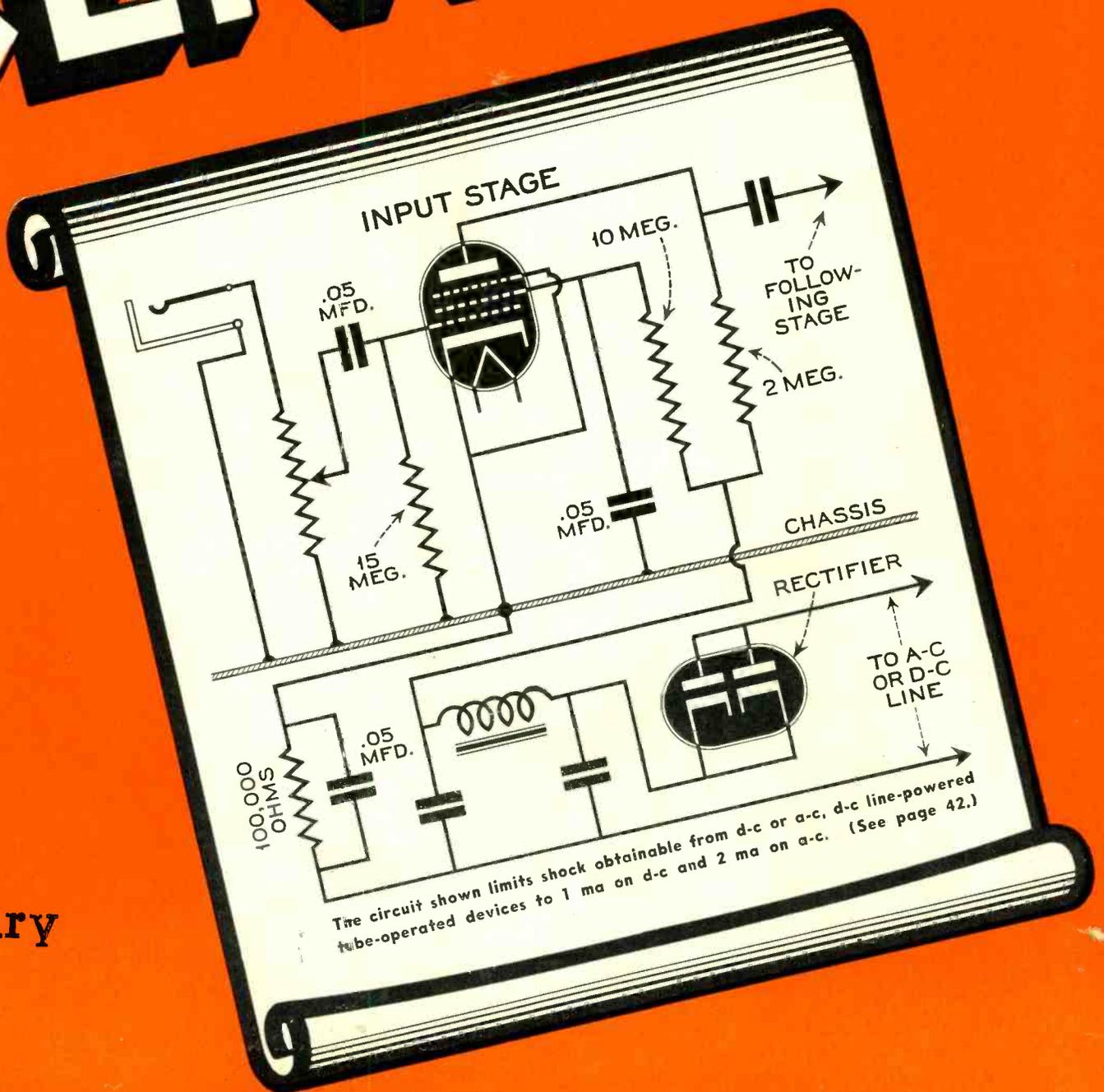


# SERVICE



The circuit shown limits shock obtainable from d-c or a-c, d-c line-powered tube-operated devices to 1 ma on d-c and 2 ma on a-c. (See page 42.)

February  
1940

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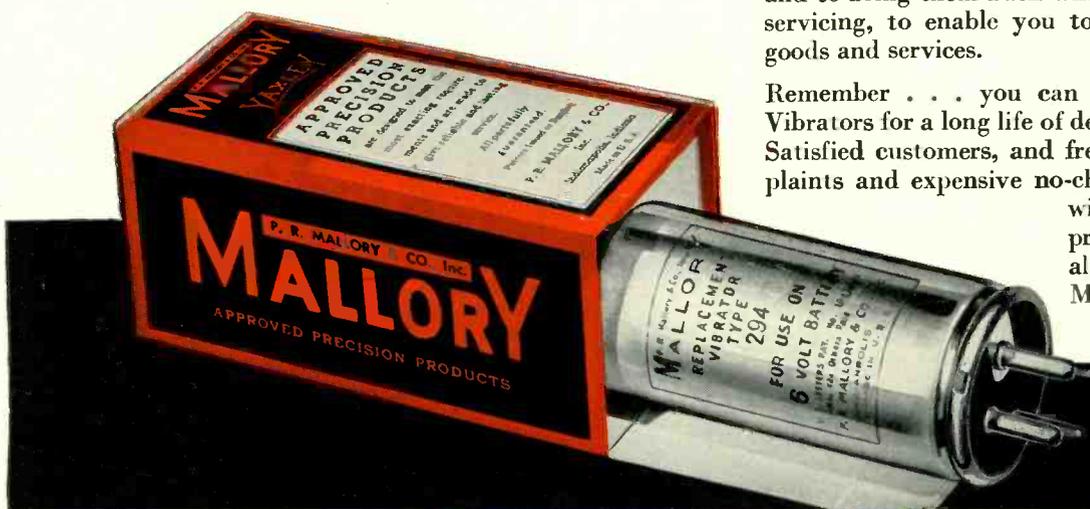
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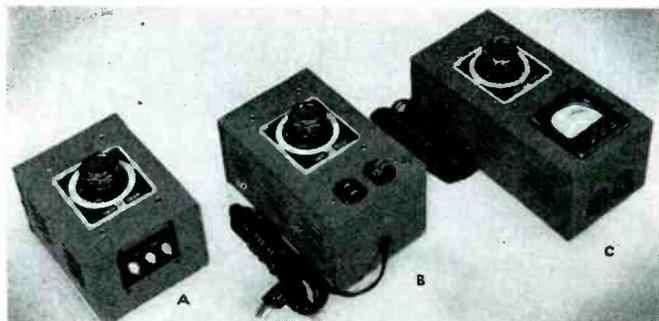
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Type	Input Voltage	Output Voltage	Watts	Maximum Amps.	Approx. Wt. Lbs.	Net Price
V-0	115 volts	0-130	230	2	8	\$7.50
V-0-B	230 volts	0-260	230	1	10	9.50
V-1	115 volts	0-130	570	5	11	10.00
V-1-M	115 volts	0-130	570	5	12	15.00
V-2	115 volts	0-130	570	5	11	9.00
V-2-B	230 volts	0-260	570	2.5	14	11.50
V-3	115 volts	0-130	850	7.5	14	14.00
V-3-B	230 volts	0-260	850	3.75	18	18.00
V-4	115 volts	0-130	1250	11	32	20.00
V-4-B	230 volts	0-260	1250	5.5	38	25.00
V-5	115 volts	0-130	1950	17	45	32.00
V-5-B	230 volts	0-260	1950	8.5	56	37.00
V-6	115 volts	0-130	3500	30	90	60.00
V-6-B	230 volts	0-260	3500	15	90	70.00
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V-7-B	230 volts	0-260	5000	22	120	95.00



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0-3	Dynamic mike to 1 grid	7.5/30	50,000	5.40
0-4	Single plate to 1 grid	8000 to 15000	60,000	4.80
0-5	Single plate to 1 grid, D.C. in Pri.	8000 to 15000	60,000	4.80
0-6	Single plate to 2 grids	8000 to 15000	95,000	5.40
0-7	Single plate to 2 grids, D.C. in Pri.	8000 to 15000	95,000	5.40
0-8	Single plate to line	8000 to 15000	50, 200, 500	6.00
0-9	Single plate to line, D.C. in Pri.	8000 to 15000	50, 200, 500	6.00
0-10	Push pull plates to line	8000 to 15000 each side	50, 200, 500	6.00
0-11	Crystal mike or pickup to line	50000	50, 200, 500	6.00
0-12	Mixing and matching	50,200	50, 200, 500	5.40
0-13	Reactor, 200 Hys.—no D.C., 50 Hys.—2 MA. D.C., 6000 ohms			4.20
0-14	50:1 mike or line to 1 grid	200	$\frac{1}{2}$ Megohm	6.00
0-15	10:1 single plate to 1 grid	8000 to 15000	1 megohm	6.00

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SERVICE, FEBRUARY, 1940



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AN experienced Service Man should never align a cold receiver. Inductance and capacity values alter with temperature and the correct values for the adjustments are those obtained with the receiver at a temperature equal to that reached and maintained under sustained operating conditions. It takes the receiver at least ten or fifteen minutes to reach this temperature. Consequently, every receiver should be allowed about a quarter of an hour to warm up before any adjustment is made.

Failure to observe this precaution will often result in a condition further from the correct alignment than that which existed before the attempt at alignment.



RESISTANCES with closer tolerances are used in the more recent receiver models and these tolerances are often marked on the resistor along with its color coding. This development comes largely as a result of more complicated circuits and improved designed features. Another factor contributing to the use of resistors with closer tolerances is that these are available at lower prices.

Tolerances are not the only change in resistors used in more modern receiver models. In many of them resistance values as high as ten and twenty megohms can be found in critical circuits. Variation from these high values easily upsets the circuit stability. In making replacements of resistor units it is, consequently, especially important to use only quality parts.

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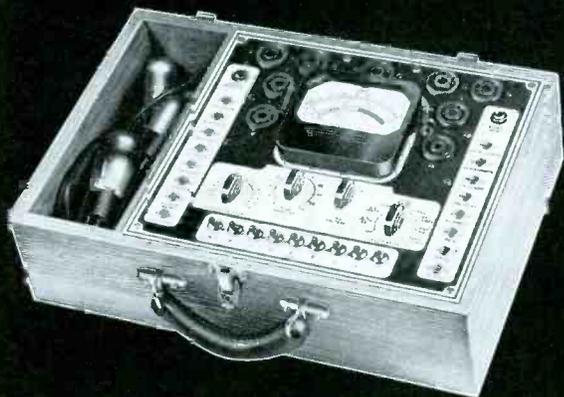
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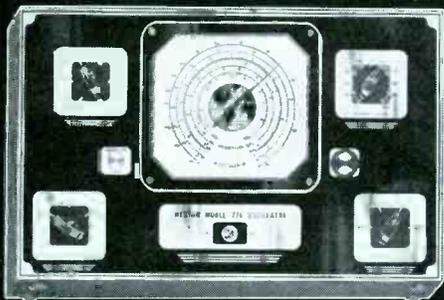
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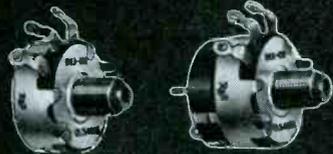
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# ACOUSTIC HOWL

By MAURICE APSTEIN

MORLEN ELECTRIC COMPANY

SINCE the earliest days of public address, acoustic feedback (howl) has been the bane of the soundman's existence. Although the reasons for its occurrence are generally, though somewhat vaguely, understood, very little has been published about it in an analytical sense. Most p-a installers consider it a necessary evil; a burden to be borne with fortitude and the calm acceptance of the inevitable. This need not be the case. While acoustic feedback can never be completely eliminated, as long as speaker and microphone are within "hearing distance of each other", a comprehensive understanding of conditions favorable and unfavorable to its occurrence, enables it to be controlled to a remarkable degree. This control may, and very often does, determine the efficacy of the system as a whole, and thus may be considered one of the most important aspects of p-a installation. It will be the purpose of this paper to outline the many factors affecting the presence of feedback, and to show how feedback itself may be controlled in turn by the control of these factors.

• • • amplifier an oscillator

The basic reason for the presence of acoustic feedback stems from the fact that every amplifier system is a potential audio oscillator. Like any other

oscillator it comprises an input circuit, an output circuit, a certain amount of amplification between them, and a path by which a portion of the output may be fed back to the input to sustain oscillation. The only difference between the amplifier system and the true oscillator, is that the oscillator utilizes an electrical path for feedback whereas the amplifier system makes use of an acoustical path to accomplish the same purpose. If, therefore we treat the sound system as an oscillator, the conditions required to prevent oscillation should be readily apparent, since the requirements necessary to sustain oscillations are well known and relatively simple.

Fig. 1 shows the similarity between an electrical oscillator and the oscillatory characteristics of a sound system. In order to sustain oscillation (Fig. 1a), the feedback loop must supply a certain critical amount of energy to the grid circuit. Conversely, in order to prevent oscillation (Fig. 1b), the energy fed back must be less than a certain critical amount. In 1a, the higher the mu of the tube, the smaller the energy

required. In 1b, the higher the gain of the amplifier, the greater must be the loss in the feedback loop to prevent oscillation, or acoustic howl.

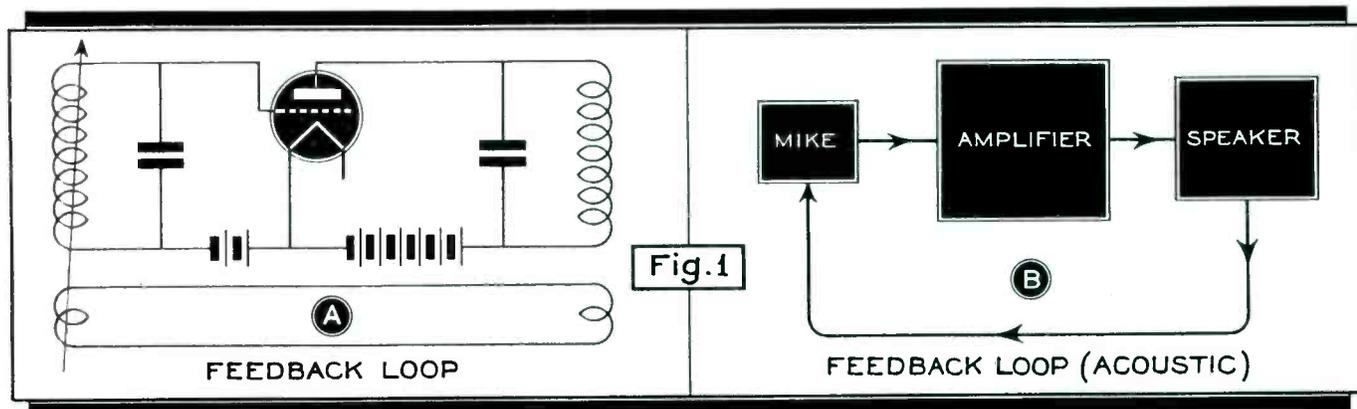
• • • coupling limits output

The first conclusion therefore is, that the amount of gain which can be used in an amplifier system is directly proportional to the amount of loss which can be introduced into the feedback loop. Stated in another way, the amount of power output obtainable from a given system is limited by the degree of acoustic coupling between the speaker and the microphone. If the amplification is to be increased the coupling must be decreased or oscillation will occur.

The problem is, how to accomplish this decrease in coupling without otherwise affecting the performance of the system. The obvious answer, and the one most generally used in practice, is to increase the distance between speaker and microphone. Unfortunately, the application of this method is limited since the speaker must be placed relatively close to the microphone in order to preserve the illusion that the amplified sound is originating from the actual source.

Another popular method is to reduce the high frequency response of the system. This helps to minimize feedback

Figs. 1a and 1b. The oscillatory characteristics of a sound system are very similar to those of a vacuum tube oscillator. In order to sustain oscillation, the feedback loop must supply a certain critical amount of energy to the input circuit.



because these frequencies are the ones most easily reflected back to the microphone even though the speakers may be pointing away from it, but unfortunately, in order to attain a worthwhile improvement in feedback reduction, so much of the high response must be attenuated that dire things happen to the quality of reproduction. A return to the oscillator circuit analogy will disclose other methods of attack, which in practice, afford beneficial results without impairment either of illusion or response, and in many instances actually improve the overall reproduction of the system.

• • • frequency response a factor

The main point of difference between a conventional oscillator and a sound system, is the frequency response. The oscillator is tuned to a definite frequency, whereas the sound system is usually considered aperiodic or non-resonant. However, this latter is not strictly true. In considering the sound system from the standpoint of a potential oscillator, we may rightly call its response curve the resonance curve. This approach leads to some very interesting and valuable observations.

Fig. 2 shows the overall response of a sound system which has a 10 db peak at approximately 5000 cycles. This means that for any given setting of the gain control, the gain of the system at 5000 will be 10 db higher than at any other point in the response range. With a given degree of coupling between speaker and microphone, energy at this frequency will reach the microphone with greater intensity than energy from the rest of the frequency spectrum. Consequently, the system will tend to oscillate at 5000 cycles much more readily than at any other frequency. *This will result in a very serious limitation in power output of the entire system at other frequencies, because it means that the average gain of the system neces-*

sarily be maintained at a 10 db lower level than would be possible if the peak were not present. It becomes obvious then that the gain which determines the point at which feedback will occur is not the average gain of the system as a whole, nor the gain at some middle frequency like 1000 cycles, but rather the maximum gain at any point in the response range i.e. the gain at the frequency where the highest peak in the response curve occurs. Moreover, the average output level, which can be accommodated without feedback, will be greatest when the average gain coincides with the peak gain. In other words the useable gain in an amplifier will be greatest when there are no peaks at all in its response and the gain is uniform from one end of its range to the other. It must be remembered that in speaking of flat response, or uniform gain, what is meant is overall acoustical response, not merely the response of the amplifier. As a matter of fact it is seldom that the amplifier is the offender in this respect. Amplifier response curves are usually fairly flat regardless of their range. The sharp peaks which are prevalent in all electro-mechanical devices (and therefore are characteristic of speakers and microphones) are the ones that cause the trouble. Those devices which show the least number of sharp peaks in a continuous response curve, and whose peaks are only a few db above the average level of the curve, will allow operation at the highest output level without howl. In the writer's opinion this is the most potent argument in favor of flat response in systems for public address purposes. When one realizes that a ten db peak in the response of a given system will limit its usable output level to one tenth of the power that could be accommodated if the peak were not present, it becomes obvious that this aspect of the feedback problem cannot be over-emphasized.

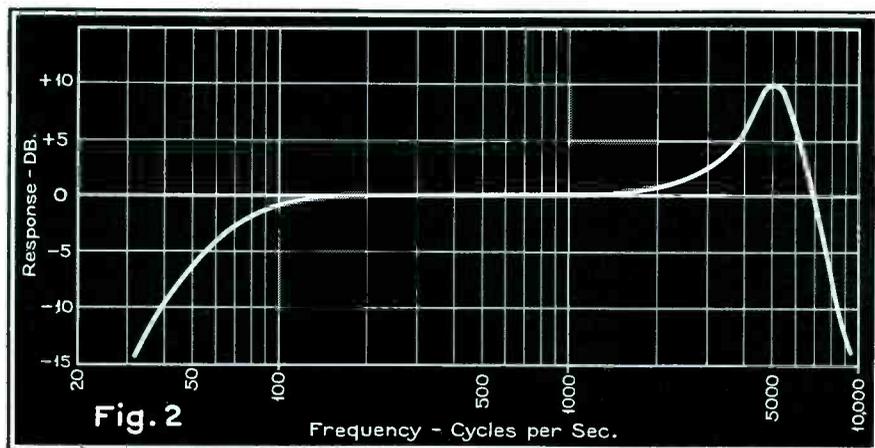
After the maximum gain permissible, with a feedback loop of given loss, has been attained by means of flat response, the next step is to increase the loss in the feedback loop. In other words we must now make it more difficult for the sound emanating from the speakers to leak back to the microphone. There are various methods by which this may be accomplished. It will be found, however, that all the conventional methods become far more effective once the peaks, mentioned above, have been eliminated. It is almost useless to attempt anything else without first removing peaks from the response.

• • • stray speaker radiation

The matter of distance between the speaker and the microphone has already been mentioned. Of course, it is advisable to keep these two as far apart as possible without destroying the aural illusion. However, much more can be done in this respect without affecting the illusion at all. The most important thing to do is to eliminate all unnecessary radiation from the speaker. Any sound which does not reach the audience is not only useless but very definitely harmful. If it doesn't travel toward the audience it must travel in some other direction and that direction usually means toward the microphone. To prevent this extraneous radiation, the rear of the speaker should be completely enclosed, preferably in some form of infinite baffle cabinet.<sup>1</sup> This treatment serves the dual purpose of completely eliminating stray radiation at the same time it smooths out the response of the speaker itself by loading the rear of the cone.

The next step is to make sure that the radiation from the front of the speaker is projected toward the audience and away from the microphone. This means that wherever possible the microphone should be slightly behind the speakers, with the speakers facing the audience. Some sort of directional flare is also advisable on the speaker to further localize the radiation in the desired direction. A short horn, mounted on the front of an infinite baffle, makes an excellent combination and goes far toward eliminating feedback troubles. Due to the fact that the enclosed cabinet provides an effective baffle even at the lowest frequencies, the dimensions of the flare need not be nearly as large as would ordinarily be required for good reproduction. However, no attempt should be made to cram the speaker into a small rear enclosure slightly larger than the speaker itself as this will seriously impair its operation. In a previous paper<sup>1</sup> the proper dimensions and general design of an enclosure of this type for

Fig. 2. For any given setting of the gain control the output of the amplifier, whose response in curve is shown below, will be 10 db higher for 5,000 cycles than for any other frequency within its range.



<sup>1</sup>"Loudspeaker Enclosures." by Maurice Apstein, SERVICE, July, 1939, p. 331.

various speaker sizes has been presented, and the reader will do well to refer to this information. For general p-a work, the minimum dimension for the diameter of the flare is about 24 in. The length of course, will be determined by the size of the speaker cone. Although in general this arrangement results in an assembly somewhat bulkier than the usual speaker mounting, it will be found that the results more than justify the inconvenience.

• • • reflection

With the speakers properly enclosed, and their radiation localized to the desired area, it will be found that speaker placement and direction is a much more easily controllable factor in acoustic feedback reduction. It now becomes significant when we place the microphone in the shadow of the speakers, because the shadow is a well-defined area, and very little direct radiation leaks around the sides of the flare and backward toward the microphone. The sound which now reaches the micro-

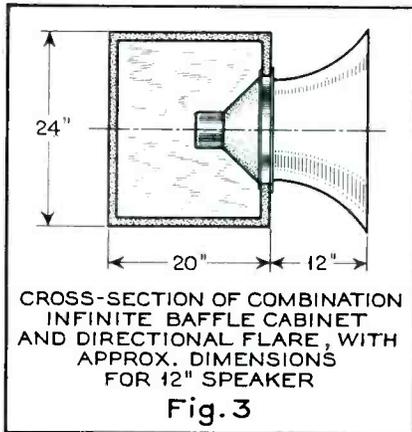


Fig. 3. A directional flare is advisable, even on enclosed speakers, to further localize the radiation in the desired direction.

phone is that which is reflected back by surrounding walls and other hard surfaces. With regard to this reflection there is, unfortunately, not very much that can be done. If the previous preventive measures have been taken to reduce other coupling paths, however, the reflected energy that remains is slight. As a matter of general principle the speakers should not point directly at hard flat walls as these are the worst offenders from the standpoint of reflection. If the speaker must face a wall, the wall should be draped or broken up so that it presents an irregular rather than a flat smooth surface. The resting of the speaker cabinet on a hard smooth surface such as a polished floor, or flat wall should also be avoided. A sound-absorbent pad should be placed between the cabinet and the floor or wall against which the speaker rests. If the

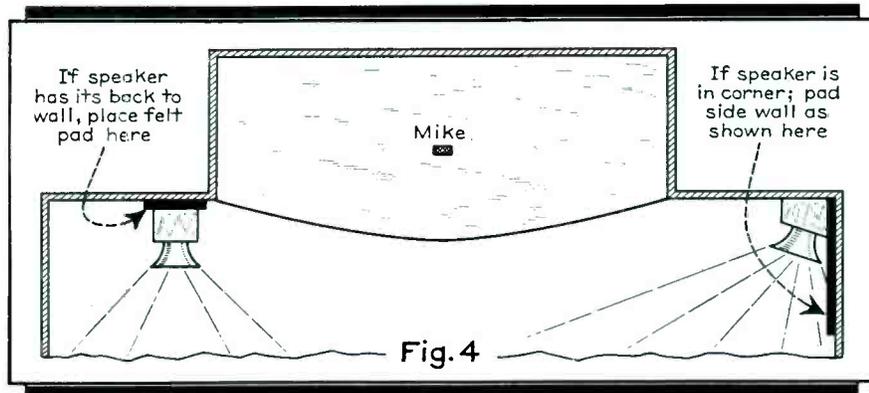


Fig. 4. If a speaker is hung against a hard flat wall, a sound absorbent pad should be placed between the speaker cabinet and the flat wall.

speaker rests on a hard surface, such as a stage or dance floor, the pad should be extended out in front of the flare as far as possible. This pad will absorb much of the radiation that would otherwise be reflected off the hard surface, and eventually leak back to the microphone. Fig. 3 shows an infinite baffle cabinet and flare combination of the type described. Fig. 4 illustrates proper placement of the absorbent pads.

• • • mechanical coupling

There remains one more type of feedback which falls under the general classification "acoustic", but which in a strict sense is more aptly termed mechanical feedback. Oscillation due to this cause, when unrecognized, can be extremely annoying because it does not respond to any of the usual treatments which help a strictly acoustical case. The cause of such oscillation is due to actual mechanical coupling between the speaker mounting and the microphone usually through the latter's stand. The frequency of oscillation is usually very low, and the howl often appears as a low pitched rumble when the amplifier gain is increased beyond some critical setting. Once the condition is properly diagnosed however, mechanical feedback is one of the easiest types to cure. The obvious remedy is to interpose in the mechanical path some resilient or sound absorbing material to prevent the vibration from traveling through the walls and floor back to the microphone. The absorbent pad between the speaker cabinet and mounting surface previously described goes a long way toward eliminating this coupling and consequently this is another strong argument favoring its use. A sponge rubber pad under the microphone stand puts an additional obstacle in the path of the vibration and thus is also effective. The low frequencies at which this coupling takes place are often more difficult than usual to absorb completely and small rubber couplings in the microphone stand are not very effective in this re-

gard, although they do insulate the microphone from sharp mechanical shock.

• • • remedies cumulative

Having read these various methods for the control of acoustic feedback, the reader may feel somewhat disappointed that no sensational cure for its complete elimination has been disclosed. The writer is certain that the soundman who analyzes his feedback problem with the above remarks in mind, and attempts to remedy the individual defects by the various procedures suggested, will find that the cumulative effect of all the small improvements thereby obtained will result in a really remarkable betterment in overall performance of the system. By using the above methods, the writer has many times been able to transform a practically unusable system into a perfectly satisfactory one, although no changes were made in the basic equipment used.

