and the "add-on" kits; "83" series, FM turnstile folded dipole; "84" series of double stacked folded dipole and reflector arrays for long distance reception in fringe areas; and "85" series Hi-Lo antennas.

ANTENNA PERFORMANCE DATA

Among the useful bits of information on the performance of antennas contained in the *Taco* No. 30 catalogue by *Technical Appliance Corporation,* Sherburne, N. Y., are included performance curves and field patterns on the various antenna types.

All of the technical data used is based on actual field tests, and any service technician may pick the antenna best suited for a particular installation without the trial-and-error process. Performance curves indicate coverage, and field patterns indicate directivity for each type. The catalogue is available through *Taco* jobbers and representatives.

RECTIFIER BROCHURE

Available without charge on request to the *International Rectifier Corporation,* 6809 S. Victoria Ave., Los Angeles 43, Calif., is a six-page brochure, C-349-848, on the company's line of selenium rectifiers for converting a.c. to d.c.

Besides diagrams, design data, prices, and operating characteristics of the standard line of full wave, single phase, bridge rectifiers, the brochure also describes the company's line of rectifier cells with operating ranges from 2 volts and 150 ma. to 5000 volts and 10,000 amperes.

INSULATED WIRE CATALOGUE

A 34-page catalogue, No. 509, just issued by the *National Electric Products Corporation,* Chamber of Commerce Building, Pittsburgh 19, Pa., describes and illustrates the "NEasbestus" line of cables, cord, and wire for projectors, arc lamps, lighting fixtures, radio apparatus, and switchboard and control equipment.

Complete specification charts are given for these and the many other applications of insulated wires and cables used for electrical installations where extreme heat, corrosive fumes and fire hazards are present.

INSERT ARRANGEMENTS CHART

Cannon Electric Development Company, 3209 Humboldt Street, Los Angeles 31, California, has put out a 1949 edition of its insert arrangements chart on the type "K" series of electric connectors, those used in aircraft, radio, instruments, radar, television, etc.

Included in the new desk-size chart are 211 layouts, with wire, contact, and clearance data. Major shells, types, and styles are illustrated with one exploded view, in this half-scale "K" chart, which measures 19 by 24 inches.

RADIO TIMER CATALOGUE

Four types of timers and how these devices can boost sales and profits for dealers and manufacturers are the subjects of the new bulletin issued by *Telechron, Inc.,* Ashland, Mass.

Descriptions, with diagrams, photographs of the timers alone, and photographs of the timers incorporated in various radio sets make the pamphlet a valuable one to have. It is written in a way that will give the dealer valuable tips on sales talks to interest his customers.

TRANSFORMER CATALOGUE

To provide a complete listing and catalogue for all of their customers and for anyone using their products, *Thordarson Manufacturing Company,* 500 W. Huron St., Chicago 10, Ill., one of the leading transformer manufacturing firms, has issued a new booklet.

This publication is free of charge and when requested should be specified as Transformer Catalogue No. 400H, 1949.

CONDENSER CATALOGUE

In the form of a six-page folder, a supplement covering the most popu-

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Socket..... .07

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1B23	4.89	3EP7	1.10	316A	.39	851	15.95	CK1005	.19	1A4	.97	6A8	.79	6V6	.97	25L6	.57
1B24	4.87	3GP1	4.97	327A	2.75	860	1.89	CK1006	1.95	1A4P	.97	6AB7	.79	6V6GT	.65	25Z5	.59
1B26	4.57	4-65A	14.49	338A	3.95	861	10.95	CK1090	2.95	1A5GT	.49	6AC7	.77	6X4	.59	25Z6	.55
1B27	4.89	4-125A	27.45	350A	1.25	864	.49	EF50	.47	1A6	.79	6AF6G	.79	6X5GT	.49	26	.57
1B29	3.49	4-250A	37.45	350B	1.89	865	.98	F123A	12.95	1A7GT	.67	6AG5	.79	6Y6G	.67	27	.47
1B36	4.59	4AP10	5.95	353A	2.95	866A	1.05	F125A	14.95	1AB5	.49	6AG7	1.10	6ZZG	1.15	28D7	.37
1B38	37.50	4B24	3.95	353B	7.95	866JR	1.10	F127A	27.50	1B4	1.05	6AH6	1.29	6ZY5G	.69	30	.57
1D21	5.75	4C35	29.50	362A	1.95	869B	39.50	F128A	69.50	1B5/25S	.69	6AJ5	.79	7A4/XXL	.59	31	.89
1N21	.95	4E27	12.95	368AS	3.95	872A	1.49	F606	22.50	1C5GT	.67	6AK5	.85	7A6	.67	32	.97
1N21B	1.95	4J32	97.50	371B	.85	874	.57	F660	125.00	1C6	.49	6AK6	.69	7A7	.57	32L7GT	.97
1N23	1.75	5AP1	3.95	388A	2.95	876	.98	F862A	450.00	1C7G	.89	6AL5	.65	7AG7	.72	33	.69
1N23B	2.25	5AP4	4.95	393A	3.85	878	1.98	FG17	2.89	1D5GP	.97	6AQ5	.69	7B4	.57	34	.69
1N34	.85	5BP1	1.89	394A	3.85	884	1.39	FG27A	9.75	1D7G	.89	6AQ6	.59	7B6	.59	35/51	.57
1P24	2.95	5BP4	2.85	417A	14.50	885	.97	FG81A	4.50	1D8GT	.95	6AT6	.47	7B7	.62	35A5	.67
1S21	3.95	5CP1	1.85	434A	3.50	902P1	3.85	FG95	12.95	1F4	.75	6AU6	.79	7C4	.37	35B5	.65
2AP1	3.89	5CP1A	9.95	446A	1.25	905	3.98	FG105	10.95	1F5G	.75	6AV6	.57	7C5	.57	35C5	.65
2C21	.27	5CP7	7.95	450TH	17.95	908	4.95	FG172	12.95	1G4GT	.69	6B4G	.89	7C7	.67	35L6	.57
2C22	.19	5C30	7.95	450TL	52.50	923	.97	FT210	13.95	1G6GT	.69	6B6G	.79	7E5	.67	35W4	.42
2C26	.27	5D21	34.95	527	7.95	930	.85	GL146	9.95	1H4G	.69	6B7	.89	7E6	.59	35Y4	.57
2C34	.27	5FP7	1.35	559	.85	931A	2.69	GL451	1.95	1H5GT	.57	6B8G	.47	7E7	.79	35Z3	.57
2C40	6.59	5GP1	4.95	575A	12.95	953B	29.50	GL562	85.00	1H6GT	.87	6BA6	.55	7F7	.69	35Z4	.44
2C43	9.97	5JP1	11.75	700A/B/C/D	34.50	954	.15	GL697	69.50	1I6GT	.89	6BE6	.57	7H7	.67	35Z5	.42
2C44	.67	5JP2	11.75			955	.17	HY115	.85	1L4	.55	6BF6	.57	7L7	.69	36	.57
2C46	6.87	5J29	17.50	701A	3.60	956	.32	HY615	.29	1LA4	.79	6BG6G	1.59	7N7	.67	37	.47
2C51	8.25	5J30	49.50	702A	3.25	957	.24	HYE114S	.39	1LA6	.89	6BH6	.57	7Q7	.59	38	.37
2D21	1.17	5LP1	13.95	703A	3.95	958A	.35	KC4	87.50	1LB4	.89	6BJ6	.59	7R7	.69	39/44	.27
2E22	1.29	5NP1	4.75	705A	1.10	959	.37	KU610	9.75	1LC5	.79	6C4	.25	7W7	.89	41	.52
2E24	4.87	6C21	24.75	706CY	18.75	991	.27	ML100	49.50	1LC6	.57	6C5	.47	7X7	.89	42	.57
2E26	3.49	6F4	5.59	707B	8.75	1603	2.95	ML101	139.50	1LD5	.79	6C6	.57	7Y4	.67	43	.57
2J21A	8.95	6J4	5.95	708A	3.95	1611	.97	ML501	69.50	1LE3	.89	6C8G	.69	7Z4	.67	45	.57
2J22	8.95	7BP7	4.65	713A	.95	1613	.59	ML502	149.50	1LG5	.89	6D6	.47	12A	.57	45Z3	.57
2J26	7.95	9GP7	12.50	714A	12.95	1614	1.45	REL21	4.95	1LH4	.65	6D8G	.87	12A6	.19	45Z5	.49
2J27	8.95	9JP1	3.75	714AY	3.95	1616	.98	REL36	.79	1LN5	.67	6E5	.69	12A7	.98	46	.69
2J30	32.50	9LP7	2.25	715C	34.95	1619	.19	RK21	.79	1N5GT	.59	6F5	.47	12AH7GT	.85	47	.69
2J31	9.75	10BP4	24.95	717A	.65	1624	.69	RK23	4.85	1P5GT	.67	6F6	.65	12AT6	.57	50A5	.75
2J32	97.50	10Y	.49	721A	1.95	1625	.37	RK25	3.65	1Q5GT	.67	6F7	.85	12AU6	.67	50B5	.59
2J33	39.50	12DP7	13.50	723A/B	24.95	1626	.37	RK33	.27	1R4	.49	6F8G	.79	12AU7	.85	50L6	.57
2J34	39.50	12GP7	13.95	724A/B	3.95	1629	.27	RK34	.27	1R5	.69	6G6G	.69	12BA6	.57	50Y6	.57
2J37	17.50	12HP7	13.95	725A	9.50	1630	1.98	RK59	1.95	1S4	.59	6H6	.47	12BE6	.57	53	.87
2J38	12.95	15E	1.95	726A	6.95	1631	1.45	RK63	18.95	1S5	.59	6J5	.49	12C8	.49	56	.45
2J39	34.50	15R	.79	730A	10.95	1632	.98	RK65	24.95	1T4	.57	6J6	.89	12F5GT	.67	57	.49
2J40	49.50	23D4	.29	750TL	45.00	1633	.98	RK72	.97	1T5GT	.67	6J6GT	.89	12H6	.35	58	.49
2J46	39.50	24G	.47	800	1.95	1636	4.75	RK73	.97	1U4	.59	6K6GT	.49	12J5	.37	59	.89
2J48	39.50	30 Spec	.35	801A	.49	1638	.79	RX21	3.45	1V	.57	6K7	.49	12K7	.57	70L7	1.17
2J49	24.95	45 Spec	.29	802	4.25	1641	.69	RX120	8.95	2A3	.89	6K8	.69	12K8	.79	71A	.67
2J50	42.50	75TL	2.95	803	4.95	1642	.27	S836	2.95	2A4G	1.25	6L5	.79	12Q7	.57	75	.57
2J53	42.50	100R	1.85	804	6.95	1665	1.10	TZ40	2.27	2A5	.69	6L6	1.17	12SA7	.57	76	.47
2J54B	97.50	100TH	11.50	805	3.85	1851	.97	V70D	6.95	2A6	.69	6L6GA	.97	12SC7	.57	77	.47
2J61	39.50	100TS	2.35	807	1.10	1960	2.95	VR65A	1.95	2A7	.69	6L7	.79	12SF7	.57	78	.47
2J62	39.50	204A	57.50	808	1.39	2050	.65	VR75	.97	2V3G	.89	6N7	.79	12SG7	.57	80	.39
2K25	23.95	205B	1.75	809	2.45	2051	.43	VR78	.65	2X2	.29	6Q7	.69	12SH7	.35	81	1.37
2K28	32.50	211	.49	810	6.49	7193	.19	VR90	.67	2X2A	.69	6R7	.89	12SJ7	.57	82	.87
3API	4.85	215A	.65	811	1.69	8005	4.75	VR105	.67	3A4	.37	6S7	.89	12SK7	.57	83	.79
3B22	2.69	217C	9.95	812	2.65	8011	.69	VR150	.55	3A5	.89	6SA7	.47	12SK7	.57	84/6Z4	.67
3B23	4.85	218	47.50	812H	6.75	8012	1.47	VT127	2.25	3B7	.35	6SC7	.59	12SL7	.67	85	.59
3B24	1.69	221A	1.95	813	6.27	8013A	1.45	VU111	.89	3D6	.35	6SD7GT	.97	12SN7	.67	89Y	.57
3B25	4.87	225	8.70	814	2.75	8014A	22.50	WL468	7.95	3Q4	.59	6SF5	.49	12SQ7	.57	117L7/M7	1.17
3B26	1.47	227A	2.95	815	1.39	8016	1.25	WL530	49.50	3Q5GT	.67	6SF7	.65	12SR7	.57	117N7	1.37
3B27	3.85	231D	1.25	816	1.05	8020	1.95	WL531	7.95	3S4	.67	6SG7	.65	12Z3	.79	117P7	1.27
3BP1	1.39	249B	2.49	826	.42	8025	3.75	WL532	3.50	5R4GY	1.10	6SH7	.37	14A4	.87	117Z3	.57
3C21	5.95	249C	1.69	829B	7.45	9001	.37	WL538	.69	5T4	.89	6SJ7	.57	14A7	.69	117Z6	.79
3C22	39.50	250R	7.45	830B	3.49	9002	.34	WL578	1.95	5U4G	.57	6SK7GT	.55	14B6	.67		
3C23	2.47	250TH	18.95	832A	4.25	9003	.37	WL616	87.50	5V4G	.79	6SL7GT	.65	14F7	.69		
3C24	.36	250TL	18.95	833A	32.50	9004	.37	WL619	29.15	5W4	.79	6SN6GT	.97	14F8	.89		
3C30	.49	274B	1.19	834	5.75	9005	1.95	WX3245	49.50	5X4G	.57	6SN7GT	.65	12H7	.65		
3C31	1.75	282B	9.75	836A	1.95	9006	.24	OA2	1.57	5Y3GT	.39	6SQ7	.50	14N7	.89		
3CP1	2.67	294A	4.57	837	1.25	C5B	7.95	OA4G	.95	5Y4G	.49	6SR7GT	.57	12Q7	.57		
3D21A	.98	304TH	3.45	838	3.45	C6A	8.45	OB2	1.75	5Z3	.49	6SS7	.59	14R7	.67		
3DP1	1.97	304TL	.99	841	.49	C6J	4.95	OZ4	.57	5Z4	.79	6T7G	.89	15	.89		

OIL CONDENSERS
NATIONALLY ADVERTISED BRANDS
All Ratings D. C.

2x.1mfd.	600v	$0.37	1mfd.	2000v	$0.97
.25mfd.	600v	.37	2mfd.	2000v	1.27
.5mfd.	600v	.37	4mfd.	2600v	3.77
1mfd.	600v	.37	8mfd.	2000v	3.47
2mfd.	600v	.37	15mfd.	2000v	4.97
4mfd.	600v	.57	4mfd.	2500v	3.97
8mfd.	600v	1.07	2mfd.	2500v	2.37
10mfd.	600v	1.17	.1mfd.	2500v	1.27
3x.1mfd.	1000v	.47	.25mfd.	2500v	1.47
.25mfd.	1000v	.47	.5mfd.	2500v	1.77
1mfd.	1000v	.57	.05mfd.	3000v	1.97
2mfd.	1000v	.67	.25mfd.	3000v	2.67
4mfd.	1000v	.87	1mfd.	3000v	2.87
8mfd.	1000v	1.97	12mfd.	3000v	6.97
10mfd.	1000v	2.07	2mfd.	4000v	4.87
15mfd.	1000v	2.27	1mfd.	5000v	4.97
20mfd.	1000v	2.97	.1mfd.	7000v	2.97
24mfd.	1500v	5.27	3mfd.	4000v	5.37
.1mfd.	1750v	.87	2mfd.	3000v	3.47
.1mfd.	2000v	.97	2mfd.	3000v	3.47
.25mfd.	2000v	1.07	2x.1mfd.	7000v	3.27
.5mfd.	2000v	1.17	.02mfd.	12300v	9.97

HIGH CAPACITY CONDENSERS
All Ratings D. C.

2x3500mfd.	25v	$3.47	200mfd.	35v	$ .57
2500mfd.	3v	.37	100mfd.	50v	.47
3000mfd.	25v	2.47	4x10mfd.	400v	.87
2x1250mfd.	10v	1.27	4000mfd.	18v	1.97
1000mfd.	15v	.97	4000mfd.	30v	3.27

TRANSFORMERS—115 V. 60 Cy.
HI-VOLTAGE INSULATION

6350v @ .025 arms..... $12.95
2500v @ 4 ma; 6.3v @ 1A; 2½v @ 2A..... 4.97
2500v @ 15 ma.... 4.29 2100v @ 10 ma.. 3.97
1700v @ 4 ma; 6.3v @ 1A; 2½v @ 2A..... 4.98
1600v @ 4 ma; 700v CT @ 150 ma; 6.3v @ 9A 5.97
525-0-525v @ 60 ma; 925v @ 10 ma; 2x5v @ 3A; 6.3v @ 3.6A; 6.3v @ 2A; 6.3v @ 1A..... 6.97
500-0-500v @ 175ma..... 4.95
500-0-500v @ 25 ma; 262-0-262v @ 55 ma; 6.3v @ 1A; 2x5v @ 2A..... 4.45
425-0-425v @ 75 ma; 5v @ 3A; 6.3v @ 1.5A.... 3.98
400-315-0-100-315v @ 200 ma; 2.5v @ 2A; 5v @ 3A; 2x6.3v @ 9A..... 5.95
385-0-385-550v @ 200 ma; 2.5v @ 2A; 5v @ 3A; 3x6.3v @ 6A—pri 110/220..... 6.27
385-0-385v @ 70 ma; 2.5v @ 10A; 5v @ 6A; 5v @ 3A..... 4.95
375-0-375v @ 240 ma; 255-0-255v @ 12 ma.... 4.98
340-0-340v @ 300 ma; 1540v @ 5 ma..... 4.95
300-0-300v @ 65 ma; 2x5v @ 2A; 6.3v @ 2½A; 6.3v @ 1A..... 3.47
150-0-150v @ 80 ma; 150v @ 40 ma; 6.3v @ 3.5A; 6.3v @ 1A..... 1.97
120-0-120v @ 50 ma..... .97
80-0-80v @ 225 ma; 5v @ 2A; 5v @ 4A..... 3.49
36v @ 15A..... 9.95 25v @ 10A..... 4.47
18v @ 15A..... 8.95 13.5v CT @ 3.25A 2.47
12.6v CT @ 10A; 11v CT @ 6.5A..... 6.95
12v CT @ 10A; 2x9v CT @ 10A..... 7.49
3x10.3v CT @ 7A..... 6.95
8v CT @ 1A..... .97
6.3v @ 21¼A; 6.3v @ 2A; 2½v @ 2A..... 4.45
6.3v @ 12A; 6.3v @ 2A; 115v @ .1 amps..... 3.45
6.3v @ 10A; 6.3v @ 6A..... 2.47
6.3v CT @ 3.5A; 2x2.5v @ 3A..... 2.97
6.5v @ 8A; 6.5v @ 5A; 5v @ 3A; 2.5v @ 1.75A.. 4.45
6.3v @ 1A; 2.5v @ 2A. 2.25 6.3v @ 1A. .77
5v @ 20A; 10 KV ins. 9.97 5v @ 20A dual pri. 3.49
5v @ 3A; 2.5v @ 2A. 2.97 2.5v @ 20A dual pri. 3.47
2.5v @ 10A oil filled..... 2.95

SELENIUM RECTIFIERS
Full Wave Bridge Type

INPUT		OUTPUT		
up to 18v AC	up to	12v DC	½ Amp.	$1.47
up to 18v AC	up to	12v DC	1 Amp.	1.97
up to 18v AC	up to	12v DC	5 Amp.	5.27
up to 18v AC	up to	12v DC	10 Amp.	8.97
up to 18v AC	up to	12v DC	15 Amp.	11.57
up to 18v AC	up to	12v DC	30 Amp.	22.57
up to 36v AC	up to	28v DC	1 Amp.	3.47
up to 36v AC	up to	28v DC	5 Amp.	8.57
up to 36v AC	up to	28v DC	10 Amp.	14.57
up to 36v AC	up to	28v DC	15 Amp.	22.27
up to 115v AC	up to	100v DC	.25 Amp.	2.57
up to 115v AC	up to	100v DC	.6 Amp.	5.27
up to 115v AC	up to	100v DC	5 Amp.	22.57
up to 115v AC	up to	100v DC	3 Amp.	17.97

FILTER CHOKES
HI-VOLTAGE INSULATION

10 hy @ 400 ma.	$5.97	1 hy @ 800 ma..	$14.97
25 hy @ 160 ma..	3.47	10 hy @ 250 ma.	2.47
12 hy @ 150 ma..	3.47	10 hy @ 200 ma.	1.98
25 hy @ 65 ma...	1.37	10/20 @ 85 ma..	1.57
.05 hy @ 15 amps	7.97	15 hy @ 125 ma.	1.47
.1 hy @ 5 amps...	6.97	15 hy @ 100 ma.	1.37
4 hy @ 600 ma...	5.97	3 hy @ 50 ma...	.27
200 hy @ 10 ma..	3.47	30 hy Dual @ 20 ma.....	1.47
600 hy @ 3 ma...	3.47	3/30 hy @ 250 ma.	3.47
325 hy @ 3 ma...	3.47		

PHONE DIGBY 9-0347

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20% Deposit Required

ular condensers used by service technicians has been issued by *Aerovox Corporation,* New Bedford, Mass.

Besides the company's regularly listed paper tubular condensers, electrolytics, oil-filled tubulars, mica condensers, interference filters, and auto-radio suppressors, the new *Aerovox* catalogue announces additional data on its Type AF or twist-prong base metal-can electrolytics. Single-element units now number 37; dual element, 27; and triple-element, 69.

Units for television replacements and for meeting the requirements specified in original equipment have been separately designated in the catalogue and marked with an asterisk. In specifying this new booklet, ask for Form SC-549.

RCA 35 MM. TV BROCHURE

An eight-page brochure on *RCA's* television 35 mm. projector was recently made available to broadcasters by the company's Engineering Products Department.

Full particulars on such features as the pulsed light source and optical system, single control switching from control racks, and equipment specifications are given, along with suggested studio layouts. Photographs as well as drawings and diagrams amply illustrate the booklet which is obtainable from any *RCA* district sales office or Department 522, *RCA* Engineering Products, Camden, N. J. Specify Form 2J-4685, "Television 35 mm. Projector, Type TP-35B."

CUSTOMER HANDBOOK

"Your Money's Worth in Good Radio and Television Service," issued by *Sprague Products Co.,* North Adams, Mass., marks an effort on the part of this manufacturer to up-grade the radio-television service technician and his business.

Designed as a business builder, the 16-page booklet may be handed out to customers, and there is room on the back for imprinting the dealer's name and address. The booklet emphasizes the extremely complicated design of modern sets, giving set owners a proper appreciation of modern service facilities. It shows why good service is worth good money and helps the technician attain more profitable business.

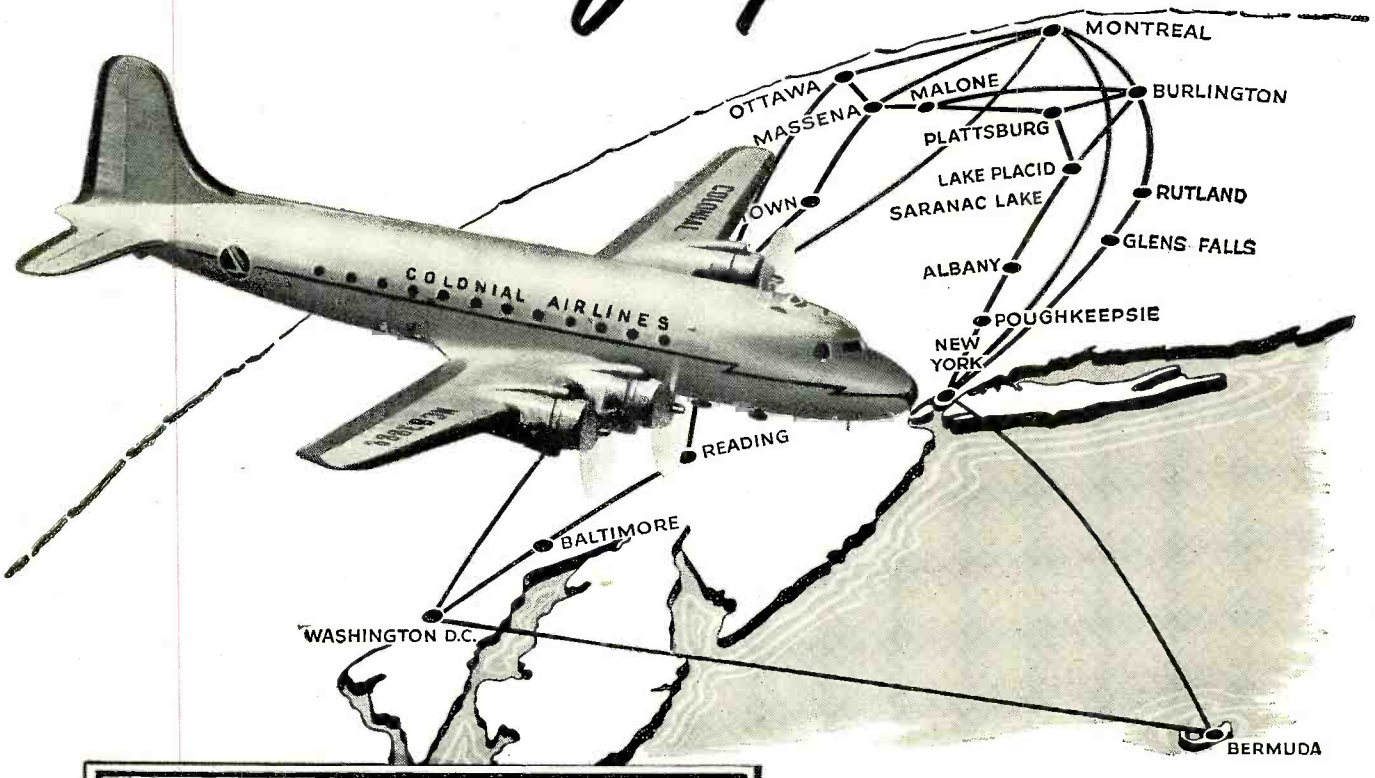
EVER-LOK BULLETIN

Russell & Stoll Company, Inc., 125 Barclay St., New York 7, N. Y., manufacturers of the Ever-Lok receptacles, plugs, and cord connectors, have issued a 12-page bulletin on these products which can be a valuable reference.

A 10-ampere, 250 volt—15 ampere, 125 volt a.c. or d.c. unit workable in all types of electrical equipment, the Ever-Lok is fully described by means of photographs, specifications, and charts.

Midget Ever-Lok plugs automatically lock when inserted into an Ever-Lok receptacle or cord connector and can be unlocked by a twist of the

SYLVANIA *Quality* LIKE COLONIAL *Safety* IS NO ACCIDENT!



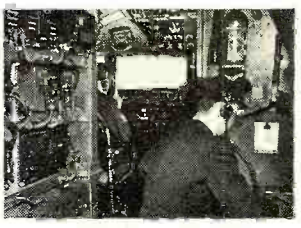
COLONIAL AIRLINES is now in its 20th year with a record of over 250,000,000 passenger miles without a single passenger or crew fatality—a result of the finest personnel and equipment.

Colonial uses Sylvania Tubes in its communication system.

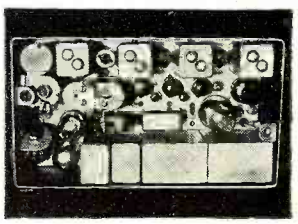
There's not much that can be added to those two statements. On the one hand you have a wonderful safety record by one of America's outstanding airlines. On the other you have this airline's entire communication system—a paramount factor in air safety—using Sylvania high quality tubes . . . from the new miniatures to the famous Lock-Ins.

Yes, like the *safety* of Colonial Airlines, Sylvania *quality* is no accident. We, too, insist on the best equipment—to make the finest small parts that go into Sylvania tubes. We, too, select our personnel with great care—for workmanship that is unsurpassed.

If you wish full information on our complete tube lines, write *Sylvania Electric Products Inc., Department R-1009, Emporium, Pa.*



Colonial's pilot and nagivator are in constant communication with landing field over extensive radio equipment.



Sylvania miniature tubes play prominent part in Glide Path Receiver that assists pilot in safe landing by instruments alone.

SYLVANIA ELECTRIC

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

wrist. Other features include dust-proof construction, arc resisting composition interiors, adjustable cord grips on plugs and connectors, and self-aligning contacts.

MATERIAL CONSTRUCTION BULLETIN

A tabulation of corrosion-resistant materials for use with over 300 industrial liquids and gases has been recently published by the *Fischer & Porter Company,* 97 County Line Road, Hatboro, Pa., a company with experience in handling corrosive fluids.

Based on previously published data, to which has been added the firm's extensive experience in the handling of such corrosive fluids, the bulletin was planned to be one of the most complete and up-to-date available for quick reference.

INSULATION BOOKLET

A new bulletin, No. 209, on insulation resistance measurement has just been issued by *Associated Research, Inc.,* 3758 West Belmont Ave., Chicago 18, Ill., for distribution without charge.

The four-page bulletin describes and illustrates the company's "Vibrotest," listing capacities and specifications of all models from 100 to 50,000 megohms. A chart on the models makes a handy base specification table for all insulation testing instruments. Also included is a discussion of the advantages of self-contained power units, eliminating hand cranking.

CONNECTOR MANUAL

A complete manual on electrical lugs and connectors has been issued by *Ilsco Copper Tube and Products, Inc.,* and may be obtained free of charge by addressing the company on letterhead, at Mariemont, Cincinnati 27, Ohio.

The 80-page booklet includes technical data and a compilation of dimensions, ampere ratings, wire sizes, weights, and descriptions, important for use in production and maintenance work. Actual photographs in color are used to illustrate the engineering information so necessary for designers, engineers, and production men.

TECHNICAL DATA BULLETIN

The "Fastell" materials developed and manufactured by the *Fansteel Metallurgical Corporation* of North Chicago, Ill., combining high electrical conductivity and low contact surface resistance, are described in No. 7.101, a new bulletin issued by the company.

Molded from a combination of materials that include, in some cases, silver, and in other applications, copper, these products are utilized in a wide range of heavy duty or light duty contacts. The catalogue divides the contacts into two groups for analysis, and diagrams and data charts are provided for both types.

Silver Fastells are used in such applications as circuit breakers, and heavy duty industrial controls, while the copper types are utilized in oil type circuit breakers, reclosers, and so forth.

