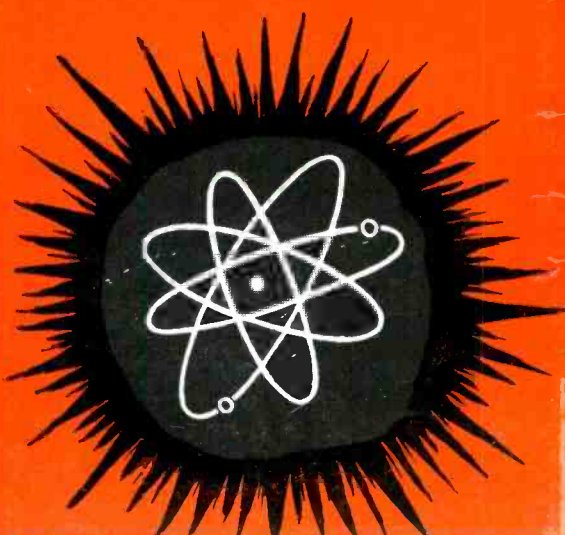




radio service dealer

APRIL, 1947



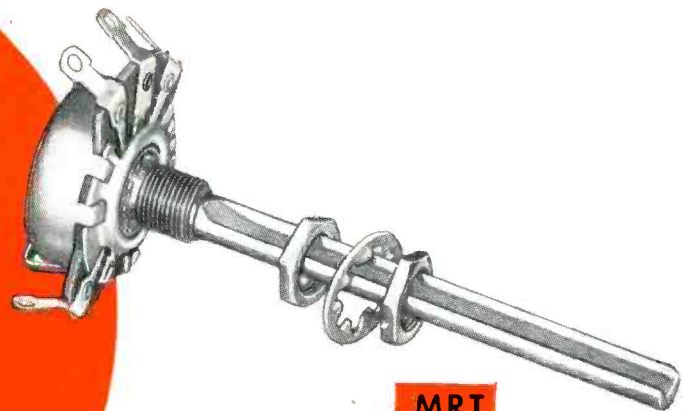
IN THIS ISSUE:
TRUTH ABOUT FM
USING THE 'SCOPE IN SERVICING
"SPARX" AT WORK
TRENDS IN P-A INSTALLATIONS
GUIDE TO RADIO PARTS SHOW — PAGE 28

More Tapped Control Values For Your "Every Need"

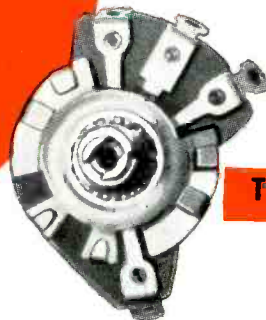
MALLORY provides every needed resistance value in its single tapped replacement controls—31 combinations of overall and tap resistances in all.

Mallory MRT Controls are available in most of the popular values, and feature an easy-to-cut channel shaft that fits all types of knobs. Mallory TMs are made in an even wider range of resistance values than the MRTs, and are used in conjunction with 30 non-wobbling, non-loosening Plug-In Shafts. They have practically universal application because they provide "special" shafts of nearly every required type.

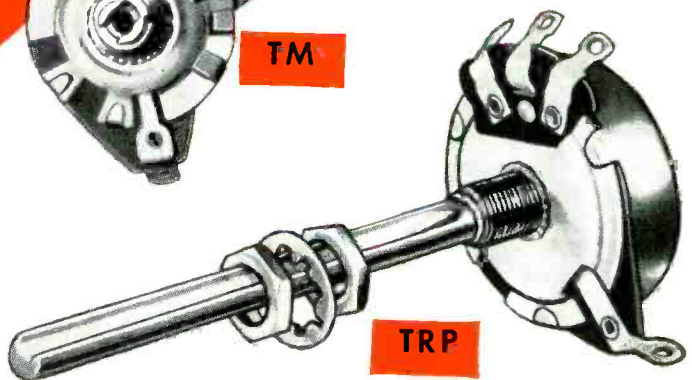
Where shaft lengths of 3 inches or less are required, Mallory TRPs (fixed shafts)



MRT



TM



TRP

replace large originals using set screw or spring type knobs. See your Mallory distributor.

Insist on MALLORY—the Complete Control Line

Mallory offers 33 Tapered Wire-Wound Controls . . . 31 Values in Single Tapped Controls . . . 10 Values in Double Tapped Controls . . . 12 Clutch Type Controls . . . 10 Universal Dual Controls . . . and 92 Popular Special Controls.

YOU EXPECT MORE—AND GET MORE—FROM MALLORY

P. R. MALLORY & CO. Inc.
MALLORY

VIBRATORS . . . VIBRAPACKS* . . . CAPACITORS . . . VOLUME CONTROLS . . . SWITCHES . . . RESISTORS . . . FILTERS . . . RECTIFIERS . . . POWER SUPPLIES.

*Reg. U. S. Pat. Off.

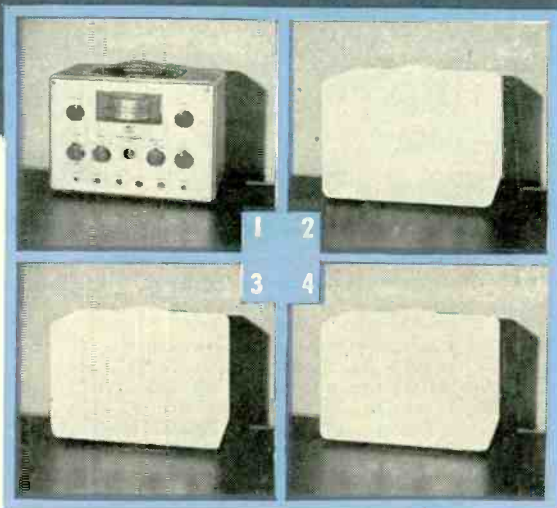
APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

DESIGNED FOR THE BETTER SERVICE SHOP...



RCA's NEW AUDIO OSCILLATOR
... first unit of a
revolutionary new line



**A real time-saver for
loudspeaker testing and radio servicing**

Profitable applications include such diverse jobs as finding the cause of loudspeaker rattle, measuring receiver fidelity and audio amplifier response.

The WA-54A is a temperature-compensated, beat-frequency oscillator with an electronic output-level indicator. The electronic eye serves as a reference to provide an even signal level at all frequencies, and also acts as a zero-beat calibration indicator.

Other outstanding features of this audio-frequency signal source include: wide range . . . continuous tuning . . . low distortion . . . low hum level . . . balanced line outputs . . . application as an a-f amplifier . . . all explained in the WA-54A bulletin, which is yours for the asking.

ON THE WAY—a superior line of test equipment that puts time-consuming service jobs on a profitable, production-line basis . . . that anticipates all FM and television needs. Matched styling of all instruments permits attractive, convenient grouping. Watch for announcements of the other units in this new line. *Keep in touch with your RCA Test Equipment Distributor.*



**TEST AND MEASURING EQUIPMENT
RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N. J.**

In Canada: RCA VICTOR Company Limited, Montreal

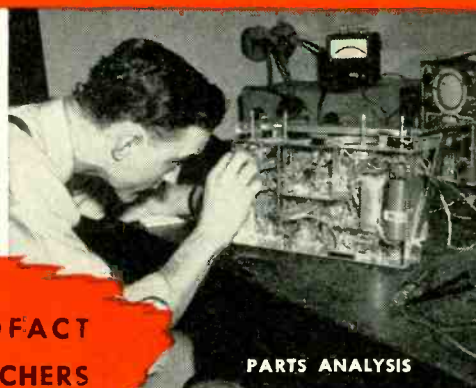
\$400,000 WORTH OF RADIO SERVICE DATA

A Continuous Service for less than 9¢ a day in

PHOTOFACT* FOLDERS



VOLUME 1, containing first ten sets of PHOTOFACT FOLDERS in de luxe binder, \$18.39. Individual sets Nos. 1 to 10, \$1.50 each. De Luxe Binder alone, \$3.39.



**PHOTOFACT
RESEARCHERS
AT WORK
FOR YOU**



COMPLETE

Everything you need in one handy, unified form—large schematics, pictorials keyed to parts lists and alignment data, complete listings of parts values and replacements, alignment, stage gain, circuit voltage and resistance analysis, coil resistances, dial cord stringing, disassembly instructions, record changer analysis and repair.

ACCURATE

All sets are taken apart and analyzed by experts in the Sams Laboratories. Every part is measured, tested and triple-checked for accuracy. All data is original. This means the data you get is *right*.

CORRECT

PHOTOFACT FOLDERS are issued twice monthly as the new receivers come off production lines. You don't have to wait for information. As receiver changes are made, you get correction and addition sheets for your files. Your data is always up to the minute.

EASY TO USE

All diagrams and pictures are coded to numbered parts lists. Everything is positively identified for fast work. All folders are set up in uniform, easy-to-follow style: big type, big illustrations—no hunting, guessing or eye strain—no more loss of time and temper.

\$403,531.05†—that's what it actually cost us to create, print and distribute Volume 1 of Sams PHOTOFACT FOLDERS. Every penny of that money has been spent to bring the industry the most accurate, complete, up-to-the-minute data ever produced for radio servicemen. And this continuing service, designed to help you make up to *twice as many repairs daily*, actually costs you less than 9 cents a day.

PHOTOFACT FOLDERS could not be produced without the support of America's leading replacement parts manufacturers—without the support, too, of thousands of enthusiastic PHOTOFACT subscribers. With their cooperation, we will continue to place in your hands ALL the information you need to do a better job—facts, figures, photographs, full-page schematics—*information compiled from actual first-hand analysis of all*

* Trade Mark Reg.

new instruments. PHOTOFACT FOLDERS cover all radios, phonographs, record changers, recorders, communications systems and power amplifiers—and are timed to reach you as these instruments are released. The cost is only \$1.50 per set of 30 to 50 folders and includes membership in the Howard W. Sams Institute.

Set No. 17 will be ready for mailing April 10th. Set No. 18 on April 25th. Sets Nos. 11 to 16 inclusive, also priced at \$1.50 each, are available for immediate order.

Start using PHOTOFACTS to make more profits. Remember, PHOTOFACT FOLDERS actually cost you nothing: *they pay for themselves over and over!* See your replacement parts distributor—or write us direct. In Canada, address A. C. Simmonds & Sons, 301 King Street East, Toronto, Ontario. Canadian price, \$1.75.

†C.P.A. Statement Available

HOWARD W. **SAMS** & CO., INC.

2924 EAST WASHINGTON STREET, INDIANAPOLIS 6, INDIANA

PHOTOFACT SERVICE

"The service that pays for itself over and over again"

EDITORIAL

Quick Switch!

Government released statistics for the 4th quarter of 1946 and January 1947 indicated that price trends were downward. This column in February stated, in effect, "since OPA passed out of the picture, as we predicted, prices would hold firm." Many readers took the time, during March, to inform us that prices were *not* down according to their findings. My wife did likewise. Emphatically! Now, I see by the papers that President Truman also finds that prices are in an upward spiral.

Contacting manufacturers, asking why prices aren't going down or levelling off, all give approximately the same answer: shortage of materials prevents mass production runs which increases unit costs; also, increased wage demands prevent a normal profit-margin in the face of which prices cannot be reduced even where hoped-for production has been achieved.

Television & Taxes

When television sets reached dealers in markets served by telecasts, owners of bars, restaurants and similar places of "eye or tummy entertainment" grabbed them knowing that customers would flock in to be amused as well as satisfied victually. The Internal Bureau of Revenue learned of this and ruled that such establishments would have to charge the 20 per-cent cabaret tax because "television is not mechanical entertainment." The Bureau has just revoked its original ruling and now cabarets or bars using teletests do not have to impose the tax on their customers.

One big objection to television at the moment is the enforcement of an additional charge for proper installation. The public accepts a reasonable installation fee as being justified, but some of the teletest manufacturers are asking from \$100 upward, and that's completely out of line. We find that teletest installers can make a nice profit on practically every job by charging as little as \$35.

Technicians Remuneration

Recently Service Dealers have asked us, "What is a fair method to use in determining remuneration for employed technicians?" Living costs and standards differ widely in this great country of ours so we had to take surveys in cross sections to arrive at a fair preliminary (but by no means final) answer to the problem. Generally speaking a technician should be paid from 33 1/3% to 50% of the labor charges alone when working on a straight commission basis. Only better technicians in thriving shops are now paid the 50% rate. Technicians are never given a percentage on tube sales, but in some cases Service Dealers pay up to 10% on the billing for replacement parts used in a job. Many Service Dealers prefer to pay a small salary and commission of 25% on labor. Technicians' earnings vary, with those in larger cities getting an average of \$55-\$60 weekly ranging downward to \$38-\$40 in very small towns for full 40 hour weeks. We would like to hear from both Service Dealers and employed technicians on this general subject in order to get a more accurate idea of conditions in the industry and when this information is assembled we'll report again in this column.

S. R. COWAN, Publisher



Member of the
Audit Bureau of
Circulations



VOL.
8
No.
4

SANFORD R. COWAN
Publisher

LEWIS C. STONE
Editor

April, 1947

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COWAN PUBLISHING CORP.



MAKING TUBES IS EASY...

If YOU KNOW HOW!

Meet **OUR MUTUAL FRIEND
THE COMMERCIAL ENGINEER**

► **Friendly, tactful, impartial, trained to serve,** these Hytron commercial engineers form the liaison between us—maker and user of electronic tubes. Few in the radio tube plant can be circuit specialists. Few outside the tube plant can be tube specialists. Both of us need these commercial engineers trained to see clearly both sides of our common problems and help us solve them.

Often their job begins with a request for advice in selecting a tube. Investigation of the circuit application helps them recommend an available type, a slight redesign, or a brand new type. If a new type is found to be the only practicable and economical solution, they cooperate with design and production engi-

neers to achieve the performance desired.

Specification of adequate factory testing procedures and preparation of characteristics sheets do not end their work. Returns are closely checked. If trouble occurs, they go into the field, help dig out the facts, and offer possible solutions—improvements in tube or application. And they stick tenaciously with the problem until it is solved.

Using a wealth of test equipment and know-how, these boys really sweat to make it easy to make Hytron tubes which will make you happy. Busy as the one-armed paperhanger, yet they always welcome the tube problems of equipment engineers. They are nice guys, and we thought you would like to meet them.

SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921

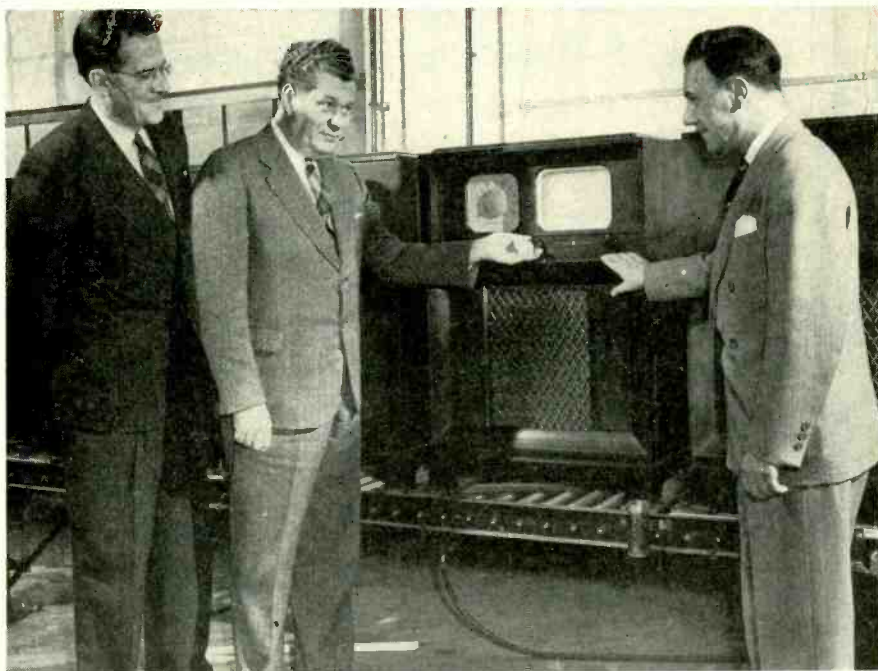


HYTRON
RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS

In & Around the Trade

Being a condensed digest of production, distribution and merchandising activities in the radio and appliance trade.



During an intermission at the General Electric two-day dealer television service school (held recently in Bridgeport, Conn.) Dave Fisher (right) radio sales manager of GE Supply Corp. of

Connecticut, visited television receiver production line. With him are (center) Paul L. Chamberlain, manager of sales of the Receiver Division, and (left) Fred A. Parnell, advertising and sales promotion manager.

Black & White Television Wins

Dr. Allen B. Du Mont, of Allen B. Du Mont Laboratories Inc., Passaic, N. J., issued the following statement: "The decision of the Federal Communications Commission rejecting the application to standardize on commercial color television, comes at an opportune time. Many radio manufacturers have withheld their television activities awaiting this decision and the public has been slow to purchase television receivers until this important question was settled. Manufacturers can immediately proceed with their production plans and make many more receivers available for the fall market. In our own case, our receiver production for the year 1947 will be more than doubled because of the decision.

"The decision by the Commission indicates their conclusion that much additional development work is needed before color television is ready for public consumption. Color pictures are vastly inferior to black and white pictures as regards to brilliance, de-

tail and size. It was further demonstrated to the Commission that high frequency transmission necessary for color pictures was only practical when transmitter and receiver were within line-of-sight. This factor, in itself, greatly reduces the coverage of color transmission, and some method must be devised to overcome this before color pictures compete in coverage with the black and white standards now being received behind hills and beyond the horizon."

Combination Radios Rise

1. Production of radio-phonograph combination console sets continued to climb in February although the total output of radio receivers dropped, largely due to a short work month, according to RMA statistics.

2. The output of both television and FM-AM radio receivers also showed slight gains over January despite the lower total. FM-AM receivers reported by RMA member-manufacturers during February totaled 55,594, while television sets rose to 6,243 —

almost as many as were produced in the whole year 1946.

3. Total radio production reported by RMA members for February was 1,379,966 as compared with 1,564,171 in January. The February output included 153,007 consoles and 843,616 were table models. The consoles included 140,200 radio-phonograph combinations.

4. Included in the FM-AM set output were 7,968 table models of which 768 were table model radio-phonograph sets; 45,626 were consoles.

5. Television receivers included 5,362 table models and 881 consoles. Ten converters also were produced. Auto radios numbered 183,940.

RADIO SERVICEMEN OF AMERICA, INC.

Editor:

The Binghamton Chapter of ISRM was founded in the fall of 1934 by a delegation from Rochester, New York. We in turn helped to organize other chapters in Syracuse, Scranton and Elmira. A member of our chapter was national president in 1936. During the year of 1938 ISRM was changed to Radio Servicemen of America, and a member of our chapter served on the board of directors and later as vice president of the national chapter.

Since the end of the war and the return of our old members, activities and membership have increased considerably, and are still growing.

We believe the continuing success of this chapter under adverse conditions has been primarily due to the fact that the control of the organization has been kept exclusively in the hands of qualified radio servicemen. In order to insure this, we have three classes of members, i.e., qualified, associate and honorary members. Only qualified members have a vote and can hold office. All others have a voice in the discussions.

Our meetings are held on the first and third Tuesday of each month except during the summer months when we have only one meeting per month. The meetings consist of talks by members and also by national engineers. Other activities include banquets, ladies' night, and picnics.

Our by-laws are revised from the one-time national by-laws to suit our conditions. All members comply with them—thus keeping ethics on a high standard in the radio service business.

We would like to hear from other organizations of radio servicemen and their activities. Also, we thank you very much for your kind consideration and attention given this.

Respectfully yours,

AARON A. BALDWIN

Secretary

[see page 10]

TRIPLE-TEST ASSURES *Quality* IN GENERAL ELECTRIC RESISTORS

TESTED FOR

- ★ CHARACTERISTICS
- ★ ENDURANCE
- ★ STABILITY

What does triple-tested mean? It means that General Electric resistors have been subjected to the most rigid tests and inspection to make certain that they conform to high quality standards. Characteristics, endurance and stability have been checked in the laboratory and in the field, under actual operating conditions. These checks are assurance to you that General Electric resistors will stand up . . . will give greater customer satisfaction.

In designing this line of resistors, quality was the first consideration. But, along with quality,

flexibility in application was demanded. The wide possible range of uses for each unit, extending from simple to complex circuits, can be met with minimum stock requirements. Your customer's needs can be supplied . . . your inventory can be kept down.

General Electric's complete line of high quality resistors also has a triple value for you. Since the customer's requirements can be supplied from one source, it saves his time. That means greater customer satisfaction, more sales, more profit. And remember, these resistors are easier to sell because they bear a name known for quality, General Electric.

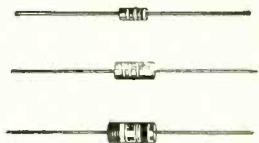
Be sure to stock the entire line of General Electric universal parts.

For complete information write: *General Electric Company, Electronics Department, Syracuse 1, N.Y.*

GENERAL ELECTRIC

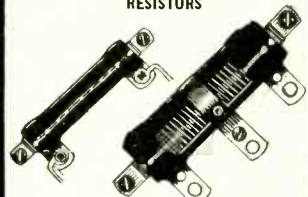
FIRST AND GREATEST NAME IN ELECTRONICS

COMPOSITION RESISTORS



1/2 watt, 1 watt, 2 watts

POWER WIRE-WOUND RESISTORS



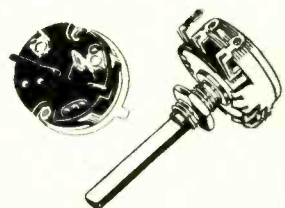
Fixed
10, 20 watt

Adjustable
10, 25, 50,
100 watt

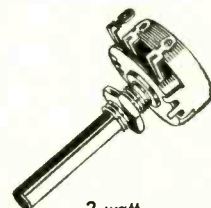
TUBE-TYPE WIRE-WOUND RESISTORS



COMPOSITION CONTROLS ATTACHABLE SWITCHES

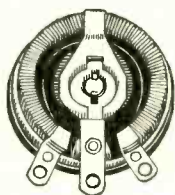


SMALL WIRE-WOUND CONTROLS



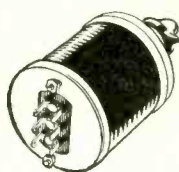
2 watt

POWER RHEOSTATS

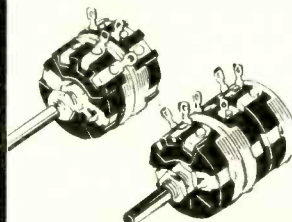


25 watt, 50 watt

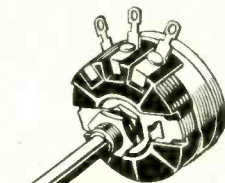
CONSTANT IMPEDANCE ATTENUATORS



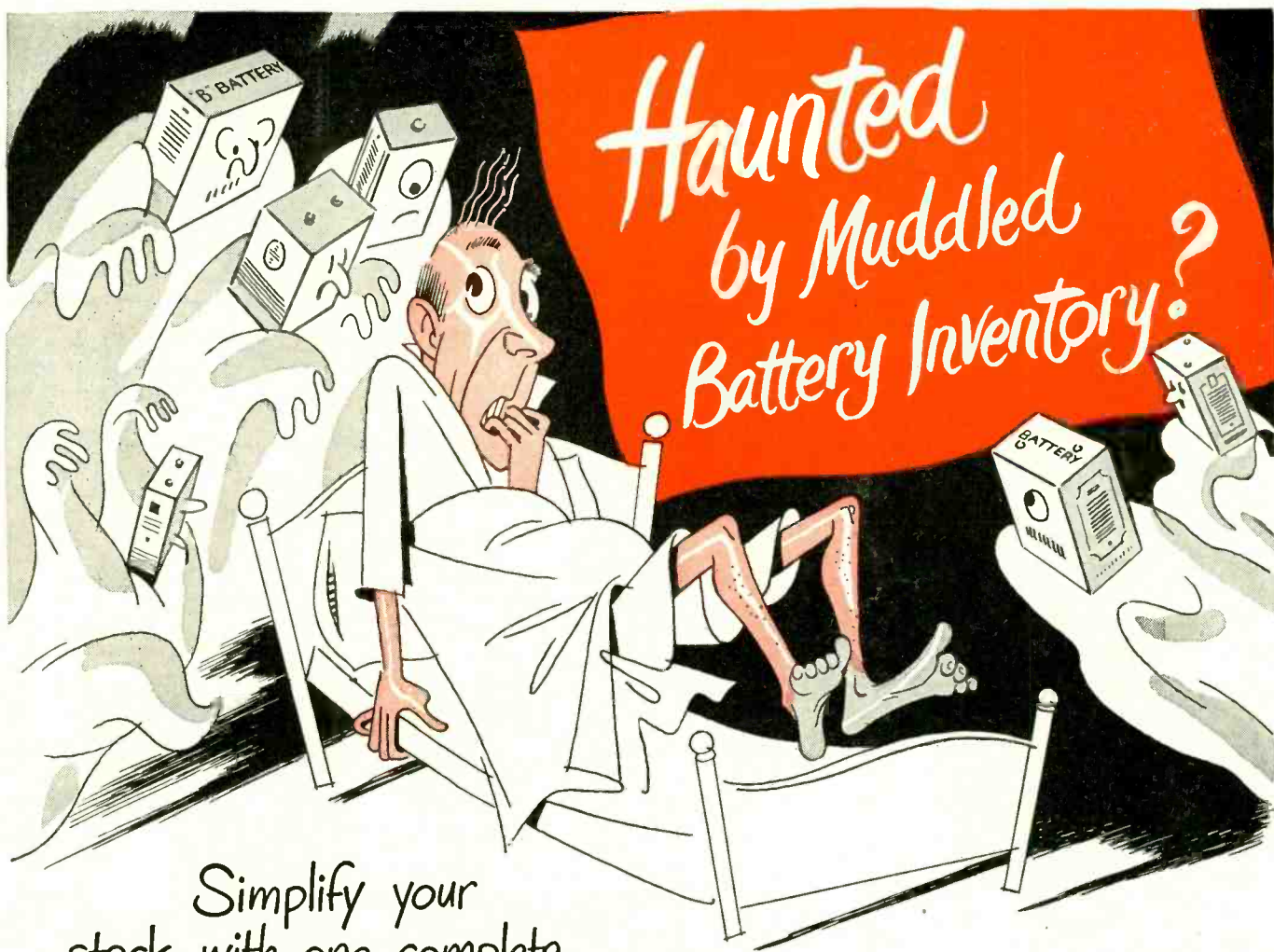
WIRE-WOUND L-PADS AND T-PADS



WIRE-WOUND CONTROLS



3 watts & 4 watts



Simplify your stock with one complete line—**"EVEREADY" RADIO BATTERIES!**

IT'S GOOD BUSINESS to concentrate your selling . . . to get your biggest volume on the line that moves without resistance.

