The Pilot Models T1451 and T1452 employ a relay which switches automatically from battery to power-line operation when the receiver is plugged into the light socket and turned on.  (See page 472)
Thousands of service men from coast to coast have already found for themselves the time saving . . . profit building possibilities of these new Mallory Condensers.

Once again Mallory's policy of unstinting investment in development work has been justified. Every condenser replacement need is adequately covered because the line has been built around an exhaustive study of millions of condensers now in use as original equipment.

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**A**—Units of larger diameter supplied with self-contained feature for universal mounting . . . for vertical or horizontal. All leads at one end.

**B**—Supplied with simple adjustable strap for horizontal mounting. Insulated leads at both ends.

**C**—These are provided with bare wire leads at both ends because of their small size. No mounting feature is required.

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QUICK, PRACTICAL SIGNAL TRACING

SERVICE, OCTOBER, 1939 • 459
ANTENNA

Within the past few weeks the tube manufacturers have cleaned house. Inflated list prices have been brought down and a price structure established which is simple and based upon a sound relationship between manufacturing costs, distributor net prices and suggested list prices. The new setup should go a long way toward stabilizing the industry. Although some of the manufacturers have been pursuing a similar policy for some time, we feel sure that general conformity will prove more profitable for all concerned. It is our hope that the better conditions which should result will induce other manufacturers of component parts to clean house.

If you had the time and money to enable you to travel from one factory to another, peek into the laboratories and find out what’s new and how it works, you would indeed be able to keep up to the very minute. Yet, strangely enough, you can do just that while remaining at your bench within your own shop. All you have to do is to turn to the pages of new products and new literature published each month in SERVICE and write for the various catalogs and bulletins. Manufacturers spend thousands of dollars annually to inform you about their products. A brief note on your letterhead is all that is necessary to bring this wealth of essential information to you.

Service men everywhere are reporting marked response to the "Curtain Raiser" program sponsored by the NAB-RMA Joint All-Radio Campaign during the week of September 24.

That this is a step forward, as far as you are concerned, goes without saying. However, on page 470 of this issue, Mr. D'Arcy tells you just where you stand today as compared with the "good old days". The Service Man has finally gained recognition as a vital link in the powerful radio industry chain. It is our belief that this recognition should be attributed to national organization on an effective scale.

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ARE designed to stand up under the most adverse conditions of excessive moisture, salt air and humidity. These TROPICALS have been subjected to unusual frigid and torrid temperature changes in the UTC laboratory TORTURE CHAMBER over a period of eighteen months. To complete our control tests, a representative batch of TROPICAL audios, with the new WETPROOF process of mould sealing the coils, have been sent out to customers in the swamy and coastal regions of the United States, Philippines, South America, India, China, and South Africa. These TROPICALS are still to be heard from and they are out more than a year. The UTC TROPICALS are specially vacuum-pressure treated followed by the UTC MOULD-SEAL process of wetproofing. THEY COST NO MORE.

Ask your distributor to show you these New TROPICAL WETPROOF Audio and Power Components

Some Typical Values in UTC TROPICAL WETPROOF Audios

<table>
<thead>
<tr>
<th>Type</th>
<th>Application</th>
<th>Description</th>
<th>List Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-33</td>
<td>1 plate to 1 grid</td>
<td>4:1 ratio</td>
<td>$1.20</td>
</tr>
<tr>
<td>R-34</td>
<td>1 plate to 2 grids</td>
<td>2:1 ratio</td>
<td>1.25</td>
</tr>
<tr>
<td>R-35</td>
<td>3 plate and 5 hole in grid</td>
<td>3:1 and 1.1 ratio</td>
<td>1.50</td>
</tr>
<tr>
<td>R-36</td>
<td>1 plate to 2 grids</td>
<td>2:1 ratio</td>
<td>1.50</td>
</tr>
<tr>
<td>R-37</td>
<td>1 plate to 2 grids</td>
<td>2% ratio</td>
<td>2.50</td>
</tr>
<tr>
<td>R-38</td>
<td>Speaker</td>
<td>Class B 15, 45, 75, 100 volts to 300 and 5,000 ohms</td>
<td>1.50</td>
</tr>
<tr>
<td>R-39</td>
<td>Plate and microphone</td>
<td>3:1 and 17:1 ratio</td>
<td>1.65</td>
</tr>
<tr>
<td>R-40</td>
<td>Plate and microphone</td>
<td>3.5:1 ratio</td>
<td>1.50</td>
</tr>
<tr>
<td>R-41</td>
<td>Plate and microphone</td>
<td>2:1 ratio</td>
<td>1.50</td>
</tr>
<tr>
<td>R-42</td>
<td>Plate and microphone</td>
<td>2有过</td>
<td>2.50</td>
</tr>
</tbody>
</table>

UTC channel frame TROPICAL WETPROOF audios are excellently designed. In addition to good frequency range, coils are vacuum-pressure treated followed by the UTC MOULD-SEAL process of WETPROOFING to prevent moisture absorption.
PUBLIC ADDRESS
AND THE NEW YORK WORLD'S FAIR

While acres of paper have been used in descriptions of various features and angles of the New York World's Fair there has been little published on the subject of its sound equipment, and this little has been concerned entirely with three or four outstanding installations of gigantic proportions. It is felt that an article covering the situation from the angle of the Service Man who gains a livelihood from selling sound installations is definitely needed—an article conveying some idea as to the important part that sound systems play in this gigantic enterprise, and pointing out some of the novel applications disclosed by several visits to this tremendously impressive extravaganza which occupies 1,200 acres of the Flushing meadows on Long Island.

- - - statistics

First of all it may be well to get down some statistics on sound equipment at the Fair.¹ The original figures were compiled in the middle of the Fair’s run and have been expanded slightly by estimate to include equipment added since that time—therefore the round numbers.

That the Fair provides the world’s greatest concentration of public-address equipment is indicated by the fact that

¹These data are presented through the courtesy of Radio Wire Television, Inc. (formerly Radio Service Co., Inc.) and are taken from an independent survey by that organization.

By S. GORDON TAYLOR

its 250 systems in 154 exhibits and concessions, utilize 700 amplifiers. There are just over 400 microphones in use, 105 record players, 34 sound on film units and 20 televisions, in addition to an unknown number of radio, television and facsimile receivers, etc. The original survey figures showed well over 1,000 speakers but during the progress of the Fair so many were added to provide increased coverage that it is believed the number now exceeds 2,000.

Of the 700 amplifiers in service over 95% are of standard manufacture, 3% were custom built by Service Men and 1% were built up from standard kits. Thirty-one amplifier manufacturers are represented but 83% of the equipment is the product of seven of these manufacturers.

The survey discloses that 51% of the systems are used to describe, explain or demonstrate exhibitors’ products. On the other hand, ballyhoo operations account for only 20% of the installations although ordinarily one thinks of ballyhoo as the life-blood of a fair or carnival. This discrepancy is largely accounted for by the fact that this type of outdoor sound system is permitted only in the amusement areas.

The other 29% of sound installations include those used purely for entertainment, 7%; educational, 13%, and sound effects, 9%.

- - - standard equipment predominates

A general impression seems to prevail that the sound systems at the Fair utilize a great deal of specially designed equipment. This impression, probably created by the publicity that has been given to a few of the larger installa-
Webster equipped plicity has Below one individual of system in several the sound system, thus great Ford description Figs. 3 and 4. At the General Motors' Futurama each visitor seated on the great conveyor belt hears only the portion of the description of the scene immediately before him. Those directly ahead or behind are at the same time hearing other portions. This is made possible by scanning the sound film at 150 points (left) along its length. Each pickup feeds an individual amplifier which drives tiny Cinaudograph speakers on the seat-backs.

The Lagoon of Nations is of interest not only in its more spectacular aspects but also in that it demonstrates a practical application of stereophonic (or binaural) reproduction which can be applied in smaller installations as well. The Lagoon is the scene of a nightly spectacle in which fountains, lights, fireworks and music are all combined in one grand symphony of sight and sound.

(See Fig. 1.) For utmost realism it was considered essential to have the music come from the heart of the spectacle. With a saturated atmosphere and literally tons of water falling from the fountains, however, the band could not be placed there. On the other hand a typical p-a system would limit realism due to the loss of sound perspective which distinguishes live music from normal loudspeaker reproduction.

T. Frank Bludworth, of Bludworth, Inc., conceived the idea of utilizing the stereophonic principle by placing a microphone on each side of a remotely located band studio and carrying the output of each through entirely separate amplifier systems to separate groups of speakers in the Lagoon. Thus the pickup coming predominately from one side of the band would be heard coming from one end of the lagoon and that of the other half of the band from the other end.

The method used in accomplishing this plan is shown by reference to Fig. 2. Pickup from microphone A is reproduced through speakers A and D, which are placed at diagonally opposite corners of a rectangle in the center of the Lagoon. The output of microphone B is reproduced through speakers B and C.

Fig. 17. The figure in the ice is a real person but reduced to a 15-inch image by means of lenses. Her voice comes from the speakers overhead through the medium of a Bogen sound system. Later the beautiful model steps out and continues her talk from the mike in front.
Thus a listener located at any point around the lagoon hears the two pickup components coming to him from different directions and in the normal perspective that would be experienced if the band were actually located out on the water.

For more complete realism this installation employs tremendous power and is capable of flat response (including speaker systems and lines) of 28 to 11,000 cps. Each of the four speaker groups consists of two Cinaudagraph, Model WPE-27, dynamic speakers with reinforcement of highs by four Western Electric 594A high-frequency units. Each of these Cinaudagraph units is capable of handling 85 watts continuously, weighs 495 pounds, and boasts a 6-inch voice coil and 27-inch cone.

Each speaker group is housed in a great cylinder 24 feet in diameter, entirely inclosed except for the mouth-openings of two great built-in exponential horns, each of which is approximately 15 feet wide by 8 feet high. One of these giant Cinaudagraph speakers is mounted in the apex of each horn while the two high-frequency units work into a smaller, cellular horn baffle mounted in the mouth opening of the larger horn.

- **sound takes a ride**

One of the most popular features at the Fair is the unique General Motors Futurama®. Essentially this consists of a scale model of a countryside depicting highways of the year 1960, complete with mountains, rivers, buildings, motor cars, trains, etc. The model is 1,600 feet long and is traversed along one edge by an endless belt conveyor on which are mounted comfortable seats accommodating 600 spectators at one time. Some idea of this arrangement is shown in Fig. 3.