—30—

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250 ohms	25w	.98
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40	400	.18
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10-10	150	.18
	10—	1.70
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20-10	150	.18
	10—	1.70
30-30	25	.18
	10—	1.70
40-40	150	.18
	10—	1.70
40-20	150	.18
	10—	1.70
40/20	150/25	.18
	10—	1.70
40/30	150	.18
	10—	1.70
10/50/100	350/100/50	.18
10-10/10	150/25	.18
16	450	.18
20	350	.18
15	250	.18
20	450	.18
10	300	.18
8	450	.18
225	15	.29
20/20	350/25	.29
20-30	250	.25
30/20	350/25	.29
10/50/100	450/100/50	.29
10-15/20	350/25	.49
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10	450	.29
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20	25	.20
20	80	.25
20	450	.40
24	350	.30
8	400	.30
8	150	.15
10	150	.20
10	50	.15
12	450	.30
4	50	.10
4	150	.14
4	250	.20
8	350	.25
10-10	150	.25
25-25	50	.30
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12	250	.30
8	600	.60
8	450	.30
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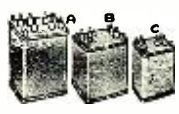

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49c Threaded Coax Terminal HiFreq Insul Silv Pl Cont 12' 3 for $1.29 /30cm. AT5/ ARR1 w/waterpf gask. flange. For MOBILE mtg BRAND NEW! PL259 for above 35c

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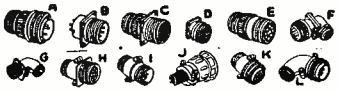
3	24	60	200
4	25	62	220
5	27	67	240
6	30	70	250
7	35	79	350
8.5	50	115	....
11	47	125	1000



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3102	18	1S	3106	18	1S
3102	18	3P	3106	22	10S
3102	18	4P	3106	24	7P
3102	20	1P	3106	28	1P
3102	20	4P&S	3106	28	2P&S
3102	22	17S	3106	28	4S
3100	28	2S	3106	28	12P
3106	10SL	4S	3108	16S	1P
3106	12	5S	3108	16S	4P
3106	14S	2P&S	3108	20	7S
3106	14S	5P&S	3108	20	11S
3106	18	5S	3108	20	17P
3106	14S	6S	3108	22	6P
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Shielding for TVI

(*Continued from page* 60)

components are mounted on metal chassis without front panels or are actually mounted on a wood base. This group of units may then be placed along the back of a table, under a bench, or on shelves. Sometimes they are housed in a plywood cabinet. A transmitter of this type is undoubtedly the hardest to shield. If the transmitter is small, it may be placed complete with its power supply in a screened box. Control shafts should be extended out through the screening, and an access door should be placed so that tubes and coils may be changed. The dimensions of the box, of course, depend on the size of the transmitter. Another method is to place each r.f. unit in a separate screened box, link coupling the units together with coax line. In the case of a plywood cabinet, one method would be to cover the entire cabinet with copper screening, while another would be to shield each unit in the cabinet.

Fig. 7 shows the construction of a frame made of wood which may be covered with copper screening. The dimensions will vary with each transmitter or r.f. unit. The general idea is to make the box large enough so that the entire r.f. unit may be slid in the back door with two or three inches of clearance all the way around.

Shielded Room

One method which should not be overlooked is that used by many electronic manufacturers to keep unwanted signals out of a given area, namely, a shielded room. A screened room, of course, also works the other way and will keep an unwanted signal confined, provided all conducting elements such as pipes, 117 volt wires, etc., are filtered or excluded from the screened area. This idea is not as far-fetched as it seems and may in many attic or basement shacks be the easiest way. The shack should be measured up and sufficient screening purchased to completely cover the floor, ceiling, and four walls. The screening may be tacked directly to the studs and ceiling joists. Obtain as wide a screening as possible to cut down the number of joints. Overlap each joint about two inches and spot with solder so that all the strips of screening are well bonded. The screening on the floor may be covered with Masonite, plywood, or linoleum to improve the appearance. The 117 volt a.c. line should enter at only one point and should be well filtered to prevent it from conducting any r.f. signals out of the room. The antenna feeders must also be well filtered, as far as harmonics go, by means of an effective low-pass filter. Design formulas for such a filter may be found in most radio-engineering text books. The room must also be fitted with a

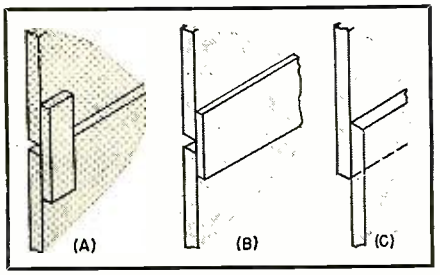
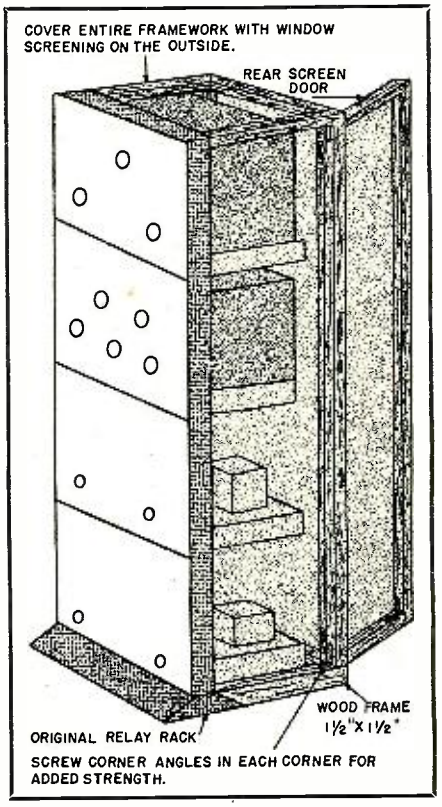


Fig. 5. A good overlap on trap doors is important. An opening like that shown in (A) spoils the shielding. While (B) is much better than that shown in (A), (C) is preferred, providing better shielding.

well bonded screen door. In particularly bad cases, it is often more effective to double shield the room. This is done by nailing a light framework against the first screening and applying a second layer of copper screening on the inside of the room. There should be about 1½ to 2 inch separation between the two layers of screening. Make sure you do not ground one layer to the other accidently by a nail or tack as there must be no connection between the inner and outer screening except at one point where the two are grounded to a common ground. The screen door must be a double-sided one in this case with the outer screen bonded to the outside of the room and the inner side bonded to the inside of the room.

The room should be large enough to accommodate not only the transmitter but also the operating position. A room of this type should be very ef-

Fig. 6. If shielding individual units is not sufficient, it will be necessary to completely enclose the rack as shown.



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3B7-15	15 AMP.	70.00

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Type #	Current	Price
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3B13-6	6 AMP.	81.50
3B13-15	15 AMP.	120.00

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Type #	Current	Price
C1-10	10 AMP.	$6.95
C1-20	20 AMP.	10.95
C1-30	30 AMP.	14.95
C1-40	40 AMP.	17.95
C1-50	50 AMP.	20.95
C1-80	80 AMP.	26.95
C1-120	120 AMP.	34.95

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B1-500	500 MA.	1.95
B1-1	1 AMP.	2.49
B1-1X5	1.5 AMP.	2.95
B1-3X5	3.5 AMP.	4.50
B1-5	5 AMP.	5.95
B1-10	10 AMP.	9.95
B1-15	15 AMP.	13.95
B1-20	20 AMP.	15.95
B1-30	30 AMP.	24.95
B1-40	40 AMP.	27.95
B1-50	50 AMP.	32.95
B1-60	60 AMP.	36.95
B1-80	80 AMP.	44.95

Input 0-36VAC		Output 0-26*VDC
Type #	Current	Price
B2-150	150 MA.	$0.98
B2-250	250 MA.	1.25
B2-300	300 MA.	1.50
B2-450	450 MA.	1.95
B2-1	1 AMP.	3.95
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B2-3X5	3.5 AMP.	6.95
B2-5	5 AMP.	9.95
B2-10	10 AMP.	15.95
B2-15	15 AMP.	24.95
B2-20	20 AMP.	27.95
B2-30	30 AMP.	36.95
B2-40	40 AMP.	44.95

Input 0-54VAC		Output 0-38*VDC
Type #	Current	Price
B3-150	150 MA.	$1.25
B3-250	250 MA.	1.95
B3-600	600 MA.	3.25
B3-5	5 AMP.	13.95
B3-10	10 AMP.	24.95

Input 0-72VAC		Output 0-50*VDC
Type #	Current	Price
B4-600	600 MA.	$3.95
B4-3	3 AMP.	14.95
B4-5	5 AMP.	17.95
B4-10	10 AMP.	27.95

Input 0-115VAC		Output 0-90*VDC
Type #	Current	Price
B6-150	150 MA.	$1.95
B6-250	250 MA.	2.95
B6-600	600 MA.	5.95
B6-750	750 MA.	6.95
B6-1X5	1.5 AMP.	10.95
B6-3X5	3.5 AMP.	18.95
B6-5	5 AMP.	24.95
B6-10	10 AMP.	36.95
B6-15	15 AMP.	54.95

Input 0-234VAC		Output 0-190*VDC
Type #	Current	Price
B13-600	600 MA.	$12.95
B13-1X5	1.5 AMP.	19.95
B13-3	3 AMP.	35.95
B13-5	5 AMP.	48.95
B13-10	10 AMP.	69.95

* Select Proper Capacitor to Obtain Higher DCV Than Indicated.

RECTIFIER CAPACITORS

CF-13	6000 MFD	10VDC	$2.49
CF-14	3000 MFD	12VDC	1.69
CF-15	6000 MFD	12VDC	2.95
CF-1	1000 MFD	15VDC	.98
CF-2	2000 MFD	15VDC	1.69
CF-20	2500 MFD	15VDC	1.95
CF-3	1000 MFD	25VDC	1.25
CF-4	2X3500 MFD	25VDC	3.45
CF-5	1500 MFD	30VDC	2.49
CF-6	4000 MFD	30VDC	3.25
CF-7	3000 MFD	35VDC	3.25
CF-8	100 MFD	50VDC	.98
CF-19	500 MFD	50VDC	1.95
CF-16	2000 MFD	50VDC	3.25
CF-21	1200 MFD	90VDC	3.25
CF-9	200 MFD	150VDC	1.69
CF-10	500 MFD	200VDC	3.25
CF-12	125 MFD	350VDC	2.49

RECTIFIER TRANSFORMERS

All Primaries 115VAC 50/60 Cycles

Type #	Volts	Amps.	Price
XF15-12	15	12	$3.95
TXF36-2	36	2	3.95
TXF36-5	36	5	4.95
TXF36-10	36	10	7.95
TXF36-15	36	15	11.95
TXF36-20	36	20	17.95
XFC18-14	18VCT	14	5.95

All TXF Types are Tapped to Deliver 32, 34, 36 Volts. XFC Type is Tapped to Deliver 16, 17, 18 Volts Center Tapped.

RECTIFIER CHOKES

Type #		Amps.	Price
HY5	.02 Hy	5	$3.25
HY8X5	.02 Hy	8.5	7.95
HY10	.02 Hy	10	9.95
HY12	.02 Hy	12	12.95
HY15	.015 Hy	15	13.95

RECTIFIER MOUNTING BRACKETS

For Types B1 through B6, and Type C1 ..... $0.35 per set
For Types B13 ..... .70 per set
For Types 3B ..... 1.05 per set

RECTIFIER KIT

6 and 12 VDC at 10 Amps.

This unit will deliver unfiltered direct current for operation of motors, dynamotors, solenoids, electroplating, battery charging and similar equipment.

The following components are supplied:

1 ea. Full Wave Bridge Rectifier
1 pr. Rectifier Mounting Brackets
1 ea. Transformer 115 VAC 50/60 CPS.
3 ea. Silver-Plated Binding Posts
1 ea. 4-Position Tap-Switch
1 ea. Fuse and Fuse Holder
1 ea. Line Cord and Plug
1 ea. Pilot Light Assembly & Bulb

The primary of the transformer is multi-tapped permitting adjustment of the DC output voltages.

Complete with schematic diagram and instructions $15.95

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2 section choke input, 2% ripple ... 19.28

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Standard Brands

12 Mmfd.	20 Kv	$4.95
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50 Mmfd.	32 Kv	5.95

SILVER CERAMIC TRIMMERS

820-Z	5-20 Mmfd Zero Temp. 24c
822-N	5-20 Mmfd Neg. 300 ..... 24c
822-AZ	4.5-25 Mmfd Zero Temp. 24c
823-AN	20-125 Mmfd Neg. 650 ..... 33c

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2 Mfd 400VDC Bathtub	.30
2X.1 Mfd 600VDC Bathtub	.39
6 Mfd. 600VDC w/mtg. clamp	.79
10 Mfd 440VAC/1500VDC w/brkts	1.55
8 Mfd 660VAC/2000VDC w/brkts	3.50
.15-.15 Mfd 8000VDC Voltage Doubler Type 26F381 w/brkts	3.95

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0-15 Volts D-C

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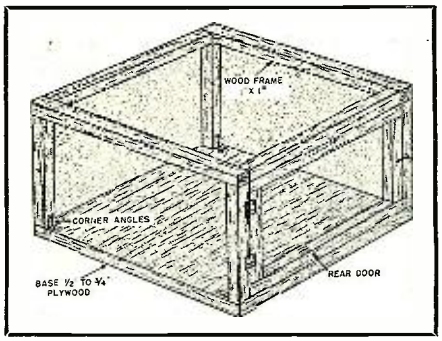


Fig. 7. A wooden framework completely covered on six sides with copper screening can be used to shield entire unit.

fective and yet quite simple to build. It is strongly recommended that any amateur considering building a new home give this idea some serious thought. During the construction of the house, the shack, no matter where it is located, could be completely double screened and provide that added insurance against TVI, in addition to preventing a lot of local QRN from feeding into the receiver. In the completed room of course the screening would be completely hidden by the walls and so would not detract from the appearance.

Conclusion

In conclusion, let me repeat that shielding a transmitter is not a cure for all TVI, but when coupled with other preventive measures, it often spells the difference between success or failure. Shielding will in no case help TVI if it is being caused by harmonics radiated by the antenna. In most cases it has been found that after harmonic generation has been reduced to a minimum and suitable filters installed in the feeders, enough harmonic radiation still comes directly from the transmitter to ruin TV reception in near-by houses. This is especially true in medium to weak TV areas, and it is in these areas that TVI is most difficult to cure. Also it is in these areas that adequate shielding is the biggest help. —30—

"Got a sale on resistors, Joe . . . 3 ohms, 79,000 watts?"

Sweep Generator
(*Continued from page* 53)

erators using an oscillator which is directly frequency modulated are usually better adapted to transmission-line testing than those operating on a beat frequency principle, because of their greater freedom from spurious frequency output. To determine whether or not the sweep generator is suitable for testing a transmission line, just disconnect the line and connect the detector directly to the output of the sweep generator. If the trace obtained is a straight line, the generator is suitable for performing transmission-line tests. (The sweep generator cable must, of course, itself be properly terminated both during this test and the transmission-line checks.)

Second, the transmission line should be at least 50 feet long. Shorter lines will produce only a fraction of the wave pattern on the oscilloscope, and the pattern will be difficult to interpret. Aside from these precautions, the methods are easy to use, fast, and accurate. They can, with reasonable, common-sense precautions, be applied to many more transmission line measurements, such as adjustment of rotary beams, FM antennas, traps, line-balance converters, filters, and so on.

—30—

EARPHONES AS EMERGENCY POWER PHONES

DURING TV installations, the problem of communication between the man at the receiver and the man on the roof can be solved in a way that is much superior to running up and down stairs.

Since there already is a line between the two, there remains only the utilization of this line for communication. Two sets of high-impedance headphones, one connected by means of spring clips to the antenna termination of the lead-in and the other to the antenna posts at the set, will provide the means.

If the antenna is a folded dipole, or contains a folded dipole in the array, one lead will have to be disconnected when the lead-in is used for speech. One lead will also have to be disconnected at the set. . . . . M.A.

AFCA NEWS

This Association is a patriotic non-profit organization, with chapters in most of the larger cities, dedicated to developing and maintaining efficient personnel, commissioned, enlisted, civilian, for the supply (including design and development), installation, maintenance and operation of communications and electronic equipment for Army, Navy and Air Force and their supporting civilian activities. It publishes a magazine "SIGNALS" at its national headquarters in Washington. Every American interested in any way in communications is eligible and invited to join. Further details may be obtained by addressing the secretary at 1624 Eye St. N. W., Washington 6, D. C.

* * *

AFCA CHAPTER NOTES

Augusta-Camp Gordon

Mr. E. Wasson Hornsby of Atlanta, general commercial manager of the *Southern Bell Telephone & Telegraph Co.*, was the principal speaker at the June 15th meeting held at the Camp Gordon Officers' Club. Mr. Wasson spoke on "Democracy" and made an excellent analysis of the strength and weakness of our form of government and the duties and responsibilities of United States citizens.

Maj. Norman J. Kinley of Camp Gordon was elected secretary-treasurer to succeed Maj. Nell Farnham who was transferred to Germany. Col. H. F. Osborne, chairman of the liaison committee, reported that steps were being taken to interest members of the various civilian components of the armed services in the local chapter. Maj. D. C. Benjamin, chairman of the arrangements committee, gave an account of plans for speakers and demonstrations at future meetings.

Chicago

On June 22nd, Chicago Chapter members turned out en masse for a highly informative visit and tour of Chicago's new long distance center. This new installation, developed by *Illinois Bell Telephone* engineers, is aptly called "an electrical brain" and "mechanical wizard." The new toll dialing equipment serves Chicago long distance operators by sending calls direct to dial telephones in some 300 communities throughout the nation.

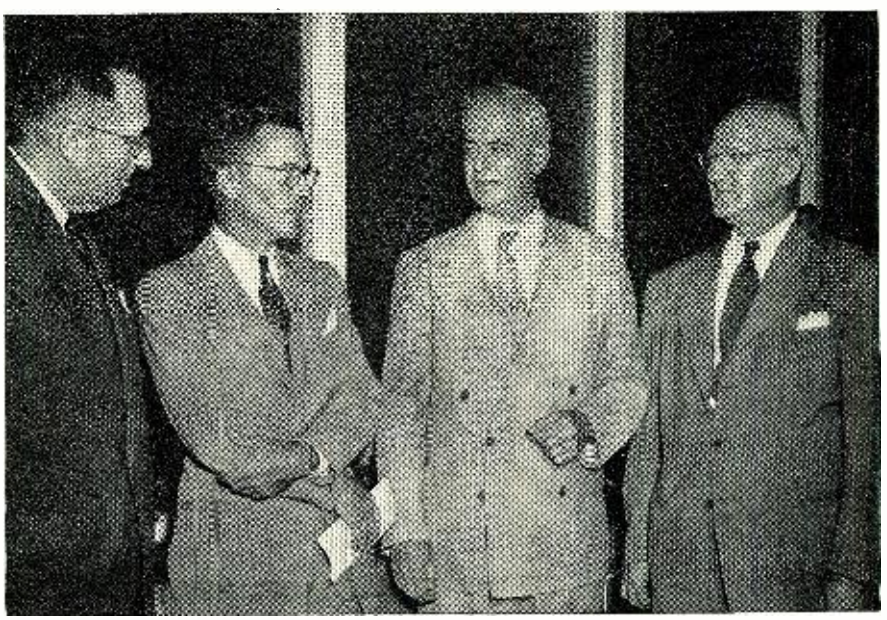
Principal speaker on the program, introduced by Chapter President Oliver Read of RADIO & TELEVISION NEWS, was Brig. Gen. Frank C. Meade (Ret.), who spoke on "Electronics and Communications—First Line Defenders." Nearly 100 members attended the dinner, and the crowd was further augmented at the meeting that followed.

The Chicago Chapter has gone on record that it is out to win the 1950 "Chapter of the Year" contest.

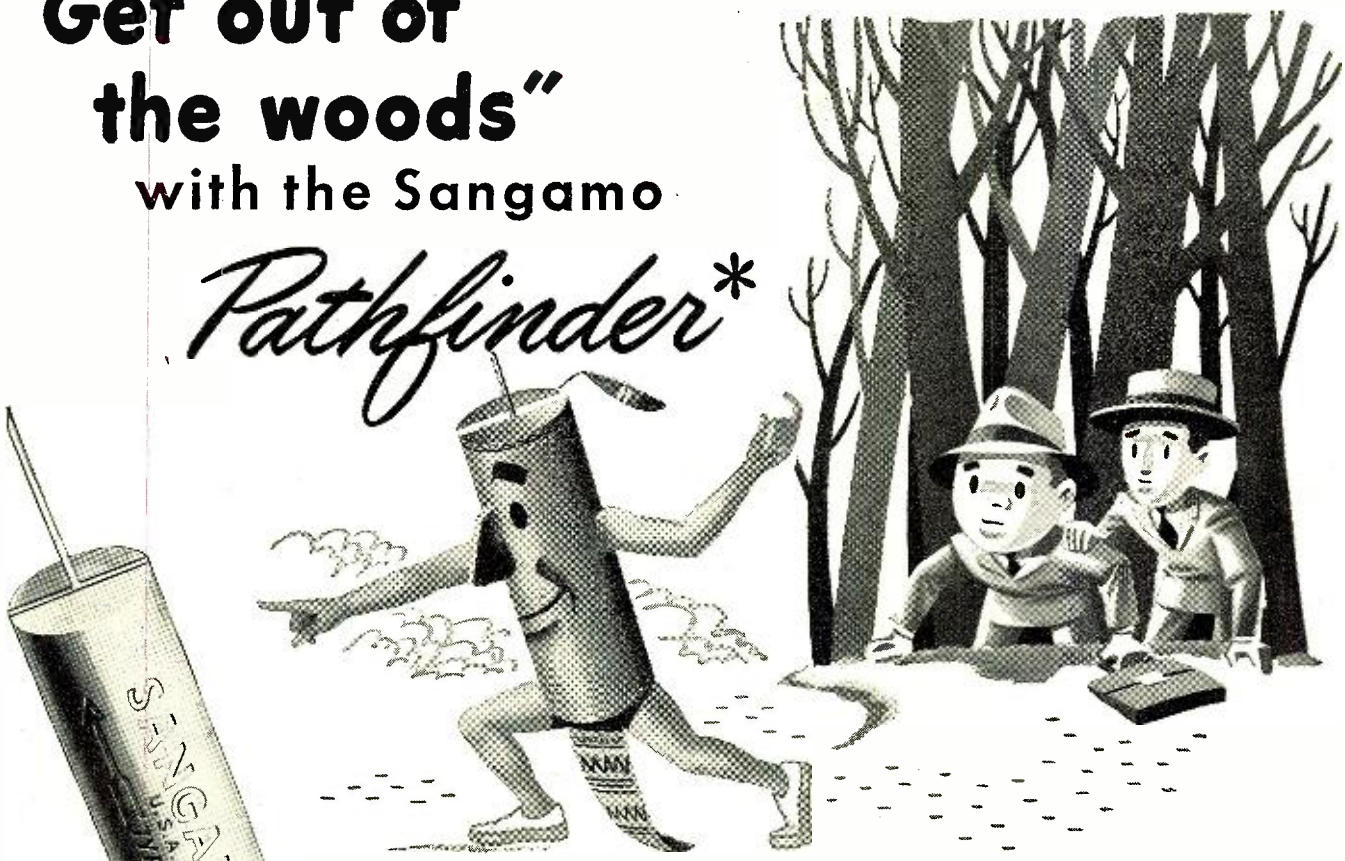
Cleveland

The board of directors of the chapter met on June 27th to formulate

Speakers at the AFCA Chicago Chapter Meeting were (left to right) Dwight L. Brown, general plant manager of Illinois Bell Telephone; RADIO & TELEVISION NEWS' Oliver Read, chapter president; Brig. Gen. Frank C. Meade (ret.), deputy chief of Gary Group Communications; and Ralph T. Brengle, program chairman of the chapter.



"Get out of the woods" with the Sangamo *Pathfinder**



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plans for the coming year. Officers were elected as follows: L. J. Shaffer of the *Ohio Bell Telephone Co.* was re-elected president for a second term; L. K. Wildberg of the *Radiart Corporation* was elected 1st vice-president; C. H. Endress of *Willard Storage Battery Co.*—2nd vice-president; T. F. Peterson of *American Steel & Wire Co.*—secretary; and T. R. Beatty of *National Carbon Co.*—treasurer. Members of the executive committee are: W. S. Sparling, *Ohio Bell Telephone Co.;* L. A. King, *The Rola Co.;* G. F. Prideaux, *General Electric Co.;* and H. E. Schafer, *Radiart Corp.*

European

The Hanau Sub-Chapter's membership drive brought in 265 new members during the month of June. This gave the European Chapter a 100% increase in membership and put it currently in the lead as "Chapter of the Year."

Fort Monmouth

Officers of the Fort Monmouth Chapter participated in the ceremony at which AFCA's first annual ROTC Summer Camp Award was made at Fort Monmouth on July 28th. Mr. Fred R. Lack, AFCA President, and Brig. Gen. S. H. Sherrill, executive director, were also present.

Greater Detroit

The organization meeting held in May was an outstanding success, as more than 100 representatives of all communications and photographic interests in Detroit appeared.

On June 9th, another meeting was held in the *Bell* Auditorium for the purpose of taking the final steps incident to the establishment of the chapter. The petition for charter was signed and the name "Greater Detroit" was selected for the chapter.

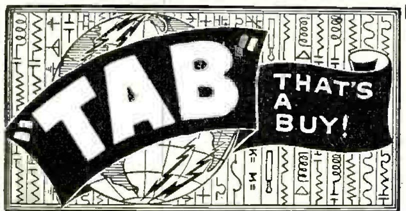
The following officers were elected to head the chapter: President—Robert J. McElroy of *Michigan Bell;* 1st vice-president—Charles E. Quick of *Detroit Edison Co.;* 2nd vice-president—George H. Goldstone, attorney; secretary—Robert Derr, *New York Central R. R.;* treasurer—James Grann, *Jam Handy Organization;* asst. treasurer—W. Clare Edwards, *Michigan Bell.*

Kentucky

The June meeting took place at the Officers' Club of the Lexington Signal Depot. After supper, President Murray P. McQuown gave a detailed report of the events at the AFCA third annual convention which he had attended in Washington. This was followed by an exhibition of color slides made by Mr. John Krauss, a prominent Lexington amateur photographer. The program was concluded with a sports movie.