"Eveready" radio batteries carry an unexcelled name and reputation; more customers ask for "Eveready" batteries than any other brand. And "Eveready" radio batteries fit virtually all makes

of sets; you freeze less capital, and please more customers, when you specialize on these famous power units!

There's no need to be haunted by the nightmare of slow-moving, private-label battery brands—wake up to the profit opportunities in "Eveready" brand radio batteries!

The registered trade-marks "Eveready" and "Mini-Max" distinguish products of National Carbon Company, Inc.



NATIONAL CARBON COMPANY, INC.
30 East 42nd Street, New York 17, N. Y.
Unit of Union Carbide and Carbon Corporation



Go to a Radio Manufacturer for Radios — a Battery Manufacturer for Batteries!


SYLVANIA NEWS

RADIO SERVICE EDITION

APRIL Prepared by SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa. 1947

RADIO SERVICEMEN! SYLVANIA'S COLORFUL NEW CLOCK BIG AID IN SERVICE SALES

**Specially Designed Famous-Make Clock Identifies
Quality Stores Stocking Sylvania Tubes**



- Bright white face... black numerals!
- Minute and hour hands in black... unique second hand in attractive red!
- The words "RADIO SERVICE" in green and black. The word "SYLVANIA" in identifying green!

- Fifteen-inch diameter!
- Radio tube in silver and black... design of carton in familiar green and black!
- Telechron movement sealed in oil; case in brown crinkle finish with silver-colored rim around face! Nominally priced at only \$7.50!

Once you place this big, colorful Telechron electric clock—with its "Radio Service" face—in *your* window, you'll have an attractive sales aid that identifies your business . . . every second of the day . . . as carrying the finest line of tubes made.

Through far-reaching advertising campaigns,

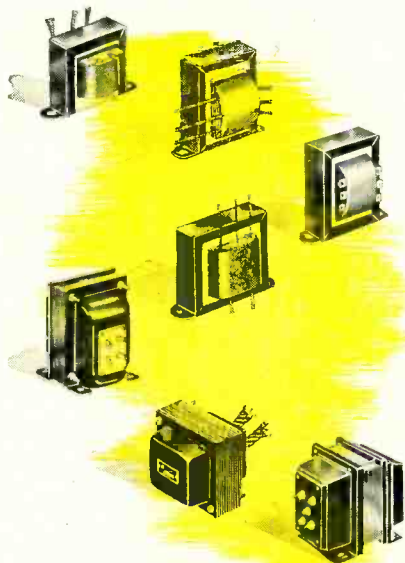
your customers are being advised of the advantages of placing Sylvania "quality-controlled" radio tubes in their equipment. By displaying this on-the-spot sales help you're telling them you sell these highest quality tubes. Get this wonderful sales aid now!

ORDER FROM YOUR SYLVANIA DISTRIBUTOR or write SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa.

SYLVANIA ELECTRIC

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

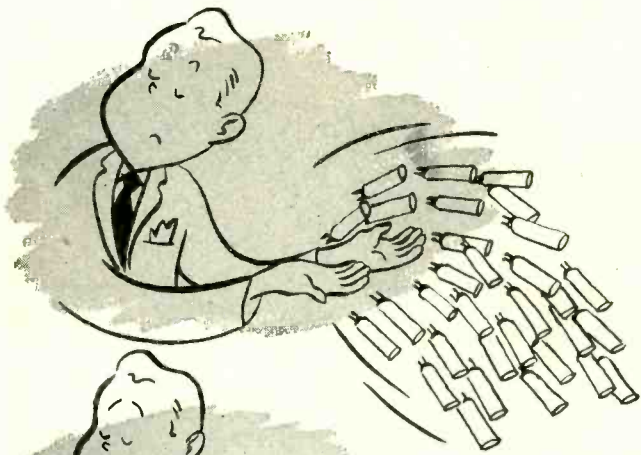
when you order a
STANCOR product
 you order the
FINEST



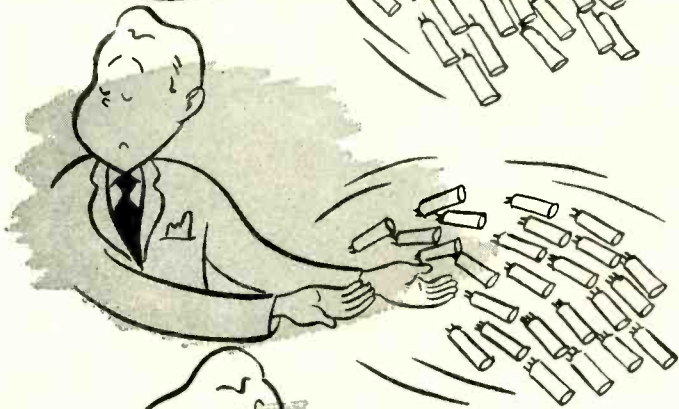
The big black-and-yellow STANCOR catalog is the logical place for the radio serviceman to turn for a transformer to meet any standard need. . . . For there you will find the most complete selection of Replacement and General Purpose Transformers. . . . And there you'll find the FINEST. . . . For the most exacting quality is built into every STANCOR product. . . . Quality plus advanced design and universal application. . . . Yes, reach for the well-thumbed STANCOR catalog . . . for behind it are STANCOR's new streamlined plant facilities to give you better products and better service . . . to help you give your customers complete and lasting satisfaction.

standardize on **STANCOR**  **TRANSFORMERS**

STANDARD TRANSFORMER CORPORATION • ELSTON, KEDZIE AND ADDISON, CHICAGO, ILL.



~~NOT
31~~



~~NOT
25~~



**BUT ONLY
13
MODELS**

... provide exact replacement on all auto-radio vibrator requirements

● The headlines tell the story—and hundreds of Electronic dealers enthusiastically back it up! A smaller inventory investment will get you more customer satisfaction—faster turnover—bigger profits when you **SWITCH TO ELECTRONIC... THE SIMPLIFIED LINE**



A complete Vibrator Replacement Guide is available. It lists alphabetically every auto-radio model serviced by E-L Vibrators, and the proper E-L Vibrator Model Number.



ELECTRONIC LABORATORIES, INC.

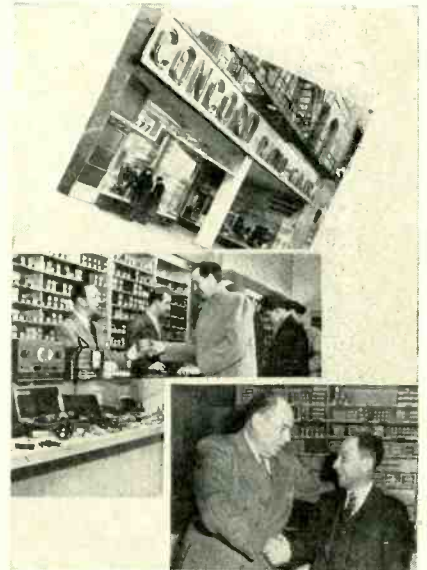
INDIANAPOLIS, INDIANA

IN TRADE

[from page 5]



Look who's visiting at Howard W. Sams Photo Fact Folder headquarters: L. to r. — Vic Mucher, Clarostat; Charley Golenpaul, Aerovox; Howard (himself) Sams — standing; Austin C. Lescarboursa, adman; Harry Kalker, Sprague.



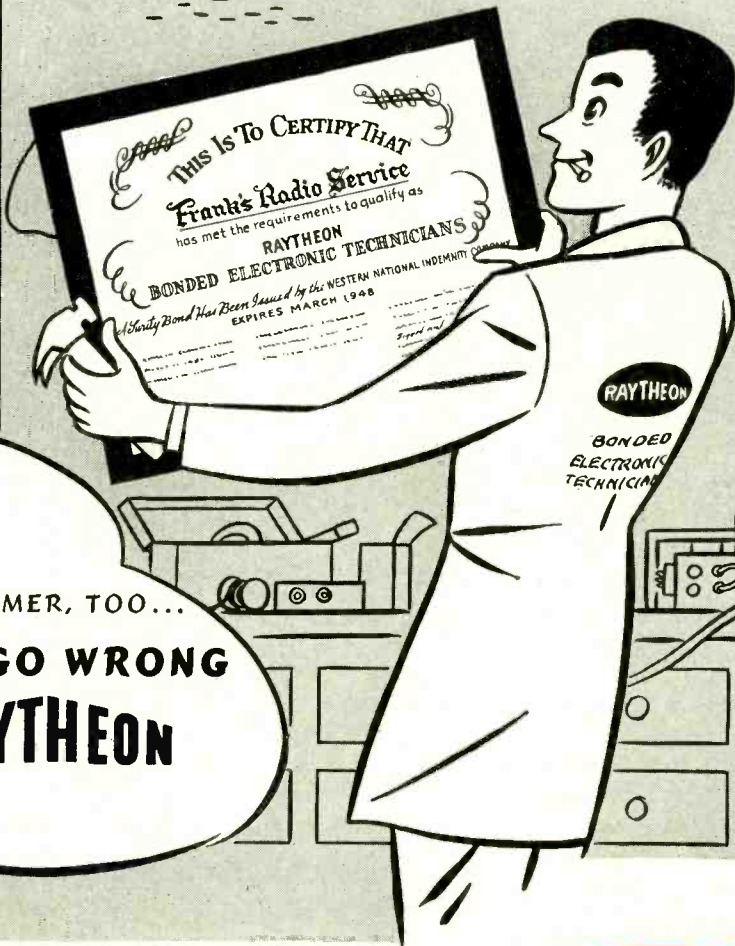
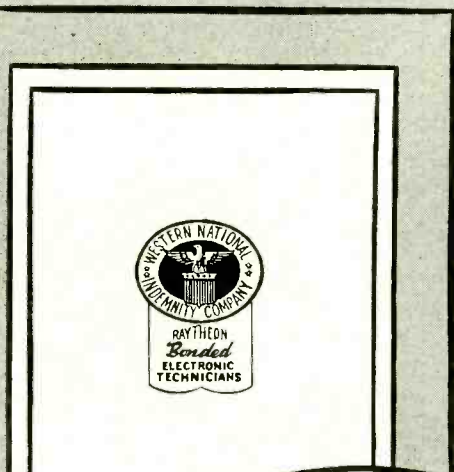
Top: New showrooms, modern front, of new Concord Buying Center, Chicago. Middle: S. W. Berk (left) makes first sale. Bottom: Oden Jester, vice president in charge of sales, Maguire Industries, congratulates S. J. Novick (right) on the opening of the new store.

RCA Plans For Parts Show

The Renewal Sales Section of the RCA Tube Department has arranged a comprehensive program for the Radio Parts Show at Chicago. In addition to its display on the main exhibit floor, a reception suite has been provided at the Stevens Hotel for visiting distributors, together with separate display rooms for the showing of tubes, batteries, parts, test equipment, packaged sound and sales aid materials.

At the same time, W. L. Rothenberger, Renewal Sales manager, will hold a meeting of his entire field sales

[see page 12]



IT'S GOOD FOR YOU
AND THE CUSTOMER, TOO...
**YOU CAN'T GO WRONG
WITH RAYTHEON**



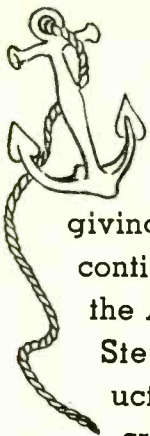
Ask your Raytheon Distributor for details on how you can qualify as a Bonded Electronic Technician.

RAYTHEON MANUFACTURING COMPANY
RECEIVING TUBE DIVISION
NEWTON, MASSACHUSETTS CHICAGO, ILLINOIS



Excellence in Electronics
RADIO RECEIVING TUBES
SPECIAL PURPOSE TUBES
TRANSMITTING TUBES
HEARING AID TUBES

Astatic Crew ARRIVES FOR THE CHICAGO SHOW!



Just in case you're not at the dock when this craft pulls in, we're giving you a preview of Astatic's first contingent of conventioners arriving for the Annual Electronic Parts Show at The Stevens. They're taking sample products along, of course... newest Astatic creations in Crystal and Dynamic Microphones, Phonograph Pickups and Cartridges. It's going to be fun showing this fine line of Astatic products, but it's going to be equally exciting to meet all the old gang again as well as newcomers in the field. Happy days ahead... in May... at the show! See you there!

**HOTEL
STEVENS
MAY
13 to 17**



IN TRADE

[from page 10]

organization to review merchandising plans for 1947 on the interrelated line of products that are sold through RCA tube and parts distributors.

Products to be displayed include miniature tubes and power tubes, television parts, loudspeakers, batteries, television sight-and-sound antennas, test equipment, phonograph modernization kits and other accessories and packaged sound equipment. Merchandising and sales promotional aids for distributors, dealers, and servicemen, will be shown, according to Julius Haber, advertising and sales promotion manager of this department.

Newly engineered and improved products to be unveiled include a showing of the new RCA sealed-in-steel radio "A" battery and the new type RCA 67½ volt portable radio "B" battery.

New test instruments for servicemen and industrial use to be shown by the RCA Test and Measuring Equipment Section, according to L. A. Goodwin, Jr., Manger, include an FM alignment oscillator and an audio oscillator for servicemen, and an audio voltmeter and a laboratory oscilloscope for industrial use.

Federal Exhibit at Parts Show

Miniature Selenium Rectifiers, wire and cable for FM and Television, battery chargers and DC power supplies will be featured in the Chicago Radio Parts Show of May, 1947, by Federal Telephone and Radio Corporation, Clifton, N. J. Incorporating all the latest electronic techniques and designed to meet the demands of the radio industry — manufacturer, serviceman and amateur alike — these products should find wide interest.

Legri S now "Inc."

Legri S Company added the "Inc." on their masthead. The business had been operating for the past two years under the sole ownership of Gregory Grinn.

Officers of the new corporation are: Gregory Grinn, president; Mrs. Charlotte Grinn, treasurer; Miss Alexandra Grinspun, vice president and acting secretary. Headquarters of the firm remain at 846-850 Amsterdam Avenue, New York 25, N. Y., with warehouses at both New York and Boston, Mass.

CHOOSE FM ANTENNA CAREFULLY

Dealers who lack widespread FM experience should not accept just any

[see page 47]

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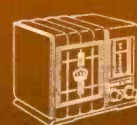
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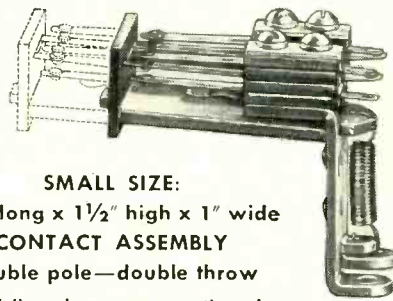


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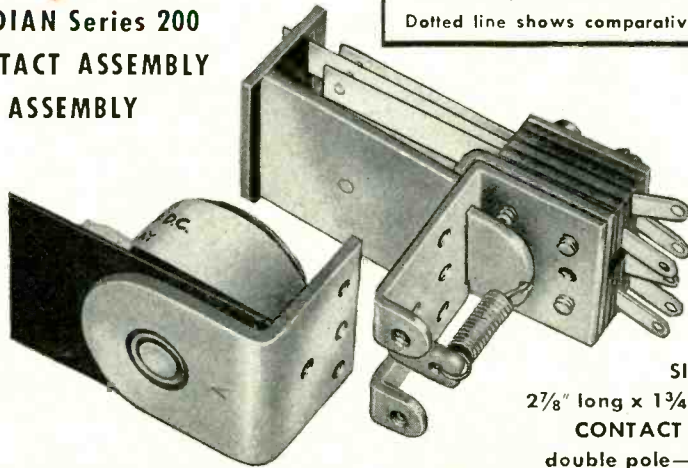
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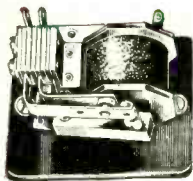


SMALL SIZE:
1 5/8" long x 1 1/2" high x 1" wide
CONTACT ASSEMBLY
double pole—double throw
Dotted line shows comparative size



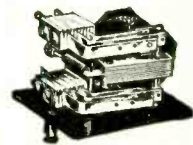
SIZE
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Popular RADIO RELAYS in the GUARDIAN line:



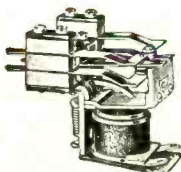
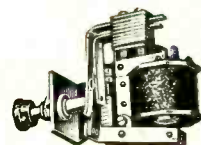
K-100 Keying Relay For low voltage control of high voltage transmission. Guardian Series K-100 Relay will follow key or bug at highest WPM rate attainable. High speed response, strong magnet and return spring give clean make and break, produce best CW note. Coils: 5 to 16 v., A.C.; coils for other voltages on specifications.

B-100 Break-in Relay For break-in operation on amateur transmitters. The Guardian B-100 Relay has laminated field piece and armature. Fine 1/4" silver DPDT contacts, capacity to 1500 watts, 60 c., non-inductive A.C., and in A.C. primary circuit of any inductive power supply delivering up to 1 KW, inclusively.



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A-100 Antenna Relay A low loss AISiMag insulated relay. For single wire fed installations specify the A-100-C, SPDT unit. Two A-100-C in place of one A-100 in open wire line systems will avoid possible impedance mismatch. A very popular relay with radio amateurs.

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THE TRUTH ABOUT FM

by JOSEPH GERL*

THE current squabble between the FM broadcasters and the radio manufacturing industry is a temporary tempest in a teapot, certain to subside completely within a year. The infant FM broadcasting industry is up in arms against the radio set manufacturers for their alleged reluctance to manufacture FM receiving sets; various politicians have threatened wholesale investigations of this alleged conspiracy; and overnight experts, writing in consumer publications, have discovered a dastardly attempt on the part of set manufacturers to marry the public to AM broadcasting and give FM the cold shoulder.

This, of course, is pure fantasy, and could be promulgated only by people unfamiliar with the problems of the FM industry. The problems facing the FM industry today — both broadcasters and manufacturers — are these: the small number of FM stations in operation, the small number of sets on the market, the low power output of the FM stations, and the quality of the FM broadcasts.

First, there are only some 50-odd FM stations in operation today. The number of cities in which these stations are located is only about 25. All of which means that the manufacturer who desires to produce FM sets in large volume at a low price is handicapped by the small market. This is a handicap which is temporary, and as the number of stations increases, production of FM sets will increase.

Second, the small number of FM sets on the market has not been due to any reluctance on the part of manufacturers to produce such sets. The drawback has been the heartbreaking shortage of component parts—a shortage which has crippled the attempts of manufacturers to produce little more than AM table model radios. This shortage has now been broken—or is well on the way to being broken. *The result is that the members of the Radio Manufacturers' Association plan to*

**President Sonora Radio & Television Corp. From a recent speech before the St. Louis Kiwanis Club.*

build 3,500,000 sets with FM bands during 1947.

Third, there has been some cry that set manufacturers are building only console FM sets, and neglecting table model sets with an FM band. To some extent this is true, although we are already beginning to see some table model FM sets on the market and should see more in the near future. The difficulty here, however, is one due almost entirely to the FM broadcasters.

By and large, most FM stations today have signals of such small wattage and of such limited radius, that nothing but a large console FM set could begin to reproduce the signal. A table model FM set, with a tube complement suitable to such a set, would give lamentable results—hurting FM rather than emphasizing its advantages. Until the FM stations increase their wattages — as many are slowly doing — we will continue to have lamentable FM reception. It is the prayer of every set manufacturer that the FM broadcasters move as rapidly as possible to their full power output, so that FM reception can be demonstrably better than AM. Of course, the FM broadcasters have been retarded, too, by equipment shortages, but I am happy to say that operating wattages are increasing daily and the

weak FM signal should be a thing of the past within a year.

Fourth, we must keep in mind the FM programs. Today, most FM broadcasts are record transcriptions of one kind or another. The Petrillo ban has had a deleterious effect upon FM broadcasting. But whatever the cause, the fact remains that FM programs are little other than record shows, and most people with record changers can easily duplicate such programs by themselves by playing their own records on large combinations with better tone quality than the FM broadcasts have. A series of recorded shows is no great inducement to prospective buyers of FM. The growth of live FM shows would be a tremendous stimulant to the sale of FM receivers.

However, there is every reason to believe that these four obstacles to the FM industry will be overcome this year. As I have indicated, many FM stations are slowly increasing their wattages, raising their antennas and doing everything possible to augment the strength of their signals. On the manufacturers' part, they are building and plan to build many more table model FM sets, and as the FM broadcasting wattages increase, the reception on the table model sets should improve to the standard the public has been told can be achieved through FM.

Finally, as the audience increases, more and more commercial FM programs, with live talent, will no doubt be used, which in turn should stimulate the sale of additional FM receivers.

Critics today who see an organized conspiracy to withhold FM from the public are obviously unaware of the facts of the industry. The problem of the FM industry can only be met by the FM broadcasters and manufacturers becoming aware of each other's problems and working together, not sniping at each other.

Survey FM Production for 1947

Estimates of radio industry leaders as to 1947 production of FM-AM receivers have varied widely from 2,000,000 to 5,000,000. Current production by RMA member-companies is running between 10,000 and 15,000 a week. January's output of FM-AM sets by RMA manufacturers was 51,318.

An RMA survey is expected to produce the first definite forecasts of future FM set production and accurate estimates of the number of FM transmitters that will be available this year.

The RMA committee, of which

Larry F. Hardy, vice president of Philco Corp., is chairman, is composed of the following industry leaders: Ben Abrams, president of the Emerson Radio & Phonograph Corp., New York; H. C. Bonfig, vice president of the Zenith Radio Corp., Chicago; E. A. Nicholas, president of the Farnsworth Television & Radio Corp., Fort Wayne, Ind.; and S. P. Taylor, of New York, chairman of the RMA Transmitter Division and an executive of Western Electric Co. RMA President Cosgrove is an ex officio member of the committee.

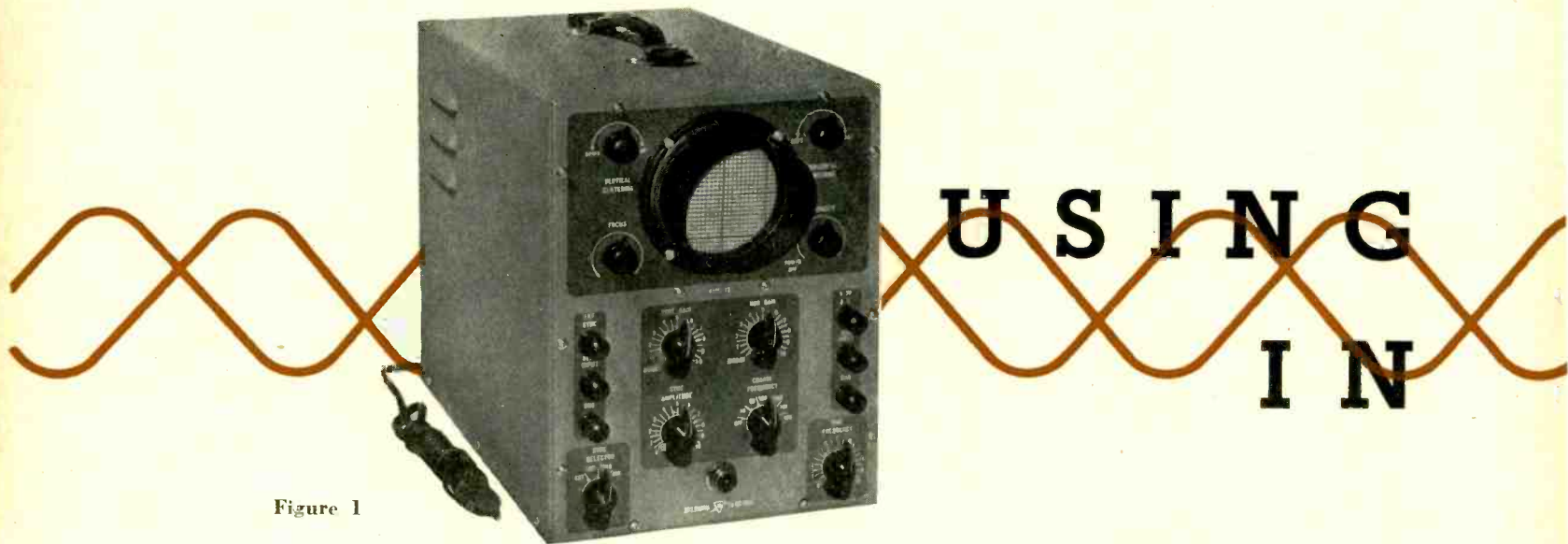


Figure 1

THE cathode ray oscilloscope is a versatile instrument. It may be used to check hum and distortion, measure peak voltages, trace audio-frequency signals, and examine signal waveforms. It also serves as a visual indicator in receiver alignment, as an output indicator in audio checking, and modulation indicator in detector circuits. The oscilloscope is indispensable in FM and television testing and in checking fidelity, and is the only entirely satisfactory peak voltage indicator for rapidly-varying a.c.d signals, such as those encountered in audio amplifier stages. These are only a few of the leading jobs this useful instrument will perform.

In radio testing, the pattern on the oscilloscope screen will give quickly information which otherwise could be obtained only after hours of testing with meters and plotting data on graph paper.

This article, and subsequent ones, will describe the technical features of a modern, moderately-priced oscilloscope and explain several of its uses in speedy, refined trouble shooting and receiver adjustment. These uses will suggest still others to the reader.

Choice of Instrument

Since oscilloscopes of various sizes, specifications, and prices are on the

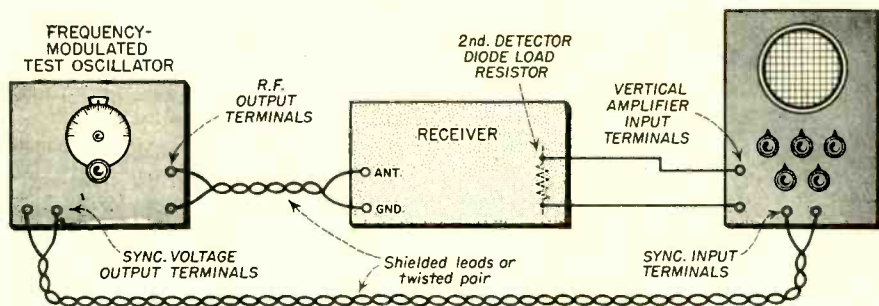


Figure 2

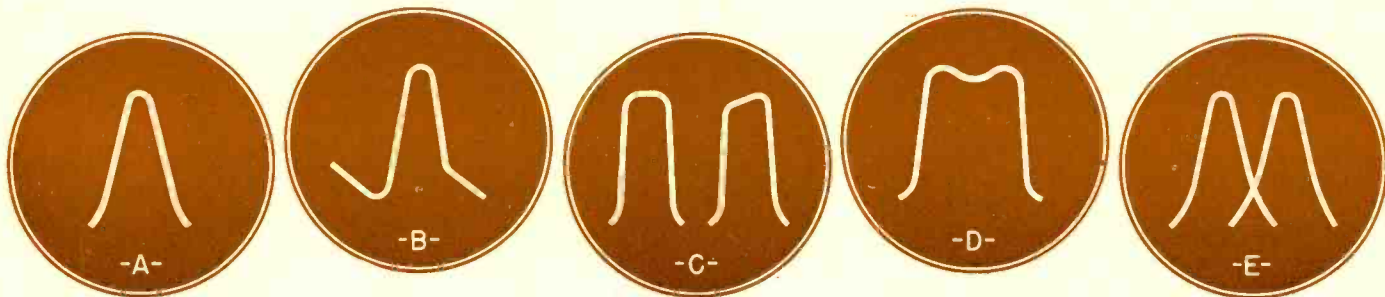
market, some indecision is apt to arise in the mind of a new buyer. Most radio service-dealers perform seek the maximum of quality and utility in a test instrument. With these facts in mind, we wish to point out that certain features are *musts* in a service oscilloscope.