Interest in this feature is tremendously heightened by the provision of a running description of the panorama; the progress of the story so synchronized with the movement of the conveyor that each spectator hears only the portion of the story applying to that section of the panorama in his immediate view. This means that other spectators in seats a few feet ahead or behind are hearing different parts of the story corresponding to the portions of the scene before them at the moment.

To make this possible each seat has a small Cinaudagraph pm speaker and two-way baffle mounted on back at approximately ear level of its two occupants. The seat is of the bucket type with high back and wide sides, all heavily upholstered, which serve to confine the sound of the speaker to that seat.

---

**Fig. 5.** The great Railroad on Parade show offers an excellent example of sound legendarium. A soloist walks across the stage with no mike in sight, yet the song, although loud enough to be heard above the roar of a locomotive on the stage, is heard with excellent quality of reproduction and appears to be coming directly from the soloist's lips and follows him across the stage.

**Fig. 6.** The general Fairgrounds system utilizes a master control console (above) to provide selection and distribution of programs covering the outdoor area of the 1,200-acre site. RCA Twin-Power cubes (first column, left) and Cinaudagraph dual-baffled dynamics (middle column) are distributed throughout the grounds.

**Fig. 11.** Sound is localized in the installations at the Beechut exhibit by projecting it directly down from overhead. Two methods of supporting the speakers are used, one in a canopy-like baffle (shown below), the other in individual decorative metal housings suspended from the ceiling (shown above). An Operaduc amplifier with Garrard automatic record players are employed in each case.

**Fig. 16.** Clothing dummy robots are made to talk and move, the movements of their lips and other parts perfectly synchronized with the speech by Robophone, a combination sound system and mechanical control device in which synchronism is insured by sound discs which carry both speech and controlling impulses.
and thus avoid interference with neighboring loudspeakers.

The description talk is recorded on 22 strips of film mounted on a revolving drum. This film moves past a bank of approximately 150 photocells evenly distributed over its length. Each photocell picks up a different portion of the description. A few of these, with their light sources are shown in Fig. 4. Each pickup feeds into its own amplifier, the output of which is fed to two of the seat-back speakers and is therefore audible to four spectators.

The amplifier outputs are fed to the corresponding speakers through a system of fixed rails beneath the conveyor which are contacted by shoes under the seats. This system, as well as that for maintaining perfect synchronization between the film and the conveyor are too complicated for description here but suffice to say that the mechatro-electrical problem involved taxed the genius of the ERPI and Westinghouse engineers who collaborated in the design and installation of this unique sound system.

By this system the Futurama may be witnessed by up to 26,000 persons daily. The conveyor ride takes about 15 minutes to traverse the 1,600-foot model. The great belt moves continuously, spectators stepping off at the unloading platform as they would off an ordinary escalator and others taking their places at the loading platform a few feet farther on.

- - - tricks of sound

The great Railroads on Parade show seating for 5,000 spectators, a 5-acre stage and a cast of 300 people, 40 horses and 15 real locomotives offers an excellent example of sound ligerement. A soloist walks across the stage without a microphone in sight and nothing within fifty feet of him which might conceal one. Yet the song, although loud enough to be heard above the roar of a locomotive on the stage, is heard with excellent quality of reproduction and appears to be coming directly from the soloist's lips, following him as he moves around the stage.

This illusion is created by a p-a sys-

Sound links a 10,000-year span when a Clarion system is used by the lecturer and guide in a Chinese temple of 5,000 years ago (left), and a Lafayette system to explain and describe the Westinghouse "Time Capsule"—a metal cylinder containing all sorts of souvenirs and records of the present age and buried 50 feet below ground where it is to remain for 5,000 years (right).

ten consisting of a number of speakers concealed about the stage with a control operator who can switch sound around from one to another at will. The lack of microphone is explained by the fact that the soloist on the stage is acting in pantomime—the actual voice comes from a singer in a sound-proof room below the grandstand, from which he watches his counterpart on the stage.

In two such rooms are soloists, chorus and band, duplicating those which actually appear on the stage.

Fig. 5 shows a block layout of speakers, the eight main amplifier channels which are capable of 400-watts output when in simultaneous operation, and two lower power channels employed by narrators who piece together the episodes of this historical pageant. Because of the complication of the mixer wiring, with its 34 input positions, it is not shown, nor is the channel-switching arrangement. Two special overall sound

- - - general fair system

Perhaps the most comprehensive and flexible public address distribution system in the world is that of the Fair itself. An RCA installation with its control position in the Communications Center Building, its pickup system extends to points throughout the fairgrounds as well as outside. Its output provides coverage of the entire outdoor area of the grounds and in addition lines extend outside to permit local and nationwide broadcasts of events and programs staged in the four studios at the Center and elsewhere on the grounds.

The master control board for this gigantic layout (Fig. 6) closely resembles those found in the larger broadcasting stations. It performs all functions of selecting, controlling and distributing programs. In addition there are remote control boards at the Fair studios through which programs, live and recorded, are fed to this main console.

Some 39 power amplifiers are utilized in this system with 24 speaker units or groups distributed around the grounds. Two types of loudspeakers are employed. One is the RCA Twin Power cube (Fig. 7) installed either in the outside walls of buildings or on giant pedestals. The other type is a Cimadograph 240 dynamic unit (Fig. 8) with two-way baffle boxes which project sound from both front and back of the cone. These latter units mounted atop steel poles, are used extensively along the roadways where advantage is taken of their semidirectional characteristics to project sound along the road but restrain it from causing interference within nearby buildings.

- - - simple systems favored

The large installations discussed thus far have been of rather specialized de-

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PROFITS

MODEL 504
Does It All
And Does It RIGHT

ACCURACY: The 504 has an overall guaranteed accuracy of 2% on all D.C. and 3% on all A.C. functions. SUPREME guarantees the ENTIRE instrument to be accurate, not just one component part.

New "Perma-Grad" TEMPERATURE compensated circuit assures this accuracy summer OR winter. This is an EXCLUSIVE feature.

GUARANTEED RECTIFIER PERFORMANCE:
The copper-oxide rectifier in the 504 is unconditionally guaranteed for 90 days—exactly the same as every other part.

COMPLETE CONDENSER ANALYZER: The 504 is also a COMPLETE condenser analyzer and will check leakage of all electrolytics, regardless of the CAPACITY or the WORKING VOLTAGE. There are seven D.C. test voltages from 25 to 450 volts with complete listings on the roll chart. Tests are made on an English reading scale and discard limits were set with the cooperation of three of the leading condenser manufacturers.

2-WAY PROTECTION AGAINST OBSOLESCENCE: There are two ways in which a tube tester can become obsolete: (1) a change in tube base arrangements and (2) a change in filament voltage.

The 504 has a "PATENTED DOUBLE FLOATING FILAMENT RETURN SELECTOR" which automatically reconnects every tube socket to the proper arrangement while the instrument is being set-up according to the tube chart. This is done REGARDLESS OF PRESENT OR FUTURE TUBE BASE CONNECTIONS.

There are now about 125 different bases—the Model 504 does not care if there are 2000 or more.

The 504 has also licked obsolescence due to high filament voltages by using the SUPREME VARI-VOLT FILAMENT SELECTOR CIRCUIT which makes possible ANY filament voltage from 1.5 to the full line voltage. Arrow-way test system, set controls from left to right—just follow the arrows.

QUALITY AT A PRICE YOU CAN AFFORD TO PAY: If you can afford a telephone or if you can buy your cigarettes you can afford the Model 504. This big Model 504 laboratory, combining a 7-way tube tester, a 31 range set tester, and a complete condenser analyzer, costs you no more than 18c a day on the world's easiest installment terms.

SEE MODEL 504 AND OTHER NEW 1940 SUPREME INSTRUMENTS AT YOUR FAVORITE JOBBER. WRITE FOR NEW LITERATURE.

Think this over, Mr. Serviceman, YOUR PROFITS DEPEND ON SATISFIED CUSTOMERS. And customer satisfaction depends on the accuracy AND COMPLETENESS of your servicing. Protect YOUR reputation as a REAL serviceman with the test instruments that have proven "Supreme by Comparison." SUPREME—today's most modern testing instruments. Sold on easy installment terms.
sign. Such installations, however, represent a very small percentage of the total. Even many of the other apparently extensive sound projects are quite standard and involve no great problems.

In the Ford exhibit, for instance, the installation comprises 26 amplifiers, 25 microphones and over 30 speakers. Yet this includes 23 small individual systems each consisting of a Webster Type FEX18 amplifier, floor-stand speaker and a breast-plate microphone, for applications such as that shown in Fig. 9. In these there are no complications whatsoever. The microphone, speaker and amplifier are close together and operate as a completely independent system. The balance of the equipment is utilized in connection with musical programs in a great outdoor court, with remote speakers and amplifiers in two private lounges and telephone line connections to enable broadcast stations to pipe the music out to their studios. This equipment is all standard, using Webster amplifiers throughout.

Frank Buck has found that a running commentary on the animals during an act lends much to the interest of the audience. His show and two employ two Clarion systems.

**coverage patterns**

Speaker angles play an important role in many installations. In some it is desirable to diffuse the sound to the greatest possible extent, but in others definite directional characteristics are important. Thus in the amusement area the ballyhoo systems at sideshows usually employ two speakers mounted on the front corners of the building and facing away from each other sufficiently to provide coverage up and down the midway, and avoid uncomfortable sound intensity directly in front where the customers have been attracted to watch the outside show which constitutes the come-on. Such an arrangement, typical of the amusements, is shown in Fig. 10.

In many of the exhibits, on the other hand, it is desirable to confine the sound to an area directly in front of the feature, avoiding interference with other exhibits nearby in the same building. Perhaps the most common way of doing this is to use one or two speakers, aimed in the desired direction and with just enough output to cover the desired area. This arrangement is typified in the installations of Fig. 9.