Pittsburgh

With its annual dinner-meeting on June 7th at the William Penn Hotel, the Pittsburgh Chapter closed a most



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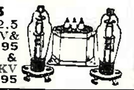

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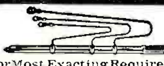

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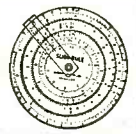

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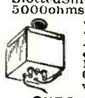

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6.25	414.3	1518	3163
6.5	418.8	1646	3259
7.8	426.9	1712	3384
7.9	427	1818	3509
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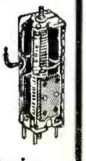

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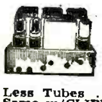

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1B3/8016	.81
1B21/471A	2.95
1B24	4.89
1B27	4.65
1C5	.86
1C6	1.26
1C7G	1.27
1D5GP	1.25
1E5	1.38
1E7G	1.17
1F4G	1.05
1F7GV	1.55
1G4GT	1.05
1G6GT	.98
1H4G	.87
1H5G	.65
1H6G	1.27
1J6G	1.27
1L4	.69
1LA4GT	1.05
1LB4	1.05
1LC6	.85
1LE3GT	.96
1LH4	1.05
1LN5	.75
1N5GT	.69
1P5GT	.69
1P24	.85
1Q5GT	.96
1R4/1294	.98
1S5	.54
1T4	.54
1T5GT	1.05
1U4	.69
1V	.87
1Z2	1.98
2A4G	1.08
2A5	.86
2A6	1.05
2A7	1.05
2B7	.85
2B22/GL559	.73
2C21/1642	.81
2C26	.25
2C34/RK34	.55
2C39	19.00
2C40	6.49
2C43/464A	8.98
2C44	1.69
2D21	.98
2E5	.86
2E22	1.34
2E24	2.98
2E25/HY65	2.98
2J21/725.	11.98
2J21A	11.98
2J25	34.95
2J26	8.89
2J31	9.95
2J33	23.98
2J34	23.98
2J38	13.89
2J47	39.95
2J48	45.00
2J50	45.00
2J61	39.95
2J62	39.95
2K28	24.89
2K29	24.95
2V3G	1.05
2X2	.49
3A4	.38
3A5	1.20
3B7/1291	.95
3B24	1.85

Tube	Price
3B25	$ 4.95
3B28	5.89
3C23	2.48
3C31/C1B	1.69
3D6/1299	.85
3D21A	1.37
3D22	7.49
3Q4	.54
3S4	.79
3V4	.69
4B27/201	2.49
4C33	81.00
4C35	22.95
4D32	7.98
4J42/700A	29.85
4J47	45.00
4T4/2	9.95
5C30/C5B	9.95
5D21	24.95
5J29	17.98
5R4GY	1.12
5T4	.80
5U4G	.46
5V4	.95
5W4	.87
5X4G	.71
5Y3GT	.38
5Z3	.81
5Z4	.88
6A3	.98
6A4	1.29
6A6	1.02
6AB7/1853	.84
6AC7	.85
6AF6G	.87
6AG5	.78
6AG7	1.00
6AH6	.98
6AJ5	.85
6AK5	.78
6AK6	.81
6AL5	.63
6AQ5	.63
6AS7G	4.68
6AT6	.45
6AU6	.63
6B4G	.96
6B8G	1.05
6BA6	.59
6BE6	.59
6BF6	.59
6BG6G	1.49
6BH6	.79
6BJ6	.59
6C4	.25
6C5	.47
6C6	.55
6C8G	1.05
6C21	24.75
6D6	.45
6E5	.81
6E6	1.05
6F6G	.59
6F8G	1.04
6G6G	1.05
6H6GT	.38
6J5	.45
6J6	.78
6J7	.75
6K5GT	.86
6K6GT	.45
6K7G	.55
6K8	.86
6L5G	.98
6L6	.98
6L7	.83
6N7GT	.90
6P5G	.81
6Q5G/884	1.27
6Q7	.75
6R7G	1.05
6S7	1.19

Tube	Price
6S8GT	$ 0.79
6SA7GT	.45
6SC7	.65
6SD7GT	.45
6SF5	.55
6SF7	.78
6SG7	.65
6SH7	.38
6SJ7GT	.59
6SK7GT	.45
6SL7GT	.55
6SN7GT	.55
6SQ7GT	.47
6SS7	.63
6T7G	1.19
6T8	.98
6U5/6G5	.72
6U6GT	.69
6U7G	.58
6V6GT	.65
6X4	.49
6X5GT	.55
6Y6G	.87
6Z7G	1.23
7A4/XXL	.70
7A6	.69
7A8	.69
7AG7	.85
7B5	.70
7B7	.69
7C4/1203A	.38
7C5	.70
7C6	.69
7E5/1201	.89
7E6	.69
7E7	.85
7F7	.85
7G7	1.03
7L7	.86
7N7	.85
7Q7	.72
7V7	1.04
7Y4	.69
10Y	.60
12A6	.23
12A8	.78
12AH7GT.	.87
12AT6	.45
12AU7	.69
12AX7	.89
12BA6	.70
12BA7	.89
12BE6	.45
12C8	.36
12H6	.36
12J5GT	.36
12K8	.85
12S8GT	.79
12SA7GT.	.55
12SC7	.70
12SG7	.69
12SH7	.39
12SJ7GT.	.46
12SK7GT.	.58
12SL7GT.	.63
12SN7GT.	.54
12SQ7GT.	.54
12SR7GT.	.39
12X3	.90
12Z3	.86
14B6	.81
14R7	.85
15R	.98
19T8	.98
20	1.17
24G/3C24	.54
25A6	1.04
25B6	1.49
25L6GT	.55
25Y5	1.08
25Z5	.46
25Z6GT	.59
28D7	.36

Tube	Price
30	$ 0.36
31	.36
32	1.17
32L7GT	1.08
35A5	.69
35C5	.69
35L6GT	.63
35W4	.45
35Y4	.70
35Z5GT	.46
37	.36
38	.39
39/44	.39
41	.58
43	.63
45S/VT52	.30
46	.81
48	1.20
50	1.49
50B5	.54
50L6	.63
70L7GT	1.39
73	1.67
75	.56
76	.47
77	.45
78	.45
80	.35
81	1.49
82	.98
83	.75
83V	1.05
84/6Z4	.65
117N7GT.	1.49
117Z6GT.	.85
117Z7GT.	1.49
205B/VT2	1.98
211/VT4C	.95
231	1.39
250TH	19.44
250TL	18.98
304TH	5.95
304TL	1.98
307A/RK75	3.95
316A	.59
327A	2.90
350	1.45
350B	1.98
371B	.85
380A	.79
388A	.40
393A	5.95
394	3.75
446A/2C40	1.49
450TH	18.27
450TL	39.95
460/HF200	11.98
527	11.95
530	4.90
531	1.80
534	2.45
550P1	19.95
575A/975	13.89
601B	.19
631P1/SN4	3.98
701A	3.95
702A/702B	3.49
703A	2.79
704A	1.08
705A/8021	1.65
707B	7.98
710A/8011	.75
713A	1.59
715B	7.29
717A	.65
721A	1.95
722A/287A	9.95
723A	6.95
723AB	14.95
724	4.90
725A	9.00
726A	7.29
803	7.95

Tube	Price
804	$11.98
805	4.50
807	1.15
808	1.50
809	2.90
810	6.95
811	2.20
812	2.85
813	8.90
814	2.61
815	2.45
816	.98
826	.47
828submin	3.98
829B	4.95
832	2.45
832A	4.50
836	.95
837	2.35
838	2.79
842	2.75
843	.59
845	4.75
851	16.95
860	1.62
861	10.26
864	.45
865	.95
866A	.99
866Jr	1.00
868/PJ23	1.90
872A	2.45
874	1.49
876	.36
878	2.29
884/6Q5G	1.27
885	.95
922	1.19
923	.85
927/CE25	1.26
930	.89
931A	3.95
954	.16
955	.18
956	.27
957	.25
958	.25
968submin	4.98
1000UHF.	59.95
1603	3.98
1609	5.98
1613/6F6X	.55
1614	1.50
1616	1.36
1619	.25
1620	4.95
1622	1.75
1624	.75
1625	.39
1626	.45
1629	.49
1633	1.19
1641/RK60	.75
2050	.59
2051	.42
7193	.18
8012A	1.49
8013A	3.95
8020	3.49
9001	.39
9002	.37
9003	.29
9004	.27
9006	.25
C1A	9.95
C6A	12.95
C6J	4.95
CK1005	.25
CRC40	.54
CRD72	1.85
CRP72	1.37
EF50	.72
F127A	16.95
FG17	2.98
FG27A	9.90
FG104	14.95
FG105	11.95
FG166	49.00
FG190	12.98

Tube	Price
GL434	$ 3.90
GL534/1S21	1.95
GL546	1.69
HY114B	.81
HY115/145	.89
HY615	.98
KU627	7.49
NR74	.29
01A	.45
PJ21	4.98
PJ22/CE1C	1.49
REL36/6J4	.81
RK65	22.98
RX21	3.20
RX215	9.95
UX6653	.69
VR75	.95
VR90	.74
VR92	.23
VR105	.60
VR150	.54
WE215A	.25
WL468	8.98
WL619	20.00
WL632A	8.98
C-RAY TUBES	
2AP1	$ 4.98
3BP1	2.98
3BP1A	7.98
3CP1	2.79
3DP1	1.62
3EP1	3.49
3FP1	1.49
3FP7	.98
3GP1	6.95
3HP7	3.49
4AP10	5.98
5BP1	1.95
5BP4	3.95
5CP1	2.98
5CP7	12.95
5FP5	6.49
5FP7	1.26
5HP1	4.95
5JP2	10.95
5LP1	11.00
5LP5	14.00
7BP7	4.75
7HP7	5.95
9GP7	13.98
9LP7	2.98
12DP7	12.49
12GP7	12.80
12LP4	34.00
16AP4	55.00
902	5.49
905	4.89
912	79.95
BALLAST TUBES	
1P1	$0.49
6-11	.49
9-3	.49
10-4B	.49
13-4	.49
20-4	.49
K49A	.36
K55B	.36
K80B	.36
L62A	.49
M55B	.39
WL121A	2.61
TUNGAR BULBS	
20X672	$2.95
189048GE	3.49
199698	2.95
289881	2.50
NEON BULBS	
NE2..100/$3.98	
NE16/991	.25
NE45/¼W	.24
NE51/NE20	.07

TEL Slidelamps 6, 12, 24, 48, 55V. Each .$0.18
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1000VCT/200Ma, 6V/5A, 5V/6A, 18V/.55A,90VbiasTapCSD ..$6.95
880VCT/125Ma, 6.3VCT/3A,5VCT/3A,6.3VCT/2A Csd Hvins Herm Sld Dlvrs250maUSN $3.98
700VCT/120Ma, 115V/100Ma, 2X 6.3V/1A.5V/2A.CsdHVins ..$2.98
650VCT/175Ma, 6.3V/1.2A,5V/3A CsdHVins Jeff/Stancor $3.29
500VCT/60Ma, 6.3V/4A USN H'sld HVins $1.29
420VCT/85Ma, 6.3V/1.9A also Pri 6-12-24-115VDC&230VAC UnivVib XfmrCsd $2.39;2/$4.39;10/$19.98

Plate Transformers

10800VCTor21000V'Dblr @ 95Ma Csd RAYTHEON $19.95
7500or15000V'Dblr/35Ma $18.95
5000V/10Ma(for2X2)Csd ...$7.95
3000V/10Ma CsdHVins....$4.50
210V/10Ma STANCOR Csd Hvins $3.98
1800V/4Ma USN Csd Altec/GE HVins $3.29
1200VCT/300Ma & 18V/1A wndg Csd HVins $6.95
2X330VCT/10Ma(or660VCT/10Ma) Csd HVins 98c

Filament Transformers

2.5V/1.75A, 4V/16A 20KV Ins, Csd $4.95
2.5V/2AHVins2X2,69c; 10/ $5.98
5VCT/60A Kenyon HVins...$6.95
5V/115A Kenyon Hvins...$12.95
6.3VCT/.7A USN CsdHVins.$1.39
6.3VCT/4A(gud6.5A)CsdUSN $1.69
6.4V/12A, 6.4V/10.6A, 3x5V/3A, 2.5V/1.75A Stancor Csd HVins UsableAsAutoFormer $4.98
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HiVolts forCR'Tube7"to20"& Plate VoltsALL Tubes&ALL Fil's Supply Compl w/data for 5000 to 20000 Volts w/QuadruplerCkt. WDGS:Full WaveDlvrg300VDC/275Ma, 6.4V/10.3A, 5.4V/8A, 2.5V/3A, 5V/3A HypersilCoreOilImpregUSN Spec by WECo,SPECIAL $9.95

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250VDC/60Ma&Filter $2.98
350VDC/125Ma&Filam's ...$4.49
550VDC200Ma&Filam's $9.98
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15000V'Dblr/35Ma&Fltr ..$39.95

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Modulation Stancor USN H'Sld PPprll807's toPP807'sRF 2000ohm Load240WattPk. $4.95
PP807's to 829RCA5500 to 2600 ohms $4.50
Amertran USN 3600or900to30or60 ohms/500W $12.95
UTAH 12W UnivOutpt 5999 to ANY Tube ANY VC.........$1.39
WECo Output 300WattPP805to9 ohmVC HiFi $12.98
UTC LVM-11 line autoformer 30 Watt $2.98
UTC 0-14 "ouncer" 50:1 Mike or LineToGrid200ohms To ½ Meg $13 List: "TAB" Special..$3.49
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STEPDOWN 220to110V. 750 Watts AMERTRAN $6.98
RAYTHEON Inpt 220-440V Outpt 3x2.5V/5A,2.5V/15A CSD..$3.98
G-E Autosyn/Selsyn ServoControl Xfmr Type20G12 Inpt115V/400cyc 1ph. Sec9phase210to360V..$1.49
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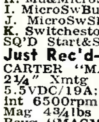
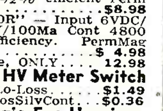
ClockMotor SYNC 24RPM/6to 10 VAC/60cyc&Switch op110V/60cy w/resistor 98c; 12 for......$10

Motor—Holtzer-Cabot



1HP/1or3ph/115V 60cy 3450RPM Ball Bearing ContDuty Remvd from Gun Cont used ..$6.98
Motor 1/40HP/1or 3ph115V60cy/3450 RPMGE/Delco/Diehl w/capacitor ContDty ⅝" shaft ..$3.49

SWITCHES



Micro, Mu Toggle A. Leaf Sw3½" DPNO & NC/ 15A ..$0.98
B. PinPlungr SPDT/10A $0.54
C. MicroSwPlungerSPDT/10A.. .69
D. MicroSwPlungerSPNO/10A.. .69
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F. MicroSwRollerSPNC/10A .. .89
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H. MicroSwPlungerSPNO'NC .. .59
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I. MicroSwButtonSPDT ...... .69
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COUNTER. Veeder Root 85c; 2/$1.49

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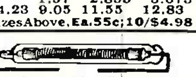

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"IRC" MVT 2Meg/5W/7.5KVwkg.....$1.08;10for$ 8.98
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active year. Chapter president F. E. Leib, of *Copperweld Steel Co.,* reviewed the accomplishments for the year, after which a demonstration of modern television models was presented by *Hamburg Brothers,* local distributors for *RCA.*

There were two featured speakers. Mr. W. J. McIlvane, executive vice-president of *Copperweld Steel Co.* and a life member of AFCA, gave an inspiring talk on the need for cooperation between industry and the armed services. The other speaker was Mr. Leon Coller, chief engineer of the Industrial Mobilization Division of the U. S. Signal Corps, who came from Philadelphia for the meeting. He used a series of interesting slides and data to show the magnitude of the problem and the different things that are being accomplished. The program closed with two movie shorts supplied by the Army and Navy.

Sacramento

Mr. Walter C. Smith, Pacific District engineering consultant for the *General Electric Company,* was the principal speaker at the June 9th meeting held at the Sacramento Signal Depot. Mr. Smith had acquired first hand knowledge of his subject while on a recent tour of research laboratories. He dealt particularly with the development of new insulating materials, magnetic alloys, plastics, and electro-coated materials. In the lighting field, he outlined the application of infrared lamps, "black-light," the germicidal lamp and the high pressure mercury-quartz lamps for television studios. He also reviewed the more recent progress made in the field of electronics, including the photoelectric cell, television, radar, x-ray and the electron microscope.

At the close of the meeting, the group was taken on a jeep tour of the depot.

Officers elected for the ensuing year are: President—M. G. Mauer, *Pacific Telephone & Telegraph Co.;* 1st vice-president—G. H. Brereton, Chief, State of Calif. Div. of Criminal Identification & Investigation; vice-presidents—H. H. Crow, *Kyle Co.;* W. E. Doyal, Science Dept., McClatchy Senior High School; H. M. Skidmore, Public Information Officer, Sacramento Signal Depot; executive secretary-treasurer—C. A. House, Management Analyst, Sacramento Signal Depot.

Seattle

A tour of the Lake Union Naval Armory was the highlight of the June 14th meeting of the Seattle Chapter. The group met at the American Legion Hall for dinner. The guest speaker was Lieutenant G. Sanner, USNR, who discussed the Naval Reserve communications net and all volunteer and organized reserve units, including plans, facilities and drills.

The tour, which was arranged by Capt. C. C. Phleger, USNR, consisted of an inspection of the submarine *Tupper,* destroyer escort *Rombach,* and the fixed communications installations and other facilities of the Naval Armory.

Washington

Mr. F. H. Engel of *RCA Victor Division* has been elected president of the Washington Chapter to succeed Mr. A. K. Mitchell of *Western Union* who has been transferred to New York. Chapter officers met on July 12th at the Raleigh Hotel to make plans for increased chapter activities in the fall. —30—

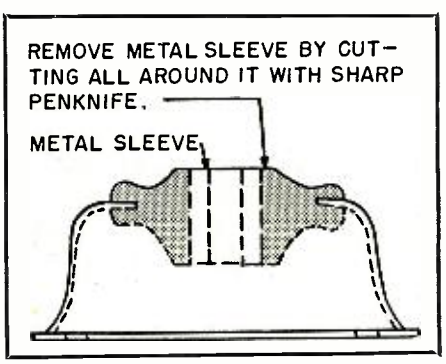
RAISING A PHONO PICKUP ARM

By ARTHUR TRAUFFER

LORD mounts, of the type used to cushion radios in planes and tanks to reduce vibration, are just the thing to remove one of the sources of vibration entering phono pickups from the motor and mounting board. Another use for the mount is to raise the pickup to the correct height in the *General Industries* Model-DR dual-speed phono motors. These have a higher turntable than is customary, because of the speed-shift mechanism that is installed underneath.

First cut away the metal sleeve molded into the center of the rubber mount, as the hole will be too small for the pickup pivot-post. This is done by cutting all around it with a sharp penknife blade.

When the sleeve is removed, the opening remaining in the center is just the right size to fit the pivot-post snug-

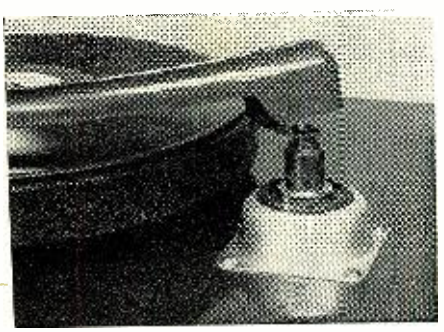


Cut-away view of the Lord mount.

ly, and a washer on top of the rubber cushion will hold the arm level.

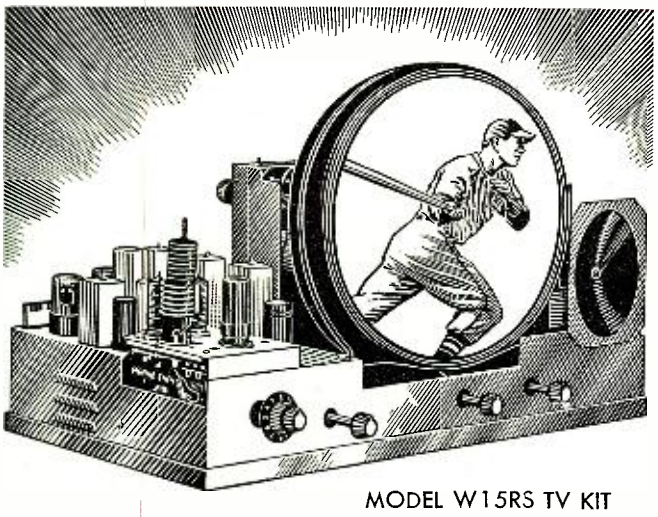
If desired, the mount may be enameled to match the pickup arm and the motor mounting board. —30—

A war surplus Lord mount cushions and raises a crystal pickup arm, which had to be raised for the General Industries Model-DR dual-speed motor. It has a higher turntable because of the speed-shift mechanism beneath.



TRANSVISION

TELEVISION KITS AND INSTRUM NTS



MODEL W15RS TV KIT

CHOICE OF BEAUTIFUL CABINETS best suited to your needs

Build it in 1 Day!

GIANT 160 Sq. In. PICTURE

- **Has 16" PICTURE TUBE**
  (All-Glass Picture Tube, giving bright, clear, steady picture.)
- **KIT COMES SEMI-WIRED and ALIGNED Can be completed in one day!**
- **SAVE by installing the set yourself.**

• NEW LOW PRICES!

***SAVE UP TO ½* on the cost of equivalent picture-size sets. For *NEW LOW PRICES*, see your Transvision Outlet listed below.**

Transvision Television Kits were ordered by the United States Government for use in Naval Reserve Training Program

SERVICE-DEALERS - - -

Be *the* TV Parts Jobber

and Service Center in your community!

- **Beat competition at a profit.**
- **Stop being undersold—by *anybody!***
- **Enjoy an Exclusive Franchise.**

Here's a real opportunity to **MAKE MONEY in Television. If you can qualify,** you can become **the Transvision Television Center** in your community—and **BUY TV and RADIO PARTS AT JOBBER PRICES.** Practically no investment required. This offer is open only to service-dealers in territories where we do not have an authorized distributor.

Contact Transvision Outlets listed below, or write to New Rochelle, for details on Transvision's "TV Center Plan". **DO IT TODAY!**

ELIMINATE the VARIABLES in TELEVISION Installation with the TRANSVISION FIELD STRENGTH METER

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, A.C.
Model FSM-1, with tubes . . . new low price. . . . **Net $79.50**

TRANSVISION, INC., Dept. RN, **NEW ROCHELLE, N. Y.** ***All Transvision Prices are fair traded; subject to change without notice. Prices 5% higher west of the Mississippi.***

For FREE 20-page TV BOOKLET and CATALOG SHEETS, SEE YOUR TRANSVISION OUTLET!

CALIF: 8572 Santa Monica Blvd., Hollywood
3471 California St., San Francisco
DEL: 4 East 15th St., Wilmington
ILL: 1002 So. Michigan Ave., Chicago
MD: 1912 No. Charles St., Baltimore
MASS: 1306 Boylston St., Boston
N. J.: 601 Broad St., Newark
N. Y.: 1425 Boscobel Ave., The Bronx
485 Coney Island Ave., Brooklyn
167-01 Hillside Ave., Jamaica
75 Church St., New York City
606 Central Park Ave., Yonkers
622 No. Salina St., Syracuse
OHIO: Fourth & Plum Sts., Cincinnati
2001 Euclid Ave., Cleveland
53 W. Norwich Ave., Columbus
PENNA: 235 No. Broad St., Philadelphia
620 Grant St., Pittsburgh
TEXAS: 700 Commerce St., Dallas
CANADA: Hamilton, Ontario

Spot Radio News

(*Continued from page* 18)

Mass., and in New Brunswick and Trenton, N. J. In the early fall, stations are expected to be in service at Hartford, Providence, New Haven, Worcester, Baltimore, and Norfolk. By the end of the year, it is expected that about 100 stations will be in operation. A frequency of 157.29 mc. is being used for mobile transmission, with 152.03 mc. applied for fixed station transmission, the same channels being available throughout the country, so that all subscribers traveling within pick-up and transmit areas can employ the service.

A monthly charge of $35.00 for 100 calls has been set up for the New York area, with a fifteen-cent charge for all messages completed after the 100 base charge.

Officers of the service are Norman W. Medlar, KEA274, *Westchester Mobilfone System, Inc.,* White Plains, N. Y., president; Terence McCarthy, KEA254, *Telephone Exchange,* New York City, vice president; J. F. Donovan, W1XNB, *Autofone, Inc.,* Springfield, Mass., treasurer, and George di Matteo, W1XRK, *Secretarial Exchange, Inc.,* Newton, Mass., secretary. Others in the service include E. J. Higgins, W1XFF, *Berkshire Radio Dispatch,* Pittsfield, Mass.; Peter J. Kroeger, KEA256, *Mobile Radio Dispatch Service,* New Brunswick, N. J.; Harold W. Graff, KEA255, Hempstead, N. Y.; W. G. Evans, W3XUQ, Rome, N. Y.; Curtis C. Young, Taunton, Mass.; Tom Smith, *Telephone Answering Service,* Washington, D. C.; Ward C. Rogers, W9XCM, *Radio Dispatch Service,* Chicago, Ill., and Newton Wolpert, W9XHM, *Mobile Radio Message Service,* Minneapolis, Minn.

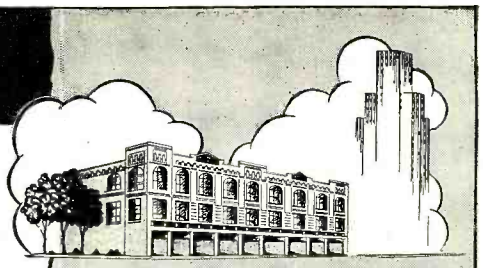
A streamlined operational program, providing non-conflicting arrangements of codes employed in selective calling, is being studied by a technical coordinating committee to assure rapid interference-free service in this new combined FM—land-wire message transmission-receiving system.

THEATRE TV appears to have become a new towering element in mass entertainment. When in '45, during the allocation hearings, representatives of SMPE cited the possibilities of theatre television, most scoffed at the testimony, indicating that such large-screen plans were simply impractical. Many called the idea a wild dream. But today the dubious attitudes are rapidly disappearing, and a growing group of enthusiasts are looking to the creation of regular theatre TV service, with two basic types being considered; receiver pick-up and relay or wire pick-up.

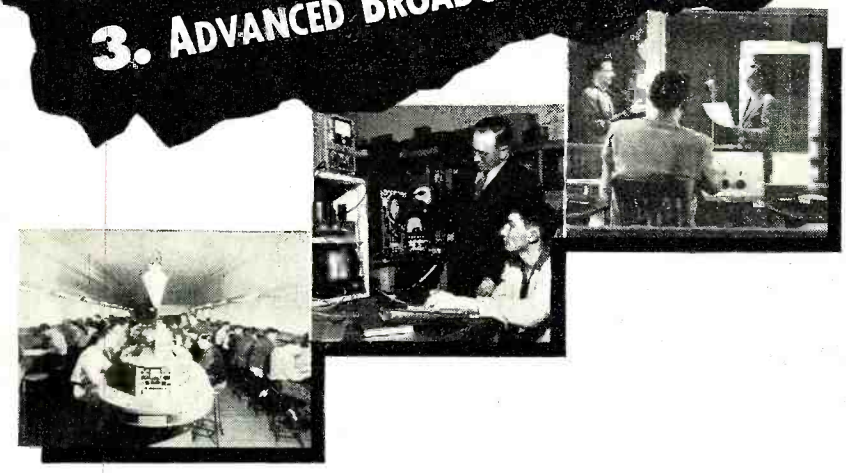
Receiver pick-up service has become quite a feature at several of the larger motion picture houses. The recently televised Wolcott-Charles fight served as an added attraction at houses in

VETERANS

Act Now Before It Is *Too Late*
Enroll in one of these courses Today



1. MODERN RADIO SERVICING
2. COMPLETE GENERAL RADIO
3. ADVANCED BROADCAST TECHNICIAN



Train now in our modern school of radio for this fascinating and profitable field.
Train under the "G. I. Bill of Rights"

Modern radio training requires a combination of facilities and a background of teaching experience that few institutions possess. The Tyler Commercial College Radio Department is proud of its well-equipped shops, classrooms and laboratories, operating under the supervision of skilled teaching personnel with years of radio experience behind them. The school of radio was established here more than thirty years ago, and has produced thousands of qualified graduates who have taken their places in the radio industry in this country and abroad.

Our courses are constantly revised and kept up-to-date in order to incorporate the latest developments in radio, including television, frequency modulation, and electronics. No effort is spared to produce the most effective courses for each job objective and to maintain a high standard of instruction in all branches of radio.

1. MODERN RADIO SERVICING

For the student interested in radio maintenance and repair work, we offer our course in MODERN RADIO SERVICING. In addition to a thorough foundation of essential electrical and radio theory, the course emphasizes maintenance and repair techniques, and includes much material on frequency modulation and television.

Average time to complete course . . . 10 months

2. COMPLETE GENERAL RADIO COURSE

To qualify for employment in the commercial fields of radio, we have developed the COMPLETE GENERAL RADIO COURSE. This course provides all the necessary radio mathematics, radio law, radio and electrical theory and other material essential for successful preparation for both second and first class radiotelephone licenses. Special attention is given to television and frequency modulation problems now encountered on the newly revised FCC license examinations. International Morse Code work is also provided and is of special interest to students preparing for second class radiotelegraph or amateur examinations. For students whose particular interest is broadcast control room work, we have recently modernized our control room facilities to provide practical experience with late-type console equipment. Graduates of the complete general radio course are now employed in hundreds of broadcasting stations throughout the country. Other graduates are radio operators aboard ship, or working for airlines, in coastal radio stations, and in government radio positions.

Average time to complete course . . . 12 months

3. ADVANCED BROADCAST TECHNICIAN COURSE

A higher level of specialized instruction is available for the licensed broadcast operator whose ambition is to qualify for a position of responsibility in his own field. This is the ADVANCED BROADCAST TECHNICIAN COURSE which requires at least a second class radiotelephone license as entrance qualification, and provides an intensified training in matters of particular interest to the future broadcast engineer. Subjects include basic engineering mathematics, fundamental design principles, details of various modulation systems, high efficiency linear amplifiers, directional antenna systems, broadcast speech input equipment, line equalizers, peak limiters and dynamic noise suppressors.

Average time to complete course . . . 6 months

Send for Free Catalogue

For full details and catalogue regarding this unique school, write to the Tyler Commercial College, Room 202, T. C. C. Building, Tyler, Texas.

MAIL TODAY

TYLER COMMERCIAL COLLEGE
115 South College Tyler, Texas

APPROVED BY VETERANS ADMINISTRATION

A STATE APPROVED INSTITUTION

Brooklyn and New York, with nearly 6000 looking on. The pictures were projected onto the 15x20 foot screen and reproduction was very satisfactory.

The FCC has found the theatre television idea, particularly via coax or microwaves, so replete with possibilities that they sent a six-point questionnaire to *Paramount, Twentieth-Century-Fox* and *SMPE,* asking what the minimum frequency requirements would be for a nation-wide, competitive theatre television service; what specific frequency bands should be allocated; the exact functions which would be performed in each assigned band; whether and to what extent such functions could be performed, in whole or in part by the use of coaxial cable, wire or other means of transmission not using radio frequencies; whether and to what extent existing common carriers have or propose to have facilities capable of performing such functions, in whole or in part by radio relay, coaxial cable or wire; and what plans or proposals there are for the establishment of a theatre television service.

In '45 the FCC opened the door for relay experimentation, as a result of an *SMPE* request, and assigned on a shared basis channels in the 475 to 920 mc. band, and channels in the 1000 to 13,000, 16,000 to 18,000 and 26,000 to 30,000 bands. Both *Paramount* and *Twentieth Century* received temporary relay grants for the 2000 and 7000 mc. channels and a bit of work was done. However, the FCC did not feel the activity was substantial, and when a request for a permanent assignment was made declared that the requirements for theatre TV were not too clear to indicate the need for specific allocation. The FCC also reported, at that time, that it appears as though . . . "a large part, if not all, the functions required by theatre television, should be handled by stations authorized to operate on frequencies allocated to the use of communications common carriers." Accordingly, if the theatre interests cannot show in their answers to the 6-point FCC query that they have a definite plan for the future and the means to carry out such a program, link-feed relays for theatres will become a service of other communication facilities.

The query notice to the motion picture companies did cite a point in favor of the film folks, the FCC disclosing that the experimental authorizations made it possible to develop two methods of projection in the theatre, one being the direct projection and the other the intermediate method under which the television programs are converted to regular 35 mm. film, which can then be shown on the screen via regular 35 mm. projectors.

Considering the pretentious TV plans of *Twentieth Century,* which were announced by Spyros P. Skouras, the film company head, at their recent annual stockholders meeting, and the accelerated interest of *Paramount* in television, it is entirely possible that an effective program will be submitted to the FCC and permanent assignments may result. But whether the film interests convince the government or not, there will be a definite film policy from the FCC, and Mr. and Mrs. Public will be viewing large-screen television in their favorite movie houses on quite a regular schedule very soon.

SOME RATHER startling facts about *firsts* have been disclosed in a report on broadcasting by Jacques Souvairan, released by the International Broadcasting Union, Geneva. According to Souvairan, it was in Great Britain that broadcasting first reached . . . "the practical stage and the country has led the way ever since both in research and study and in the manufacture and development of radio equipment."

Souvairan states that television had its beginning in England and that a regular broadcasting service was introduced twenty-five years ago. Describing the British television service, Souvairan points out that the regular transmissions began in 1937, and in 1939 there were "already 20,000 owners." Today he says there are about 150,000 sets registered, and in three years about 500,000 are expected to become available.

The Souvairan *firsts* and current production figures do not seem to jibe with the records we have seen of our activities on all radio fronts. Seems as if the boys and girls, too, over here have rung up quite an assortment of firsts for themselves in broadcasting, TV, receiver development and production, and allied fields, *firsts* which have given the American public an outstanding broadcast and telecast service that has set a pattern for most of the world.....L. W.

ARRL CONVENTION AND SHOW

AS PART of the 1949 ARRL Hudson Division Convention in New York City October 7, 8, and 9, an amateur radio show will be held at the 9th Regiment Armory, 125 West 14th St., New York.