Prominent among these features is screen size. However, the larger the screen, the more expensive is the instrument. In most busy shops, the 3-inch screen will be adequate for all operations, and definitely superior to the 1- and 2-inch sizes. The horizontal and vertical deflection amplifiers must be reasonably flat in response throughout a frequency range extending some distance beyond the upper limit of the a. f. spectrum. At the same time, these amplifiers should afford good sensitiv-

ity. An internal sweep oscillator must be provided and should have a wide frequency range. External, internal, and 60-cycle synchronization must be available by means of switching; non-interlocking control of intensity (brightness) and focus is imperative; and both horizontal and vertical beam-centering controls must be included. The complete instrument must not be so heavy as to be burdensome to handle.

The new *Sylvania Type 131* (Figure 1) oscilloscope is a stable, lightweight instrument having all of the features demanded by modern radio service practice. The horizontal and vertical amplifiers in this instrument have a uniform response within 3 db from 10 cycles per second to 100 kilocycles. The amplifier sensitivity is

Figure 4



YOUR 'SCOPE RADIO SERVICING

Details of operation of moderately priced Sylvania Type 131 Oscilloscope in rapid and efficient servicing of AM receivers, FM and television circuits, etc. Hows and whys of selecting the right instrument.

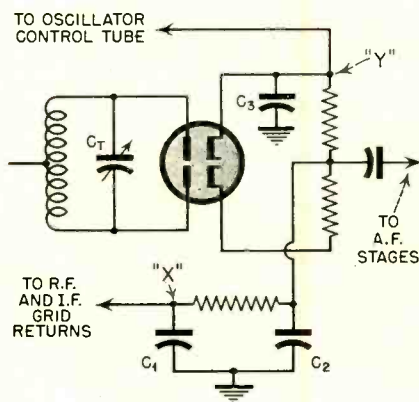
by RUFUS TURNER*

sufficient to cause a 1-inch total deflection on the screen when a 0.5-volt RMS signal is applied to the amplifier input terminals.

Smooth gain control is provided for each amplifier. Sensitivity going directly to the deflection plates, with the amplifiers switched off, is 19 volts RMS peak-to-peak per inch of deflection on the screen. Other features of this instrument are:

- (1) a rotary switch for selecting external, internal, or 60-cycle synchronization;
- (2) positive synch control (locking of image);
- (3) vertical and horizontal beam-centering controls on the front panel;
- (4) internal sweep (timing) oscillator range of 15 cycles to 40 kilocycles in five steps;

Figure 5



(5) fine frequency control for the sweep oscillator;

(6) clear three-inch screen.

This instrument has been put through adequate field tests in which it has proven its serviceability for receiver trouble-shooting operations.

Visual Receiver Alignment

Any radio receiver operates most efficiently when its r. f., detector, and i. f. circuits are properly aligned. Radio men use various methods of indicating output to determine the completeness of alignment. These include audible checks, use of an a. c. voltmeter across the output terminals of the receiver, connection of a d. c. milliammeter in a plate-cathode circuit, and connection of a d. c. vacuum-tube voltmeter across the detector load resistance. However, *proper* alignment does not always mean peak output alone. Very often, the *shape* of the selectivity curve is important, and none of the above methods gives a quick and accurate indication of this feature. The oscilloscope has the advantage that it will show the influence of each aligning adjustment upon the shape of the selectivity curve, while also showing the latter's amplitude. Using the 'scope for this purpose requires no more time than using an ordinary output meter, and the oscillo-

*Engineer, Industrial Electronics Division, Sylvania Electric Products, Inc.

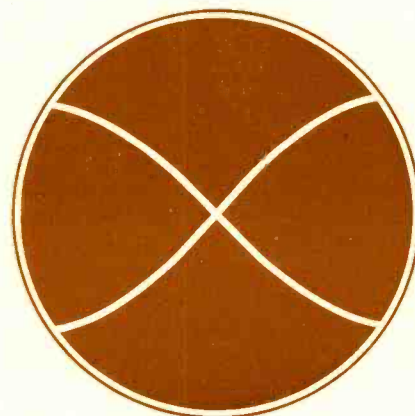
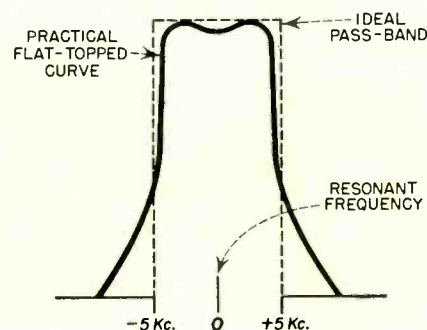


Figure 3

scopic method pays larger dividends.

For visual set alignment, the operator will require, in addition to the oscilloscope, a frequency-modulated test oscillator (signal generator) covering both the r. f. and i. f. frequencies. Several of the late-model oscillators and signal generators are now equipped with internal frequency modulators or have terminals for the connection of an external frequency modulator. The latter may consist of an electronic modulator or a motor-driven capacitor type of "wobbulator." The electronic type will be superior in most cases; since the motor-rotated capacitor, con-

Figure 6



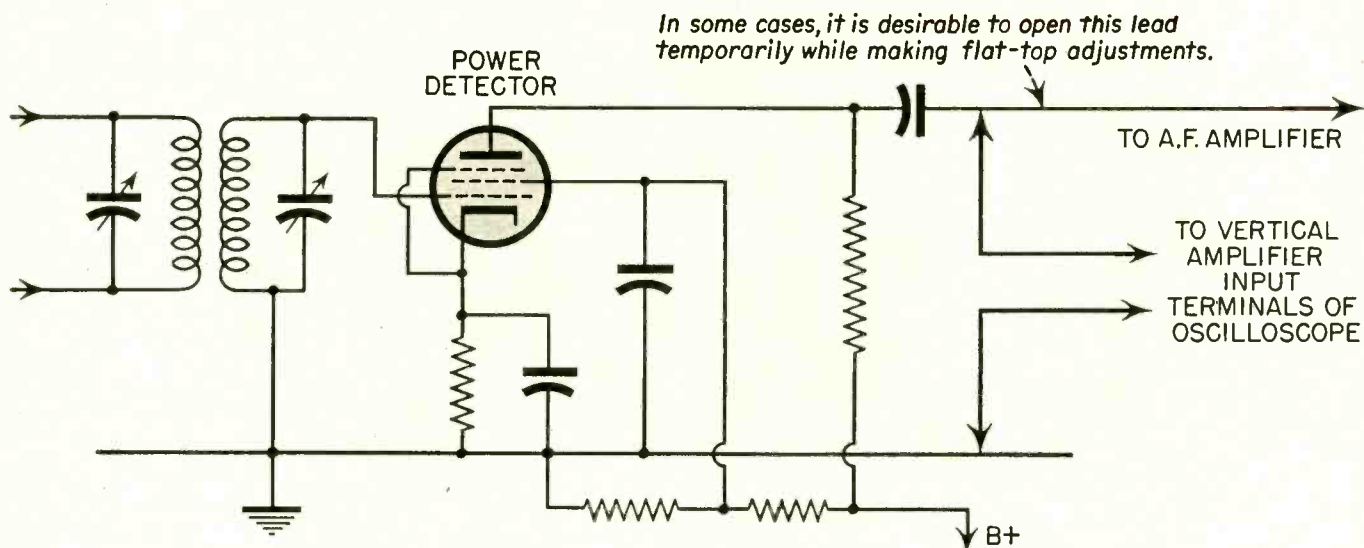


Figure 7

ected across the oscillator tuned circuit, introduces objectionable amplitude modulation. The electronic modulator also supplies a 120-cycle signal voltage for synchronizing the 'scope.

Figure 2 shows the setup for visual alignment of a superhet receiver. The oscilloscope controls are set in the following manner:

- (1) internal sweep (timing) oscillator switched on and set to 120 cycles;
- (2) vertical amplifier switched on;
- (3) synchronization switched to EXTERNAL;
- (4) horizontal amplifier gain set about half-way;
- (5) vertical amplifier gain set about quarter-way.

Before connecting the oscilloscope to the receiver and oscillator as shown in Figure 2, the sweep oscillator must be set carefully to 120 cycles in the following manner:

- (1) Connect a low-voltage 60-cycle source, such as the output of a 6.3-volt filament transformer, to the vertical amplifier input terminals.
- (2) Switch-on the internal sweep oscillator and set its coarse frequency control to the proper range.
- (3) Adjust the fine frequency control and synchronization controls until a stationary pattern such as shown in Figure 3 is seen on the screen.

This pattern indicates that the sweep oscillator frequency has been set exactly to 120 cycles. Increase the settings of the horizontal and vertical amplifier gain controls until the pattern fills up the screen in the manner shown in Fig. 2. After this adjustment is completed, disconnect the 60-cycle source from the 'scope but do not switch off the power nor change any of the oscilloscope settings.

For the visual alignment, the vertical amplifier input terminals are connected across the load resistor of the 2nd detector diode (not the AVC rec-

tifier). That is, the "high" vertical amplifier terminal is connected to the end of the load resistor closest to the diode, and the "low" amplifier terminal to receiver chassis (or to the B-minus point if the chassis is not at ground potential). In detector circuits in which the load resistor normally is connected in series with the audio gain control or in series with the cathode resistor, the high vertical amplifier input terminal must be connected to the junction point of these two resistors.

The r. f. output terminals of the test oscillator are connected to the antenna and ground terminals of the receiver, and the oscillator is set to the frequency to which the receiver is tuned. (If the i. f. amplifier alone were to be aligned, the oscillator output terminals would be connected to receiver ground and to the i. f. input. The most satisfactory input to the intermediate frequency amplifier usually is through the 1st detector grid circuit. The sync voltage output terminals of the test oscillator are connected to the sync input terminals of the 'scope by means of a short length of twisted pair. The oscilloscope sync

switch is then thrown to its EXTERNAL position.

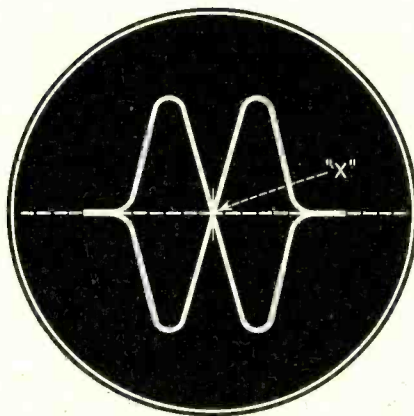
The following procedure is followed in visual alignment of the receiver:

With the equipment connected as shown in Figure 2; set the receiver r. f. gain control (if any) for maximum output, advance the oscilloscope vertical amplifier gain control for a signal pattern of good visibility, and adjust the oscilloscope sync control for a stationary pattern on the screen. In a standard superhet, having no flat-topped i. f.'s, this pattern should resemble closely Figure 4-A. As the various r. f., detector, and i. f. trimmers are adjusted, the pattern should increase in height (indicating peak gain) and its shape should be improved (indicating best selectivity). It will be desirable in aligning most superhets to make the top of this figure as sharp as possible; that is, pointed in shape. However, the curve should be as wide as possible between skirts at a point about one-quarter down from the top of the peak. If the pattern jumps or drifts on the screen, adjust the sync control for better stability. No trouble should be experienced in locking the figure in a center position on the screen.

Various departures from the ideal curve of Figure 4-A will indicate abnormal conditions within the receiver. Tilted feet at the bottom of the curve (see Figure 4-B) indicate receiver overloading. To correct this condition, turn down the output control of the test oscillator, reduce the setting of the receiver r. f. gain control, or both.

Flat-topped (peakless) curves, such as those shown in Figure 4-C, indicate the same sort of overloading. In a standard superhet, a selectivity curve with a broad, flat top and a sunken peak (see Figure 4-D) usually indicates "staggering" in the i. f. settings. Careful adjustment of each i. f. trim-

Figure 8



mer to the intermediate frequency will sharpen and narrow the curve and correct the broadness. If the i. f. stages previously have been aligned to the wrong frequency, a double curve, such as *Figure 4-E*, will be seen on the screen. Usually when adjusting a badly misaligned receiver, pattern E first will be seen on the screen. Then, as the stages progressively are trimmed, patterns D, B, and A will follow, generally in that very order.

In visual alignment, the conventional alignment *order* is followed. That is, the i. f. amplifier usually is aligned first to the specified intermediate frequency, and the receiver front-end next. Common practice is to align the front-end section first at the high-frequency end of the standard broadcast band, and next to adjust the series paddler (s) at the low frequency end of this same band. After completion of the broadcast band, the procedure is repeated on the various short-wave bands.

When it is desired to check i. f. alignment alone; the test oscillator output terminals are connected to the i. f. amplifier input, rather than to the receiver input terminals as shown in *Figure 2*. For this purpose, the high output terminal of the test oscillator is connected to the first detector control grid (in some receivers, it may be necessary to disconnect any other connection temporarily from the control grid), and the low terminal of the test oscillator is connected to receiver ground. All other connections remain as shown in *Figure 2*.

In most receivers, both AVC and AFC circuits must be placed temporarily out of operation for best results in visual alignment. The AVC may be interrupted in most receivers by connecting a temporary short circuit between the r. f. and i. f. *grid returns* and ground. In other sets, especially those employing delayed AVC, the AVC filter must be connected temporarily direct to the voltage divider tap from which the delay voltage is obtained. When a separate and special AVC tube is employed, aside from the 2nd detector, this tube usually may simply be removed from its socket to interrupt AVC operation.

Figure 5 shows a typical discriminator circuit for automatic frequency control. In order to interrupt AFC action here, connect a jumper temporarily from point "Y" to ground — or, instead, if the receiver has an AFC switch, throw this switch to its OFF position. If capacitor C_2 normally is larger than about $0.001 \mu\text{fd.}$, it must be changed temporarily to that value. To interrupt AFC action in this circuit, connect a jumper temporarily from point "X" to ground.

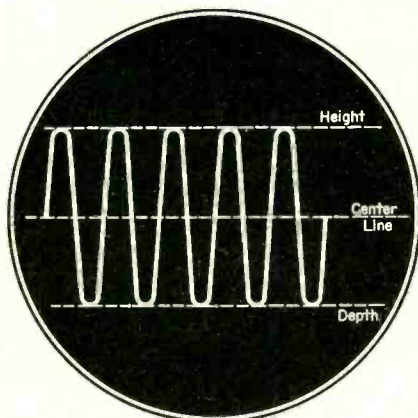


Figure 9

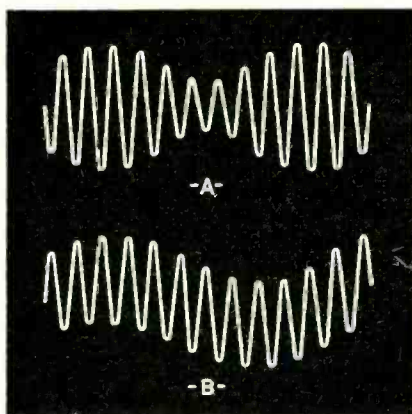
When making visual alignments on ac-dc sets, the oscilloscope must be protected from possible damage by the power-line connection in these receivers. This may be done simply by connecting a $0.1\text{-}\mu\text{fd.}$, 400-volt tubular capacitor between the low vertical amplifier input terminal and the receiver ground.

Aligning Flat-Topped High-Fidelity Sets

Flat-topped selectivity curves are desirable in certain high-fidelity a. m. receivers. Some of these receivers employ broadly-tuned i. f. stages in super-het circuits, while others are of the tuned radio-frequency type employing flat-topped adjustment of the r. f. amplifier and detector stages. In each case, successive stages are "staggered" deliberately (that is, they are tuned slightly to either side of resonance. One stage usually is tuned to the lower side of resonance; the next stage to the higher side). This results in a wider pass band than usual, and a corresponding wider range of reproduction. *Figure 6* shows the appearance of ideal and practical flat-top curve selectivity curves.

The oscilloscope is especially well-suited to the flat-top alignment of receiver stages. In fact, no other instrument is able to show so quickly the overall effect of tuning adjustments

Figure 10



upon the curve shape.

For visual flat-top alignment, a frequency-modulated test oscillator again is required. If the i. f. section alone is to be flat-topped, the output of the oscillator, tuned to the intermediate frequency, is presented to the 1st detector control grid, as previously explained. The oscilloscope is adjusted also in the manner previously described in this article, and is connected to the 2nd detector as shown in *Figure 2*. The i. f. trimmers then are adjusted separately for the best flat-top pattern, as observed on the 'scope screen. In some receivers, shunt resistors are employed in each tuned circuit to aid in broadening the selectivity curve. If these resistors must be adjusted in value, the effect of such adjustments may be followed closely by means of the oscilloscope. All flat-top adjustments should be augmented with listening tests to appraise progress.

When the high-fidelity receiver is of the tuned r. f. type, the r. f. output of the frequency-modulated test oscillator must be presented to the antenna and ground terminals of the receiver exactly as shown in *Figure 2*. The oscilloscope is adjusted in the same manner described previously under *Visual Receiver Alignment*, and is connected to the test oscillator synchronizing terminals as shown in *Figure 2*.

In this case, however, the vertical amplifier input terminals of the 'scope must be connected to the plate-output circuit of the detector. (The detector in such receivers almost always is of the *power type*, employing a triode, tetrode, or pentode tube). Suitable connections are illustrated by *Figure 7*. Trimmer adjustments are made in the same manner as described in the preceding paragraph. In general, the flat-topping of r. f. amplifier stages may not be carried as far as in i. f. amplifiers. This is because adjacent channel station interference becomes more pronounced as the selectivity of the receiver front-end is broadened.

AFC Alignment

The oscilloscope is invaluable for adjustment of the discriminator stage in receivers having automatic frequency control. One such AFC discriminator circuit is shown in *Figure 5*.

For this adjustment; the apparatus is connected as shown in *Figure 2*, except that the vertical amplifier input terminals of the 'scope are connected to receiver ground and point "Y" (see *Figure 5*), capacitor C_2 is disconnected temporarily, the AFC switch in the receiver is opened, and trimmer C_1 is set for maximum amplitude of the pattern seen on the oscilloscope screen. *Figure 8* shows the pattern which

[see page 48]

ANALYSIS OF COIL CHECKERS

by THOMAS PIERCE

ALL manner of coils ranging from the single layer solenoid of a few turns to high-inductance filter chokes, are encountered daily in service practice and often need to have their inductance measured. Where such measurements must be made, a coil checker can be used to good advantage. These instruments are now rather scarce and if need be, the serviceman may build for himself a very handy inductance bridge, with stock components.

The bridge may be calibrated, as will be explained later in this article, with an ordinary ohmmeter. The inductance ranges provided are 10 to 100 microhenries, 100 microhenries to 1 millihenry, 1 to 10 millihenries, 10 to 100 millihenries, 100 millihenries to 1 henry, 1 to 10 henries, and 10 to 100 henries. This wide range includes the inductance values of all coils employed in radio receivers, from the small short-wave inductors to the large filter chokes.

A1. Basic Circuit

The basic circuit is the Maxwell Bridge (Figure 1) well known to engineers and laboratory technicians. Here, the unknown inductance, L , is balanced against a known capacitance, C , and two known resistances, R_1 and R_2 . While the bridge detector is shown in Figure 1 simply as a pair of headphones, better results usually will be obtained with an a.c. vacuum tube voltmeter, magic eye indicator, or cathode ray oscilloscope.

The a.c. signal voltage may be supplied by an audio oscillator or by a low-voltage secondary of a filament transformer operated from the 60-cycle power line. If an oscillator is employed, it should be set to a frequency of 1000 cycles. Whether the signal frequency is 60 or 1000 cycles, the voltage should be limited to a low value (not more than $\frac{1}{2}$ volt when

inductances between 10 and 100 microhenries are measured). This is because the unknown inductance, L , and the ratio resistor, R_1 , effectively are connected in series across the voltage supply and will be damaged by high currents if this voltage is too high. When using such low voltages, the bridge sensitivity may be increased by employing an audio amplifier between the bridge and the headphones, or by employing an oscilloscope or sensitive v. t. voltmeter as the detector.

A1. Operation

In operation, rheostat R_2 , which previously has been calibrated, is set for null (zero signal in the detector). At null, the value of the unknown inductance L equals $C(R_1R_2)$, where L is in henries, C in farads, and R_1 and R_2 in ohms. Thus: if $R_1 = 10$ ohms, $C = 1$ microfarad (0.000001 farad), and null occurs when R_2 is set to 150 ohms, the unknown inductance (L) equals 150 times 0.000001. This is 0.0015 henry or $1\frac{1}{2}$ millihenries.

It is easily seen that the dial of rheostat R_2 may be made direct reading in inductance units; and by switching-in various values of C and R_1 , the various inductance ranges listed earlier in this article may be covered.

B1. Complete Circuit

The simple arrangement shown in Figure 1 may be used as is. That is; rheostat R_2 may be provided with a dial reading directly in ohms (and consequently in inductance units), and various range-setting resistors and capacitors may be plugged into positions R_1 and C , respectively.

A more satisfactory arrangement, however, is shown in Figure 2. Here, a 2-pole, 7-position rotary selector switch selects the various inductance ranges provided by the two fixed capacitors, C_1 and C_2 , and the five resistors, R_2 to R_6 , inclusive. Binding posts

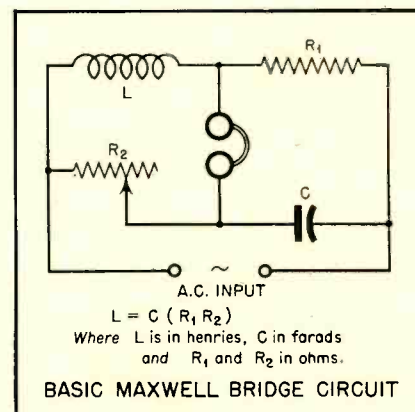


Figure 1

are provided for connection to the unknown coil, a.c. voltage source, and external detector (headphones, a.c. vacuum tube voltmeter, or oscilloscope). The several inductance ranges are listed with Figure 2.

Capacitors C_1 and C_2 and resistors R_2 to R_6 should be selected to have exact specified values. For best accuracy, the resistors should be precision non-inductive units. However, carefully selected 1-watt carbon resistors will be satisfactory for most purposes.

Rheostat R_1 should be calibrated before wiring it into the circuit. This is done in the following manner:

- (1) Provide R_1 with a plain dial. (This may be done by cementing a stiff white disc to the face of a regular 3-inch dial).
- (2) Connect R_1 to a good ohmmeter or Wheatstone Bridge and set for a resistance of 1000 ohms as indicated by the meter or bridge.
- (3) Mark this point 1 on the rheostat dial.
- (4) Set R_1 for a resistance of 1500 ohms and mark this point 1.5 on the dial.
- (5) Repeat rheostat settings for each 500 ohms up to 10,000 ohms, accord-

ing to the following table, and inscribe the dial points and figures permanently in black ink:

Resistance	Dial Reading
1000	1
1500	1.5
2000	2
2500	2.5
3000	3
3500	3.5
4000	4
4500	4.5
5000	5
5500	5.5
6000	6
6500	6.5
7000	7
7500	7.5
8000	8
8500	8.5
9000	9
9500	9.5
10,000	10

and to do all wiring with No. 12 or 14 solid bus wire.

If an audio oscillator is used as the signal voltage source, turn down its output control for the lowest possible voltage which will give good bridge sensitivity (easily recognizable null point). If a 60-cycle voltage is obtained from a filament transformer, some means, such as a primary rheostat or Variac, must be provided for signal voltage control.

B). Operation

Use of the instrument is extremely simple. Connect the unknown coil, signal source, and detector to the bridge. Set the selector switch to range A and adjust rheostat R_1 for null. If no null point is found, set the selector

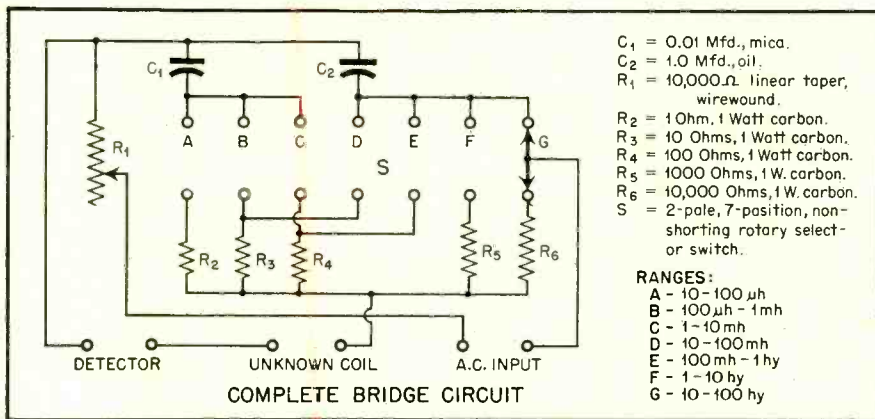


Figure 2

No particular shielding nor layout kinks are necessary in construction of the coil checking bridge. The instrument may be built into a small metal box, metal cabinet, or wooden box. Either a metallic or non-metallic panel may be used. *It is advisable, however, to keep all leads as short as possible*

switch to range B and repeat adjustment of R_1 . Progress to each successive range until the null is found. At this point, read the inductance directly from the rheostat dial and the setting of the selector switch. Thus, a rheostat reading of 2.5 with the selector at range B shows 250 microhenries.

plex schematics, by wiping out the problem.

Rider engineers and draftsmen have done the tracing themselves. One combination set is broken down into as many as eighteen individual schematics. The serviceman using Volume XV can know immediately just which components are in operation under each switch position.