A less usual but highly practical arrangement is that employed in the Beechnut Products Building, as shown in Fig. 11. Here there are several Opera radio sound systems operating simultaneously in the various parts of the exhibit, each with its own separate descriptive talk. To avoid conflict with one another the speakers of each system are mounted just a few feet above the heads of onlookers and pointed directly down. By using very low power each speaker provides coverage of only a very limited area of floor space, but with a suitable number of speakers any required area can be effectively covered. Other variations are numerous. At Billy Rose’s Aquacade, for instance, the main ballyhoo system utilizes a 70-watt Lafayette amplifier with four 6-foot trumpets driven by Cinadagraph units. With such power severe discomfort would be experienced if nearby areas were within the direct field of the speakers. Moreover, the immense size of the Aquacade provides its own visual ballyhoo for everyone within a block or so of it.

The trumpets are therefore mounted atop the great sign a hundred feet or so above the ground level as seen in Fig. 12. Moreover, they are tilted down only slightly. In this way sound is directed out over the nearby buildings to distant points so effectively that the ballyhoo is

Puppet shows play an important part at the Fair. Here are two which illustrate the extreme-life size dancers at the Fair’s largest dance place, the Savoy (left), and the tiny figures on the 4-foot stage of the Swift exhibit. Both use Lafayette systems.
As the machines. microphone input provided troubled. The sounds are brought out through a speaker and the noise contrast visually indicated on the oscilloscope mounted on the back wall. easily audible a half-mile or more distant, even above the high noise level prevailing throughout the amusement area, and no discomfort is experienced either by the public or other exhibitors nearby.

In the Remington-Rand exhibit, also Lafayette equipped, the problem of demonstrating a long line of business machines without conflict between descriptive talks was solved in another manner. Here attention is concentrated on one machine at a time (Fig. 13) and is centered by directing the sound over an area immediately in front of this machine. For this purpose the sound is provided by a single amplifier with its microphone input circuit wired to several jacks mounted along the line of machines. Six speakers are used, mounted in dome baffles, along the wall. As the demonstrator progresses along the line he plugs in his breastplate microphone at successive jacks and in doing so automatically cuts in speakers providing proper coverage for each particular demonstration. This is illustrated in Fig. 14, which shows the condition when he is starting his demonstration at one end of the line and with his microphone in jack No. 1. When he moves on to position 2, loudspeakers 3 and 4 are made operative, the field of coverage advances and the crowd moves along with it.

The advantage of this system is that the crowd is automatically kept close enough to each demonstration to give it concentrated attention, yet at the same time is kept circulating and in this way is enabled to cover the entire exhibit thoroughly, under expert guidance.

The Remington-Rand noiseless typewriter exhibit provides a highly practical solution of an otherwise insoluble demonstration problem. To show the advantages of a noiseless typewriter versus one of the standard variety is easy in a normally quiet room, but in an exhibition hall with its constantly high noise level this is something else again because even the standard machine will sound relatively quiet. A soundproof room was therefore fixed up, as shown in Fig. 15, separated from the hall by a large glass window to enable the public to see inside. In this room, which is furnished as a private office, a skit is staged. An executive at his desk receives a telephone call, but is unable to hear the party at the other end of the line because of the clatter of his secretary's typewriter. He therefore has to ask her to remain idle while he finishes his conversation. In the next scene the same thing is repeated except that this time she is using a noiseless typewriter and, of course, it does not interfere with his phone conversation.

The sound system brings all of this (Continued on page 484)

One of the few custom-built sound systems at the Fair is the one employed in the exhibit of the Aetna Life Insurance and Affiliated Companies to demonstrate actual heart beats by means of speaker and oscilloscope, showing the effect of exercise on this organ.
HIGHER GOALS

By SAN D'ARCY

The National Association of Broadcasters' statement "the Service Man's activities are part and parcel of the industry's efforts to promote all phases of radio, new set sales and service..." forcibly indicates that at long last the Service Man is recognized as an extremely vital link in the billion dollar radio industry. To further express their faith in Service Men, NAB reports that "an increase in the number of radio stations cooperating in the year 'round campaign with the local chapters of the Radio Servicemen of America currently is being registered."

It is not strange that for nearly fifteen years such recognition has been either withheld or reluctantly given. Ten years ago the most reliable sources estimated that over 40,000 men were engaged in servicing, either full or part time, the 14,850,000 receivers then in operation. The ratio of Service Men to set owners was 1 to 371.

- poor beginnings

It was easy for screwdriver mechanics to make money in 1929 and during the next few years when the depression became acute. Many receivers employed 12 to 15 tubes, and even a calloused faker who knew nothing about repairing radio sets could unluckily acquire the fault in any receiver to "a few defective tubes"—install these, pocket the few dollars—and seek a new sucker.

By 1934, the picture had changed in a few respects. There were, it is estimated, 26,000 men engaged in service work on a full-time basis and another 10,000 part time. The continued unemployment era accounted for the large number of part-time operators who still held on. Thus with 21,500,000 sets in operation, the ratio of sets to Service Men approximated 597 to 1.

As this is written the entire picture is completely altered. Even the most liberal estimates count only 16,000 men engaged in service work on a full-time basis. Perhaps, another 3,000 is capable in part time work. Yet there are over 40,000,000 receivers in home (or portable) operation with another 7,000,000 in automobiles. We now find the ratio of sets to Service Men approximates 2,473 to 1 as compared with 391 to 1 in 1929.

- other transitions

In 1929 over 22,000 dealers, department stores and other retail establishments maintained their own service departments. By 1934 the number dropped to 18,000. Meanwhile, independent service shops gained recognition and took over repair work formerly done by dealers' own service departments on a split fee or profit sharing basis. Today, this cooperative arrangement is more firmly established than ever before. Less than 7,000 retail stores and dealers operate their own service departments. In many small communities that support 8 or 9 radio retailers (including department, electrical supply, hardware, drug stores or cigar stores) 2 or 3 capable Service Men have cooperative arrangements for handling all repair work. These Service Men generally operate from their homes or from a service shop that does not include an inventory of radio receivers other than midgets or battery portables and they buy their parts from local distributors at established Service Men's discounts. Statistics indicate that the average Service Man who operates from his home maintains an inventory closely approximately $900. Aside from instruments and tools he generally carries a representative stock of fast turn-over component parts and tubes—also an automobile not included in this figure.

Service Men who operate stores or separate shops, according to statistics, carry an inventory just two and a half times as large—the difference being made up by an inventory which will include some receivers, electrical appliances and incidentals such as flashlights, batteries, electric fans, incandescent lamps, etc. In either case, whether the Service Man operates from his home or from a shop, he is in most cases a well established figure in his community and has a listed telephone. In other words, he is a small merchant and many are members of their local Kiwanis Club, Chamber of Commerce and similar civic organizations. Compare this figure with the transient Service Man of 1929 who, operating on a part time basis, could only reach during the dinner hour or the night as otherwise he was engaged out on the streets seeking some means of full time employment. Of course, this floater generally had no business card and the classified phone book rarely listed him under the Radio Service classification.

- constant improvements

So the position of those Service Men who have been able to survive these last few years has constantly been enhanced. In no small measure the development of ever increasingly complicated circuits has played its part. Today, a Service Man must be able to repair any and all sets regardless of vintage or circuit design to earn recognition in his community.

During the first nine months of this year over 30,000,000 tubes were sold as replacements. Service Men were point-of-contact and handled 70% of this volume or over 21,000,000 tubes. Before this year is over, Service Men will probably account for the sale of another 7,000,000 tubes for a grand total of 28,000,000 units during 1939. Present estimates indicate that only 13% of the total volume of tubes sold for replacement will be handled by retail establishments, mail order houses and all other outlets, while 87% will pass through the hands of Service Men engaged in service work primarily.

- vital link

As stated in our opening paragraph, the vital importance of America's 16,000 Service Men in helping keep over 47,000,000 receivers operating efficiently, was finally recognized by the National Association of Broadcasters. It is well for NAB to support the very foundations upon which their structure rests.
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---

GREAT VALUE at $22.00

Model RAH (or RAL)

Excellent for both speech and music... Reduces Feedback... Gives flat response without undesirable peaks... Amazingly rugged. Frequency range 60 to 7500 CPS. Output, –58 db.

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(1) FREE Window Decal advertising your Sound Service. Size 5¼ x 9¼, finished in 4 colors. 2) FREE Window Display, 1 x 17 (3) Special Sound Equipment Letterheads. Samples and prices on request. (4) FREE use of cut for printing business cards, etc.

Specify AMPERITE MICROPHONES

AMPERITE CO., 561 BROADWAY, N. Y., U. S. A. CABLE ADDRESS ALKEM, NEW YORK

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History repeats itself, even in the radio industry. We are again witnessing a rise in the popularity of furniture combinations with radio tables, radio bookcases, radio secretaries, sponsored, among others, by Zenith. Voltage doubler power supplies are coming back, also by Zenith. We have with us once more some clock model sets of Majestic and Detrola. Magnetic phonograph pickups are also staging a comeback, some with ultra-midget step-up grid matching transformers for additional pep. We have headset adaptors in Stromberg-Carlson's Model 405, for both magnetic or crystal types. Oh, yes, we have battery sets, aplenty!

We are glad to report further efforts in the industry towards standardization including speaker voice coils which now lie in the range between 2 and 6 ohms. Octal sockets are standardized at 1 15/16 inches between mounting centers. More and more sets are earning the approval of the Board of Underwriters, which is a healthy sign. Battery sets are included.

• • • parts

There are many noteworthy improvements in parts: wire-wound resistors have new ceramic coatings rendering them entirely waterproof; carbon comp.

Fig. 2. Wilcox-Gay is pushing home recording with their model A70 portable Recordio.

position resistors are better all-round; they are smaller with better insulation. Glass is used on resistors and on wire by Charostat and Lenz, adding considerably to the safety of all kinds of sets and equipment. Solar has a new line of improved wax-moulded tubular condensers... Micasolid has introduced their Kodacap, a 600-volt tubular which uses a treated cellulose derivative di-

are becoming popular. Speakers come in for their share of improvement with more and better permanent magnets. Alnico type magnet manufacturers have four types of alloy available for speakers known as red, blue, green and red dot magnets—for various price classes. For compacts, speakers are smaller with closer air gaps and higher pitched to give more apparent volume.

