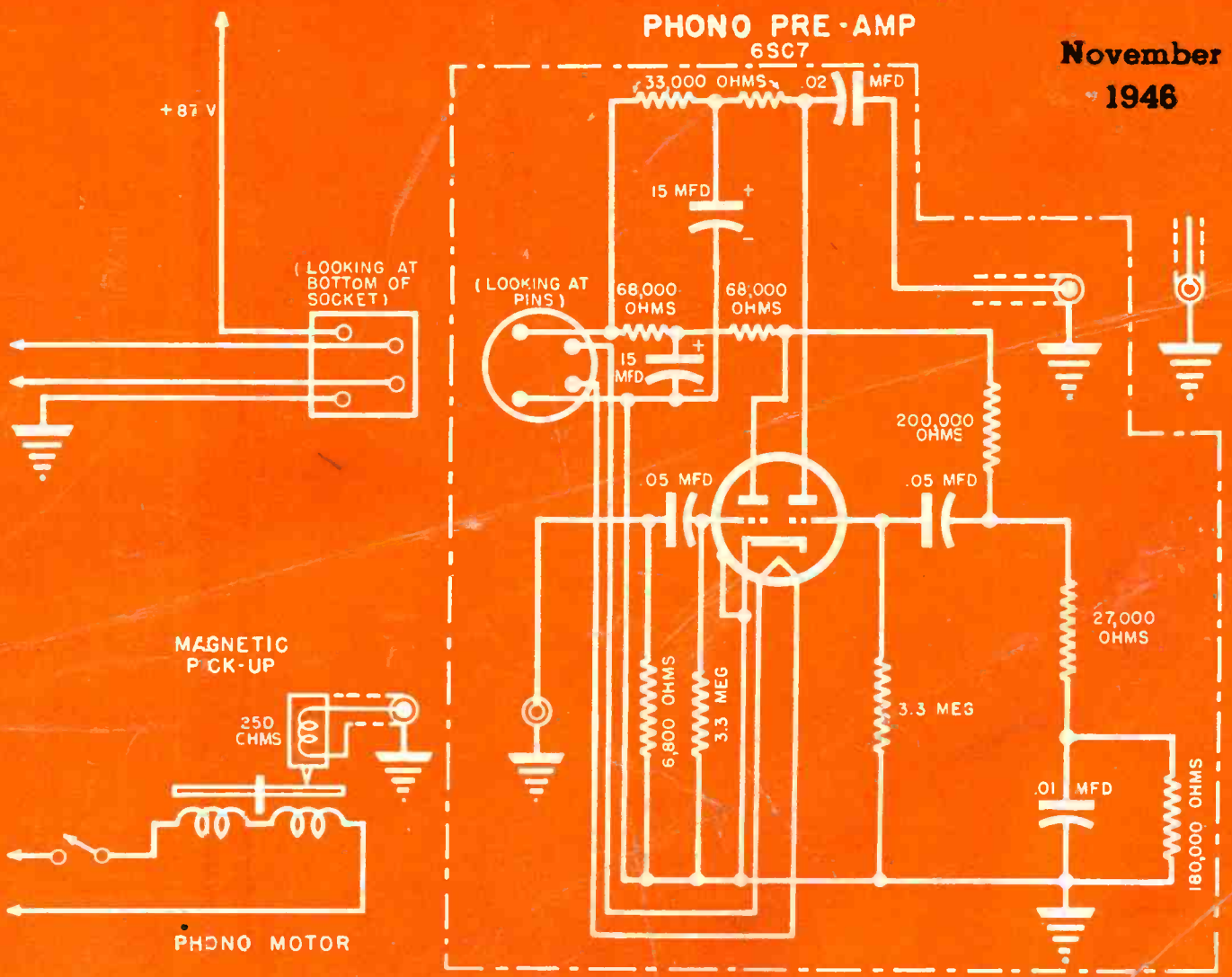
RADIO • TELEVISION • ELECTRONIC

SERVICE



November 1946

Variable-reluctance-pickup preamplifier used in 2-band phono console model.

[See page 26.]

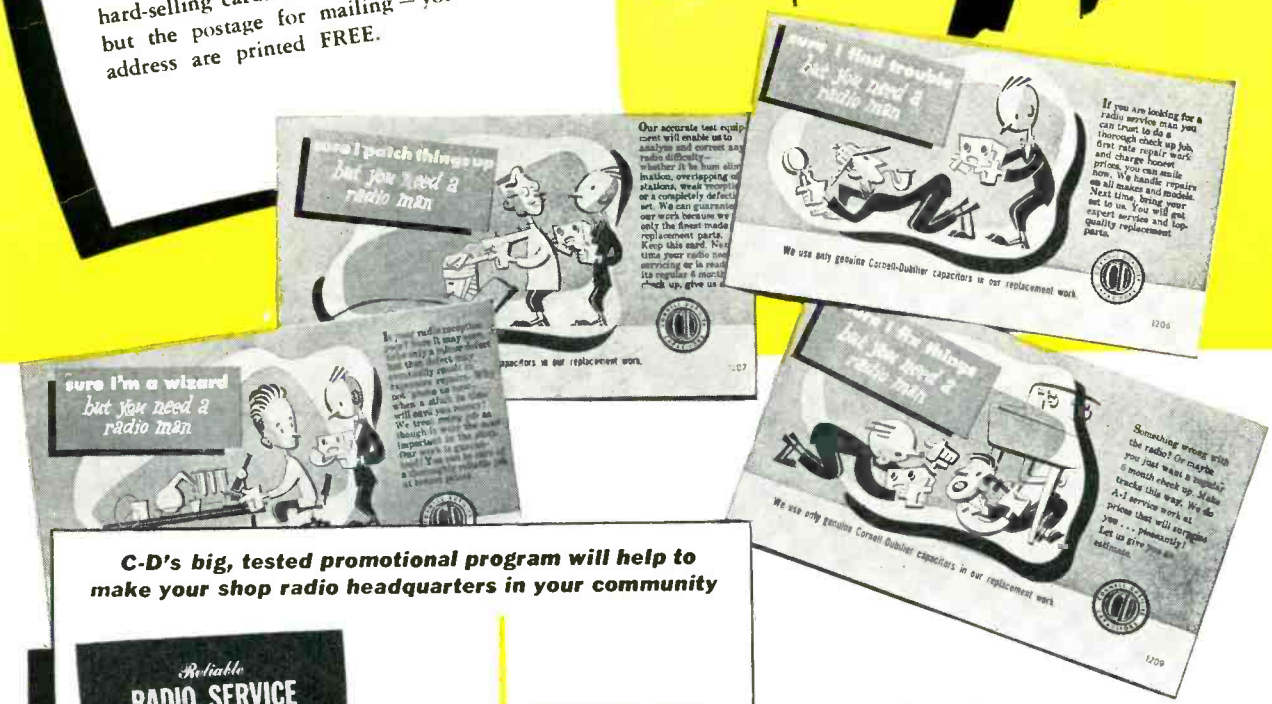
THE TECHNICAL JOURNAL OF THE RADIO TRADE

Shake hands with your Best Salesman!

Yes, every time he delivers one of these cards he's building your name as the one folks think of when they need radio service — establishing your shop as the leader in your community.

Don't stall around waiting for folks to learn your name just from seeing it on your shop window. Go after them in their homes. Frequent mailings of the attention-getting cards C-D has prepared for you will help build up your service business overnight.

Ask your jobber about your supply of these hard-selling cards today. They cost you nothing but the postage for mailing — your name and address are printed FREE.



C-D's big, tested promotional program will help to make your shop radio headquarters in your community

- NEWSPAPER MATS
- MATCH BOOKS
- COUNTER CARDS
- STATIONERY
- DECALS
- SHIPPING LABELS
- POSTCARDS
- "C-D CAPACITOR"
- CATALOGS

let yourself grow! See your C-D jobber today and order these powerful sales builders. Cornell-Dubilier Electric Corporation, So. Plainfield, N. J. Other large plants at New Bedford, Worcester and Brookline, Massachusetts, and Providence, Rhode Island.

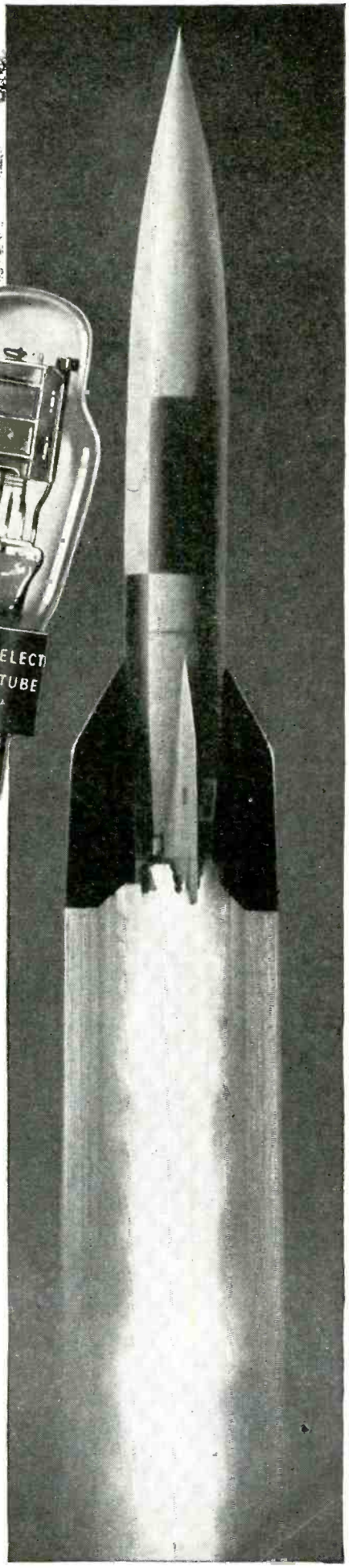
CORNELL-DUBILIER
WORLD'S LARGEST MANUFACTURER OF
CAPACITORS

CORNELL-DUBILIER CD CAPACITORS

MICA • DYKANOL • PAPER • ELECTROLYTIC

William Dfortz ko
Sugar Bowl

IT'S POWER THAT DRIVES THE ROCKET MILES UP INTO SPACE . . .



Be smart—use G-E *sales power* to lift your tube volume to higher, more profitable levels!

RADIO TUBES

Ronnie Kazanow

MIGHTY productive sales-wise, the force which the G-E monogram exerts as a popular symbol of quality! Poll your area, and an overwhelming number of buyers will vote G-E on every ballot. That's because their G-E lamps, fans, irons, refrigerators, as well as radios, have served them long and well. In consequence, they'll come to *you* for tubes, once they know you sell the G-E make. . . . So your money-making formula is simple. (1) Arrange to handle G-E radio tubes! (2) Let local owners *know* you handle them! That part's made easy by the display and promotion material you get free as a G-E tube dealer. . . . Write for complete information about tube selling rights to *Electronics Department, General Electric Company, Schenectady 5, N. Y.*

The Technical Data you need to sell or replace radio tubes is contained in G.E.'s Tube Characteristics Booklet ETR-15. Send for your free copy!

GENERAL ELECTRIC

176-E6-8850

FIRST AND GREATEST NAME IN ELECTRONICS

EDITORIAL

THE MANY NEW COMPONENTS AND ACCESSORIES now being introduced offer the alert Service Man innumerable increased-income opportunities. For these new items make it possible to improve receivers, old and new.

The recently announced miniature selenium rectifiers, for instance, will add an instantaneous-operating feature to most receivers, and also permit the addition of another power tube to increase audio output. The rectifier also provides a quiet-operating feature and is practically breakproof.

Then there are the new permeability tuners that increase receiver sensitivity. One model consists of an r-f tuner and oscillator section that can be adapted to most any type receiver.

In installing the components, it is, of course, necessary to exercise the usual installation care particularly with tuning devices. Here skillful alignment with signal generators is essential. A 'scope will be found most helpful, too.

P-M speaker replacement offers another added-income opportunity for Service Men. This is particularly true with speakers several years old. In many instances, the paper or other material used for cones will be found to have dried out, and damaging dust particles will have accumulated in the voice coil-magnet areas. And although the reproduction may appear satisfactory, a test with a new type speaker with such improvements as Alnico V, cellular insert, coaxial woofer-tweeter, dual-cone, etc., will prove the superiority of the new types, in wider ranges and more power. For a simple comparison test an a-f oscillator tone test can be used on the old and proposed new speaker. It is, of course, necessary to watch output matching very carefully and employ the proper universal matching transformers.

To promote these improvements, a carefully planned item-installation package charge chart should be prepared with the cost of new items plus the time charges very clearly defined. In preparing servicing charges, installation time should only be considered, with sales time charged against your cost and the sale price of the item.

There are many other new recently- announced components and accessories such as volume controls, dry electrolytics, loops, etc., that can be effectively applied to the receiver-improvement service program. A bit of sales effort will be required, but there will be ample rewards for the effort!

RADIO · TELEVISION · ELECTRONIC
SERVICE
Reg. U. S. Patent Office

Vol. 15, No. 11 November, 1946

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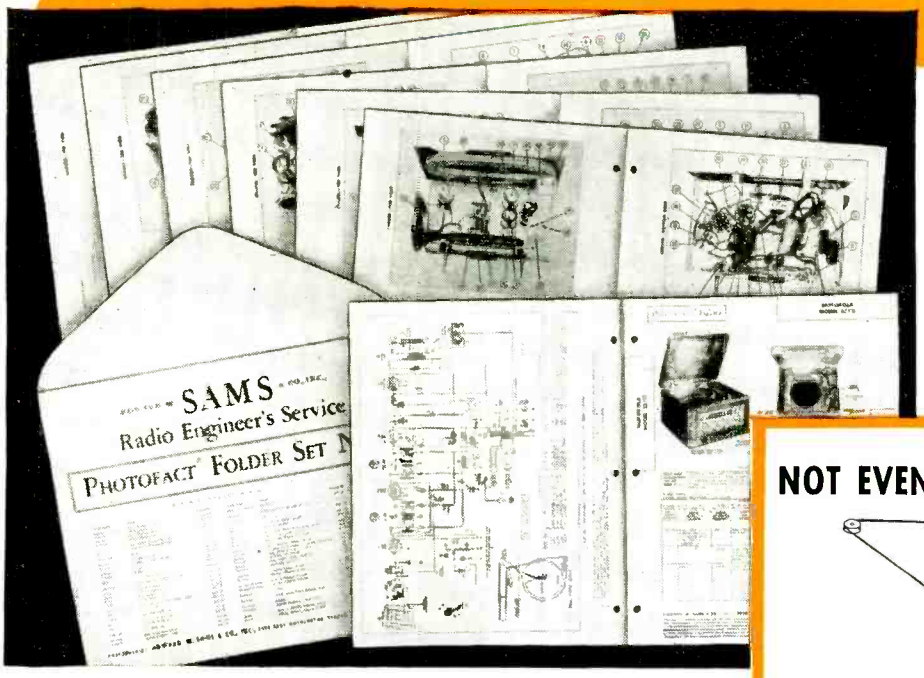
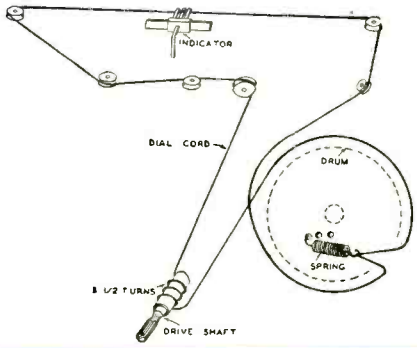
No Service Problem Can Stump You When You Use PHOTOFACT* FOLDERS...



NOT EVEN DIAL CORD STRINGING!



What kind of service problems give you trouble, waste valuable time? Restringing dial cords? Identifying parts? Deciding on correct replacements? Shelve such worries — *make service time twice as productive*—with Howard W. Sams PHOTOFACT FOLDERS.

PHOTOFACT FOLDERS speed up work, make profits bigger, by helping you lick *every* service problem. No other radio service data compares with PHOTOFACT FOLDERS in completeness, dependability, timeliness. Full-page schematics, clear-cut photos, *original* technical dope tell you *everything* in a jiffy about every radio manufactured since January 1, 1946. What's more, you get the information when you need it without waiting.

*Trade Mark Reg.

The cost per set (30 to 50 folders on the latest radios, phonographs, intercommunication systems and power amplifiers) is only $1.50. This includes membership in the Howard W. Sams Institute. Demand is big, paper is limited. Use the coupon below for Sets No. 7 and 8 *before they are sold out!*

In Each PHOTOFACT FOLDER *You Get—*

1. A cabinet-view photo of the receiver to help you establish identity and control functions. **2.** A top-view photo of chassis and speaker to identify component parts and alignment points. **3.** A bottom-view photo of chassis and/or accessories. **4.** A complete list giving keyed reference to all parts, alignment and schematic diagram. **5.** A complete full page schematic diagram of the receiver. **6.** Stage gain measurements listed on the schematic diagram. **7.** A complete voltage and resistance analysis chart for rapid check of operational values. **8.** Complete alignment instructions on the receiver consistent with the keyed alignment points indicated in top and bottom-view photos. **9.** Dial cord diagram and restringing instructions on all receivers. **10.** Complete disassembly instructions, where required.

Set No. 7 Due November 19—Set No. 8 Due November 29

Cut This Out and Mail It to Your Distributor! If you do not know his name and address, send it directly to Howard W. Sams & Co., Inc., 2924 East Washington Street, Indianapolis 6, Indiana, and we will see that your nearest distributor gets it. In Canada—write to A. C. SIMMONDS & SONS, 301 King Street East, Toronto, Ontario. Canadian Price $1.75.

PLEASE PRINT

☐ Send Set No. 7 ☐ Send Set No. 8

(Circle one or more of following) Send Set No. 6, 5, 4, 3, 2, 1, ($1.50 a Set)

☐ Send me a DeLuxe Remington Rand Binder @ $3.39.

My (check) (money order) (cash) for _____ is enclosed.
(If you send cash, be sure to use registered mail)

Name _____

Address _____

City _____ *Zone* _____ *State* _____

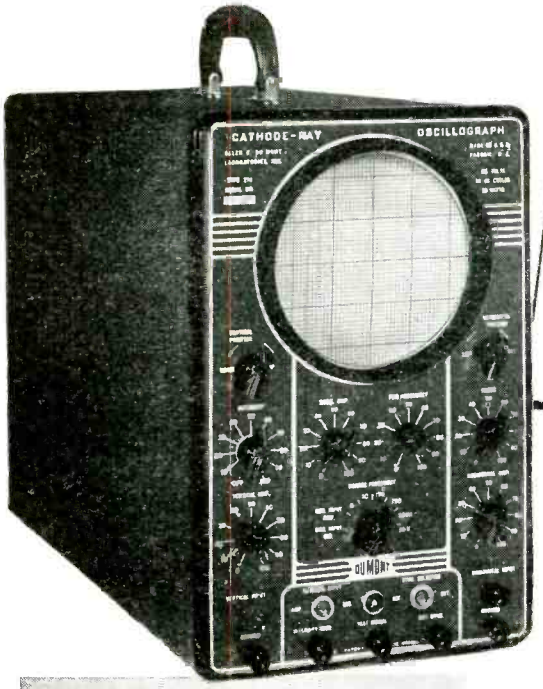
Company Name _____

My Distributor's Name _____ *City* _____

HOWARD W. Sams & CO., INC. RADIO PHOTOFACT SERVICE

In Canada—write to A. C. SIMMONDS & SONS, 301 King Street East, Toronto, Ontario

ALL SET FOR *Modern Servicing...*



DU MONT Type 274
THE "MUST" INSTRUMENT designed for the go-getter serviceman

At only $99.50, here's your "Best Buy" today. Note its many fine features. With this popular instrument, you're ready to tackle the widest range of profitable service jobs today, and the still more profitable jobs coming up soon. A Type 274 Oscillograph pays for itself over and over again. Here's how:

FEATURES AT A GLANCE . . .