Features of the show include radio equipment demonstrations for the full-fledged "amateur engineer" as well as the embryo ham, and a complete mobile-radio installation will be shown in operation. A radio-teletype communication circuit will handle free messages to all parts of the country, and several transmitters will be on hand to relay messages to parts of the U.S.A. and to GI's in foreign countries.

Among regular convention activities are planned lectures and a seminar on "How to Get Started in Ham Radio," plus a motion picture dealing with TVI elimination. The special lectures and seminar are designed for the younger generation. There will be door prizes, special activities, code contests, a Wouff Hong imitation, and other entertainment ideas. -30-

TV EXTRA EDITION

WARD MINUTE MAN

1949 IS TV YEAR

WARD PRODUCTS CORPORATION • 1523 E. 45TH ST., CLEVELAND, OHIO • SEPTEMBER 1949

WARD SMASHES TV ANTENNA INSTALLATION COSTS!

IT COSTS ONLY 6c IN LABOR TO ASSEMBLE WARD'S SENSATIONAL MINUTE MAN ANTENNA

(WP) CLEVELAND, OHIO

The Chief Engineer of the Ward Products Corporation states that the new sensational Minute Man antennas are being made of PERMA-TUBE — a newly perfected non-corroding coated steel tubing, created especially for Ward by the Jones and Laughlin Steel Corp., Pittsburgh, Pa. Independent laboratory tests on over 30 metals commonly used for antennas have proved PERMA-TUBE the best for all weather installations. Aluminum is too weak and other types of coated steel corrodes. Ward is the only manufacturer using PERMA-TUBE in constructing antennas. See your Ward Distributor today.

Dick Moss, television engineer, flicks up dipole in assembly operation of Ward Minute Man antennas. (Model TV-46).

A few seconds later and Dick snaps the high frequency dipole into position. It costs only 6c in labor to assemble this Ward Minute Man antenna.

FLASH!

WARD USES PERMA-TUBE IN CONSTRUCTING MINUTE MAN ANTENNAS.

(WP) CLEVELAND, OHIO

The Ward Products Corporation, a Division of the Gabriel Company, disclosed today their new Minute Man line of TV antennas. These 13 antennas, ranging in list prices from $2.45 to $49.95 are completely pre-assembled. Where it formely took two installation men three-quarters of an hour (or approximately $7.50 in labor) to assemble the ordinary TV antenna, one man can assemble any Ward Minute Man antenna in a few minutes. This is the greatest technical engineering improvement in the antenna field and the Ward engineers are to be congratulated on its achievement. They have spent many months in their laboratory perfecting the many ingenious construction features. See your Ward distributor today.

GREATER INCOMES AND PROFITS REALIZED BY INSTALLING WARD ANTENNAS.

(WP) NEW YORK, N. Y.

Now you can make big money on a standard installation fee. It has been reported that servicemen and retailers are realizing greater profits by installing Ward Minute Man Antennas. The quick 3 minute installation makes the big difference. It means more installations per day and at greater returns. No consumer complaints have been registered by big labor bills. See your Ward distributor today.

See Your Ward Distributor Today

INTRODUCING WARD'S NEW "MINUTE MAN" TV ANTENNAS

- Completely Pre-Assembled
- Constructed of Non-Corroding Permatube
- Profitable to Install

There are Ward Minute Man Antennas for every purpose and use from any distance from the transmitter. See your distributor today.

NEW TV RECEIVERS ---------- on the Market

GAROD "RALEIGH"

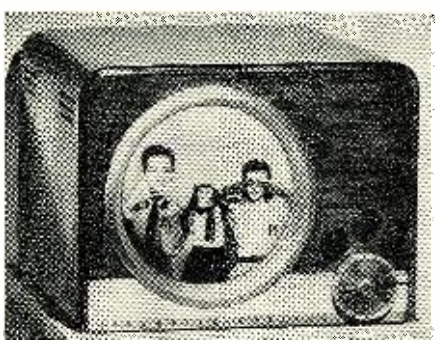
Recently announced by the *Garod Electronics Corporation,* 70 Washington Street, Brooklyn 1, N. Y., is a new 16-inch direct-view console TV receiver with a 140-square-inch screen.

Known as the "Raleigh," the set is available in a mahogany cabinet, 24 by 41 by 21 inches in size and features a continuous tuning unit and slide-rule dial. In a blonde mahogany version, this model, No. 1548, is called the "Granada."

"MANHATTAN" TABLE RECEIVER

An "opera glass" feature is incorporated in the Model TC 10 H "Manhattan" table receiver manufactured by *Stromberg-Carlson,* 100 Carlson Rd., Rochester 3, N. Y.

This innovation permits the center interest of the picture to be enlarged at the push of a button to take in the entire face of the tube. The 10-inch picture tube in the set does not have the conventional mask framing the image. Another push of the button will allow the image to be returned to normal size.



The enlargement increases the area from only 61 to 71 square inches, but company engineers state that the actual increase in size of the center interest is about one and one-half diameters, or more than double the area of the original.

GIANT PICTURE TV KIT

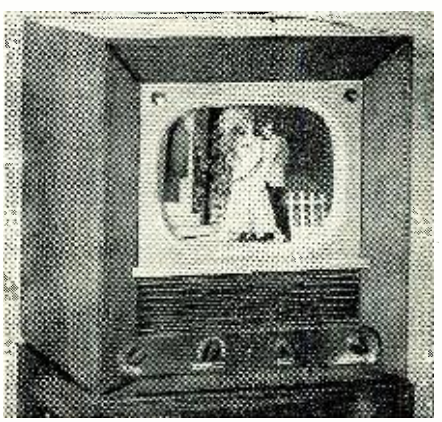
Transvision, Inc., 460 North Avenue, New Rochelle, N. Y., is producing a lower-priced console Model 12CL TV kit, featuring a 200-square-inch picture.

A larger picture is attained by using a 12½-inch picture tube with a specially fitted, built-in, all-angle lens, a recent Transvision development.

An electromagnetic kit, the model uses 22 tubes plus the picture tube, and it has a 6" by 9" Alnico speaker. Continuous tuning on all 12 TV channels is permitted by the tuning unit. A choice of indoor or outdoor antenna, 60 feet of lead-in wire, and a console cabinet in mahogany or walnut, complete with tubes, are included in the quoted price of the kit.

G-E CONSOLETTE

Model 815, a consolette ensemble combining a receiver and matching table is the first receiver made by *General Electric,* Syracuse, N. Y., to use a 16-inch picture tube. Appearing to be one piece of furniture, the ensemble retains the convenience of separate units.



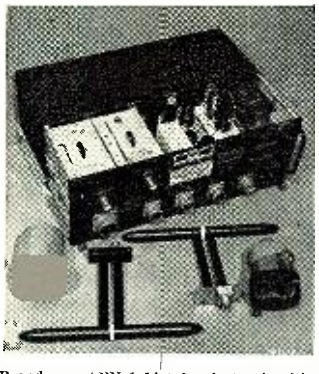
Other features of the set include dual dynapower loudspeakers that allow a full, undistorted receiver output, and separate circuits for each of the 12 channels for best reception. A Gruen circuit is incorporated, which automatically locks the picture in synchronization, and each set is provided with automatic gain control.

CROSLEY PORTABLE TV

Expansion of the *Crosley Division, Avco Manufacturing Corporation,* Cincinnati, Ohio, TV line was announced by the addition of a portable receiver weighing only 38 pounds.

RADIOMEN'S HEADQUARTERS ✱ WORLD WIDE MAIL ORDER SERVICE!!!

ELECTRONIC ALTIMETER
Only $45.00



Brand new APN-1 14 tube electronic altimeter in original factory packing. This famous 18x9x7 unit, which weighs only 25 lbs. without plugs or cables, cost the gov't $2000 and includes a transmitter, a receiver, all tubes, an altitude meter, an altitude limit switch, and two easily installed 11" antennas. Working on the radar principle, the receiver measures the absolute altitude from 3 to 4000 feet, with precision enough for blind landings. In addition the altitude limit switch gives an alarm if the plane's height varies by more than 10 feet from a preadjusted value. Fills recent C.A.A. requirements effective Feb. 15, 1949, that all scheduled airlines must have terrain clearance indicators capable of giving warnings at 500, 1000 and 2000 ft. Another outstanding feature is that connections are provided to control an electronic automatic pilot. Send for our aircraft radio equipment catalog. Export inquiries invited.

Model for 12 to 14 volts D.C.....$75.00
Model for 24 to 28 volts D.C.....$45.00

CERAMIC INSULATED VARIABLE AIR CONDENSERS

350 mmfd, 5 gang—$1.95; 4 gang—$1.49; 3 gang—$1.29		
10 mmf	$.35—10 for	$2.90
	100 for $23.00	
15 mmf	$.35—10 for	$2.90
	100 for $23.00	
25 mmf	$.35—10 for	$2.90
	100 for $23.00	
35 mmf	$.40—10 for	$3.40
	100 for $28.00	
50 mmf	$.45—10 for	$3.70
	100 for $30.00	
75 mmf	$.50—10 for	$4.40
	100 for $38.00	
100 mmf	$.55—10 for	$4.50
	100 for $39.00	
140 mmf	$.80—10 for	$7.40
	100 for $64.00	
160 mmf	$1.00—10 for	$8.50
	100 for $70.00	
2 Gang 140 mmf	$1.60—10 for	$12.50
	100 for $100.00	

SUPER SPECIALS

2 gang midget superhet tuning condensers with ¼" shaft & trimmers. 9 for **$2.50**

Butterfly condensers, rotor has double ball bearings and a ¾" shaft.

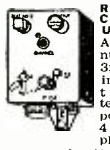
15 mmf, per section	$.50—10 for	$4.50
	100 for $40.00	
30 mmf, per section	$.60—10 for	$5.50
	100 for $50.00	
50 mmf, per section	$.70—10 for	$6.50
	100 for $60.00	

Manufacturers and distributors write for prices on larger quantities.
WE HAVE OVER 250,000 VARIABLE CONDENSERS IN STOCK.

AUDIO AMPLIFIER—Brand new, dual triode amplifier having 2 of the valuable and scarce ouncer type audio transformers that sell for over $10.00 apiece. Neat aluminum case, fully enclosed (largest dimension 6 inches). Perfect for intercom systems, phono amplifiers, mike amplifiers, or signal tracer amplifier for testing radio sets. A sensational bargain at only.....**$3.40** each

Television 300 ohm twinline, per 500 ft. spool $9.95
Miniature bayonet pilot light sockets—per hundred $2.50

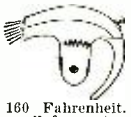
STROMBERG CARLSON—



REMOTE CONTROL UNIT—Aluminum case 4x3x2 containing 2 potentiometers, triple pole switch, 4 knobs, phone jack, gear mechanism and revolution counter—**99c.** With 8 prong JAN connector to fit box—**$1.39.**

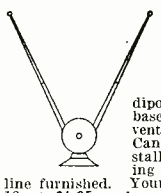
Power Switching Relay Box. Neat 3½ x 4 x 5¼" Steel case with tight fitting cover finished in Stromberg's usual beautiful chocolate color crackle finish—**98c.**

HEAT GUN



Streamlined pistol grip heat gun in vivid red housing, that delivers a powerful 20 Cubic Ft. per minute blast of hot air at 160 Fahrenheit. Ordinary blowers have small fan motors, but this has a lifetime-lubricated AC-DC motor of the rugged vacuum cleaner type, that produces a hurricane of either hot or cold air. Perfect for blowing out dirt or dust from radio chassis, drying out ignition systems, warming up carburetors, quick-drying paint, thawing out radiators or water pipes, etc. Warning:—Keep this away from your wife, or she will be using it to dry her hair because it will do it in half the time of her ordinary hair dryer, to say nothing of her using it to dry stockings or clothing, or defrost the refrigerator instantly. **Only $12.95.** Satisfaction guaranteed or money refunded if returned prepaid within 5 days.

NO ROOFTOP CLIMBING HERE!



The BUFRAD Model MP portable indoor antenna adjusts easily to any channel and any station direction. Forty inch golden three section dipole, with ivory plastic base with felt pad to prevent scratching furniture. Can also be readily installed, attached to ceiling base up. 300 ohm line furnished. Your cost $2.45. Lots of 12 at $1.95 each.

STUPENDOUS VALUE IN 3 SECTION PERMEABILITY TUNER

The entire variable tuning section of a deluxe current model General Motors radio. Amazingly tiny (4x3x2½"), though truly half of a radio. Shielded R.F. sections litz wire wound. All 3 tuned circuits adjustable at both low and high ends of dial. Compact enough to be used to pep up any 2 or 3 gang superhet or 2 gang TRF. Will substitute for entire original tuning system including variable condenser or if desired the original tuning condenser can be connected to these coils, and the coils set to proper inductance (no instruments required), and the set tuned just as before, although much greater sensitivity and selectivity will result. Can be used as a multiple section wavetrap that will cut out undesirable interference as with a knife. If only a little bit better than average results with a slug-tuned wavetrap are necessary, the unit can be split up in a couple of minutes into 3 coils that can be used on 3 different jobs. These coils, super-compact and really hot, can also individually replace any broadcast band RF, oscillator, or 1st detector coil with improvement in results in any set. After seeing one of these units, you'll order a dozen just for general repair or replacement work. Cost the manufacturer several dollars. Your cost—**$1.49.**

GENERAL ELECTRIC 150 WATT TRANSMITTER
COST THE GOVERNMENT $1800.00
COST TO YOU—BRAND NEW—EXPORT PACKED $100.00

This is the famous transmitter used in U.S. Army bombers and ground stations, during the war. Its design and construction have been proved in service, under all kinds of conditions, all over the world. The entire frequency range is covered by means of plug-tuning units which are included. Each tuning has its own oscillator and power amplifier coils and condensers, and antenna tuning circuits—all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle, and the milliammeter, voltmeter, and RF ammeter are mounted on the front panel. Here are the specifications: FREQUENCY RANGE: 200 to 300 KC and 1500 to 12,500 KC. (Will operate on 10 and 20 meter band with slight modification for which diagrams are furnished. OSCILLATOR: Self-excited, thermo compensated, master hand calibrated. POWER AMPLIFIER: Neutralized class "C" stage, using 211 tube and equipped with antenna coupling circuit which matches practically any length antenna. MODULATOR: Class "B"—uses two 211 tubes. POWER SUPPLY: Supplied complete with dynamotor which furnishes 1000 V at 350 MA. from either 12 or 24 volts. Complete instructions are furnished to operate set from 110V AC. SIZE: 21½x23x9¼". Total shipping wgt. 300 lbs., complete with all tubes including a full set of spares besides those necessary for operation, dynamotor power supply, seven tuning units, antenna tuning unit and the essential plugs.

OUR PE-109 POWER PLANT
Direct Current

This power plant consists of a gasoline engine that is coupled to a 2000 watt 32 volt DC generator. This unit is ideal for use in locations that are not serviced by commercial power or to run any of the surplus items that require 24-32v DC for operation. The price of this power plant tested and in good condition is only $79.95 F.O.B. Buffalo, or we can supply in strictly "as is" condition for $58.95 F.O.B. New York City. These latter are exactly as received, in heavy steel-strapped gov't cases, and we are unable to determine if the individual units are new, or what the condition is if used, while the $79.95 are some of the same that we have brought to Buffalo for testing and repair if necessary. We do not recommend gambling on the "as is" condition, except for quantity purchasers. We can also supply a converter that will supply 110v AC from the above unit or from any 32v DC source for $12.95.

Terrific Value—
PORTABLE ELECTRIC DRILL
(Sold at less than established factory price so we cannot mention brand name)

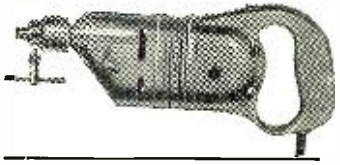
Only $19.95 equipped with ¼" Jacobs Geared Chuck and Key. Not an intermittent duty drill, but a full size rugged tool. Most convenient type switch, natural grip handle, and balance like a six shooter. Precision cut gears—turbine type cooling blower—extra long brushes.

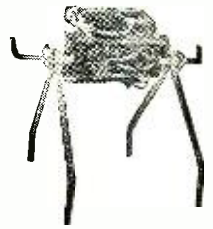
No stalling under heaviest pressure because of powerful 110 Volt AC-DC motor and multiple ball thrust bearing.

Other bearings self-aligning lifetime-lubricated Chrysler Oilite type.

Made for toughest year-in and year-out service in plant or on construction jobs.

Amazing perpetual factory guarantee assures you of a lifetime of trouble-free use. 25% deposit on C.O.D.'s. Full refund (you pay transportation) if not pleased with drill after trial.





ACRO TELEVISION CHASSIS CRADLE

Pays for itself in a week—Saves and eliminates broken tubes, coils, dials, etc. Cadmium plated steel, finger-tip control. A necessity for Television Service.

SELENIUM RECTIFIERS

All types are rated at 130 V.A.C. **Do not assort to make quantity.**

	Single Lots	10 Lots	50 Lots
75 MA	$0.70	$ 6.50	$31.00
100 MA	.75	7.00	32.50
150 MA	.80	7.50	35.00
200 MA	1.05	10.00	47.50
250 MA	1.25	12.00	57.50

TWIN COAXIAL CABLE
at a Sensational Price

Two No. 12 stranded conductors within a copper shielded, vinyl jacketed, polyethylene core. Can handle over 5 KW. of R.F. power. The ideal TV leadin for the most exacting installations such as apartment house antenna systems. Perfect for any twinax use calling for cable within the range of 70 to 95 ohm nominal impedance. Regular price $.72 per ft. Your cost **$15.00** per hundred feet. Ask for RG-57U.

RG-59U 72 Ohm Coax. The most popular TV type. Regular price $.17 per ft. Your cost **$.05** per ft. or **$4.50** per C.

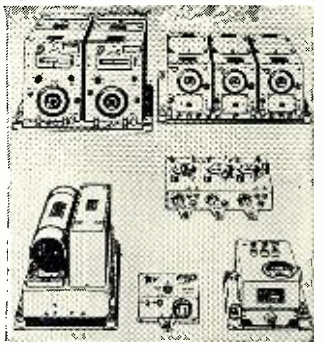
Super Special On
ISOLATION TRANSFORMERS $1.95

Many adjustments on radios and TV sets especially the AC-DC types, require that the chassis be grounded for stability and successful results. Using an isolation transformer this can be done as a routine procedure on every set on the test bench, ending the hazard of shock and the usual but unwelcome fireworks.

Connected as auto transformers these isolation transformers can also be used to change 110 v to 220 v or the reverse. We do not believe that 100 watt 110 v isolation transformers have ever before been offered at less than double our price of **$1.95.**

SUPER SPECIAL

FAIRCHILD bombsight **POWER UNITS.** Our quantity of these is too limited to justify the space required by a photo, but each unit is brand new, contains 9 tubes which alone have a total value of **$15.00;** 8 electric motors or generators, 6 of which are of the permanent magnet field type; **relays; and 20 valuable precision resistors.**



SCR-274N COMMAND SET
The Greatest Radio Equipment Value in History

A mountain of valuable equipment that includes 3 receivers covering 190 to 550 KC; 3 to 6 MC; and 6 to 9.1 MC. These receivers use plug-in coils, and consequently can be changed to any frequencies desired without conversion. Also included are two Tuning Control Boxes; 1 Antenna Coupling Box; four 28 V. Dynamotors (easily converted to 110 V. operation); two 40-Watt Transmitters including crystals and Preamplifier and Modulator, 29 tubes supplied in all. Only a limited quantity available, so get your order in fast. Removed from unused aircraft and in guaranteed electrical condition. A super value at $59.95, including crank type tuning knobs for receivers. Without these knobs the receivers can't be tuned, and are only useful for parts. Don't buy without knobs!

Supreme 592 Multimeter—The finest that money can buy. Uses 40 microamp 25000 ohms-per-volt meter. 14 push-buttons select instantly any one of 44 ranges of AC-DC volts, current, resistance or output. Truly a real precision meter. YOUR COST **$55.95**

SPEAKERS—These PM speakers are the finest that are available. All have heavy oversize Alnico V magnets.

3½"	$1.15	6 for	$6.60
4"	$1.15	6 for	$6.60
5"	$1.10	10 for	$9.50
6"	$1.50	6 for	$8.70
6"x4" Oval	$2.10	6 for	$10.80
7" (Car Radio Side)	$4.50	6 for	$21.50
8"	10 oz. $3.95	6 for	$20.50
8"	21 oz. $4.95	6 for	$26.50
10"	21 oz. $5.50	6 for	$30.00
12"	21 oz. $7.95	6 for	$42.00

AUTO-TRANSFORMER—Steps up 110v. or steps down 220v to 110v—**$1.95.**
FIL. TRANSF.: 6.3v, 3 Amps.—**$1.35:** Universal Output Trans. 8 Watt—**89c;** 18 Watt—**$1.29;** 30 Watt—**$1.69.** **AUDIO TRANSFORMER:** S. Plate to S. Grid 3:1—**79c;** S. Plate to P.P. Grids—**79c;** Heavy Duty Class AB or B, P.P. inputs—**$1.49;** Midget Output for AC-DC sets—**69c;** **MIKE TRANSFORMER** for T-17 Shure microphone, similar to UTC ouncer type—**$2.00.** Stancor SB or DB mike to line or grid—**$1.95.**

Fully shielded GE single button mike transformer in beautiful silver finish case...**99c**
POWER TRANSFORMERS—Half-shell type, 110V. 60 cy. Centertapped HV winding. Specify either 2.5 or 6.3V filament when ordering.

For 4-5 tube sets—650V. 40MA, 5V & 2.5 or 6.3V **$1.49**

For 5-6 tube sets—650V, 45MA, 5V & 2.5 or 6.3V.....**$1.75**

For 6-7 tube sets—675V, 50MA, 5V & 2.5 or 6.3V **$1.90**

For 7-8 tube sets—700V, 70MA, 5V & 6.3 or two 2.5V **$2.35**

For 7-8 tube sets—700V, 70MA, 5V & 6.3 (25 Cycles) **$3.60**

For 8-9 tube sets—700V, 90MA, 5V, 3A, 2.5V-3.5A, 2.5-10.5A **$2.85**

For 9-11 tube sets—700V, 5V & 6.3V 4A **$2.85**

For 9-13 tube sets—600V, 150MA, 5V & 6.3V **$2.85**

1950 MODEL MUTUAL CONDUCTANCE TUBE TESTER $52.95

No possibility of good tubes reading "Bad" or bad tubes reading "Good" as on dynamic conductance testers or other ordinary emission testers. Attractive panel and case equal to any on the market in appearance . . . Large 4½" meter . . . Calibrated micromho scale as well as a Bad-Good scale . . . Front panel fuse . . . Individual sockets for all tube base types—voltages from .75 volts to 117 volts and complete switching flexibility allow all present and future tubes to be tested regardless of location of elements on tube base . . . Indicates gas content and detects shorts or opens on each individual section of all loctal, octal and miniature tubes including cold cathode, magic eye and voltage regulator tubes as well as all ballast resistors. Name of the nationally known manufacturer withheld because of special price offer.

Model "C"—Sloping front counter case **$52.95**

Model "P"—Handsome hand-rubbed portable case **$57.95**
Built-in roll chart with either of above $5.00 extra.

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. RN-8, BUFFALO 3, N. Y.

The set provides a 28½-square-inch picture on a 7-inch direct-view tube. This model, 9-425, is provided with a special automatic control that holds

picture contrast constant even when reception is being switched between strong and weak stations.

Encased in a luggage-type cabinet, the receiver is styled in two-tone brown leatherette with a leather carrying handle. An adjustable dipole antenna is carried inside the cover.

SPELLMAN "IMPERIAL"

A television receiver especially designed for large audiences is being manufactured by *Spellman Television Co., Inc.,* 130 West 24th St., New York 11, N. Y.

Answering the needs of commercial establishments and institutions, the

"Imperial" was designed for theaters, hospitals, schools, churches, factories, large homes, etc. Among the features of the unit are a 3 by 4 foot picture, remote control operation, an exclusive regulated power supply, and an automatic cut-out relay for tube protection.

"HOME THEATER" TELEVISION

A line known as "home theater" television receivers has been introduced by *American Television, Inc.,* 5050 N. Broadway, Chicago, and will include all popular direct-view sizes and models.

For many years the company has been manufacturing cathode-ray tubes under the direction of its inventor-

president, U. A. Sanabria, and Dr. Lee DeForest, director of research. Thousands of television technicians have been trained in the three Chicago schools maintained by the company. The "home theater" line will admit the company to the ranks of television receiver manufacturers for the first time.

COIN OPERATED "SLAVE" TELEVISION

Three minutes of television for a nickel is what the *General Electric Company,* Syracuse, N. Y., is offering in conjunction with a juke-box manufacturer at a luncheonette in Hoboken, N. J. Results of the experiment will not be available for several months.

Two booth sets are now operating experimentally, the sets being mounted in the wall above each table; the 10-inch tube is mounted vertically, and the patrons see the picture on a slanted mirror at their eye level. Each set has its own coin mechanism, which will take up to a quarter.

The master receiver, to which each booth set operates as a "slave," may be located anywhere in the room, delivering the signal by cable to the individual set. The proprietor selects the programs, and regulates them; only the sound volume can be regulated in the booth sets. One master receiver powers about 20 "slave" units.

TRANS-VUE HOME TELEVISION

A 31-tube combination TV-AM-FM receiver enclosed in a warm blonde bisque cabinet was shown recently by *Trans-Vue Corporation,* 1139-41 S. Wabash Ave., Chicago 5, Ill.

This Cine 145B home television consolette incorporates a phonograph

plug-in receptacle, and features a 15" expanded round *DuMont* picture tube, providing a direct-view picture of 145 square inches. The set also has the advantages of the "instantuner," a graduated slide tuner for sharp and steady pictures.

—30—

International Short-Wave

(*Continued from page* 66)

transmitter of the Northwest Territories and Yukon Radio System, Canadian Army, at Edmonton, Alberta, Canada:

"The power output of the transmitter you heard is 5 kw. The transmitter employed is known as a TH41 and is manufactured by the *Marconi Company* of Canada for the Army. It is a multi-channel transmitter capable of (a) 3 c.w. channels at 5 kw. each; (b) 1 c.w. and 1 phone at 5 kw. each, or (c) 3 c.w. frequency shift channels at 4.5 kw. each. Power input is 40 kw. at 90 per-cent power factor. Frequency range is from 2 to 20 megacycles. We find your reception report extremely interesting in that the antenna employed is a rhombic whose direction is (theoretically) beamed on the Northwest Territories. The various programs you heard were produced by the *Canadian Broadcasting Corporation*. This is the Government broadcasting agent and their programs are 'piped' to us from their local station, 'CBX.'

"This system re-transmits on 8.265 for the benefit of isolated settlements in the Northwest Territories and Yukon where, under normal conditions, broadcast stations are seldom heard. Actually, this line of endeavor is a little outside the sphere of the system, our normal function being wireless telegraphy in the area indicated. However, we do maintain small, low-powered broadcast transmitters at some of our Northern stations. Included among these are Aklavik, Dawson City, Whitehorse, Hay River, Normal Wells, and Brochet. It is considered extremely likely that the warrant officers in charge of any of the stations mentioned would be pleased to hear from you." Signed by F. J. McCauley, *Yukon Radio System*, Calder, Alberta, Canada. The station also verified promptly for Kary, Pennsylvania. VED is operated by the Royal Corps of Signals, Canadian Army and appears scheduled around 0900-0200 on 8.265.

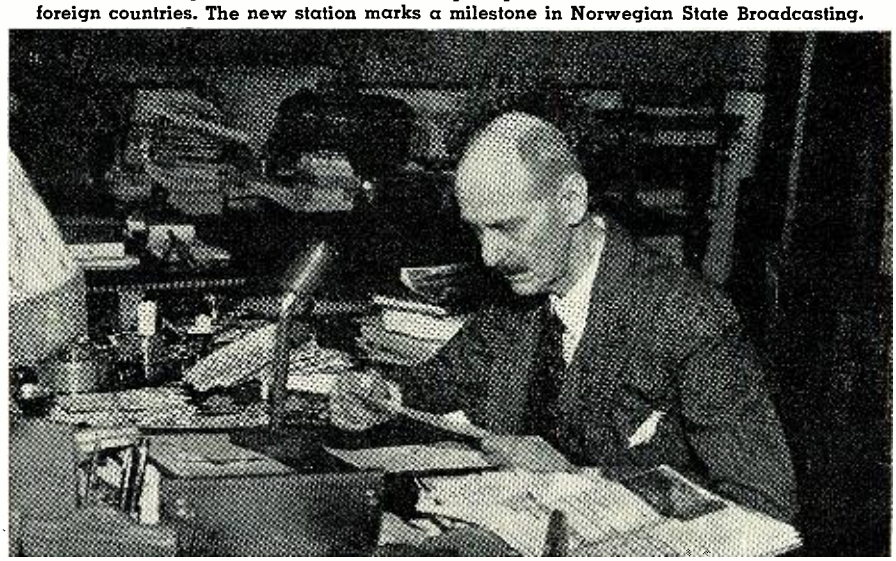
* * *

Club Notes

England—In Worksop, England, Eric Good has formed a club called "The Sweden DX-Fan Club." He wants to have members from all over the world. In May the club started a log-book competition and prizes will be sent to the winners. Members in England should send their log-books on the 16th of each month at the latest; other participants should send their log-books every second month, same date. As of April, the club had 13 British, 1 German, and 75 Swedish members. Membership is free, but Mr. Good is happy to receive one IRC for return postage. The club also has a sub-club in England, headed by Ken Gray; this group has 12 members. All club members receive a membership card, and in the autumn the club will print a magazine. Anyone who is interested may write to Eric Good, Chief, Sweden DX-Fan Club, 5 Aldred St., Worksop, Notts., England. The "DX-Fan News," house organ for this club, was first published in May; it was stated that winners of the log-book competition would receive prizes of log-books, papers, souvenirs, and so on. It declared "The Sweden DX-Fan Club is International and all new members are welcome." Officers were listed—chief of the club, Eric Good; Swedish representative, Gengt Nilsson; German representative, Gerhard Kensy; Swedish correspondent, Nils Lekstrom; editor of DX-Fan News, Bertil Falk, Sweden. (This item was received direct from Mr. Falk.)