Sprague has a push-button switch assembly with the capacities all contained in one unit. Cornell-Dubilier has a new dual urica condenser for diode by-pass and r-f filter. New glove type tube shields have become standard. Slow-acting Littelfuses have been designed for reactive circuits where surges are large and steady-state currents much lower.

There is something new under the sun in switches and switching. RCA's Model U12, shown in Fig. 1, has a silent mercury on-off switch for automatically starting (or stopping) the turntable as the pickup is moved toward the record. Incidentally, another feature of this particular table model is that both 10- and 12-inch records may be played with the lid down, a decided advantage, we believe. On one of G. E.'s phonograph electric... Mallory and Magnavox are specializing in fabricated plate types of electrolytics and Cornell-Dubilier, among others, specializes in an etched foil type. In general, all types of condensers have less leakage, higher voltage breakdown, less equivalent resistance, improved power factor, better by-pass action and a longer expected life. We hope the cardboard types used in the cheaper midgets will also come in for some of these advantages, especially the longer life expectancy.

Volume controls are better, smaller and cheaper with better tapers now available and ranges are extended as high as 20 meg. The old paper-ink surface is replaced with a fired-carbon coat on bakelite which has a longer life with less noise. Non-microphonic sockets for 1H5 detector-audio tubes in battery sets

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combinations there is a dual switch on the pickup, automatically switching off the radio end and starting the phonograph motor when the pickup is raised. A new type of slide switch, approved by the underwriters, has been developed for a wide variety of uses including tone control and waveband switching, as well as for television audio and photo pickup input circuits.

**• • • phonographs and records**

Phonographs and the record business are booming. Prices have dropped and lower priced records are becoming available in order to reach the masses. New magnetic cartridge pickups have already been mentioned. Pickups by Webster all have dial lights in the head which light when combinations are switched for phonograph operation. The trend is definitely toward rim-driven motors. A variety of new, small, cheap rim-driven, shaded pole, constant speed motors are now available. A great advantage is the elimination of all gear noise. On d-c, vibrator converters are being used to generate 60 cycle a-c, for operation of these motors. These vibrators have been highly developed so that they are thoroughly reliable, creating a minimum of noise and having very good frequency regulation. Service has shown a 2-tube 60-cycle oscillator which is also suited to running many phonograph motors on 115 volts d-c. Wilcox-Gay is pushing home recording with their phonographs. Model A71 (Fig. 3) is a large combination console for home use and Model A70 portable Recorder for portable use. See Fig. 2.

**• • • battery sets**

There is no let-up in battery receivers. The battery-power line combination sets are proving popular as all-year-round models for use on a-c or d-c line during the indoor season while using batteries for portable operation only. A new arrangement provides high power output for line operation. This is accomplished by using a real power tube and special tapped output transformer.

**Fig. 8. Decorative metal bars on speaker grills in true modern fashion are appearing on the Westinghouse WR172 and WR272.**

The power tube, for reasons of economy, is combined with a half-wave rectifier, two tubes now being available—the 70L7 and the 117L7—the latter being the first line voltage heater available. Obviously a substantial speaker is required in these models. There are many new ingenious methods of increasing battery life through the use of clever nick-tacks. Pilot has two ideas. In Model T1021 (Fig. 4) there is a small switch midway between the usual two knobs which operates the Economizer. When moved to the right, to Normal, maximum volume and sensitivity are obtained. When moved to the left, to Low, an 800-ohm resistor is inserted in the B-minus lead to ground (see Fig. 5), increasing the grid bias on the power tube which slightly decreases sensitivity and volume but cuts the current drain from the B batteries to about half. Of course, the quality must suffer somewhat, but, in some cases, the saving will be more important than the increased harmonics. The other battery saving stunt is a safety switch on the top of the panel. See Fig. 6. When the panel is covered when not in operation, the switch opens the battery circuit. In Models T1451 and 1452 a relay is employed which switches automatically from battery to line operation when plugged into a power line. (See front cover.) Another feature is that, when used on line operation, the set starts immediately, being powered by the batteries until the rectifier tube warms up, at which time the relay throws over to power operation.

RCA has a neat pilot device to show when the set is turned on. Model BT42 has an Economy Blinker. This is only a familiar low period neon oscillator used in parallel with the B battery but does the job remarkably well. Fig. 7 shows the details of the system. The current drain through the 3.9 meg resistor is very low and can readily be considered negligible in practice.

As to trends in cabinet designs, decorative metal bars on speaker grills are appearing in true modern fashion. See Westinghouse WR172, WR272, Fig. 8. Other Westinghouse styles include table models with bent sides as in Model WR168, Fig. 9, and models with rounded tops known as waterfall tops as in WR169, Fig. 10. RCA Model T62 shows a distinctive style cabinet, a typical attempt to deliver something different. See Fig. 11. Note the one-piece escutcheons including push buttons on some of these models. European dials with tables of data are appearing on some sets. The RCA Aviation Division's 6Q4 and 6Q4X are representative. (See Fig. 12.) RCA has several World's Fair models.

**• • • other trends**

The arrival of a new European war has stimulated interest in short-wave reception which ought to promote some service jobs. (Most owners previously haven't cared much whether the short-wave end of their sets was in working order or not.) It might also promote sales of new sets with emphasis on
short-wave performance. Tube sales should also be stimulated as the short-wave end always goes dead before the broadcast band when tubes start losing their normally high values of transconductance. The export departments have shifted their attention from Europe to South America which may change the wavebands somewhat in future export models. But long waves will still be used in American aviation. RCA's Pilot home receivers have already been mentioned. These sets permit high quality reception of conventional broadcasts as well as short-wave foreign broadcasts down to the 13-meter band. But they also cover the long-wave aviation beacon bands. Emphasis is placed on performance between 2000 and 6000 kc where plane intercommunication takes place. Thus, pilots and their families can keep in touch with everything that goes on in aviation. Aviation weather is given by beacon stations in between the beam signals although new stations are designed to give weather and beam information simultaneously. Filters in the receiver are required to separate the voice from the beam. Learadio, who specialize in radio equipment for planes, have a pilot's battery portable receiver which takes in the long-wave beacon band as well as standard broadcast.

Zenith had the right idea in using a moulded chassis. Maybe they had advanced information on the war and knew what would happen to steel! More cabinets and parts are being moulded all the time. Wood photo finishes are being used for two-toning.

The tendency is away from dual tuning knobs with various ratios, only single knobs are used. The trend is also away from complicated friction and other drive arrangements and toward a simple string cable drive. Those Service Men proficient in knitting or crocheting will be a jump ahead of others.

Figs. 15 and 16. Ansley has a hum balancing scheme which uses a potentiometer in either the control or screen grid circuit of final stage.

We note a conservative trend, too. All DeWald a-c models are using 6Y6s, 6K6s or 41s on 150 volts B, thereby eliminating many chances of voltage breakdown, especially in power transformers. Filter condenser life should be greatly prolonged also as plenty leeway is available. Less heat is generated within the set, too. There is a strong tendency toward the complete elimination of grid bias in all tubes except the power stage. The r-f tubes receive bias from the diode-detector-a-c voltage and the first-audio tube is operated with the cathode directly grounded and the grid grounded through a very high grid leak resistance usually of the order of 10 or 15 meg. This system of operation is satisfactory only when the input level is very low—such as the output of a diode detector. In large sets, special function tubes such as phase inverters and noise eliminators or noise gates may require individual bias systems.

In sets using loop antennas with two or more wavebands, separate loops are used in some cases rather than a single tapped loop. Fig. 13 shows Wells-Gardner 1A29 which uses two loops and a loading coil for three-hand operation. A noise gate, just mentioned under special bias, is also featured in this model. Antennas are usually coupled to loop sets inductively with a turn around the outside of the loop. Fig. 14 shows Wells-Gardner 6A27, which features capacity coupling from antenna to loop. Trav-ler mounts their loop trimmers right on the loop.

An absence of single tuned i-f transformers is noted; most new transformers use two trimmers. Ansley has a hum bucking or balancing scheme which uses a potentiometer in either the control grid or screen grid circuit of their phonograph amplifiers which might be applied to the final stage of a radio set as well. See Figs. 15 and 16.

• • • tubes

Tube types are still on the increase. The present principal fields of activity are battery and combination line and battery portable tubes and also the 150 ma a-c, d-c series with more single-ended tubes and higher voltage cathodes or heaters. Just as a few examples, the

Fig. 9. Westinghouse WR168 table model cabinet has bent sides which give it stylish lines.

3C5GT is identical in many respects with the popular 1C5GT except for the filament which has two strands permitting either series or parallel operation. With the parallel connection, the tube draws 110 milliamperes at 1.4 volts, just as the 1C5GT. However, when the filaments are operated in series, the current is then only 50 milliamperes (the same as the other tubes in the set), but, of course, the voltage is doubled. It should be noted that, when the filaments are used in series connection, approximately 1.4 volts less bias is required as the increased filament voltage adds to the effective control grid bias. The 12SF5 is a similar beam-power output tube with series or parallel filament arrangement. The 12S5F5 is a single-ended metal type of high-ma triode similar to the 6S5F5 except for the heater rating of 150 ma. The 70L7GT and 117L7GT are cathode type duplex tubes consisting of a beam-power amplifier and a half-wave rectifier in a single envelope. They are designed especially for use in small a-c.
Fig. 19. A four-pole television antenna array, such as the RCA type shown, is used in localities with very high noise level and low signal strength.

d-c and combination battery and line receivers where space and heat dissipation are prime considerations. The ITSGT is a beam power output tube intended for use in low-drain battery operated portables. The filament consumption is only 50 milliamperes. The IBGT is a triple-purpose diode-triode detector audio voltage amplifier and output beam-pentode power-amplifier in one envelope. The primary purpose for the combination is for the conservation of space in portable compact sets, although there is an actual gain in audio output over the JHSGT-ITSGT combination.

There is also a tendency to provide certain rectifier tubes to automatically supply the correct filament requirements for pilot lamps, in a-c, d-c sets. The 45ZGT is the newest member of this family. This system of operating pilot lamps does away with external resistors and, more important, prevents the filament-wrecking surge that occurs every time the set is turned on.