- Big, detailed, easily-studied traces on the 5" Type 5BP1 cathode-ray tube.
- Frequency Range: Sine wave response (at full gain) uniform within ±20% from 20 to 50,000 c.p.s., down less than 50% at 100,000 c.p.s.
- Linear Time Base: Variable from 8 to 30,000 c.p.s. Synchronization from vertical amplifier or external signal.
- Deflection Sensitivity: Amplifiers at full gain, 0.65 r.m.s. volt/in.; direct, ± 18 r.m.s. volts/in.
- Power Supply: 115 volts, 50-60 cycles. Approx. 50 watts. Fuse protection: 1 amp.

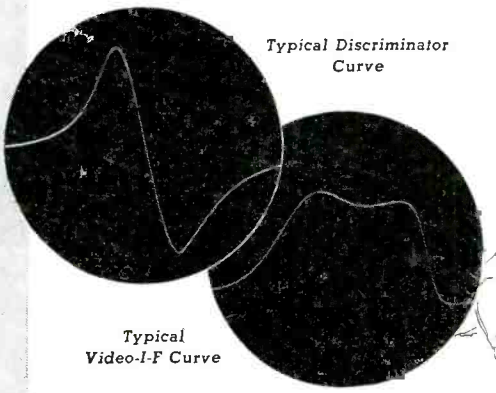
Weight: 35 lbs. Dimensions: 14" x 8⅝" x 13⅜".

- And handsome! Green wrinkle-finish steel cabinet. Plastic carrying handle. Modern design green front panel with white characters. Black knobs.

TELEVISION RECEIVERS . . .
Forecasts indicate that within the next year thousands of television sets will be produced, bought, installed. Much of the servicing of the complex circuits is easily and quickly performed by the serviceman equipped with a Du Mont Type 274 Oscillograph.

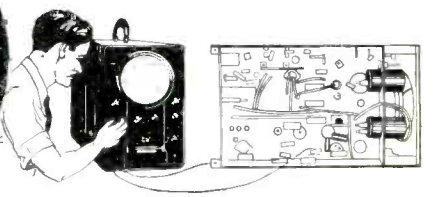
F-M RECEIVERS . . .
For faithful reproduction of tonal values, F-M receivers must be aligned right "on the button." For this critical job, too, Type 274 provides the best method of servicing.

A-M RECEIVERS . . .
The exceptional versatility of Type 274 can be put to good use with standard A-M receivers. For the accurate adjustment of radio and intermediate frequency circuits, as well as trouble-shooting audio-frequency amplifiers, this instrument is a time-saving tool.



Typical Discriminator Curve

Typical Video-I-F Curve



ASK YOUR JOBBER TO SHOW YOU THE NEW DU MONT TYPE 274 OSCILLOGRAPH. OR WRITE US FOR LITERATURE.

DUMONT *Precision Electronics & Television*

ALLEN B. DuMONT LABORATORIES, INC., PASSAIC, NEW JERSEY • CABLE ADDRESS: ALBEEDU, PASSAIC, N. J., U. S. A.

ANOTHER RIDER "FIRST"
in our continuing program of
"SERVICE FOR THE SERVICEMAN"

Is it right for you to charge a customer for the time you use in breaking down a circuit? We think not.

Yet admittedly someone must spend the time tracing out the circuit before troubles can be located—especially in a modern multi-wave receiver. For, with such receivers each turn of a switch creates an entirely different circuit and only a laborious time-consuming process of diagram tracing will show you the operative parts under each switch position.

We recognized this problem and have solved it with another Rider "First." We have eliminated the necessity of your doing this in *your* shop, by doing it for you in *our* laboratories.

We have traced through hundreds of sets under all of their varying operating conditions and prepared special schematic drawings which break down all multi-wave band jobs to show what parts are in and out of operation for each possible position of the band switch.

With these Rider "clarified-schematics" you have before you the precise circuit as it exists when the switch is thrown. You know immediately, without tracing an original schematic just which components are in operation under each condition.

Actually a multi-wave receiver is many receivers in one; "clarified-schematics" provide you with a separate schematic for each of these many receivers. A case in point is one combination set which we have broken down into *eighteen* individual schematics.

Servicemen will be quick to recognize the time-saving, money-making value of this Rider "First" yet it will be made available not at added cost to you, but as a part of our program of "A Continuing Service For The Serviceman." It will be just another time-saving bonus for the loyal Rider Manual users. It will be one of the important features of Volume XV (out in January), yet *only* one of the many time-saving exclusives that make Rider Manuals pay for themselves many times over each year they are in use.

Other features will be outlined in next month's advertisements—all are good reasons why leading servicemen throughout the world know "You're Right With A Rider Manual."

Place your order with your wholesaler today, paper conditions yet require our allocating production.

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RIDER RADIO BOOKS KEEP YOU IN TOUCH WITH SUCCESS

This new Rider Book, soon to be announced, will be of lasting usefulness to everyone interested in any phase of radio.

The Cathode Ray Tube at Work
Accepted authority on subject . . . $4.00

Frequency Modulation
Gives principles of FM radio . . . 2.00

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A-C Calculation Charts
Two to five times as fast as slide rule 7.50

Hour-A-Day-with-Rider Series—
On "Alternating Currents in Radio Receivers"
On "Resonance & Alignment"
On "Automatic Volume Control"
On "D-C Voltage Distribution" $1.25 each

RADAR $1.00
Entertaining, Revealing, even a layman can understand explanation

Type 403D2625

by Installing Federal's Miniature Selenium Rectifier—in AC-DC home radio receivers to replace rectifier tubes

HERE'S A REAL OPPORTUNITY for the progressive service man — a chance to make extra money and do a better job. For Federal's new, miniature Selenium Rectifier is more than just a substitute for a tube. It's the modern way to give old sets new performance —gives them instant starting without warmup, makes them run cooler, last longer—replaces 29 different rectifier tube types.

Only 1¼ x 1 3/32 x ⅝ inches, it fits anywhere, with just a few simple soldered connections and minimum circuit changes. Once installed, it's in for the life of the set. It withstands overloads from defective electrolytic condensers, and is practically unbreakable.

This miniature Selenium Rectifier gives the same performance that has made Federal "Center-Contact" Selenium Rectifiers the standard of the industry.

*HERE'S HOW YOU CAN DO THE SAME

By installing Federal's Miniature Rectifier in place of a tube, you earn from $1 to $2 *extra* per set serviced. Ten sets a day gives you $60 a week (or more) *added profit.*

Replaces these 29 different rectifier tubes:

5T4	5Y3	6Y5	25Z6	50Y6
5U4	5Y4	6Z5	35W4	50Z7
5V4	5Z4	12Z5	35Z3	117Z3
5Z3	6X5	7Y4	35Z4	117Z6
5W4	0Z4	12Z3	35Z5	OY4
5X4	80	25Z5	35Z6	

FREE —eight page service bulletin telling how to install this rectifier in AC-DC radio sets. Miniature Selenium Rectifiers now available in standard packages of 12, with window poster and mailing pieces. Send check or money order for $12.00* for 12 rectifiers in display carton and complete sales accessories. Write to Dept. **F856.**

*(excludes State and City use and sales taxes

Federal Telephone and Radio Corporation

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

An IT&T Associate — Federal Telephone & Radio

Newark 1, New Jersey

REPLACE CAPACITORS

Faster···Better···at Less Cost

with SPRAGUE ATOMS

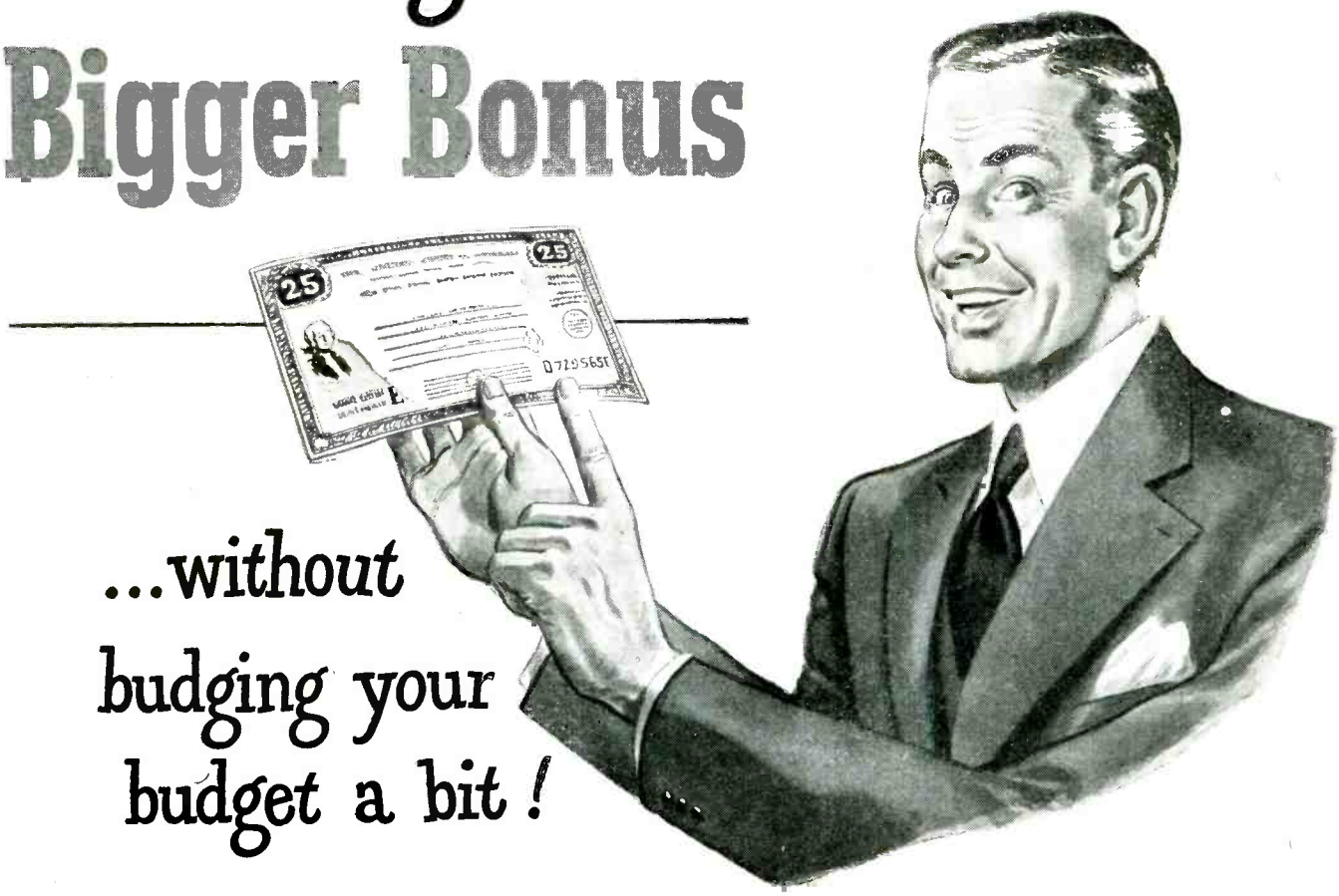
NEW CATALOG — JUST OUT!
The finest, most complete and most helpful Sprague catalog ever issued! Contains complete details, dimensions, data, etc. on Sprague Capacitors and *Koolohm Resistors for every service, amateur and experimental need.
*Trademark Reg. U. S. Pat. Off.

- Use them universally for ALL dry electrolytic replacements.
- A small supply equips you for ANY job — any voltage, capacity or capacity combination.
- Order them by name — be sure of getting genuine, factory-fresh Sprague Atoms — the kind that will not let you down.

SPRAGUE PRODUCTS COMPANY
North Adams, Mass.

JOBBING DISTRIBUTING ORGANIZATION FOR PRODUCTS OF THE SPRAGUE ELECTRIC CO.

How to give a Bigger Bonus



...without budging your budget a bit!

SUPPOSE Bill S., one of your employees, is due for a $75 bonus this year. If you give the bonus in U. S. Savings Bonds, Bill will receive—not $75, nor a $75 Bond—but a *$100* Bond.

Yes, the bonus in Bonds looks like a lot more—and it *is* more. (Every $3 put into U. S. Savings Bonds pay $4 at maturity.) With the same size appropriation, you're actually giving a bigger bonus.

Consider, too, that Savings Bonds mean individual security for each Bond-holder—and collective security for all of us, because they help to control inflationary tendencies. You can easily see that you're doing yourself, your employees, and your country a favor by deciding to...

Give the BONUS in BONDS

...and keep up your Payroll Savings Plan!

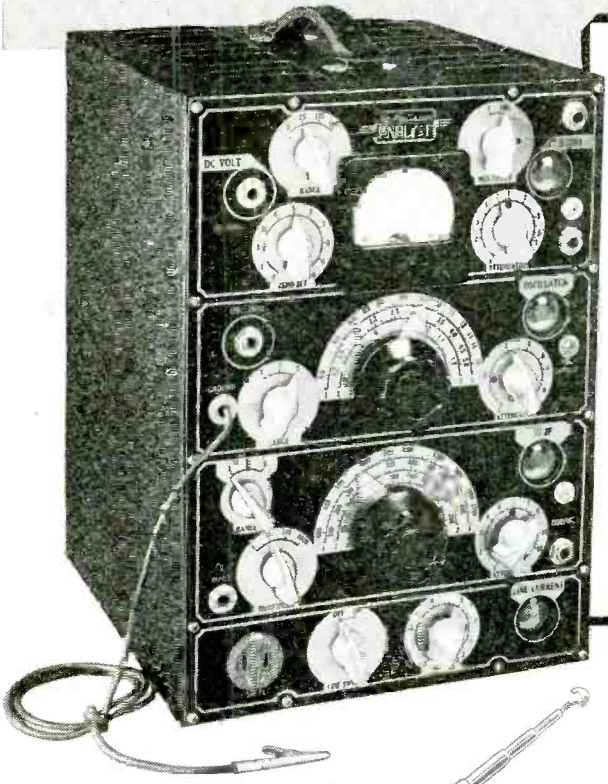
IMPORTANT: If you have not already received your copy of "How You Can Help Give Free Enterprise a Boost," write on your letterhead to: Room 750, Washington Building, U. S. Savings Bonds Division, Washington 25, D. C. Limited supply. Please write today.

The Treasury Department acknowledges with appreciation the publication of this message by

SERVICE

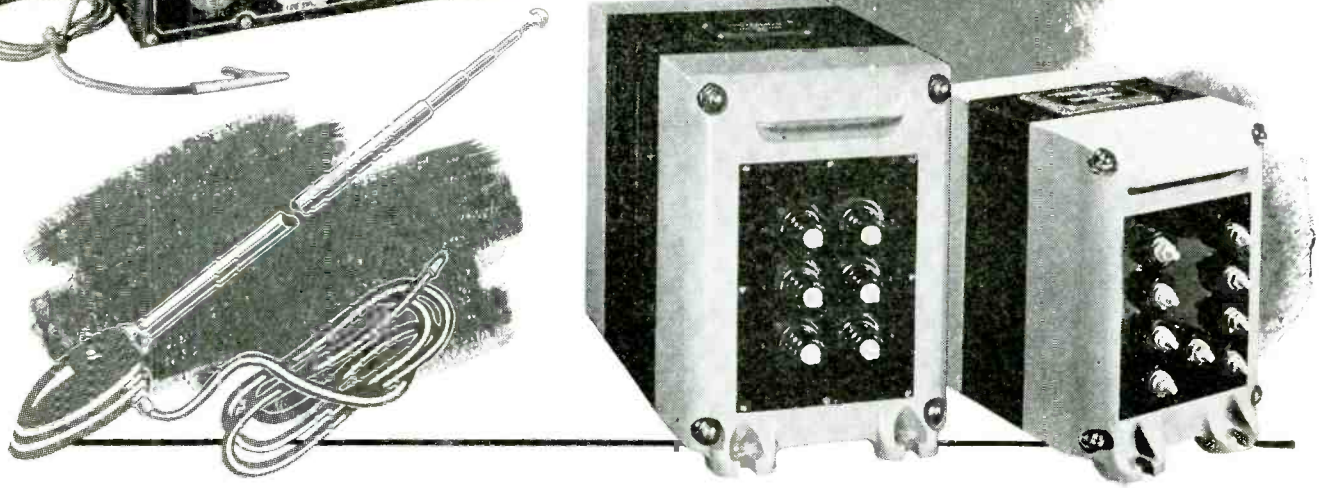
This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and The Advertising Council.

For Outstanding Performance!



MEISSNER *Analyst*

The fastest and most reliable set testing instrument available to the service trade. Five separate and distinct channels. All controls accurately calibrated . . . functions clearly indicated. Completely equipped with all devices that might be needed to make simultaneous checks on various parts of the receiver circuit . . . The modern service instrument.



RADIART

Radiart Aerials for all cars...feature Static Muffler Ball to minimize corona discharge static and Anti-Rattler for smooth, quiet operation.

THORDARSON

Thordarson Transformers are backed by 51 Years of outstanding reputation for quality manufacture. You get the best when you buy Thordarson.

THORDARSON • MEISSNER • RADIART PRODUCTS LISTED AND RECOMMENDED BY PHOTO-FACT FOLDERS.

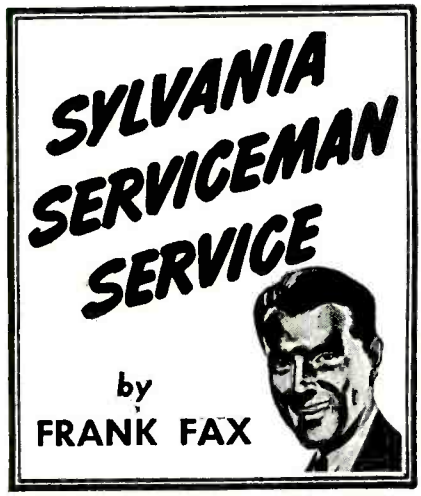
ELECTRONIC DISTRIBUTOR AND INDUSTRIAL SALES DEPARTMENT MAGUIRE INDUSTRIES INCORPORATED,

936 NORTH MICHIGAN AVENUE, CHICAGO 11, ILLINOIS

SYLVANIA NEWS
RADIO SERVICE EDITION

NOV. *Prepared by* SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa. 1946

FREE, AT YOUR SYLVANIA DISTRIBUTOR'S: VALUABLE BUSINESS AND TECHNICAL AIDS



In case you haven't already taken advantage of the opportunity, Sylvania has a lot of valuable helps for the radio repairman that are *absolutely free.*

They include attractive, customer-catching window displays, interesting booklets on radio care to give to your customers, service hints and many useful technical charts and booklets.

GIVE-AWAYS

Now is the time to dress up your windows and invite new customers into the store. Inside, have the complete line of Sylvania tubes to satisfy your customers, the usual snappy service and a pamphlet or two to give away — as a reminder to stop in again.

Every item shown at the right is free (there are many others, some at a nominal charge). Just call on your local Sylvania distributor for your supply, or write to me at Sylvania Electric, Emporium, Pa. And *remember* — to carry the customer's goodwill, carry Sylvania tubes!

BASE CHART
Types and base views of Sylvania tubes

FOLDER-TAG
Or radio cleaning

GIVE-AWAY FOLDER
Helps customers understand your repair problems

"HELPFUL HINTS" BOOKLETS FOR RADIO SERVICING

WINDOW DISPLAY

COLOR CODE CHART

CHARACTERISTICS CHART
Characteristics of Sylvania tubes and panel lamps, with tube base views

SYLVANIA ELECTRIC

Emporium, Pa.

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS

RADIO · TELEVISION · ELECTRONIC
SERVICE

Fluorescent Lamp INTERFERENCE FILTERS

by LEONARD MILTON
Senior Engineer, Filter Division
Solar Manufacturing Corp.

FLUORESCENT LAMPS ARE inherently prolific sources of interference. This is the result of their basis of operation; oscillatory discharges through ionized gas in a sealed tube.

Under conditions commonly found in homes, offices, factories, stores, laboratories, etc., lamp-generated interference may be sufficiently strong to interfere seriously with reception over both the standard and short-wave broadcast bands and the bands allocated to f-m and television. Lamp-caused static is particularly objectionable in rural and suburban localities where station signal strengths are relatively weak.