• • • summary

A brief summary of the salient points to keep in mind follows:

- 1) Be sure that the response of the entire system is as flat as possible, and that any unavoidable peaks have been reduced as close to average as practicable. This means the choice of a speaker with the smoothest possible response curve regardless of width of range. It also means the selection of a microphone type which inherently is peakless in response.
- 2) Wherever possible completely enclose the rear of the speaker preferably in some form of acoustically treated infinite baffle cabinet, to minimize stray radiation.
- 3) Increase the directivity of the front radiation by mounting a short flare on the front of the cabinet. Such a flare will not in general cause enough directivity to result in beaminess of

(Continued on page 11)



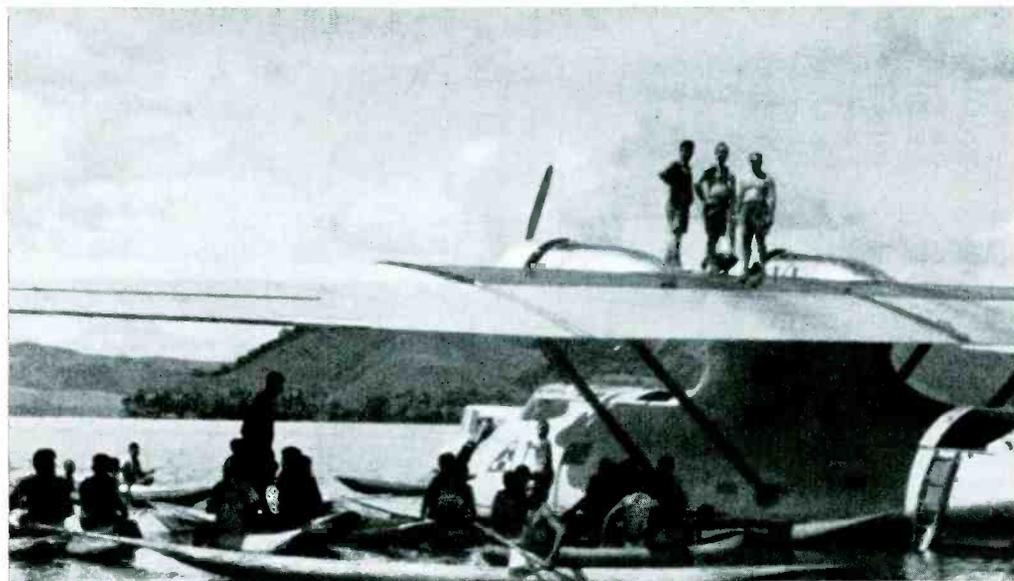
# ARCHBOLD EXPEDITION

## *Circles the World*

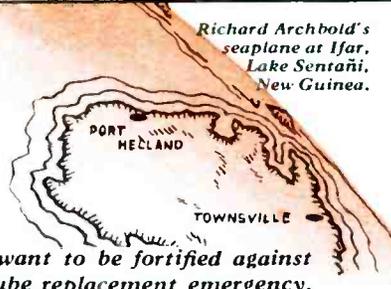
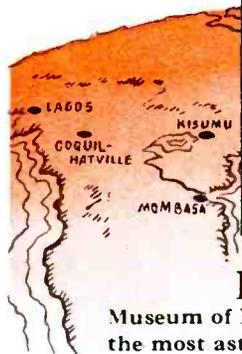
### with **RAYTHEONS**



Richard Archbold (left) at Wake Island, enroute to San Diego, Hollandia.



Richard Archbold's seaplane at Ifar, Lake Sentani, New Guinea.



**RICHARD ARCHBOLD**, of the American Museum of Natural History, has recently completed one of the most astounding expeditions of modern times.

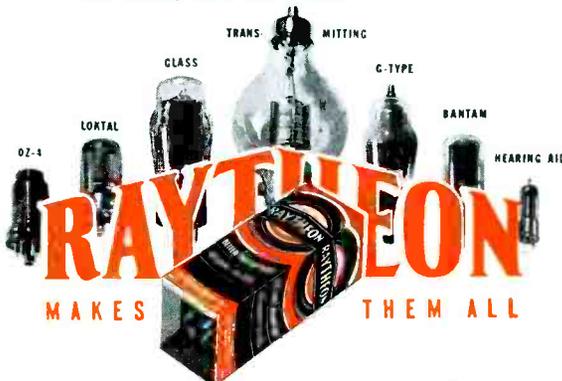
With his Consolidated Aircraft seaplane "GUBA," he was the first to follow the equator around the world, spanning the Pacific, Indian, and Atlantic Oceans. The first to fly a seaplane across Australia, Africa and North America. The first to explore the interior of Netherlands New Guinea where he discovered a new tribe estimated at 60,000 people. Hardships, privations, dangers, tests of skill, resourcefulness and courage 24 hours of every day for more than a year!

On such an expedition the equipment **MUST** be good . . . the **VERY BEST**. And so it was inevitable that **RAYTHEONS** were chosen for the communications system. And they *delivered* in the most grueling test imaginable.

Yet there was nothing *special* about these **RAYTHEONS**. They were the *one quality* product of **RAYTHEON** engineers, specializing exclusively on tubes . . . engineers anticipating fast moving radio circuit developments, and pioneering in tube design and constructions to meet these developments in advance, with the utmost of efficiency.

So today there's a **RAYTHEON** for every tube requirement, whether for the ordinary or for the most exacting of needs such as the Archbold Expedition demanded.

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SERVICE, FEBRUARY, 1940 • 9





# SERVICE CHARGES

By F. WOODSON SMITH

A SYSTEM of flat rates is the simplest to use and in most cases is entirely satisfactory to both the customer and the shop. The flat rate method has been proved sound and will operate for us just as well as it does for the automobile service stations.

A flat rate is a fixed labor charge for the performance of certain specified work. It is based on the cost of the average time consumed in carrying out the work. Sufficient experience has been gained in this field to permit averaging the time used in locating the sources of most receiver trouble.

A careful study of the cost of doing business should be made by each shop owner and any flat rate schedule adopted must be adequate to cover these costs. Few if any shops can operate for less than \$2.00 per hour. To figure cost per hour simply add together cost of heat, rent, lights, telephone, advertising, car expense and depreciation, test equipment and service manual replacements and additions, insurance, 6% interest on the total investment, taxes and at least \$150.00 per month wages for the Service Man-operator. Reduce all items to their monthly total and divide by the number of working hours per month. Figuring 26 days to the month and 8 hours per day totals 208 hours, but the operator is not gainfully employed more than 50 to 60% of the total time, or about 120 hours. There are other items of expense also which influence costs in particular instances but many of these will vary widely in different types of operation. Put down all the items of expense you encounter in your particular shop and work out the problem along the lines suggested and you will find the answer will not be less than \$2.00 per hour unless you are working long hours or for short wages.

This procedure was followed to the letter in setting up the flat rate schedule presented here.

To illustrate the use of this chart let us assume that a 2-year old 8-tube "Zenco" receiver is brought in. The owner states it had lost some of its power, didn't sound clear and an objectionable hum was noticeable from the speaker before the set went dead. Of course the first question is "How much?"

We explain that a detailed examination on the test bench will be necessary to determine the condition of the vari-

IT IS our intention, in this and in future articles, to feature the practices and opinions of individual Service Men on the all-important subject, "Service Charges". These articles will not necessarily express our own views. They will, rather, be as varied as possible and will be presented impartially, in the Service Man's own words without editing.—EDITOR.

ous components. This in turn will allow a fairly close estimate of the parts and services needed to restore proper operation. We are told to go ahead with the examination.

We refer to the chart and find under item "General diagnosis and repair",

the labor charge is \$6.00 less \$1.50 (no pickup and delivery) or \$4.50 net. As a result of the examination we find in addition: Alignment of i-f and 3 bands with automatic tuning—\$4.00; two 16-mfd filter capacitors—\$2.70; one audio coupling capacitor—\$0.15 and 4 tubes—\$3.20, for a total of \$14.55. In accordance with previous arrangements we now advise the owner with what we have found.

He may authorize the repairs suggested or express his intention of purchasing a new set instead of repairing the old one or may decide to do part of the work or perhaps nothing at all. In case no further action is taken the only charge is \$1.50 for the bench test. Most shops will credit this charge if the owner has the work done within 30 days according to the estimate.

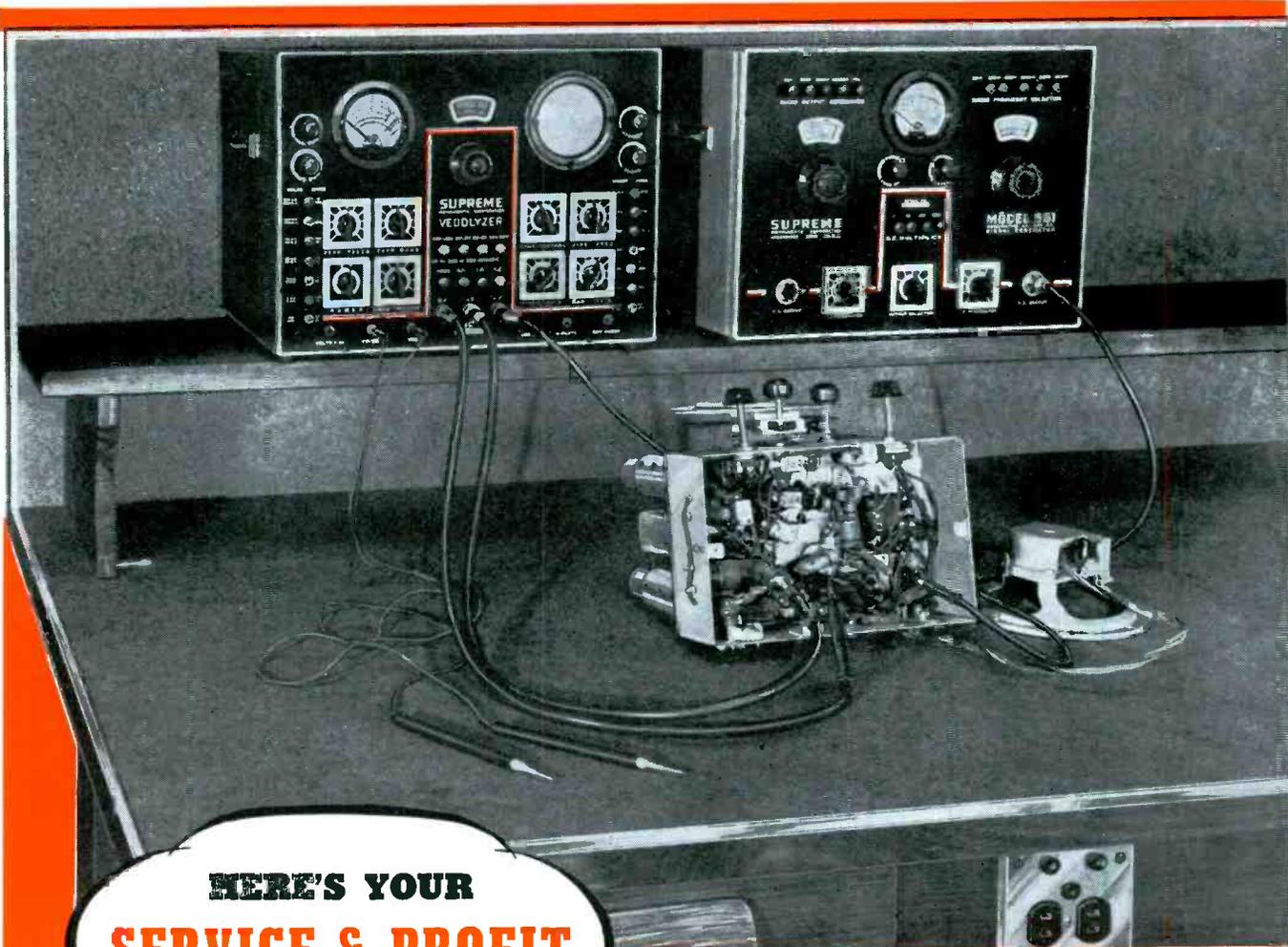
Many set owners think that the purchase of a new radio is the end of maintenance. The purchase usually defers this expense for about one year; then the decision must be made again. Buying a new radio every year is an expensive process. After all it really isn't the radio that is purchased it is the programs the radio will produce. If the

(Continued on page 49)

Flat rates are the simplest to use, have been proved sound and will operate for us as they do for the automobile service stations.

ALL MATERIALS AT ESTABLISHED PRICES ARE EXTRA	
SERVICE CALLS	\$ 1.50
within city limits	
outside city limits add 10¢ per mile each way	
PICK UP AND DELIVERY (PUD)	1.50
75¢ each way	
BENCH TEST	1.50
for information or estimate. This charge does not apply when work recommended is authorized.	
GENERAL DIAGNOSIS AND REPAIR (Minimum labor)	
Midget radios	4.00
5 to 8 tubes	6.00
9 to 12 "	7.50
13 to 15 "	9.00
over 15 "	no flat rates apply
These rates include PUD.* Deduct PUD* if radio is brought in and called for by customer.	
ALIGNMENT with other repairs	
I-F and single band	1.50
" " two "	2.50
" " three "	3.00
" " four "	4.00
" " five "	5.00
Add for automatic tuning	1.00
" " frequency control	1.00
ALIGNMENT ONLY (Add to above)	1.50
SPEAKER ADJUSTMENT (Labor only)	1.75
SPEAKER CONE INSTALLATION (Labor only)	2.50
TUNING COND. REPAIRS or HIGH VOLTAGE FLASHING	1.50
AUTO RADIO GENERAL DIAGNOSIS AND REPAIR (Labor)	5.50
(Deduct \$1.00 if bench job only)	
FADING OR INTERMITTENT RADIOS	Add \$3.00 labor unless owner authorizes replacement of all parts likely to cause this trouble.
SPECIAL ELECTRONIC WORK or regular radio repairs where flat rates are not practical or time estimate is difficult:—	
Time and material basis only. Technician's time per hour	2.50
SPECIFIC REPAIRS	both time and material included for the ONE operation indicated. Pick up and delivery not included.
STANDARD VOLUME CONTROL Installed, no PUD*	\$ 4.50
SPECIAL VOLUME CONTROL Installed, no PUD*	5.50
DUAL VOLUME CONTROL Installed, no PUD*	6.50
DIAL CABLE or BELT Installed, no PUD*	3.85
FILTER CAPACITORS Installed, no PUD*	
8 mfd. paper container	4.50
8 " to 16 mfd. wet type	5.50
16 " and larger	6.00
Low voltage units (Midget AC-DC)	
Single section	3.50
Dual "	4.50
TONE CONTROLS (Potentiometer type)	4.50
BY-PASS or COUPLING CAPACITORS	3.60
RESISTORS	3.60
PHONOGRAPH JACK AND SWITCH COMPLETE	3.75

\* PICK UP AND DELIVERY



**HERE'S YOUR  
SERVICE & PROFIT  
SET-UP**

The test bench illustrated above is not an elaborate affair. It was built for about \$10.00 by a serviceman eight years ago and is still doing duty.

We like this test bench not only for the fine instruments shown, but because it's an ideal service set-up to get out the most work in the shortest and most convenient manner. It's neat, it's efficient, it's business-like and it's attractive—it's not a junk shop nor is it a store window mannequin. That's why it is a real work bench.

Please note that your instruments are solidly placed on a shelf about 3" above the table surface. As compared to a rack and panel or built-in job, this alone means that on only a 5' bench, you have saved over 1000 square inches of working space because the instruments require no working space at all. Add to this—the instrument probes come out at a natural "reach for" position—over your work, not behind it. And the instrument panels too—all indicators and controls in full view. No squat—no stoop—no squint. Give yourself a rest.



**GET YOUR TEST  
BENCH PLANS FREE!**

*We do not make or offer for sale any panels or test benches. But it is a definite part of our policy to help all service men. Therefore, we have prepared a large 4-page booklet in which we discuss service benches in general, give valuable cost data, actual designs with detailed instructions for building, and our suggestions for necessary accessories. Sent free.*

Do a better job, too, by using the modern and improved instruments now available. For the most complete and modern service shop imaginable only three instruments are required. On the left a Model 560 Vedolyzer is illustrated

(a 562 Audolyzer could be substituted); on the right is one of the new 561 R. F. and A. F. Signal Generators. Open on the work bench or on the shelf above, or tucked away in the compartment below the bench (not shown) there should be a 504 Set and Tube Tester instantly available for bench work or an urgent outside service call. This is the only instrument which need be portable. You could spend over a thousand dollars and still not have as complete an equipment set-up as these three instruments will give you. In only three instruments you have:

1. C. R. oscilloscope, 3" tube, standard controls all on front panel.
2. Three stage vertical amplifier, wide range video.
3. Vacuum tube volt meter, 29 ranges A. C., D. C., R. F. volt and resistance.
4. Wave meter, 3 band.
5. Multi-input R. F., I. F. and A. F.
6. A. F. oscillator, 15 to 15,000 cycles.
7. R. F. oscillator, variable amplitude or frequency modulated.
8. Carrier meter, vacuum tube.
9. Modulation monitor, with vacuum tube voltmeter circuit.
10. Frequency modulator, audible image, positive self-synchronizing.
11. Tube Tester, patented circuit which tests all present or future tubes regardless of tube base terminations or filaments.
12. Leakage tester, tests 7-ways for quality, "hot" or super-sensitive leakage, etc.
13. Condenser tester, tests all electrostatic condensers for leakage up to 20 megohms.
14. Electrolytic tester, accurately tests them all. Settings on tube roller chart and tested on "English Reading" scale.
15. Complete push button multimeter, 31 necessary ranges of A. C. and D. C. volts, micro-amperes and amperes, output ranges, ohms and megohms.

All of this and more in only three instruments; more additional ranges and functions than we can describe here. Write now for your free Test Bench booklet and get your perfect Service and Profit Set-up.

**SUPREME**

**SUPREME INSTRUMENTS CORP.  
GREENWOOD, MISSISSIPPI, U. S. A.**



A flip of the Centralab Switch tells all . . . whether to read the tell-tale meter . . . to test a reluctant tube, or to solve the inner mysteries of some intricate testing apparatus.

Just a habit with Centralab . . . to turn out a better mouse-trap so that a world of service men can make a beaten path to our jobbers.

Switches, controls, resistors, ceramic capacitors . . . in each field of endeavor . . . like Abou Ben Adam . . ." our name leads all the rest."

Contact clips of spring brass heavily plated (silver) treated for easy soldering. Switching combinations available use up to 12 clips per section.



**Centralab**

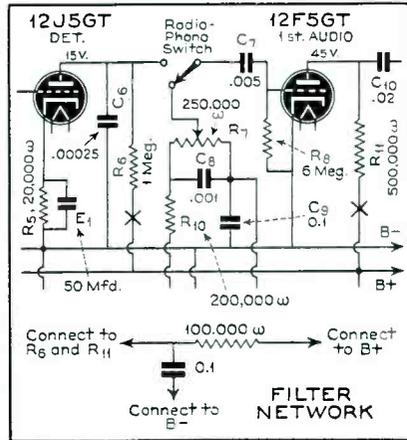
Div. of **GLOBE-UNION INC.**  
Milwaukee, Wisc.

**SILVERTONE 6326**

*Excessive hum:* In cases where excessive hum is encountered, it may be reduced by either one of the following methods:

1) In many cases, heater to cathode leakage in the 12J5GT or 12F5GT tubes may be causing excessive hum. If replacing the faulty tubes does not materially reduce the hum, it will be necessary to proceed as follows:

2) Disconnect the plate resistors (R6 and R11) of the 12J5GT and the 12F5GT



tubes from the plate supply at the points marked "x" in the circuit diagram and connect them to the filter network as shown in the filter network diagram. The filter network consists of a 0.1-mfd 400-volt paper condenser and a 100,000-ohm 1/4-watt resistor.

A number of these sets were sent to the field without a shield on the 12F5GT tube. One should be on this tube in order to reduce the hum level. Currently produced models have this shield installed at the factory.

B. Wixon, Service Department  
SEARS, ROEBUCK AND COMPANY

**SILVERTONE 6403, 6404, 6405, 6406, 6407, 6408, 6409, 6492, 6496**

*Production changes:* In order to broaden the selectivity somewhat, chassis identified with the addition of suffix number, -1, have had the connections of the first i-f transformer reversed so that the blue wire goes to B+ and the red wire to the 12A8GT plate. This decrease in selectivity improves the repeat accuracy of the push button setting. Some of these sets also have a 22,000-ohm resistor in place of the 47,000-ohm resistor, R2.

Chassis identified by the addition of suffix number, -2, have a different first i-f and second i-f transformer, giving a still greater decrease in selectivity and a still further improvement in repeat accuracy of the push button settings. The value of R2 in these chassis is 22,000-ohms.

B. Wixon, Service Department  
SEARS, ROEBUCK AND COMPANY

**STROMBERG CARLSON 400 SERIES**

*Dial pointer rubs:* In case the dial pointer in any of the 400-series receivers becomes bent during transportation or handling, so that it rubs either against the background of the dial or the glass, it is a simple matter to correct this without removing the chassis from the cabinet.

Adjust the pointer so that it is approximately in the middle of the dial and reach in from behind and lift the slide, to which the pointer is attached, until it is just off the slide bar. Then holding the slide be-

*Big Value . . .*  
**TUBE TESTER COMBINATION**

ONLY  
**\$26.85**  
DEALER NET

**MODEL 432-A-742**

With RED-DOT Lifetime Guaranteed Meter

**Readrite RANGER**

- Model 432-A-742 is a combination Tube Tester and Volt-Ohm-Milliammeter.
- Complete Volt - Ohm - Milliammeter, 16 Ranges • Sockets for All Tubes . . . Filament Voltages from 1.1 to 110—A Safeguard Against Obsolescence • Precision Indicating Instrument with Two Highest Quality Sapphire Jewel Bearings • Separate Line Control Meter • Neon Shorts Test • Approved RMA Circuit • Portable Black Latherette Covered Case—Professional in Appearance, Etched Panel. Complete, less batteries . . . \$26.85 . . . Dealer Net Price.

**Write for Catalog! Sec. 217 College Ave.**

**READRITE METER WORKS, Bluffton, Ohio**

tween the thumb and first finger, bend it in the appropriate direction so that when it is replaced on the slide bar, the pointer will be in the proper operating position.

J. E. Ward, Service Manager  
STROMBERG CARLSON TELEPHONE MFG. CO.

**WEBSTER AUTOMATIC CHANGER**

*Landing position of needle is not constant or pickup arm cannot be adjusted to set needle down in starting groove of record:* In the first production of the automatic record changer the pickup arm may display the following symptoms:

1) After the pickup arm has been set for the correct landing position, the needle does not lower consistently to the starting groove of a record during the playing of any one size of records.

2) The needle lowers so far away from the starting groove of the record that turning the needle landing adjusting screw does not bring the needle to the starting groove.

In early production, the pickup lead was permitted to hang down directly below the foot of the pickup. In such instances, the lead may become entangled with the rotating mechanism for the pickup arm. This will produce either one of the above actions.

To remedy the condition, clamp the pickup lead to the bracket, leaving enough slack to permit free action of the pickup arm. That portion of the lead under the clamp should be covered with tape. The clamping arrangement consists of a small clamp, a No. 6 lockwasher, and a 6-32 self-tapping machine screw.

*Pickup arm does not set needle down in starting groove of both 10- and 12-in. records:* It may be found that any one setting

of the needle landing adjusting screw will not cause the phono pickup arm to set the needle down in the starting groove for both 10- and 12-in records.

This condition may be remedied as follows: Set the automatic record changer for 10-in record operation. Turn the needle landing adjusting screw so that the pickup arm sets the needle down in the starting groove of a 10-in record.

Replace the 10-in record with a 12-in record and set the automatic record changer for 12-in record operation. Start the mechanism. Check the landing position of the needle.

#### WELLS-GARDNER 1938 AND 1939 SETS

*Distortion and overloading in sets which use the 6U5 and 6AB5 visual indicator tubes:* Distortion and overloading on strong signals in sets using the 6U5 and 6AB5 tuning eye tubes may be caused by grid current in these tubes. Try one or more new tubes and check results.

The control grid of the triode section of the 6U5 and 6AB5 tubes is connected to the avc circuit and grid current will affect the avc voltage.

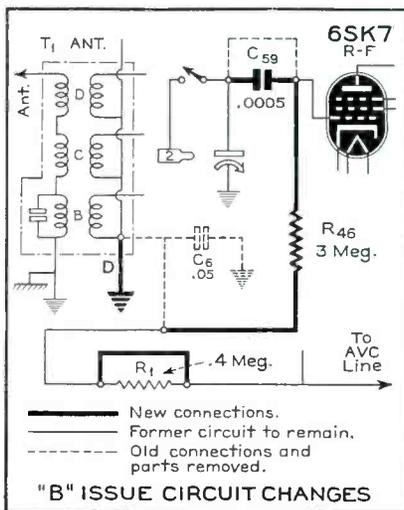
These tubes were used in sets made in 1938 and in some sets made in 1939.

Joseph K. Rose, Service Manager  
WELLS-GARDNER & COMPANY

#### WELLS-GARDNER 1A29

*Production changes to reduce modulation hum:* The circuit changes indicated on the accompanying schematic have been made in these models to reduce modulation hum. Models in which the changes have already been made at the factory can be identified by the chassis number 1A29-2B or 1A29-3B.

Resistor R1, 400,000 ohms, in series with the avc connection to the antenna coil, has been removed from the circuit. The avc line is no longer connected to the antenna coil at terminal D. Instead, this terminal is connected to ground. The by-pass condenser C6, 0.05 mfd, formerly connected



between the same terminal and ground, has been removed from the circuit.

The avc line which formerly connected to the D terminal of the antenna coil and C6, is now connected through a 3-meg resistor R46 to G1 of the 6SK7 r-f tube.

G1 of the 6SK7 r-f tube, which was formerly connected directly to the stator of the gang condenser, is now connected to this point through a 0.0005-mfd condenser, C59.

Joseph K. Rose, Service Manager  
WELLS-GARDNER AND COMPANY

# Where Perfect Reception is Essential—



IN SCHOOLS  
AUDITORIUMS  
HOTELS  
RESTAURANTS  
CLUBS  
GYMNASIUMS  
RECREATION HALLS

Wherever High-Quality Radio  
Reproduction is to be used  
with Audio Amplifying Equipment

## Use a Meissner P-A Tuner!

Whatever type of Radio-Public Address installation is to be made—fixed or portable—there's a Meissner P-A Tuner to fill the bill. Three efficient models to select from—also provided with multiple output impedance to feed any good Audio Amplifier.

These P-A Tuners are supplied as complete kits (except tubes) with detailed printed instructions and diagrams. Assembly and wiring is merely a matter of a few interesting hours with soldering iron, pliers and screw-driver.

#### HIGH-FIDELITY MODEL

Broadcast-band coverage, two-stage band-pass TRF with diode detector, AVC and dual-triode audio and monitor amplifier. Especially designed for most faithful reproduction of High-Fidelity Broadcasts. Five tubes, operates on 110 volts, 60 cycles.