U.S.A.—The Grand National Radio Society, Box 178, Stockton, New York, has chosen these new officers—Edward Shirley, president (re-elected); Robert McArthur, first vice-president; William

Principal speaker at the ceremonies attending the opening of the short-wave station for Norwegians abroad in Fredrikstad was King Haakon VII of Norway. In his talk the king said he believed the station would bind still faster the ties always existing between Norwegians, no matter where they may be, whalers, fishermen, or those in foreign countries. The new station marks a milestone in Norwegian State Broadcasting.



Frothingham, second vice-president; Betty Pearl Elder, secretary; and George H. Jacobs, presidential aide.

Secretary of the reorganized Short-Wave Listeners Registry and Hobby Exchange Club is LeRoy Rasmussen, 5828 Ohio Street, Omaha 4, Nebraska. Glen Jensen is president of the club with headquarters at 6531 Binney Street, Omaha 4, Nebraska. The new BCB editor is Clarence Mustoe, Brady, Montana. The TV column in the first bulletin of the reorganized club was compiled by Russ Bearinger, Ottawa Lake, Michigan.

G. Dudley Clarke, Verdun, Quebec, has been declared the elected Canadian vice-president of the Newark News Radio Club. This group has amended the club by-laws to increase the number of (U.S.) vice-presidents from 8 to 12. They now are Louis Hahn, Rutherford, N.J.; Lester W. Kraemer, Newark, N.J.; Arnold E. Gerrard, Miamisburg, Ohio; Henry T. Tyndall, Burlington, Vt.; Eugene S. Allen, Vallejo, Calif.; Charles S. Sutton, Toledo, Ohio; Charles F. Atherton, Exeter, N.H.; Lloyd J. French, West Hartford, Conn.; Kenneth Albrecht, Lake Charles, La.; John W. Reichert, Belleville, N.J.; Harold Robinson, Lansdale, Pa., and Le Roy Waite, Ballston Spa, N.Y. This group again held its summer outing at the home of vice-president and Mrs. Harold Robinson, Mapine Farm, Lansdale, Pa. The arrangement committee, in addition to the Robinsons, included Howard Sellers, Vincent C. Stasen, and Richard Daneker.

* * *

This Month's Schedules

Albania—ZAA, *Radio Tirana,* 7.852, lists schedule of 1300 Russian; 1315 Rumanian; 1330 Italian; 1345 French; 1400 Albanian; 1415 Greek; 1430 Bulgarian; 1445 Turkish; 1500 Serbo-Croat; 1515 *English;* 2030-2100 (sign-off) Albanian. (Gillett, Australia)

Andorra—*Radio Andorra* is now officially listed 5.976V. Has been heard in New York by Bellington around 1820-1900, also by Beck, through terrific QRM; both man and woman announcer, in French and Spanish. Schedule is 0630-0900, 1300-1900. Pearce, England, says *Radio Andorra* is now sending out "a monster-size QSL card."

Anglo-Egyptian Sudan—*Radio Omdurman* lists channels as 572.5 kcs., 5.940, 9.770. (Alfred, Ontario) Location is officially listed Khartoum, *not* Omdurman.

The 9.747 outlet heard weak on the 1400-1430 Arabic transmission, almost as much noise as signal. (Fuller, R.I.) Measured 9.748 in the 2315-2345 (Arabic) beam. Schedule listed to Alfred, Ontario, as daily 2315-2345; daily *except* Fridays 1130-1300, 1400-1430; Fridays 1130-1230, 1400-1430, 0300-0400, 0900-1000, for Arabic programs; *English* on Fridays *only* 1230-1300.

Angola—In verifying for Simpson, Australia, CR6RG, 8.242, Dundo, said: "Our station is on the air every 'night' at 1330-1430 (EST) and on Sundays at 0600-0700 (EST)." QRA was

given as Companhia de Diamantes de Angola, Dundo, Angola. (*Radio Australia*)

CR6RB, 9.165, *Radio Clube de Benguela,* heard from around 1330 but has almost continuous CWQRM; at 1358 gives call, preceded by chimes, and after closing announcements station signs off with Portuguese National Anthem; CR6RL, 9.470, Luanda, heard from around 1430; cannot hear anything of CR6RN, 7.142; *Radio Diamang,* CR6RG, 8.242, Dundo, still heard well except for some CWQRM, heard around 1345, man and woman announcers, off at 1430 with Portuguese National Anthem. (Pearce, England)

Argentina—Radio El Mundo in verifying for Weisberg, N. Y., stated: "This station is owned and operated by Editorial Haynes, Ltd., publishers of *El Mundo* (illustrated daily), *El Hogar* and *Mundo Argentina* (weeklies), and *Selecta* (monthly fashions); our broadcasting plant is the largest in South America. Hours generally are 0530-2235; transmitters are LRI, 50 kw., 1,070 kcs.; LRX, 7 kw., 9.660; and LRX-1, 6 kw., 6.120. There are seven studios with individual controls, hi-fidelity equipment, acoustic treatment and air conditioning." Did not list LRU, 15.29, which is now used widely for international services.

Radio Splendide definitely has moved its transmitter LRS-2 from 11.84; the frequency is now 11.88, formerly used by *Radio Ovidio Lagos,* LRR, and with call modified to LRS to harmonize with the two others (LRU, LRY); call LRS-2 is now used by *Radio Splendide* on 9.32 which does *not* take part in the S.R.I. (international programs), but is still paralled with m.w. LR-4. LRU and LRS are used exclusively by S.R.I. while LRY is used by the international service only at certain times of the day, at other hours being parallel with m.w. LR-3. *Radio Belgrano* seems to have dropped its 9.545 frequency entirely, having returned to the old 9.455 channel. Recently, Buenos Aires has used telephone stations LQV-4, 15.715; LSD-9, 18.115, and LSD-4, 22.52, in addition to transmitters of *Radio del Estado, B.A.,* for relaying special events; these telephone stations are owned by Compania Internacional de Radio, and *are normally used only* for telephone contacts with Europe and South America. (Leven, Brazil)

LRY has been measured 9.451. (Huse, Washington)

Australia—The morning east coast beam from *Radio Australia* has been extended by 15 minutes for the summer, now heard 0700-0900 on VLB, 9.54, VLC7, 11.81; news is now 0715, 0830; Sunday DX session 0843. The British Isles, Europe, Asia beam now runs 0900-1000 on VLA6, 15.200, VLG3, 11.710; 0915-0945 on VLB3, 11.76, VLC11, 15.210; Sunday DX session 0902.

VLB5, 21.540, heard recently 2210 ending news and announcing program in Spanish on Fridays 0730 (2230 Australian Time); continued with orchestra. (Ferguson, N.C.)

VLI2, 6.090, Sydney, N.S.W., heard in Washington State 0330-0400, fair signal with light CWQRM; VLI3, 9.500, good signal around 0150-0315 sign-off. (Huse)

Full schedules for the *new* VLX transmitter at Perth, Western Australia, are VLX2, 6.130, Sunday to Friday 1700-0515; Saturday 1745-2115; Monday to Friday 0515-1030; Saturdays 0515-1100; Sundays 0545-1030. VLX3, 9.610, Monday to Saturday 2130-0500; Sundays 2130-0530. All reports should be sent direct to the Australian Broadcasting Commission, Perth, Western Australia. *(Radio Australia)*

Austria—Official frequency of KZCA, Salsburg, formerly on 7.220, is 9.582; this is the U.S. Forces Station (Blue Danube Network). No change in schedule reported.

Radio Wien, Vienna, heard well in England around 0045 on 7.24, 9.664, 11.785 in relay; news in German 0100. (Pearce)

Azores—Ponta Delgada's 4.845 outlet is heard in Australia 1600 with Portuguese news, music. (Sanderson.) CUM-4, approx. 6.924, Ponda Delgada, works Lisbon 1645. (Peddle, Newfoundland)

Belgium—ORG, approx. 19.230, Brussels, heard to Buenos Aires 1300; ORY-7, approx. 21.435, Brussels, heard to LQB-5 at 1230, irregularly. (Peddle, Newfoundland)

Belgian Congo—The 2315-000 *new* transmission from Leopoldville, 9.767, is beamed to Belgian missionaries all over the world. (Gaynor, Calif.)

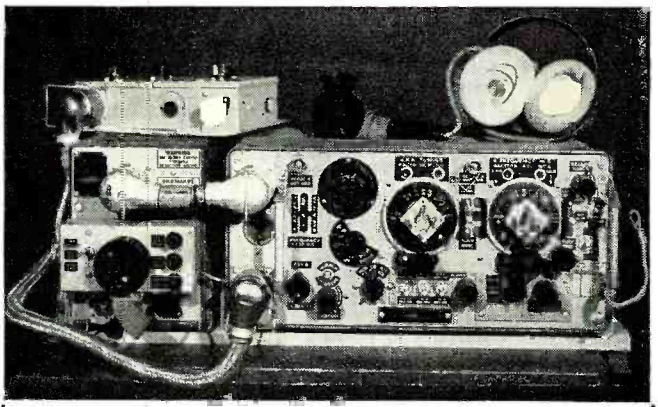
OTH, 9.210, *Congo Belge,* heard signing on (Sundays) at 1230 with march; call in French and native dialect; program of music and songs in native, but announced in French; at 1330 has march and closing call in French and native; signs off with band selection, *not* with the usual Belgian National Anthem. *Radio Congo Belge,* OTM-2, 9.380, has news in French 1345, signs off 1500; bad QRM in England from around 1420 to closedown (from spread of attempts to jam Russian language broadcasts from Madrid's 9.369 outlet). (Pearce)

Brazil—ZYN-6, 6.105, Fortaleza, heard 2145-2215 in Portuguese; ZYC-9, 15.370, Rio de Janeiro, heard 2100-2130 in Spanish (this one is officially listed on 15.365, *"Radio Tupi,"* with 50 kw.). (Peddle, Newfoundland)

PRL-8, 11.72, Rio de Janeiro, heard 0430 in Australia with excellent signal. (Sanderson)

Radio Jornal do Comercio, Recife, gives this schedule for *English* periods —Sundays 1530-1600, ZYK-3, 9.565, *"Brazil Calling"* (to European listeners); daily 2030-2045, ZYK-2, 6.085, ZYK-3, 9.565, *"About Brazil"* (to American listeners). (Leven, Brazil.) ZYK-3 sent verification via registered airmail, gave *new* schedule 0600-1100, 1300-2100. (Ferguson, N.C.)

PRA-8, 6.015, Recife, *"Radio Clube Pernambuco,"* 5 kw., heard in England



THE FAMOUS No. 19
MK II ARMY RADIO

For communications on 2 to 8 Mcs and 230 to 240 Mcs.

SOLD COMPLETE. BRAND NEW with Supply Unit, Transmitter (807) Receiver, Aerial Variometer, Tubes, Antenna and base, Headset, Microphone, Key, Junction boxes, all interconnecting cables and complete Instruction Book. For operation on 12 v. battery (Supply Unit No. 1—Dynamotor). Net price.....**$54.50**

These sets are complete in all points but do not include spare parts. Domestic packing.

SPARE PARTS available as we have large stock. Ask for prices. Tubes EF50 and E1148 at $0.60 each, new surplus; other tubes regular make at regular prices.

INSTRUCTION BOOK on MK II, giving installation and working data, diagrams and specifications at $1.00, mail free.

TERMS. 25% deposit on C.O.D. orders. Prices net, F.O.B. Shipments will be made from warehouses Plattsburg, N. Y., or Montreal, Canada.

NORTH AMERICAN ELECTRONICS COMPANY
P.O. BOX 178, PLATTSBURG, N. Y.

NEW Rauland High-Fidelity 1825 Phono Amplifier
TOPS FOR CUSTOM INSTALLATIONS

U/L LISTED

EXCLUSIVE! Detachable Remote Preamplifier

Preamplifier is detachable; mounts in any position to meet mechanical requirements of any custom installation. Compact; only 2⅜x2⅜x 11". Unlimited flexibility for custom-built installations.

5-Position Frequency Cut-Off
Boost Type Tone Controls
Dual Volume Controls
Dual Input Selector
Plug-In Equalizer

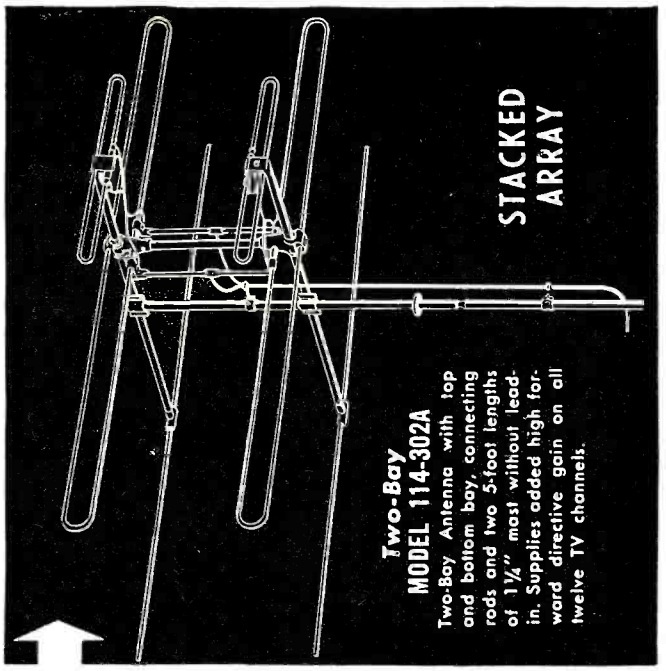
± 1 DB, 40 TO 20,000 CPS
25 WATTS OUTPUT (5% harmonic distortion)

AVAILABLE AT YOUR REGULAR SUPPLIER, OR WRITE FOR DETAILS

Electroneering is our business

SOUND EQUIPMENT — Rauland — INTER-COMMUNICATION

RAULAND-BORG CORPORATION • 3523-G ADDISON ST., CHICAGO 18, ILL.



STACKED ARRAY

Two-Bay MODEL 114-302A
Two-Bay Antenna with top and bottom bay, connecting rods and two 5-foot lengths of 1¼" mast without lead-in. Supplies added high forward directive gain on all twelve TV channels.

TV ANTENNAS
INLINE

The best reception of picture and sound on ALL TV CHANNELS is directly dependent upon the mechanical and electrical construction of the antenna.

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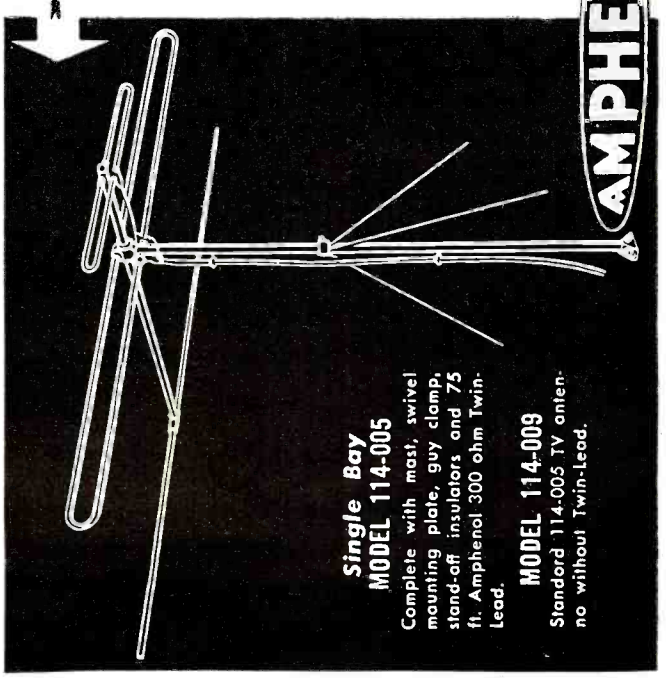

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MODEL 114-009
Standard 114-005 TV antenna without Twin-Lead.

around 1900; PRC-5, 4,865, Belem, Para, *"Radio Clube de Para,"* 250 w., heard there at 1830. (Patrick)

British Guinea—ZFY, 5.983, Georgetown, is scheduled 0545-0745, 1045-1145, 1445-2045 (or 10 p.m. Guinea time). (Osterman, N.Y.)

British New Guinea—VLT7, 9.52, Port Moresby, Papua, heard signing off 0300, good signal in New York from 0225; uses bagpipes. Re-opens 0315 on VLT5, 7.280, also good level. (Bellington)

Bulgaria—Radio Sofia, 7.671, weak lately around 2330. (Bellington, N.Y.) Heard in Newfoundland 1645-1700 in *English.* (Peddle)

Canada—Peddle, Newfoundland, furnishes us this data on radio in that Province: "The Broadcasting Corporation of Newfoundland is now the Newfoundland Division of the Canadian Broadcasting Corporation. Four stations are operated—CBN (old VONF), 640 kcs., 10 kw., and CBNX (old VONH), 5.970, 300 watts, St. Johns; CBG (old VORG), 1450 kcs., 300 watts, Gander; and CBY (old VOWN), 790 kcs., 1 kw., Corner Brook. Scheduled 0600-2230. A *new* station (presumably m.w.) is under construction at Grand Falls, call to be CBT. Other stations for the time being retain their former calls—VOWR, 700 kcs., 500 watts, *Wesley United Church Radio;* VOAR, 1230 kcs., 100 watts, *Seventh Day Adventist Radio;* VOCM, 1,005 kcs., 250 watts, Colonial Broadcasting System, and VOUS, Fort Pepperwell (½ mile from St. Johns), A.F.R.S., 1480 kcs., 500 watts. Amateurs also retain calls VO-1, 2, 3, 4, and 6." Peddle recently visited the transmitters of CBN-CBNX at Mount Pearl, near St. Johns; says the m.w. outlet is a Marconi transmitter of 40 kw., using CAT-9 tubes, among others, but running only 10 kw.; the s.w. 300 w., rig, "is a beautiful job," approximately 4 ft. high, 2 ft. wide, and 1½ ft. deep. The large rig is distilled water-cooled. The s.w. rig also is a Marconi. Both antennas are verticals because of heavy sleet. Some new studio equipment has recently been installed and studio space enlarged quite a bit.

Lyttle, Ontario, says although he has been unable to log the station, an official has informed him that CFVP, 6.030 Calgary, Alberta, is on the air with 100 watts. *Does anyone have schedule?*

CBRX, 6.160, Vancouver, British Columbia, heard in Oregon 2330. (Slattery)

Ceylon—Radio Ceylon, 15.120, heard 0730 with announcement from BBC; stated had carried programs in Japanese, French, *English* for past 1½ hours. (Ferguson, N.C.) Has BBC news 0600; good level at that time in West Virginia. Has program preview 1200 just before 1205 closedown.

Chile—CE1174, 11.742, *"Radio Nuevo Mundo,"* Santiago, heard 2330-0000 sign-off, much improved signal; signs on 0630. (McPheeters, La.)

China—At press time we learned that T. Y. Woo, director of the Nan-

king Radio (Central Broadcasting Administration) left Nanking for Canton before the Communists entered the Nationalist capital, but no information has come in as to what disposition was made of radio equipment in Nanking. However, it appears that former XGOA, 9.730, fell into the hands of the Chinese Communists and is now being operated in relay with other Communist-controlled outlets. Dilg, Calif., informs me that these Communist-controlled stations announce channels of 9.730 (Nanking), 7.500, 6.096, 9.040, and 10.260 (Peiping), plus 1 m.w. outlet. The 7.500 channel, however, was no longer being heard by Dilg at the time this was compiled. After 0900 they appear to give press news at dictation speed with each sentence repeated; leave air around 1015 or later; man and woman take turns at reading, usually play a musical number while changing places. *English* is 0830-0900 now.

Peiping, 10.260, is heard in New York from 0500 to around 0615 or later. At 0500 woman reads news in Chinese at dictation speed. (Bellington.) Also heard early mornings here in West Virginia, but fades out before 0830-0900 *English* session time.

Canton, 9.685, was still on when this was compiled but had only a fair signal, mornings. (Dilg. Calif.) This is officially listed as BEE4, *"Kwang-chow Broadcasting Station,"* with 1 kw.

Hankow, approximately 11.500, heard 0515 with Western music, then Chinese news. (Sanderson, Australia.) Heard on West Coast around 0900-1010 sign-off with much improved signal; identifies as BEL2 and BEL7. (Rosenauer, Calif.) Is officially listed 11.492.

At the time this was compiled, Chungking appeared to have gone on Summer Time; at least I had heard for several days the *English* news session at 0600 instead of former 0700 on 15.172. It is presumed that all transmissions *have moved up one hour* for the summer.

Columbia—HJFA, 4.865, *"La Voz de Pereira,"* can be heard 2145. (McPheeters, La.)

Czechoslovakia—The daily North America beam during summer is heard over OLR4A, 11.840, Prague, 1900-2000; news at start; good signal in New York. (Worris)

Prague gives power as 35 kw., although is officially listed at only 30 kw. (Lyttle, Ontario)

Broadcasts in *English* for Europe are now 1245, 11.840; 1445, 1645, 9 55. (Pearce, England.) The 11.84 outlet is good level in New York 1600-1700. (Beck) Evidently this is the Home Service.

Dominican Republic—HI4T, 5.970, Ciudad Trujillo, heard signing off 0000; parallels HI2T, 9.735, and HI3T, 1,170 kcs. (Mueller, Ohio) Beck, N.Y., reports a *new* station operating from this country on approximately 6.140 around 1900-2000; could this be listed HIG, 6.138, Ciudad Trujillo, *"Radio Nacional?"*

Ecuador—HCJB, 17.890, Quito, good level afternoons in Texas. (Stark) Is beamed to Europe.

El Salvador—In verifying for Weisberg, N.Y., YSUA, *Radio Mil Cincuenta,* listed YSUA on 6.250, 1 kw., and YSU on 1,050 kcs.; uses a half-wave Hertz antenna at an angle of 15 degrees; programs generally run 1300-1600, 2000-0000. Is officially listed 6.255.

England—BBC heard on (measured) 25.750 at 0725 to Far East; closed down 0730 and stated was continuing in 13- and 19-m. bands. (Ferguson, N.C.) This is officially listed GSQ, 15-50 kw.

Finland—OIX4, 15.19, Helsinki, noted recently in clear 0700-0730; news 0715. (Ferguson, N.C.) Same noted in West Virginia. Huse says this channel is heard well in Washington State in the 2200-0000 broadcast.

Helsinki relay noted on 9.55 around 2300-0000, church bells 2320 and choral singing; signs off with chimes at 0000. (Fargo, Ga.) This one is now officially listed OIX2, Lahti, 9.556, 20 kw.

France—The daily North American transmission from Paris for the summer has been shifted to 1845-1900 on 9.55, 11.70. (Worris, N.Y.) The 21.740 Paris channel heard in Newfoundland 1045-1100 in French. (Peddle.) The 15.350 outlet has been noted in French around 1130 to after 1200.

French Equatorial Africa—Radio Brazzaville, 17.840, runs until *after* 1600, probably as late as 1700. Mueller, Ohio)

French Indo-China—English periods from *Radio Saigon* are listed 1830-1845, 1930-2000, 0415-0530, 0830-0930; frequencies given 11.78, 6.165, 1,050 kcs. (Ogilvie, Washington.) Some days the 1830 newscast is still audible in West Virginia, but usually is buried in CWQRM.

French West Africa—Radio Dakar, 11.897, heard from tuning 1710 to sign-off 1800 with French and music. (Ferguson, N.C.) Heard with news in French 1745. (Bishop, Ohio)

Germany—Ray Simpson, Australia, has logged *Radio Stuttgart* on 6.030 at good strength from 1400; both male and female announcers; interval tune on the hour; at 1515 the day logged had dance music. *(Radio Australia.)* Summer schedules are believed to be Monday, Wednesday, Friday, 0430-0745, 0855-1700; Tuesday and Thursday 0430-0730, 0855-1700; Saturdays 0430-1700; Sundays 2300-1700. In a letter-verie it was explained that programs are relayed by permission of the American Military Government; power listed 10 kw. (Pearce, England.) Patrick England, says announces in both German and *English.*

Leipzig, 9.728.5 (measured), good level in German, 2300-0105. (Huse, Washington)

RIAS, 6.080, Berlin, has German news 0930; heard signing off 1012, prior to sign-on of "Voice of America" on this channel; RIAS also heard opening 1704 another day. (Pearce, England.)

Greece—JJOY, 8.000V, Athens, "Station of the U.S. Corp of En-

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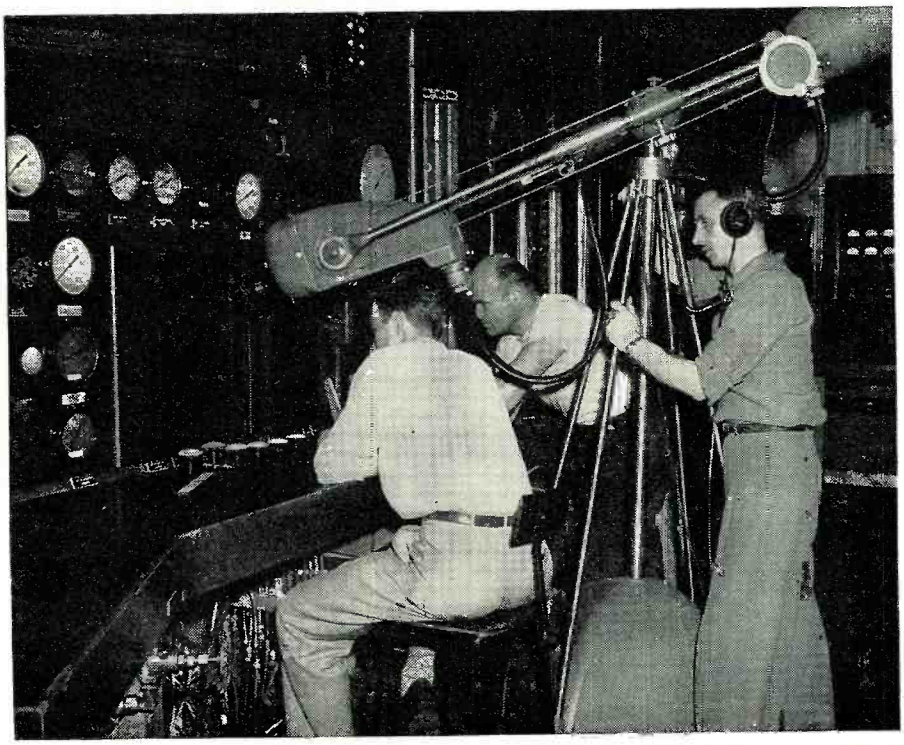

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1U5	6BJ6	6T8	12BF6	50B5
3A4	6C4	6V6GT	12J5GT RCA	53
3Q4	6C5GT	6W4GT	12SA7GT	117Z3
3S4	6C6	6X4	12SJ7GT	9001
3V4	6J6	6X5GT	12SK7GT	9002
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gineers," is heard Fridays 1330-1430, good signal in New Zealand but with some QRM from JJY, Japan. (Cushen)

Radio Athens, The National Broadcasting Institute, No. 4 Rigillis Street, Athens, Greece, is sending out a mimeographed reply to reception reports; in part, it says: "We thank you for your letter reporting reception of our short-wave broadcasts. Reports from listeners are so numerous and the volume of work so great that it is quite impossible for us to reply to each one of you separately, much as we would like to. We have pleasure in informing you that as a result of various views and opinions received, which have been most valuable, our short-wave program has been arranged as follows . . ." Gave schedule as daily on 15.345, rhombic antenna, beamed to N.W. Europe and U.S.A.; 7.5 kw., 1015-1045 news in Greek; 1045-1100 news in *English;* 1100-1115 news in French; 1730-1830 special program for US.A. (news in *English,* a half-hour musical program, news in Greek); 9.607, horizontal dipole, 7.5 kw., 0030-0235 and 0500-0800 relay of Greek program on m.w.; 7.300, horizontal dipole, 7.5 kw., 1200-1330, 15 minutes of news in Turkish, Russian, Rumanian, Serbian, Bulgarian, and Albanian; 1330-1335, advice to shipping from the Hydrographic Service of the Ministry of the Royal Navy. Identification in Greek is "Radiofonikos Stathmos Athinon, I foni tis Ellados"; in *English,* "This is *Radio Athens,* the Voice of Greece"; and in French, "Ici *Radio Athens,* La Voix de la Grece." Interval signal is the first few bars of the Greek song, "Kato ston Valto"; letter signed by D. C. Svolopoulo, Directing Counsellor. (McPheeters, La.) The 15.345 channel is heard in Georgia with news 1045, good signal strength but deep fading. (Fargo.) Is poor level here in West Virginia at that time.

Guatemala—TG2, 6.621, *"Radio Morse,"* heard 2300-0015; QRA is TG2, *Radio Morse,* Direccion-General de Communicaciones Electrica, Guatemala City, Guatemala. (Dallemier, N.Y.) Heard in Newfoundland 1830-2130 and later in Spanish. (Peddle.) TGDA, 7.462, Quezaltenago, heard 1900 with good level. (URDXC)

Hawaii—KRO-2, 15.67, Honolulu, heard point-to-point carrying "Hawaii Calls" at 1900 *(Saturdays only).* (Slattery, Oregon)

Honduras—HRN, 5.880, Tegucigalpa, heard in Newfoundland 1900-2230 and later in Spanish. (Peddle)

Hong Kong—ZBW-3, 9.525, heard 0545. (Sanderson, Australia)

Hungary—Swedes report *Radio Budapest* on 6.250 and 9.700 relaying Home Service 1400-1730 or later; another Swedish report, however, gave higher frequency as 6.205 and *not* 6.250, and stated that has interference from Bucharest (6.210) until latter closes 1630; Budapest appears to run to 1745 at least on some occasions; *English* at 1720 and French at 1730; seems to parallel m.w. 540 kcs. (Swe-

dish DX broadcasts.) Was heard by Pearce, England, on 6,250 and 9.700 with French news 1710, *English* news 1720; said operating "3 to 12" (presumably Hungarian time) and asked for reports to *Radio Budapest,* Hungary; Pearce has heard it sign off 1745; has been noted by him early as 1030, also around 1200.

India—Ray Simpson, Australia, reports AIR, Delhi, now using 11.890, with *English* program beginning 2030; news 2130 but difficult to follow due QRM from a Soviet transmitter on same channel. *(Radio Australia)*

In verifying for Stein, Calif., AIR, Delhi, stated that the outlet in the 25-m. band in European beam (afternoons) which has been listed as VUD11, 11.76, is actually VUD5, 11.79.