How Interference Is Transmitted

The r-f energy generated by a fluorescent lamp is transmitted from the lamp to receivers in two principal ways:

(*a*) Part of the energy is conducted along the power lines feeding the lamp, reaching the power supply of the receiver over these lines or through inductive coupling with adjacent lines.

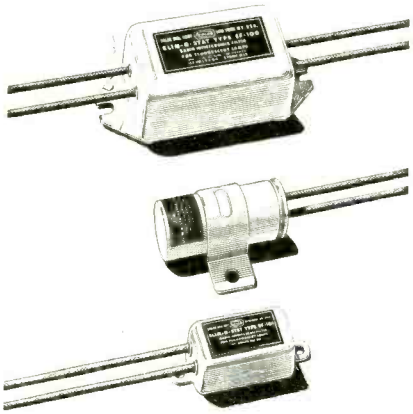
(*b*) The energy in both the lamp and the power lines sets up *induction* and *radiation* fields which induce currents in the receiver antenna, antenna leadin, and in the i-f and r-f circuits of the receiver itself.

Induced Versus Radiated Interference

In accordance with accepted theory, the induction field is stronger than the radiation field near the source of energy but varies in intensity inversely as the square of the distance. At a point approximately equal to the wavelength divided by 2 π, the induction field is equal to the radiated field, and at a distance of three or four wavelengths its effect is negligible. The radiated interference varies in intensity inversely with the distance from the lamp. Accordingly, at a wavelength of 200 meters (1,500 kilocycles) near the upper end of the standard broadcast band, interference caused by the induction field will be greater than interference from the radiation field, up to a distance of approximately 100 feet. The interference due to the induction field will be negligible only at distances greater than 1,800 feet. At a frequency of 150 megacycles the induction field is approximately equal to the radiation field at about 1 foot and is negligible beyond about 18 feet.

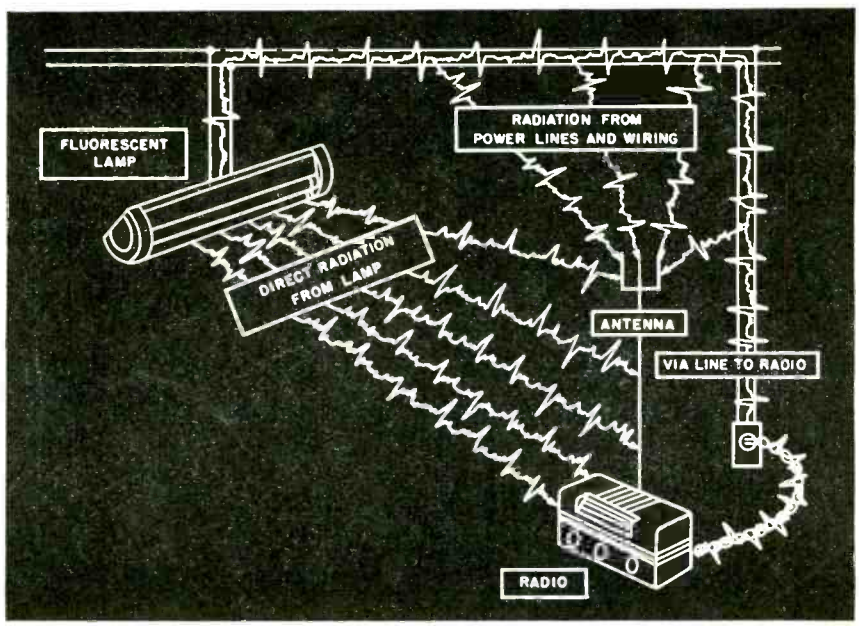
For interference to f-m and television, therefore, the radiated field is

(*Continued on page* 34)



Wide-range filters. Top, twin-π capacitive-inductive network type; center and bottom, Δ-connected capacitive network type.

Fig. 1. Types of interference caused by fluorescent lamps.



TELEVISION SERVICING

INSTALLATION AND SERVICING of television receivers is a very definite and very important part of selling those receivers.

In this respect, the problem differs extensively from that found in the sale of broadcast receivers which today have been brought to such a state of technical perfection, that a customer may take his radio receiver home, plug it in, and listen to programs.

Most television receiver manufacturers are attempting to combine service and sales in various ways. Some are establishing their own service and installation departments. Others are using control and inspection groups to insure a high standard of dealer servicing. Whatever their methods, their goal is identical, to provide satisfactory television reception for the ever-increasing audience now in existence, and the vast audiences to come.

In the event that the sets of a manufacturer, which are being serviced by dealers, through lack of such control, do not give adequate service, the manufacturer is the sufferer and not the dealer. This point cannot be stressed too strongly, and it is obvious that it shall be the manufacturer's responsibility to insist on a high standard of service from his dealers or any other organizations whom he is entrusting with that important work.

One of the most important factors in selling television receivers is the matter of surveying the prospective customers' residence, to ascertain the feasibility of receiving satisfactory signals at that point.

Where it is found that the location is a difficult one, it is by no means hopeless. The manner in which this problem is to be attacked shall largely depend upon what difficulties are encountered. The most common difficulty will undoubtedly prove to be reflections which produce ghosts in the receivers, and, in some cases, the locality will have to be carefully surveyed to ascertain whether directional antennas properly oriented, or reflectors may be indicated, or whether in some extreme cases wave traps may have to be installed, utilizing a favorable direct-to-reflected signal strength ratio.

There may be other cases where there is a low-signal-to-noise ratio, which can be corrected by the installation of high-gain antennas positioned to discriminate against any local noise sources. Augmenting this, it is, of course, possible to use filters on the local noise sources, usually motors, neon signs, diathermy equipment and x-ray apparatus. Then too, there is the possibility of applying special wide-band r-f amplifiers to raise the signal-to-noise ratio.

In difficult cases like these, the cost of an installation will necessarily be somewhat higher than in the average case. However, it is not likely that there will be a very large percentage of such cases, and this belief is based on what we have already experienced in the congested N. Y. City residential area where reflections and counter-reflections are prevalent, and where external noise from traffic and other disturbing factors are very likely to be present.

It is far more difficult to excuse a poor picture because of these possible disturbing factors, than it is to excuse poor radio reception on an ordinary radio receiver. The reason for this, of course, is obvious. The eye is a far more sensitive organ than the ear, and the slightest deviation from normal in the picture is instantly disturbing and disagreeable, whereas in the case of the ear, only a few of us have ears so delicately attuned that we seriously object to minor disturbances and limited audio-frequency response.

Installation crews, whether they are part of a manufacturer's, dealer's, or an independent organization, will probably have to follow similar lines in their approach to servicing. All of them will necessarily have to have the very best and the most complete test equipment necessary, including a small portable television receiver for survey purposes. They will require a mobile truck unit in most cases with extension power cables, antenna kits, hand and power tools, hardware, and other equipment. All this will be in addition to the equipment necessary at service headquarters.

Who is to organize these service organizations and train the men? The average Service Man, unless he has broadened his experience and education in the field of electronics and high frequency, is certainly unable to cope with television servicing. Certain manufacturers, therefore, have established free schools for their service representatives, and are careful to screen the men reporting to these schools, in such a way that only those who have had ultra-high frequency backgrounds, and have an understanding of radiation and propagation, as well as sweep circuits and synchronizing pulses, will be accepted in the course.

We are engaged in just such activities, and in this way are expecting to bring about among our dealers and service representatives whom we will certify, a substantial group of well-trained men with good backgrounds, who will become the nucleus of a new group of television Service Men.

At the present time it is expected that installation charges may range from $25 to $75 depending upon location. Difficult locations will, of course, run somewhat above this figure, but I do believe that these figures should include the great majority of installations.

Some manufacturers are guaranteeing their sets for a year against possible breakdown. Others are using the ninety-day RMA guarantee for the electronic parts, and a year's guarantee for the cathode-ray tube. The ultimate decision as to which of these procedures will survive, is largely a matter of experience and competitive approach, and it is somewhat early to predict them. The same holds true of the amount of money it will cost the average set-owner to maintain his set in good-working condition over a period of time. But at this point it is interesting to note that many of our early sets are still in daily use after eight years, and the cost of their upkeep has been relatively insignificant, considering the length of time they have given service.

Installing television receivers in apartment houses and hotels represents another problem that will face many Service Men. This is directly tied up with the realty situation in areas like N. Y. City and an energetic and intelligent sales program is necessary to convince the landords that it will be profitable for them to install antenna distributing and amplifying systems for their tenants.

If all of us realize the hurdles and difficulties that lie ahead of us, it is going to be much simpler to carry out a successful program which will be satisfactory to manufacturer, dealer and customer alike, than if we close our eyes at this point to these highly important problems and merely try to sell television receivers without backing the sales up with the necessary technical assistance.

DuMONT'S SERVICE PLAN

Ernest A. Marx
General Manager, Tel. Div.
Allen B. DuMont Labs.

THE G. E. PLAN

W. L. Parkinson
Supervisor, Technical Serv. Div.
General Electric

INSTALLATION AND SERVICE on television is a new problem to most service people at the present time. We must, however, recognize the fact that television program service and television receivers have been in use by the public for the past seven years, and there are some Service Men who have been installing and servicing television equipment for the past seven years and are fully qualified.

General Electric however recognizes the need for education and experience of service personnel in television, and we are about to embark on a training program for our distributors' technical people, who will be responsible for the proper installation and warranty service on our television receivers.

The first objective will be to train service personnel in the present television service areas: New York, N. Y., Newark, N. J., Philadelphia, Pa., Washington, D. C., Albany and Schenectady, N. Y., Chicago, Ill., and Los Angeles, California. When this program is completed, service courses will be held in various distributors' headquarters for dealers' Service Men.

Our distribution organization will be responsible for proper installation and warranty service on our television re-

Highlights of Talks Presented Before TBA Television Receiver Panel by John F. Rider, Ernest A. Marx, Madison Cawein, George Duvall, W. L. Jones, W. L. Parkinson, Richard A. Burtner, W. J. Jones and Albert Preisman.

As Viewed by the Manufacturer, Engineer, Service Man and Instructor at the TBA Conference in New York City

The TBA television receiver servicing panel. At table, left to right: John F. Rider (John F. Rider Publisher, Inc.), William J. Jones (Amie Associates), ye editor, who served as panel moderator, Ernest A. Marx (Allen B. DuMont Labs.) and Richard A. Burtner (Telicon Corp.). Standing, left to right: Madison Cawein (Farnsworth Radio & Television), W. L. Jones (RCA Service Co.), Ken Kenyon (Philco Corp.), W. L. Parkinson (General Electric) and George Duvall (Television Technicians).

ceivers. Each distribution branch will be set up to install equipments for consumers and will provide warranty service. The television franchise will be separate from our *radio receiver franchise.* The fact that a dealer is franchised to sell radio receivers does not necessarily mean that he will be franchised for television. The television franchise will qualify a dealer as: (*1*) A sales and service dealer, or (*2*) a sales dealer.

To qualify as a sales service dealer, the dealer must be capable of installing television receivers, and able to provide satisfactory service on television receivers. This means that test equipment must be provided, and trained technical personnel be included in the sales-service dealers own organization. A sales service-franchise must be approved by the *G. E. receiver division, technical service section.* The approved sales-service dealers will be responsible for installation and warranty service on the television receivers they sell.

The sales dealer will be franchised for sales only, and the distributing organization will be responsible for the installation and warranty service on television receivers sold by sales dealers.

Two discount brackets will apply, with the larger discount to the sales-service dealer.

The cost of installation, including a one-year warranty, will be approximately $50.00 for average installations.

General Electric realizes that many Service organizations are capable of installing and servicing television receivers, and they are anxious to learn more about the latest developments in this field. We do not close the door to these people with the statement that they cannot and will not be able to install and service G. E. television receivers.

THE RCA PROGRAM

W. L. Jones
General Manager
RCA Service Company

IT IS A MAXIM OF SUCCESSFUL merchandising that the best customer is a satisfied customer. This is important especially for the television industry. The successful merchandising of television instruments requires a new conception of installation and service. Since our first early television field tests begun in New York in 1936, experience indicates that television manufacturers should assume a major responsibility for installing and servicing their television instruments. Based upon our experience in the prewar television market and on our continuous service experience since that time, RCA has established a program which falls into two broad classifications:

(*1*) The establishment of our own Service Shop facilities, manned by thoroughly competent and trained personnel. These facilities-stations will be set up in all of the initial television market areas; New York, Philadelphia, Los Angeles, Chicago, and the Schenectady/Albany locality.

(*2*) A well planned program of continuous education to train wholesale distributors, retailers, and members of the Service profession in the fundamentals and techniques of television installation, servicing, and maintenance; and to keep them abreast of timely developments.

We have established a *television training committee* composed of representatives of interested departments of the organization. This committee is considering a training program designed to qualify distributors' and dealers' service personnel and independent Service Men to handle the installation and service of television receivers.

In our program dealers will make arrangements through the RCA Service Company, at standard prices and rates for complete RCA antenna, accessories and approved installation, or supervisory services to assure installation of approved demonstration facilities in dealer's store. RCA Service Company will inform the distributor as to technical approval of dealer's installation.

Provision will be made for consultation service for dealers on television reception in various areas in which dealers propose to sell receivers. This verification service will enable dealers to check reception by area in advance of sale.

Provision wil be made for information service to dealers, including technical bulletins, literature, and other necessary information for sales purposes.

All receivers, to be maintained for one year, will be installed in locations where the signal strength from the desired television stations is at least equal to the minimum signal required for satisfactory reception as defined by the FCC at 500 microvolts per meter, and where reflections and interference can be reduced to an acceptably low value by proper selection, orientation, and positioning of a standard antenna.

In our program, we will make all service calls and repairs, if necessary, to repair receiver and antenna and maintain both in first class operating condition during the period of one year from date of original installation. We will furnish all materials, parts and tubes, including the kinescope, if failure or breakage re-

sults under conditions of normal usage during the one-year period.

Customers will be asurred of installation by qualified factory engineers, and distributors and dealers will be relieved of the initial multiple problems of installation and service. Extensive investment in test equipment, facilities, etc., will be minimized.

Rates for standard installations, antennas, service, and materials will be $45.00 and $50.00 for the 7" and 10" models. Rates will be announced specifically on each additional model receiver.

On non-standard type of installations which may require a special antenna or several antennas, or that have unusual structural or technical limitations or transmission difficulties, where power is other than 60-cycle, 110-120 volts, or where power is not synchronized with the transmitter, we will quote in advance on any additional cost over the standard rate to the dealer, and will arrange to bill the dealer for this amount when installation is completed. This same procedure will apply on some apartment houses; also, it will apply to commercial installations, such as hotels, tap-rooms, public places, schools, hospitals, theatres, etc., which will require special or unusual installation and service. The amount of such extra charge will be billed on a time-and-material basis.

It is intended that as other qualified personnel and facilities become available for the installation, service, and maintenance of television receivers, such agencies will be considered for such work.

We realize that there are many problems which will be met, and they must be solved rapidly and successfully if we are to have satisfied customers. Our shops are staffed with groups of qualified technicians and mechanics. They are equipped with complete alignment and service test instruments, mobile field-strength measuring sets, television signal simulators, repair parts, tubes, antennas, and materials.

THE PROBLEM OF TELEVISION SERVICING

John F. Rider

John F. Rider Publisher, Inc.

WHATEVER MAY BE SAID about the importance of television programming and transmission as the cornerstones for a successful industry, it is equally important to recognize the stature of the maintenance issue.

While the fulfillment of proper installation and maintenance requirements is recognized by all concerned, the manner of accomplishment looms as the main bone of contention. There is the feeling on the part of the television-receiver manufacturers that the radio Servicing industry is not technically qualified to cope with the television technique; therefore the manufacturers must establish factory-owned installation and repair facilities to service the public.

To a limited extent, the reasoning is understandable. Each manufacturer feels that his name and reputation is at stake; moreover they are anxious to start off on the right foot. No fault can be found with these desires, but is the means to the end equally commendable? Of course, all ideas on the subject are not yet crystalized. In other words, some of the manufacturers are waiting to see what others are doing, so that these comments are based on the indicated plans of some organizations and not each and every one with television receivers on their production lines.

It is impossible to deny that the general technical level of the majority of personnel now engaged in servicing is not on par with the level necessary to understand fully the operations involved in pre-installation surveys, the kind of equipment used for such work, and the circuital structure of television receivers. Granting this to be true and the necessity for initial effort by the manufacturers of the receivers, it still does not justify the establishment of a long-range program which is intended to freeze out the independent operator. As a matter of fact, it does not make sense, for in time—and it is not too far distant—the service of these people will be needed badly. It must be borne in mind that a few of the men now active in Servicing had sufficient vision years ago to acquire more advanced technical knowledge and they should be given the opportunity to participate. Many men are taking advanced training at this very moment and if their desire is to enter the repair field, they should have that right.

The Servicing industry appreciates the need for technical skill in the television field, but what it does not appreciate is a manufacturers' maintenance program which is established on the basis of technical incompetency and that fact is conveyed to the public. The harm it can do to the Servicing industry as a whole, in connection with their present activity, is tremendous and in the end may prove to be a boomerang to those who conceived it.

Manufacturers should not lose sight of the fact that while a distinct separation does exist, technically speaking, between television receivers and home-broadcast receivers—many of these television units sold to the public will contain equipment of the kind which has been repaired by the present Servicing industry. Can the public distinguish between the television portion of a complete apparatus and the broadcast receiver, record player, or whatever else which is not used during television reception, when it goes bad? Or is it the plan of the television-equipment manufacturer to take over radio Servicing? The answer to the latter more than likely is negative; if so, it seems strange to disparage a man's technical ability and later suggest that the defective unit be given to him for repair.

It is important for the television-equipment manufacturers to realize that the pattern of repair of electronic equipment used in the home is well defined. The past success enjoyed by the radio-manufacturing industry is due in part to the fact that the independent Service Man and the set dealer furnished nation-wide repair facilities. Few if any broadcast-receiver manufacturers can envision the establishment of factory repair shops in so many parts of the country as to serve all of their customers. It would not be sound financially and, therefore, it is not practical. Everybody in the radio industry knows of the abuse heaped upon the Servicing industry; yet taking everything into account, they have not done such a bad job; the nation's receivers have been kept in operation.

Let us not lose sight of the fact that like conditions will apply to television. Television equipment costing a thousand dollars or more will never make television successful, anymore than broadcast receivers costing several hundreds of dollars made conventional radio reception successful. At the moment, television is considered a highly technical art—a very critical art involving techniques and equipments foreign to the general run of Service Men. Apparently many have forgotten that the same line of reasoning was used when the first superheterodyne receiver appeared. In fact, one manufacturer went so far as to seal the assembly to assure that it could not be touched by unauthorized hands. Everyone here knows what happened. The superheterodyne receiver increased in popularity with such leaps and bounds that nationwide independent Service facilities were a blessing to the manufacturers, and the Servicing industry as a whole learned how to repair them to the public's satisfaction, the *Reader's Digest* comments nothwithstanding. Any program other than free enterprise by independent Service Men and set dealer's Service departments would have retarded the sale of such receivers tremendously.

The same is destined for television. Because of the higher cost for stations, programming, and the like, the spreading of the art will take place more slowly—it will be centralized in the larger communities—but widespread appeal, even in the well-populated areas, will not come until those same critical details which now are set as to make factory service necessary, are eliminated. And when that day comes,, adequate service facilities will be required and factory service is not the answer. It is no more the answer in this situation than it is in the case of automobiles. Factory branches may exist in some cities, but just as many if not more cars are serviced by independent repair men and car dealers as are serviced in factory-owned shops.

There is no technique in television receivers which is so complicated that it cannot be assimilated by the better grade of Service Man intelligence. In fact, the goal of the design engineer must be such fabrication of equipment that it is foolproof and simule to repair. The latter condition has contributed much to the public response to conventional broadcasting. Just so long as the services of a highly trained engineer are required to make a television-receiver installation or to effect a repair—just so long will the popular acceptance be retarded. The ownership of a television set cannot be a restriction to free placement of the receiver to meet home needs or changes in location to meet family increase requirements.