#### "UTILITY" MODEL

Broadcast-band coverage, three-stage Ferracart (iron-core) TRF with diode detector, AVC and dual-triode audio and monitor amplifier. Ample selectivity and sensitivity for excellent reception of local or distant

Broadcast stations without interference. Six tubes, operates on 110 volts, 60 cycles.

#### DUAL-BAND MODEL

A seven-tube super-het with tuning indicator—covers regular broadcast and the 5.9 to 18.8 mc short-wave band. Has RF stage on both bands, diode detector, AVC and dual-triode audio coupler monitor amplifier. This is the Tuner to use where distant reception of Broadcast or Foreign programs is desired. Somewhat larger than the other two models—has 7¼-inch linear scale dial. Operates on 110 volts, 60 cycles.

To obtain any of the literature listed below, just clip the lower part of this ad, check the items you want, write your name and address in the margin and mail to the address below.

### Get This New Book!



A brand new 168-page book, full of live, interesting, up-to-the-minute radio constructional data and information. Contains complete diagrams and instructions for all the Meissner Kit Receivers as well as complete data on ready-wired units.

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For more detailed information and prices on these unusual P-A Tuner Kits, as well as a complete listing of all Meissner Products, get this big 48-page 1940 Catalog, absolutely free.

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Ask your Parts Jobber for details of the Meissner Time Payment Plan on which these P-A Tuners and many other Meissner Products may be purchased.

DEPT. S-2



# RCA SIGNALYST



The RCA Signalyst is an all-wave oscillator designed as a companion to the RCA Rider Chanalyst.

**T**HIS device is a signal generator designed for the service field and consists of an oscillator, a buffer-modulator stage and an output metering circuit. It is similar to the type of equipment used in the industry for factory development and production tests.

### • • • circuit

A 6J5 is employed in a Colpitts circuit and generates radio frequencies between 100 kc and 120,000 kc in 10 bands. The output of this oscillator is capacity-coupled to the No. 3 grid of a 6SA7 used as a buffer modulator. Modulating voltage, either internal 400 cycles generated by the triode section of a 6F7, or external voltage of any frequency up to 5 mc is introduced on the No. 1 grid of this modulator. The modulated voltage in the plate circuit of this buffer is capacity-coupled to the output system consisting of a shielded resistance ladder attenuator and the metering circuit consisting of a 6H6 rectifier and a d-c meter. Metering is done at a fixed level up to a value of 50,000 microvolts

and the subdivision of the voltage accomplished by means of the stepped and fine controls of the attenuator. For voltages between 50,000 microvolts and 0.3 volt a separate output jack is used with the meter in shunt with this jack.

Other features include a heterodyne detector for calibration purposes, consisting of the pentode section of the 6F7; the conversion of the audio oscillator to an audio amplifier when the detector is in use; regulated plate and screen voltages and a regulated plate voltage supply for an associated crystal calibrator when used.

### • • • features

The iron-core coils and air-trimmer capacitors permit very accurate and stable alignment and dial calibration for each range. Three color bands are used on the large dial (approximately 90 inches scale length) to facilitate setting. The tuning condenser has a positive gear drive and two tuning ratios (90:1 and 16:1) are provided. Output is available at the end of a coaxial cable which reduces leakage to a minimum and facilitates connections to stages. The

A ladder attenuator and output metering circuit is employed in the Signalyst. Metering is done at a fixed level up to a value of 50,000 microvolts and the subdivision of the voltage accomplished by means of the stepped and fine controls of the attenuator.

attenuator is calibrated directly in microvolts.

The instrument provides for internal 400-cycle modulation. This 400-cycle audio output can be used externally.

The metering circuit is also useful as a zero-beat indicator in calibration work. The self-contained heterodyne detector allows direct calibration of any external signal.

### • • • specifications

Finish: Gray oven-baked crinkle. Three color dial.

Controls: Band switch, fine and coarse tuning controls, r-f control, power (modulation) selector, fine and coarse attenuator controls.

Range: 100 kc to 120 mc.

Bands: 10.

Modulation: 400 cycles.

R-f output: Maximum, low range—0.05 v, high range—0.3 v; minimum, low range 100 kc to 15 mc, 1 microvolt; 15 mc to 30 mc, 5 microvolts; 30 mc to 60 mc, 25 microvolts; 60 mc to 120 mc, 50 microvolts; high range—0.1 v.

Accuracy: 1%.

Output attenuator: Ladder type direct reading attenuator; 5 position.

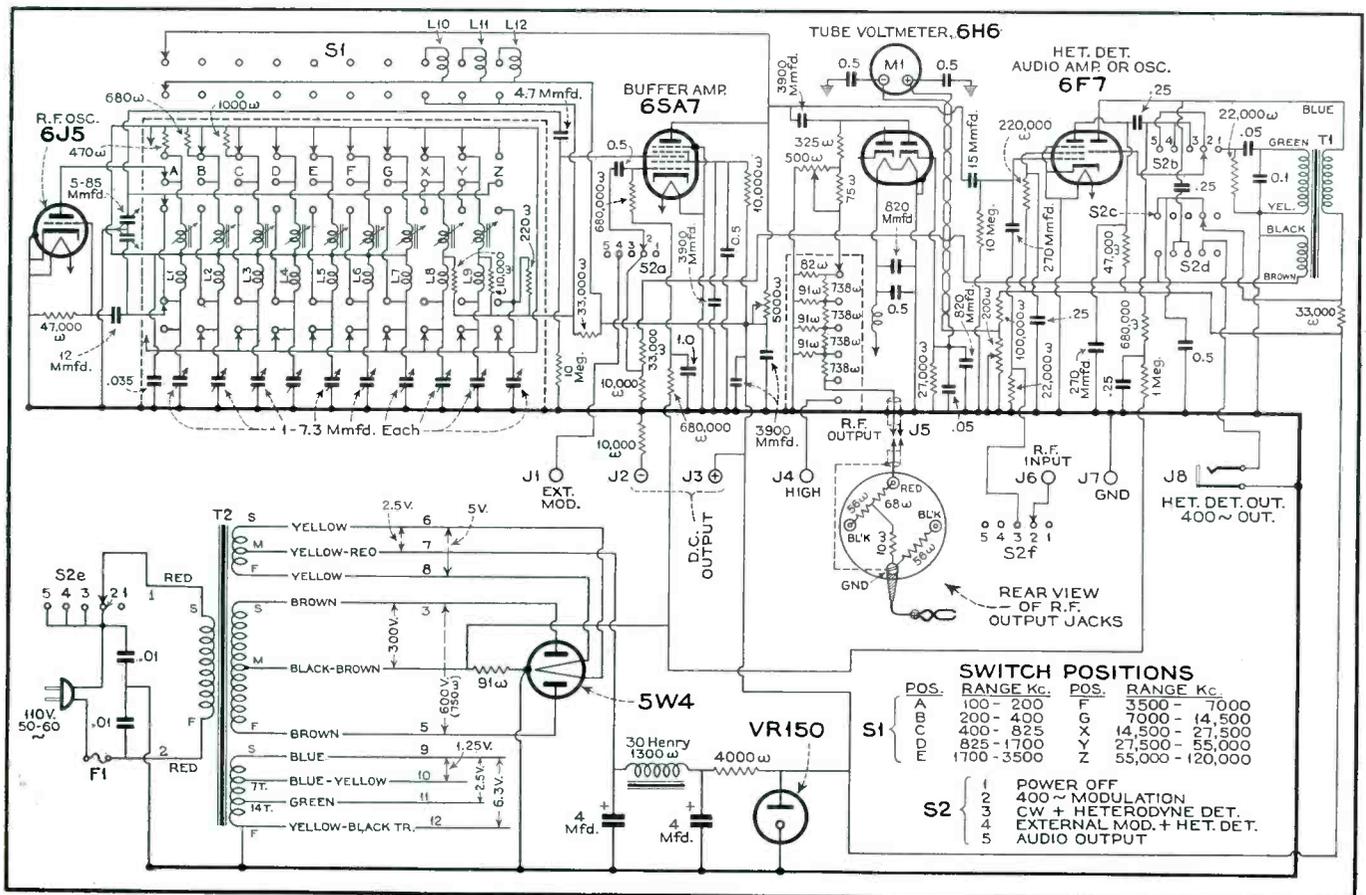
Power supply: 110-120 v, 50-60 cycles.

Power consumption: 35 watts.

Tube compliment: (See circuit).

Dimensions: 9 3/4 h x 14 1/2 x 8 d.

Weight: 21 lbs. net.



# 1940 SOUND

By S. GORDON TAYLOR

**T**HE time is definitely ripe for sound men to take stock of themselves and their markets. If preliminary reports on the volume of sound sales during 1939 are correct, the business is somewhat off from the peak year 1937, although ahead of 1938. Does this mean that the market is approaching saturation? That it will be necessary to scratch even harder for business than in the past? Before going into a dither of pessimism let's look at the facts.

At best, such reports and forecasts are of limited value to individual sound men. If local economic conditions result in a buying slump in one community, the dealer located there is going to get little satisfaction from the fact that the nation as a whole is on a buyer's spree. Of far greater importance to those who depend on sound sales and service for a livelihood are numerous other indicators found by keeping one's eyes and ears open. During the past year, for instance, scarcely a week passed without extensive reference in the newspapers

Fig. 2. Buddy Wagner's Electro Swing Band introduced the novelty of electronic wind instruments, utilizing magnetic pickups attached to the individual standard instruments.

- ◆ Orchestras
- ◆ World's Fair
- ◆ Home Recording
- ◆ Replacements
- ◆ Legislative Halls
- ◆ Electronic Equipment
- ◆ Window Displays
- ◆ Intercommunications
- ◆ Schools and Churches
- ◆ Stadiums and Auditoriums
- ◆ National Election
- ◆ South America

to new applications of sound systems among musicians and orchestras.

Both the Cracraft and Buddy Wagner orchestras received column after column of publicity, introducing the novelty of

completely electrified orchestras in which each instrument had its own amplifier system and speaker but with the volume, individually and as a group, controlled from a multiple panel on the leader's table. Here was beautiful propaganda, setting the stage in readiness for the sound man to step in, aiming at sales not of single sound systems but of perhaps a half dozen or more individual systems to a single orchestra.

Rubinoff, playing his famous Stradivarius under an umbrella rather than disappoint a rain-soaked crowd of 5,000 people at an outdoor concert, likewise provided grist for the press, whose incidental mention that he employed a contact mike and amplifier overnight made thousands of instrumentalists sound-system conscious.

When a famous director of a symphony orchestra went into temporary seclusion with the expressed intention of emerging with a fully electrified orches-

Fig. 1. The Cracraft Electronic Orchestra is credited with being the first in which every instrument is electrified. Inset shows a close-up of the director's control panel by means of which he can regulate volume of individual instruments, certain groups or of the orchestra as a whole.

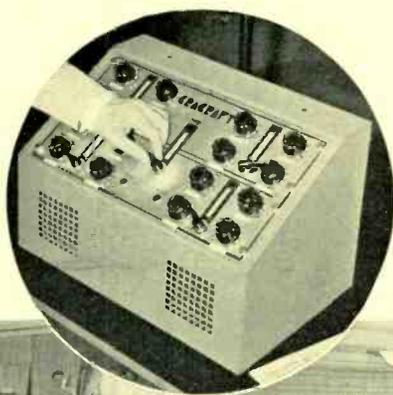




Fig. 3. The Wurlitzer String Symphonon employs a wide variety of string instruments, each with the pick-up built in and working into its own amplifier and speaker.



Fig. 4. The sale and servicing of electronic pianos such as this Krakauer Electone opens up a new field for sound men which is destined to become a highly promising one.

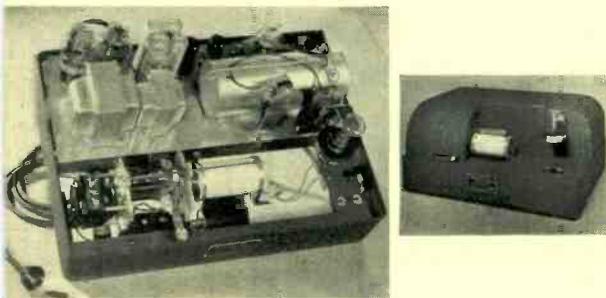
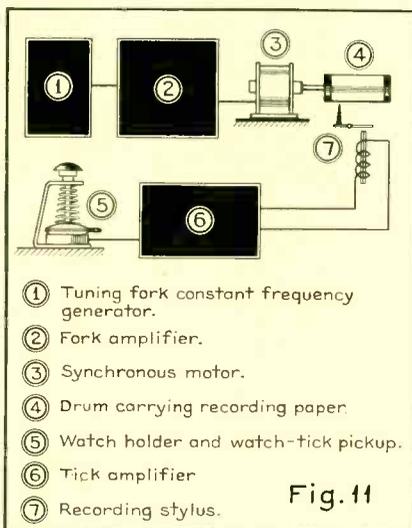


Fig. 10. Manufacturers of commercial and industrial electronic devices, such as this unit, for instantly checking the accuracy of watches, encourage sound men to function as local service representatives.



tra, that was *page one* news, creating still further interest among orchestra and band leaders.

Such publicity not only points the way to expanding markets for the sound man, but provides invaluable propaganda to aid him in developing and interesting prospects.

But all the possibilities do not lie along musical lines. There are constantly developing new applications of amplifier equipment for non-sound purposes. Many industrial and commercial applications are being found for systems that differ from standard sound installations only in that input and output devices are other than the conventional microphone and speaker. Standard amplifiers with contact pickups or photo-cell inputs are serving innumerable purposes and the future market for this equipment is limited only by the imag-

Fig. 21. Prospects appreciate the compactness, wide utility and simple control of modern school systems. This neat Clarion equipment provides general sound distribution from radio, voice or records, plus 2-way intercommunication facilities.



inations of sound men themselves—and by their willingness to spend the time to ferret out the needs of potential prospects.

Then, finally, there is the replacement market. The public address and sound games have been active now for well over a decade and much of the equipment installed in the earlier years is definitely outmoded if not actually inoperative. A check up on old business will sometimes provide surprising results in the form of new sales.

To keep posted on all of these possibilities is the business of every progressive sound man. The information he gleans in this way is of infinitely greater value to him than whole flocks of statistical data on the dollar value of last year's p-a equipment production, or someone's guess as to the volume for the coming year.

The following brief descriptions and illustrations are presented to indicate trends; ideas from here and there which it is believed will prove suggestive to all sound men.

#### electronic music

Nowhere are the opportunities more striking than in the musical field. The introduction of completely electrified orchestras such as those of Cracraft and Wagner referred to above indicates one highly important line of development. From the standpoint of the sound man such an arrangement involves not alone the sale of several complete sound systems to a single orchestra but perhaps commissions on special electrified musical instruments as well. He may also supply the special music stands to accommodate the amplifier equipment, the remote multicontrol panel for the leader, and so on.

The amplifier and speaker equipment utilized in this service is standard in

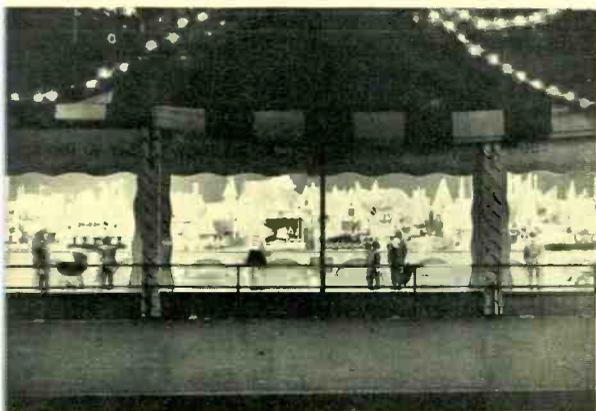
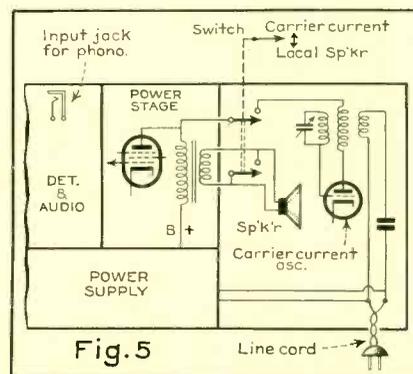


Fig. 13. Sight and sound window displays such as this Lafayette installation in Macy's department store in New York offer a medium through which sound men can cooperate with advertising men with mutual benefit.



Fig. 16. An unusual intercommunication installation by Morlen Electric Co. in the Metropolitan Life Insurance Co.'s main offices links five executives' desk sets with 10 talk-back speakers in the supply department, the latter so sensitive to pick-up that supply clerks can talk back from any point without interrupting their work.





Fig. 8. A complete sound system including a microphone on the desk of each legislator increases comfort and expedites business in the North Dakota State Legislature.

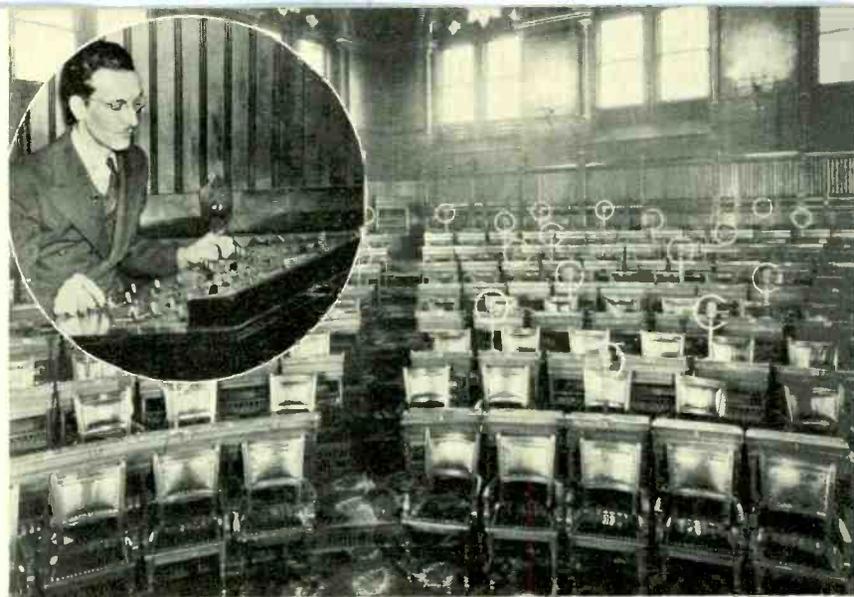
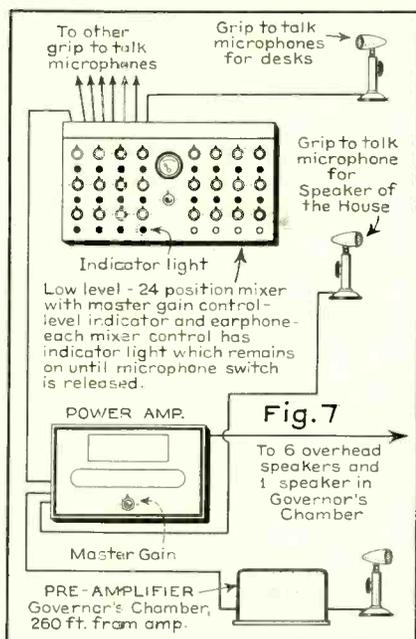


Fig. 9. (Right) The sound system in the Connecticut State Capitol successfully overcomes the former serious problem of dead spots and reverberation. Inset shows the control panel which brings individual microphones into action as required.

every respect. Buddy Wagner (Fig. 2) employs Lafayette Model 440TDF amplifiers throughout, for instance. These are 25-watt units and provide a maximum combined output of well over 200 watts for his orchestra.

In his case the pickups consist partly of Amperite Kontakt mikes and partly of special magnetic units developed by his own technical expert for attachment to the reeds of wind instruments. Cracraft (Fig. 1) on the other hand employs instruments especially designed for this service. Novel among these is the set of electronic kettle drums which, in a small unit not more than a couple of feet square, provides the equivalent output and playing flexibility of eight great drums. The Wurlitzer String Symphony (Fig. 3) likewise employs instruments designed for the purpose. These are the Epiphone "Electars"—a complete variety of plucked-string instruments with pickups built in during construction.

Electronic pianos offer increasing service possibilities for sound men—and perhaps more important, sales opportunities. Inquiry shows that piano manufacturers are glad to cooperate with sound men in the matter of discounts in territories where they do not have established dealers, and in dealer territories the dealers are entirely willing to allow satisfactory discounts. The unit value of each sale is large here and these discounts can mount into important figures. To date the largest sale for these pianos is among orchestras, theatres, amusement spots, etc. With rapid development work now going on, aimed at size



and price reduction, they are certain to become popular in the home, opening an entirely new and lucrative service field for qualified men. Electronic organs likewise may become an important factor both from the sales and service angles.

A novel stunt which means added service or installation revenue is that shown in Figs. 5 and 6. It is a simple means for adapting a piano, organ or other amplifier system for the reproduction of a remote radio tuner or record player. The system is shown with the Krakauer "Electrone" piano. In this case the RCA "Little Nipper" Model 5X5 (shown atop the piano in Fig. 4)

Fig. 12. (Below) Technically very similar to an ordinary sound system is this portable device which accurately locates underground leaks in water mains. Another item which logically lends itself to merchandising are servicing by sound men.



Fig. 14. This relatively simple window display, with sound effects from chime records reproduced through speakers above the sidewalk attracted wide attention at Lord & Taylor's department store during Christmas week.



Fig. 17. Signal lights, annunciator drops, elimination of manual push-to-talk switch operation, and privacy through use of a hand-set when desired, mark the latest intercom equipment.

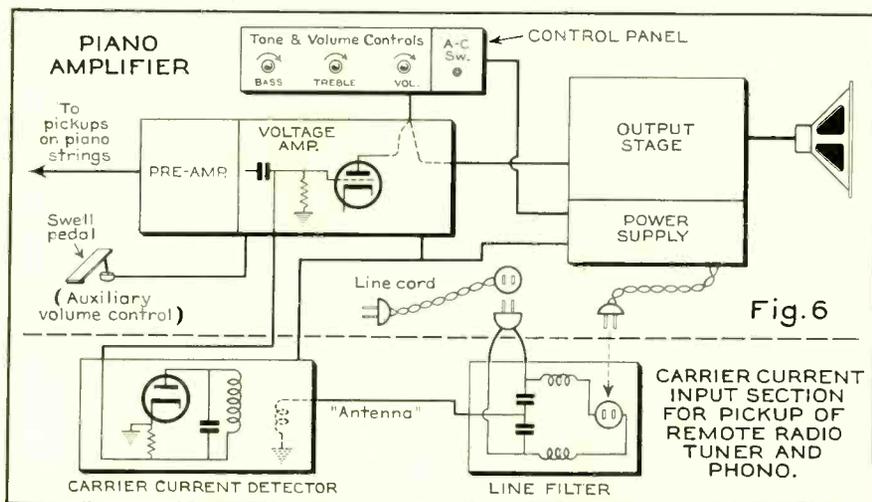


Fig. 15. A 10-day 'Buy at Home' campaign by the Plainfield, N. J., Chamber of Commerce provided a nice rental job for the owner of the Clavin equipment, shown below.





Fig. 19. St. Andrews Church, Calumet City, Ill., is fully sound equipped with two 60-watt Thordarson amplifiers. These drive directional speakers behind the cross-shaped grill in the ceiling from four Shure uni-directional microphones at the pulpit and altar, and reproduce recorded chimes through heavy-duty speakers in the belfry.

is employed as the remote tuner and its built-in phono jack provides for record pickup. This is a complete superhet receiver but also includes an r-f oscillator and switching arrangement (Fig. 5) such that the output of the radio (or phono) can be employed to modulate the oscillator output. This modulated carrier is then fed into the power line through the line cord and can be picked up from any other point on the line by means of a simple detector circuit tuned to the same frequency. To adapt any amplifier for such use it is only necessary to build in this detector circuit and a line filter. These circuits are shown at the bottom of Fig. 6 as they are in the "Electrone" piano. No changes are required in the "Little Nipper." It

Fig. 22. Uni-directional microphones aid materially in overcoming feedback tendencies inherent in many school auditoriums. They solved the problem for the Radio Equipment Co., Dallas, Texas, in making this installation in the Woodrow Wilson High School. Shure Unipler mikes were used.

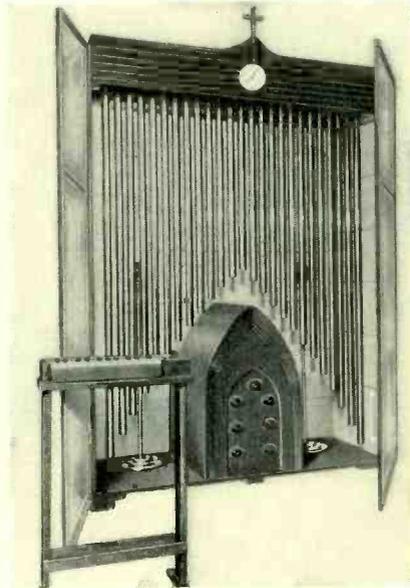
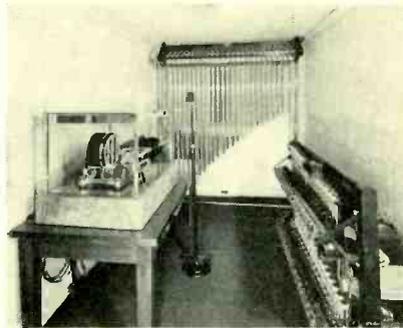


Fig. 18. (a) (Above) This Amplified Carillon marketed by Sundt Engineering Co., provides outputs suitable for indoor and outdoor reproduction, the latter with a range of several miles if desired. (b) (Below) The Singing Towers automatic equipment of the AMI Distributing Co. includes not only chimes but a vibro-harp (right) and record player (left) and provides the utmost in variety and automatic operation.



might be added that such a scheme provides the answer to the problem of radio and phono inputs to p-a systems where the amplifier is located at some distance and interconnecting wires are either undesirable or expensive to install.

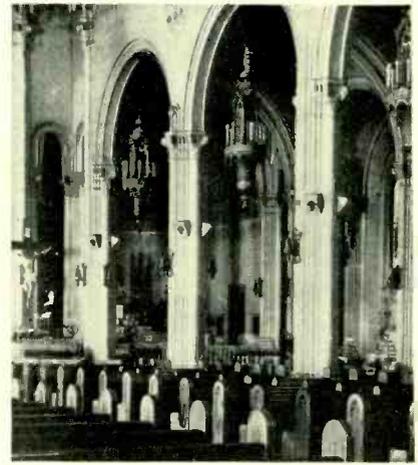


Fig. 20. The interior design of St. Peter and Paul's Cathedral, San Francisco, Calif., presented a difficult acoustic problem which was overcome by a carefully planned RCA sound system. Speakers are mounted in appropriate housings on the pillars.