AIR, 11.79, Delhi, still pounds in daily 1845-1900. (Fuller, R.I.) This is an experimental transmission beamed to Indonesia.

Delhi has inaugurated a new channel, 17.84, heard coming on 0630 with news; announces 21.520, 17.840 in parallel. *(Radio Australia.)* (I believe VUD11, 21:510 is meant instead of 21.520.—KRB.)

The 9.620 channel (VUD3) heard in Newfoundland 1400-1500 in *English.* (Peddle.) Is beamed to Europe.

Indonesia—Dilg, Calif., recently heard Makassar's 5.030 channel, mornings, in dual with 9.550, but weak.

YCN-3, 8.090, 150 w., Pontianak, Dutch Borneo, verified by card; heard around 0630; chimes strike eight at 0700, then has news in Dutch. (Cushen, N.Z.)

Iran—Radio Teheran, 15.100, now has news 1400. (Fuller, R.I.) Sign-off varies; one day left air 1405, another still on at 1450. (Fargo, Ga.)

Israel—Kol Yisrael, 6.820, heard 1500 with 15 minutes of news; then announced that news is on 8.170 (presumably Haifa) and 6.820 plus a m.w. outlet, latter two Tel Aviv. (Simpson, Australia, via *Radio Australia.*) *Kol-Yisrael,* 8.170, Haifi, heard in English 1500 through bad CWQRM with the "10 o'clock news" relayed from Tel Aviv (6.820). (Pearce)

Japan—JBD4, 15.225, Tokyo, weak signal 0125-0130. (Huse, Washington.) JJY, 4.000, Kemigawa, has continuous tone signal; JJY on 8.000 heard 1354-1435, each two hours thereafter. (Cushen, N.Z.) JBD, 9.505, still coming through around 0600 in Texas. (Stark)

Kashmir—Radio Srinagar, 4.856, heard 0700 with native program of news, music. (Sanderson, Australia.) Sampat, India, informs that this station is on approximately 4.866 daily 2130-2300, 0100-0230, 0630-1130, with news 2130, 0730, 1030.

Kenya—VQ7LO, 4.855, Nairobi, good in New Zealand to 1400 weekdays and to 1500 Sundays. (Cushen.) Should have BBC news relay 1300.

Libya—Pearce, England, has received a letter-verie from Forces Broadcasting Service, MELF-6, Benghazi, stating that broadcasts heard by him were test transmissions on

4.782; it was explained, "Normally, we operate on 833 kcs. in the m.w. band and were testing on this frequency (4.782) to provide a s.w. hook-up with other stations; they were not, however, successful, and we had to discontinue them, although there is the possibility of our originating a further series—either from here or from Malta."

Luxembourg—Radio Luxembourg, 15.352, heard in French 0630-0715. (Peddle, Newfoundland.) Patrick, England, has received word from Frank Lee, manager of the *English* programs, 36, Davies St., London, W-1, giving schedules as on 15.350, 5 kw., 0600-0930, and on 6.090, 5 kw., 1130-1700; all programs relayed from l.w. 232 kcs.; reception reports are welcomed and may be sent either direct to Luxembourg or to Mr. Lee.

Madagascar—Radio Tananarive, 9.694, is believed to open 2230 with "La Marseillaise"; weak signal. (Stark, Texas.) The 9.694 outlet is fair level in Hawaii. (Fellers.) The 7.380 outlet is reported heard in Sweden 1100-1330. (DX-Radio, Sweden)

Malaya—Station heard by Stark, Texas, on 6.025 with *English* 0630 is most likely *Radio Kuala Lumpur.* Reported by Sanderson, Australia, at that time with news, weather reports, stock exchange news, and music.

Mauritius—Cushen, N. Z., received an airmail verification letter recently from Mauritius Broadcasting Service, Forest Side, Mauritius, from Noel Rambert, Chief Engineer. It was stated that due to heavy sideband interference the station would soon move from (officially listed) 7.340 to the 19-m. band, just as soon as confirmation was received from London. (This may mean the use of a BBC frequency in the 19-m. band.—KRB) Schedule was given Fridays 1045-1230 but said that when moves to 19-m. will be on the air daily for several hours. Transmitter is SABC, 1:5 kw., located 2,300 feet above sea level at highest point on the island; also operating a 5 kw. Marconi transmitter on m.w. 1,364 kcs. for "Home Programs."

Monaco—Radio Monte Carlo, approximately 9.790, heard 0115 with French news and music, good signal to 0345 when fades. (Sanderson, Australia) Excellent signal on this channel (possibly low as 9.785), opening 0100 in French. (Bellington, N. Y.) Has been noted by Ferguson, N. C., on (measured) 7.353 at 1720 to sign-off 1739; another day heard to sign-off 1811; all-French program. Apparently the 41-m. channel has replaced 6.035 for the summer. *Radio Australia* reports the new 7.353 channel has been heard from 0100 and again around 1600 in parallel with 9.790 at least during the transmission which begins 0100. The 31-m channel also is heard in Louisiana by McPheeters; and in Newfoundland by Peddle around 1430-1500 sign-off. Pearce, England, reports this outlet from 0600, also as late as 1045, and on a Sunday after 1300 and says it may run as late as 1715.

Mozambique—CR7BU, 4.92, excellent with music 1530; CR7AB, 3.49, heard 1545 in parallel CR7BU. (Sanderson, Australia) CR7BE, 9.763V, Lourenco Marques, is still heard well in U.S. with *English* 0000-0100; at times is heard by Stark, Texas, as early as 0700 fade-in, mornings runs to 1100.

Panama—HORT, 6.060, heard 2130-2230 in Spanish. (Peddle, Newfoundland) HOB, 6.200, Panama City, heard from tuning 2200 to 2300 sign-off; announced as *"Radio Panamericana,* HOB and HOA." (Flynn, Mich.) HOLA, *"Radio Atlantico,"* 9.505, Colon, verified in 2 weeks from date airmail report was sent; transmitter is 1 kw. *RCA* job; complete schedule listed as *English* 0900-1100, 1500-1800, 1900-1930, 2100-2300; Spanish 0700-0900, 1100-1500, 1800-1900, 1930-2100. (Bachman, Pa.)

Paraguay—ZPA-5, 11.945, Encarnacion, heard with poor signal 2000, bad CWQRM. (NNRC)

Philippines—DZH4, 6.000, Manila, heard 0500 with news; also 1600 with news, music, weather reports; DUH5, 11.84, good musical program and news 0430. (Sanderson, Australia) DZH5-DZAB, "Station of the *Stars"* (may mean "Station of the *Skies,"* as officially listed?), Town House, Dewey Blvd., Manila, sent veri-letter from Bob Stewart, Station Manager; runs 20 hours daily—1600-1200—but on week-ends is on continuously from sign-on 1600 Friday to sign-off 1200 Sunday. *"Radio Manila,"* DZH4-DZMB, 6.000, has much improved signal now after 0530 when *Radio Noumea,* New Caledonia, leaves this channel. (Cushen, N. Z.) DZH5 (former KZOK) is officially listed 9.685.

DUH4, 9.620, and DUH5, 11.840, Manila, heard in California 0845-1000. (Gaynor)

Portugal—Lisbon, 15.160, heard in Newfoundland at 1600; CS2WI, 12.865, Parede, heard there 1900-2000 in Portuguese. (Peddle) The 15.160 Lisbon channel is now officially listed as CS—with 10 kw.

Portuguese Guinea—CQM-7, 6.998, Bissau, heard 1630-1800 in Portuguese. (Peddle, Newfoundland) Officially listed 6.993.

Roumania—In verifying for Pearce, England, *Romana Libera* listed frequencies as *Radio Bucharesti* I, 823 kcs., 5.990, 6.205, 9.250, 11.900; *Radio Bucharesti* II, 1,051 kcs.; *Radio Romania,* 160 kcs. While the 50-m. outlet is listed 5.990 by station, Swedes say it is actually being heard on 5.930 with German 1500, French 1530, and *English* 1600. Is officially listed 5.965 for European Service.

Siam—Bangkok channels in the 25-m. band are now officially listed 11.64, 11.715 with 1 kw. According to Cushen, N. Z., and Sanderson, Australia, the daily 0500-0630 overseas beam is now on 6.010 and 11.650, news 0615. Stark, Texas, has heard the 6.010 channel leaving air 0635.

(*Continued on page* 145)

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Profit on Sales

(*Continued from page* 36)

Of course, this is an extreme case which we outline just to emphasize an important phase of business analysis that should be watched from year to year. The current ratio, the difference between the current assets and the current liabilities, which gives the working capital, and the ratio of net profit to net worth are the two most important yardsticks of operating efficiency. Both are pretty much ignored by radio and television dealers. When times are good and sales come easy, it doesn't take much business wit to earn a profit. Since the war, any established business could show a profit. In this new buyer's market, dealers must pay marked attention to business analysis if they expect to earn satisfactory profits.

Because of what has happened during the past ten years, the return on capital investment is one yardstick of business analysis that should be watched carefully. If this return has decreased since prewar days, you are not making your invested dollars work hard enough today. If our experience is any criterion, we believe that many dealers are earning less profit on their capital than they earned before the war. This means that their business has slipped somewhere. That "somewhere" depends upon circumstances. It may be overexpansion, high credit losses, or "invisible losses" of one kind or another.

Sales	$50,000
Cost of goods sold	32,500
Margin on sales	$17,500
Overhead expense	15,000
Net profit on sales	$ 2,500

Table 4. Profit and Loss statement.

Bad managerial methods depress the turn on net worth, otherwise, the return on invested capital. By improving managerial practises, keeping adequate and accurate books and analyzing business figures regularly, many dealers can boost the return on net worth quite substantially.

Stock has turnover, so has labor, so has net worth. The average businessman is familiar with the first two turns, but the last is Greek to him; yet, it is one of the most important turns in his business. Tables 4 and 5

Table 5. Balance sheet.

Current assets	$10,000
Fixed assets	20,000
Total	$30,000
Current liabilities	$ 5,000
Net worth	25,000
Total	$30,000

show how to figure the turn on net worth.

These statements show two turns a year on net worth, the net worth divided into the sales, $25,000 into $50,000, and 10% return on capital invested, $2,500 sales to $25,000 net worth.

Before the war, surveys in this field showed that the average turn on net worth was 3.5 and the return on capital investment, about 15%. However, the turn on net worth depends upon sales, profits, and the dollars invested in the business, and there are as many different combinations of these three factors as there are hands in poker.

Over-capitalization is at the root of much of the trouble when the turn on net worth is low. That is one reason why the dealer should watch this turn. It flashes the red light when he is sinking too much money in his business for the return it yields. It tells him when to put promotional pressure behind his sales to get enough business to justify the investment.

Before the war, spot-checks of dealers in this field with high capital investments showed that many had a low turn on net worth, sometimes less than 3%, whereas, those with smaller business investments earned as high as 24% on their invested dollars. This would indicate that some of the larger dealers earn less than they should on their invested dollars, which may be due to the fact that they pay too little attention to the yield on their invested capital, or they have invested too much in expansion without due consideration for all influencing factors, or they are not promoting their sales with top-flight effectiveness.

Because there are so many variables in the picture, we cannot give specific recommendations. It can be said, however, that the dealer who gets a big return on his invested dollars is a top-flight operator and that all dealers should keep their eyes on this return and compare the yield with that of safe outside investments.

If you are approximating outside yields on safe investments, then you are not getting enough return from your own business for the risk and overhead-aches—and when sales recede, the return may drop to less than the yield on safe outside investments. Business may take the low road some day, and then it won't be so healthy for the dealer who has been making a low return on capital invested while business has been on the high road. Even if we go along full speed ahead, it is wise business to be prepared for the worst.

Check this return against prewar figures. If you are doing a sound managerial job, this return should have increased, not decreased. Watch it periodically. Try to keep as far above the return on safe outside investments as possible to pay you well for your business efforts and risk, and to "cushion" a decrease to outside yields or less if business tapers downward. When you contemplate expan-

sion, try to appraise the effect on this return.

Finally, the higher your return on capital investment, the more your business is worth on the market. This return is the most important factor when appraising the value of a business. A buyer considers the excess of the earnings on net worth over the earnings on safe outside investments when he dickers for possession of an established business. -30-

Atomic Energy Program
(*Continued from page* 33)

of protection against exposure to the radioactivity released in atomic energy experimentation, they may also find the key to long life among human beings and animals. It may give man a life span so long that he will be more likely to die from accidents than from old age.

More recent claims that man can safely withstand a certain amount of milliroentgen units per hour, day, week, or lifetime have had to be modified and the speculated amounts reduced. Medical men are reluctant now to say with certainty what this can be. Where such statements have been made in public gatherings, the speaker often changes his figures or qualifies his statements when the technical audience has questioned him in detail. The author feels that man's life is shortened by exposure to any amount of radioactivity and that, furthermore, this radioactivity may be attributable to other than naturally or artificially fissionable uranium used in the atomic energy program. There is no disputing the fact that high radioactivity exposure produces premature death in man. Cells are destroyed by exposure or damaged, and, thereafter, cannot maintain ideal health life.

Although the nuclear physicist likes to call it "particles" or "rays," radioactivity may be associated with wavelength and frequency as electromagnetic radiations. Certainly, if the wavelength is sufficiently short or the frequency sufficiently high, we have radioactive radiations. It is conceivable that harmonics of longer wavelengths or lower frequencies used in x-ray and even radio applications can fall into that region. It is already known, for example, that cathode-ray television viewing tubes, such as are used for screen projection by the application of high anode voltages in excess of 20,000 volts, can produce x-ray effects. This is but one step removed from gamma radiations encountered in radioactivity situations.

The electromagnetic spectrum in kilomegacycles (millions of kilocycles) is roughly as follows: Radio band—.00001 to 1000; infrared region—1000 to 375,000; visible light region (all colors)—375,000 to 750,000; ultraviolet region—750,000 to 22,500,000. X-rays change into radioactivity as frequency keeps increasing from 22,500,000 to beyond 50,000,000 kilomegacycles.

Adding considerable impetus to the atomic energy program is a Federal regulation promulgated last year, whereby anyone finding a deposit containing twenty or more tons of uranium ore is eligible to a reward or bonus of $10,000. Aside from, or in addition to, this incentive, the government has obligated itself for a period of ten years to pay $3.50 per pound for uranium ore. It will also buy lower grade ores at a corresponding reduction in price. Since the establishment of this regulation, the New York office of the Atomic Energy Commission has received 1900 samples for analysis. These have been of no important value, however, because they evidently had not been checked for radioactivity.

Uranium is still the only satisfactory source of fissionable material in nature which makes possible the release of large amounts of energy in accordance with Einstein's great discovery of the formula E equals mc^2, where energy E equals mass m, multiplied by velocity—the velocity of light, c, squared. Mass and energy are interchangeable. Today we hear of the term "critical mass," which must be exceeded to produce the required release of energy for useful applications, and which is assurance to us that the earth will not disintegrate and destroy us.

The growth of nucleonics depends on a more active and extensive participation by men now engaged in the fields of radio and electronics. It is necessarily progressing at a slower pace than would otherwise be true, despite heavy Federal expenditure, because of a dependence on the too limited supply of physicists, augmented in part by chemists and medical doctors. These men have had to take time out for research, development, and production of the radio-electronic apparatus necessary to facilitate their work, even though these activities are only incidental to their principal efforts and interests. Those engaged in radio-electronics can be of invaluable help in relieving these scientists of such tasks, and also by performing the work better and cheaper because of their greater familiarity and experience with electronic circuits, equipment, and gadgetry. No work is available to radio-electronic men which can do more, or as much, to benefit mankind and bring about a better and safer world to live in, and their participation will insure the use of atomic energy in the more important non-military applications, rather than as an instrument of war and destruction.

One of the greatest causes of war is the fact that nations poor in natural resources must fight to survive against nations rich in natural resources. The field of nucleonics offers the greatest hope in making available to all nations natural resources necessary in this modern age. If necessary materials are not indigenous in the resources of some particular nation, then nucleonics in its ultimate development can make possible their artificial creation

or production, by utilizing materials at hand by nuclear processes. It is exactly comparable with radio-electronics where the basic items such as inductors, resistors, and condensers can, by their number, size, and manner of arrangement or connection, become either a television receiver, a mobile radio station, a broadcasting station, a diathermy apparatus, or an electronic control device.

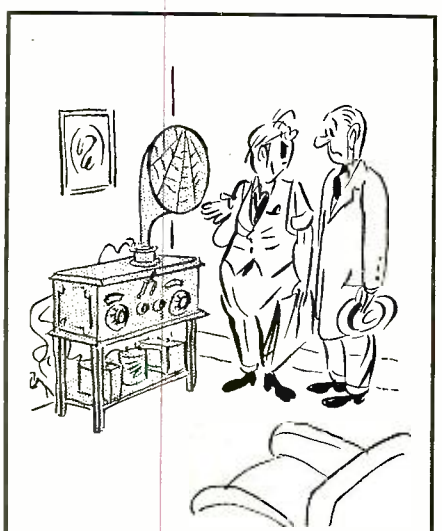
Nucleonics work is not complicated, though there is much yet to be discovered about it. Radio-electronic men at all levels, from operator to engineer, have as much reason to be in that field as has any physicist or doctor; they are definitely going to be there, quite soon, too, and in such numbers as dwarf the total now working in the over-all fields of radio and electronics.

Although such technicians may know a good deal less about nucleonics and related fields than the comparatively few scientists who are now close to the problem, it remains a fact that these same scientists have only a limited knowledge themselves of the field, and much still remains to be developed. Consequently, they are not so far ahead that radio and electronic personnel will be handicapped by entering into the work at this late date.

Several outstanding participants in the atomic energy program today are radio-radar technical personnel who came from the M.I.T. Radiation Laboratory after it closed down at the war's end. It is such men, implemented by still more radio-electronic technicians, who are in a position to make heavy contributions toward furthering the work of the nucleonic program.

Although these men were still in the minority when the author visited Oak Ridge, Los Alamos, and Sandia, time is on their side, and their ideas on what needs to be done and obtained will expedite progress when their skills are fully recognized and utilized.

—30—



"It's a three-way job . . . a.c., d.c., and B.C.!"

Household Interference

(*Continued from page 35*)

levels will well bear recalculation.

Filtering of multiple dwellings is a matter of source suppression of noise producing devices at the point of installation and of line suppression at point of entry into the building. Ground reference points will be provided by many such buildings through their use of conduits.

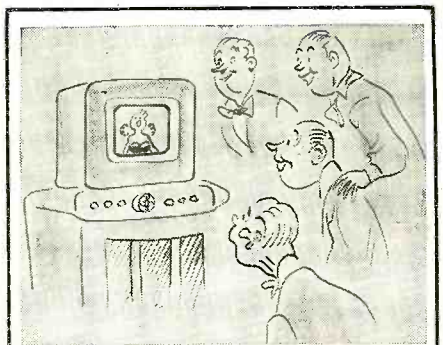
It is the understanding of this writer that dialing noise produced by automatic telephone installations can be reduced through a request to the telephone company to install a filter on the noise producing stepping relay.

In summation, the problem of household filtering is, to repeat, finding the true earth ground or a satisfactory reference point. For houses that are wired with steel conduit or with BX, the problem is partially solved, because such conduiting can be used as the filter grounding point. But for houses built and wired with Romex, the only solution is the artificial reference point or the additional true earth ground for r.f. In establishing too many true earth grounds in the same house, another danger may be encountered, that of various r.f. currents developing an actual r.f. potential between the different ground points. It is but another expression of the technique used in high-frequency receiver design of consolidating stage or set grounding to a single point.

One more word, when considering building a new house or embellishing an old one: To insure that the house does not pick up interference from the power line, an interference filter should be installed in each line, adequately grounded and placed as close to the power meter as possible.

With all these installations effected, noise appearing in the loudspeaker other than direct antenna pickup may be charged to set noise (What! no grounded grid r.f. amplifiers, crystal, or triode mixers?), or antenna and lead-in difficulties.

In conclusion, the writer wishes to extend his appreciation to Mr. R. O. Lewis, of the *Lewis Company,* for invaluable counsel and advice in the preparation of this article. —30—



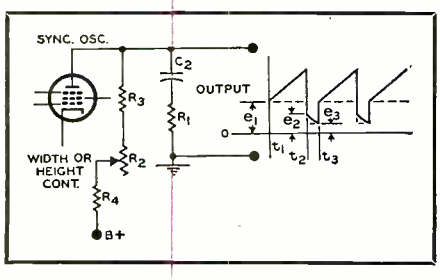
"I saw her on a 16" screen last night . . . WOW!"

image tube. Note that the two coupling condensers between V_2 and the deflection plates must be able to withstand the high voltage which is present on the deflection plates. Since the 7JP4 uses an accelerating voltage of 5000 volts, these condensers have a nominal rating of 6000 volts. If the leakage current through C_3 and C_4 should become appreciable, one of several things may happen. The vertical amplifier tube may burn out, the high voltage will decrease to a fairly low value, or the image may be shifted far to the top or bottom of the screen. The last effect will occur if only one coupling condenser develops a partial or total short.

Vertical and horizontal centering of the beam is accomplished as shown in Fig. 9. A high fixed voltage is placed on one vertical and one horizontal deflecting plate from a tap between two 3.3-megohm resistors. In parallel with these two resistors are two 5-megohm potentiometers, the center arm of each going to the other vertical and horizontal deflection plates. When the arms of the potentiometers are in the center position, there is no d.c. potential difference *between* the plates of the horizontal and vertical sets. A balance exists. Any change in the position of these potentiometer arms, however, will make one plate more positive than the other of its set and bend the beam toward the more positive plate. The deflecting voltages for the image are applied separately as shown, with large-value resistors placed in the centering leads to act as connecting elements to couple the deflecting voltages to the plates themselves.

The preceding vertical deflection system feeds saw-tooth voltages to an electrostatic deflection tube, the 7JP4. In other television receivers, the system might be required to drive a set of deflection coils and now some slight modifications become necessary. In order to determine what these are and why they are required, let us see what the vertical deflection system would look like if used in a set employing electromagnetic deflection. The diagram is shown in Fig. 8. The first change we note concerns the condenser C_2. Instead of using only a condenser, as in Fig. 2, we now have

Fig. 12. A common method for generating deflecting voltages suitable for application to deflecting coils.



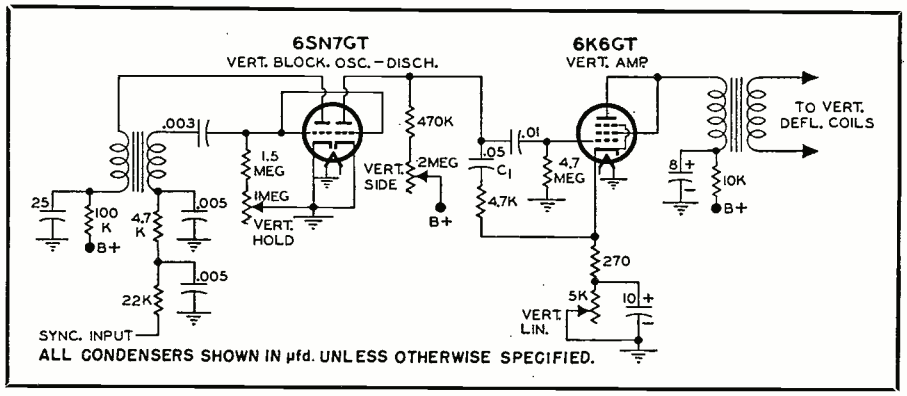


Fig. 13. A vertical sweep system using a blocking oscillator.

a condenser and resistor in series. It is here that our deflection wave is produced and as may be guessed, the shape will no longer be saw-tooth, but instead possess the form shown in Fig. 10. Why this form is necessary can be seen from the following explanation.

Saw-Tooth Current Waves. We have seen that a saw-tooth wave is necessary at the deflecting plates in order to swing the electron beam properly across the screen. The simple charging and discharging of a condenser is sufficient to produce the desired wave-shape. If the same saw-tooth voltage is applied across the coils of an electromagnetic deflecting system, it will be found that the beam no longer moves across the screen in the desired manner. The reason is this: In order to cause the electron beam to move slowly across the screen from top to bottom and then rapidly back to the top of the screen again, the beam must be subjected to a field of force that is varying in a saw-tooth manner. In the electrostatic case, a saw-tooth voltage at the plates will do this. In electromagnetic deflection, applying a saw-tooth voltage to the coils will not result in a saw-tooth current wave through the coils. And, since the magnetic flux varies directly with the current through the coil and not with the voltage across it, the flux variation will likewise differ from the necessary saw-tooth shape. If the charging and discharging of a condenser is to be utilized at all, then some modification becomes necessary in order that the voltage applied to the deflecting coils will cause a saw-tooth current wave to flow through the coils.

The final form of the voltage wave applied to the deflecting coils is derived by analyzing the components of the coils and their action when subjected to voltages of various shapes. Each coil contains inductance plus a certain amount of resistance. For the resistance in this circuit, a saw-tooth voltage will result in a saw-tooth current. For the inductance, considering a pure inductance, a voltage having the form shown in Fig. 11B is required to produce a saw-tooth current flow. Combining both voltage waves, we obtain a resultant that varies in the manner shown in Fig. 11C. A voltage of this type, when applied to

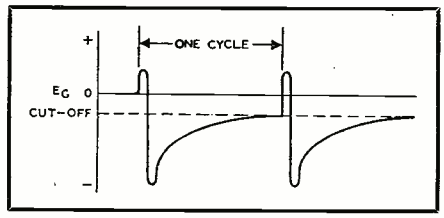


Fig. 14. The grid voltage waveform of a blocking oscillator.

the deflecting coils will give rise to a saw-tooth current, and the magnetic flux, varying in like manner, will force the electron beam to sweep across the screen properly. Note carefully that the resultant wave is not obtained by combining the two voltage waves in equal measure. If the deflection circuit contains more inductance than resistance, the resultant wave will be closer in form to Fig. 11B. On the other hand, if the resistance predominates, then the resultant wave will resemble Fig. 11A more.

With the correct shape of the voltage that must be placed across the deflecting coils known, the next problem is to generate the voltage. It was found that this could be accomplished readily by obtaining the output from the charging condenser and a series resistor in place of the condenser alone. The circuit is shown in Fig. 12. To understand how the desired deflection voltage shape is achieved, consider first that the condenser is uncharged, that the discharge tube has just been cut off. The condenser C_2 will then act as if it were shorted, and the voltage between the plate of the discharge tube and ground will be the voltage developed across resistor R_1. This voltage, e_1, would be the fraction

$$\frac{R_1}{R_1 + R_2 + R_3 + R_4}$$

of the applied "B +" voltage. Condenser C_2 then starts to charge, and the voltage at the plate of the discharge tube increases. It rises until, at the time t_2, the positive pulse from the sweep oscillator acts on the grid of the discharge tube and causes it to conduct sharply. The discharge tube then offers a very low resistance path to ground. This immediately drops the voltage at the plate to the value e_2. The condenser also discharges dur-

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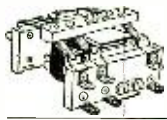

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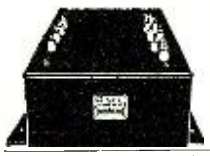

BARGAIN OF THE MONTH

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Model DW51 ..... $4.50 ea.

FEDERAL ANTI-CAPACITY SWITCH. Double Pole, Double Throw.....85c each; 10 for $7.50

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250 ohms imp. Can be used for sound power Telephones, etc.

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20 mfd	330 vdc.	$1.85	15 mfd	1000 vdc.	$2.95
1 mfd	600 vdc.	.29	2 mfd	1500 vdc.	1.25
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4 mfd	600 vdc.	.59	1 mfd	2000 vdc.	1.45
6 mfd	600 vdc.	.79	2 mfd	2000 vdc.	2.25
3/3 mfd	600 vdc.	.79	4 mfd	2000 vdc.	3.65
10 mfd	600 vdc.	.95	6 mfd	2000 vdc.	3.95
2 mfd	1000 vdc.	.79	2 mfd	4000 vdc.	5.50
4 mfd	1000 vdc.	.95	1 mfd	5000 vdc.	3.95

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5 Watt type AA, 20-25-50-200-470-2500-4000 ohms ..... $0.09 ea.
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2.5 Volt 10 Amp 3.49
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5½ V CT 21A, 7.5V 6A, 7.5V 6A..... $4.95
6.3V 21 Amp, 6.3V 2A, 2.5V 2A 3.95
5 Volt 4A, 6.3V, 3A 2.45
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Heineman 5 Amp. 110VAC CKT BRKR .... .99
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2 Mfd 250 VAC Condensers .....6 for .99
TRIMM "Commercial" Head Phones 3.75
10 Meg. 10 Watt Resistor ..... .59
.02-400 VDC Tubulars .....15 for .99
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MU Switch with Roller SPST 15A 110VAC .39
C-H Toggle DPST 20 Amp 250VAC ..... .85

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ing this brief interval, decreasing the voltage across C_2 and R_1 to e_3 at the lagging edge of the oscillator pulse. With the pulse removed, the discharge tube becomes non-conductive again, and the voltage across the combination of C_2 and R_1 immediately rises to the value of e_1 again. Thereafter, C_2 starts to charge again.

To permit adjustment of the output voltage in order that the proper size image may be attained, R_2 is made variable.

The only difference, it is noted, between the methods for generating suitable deflecting voltages for electrostatic and electromagnetic systems lies in the components connected across the output of the sweep oscillator. For electrostatic deflection, the output is taken from a condenser alone, whereas, for the electromagnetic deflection, a series resistor is included. Either combination may be used with a blocking oscillator or a multivibrator.

Blocking Oscillators in Vertical Systems

Besides multivibrators, the only other type of circuit employed as the vertical sweep oscillator is the blocking oscillator shown in Fig. 13. The waveform of the voltage at the grid of the blocking oscillator is a small positive surge (due to the applied positive sync pulse), followed by a large negative drop which returns to above grid cut-off at a rate determined by the values of the blocking grid condenser and resistors. (See Fig. 14.) During the time that the grid is cut off, condenser C_1 charges. When the tube is driven sharply into conduction by the sync pulse C_1 discharges, initiating beam retrace. The form of the deflection wave will depend upon the method employed at the cathode-ray tube in deflecting the beam. For electrostatic deflection, we would use a condenser only and develop a saw-tooth voltage wave. For electromagnetic deflection, we would connect a condenser and resistor across the oscillator tube and obtain the peaked wave shown in Fig. 12. Thereafter, the wave would be amplified and applied to the cathode-ray tube.