The greatest fault to be found with present maintenance planning by the equipment manufacturers is that a short-term requirement is being used for long-term planning. Even the Servicing industry admits that factory participation is essential at the start—on the just grounds that ample familiarity with the technical requirements does not exist in the Servicing ranks, the necessary equipment is not available, and last but by far not the least, that much information must be gathered for future use and possible simplification of the installation effort. However, the Servicing industry does object violently—and rightly so—to any and all statements that the reason for factory participation is technical incom-

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petency on the part of the Service group. Any such statement or even an implication, is placing the entire industry in jeopardy—even in cities where the installation of television equipment is in the distant future. Bad news travels fast and in devious ways.

Instead of condemning the Servicing industry to justify factory participation at the advent of television, it would be infinitely better to permit independent Service Man participation if the organization is found capable. The entire industry as a whole would benefit greatly if it fostered the technical advancement of the radio-repair group. Manufacturers spend unlimited funds teaching their dealers how to sell merchandise. Similar efforts—or at least sponsoring of programs whereby the radio repairmen of this nation could become more proficient technically—would reap untold benefits to the advantage of all concerned. In this respect the television broadcaster also can play his part. In fact, this is being done in Philadelphia where one of the broadcast stations is sponsoring a training program.

The Servicing industry of this nation is not blind to the realities of a situation. Its trials and tribulations during the past fifteen years have taught them that. They know that by and large they cannot make a pre-installation survey or repair a television receiver without special training. However, it is true that not much training would be needed to enable an individual or an organization to make an installation after the survey had developed the facts concerning the site. Moreover, they feel that their reputation should not be impugned, thereby causing them to lose customers who have other receivers in their home and for whom they had done work previously. The Service group does not feel that the receiver manufacturers owe them a debt of gratitude. All they want if a fair shake of the dice, which in the final analysis, will prove advantageous to the manufacturer and television broadcaster.

SERVICE MAN'S APPROACH

William J. Jones
Amie Associates

BROADCASTERS AND MANUFACTURERS have produced an amazingly efficient, accurate and dependable system. However, that portion of the technical completeness and dependability of the reception which is governed by the installation and servicing of the television receiver can become the Achilles heel.

If this phase is not generally accorded the attention, planning and action it requires, the whole television industry (sales, broadcasting, and manufacturing) will collapse.

The growth of the industry will be seriously impaired as it will be an expensive, tedious, and gigantic task to regain consumer confidence.

Any receiver manufacturer who fails to arrange for adequate installation and service facilities, while others do, will be inviting disaster.

Every television receiver is a salesman. None is neutral. It will always be in competition with other lines, in the same store, in other stores, or in the homes of friends or prospective customers.

The main thing that we have learned is that television receiver maintenance is an expensive proposition. There are few, if any, repairs which can fall into the $2.50 to $9.00 class.

Television receivers cannot be safely or adequately serviced in the customer's home. This means that a pick-up and delivery service for large heavy, expensive pieces of furniture must be maintained. The delivery and installation crews have to be bonded and insured.

As for installations, each one, whether in a dealer's store or in a customer's home requires separate consideration. There are no one or two standard arrangements which can suffice for any physiogeographic condition. It is unwise to suppose that one or two single fixed installation fees can be established which will suit the majority of conditions.

We have found it necessary to inspect the premises of each prospective owner and to attempt to place the particular installation problem in one of four catagories ranging from the simple condition which is a line-of-sight location high field intensity with no reflection, and short-leadin, to the more complex type which requires a high-gain, highly-directive antenna with long low-loss transmission lines or special antenna towers or mountings.

It has been necessary to establish fixed fees for the first three classes. These are proportionate to averages of materials and man-hours required. Installations falling in the fourth class are those which have to be estimated separately. Installations charges should be separate from the cost of the set.

Insurance for installation personnel, and insurance against liability due to damage to the home, property occupants or the general public as a result of an installation must be carried.

Repair charges must be based on the cost of material used and the number of man-hours required.

It must be realized that parts (power transformers, filter capacitors, i-f transformers) are considerably more expensive than those used in conventional broadcast receivers. There are numerous critical parts which must be replaced by exact duplicates if top performance is to be regained.

The formal technical training and experience required of repair men is of a high level.

Dependable, precision made test equipment must be available. We estimate that cost of special television repair equipment is in the order of $4,000 as a minimum with a figure of $5,000 being more desirable.

The fixed rate includes all costs plus a small margin of profit.

Service calls of the inspection and estimate types are made for a fixed fee.

Antenna system repairs and other types of on-the-spot Service are charged for on the same fixed shop labor rate.

For warranty period Service there are two possible arrangements. In one, the dealer pays separately for each service call made. In the other, the dealer deposits with the Service organization an *insurance fee* for each set sold by him. The Service organization then provides, during the warranty period, all necessary service without additional charge. The size of the fee must be based on the type and quality of the sets to be covered and a figure of maximum percentage of total sets covered by the insurance that may require service.

Technically, installation problems have been sub-divided into two catagories, simple and complex. Simple installations are those in suburban, residential and rural areas. Complex installations are those in built-up city areas.

For proper orientation of the antenna, two installation men are necessary. One on the roof, the other at the set observing the picture on the screen. The antenna must be rotated, moved in elevation or horizontal position for best overall results on all stations. Communication between the two is accomplished by means of hand telephone sets.

The problems to be overcome in the installation of the television receivers in a highly urbanized area are many, and unless they are properly approached the results will be most confusing and detrimental to volume sales of receivers.

Installation of antennas for the hundred or so television receivers that may be owned by the residents of a single apartment house in New York City represents quite a problem.

The only two arrangements that appear to be practical to date are:

(1) A receiver on roof with a video distribution system and video type receivers in apartments.

(2) An r-f distribution system, utilizing a single antenna or at most one for each station, to which receivers of existing design can be connected.

The first suggestion means a complete upheavel of the receiver manufacturing industry. Perhaps this should have been done or probably will have to be done. At any rate, it would mean special types of receivers and considerable research to determine if separate coaxial lines would be necessary for each channel or if several video signals could be propagated down a single line.

Attempts to cope with the problem by an r-f distribution system have not been discontinued. We have devised a system whereby a maximum of about 20 receivers may be operated independently of each other from a single antenna. Briefly, the antenna is coupled to a wide-band r-f amplifier. From cathode-follower stages connected in parallel across the output, separate r-f transmission lines are connected to the individual receivers. This system was operating as a bread board model, utilizing resistances for loads and connecting a television receiver at each point. The FCC shifts in frequency allocations introduced complications and before scaling to the new frequencies was complete the two men working on this project left us to return to school. We are still working on it however. One major phase of the problem is getting enough power out of the amplifier without cross-modulation. In apartment houses a leadin of 500' would be commonplace. What with attenuation in cable and the power requirements of each set, a fairly high level is required instead. The amplifiers must have extremely wide band coverage with uniform gain and introduce no troubles because of phase shift. The technical problems sometimes appear unsurmountable.

Whatever solution is reached, the financial cooperation of the apartment house owners and operators must be engaged.

Under existing circumstances, the landlords do not have to install facilities for television reception in order to attract tenants. Eventually, with the re-

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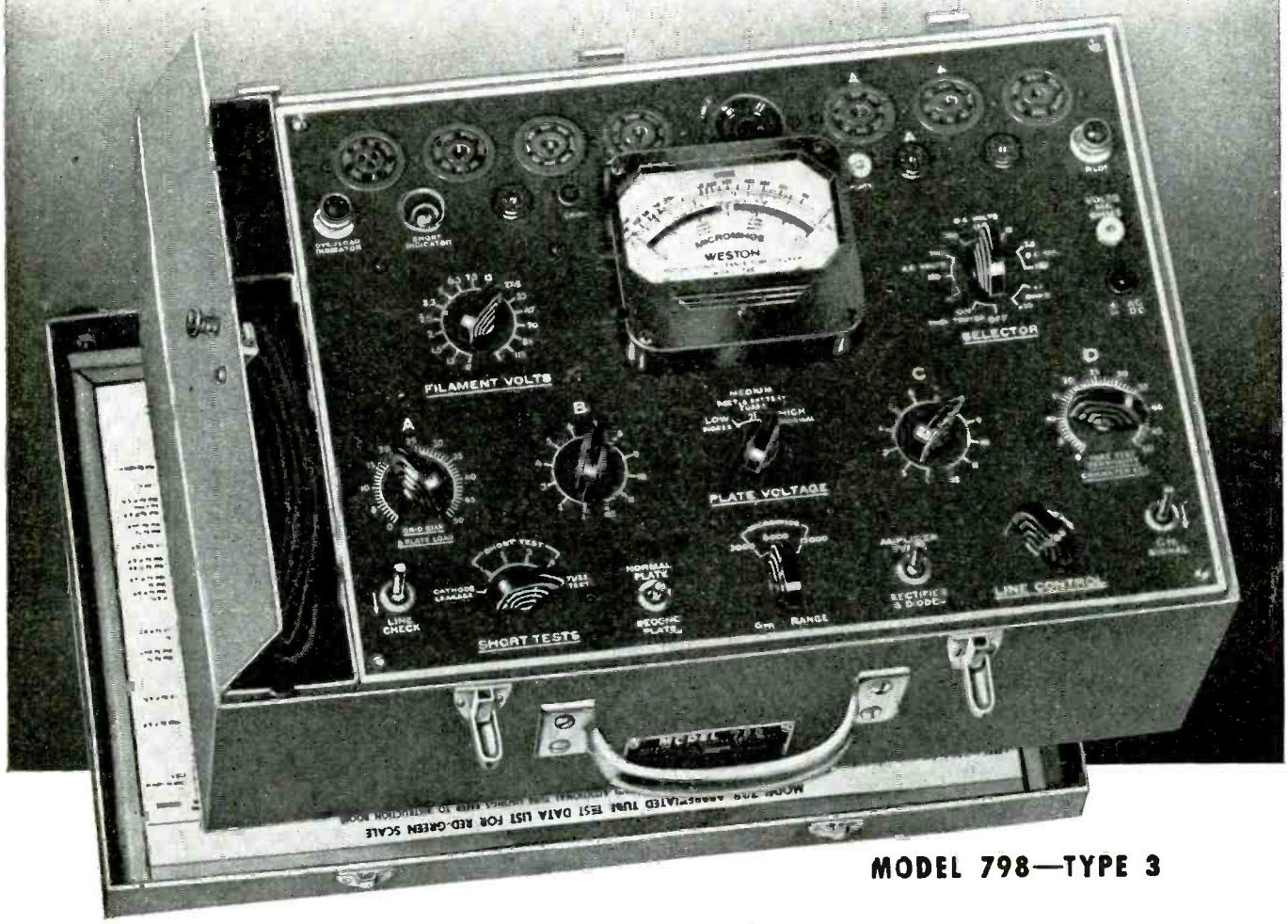

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Model 798 combines broad utility, ruggedness, and dependable accuracy for maintenance of sound and electronic equipment. Detailed bulletin available. Weston Electrical Instrument Corporation, 604 Frelinghuysen Avenue, Newark 5, New Jersey.

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ALBANY • ATLANTA • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • JACKSONVILLE • KNOXVILLE • LOS ANGELES • MERIDEN • MINNEAPOLIS • NEWARK
NEW ORLEANS • NEW YORK • PHILADELPHIA • PHOENIX • PITTSBURGH • ROCHESTER • SAN FRANCISCO • SEATTLE • ST LOUIS • SYRACUSE • IN CANADA, NORTHERN ELECTRIC CO., LTD., POWERLITE DEVICES, LTD.

turning of the housing situation to the pre-war phase, television reception facilities will be as necessary as refrigerators.

To adaquately service television receivers, a Service Shop must have data, personnel, parts and test equipment.

Complete engineering data obtained from the receiver manufacturer, must include circuit diagrams, functional block diagrams, detailed explanations of operation of the various circuits, alignment information, performance specifications, sensitivity (signal-to-mask voltage ratio), voltage and current figures, and engineering notes.

It is not sufficient to be supplied with figures like "250 microvolts sensitivity and gain of 700." Detailed information as to the measuring equipment (generators, connectors, detectors) gain settings, and techniques employed is mandatory. If possible, factory test conditions should be duplicated by the Service Shop.

Personnel should be well grounded in mathematics and electronic theory. They should be permitted to become familiar with the receivers at the manufacturer's plant. Constant liaison between design and production engineers with the Service Man is desirable.

Exact replacement parts should be available from the instant a model becomes available on the market. Manufacturers are urged not to use all components for manufacture, but to earmark a certain percentage for service. The amounts of each component would vary in accordance with anticipated fatality rate.

The requirements for test equipment are extremely rigid. The instruments must be accurate and dependable. The minimum types of equipment necessary for proper installation of receiving equipment include test antennas (different types), rigging equipment (ladders, hoists, etc.), hand telephones and wire, plumber's "snakes" for pulling coaxial lines through walls, down shafts. tools, and a field intensity measuring instrument is desirable.

The minimum types of equipment necessary for proper Service include voltmeters, ammeters, resistance bridge, capacitor bridge, inductance bridge, d-c vacuum tube voltmeter and a-c (to 400 mc) vacuum-tube voltmeters.

Required too are an a-m signal generator, f-m wobbulator and a crystal-controlled oscillator for adjustment of the local oscillator. Also needed are connecting cables, bias boxes, high voltage capacitor breakdown test sets, safety eye glasses, connecting cables, frequency meter, oscillograph (with wide-band amplifier), audio oscillator, square-wave generator, pulse generator, monoscope (image-signal generator), device for measuring ripple voltage in the high voltage supply, voltage divider, and a screen room.

Only with such an array of equipment can the Servicing of television receivers be considered.

Television Servicing is a highly technical business. It requires skilled Service Men and elaborate equipment.

Television Servicing will be expensive and because of certain characteristics will require a system of price calculation which has not been used in connection with broadcast receiver Servicing.

The importance of satisfactory television receiver installation and service facilities makes it mandatory that the receiver manufacturers and distributors see to it that the facilities do exist.

THE SERVICE MAN AND TELEVISION

George Duvall
General Manager
Television Technicians, Inc.

TELEVISION SERVICE MEN must necessarily be real technicians with long experience in repairing all types of equipment.

We have found that a variety of test apparatus is necessary for television Servicing. We have used infinite-impedance input instruments for all measurements; capacitor bridges; frequency-modulated sweep generators covering television frequencies; crystal-controlled marker generators and 5" scopes.

A study of our repair records reveals that many faults are common to most receivers. As a matter of fact we have found that approximately 75% of the failures, on 9" and 12" receivers, included:

High voltage failure due to gaseous rectifiers. If the transformer was overiused this failure would also break down the transformer.

Focus failures due to changing values of resistors. Vertical sweep failures due to tube failures and in many cases oscillator transfer failure.

Horizontal sweep failure; same reasons as vertical. Sound failures, due to failing capacitors.

Usual breakdown of resistors and capacitors, and the wearing out of various controls.

Oscillator and bandswitch trouble was found in 25% of the cases.

Video tube failures ran to much less than 10% during the 7½-year period we have been servicing television receivers, with less than 1% due to wearout. Most failures were found to be due to open and shorted elements and in some case leakage between elements.

There are three types of installation charges:

Simple—$30 . . . About 25% will fall under this heading.

Moderate—$50 . . . About 50% will come under this heading.

Difficult and exceptionally difficult—from $100 up . . . These should be made on a time-material basis. We made one at a cost of $250.00. Another one brought to our attention cost around $1200.

REMOTE CONTROL TELEVISION ANTENNAS

Madison Cawein
Research Engineer
Farnsworth Television and Radio Corp.

MOST SERVICE ORGANIZATIONS are aware that television antenna installations constitute one of television's most serious problems. Antenna installations in the mid-town areas of metropolitan centers present the only real problem which the Service Man will encounter.

We have found that it is not possible to install a fixed television dipole in the mid-town area of New York City to receive satisfactorily the radiations from all three of New York's television transmitters. The problems presented by reflections and spurious path transmissions are real and are quite difficult of solution in most cases. Extra problems will occur with the addition of television assignments on group *B* channels.

Most installation problems can be solved, however, by the use of remote-controlled, orientable antennas[1]. Such antennas consist of two dipoles at right angles, the shorter arms being tuned approximately to 192 mc, and the longer, to 64 mc. These are the geometric mean frequencies of the *A* and *B* channels The dipole arm-assembly is rotatable in either direction by use of a remote-control box. The control buttons on this box actuate a fractional horse-power motor in either forward or reverse direction by closing both primary and secondary windings of a 30-volt output, 110-volt 60-cycle bell-ringing transformer.

A continuous rotary switch-mechanism connects the short dipole or the long dipole to the transmission line at alternate 180° orientations. This, in effect, gives better matching of antenna-to-line for the two channel groups, *A* and *B*. and allows for optimum orientation to all transmissions as regards spurious reflections.

The RMA engineering department has been well aware that an antenna installation problem exists for television receivers, and has tried to solve this problem by standardizing on a 300-ohm parallel, unshielded line. It was hoped that the adoption of this standard would pave the way for economical and efficient antenna installations. This may be true for residential areas, but the use of an unshielded line can increase the problem of spurious signal reception in a region of strong field-strength.

The use of a shielded line is always a good precaution in critical locations, insuring that bad reflections which have been eliminated on the receiving dipole by proper orientation will not be picked up on the transmission line. Some difficulty may occur in finding the proper orientation for even a single station unless the Service Man is equipped with a dipole which can be remotely oriented, because of the distortion of field pattern due to the presence of a man.

Most moderately well designed receivers are capable of showing very good television pictures providing the proper antenna installation has been made. In at least 90% of the cases of poor television reception, the troubl can be traced directly to the antenna and transmission-line installation.

One solution to the problem of installations in metropolitan areas requires that apartment houses be equipped with master antennas and centralized distribution systems designed to carry a number of receivers. Until this practice becomes general, however, the Service Man can expect to have many headaches, the number of which will increase as the number of installations in any locality increases. Since the presence of two or more dipoles in close proximity on a single roof alters the field pattern for all received frequencies, there is some advantage in being able to orient the dipoles independently for best results. The consumer who has remote control of his dipole orientation will have a definite advantage.

The dipole impedance when tuned to the mean frequency of *A* or *B* channels can be expected to vary between the limits of 50 ohms and 150 ohms. This indicates that the mean impedance for all

(*Continued on page 20*)

[1]Service; February 1946.

NOW... Cunningham's second set of radio service utility displays for your shop

Tie-in of high-quality service with high-quality Cunningham Tubes brings you extra two-way profits

Cunningham's Set No. 2 of colorful window and counter display cards work continuously to advertise your business and let customers know that you carry Cunningham high-quality renewal tubes. Their rich colors instantly catch the eye and help to get over the story that you're equipped for rapid, high-quality repair work on all makes of radios.

You'll want these Cunningham utility displays to help you get your full share of today's business—and to identify you with big "C". So, waste no time in getting a set from your Cunningham Tube Distributor.

And look for more Cunningham Sales Aids soon.

Listen to "THE RCA SHOW," Sunday, 2:00 P.M., EST, NBC Network.

A QUALITY PRODUCT FOR RADIO SERVICEMEN AND DEALERS BY THE RADIO CORPORATION OF AMERICA

TELEVISION

(Continued from page 18)

conditions of operation is approximately 100 ohms. For all practical purposes, therefore, a transmission-line impedance of approximately 95 ohms will be satisfactory. The resulting mismatch at frequencies slightly different from the mean is not too important from the standpoint of receiver performance. Transmission line cable of 95-ohm impedance is available in both the concentric-line and parallel-line types. The 300-ohm line adopted by RMA is for use with a folded dipole which is in general less directional than the ordinary dipole.

Service organizations and dealer organizations are going to have to work together pretty closely in the installation business, particularly as regards mid-town area installations in large cities. In these localities installations are apt to require a considerable amount of transmission-line, on the average. A customer who purchases a receiver for a fixed sum might become quite dissatisfied if he discovered later that the installation would amount to a large percentage of the original purchase price. Various plans can be devised to overcome this difficulty. One of these would be to zone a city as regards necessary average lengths of transmission-line required, and to set fixed installation fees for various zones, which fees would take care of the cost of the transmission-line and the type of antenna required for that zone.