We can be sure that special purpose tubes will be ever appearing whenever a sufficient demand exists for them. The Bantam Jr. series of Hytronics Laboratories consists of a general purpose triode, a high gain, high impedance interstage a-f pentode and a power-output pentode. The principal applications of these ultra-midget tubes are for wearable hearing aids, portable pre-amplifiers, miniature compact receivers, remote control apparatus, meteorological instruments and sensitive measuring devices. We may expect even smaller tubes than these sooner or later for various novelties such as true pocket receivers as well as for the above range of applications.

It is interesting to note that the harmonic distortion in all the power-output tubes, beam and otherwise, is still between 7.5 and 11 percent and, more commonly, the latter. While this is undoubtedly justified in portable and compact secondary receivers it is about time that improvements were made up the line. We hope the trend next year will be toward better quality—say, for instance, by the use of more push pull stages in medium-priced table models and low-priced consoles. With few exceptions, at present only the high-priced consoles and large table models are permitted push-pull output stages with their attendant high quality.

- *frequency modulation*

While considering quality we might as well bring up the subject of frequency modulation right here. It is interesting to note that this is an exclusive American development by Major Armstrong. There is no counterpart whatsoever in Britain or Europe. The new frequency modulated system employs the use of ultra-short waves and the signals travel only slightly beyond the horizon. This would allow many stations all over the country to operate on the same frequency, opening up an almost unlimited number of channels. Dr. W. R. G. Baker of General Electric says that frequency modulated transmitters can be built for approximately one-fourth of the usual broadcast station which would open up the market for a lot more customers. Since the characteristics of frequency modulation differ greatly from the conventional amplitude modulation and since most static acts like an amplitude modulated signal, the frequency modulation receiver picks up the new type of broadcast almost completely free of static. G. E. radio officials showed that 96 percent of existing static, both atmospheric and man-made, is eliminated from programs broadcast with the frequency modulated system. Also, when there are two or more interfering frequency modulated signals present in the receiver, no interference with the strongest signal will take place even though the interfering stations represent a considerable fraction of the level of the strong station. Contrast that with our present system where even a very weak signal will produce a very annoying beating note.

Stations in New York, Boston and Schenectady are already on the air with frequency modulation. There will probably be a half-dozen or more during 1940. G. E. already has three models of receivers available, two of them equipped to receive only frequency modulated broadcasts, and a third (see Fig. 17) which also combines three-band radio reception of the conventional type. Outstanding characteristic of the new receivers, so far as the public is concerned, is their ability to recreate music and voice to an astonishingly life-like degree, with an almost complete absence of static and interference.

- *television*

With many new stations under construction and many more construction permits applied for, television is making great headway. With five or six principal receiver manufacturers having sets in the field, it remains only for the stepping up of broadcast schedules to put a lot of sets in the hands of the public. For a while, at least, transmission will take place only in the larger cities where a reasonable prospective audience will be located within range of the transmitter. This is an economic consideration, as a television transmitter represents a considerable investment. A number of manufacturers now have special television antennas on the market. Both RCA and G. E. have single, double and four-element arrays which, though not alike, represent general practice. A single dipole is sufficient where the receiver is close to the transmitter or where a good signal is received and no great amount of reflective interference or man-made static is encountered. A reflector is added when reflective interference produces ghost images in order to confine the received signal to one direction only. The reflector also increases the pickup. A four-pole antenna (Continued on page 489)

Fig. 17. The RCA Aviation Division's 6Q4 and 6Q4X employ European type dials with tables of data.

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FREQUENCY MEASUREMENT

By GLENN BROWNING & FRANCIS GAFFNEY

Here are at least two general methods employed for frequency measurement. One depends upon the reaction from an accurately calibrated wave meter. The wave meter either indicates resonance on a vacuum-tube or similar voltmeter or gives a readable reaction of the frequency source.

The second method employs a heterodyne frequency meter. There are many variations to the general procedure. However, they all depend upon combining two frequencies, one of which is accurately known, in some type of mixer circuit and obtaining an audio beat note between the two frequencies. This method of procedure is comparatively simple and at radio frequencies the accuracy is extremely good. Unknown frequencies can be determined to 1 part in 100,000 or better. This article concerns itself with the latter method. It is believed that sooner or later the Service Man must have as part of his equipment some means of accurate frequency determination.

A very simple and inexpensive frequency standard composed of a 100- and 1000-kc oscillator, such as that shown in Fig. 1, may readily be set with an accuracy of one part in 200,000 against the national Bureau of Standards station WWV, which transmits a standard signal accurate to one part in 5,000,000. Provision is made for either modulated or unmodulated 100- or 1000-kc standard frequencies, any of which are available by switching. The circuit utilizes a mixer tube so that a frequency from a signal generator, oscillator or other device may be fed into the mixer tube and an audio beat note produced in the plate circuit. An audio amplifier and phone jack allow the beats to be heard readily.

The wiring diagram of the apparatus is shown in Fig. 2. A 6SK7 is used in conjunction with a stable 100-1000-kc oscillator standard for producing the radio frequencies. The standard is an integral unit consisting of the two coils for 100 and 1000 kc respectively, together with their large silver mica condensers and a band switch for switching either of the coils into the circuit. The entire assembly is mounted in a shield can similar to those used for i-f transformers. Brass plungers are used for varying the inductance of both the 100- and the 1000-kc oscillators slightly and thus the standards may be set against WWV or any broadcast station. The procedure in this case is to tune to WWV and also impress the signal from the frequency standard on the antenna. When these two signals are picked up in the receiver, the resultant output is a beat note between the two, and this beat may be adjusted readily to within 25 cycles of zero, in which case the 100 and 1000 kc are at their respective frequencies to about one part in 200,000. Better initial accuracy may be obtained when extreme care is taken in the audio beat adjustment. A 6C5 tube in an audio oscillator circuit is used for modulating either the 100 or the 1000 kc so that the apparatus may be used in place of a signal generator for particular applications.

By including a 6SA7 mixer tube and bringing out a terminal from one of the

**Fig. 2.** The Browning frequency standard utilizes a mixer tube so that a frequency from a signal generator or other device may be fed into it and an audio beat produced.
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NATIONAL UNION RADIO CORP.

57 State St., Newark, N. J.

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YOU can bank on the dependability of every instrument in RCP's complete line. You can bank on them to save valuable time. And you can bank the money earned whenever you use RCP equipment... because they cost you less.

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The Quirk Charg-O-Matic battery is a small storage cell enclosed in a specially designed Lucite spill-proof case. It has been made to fit all standard flashlight cases in which two ordinary 1/4-in., size D cells are used. A small charging unit is provided to recharge the little storage cell from the 115-watt a-c power lines. A special charging clip for automobile use is also available for operation from a 6-volt storage battery. One discharge cycle the Quirk cell is said to be the equivalent of a pair of average dry cells. The unit should find application in battery portables, it is claimed.

Additional information may be obtained directly from Quirk Battery Co., Highland Park, Ill.

RCP Electronic Multimeter Model 660

NOT RARE. IN INSTRUMENTS OBTAINING 3 in 1, others will find the same extraordinary ranges, the sensitivity and facilities for measuring large values at this new vacuum tube-volt-meter-ohmmeter offers. Ranges up to 600 volts and 1 billion ohms. Lowest voltage reading 0.1 volt. Gets its unusual sensitivity from an input resistance of 5.9 million ohms. Total of 12 ranges all on direct reading meter scales. Extreme operating simplicity, remarkable versatility. Supplied complete in hand-rubbed anodized metal case. Net $18.85

RCP Trouble Shooter Model 432

LOWEST PRICED "LEGITIMATE" tester on the market. Multi scale D'Arsonval meter 1 mill, accurate within 3%. Individual scale 1000 to 10,000 ohms, with sensitivity of 0.1% per milliohm. DC voltage 0-5/0-50/0-500/0-1000 at

RCP Universal Supersetter Model 411

THE MOST COMPLETE. No tester ever designed to provide measurements of such accuracy in room before additional installation. Use it to check heavy circuits, use it in Picture testing. Features include: 12 AC-DC voltage ranges to 1000 volts. 6 AC-DC current ranges to 25 amps. DC milliamperes 0-10/0-100/0-1000 DC microamperes 0-1/0-25/0-250/0-2500. DC volts 0-100/0-1000/0-10,000/0-100,000. DC millivolts 0-1/0-10/0-100. DC watts, 0-1/0-25. In attractive natural finish wood case. Net $16.25

RCP Pocket Multimeter Model 413

IT TOOK RCP to design a pocket size instrument with all the sensitivity, ranges, and features of the large expensive testers. Here in the same quality and accuracy of component parts, but think of the ease and the money you save! Sensitivity: 600 microamperes, or 5500 ohms per volt. Free Ahsler magnet identical to that used in ultra-sensitive, high current meters. AC, 3/19/30/350/1000/2000/5000. DC volts, 1/10/0-25/0-500/0-1000. Ohms, 0-25/0-500/0-5000/0-100,000. DC milliamperes 0-1/0-25/0-250/0-1000. DC amperes, 0/1/0. In attractive natural finish wood case. Net $12.90

grids of this tube, signal generators, oscillators, etc., may be calibrated accurately without the aid of auxiliary equipment.

... calibration

Let us assume that an accurate calibration of an oscillator or signal generator is desired. For purposes of illustration, we shall start with the signal generator adjusted to exactly 100 kc on its dial and proceed to check this point and then obtain further check points at higher frequencies. The procedure is as follows: The signal generator output is fed into grid No. 1 or the 6SA7. The signal from a 100-kc oscillator standard is fed into grid No. 3 of the same tube. In the plate circuit of the tube there will be the sum of the frequencies from the 100-kc standard and the frequency from the signal generator. There will also be the two individual frequencies as well as the difference between them. If the frequencies are near enough together or if their harmonics are sufficiently close together, the difference frequency will produce an audio note which is amplified by the 25AZ7 and is readily audible in head phones. If the signal generator is emitting a 100-kc signal (and of course this should be an unmodulated signal) and the standard oscillator is producing a 100-kc signal (this is unmodulated when the phones are plugged into the jack), zero beat (zero signal) will be obtained between these two due to fundamentals of the two being mixed in the 6SA7 tube. However, if the signal generator when set to the 100-kc mark on the dial is actually producing a 101-kc signal, the difference between the two will produce an audio note of 1 kc which is heard in the phones. The signal generator frequency can then be varied slightly to obtain zero beat and the corresponding point on the dial noted. If the frequency of the signal generator is varied to 125 kc, the fourth harmonic of this frequency will be 500 kc and this will beat with the fifth harmonic of the 100-kc oscillator so that zero beat can again be
obtained. In a similar manner the third harmonic of 133 1/3 kc will beat with the fourth harmonic of the 100-ke standard and thus can be accurately determined. The second harmonic of 150 kc will beat with the third harmonic of the 100-ke oscillator, etc. Thus, by means of a standard frequency such as 100 kc, numerous calibration points may be obtained on any variable oscillator.