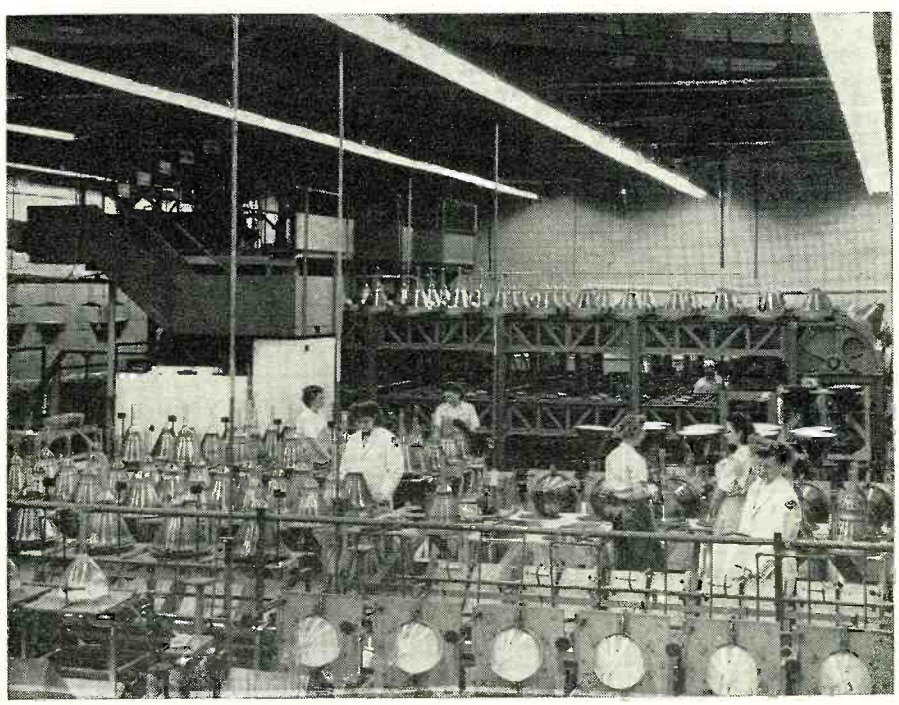
Coming in next month's article of this series: "Horizontal Sweep Systems for Electromagnetic Deflection Tubes." The author will cover a complete discussion of their operation and how they differ from those used with electrostatic tubes.

(To be continued)

REFERENCES

1. *"Television Simplified"—by Milton S. Kiver. Revised edition, 1948. D. Van Nostrand Company, Inc., New York City.*
2. *"Television & FM Receiver Servicing"—by M. S. Kiver, 1948, D. Van Nostrand Company, Inc.*
3. *"Radar Electronic Fundamentals"—U. S. Government Printing Office. Washington 25, D. C.*

The "settling room" of the RCA Tube Department's Lancaster, Pa., plant. In this room the glowing fluorescent screen of the tube on which the television picture appears is applied to the face of the tube. The process consists of pouring a quantity of a solution containing the powders to settle smoothly and evenly on the face of the tube to form a flawless viewing surface. After this, the aqueous part of the solution is poured off. In the foreground is seen the old process in which the tables were tilted by hand to pour off the remainder of the solution after the settling of the face had taken place. In the background is one of three giant "settling belts," containing RCA's new 16-inch metal television picture tube, on which the process is now automatically accomplished. On these unique new machines, the bulbs, untouched by human hands, have the screen face applied, are automatically washed in a variety of solutions, dried, and readied for the trip via conveyor belt to the next robot machine.



International Short-Wave

(*Continued from page* 134)

South Africa—Cape Town, 5.88, good level 1530; Johannesburg, 4.37 and 4.80 heard around 1545. (Sanderson, Australia)

Laubscher, South Africa, confirms location of ZUD, 17.748, is near Pretoria; ZUD tested in April but has not been reported since.

ZRB, 9.11, Pretoria, South African Air Force Station, good volume in Hawaii signing on daily *except* Sundays 2345. (Fellers)

ZSB-36, approx. 22.775, heard working London 1130 in *English.* (Peddle, Newfoundland)

Spain—EDV-10, 7.170V, Madrid, heard around 1745 to 1900 sign-off; good signal in N. C.; gives a number of calls, such as "La Voz de Juventud," "EDV-10," and "S.E.U."; drifts around. (Ferguson) Officially listed 7.149V.

Peddle, Newfoundland, reports Madrid on 15.610 at 1130-1200 in Spanish; has been heard 1130 by Beck, N. Y. *"Radio Nacional,"* Madrid, is listed officially on 15.625 with 40 kw.

Spanish Guinea—Short-wave News, London, states: *"'La Sociedad de Radiofusion Intercontinental'* has started to construct a 200 kw. s.w. transmitter which will be the most powerful commercial broadcasting station in the world. *'Radio Atlantica,'* Fernando Po, will possess a record library numbering 55,000, and its programs will be in six languages—*English,* Spanish, French, Portuguese, German, Italian. Probable schedules are 0600-0800 for Europe; 0900-1200 for Africa; 1200-1300 for North America; 1300-1400 for South America; 1400-1900 for Europe; 1900-2200 for North America; and 2200-0100 for South America. Inauguration date is not known but reliable sources say it will be early 1949; frequencies, 17.600, 11.600, 8.800." Latest official listings give location as Mosula, Fernando Po.

Sweden—SDB-2, 10.78, Stockholm, heard signing off 2030 in *English.* (Smith, Ala.) SBT, 15.155, now carries *all* short-wave sessions of *Radio Sweden.*

Switzerland—Leven, Brazil, says Berne's European Service being relayed on 15.305 to South Africa is good level from around 1300 to sign-off 1700; frequencies used to Europe—1700 sign-off.

SBC is now announcing call-signs. (Worris, N. Y.)

Red Cross Radio, 6.345, Geneva, states the station was "withdrawn due to lack of funds"; will resume broadcasts soon but *only over m.w.* outlets in several European cities. (Cushen, N. Z.)

Syria—Radio Damascus, 12.00, heard in England to 1630 sign-off; uses quite a few Western recordings interspersed with Arabic broadcasts. (Pearce)

Turkey—TAP, 9.465, Ankara, announces that Sunday Mailbag feature

is now 1530 over TAQ, 15.195; TAP is heard in Brazil 1430 with German transmission and to 1500. (Leven) *English* news is now at 1345 over TAP. (Pearce) Summer schedule for the Monday and Thursday (*English*) periods to the United Kingdom is 1530; when reported was over TAP but by this time will have changed to TAQ. (Swedish DX program)

Uruguay—Veri from CXA-19 gives this information—CX18, *"Libertad-Sport,"* 890 kcs., 5 kw., 1300-0200; CX14, *"El Espectador,"* 810 kcs., 15 kw., 1100-0300; CXA19 (s.w. outlet of CX14 and announces the same), 11.835, 5 kw., 1100-0300. Under "Radio Network of Uruguay" listed CW1, Colonia; CW19, Rocha; CW23, Salto; CW33, Florida; CW35, Paysandu; CW43, Minas; CW45, Trienta y Tres; CW46A, Tacuarembo; CW47A, San Jose (presumably all MW). (Weisberg, N. Y.)

U.S.S.R.—Swedes report several new Russian stations on the air, among these are 11.802, 11.920. (Swedish DX program)

Kiev, 11.720, noted opening 1330 with *English*. (Ferguson, N. C.) Noted also late as 1700 in *English*. (Stark, Texas) Has news 1530 and 1630. (Beck, N. Y.)

Moscow, 15.140 (measured), heard with news 0710. (Ferguson, N. C.) I find this one lately to be parallel 15.34 with program (*English*) to the Far East and Asia around 0700-0800.

Dilg, Calif., has noted a Soviet transmitter on 6.115 to Far East, opening 0845 in oriental languages.

Venezuela—New callsign of Maracaibo, 4.800, is YVMG, and on m.w., YVMN; signs off 2330 and returns 0615; YVOA is believed to be new call for 4.830 outlet of San Cristobal, *"La Voz del Tachira,"* heard 2100-2130 sign-off. (McPheeters, La.)

* * *

Last Minute Tips

By this time the *new* 100 kw. shortwave transmitter of *Radio Indonesia,* Batavia, Java, should be in operation. Look for this one on 15.150 during the *English* period 0600-0700. (Gaynor, Calif.)

Radio Eireann has been given the green light to complete construction of its high-powered short-wave transmitter. Work was suspended about a year ago. Arrangements are being made to provide experimental short-wave transmissions to the U.S.-Canada within a few months. If the first broadcasts prove successful, the transmissions will no doubt be extended later to include listeners in other parts of the world. (Patrick, England.) *Watch for this one on 17.840 and/or 9.595!*

At the time this was compiled, I had no information that the long-projected Fernando Po (Spanish) station (off African West Coast) had started to test. *Any information on this one will be welcomed!*

Radio Monte Carlo, Monaco, advises that the 7.350 channel was an experimental one and was discontinued on

May 15; over-all schedules on both 9.785 and 6.035 are 0100-0300, 0600-0800, 1300-1715; m.w. outlet is 959 kc. (Kary, Pa.)

British listeners report that programs in *English* from Warsaw, Poland, are transmitted on 9.530 daily except Thursdays and Sundays at 1830-1850; 9.215 is used on Thursdays, Saturdays, Sundays. (Swedish DX broadcast) *Can anyone confirm use of 9.530?*

Bangkok, Thailand, is now using 11.650 in parallel with 6.010 for two daily transmissions—0500-0630 and 0700 to around 1030. The first period carries news 0515, 0615. The second broadcast actually opens 0659 with chimes, followed by announcement in Thai, which language is used for this entire second transmission. Bangkok has been testing more recently on 7.105 in parallel with 11.650, 6.010. (DeSouza, Singapore) A UP dispatch from Bangkok states that Siam again has become Thailand ("The Land of the Free"). (Hankins, Pa.)

DeSouza, Singapore, informs me via airmail that the "unknown" Chinese outlet on 7.025, first reported some time ago by Gillett, South Australia, announces as BYA; identification is given every 15 minutes after chimes of the two notes. Schedule is around 0700-1130. Programs include Chinese 0700-0915; Indian languages 0915-0930; Chinese 0930-1015; French 1015-1030; popular Western music 1030-1115, and Chinese 1115-1130. Closing announcements are in Chinese and French. Location is not yet known.

Radio Pakistan, Dacca, has been heard testing on 17.835, apparently is using this channel around 2230-0430. (*Radio Australia*)

CR7BJ, 9.65, Lourenco Marques, Mozambique, noted back on the air 0000-0100 in Portuguese, improved signal. (Balbi, Calif.)

Former XGOY, 11.913, Chungking, at the time this was compiled was still being heard with poor to fair signals, through bad QRM, to 1145. (Balbi, Calif.) Has news 0800 now, in parallel with 7.100. (Fellers, Japan)

Latest North American Service listing of BBC is GSI, 15.26, 0600-0800; GSG, 17.79, 0800-0900, 0915-1115, 1200-1545; GSF, 15.14, 1445-2015; GWH, 11.80, 1615-2200; GRH, 9.825, 2000-2215; GSF, 15.14, 1615-1845, and GSB, 9.51, 1845-2215, especially for West Coast.

Radio Pontianak, 8.090.5 (measured), Indonesia, noted 0818-0838 sign-off; fair signal; *Radio Indonesia,* 10.367.5 (measured), Batavia, fair signal 0845-1008 sign-off; YDQ-3, 11.-085.5 (measured), *Radio Makassar,* Celebes, fair signal through CWQRM, 0831-0850. (Huse, Wn.)

Swedes report ZNB, 5.900, Mafeking, Bechuanaland, is being heard frequently now in Sweden around 1300 although it operates before and after that hour; station says it appreciates reports and will reply via airmail. (Swedish DX broadcast)

YI5KG, 7.092, Baghdad, Iraq, is re-

ported heard in Sweden with music 1330. (GDX-aren, Sweden)

Paris has been in the process of revising its schedules and is expected soon to resume its second daily broadcast to North America (probably around 2100-2130 on 9.55, 11.700); at last report, the only daily program for North America was on these channels around 1845-1900. Reports may be sent to the French Broadcasting System in North America, 934 Fifth Avenue, New York 21, New York, and will be forwarded promptly to Paris for verification. (Leinbach, N.Y.)

Huse, Wn., has noted a Chinese station on measured 11.795.5 at 0830 carrying the *English* news from Communist-controlled outlets.

One of the best Indonesians on the West Coast this summer is the 11.770 Batavia channel; has a "real sock" with oriental music around 0915, French 1000. (Dilg, Calif.)

QRA of *Radio Moscow* now is given as *Radio Moscow*, Listeners Letters Department, Box 787, Moscow, USSR. Asks for further reports. (Dallemier, N.Y.)

The 17.84 channel of Post National Francais, *Radio Brazzaville*, signs off the European transmission 1700; does *not* return with the NA transmission 1705 which beam is carried over 11.792, 9.440, and possibly others.

Dallmeier, N.Y., has received summer schedules from Leipzig, 9.730; opens daily 2300 *except* Friday when opens 2200; closes 1800 on Sundays, Wednesdays; 1700 on Mondays, Tuesdays, Thursdays, Fridays, and runs to 2000 on Saturdays.

OZH-2, 15.165, Copenhagen, Denmark, beams a program to Latin America 2000-2100 on Mondays, Wednesdays, Fridays. The tuning signal used by Copenhagen is a theme taken from "The Mothers" by Carl Nielsen; the piece played at closedown is *not* the Danish National Anthem. The North American transmission daily from OZF, 9.52, is now at 2100-2230. (Worris, N.Y.)

Radio Nederland, Hilversum, Holland, has again changed the instrument used in playing its tuning signal "Merck togh hoe sterck" (Old Dutch for "See How Strong"); at present it is using a carillon which sounds just like the famous one at the Rainbow Bridge in Niagara Falls, Ontario, Canada. (Worris, N.Y.)

Radio Andorra; 5.980, heard 1300 in England and elsewhere. Announces in both French and Spanish. (Staples.)

Lisbon noted on 15.16 at 1523 when had news in Portuguese, read by man. Damascus, 12.00, Syria, heard 1345-1400 with news. (Staples, England.)

Radio Australia is now using VLA8, 11.76 (replacing VLA5, 15.23) in the daily "evening" East Coast beam 1643-1800 (to only 1755 Saturdays).

Acknowledgement

Many thanks for the FB reports; sorry that during the summer, due to space limitation, all reports could not be used in full.....K.R.B.

What's New in Radio

(*Continued from page 82*)

areas, concentrating the signal from the transmitter and discriminating against signals, interference and reception from all directions except the one desired.

AUTO RADIO TOOL

Still another of the contest winner gadgets for radio service technicians being manufactured by *Hytron Radio & Electronics Corp.*, of Salem, Mass., is the auto radio tool, which will fit over 90% of universal sets.

Much better than a screwdriver to tune the radio after disconnecting the

control cables, the *Hytron* aid slips easily into control fittings and can turn the set on or off, tune, adjust volume and tone, and realign to the dial. The square tip fits splines, and the slotted tip at the other end is V-shaped for different thicknesses of spade and similar key fittings.

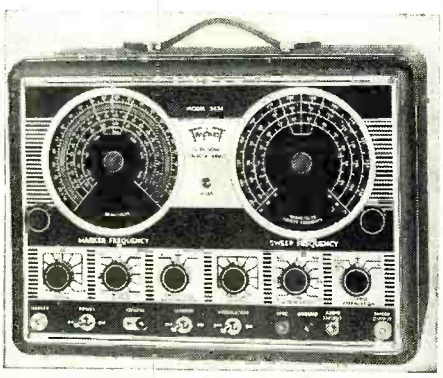
The tool is in one piece, of bright, zinc, plated steel, with a hexagon handle to prevent its rolling off the bench.

TV-FM SWEEP GENERATOR

A TV-FM sweep generator, Model 3434, is being manufactured by *The Triplett Electrical Instrument Co.*, Bluffton, Ohio, with a large marker dial mirrored for easy reading.

Continuous tuning is provided over all TV and FM bands and continuous ranges to 240 mc. cover all TV carrier and i.f. frequencies. Sweep width is 0-12 mc. (continuously variable).

Two built-in markers in the unit can be used simultaneously: 19.5—40 mc. for i.f., 57—240 mc. for r.f. and oscilla-



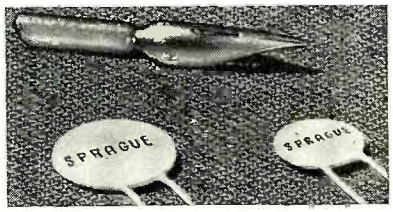
tor. Stability is increased by use of ceramic trimmers, zero temperature coefficient condensers, silver plated coils and critical r.f. conductors, and copper plated steel construction.

SMALL DISC CERAMIC CONDENSERS

Newest products of the *Sprague Electric Company*, North Adams, Mass., are tiny, wafer-thin disc ceramic condensers which not only save chassis space but reduce assembly

time and improve receiver performance.

Consisting of a half-dime or dime-



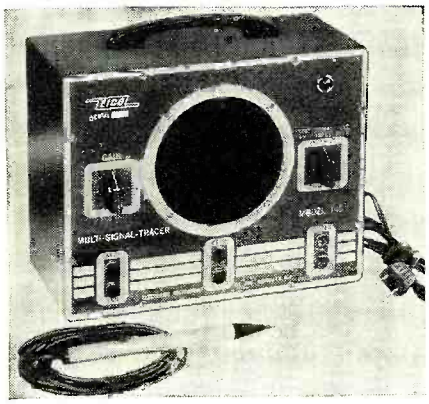
sized ceramic plate of extremely high dielectric constant with silvered electrodes fired on both disc faces, the condensers are coated with a tough, moisture-resistant insulating resin.

They are available in ratings up to .01 or 2×.004 μfd., 500 volts d.c. working.

MULTI-SIGNAL TRACER

A versatile test instrument is the new EICO Model 145 multi-signal tracer, designed for audible tracing of r.f., i.f., FM, audio, and video circuits. It has a self-contained test speaker that may be used for either amplifier or speaker testing. The high-gain signal tracer may also be used as an emergency or substitute amplifier.

Model 145 follows the signal from



the antenna through the speaker of the receiver. Frequency response is well over 200 mc., and the unit operates on 110-125 volts, 60 cycle a.c.

Manufactured by *Electronic Instrument Co., Inc.,* 276 Newport Street, Brooklyn 12, N. Y., the Model 145 comes supplied with EICO P76 high-frequency probe, isolation transformer, and all necessary tubes and parts.

MOBILE RADIOTELEPHONE

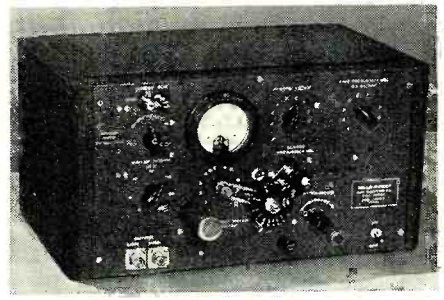
A new unit, called the FT-145-10, complying fully with new rules and regulations of the FCC that specify a higher degree of performance for mobile equipment, has been manufactured by *Federal Telephone and Radio Corporation,* 100 Kingsland Road, Clifton, N. J. It has a power output of 10 watts at any frequency in the 152-162 mc. band.

Although it is not required under the new regulations until July 1, 1950, modulation limiting has been built into the *Federal* unit as an integral part of the circuit and prevents interference due to over-deviation that causes "spill-over" from the operating channel to adjacent channels.

The small size of the unit, with its low cost, will probably make it widely used not only in the mobile communications field, but in many new industries where mobile facilities were impracticable, although desirable.

CALIBRATED MEGA-SWEEP

Kay Electric Company, Pine Brook New Jersey, has produced a new Mega-Sweep which makes it possible to tune with a single knob over the



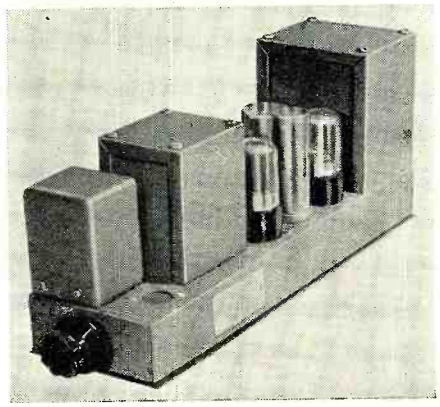
entire frequency range, approximately 50 kc. to 100 mc.

That feature has been added to the company's sweep oscillator providing it with greater speed and simplicity of operation. It is possible to tune without re-peaking the klystron beat frequency oscillators. An indicating dial also is included which shows the center frequency of the sweep to within the accuracy of the sweep width.

ADC TYPE 71 AMPLIFIERS

Audio Development Company, 2833 13th Avenue, South, Minneapolis, Minn., has introduced a new series of four high fidelity, 8-watt amplifiers designed for use in radio and television broadcasting studios, wired music applications, recording studios, and similar installations.

These amplifiers may be used in either a console or rack, and plug-in connections permit rapid exchange of units for servicing or terminal impedance change. All in this series have a power output of 8 watts with nominal distortion of not more than 2 per-cent at any frequency between 50 and



12,000 cycles. Response is flat within ½ decibel over the same range.

Over-all dimensions are 3¾ by 16 by 6⅞ inches, and the net weight is 11½ pounds.

—30—

Within the Industry

(Continued from page 26)

ticing in Florida and in North Carolina. He is a member of Phi Beta Kappa and Kappa Alpha.

* * *

JOHN REINARTZ has recently been added to the staff of *Eitel-McCullough, Inc.'s* field engineering department to assist in directing the application of *Eimac* tubes for amateur use.

Formerly acting as technical expert with *RCA*, he numbers among his accomplishments, the design of the "Reinartz Tuner," a published work on "Reflection Theory of Short-Waves," communications work with the Byrd Arctic Expedition in 1925, and the establishment of over twenty patents covering new circuitry.

Mr. Reinartz, a captain in the USNR, served seven years with the Navy before returning to inactive duty. Memberships include the Explorers Club of N. Y., the Naval Institute, IRE Senior Membership, and the ARRL.

* * *

WILLIAM J. MORELAND, JR. is the recently appointed vice-president in charge of manufacturing at the Glendora, Calif., firm of *Conrac, Inc.*, manufacturer of TV receivers.

Possessing an extensive background in the electronic field, Mr. Moreland was until recently the head of development engineering for the *Altec Lansing Corp.*

* * *

P. R. MALLORY & CO., INC., of Indianapolis, Indiana, has opened a new branch office in Los Angeles, at 1338 South Lorena Street, which will be under the direction of Mr. J. E. Templeton. The branch will serve *Mallory* customers in Southern California and Arizona, an area previously covered by the *Henger-Seltzer Company.*

Mr. Ray F. Sparrow, vice-president in charge of *Mallory* sales, explained that in view of the highly technical nature of the company's business, it was only logical that it would desire to establish its own office from which to supply the necessary engineering and application services needed.

* * *

JENSEN MANUFACTURING COMPANY, a subsidiary of *The Muter Company,* has purchased *Radio Speakers, Inc.,* formerly owned by *Emerson Radio & Phonograph Corporation.* A new trade name will be selected for the products manufactured by *Radio Speakers.*

According to a spokesman for *Jensen,* the acquisition was made for the purpose of expanding the company's operation to an increased production of loudspeakers more commonly used in radio receivers and television sets than those previously identified with the *Jensen* name. —30—

Television Servicing

(*Continued from page 47*)

ed lead grounded at both oscilloscope and generator ends. It is often recommended that a steel plate be used as a bench top for TV service to aid in properly grounding the instrument. In this case, the rubber feet should be removed from the generator and oscilloscope.

A check of proper grounding can be done after the set-up is made, by touching each instrument. If the trace jumps, additional grounds between instruments are desirable.

The next important step is to stop the television receiver's own oscillator from operating, either by removal of the oscillator tube or by disconnection of the "B +" to this stage. This step is necessary as, otherwise, the generator will beat with the oscillator and create many confusing traces.

An oscilloscope (which for alignment purposes need not have a response beyond 20,000 cycles and gain of more than ½ volt-per-inch) is connected with the picture detector output to the vertical input, and the horizontal sweep output of the sweep generator is connected to the horizontal input terminal, with the horizontal switch set to horizontal input.

Output of the sweep generator is fed into the input of the first i.f. stage. If d.c. voltage is present, the connection should be made through an .001 μfd. mica or ceramic condenser.

Sweep width should be advanced to 10 mc. and the oscilloscope gain controls advanced to give an adequate trace.

Sweep generator center frequency control can be adjusted until the trace is properly centered on the oscilloscope screen.

Marker amplitude control is advanced until a "V" shaped pip appears in the trace. By turning the marker frequency control, this pip can be moved directly through the trace to locate any desired frequency point. As the marker is absorbing the signal output, it will give indication only in the portion of the trace increased by the amplifier under alignment and will not appear in the base line. Too high a marker amplitude setting will attenuate the entire trace. Trace on the oscilloscope will appear as a pair until the phase control is properly adjusted to obtain one trace.

The over-all bandwidth of the amplifier can be measured by noting the frequency at each end of the amplified trace and subtracting one frequency from the other. Sweep width can be reduced until the trace covers only the amplified portion and the oscilloscope controls are adjusted for largest trace to give maximum clarity. As there is an interaction between the sweep width and the phasing, the phase control should be readjusted for single trace each time a different setting of sweep width is made, and a trace simi-

lar to the one shown should be obtained.

In all instances, the manufacturer's instructions for the television receiver in question should be consulted as, at the present time, no standardized procedure has been adopted.

Unless the service technician has good reason to suspect maladjustment, r.f. and oscillator sections should not be adjusted. Response of each channel can be checked, however, by feeding the frequency modulated signal into the antenna terminal. On some receivers, improved results are obtained if the output terminals of the generator are shunted with a 100-ohm resistor.

Sound traps can be adjusted audibly by turning the sweep width control to zero and switching on the AM modulation. A signal tracer connected to the picture detector can be used to amplify the audio note. —30—

WASHINGTON CALLING

OPERATORS of emergency repair streetcars of the *Capital Transit Company's* service in Washington, D.C., will no longer be candidates for padded cells, an occupational hazard for the past four years.

The thirty cars comprising the service are operated at the beck and call of a chief dispatcher through a two-way radio circuit which, prior to the summer of 1949, was on a wavelength of 31.46 megacycles. Operators, rolling the trolleys along, would suddenly get directions to highball to non-existent streets.

After four years of such bewildering instructions, *Capital Transit* officials discovered that the same wavelength served power companies on the West Coast, among them the *California Edison Company* and the *San Diego Light and Power Company*. Instructions given trolley service operators on lines owned by such companies were being received in the nation's capital! San Diego signals, ordinarily efficient only over a 25-mile radius from a 250-watt broadcasting station, bounced off a California hill into the stratosphere to be carried to the ears of the dazed Washington operators. Even San Antonio, Texas, came into the picture!

Brotherhood in emergency was exemplified early in 1948 when a *Capital Transit* trolleyman received the call of a radio car of the *San Antonio Power Company* which was trying desperately to reach its headquarters to order disconnection of high-tension lines at the scene of a large fire.

So urgent was the San Antonio message that the Washington operator relayed it to his dispatcher who, in turn, immediately called the *San Antonio Power Company* authorities with the message, thereby preventing further untold fire loss.

But for four years, other than this incident, the orders being received were just plain screwy, until recently when the *Capital* wavelength was changed to 31.14 mc. Now the Washington trolleymen talk only to the chief dispatcher and to each other instead of muttering dazedly to themselves as when they careened along Pennsylvania Avenue searching for cars stranded on canyon rims that existed only in California.

. . . . . J. L. H.

MARS Station of the Month

THE Air Force laurels for "The MARS Station of the Month" go to W1LUU aerial mobile and Captain Charles C. Mouckerezi (pronounced McKersey, and the handle is Charley), who operates his ham shack high in the sky; TVI is just something he reads about in radio magazines.

Charley has been a v.h.f. enthusiast since 1937, when he first installed 112 megacycle gear in his automobile, and he carried on consistently until December 7, 1941. He started post-war operation right after VJ day, again on 2-meter mobile, until one day when the surplus SCR522's hit the market. He latched on to one of them, modifying the BC624 receiver portion to tune continuously over the 144-148 megacycle amateur bands, and he was in like Flynn.

Since Charley is an airplane driver with 2000 hours under his belt, and is stationed at Mitchell Air Force Base where he is assistant director of MARS for the Continental Air Command, he gets in many hours of aerial mobile operation every month.

As soon as he clears the traffic patter, he turns on his ARC-3 and puts out a shout with the call William One Love Uncle Uncle aerial mobile; the session is on and doesn't end until he asks for landing instructions at his destination. If the flight is. in the morning or early afternoon, it results in a rag chew that may go on for over an hour; but if it is at night or late evening, then it turns into a rat race with layer after layer of 2-meter men lined up for their first QSO with an aerial mobile.

About the longest QSO that Charley remembers is one he had with W2JTP whose QTH is Mitchell Gardens, Long Island. Charley left Mitchell Field in an F-51 and was. in contact with W2JTP less than two minutes after he was airborne and kept it solid until he was over Blackstone, Virginia, at 30,000 feet, an hour and 45 minutes later. Receiver trouble prevented what might have been a record rag chew if not DX.

The best DX Charley recalls was with a W4 in Smyrna, Tennessee, when he was just entering the traffic pattern at Mitchell, which is a little better than 400 air line miles.

Most contacts per minute were rolled up one evening when Charley was flying in the New York area and logged 23 brief QSO's in 30 minutes. DX under these conditions is out of the question, since signals are six layers deep in every portion of the band. He works the loudest first and then down through, but he never gets to the weak DX man before some local zeros on the present QSO frequency.

Charley makes scrupulous observance of AF Regs and FCC rules which is no small amount of trouble. FCC Rule 12-94 forbids the use of installed equipment in ship or airplane for operation in the amateur spectrum. Charley has his control cables and coax cut and coiled so that his personal ARC-3 and BC624 receiver can be installed in any of Uncle Sugar's

Captain Charles C. Mouckerezi, assistant director of MARS for the Continental Air Command preflights his BC-624 receiver before taking off. He has modified the BC-624 to tune continuously through the amateur 2-meter band.