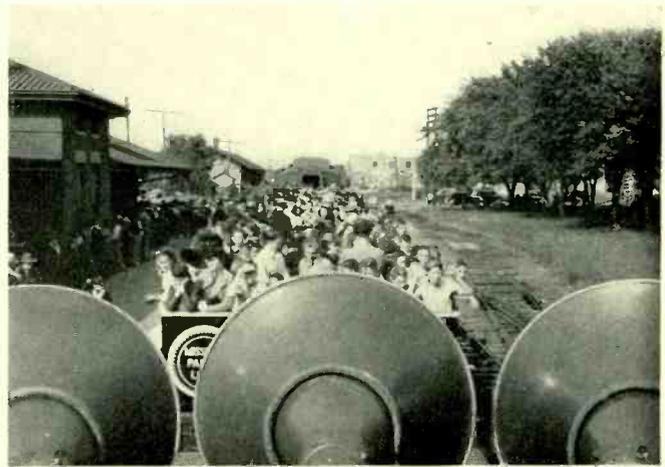
### legislative halls

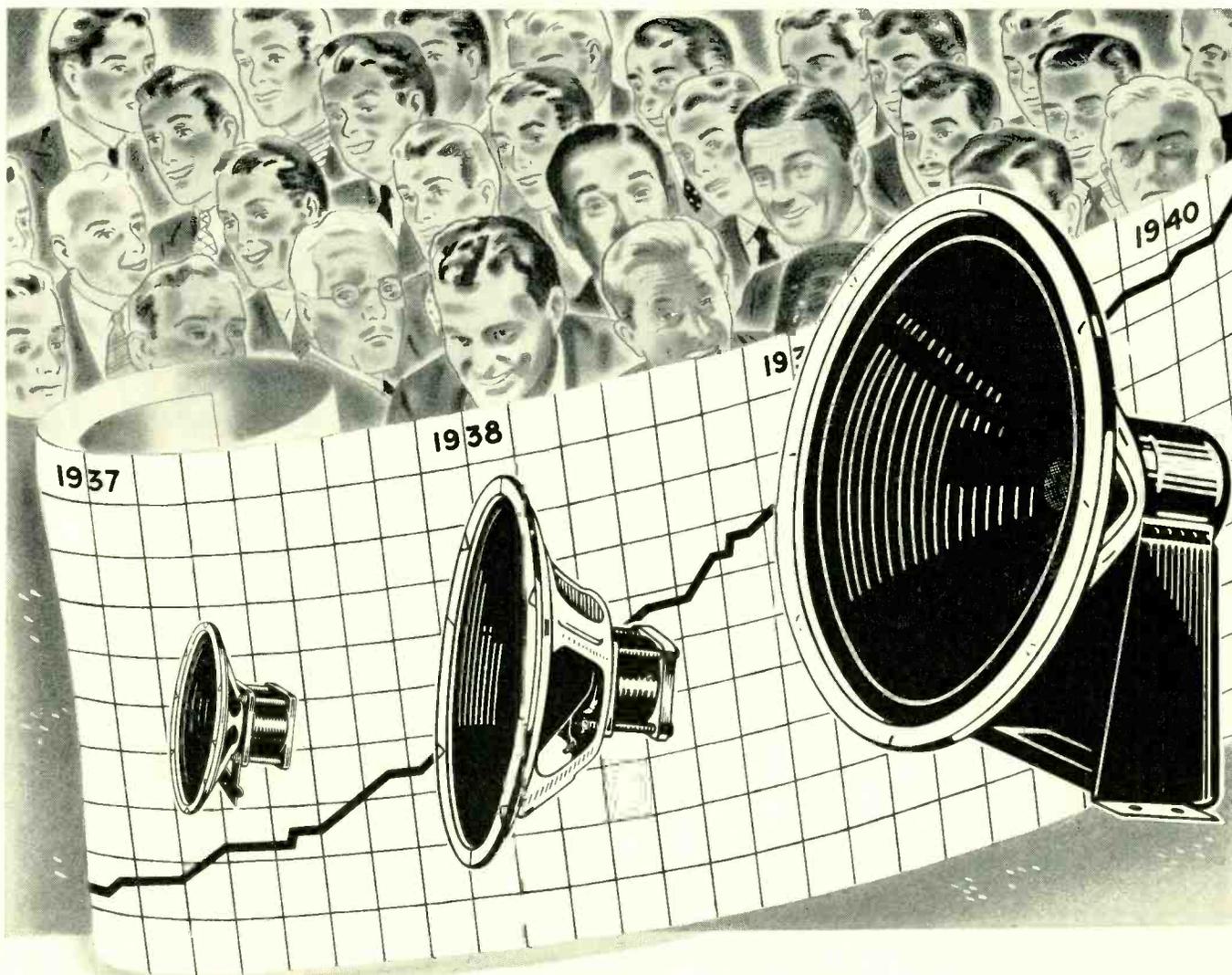
State legislatures and city councils can use p-a installations to excellent advantage. Not only are their meeting halls usually of large size, making it difficult for an individual speaker to be heard comfortably, but are often of out-moded design with acoustic conditions badly in need of correction.

This field is made particularly promising by the fact that the equipment re-

(Continued on page 23)

Fig. 23. Sound distribution on a moving train was one man's sound problem with only 24 hours' notice. The solution is shown in the two pictures below.





## *Preference* FOR UTAH SPEAKERS CONTINUES TO RISE RAPIDLY

The *balanced line* of Utah Speakers has won a continually increasing preference from every branch of the radio and sound equipment industries. It is a preference earned by time-proven dependability, uniformity and consistent high quality.

Last year 1,676,622 Utah Speakers were selected to meet the specific requirements of engineers and service men in every part of the country. Ruggedness and adequate power handling capacity are built-in characteristics of service-free Utah Speakers.

Utah engineering keeps abreast of the developments and improvements in both industries. Outstanding tone quality is obtained by the careful selection of high quality materials and the precision

manufacturing and treatment of each individual part—a special plasticizing process insures voice coils against mechanical failure or heavy overloads—cones are treated to give minimum absorption—heavier gauge metal assures ample overall rigidity—they are completely dustproof throughout—these and many other features assure “audience approval.”

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**S P E A K E R S**  
VIBRATORS • TRANSFORMERS • UTAH-CARTER PARTS



## 1940 SOUND

(Continued from page 20)

quired is usually extensive, involving an individual microphone for each legislator, a central control system whereby individual mikes are cut in as members are recognized by the Chairman, several speakers for proper sound distribution and oftentimes special output circuit arrangements to permit proceedings to be relayed to local stations for the broadcast of special proceedings.

A general circuit arrangement suitable for such installations is shown in Fig. 7. This is the circuit employed in the Webster (Chicago) installation made by the Technical Radio Supply Co. of Mandan, N. D., in the North Dakota



Fig. 24. 5000 sight-seers visit the Schultz Brewery weekly. A sound system and recorded talk provide the description, as the guided tours move along, easily over-riding the noise of the machinery.

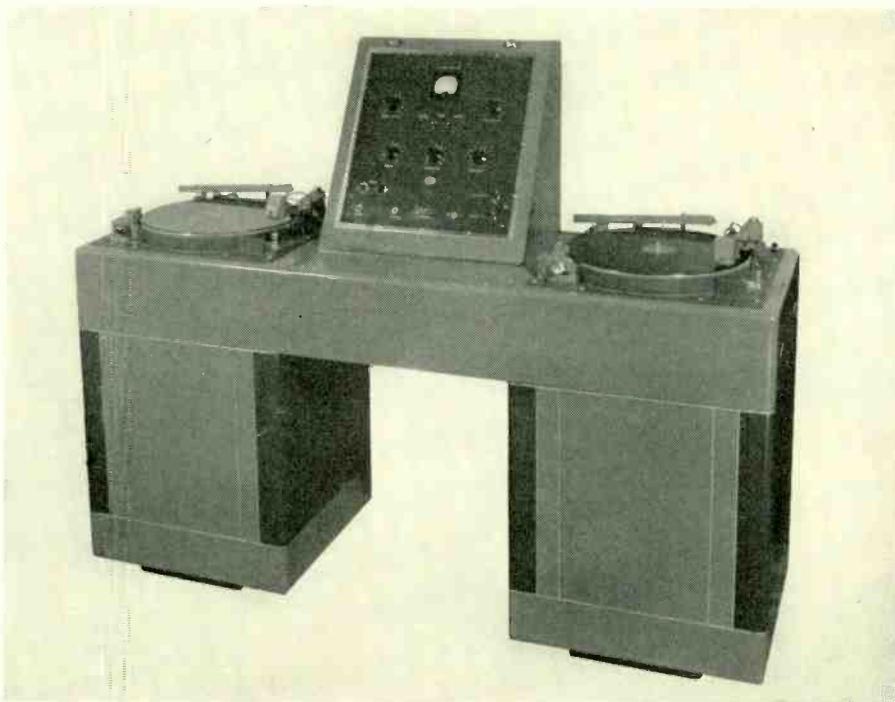
State Capitol as shown in Fig. 8. In this installation over a hundred microphones are employed. Fig. 9 shows a Western Electric installation in the Connecticut State Capitol and the central control panel with its operator. Here the circuit layout is similar to that of Fig. 7 but had reverberation characteristics of the hall made it necessary to group the speakers and train them directly on the legislators. To avoid feedback under these conditions advantage had to be taken of the sharply directional characteristics of the W. E. 639A cardioid microphones.

### non-sound applications

Indicative of opportunities for servicing commercial electronic equipment is an invitation recently extended by American Time Products, Inc., to radio and sound service men to apply for appointments as official service agents for the "Watch Master," a device widely used by high-grade jewelers for checking the

(Continued on page 27)

# PRESTO offers a new Dual Turntable Transcription Recorder complete in a single unit



**T**HIS new, moderately priced Presto Model F recorder makes the perfect installation for broadcasting stations, colleges, advertising agencies and personal recording studios. It records continuously, without interruption, on records up to the 17 $\frac{1}{4}$ " master size and also rerecords from one record to another. The quality of the recordings made on the model F recorder make them suitable for use by any broadcasting station.

### Note these operating conveniences:

- The exclusive Presto rubber-rimmed turntable driven directly by a steel pulley on the motor shaft, a drive system that eliminates idler wheels, belts and gears and other parts subject to rapid wear. Speed shift-lever changes instantly from 78 to 33-1/3 R.P.M.

- Tables equipped with the Presto 1-C high fidelity cutting head which records

uniformly a range from 50 to 8000 cycles and completely modulates the groove at a pitch of 112 lines per inch.

- A vertical damper eliminates vertical modulation in the groove and prevents rapid changes in groove depth due to surface irregularities in the disc.

- A time scale on the cutting arm shows the correct starting point for all sizes of discs and elapsed recording time at both 78 and 33-1/3 R.P.M.

- Amplifier gain 125 DB, output 10 watts. Amplifier controls include two microphone mixers, playback gain control, combination control for increasing the high frequency response for 33-1/3 R.P.M. recording and attenuating the high frequencies for playing commercial records, low frequency equalizer and a switch for changing instantaneously between cutters and for re-recording.

- The complete equipment mounts in a wood table (Length, 67" — Depth, 21" — Height, 49") attractively finished in two tones of gray with silver trim. Height of turntable above floor level, 32".

For descriptive folder and price quotations, write:

**PRESTO RECORDING CORPORATION**  
242 West 55th St., New York, N. Y.

**- DYNAMIC MICROPHONES -**  
(Continued)

MANUFACTURER	MODEL	IMPEDANCE (Ohms)	(1) OUTPUT	FREQ. RANGE (c.p.s.)	db VARIATION OVER RANGE	(4) DIRECTIVITY	FINISH	NET W'G'T (Lbs)	DIMENSIONS (Inches)	MODEL	IMPEDANCE (Ohms)	(1) OUTPUT	FREQ. RANGE (c.p.s.)	db VARIATION OVER RANGE	(4) DIRECTIVITY	FINISH	NET W'G'T (Lbs)	DIMENSIONS (Inches)
SOUTH BEND MICROPHONE COMPANY	D3	50, 200, 10,000	-53	40 to 10,000	±5	SD	Chrome	1½	2½" dia.									
TRANSDUCER LABORATORIES	TR56	50, 200, 50,000 or 500,000	-42	100 to 6000	±8	SD	Black Bakelite	1 Lb. 10 oz.	5" X 3"									
TURNER CO.	U9	30-50, 200 500 or High	-52	40 to 9000	±3	SD	Battleship Gray	2½	3½" X 3½"	88	30-50, 200 500 or High	-54	40 to 9000	±3	SD	Deep Chrome	•	•
	22D	"	-54	40 to 8000	±4	"	Satin Chrome	•	•	99	"	-52	"	"	"	Gunmetal	•	•
	33D	"	"	40 to 8500	±3	"	"	•	•									
UNIVERSAL MICROPHONE Co., Inc.	300 Series	33, 200, 500, High	-58	50 to 8000	•	•	Chrome	11	2¼" X 2¾"									
WESTERN ELECTRIC CO.	630 A	20	-89	40 to 10,000	+4 <sup>(11)</sup>	ND	Black	1	2½" dia.	639A	35	-84	40 to 10,000	-4 <sup>(11)</sup>	Cardioid	Aluminum Gray	¾	3½" X 4½" X 7½"
	633A	"	"	"	+3 <sup>(11)</sup>	"	Aluminum Gray	5/8	2" dia. X 3½"	639B	"	"	"	" <sup>(11)</sup>	Hyper-Cardioid	"	"	"

**VELOCITY MICROPHONES**

MANUFACTURER	MODEL	IMPEDANCE (Ohms)	(1) OUTPUT	FREQ. RANGE (c.p.s.)	db VARIATION OVER RANGE	(4) DIRECTIVITY	FINISH	NET W'G'T (Lbs)	DIMENSIONS (Inches)	MODEL	IMPEDANCE (Ohms)	(1) OUTPUT	FREQ. RANGE (c.p.s.)	db VARIATION OVER RANGE	(4) DIRECTIVITY	FINISH	NET W'G'T (Lbs)	DIMENSIONS (Inches)
AMPERITE COMPANY	ACH ACL	2000 200	-70	60 to 7500	±2 Approx.	BD	Gunmetal or Chrome	¾	1½" X 2¾" X 1¾"	RBHk RBMk	2000 200	-65	40 to 11,000	±2 Approx.	BD	Gunmetal or Chrome	3	3" X 3½" X 8"
	KKH <sup>(8)</sup> SKH <sup>(8)</sup>	2000 2000	-40	60 to 6000	•	•	"	•	•	RBHn RBMn	2000 200	"	"	"	"	"	"	"
	KTH <sup>(8)</sup> KF <sup>(8)</sup>	2000 200	"	40 to 9000	•	•	"	•	•	RSHk RBSk	2000 200	-68	60 to 8000	"	"	"	"	"
	RAH RAL	2000 200	-68	60 to 7500	±2 Approx.	BD	"	2	3" X 2½" X 8"	SR80Hn SR80n	2000 200	-56	40 to 15,000	"	"	"	5	3½" X 3" X 9"
	RBBn RBBn	2000 200	-65	40 to 11,000	"	"	"	3	"	7JH 7J	2000 200	-70	60 to 7500	"	"	"	1/2	2½" X 1½" X 2½"
BRUNO LABORATORIES Inc.	H <sup>(2)</sup>	High	-55	70 to 9000	±5	BD	Silver Crystalline	5 oz.	4¼" X 1" X 2¼"	PR	High, 500, 200 or 50	-61	30 to 14,000	±1	BD	Telephone Black	5	9" X 4¾" X 3¾"
	MB <sup>(2)</sup>	"	-50	"	"	"	Gunmetal or Chrome	2	8" X 2¾" X 3"	OR	High or 200	-65	50 to 12,000	±2	"	Gunmetal or Chrome	3	3¾" X 7" X 2"
	MP <sup>(2)</sup>	"	-55	"	"	"	"	4 oz.	2½" X 2¾" X 1½"	VR	High, 500 or 200	-67	"	±3	"	"	"	7¼" X 3½" X 2½"
	MS <sup>(2)</sup> MS-S	"	-45	"	"	"	Silver Crystalline	2	7" X 3½" X 2"	WM	High	-65	"	±2	"	"	3¾	7¼" X 3½" X 2¼"
CARRIER MICROPHONE COMPANY	300V	200, 500	-70	30 to 10,000	±3	BD	Dark Statuary	7	9¾" X 4"									
ELECTRO-VOICE MFG. CO., Inc.	L15	High, 500 200, 50	-68	50 to 7500	±5	BD	Chrome	1¼	•	V2	High, 500 200, 50	-64	35 to 11,000	±3	BD	Gunmetal, Chrome Trim	2¾	•
	V1	"	-65	40 to 10,000	±4	"	Gunmetal, Chrome Trim	1¾	•	V3	"	"	30 to 12,000	±2	"	"	3	•
RCA MFG. CO Inc.	30A	250	-80 <sup>(3)</sup>	80 to 7000	•	BD	Black	•	•	77B	50, 250	-66	30 to 10,000	±5	UD	Chromium and Black	2	10" X 3¾" X 2½"
	44BX	50, 250	-61	30 to 15,000	±1	"	Chromium and Black	8½	12" X 4¾" X 3¾"									
	74B	50, 250, 15,000	-63	70 to 8000	±4	"	"	2½	7¾" X 4" X 2½"	77C MI4042	50, 250	-68	30 to 10,000	±3	UD, BD, or ND	"	3	8½" X 3¾" X 2¼"
SOUTH BEND MICROPHONE CO.	R, RV	50, 200, 10,000	-64	30 to 12,000	±3	BD	Chrome, Bronze, Black, Nickel	1½	2" X 3" X 7"									
UNIVERSAL MICROPHONE CO., Inc.	AV	33, 200, 500 or High	-56	30 to 12,000	±1 Approx.	BD	Satin Chrome	3	3¾" X 5½"	800 Series	33, 200, 500 or High	-60	40 to 10,000	±2 Approx.	BD	Chrome	1	1¼" X 4½"
	M4	"	-58	40 to 10,000	±2 Approx.	"	Black & Chrome	2½	"									

For additional information, such as price, accessories included, etc. write to the individual manufacturers.

FOOTNOTES -

- (1) FROM 1 VOLT/BAR.
- (2) VELOTRON (ELECTROSTATIC VELOCITY).
- (3) 10 DYNES/SQ. CM., 12½ MW. ZERO LEVEL.
- (4) BD = BI-DIRECTIONAL, UD = UNI-DIRECTIONAL, SD = SEMI- " , ND = NON- "
- (5) SOUND CELL
- (6) DIAPHRAGM TYPE
- (7) AT 100 C.P.S.
- (8) CONTACT MICROPHONE.
- (9) FOR HEARING AIDS, ETC.
- (10) LAPEL MICROPHONE.

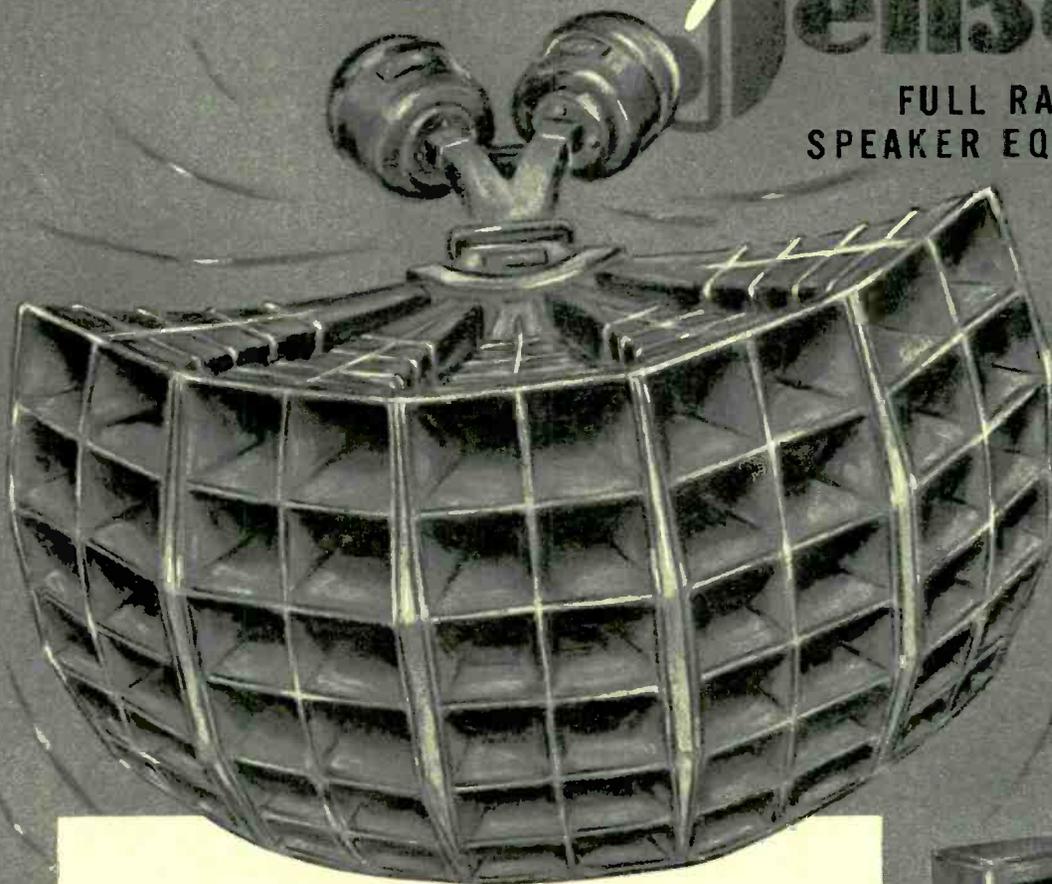
- \* (a) DIRECTIVITY CONSIDERED IN BOTH HORIZONTAL AND VERTICAL PLANES.
- (b) FRONT TO REAR DISCRIMINATION, 12 TO 15 db. FOR WIDE RANGE.
- (c) COMMUNICATIONS TYPE - R-F PROTECTED.
- (d) AT END OF 25 FT. CABLE.
- (e) FRONT TO REAR DISCRIMINATION, 20 db. FOR WIDE RANGE.
- (f) HAND MIKE
- INFORMATION NOT SUPPLIED.

(11) AT MOST EXTREME POINT FROM 1000 ~.

(COMPILED FROM DATA SUPPLIED BY MANUFACTURERS)

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**Jensen**

FULL RANGE  
SPEAKER EQUIPMENT



**A Complete New Line  
of Jensen Products of Commanding  
Character and Magnitude**

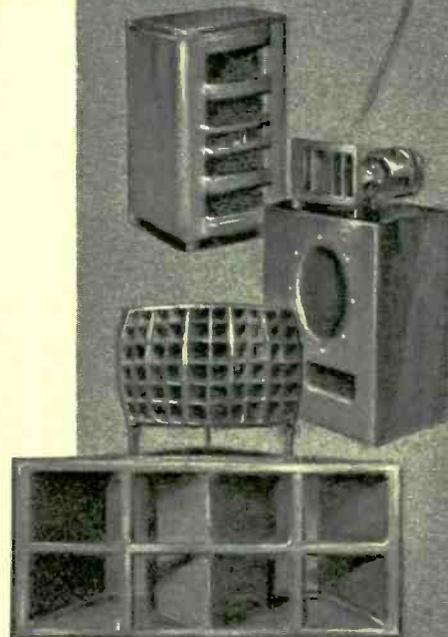
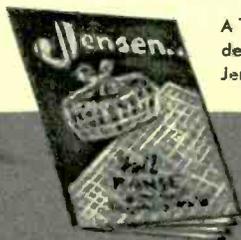
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# RECORDER CHARACTERISTICS

( COMPILED FROM DATA SUPPLIED BY MANUFACTURERS )