A television antenna should in most cases be mounted as high above the roof and as far from the street as practicable, and in line-of-sight of all the transmitting antennas possible. The received signal strength is proportional to the square-root of antenna height, so that one dipole which is placed at four times the height of another will provide twice the signal. Interference from automotive ignition and other electrical noises will be correspondingly less, so that a considerable signal-to-noise advantage is obtained. This may in some locations represent the difference between a useable and a non-useable installation.

For best results in outlying locations the receiving dipole should be in a plane perpendicular to the direction of the transmitting antenna. This optimum position may be modified by the location of tall, reflecting structures relatively near the line of transmission. In mid-town areas this condition is impossible of fulfilment because transmitters will in general be located on all sides of the receiver, and reflecting structures may be anywhere. In such cases the best that can be done with a fixed dipole is to effect a compromise location to give satisfactory reception from the favorite transmitter. Reception from other transmitters may or may not be useable.

In many cases it may be necessary to erect two or more antennas, either with separate transmission lines or with a remote-controlled switching arrangement. This would be particularly true where a very tall intervening structure exists in the path of either one or another of the transmitters, and near to the receiver location.

Specifically, there are several things which can happen to a television signal due to reception of spurious, reflected signals. The relative phase of the various received signals, which depends on length

of path from transmitter to receiver, can lag or lead by 180°. Dependent upon phase and relative strength of two or more received signals originating at the same transmitting antenna, bas-relief effects, negative pictures, reversal of sync polarity, and loss of synchronization can occur at the receiver. Perhaps the worst effects are produced when only certain side-band components are reflected out of phase with the line-of-sight signal, in which case the synchronizing signals may be lost completely, or the blanking pedestals may reverse and brighten the retrace of the cathode beam at the receiving picture tube.

The most usual phenomenon is the occurrence of several images on the receiver screen, each lagging behind the other by a few microseconds of path difference. The primary image is then followed by several ghost images which are quite annoying to say the least. Usually, these effects can be cleared up by rotating the antenna, although there are a few cases in which the antenna location must be physically changed.

There have been reports of locations in which nothing could be done to obtain good reception. We have encountered such locations only inside of buildings or directly in the shadow of large structures.

On the other hand, we have found it possible to obtain good reception by properly locating and orienting a dipole inside of an apartment building several miles from the transmitters in New York City, and relatively close to the ground, as in Jackson Heights. Fire escapes and interior metal structures in walls and floors are important factors to watch in such temporary installations.

MULTIPLE ANTENNA SYSTEMS

Richard L. Burtner
Chief Project Engineer
Telicon Corporation

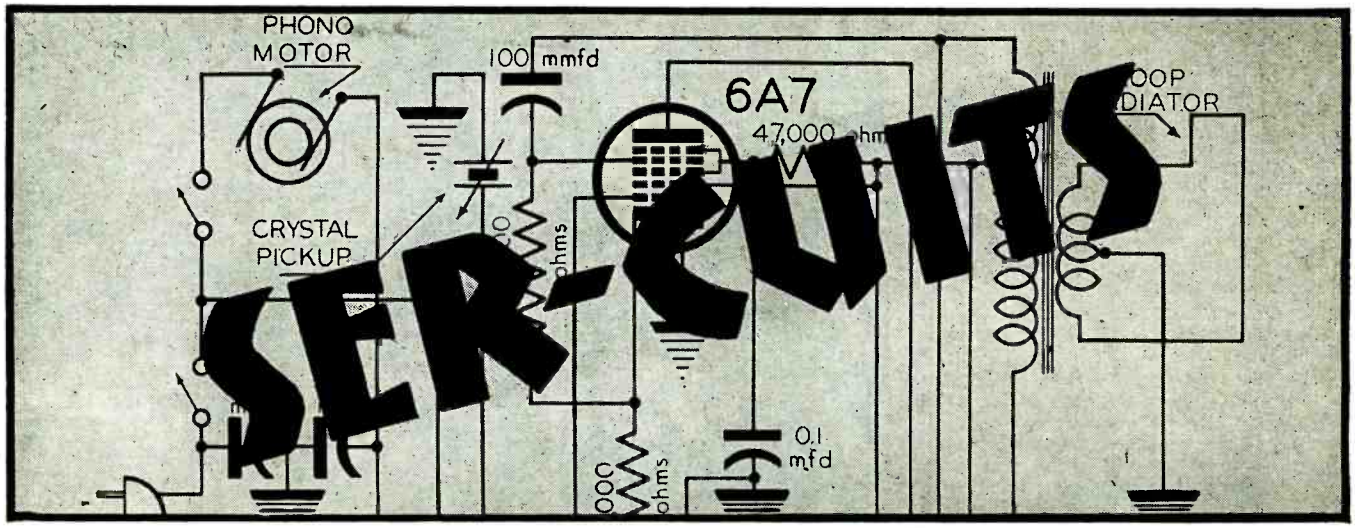
THE INTRA-VIDEO ANTENNA SYSTEM is intended to supply, simultaneously, any number of television receivers in a building with satisfactory signals from all transmitters in the area, with freedom from ghosts, no mutual set interference, and sufficient signal strength to provide a good signal-to-noise ratio in the first stage.

The progressive Service Man should be familiar with television distribution systems for a number of reasons. Not only will he be called upon to service sets which are connected to distribution systems. We anticipate that he also will find it necessary to advise apartment house owners, television dealers and individual set owners as to the particular system to meet their needs.

Multiple television receiver installations usually present many knotty problems. For instance, under the most ideal conditions no more than six or eight receivers may be directly coupled to the same antenna simply because there is not enough energy to operate more. Even this is impossible except in a high-signal strength region within five or ten miles of the transmitter. Furthermore a number of sets so connected are quite likely to cause mutual interference between themselves when tuned to different frequencies or when improperly adjusted.

Another possibility is a separate antenna for each receiver but the difficulty

(*Continued on page 39*)



SER-CUITS

by HENRY HOWARD

WITH EXTENDED-RANGE REPRODUCTION a must in all types of receivers, even the smaller types, designers have been concentrating on audio-system improvement circuits. Covering the very low frequencies has been a major circuit project of most designers. In extending the range to these low frequencies, hum becomes quite a problem. To solve this, several interesting circuits have been evolved.

In Figs. 1 and 2 appear two different approaches toward combating the hum problem with p-m speakers. Since

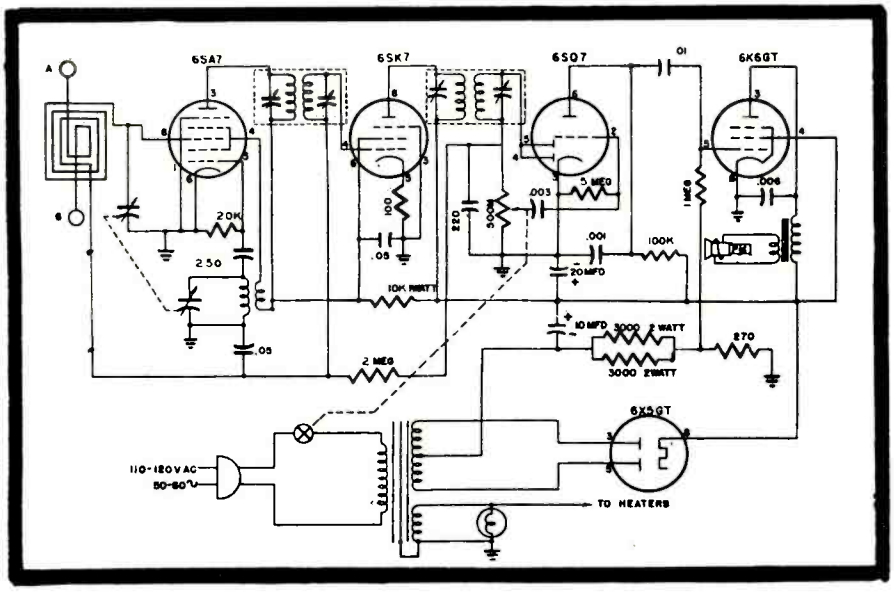
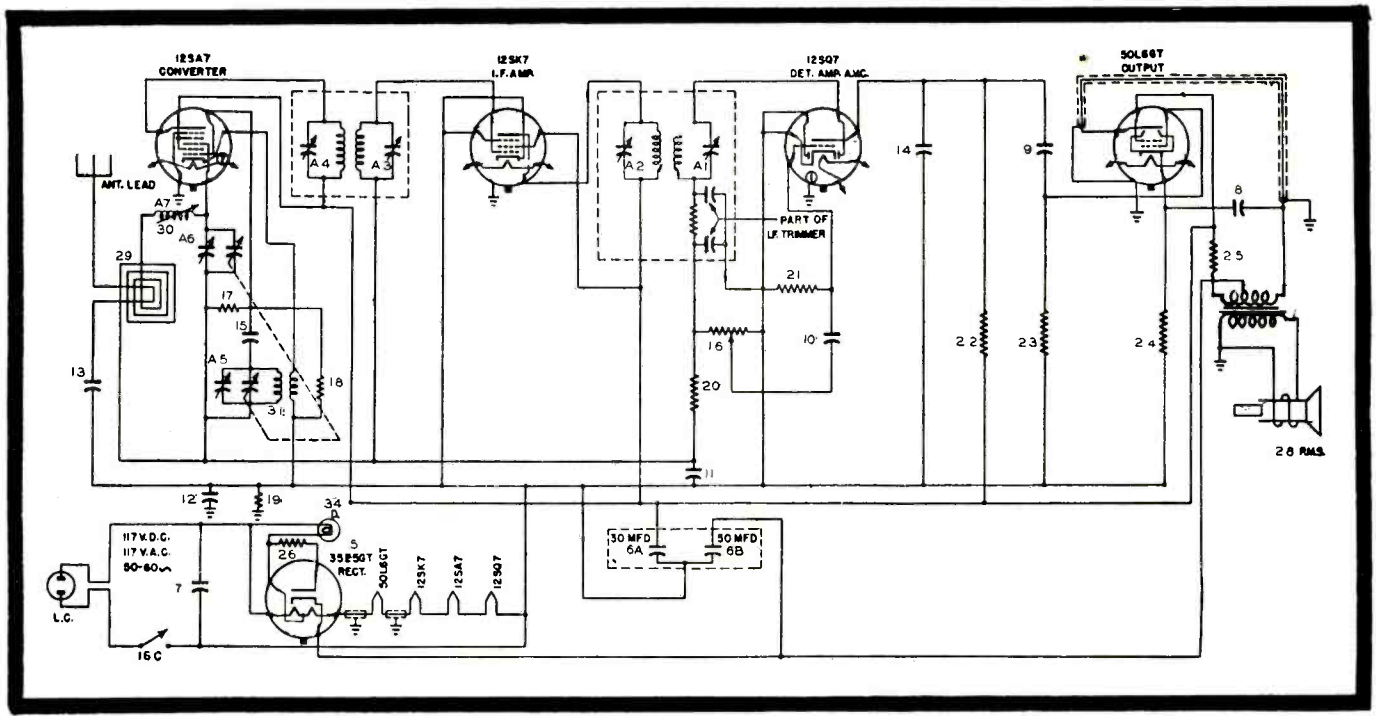


Fig. 2. Packard-Bell 5FP-a-c receiver with a resistance filter in the negative high-voltage lead.

Fig. 1. Learadio models 561, 562 and 563 with a tapped primary on the output transformer for hum neutralization. List of parts on page 24.



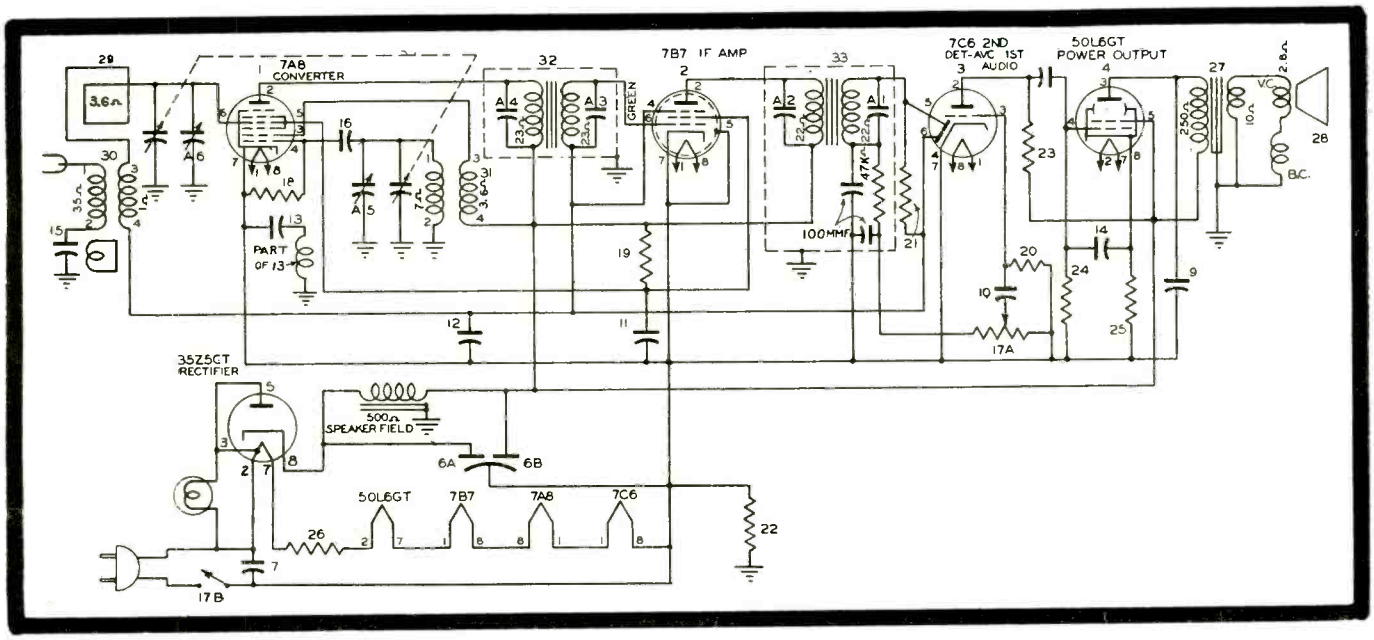


Fig. 3. Philco 46-200 series, using an e-m speaker with field acting as a filter choke.

p-ms are becoming universally popular and the familiar bucking coil of e-m speakers cannot be used either some other method of hum neutralizing is required or more efficient filters must be employed. This is not too great a problem in the larger models but in the smaller types it is a major problem.

Learadio 561,562,563

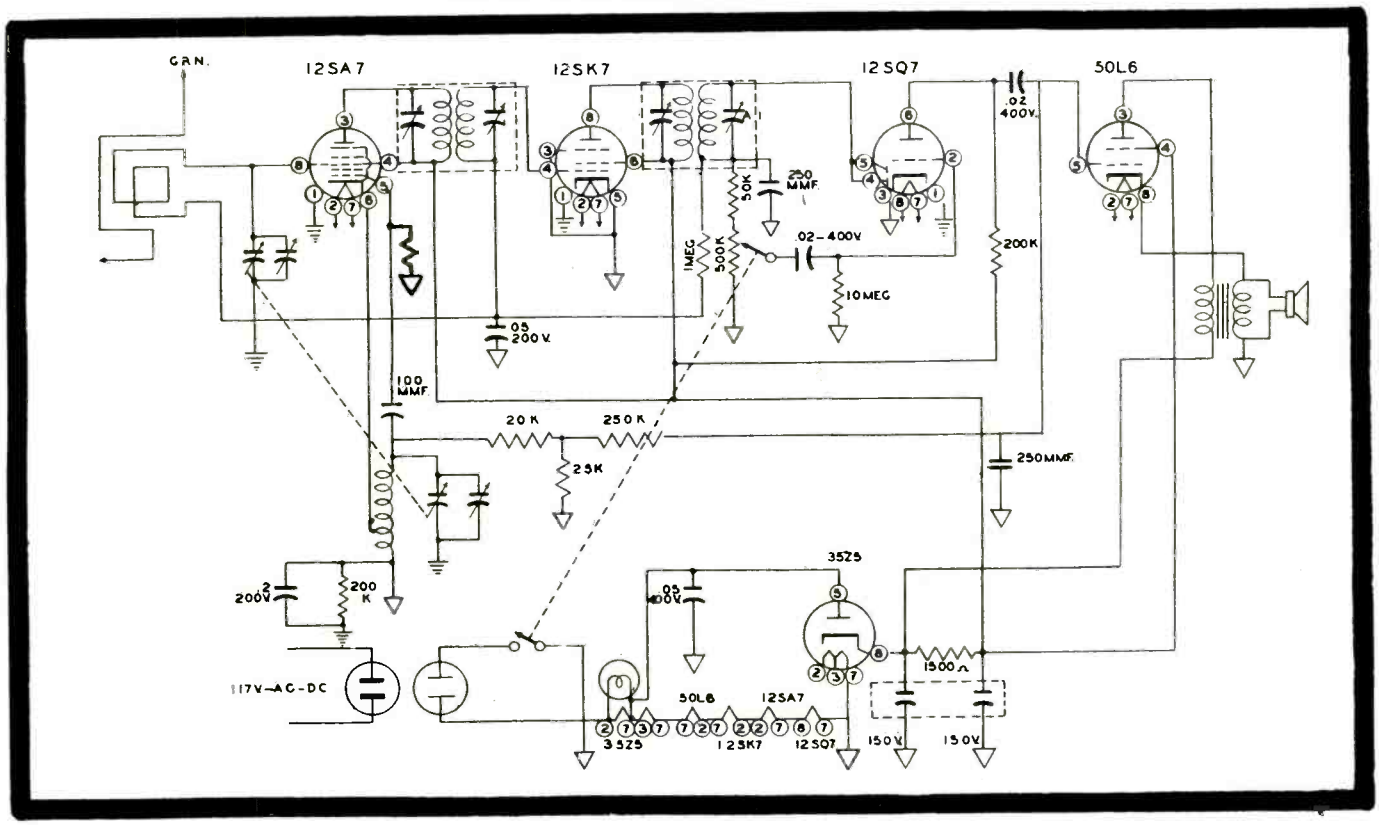
The Fig. 1 method (Learadio models 561, 562, 563), utilizes a tapped primary on the output transformer for hum neutralization in the power amplifier. This system has been analyzed in previous issues of SERVICE.

Briefly the circuit operates in the following way: The ripple voltage causes ripple currents and core fluxes which flow in opposite directions from the *B* supply tap. When the tap is in the electrical center and the loads at both ends of the winding are equal, as in a balanced push-pull stage, the fluxes cancel, inducing no voltage in the secondary winding. In the smaller sets balanced loading is not attempted since, with a single tube, half the power would be wasted. Therefore, some compromise must be reached between the amount of hum cancellation and the amount of audio power sacrificed.

The parasitic load on the transformer consists of a 1,200-ohm resistor

(*Continued on page* 24)

Fig. 4. ECA 101 featuring a novel feedback circuit.



SER-CUITS

(*Continued from page 23*)

which feeds a 50L6 screen as well as the remainder of the tubes.

These models also employ an adjustable loop loading coil.

Packard-Bell 5FP

Another approach to the hum-problem is shown in Fig. 2, Packard-Bell's 5FP. This is an a-c model with a 6X5 rectifier and a resistance filter in the negative high-voltage lead. The filter components include a 10-mfd capacitor, 1,500-ohm resistor, and a 270-ohm and 20-mfd unit. Bias for the 6K6 power tube is taken from the drop across the 270 ohms and is unfiltered except for the 10-mfd input capacitor. Thus a certain amount of ripple voltage is delivered to the grid to neutralize the ripple in the plate and screen supply. The 1,500-ohm system consists of two 3,000-ohm 2-watt units in parallel. An additional r-f decoupling filter of 10,000 ohms and .05 mfd feeds the 6SK7 i-f screen and the plate and screen of the 6SA7.

Philco 46-200

Not all new compacts are using p-ms. Philco model 46-200 series, Fig. 3, uses an e-m speaker with the field acting as a filter choke.