Charley slips in his pet crystal for spot frequency aerial mobile operation with his personal crystal controlled ARC-3. Captain Charley has logged more than 1000 aerial mobile QSO's on two meters. New call is W2BRJ.

flying machines in a moment. His 2-meter gear is just as adaptable to an F-51 as it is in a Charley 45 or Charley 47, and it is kept in readiness for installation in any available aircraft for airborne operation to cover any emergency, flood, or disaster where coordination of ground parties is essential.

While it is not required that the pilot monitor the Airways v.h.f. channels after clearing the flight pattern on VFR flight, Charley uses a split headset with one ear cocked for 2-meter CQ's and the other bent toward Channel C of the installed ARC-3.

Charley got his first ticket in 1933 as W1LUU and has held it continuously until July 14, 1949, when he received his modified call, W2BRJ. He has done a lot of brass pounding on 40- and 80-meter c.w., and he fills a regular trick on the c.w. nets at K2AIR at Headquarters Continental Air Command. He has been checked out in F-38's, F-39's, F-40's, F-47's, F-51's, F-84's, B-26's, B-25's, C-45's, and C-47's and has 33 combat hours to his credit.

So, now, when you hear a new call, W2BRJ on 2-meter aerial mobile, you can't mistake that old familiar voice or forget that the handle is Charley of ex-W1LUU. —30—

TYPEWRITER CUSHION

HARRY C. AICHNER, JR.

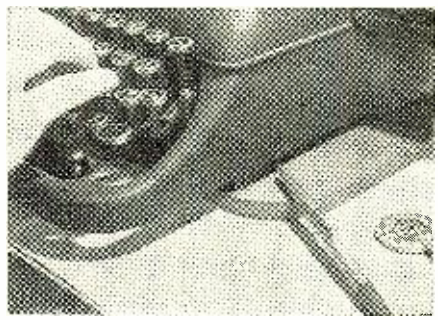
IF YOU are a ham and copy much of your c.w. "on the mill," the clackety-clack sound of a typewriter going full blast can be most annoying. Most fellows usually resign themselves to the idea that it's a necessary evil and let it go at that. But YOU CAN do something about it!

Most department stores carry an item called a "sponge rubber kneeling pad," which sells for no more than 49 cents. And that's the secret! Just slip the pad under the feet of your typewriter, and type away in comparative silence (see Fig. 1).

Although the rubber pad is a good investment in any situation, it's most effective if you're using your machine on a regular metal typewriter stand—for some reason these stands seem to double the actual noise made by the typewriter.

Be sure the pad you buy is large enough to support all four typewriter feet; the minimum size varies with different makes and models of typewriters. And if the price is bothering you, just remember that most nerve tonics cost every bit as much, or more! —30—

Fig. 1.



Mac's Service Shop

(*Continued from page 48*)

"Well, their filter condensers do not last very long, it seems to me."

"That's true in a lot of cases," Mac agreed, "but you can usually spot the reason. Quite often it is poor design. The filter condenser will be jammed up against a hot resistor, rectifier, or output tube, and the moisture will be literally baked out of it because the temperature rating of the condenser manufacturer is greatly exceeded. Another common fault is to mount a filter condenser in a spring clip with too-tight jaws. As the wax of the condenser container is softened by heat, these spring jaws sometimes pinch the condenser nearly in half, causing various kinds of damage to the foil, oxide coating, and connecting tabs."

"What's the cure?"

"Always mount a replacement condenser in as cool a spot as you can find. This usually means at the bottom of the receiver chassis and as far away from the heat-radiating elements as possible. Make sure the condenser is mounted securely in place, but also make sure that it is not gripped by any clamp that will distort its form. See that the set has all of the ventilation you can give it without actually baring any portions of the 'hot' chassis to possible contact with the owner's hands."

"Well," Barney thoughtfully conceded, "when everything is taken into account, perhaps the a.c.-d.c. set does a pretty good job after all. Such sets are comparatively cheap to purchase, and most of them see lots of action without receiving too gentle usage. I suppose, though, that they are on their way out now that television is here."

"Never think it!" Mac said as he picked up a service sheet he had been reading. "Here is some dope on a new TV receiver using an improved voltage-doubling, transformerless type of power supply with the receiver tube filaments connected in series strings. The voltage-doubling circuit yields all of the "B" voltage needed, and a new type of resistor, called the "Globar," is used in series with each string of filaments to remove the curse of the high initial surge of current.

"A globar resistor has a negative resistance characteristic that is just the opposite of that of a tube filament. Its resistance is highest when it is cold. As it warms up, its resistance will decrease to less than one-fifth of its cold value. That means that the current through the filaments of a string of tubes in series with such a resistor will remain practically constant during the complete warm-up cycle. Such a system is actually easier on the filaments than heating them with a transformer."

After a little pause, Mac summed up what he had been thinking:

"I think the root of the whole mat-

ter is that the a.c.-d.c. circuit was first employed in an attempt to make a cheap receiver, and gradually the term 'a.c.-d.c.' came to be used as a synonym for cheap construction and pinch-penny engineering. This really does an injustice to the transformerless type of circiut, because with modern tubes, selenium rectifiers, Globar resistors, etc., you can do just about anything with this type of circuit that you can do with one employing a transformer, and you can usually do it on a smaller chassis, with less weight, and at a lower cost. Communication receiver engineers have proved that. Furthermore—"

"Say no more!" Barney interrupted with an upraised hand. "Let the defense rest. Its case is won. From now on, I would no more think of saying anything against an a.c.-d.c. set than I would of criticizing Margie's appearance in a sun suit; and *that* is just as near perfection as you will find anywhere!"

—30—

Antenna Switching

(*Continued from page 43*)

channel. The inside view of the control box shows the two r.f. chokes which isolate the secondary of the power transformer from the incoming signal. The blocking condensers which prevent the flow of 60-cycle a.c. into the receiver input terminals are also visible in the photograph.

Where single-channel antennas are used, properly cut quarter-wave stubs can be connected to the transmission line terminals. These stubs cut down off-channel response to a remarkable degree, thus reducing all types of off-channel interference.

Other photographs show the antenna switch with the cover removed and a bottom view of the switch showing the terminal arrangement. The two terminals fitted with lugs connect to the transmission line, and the two wires from each antenna connect to one terminal in the inside ring of contacts, and one terminal in the outside ring of contacts that lie along the same radius.

The design of the antenna switch presented many problems. One, of course, is mechanical reliability, and the second is resistance to corrosion. In order to avoid trouble from condensation inside the switch box, it is necessary to provide "breather holes" in the bakelite contact plate. If this is not done, the switch box can collect a surprising amount of water in humid weather.

The admission of air with various amounts of water and vapor content makes corrosion-proof construction mandatory. For this reason the relay coil must be impregnated, and all metallic surfaces must be plated. In order to maintain maximum electrical efficiency, the switch contacts, switch arms, and collector rings are silver plated

The photograph shows the blocking condensers which prevent a short on the line from a 60-cycle standpoint as well as the r.f. chokes which keep the signal out of the stepper relay winding. The blocking condensers are connected to the two concentric slip rings. Contact between these two rings and the two sets of concentric contacts is made by the two silver plated beryllium copper switch arms. These arms are mounted on a bakelite strip which is rotated step by step as the relay actuates the ratchet.

It is not absolutely necessary to use individual antennas on each channel, although this is the ideal situation from a technical standpoint. For example: Channels 2 and 4, or 4 and 5, can be received well on a broadband type antenna in many locations. This, of course, cuts down the number of antennas on the roof which reduces costs and improves the appearance of the installation. However, there are many locations that will require three or four antennas for the proper reception of seven v.h.f. channels. Looking ahead to u.h.f. television, it is obvious that several specialized antennas will be required for the reception of these new stations. The Select-O-Vision switching system anticipates this need with its ability to switch in a total of twelve different antennas.

Another application of this system is in the radio amateur field. The Select-O-Vision switch will handle an output power of 250 watts without difficulty. The radio amateur can put up a large number of transmitting or receiving antennas on the 28, 50, 144, and 235 mc. bands and obtain the same freedom from a bundle of transmission lines that the system provides for television reception.

—30—

NEAT AND PERMANENT LABELING

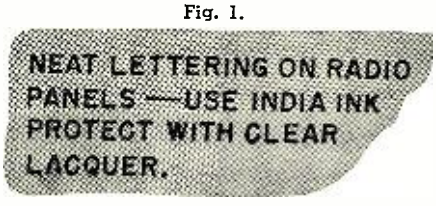
By
LEON G. WILDE

RADIO equipment panels may be lettered neatly and permanently by means of india ink and a commerical lettering guide.

First sand the panel smooth with fine sandpaper and spray it with a lacquer of the desired color. An insecticide gun will do nicely, provided the lacquer is thinned slightly. When the lacquer is dry, apply the letters in india ink, using the lettering guide. After the ink, in turn, has dried thoroughly, the lettering is protected by a coat of clear lacquer.

It has been found that lettering done with a 324-1C template, a 3237-1 scriber, and 3233 pen is very satisfactory, the Keuffel & Esser Leroy guide being the one chosen in this instance. (See Fig. 1)

Fig. 1.



The TV Antenna

(*Continued from page 70*)

be a contour in which the signal strength is 200 microvolts-per-meter, or higher. This contour depends upon a number of factors which include the power of the transmitter, the height of the transmitting antenna, the topography of the land, the effect of shielding by buildings and other structures, and the height of the receiving antenna.

Television reception at points beyond the radio horizon (see Fig. 3) is not reliable, and for this reason many of the television manufacturers have restricted the sale of television receivers to areas in which reliable performance can be anticipated. However, the competitive nature of the radio business, as well as the intense public interest in television, is resulting in the sale of receivers in localities beyond the defined service area of transmitters. The Federal Communications Commission has granted higher power licenses to "rural stations" for service areas larger than metropolitan coverage. Long distance reception is being attempted with these stations.

The radio service technician should realize that operation in these fringe areas cannot be guaranteed and is subject to the vagaries of transmission due to weather conditions and other effects, not completely understood. Extensive experimentation is being conducted in fringe areas and the following suggestions are offered for the experimentally minded technician who wishes to obtain the best possible reception in such a fringe area:

1. Highly efficient antenna structures, such as four and five element arrays (see Fig. 20), will assist in increasing the signal pick-up. Such arrays are used primarily for a single channel reception as they are essentially narrow-band devices.

2. As shown in the nomograph of Fig. 3, Part 1, the radio horizon is increased by additional height at the receiving location. Towers for this purpose are commercially available. Representative types are shown in Fig. 21.

3. Television boosters can provide additional r.f. gain. There are many commercial types available.

Care should be exercised to insure a sufficiently wide band for reception of the channel. The addition of the selectivity of a "booster" to that of the multi-element array may harm the quality of the received picture. The bandwidth may be restricted to such an extent that the sound channel suffers from attenuation or that picture quality is impaired.

(EDITOR'S NOTE: *Material contained in this article has been taken from Chapter 12 of the Howard W. Sams & Co., Inc., book, "PHOTOFACT Television Course."*)

—30—

LETTERS *from our readers*

A FOLLOW-UP

"WITH reference to the reprint of my original letter in the April issue of RADIO & TELEVISION NEWS, I feel you will be interested in the requests I have received for my "scaled down version" of Taylor's Super-Modulation. I wrote to him, and have modified my original version according to his suggestions, passing the ideas along to those who have written me. The requests have come from Wyoming, Texas, Indiana, Michigan, and Canada.

"In his letter to me, Mr. Taylor mentioned the preparation of an article on a low-powered Super-Modulated Transmitter. It can't be published too soon judging from the interest which his original article developed. I assume RADIO & TELEVISION NEWS will run it.

"The following amateur stations are using or building Taylor Super-Modulation rigs to my knowledge: W1QIU, W1DRL, W3BOL, W4MIP, W6CBU. This does not include the fellows who have written to me.

"I have been running 70 watts to my 807's in T.S.M., and contacts with W5, W7, W4, Wϕ, while not phenomenal, show definite promise, especially as they have been made during weekend daylight hours. And ten meters can sure be busy when it wants to. Quality reports have been excellent.

"I'm definitely sold on Mr. Taylor's system. The ability to operate your modulated final stage at c.w. rating, and the ridiculous amount of audio power required, is very satisfying as well as economical. It means that a smaller tube may be used to provide a modulated carrier level usually associated with a larger power tube. And this with 100% amplitude modulation.

"Thank you again for your help and encouragement."

John K. McCord, W1BIJ
48 Franklin St.
Medford, Mass.

You won't mind our publishing your letter again, will you, John? Maybe other readers would be interested in seeing how things turned out.

* * *

SIGNAL TRACING SPEEDED UP

"EVERY time I read an article on signal tracing, I am burned up, for, invariably, the writer hasn't the slightest idea how to use the equipment.

"Your article in the April issue is a good example. Having written that one should go tediously and painstakingly from the loudspeaker to the antenna, step by step, they write another reversing the direction; but with no more sense.

"My business card says 'Service While You Wait.' It means precisely that; repairs done in the presence of the customer, and done fast. How do I work? By a combination of test equipment, finger tests, observation and judicious tapping. Some jobs require no signal tracing. Others are made a matter of minutes with the aid of a tracer.

"Good sense will tell anyone that the way to locate an unknown point of defect is not to go plodding from front to back (or back to front) but to use simple arithmetic. Divide your radio in half, then again by half, and so on to the exact trouble.

"The half-way point is the second detector. Test for the presence of r.f. voltage (at i.f. frequency); how much signal is present. Test for the audio. The most convenient point for all this is the top of the volume control—and at the same point, a finger test will tell you whether, and approximately how well, the audio amplifier and loudspeaker are working.

"Very often a serviceman has to repair more than one defect in the same set. By signal tracing (backed up by his volt-ohmmeter and his eyes and ears), he can locate and repair several troubles at the same time. The tube tester, for the most part, is not used. Alignment becomes a snap with the tracer. I practically never turn on my signal generator; local stations provide far better signal, and weak stations serve for peaking trimmers.

"FM can also be serviced by an adaptation of the above methods. In television, signal tracing becomes automatic by the simple procedures everyone uses, observing the kinescope to determine the general nature of the defect, or defects.

"If you feel I have criticized too severely, let me say that my annoyance on this subject started during the war. If we had used the method prescribed by the Army manual, the Nazis would have won, while we servicemen in uniform strove to keep our equipment in operation."

John D. Burke
Jack's Radio Service,
168-08 90th Ave.
Jamaica, N. Y.

These are the types of letters we like. No, we don't mind your suggestions, nor do the authors, as long as they are helpful.

* * *

THE CASE FOR HIGHER SPEED

"THE views of C. D. Flynn appearing on Page 124 of the June issue of RADIO & TELEVISION NEWS, regarding the reduction of the code speed are not unfamiliar. There is no

line of human endeavor in which the requirements do not become constantly more severe. Lifting the bars is invariably a sign of decadence. Believing that ham radio is not decadent, I welcome a stiffening of the regulations and higher grades of licenses. I, for one, am always looking for more fields to conquer.

"At one time the code speed was ten w.p.m., but when it was raised to thirteen, probably ten times as many hams passed the higher speed test.

"As a believer in the vigor of America, I welcome stiffer requirements as it will result in more competent and versatile members, and I, personally, will qualify myself for the new regulations."

Bill Case, W5FNA
122 West White Ave.
San Antonio 4, Texas

* * *

ABOUT TVI

"YOUR June, 1949, Editorial, 'Public Entitled to TVI Control,' hit the nail on the head. As both an amateur and TV set owner, I am fully acquainted with the problem of TV interference. Due to the general public's lack of knowledge about the workings of television, the ham is in many cases unjustly blamed for much interference.

"It would be a wise and beneficial move for the television industry to educate the public on this subject. But why stop at auto ignition interference? Household articles of every description are responsible for much TVI, and they are at times even more objectionable due to their closer proximity to the TV set.

"A filter placed at the source of the interference is usually quite effective. If any action is taken, however, it should not be directed against one source, but rather against all sources of interference."

B. Kasmir, W2VBX
2013 Bryant Avenue
Bronx 60, N. Y.

* * *

CQ MANILA

"WITH regard to your ham contest, American would-be amateurs sure are lucky. I wish we in the Philippines who are radio-bug bitten were given the same opportunities. Maybe if our country weren't given independence so soon, your ham contest would include us here. As it is now, in my case, I am left to my own devices with no interested ham clubs to turn to.

"'My own devices' means trying to learn the code by myself. Result: I can send at thirty w.p.m. but cannot receive or decipher what comes dot-dashing occasionally in the short-wave bands. A very expensive dilemma I must say, 'cause I may have to learn via the automatic-code-teacher way.

"Before the war I had some pen pals in the States, but now have lost track of them. When the GI's were here in the Islands, Tacloban and Guiuan in particular, I struck up acquaintances with them, but never was I lucky

enough to meet the radio fellows. They operated station WVTK, first in Tacloban, then later in Guiuan, Samar. That was a long time ago. Perhaps those boys are home now, and with their own stations, no doubt. Some day when I will be able to call *CQ*, I hope to work some of them, wherever they may be. In the meantime, it would be mighty interesting if correspondence could start between us. I enjoy writing and am an avid radio enthusiast. Maybe those fellows could help me with a few pointers. I will be very glad indeed to have pen pals again Stateside."

Orlando A. Badillo
San Fernando
Masbate, Philippines

* * *

"DISTURBANCE TESTING"

"AFTER reading the July issue of your magazine, I would like to comment on an article written by Mr. Cyrus Glickstein, called 'Disturbance Testing.'

"I think that this is one of the best that I have read so far. It will do more for the general run of service technicians than all the oscilloscopes in the country.

"The way that it is written makes it seem very simple, and it is; for common sense has located the trouble faster than the time taken to set up a signal generator, pip marker, and scope. I would not doubt for a moment that Mr. Glickstein will have a hoard of letters poured his way condemning him for the old standby of the screwdriver tinkerer.

"Well, I have said my piece and will stick by it, and state that I got my three-year subscription fee back, and more, after I read 'Disturbance Testing.'"

Jack P. Golden
Golden's Radio Service
28 S. Main St.
Portville, N. Y.

* * *

IRELAND SPEAKS

"I HAVE been a reader of your very valuable periodical. I can find no words to praise the simple methods of approach your many writers use in dealing with difficult phenomena. Such people are a great credit to the U. S. A. The point that amazes me most of all is that your writers never seem to put long strings of letters after their names (I am sure many of your writers must have several degrees).

"It has always been my wish to go to America, and I would like to receive some information concerning the possibility of employment with some manufacturer in the U. S. A. I am a fully trained radioman, and there is very limited scope for such people here. Any endeavors you may put forth for me would be considered a great favor, never to be forgotten."

James Levens
Newtown, Queensboro
Drogheda, County Louth, Ireland

—30—

Signal Tracer

(*Continued from page* 51)

box. In this way, the meter is connected only when the button is depressed, so that if care is taken, no damage will result even if the meter should throw off-scale. The variable resistance can be an ordinary volume control of 50,000 ohms or less. Whatever the arrangement, the meter box should have a short piece of cable attached to it with a phone jack plug such as a PL55 or the equivalent at the other end. If it is desired to listen *and* look, a second open-circuit jack can be placed in the meter box in parallel with the meter for the phones. It is generally considered good practice to put a small condenser across the meter, but the writer has used this circuit successfully without such a capacity.

At r.f. and i.f. frequencies, the instrument acts as a crystal radio. At a.f. frequencies it acts simply as a pickup for the audio. This instrument will not perform miracles, but it will pick up signals as described. It may detune the circuits somewhat but not to an extent sufficient to upset the signal in most receivers, although it is best to tune the receiver under test to the same frequency as that of the tracer.

This instrument has been used successfully on one of those extremely temperamental intermittent fade-out cases—the kind that all service technicians hate to see come into the shop. While the set was playing normally, the instrument with a meter attached was connected to the second i.f. and the reading noted. The instrument was left in contact while the radio played and the service technician went about other business. As soon as a fade-out occurred, a reading was taken. In this case it showed an extreme drop which indicated that the trouble was ahead of the second i.f. Thus, the trouble was finally cornered and discovered to be a loss of the grid leak in the input of the r.f. tube. Each time a reading was taken, the instrument was moved one stage closer to the antenna and in each instance the service technician made use of the waiting time at other duties.

The process outlined above is the reverse of that usually prescribed for signal tracing, but in the case of an intermittent fader the writer believes it is the best method to use. As a matter of fact, it is not necessary in most cases to follow the signal from each point. Should the user decide that he wants to follow every point, the procedure is as follows. Start at the antenna, remembering that the tracer may need an outdoor type so that if you can skip to the second i.f., you won't need to bother with antenna load. If the receiver has an outdoor antenna attached to it, however, or if one is handy, this obviously is no problem.

Check the signal at the grid input

and plate output of each tube, keeping in mind that if it is an a.c.-d.c. set, the check can be made only after all the tubes have been tested for continuity of filament. If there is a signal at the last output but not in the speaker, it is undoubtedly the output transformer or the speaker itself that is to blame. A good idea would be to rig up tube adapters with leads on each pin (these may be purchased from the *Amphenol Co.*) then the whole set can be checked without removing the chassis.

If the unit is a transformer set, the method just described will also test each tube. As previously stated, the routine is to start at the antenna, but the author prefers to start at the second detector, working both ways. Don't let anyone fool you about taking readings when the set is working okay and then taking more readings after it has faded or cut out. Usually such cases are more temperamental than a princess on a request tour. You can't touch them with a probe without bringing them back to life. If you leave the probe in contact, however, they will fade by themselves unless you just happen to put it on an open condenser. —30—

TV RECEPTION TIP

BY ROBERT L. DONALDSON

MANY times, in very bad locations, after everything feasible has been done to the antenna, television reception is still spoiled by excessive automobile ignition interference. The exact defect referred to is where the ignition pips tear out horizontal sections of the picture, or cause vertical roll-over. An improvement in signal-to-noise ratio, and in over-all results, can be obtained in this case by shifting the video i.f. alignment so that the video carrier is brought further up the slope than is normally recommended.

Usually the carrier should be at 50 per-cent, but by shifting the point to perhaps 80 per-cent or even close to 100 per-cent response, the strength of the sync pulses can be improved to the point where tearing and roll-over will not be experienced. Of course, doing this inevitably decreases the high frequency response slightly, and causes an increase in the smear seen after lettering, etc.; but many times a suitable compromise can be worked out that will definitely give a better over-all picture. Better to have a somewhat lower definition picture than one that rolls over every time a car or bus passes the door.

Then, too, the writer has found that a number of factory aligned sets that had the video carrier placed at 25 per-cent or less, gave very poor signal-to-noise ratio but otherwise a good-looking picture. A quick way to check this is to detune the h.f. oscillator by means of the "fine tuning" control in the direction of stronger carrier. If sync action is improved, then the shift in i.f. alignment is indicated. Needless to say, it is very inadvisable for anyone to do any video i.f. tuning without having the full complement of test equipment at hand so as to make sure that no harm is done that would be worse than the original fault. —30—

V.F.O.—Exciter Unit

(*Continued from page 40*)

slug tuning, but once they're set the slugs can be locked with a nut run down on the threaded rod next to them, and forgotten.

The 807 plate condenser is also set for the middle of the band in use, and from then on all tuning is done with the v.f.o. dial. The output drops slightly at the extreme band edges, and may require a bit of retuning to resonance, but for all practical purposes it is "single dial control."

Total current consumption of the 6AG7's is about 50 to 60 ma., depending upon how many are in use at the time and receiving excitation. The 807 can be loaded to an antenna, in which case the maximum rating of 100 ma. or so can be used. When driving a high power amplifier the 807 current is around 75 ma. at resonance.

The power supplies are standard items, and require only a little patience in fitting the parts into the limited chassis space available. The input condenser for the 550 volt supply is mounted under the chassis. The voltage dropping resistors and the 807 screen dropping resistor are mounted upright on top of the chassis for better ventilation.

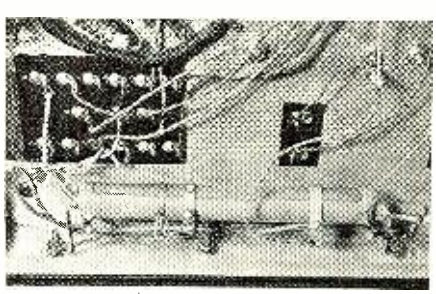
An input of about 40 watts is average for all bands. The unit has been used to feed an antenna direct with excellent results, even on 20 meter c.w. where the going is really tough! To go from c.w. to NBFM, simply turn on the FM filaments, adjust the gain control for the proper deviation on the band chosen, and you're all set.

—30—

BURNED OUT RESISTORS

MANY voltage-divider resistors of the wirewound type are needlessly thrown away after they develop "opens" through burnout or mishandling. It is a simple matter to bridge the open section by a jumper wire to two adjacent slider taps. The exact location of the break is easily determined by running an ohmmeter prod lightly over the wire, with the other lead connected to either end of the resistor. The slight reduction in the over-all resistance value brought about by the use of the slider taps doesn't affect the operation of the voltage divider, which originally is usually of rather high resistance.

One resistor used in an experimental transmitter has been patched this way three times and is still good for a lot more service. . . . . R.H.



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FREQUENCY Shift receiving rack for teletype operation. Two receivers, converter, teletype driver, $400. George Nagrodsky, 107 Jefferson Ave., Mineola, New York.

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BC-412 OSCILLOSCOPE, partially converted (see RN August, '47). All original parts and more. $35. Jay Koogle, 617 North Ave., Dayton, Ohio.

BC-348-R. RECEIVER AC. powered and speaker. New condition. $75.00. John Kirby Jr., Box 299 R. 17, Indianapolis, Ind.

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GCARA TO HOLD HAMFEST

THE GCARA (Greater Cincinnati Amateur Radio Association) will hold its annual hamfest on Sunday, September 11, at Ash Grove on Winton Road, just north of Cincinnati.

Everyone is cordially invited to attend and help break last year's record of 487 hams. —30—

CONSTRUCTION REFERENCES

AFTER constructing a piece of equipment from a magazine article, it is a good idea to glue a small label onto the chassis with the following information: The magazine from which the gear was built, the month and year of the magazine, and the page on which the article appeared. The date the equipment was built can also be added.

Then later, when a bit of trouble-shooting is necessary, or the constructor wants to refer to the original article again, the material may be found very easily by referring to the label. In that way, a good deal of time can be saved, and there is no annoying necessity to thumb through several magazines looking for an article. . . . . M. K.

ERRATA

Pin No. 3 on the 6C4 speech amplifier tube (July issue, Fig. 2, Page 33) should run to ground, instead of to the cathode resistor, R_1.

• • •

The photograph appearing in the Turner Company's "New Products" item (Page 100, August issue), is not of Model 25D as indicated. The photograph shown is, instead, of Model 77, a new cardioid type microphone produced by the Turner Company.

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SEPT. 1949

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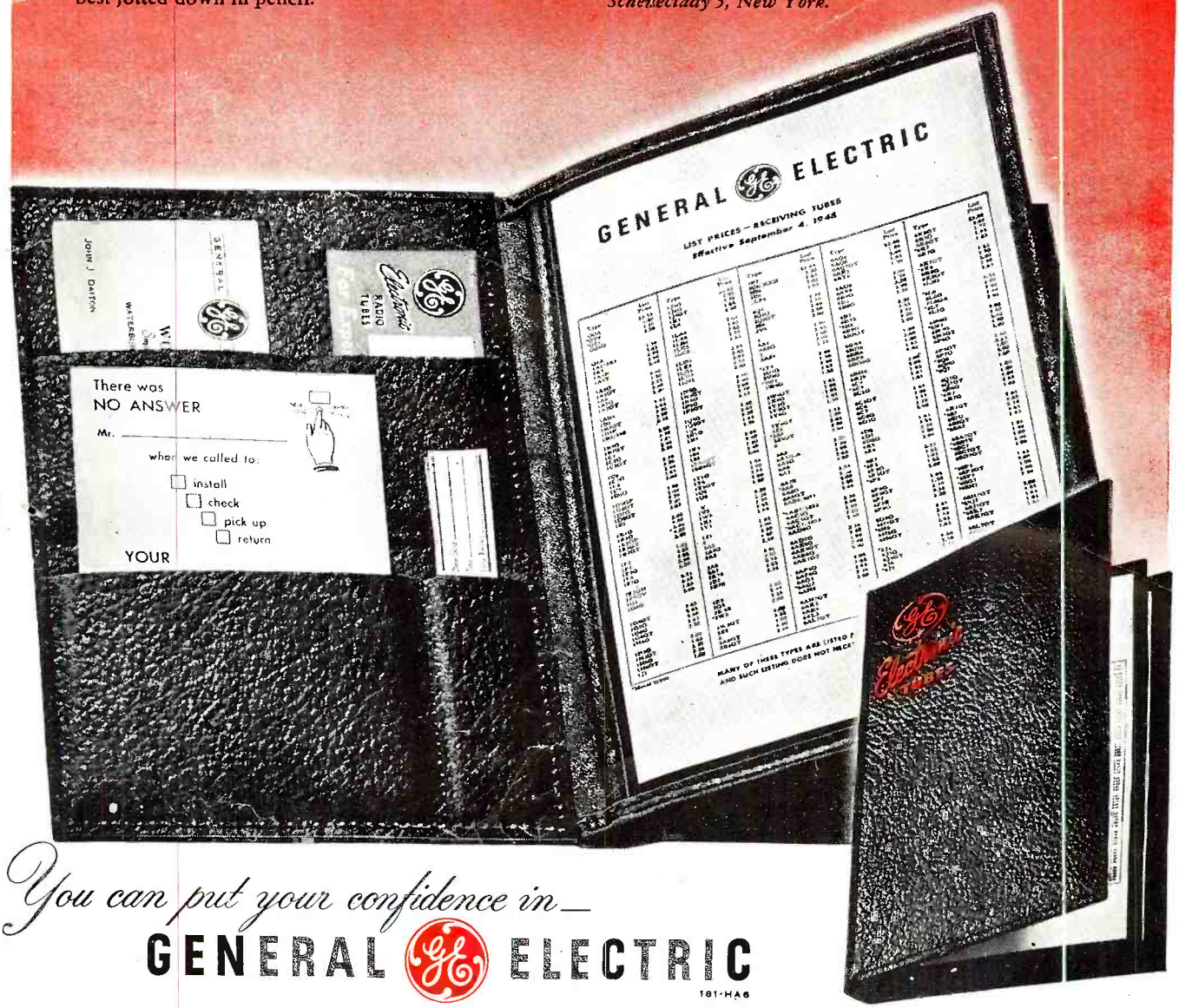

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