"New gimmicks and gadgets blossoming in postwar sets reflect great credit on the manufacturer. But they make another headache for the troubleshooter," observes Mr. Rider. And his answer to that one is another time-and-money saving feature: the 200-page "How It Works" supplement which is packaged with Volume XV. This extra handbook, 8½ x 11 inches, is many times bigger than any earlier one. It explains the theory behind the multitude of postwar technical features in home radio receivers. Not only are their functions and operation described, but many of the complicated devices are illustrated, with an analysis by Rider engineers. Each of these discussions of theory is tied up with the sets shown in Volume XV. The book offers clear and simply-explained theory to be used as a framework for practical facts.

Other features of the latest Manual are data on new record players and changers, "ham" receivers, and all the Scott receivers not shown in previous volumes.

"Clarified Schematics" are by no means Mr. Rider's first pioneering development in the radio trouble-shooting field. It was he who introduced the now widely-used signal-tracing system, and urged on the industry the use of the cathode-ray tube oscilloscope for more accurate servicing, as well as numerous other widely used service ideas.

Rider Manuals are prime working tools at many service benches.

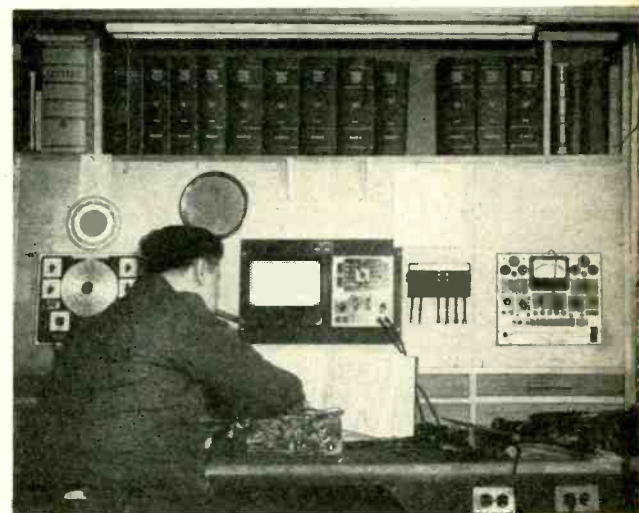
(Photo Courtesy J & D Radio Service, New York, N. Y.)

NEW MANUAL FEATURES "CLARIFIED SCHEMATICS"

WHO'S to stand the loss for the time a radio serviceman spends tracing the schematics of today's complex multi-band receivers? The customers? The serviceman? John F. Rider, publisher of the Rider Manuals, answers "Neither! American ingenuity in designing complicated radio receivers is cash-in-pocket to the manufacturer, but it's making headaches for the trouble-shooter who must keep the designers' brain-children

in repair." The new Manual makes its bow this spring, with a fully-developed solution to that problem: "Clarified Schematics".

The two thousand pages of Volume XV carry a separate "clarified schematic" diagram for every brand of every multi-band set put out by manufacturers during 1946. *This solves the problem of who's to stand the loss for the laborious process of tracing com-*



TRAINED STAFF

by G. LOWRY



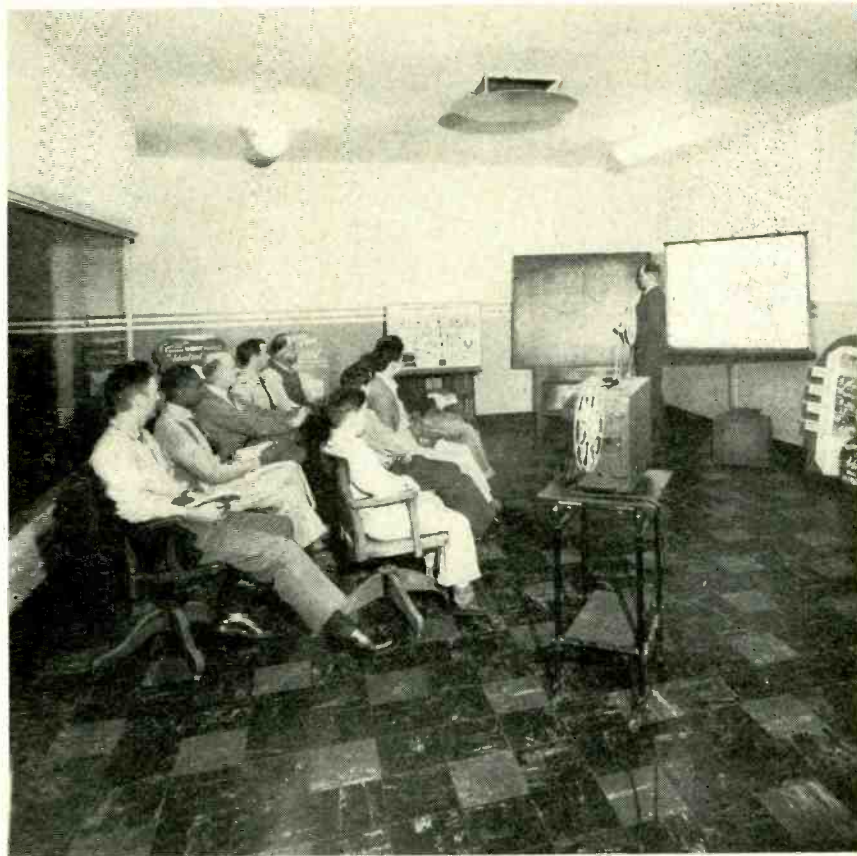
A NEW and better era for radio and electronic service employees is visualized by C. W. Donaldson, Donaldson Radio & Electric Company, Kansas City, Missouri. President of one of Kansas City's largest radio service organizations, Donaldson has constantly championed the rights of electrical service workers to comfortable working conditions, fair returns for their work, and the opportunity to advance to better-paying positions through an educational program sponsored by employers.

Outgrowth of a well-trained, expert, reliable radio and electronics service staff at Donaldson's has been a following of satisfied customers which has been steadily growing since the enterprise was launched in 1922.

At the spacious radio service plant, a stone's throw from McGee Trafficway, heavy-trafficked Kansas City boulevard, over 15,000 registered motorcars a year cruise through the big inside driveway to the motorcar radio service facilities housed in the rear of the building, and which absorb 5,000 of the 10,000 square feet the building occupies. Home and motorcar radio set servicing are specialties of the company, and the solid traffic developed by dependable repair on this equipment has figured most prominently in the growth of the business.

Staffed with competent technicians and electronics experts, the company offers diversified repair and/or installation on:

Sound equipment used by top-flight Kansas City industries;



Above: Staff gets earn-while-learning training. Evening sessions cover black-board talks on radio FM and TV circuits, also sales techniques for merchandising appliances, radios and sound. Note RCA Dynamic Demonstrator on easel in background. *Top:* Building is close to much traveled McGee Trafficway in Kansas City; layout encourages motorcar patronage.

Instruments for checking the content of moisture in lumber used by lumber companies;

Leak detectors used by the water company; the Donaldson staff.

Also maintenance on electro-therapy equipment used by physicians;

And inter-communication equipment and amplifying systems located in large industrial plants is other

equipment on which the staff furnishes maintenance service.

Service Area Promotes Sales

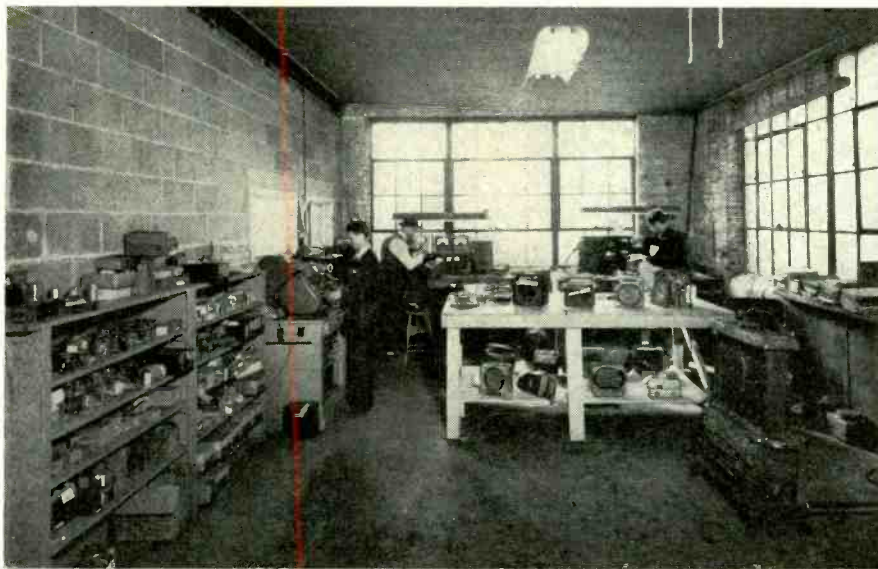
In a move to capitalize on the large potential business for electrical appliances represented among the thousands of motorists who enter the plant every year, Donaldson recently

KNOWS ITS STUFF

Courses in appliance, radio, sound and electronic servicing, plus merchandising and sales, help build volume for dealer Donaldson, Kansas City.



Owner Donaldson considers radio servicing is highly specialized, keeps personnel abreast of trends through special training.

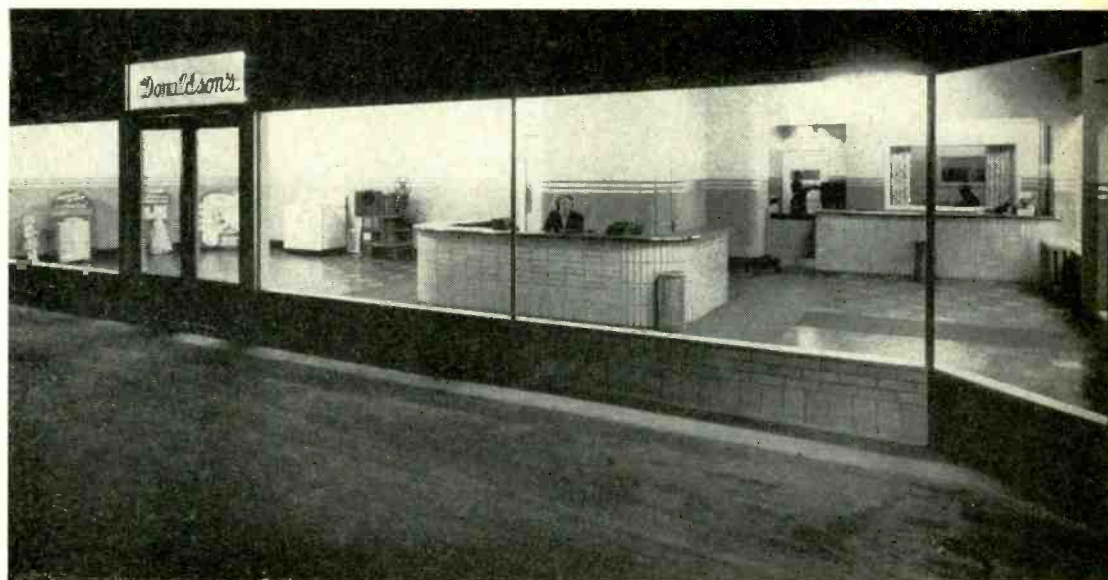


Above: Men work in air-conditioned, soundproof quarters. Change from production-line service operation to a two-men-to-a-room method has resulted in 20 per cent increase in service job output. **Below:** Driveway used by auto radio service customers is flanked by 50-foot-long display window with full view of salesroom, seen by customers as they enter and leave.

spent \$10,000 in a modernization of the front of the building, which resulted in a conversion of the formerly bricked-in driveway into a 50-foot-long display window for electrical appliances. The appliance showroom was allocated 1,800 square feet of space in the remodeling program.

Now the entire appliance sales room is a focal point for the motor-car radio repair traffic, a traffic which rates as topnotch prospects for home appliances. A man with a car and a car radio is a home owner is the premise on which this conclusion is based. Since the car radio patrons use the driveway both upon entering and leaving the building, the appliance display is twice-blessed by their inspection.

Tan commercial glass, pastel-tinted walls, curved archways, and asphalt linoleum-covered floors combine to create a striking sales backdrop for



B. G. Bailey, foreman of the motorcar radio shop, and C. W. Donaldson collaborate on the supervision of appliance merchandising operations. Bailey, a member of the staff for eighteen years, has the opportunity in frequent contacts with customers to suggest replacing outmoded motorcar and home radio sets with new models. A mailing list of 5,000 customers, to whom is periodically dispatched illustrated merchandising material, is the mainstay of the promotional attack.

Mixes Displays

Home appliances vie with sound



Dealer Donaldson demonstrates a radio combo. He will draw appliance and radio trade from 15,000-plus motorists who come in annually for auto radio work.

equipment for sales honors. Washers and home and car radios mingle with movie projectors and intercommunication equipment in discussions of merchandise sales possibilities.

Visual education is pet conversational fodder with Donaldson, and he forecasts tremendous sales of movie projectors and sound equipment to Kansas City industrialists who are becoming increasingly aware of the value of visual instruction in the training of personnel and the publicizing of their products.

Movie film has replaced the family album in modern homes, and sales of movie projectors and sound equipment will progressively develop among homeowners. At Donaldson's, movie projectors are likely to be jux-

taped in the appliance showroom with refrigerators and washers.

The intense interest of the owner of the Kansas City radio service plant in the retail sales possibilities of visual education equipment is natural since he has availed himself of this means of furthering the education of his own personnel for years.

Training is an Investment

Tuesday nights, the Donaldson staff assembles in the lobby for a training session which takes up fundamentals of electronics, appliance servicing, and often includes a brisk work-out in mathematics, a subject

board-illustrated talks. Films supplied by manufacturers, illustrating the function of electronics equipment, are displayed. A screen, projector, and movie sound equipment are essential school paraphernalia. Cartoon films are interpolated between serious lectures in order to provide relaxation breaks in the school routine.

Textbooks for the Donaldson school were purchased from disbanded army schools, and the Kansas City Board of Education cooperated by lending movie film and other material. A piece of equipment which has proved tremendously useful in demonstrating to the students the role each radio part plays in the operation of the whole set is the RCA Dynamic Demonstrator No. III. With every part of a radio set, and circuit, clearly visible on an open panel, students are able to observe the function of each part when not compactly bound together. They disconnect various units, notice the results. A diagram on the face of the generator shows the values and functions of all parts. Different colors for each circuit—green for the audio, yellow for the oscillator, etc.—enable students to distinguish at a glance between the operations of various circuits.

Faculty of the school is composed of Donaldson and his top experts. Special lecturers are borrowed from



Auto radio servicing is 60 per cent of dealer's volume. Trade is handled by expert radio and electronic servicemen, in spacious drive-in quarters.

with which the company president declares any service technician should become well acquainted before he can hope to achieve much progress in his field.

Chalk talks on sales technique to be applied when selling appliances and sound equipment are often on the agenda of the course offered the Donaldson personnel—from file clerk to the top expert on the electronics staff! Classes are three hours long, and instruction is varied so as to maintain the interest of the class. Brief, pointed lectures are succeeded by black-

the staffs of Kansas City electrical equipment manufacturers.

Significant, indeed, is the fact that while the plant president placed attendance at the school strictly on a voluntary basis, with no pressure on the staff to attend, attendance is virtually 100 percent at every session.

"That these men will give up a complete evening which they might have spent bowling with the fellows, or at home with their family," points out Mr. Donaldson, "should be sufficient evidence of the desire of the

[see page 42]

This may be your work bench: In foreground is the "Sparx" dynamic signal tracer, with probes in use on a radio chassis. Functions and circuits are analyzed: "improved" setup shown in Figure 1.



"SPARX" AT WORK

ONCE in a while a manufacturer will come up with a *natural* in test equipment, and as a result paves the way for smoother servicing. Examples of this are the vacuum tube voltmeter and the signal tracer. Instruments of this type in the serviceman's shop a few years ago were the exception rather than the rule; today the opposite is true.

Within the past few months an instrument called "Sparx" has been made available to radiomen which bids fair to fall in the category of *naturals* mentioned above. Manufactured by the McMurdo Silver Company, its versatility and dependability have already made it immensely popular with those whose first requisite of a piece of test equipment is its ability to speed up servicing.

FUNCTIONAL INSTRUMENT BREAKDOWN ANALYSIS

Actual operation uncovers the following range of utility of this instrument:

1. High input resistance *vacuum*

A versatile serviceman's operating tool, with improved circuit suggested by manufacturer (page 26) and instructions for changing earlier models.

by SAMUEL L. MARSHALL

tube voltmeter, D.C. and A.C., the latter with a frequency limit well above 100 megacycles.

2. Aural and visual, gain controlled, A.F. and R.F. *signal tracer*.

3. *A.F. amplifier* for measuring phono-pickup and speaker characteristics.

4. *Test speaker*.

5. *Power supply* source of high voltage (280 V.) rectified and filtered D.C.

CIRCUIT BREAKDOWN ANALYSIS

The circuit diagram is illustrated in Fig. 1. The instrument will be seen to contain the following circuit units:

1. *Crystal probe*. This consists of

the new 1N34 crystal diode rectifier. The mechanical construction of this probe is shown in Fig. 2.

2. *Visual indicator*. This is the 6E5 electron ray tube.

3. *Linear gain control*. Indicated in the diagram as P1, this control has a linear taper so that quantitative voltage measurements may be calculated from its corresponding dial readings.

4. *Audio amplifier*. With an audible frequency response extending to 20 cycles in the lower audio frequencies, this unit is particularly suitable for locating sources of hum in a receiver.

5. *Loud Speaker*. This speaker may be switched to panel jacks for use independently as a shop speaker, or used in conjunction with the aural signal

tracing units of the instrument.

6. *Indicator switch.* The purpose of the indicator switch, S1, is to enable the operator to:

a) Apply the measured input to the 6E5 directly. (Indicator switch in INPUT position. See Fig. 3)

b) Apply the measured input to the 6E5 through the linear gain control. (Indicator switch in OSCILLATOR position)

c) Apply the measured input to the 6E5 through the gain-controlled amplifier. (Indicator switch in OUTPUT position.)

7. *Output switch.* The purpose of the output switch, S2, is to enable the operator to:

a) Connect the speaker to the final tube of the amplifier for aural testing. (OUTPUT switch in INT. position)

b) Connect the amplifier for use with an external speaker. (OUTPUT switch in AMP. position) Terminals P and B+ are used to connect up this external speaker.

c) Make available the speaker itself as a test speaker through terminals P and B+. (OUTPUT switch in SPKR. position.) Line plug of instrument need not be inserted in power receptacle for this test position.

d) Make available the rectified D.C. of the power supply



Figure 3. Front panel view, with operating indications. Referred to in text at left, beginning with paragraph 6.

through terminals GND. and B+. (Speaker position of OUTPUT switch)

8. *Input terminals* to amplifier through gain control.

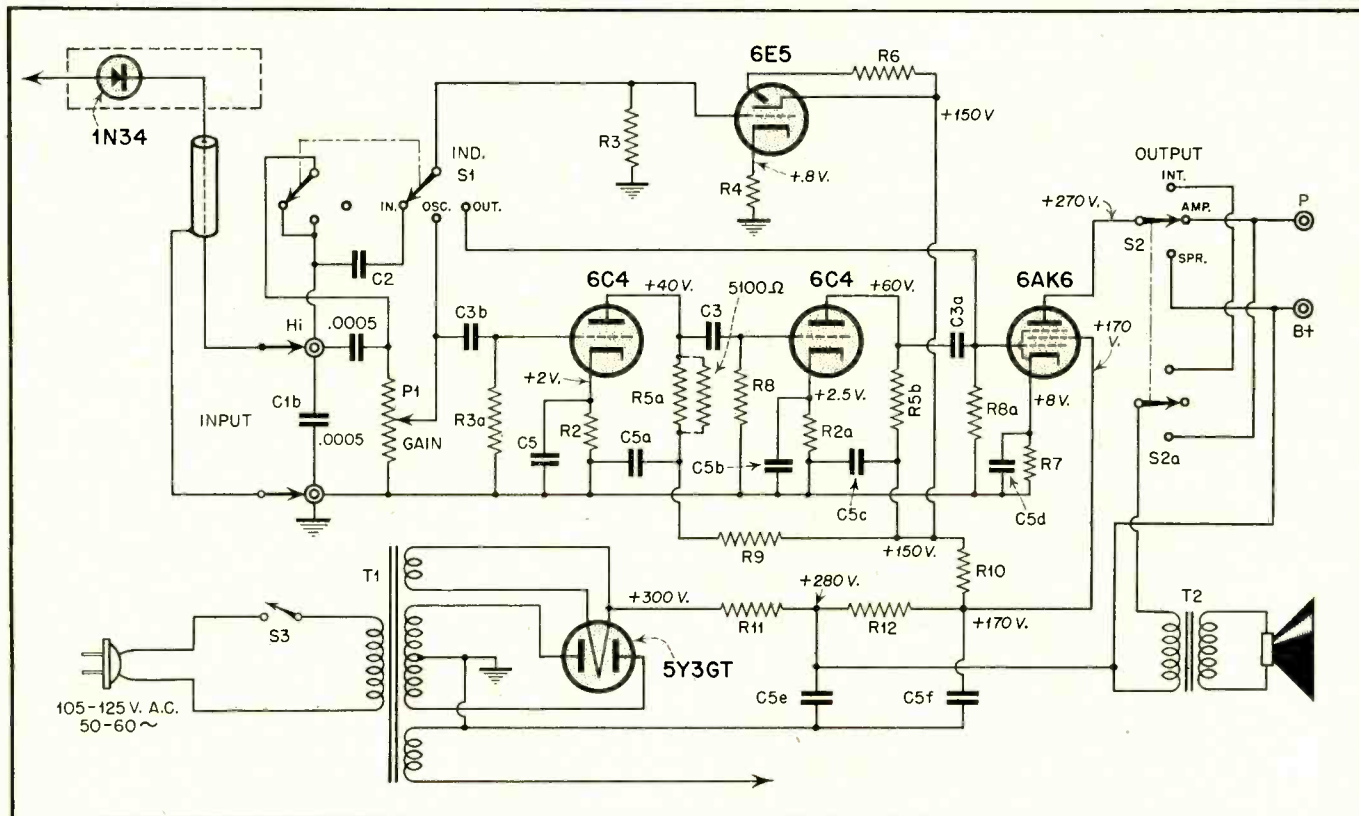
9. *Output terminals.* The circuit connections to the output terminals have been covered in the discussion on the Output switch.

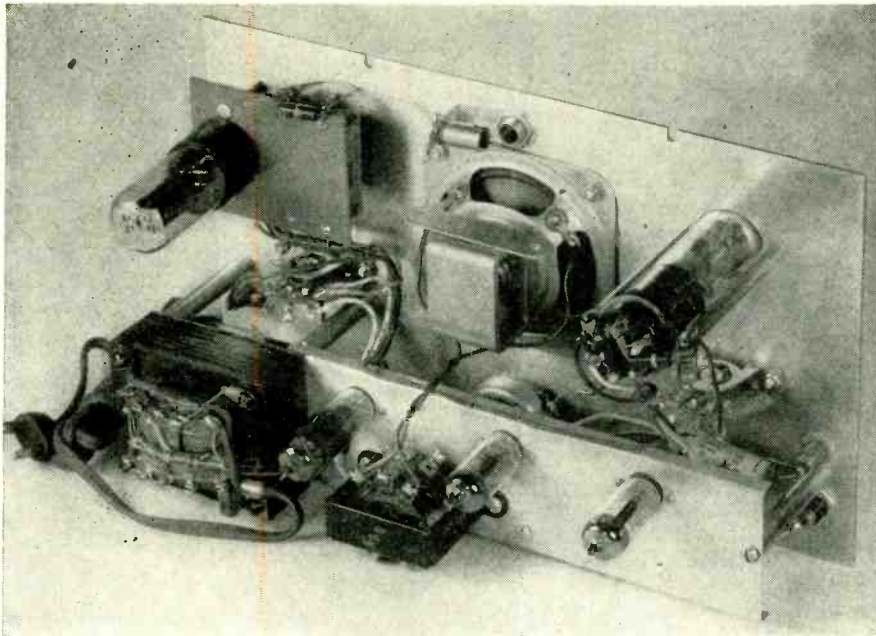
Sparks can be used to measure D.C. terminal voltages without affecting or disturbing the circuit constants in the circuit being measured. Since the shadow of the 6E5 tube is completely closed when the applied input voltage is about 5.5 volts, this value represents the minimum measurable voltage. Higher D.C. voltages can be measured by reducing the gain control until the shadow is just about ready to open again. The value of the measured

SERVICING APPLICATIONS

1. As a *vacuum tube voltmeter*

Figure 1. Circuit diagram of "Spark". Note Crystal probe with new 1N34 crystal diode rectifier. Schematic is revised as described in section under "Special Note"



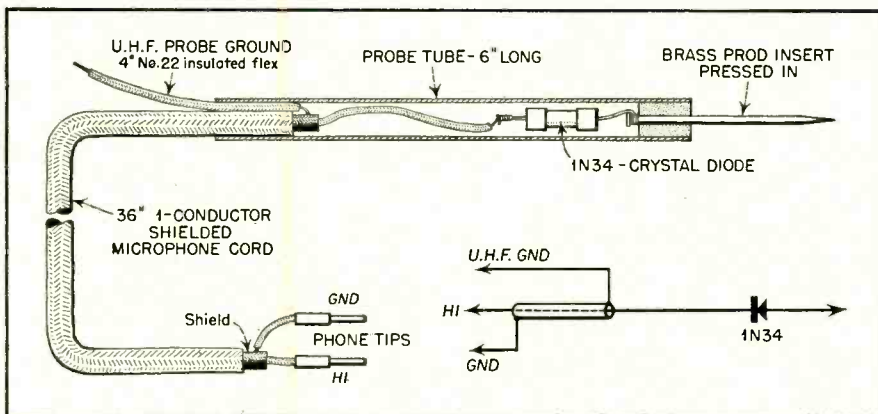


Rear panel view, showing compact arrangement of components, indicated in Figure 1.

voltage can then be calculated from the setting of the gain control. Thus, if the control setting reads 50, it stands to reason that the voltage measured is $100/50 \times 5.5 = 2 \times 5.5 = 11$ volts. If the gain control setting for another voltage reading is 20 the voltage measured is $100/20 \times 5.5 = 5 \times 5.5 = 27.5$ volts. A chart indicating the voltages measured for corresponding gain control readings can easily be drawn up by the operator. The calibration of this

the prod attached to the antenna terminal of the receiver it is possible to hear the signal in the loud speaker. Since the probe has little or negligible effect on the tuning of a circuit it is possible to trace this signal from the antenna to successive grids and plates of each stage of the receiver aurally. Actual quantitative signal gain measurements can be made by feeding the output of a signal generator into the antenna terminals of the receiver. With

Figure 2. Mechanical construction of probe, with revisions as explained in text at right.



chart, of course, is determined by the voltage required to close the shadow of the particular 6E5 tube in use.