An unusual loop-antenna coupling circuit is used in this model with a coupling transformer at the low potential end of the loop. To reduce the *Q* and prevent serious antenna resonance with its overcoupling tendencies, a short-circuited tertiary winding is used.

ECA 101

A novel feedback circuit is employed in ECA's model 101, Fig. 4. The

List of parts for Learadio 561, 562 and 563

CAPACITORS		RESISTORS	
6(A)	30		
(B)	50	17	15 MEG
7	.05	18	22,000 OHMS
8	.05	19	220,000 OHMS
9	.004	20	2.2 MEG.
10	.02	21	6.8 MEG.
11	.05	22	470,000 OHMS
12	.1	23	470,000 OHMS
13	.001	24	150 OHMS
14	220	25	1800 OHMS
15	47	26	15 OHMS

cathode of a 50L6 power amplifier is grounded through an output transformer secondary which applies voice-coil voltage to the cathode. Bias for this tube is generated by an oscillator grid leak which consists of 20,000 ohms in series with 25,000 ohms, the bias being taken from the junction. Thus, 56% of the d-c grid voltage is utilized as bias. The r-f component is filtered out by 250,000 ohms and a 250-mmfd capacitor.

•

FCC VISITS RCA PLANT

J. B. Elliott, vice president of RCA Victor in charge of home instruments, showing FCC members 10" video tube used in table model television receivers now in production. Left to right: FCC Commissioner, P. A. Walker; acting chairman C. R. Denny; W. W. Watts, RCA vice president in charge of engineering products; Mr. Elliott; and FCC Commissioners E. K. Jett, R. C. Wakefield and R. H. Hyde.

•

JFD HANDY SPOOL DISPENSER

Handy spool dial cord and cable dispenser recently developed by the JFD Manufacturing Company.

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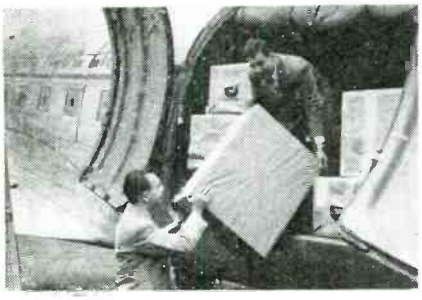
RECORDERS FLOWN IN



Bob Corenthal and William Filler, general manager and president, respectively, of Terminal Radio with Radiotone recording machines recently flown in from Los Angeles to Teterboro, N. J.

Two-Band Phono Receiver With VARIABLE RELUCTANCE PICKUP

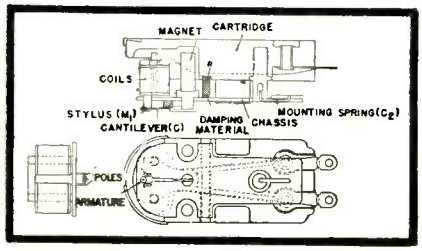


Fig. 1. Magnetic or variable reluctance reproducer used in G. E. receiver.

WITH RECENT DESIGNS of new types of pickups have come several interesting circuit developments to accommodate the pickups. An interesting example of this circuit design appears on the cover this month, the preamplifier of the G. E. 326 and 327 two-band phono consoles, featuring the magnetic or variable reluctance pickup.

Pickup Features[1]

The variable-reluctance pickup, which has a low level, has a very wide-

[1]W. S. Bachman, *Reproducer Design*, Transactions of the AIEE.

(See Front Cover)

frequency range extending from below 20 cycles to 10,000 cycles, a very light record loading of only 16 grams and considerable resistance to shock which greatly overbalances its low level. The armature is a steel ribbon having a cross section of .010" by .030" which is located right at the stylus so that the motion of the armature is inseparably that of the stylus. And as long as the stylus properly tracks in the groove, the output voltage will be proportional to the stylus velocity, the armature having no frequency characteristic of its own.

The armature has a 90° twist near the fixed end, which makes possible nearly as much compliance in the vertical direction as laterally. This is desirable to permit the stylus to recede within the guard provided by the two pole faces when subjected to excessive downward forces, such as in dropping. A small block of pyralin, just forward of the twist, provides sufficient damping to restrain the second mode of vibration (second harmonic) of the cantilever. At the free end the width of the armature is increased to receive the stylus. The dynamic mass of this stylus-armature assembly is about 8 milligrams. This mass is suspended on the spring, represented by the cantilever, the mechanical schematic of which is shown in Fig. 2 (left). At right is electrical equivalent, a simple series circuit which expresses the mechanical impedance at the stylus tip.

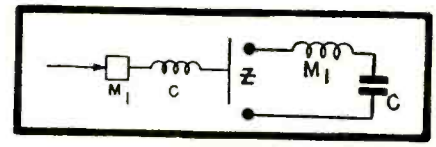
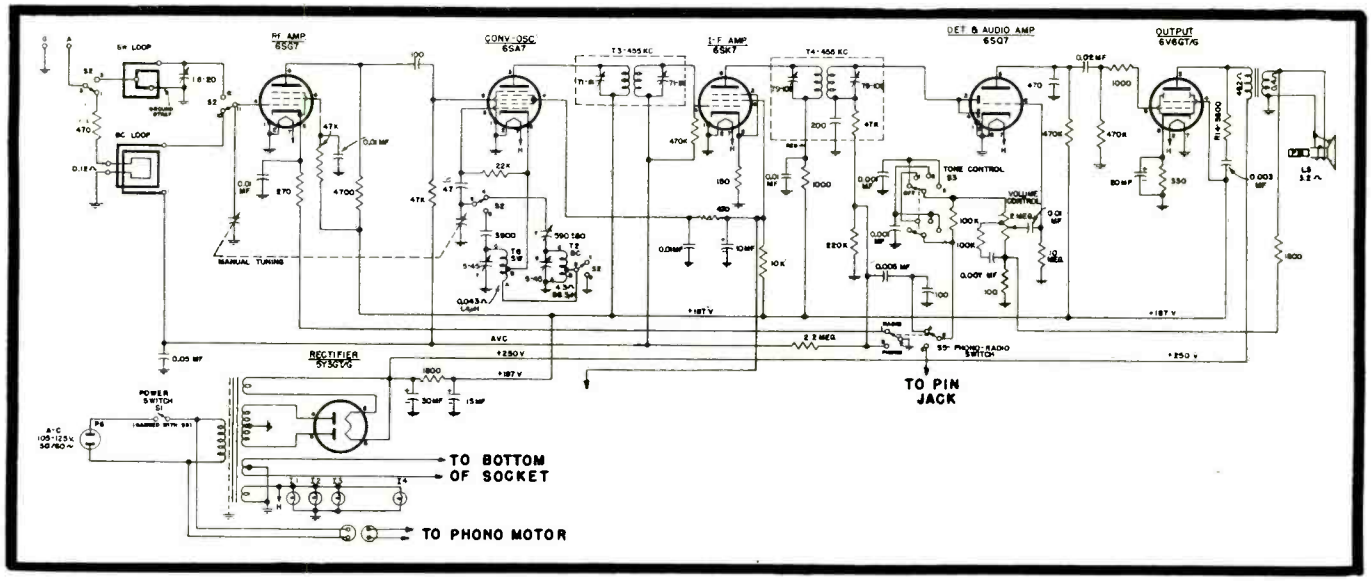


Fig. 2. Mechanical schematic of the stylus cantilever assembly of pickup. Fixed end of the cantilever is assumed to be rigid which is very nearly so at high frequencies; M_1 is the dynamic mass of the stylus assembly and C is the compliance of the suspension.

At low frequencies the system is stiffness controlled, the impedance decreasing until the M_1 and C resonate. At this frequency (2,300 cycles) the

(Continued on page 28)

Fig. 3. Circuit of the G.E. receiver in which the preamplifier and variable reluctance pickup is used.



PHONO RECEIVER

(*Continued from page 26*)

impedance becomes very small, which means that practically no force is required to move the stylus. Above resonance, the system is mass controlled, the impedance increasing directly with frequency.

Preamplifier Design

The pickup is resistance coupled to the first amplifier grid across 6,800 ohms and a 3.3-megohm grid leak. Separate plate supply decoupling filters are used in each triode of the 6SC7 for added stability and hum reduction. This is in addition to the two conventional resistance-capacity filter sections of the receiver proper.

The first preamplifier filter uses a 68,000-ohm resistor and 15 mfd capacitor; the second filter, a 33,000-ohm resistor and 15-mfd capacitor. The coupling circuit from first to second triode contains a 200,000-ohm series resistor and a low-frequency boost network consisting of a .01-mfd capacitor in parallel with 180,000 ohms, all in series with 27,000-ohms loading resistance.

The preamplifier output is applied to the high side of the volume control through a 4-position tone control, the output level after the amplifier being equivalent to that obtained directly from a standard crystal pickup.

Circuit Features

Other features of the circuit (Fig. 3) include two loops, tuned r-f stage and resistance-coupled first detector. When used with an external antenna, the b-c loop has 470 ohms in series with an inductively-coupled primary while the s-w loop is directly coupled by means of a tap. The 6SG7 r-f amplifier has a supplementary 270-ohm cathode bias resistor which is disconnected from ground in the phono position, rendering the r-f stage inoperative. The plate-load resistor is only 4,700 ohms, which is shunted by the detector grid leak of 47,000 ohms through a 100-mmfd blocking capacitor.

The 6SA7 oscillator grid is switched to either of two oscillation transformers through padding capacitors; 3,900 mmfd for s-w and 590±80 for b-c. The cathode is permanently connected to the s-w coil tap with the low end of the coil connected to the tap on the b-c transformer. The latter is grounded

for s-w. The 6SK7 i-f stage has a 150-ohm supplementary cathode bias.

Audio degeneration is applied to the low end of the volume control across 100 ohms to ground, being taken from the voice coil through 1,500 ohms. A 2-megohm control is tapped for bass compensation through a 0.1-megohm resistor and .007-mfd capacitor. The detector or preamplifier output is connected to the volume control through a 4-step tone control which operates as follows: step *1*, .1 megohm in series with the v-c, then .001 mfd to ground; step *2*, direct connection to the v-c (.1 megohm shorted); step *3*, direct connection and .001-mfd to ground; step *4*, .001 mfd, .1 megohm and a second .001 mfd in a pi low-pass filter. It will be seen that the control progressively cuts the high frequencies.

In the 6V6-output stage is a 1,000-ohm series resistor at the grid to limit the amount of overloading. This is becoming a pretty common practise. Instead of the usual shunt capacitor from plate to ground, this amplifier uses a .003-mfd capacitor in series with 5,600 ohms which is connected between plate and screen.

The audio gain is such that 60 millivolts, at a frequency of 400 cycles, applied between the high side of the volume control and ground, will build up ½ watt across the voice coil.

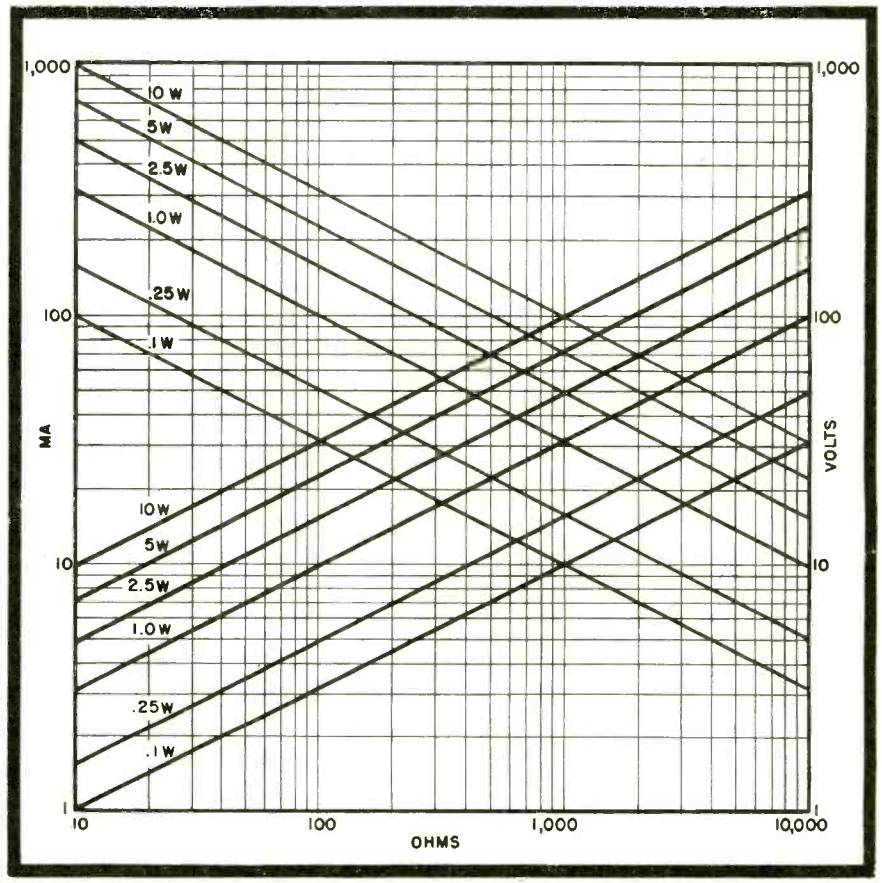
R-f stage gains are: antenna to r-f grid, gain of 4 at 1,000 kc; 6SG7 grid to 6SA7 detector grid, gain of 14 at 1,000 kc and detector grid to 6SK7 i-f grid, gain of 74 at 455 kc.

BRITISH MODELS

Above, British type receiver, Murphy A104, with entire cabinet used as baffle for speaker. Below, personal type of British receiver recently displayed at exhibition in London.

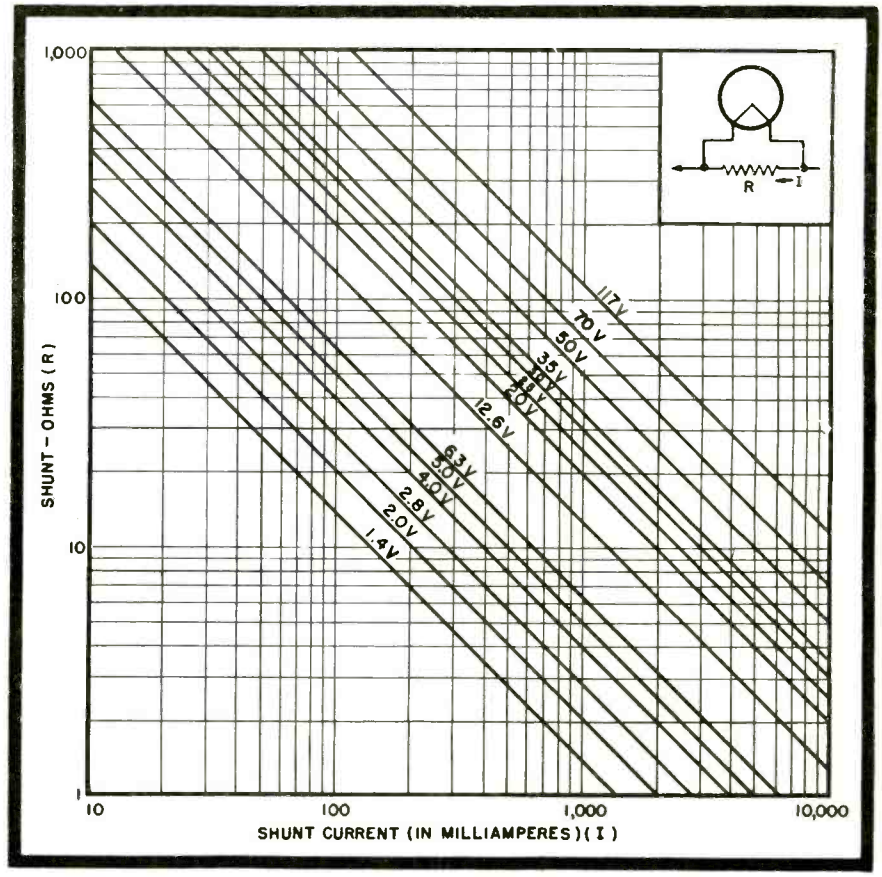
Quick Reference Charts

by E. B. MENZIES



A chart that can be used to determine the watts dissipated when the resistance and either voltage or current are known.

This chart reveals the resistors required in filament and heater shunt circuits.



FOR HIPERM ALLOY TRANSFORMERS

The UTC Hiperm alloy audio transformers are specifically designed for portable and compact service. While light in weight and small in dimensions, neither dependability nor fidelity has been sacrificed. The frequency characteristic of the Hiperm alloy audio units is uniform from 30 to 20,000 cycles. These units are similar in general design and characteristics to the famous Linear Standard audio Series.

UTC Hiperm Alloy Transformers Feature

True Hum Balancing Coil Structure . . . maximum neutralization of stray fields.

Balanced Variable Impedance Line . . . permits highest fidelity on every tap of a universal unit . . . no line reflections or transverse couplings.

Reversible Mounting . permits above chassis or sub-chassis wiring.

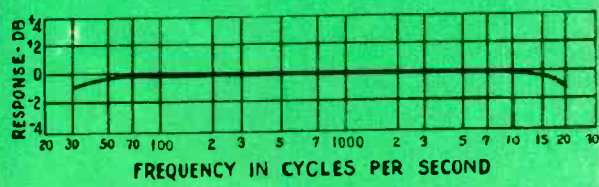
Alloy Shields . . . maximum shielding from induction pick-up.

Multiple Coil, Semi-Toroidal Coil Structure minimum distributed capacity and leakage reactance.

High Fidelity . . . UTC Hiperm Alloy Transformers have a guaranteed uniform response of ±1.5DB from 20-20,000 cycles.

FOR IMMEDIATE DELIVERY

From Your Distributor



Typical Curve for HA Series

Type No.	Application	Primary Impedance	Secondary Impedance	± 1 db from	Max. Level	Max Unbal. DC in primary	List Price
HA-100	Low impedance mike, pickup, or multiple line to grid.	50, 125, 200, 250, 333, 500 ohms	60,000 ohms in two sections	30–20,000	+22 DB	5 MA	18.60
HA-100X	Same as above but with tri-alloy internal shield to effect very low hum pickup.						23.95
HA-101	Low impedance mike, pickup, or multiple line to push-pull grids.	50, 125, 200, 250, 333, 500 ohms	120,000 ohms overall, in two sections	30–20,000	+22 DB	5 MA	21.25
HA-101X	Same as above but with tri-alloy internal shield to effect very low hum pickup.						26.60
HA-108	Mixing, low impedance mike, pickup or multiple line.	50, 125, 200, 250, 333, 500 ohms	50, 125, 200, 250, 333, 500 ohms	30–20,000	+22 DB	0	18.60
HA-106	Single plate to push-pull grids	8,000 to 15,000 ohms	135,000 ohms 1.5:1 ratio, each side	30–20,000	+22 DB	1 MA	15.95
HA-113	Single plate to multiple line.	8,000 to 15,000 ohms	50, 125, 200, 250, 333, 500 ohms	30–20,000	+22 DB	5 MA	17.95
HA-134	Push-pull 89's or 2A3's to line.	5,000 to 10,000 ohms	50, 125, 200, 250, 300, 500 ohms	30–20,000	+32 DB	5 MA	19.95
HA-135	Push-pull 2A3's to voice coil.	3,000 to 5,000 ohms	30, 20, 15, 10, 7.5, 5, 2.5, 1.2	30–20,000	+32 DB	5 MA	18.60

The above listing includes only a few of the many Hiperm Alloy Transformers available . . . write for catalog.

United Transformer Corp.