MANUFACTURER	MODEL	TYPE	TURN-TABLE DIA. (Inches)	TURN-TABLE SPEED R.P.M.	SPEED CHANGE SYSTEM	TYPE OF MOTOR	TURN-TABLE DRIVE SYSTEM	PITCH LINES PER INCH	CUTTER FEED SYSTEM	FEED DIRECTION	CUTTER TYPE	CUTTER IMPEDANCE (Ohms)	MICRO-SCOPE	PICKUP TYPE	INTERNAL OR EXTERNAL	OVERALL GAIN db	ADDITIONAL INPUTS	AMPLIFIER		LEVEL INDICATOR		
																		INPUT LEVEL db	INPUT IMPED. (Ohms)		UNDISTORTED OUTPUT (Watts)	SPEAKER DIA. (Inches)
ALLIED RECORDING CO.	12	Portable	17	33 1/3 and 78	Panel Control	Sync.	Rim	96-104	Overhead lead screw	I-O or O-I	Magnetic	500 or 15	Yes	Crystal or Mag.	Separate	110	Mike and Line	2-High 1-500 1-High 1-Inf.	10	Meter		
	16		115	40																		
	A		115																			
BELL SOUND SYSTEMS, Inc.	RC1M	Portable	•	78	—	•	•	•	•	O-I	Crystal	158,000 @ 100 c.p.s.	No	Crystal	•	•	•	•	•	•		
	16 RC	Portable	17 1/2	78-33 1/3	See Note (10)	S.S. (11)	Rim	90-130	Overhead	I-O or O-I	Mag.	500	No	Magnetic	Int.	1 Phono.	500,000	10	10	Meter		
DAVID BOGEN CO., Inc.	16 RP	"	"	"	Rubber pulley reversed	"	"	"	"	"	"	"	"	"	Ext.	"	"	"	"	"	"	
	212 RC	"	12	"	"	S.S. Induction	"	"	"	"	"	"	"	"	Int.	"	"	"	"	"	"	
	212 RP	"	12 1/4	"	"	"	"	"	"	"	"	"	"	"	Ext.	"	"	"	"	"	"	
	JR112	"	12	78	—	S.S. Sync.	"	110	"	O-I	"	6	No	Crystal	Int.	114	"	"	5	"	"	
BRUNO LABORATORIES Inc.	B12	Portable	12 1/2	33 1/3 - 78	By inverting later wheel	S.S. Split Capacitor	Rim	90-110	Overhead	I-O or O-I	Magnetic	6 or 500	No	Magnetic	With out Amp.	117	2 Mikes 1 Phono	High	10	10	Meter	
	BR16	Stationary	17 1/2	"	Change of two idlers	S.S. Sync.	"	120-130	"	"	Mag. Cr. (4) or Hi-Fidelity	"	No (4)	"	"	"	"	"	"	"	"	
	RA12	Portable	12	78	"	S.S. Split Capacitor	"	100	See (12)	O-I	Magnetic	6	No	Crystal	Int.	112	1 Mike 1 Phono.	"	6	"	"	
DUPLEX RECORDING DEVICES CO.	A16 (9)	Portable	17	33 1/3 and 78	Turn Dial	S.S. Sync.	Gears	96-108 (4) 112, 120	Permanently fixed overhead for gear	I-O (4) or O-I	Magnetic	5000	No (4)	Crystal	Ext.	•	•	•	•	•	•	
	E12 (13) E16 (14)	Portable	12 5/8	78	—	S.S.	Rim	100	Subparallel lead screw	"	Magnetic	10	No	Crystal	Int.	115	1 Radio	5 Meg.	4 1/2	8	Meter	
ELECTRICAL INDUSTRIES MFG. CO.	L16 (13)	"	"	"	Manual control	Permanent split capacitor	"	"	"	"	"	"	"	"	"	125	"	"	"	12	"	
	L16 (14)	"	17	33 1/3-78	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	15	12	
FAIRCHILD AVIATION CORP.	F26-3	Portable	16	33 1/3 and 78	Press down shaft	S.S. Sync.	Worm gear and adhesion	98, 118, 141, 161	Overhead Feedscrew	I-O or O-I	Crystal	500	No (4)	Crystal	Ext.	105	Mike Pickup 500 ohm Line	-35 250-333 (500 ohm) -60	2.5 Watts (500 ohm) 60 db	10	Meter	
	F29-3	Portable	12	33 1/3-78	Double size pulley	S.S. Induction	"	100	Overhead	O-I	Magnetic	8	No	Crystal	Int.	•	2	•	•	15	8	
FEDERAL RECORDER CO.	Little Pro 12	Portable	16	"	"	"	"	120	Overhead	I-O or O-I	"	"	"	"	"	•	2	•	•	"	12	
	Symphonic 16	"	17	33 1/3 and 78	Lever	S.S.	Belt and Gears	88 to 150 (7 changes)	Feed screws	I-O or O-I	None supplied	—	No	"	"	—	—	—	—	—	—	
POINSETTIA, Inc.	—	Stationary	16 (3)	33 1/3-78	Lever	S.S. Sync.	Idler wheels	112	Overhead screw	I-O or O-I	Magnetic	500	Two Optional	Magnetic	Ext.	135	3-Position Mixer	-105	50, 200, 500	10	Meter	
	A	Stationary	16 (3)	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
PRESTO RECORDING CORP.	B	Portable	16 (3)	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
	C	Portable	16 (3)	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
	Y	Stationary	16 (3)	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
	F	Stationary	16 (3)	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
	K	Portable	12	"	"	Change motor pulley	S.S. Constant speed Ind.	"	100	"	"	"	"	"	"	"	"	"	"	"	"	"
RADIO ELECTRONIC ENG. CO.	65R15	Cabinet (4)	12	33 1/3 and 78	8x change of drive wheels	S.S. Induction	Rim	96 to 120	Overhead lead screw	I-O or O-I	Magnetic	500	No	Crystal	Ext.	•	•	•	•	15	30 72	Meter
	65R70	Stationary	16	33 1/3-78	"	S.S. Sync.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
RCA MFG. CO. Inc.	MI 12700	Stationary	16	33 1/3-78	"	S.S. Sync.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
	MI 12701	Portable	12	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
SCULLY MACHINE CO.	— (6)	Stationary	16	33 1/3 and 78	Shift lever	S.S.	Belt	88, 96, 104, 112, 120, 128, 136	Lathe type	I-O or O-I	None supplied	—	Yes	Magnetic	"	"	"	"	"	"	"	
	A5	Portable	12	78	"	S.S.	Belt	96 (7)	Simplex mechanism	O-I	Magnetic	15 (8)	No	Crystal	Int.	•	•	•	•	5	6	
SOUND APPARATUS CO.	A6	"	"	"	"	S.S.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
	VIBROGRAPH COMBINATION	Stationary	See (9)	33 1/3-78	Switch	M.S. Sync.	"	96	Simplex mechanism	I-O or O-I	"	"	"	"	Ext.	"	"	"	"	"	"	
SPEAK-O-PHONE RECORDING & EQUIP. CO.	1-52	Portable	12	78	"	S.S. Induction	Rim	96	Under panel-worm gears	O-I	Magnetic	15	No	Crystal	Int.	112	1 Phono.	•	45,000	4.2	5 1/2	Meter
	161 Port.	Portable	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	PROFESSIONAL MASTER	Stationary	16	33 1/3 and 78	Flat Belt	S.S. Sync.	Flat Belt	90-110 130 Variable	Lead screw Friction	I-O or O-I	Magnetic	15	Separate Yes	Crystal	Ext.	112	3	-80	High 500 ohm High	12	12	Meter
	5150-5160	Portable	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	5151-5161	Console	12	78	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
UNIVERSAL MICROPHONE CO.	5152-5162	Chassis	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	5153-5163	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	A70	Console	10	78	"	S.S. Cons. Ind.	Idler wheel	109	"	O-I	Crystal	50,000	No	Crystal	Int.	•	•	•	•	7 1/2	12	Visual Indicator
	A72	Portable	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
WILCOX-GAY CORP.	A81	Console	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	A82	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

† For additional information such as price, accessories included, etc., write to the individual manufacturers. \* INFORMATION NOT SUPPLIED. † BALANCED CENTER TAP. (12) RADIAL ARM, GEAR DRIVEN UNDER CHASSIS. FOOTNOTES (1) S.S. = SELF STARTING. (13) BUILT-IN RADIO. (14) CAN BE OBTAINED WITHOUT CUTTING MECHANISM FOR TRANSCRIPTION WORK OR WITHOUT AMPLIFIER. (2) I-O = INSIDE-OUT, O-I = OUTSIDE-IN. (3) DUAL TURNABLES. (4) OPTIONAL. (5) SYNCHRONOUS CAMERA DRIVE, OPTIONAL. (6) SUCTION NOZZLE, CHIP COLLECTOR JAR & SUCTION MOTOR. (7) AVAILABLE IN 100, 110, (8) 500 OHMS ON REQUEST. (9) 16" FOR PLAYBACK. (10) PULLEY CHANGE OVER BY MEANS OF FLANK KNOB. (11) SYNC. WITH CENTRIFUGAL STARTING WINDING.

**1940 SOUND**

(Continued from page 23)

accuracy of watches.

The reason for this choice is evident from Fig. 10 which shows the instrument with its cover removed to disclose the special Clarion amplifier designed for this job by the Transformer Corporation of America. As illustrated in Fig. 11, this amplifier actually consists of two separate channels. One is employed to build up the output of a tuning-fork type constant frequency generator sufficiently to drive a small synchronous motor which in turn drives a recording drum. The other amplifies the ticks of the watch under test, driving a stylus which records them on a paper strip on this drum in the form of dots. The drum speed is precisely 300 rpm, and standard watches, if accurate, tick exactly this same number of times per minute (believe it or not). If the watch is accurate there will be one recorded dot for each revolution and with the stylus automatically moving along the drum these dots will form a straight line across the paper. If the watch is slow or fast even to the extent of a second per day this line will slope up or down, indicating the exact amount of error.

Another interesting non-sound development is a water leak detector developed by Lafayette. A problem of municipal and private water supply organizations, and of large industrial consumers of water, is the location of leaks in underground water mains. Inability to determine the exact location of a leak may mean tearing up large sections of



Fig. 26. Roller rinks are good sound prospects, with electronic organ music most adaptable to the tempo of this sport. That such organs can operate through standard amplifiers is indicated by the use of Lafayette amplifier equipment in this great rink in New Jersey.

paving in the search.

The Lafayette leak detector (Fig. 12) is in effect a completely portable, battery-operated noise meter with a sensitive pickup which is placed in contact with the ground. Built-in filters prevent the pick up of traffic and other interfering noises. The sound of even a tiny

**SOUND TIPS ABOUT THE SOUND THAT'S TOPS**



**M**ATCHED commercial sound products are as important to your customer's use and satisfaction as matched skiing equipment is to the fellow in the picture above. Because by offering "matched" equipment, you can easily present a more convincing sales story to prospects.

Co-ordination of design is one of the many reasons why it will

pay you to recommend RCA Commercial Sound. Every unit—from the smallest microphone to the largest sound distribution system—is designed to operate perfectly with all other units. And that's the sort of performance efficiency your customers will gladly pay for. The sort of efficiency that means increased sales and profits for you!



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Catalogs now available for microphone and recording divisions. Send for your copy.

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UPON  
**ALL**



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Cutting and Playback

## NEEDLES

Insure **BETTER** Record  
Performance

A standard for the entire industry! Sound technicians and engineers, studio production men and lay listeners agree that RECOTON hi-fidelity is absolutely dependable.



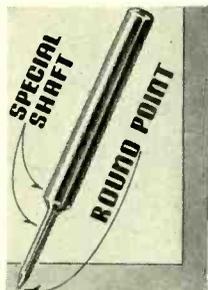
### STEEL CUTTING NEEDLES

Famous for Uniformity

Of very fine steel, highly polished; for acetate records; cuts a smooth, quiet groove. Your standby, once you've tested its quality!

**4**

Serviceable  
**PLAYBACK  
NEEDLES**



**Superior**—10 perfect playbacks per needle! Special shaft, rounded point, extremely hi-fidelity, minimum surface scratch and distortion.

**Transcription**—Round pointed, high polished steel; for acetate and conventional phonograph records. Extreme hi-fidelity.

**Automatic**—Made of hand-turned steel; minimizes snapping when used with record changers.

**Acoustic**—For acoustic and electric phonographs; of specially treated brass-plated steel alloy; loud, brilliant, emphasizes basses.

Also a Complete Line of

### SAPPHIRE

CUTTING and PLAYBACK NEEDLES

Long-life gems of extra fine structure, supremely precision-ground and high-polished. These are hi-fidelity products of the very first quality; nothing better on the market today.

### RECORD RENEWER

Cleanses, lubricates and preserves the original hi-fidelity qualities of your discs; also available, a special Acetate Renewer that will not mar the delicate surface. Should be on hand in every laboratory and studio.

Write for Literature

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CORPORATION

178 Prince Street - New York City

trickle of escaping water many feet below ground is picked up readily and it is only necessary to move the pickup along the ground until the maximum indication is obtained on the meter.

Water companies, city water depart-

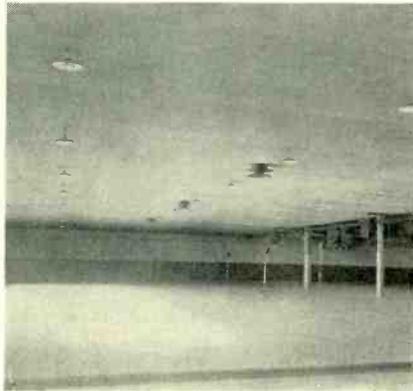


Fig. 25. Chandelier-type speakers with their 360-degree, slightly downward distribution pattern provide complete sound coverage of this roller skating floor of 100,000 sq. ft. with an acoustically deadened ceiling only 15 feet above the floor.

ments, large industrial properties, all include prospects for such equipment and for occasional service.

specialized equipment

In the sound and in the commercial and industrial electronic fields, the need for highly specialized equipment is frequently uncovered; equipment which the sound man may have neither the facilities nor time to design. In such cases it is well to bear in mind that many of the larger manufacturers of sound equipment have a wide variety of special designs in their laboratories for equipment which they have developed on special order, and some have engineers who devote their entire time to cooperating with sound men in the development of special apparatus.

window displays

The effectiveness of window displays in department and other stores can be greatly heightened through the addition of sound. Not the stentorian sound aimed to attract the attention of persons from afar, but sound adequate to reach only those close to the windows. Permits for such low-level jobs can often be obtained even in cities with rigid anti-noise laws.

Fig. 13 shows an animated presentation of the "Wedding of the Wooden Soldier and the Painted Doll" in one of the show windows of R. H. Macy's in New York. The increased effectiveness lent by accompanying music can readily be imagined—and is demonstrated by the iron pipe rails which it was found necessary to erect on the sidewalk to



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and a technical staff to assist in solving special sound problems without obligation.

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**COMPLETE!**  
BUILT-IN PHONO  
NOTHING TO ADD

**FILLS 75%  
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REQUIREMENTS**

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protect the windows from the immense crowds.

Another display with sound was that of the Lord & Taylor department store. A group of bells in the window (Fig. 14) with chimes records reproduced through a Bogen DX30 sound system and trumpet speakers above the sidewalk so aptly interpreted the spirit of Christmas cheer that even passing buses slowed down to afford passengers a moment's enjoyment.

The Christmas season, incidentally, provides excellent rental business. The Woolworth stores in New York contracted for a special musical service (Telemusic) throughout the shopping period and in Plainfield, N. J., the Chamber of Commerce arranged with one of its members, the Standard Sound Service, for rental of the equipment shown in Fig. 15 as part of its "Shop in Plainfield" campaign. This was installed in the Plainfield National Bank Building and gave three half-hour concerts of appropriate chimes and harp recordings daily. In addition to the rental fee the sound equipment owners obtained write-ups in the local papers to which they attach much value as publicity.

#### intercommunication

A little study of requirements, tintured with imagination, can produce results in selling these systems. They are not necessarily limited to combinations involving a few desk installations. In the Metropolitan Life Insurance Company's offices in New York an installation (Fig. 16) consisting of five executives desk stations and ten two-way (12-in. Cinaudagraph) speakers distributed throughout the two floors of the supply room enables executives to carry on two-way conversations with supply clerks without the necessity for the latter leaving whatever work they are engaged in at the moment. The large speakers are ceiling mounted and so located that every clerk is within range of some one of them at all times and can talk back through it without even raising his voice.

The newest types of desk equipment offer some excellent selling points. Webster (Racine) for instance has introduced equipment (an example of which is shown in Fig. 17) which eliminates manual "push-to-talk" switch manipulation, includes a telephone handset for privacy, cutting out the speaker when lifted from its hook, pilot lights which indicate if a station called is busy and again when that station is clear, an annunciator system which shows stations that may have called during an absence, etc. These added refinements should hook holdout prospects whose require-



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- High output (2 volts for .001 inch displacement).

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The Brush Development Company also has available high fidelity crystal recording heads, microphones and headphones.

*Write for complete details today*

**THE BRUSH DEVELOPMENT CO.**

3318 PERKINS AVENUE



CLEVELAND, OHIO

ments could not be satisfied by the more ordinary intercom systems.

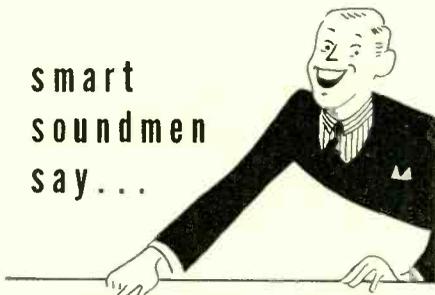
An especially interesting installation is a Bogen Communi-Phone system which permits communication between elevators in a Jacksonville building. These are units of the "wireless" type and utilize the grounded leg of the power line for one side of the circuit and actual grounding (through the car) for the other side. This arrangement eliminates the drawback in many power-line carrier systems of not being able to communicate between different phases of a power system, opposite sides of a three-wire system or between a-c and

d-c power lines. Such a system as this, operating two-way, can solve many problems involved in the efficient operation of elevators—and freight elevators in particular.

#### schools and churches

These markets are too widely recognized to warrant extensive discussion here. It may be well to point out, however, that with the present steady trend toward better economic conditions, churches in particular are becoming better prospects. Sound systems for correction of poor acoustics, amplified chimes, group equipment for the hard of

smart  
soundmen  
say...



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hearing, etc., are all of intense interest to them. As always, well-to-do members of the church sometimes are the best prospects for the purchase of such equipment, contributing it to the church as an anonymous gift, or perhaps a memorial.

In selling sound to churches, chimes offer a very special appeal. It is the ambition of every sizable church, and many of the smaller ones as well, to provide constant reminder of its presence and purpose. Chimes present the most effective and far-reaching means to this end—a fact that has been recognized for hundreds of years. And the amplified chimes of today cost only a fraction of the real bells that they so effectively simulate. Modern equipment of this type is shown in Figs. 18(a) and 18(b).

The school field has been extensively sold but still offers excellent prospects, not only for new equipment but for replacement. The modern centralized school equipment is compact, flexible and highly practical. There is a marked trend toward standard equipment and away from the older system of selecting a miscellaneous assortment of odd units and combining them all on a rack which required a Houdini to operate. It is of interest in this connection that the Clarion installation at the exclusive St. Francis Academy pictured in Fig. 21 won out over competitors partly because "... it fitted the school's needs perfectly without the need for adding a lot of extras" according to Will County Radio Supply Co. of Joliet, Ill., the sound organization that made the installation.

For greatest effectiveness a school system should include not only inter-communication and program distribution facilities but radio pickup as well. Every sound man should be familiar with the important place that radio holds in education and should, by all means, obtain literature on the subject available from the National Association of Broadcasters and the Federal Radio Educational Committee of the Federal Communications Commission.

### miscellaneous

In Beaumont, Texas, each of the 11 fire houses has been equipped with one or more sound units which not only replace the old gong for fire alarms but permit two-way voice communication between stations and headquarters. Further, similar units are placed in the homes of the fire chief, his assistants, city executives and police stations to provide complete coordination of all activities when an alarm is sounded. In all there are 70 Oxford 12-inch speakers.

Fire departments have been slow to give up the old gong systems but there is much to be said for the substitution

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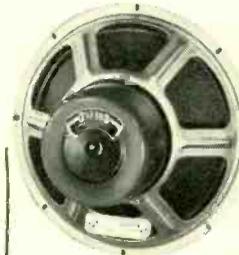
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open. Write

of city-wide sound systems which permit alarms to be spoken, accompanied by detailed directions for apparatus, etc. It is understood that many cities have evidenced interest in such installation, indicating possibilities of an important market.

Perhaps one of the most unusual rental jobs on record is one handled by Carroll Radio Service of Coffeerville, Kansas, on the occasion of this town's annual Industrial Festival Day. With only 24 hours' notice this organization was called upon to install complete sound equipment in an observation train scheduled to tour the industrial sections, the system to be used in describing points of interest along the way. Arthur Carroll solved the problem by rolling his 200-watt, Clarion-equipped sound truck onto a flat car included in the train and with its speakers aimed at the box cars in which much of the younger generation rode. Additional individual speakers were installed in the coaches. One coach was fixed up to serve as a studio and here the announcer and special guests (many of whom were introduced over the speakers) rode. Fig. 23 shows part of the train, looking forward from the sound car roof, while the inset shows the sound car enthroned on its flat.

Every week some 5,000 guests make a sight-seeing tour of the Schlitz Brewery in Milwaukee. Life has now been made easier for the guides through the use of a recorded descriptive talk and the introduction of a novel sound system installed by the Continental Engineering Corporation of Milwaukee. Formerly the guides found it difficult to make themselves heard above the noise of machinery. Now twelve Atlas marine type speakers distributed along the path (Fig. 24) do the job for them. The novelty of the system lies principally in the switching arrangement employed. First a complete recording of the description was made. This was divided into sections each applying to one portion of the inspection tour. As guests are conducted to the first point in the tour the guide presses a button and the first section of the talk comes from the speakers in that area. Then the record stops. Moving to the second part of the tour a button located there is pressed and the appropriate description follows, and so on throughout the entire trip. This is an idea that could logically be applied by many plants which have similar sightseer problems.

Roller skating rinks with their terrific noise level present a real problem for sound men. An interesting installation is one in Perth Amboy, N. J. Here the great floor, 360 feet long and 300 wide, is covered by a fabric canopy to deaden the noise. Rather than simplifying the sound system problem, however, this

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gives you **THE ACOUSTIC COMPENSATOR**  
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By moving UP the Acoustic Compensator you change the Amperite Velocity to a DYNAMIC microphone without peaks.

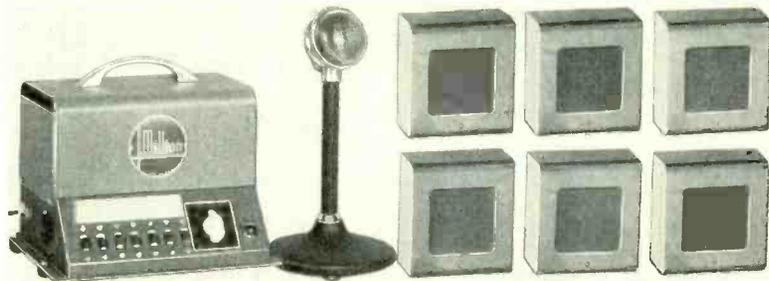
**THE ACOUSTIC COMPENSATOR** (also Cable Connector and Switch) are standard on these models: RBHk (hi-imp); RBMk (200 ohms), chrome or gunmetal, LIST \$42.00 . . . RSHk (hi-imp), RBSk (200 ohms), chrome or gunmetal, . . . LIST \$32.00.

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Complete system with 6-inch speakers in cases. No. CS10-6.

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introduced the additional problem of distributing sound over such a large area when the effective height of the room was only about 15 feet. The solution was found in the use of 14 speakers suspended overhead in Atlas Chandelier-type baffles as shown in Fig. 25.

Fig. 26 shows the studio of this rink. Two turntables, a microphone and a Hammond organ constitute the input equipment to two Lafayette 70-100 watt Model 490's (one of which is missing in the photo, having been taken to another rink in an emergency due to the failure of the original equipment there). Each amplifier operates seven speakers, these speakers being staggered so that, should either of the two systems fail, the other will provide coverage over the entire floor area. As a further precaution against failure, the driver stages of the two amplifiers are connected in parallel so that the voltage amplifier stages of either amplifier will drive the output stages of both.

And so sound progresses! The novelties of today are the standards of tomorrow.

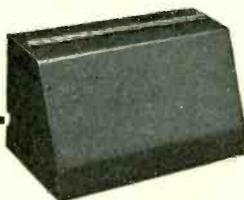
As for the market being saturated, that is ridiculous. There isn't a single phase of the market that has even approached within gunshot of saturation.

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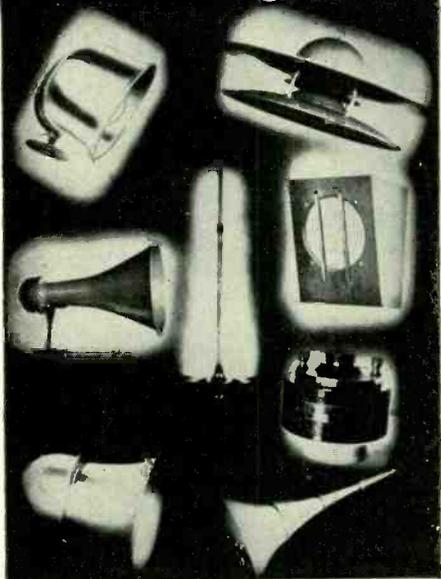
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**NEW** 1940 Sound Catalog  
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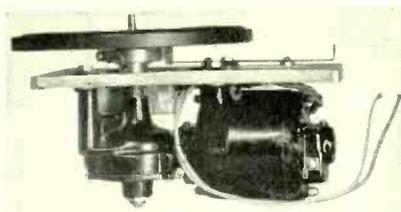
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**JOHN MECK INDUSTRIES**

1313 West Randolph Street, Chicago, U. S. A.

### PLAYBACK TURNTABLE

Universal Microphone Co., Inglewood, Cal., has started to distribute its new syn-



chronous motor and turntable for playback. The new equipment is manufactured particularly for radio stations and recorders who dub or re-record from other records.

### RECOTON BULLETIN

The Recoton Corporation, 178 Prince Street, New York City, have recently issued a bulletin covering their line of cutting and reproducing needles, recording blanks and record renewer. A copy can be secured from the above organization.

### AUDIOGRAPH SOUND CATALOG

The new low-priced Audiograph sound equipment line is described in a new catalog just offered by John Meck Industries, Randolph at Elizabeth Sts., Chicago. A copy of the catalog will be sent on request.

### RECORDING BLANKS

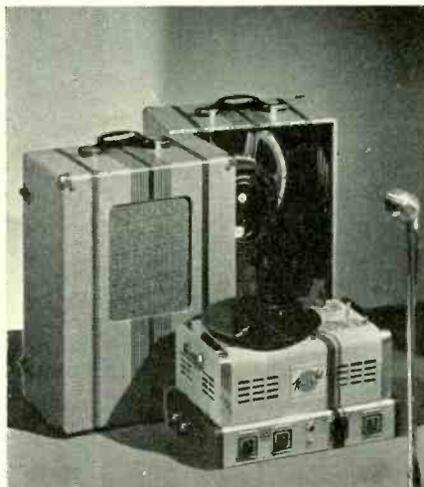
A new instantaneous recording blank, known as Phonoflex, has been announced by Bruno Laboratories, Inc., 30 W. 15th St., New York City. According to the manufacturer, the blanks will not dehydrate, are non-inflammable, flexible, economical and will play back over 100 times. A bulletin describing these blanks may be secured from the above organization.

### BOGEN CATALOG

"The 'Blue Book' of Sound Equipment" is the title of a new catalog made available by David Bogen Co., Inc., 663 Broadway, New York City. Rather complete data are given.

### PORTABLE SOUND SYSTEM

Model A12132, 30-watt high-gain sound system is presented in portable form with all components housed in a single split modern carrying case. For operation from 110 volts, 60 cycles a-c. Allied Radio Corp., 833 W. Jackson Blvd., Chicago.



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*The Most Complete  
Line of Phonograph  
Needles Available*

For 11 years Permo Products Corporation has been the leading manufacturer of needles for use in automatic phonographs. In fact, the 2000 Play PERMO POINT Needle is the ONLY needle recommended by every automatic phonograph manufacturer. It is only logical then that PERMO POINT should manufacture the most complete line of long play needles for home use!

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*Permo Point Needle*

—perfect for transcription— gives even response over entire audio frequency range. Specially designed to transmit all frequencies useful in modern broadcasting and recording work. Fits standard record groove. Valuable in play-back and dubbing work. Permo Metal tip gives 35-50 hours service. Won't wear acetate, nitrate coated or commercial records — prolongs life with self-lubricating Permo Metal Point.



## THE FIDELITONE

*Permo Point Needle*

—ideal for home record players and changers. Keeps surface noise at a minimum. Permo Metal point assures finest full range reproduction. Record wear is negligible due to self-lubricating action of Permo Metal point. Gives 50 hours service on standard recordings. Long play for use in home, salon, sound distributing systems, schools, etc.



## FOR RECORDING

—Permo offers a new cutting stylus equalling ability of sapphire on nitrate coated blanks. Cuts clean grooves, free from surface noises. Records entire frequency range. Minimum loss of high frequencies—no "peaks". Rugged Permo Metal point gives long life. MICRO-SPECTED for uniformity and packed in a special protective metal container.



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**PERMO PRODUCTS CORP.**  
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## RECORDING TURNTABLE

The Presto type 8-B recording turntable is shown in the accompanying illustration. A 16-inch dynamically balanced cast-iron turntable, weighing 30 lbs., revolves on a single ball-bearing at the base of a bronze shaft well. It is driven at the rim by a heavy-duty self-starting synchronous motor. A speed shift lever controls the motor switch and changes speed instantly from



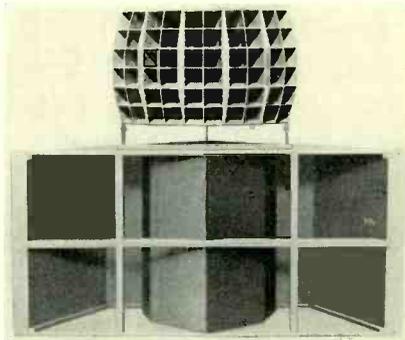
78 to 33 $\frac{1}{3}$  r-p-m. Complete information may be secured from Presto Recording Corp., 242 W. 55th St., New York City.

## TRANSDUCER ANNOUNCEMENT

Transducer Laboratories has assumed all the manufacturing and experimental facilities of Transducer Corporation. The Laboratories are handling all microphone repairs and sales that were carried on by Transducer Corporation, as well as new experimental work in the electro-acoustic and allied fields. Transducer Laboratories, under the direction of Mr. B. Eisenberg, are located at 42 West 48th Street, New York City.