Some of the more difficult voltage measurements, such as oscillator grid, A.V.C., and contact bias grid voltages can be determined by this section of the instrument. To repeat, those voltage values above 5.5 volts can be determined quantitatively, those less than 5.5 volts can only be roughly estimated.

2. As a signal tracer, the sensitivity of this instrument is such that with

the magic eye connected in the output circuit of the amplifier it doesn't take too much of a signal from the signal generator to close the shadow even when the probe is connected directly across the output of the signal generator.

To make measurements of audio or radio frequency gain between two points it is only necessary to place the probe at the first point and adjust the gain control until the shadow is just about ready to open. The gain control position being duly noted, the probe is

placed at the second point, and again the gain control is adjusted until the shadow is just about to open. The voltage gain of the stage is then equal to the first gain control reading divided by the second. For example, if with the probe placed successively at the grid and plate of a tube, the corresponding gain control readings are 90 and 3, the gain of the tube is $90/3 = 30$.

All the advantages of signal tracing are thus made available with this instrument. These include measurements of stage to stage gain, phase inversion, and inverse feedback. In addition, a resourceful serviceman should be able to develop many testing techniques in F.M. and television receiver measurements that are potentially possible with a Sparx.

3. Phono pickup and speaker characteristics may be obtained with the A.F. amplifier which is an integral part of the instrument. In addition, recording head characteristics may be determined in conjunction with a frequency test record.* Because of its excellent low frequency response the amplifier may also be used in tracing down the source of hum in a receiver. This applies to noise tracing as well.

4. A test speaker in a service shop is almost indispensable. The one in the Sparx is easily made available through the output terminals.

5. Examination of the circuit diagram will reveal that the power supply voltage is also made available through the output terminals. The need of this type of supply and its applications are so obvious that any discussion on this subject is superfluous.

SPECIAL NOTE TO USERS

It has been found that upon some A.C./D.C. receivers no audible signal will be heard when the prod is connected to the converter plate and the return is connected to the receiver chassis. Shifting the return connection to the "low" end of the first I.F. transformer primary (B+) will render the converter output (I.F. input) signal audible.

All instruments shipped from the factory after March 1, 1947 are known as the "Improved Model", being so identified by a stamp upon the rear of each instrument panel. The design modifications involved are so simple, however, that owners of earlier "Sparx" can easily and quickly change them into Improved Models at small cost in time and material — only two .0005 mfd. condensers and one 5100 [see page 40]

*See Shop Notes, March 1947, "Radio Service Dealer."

GUIDE to RADIO PARTS SHOW

MAY 10 TO 16, AT HOTEL STEVENS, CHICAGO

ADVANCE registration for the Radio Parts Show, to be held at the Hotel Stevens in Chicago during the week of May 11, points to the most successful show of this type ever to be held. The total advance registration is 2054, with 885 member-exhibitors, 39 guest exhibitors, 489 NEDA members, 274 non-NEDA distributors, and 367 representatives included in this figure. Badges (see cut) have already been mailed to these registrants, who have been cautioned to bring the badge with them when they come to the show, to avoid waiting in line. *No one will be admitted to the exhibition hall without the proper identification badge, except on Open House Day, Friday, May 16.*

Principal speaker for the Keynote Dinner, to be held on May 12, will be Bill Cunningham, well-known syndicated sports writer and radio commentator. Cunningham, who is a living, dynamic exponent of the American way of life, will be sure to spark this largest of peacetime conventions of the parts industry to a sure-fire send-off, with his brilliant wit and wise comment on the conduct of American business under the free enterprise system. All people who plan to attend the Keynote Dinner are urged to get their reservations in the mail immediately.

Announcement has been made by Jack Berman, of Shure Brothers. President of the Show Corporation, that Monday, May 11 will be designated NEDA Day. (Previously scheduled for Thursday May 15). Events during that day will include a special breakfast by National Electronic Distributors Assn. for member-exhibitors; and a luncheon meeting for members of Radio Manufacturers Association, Electronics Parts and Equipment Manufacturers, Sales Managers Club Eastern Division and N. E. D. A.

With the rescheduling of NEDA Day, the following program will be in effect:

SATURDAY AND SUNDAY, May 10 and 11 — Organization meeting and sales meetings.

MONDAY, May 12 — NEDA DAY — No sales meetings to be allowed. Breakfast sponsored by NEDA for member-exhibitors and NEDA members.

12:00 noon — Luncheon meeting of members of sponsoring groups of the show corporation.

7:00 P.M. — Keynote Diner for entire industry, featuring Bill Cunningham, noted sports writer and radio commentator, as guest speaker.

TUESDAY, WEDNESDAY AND THURSDAY, May 13, 14 and 15 — No sales meetings to be allowed on these days. Attendance in Exhibition Hall to be confined to members of sponsoring manufacturers, their

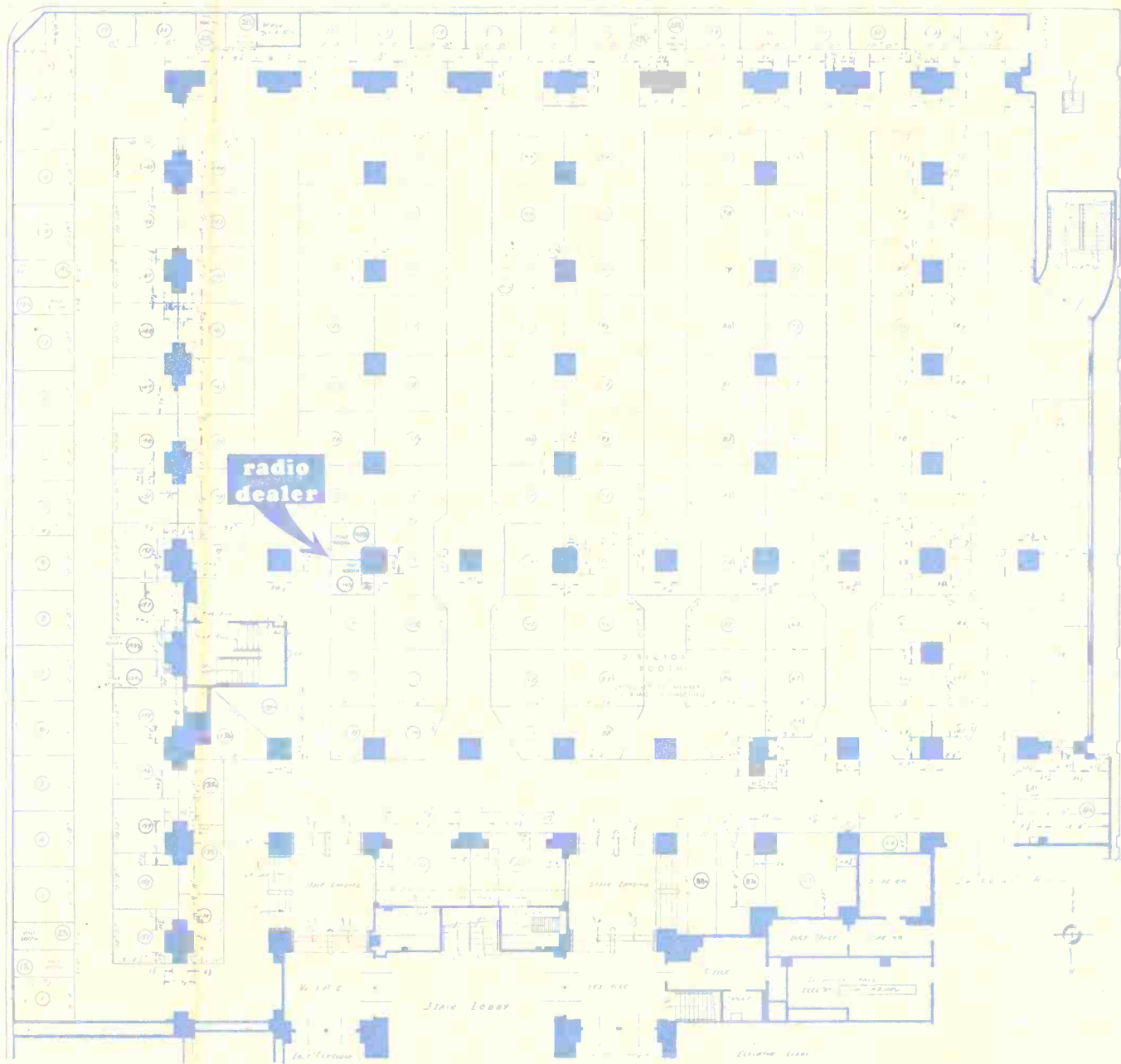
booth attendants, their sales representatives and distributors. Exhibition Hall open from 10:00 A.M. to 6:00 P.M.

FRIDAY, May 16 — OPEN HOUSE DAY—Radio servicemen, amateurs, engineers and the general public will be admitted to the Exhibition Hall without registration. Exhibition Hall open from 10:00 A.M. to 6:00 P.M.

Kenneth C. Prince, show manager, asks that all people who have not obtained their hotel rooms get their requests for hotel space in immediately since there are still a substantial number of rooms available in hotels other than the Stevens.



Officials of the Radio Parts Show: L. to r., top: J. A. Berman (Shure Bros.) president; Sam Poncher (Newark Electric Co.) treasurer; J. J. Kahn (Standard Transformer) secretary; R. C. Sprague (Sprague Electric Co.) director. Middle: R. J. Sherwood (The Hallicrafters Co.) director; Bill Cunningham (sports writer & radio commentator) principal speaker at Keynote dinner; Kenneth C. Prince, general manager; Charles Golenpaul (Aeovox Corp.) vice-president. Bottom: W. W. Jablon (Hannarlund Mfg. Co.) director; W. O. Schoning (Lukko Sales Co.) director. In middle of bottom row are reproductions of various style badges that will be worn.



LIST OF EXHIBITORS

BOOTH LOCATIONS ARE KEYED TO ABOVE FLOOR PLAN

Company	Booth Number <i>(See Plan)</i>		
Advance Electric Relay Company	47	Barker & Williamson	77
Aerovox Corporation	85	Belden Manufacturing Company	128
Alliance Manufacturing Company	123	Bell Sound Systems, Inc.	43
Alpha Metals, Inc.	144	Bliley Electric Company	78
Alpha Wire Corporation	125	David Bogen Co., Inc.	40
American Coil & Engineering Co.	116	William Brand & Company	13
American Condenser Company	129	British Industries Sales Corp.	112
American Microphone Company	4	Bruno Tools	76
American Phenolic Corporation	65	Brush Development Company	118
American Radio Hardware Co., Inc.	75	Bud Radio, Inc.	39
Amperex Electronic Corp.	67	Burgess Battery Company	147
Amperite Company	60	Burlington Instrument Co.	22
The Astatic Corporation	95	Camburn, Inc.	143
Atlas Sound Corporation	134	Carron Manufacturing Company	57
Audio Devices, Inc.	148	Centralab	68
		Chicago Transformer Division	11
		Cinaudagraph Speakers, Inc.	3
		Clarostat Mfg. Co., Inc.	124
		Condenser Products Company	153
		Continental Carbon, Inc.	150
		Cornish Wire Company, Inc.	48
		*COWAN PUBLISHING CORP. 130½	
		342 Madison Avenue	
		New York 17, New York	
		Croname, Incorporated	84
		Dial Light Co. of America, Inc.	109
		Drake Electric Works, Inc.	61
		DuMont Electric Corporation	12
		Duotone Company, Inc.	20
		Eastern Amplifier Corp.	34
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			[see page 52]



TRENDS IN P-A INSTALLATIONS

REGARDLESS of size or type, all P-A installations must consist of well matched components — since each part is dependent upon the others for satisfactory performance. From speakers to cables to amplifiers and mikes, this factor of proper matching should be a prime consideration.

For matching impedance of speaker, *Chart A* shows a simple means of connecting one or more speakers to an amplifier which has a tapped output transformer. Where voice-coil impedances differ from those shown in the chart, the same speaker connections shown should be used, while allowing for the difference of impedance.

Speaker phasing assures full output and good tonal quality. They can be phased as shown in *Figure 2*. The procedure is to face speakers, connect them to amplifier. Place tone control at "bass". Play phono or tone record (50 to 100 cycles) at low level. Speakers which are to face in the same direction when in use, are phased if "lows" are absent. Speakers facing opposite directions should have "lows" in evidence. Speakers that are out of phase can be phased by reversing the connections of one of them.

And of course, there are speakers for every type and condition and use. For example: Cone speakers are suitable for all indoor use, but can also be used out of doors where the desired range of coverage is small. Baffles (either wall type or portable ones) are generally used for rendering voice and music in indoor installations. Parabolic horns give maximum indoor coverage, but have only a limited coverage outdoors. Where maximum fidelity is necessary indoors, reflex cabinets are used, usually at low or medium levels.

Packaged sound apparatus brings wider selling and maintenance opportunities for service dealers; applications described.

by **LEWIS C. STONE, Editor**

For large auditoriums, arenas, skating rinks, restaurants, theatres, etc., a driver unit with reentrant horn gives

best results. Also for outdoor work this equipment has been found to give satisfactory coverage and clarity.

NUMBER OF SPEAKER	VOICE COIL IMPEDANCE	CONNECTION	TAP OF AMPLIFIER
1	8 OHMS		8 OHMS
2	8 OHMS		4 OHMS
3	8 OHMS		2 OHMS
4	8 OHMS		2 OHMS

Chart A



Figure 1

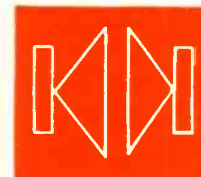
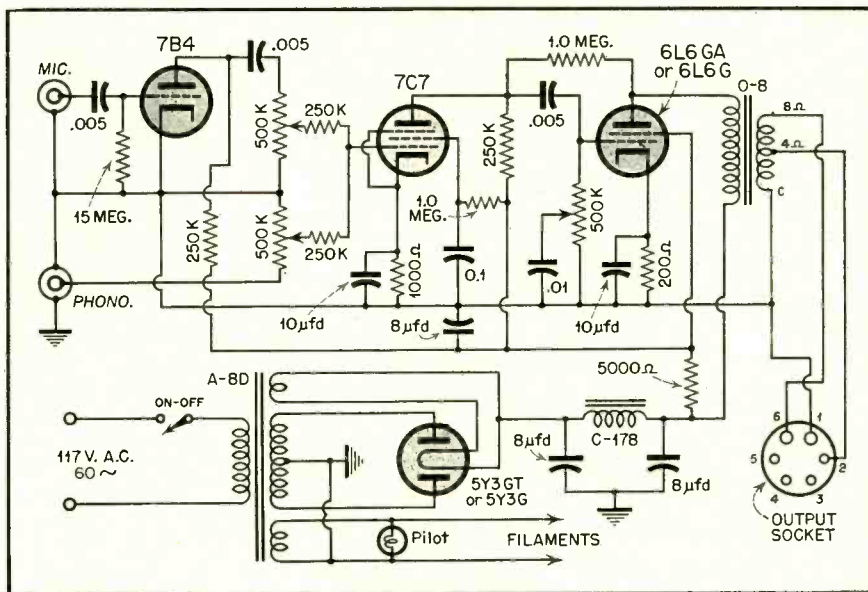


Figure 2

Schematic of Masco Model MA-808, typical of units available.



TROUBLE SHOOTING

Trouble	Remedy
1. Unit fails to operate.	a) Check on-off switch b) See that all tubes light c) Check speaker connections for open circuit d) Check output transformer secondary for open circuit e) Measure 6L6GA plate voltage—should be approximately +280 volts, measured to ground
1.a—No plate voltage on 6L6GA	a) Check rectifier tube (5Y3GT/G)—may be defective b) Check 8 mfd. filter condensers for short circuit c) Check C-178 (filter choke) for open circuit d) Check output transformer primary for open circuit
1.b—Plate voltage on 6L6GA — No screen voltage	a) Check 5000 ohm resistor for open circuit b) Check 16 mfd. screen by-pass for short circuit
1.c—Low plate and screen voltage 6L6GA	a) Check input filter condenser for open circuit or low capacity b) Check 200 ohm cathode resistor and 10 mfd. by-pass for short-circuit c) Check 6L6GA grid voltage—should be 0. If grid shows minus voltage, replace 6L6GA. If grid shows positive voltage, replace .005 coupling condenser. d) Check 500,000 ohm grid resistor (tone-control potentiometer) for open circuit
1.d—High plate and screen voltage 6L6GA	a) Check 200 ohm cathode resistor for open circuit
1.e.—6L6GA voltages all correct — unit still dead	a) Check 7C7 tube b) Check 7C7 voltage c) Check plate, screen, grid and cathode resistors and by-pass condensers of 7C7 for either open or short circuit d) Check .005 coupling condenser (7C7 to 6L6GA) for open
2. Unit operates on phono—dead on mike	a) Check 7B4 tube b) Check 7B4 voltage c) Check 7B4 grid and plate resistors for open or short d) Check .005 condensers (mike to 7B4 and 7B4 to volume control) for open or short e) Check 250,000 ohm resistor (mike control to 7C7 grid) for open f) Check mike connector for short or open connection
3. Unit operates on mike—dead on phono	a) Check phono connector for short or open connection b) Check 250,000-ohm resistor for open. (Phono control to 7C7 grid.)
4. Rotating volume control of either channel greatly affects volume of other channel	a) Check value of both 250,000 ohm resistors from volume controls to 7C7 grid
5. Unit operates with loud hum	a) Check 8 mfd filter condenser (between choke and output transformer) for open circuit b) Check 10 mfd cathode by-pass condensers for open circuit c) Check tubes for heater to cathode shorts or leakage
6. Unit has excessive distortion.	a) Check grids of all tubes to see that grids are properly grounded through either resistors or controls. With all controls at 0 grids should measure following to ground. 7B4— 15 megs 7C7— 125,000 ohms 6L6GA— 500,000 ohms
7. Unit has very weak output	a) Check tubes—especially 6L6GA and 5Y3GT/G b) Check high voltages at 5Y3GT/G and 6L6GA
8. Unit has low gain	a) Check all tubes—especially 7B4 and 7C7 b) Check voltages at 7B4 and 7C7 c) Check values of components connected to 7B4 and 7C7

[see next page]

Wire sizes and lengths are important. When selecting cables, bear in mind to keep lines as short as possible. For running voice-coil lines, use #18 wire or heavier, twisted or parallel. For example, when running a 500-ohm line, #22 wire may be run up to 750 feet, but longer stretches require heavier gauge wire. Line transformers, if used, must have all circuits carefully matched to the amplifier impedance tap.

As far as mikes go, a crystal type is good for normal speech and music reproduction. Cardioids can be used where "behind-mike pickup" must be eliminated to avoid feedback, crowd noises and other forms of outside interference. For vocalists, many prefer the velocity mike, because of "mellow" quality. Good for music pickup and reproduction as well. The dynamic mike is a good all-round unit both for voice and music pickup and reproduction.

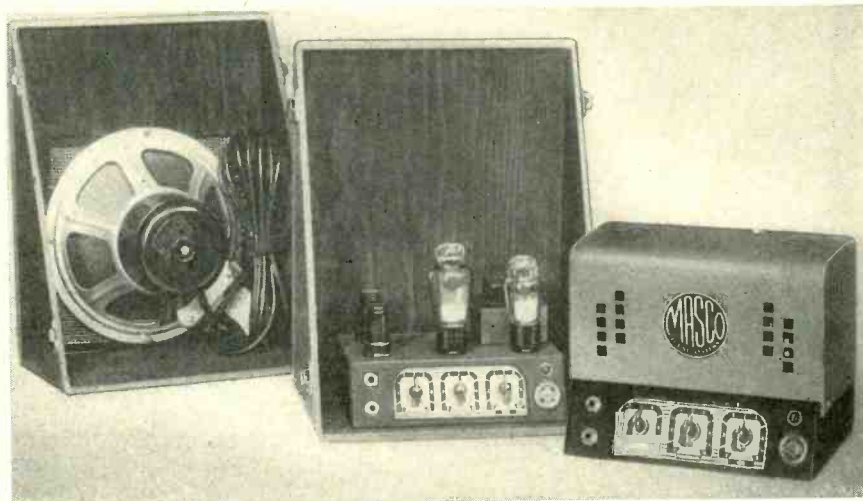
Microphone cables should be low-loss types, and lines must be kept as short as possible under given conditions, when working into a high impedance input. If long lines are unavoidable, use low impedance microphones into low impedance input. Always, when installing a system, keep the microphone behind the speakers, as shown in Figure 1.

Before turning power on, make sure that speakers and mikes are plugged in to amplifier. Place controls at zero; and after 30 seconds' wait for tube filaments to heat, place tone control at normal position. Increase mike control gradually until the desired volume level is reached. Then use tone control for better adjustment to the prevailing acoustical conditions.

Chart of applications, by types of use and equipment. This article was prepared with the help of G. L. Werner, chief engineer, Mark Simpson Mfg. Co.

APPLICATIONS	8-12 WATT AMPLIFIER		17-20 WATT AMPLIFIER		25-40 WATT AMPLIFIER		50-60 WATT AMPLIFIER		75-90 WATT AMPLIFIER		
	AREA SQUARE FEET	NUMBER OF SPEAKERS	TYPE OF HOORN OR Baffle	NUMBER OF SPEAKERS	TYPE OF HOORN OR Baffle	AREA SQUARE FEET	NUMBER OF SPEAKERS	TYPE OF HOORN OR Baffle	AREA SQUARE FEET	NUMBER OF SPEAKERS	TYPE OF HOORN OR Baffle
ARMORIES AND AUDITORIUMS	500 TO 1000	1 OR 2	WOODEN WALL Baffle	2	WOODEN WALL Baffle	1000 TO 1500	4 TO 8	WOODEN WALL Baffle	1500 TO 2000	8 TO 12	WOODEN WALL Baffle
BALL ROOMS DANCE HALLS BANQUET HALLS	500 TO 1500	1 OR 2	WOODEN WALL Baffle	2	WOODEN WALL Baffle	1000 TO 1500	4 TO 8	WOODEN WALL Baffle	1500 TO 2000	8 TO 12	WOODEN WALL Baffle
CARNIVALS FAIRS OUTDOOR MEETINGS	NOT RECOMMENDED			2	12" PM DRIVER UNIT	1000 TO 1500	4 TO 8	WOODEN WALL Baffle	1500 TO 2000	8 TO 12	WOODEN WALL Baffle
CHURCHES AND FUNERAL PARLORS	500 TO 1500	1 OR 2	WOODEN WALL OR BASS REFLECTOR	2	WOODEN WALL OR BASS REFLECTOR	1000 TO 1500	4 TO 8	WOODEN WALL OR BASS REFLECTOR	1500 TO 2000	8 TO 12	WOODEN WALL OR BASS REFLECTOR
NIGHT CLUBS AND TAVERNS	500 TO 1500	1 OR 2	WOODEN WALL Baffle	2	WOODEN WALL Baffle	1000 TO 1500	4 TO 8	WOODEN WALL Baffle	1500 TO 2000	8 TO 12	WOODEN WALL Baffle
PLANT BROADCASTS ROLLER SKATING RINKS VOICE-MUSIC (HIGH NOISE LEVEL)	NOT RECOMMENDED			2	12" PM DRIVER UNIT	1000 TO 1500	4 TO 8	WOODEN WALL Baffle	1500 TO 2000	8 TO 12	WOODEN WALL Baffle
STORES OFFICES CLASS ROOMS PAGING	500 TO 2000	1 OR 2	WOODEN WALL Baffle	2	WOODEN WALL Baffle	1000 TO 1500	4 TO 8	WOODEN WALL Baffle	1500 TO 2000	8 TO 12	WOODEN WALL Baffle
STADIA ATHLETIC FIELDS RACE TRACKS	NOTE AREAS INDICATED COVER BLEACHERS OR GRAND STANDS			2	12" PM DRIVER UNIT	1000 TO 1500	4 TO 8	WOODEN WALL Baffle	1500 TO 2000	8 TO 12	WOODEN WALL Baffle

This chart offers general suggestions for handling the average type of installation, and should be of invaluable assistance as a basis for the selection of correct components. It must be remembered, however, that conditions and requirements may vary in specific instances, and the directions given here may not always fully apply. For complete information in cases of special installations, consult your distributor.



Portable type (MA-808, MAS-808), described in text below.

Feedback can be eliminated as follows: a) Introduce more bass in amplifier; cut "highs" with tone control. b) Locate speakers for minimum reflection from walls or ceiling. c) Try using a cardioid microphone. And d) Keep microphone behind or below speakers.

Hum can be minimized in the following manner: a) Remember to try power plug both ways in wall outlet. b) Check tubes (of course). c) Check grounding of microphone shielded cable. And d) Keep volume controls of unused inputs at zero.

The foregoing precautions and methods apply equally to fixed or portable P-A installations. Manufacturers have in recent months tended more and more to the production of "packaged" sound systems, the market for these types having been found upon investigation to be so great potentially that some standardized complement of units

needed to be produced to take full advantage of the demand.

Some portable types of sound systems were discussed in the article, "Servicing Public Address Installations", on page 14 of the March issue of "Radio Service Dealer". From time to time, additional material will be published describing a particular make of portable sound system, together with suggested servicing and trouble shooting techniques, based on actual field experience.

The Mark Simpson (Masco) types MA-808 and MAS-808 (see cut) comes under that heading. MA-808 delivers 8 watts full output, is adaptable for use with either microphone or phono pickup through individual controls. The separate tone control includes an on-off AC switch. Overall circuit design features negative feedback. A microphone gain of 116 DB permits use of general types of high impedance microphones; the phone gain of 76 DB lends itself to the popular types of crystal pickups. Output transformer is tapped at 3.2 and 8 ohms to match standard speakers.

Amplifier specifications are: 8 watts power output; inputs: separate microphone and phonograph. 50 to 10,000 CPS frequency response. Mike sensitivity, .0035 volts for 8 watts; phonograph sensitivity, 0.4 volts for 8 watts. Tubes used: 1-7C7, 1-7B4, 1-6L6GA and 1-5Y3GT (rectifier). (Late models have 5Y3GPG rectifiers). Output impedances 3.2 and 8 ohms; hum level 25 DB below zero level of .006 watts; power consumption 75 watts; operates on 117 volts 60 cycles. 3 controls: microphone, phonograph, tone with on-off switch.

Model MAS-808 portable amplifier system includes the above amplifier, together with a heavy duty 10-inch PM speaker, with 25 feet of cable with plug. Carrying case design permits easy operation of system.