150 VARICK STREET NEW YORK 13, N. Y.

EXPORT DIVISION: 13 EAST 40th STREET, NEW YORK 16, N. Y., CABLES: "ARLAB"

NEW PRODUCTS

AUDAR PORTABLE RECORD PLAYER

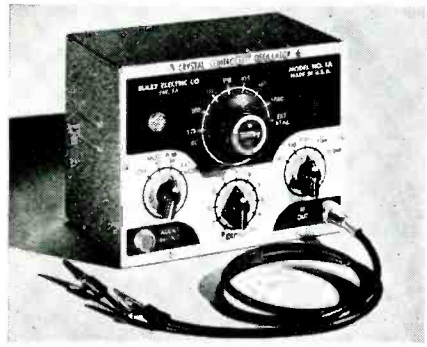
A portable, with a three-tube amplifier with broad-band bass boost and separate tone control which boosts the treble, a 6½" dynamic speaker, and a crystal pickup has been produced by Audar, Inc., Argos, Indiana, an affiliate of John Meck Industries, Plymouth, Indiana.

* * *

BLILEY CRYSTAL-CONTROLLED OSCILLATOR

A crystal-controlled oscillator, type CCO, for receiver alignment has been developed by Bliley Electric Company, Erie, Pennsylvania. Employs low-temperature-coefficient quartz crystals, stable to within ± 0.1%, for selection of the five most commonly used intermediate frequencies: 175, 262, 370, 455 and 465 kc. Crystal control is also provided at 200 kc for r-f alignment and at 1000 kc for short-wave alignment.

An external socket is provided to accommodate special frequencies that may be required. Provided also is a three-position modulation selector and a five-step attenuator with vernier output control from 0 to 15 volts. No warm-up period is said to be necessary since the crystals are on frequency as soon as the oscillator is energized.



* * *

ST. LOUIS COLOR MICROPHONES

Colormike microphones, in 5 colors, red, blue, green, yellow and orange, have been produced by the St. Louis Microphone Co., 2726-28 Brentwood Blvd., St. Louis 17, Mo.

Features are said to include unbreakable diaphram and Alnico V. Variable-impedance output permits choice of 50, 200, 500 or 50,000 ohms for balanced-line output.

* * *

GENERAL CEMENT WIRE STRIPPER KIT

A wire-stripper kit (Speedex 733-K) for stripping of insulation of No. 8 to 30 wire has been produced by the General Cement Manufacturing Co., 919 Taylor Avenue, Rockford, Illinois.

Supplied with seven interchangeable blade

* * *

MONEL CHERRY BLIND RIVET

Cherry blind rivets in monel metal have been announced by the Cherry Rivet

(*Continued on page* 42)

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of SERVICE, published monthly at New York, N. Y., for October 1, 1946.

State of New York } ss.:
County of New York }

Before me, an attorney and counselor-at-law, in and for the State and county aforesaid, personally appeared B. S. Davis, who, having been duly sworn according to law, deposes and says that he is the Business Manager of SERVICE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, Bryan Davis Publishing Co., Inc., 52 Vanderbilt Avenue, New York 17, N. Y.; Editor, Lewis Winner, New York, N. Y.; Managing Editor, F. Walen, Union City, N. J.; Business Manager, B. S. Davis, Ghent, N. Y., 2. That the owners are: Bryan Davis Publishing Co., Inc., 52 Vanderbilt Avenue, New York 17, N. Y.; B. S. Davis, Ghent, N. Y.; J. C. Munn, Union City, Pa.; A. B. Goodenough, Port Chester, N. Y.; P. S. Weil, Great Neck, N. Y.; F. Walen, Union City, N. J.; G. Weil, Great Neck, N. Y.; L. Winner, New York, N. Y. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities, are: None. 4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock, and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) B. S. DAVIS, Business Manager.

Sworn to and subscribed before me, this 27th day of September, 1946.

(Seal) BERNARD M. KOMMEL,
Attorney & Counselor-at-Law.

Commission expires March 30, 1948.

Model 2450
ELECTRONIC TESTER

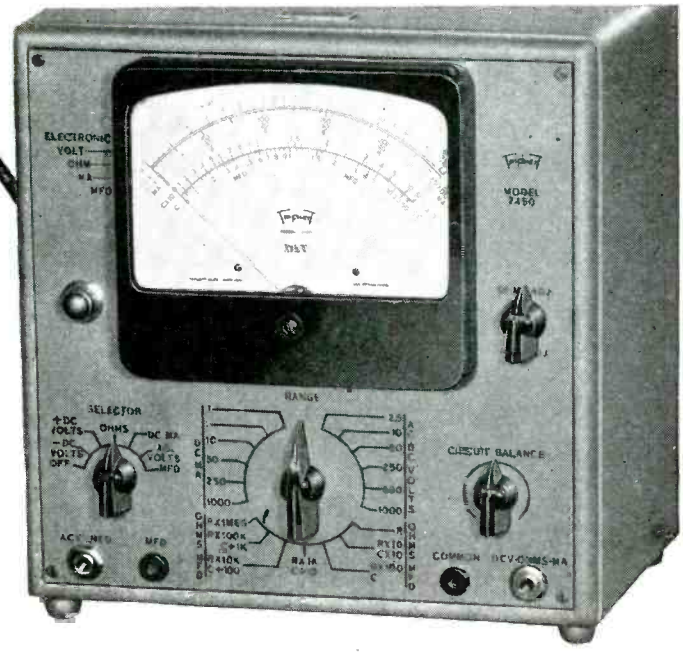
★

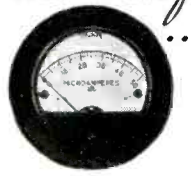
There's never been a tester like this!

Here's a tester with dual voltage regulation of the power supply DC output (positive and negative), with line variation from 90 to 130 Volts. That means calibration that stays "on the nose"! That means *broader service* from a tester that looks as good as the vastly improved service it provides. This model includes our Hi-Precision Resistor which outmodes older types.

HIGHLIGHTS—42 ranges: DC and AC. Volts: 0-2.5-10-50-250-500-1000 • DC MILLIAMPS: 0-0.1-1.0-10-50-250-1000 • OHMS: 0-1000-10,000-100,000 • MEGOHMS: 0-1-10-100-1000 • CAPACITY IN MFD: 0-.005-.05-.5-5-50 • LOAD IMPEDANCE: 51 megohms on DC Volts • CIRCUIT LOADING: Low frequencies. Circuit loading equal to 8 megohms shunted by 35 mmfd. High frequency circuit loading equal to 8 megohms shunted by 5 mmfd.

Detailed catalog sheets on request.





Precision first ..to last

Triplett

ELECTRICAL INSTRUMENT CO. BLUFFTON, OHIO

STANDARDS ARE SET BY TRIPLETT

Olson's 2 Great Money-Savers!

OHM CHEST

packed with 100 Insulated Resistors

This handsome Chest has twenty compartments — 10 in the base and 10 in a removable tray. Walnut finish; brass hinges and fastener. Contains 100 resistors stamped with resistance values, 5 ohms to 20 megohms, ½ watt to 2 watts, color coded. Every size is popular. No war surplus resistors in this Ohm Chest!

$4.95

Free!

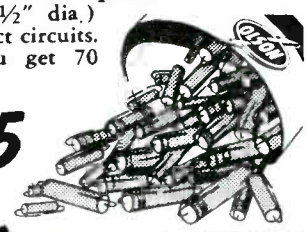
With each Ohm Chest ordered, we send our "Resist-O-Guide" free. Revolving wheels in color show all resistance values.

CONDENSER KITS

Sweet savings on seventy 600-V. By-Pass Condensers, made to rigid Olson specifications. Will withstand voltages higher than ratings. Worth much more than our low price! Small size (approx. 1½" long, ½" dia.) makes these units right for compact circuits. Long tinned copper leads. You get 70 Tubulars, as follows:

QUANTITY	CAPACITY
20	.01
10	.02
20	.05
20	.1

$4.95



Send for our Free BARGAIN CATALOGS

OLSON FREE

Panel Lamp Tool

with each Condenser Kit ordered. Rubber tool grips bulb for easy installation or removal in hard-to-get-at positions.

Paste this Coupon → on a penny postcard and Mail Today to

OLSON RADIO WAREHOUSE INC.

73 E. MILL ST., DEPT. 64, AKRON, OHIO

Send me _____ Ohm Chests with 100 Insulated Resistors in each, @ $4.95. (Resist-O-Guide free with each Chest.)

Send me _____ Kits of 70 Condensers each, @ $4.95. (I will receive a Panel Lamp Tool FREE with each Kit.)

☐ I enclose $_____ Order will be postpaid.

☐ Send my order C. O. D. I will pay postage.

NAME _____

ADDRESS _____

CITY _____ STATE _____

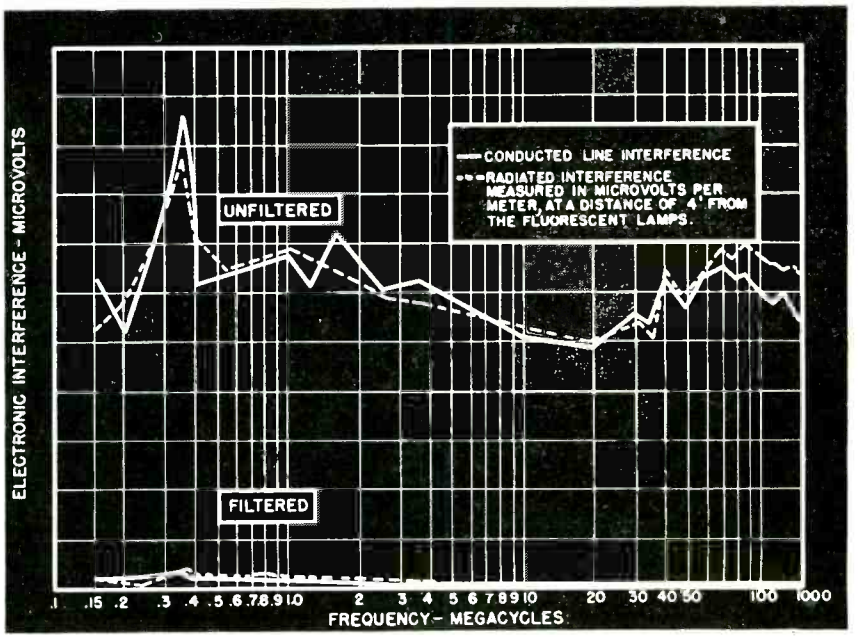


Fig. 2. Curves illustrating degree of interference with and without filters in circuit.

FLUORESCENT LAMP NOISE FILTERS

(*Continued from page* 11)

the most important factor. At the high frequencies used, the field produced by very small amounts of r-f power from lamps may be sufficiently strong to interfere seriously with reception over an area of several city blocks.

Eliminating at Source

It is, therefore, of great importance that the interference be eliminated at its source, with a filter within the lamp fixture itself, since other protective or defensive measures such as shielding the antenna leadin and installing a filter in the power line of a receiver can protect this one receiver only partially. They afford no protection for other receivers in the interference area.

The use of some type of shielding on the lamp tubes, such as wire mesh, has no effect on the interference conducted by the power line and has little or no effect on the induction and radiation fields unless used in conjunction with a properly designed filter. Grounding the lamp fixture to metal lathing or similar material has been found actually to increase the interference under certain conditions.

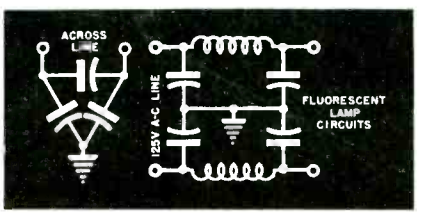
Interference from Lamp Starters

The *starter* for igniting the fluorescent lamp is also a serious source of unwanted r-f energy. This energy, generated by oscillatory surges resulting from sparking at the starter contacts during the ignition period, is of the high-intensity, short-duration type. This is the type of interference which causes the most annoyance in all bands.

Small capacitors, it is true, are generally included in the starter and are connected across the contacts to reduce the interference. While such capacitors may have a slight effect on the standard broadcast band, their effect is for the most part negligible on either

(*Continued on page* 36)

Fig. 3. Two types of filter networks. At left, a △-capacitor network and at right, a balanced twin-π network.



FILTERS

(*Continued from page* 34)

conducted or radiated interference over the wide band of frequencies used today.

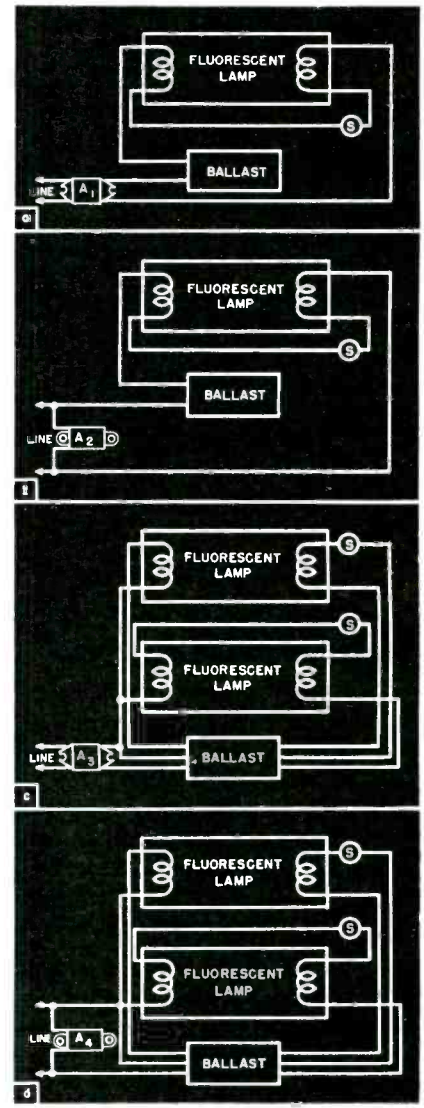
Filters and Interference Elimination

A properly-designed filter, properly installed in the lamp fixture, effectively reduces conducted and radiated interference to a negligible intensity over a wide frequency band. Supplementing the filter with some type of electrostatic screen over the lamp tube results in practically complete attenuation of both the induction and radiation fields.

There are a number of interference-filter circuits. In the past attempts have been made to treat the problem by the use of brute force filters consist-

(*Continued on page* 38)

Fig. 4. In *a* and *b* appear filter installations for single fluorescent tube. A twin π-filter (A_1) installed between line and lamp is at *a*, while a Δ-capacitor filter, (A_2) placed across line is shown at *b*. In *c* and *d* appear multi-tube installations. The A_3 filter is similar to the A_1 filter and the A_4 filter is similar to the A_2 filter.



Replacing 35Z5 With A 100-ma Selenium Rectifier

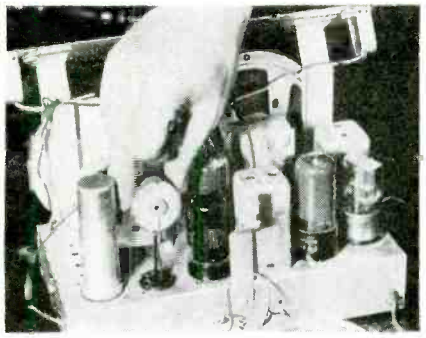


Fig. 1 (left). Typical home receiver (FTR 1030T) with 100-ma selenium rectifier that has replaced 35Z5. Fig. 2. Circuit diagram of a power supply using a 35Z5 rectifier. Fig. 3, an alternative method of replacing a 35Z5 with a 100-ma rectifier. A 15-ohm resistor provides the pilot potential and a 200-ohm resistor the filament continuity. (*Photos and diagrams courtesy Federal Telephone and Radio Corporation, 200 Mt. Pleasant Avenue, Newark, N. J.*)

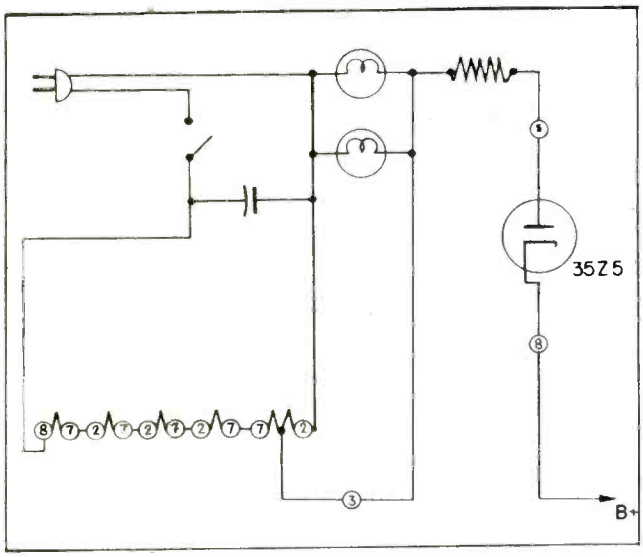
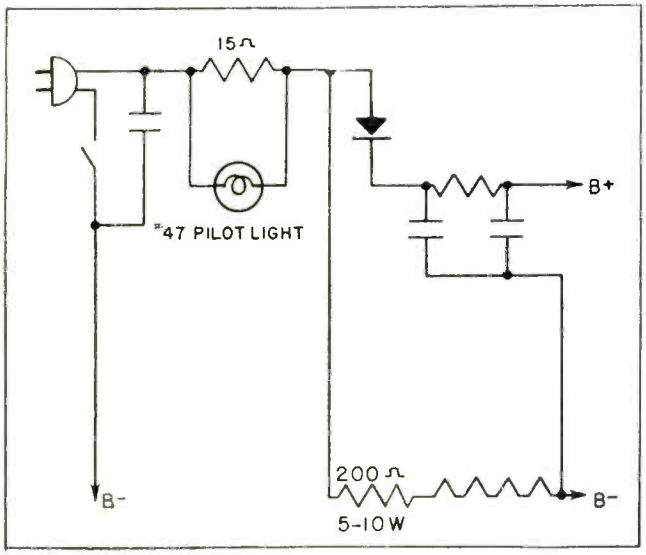


Fig. 2 (above) and (below)



FILTERS

(*Continued from page 36*)

ing of a lumped capacitance, or of a combination of lumped capacitance and inductance. They did not give the desired results. The inherent inductance of a capacitor and its leads would cause the capacitor to resonate at a relatively low frequency and become inductive at the higher frequencies. Likewise, a simple π filter, effective up to 5 megacycles, was found practically useless at 20 megacycles, the distributed capacitance of the inductance causing resonance at some frequency below 20 megacycles, and making it capacitive above the resonant frequency.

New Type of Filters

To replace these types of filters two types of wide-range filters were recently developed. One, which is practically 100% effective, is a symmetrical twin-π capacitive-inductive network,[1] while the other slightly less effective is a Δ-connected capacitive network.[2]

The capacitive-inductive network filter provides maximum noise attenuation from 150 kc to 150 mc.

The effectiveness of all three filters is not affected by whether the lighting fixture is *grounded* or *floating*. This is particularly important since a *ground* connection may be a low-impedance path for 60 cycles but may offer a very high impedance to radio frequencies. Therefore, a filter which depends on a good r-f ground will be ineffective in many, if not all, lamp installations.

Importance of Proper Installation

In installing these filters within the fluorescent lamp fixture, it is important that the filter housing be securely and cleanly connected to the lamp fixture. A permanent low-impedance contact at this point is essential for effective filtering. Any paint on the fixture at the point where the mounting feet of the filter are fastened must be thoroughly removed.

The leads and area associated with a fluorescent lamp starter have been found to carry a considerable amount of r-f energy. Consequently, filters should be installed, whenever practical, as far away from the starter as possible to avoid bypassing. In single-lamp fixtures, the starters are usually at one end of the fixture. For these installations the filter should be placed at the opposite end of the fixture and the out-

(*Continued on page 39*)

[1] Solar EF-100 Elim-O-Stat.
[2] Solar EF-101 and 102 Elim-O-Stat.

TELEVISION

(*Continued from page* 21)

with this scheme becomes apparent immediately when one realizes that an average large apartment building may have 300 television set owners and a roof only 100′ by 50′. Mutual interference would here again be a problem. The final complication is encountered when the receiver is located in the midst of several transmitters so that the signals arrive from different directions. In this case an antenna that is satisfactory for the reception of one station may be completely inadequate for another.