## JENSEN SPEAKERS

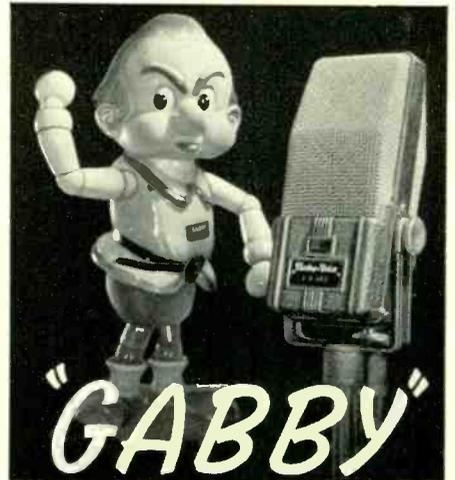
Jensen has recently announced a new line of full range speaker equipment of unusual character. Type B System, illustrated, consists of a multicellular high-frequency horn utilizing two annular diaphragm speaker units, and one of the new Jensen "folded"



type horns equipped with two low-frequency loudspeakers. A catalog describing the entire new line is being distributed. Jensen Radio Mfg. Co., 6601 South Laramie Avenue, Chicago.

## MIKE BOOM STAND

A new microphone boom stand for broadcast and other microphone applications is now available from the Atlas Sound Corporation, 1447 39th Street, Brooklyn, N. Y. The new stand features "Floating Action" which permits movement of the boom arm in every direction without moving the adjustments.



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This colorful, laughable, lovable town crier of Paramount's full length, technicolor cartoon motion picture romance, "GULLIVER'S TRAVELS," is a vibrant personality.

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may not, in themselves, be "alive" . . . but they possess clean, crisp highs . . . real vibrant lows . . . true reproduction qualities for precise inflections that convey easy-to-listen-to, pleasing personalities over the air waves.

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Jobber Days  
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ZENITH TEST EQUIPMENT

Zenith Radio Corp. announce a dry battery pack tester and noise detector and a universal test speaker (illustrated). The former is designed to test dry battery packs

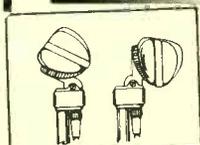
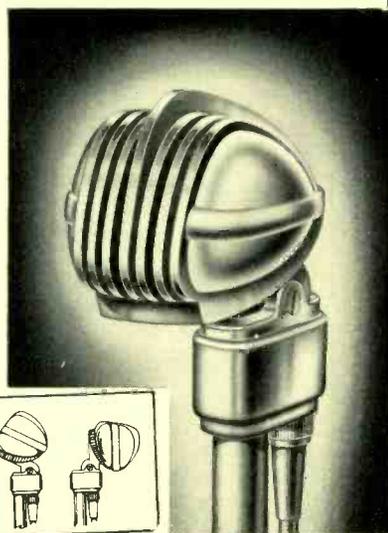


Zenith universal test speaker.

under proper load. A special noise test device is also incorporated in the instrument to discover noisy units.

The universal test speaker offers a field substitute which is variable from 375 to 3000 ohms. It is designed to operate from any type of radio receiver, it is said. Additional information can be obtained directly from Zenith Radio Corp., 6001 Dickens Ave., Chicago.

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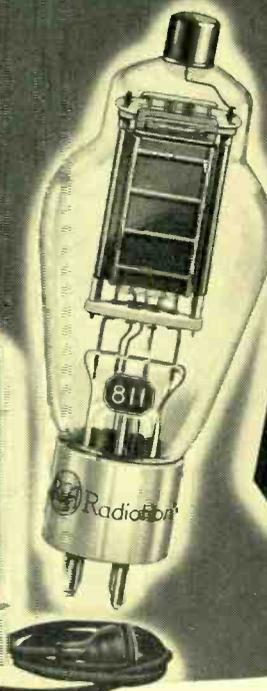
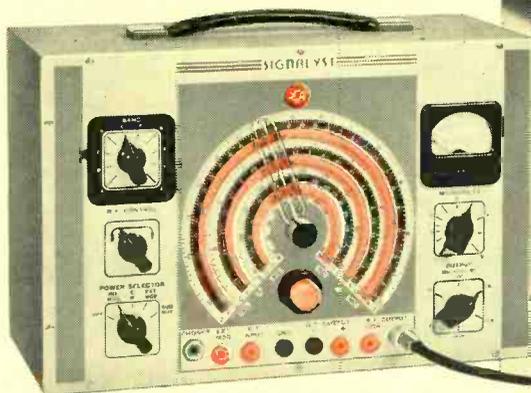
**Only RCA Offers You**  
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**1. TEST EQUIPMENT**

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# NOISE INTERFERENCE

By **HARRY KALKER**

SPRAGUE PRODUCTS COMPANY

LET us stop a moment from our everyday toil and consider these facts: (1) Many towns and cities have already passed ordinances which prohibit man-made radio noises. (2) Anti-noise legislation has come before other legislatures and is now pending in several states. (3) Electrical appliance manufacturers make a point of advertising that their products will not create noise in radio receivers. (4) Public utility companies receive countless complaints from people who believe that the radio noises are the result of power line troubles. The utilities will gladly trace such noises.

All these things show which way the wind is blowing. They prove that there is a big job waiting to be done. It is up to the Service Man to make himself capable of producing results. It seems, however, that Service Men and jobbers have been somewhat slow in taking advantage of the business opportunities thus presented. There probably has been more talk and less constructive action on radio interference elimination than on any other subject in the radio industry.

Of course, this hasn't been altogether the fault of the jobber or Service Man. Interference is not an easy subject. It is often a thankless job. Some who have gone into it have become discouraged as a result. The fact remains, however, that there are Service Men who have rung up outstanding success, not to mention substantial profits, through efficient and complete interference elimination work in their communities.

More important than this, perhaps, is the fact that every community is faced with its own radio noise problem. There are literally hundreds of noise sources to be filtered—all at a profit. Every home is a prospect, every hospital, apartment house, barber shop or beauty parlor, physician's or dentist's office, every store and



An interference locator can be used by the Service Man to locate the source of the man-made noise.

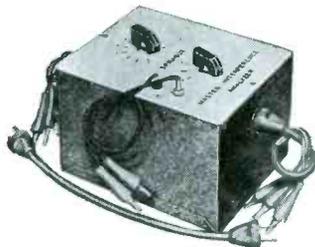
a host of others. Such work can be done, either by the Service Man as an individual or working in cooperation with the local public utility.

The public utility usually bears the brunt of interference complaints. Conse-

quently, interference elimination is a subject in which utility engineers are deeply interested. In general, utilities make it a practice to locate the noise source for customers. Then, they recommend that the customer call someone to do the actual job, inasmuch as such work is not regarded within the province of the public utility company.

Of course, the big bugaboo in interference is the difficulty of doing a complete job. It is easy to understand how a Service Man, called in to eliminate noise for some set owner, might find that this noise is caused by an oil burner in a neighbor's house or a traffic light down the street. Again, there may be a large number of radio noise-makers, say, in an apartment house, and all of them would have to be filtered in order to clear up reception at a given point.

These difficulties are not the easiest things in the world to overcome—but this is a factor that should make the business all the more profitable to Service Men



An interference analyzer is helpful in selecting the proper device for suppression of man-made noise.

who really have good business ability. Once you get a good start in this line; once you prove your expert ability, it is really amazing the amount of business that can be obtained. I dare say that condenser and instrument manufacturers who feature interference elimination materials can point to many who are making such work show them a nice profit.

If a Service Man got no more business than was referred to him by a public utility company with which he cooperated, it should prove well worth while. It is a type of work wherein one job quickly leads to another.

Interference elimination should prove especially attractive to Service Men in cities up to, say, 25,000 population. It is altogether feasible for a wide-awake man to eliminate man-made radio noises almost 100 per cent over a period of time. There are Service Men who have done exactly that or who are busy doing it at the present time.

Such procedure is always greatly simplified when the town or city has a local or-

A small advertisement in local publications and newspapers should bring profitable calls. Manufacturers supply mats for the purpose.

ordinances which prohibit man-made radio noises. Many towns would quickly pass such laws once it had been proved to them that, with the right man with the right equipment on the job, radio noises no longer need be endured.

Parts jobbers should make it a point to contact public utility companies throughout their entire territory. Discuss radio interference problems with them. Tell them that you will equip and train Service Men upon whom they can call for this type of work.

The next step is to approach the Service Men themselves. They can be equipped with a locator, interference analyzer and other equipment for very little money, even to the extent of credit privileges in order to make it easy for them to pay. Once they are ready, introduce them to the public utility engineers and let nature take its course.

Regardless of all of the discussion about the subject, the fact remains that man-made radio noises can be eliminated. The work is not too hard and it is profitable. Manufacturers offer interference manuals and a wide variety of sales helps. Write for them today.

The man who really wants to equip himself for this work will have little trouble in so doing. What's more, his opportunity for new business and new profits is limited only by his own ability to cooperate with his public utility company or to merchandise his services along these lines to set owners in general.

Of all the 45 or 50 million radio sets in the United States, there is hardly one that is not picking up radio noises that have no right to be there—and by far the larger majority of these noises are of the man-made variety that can quickly be eliminated by a Service Man who has taken the trouble to learn what it is all about.

The time has most certainly come when the radio industry should do something about man-made radio noises.



← A *Giant* Tube Tester - MODEL 325

● A great tube merchandiser is this Model 325 with 9-inch dial artistically colored—red, green and black—brightly illuminated by two easily replaced 6-V bulbs. Provides for complete range of filaments from 1.5 to 120 volts. Tests loctals, single-end tubes, bantams, midjets, ballast tubes, gaseous rectifiers, even Christmas-tree bulbs. Individual toggle switches permit checking each element separately. Large neon tube for checking shorts and cathode leakage; head phone jack for noise test. Line adjustment with smooth vernier control. Drawer with handy tube charts. Dealers net price.....\$34.50



A *Giant* Set Tester MODEL 320

● The big, easily read 9-inch illuminated meter applied to a wide range set tester. First tester to incorporate a meter of this size; also first to incorporate 50 ranges — nine A.C. and nine D.C. voltage ranges; six milliamperere ranges; five resistance ranges; four capacity ranges; seven decibel ranges. Entirely A.C. operated. All voltage ranges have resistance of 1,000 ohms per volt. Test leads are included. Rack mountings available. Dealers net price \$37.50



An Advanced Signal Generator MODEL 310

● Here, too, you have the easy readability of a 9-inch meter in the new Simpson Signal Generator designed to the most minute detail for highest accuracy, greatest stability, minimum leakage and good wave form. Smooth vernier control permits close settings and knife edge pointer, accurate readings. Your kind of Signal Generator. Dealers net price.....\$37.50

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in everything but price

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From these shop instruments with their nine-inch dials down to pocket-size testers, all Simpson Instruments have the same unrivalled beauty of design and unerring accuracy that could only have been built into them by Ray Simpson and a group of associates who have made a life study of instrument design and production.

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Remember this Group Plan when Your Subscription Expires

### RESISTANCE APPLICATIONS

THE simplest form of circuit application in which a resistance is used is that in which a fixed resistance is connected in series with a load and a power supply. Such a circuit is used when it is desired to operate some device from a power supply of higher voltage than that for which the device was designed; or when it is desired to operate the device at less than full load, etc.

When the rated current drawn by the device is unknown, or when the amount of reduction desired is unknown, it becomes necessary to make a simple measurement of the current and subsequently to measure (or calculate) the resistance.

A simple series circuit is all that is needed, generally to determine the current and proper resistance of a resistor (or rheostat) to be used in a specific application. Fig. 1 shows the circuit as it can be used separately or as a part of a more complex circuit. Fig. 2 illustrates a convenient way of inserting the trial resistance and an ammeter by means of a series plug.

#### ● ● ● resistance

The trial resistance may be a rheostat, a Dividohm adjustable resistor, one or more fixed resistors, a length of resistance wire or any combination of these forms. The units to be used should have a current rating at least equal to (but preferably more than) the maximum current to be carried in the test circuit. If due care is observed in running the test and several resistances are connected in series, each resistance unit may have a current rating only equal to the current value at the time that particular unit is in the circuit.

The amount of resistance to be used is approximated by using Ohm's law after assuming some minimum value for the current. However, the actual number of ohms in the trial resistor should be greater than that which it is calculated will be required, in order to allow for errors in the assumed values. The maximum current which is likely to occur (rather than the minimum) should be used when selecting the rating of the trial resistance, in order to prevent overloading.

The trial resistor should be set at the maximum ohms position before connecting the circuit to the power supply. Then the current should be turned on and the device tried for satisfactory operation (i.e., mechanical motion of a relay, speed of a

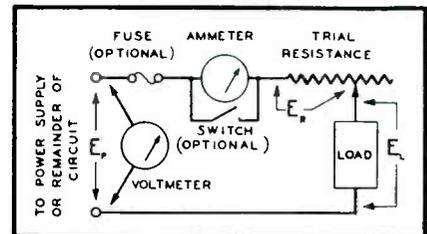


Fig. 1.

motor, temperature of a heater, amount of light from a lamp, etc., as the case may be). The trial resistance should be gradually decreased until the desired conditions are reached. Enough time should be allowed for conditions to stabilize before taking final readings.

#### ● ● ● current

The current at the desired condition is given by the ammeter reading. The resistance in use can be determined by Ohm's law, if the voltage across it is measured, or the resistance can be obtained (later)

by measurement with a Wheatstone's bridge or an ohmmeter. Knowing the current and resistance, the proper resistor for permanent use can be selected. Ventilating conditions, of course, must be considered also in the selection.

• • • meters

Before connecting any meter in a test circuit, the maximum current and voltage expected must be determined or estimated from the nameplate rating of the equipment or other known data. If in doubt, a higher rating meter than assumed necessary should be used first to check the ap-

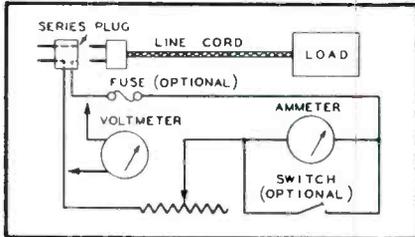


Fig. 2.

proximate values. Then if possible the meters should be chosen so that the readings will be well up towards full scale, in order to secure maximum accuracy. Ammeters should be protected against starting current surges as occur in motor circuits (starting or locked rotor currents may be more than five times full load values) by means of a low resistance short-circuiting knife switch.

Convenient permanent magnet (D'Arsonval) d-c meters read average values. When used on pulsating d-c the average value indicated is not the true measure of the heating effect or power. For battery charging circuits, the average values are used but for lighting or heating circuits the rms (root-mean-square) value must be used. For unfiltered half-wave rectification this is 1.57 times the average value; for unfiltered full-wave rectification it is 1.11 times the average. For filtered circuits where the amount of ripple is less than a third of the maximum, the difference between the average and rms is less than 1%.

Ohmite News

**WELLS-GARDNER 1A28, 8A30, 8A31, 8A32, 0A33, 8A34, 0A35, 8A36, 8A37**

**Modulation hum:** In case modulation hum (hum with signal) is encountered on the above models, the trouble may be due to the 6SK7 first a-f tube. Interchange this tube with the 6SK7 r-f and 6SK7 i-f tubes. Note the results. The 6SK7 first a-f tube may be left in either the r-f or i-f tube sockets if the arrangement reduces the hum.

If the hum is still appreciable after the above procedure try out several new 6SK7 first a-f tubes. Use the one which reduces the hum to a minimum.

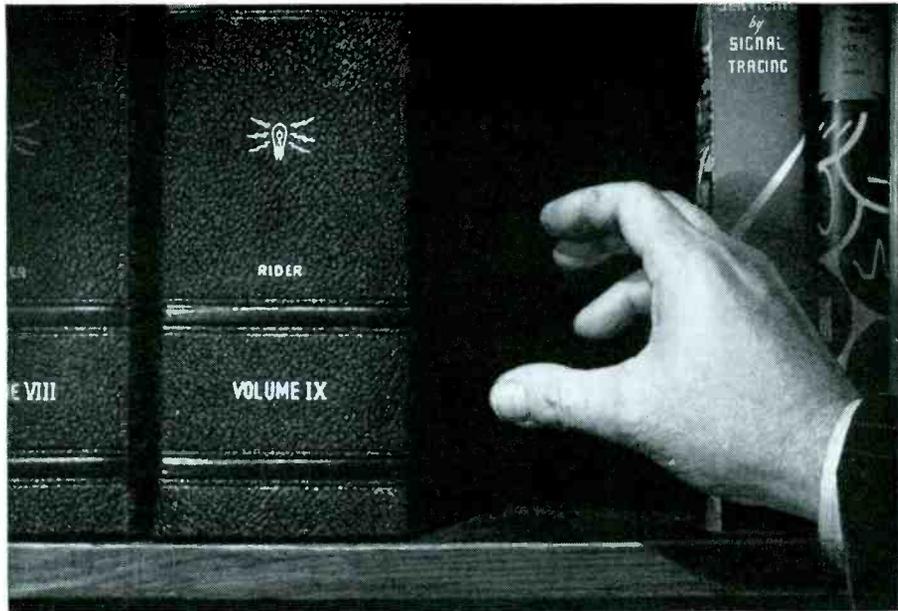
**WELLS-GARDNER 5D2, 6A26, 6A27**

**Excessive hum:** If hum modulation is noticeable on stations of weak signal strength, the condition may be corrected as follows:

Disconnect the 0.05-mfd grid return condenser (C1 in the Series 6A26 and 5D2 schematic diagrams—C2 in the Series 6A27 schematic diagram) from the chassis ground and connect this side of the condenser to B — (point marked "X" in the schematic diagram).

On later production sets, this change has already been made.

Joseph K. Rose, Service Manager  
WELLS-GARDNER AND COMPANY



# The Data that wasn't there!

He was a serviceman and had been rushed all that day. Now it was late in the afternoon that he had promised the set to his pet customer. He reached for the volume of Rider Manual containing the diagram on the set—AND, that was *the Data that wasn't there*. Every volume of Rider Manual but the *very* one he needed *then*. Sure he would buy it "tomorrow," but tomorrow in his, as it will probably be in your case, was too late. A haphazard job—wasted time—a broken delivery promise—a disgruntled customer . . . IT ISN'T WORTH IT!

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—make a note of missing numbers and take that note to your jobbers and place the order for the Data you are sure to need. But don't do it "tomorrow"—do it today—don't put yourself in the position of the man who reached for "the Data that wasn't there."

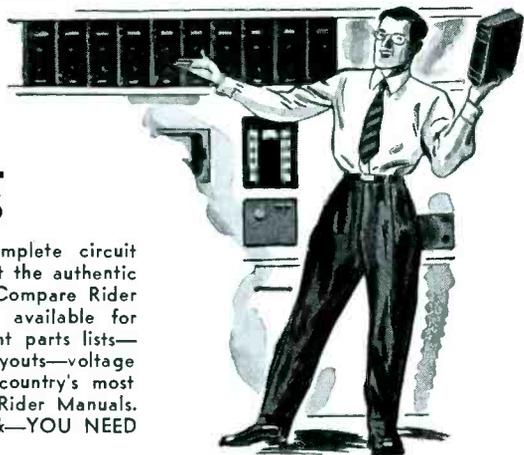
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# ASSOCIATIONS

## RADIO SERVICEMEN OF AMERICA

### • • • cleveland

Eighty-one radios were distributed to orphan asylums, social settlement houses and the homes of needy shut-ins as a result of the "Give-A-Radio" campaign conducted by WGAR, Cleveland, in cooperation with the Cleveland Chapter of the Radio Servicemen of America and the Cleveland Welfare Federation, according to announcement by John F. Patt, vice-president and general manager of WGAR.

Radios were donated by listeners in response to the plea voiced on a special series of WGAR programs. Listeners who had used or extra sets were asked to contribute them by phoning the station. Goodwill Industries, an agency of the Welfare Federation, assigned trucks to pick up the sets and provided space for storage and facilities for repair at its headquarters.

Alex Plakadis, president of the Cleveland Chapter of Radio Servicemen, arranged to have members of the Association donate their time in repairing the sets and putting them in first class working order. Cleveland parts jobbers agreed to donate tubes, condensers, wiring and other chassis parts as their participation in the campaign.

A series of nine programs on WGAR brought 123 pledges of radios, 81 of which the men were able to put in working order. When sets could not be efficiently repaired, they were dismantled and the parts utilized for other sets.

Encouraged by the splendid reaction to the campaign, Mr. Patt has mapped plans for an even more extensive campaign in 1940.

Maurice Condon, WGAR.

### • • • dallas

Another jimmie, Jimmy Hunt reports good business this fall in both sound and service.

Saw Cecil Hardy down from Denison at the service meetings. He had some of the boys with him. Come again.

One of the other jimmies, Jimmie Williams is riding heck for leather out of Bill Inman's truck and making a good job of it.

Peaslee Gaulbert recently promoted Gordon Otens upstairs to a desk in the sales department and put Tippet in charge of the service department.

One of our sometime Houston service men, Harry Ernstrom, has recently invaded our city and established the Record Shop in downtown Dallas. Business is good, he reports, and getting better. Yep, sometimes a service man does get away from the bench.

Likewise our faithful group from Greenville were on hand and had a smile for every one.

Texas Norge Sales Co. is back in the radio business with the Farnsworth line. It sure is hard to stay

away from the radio game, isn't it. Congrats to both companies for their able selections.

We saw Uncle Joe Sessums 'tother night at the RCA meeting; said he had been 'possum hunting so much he had about forgot all about the boys. His new house is nearly done, looks like the local association ought to call on him in a body and give him a tik-tak party.

Jimmie Moffet is now in charge of all radio service activities of the Sanger Bros. department store. That is a big order for one man, but Jimmie brings to his new job many years of radio and business experience and is thoroughly capable of doing a good job for them. Congratulations are in order.

Texas Broadcaster.

### • • • evansville

At the combined annual banquet and regular monthly meeting of the Radio Servicemen's Association of Evansville, Indiana, two members of the engineering staff of the Ken-Rad Tube & Lamp Corp., Owensboro, manufacturers of radio tubes and lamp bulbs, presented interesting and instructive data on new developments in the radio industry.

George W. Bain, Ken-Rad chief engineer, discussed briefly "Frequency Modulation," pointing out the essential difference between this new method and the more common system of broadcasting and reception in general use today.

Charles R. Wexler, head of Ken-Rad's circuit laboratory, offered for the benefit of the Service Men present, his interpretation of recent trends in receiver design, with particular reference to their effect on the problems of the servicing industry. His talk included a discussion of the various classes of tubes, their functions and the advantages of certain types.

Talks were also made by officers of the association, including Van C. Norwood, newly elected president.

### • • • new york

At the Jan. 22 meeting the New York Chapter was fortunate in having both John Meagher, RCA Service Engineer, and Robert G. Herzog, Editor of SERVICE magazine. The lecture, at the Hotel Capitol, centered around the RCA Dynamic Demonstrator, an ingenious device which John Meagher invented for RCA. The Demonstrator is actually a working radio receiver constructed on a large board especially for lectures and demonstrations. Each part of the receiver circuit is visible to the audience and pin-jack connections are provided at strategic points for the connection of external parts or instruments.

Mr. Herzog has recently planned and conducted the performance test for candidates for license to teach radio mechanics in the New York

City High Schools, for the Board of Education. Some of our boys took that exam; we hope Bob went easy on them. And, by the way, Bob's wife just presented him with another (this makes two) bouncing baby boy. . . . They call him Jay Allen (poor kid). Mother and son doing nicely.

Feb. 26, Mr. J. C. Aceves, of Amy, Aceves & King, will discuss and demonstrate their latest antenna coupling system, at the Hotel Capitol. . . . Don't miss it!

Selig Rosengarten, Secretary.

### • • • pittsburgh

The Pittsburgh Post-Gazette, The Pittsburgh Chapter of the Radio Servicemen of America and the radio stations KDKA, WWSW, KOV and WJAS combined to stage one of the biggest charitable tieups in the history of the city.

On Tuesday, December 12, the four radio stations and the newspaper started a campaign appealing to the public to donate their old radio sets to the committee for rehabilitation and distribution to needy families.

The original goal was 500 sets, but within two days the response was so great that the goal was doubled. Five days before Christmas this doubled goal had been reached and offers of radios were coming in so fast it was necessary to appeal to the public to let up. Facilities for collecting and repairing the sets were far surpassed.

Samuel Avins, general counsel for the Radio Servicemen's Association of Pittsburgh, declared: "At the rate offers were pouring in on us, we could have received 2,000 sets. Next year we will start earlier with a goal of 2,500 sets."

One of the features of the promotion was "Santa's Radio Workshop," a gaily decorated booth in the lobby of the Grant Building. Here crews of repairmen were on duty rehabilitating the sets in full view of the public.

In addition to the radio stations, the newspaper, and the Service Men, the following contributed to the success of Radio Christmas in Pittsburgh: everyone of the city's eighteen radio jobbers and distributors who supplied funds to finance the pay-roll for the unemployed Service Men who were engaged to repair the sets; the Pittsburgh Milk Co., whose fleet of trucks was called in to assist the Post-Gazette in the pick-up of the receivers; the entire membership of the Radio Servicemen's Association of Pittsburgh, who contributed 1,000 tubes in addition to working at night at "Santa's Radio Workshop" without pay so that such could be repaired and distributed in time for Christmas, and the Federation of Social Agencies whose case workers surveyed the city for worthy needy homes and supervised the entire distribution of the sets after they were repaired.

A breakdown of offers of sets, received by telephone and otherwise, follows: Offers resulting in pickup of one or more sets, 590; offers with incorrect addresses, 81;

offers originating outside of collection radius, 170; not at home when set was called for, 132; miscellaneous inquiries, repeat calls and false calls, 203; offers not followed up because received after deadline, 270; total offers of sets, 1,446. A total of 671 sets have been received at the central repair station of which 632 were picked up from 590 donors. Forty-eight sets were brought in directly by donors.

Jim Luntzel, KDKA.

## OTHER GROUPS

### • • • prsma

The two big features for December are (1) the open meeting December 5 and (2) the closed meeting December 19. At the first RCA came to town with an interesting story on facsimile, both transmitting and receiving. Distinguished engineers described and demonstrated the how, why and when. At the closed meeting matters of importance to all members will be discussed.

PRsMA News.

### • • • south and southeast

Stressing the importance of keeping fully informed on new tubes and their circuit applications, Walter R. Jones, Hygrade Sylvania Commercial Engineer, addressed more than a half dozen Service Men's groups in the south and southeast. He presented a diagrammatic story of new tubes which have been recently announced and explained their functions in receivers, preparing Service Men for problems they may encounter when the new sets will need servicing.

The usual sunny climes that lift the traveling man's spirit on a winter trip in the south were painfully absent this year. Temperatures that reduced the mercury to zero pursued Mr. Jones from Miami to New Orleans. However, in spite of the unusual record cold, attendance at the Sylvania meetings was good. Only in New Orleans, where the onslaught of frigid weather was more than a match for the heating facilities, did the attendance suffer.