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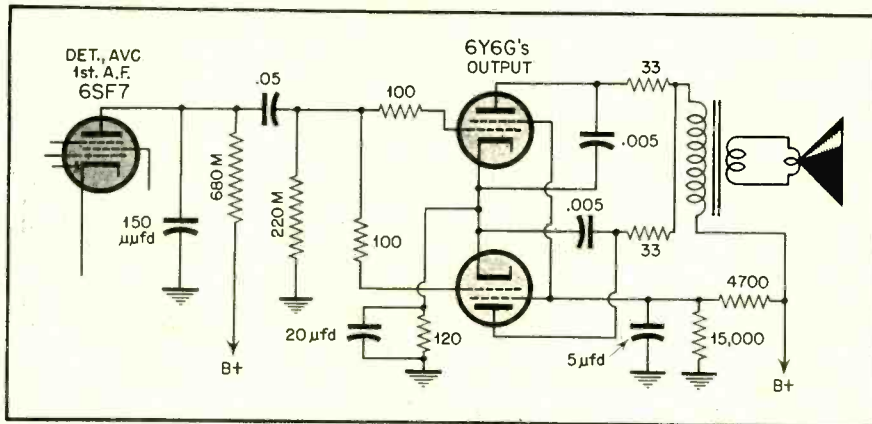


Figure 1

WESTINGHOUSE MODEL H-138

This seven-tube, two-band set makes use of an uncommon type of output stage. Two tubes appear, but instead of the usual push-pull circuit, they are con-

CROSLEY MODELS 106-CP AND 106-CS

These ten-tube instruments employ a push-pull parallel output stage provided with balanced drive by utilizing the phase inversion properties of a 6J5 stage.

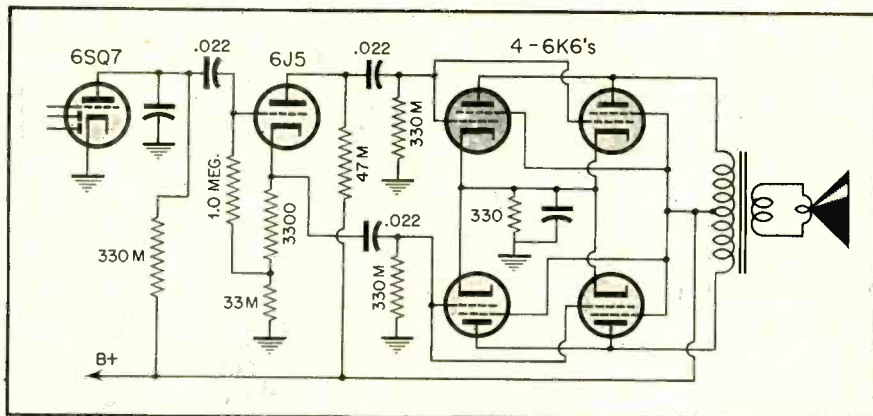


Figure 2

nected in parallel. In this manner, it is possible to obtain substantially double the power output which one tube would provide and yet avoid the use of a phase inverter or other coupling device. In the present case the output tubes, 6Y6G, are fed directly from a 6SF7 which also functions as second detector and AVC source. (Figure 1).

One problem sometimes encountered when high gain tubes are paralleled is that of oscillation. An inspection of the partial schematic shows that actually the 6Y6G tubes form a tuned plate-tuned grid oscillator circuit. It will be noted that each grid has a 100-ohm resistor and each plate a 33-ohm unit joining the separate elements to the circuit proper. These resistors serve as lossers to suppress any tendency to oscillate. They also tend to equalize the drive to, and load on, the tubes.

Being high current tubes, the 6Y6 demands an unusual current and a 5U4G rectifier is used to provide same. Note voltage divider for 6Y6G screen voltage.

A partial schematic is shown (Figure 2) indicating the important components.

The second detector and first audio functions are combined in a 6SQ7 in the usual manner. The output of this stage is capacity coupled to the 6J5 stage but

it will be noted that the grid resistor of this stage returns to the junction of two resistors between the cathode and ground. No by-pass condensers appear in this cathode circuit, and the sum of the resistors is calculated so that the audio voltage developed at the cathode is equal to that appearing on the plate. Being 180 deg. out of phase, the plate and cathode serve to excite the grids of the push-pull parallel output stage, being coupled via .022 mfd. condensers as shown.

A bias voltage of 17 is developed by the 6K6S by the 330-ohm cathode resistor. Plate and cathode voltages of the 6J5 measure 34 and 38 respectively. This stage will provide no gain but serves only to develop the required out of phase drive for the output stage.

HOFFMAN MODEL A-500

The incorporation of provision for tuning receivers by pre-set push buttons brings to light many schemes, some clever, some complicated and some simple. An example which is typical of many so-called "electrical" systems is shown in elementary form in the partial schematic of the Hoffman Model A-500. (Figure 3). This set, a six-tube, AC instrument covering only the broadcast band, has a tuned RF stage on manual tuning but not on push-button selection. This is a common simplification, and since push-buttons are customarily used only on local stations, causes little or no customer complaint.

Referring to the diagram we find the several sections of the manual-automatic push button switch labeled S1, S2 and S3. It will be seen that in the "up" position the loop connects to the grid of the 6SK7 RF stage and its associated tuning condenser (C1). The grid of the 6SA7 mixer is connected to the secondary of the interstage transformer and its tuning condenser (C2). The oscillator portion of the 6SA7 is permanently connected to the coil (L1) and the tuning condenser (C3) is switched in by S3.

[see page 45]

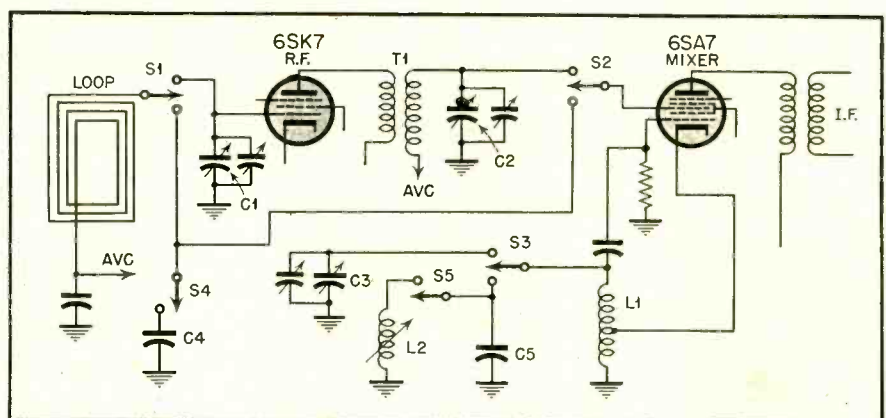
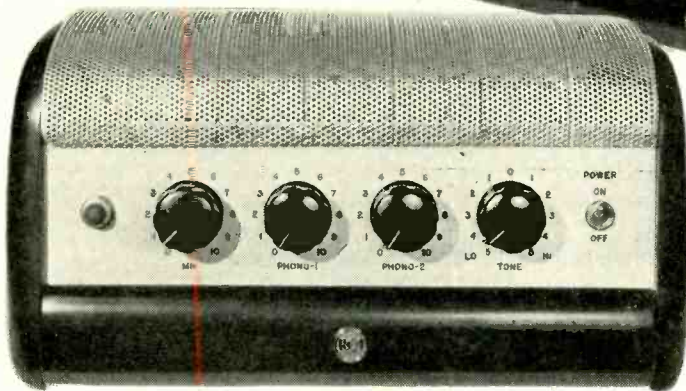


Figure 3

MI-12296 . . . 30 watts

Superbly styled in satin chrome and black. Plenty of power for the large auditorium, hotel and playground class of installation.



MI-12295 . . . 15 watts

Medium power, smart appearance . . . ideal for the smaller auditorium, dance hall, church, restaurant, or sound truck.

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Frequency range	50 to 10,000 cycles
Gain-Microphone Input	114 db
Phono Input—	
Model MI-12295	77 db
Model MI-12296	100 db
Input impedance—	
Low impedance microphone	250 ohms
High impedance microphone	100,000 ohms
Output impedances—	
	4, 8, 15, 60, 250 ohms
RCA 6J7 input tubes . . . greatly reduce microphonics and hum.	

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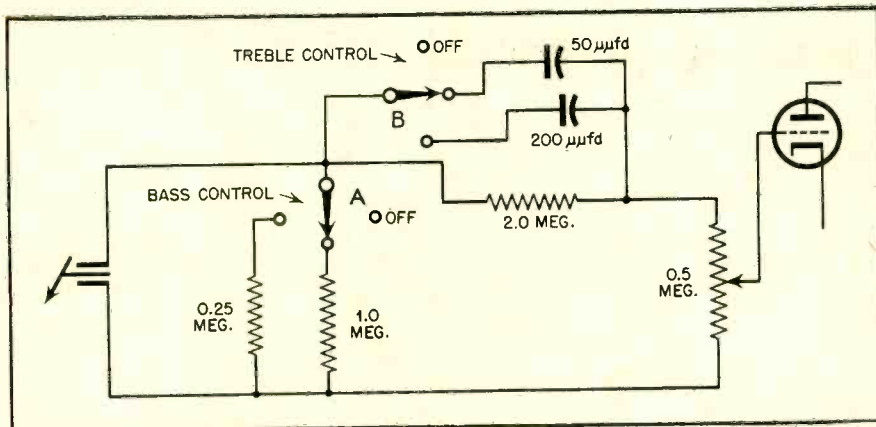


Figure 1

PHONOGRAPH EQUALIZER RESPONSE CIRCUIT

With so many electric phonographs in use today the serviceman is in a good position to increase his service trade by "selling" improved response of the customers unit. An excellent circuit in which high and low frequency equalization can be obtained is shown in Fig. 1. Switch "A" controls the bass response, and switch "B" the treble response.

STEWART-WARNER MODELS 61T16 AND 61T26

The audio system of this receiver utilizes a two stage type of inverse-feedback arrangement and, should it ever be necessary to replace the speaker or output transformer, it is important to maintain a definite phase relationship in the feedback circuit. If the connections to the output transformer are reversed or if the feed-back connection is made to the wrong side of the output transformer secondary, the system will become regenerative instead of degenerative. Under these conditions audio oscillations may result. If that occurs, oscillation may be prevented by reversing the connections to the secondary of the output transformer.

ZENITH CHASSIS 5724-5725

1. Noisy tuning on automatic:
 - a) Poor contact in speaker socket.
 - b) Washer on latch bar grounding lug.
 - c) Poor contact on band switch.
 - d) Aeroplane lug on automatic grounding to No. 5 push rod.
 - e) Automatic trimmer shorting.
2. Signal cuts out above 1400 K.C.:
 - a) 5 megacycle trimmer screwed in too tight.
3. Signal cuts out on local-distance switch:
 - a) Defective 6A8 tube.
4. No change on treble button:
 - a) Insulation of blue tone control lead cut by fastening lug.
5. Weak audio:
 - a) Poor contact in television switch.

- b) Open coupling condenser.
6. Oscillates:
 - a) Open Screen bypass
 - b) Grid lead of 6K7 near AVC lug or near plate of 6A8.
 - c) Wave trap open or not properly adjusted.

REPLACING VOICE COILS & CONES

R.C.A. Service Division recommends the following procedures when replacing voice coils and cones in certain R.C.A. speakers. These procedures are general enough to apply to many other types of loud speakers. In following these instructions refer to Figs. 2 and 3.

To simplify cone replacement in certain speakers, the cone and voice coil are supplied as two separate units: (1) The voice coil and the support, (2) The cone diaphragm.

General Procedure

- (a) Cement voice coil support to the speaker, using centering gauge or speaker shims.

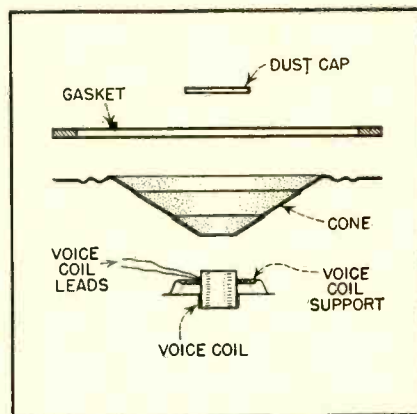


Figure 2

- (b) Solder voice coil leads.
- (c) Put cone in place cementing around rim of speaker frame.
- (d) Cement junction of cone & voice coil.

Detailed Instructions

- (a) Remove old cone & voice coil. Protect air gap with scotch tape. Clean off all paper & cement.
- (b) Apply a ring of cement (as General, JFD, etc.) on top plate.
- (c) Insert centering gauge in new voice coil. Handle first from the winding end.
- (d) Remove scotch tape from gap. Insert voice coil and gauge in gap with leads in correct position for soldering. Press rim of voice coil support into the cement.
- (e) Solder the voice coil leads to terminals allowing sufficient slack to permit free motion of the cone. Dress leads in the plane of motion, clear of cone & housing.
- (f) Apply a ring of cement around the rim of the speaker frame. Place cone down over voice coil & press rim tight to speaker frame.
- (g) Allow cement to dry on cone rim and voice-coil support. Then run a ring of cement around the junction of the cone and voice coil, being careful the cement does not run inside voice coil.
- (h) After cement at junction has

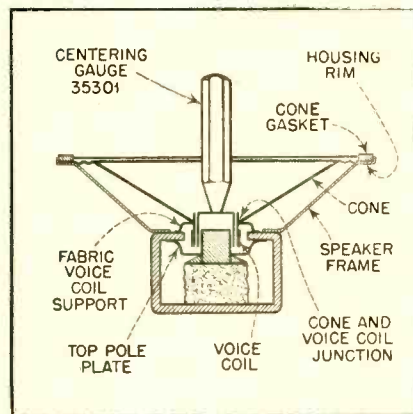


Figure 3

dried, remove gauge, using a rotary motion.

- (i) Cement large cardboard gasket in place. Set the speaker in inverted position on a flat surface until gasket is dry. Cement dust cap on cone center.

VIEWTONE TELEVISION RECEIVER ALIGNMENT I.F. Alignment Procedure

1. Instruments required: Signal generator 8-15 Mcs.; Output Indicator (oscilloscope, V.T.V.M.) Remove Oscillator Tube: Type VP100 Chassis distinguished by black serial number. Type VP100A Chassis distinguished by red serial number.

2. Alignment of 4th IF transformer:
 - a) Apply output of signal generator to grid of third IF tube.
 - b) Tune in slug of trans. for maximum deflection in indicator

[see page 44]

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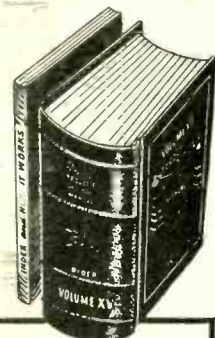
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Stewart-Warner Radio Phono Combo, Model A92CR6, console. AM-FM radio reception; 8 tubes plus rectifier. AM band has built-in high impedance loop FM antenna self-contained folded dipole loop type. Provision for external antenna for either AM or FM. 6 push buttons; AM band 540-1600 kc.; FM, 88-108 mc. AC operation. Intermix record changer for 10 and 12-inch records simultaneously; 2 record storage compartments; approved by Underwriters.



Stewart-Warner "Consolette" AC Radio Phono Combo, Model 61TR46-56; table model with four accessory legs for chairside or other use, and still "portable." Straight AC, 5 tubes plus rectifier; standard record changer; 540-1725 kc. band; approved by Underwriters.



Air-King "Royal Troubadour" — 3-way portable; 4 miniature tube plus selenium rectifier; superhet, automatic volume control; Alnico 5 PM speaker; die-cut antenna; AC-DC-battery; provision for external aerial. List \$37.95.



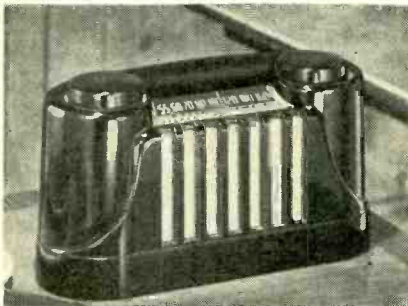
Stewart-Warner Table Model AM-FM, A72T3-4; 7 tubes plus selenium rectifier; built-in antenna for both AM-FM bands. 540-1600 kc., on AM; approved 88-108 mc. on FM. 5-inch pm. dynamic speaker; approved by Underwriters.



Stewart-Warner Table Model AM-FM, model A72T1-2; 7 tubes, plus selenium rectifier; built-in antenna for both AM and FM bands; 5-inch pm dynamic speaker; approved by Underwriters.



Stewart-Warner "Videorama" radio television receiver is shown at demonstration conducted by Commonwealth Edison Co., in Gold Room, Congress Hotel, Chicago, Ill. L. to r. Ardiem B. Rodner, Jr. President, Television Advertising Productions, Inc., and Norman C. Lindquist, of Commonwealth Edison.



Stewart-Warner "Air Pal", Model A51T2-3-4; weight 3 1/4 pounds; smaller than a cradle telephone; 4 tubes plus rectifier; AC-DC, 535-1600 kc. Built-in Radair antenna and pm. speaker; approved Underwriters.



RCA new intercom system features speaker stations as small as desk clock; comes with separate amplifier, placed anywhere. Two-station system is easily installed, adapted for theatres, homes, doctors' offices; plugs into any 110-volt AC or DC outlet. RCA Victor, Camden, N. J.

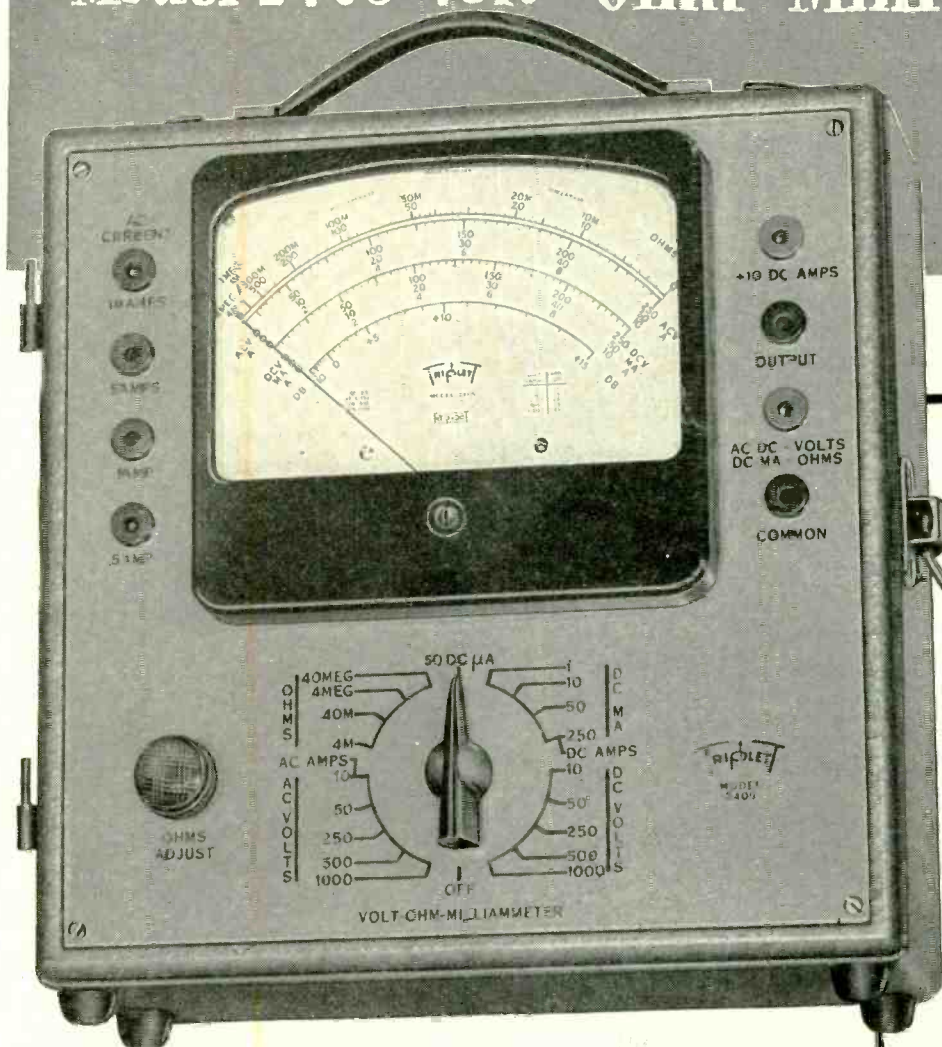


Sentinel Radio Corporation's "Treasure Chest" (Evanston, Ill.) is now in production. Set is 4-inches high, 4-inches deep, 8-inches wide. Are marked for a production of 100,000 this year.

[see page 50]

Model 2405 Volt • Ohm • Milliammeter

25,000 Ohms
per volt D.C.



Specifications

NEW "SQUARE LINE" metal case, attractive tan "hammered" baked-on enamel, brown trim.

✓ PLUG-IN RECTIFIER

Replacement in case of overloading is as simple as changing radio tube.

✓ READABILITY

The most readable of all Volt-Ohm-Milliammeter scales—5.6 inches long at top arc.

✓ RED • DOT LIFE-TIME GUARANTEE

on 6" instrument protects against defects in workmanship and material.

New **ENGINEERING** • New **DESIGN**
New **RANGES** •

(50 RANGES)

Voltage:	5 D.C. 0-10-50-250-500-1000 at 25000 ohms per volt. 5 A.C. 0-10-50-250-500-1000 at 1000 ohms per volt.
Current:	4 A.C. 0-.5-1.5-10 amp. 6 D.C. 0-50 microamperes—0-1-10-50-250 milliamperes—0-10 amperes
4 Resistance	0-4000-40,000 ohms—4-40 megohms.
6 Decibel	—10 to +15, +29, +43, +49, +55.
Output	Condenser in series with A.C. volt ranges.

Model 2400 is similar but has D.C. volts

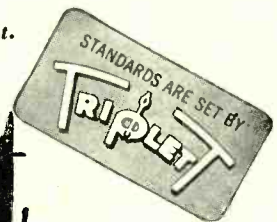
Ranges at 5000 ohms per volt.

WRITE FOR COMPLETE DESCRIPTION.

Precision first
...to last



Triplet



ELECTRICAL INSTRUMENT CO. BLUFFTON, OHIO

SILVER

EXPERTS CHOOSE



"VOMAX" is the overwhelming choice of experts because it's the finest, perfected v.t.v.m. . . . because greatest demand makes greatest production and lowest cost to you.

"VOMAX" gives you a total of 51 ranges to directly measure d.c., a.c., a.f., i.f. and r.f. volts up through hundreds of megacycles, resistance ranges covering 20 ohms through 2,000 megohms, three output meter-decibel ranges from -10 through +50 db., direct current ranges measuring from 50 microamperes through 12 amperes. Most important is the absolute stability, complete freedom from usual grid current errors . . . and its astronomical input resistance . . . an honest 20 megohms upon a.c., a.f., i.f. and r.f.; 51 and 126 megohms upon d.c. Voltage ranges measure from .1 through 3000 volts d.c., .1 through 1200 volts a.c.

If you want to guard your meter dollar investment . . . to make it only once for many years to come . . . then "VOMAX" at its present low \$59.85 net price is your logical choice . . . as thousands more wise technicians like yourself have proved to their profit.

Let's look at this matter of what meter you buy seriously . . . for your choice of this, the service technicians basic instrument, can spell either peace and profit . . . or annoyance and loss to you. You must have the best meter to meet "smart" competition. And "smart" competition overwhelmingly uses "VOMAX." The reason is simple. Other manufacturers have had to copy "VOMAX" inventions to try to satisfy your demand for a modern, post-war, obsolescence-proof universal meter. Yet, "VOMAX," the perfected v.t.v.m., stands head and shoulders above all other meters. This is proved by its heavy purchase and use by the Bureau of Standards in Washington, by Western Electric, G. E., Westinghouse, university after university, by top-ranking industrial laboratories, F.C.C., C.A.A., Veterans Administrations, schools, colleges . . .

NEW IMPROVED "SPARX"



Thousands of technicians today rely on "SPARX" dynamic signal tracer to save time . . . increase efficiency . . . cut their costs. It lets you hear and see signals . . . traces signal right on thru every receiver circuit from antenna thru voice-coil . . . is shop test speaker, too. Continuous laboratory research has now improved "SPARX" immensely . . . created the Improved Model . . . tremendously increased sensitivity . . . greatly expanded general usefulness. And the SILVER policy of protecting your dollar investment pays out handsomely . . . a free bulletin tells every user how to convert his "SPARX" into the new, Improved Model in a jiffy . . . goes to prove that for the really serious, profit-conscious technician there's no substitute for SILVER, that "SPARX" costing you only \$39.90 is outstandingly the world's best signal tracer. "SPARX" will earn you, too, more profits in less time than any other instrument you can buy.

906

Thanks for your patience. Model 906 Signal Generator is now flowing to your favorite jobber. And what an instrument . . . 90 kc. through 170 mc. on fundamentals . . . 6 air-trimmed bands . . . variable % 400 ~ amplitude modulation . . . built-in variable electronic FM sweep . . . laboratory triply adjustable attenuator . . . metered microvolts . . . output 1/2 microvolt to over 1 volt . . . multiply shielded . . . strays lower than \$300.00 laboratory generators. Yet all this costs you only \$89.90 net. Better order your 906 now for demand far exceeds production capacity on this precision instrument for months to come.

Send Post Card for Catalog of new measuring equipment, communication receivers, transmitters, kits, parts. See them at your favorite Jobber.

OVER 36 YEARS OF RADIO ENGINEERING ACHIEVEMENT

McMurdo Silver Co., Inc.

1249 MAIN ST., HARTFORD 3, CONNECTICUT

"SPARX" AT WORK

[from page 27]

ohm, 1/2 watt resistor (any resistor between 5000 and 5500 ohms is satisfactory) are needed.

To convert "Sparx" into Improved Model, proceed as follows:

1. Holding tip of r.f. probe between thick paper in jaws of bench vise, gently pull red sleeve off metal tip-insert. Remove R1 and C1a from circuit. Modify r.f. probe circuit so "-" lead of 1N34 crystal diode is soldered to metal insert, "+" lead of 1N34 to inner conductor of shielded cable, and short u.h.f. grounding wire is soldered to cable shield braid. Keep 1N34 leads short, with cable shield braid running up close to 1N34 so as to avoid hum due to hand capacity in handling r.f. probe. Reassemble probe by pressing red sleeve back over vise-held metal tip-insert plug.

2. Shunt R5a (1000,000 ohms) with a 5100 ohm, 1/2 watt resistor. (R5a is found beneath amplifier channel close to 6C4 first a.f. amplifier stage). Shown in Fig. 1.

3. Remove all connections to four lugs on top of INDICATOR switch. Connect left top lug (seen from rear) to bottom lug of GAIN control P1. Connect two top center lugs of INDICATOR switch to INPUT jack. Remove connection (or .02 mfd. capacitor) between bottom lug of P1 and INPUT jack. Connect .0005 mfd. condenser between bottom lug of P1 and INPUT jack. (See Fig. 1).