- nomograph

Some of these beat notes, due to harmonics, may not at first be readily recognized and it is believed that the nomograph shown in Fig. 5 will be of great interest in helping to identify these beat notes.

On the graph, harmonic numbers of the 100-ke oscillator are plotted along the horizontal axis while the fundamental frequency in kc of the oscillator being checked is plotted along the vertical axis. A series of oblique lines are drawn which represent harmonic numbers of the variable oscillator. We shall call these oblique lines the "harmonic lines of the variable oscillator" and refer to them as the "fundamental line," the "second harmonic line," etc. To obtain an idea of the working of the graph, suppose we consider the variable oscillator to be set at 500 kc. At this position, the fundamental of the variable oscillator will beat with the fifth harmonic of the 100-ke standard. This is shown by the intersection of the fundamental harmonic line with the ordinate (vertical line) drawn through the fifth harmonic point of the 100-ke oscillator.

In this position, it can also be seen that the second harmonic of the 500-ke oscillator will beat with the tenth harmonic of the 100-ke oscillator as denoted by the intersection of the second harmonic line with the ordinate through the tenth harmonic of the 100-ke oscillator. Similarly, the third harmonic of the variable oscillator will beat with the fifteenth harmonic of the 100-ke oscillator, the fourth harmonic of the variable oscillator will beat with the twentieth harmonic of the 100-ke oscillator, etc. Notice that all of the harmonics of the variable oscillator will zero beat with some harmonic of the 100-ke standard so that absolute zero beat will be obtained in the phones when perfect synchronism is reached.

Now as to the use of the chart in determining the beats produced as the variable oscillator is advanced from say 500 to 600 kc. In making this analysis, one restriction on the chart which differentiates it from an ordinary graph must be borne in mind. This is that beat notes will occur only where a harmonic line crosses a vertical line drawn on an integral harmonic number of the 100-ke oscillator. This is obvi-
Fig. 3. The fundamental of the signal generator is shown by the intersection of the harmonic line with the ordinate (vertical line) drawn through the particular harmonic point of the 100-kc standard.

obtaining possible beats with a 1000-kc standard. This is done by using the same harmonic numbers along the horizontal axis and by multiplying the variable frequencies plotted along the vertical axis by 10. The same harmonic lines may be used and the same extension method employed as previously described. For instance, the tenth harmonic of 5 mc will give zero beat with the fiftieth harmonic of a 1-mc standard, etc.

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482 • SERVICE, OCTOBER, 1939

Behind every CLAROSTAT control there's almost two decades of specialized experience with resistance problems. It's this unparalleled experience, more than so much metal or bakelite or resistive material, which is of prime importance to you in your service work.

Remember, too, CLAROSTAT comes in both compositions and wire-wound types. Also in both standard and in exact-duplicate types for replacements.

The new Midget or Type M control, introduced a year and a half ago, has already won over many servicemen because of its fine performance in many sets.

Most important of all, CLAROSTAT controls are backed by a really complete service manual which lists the control requirements of all standard sets in use.

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Clarostat Mfg. Co., Inc.
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Here's a brand new feature that will UP your profits!

THE NEW WESTON MODEL 777 TUBE and BATTERY TESTER

tests batteries as well as tubes under load
... gives dealers and servicemen extra sales and profit from battery replacements!

Tests Radio Batteries Under Correct Load
"Good — Replace" indications based on battery manufacturers' standards and receiver requirements for good reception.

★ Tests high filament voltage tubes (up to 117 volt types)
★ Tests Loktal tubes
★ Tests OZ4
★ Tests ballast tubes
★ Tests for shorts
★ Tests for noise
★ Tests open elements
★ Individual element test
★ Spare socket for possible future requirement
★ Large WESTON Meter

Look at the figures ... and the opportunity. Over 30% of radio sales in recent months were portable battery or combination receivers. And sales still mounting and expected to climb in 1940. Here's a real opportunity to sell tubes ... and a brand new market in the sale of battery replacements. To enable servicemen and dealers to 'cash in' on this opportunity, WESTON provides the Model 777 Tester ... which not only provides a thorough check on all tubes, but also tests all radio batteries under load. The "Good — Replace" scale instantly indicates whether the battery delivers sufficient potential to insure good reception. (Such a test cannot be made with ordinary battery testers, nor with high current drain meters.)

So with Model 777 you not only will be equipped with a tube checker that will remain serviceable for years, but you also will be able to check the batteries while you are checking the tubes. No tube checker today is up-to-date unless it supplies this battery test ... enables you to give complete customer satisfaction, with more profit for yourself.

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Newark, New Jersey

Available in counter and portable types
PUBLIC ADDRESS

(Continued from page 469)

action to the observers outside the window through the media of microphones on the desks to pick up the voices, and contact microphones attached to the two typewriters. The output level at the Jensen 15-inch dynamic mounted just above the large window is set to overcome the local noise and thus provides a highly realistic and effective demonstration. An oscilloscope permits the audience to see as well as hear the relative sound peaks of the two machines.

- animated sound

One variety of sound equipment that finds considerable favor with exhibitors is the Robophone, a system in which all sorts of mechanical operations are controlled and perfectly synchronized with sound from records. Thus, robots are made to move their lips in unison with the recorded speech accompaniment, pictures are turned over or stereopticon views are changed as a recorded description of them proceeds, doors or panels are opened to disclose exhibits (see Fig. 16) being described, etc. In fact, there are almost no synchronized mechanical operations that cannot be accurately controlled in any predetermined manner by this equipment. For sound specialists who are not familiar with the possibilities of the Robophone it is something that would bear looking into.

- showman’s ingenuity

A Bogen Model D-28 sound system makes possible one very striking stunt, Fig. 17, found in the Eastern States Ice Association exhibit in the Food’s North Building. Here is a large ice-box with the glass door of the center section showing the ice and food compartments. In the block of ice appears a 10-inch image of an actual living Ice Princess who is seen to move around and whose voice is reproduced through the speakers above. Later the Princess in person steps out of a side door of the box to continue her act from a microphone out front. The visual part of the scene is worked by means of a series of lenses. It is really an astonishing presentation and even a grown-up is almost moved to believe in fairies when he sees it. Obvi-ously the use of sound to bring the Princess’ voice outside the box greatly increases the realism and effectiveness of the presentation. A stunt such as this should be easy for the sound man to sell to department stores, etc., for use as an attraction for the children during the Christmas shopping period and at other times as well.

The installations and applications that have been discussed and pictured here represent only a few of the many found

Centralab
DIV. of GLOBE UNION INC.
Milwaukee, Wisc.
at the Fair. But they should help to convey some idea of the variety, both practical and novel, that has found expression in these sound installations, contributing so much to the interest and effectiveness of exhibits. It can fairly be said that sound has widened the horizons of the exhibitor many fold and has made millions of Fair visitors more sound conscious. It is now up to the sound man to capitalize this start through the application of redoubled sales efforts. Not the least part of such effort should be the full exercise of imagination and ingenuity in finding new applications. It is hoped that the foregoing will prove helpful toward this end. The result will be not only an ever broadening market for sound equipment, but definitely reduced sales resistance.

**HIGHER GOALS**

(Continued from page 470)

New set sales mean, generally speaking, an increase in the quality of home reception. Keeping sets in American homes operating is vitally important to broadcast stations who realize that 85% of all radio homes in the United States are already equipped with one or more receivers. The conversion of non-radio homes should have an inconsequential effect on broadcasters' rate structures because the addition of remaining non-radio homes would not noticeably increase buying power. The present non-radio homes exist because they simply have not the financial capacity to buy. Therefore, broadcasters will always want the best home reception it is possible to have and the burden of accomplishing this rests with the American Service Man. To that end, NAB members are cooperating with radio Service Men throughout the country by affording a special window trim to be used in their store windows. New sets are being displayed in radio studios from Baltimore to San Antonio and beyond for the benefit of listeners who are invited to inspect them. Even more active NAB participation is now beginning in the form of broadcast announcements that are being made periodically over the networks calling the listeners' attention to the fact that the station is in touch with reliable, qualified Service Men in that community and that by merely phoning to the station the listener will be advised as to how to reach that Service Man or service organization.

**BURGESS WINDOW TRIM**

A Santa Claus window background, 33 by 48 in, in full color, is offered by the Burgess Battery Co., Freeport, Ill., with an assortment of flashlights and batteries. For further information write directly to Burgess.

---

**SPRAGUE Koolohm Resistors**

The Biggest Improvement in Wire Wounds in 20 Years

Note the above exclusive features of Sprague Koolohm Resistors—and they're not all! The 9 points of outstanding koolohm superiority also include:

- Larger wire size for every value.
- Every bit of wire insulated before winding with a new resistance coating—further protected by a dark brown ceramic outer shell. The only truly insulated wire wound on the market.
- No cements or brittle enamels on Koolohms! Koolohm wire insulation allows units to be laver wound with larger wire. Values are guaranteed accurate to 5% or better, and remain constant. Now available in 5-watt fixed types; 10-watt fixed; 10-watt non-inductive and 10-watt adjustable. Sold at ordinary resistor prices. The greatest resistor buys on the market. Your jobber has them!

**CASH IN ON INTERFERENCE ELIMINATION**

No‒it is made easy for you to build new business in a growing, non-competitive field! For years, Sprague engineers have been developing practical methods for eliminating man-made radio noise from every type of electrical appliance. The Sprague Manual of Radio Interference just off the press is the result. Tells you what to do and exactly how to do it. Easy to understand—indispensable in your work. 24 pages—fully illustrated—more than 50 diagrams. Only 25c net from Sprague jobbers or direct from us.

- Shown here are the new Sprague Master Radio Interference Analyzer (at top) and the new Sprague Interference Locator (below). Low in price—easy to use—fully practical. Write for details on the complete Sprague Interference Elimination Plan.