Meetings were held in Jacksonville, Orlando, Tampa and Miami, Fla.; Atlanta, Georgia; Mobile, Alabama; New Orleans, Louisiana, and were sponsored respectively by the following Sylvania jobbers: Radio Supply and Equipment; Radio Accessories Company; Thurow Radio Distributors; all Atlanta jobbers; Nelson Radio, and Shuler Supply.

Henry C. L. Johnson.

## TRADE SHOW

The 1940 Radio Parts National Trade Show will be held at the Stevens Hotel, in Chicago, from Tuesday, June 11, to Friday, June 14, inclusive.

The main exhibition will be in the large exhibition hall in the Stevens Hotel, and demonstration and conference rooms will be in both the Hotel Stevens and the Blackstone Hotel.

The first three days of the Show, June 11 to 13, inclusive, will be Jobber Days, and Friday, June 14, will be open house for the general trade.

Pittsburgh's "Radio Christmas" was so successful that additional space in the basement of the Grant Building was required to enable checking and repairing of the many sets donated.



A group of representatives for some of the manufacturers who took part in the three-day Allied Radio Show, December 14, 15 and 16. Over 9,000 people attended.

# OUT IN FRONT

1. Dynamic Mutual Conductance
2. Cathode Structure or Emission

Neither one of these fundamental tube characteristics can be neglected. The "PRECISION" Dynamic Mutual Conductance Type Tube Tester, incorporated in all nomometers (Series 910, 912, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000) with the foregoing as its exclusive features insuring exceptional precision, accuracy in test results, efficiency to accommodate future filament voltage requirements, filament pin or cap positions, or construction.

### CIRCUIT

To best familiarize yourself with the exclusive "PRECISION" instrument, briefly observe the operation of the 2A5, in a standard circuit diagram A, with the following plate circuit.



with a signal voltage applied to the grid, no volume is obtained from the circuit components aside from the hum which is attributable to low MUTUAL CONDUCTANCE. This is caused by poor tube conditions, including filament voltage requirements, even though the tube's cathode is normal.

that the overall Quality of the instrument is dependent on both MUTUAL CONDUCTANCE and CATHODE STRUCTURE, of which can possibly

Dynamic Electronometer is interesting to note the difference between this schematic

grid voltages and load impedances of the tube under test in the manner in which the tube

## PRECISION ELECTRONOMETER SERIES 920 DYNAMIC MUTUAL CONDUCTANCE TYPE TUBE and SET TESTER

- The PRECISION Series 920 Combination Dynamic Mutual Conductance Type Tube Tester and 33 Range Rotary Selective AC-DC multi-range Set Tester, has set an unduplicated high in performance, quality, value and utility.
- Engineered, designed and built by PRECISION, the Series 920 represents the product of an organization whose sole efforts are confined to the development of BETTER test equipment within the reach of all discriminating service engineers.

### QUICK FACTS

- Directly accommodates ALL receiving tube types (including the new miniature Button 7-Pin and new Hearing Aid Tubes).
- Supplies all filament voltages from 1.4 through 120 volts—Tests any tube regardless of arrangement of filament or any other pin positions.
- Tests all tubes in an exclusive PRECISION engineered circuit, which in one operation, effectively tests for BOTH Mutual Conductance and Cathode Structure. Neither of these two all-important tube characteristics can be neglected.
- Double Window Roller Tube Chart—New charts furnished FREE for the life of the instrument.
- Six AC-DC voltage and output ranges to 3000 VOLTS.
- Five DC current ranges to 12 AMPERES.
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- Six decibel ranges, — 10 to + 64 DB (15,000 watts in 500 ohms).
- Large 4 5/8" modern, PRECISION square type, 400 microampere, double jewelled D'Arsonval meter.
- Individual 1% wire wound shunts and 1% matched metallized multipliers.
- Instrument guaranteed for ONE FULL YEAR against any mechanical or electrical defects.

More than 40 models in the PRECISION 1940 LINE . . . 15 Mutual Conductance Tube Tester and Set Tester models ranging in price from as low as \$29.95 . . . 16 Multi-Range Tester models from as low as \$10.95 . . . Signal Generators from \$24.95 . . . etc. . . See them at your local distributor . . . Ask for the PRECISION TEST EQUIPMENT 1940 CATALOG.



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## REDUCING SHOCK HAZARD

(See Front Cover)

By **NATHAN I. DANIEL**  
DANIEL ELECTRICAL LABORATORIES

**T**HE reduction of shock hazard is definitely a problem which must be solved in the manufacture and servicing of power-line operated equipment. That the public is becoming more aware of the danger can be seen by the fact that Underwriter's laboratories and consumers groups stress the possibility of shock hazard in their listings.

Amplifiers and radio receivers which use a power transformer and are designed for operation from a-c lines (only) present a far less serious problem than those designed for d-c or a-c and d-c operation. The maximum possible shock obtainable from the former (by touching a phono pickup, mike stand, or the chassis itself and at the same time some grounded object such as a switch plate, window frame or pipe line) is limited by a small condenser. This condenser is connected from the chassis to one side of the power line and may not be larger than 0.1 mfd if

the device is to comply with Underwriter's specifications. Although such a shock can be annoying it is decidedly not dangerous.

On d-c or a-c and d-c receivers and amplifiers the story is entirely different. Here one side of the power line becomes the negative leg of the B supply. It should be noted that even if the chassis is insulated from B—, as is sometimes done, the input jack (to the audio) is not. A dangerous shock can still be obtained from a phonograph pickup, etc. This is especially true for children or even adults with damp hands.

The circuit shown on the front cover was developed primarily for amplifiers to be used with electronic musical instruments wherein the musician must continually handle the grounded instrument. It can, however, be easily adapted to public-address systems, or for the audio section of phonograph combinations. It should prove of interest at this time in view of the renewed popularity of the latter.

• • • circuit

As shown the circuit limits shock to small currents. Variations are possible, but the values given are those used in the original model developed and are carried through in production. The maximum shock that can be obtained is 1 ma on d-c and 2 ma on a-c.

The ground side of the input jack is connected to the chassis, to which the cathode of the input audio stage is also connected. It is desirable that this stage have as much gain as possible. For this reason extremely high plate and screen loads are employed. Smaller plate and screen resistors could be used with a corresponding loss in gain. Grid biasing is accomplished by using a very high grid load resistance. This method was chosen as the most convenient and the least likely to introduce hum at this sensitive point.

• • • hum level

The hum level is very low, approximately the same with the anti-shock circuit as it was without it, in spite of fairly high gain, three inputs and ten watts of output power. The 0.05-mfd. condenser by-passing the 100,000-ohm resistor in the cathode circuit is too small to completely pass all the hum voltage, therefore some hum is introduced at this point. However, this hum voltage is not amplified in the first stage because it is not in the grid circuit. The gain beyond this stage is not sufficient to bring this hum up to an audible level.

Although the plate current of the tube passes through the 100,000-ohm shock limiting resistor, the voltage lost is negligible because of the minute current drain of this stage.



## NUMITE

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**Aluminum Tubular**

All Popular Types

In spite of drastic reductions in size which have been accomplished, no compromise has been made with quality, uniformity or characteristics.

We have attempted to design a complete line of replacement condensers which would adequately meet the needs of the serviceman. Uniformity and excellent electrical characteristics result in freedom from "call-backs" and field difficulties. Smaller sizes and mechanical ruggedness result in quick and easy replacement installations.

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S-240

## FEATURES

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Uniformly aged and tested considerably above their rated operating voltages.

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Double checked to insure reliability and uniformity of characteristics.

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Very close tolerances result in extreme uniformity and freedom from replacement difficulties.

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Remember N.U.'s check-test of every condenser insures uniformly low leakage and good leakage recovery. Excessive leakage causes more service difficulty than any other type of condenser trouble. Just compare.

**POWER FACTOR—**  
The life and performance of electrolytic condensers are determined to a considerable extent by the power factor. Compare the low power factor of National Union condensers with other leading makes.

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*Can be applied to all  
National Union Tube Deals*

ASK YOUR JOBBER OR WRITE  
**NATIONAL UNION RADIO CORP.**  
57 State St., Newark, N. J.

**WELLS-GARDNER 6A26, 6A27**

*Steady a-c hum:* Try a new 35L6GT output tube. Reverse the power line plug.

*Modulation hum:* Try a new 12SK7 i-f tube.

In early production, there was a high resistance path from the dial lamp socket to the chassis. A certain amount of a-c was fed by this means from the dial lamp to the chassis and from the chassis through the 0.05-mfd antenna condenser to the control grids of the first-detector and i-f tubes. Correct this by using insulating tape on the dial lamp socket mounting bracket to insulate the dial lamp clip from the bracket.

In early production, the 0.05-mfd antenna condenser was connected to chassis ground. Remove lead to chassis ground and connect to B —.

Try a new 6AB5 tuning indicator tube.

The lead from the 0.004-mfd or 0.005-mfd first audio coupling condenser to the volume control should be as far away from the filament leads as possible.

On series 6A26 a ground connection should be used with an external antenna.

*Distortion and blocking:* The 500,000-ohm output tube grid resistor (R10) may have open circuited due to a loose pigtail connection to the resistor proper.

*Joseph K. Rose, Service Manager  
WELLS-GARDNER AND COMPANY*

**WELLS-GARDNER 6B7**

*Production changes:* To compensate for variations in tube characteristics as well as high line voltages, the following changes have been made in the filament series circuit to reduce the voltages across the tube filaments and to prolong tube life:

Resistor R12, which is in series with the filament circuit, has been changed from 1,959 ohms to 2,200 ohms.

There was unequal emission from the 2 sections of the filament of the 3Q5GT output tube. This caused unequal voltages across the 2 sections of the filament and shortened the tube life. A 750-ohm resistor (R27) across one section equalizes the currents through both portions.

The four 1½-volt tube filaments were shunted with 1,200-ohms resistors, R19, 800 ohms and R18, 400 ohms. (See old schematic.) The connecting point between these two resistors established the grid (bias) voltage for the output tube. These four tubes are now shunted by one 1,200-ohm resistor R26.

The 1A7GT first detector filament is now shunted with a 1,500-ohm resistor, R25. The 1H5GT second detector filament is now shunted with 340-ohms resistors, R24 and R23 in series. The connecting point between these two resistors establishes the grid (bias) voltage for the output tube.

*Joseph K. Rose, Service Manager  
WELLS-GARDNER AND COMPANY*

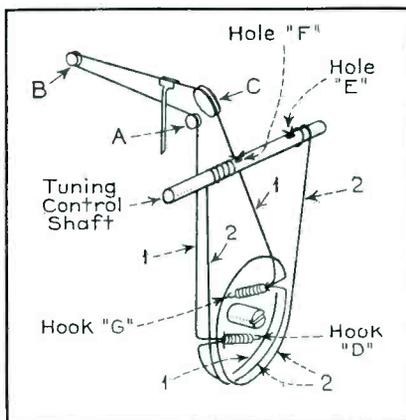
**WELLS-GARDNER 93WG663, 93WG668**

*Production changes:* See model 6B7.

**WELLS-GARDNER 36A26, 36A27, 36D1**

*Dial drive-cord replacement:* Before replacing the dial drive-cord No. 1 (see illustration) you must remove drive cord No. 2.

Remove tension spring for drive cord No. 1 from pulley. Double new drive cord and knot both ends of cord to same loop on tension spring so that there is a distance of 9 in. between knot and looped end of doubled



cord. Thread looped end of cord, starting from inside of drum pulley, through hole on inner groove (groove nearest tuner assembly) and draw spring flush against rim. Turn gang condenser to completely closed position. Remove any twists in doubled cord.

Wind one portion of cord around pulleys A, B, and C as shown. Loop remainder of cord around inner groove of pulley. Secure free end of spring to hook D on pulley.

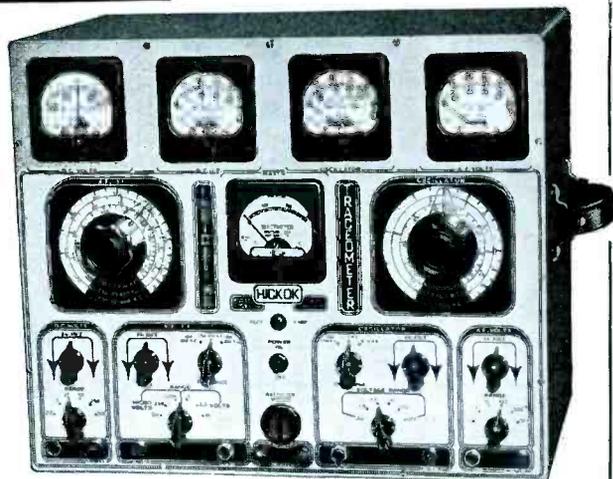
To replace drive cord No. 2 (see illustration), remove tension spring for that cord from pulley. Use a new drive cord approximately 24 in. in length. Thread one end through hole E on tuning control shaft. Tie a large knot on this end and pull knot flush against shaft. Wind approximately 2 turns counter-clockwise (from

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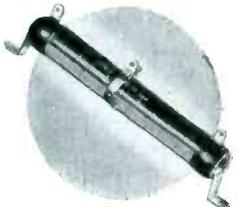
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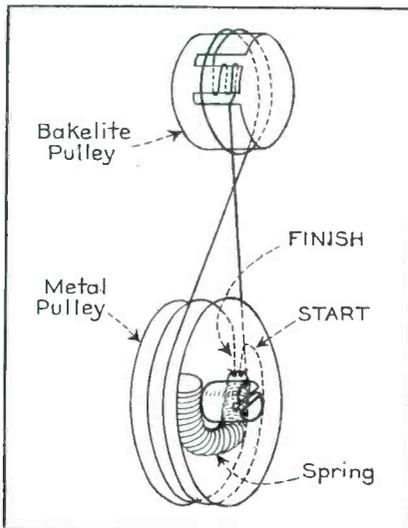
rear of chassis) around tuning control shaft. (See illustration.) Hold tuning control shaft steady and wind one turn clockwise (from tuner side of chassis) around outer groove of large pulley.

Pass cord through either one of the 2 holes in outer groove and then knot cord to tension spring. Knot should be made as close as possible to rim of pulley. Pass cord back through same hole. Turn tuning control shaft counter-clockwise from front of chassis until spring is flush against rim. Continue cord 1/2 turn clockwise (from tuner side of chassis) around outer groove of large pulley. Wind approximately 6 turns clockwise (from front of chassis) around tuning control shaft (see illustration). Thread cord through hole F in shaft. Pass cord under last turn on shaft and knot securely to this turn. Secure spring to hook G.

Joseph K. Rose, Service Manager  
WELLS-GARDNER & CO.

**WELLS-GARDNER 16A26, 16A27, 15S3**

*Dial drive cord replacement:* Remove tension spring from pulley. Double new drive cord and knot both ends to same loop on tension spring. There should be a distance of 9 1/2 inches between knot and looped end of doubled cord. Turn-gang condenser to



completely closed position. Turn tuning control drum until slotted section of bakelite pulley is on top.

Thread looped end of cord starting from inside of drum pulley through hole in rim

of metal drive pulley and draw spring flush against inside of rim. Remove any twists in doubled cord. Wind right hand portion (from right side of chassis) of cord 1/2 turn clockwise around metal drive pulley. This turn should be on right side (from front) of pulley groove. Hold tuning control drum steady. Wind 1 1/4 turns counter-clockwise (from right side of chassis) around bakelite pulley. Wind 2 1/2 turns clockwise around small bakelite section between two slots. (See illustration.)

Wind remainder of cord clockwise around metal pulley. Secure spring to hook on pulley. (See illustration.) Bend hook toward pulley disc.

*Calibration:* Replace chassis in cabinet. If it is necessary to calibrate the radio, turn the tuning control drum until the two setscrews on the dial hub near the volume control can be reached with a screwdriver. Loosen the two setscrews by turning them about 1/8 turn in a counter-clockwise direction. Tune in an 800-kc signal. Hold the tuning control drum steady and at the same time turn the dial drum until the dial is in calibration. Then slowly turn the tuning control drum until the two setscrews can be reached and re-tightened with a screwdriver. If the radio detunes as the dial drum is turned, loosen the two setscrews a slight additional amount. Check to see that the dial has remained in calibration.

Joseph K. Rose, Service Manager  
WELLS-GARDNER AND COMPANY

**WELLS-GARDNER 93WG562, 93WG602, 93WG603, 93WG604, 93WG605**

*Dial drive cord replacement:* See model 16A26.

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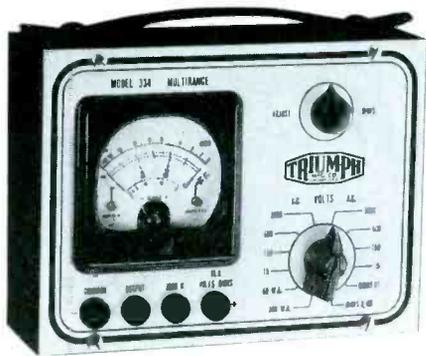
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**THE CATHODE RAY TUBE AT WORK**

By JOHN F. RIDER

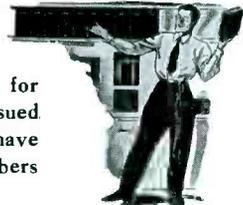
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Roy Ramsey has built up a fairly large car dealer service business through his close association with local dealers. He continually sells them on the need for expert installation and service to assure customer satisfaction.



periodically if it is to render maximum service," explains Roy Ramsey, owner of the shop. "We stress in our personal contacts and advertising that the mere fact that a set is working does not mean that it is rendering its maximum of service, that regular use just naturally throws it out of balance and that only through a periodical check can the owner be assured that his set will give him best service."

This is especially true during the fall and early winter, so far as Roy's sales and advertising are concerned. He stresses the importance of having the set checked after constant use.

He recommends that every receiver, regardless of its quality, should have a complete check-up at least once a year. In his advertising he figures out the cost by the day and thus emphasizes the low cost of assured service at its best.

Roy advertises this check-up service consistently through a small newspaper advertisement and by circulars distributed house-to-house. He lists the specific operations included in the general job, as follows: Call for and deliver the set; check aerial; check ground; clean set throughout; align set for best reception.

To feature check-up and other services, the shop prints stickers each fall

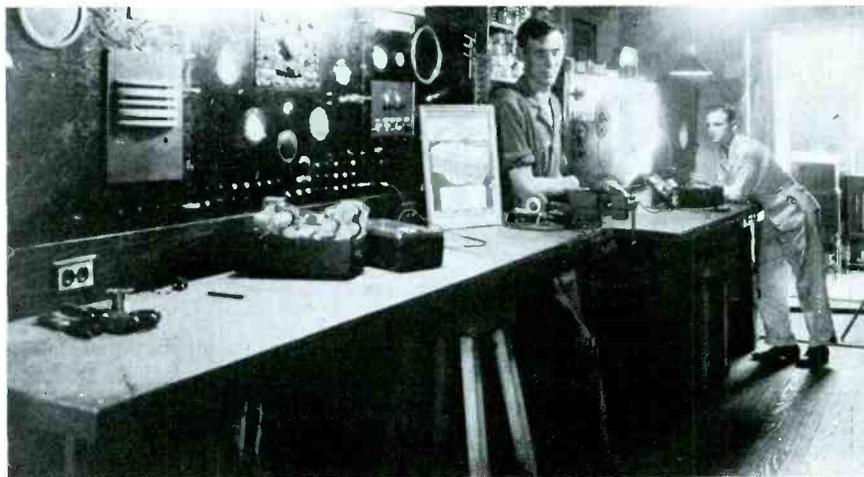
showing the football schedule of the local college and high school teams. He gives these mostly to high school and college students, who stick them on their cars. One side of the sticker carries the schedules, the other a list of services featured by the firm. He follows a similar plan in the spring to cover baseball.

An advertising feature which Roy has found of value in selling the public on the firm's ability to fix radio sets is to run an advertisement occasionally, telling of the set of ten manuals on radio service, explaining that the shop owns these and other reference books—the finest and newest literature on radio service which are available at all times by the shop men.

Service Men work on salary but receive a commission on all new or used receiving sets they sell. They receive nothing on the sale of parts. The commission for new and used set sales has helped materially in making the service department a better sales factor.

The shop has built up a fairly large car dealer service business through Roy's close contact with local dealers and because he consistently sells them on the need for expert installation and service to assure car radio customers maximum satisfaction.

The Roy Ramsey Radio Shop, Tyler, Texas, has built a profitable check-up volume by featuring the remarkably low cost of periodic service, by the day.



### HICKOK JUMBO TESTER

Hickok Model 4922S jumbo volt-ohm-milliammeter has 20 ranges for 5 functions. A 9 1/4-in. rectangular meter is used. The instrument incorporates a new type of rec-

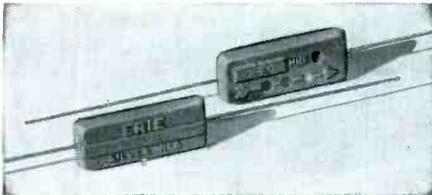


tifier circuit which will withstand more overload than older types, it is said.

Additional information on this and other Hickok instruments may be obtained directly from Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio.

### SILVER MICA CONDENSERS

Erie Resistor announces an addition to its line of silver-mica condensers. Known as type J the unit measures 13/64" x 7/16" x 11/32". The type J unit is said to be unusually stable over a wide range of tem-



perature and humidity changes. Average temperature coefficient (20 to 80° C.) is + .000025 mmfd/mmfd/°C. Maximum power factor at 1,000 kc is less than .04%. Erie Resistor Corp., Erie, Pa.

### MILLION MULTIMETER

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a 4-in. meter are used. For additional information write to Million Radio & Television, 671 W. Ohio St., Chicago.

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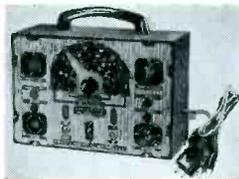
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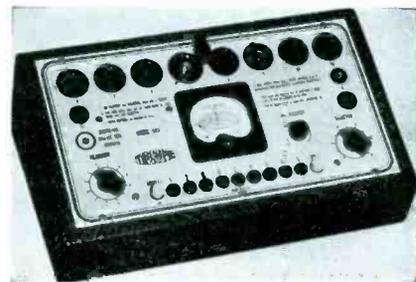
### TELEVISION ANTENNA

The Verti-flex television antenna consists of crossed dipoles with convenient switching means at the receiver for choosing either dipole. In addition the switching means allows alternate halves of the dipoles to be connected together so as to receive from the 45° direction also. This means that by switching the antenna can be adjusted to within twenty-two and one-half degrees of the best receiving position . . . and hence is convenient for locations where it is desired to receive signals from more than one station. Verti-flex Division, Illinois Seating Corp., 2138 N. Racine Ave., Chicago

### TRIUMPH TUBE TESTER

The Triumph Model 443 tube tester is designed to check all types of tubes, in-

cluding the new 117-volt types, gas rectifiers, bantam juniors, miniatures, visual indicators, ballasts and pilot lamps. The instrument provides push-button operation. Additional information may be obtained directly from Triumph Manufacturing Co., 4017 West Lake St., Chicago.



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**MODEL 538**—Special features are: Superheterodyne AC-DC. Five tubes, Vernier tuning. Illuminated dial; has LOOP-TENNA. needs no aerial or ground. Range: (170-555 meters.) Plastic cabinet. Width 7¾". In Walnut and Ivory. Also available with short wave.



**MODEL C500**—Special features are: Superheterodyne AC-DC; AUTOMATIC TUNING; A.V.C.; 5" P.M. dynamic speaker; LOOP-TENNA. Needs no aerial or ground. Width: 13". Range: (170 to 555 meters).

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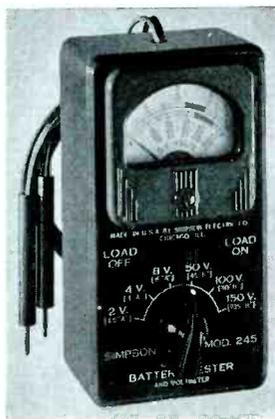
## DEWALD RADIO MFG. CORP.

440 LAFAYETTE STREET, NEW YORK

48 • SERVICE, FEBRUARY, 1940

### SIMPSON BATTERY TESTER

The Simpson Model 245 pocket-size battery tester is designed to test dry batteries under a load condition which is set up by



introducing an artificial load into the circuit, within the meter. Six-voltage ranges are provided to cover the popular sizes of A and B batteries. The meter is provided with a toggle switch to introduce the load. With the switch in the load-off position the meter may be used as a 1,000-ohm-per-voit voltmeter on any one of its ranges. For additional information write to Simpson Electric Co., 5216 Kinzie St., Chicago.

### GTC TWIN POWER

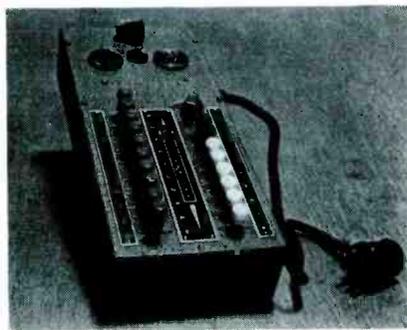
The General Transformer Corp. Twin-Powered Model P Porta-Power provides



two separate 6-volt sources, at 1½ amp each and operates from the 105-125 volt a-c power lines. It is designed for use with 6-volt receivers to allow separate connection of the filaments and vibrator supply. Additional information may be obtained directly from General Transformer Corp., 1252 W. Van Buren St., Chicago.

### RTL MODERNIZER

The RTL modernizer illustrated is designed to bring tube testers up to date. It



plugs into any tester having a 6-prong socket and heater voltages up to 7½ volts and enables it to handle present tubes and heater voltages. There is also a special

blank socket on the modernizer panel to enable its adaptation to future types. A chart accompanying the modernizer gives current settings for practically any tester now in use, it is said.

The instrument is obtainable on a special offer made by Philco Radio & Television Corp., Tioga and C Sts., Philadelphia, Pa.

### ATR VIBRATORS

American Television & Radio Co., 300 E. Fourth St., St. Paul, Minn., have announced their 1940 replacement vibrator line. Among the features claimed for these units are oversized tungsten contacts with full wiping action, perforated reed of Swedish spring steel, efficient magnetic circuit, formed base, mica and metal stack spacers with two-bolt construction, extra flexible leads with tinned clamp supports



and a manufacturing tolerance, on practically all parts, within 0.0005 in.

These vibrators are illustrated and described in the ATR 1940 sixteen-page vibrator guide which is available directly from ATR.

### BOOK REVIEW

*THE HOT-CATHODE LOW-VOLTAGE CATHODE-RAY TUBE*, by G. R. Mezger, published by Allen B. DuMont Laboratories, Inc., Passaic, New Jersey, 1939, 24 pages, paper covers, price 35 cents.

This book, although containing a relatively small number of pages, covers a surprisingly large amount of ground. This is accomplished by employing a highly compressed style and by restricting the discussion to the cathode-ray tube itself and omitting descriptions of associated circuits and applications of the tube.

The first two chapters dispose of the history of the cathode ray tube and of the operation and disadvantages of the gas-focused tube. The next two chapters then discuss: electrostatic focusing; magnetostatic focusing; electrodynamic deflection systems; magnetodynamic deflection; disadvantages of magnetodynamic deflection; comparison of magnetic and electric systems. The final chapter concerns itself with fluorescent screens, and covers such topics as general screen characteristics, types of screen material, and effect of spot writing-rate. A full page is devoted to an illustration of a cross-sectional view of a cathode ray tube, including the positioning of the DuMont intensifier electrode.