4. Make sure C1b (connected across INPUT and GND. jacks) is .0005 mfd. (See Fig. 1).

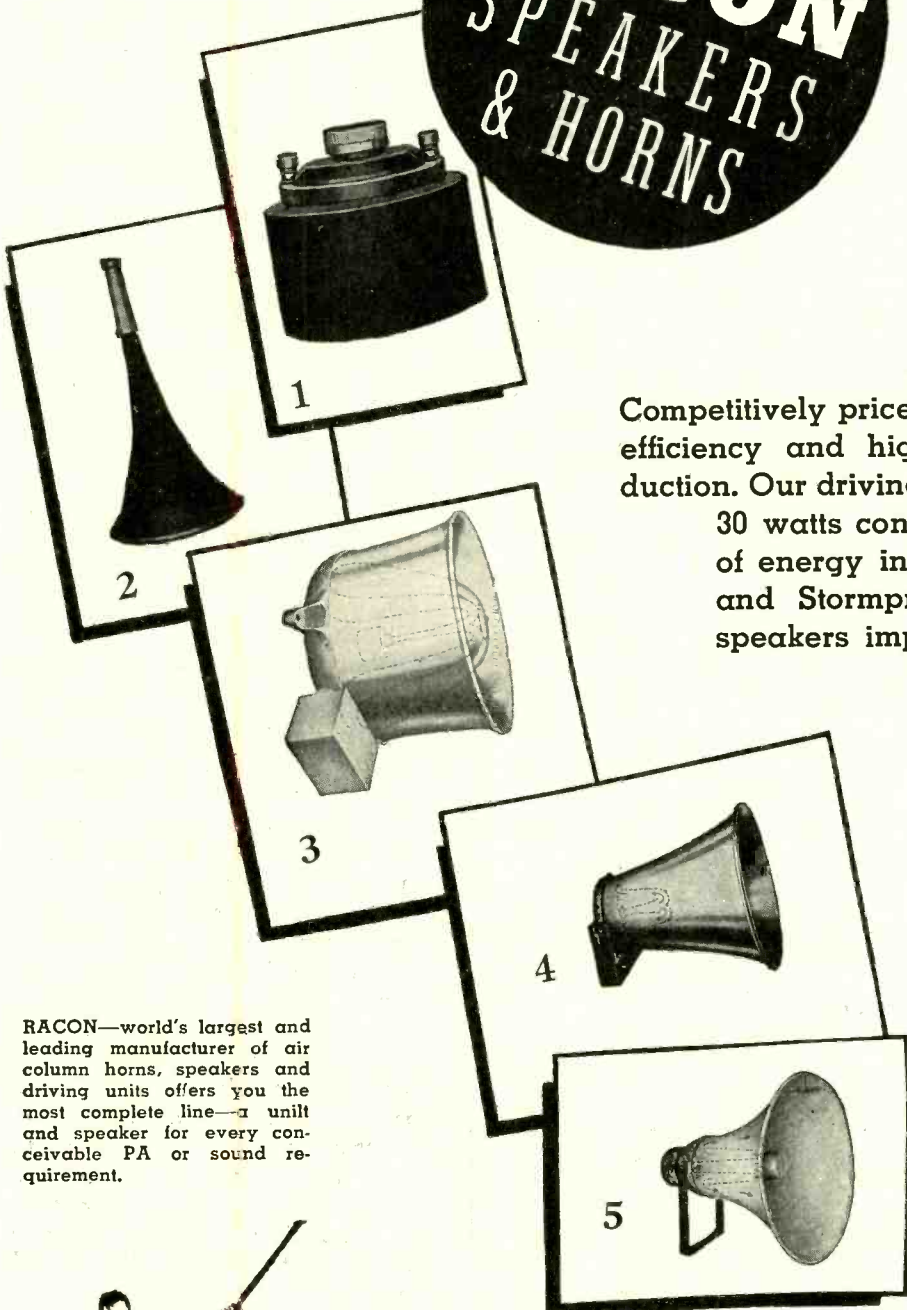
5. Recheck operations made as above for correctness. Note elimination of any hum which may have been present in original "SPARX" and greatly increased sensitivity in signal tracing when INDICATOR switch is set to OUTPUT position.

G-C Flock Finish Spray Kits

General Cement Mfg. Co. has recently placed on the market a new patented blower spray gun for flock. A professional job can be done without any experience; no special skill is required. This new method is applicable on phono turntables, cabinets, grilles, instrument cases, tool boxes, toys, ornaments, signs, and hobby uses. The kit contains: 1 blower gun; 1 can brown flock; 1 can ivory flock; 1 can thinner; 1 brush and instructions; 1 can brown undercoat. List price \$10.75.

For further information write to the company at 919 Taylor Avenue, Rockford, Illinois.

use
RACON
 SPEAKERS
 & HORNS



Competitively priced, RACONS assure maximum efficiency and high-fidelity "true tone" reproduction. Our driving units give 60 watts peak and 30 watts continuous output at lowest watt of energy input. All-Weather construction and Stormproof Material make RACON speakers impervious to any climatic condition. RACON Acoustic Material prevents resonant effects.

RACON—world's largest and leading manufacturer of air column horns, speakers and driving units offers you the most complete line—a unit and speaker for every conceivable PA or sound requirement.

SEND FOR OUR NEW FREE CATALOG TODAY!



RACON

1. GIANT P-M HORN UNIT
2. DEMOUNTABLE TRUMPET
3. MARINE SPEAKER
4. MINIATURE LONG BELL HORN
5. RE-ENTRANT

RACON ELEC. CO., INC., 52 E. 19 ST., NEW YORK, N. Y.

TRAINED STAFF KNOWS ITS STUFF

[from page 24]

average service worker to obtain advancement through increased knowledge. It is the veteran serviceman, with years of experience in servicing radios and other devices, but who has always been deplorably weak in fundamentals—a factor that has retarded him in advancing to better positions—that these training sessions especially benefit. But they also benefit the green youngster fresh from radio school."

From a production line method of radio servicing, the firm has shifted to sound-proof, insulated rooms with individual heat control, housing two workers, with a resultant increase of twenty percent in repair output. Increased comfort for the servicemen, and less interference among workers has achieved the bettered volume, according to Mr. Donaldson. Five such sound-proof labs are located in the building.

An employees' kitchen, locker and recreation rooms, are other contributions the dealer has made to improve working conditions in his plant.

Radio Warranty Work

The Donaldson plant is warranty service headquarters for several distributors of well-known lines of radios. The Western Auto, Good-year, Goodrich, and Firestone companies utilize the plant services to make good their warranty offer on new sets. Many other retail concerns and distributors are set up under the same program. Authorized factory service is extended on Zenith and Philco motorcar radios. A newcomer to the warranty service fold at the Donaldson Radio & Electric Company is the home radio produced by Radiola, and distributed in Kansas City by McKesson-Faxton, a wholesale drug company, and the Good-year stores.

Parts inventory at Donaldson's is maintained at an inventory approximating \$9,000, to which Donaldson would gladly add sufficient parts essential to the speedy servicing of all radios serviceable for distributors on a warranty basis.

A boon to sales of motor car radios and other merchandise is the present credit structure of Kansas City banks, the dealer believes. Inexpensive, quick credit on appliances is extended by the progressive banks, on a time-payment basis, and the tendency is to extend loans on the borrower's reputation, rather than on securities.

"Car radio sales firms were handicapped hitherto," said Mr. Donaldson, "by the policy of finance companies to take either a first or second mortgage on the car. Today the banks accept straight time payment plans, with the usual mortgage taken on the radio sets. The new credit arrangements will spur car radio sales.

"Radio servicing has undergone a transition in the past few years," Donaldson contends. "We're no longer curbstome mechanics equipped merely with a screwdriver and pliers; we're highly specialized technicians. To keep abreast of the trend in service represented by FM and Television necessitates an education program that will keep personnel informed of the latest equipment in the field, and the technical knowledge required to service new devices."



THE NAME OF GROWING IMPORTANCE IN SOUND EQUIPMENT

THE MASCO line has earned a unique position in the sound field.

Standard component parts of nationally advertised manufacturers are used in the manufacture of Masco equipment . . . the same parts that you regularly merchandise . . . none but the finest!

Superior engineering and precision manufacture are the key to Masco performance. High factory morale, extensive inspections and executive know-how play their role in maintaining Masco quality.

And of highest importance is Masco's VALUE concept. In building for the future we believe that the widest use of sound equipment can result only from a pricing policy that expands the market to the greatest possible number of users.

Compare Masco values with those of ANY other line.

MASCO

MARK SIMPSON MANUFACTURING CO., Inc.
32-28 49th Street, Long Island City 3, N.Y.

SOUND SYSTEMS and Accessories



RAvenswood 8-5810-1-2-3-4

SPRAGUE TRADING POST

SWAP — BUY OR SELL

FOR SALE—Complete radio tube stock as a lot at 50% off. Also parts gear, etc. Closing out shop, also typewriter, automatic rifle, manuals, etc. Eddie Howell, 501 W. Harden St. Graham, N. C.

FOR SALE—Supreme universal tube checker and test meter, Meissner analyst, Radio City VTVM, Radio Communications Service, 4475 Myrtle St., San Diego, Calif.

FOR SALE—Supreme 599 tube-set tester, \$40 Simpson 260 Ohm analyzer, \$35. Write K. McLaughlin, 255-21 Northern Blvd., Great Neck, N. Y.

SELL OR SWAP—Rider's I, III, IV and VI; Supreme multi-tester; other items. Want Hallicrafter Sky Traveler; volume expander. Glenn Watt, Chanute, Kans.

WANTED—Record changer midget radio; phono amplifier; typewriter; adding machine; recorder; tube tester. E. G. Bartlett, Atlanta, Mo.

FOR SALE—Used radio books, excellent condition at reduced prices. Write for list; also Bud 5 meter coil, new 50¢. S. Marzucki, Apt. 2 1308 Rosedale Ave., Chicago, Ill.

WANTED—Condenser tester, any make, in good condition, must be reasonable. Also will buy table model radios in cabinets, any condition. Cash waiting. Your Radio Doctor, 397 Melrose St., Brooklyn 6, N. Y.

FOR SALE—Complete set Rider manuals, 14 vol's. very little used. W. M. Hohne, 156 Water St., Binghamton, N. Y.

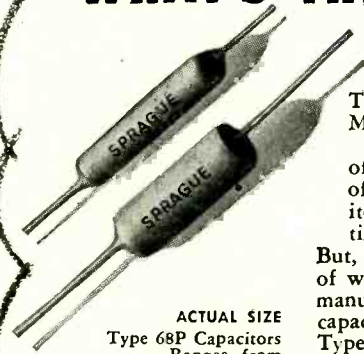
FOR SALE—Large number back issues of popular radio magazines. Radio News, Radio Craft, Scientific American, Radio Retailer, Radio and Television, and others. Some subscriptions are complete. Write for details. W. A. Mueller, R.F.D. 5, St. John's, Mich.

FOR SALE—G.E. tube tester TC-3, \$55; G.E. 3" scope CRO-3A, new, \$85; Weston 787-U-H-F oscillator, new, complete with batteries and crystal, \$125. Send certified check or cash, we'll ship equipment. Radio Laboratory, 709-706 N. Washington Ave., Scranton, Pa.

SWAP—Brand new automatic record changer, Detrola, plays 10" & 12" records; large Weston tube checker, counter model 676, for good vacuum tube volt-meter, condenser analyzer, or chanalyst or what do you have? Gibbons Radio Repair, Sussex and Ball Sts., Port Jervis, N. Y.

SWAP OR SELL—Wheatstone Bridge; Leeds and Northrup 5300 complete with galvanometer like new. Need amateur 10-meter transmitter or other gear. Carl H. Harp, Box 242, Crescent, Okla.

WHAT'S THIS ABOUT MIDGET TUBULARS?



ACTUAL SIZE
Type 68P Capacitors
Ranges from
.001 mfd. 400V to
0.5 mfd. 100V.

There's more about the new line of Sprague Type 68P Midget Tubular Capacitors than appears on the surface:

They're the smallest, most dependable midgets yet offered for normal applications. They're the direct result of Sprague engineering experience in developing capacitors for the famous VT fuse and other miniature wartime electronic assemblies. . . .

But, even more important, they offer concrete evidence of what you can expect from Sprague in the future. No manufacturer was called upon to engineer as many unique capacitor types for war equipment as was Sprague. The Type 68P Midgets are the first of these to be converted for everyday service and amateur radio use. Many more are coming.

Look to Sprague for the newest—and the best!

See us at **BOOTH 89** at the **Chicago Show**

WANTED—Record changer with or without amplifier; Jensen coaxial speaker or large speakers and tweeters; short wave receiver, condition not important. Have Rider's manuals and some testers. Buy or trade. Glenn Watt, Chanute, Kan.

FOR SALE—Any part of my stock of 2000 radio tubes, new and guaranteed at 60% off list price. Send for list. M. Koch, Inc., 47 N. Main, Paterson, N. J.

FOR SALE—Phileo D-50 tube tester \$30; 2—Elmac 50T's, \$5 each; 2—832's \$4 each; 200-watt voltage dividers, \$1 each. W. L. Thiel, Rib Lake, Wis.

WANTED—Signal generator, must be in perfect condition. Will trade 2 Simpson 324 D-C volt-ohmmeters, both are new, \$27 each. National Radio Service, 1551 S.W. 27th Ave., Miami 36, Fla.

FOR SALE—Majestic "R" Eliminators, perfect condition, \$20, or trade for new tubes. Also Meissner 8-tube FM set complete, attach to any amplifier, factory built \$25. (Cost \$55); Used tubes 2½V type, perfect condition 50¢ each. Mc Green, 5047 Washington Blvd., Chicago 44, Ill.

FOR SALE—Jenson bass reflex CA-15 cabinet; G.E. 12" P.M. speaker; 3" Utah P.M. speaker; filament 2½V-5V c.t. transformer; T-52 audio transformer; crystal mike. All new. Write C. Horn, 325 E. 163rd St., New York 56, N. Y.

FOR SALE—148 Philco tubes, all new in cartons, standard brands, 40% discount. List on request. Waters Radio Service, 604 Main St., Covington, Ky.

WANTED—Necor radio service sign for indoors or outdoors. Paul Kitterman, Corydon, Ind.

WANTED—Very old radios: Westinghouse, R.C.A., Radiola III, early Crosley, Zenith, Paragon, Grebe, Kennedy and others. Ralph Atherton, Miami University, Oxford, Ohio.

FOR SALE—Rider Chanalyst, \$90. Excellent condition, complete with all cables and instruction book. William Brown, 1155 Neilson Ave., Far Rockaway, N. Y.

FOR SALE—New and used radio tubes, supplies, radios, phonos, etc. Want recording equipment and movie projectors. Have many items to swap. Write for free list. Ben W. Mueller, North Tonawanda, N. Y.

FOR SALE—New radio tubes in cartons, at prices indicated. 1R5, 1N5, 1B5, 384, 6N7, 6R5 \$1.08 each; 6H6, 6SN7GT, 6SJ7, 6SK7, 73¢ each; 31, 34, 37, 38, 75, 76, 77, 63¢ each. Many others. High-Tor Radio, Haverstraw, N. Y.

FOR SALE—Meissner Analyst model 6, \$90 complete; RCP 802 tubetester, \$35; RCP 304 tube tester (no chart) \$15; Single horn P.A. system with table and stand mike, complete, \$35. Harry Hollander, 21-36 77th St., Jackson Heights, N. Y.

WANTED—Meissner Perrocort i.f. interstage 16-5981 or two Meissner dual 22-5293, 100-300 mmf. E. K. Berg, 16 Flint St., Bridgton, Me.

WANTED—Rider Manuals 5 & 11. Write giving price and condition. Globe Radio Service, 106-10 New York Ave., Jamaica, N. Y.

FOR SALE—Short Wave receiver. Includes 20-40-80 meter bands, B.C. band, built in power supply, tubes, etc. \$15 prepaid. Bruce Radio, 1171 Union St., Manchester, N. H.

SWAP OR SELL—De Forest radio course in good condition, no pages missing; 102 booklets covering radio & television. John Saul, 916 S. Mercer St., New Castle, Pa.

WILL SWAP—Complete parts/assortment, 13 hard-to-get tubes, headphones, speaker, i.f. & audio transformers, 3 lbs. resistors, condensers, etc. \$15 value. Want small V.O.M. worth about the same. Ernest F. Johnson, Route 1, Jonesboro, Tenn.

FOR SALE—Hallicrafter S-39, complete, used two months, \$60; Pair SCR-536 Handie-Talkies with batteries, 75 meter band, \$60; RCP VTVM complete, \$40; Supreme 89 tube and set tester, \$25. Robert H. Lang, R.F.D. 3, Boonville, Missouri.

WILL SWAP—One and two tube radios crystal sets; metal locator; molds for casting plaster novelties; Wand band spread coils for SW-3; radio parts of all kinds. John Haynes, Doe Run, Missouri.

FOR SALE—Guaranteed tubes at 60-70% off list. Parts at equally low prices. Will swap for camera, short wave receiver or what do you have? H. Gershowe, 147 Chester St., Brooklyn 12, N. Y.

WANTED—TM11-4001 on army radio receiver BC 312M. David Ross, 666 E. 17th St., Brooklyn 30, N. Y.

FOR SALE—S-39 Hallicrafter portable communications receiver. A-C, D-C and batt. Collapsible antenna, original cost \$110 good condition, \$85 less batteries. S. W. Gates, 214 Chicago House, Ann Arbor, Mich.

FOR SALE—Hallicrafter S-20R receiver in excellent condition, barely one year old. All inquires answered. Will ship to you express collect. Joe Gene Roberts, 340 Davis St., Conway, Ark.

FOR SALE—Late model R.M.E. 45, \$150. Frank E. Hall, 312 Blatterman St., Charleston 2, W. Va.

WANTED—PE-104 vibrator power supply for receiver part of BC 654A, connecting cable from supply to set. Will trade tubes or pay cash. Ferris J. Finery, West Branch, Lock Box 431, Mich.

FOR SALE—BC 348P army communication receiver converted for 110V A-C operation. Complete with tubes and manual, \$35 or trade for volt-ohmyst or tube tester. N. Weintraub, 92-16 Whitney Ave., Elmhurst, N. Y.

YOUR OWN AD RUN HERE FREE

The Sprague Trading Post is a free advertising service for the benefit of our radio friends. Providing only that it fits in with the spirit of this service, we'll gladly run your own ad in the first available issue of one of the six radio magazines in which this feature appears. Write CAREFULLY or print. Hold it to 40 words or less.

Confine it to radio subjects. Make sure your meaning is clear. No commercial advertising or the offering of merchandise to the highest bidder is acceptable. Sprague, of course, assumes no responsibility in connection with merchandise bought or sold through these transactions.

Send your ad to Dept. RSD-47

SPRAGUE PRODUCTS COMPANY

North Adams, Mass.

(Jobbing distributing organization for products of the SPRAGUE ELECTRIC COMPANY.)

ASK FOR SPRAGUE CAPACITORS AND ★ KOOLOHM RESISTORS By Name!

* Trademark Reg. U. S. Pat. Off.

SHOP NOTES

[from page 36]

connected to C.R.T. video lead.
Frequency: Model VP100, 12.8 Mcs.;
Model VP100A, 11.5 Mcs.

3. Alignment of 3rd IF transformer:

- a) Apply output of signal generator to grid of second IF tube.
- b) Tune bottom slug of IF Trans. for MAXIMUM deflection in output indicator connected to C.R.T. video lead.

Frequency: Model VP100, 12.0 Mcs.;
VP100A, 12.0 Mcs.

Tune top iron slug of IF trans. for MINIMUM deflection of output indicator connected to C.R.T. video lead.

Trap Frequency: Model VP100, 8.25 Mcs.; Model VP100A, 8.25 Mcs.

4. Alignment of 2nd IF transformer:

- a) Apply output of signal generator to grid of first IF amplifier tube.
- b) Tune bottom slug of IF for MAXIMUM deflection of output indicator connected to video lead of C.R.T.

Frequency: Model VP100, 11.5 Mcs.;
VP100A, 10.3 Mcs.

Tune top slug of IF trans. for MINIMUM deflection of output indicator connected to video lead of C.R.T.

This will correspond to MAXIMUM audio output.

Trap Frequency: Model VP100, 8.25 Mcs.; Model VP100A, 8.25 Mcs.

5. Alignment of 1st IF transformer.

- a) Apply output of signal generator to grid or cathode of converter tube.
- b) Tune bottom iron slug for MAXIMUM deflection in output.

Frequency: Model VP100, 10.3 Mcs.;
Model VP100A, 9.0 Mcs.

In the model VP100 there is a 14.25 Mcs. trap which is tuned for MINIMUM deflection.

6. Alignment of sound IF transformer.

- a) Apply output of signal generator to grid or cathode of converter tube.
- b) Tune top slug for MAXIMUM sound output. Maximum sound can be determined by ear or by applying V.T.V.M. or oscilloscope to grid of 7C5 audio output.

Frequency: Model VP100, 8.25 Mcs.;
Model VP100A, 8.25 Mcs.

R.F. Alignment Procedure

1. Replace 6C4 oscillator tube.

- a) Apply output of sig. gen. to antenna terminal of chassis.
- b) Connect output indicating device to video lead of C.R.T. Set oscillator condenser half way open.

2. Adjust osc. coil slugs so that sound output is heard as the sig. gen. is set on the sound carrier frequency of the television channel.

Channel	Sound Carrier
1	49.75 Mcs.
2	59.75 "
3	65.75 "
4	71.75 "
5	81.75 "
6	87.75 "

3. Adjust antenna coil slugs so that the output indicating device indicates MAXIMUM as the sig. gen. is set on the frequencies listed below. These frequencies are between the sound and the picture carriers to give response to both.

Channel	Set Ant. Coil To:
1.	47 Mcs.
2.	58 "
3.	63 "
4.	70 "
5.	78 "
6.	85 "

FLUORESCENT NOISE ELIMINATION

Interference due to fluorescent lamps has been a source of annoyance both to servicemen and set owners because of its difficulty of elimination. This is due pri-



ANNOUNCING the Sensational
New PERMA-POWER by GTC

Help your customers

take advantage of the High Line . . .
Convert 1½ volt Battery Radios to All-
Electric Operation with



MODEL "A" PERMA-POWER

(Successor to
Porto-Power)

- ✓ GUARANTEED ELECTRICALLY FOR 3 YEARS
- ✓ SELENIUM RECTIFIERS. NO TUBES

Radio Plays Immediately

Visit
us at
Booth 63 at
the Radio
Show

Made and Guaranteed by

GENERAL TRANSFORMER CORPORATION

1250 WEST VAN BUREN ST. CHICAGO 7, ILL.

CIRCUIT COURT

[from page 34]

Normal dial tuning is accomplished in this position.

When the switch is depressed for push-button tuning, the following changes are made: S1 switches the loop from the RF grid to the mixer grid. S2 disconnects the mixer grid from the interstage coil and completes the circuit to the loop. S4 is one of the station selector switches and shunts the loop with an adjustable trimmer type condenser which can be pre-set for the desired signal frequency. At the same time another switch, marked S3, disconnects the oscillator tuning section of the gang and substitutes a fixed padding condenser (C5) and a shunt coil, by means of S5.

It might be well to examine the results of connecting two RF inductances in parallel. Except in the special case where they are in inductive relation, and properly oriented, as in a Variometer, the resultant is always of a lower inductance than either coil alone. Thus, to get the oscillator portion of the mixer to tune to the proper signal-minus-IF frequency, it is necessary to add the shunt condenser C5.

The coil L2 (and ones for all other selector buttons) are made adjustable by means of movable iron cores. The tap on L1 provides feedback voltage in all cases.

REMLER MODEL MP5-5-3

A rather unusual bias circuit is to be found in this set. A partial schematic showing the pertinent circuits is shown (Figure 4). The set is a five-tube, AC table model covering the broadcast band.

The power supply circuit, using a 6X5 rectifier is shown. It will be noted that between the negative terminal of the supply, the center tap of the high voltage winding and chassis ground, there is a series of resistors. These provide proper bias for all plates and screens, except the plate of the 6V6

[see page 47]

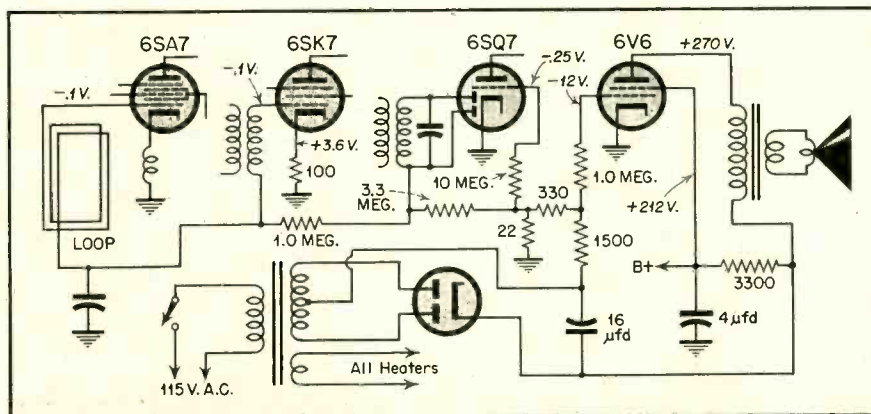


Figure 4

MASCO SOUND

puts everyone
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MASCO Mobile MC-25P for 6 Volt D. C. and 115 Volt A. C.

Wherever a sound truck rolls there's a sale to be made for MASCO's MOBILE MC-25P 25 watt amplifier with built-in phono-top. For elections, parades, resort work, fairs, playgrounds, tent meetings! It operates on battery where A.C. current is not available. And operates on 115 volt A.C. 60 cycles. For all outdoor audiences. A MASCO precision-built amplifier... a great MASCO value.

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MC-25P, phono-top amplifier, less tubes	\$131.25
Kit of matched tubes	\$16.00
MASCO-25P complete portable system available, see catalog 45 ML	\$223.75

Add 5% west of Rockies

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SOUND SYSTEMS and Accessories

RAvenswood 8-5810-1-2-3-4

SHOP NOTES

[from facing page]

marily to the extremely broad frequency spectrum associated with the arc discharge characteristic of these lamps. Extending from 150 Kc. to 150 mc. this spectrum has necessitated the design of special twin-pi and delta connected capacitive network which are now made available by leading condenser manufacturers in suitable containers. Each lamp unit requires an individual noise eliminator installation for complete and effective elimination of this source of interference.

A FIRM GROWS IN BROOKLYN

Julius Finkel, president of the JFD Manufacturing Company, Brooklyn, N. Y., has never stopped pushing on to new unexplored radio service fields. The firm is responsible for some very vital contributions to the art of radio servicing.