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It's not only Scotch money-saving instinct—it's good business that leads more servicemen to use more Sprague Atoms than any other midget dry electrolytics on the market today. Atoms are smaller—more dependable—made in more single and dual capacities—have lower leakage—without higher surge—cost less! Use 'em anywhere. Atoms stand the ziff!

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NORTH ADAMS, MASS.

SERVICE, OCTOBER, 1939 • 485
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No matter what units you need to modernize your store and shop facilities, chances are you can obtain them easily and quickly merely by selling high-quality Arcturus Tubes!

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BOOK REVIEW


This year’s manual presents the servicing data for more than 2600 receiver models, an increase of about 25% over last year’s manual. This increased coverage, in 1664 pages, has been made possible through the condensation (and cross reference) of those portions of the data which are common to a number of models of a particular manufacturer’s receivers. For example, instead of running the data on the automatic tuning system along with servicing information on each receiver in which it is incorporated, etc., the data is arranged so that it is once in that manufacturer’s section and reference made to that page.

Another saving is being effected in many instances by letting in voltage values on the schematics and alignment figures on the chassis layouts that show the location of the tubes. The 188-page cumulative index which accompanies the manual makes it possible for the Service Man to find information with a minimum of effort. Each bit of data in all ten manuals is listed. Not only are the chassis numbers cross-referenced to the model numbers, but if more than one model number is used with a chassis, these are listed numerically and referred to the lowest number of the group.

The “How It Works” section contains a theoretical description of the RMA system of television transmission and reception, wireless record players, radio facsimile, and frequency-modulation receivers. An overall description of a television system occupies a quarter of the book. This covers the problems of scanning and synchronizing, the camera, and picture tubes, etc. The television signal itself is considered: the signal and sync pulses, frequency ranges, channel makeup, the RMA standard signal, etc. The remainder of the television section is devoted to those circuits with which the Service Man will have to deal, i.e., those in the receivers. A sufficient number of television receivers of different manufacturers are covered in the manual proper, so that variations in the various circuits can be discussed and this portion of the book should prove of the greatest value. Circuits have been redrawn stripped of those components which are supplementary and not essential to a comprehension of the functioning of the portion of the circuit discussed in the simple text. Power supply circuits, antennas and their installation are also covered.

It is the reviewer’s opinion that Rider’s Volume X is as essential to the Service Man as a soldering iron or voltmeter.

G. R.

ARISTON ELECTROLYTIC CONDENSERS

A newly developed line of by-pass and electrolytic condensers is announced by Ariston Laboratory, Inc., 4057 Diversey Ave., Chicago. P. H. Tartak, president of the company, states that a new etching process, to give uniform etched foil and extended condenser life, has been installed.

A new catalog has been issued, for jobbers and Service Men, which lists a complete series of replacement condensers. Copies are available on request.

THE NEW BROWNING FREQUENCY GENERATOR

(A 100-1000 Kc. Modulated Calibrator)

At last here is an accurate 100-1000 Kc. stand and which is designed to produce checking frequencies of telegraph or radio receivers at intervals of 1000 cycles. $1000 and 5000 Kc. = at a price that will enable the manufacture of this equipment to be undertaken. A built-in automatic calibrator is provided for accurately checking at 100 and 1000 Kc. intervals the frequency of oscillators, signal generators, transmitters and other apparatus. Note these outstanding features:

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6. Built-in min circuit allows checking signal generator and receivers for exact frequency.
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10. Inexpensive $19.80.

From the gadget that can write your name to the gadget that can write your signature, you have chosen devices which are accurate, dependable, and, above all, simple.

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volts, eight D.C. current ranges to 10
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50 microammeters rectangular meter.
Indicated for accuracy of measurements
in high resistance and low current circuits
employed in radio, television, sound on
film, amplifiers, etc. 852P illustrated above.

★ 844 34 range Rotary Selective
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Milliammeter including ranges to 6,000
volts A.C. and D.C. at 1,000 ohms per
volt, 11 Amps D.C. 10 Megohms, —12
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similar to Series 852.

★ 862 A Laboratory Multi-Range
Tester with large 9" x 600
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Remote Control Rotary Selective Unit.
Electrical specifications same as for
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★ 870 Complete, compact, Auto-
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3" square type D’Arsonval meter. Tests
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volts. D.C. current to 1.2 Amps, resistance
to 5 Megs, decibles to +64 D.B. Size
only 7 x 4 x 3 inches.

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Next time, remember what's in a name. Specify Cinaudagraph — your jobber (profit-minded like yourself) carries them. Complete line of electro-dynamics and P.M.'s for both indoor and outdoor application available. Catalog on request.

N. U. FOOTBALL SCOREBOARD
National Union Radio Corp. released to the trade a new football scoreboard sign produced in black, green and white 20 by 28 inches overall. The scoreboard provides for the listing of five sets of teams with team names, score by quarters, and final blanks finished in a special blackboard black paint which enables the dealer to write in the information in chalk and wash it off so it can be used week after week throughout the season. A space is also provided for the dealer to have his name lettered on as well as a space marked "special" where the dealer or person displaying the board may write in a weekly merchandise special.

National Union football scoreboard signs are made available through National Union distributors at 50c each.

WEBBER BULLETIN
Earl Webber Co., 1313 W. Randolph St., Chicago, have issued an 8-page bulletin illustrating and describing their latest test equipment for the Service Man. Copies may be obtained directly from Webber.

RCA PARTS CATALOG
In their test equipment and accessories catalog for 1939-40, the RCA Manufacturing Co., Inc., Camden, N. J., have announced many new additions to the RCA test equipment, accessories and parts lines. The catalog contains a fully illustrated listing of accessories, parts and test equipment. In addition, it presents a 16-page index of the principal replacement parts for all RCA radio, Victrola and phonograph models of the past 5 years. Copies may be obtained directly from RCA at the above address.

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488 • SERVICE, OCTOBER, 1939
array is used in localities with very high noise level and low signal strength. This type of antenna provides great sensitivity, strong and sharp discrimination against electrical and reflective interference as well as increased directivity in pickup. All these types of antennas are erected parallel to the ground and at right angles to the direction of the transmitter.

- communications receivers

A discussion of this type could never be considered complete without including the group of communication and high-quality short-wave receivers built primarily for short waves and used by many thousands of transmitting amateurs and fans. Hallicrafters, Hammerlund, Howard, National, RCA and Radio Manufacturing Engineers do the bulk of this business. The trends are toward better stability, more band spread, smoother controls, accurate calibration, variable selectivity with razor sharpness for c-w signals to broad high fidelity, higher image rejection and signal/noise ratios and output meters (called S meters) that operate over a wide range of signal voltages. Hallicrafters start with the Sky Buddy at $29.50 (see Fig. 18), which has 6 tubes, 4 bands, .04 mc to 545 kc, speaker, phone jack, avc and send/receive switches, separate band spread dial, beat oscillator with pitch control and provision for d-c vibrator operation. More expensive models have an output meter, crystal filter and many refinements. Besides their standard receivers covering these same specifications, RME has a portable-emergency receiver, a high frequency converter and a pre-selector giving additional amplification and image rejection to a value approximating 50,000 to 1! National has a wide range of receivers and gadgets including receivers in several price classes, but specializing in very high quality products for commercial installations such as government services, airports, marine installations, etc. A 1-10 super-regenerative receiver covers all wavelengths from 1 to 11 meters. National also makes a complete line of parts too numerous to consider here. Hammerlund's receivers are also in the upper price brackets and they, too, have a large number of parts available. Howard's receivers are more in the popular price class. Other manufacturers offer a considerable number of converters, preselectors, filters of all sorts and antennas and other accessories that would fill an album.

**RECEIVER TRENDS**

(Continued from page 477)
WITH SERVICE ON THE MOVE:
YOU and a SIMPSON
TESTER can go places!

WHEN servicing jobs were scarce, you may have hesitated to "treat" yourself to some much-needed Simpson Testing Equipment. But now it's a different story. With service again on the march, Simpson speed, convenience and accuracy can put dollars right into your pocket.

A few of the "hit numbers" of today's Simpson line are illustrated here. Notice the wide range of requirements they cover—and the better way they cover them. Men who know testers have acclaimed Simpson equipment the first real advance in ten years of instrument building—and the proof of this is as close as your jobber!

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Tests All Tubes—Tests All Circuits
Filament Voltage 1.5-120 Volts
Has screen fluorescence and ampli-
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"high sensitivity" neon short check;
"good" and "bad" scale, and "noise
test." Has six A.C. and D.C. voltage
ranges; three resistance ranges; four
milliamper ranges; six Decibel
ranges.
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MODEL 325 GIANT TUBE TESTER
Tests All Tubes—Filament Voltage 1.5
to 120 Volts
Has handsome, illuminated red, green
and black scale on a silver
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inch scales. Checks each
element separately; shorts
on dual-sensitivity neon
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test. Convenient drawer
contains neat tube charts.
Battery pack, with reversible
for horizontal use. Wings
available for rack mounting.
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MODEL 260
The new high sensitivity
ity test for television and
radio servicing. At
20,000 ohms per volt this
instrument is far more
sensitive than any other
in its price range. Six
voltage ranges, both A.C.
and D.C.; Resistance
ranges from \( \frac{1}{2} \) ohm
to 100,000 ohms. Current
readings from 1 micro-
amp to 500 milliamps.
Your price $27.50

(See model No. 215,
with 5,000 ohms per volt at $22.85.)

MODEL 320 GIANT SET TESTER
First set tester with
giant (6 inch scales) illumi-
nated dial meter—first
with 50 ranges which in-
clude nine voltage ranges
both A.C. and D.C.; six
milliamperes ranges; five
resistance ranges; four ca-
pacity ranges; seven De-
cibel ranges. Test leads,
insulated for 5,000 volts
furnished with each test-
er. Entirely A.C. oper-
ated—no batteries needed.
Wings are available
for rack mounting.
Your price $37.50

THORDARSON 14-WATT AMPLIFIER
The newest Thordarson 14-watt amplifier features a multiple stage inverse feedback circuit and low-frequency booster which is said to provide linear response to 15,000 cycles with the addition of accentuated bass. Additional information may be obtained directly from Thordarson.