This is an interesting book and is recommended both to the serious worker in the field of cathode-ray oscillography and to the Service Man who is interested in securing general information about the tube. D. B.

## SERVICE CHARGES

(Continued from page 12)

set brought in for repair is capable of good reception when operating correctly, it usually will cost less to keep it in good condition than to buy a new one, then keep it in good order.

Perhaps as a temporary expedient the owner will want to get the set in playing condition even though it does hum and lacks its normal power. In this case use the specific repair rate list for installation of one coupling capacitor indicated on the list at \$3.60. Perhaps one or two tubes would have to be installed also.

In using a flat rate chart always differentiate between a complete job and a specific repair. Both have a place but the two types of service are entirely different. The specific repair is for use in those cases where the set is new and a premature breakdown occurs or where the owner wants to make a temporary, low cost repair even though fully aware that more work is necessary to insure lasting good results.

Competent service takes time, expensive equipment cursed with rapid obsolescence, and never ending study. Operation cost of this business is high compared with many other businesses mostly because of waste motion which cannot be avoided. We should take advantage of every opportunity to enlighten the owners we serve as to the problem of supplying them with adequate service at reasonable prices. A better understanding between the Service Men and the public they serve should result in less waste motion and an expanded market for their services. Adoption of a flat rate labor charge system is a long step in this direction.

### CORNELL-DUBILIER CATALOG

The Cornell-Dubilier Electric Corp., S. Plainfield, N. J., has issued their catalog 175A, a 16-page edition covering mica, paper, dykanol, wet and dry electrolytics as well as descriptions of the C-D capacitor test instruments and Quietone interference filters. Copies may be obtained directly from Cornell-Dubilier.

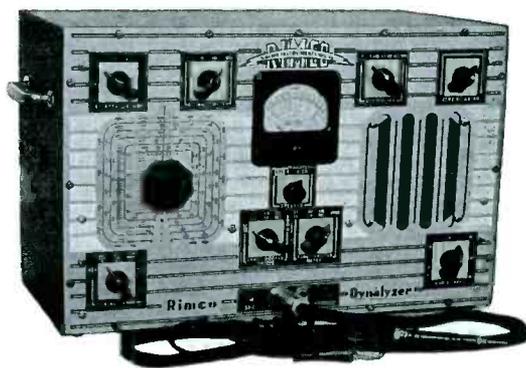
### MEISSNER VIBRATOR DISPLAY

To aid jobber sales Meissner has prepared a 3-color counter display. It contains 6 replacement items and carries a sales appeal which stresses each of the features of the new Meissner vibrator element illustrated on the back-card.

A limited number of these displays are being offered to jobbers on a special price plan which permits resale of the entire unit to Service Men. A large Meissner vibrator replacement wall chart is packed with each of these display units.

Additional information on this display

# NATIONAL UNION GIVES DYNALYZER signal tracer on special LIMITED OFFER



**\$3700** DEPOSIT!

(Regularly \$88.50 Dealer Price)

**1600 points\* . . .**  
**and this complete**  
**3 channel tester**  
**is yours!**

\*Points are easy to make when you sell National Union Tubes and Condensers.

## OFFER EXPIRES MARCH 15th . . . ACT NOW

### Look at these great features. Read why you should own a DYNALYZER for better work!

1. Accurately measures signals from 95 K.C. to 15 M.C. in ANY LF. or R.F. Channel—Only 1 tuning control required.
2. Meter enables visual tests of Osc. or Control Channels, voltage measurements up to 2,000,000 ohms per volt, and resistances up to 10 megohms.
3. Built-in Speaker enables "Listening-in" on (1) any other channel while (2) meter being used for Osc. Tests and while (3) speaker of radio is used to listen to audio channel of radio.

### It Pays to Sell National Union Tubes and Condensers! National Union Equipment Offers Build Better Business! Ask Your Parts Wholesaler

## Get COMPLETE information on the DYNALYZER and SPECIAL LIMITED OFFER now!

National Union Radio Corporation

Newark, New Jersey

may be obtained directly from Meissner Manufacturing Co., Mt. Carmel, Ill.

### AEROVOX DISPLAY

As a local tie-in with their advertising of the L-C checker, Aerovox Corp., New Bedford, Mass., is distributing red and black display cards to its jobbers. This card features a picture of the instrument which checks condensers and inductances while connected in circuit and invites Service Men to ask for demonstration and the printed bulletin.

### RCA TUBE MANUAL

The RC14 RCA Receiving Tube Manual has been completely revised and brought up to date with information on

the latest RCA receiving tubes, it is said. It now covers a total of 237 types arranged in numerical-alphabetical sequence. Readers of SERVICE can obtain copies of the manual by sending 25c to the Commercial Engineering Section, RCA Manufacturing Co., Inc., Harrison, N. J.

### WEST COAST RAYTHEON MOVES

Raytheon Production Corp. have moved their west coast warehouse and offices to new and larger quarters at 1045 Bryant St., San Francisco, Calif. Increased sales volume in this area made this move necessary to assure Raytheon Distributors of prompt and efficient service, it is said. Orders and adjustment returns will now be handled from this new address.

SERVICE, FEBRUARY, 1940 • 49

THESE *Sylvania*  
"STOCK BOY" CABINETS  
CAN HELP YOU SELL

**Ask Your Jobber  
How You Can Get Them**

For neat and handy storage of tubes and parts the cabinet on the right has everything—space for over 250 tubes; drawers of 21 compartments; another 4 compartments; and storage bin at bottom. All-steel, 59½" high, 22" wide, 12" deep. The folding cabinet below holds 240 tubes; is 18" high, 21¾" wide and 11½" deep when closed. See your Sylvania jobber about getting one of these cabinets . . . today.



## SIGNAL TRACING without Extra Equipment

**Model 1252**  
The Vacuum Tube Voltmeter for High Frequency Measurements. Self-Calibrating . . . This feature is automatic and controlled by the tube bridge circuit. Ranges: 3-15-75-300 volts. RED • DOT Lifetime Guaranteed Twin Instruments with two Separate DC movements. Dealer Net Price. . . \$48.34

**Model 1232-A**  
New AC operated Signal Generator with Triple Shielding and completely NEW design. Top panel insulated from R.F. Main wiring beneath double shielded panel. Coils and band switch individually shielded. Six bands from 115 KC to 30.5 MC, all fundamentals. Dealer Net Price. . . \$29.84

**New Battery Tester!**  
Model 696 speedily checks all dry batteries under proper loads. Eleven loads from 1½ to 135 available by selector switch control . . . This tester is the first to provide a GOOD sector for all dry batteries in common use . . . Model 696 also can be used as a 1000 ohms per volt Voltmeter with nine DC ranges. 2-4-8-10-25-50-75-100-150 volts. Net Price. . . \$2.84

Using Model 1252 Vacuum Tube Voltmeter and Model 1232-A Signal Generator any service engineer can do quick, efficient signal tracing without the need of buying additional equipment. (See diagram below.)

A Signal Generator Voltage	L Audio Voltage Gain A.F. Transformer
B Gain R.F. Transformer	M Audio Voltage Gain Audio Tube
C Gain R.F. Tube	N Audio Voltage speaker coil
D Gain Det. Transformer	O Oscillator Voltage D.C. Voltage
E Gain Det. Tube I.F. Voltage	B Grid Voltage from AVC Controlled by
F Gain I.F. Transformer	attenuation of Signal Generator
G Gain I.F. Tube	E&F Grid Voltage See B
H Gain I.F. Transformer	L Grid Voltage
K Audio Voltage Second Detector	I Diode Voltage Control Oscillator

### TELEVISION DEMONSTRATION

Recently some seventy-five radio authorities and engineers were shown larger screen images with improved pictorial detail which it is said can be obtained within present transmitting frequency limitations. In the Allen B. Du Mont Laboratories at Passaic, N. J., representatives of the Federal Communications Commission, Radio Manufacturers Association, NBC and CBS networks, RCA and other interested organizations and individuals were shown a persistent type cathode-ray screen which, it is claimed, permits slashing the present RMA image repetitive rate in half without introducing noticeable flicker. Du Mont engineers demonstrated television transmission and reception at just half the usual RMA repetitive rate, or 30 fields or 15 complete interlaced pictures per second. Halving of the repetitive rate means that the transmitting frequency channel or space on the air can likewise be cut in half. Two television channels can be made available where but a single one existed before. However, Allen B. Du Mont favors using this extra elbow room thus gained for an increased number of scanning lines, so as to step up the pictorial detail still more.

### ARCTURUS REPRESENTATIVES

Salesmanager Jack Geartner of the Arcturus Radio Tube Co., Newark, N. J., sends word of the appointment of the S. & S. Co., Staunton, Va., as their representatives covering the Southeastern territory. This firm travels four men and is well known throughout the trade.

The S. & S. Co., Memphis, Tenn., has also been appointed to cover the deep South. This organization is affiliated with the Staunton firm and has three traveling representatives.

### WESTON BULLETIN

"Ideas for Profitable Servicing", an 8-page bulletin issued by Weston Electrical Instrument Corp., Newark, N. J., has the primary objective of offering helpful hints to the Service Man. These ideas are outlined in separate sections, each one bearing on some aspect of successful servicing. In one section, for example, titled "Organize Your Service Procedure", trouble shooting is analyzed to find ways to locate trouble quickly.

The final section, "Cut Overhead", has to do with equipment obsolescence. Accompanying the text throughout the bulletin are illustrations of instruments which should help in the application of each idea. Specifications and prices are listed for these instruments.

Copies of the bulletin may be obtained directly from Weston.

### WILCOX-GAY BULLETINS

A series of service bulletins is being prepared by Wilcox-Gay Corp., Charlotte, Mich., for dealers and Service Men. Copies may be obtained directly from Wilcox-Gay.

While some of the information contained in these bulletins will be of the usual service data nature, including schematic diagrams, voltage data charts, circuit alignment instructions, etc., considerable space will be devoted to a semi-technical discussion pertaining to the function of the equipment employed in some of the models such as the latest development by Wilcox-Gay, the Recordio, which is a radio-phonograph-home recorder combination.

### TRIPLETT BATTERY TESTER

The Triplett Model 696 checks dry batteries with their proper loads. Eleven



different loads are available by means of a selector switch. English reading meter scales are employed. In addition, the Model 696 can be used as a 1,000-ohm-per-volt voltmeter with nine ranges from 2 (full scale) to 150 volts. A 3-in rectangular type meter is used. Additional information may be obtained directly from Triplett Electrical Instrument Co., 1712 Harmon Ave., Bluffton, Ohio.

### COMMUNICATIONS RECEIVER

The Hallicrafters, 2611 Indiana Ave., Chicago, announce the "Sky Champion" communications receiver, Model S20-R. The tuning range is from 540 kc to 44

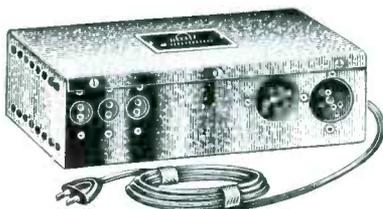


megacycles in four bands. The tube line-up includes: 6SK7 tuned r-f stage, 6K8 oscillator-mixer (with special input tuned circuit which is said to provide approximately twice normal conversion gain at frequencies above 14 mc.), two 6SK7 i-f stages, 6SQ7 detector—a-v-c—first audio, 6F6G audio power stage, 6H6 automatic noise limiter, 6J5GT beat-frequency oscillator, and 80 rectifier.

### BATTERY ELIMINATOR

The Electro Products Laboratories, 549 W. Randolph St., Chicago, announce a special A and B battery eliminator for use with portable and home receivers using 1.4-volt filament tubes.

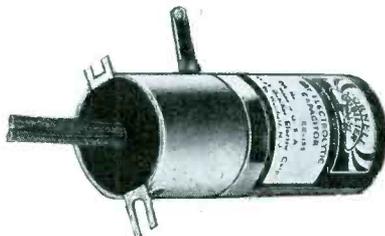
This new Model P is suitable for receivers with 4, 5 and 6 tubes and provides 90-volt B voltage when connected to a



115-volt, 50-60 cycle power source. Special plug harness enables eliminator to accommodate all types of receivers and battery plugs or connectors, it is said. The power consumption is 12 watts.

### REPLACEMENT CAPACITORS

The Cornell-Dubilier Type EZ dry electrolytic capacitor is designed for replacement of vertical can, spade lug and strap mounted originals. Single, dual, triple and quadruple units are available, with a choice of common negative leads or separate sections; in all, 38 different varieties and combinations ranging from single 8-, 12-, 16- and 24-mfd capacitors with ratings of 250, 350, and 450 volts, to multiple units which provide the several capacity and working voltage values required for different typical receiver circuits. Enclosed in cylindrical cardboard container, EZ units are stamped with capacity and voltage ratings, and

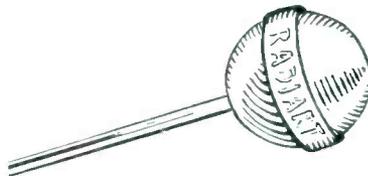


leads are insulated and color coded.

Additional information may be obtained directly from Cornell-Dubilier Electric Corp., 1026 Hamilton Ave., S. Plainfield, N. J.

### RADIART STATIC MUFFLER

The Radiart Corp., Cleveland, Ohio, announce their Static Muffler ring, which is described as a corona discharge equalizer. The aerial rod terminates in a plastic ball of broad surface area, encircled by a metal ring, the effect of which, it is said, is to set up equal potential zones for the dissipation of static electricity which ordinarily collects at the tip of the aerial rod. The



gradual, instead of abrupt, discharge of this energy quiets the crackle.

The Static Muffler ring is standard equipment on most Radiart aerial types.

### STEWART-WARNER F-M RECEIVERS

Stewart-Warner Corp. will introduce, in May, a representative line of table and console radio sets equipped to receive programs transmitted by the Armstrong system of wide-swing frequency modulation broadcasting, according to L. L. Kelsey, manager, Stewart-Warner radio division.

The Stewart-Warner f-m sets also will be equipped to receive standard band broadcasts. Sets will be first merchandised exclusively in territories where f-m transmitting facilities are available.

### MULTIPRODS

Standard Technical Devices, Inc., 3008 Avenue M, Brooklyn, N. Y., have introduced their Multiprod and Saf-T-Prod test leads for use with ordinary meters on higher voltage ranges. The Multiprod is an insulated lead which incorporates the resistance multiplier for extending the range of the meter to 5,000 or 10,000 volts. The Saf-T-Prod is an insulated lead without the multiplier.

# IT'S HERE!

## Your New RADIART AERIAL Display



• Dealers and Servicemen who remember how Radiart Displays have helped to sell more aeri- als, better aeri- als, profitable aeri- als, will hurry an order in to a Radiart jobber.

**BULLETIN 640-A** tells all about Radiart's

- Ro-TENNA (Wind-up)
- Mirror Combinations
- Universal Mount Cowls
- "Static-Muffler" MAGIC RING and dozens of other features



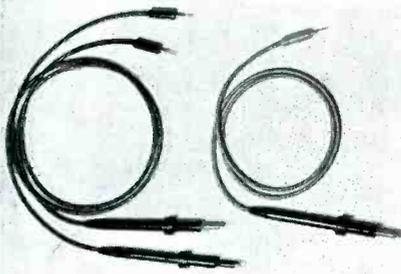
The RADIART Corporation  
CLEVELAND, OHIO

## RADIART VIBRATORS

Guaranteed 1 YEAR

**VOLTAGE MEASUREMENTS**  
up to  
**10,000 VOLTS**  
with ease and safety  
**ON YOUR PRESENT EQUIPMENT**

The STANDARD MULTIPROD contains its own precision multiplier which, used as one of the test leads, makes your lowest voltage range read 10,000 volts full scale. (Also available for 5,000 volts.)



Pat. App. For

- \*Hardened and plated steel tips.
- \*Flanged for long leakage path.
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- \*High voltage kinkless wire.
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- \*Real he-man construction.

The **LOWEST COST LIFE INSURANCE** is yours in the new **STANDARD SAF-T-PRODS**. These **SAF-T-PRODS** contain all the exclusive features of the **MULTIPROD** less the precision multiplier.

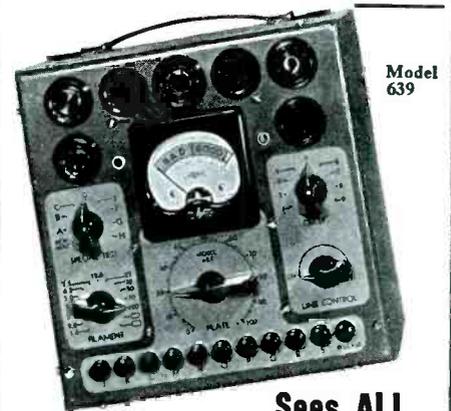
10,000 volt Multiprod (for 1 ma. meter) Net price \$3.75 ea.  
5,000 volt Multiprod (for 1 ma. meter) Net price \$3.00 ea.  
**SAF-T-PROD** Net price \$1.25 ea.

Multiprod also available for meters other than 1 ma. See these superior **STANDARD PRODUCTS** at your dealer or write direct

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3008 Avenue M, Brooklyn, N. Y., U. S. A.  
Distributors: Write for interesting information

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Model 639

**Sees ALL, tells ALL about any tube!**

The Jackson Tube Tester gives you the real "low down" on radio tubes. It obtains a more accurate test on every tube because it tests at higher plate voltages.

Tests tubes by the exclusive Jackson **DYNAMIC** method. Has full range filament selection up to 117 volts—tests all the latest tubes—is speedy and simple to use.

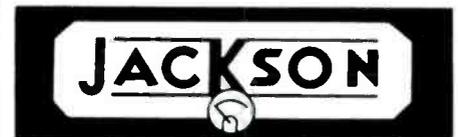
Best of all it costs only **\$28.95 net.**

See Your Jobber Today!

Write for free catalog

**The Jackson Electrical Instrument Company**  
DAYTON, OHIO

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**SERVICE MANUAL**

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**DIAGRAMS**  
**OF MOST**  
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**RADIOS**

**DIAGRAMS YOU NEED**

In one handy manual you have all the diagrams of the most often serviced radios today. Over 80% of all sets you service every day are included. These important hint-giving, trouble-shooting circuits make your job easier, permit faster and better repairs.

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**COMPLETE**  
**\$1.95**  
**POSTPAID**

**NEW SERVICE HELP**

Helpful diagrams will cut hours of work, point to the fault quickly, assist you on the tough jobs. Carry this manual on the job; use it in the shop; look up the circuit, alignment data, service hints. The low price will be repaid many times the very first day. Plan to use the manual this week. Answer today!

**MONEY-MAKER FOR SERVICEMEN**

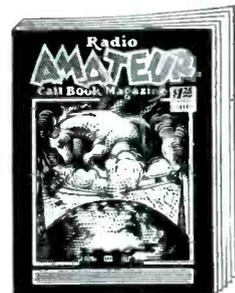
Get your copy of this radioman's biggest time-saver. No need to spend money for bulky, space-wasting manuals. Only \$1.95 today, brings your copy of the handiest "on-the-job" handbook of useful diagrams. (Models 1926 to date.) Well printed, with complete service data and values, large size 8 1/2 x 11 inches. Limited quantity at the special \$1.95 price. Rush order now for prompt shipment.

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 I am enclosing \$1.95, sent postpaid.  
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The **CALLBOOK** is the only publication that lists all licensed radio amateurs in the United States and over a hundred and seventy-five different foreign countries.

Each issue also contains a world map showing amateur prefixes, press time and weather schedules, amateur prefixes listed alphabetically and by countries and a world time conversion chart.

**Complete . . . Accurate . . . Up-to-Date**

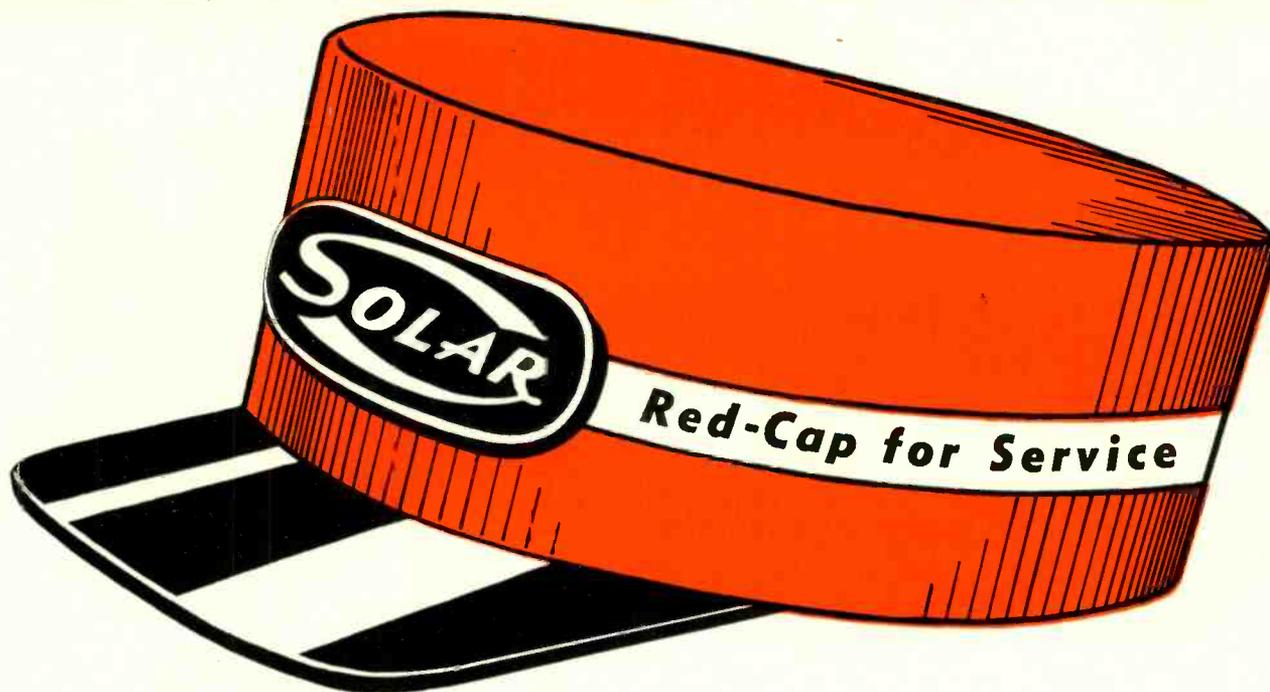
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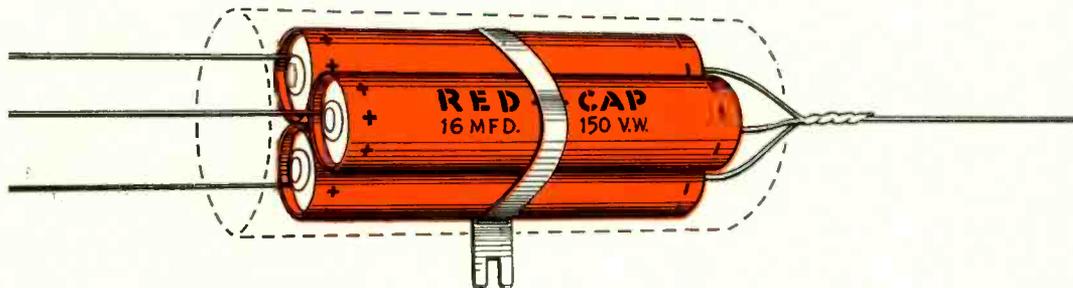


# RED - CAPS

## CUT SERVICING COSTS

Here are *smaller* dry electrolytic condensers than ever offered before. They were designed especially for radio service work. New Solar developments in producing higher gain etched foil have made Red-caps possible. As few as 12 condensers cover most repair requirements for electrolytic filters. Utmost simplicity, adaptability, low-cost.

You have wanted Red-caps! Why delay repair jobs awaiting exact replacements? You have wondered when someone would offer unit dry electrolytics sealed in metal tubes—so small in diameter that several strapped together will occupy no more space than the filter condenser they replace — so high in quality they will stand up under surges which the original filters could not "take"—so low in price that they leave you much room for profit. These are your Red-caps!



**SO HANDY!** Diameters are absolute minimums; lengths are uniform. An adjustable strap enables you to build your own filters with 1 or 2 or 3 or 4 Red-caps. Space-saving. (See illustration.) Ask for Red-cap price list.

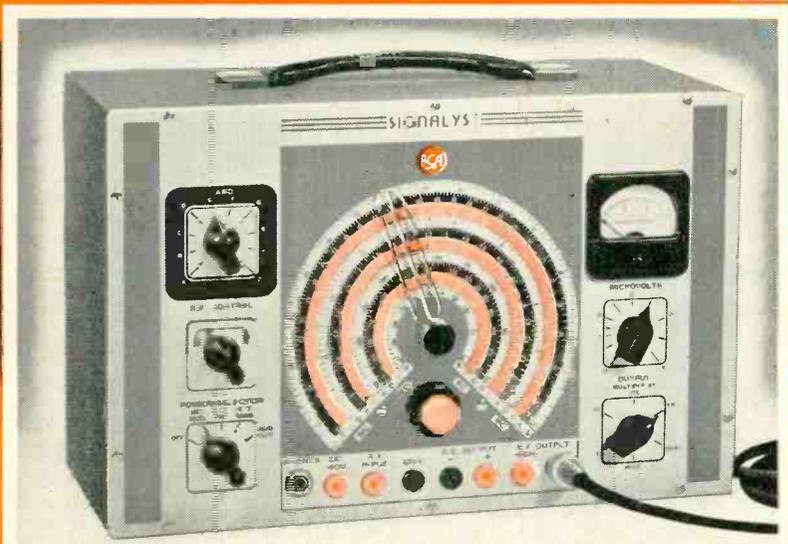
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**BAYONNE** **NEW JERSEY**

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## the *Big Three* by RCA



1 **The RCA Rider Chanalyst**... The Original Signal Tracer that Revolutionized Servicing! Net Price \$107.50



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### More equipment for your money . . . more money for you from your equipment

THE DAY OF profitable hunch-work in servicing radios is past. No longer can the defects in radio receivers be guessed by pinging tubes or "spitting on your finger." These methods waste too much time, too many motions. RCA, with the greatest radio service experience in the world, designs and builds the test equipment you need to make your time worth more money, to take the guesswork out of servicing.

With RCA Test Equipment, every step you take in checking a set is a step on which you can collect in cash. Look at these three leaders.

The Rider CHANALYST permits you to probe into every part of every receiver in a way that has never before been possible.

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The Rider VOLTOHMYST is the only instrument of its kind. For the first time you can measure rapidly and accurately *any* and *all* DC voltages from 0.05 volt to 5,000 volts. Its extremely wide ranges will take care of the servicing and engineering requirements of today and tomorrow.

Designed to minimize obsolescence, the RCA Big Three put the dollar sign in Service. Get more equipment for your money . . . and get more money from your equipment. Invest in the RCA Big Three now.



## Test Equipment

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