He encouraged the creation of the entire business of radio dial belts. Until his arrival on the scene, there was no dial belt business. Radio servicemen were confronted with an enormous problem when they needed a

replacement belt. Mr. Finkel catalogued and systematized all belt lines and made ordering a specific dial belt the simple thing that it is today.

Then there are the Adjustable A-B-C Ballasts — three little ballast tubes which, with a simple adjustment, may be adapted to replace over 98% of the ballast tubes in use today.

The firm designed the "Remote-O-Cable Replacer," a compact machine which swedges auto radio shafting to prevent unravelling, cuts shafting to



It happened in Brooklyn: Julius Finkel, president J.F.D., with sons Al and Ed.

exact length, and replaces old fittings on new shafting. Until the introduction of this machine, the radio serviceman had to resort to all sorts of makeshift, unsatisfactory methods to splice cable. Now, he can get a factory-type job right in his own shop.

He also introduced flexible auto radio cable and fittings to radio parts jobbers.

They originally designed the Universal Line Cord, the replacement item that matches most of the line cords in use today. This cord is the famous No. 2175 that can be found on the shelves of every radio parts jobber in the country.

Then there is Radio Dial Cable and Cord which the firm was first to introduce to radio parts jobbers and was instrumental in making it the wide, varied, orderly line that it is today.

More recently, a revolutionary method of packaging cables and cords was devised by Mr. Finkel. This is the popular Handy Spool Line of Cables and Cords, in which the cable comes housed in a transparent plastic container which renders the cable weather-resistant, moisture-proof, will not let it rot, and permits it to be dispensed with no possibility of tangling, knotting or kinking. This non-breakable, clear-view plastic container has proved popular with servicemen as a handy all-purpose container for small parts, washers, screws, bolts, springs, etc.

JFD also originally designed the universal mounting roof antenna. The firm is still the only supplier of a complete line of Resistance Cords for the entire radio parts industry.

In addition, Julius Finkel initiated the "All under one roof" principle in the distribution of radio parts. He has collected all the essential radio parts under his one roof, thus removing the necessity for jobbers to go to a dozen different sources for their needs. Now the firm is one of the nation's fastest growing radio parts manufacturers. 1946 has been the biggest in its history. Over 6,000,000 JFD Dial belts and over 4,000,000 JFD Ballasts have been sold to date.



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For additional information, write: General Electric Company, Electronics Department, Syracuse 1, New York.

GENERAL  ELECTRIC

164-F3

CIRCUIT COURT

[from page 45]

output tube, is provided by the 3300-ohm resistor in the positive of the supply.

To return to the bias system, we find 1500, 330 and 22 ohm values in the series. The grid of the 6V6 is supplied with —12 volts by a tap between the first two. At the junction of the 330 and 22 ohm resistors leads go via 10 megs. to the 6SQ7, first audio; grid and via 3.3 megs. to the AVC bus. A potential of —.25 will be read on a 20,000 ohm/voltmeter at the 6SQ7 grid. Similarly, with no signal, —.1 will be measured at the mixer and IF grids. Actual operating voltages, and indications on VTVM instruments are in excess of these values. Application of a signal will develop AVC voltage which will make the mixer and IF grids more negative, depending on the strength of the signal. An additional bias of 3.6 volts is applied to the 6SK7 IF stage by a 100-ohm cathode resistor.

This system should make for excellent stability, overload characteristics and good tone quality.

IN TRADE

[from page 12]

antenna as a means to curing marginal FM reception, is the warning given by Don Kresge, Bendix Radio service manager, in a bulletin just released to distributor service heads. As pointed out by Kresge, acceptance of an antenna to permit maximum reception from an FM installation should be based upon its efficiency across the entire FM band.

"It will not reward the dealer to foster antenna installations which permit high efficiency in the center of the band, and yet suffer low signal efficiency at either the 88 or 108 mc ends. As more stations go on the air, overall efficiency across the dial must be demanded. At this period in its growth, FM radio should be given the patient understanding deserved by an infant, in order that it can grow and flourish," he said.

The Bendix Radio FM dipole was recently announced to the trade by Kresge. Its standing wave ratio is two to one or less across the entire band. This is not true of all FM dipole antennas which may provide efficiency but over a limited expanse of the band. Kresge recommends careful study of the FM antenna problem by every radio dealer and service dealer looking toward the long-pull promise of FM.

Every Radio Serviceman
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AC-DC BALLAST TUBE MANUAL

JFD's new 68-Page Ballast Manual is a treasury of information for Radio Servicemen and Dealers — **AND ITS' FREE!**

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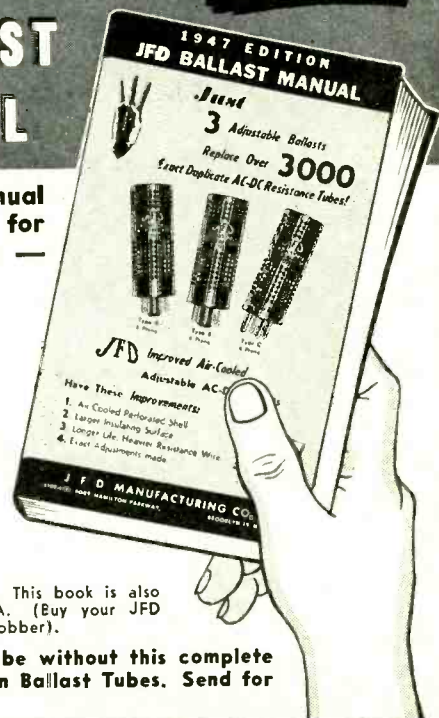
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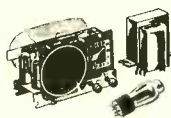
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USE OF 'SCOPE

[from page 19]

should be obtained. The two halves of the figure should intersect exactly along the center line (horizontal) of the 'scope screen at the point marked "X" in *Figure 8*. If intersection is above or below this line, trimmer C₁ must be readjusted.

Set Alignment with an AM Test Oscillator

If the serviceman does not have access to a frequency-modulated signal generator, he may use his regular amplitude-modulated test oscillator for oscillographic alignment of radio receivers. The modulating frequency in this type of oscillator usually is approximately 400 cycles per second. In this application, the oscilloscope serves only as a sensitive output indicator and does not show the selectivity curve.

The vertical amplifier input terminals of the oscilloscope are connected across the audio output terminals of the receiver (usually across the speaker voice coil). The sync switch is thrown to its INTERNAL position. The internal sweep oscillator is set to a relatively low frequency (100 cycles or lower), and the sync control advanced about half-way.

If the entire receiver is to be aligned, the amplitude-modulated test oscillator is connected to the receiver antenna and ground terminals. If the i. f. stages only are to be aligned, the i. f. output of the oscillator is applied between ground and the 1st detector control grid.

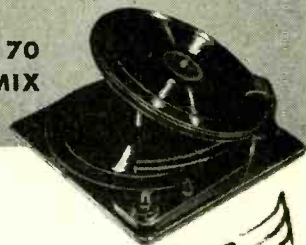
The pattern appearing on the 'scope screen will be a train of sine-wave cycles (see *Figure 9*). As the various trimmers in the receiver are adjusted to resonance, both height and depth of these cycles will increase, both reaching maximum at resonance. A flattening off of the peaks will indicate receiver overloading, which may be corrected by reducing receiver gain, test oscillator output, or both. If the pattern is too short horizontally for easy visibility, increase the horizontal amplifier gain control setting, decrease the sweep oscillator frequency, or both.

Hum Tracing

The oscilloscope pattern shown in *Figure 9* should have constant amplitude. That is, both the height and depth of successive cycles should be the same. Extraneous signals, such as hum and oscillation, will tend to modulate this wave pattern, thereby altering the successive amplitudes. Two such conditions are shown in *Figures 10-A and 10-B*. In each case, a hum voltage arising within the receiver has

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imparted to the wave pattern a successive rising and falling amplitude. If the test oscillator is a high-grade instrument having a low internal hum level, any such distortion of the pattern as shown in *Figure 10* discloses that hum is being generated within the receiver.

This hum may be identified in frequency and traced to its origin by means of the following procedure:

(1) Set the internal sweep oscillator of the oscilloscope to 60 cycles.

(2) Set the sync switch to 60 cycles (line frequency).

(3) Connect the vertical amplifier input terminals to standard test prods with shielded leads.

(4) With the receiver running "wide open" but with no antenna or ground connected, connect the test prods to the speaker voice coil.

If no hum is present, the straight, horizontal line on the scope screen will be undisturbed. If hum is present, however, an a. c. cycle pattern will appear. With the internal sweep oscillator set at 60 cycles, one complete cycle will be seen for 60-cycle hum; two complete cycles for 120-cycle hum. 120-cycle hum arises almost always from defective rectifiers or filters in the power supply section of the receiver. 60-cycle hum is due to defective tubes, ungrounded filaments or heaters, strong magnetic fields from transformers or power line leads, etc.

Trace the hum to the stage in which it originates by connecting the "low" vertical amplifier input terminal to receiver ground, and touching the "high" test prod successively to the output terminals of the various receiver stages. Work from the antenna stage through the set toward the output stage. The cycle pattern will appear for the first time when connection is made to the hum-originating stage.

Conclusion

Use of the oscilloscope in checking each radio is a good habit. This invaluable instrument should not be saved for special sets or for extraordinary troubles. With its steady use will come a skill and a kind of sureness which are bound to pay large dividends to the alert radio service-dealer. Certainly, every serviceman with business sense wants to acquire each skill which will enable him to do a thorough job quickly.

It has not been possible in this space to cover all service applications of the oscilloscope. We accordingly have described those uses which are of principal interest in receiver trouble shooting and adjustment. From time to time, we will present other articles covering additional applications.

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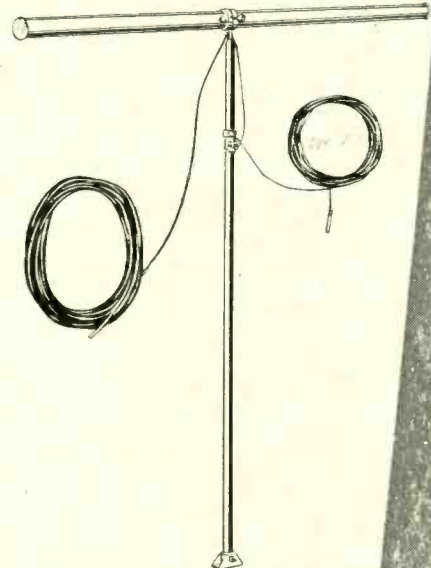
The FM section of this new 3-way antenna is a horizontally polarized dipole. It operates most efficiently between 88 and 108 mc.

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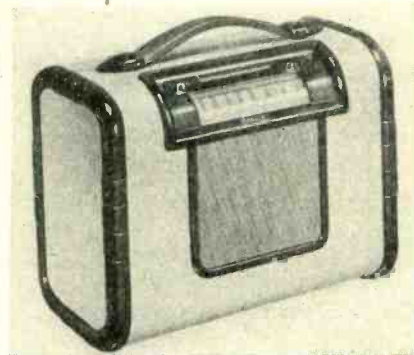
PRODUCTS

[from page 38]

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William Kellogg, Motorola Communications Field Engineer, demonstrates operation of Motorola Mobile FM 2-way Receiver-Transmitter units, Models FMTRu-30D, FMAR-13-V and FMRU-16-V.



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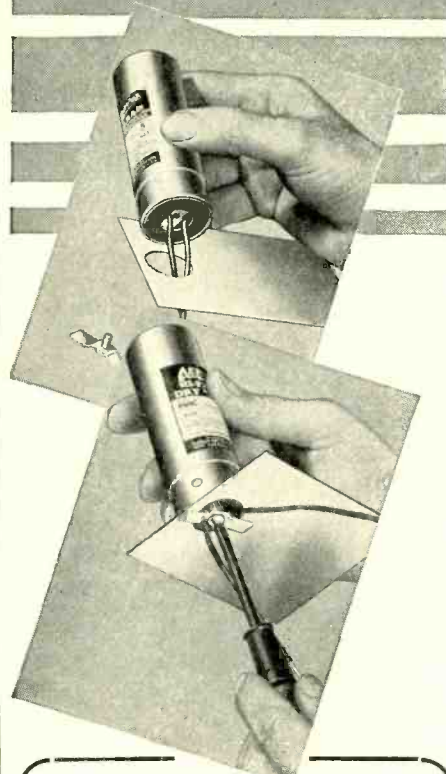
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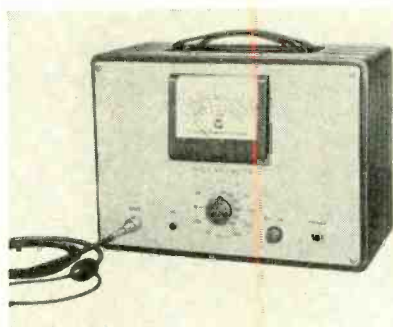
Technical Characteristics: Scales—Volts Mils: 0-3, 0-12; 0-3 Volts: A.C. only; Ohms: 0-10,000-Inf.; Capacity: MMF - 0-1000-Inf.; MF - 0-10-Inf.

Ranges—Volts: A.C. or D.C. & Mils., D.C.: 0-3, 12, 30, 120, 300, 1200; Capacity: 1-10,000 MMF in 2 ranges; 1-1000 BF in 5 ranges; Ind: 50 Mh-100 Henries (Use conversion chart); Ohm: 1/10 to 10,000 megohms in 8 ranges.

Input Impedance—Volts A.C.: 12 megohms shunted by 6 mmf.; Volts D.C.: 15 megohms.

Tube Complement—2 6X5GT A.C. Rectifiers; 1 6SJ7 Cathode Follower; 1 6SN7GT Vacuum Tube Voltmeter; 1 OD 3/vR 150 Voltage Regulator; 1 9006.

Instrument and meter are fully manufactured by the Hickok Electrical Instrument Co., 102533 Dupont Avenue, Cleveland 8, Ohio.



Voltmeter Aids Audio Frequency Testing

The new Audio Voltmeter (RCA Type WV-73A) announced by the RCA Engineering Products Department is applicable for testing radio receivers and sound systems and is used to measure gain and noise level in power amplifiers and ripples voltages in power supplies. The meter is also used to locate sources of frequency distortion and faulty amplifier components in receivers, phonographs, and public ad-

[see page 54]

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Merit Appoints

Merit Coil & Transformer Corp., Chicago, announces the appointment as assistant sales manager of A. "Bud" Fields. He will act as general assistant to John I. Crockett, Jr., sales manager.

EXHIBITORS

[from page 29]

Company Booth Number (See Plan)

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Electronic Laboratories, Inc.	56
Electro Products Laboratories ..	81
Electro-Voice, Inc.	15
Electrovox Company, Inc.	122
The Erwood Company	105
Federal Telephone & Radio Corp.	135
Freed Transformer Corp.	113
General Cement Mfg. Co.	96
General Electric Company	8
General Industries Company	110
General Transformer Corp.	63
Guardian Electric Mfg. Co.	51
The Halldorson Company	37
The Hallicrafters Company	86
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J. F. D. Manufacturing Co.	117
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Operadio Manufacturing Co.	139
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Panoramic Radio Corp.	115
Park Metalware Co., Inc.	136
Par-Metal Products Corp.	24
Permo, Incorporated	41
Philmore Manufacturing Co.	119
Pioneer Electric & Res.	9
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Premax Products Division	18
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Price Electric Corporation	145
Pyramid Electric Company	157
Quam-Nichols Company	140
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Revolutionizes the Industry!
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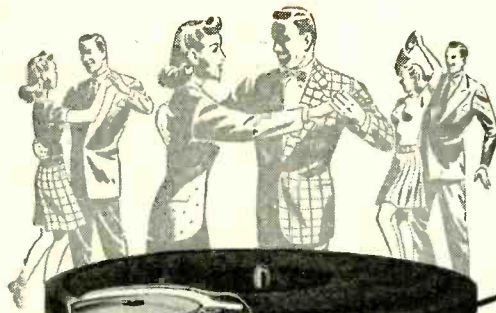
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Golf in Chicago

According to Kenneth C. Prince, executive secretary, Association of Electronic Parts & Equipment Manufacturers, there will be two Inter-Association Golf Tournaments in the Chicago area this year. EP & EM has made reservations for the first tournament to be held at Edgewood Valley Country Club on Friday, June 20th, and the second to be held at Elmhurst Country Club on Friday, August 29th. These tournaments will be sponsored by EP & EM, the Chicago Chapter of National Electronic Distributors Association and the Chicago Chapter of "The Representatives" of Radio Parts Manufacturers, Inc.



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You'll make better friends of your customers when you equip your phonographs with General Industries *Smooth Power* Motors.

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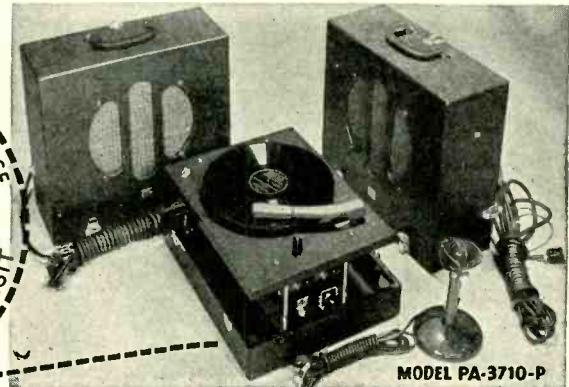
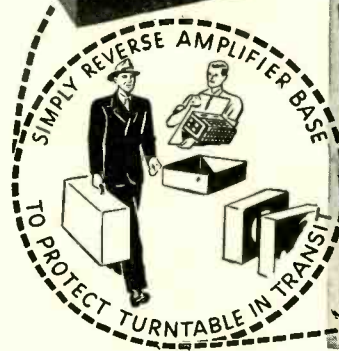
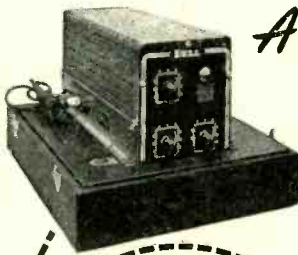
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MODEL PA-3710-P

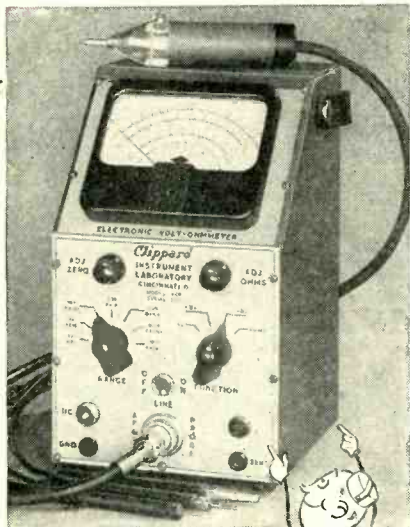
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CLIPPARD INSTRUMENT LAB., INC.
1129 Bank St., Dept. 6, Cincinnati 14, Ohio



PRODUCTS

[from page 51]

dress systems.

The new audio voltmeter includes an input circuit with low capacity and high resistance which makes it particularly suitable for measuring voltages in high-impedance circuits. This makes it possible for the electronic meter to measure the response of audio frequency power amplifiers and loudspeakers without disturbing their frequency characteristics. The range of the meter is 20 cycles to 20 kilocycles.

The main components of the RCA WV-73A consist of a precision attenuator, a three-stage high-gain stabilized amplifier, a balanced diode rectifier, a special d-c microammeter, and a regulated power supply.

The voltage to be measured is fed to the attenuator through a shielded cable attached to a jack on the front panel. The attenuator consists of an eleven position switch connected to non-inductive resistors, arranged in such an order that consecutive switching ranges overlap by 10 decibels. The meter can measure one one-thousandth of a volt, to one thousand volts.

From the attenuator, the voltage is fed to the high-gain amplifier, which employs a conventional feedback circuit to obtain stabilization and sharply reduces the input capacity of the first tube. Output voltages from this amplifier are fed to a balanced diode rectifier in order to produce d-c for energizing the meter.

The high-level rectifier is designed to produce an output voltage that is proportional to the average value of the full wave, thereby giving a meter reading that agrees very closely with an RMS meter for all usual distorted wave-forms. Because a balanced diode rectifier is used, the meter indicates the true value of both halves of the wave, avoiding the polarity or "turn-over" error of half-wave circuits.

Other applications of the new RCA Audio Voltmeter include: use as an audio amplifier which gives high gain with essentially perfect fidelity, and whose sensitivity makes it especially adaptable for use with microphones having low output; bridge measurements which readily indicate the null point at either high or low audio frequencies; measurement of the output of a phototube with sensitivity that will indicate extremely slight variations in light intensities to which the tube is exposed; and measurement of currents as low as one one-thousandth of an ampere, or if an 0.1 megohm external resistor can be used, currents as low as 0.0001 milliampere can be measured.

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- Heating element wire. 10 ft. coiled 3/16" O.D. #22 1.77
- Hot Plate bricks 5/8" diameter. 6 for .. 1.62
- Appliance cord. Rubber covered. 20 ft. \$1.00; 450 100 ft. 4.50
- Electricians Drill Bits. 1/4", 3/8", 1/2", 3/4" Complete set 6.75
- Ribbon element heating wire. Std. size 100 ft. . 75
- Percolator elements. Universal. Flat type. 1 yr. guar. 2 for 1.20
- Element cement. Withstand 3000° F. 1 lb pkg. \$1.00. 5 lb. pkg. 3.50
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- Carbon brush set. Assorted. 104 brushes. 15 Springs. Complete set 3.00
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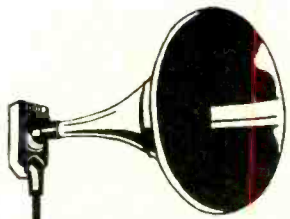
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Air-column speakers are something really new in sound. The idea is so new that it may take a little thinking to grasp it, but it's really quite simple.

A diaphragm driver is actually a piston air compressor of variable speed. Its low efficiency is suitable for indoor use, but to cover large outdoor areas higher efficiency is required.

The logical means is an ordinary air compressor. We couldn't use this simple method of generating audio power until VOCAL-AIRE driver units were developed. In this system, steady air pressure is modulated by the Voice Valve just as your larynx modulates your breath to produce speech. Since generation of air pressure is not the function of the driver unit we don't need tremendous 500-watt amplifiers.

The compressed air supply comes from a motor or gas-engine unit or from any other available source. For portable use, the gas-engine compressor also supplies the 110-volt A.C. for the amplifier.

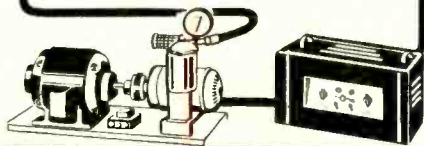
A special amplifier has been designed to match the VOCAL-AIRE driver unit. The impedance of the driver varies with the frequency of the signal and the VOCAL-AIRE amplifier matches this condition to achieve peak efficiency.

The coverage of these speakers may be hard to accept—but two drivers, each driving a pair of horns, cover the Yale Bowl which is 900' long, 500' wide and seats 75,000 persons. Two 20-watt amplifiers in cascade are all that is needed, one amplifier for each driver unit.

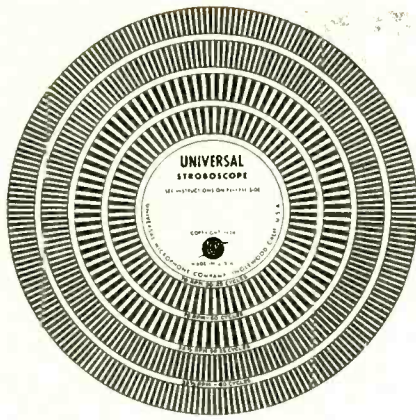
The compressor can be switched on and off remotely, from mike or amplifier... or a switch at the mike may be used to control plate voltage for stand-by.

Servicemen: If you haven't read up on air column speakers, we'll be glad to send you literature describing our system and if you have occasion to service our equipment, a request on your business stationery will bring you a free copy of our Service Manual.

Vocal-Aire Sound
Systems are made by



DILKS, INC.
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Checks Phono Turntable Speed

The Universal Stroboscope is once more available to radio service men and recording technicians, at its pre-war cost of twenty-five cents each. It is a hard cardboard disc 6" in diameter which is imprinted with four circles of black and white spaces, each circle carefully calculated to measure a particular light and turntable combination. It checks standard speed phonograph turntables (78 RPM) and transcription turntables (33 1/3 RPM) under either 25, 50, or 60 cycle light.

This disc is placed on the turntable in the same manner as a record. By viewing the circle which corresponds with the recommended speed of the turntable and the known source of light, you can see at a glance whether or not there is any variation from the correct speed. At the proper number of revolutions per minute the black and white spaces of this particular circle will provide the illusion of not moving at all. If the turntable speed is too fast the black and white spaces will appear to be moving in the direction that the turntable is rotating. If the turntable speed is slow the spaces will appear to move in the reverse direction.

Because a recording's quality is only as good as the speed regulation of the equipment upon which it is recorded and reproduced, radio service men and recordists find this Stroboscope invaluable in checking turntable speeds to assure true quality in pitch and tempo. For example, with this handy indicator a radio serviceman on a home call can readily determine if a turntable motor is on the wrong cycle and can easily demonstrate the trouble to the customer. In addition to its phonograph use, the Universal recommends it for laboratory and industrial applications as well as in schools and colleges for educational purposes. The Universal Microphone Co. of Inglewood, California, distributes this product.

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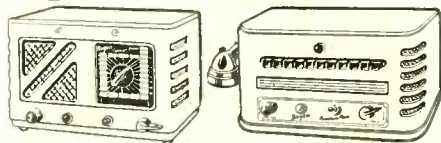
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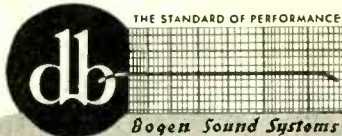
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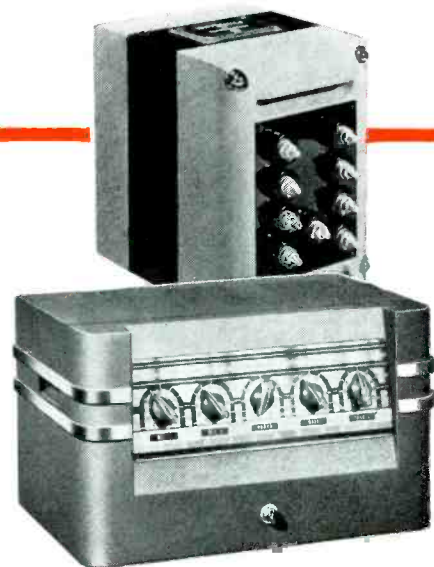
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