AEROVOX CONDENSER CHECKER
A radically new means of testing con-
densers and coils in the r-f range under
actual operating conditions is offered in the
Aerovox Model 95L-C checker, it is claimed.
The instrument determines the effectiveness
of a condenser or coil without disconnect-
ing it from the circuit in which it is used.
It is self-powered. Additional information may be obtained directly from Aerovox

CD DUAL ELECTROLYTICS
The Cornell-Dubilier type BRL dual
electrolytic condensers are said to offer
convenience and security of parts mount-
ing. These tubulars are dual units with a
common negative and a mounting strap
around the center. They are available in
6 popular capacity ranges from 25 to 450-
volts ratings. Additional information may be
obtained directly from Cornell-Dubilier,
South Plainfield, N. J.

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SERVICE, OCTOBER, 1939 • 491
SOLAR EX1-60, EX2U EXAM-ETER

The Solar Exam-eter can be used to determine the electrical characteristics of electrolytic, paper, mica, trimmer and air dielectric condensers. In addition, it can be used as a peak reading voltmeter.

Condensers may be tested for capacity, leakage, opens, shorts, intermittent operation and power factor. The peak voltmeter is provided for measurements of circuit voltages to determine the required voltage rating of condensers to be used for replacement. It can also be used for checking output levels and signal voltages at various points of a receiver. The leakage tester can be used for checking insulation resistance and as a circuit tester.

Calibrated markings on two color scales are provided for measurement of capacity and resistance. These tests are made on a Wein bridge with direct reading ranges and by multiplying the scale reading by the bridge constant. The power factor of electrolytic condensers including a-c or motor starting types can be read directly from a scale which is calibrated zero to 50% power factor. The capacity range of this instrument is from 0.0001 mfd to 1600 mfd and the resistance range is from 50 ohms to 7.5 meg.

Two test terminals are provided on the panel for resistance, capacity and leakage tests. The switch within the Exam-eter connects the unit under test to the proper circuits.

The leakage test portion of the instrument consists of a d-c power supply and a neon lamp. A switch is provided with vola-

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Owensboro, Kentucky
A fixed d-c reference voltage is supplied by the drop across the neon lamp N. A part of this voltage appears across the potentiometer R2. The applied test voltage is rectified by the 6H0 tube in the test prod and appears as a d-c voltage across capacitor C4 in the prod. Due to the action of the rectifier, C4 charges up to the peak value of the applied test voltage, regardless of its wave form.

The d-c voltage across C4 is compared with the known voltage across the potentiometer R2 by means of the 6E5 null indicator. When the voltage between the grid and cathode leads to the indicator tube is zero, the potentiometer setting is at a voltage equal to that developed across C4. When the grid and cathode leads to the 6E5 have zero voltage across them, the operation of the test switch button will result in no change in the indication of the eye. Under all other conditions, there will be either an opening or closing of the eye.

The useful range of the voltmeter is from 3 to 3000 volts. The short test leads, low input capacitance and high input resistance of the test prod permit use of the voltmeter in the broadcast and short wave communications bands with little error and slight loading on the test circuits.

A zero adjustment of the voltmeter is provided to compensate for contact potential in the voltmeter tube.

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- External Oscillator Circuit
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- Self-contained power level meter with three ranges from -10 to +38 db.
- Eight continuously variable R.F. ranges to 120 megacycles with accuracy better than 5%.
- Two negative resistance audio frequency outputs—10 to 10,000 cycle variable—100 cycle fixed.

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Controls: Range selector, capacity balance potentiometer, power-factor balance, vtvm zero adjuster, test switch, and off-on switch.

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MEISSNER VIBRATORS
G. V. Rockey, vice-president and general sales manager of Meissner Manufacturing Co., Mt. Carmel, Ill., announces a Meissner vibrator which life tests and field reports prove to be of exceptional value, it is said. Additional information and characteristics may be obtained directly from Meissner.

TURNER DYNAMIC MIKE
A new Turner Mike is being offered by the Turner Co., Cedar Rapids, Iowa. The unit, Model 33D has an output level of -54 db, at high impedance and a frequency range from 40 to 9000 cycles, it is said. It is streamlined and is supplied in satin chrome finish. Additional details and prices may be obtained directly from Turner.

SIMPSON GIANT INSTRUMENTS
Simpson Electric Co., 5214 Kinzie St., Chicago, have introduced two new Giant instruments in their Model 320 Set tester and the Model 325 tube tester. The set tester incorporates 29 ranges in a.c. and d-c volts (at 1000-ohms-per-volt), ohms, amperes, milliamperes, microamperes and decibels. A 9-in meter is used with an indirectly illuminated face.

The tube tester also features the 9-in meter and is capable of testing loctal, single-ended, buntast, gridcut, gas rectifier and standard tubes as well as plug-in resistors, Christmas tree and pilot lamps.

ADIRAL AEROMETER
The Continental Radio & Television Corp., 3800 Corliss St., Chicago, have developed the Adimal Aermeter, a device for checking the normal sensitivity of loop operated receivers. The Aermeter is a loop radiator to be used in conjunction with a signal generator as a signal source for loop measurements. The device is completely shielded and surrounding objects have no effect upon measurements made through its use, it is said. Additional information may be obtained directly from the manufacturer.

CLARION 16-WATT AMPLIFIER
The Clarion Model C418 sound system uses push-pull 6L6s in the output stages; is capable of delivering 16 watts rated, 18 watts peak, has a microphone input gain of 113 db and a frequency response from 40 to 9500 cycles, it is said. The system is complete with two 10-in pm speakers, wall baffles, microphone, floor stand and cables. Further information may be obtained by writing Transformer Corp. of America, 69 Wooster St., New York City.

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Radios' Smartest Auto Aerials are Made by Brach

New streamline design; smooth, noiseless; anti-rattle construction. Made of chrome-plated Admiralty brass. Approved and recommended by leading auto manufacturers.

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(Radios with the new built-in type aerials)

With This Easy-to-Use Tester

**Admiral Aerometer**

STANDARD procedure for checking receiver alignment is impractical with radios having the new built-in type loop antenna. Any direct connection with the signal generator loads the antenna coil so that alignment is incorrectly made with an added capacity which is subsequently removed.

To meet the demand for a simple, yet accurate method of aligning loop receivers, our laboratory has developed the Admiral Aerometer. It consists of a shielded loop radiator and a reactance wand for checking the tracking of loop receivers.

**Completely Shielded**

Connected to the output terminals of a test oscillator, the loop radiator transmits the signal to the loop antenna and the sensitivity of the set is checked in the usual manner. Since the radiating loop and connecting cable are completely shielded, there are very few precautions to observe.

The reactance wand has been developed to indicate the mistracking of sets having a cut plate gang (similar to the action of a tuning wand on a conventional antenna coil). The wand is brought close to the antenna coil—first one end and then the other. If the output of the set drops in both cases, the set is tracking perfectly. The wand is marked on one end "Increase Antenna Capacity" and on the other "Decrease Antenna Capacity."

The Aerometer is substantially constructed of finest materials and workmanship characteristic of Admiral Radios. If your jobber cannot supply you, order direct from our factory.

$5.00

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The Weston Model 777 tube and battery tester has provisions for battery tests under load, as well as for normal tube tests. The condition of a battery is indicated on a good-replace scale with the cut-off point set at the proper value. Five pin jacks are provided for different battery voltages encountered. The tube tester permits the testing of octal, loktal, single-ended and other recent type tubes as well as 4, 5, 6 and 7-prong standard types, gas rectifiers, plug-in resistors, etc. Additional information may be obtained directly from Weston Electrical Instrument Corp., Newark, N. J.

SPRAGUE CONDENSERS
Three new spade-bolt type tabular card-board dry-electrolytic condensers announced by the Sprague Products Co., North Adams, Mass., are designed to serve as universal replacements for the many condensers of this type used in modern receivers. The units include an 8-8 mfd and an 8-16 mfd at 450 volts, working and a 12-16 mfd, 200-volt type. These and other Sprague condensers are described and illustrated in the 1939-40 catalog, copies of which may be obtained directly from Sprague.

HICKOK TUBE TESTER
The Hickok Model 530 tube tester measures dynamic mutual conductance of tubes set on three ranges of micromhos. A dual reading scale also indicates good, bad or doubtful. The instrument will test octal, single-ended, loktal, gas rectifier, and standard tubes as well as plug-in resistors and pilot lamps. For more complete details write to Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio.

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496 • SERVICE, OCTOBER, 1939

www.americanradiohistory.com
ERWOOD 18-WATT AMPLIFIER
Erwood Sound Equipment Co., 224 W. Huron St., Chicago, have announced their Model 2418A, 18-watt amplifier, shown in the accompanying illustration. The unit has two input positions as well as a tone modifying control and variable output impedance. Seven tubes are used. Additional information may be obtained directly from the manufacturer.

ASTATIC CRYSTAL PICKUP
The Astatic Model AB8 crystal pickup has been made available. This unit features spring-axial cushioning, Astatic type B cartridge with ebonite waterproof coated crystal element, Tru-Tan offset head to reduce tracking error, threaded stud base for single hole mounting and a new diecast arm. Response of the AB8 may be altered according to requirements by a slight modification of the input circuit or by the use of Astatic's E4P tone equalizer. Astatic Microphone Laboratory, Inc., Youngstown, Ohio.

RADIO CITY MULTITESTER
A new pocket-sized multimeter meter has been announced by Radio City Products Co., 88 Park Pl., New York City. The unit, Model 412, employs a 400-microampere meter and covers 13 ranges in d-c volts, ohms, milliampere and microampere. Additional information on this and other Radio City test instruments may be obtained directly from the manufacturer.

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SYLVANIA'S BIGGER AND BETTER
Send for your copy of this big "tube fact" book today

THE 1940 Sylvania Technical Manual is bigger and better than ever with a new easy-to-use arrangement. It has 264 pages packed with vital tube information for servicemen, radio technicians, engineers and amateurs.

It gives you complete data and tube diagrams for 344 types of tubes all now listed in numerical-alphabetical order for quicker reference. Operating conditions, characteristics and circuit applications for standard glass tubes, "G" types, "GT" types, Loktal, Metal, Majestic and special types. Full information, too, on Sylvania's complete line of panel lamps.

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