In the *intra-video* system the antenna array consists of only as many antennas as there are transmitters in the area. If f-m coverage is desired, one additional antenna may be necessary to take care of the whole band. Each television antenna is constructed and adjusted to receive one station well. The elimination of *ghosts* is purely an antenna problem and may effectively be dealt with by use of directional antennas. Each antenna then must be carefully chosen and adjusted to assure ghost-free reception on the station for which it is intended. It should be mentioned that the war stimulated and supported a great deal of scientific work on radar antenna systems. The results of some of this research are directly applicable to television frequencies giving us a number of new antennas with desirable characteristics such as colinear arrays, slot antennas and wide-band dipoles.

Small, solid-dielectric coaxial cable is used to connect each antenna to its corresponding amplifier, the amplifiers being located at some convenient spot near the roof of the building, perhaps in an elevator or blower house. Each amplifier is permanently tuned to the one channel for which its antenna is intended. For example in this area the antenna, adjusted to give ghost-free reception from one station, say WNBT, may have very bad ghosts when used to pick up the other stations. The amplifier to which it is connected, however, amplifies only the desired WNBT signal and rejects the others. Correspondingly the other amplifiers and antennas are sensitive only to those stations for which they are designed.

Physically the *intra-video* amplifiers are small plug-in units using a common, regulated power supply. Each amplifier is stagger tuned and phase corrected with an amplitude response flat within 1 db over the entire six-megacycle band. The amplifier gains are adjusted to give output on all stations so that no readjustment is necessary at the receiver when switching from one station to another.

The outputs of all the amplifiers are coupled through an isolating network, to one coaxial cable which then carries all the television signals.

The coaxial, distribution line is ¼″ in diameter and runs throughout the building having outlets wherever a television set is desired. As many as 50 outlets may be connected to this one line. If more are desired, a second or more lines may be connected to the amplifiers.

The outlets are small three-terminal receptacles which fit into standard electric wall boxes. A resistance network is used at each outlet to isolate the receiver from the line so that a faulty connection or receiver will in no way affect operation of other receivers connected to the line. A dead short across the outlet terminals has no noticeable effect on other receivers on the line.

The antenna size is of course determined by natural factors over which we have little control. In actual installations the different antennas are often located at a number of points on the roof. The amplifiers and regulated power supply are located in a metal box approximately 20″ x 14″ x 8″ which bolts to a convenient wall.

The distribution line is small enough (¼″ diameter) to be pulled into any of

(*Continued on page* 41)

FILTERS

(*Continued from page* 38)

going lines extended from this point for maximum results.

For fixtures that have their outgoing lines in the center of the fixture and starters at each end, the filter should be placed in the center of the fixture channel and connected to the outgoing lines at this point.

NEWS

PARTS-EQUIPMENT SHOW TO BE HELD IN MAY, 1947

A four-day parts and electronics equipment show conducted by Radio Parts and Electronic Equipment Shows, Inc., 111 W. Washington Street, Chicago, Illinois, will be held at the Stevens Hotel, Chicago during the week of May 11, 1947. The show will be jointly sponsored by the National Electronic Distributors Association, Association of Electronic Parts and Equipment Manufacturers, Sales Managers Club Eastern Division, and RMA.

Kenneth C. Prince is show manager. Show board members include Jack Berman, Shure Brothers; Charles Golenpaul, Aerovox Corp.; Jerome J. Kahn, Standard Transformer Corp.; Sam Poncher, Newark Electric; Walter W. Jablon, Hammarlund Manufacturing Company; Robert C. Sprague, Sprague Products; R. J. Sherwood, The Hallicrafters Company; and William L. Schoning, Lukko Sales Corp.

Conferences will be held during the entire week of May 11, but the exhibition hall will be open from May 13 to 16 inclusive. Planned is a *NEDA Day* with program planned and executed by the distributors' association and *Open House* day, at which time radio Service Men, amateurs, engineers and the general public will be admitted.

* * *

RALPH S. MERKLE NAMED SYLVANIA ELECTRIC PARTS SALES MANAGER

Ralph S. Merkle has been appointed manager of parts sales of Sylvania Electric Products, Inc. He will direct sales of small metal and mica parts, wire, and welded wire products manufactured in the plants at Emporium and Warren, Pa. and Jamestown, N. Y.

* * *

JFD BALLAST BULLETIN

A 4-page a-c/d-c ballast bulletin, with listings of a-c/d-c ballasts for individual sets, and listings of air-cooled adjustable ballasts has been released by the JFD Manufacturing Co., 4117 Fort Hamilton Parkway, Brooklyn 19, New York.

* * *

FTR MINIATURE SELENIUM RECTIFIER INSTALLATION BOOKLET

An 8-page booklet describing installation of miniature selenium rectifiers to replace 117Z6, 117Z3 and 35Z5 tubes has been published by Federal Telephone and Radio Corporation, Newark 1, N. J.

Step-by-step replacement procedures for Motorola, Zenith, Admiral and FTR receivers are also described and illustrated.

TELEVISION

(*Continued from page 39*)

the standard sizes of conduit. If desired it may even be pulled into a conduit containing electric wiring. Since it is a coaxial cable there will be no interaction.

TELEVISION TRAINING

Albert Preisman

Vice President, in Charge of Engineering
Capitol Radio Engineering Institute

SERVICING, IF HONESTLY DONE, is particularly difficult and in many ways as profound an activity as design and development. Many engineers and executives do not have a high regard for the service end of a technical development; the Service Man, in their opinion, is nothing but a mechanic, and often a poor one at that. It is unfortunate that this opinion is honestly earned by many Service Men, who hardly know the rudiments of Ohm's law and are satisfied with their ignorance.

Yet Servicing is really technical detective work, and the location of a fault is often as great a triumph as the improvement in the design of the equipment or the invention of a new method of performing a certain function. Often design and development are based on the constancy of some factors, and the minimizing of other factors, whereupon the operation of the device is amenable to calculation and predictability. On the other hand, when the equipment becomes defective, some of these factors may change markedly, or assume other than negligible values, whereupon the most brilliant engineer may be no more able to calculate or explain what has happened than the humble Service Man.

The complexity of television gear, and the wide range of subjects it embraces, indicates that the operating, maintenance, and service personnel must be well trained in a variety of subjects. Thus, r-f, i-f, audio, and video amplifiers must be studied, a knowledge of u-h-f is essential; pulse techniques, electron optics, antennas (particularly for reception), light optics, motion picture projectors, lighting, photoelectric effects, secondary-emission phenomena, etc., must all be learned in order that the Service Man may have a clear idea as to how the system functions and mal-functions.

In our training program we do not make a penchant of mathematically deriving the formulas presented to the student. However, they are not offered in cook-book style; instead, the student is given a physical analysis of the problem, and the reasonablesness of the formula is made clear to him as far as possible. It is true that such qualitative reasoning is often inadequate, particularly in explaining the points and details of a theory, but many schools and institutions of higher learning have erred in presenting such a highly mathematical picture of the phenomenon that the bewildered student hardly grasps its physical significance, and is therefore often unable to use the formulas in the actual performance of his work.

Many practicing engineers will attest to the fact that often the physical picture is all that they remember of a beautiful exposition and derivation of a formula, and that in developing a new application or method they are forced to proceed boldly from elementary considerations because the mathematics, for all its profoundity, is inadequate to guide them in a pioneer field.

This does not mean that mathematics and the derivation of formulas are useless; it merely points out that for normal operations, Servicing, and even development work, a type of training that gives the men a physical picture of the functioning of the equipment, together with such formulas as are necessary in the practical application of their work, is invaluable to them.

Such training is often referred to as terminal education; upon completion of such a course a man is capable of doing the work without much further training. It is sometimes assumed that he has at the same time reached a dead-end street; that he cannot advance from this point because he lacks the fundamentals for further and more profound development. Such is not the case, however. A man who has a good physical picture of the operation of the equipment is especially ripe for mathematical development, because he now sees its value and need, providing he is of the inquiring type of mind. If he is not, he is still a valuable man, and is better off for having taken such a course rather than the more conventional type of training.

NEW PRODUCTS

(Continued from page 32)

Company, 231 Winston Street, Los Angeles 13, California.

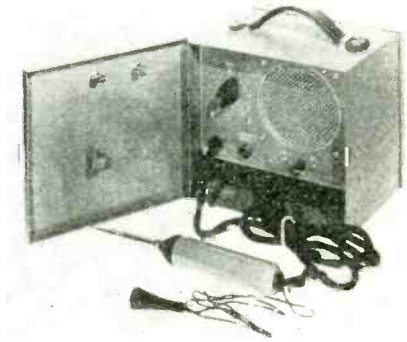
Made in two standard types, self-plugging and pull-through hollow; two standard head styles, modified brazier and 100° countersunk; 1/8", 5/32", 3/16", 1/4" and 9/32" diameters; and in a wide range of grip lengths.

* * *

SPECO SIGNAL TRACER

A portable battery-operated signal tracer has been produced by Special Products Company, Silver Springs, Maryland.

The instrument housed in a 5¼" x 6¼" x 6⅛" steel case, weighs 4 pounds, 10 ounces.



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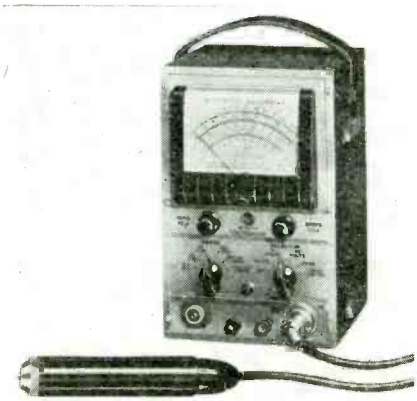
RCA VOLTOHMYST FOR F-M AND TELEVISION TESTING

A voltohmyst (WV-75A) for high-frequency application has been announced by the test and measuring equipment section of the RCA engineering products department.

Instrument provides six-meter use; v-h-f voltmeter, audio voltmeter, a-c voltmeter, d-c voltmeter, ohmmeter, and f-m indicator. Both a-c and d-c voltages up to 1000 volts can be read on meter. A polarity reversing switch is also provided.

A full-wave rectifier, built into the a-c probe, provides reading of both negative and positive voltage peaks. Diode probe contains a standard AN (Army-Navy) integral female fitting for direct connection to a coaxial line. Measurements at high frequencies are made by direct contact with central pin and ground ring at end of the diode probe, while an alligator clip for central pin and the short ground lead serve as adaptors for voltage measurements at the lower frequencies.

When used as an ohmmeter, one scale works for all ranges with no zero reset-



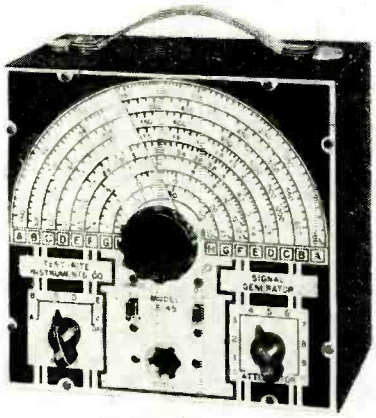
ting necessary. Has six scales for d-c resistance readings, covering the zero-to-1,000 ohm to zero-to-1,000 megohm ranges.

* * *

TEST-RITE SIGNAL GENERATOR

A one-tube self-modulated signal generator (B-45) generating r-f frequencies from 150 kc to 50 mc (150 kc to 12.5 mc on fundamentals and from 11 mc to 50 mc on harmonics), has been announced by Metropolitan Electronic and Instrument Co., 6 Murray St., N. Y. 7.

Uses a grid-loaded circuit to provide a constant load on the oscillatory circuit.



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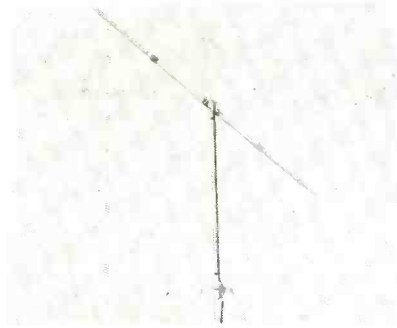
KINGS ELECTRONICS TUNABLE DIPOLE

A dipole for television and f-m, with adjustable arms, has been developed by Kings Electronics, 372 Classon Avenue, Brooklyn 5, New York.

Adjustable feature consists of an element calibrated from 1.0 to 21.5 in half-steps. After facing antenna in direction of greatest signal strength, should any weak stations develop, this element can be moved in or out, according to a carefully calculated table, and then locked into position.



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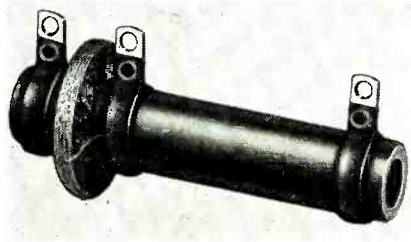
MALLORY VIDEO COUPLER

A three-terminal network designed to couple the video amplifier to the picture tube in television receivers, videocoupler type VC-1, has been announced by P. R. Mallory & Co., Inc., Indianapolis, Ind.

Combines three units in one assembly, including two peaking inductances and the load resistor.



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SNYDER MICROPHONE STAND

A chrome-plated microphone stand, which lowers to 30" and extends to 60", has been announced by the Snyder Manufacturing Co., Philadelphia.

Features a cast-iron base with non-skid rubber pads and a quick-grip locking nut.

JOTS AND FLASHES

THERE'LL DEFINITELY BE TELEVISION receivers around this Christmas, according to RCA, General Electric, DuMont, Farnsworth and Emerson. Models will be direct view types using 7" and 10" tubes and will retail at between $250 and $350. . . . The Henney Motor Company, Freeport, Illinois, an affiliate of International Detrola, has purchased the majority of the National Union stock held by Philco. . . . An interesting 32-page brochure describing school sound systems has just been published by the RMA. The book contains an excellent discussion of the variety of applications for sound systems. . . . Alcide Prosdocimi has been elected vice president in charge of the international division of Solar Mfg. Corp. . . . Garrard Sales Corp. has moved from 401 Broadway to 315 Broadway, N. Y. City. William Carduner is president of the corporation. . . . Paul H. Klein has been named advertising manager of the JFD Manufacturing Co., Brooklyn, N. Y. . . . Baldwin Boomgard is now with the Universal Radio Supply Co., 1404 Venice Blvd., Los Angeles, Calif. . . . Brigadier General David Sarnoff, president of RCA, received the wireless key he used to contact ships during the Titanic disaster of 1912, during the 40th anniversary dinner held in his honor at the Waldorf-Astoria in New York City recently. . . . Clarence G. Stoll, president of Western Electric and Oliver E. Buckley, president of Bell Telephone Labs. have received the Medal for Merit. . . . Morton E. Ornitz has resigned as vice president and controller of Emerson Radio. He has been retained by Emerson as a consultant. . . . A. J. Rosebraugh has been named sales manager of the industrial radio division of Philco Radio Corp. He will be in charge of receiver sales to the automobile industry. . . . The Asco Corporation has moved to 17702 Waterloo Road, Cleveland 19, Ohio. John Altmayer is president of the corporation. . . . R. E. Smiley, 503 Market Street, San Francisco 5, California, will represent Ward Leonard in Northern California and Nevada. . . . William C. Lewis is now assistant sales manager of Stromberg-Carlson. . . . Victor E. Olson has been named sales manager of the receiver sales department of Allen B. DuMont Labs., Inc. . . . National Union Radio Corp. has prepared a 7-piece window display to further the professional standing of the Service Man. . . . Webster-Chicago Corporation, 5610 Bloomingdale Avenue, Chicago, Illinois, recently demonstrated their wire recorder to their employees. About 50 minutes of recording is available with this new device. . . . Federal Telephone and Radio Corp. have prepared counter displays and booklets to describe their miniature selenium rectifier. . . . An 8-page booklet describing hearing aids has been prepared by Paraphone Hearing Aid, Inc., 2056 E. 4th Street, Cleveland 15, Ohio. . . . Roy S. Laird and Herbert E. Lense of Ohmite have received ASA certificates of appreciation for contributing their time and experience during the war. . . . KSD, St. Louis, will soon go on the air with a regular schedule of television programs. . . . Current issue of "The Tripletter" published by the employees of the Triplett Electrical Instrument Co., Bluffton, Ohio, contains an interesting story on the first Triplett moving coil instrument produced in 1905.

ADVERTISERS IN THIS ISSUE

SERVICE INDEX—NOVEMBER, 1946

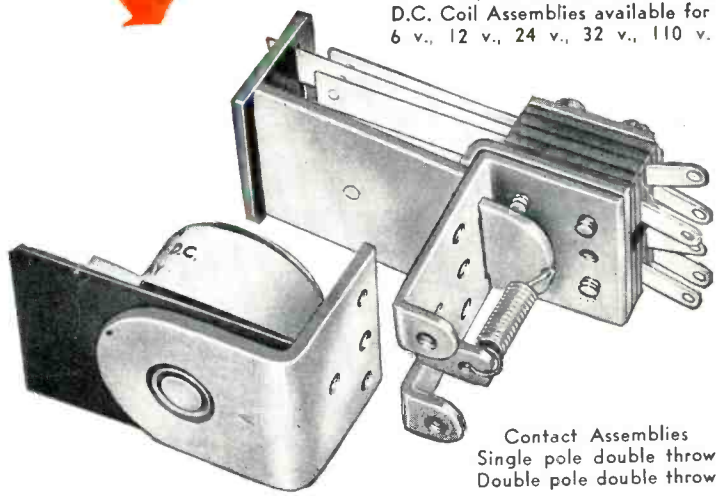
New! Series 200

A RELAY BY GUARDIAN with Interchangeable Coils

BUILT IN TWO PARTS

Two basic parts—a coil assembly and a contact assembly—comprise this simple, yet versatile relay. The coil assembly consists of the coil and field piece. The contact assembly consists of switch blades, armature, return spring, and mounting bracket. The coil and contact assembly are easily aligned by two locator pins on the back end of the contact assembly which fit into two holes on the coil assembly. They are then rigidly held together with the two screws and lock washers. Assembly takes only a few seconds and requires no adjustment on factory built units.

A.C. Coil Assemblies available for 6 v., 12 v., 24 v., 115 v.
D.C. Coil Assemblies available for 6 v., 12 v., 24 v., 32 v., 110 v.



Contact Assemblies
Single pole double throw
Double pole double throw

SERIES 200 RELAY

On Sale at Your Nearest Jobber NOW!

See it today! . . . this amazing new relay with interchangeable coils. See how you can operate it on any of nine different a-c or d-c voltages—simply by changing the coil. Ideal for experimenters, inventors, engineers.

TWO CONTACT ASSEMBLIES

The Series 200 is available with a single pole double throw, or a double pole double throw contact assembly. In addition, a set of Series 200 Contact Switch Parts, which you can buy separately, enables you to build dozens of other combinations. Instructions in each box.

NINE COIL ASSEMBLIES

Four a-c coils and five d-c coils are available. Interchangeability of coils enables you to operate the Series 200 relay on one voltage or current and change it over to operate on another type simply by changing coils.

Your jobber has this sensational new relay on sale now. Ask him about it. Or write for descriptive bulletin.

GUARDIAN ELECTRIC
1617-M W. WALNUT STREET CHICAGO 12, ILLINOIS

A COMPLETE LINE OF RELAYS SERVING AMERICAN INDUSTRY

SENSITIVITY COMPENSATION + ACOUSTIC COMPENSATION

William Dorrit, Jr.

SOMETHING NEW that Meck Dealers can APPRECIATE • DEMONSTRATE • SELL

Model 6A6W4 Wood cabinet

Model 6A6P9 Ivory plastic for AC-DC service

Here's the exclusive Meck Sensitone model for Meck radio dealers —with the kind of features that the radio specialist can appreciate, demonstrate, and *sell*.

1. Sensitivity control permits gain adjustment of the set in the home to local broadcast conditions.
2. Acoustic compensation control permits bass boost to a point most pleasing to the user, without loss or distortion of treble notes.

Other FEATURES

Despite compact size of cabinet, a six-inch oval speaker is used for superior reproduction of low frequencies.

8½-Inch slide rule dial, illuminated.

Built-in loop antenna with primary turn for connection to external antenna and ground.

Choice of wood or plastics. Ivory-finished plastic models.

It will pay you to check your Meck distributor about this new 6A6 Sensitone Receiver.

MECK RADIOS

John Meck Industries, Inc., Plymouth, Ind.