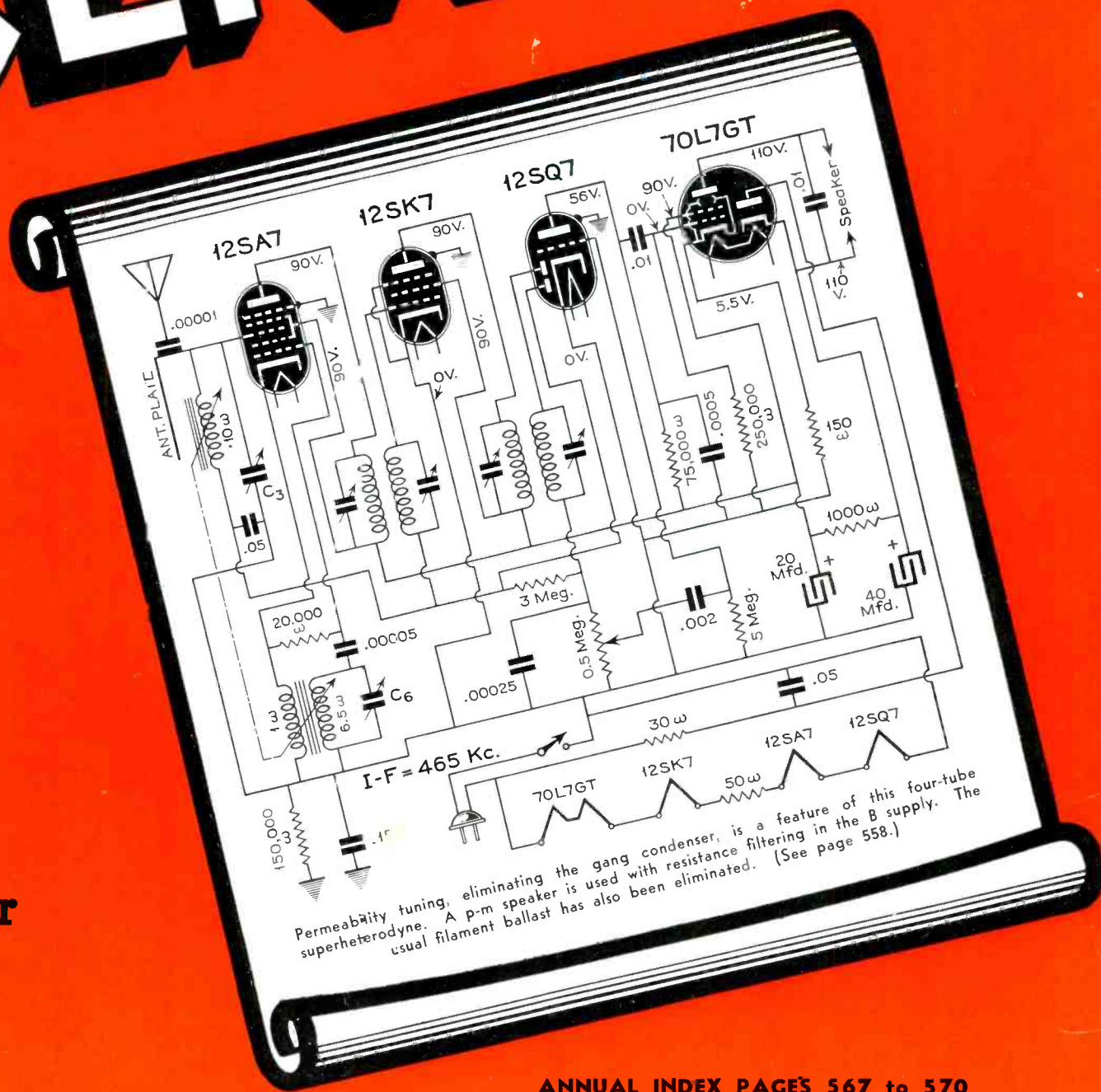
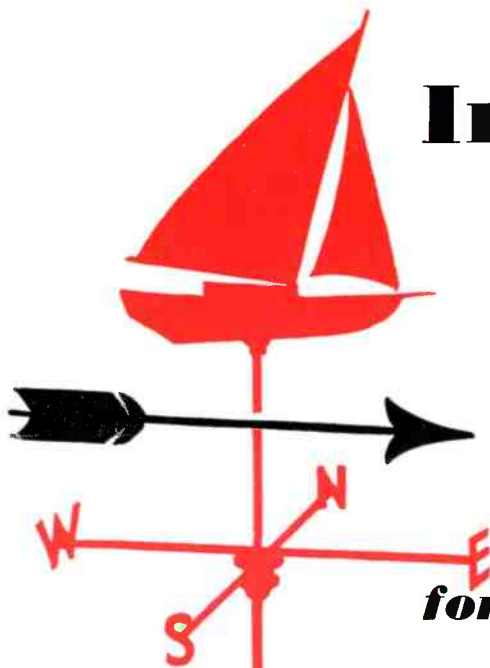


SERVICE



December
1939

ANNUAL INDEX PAGES 567 to 570



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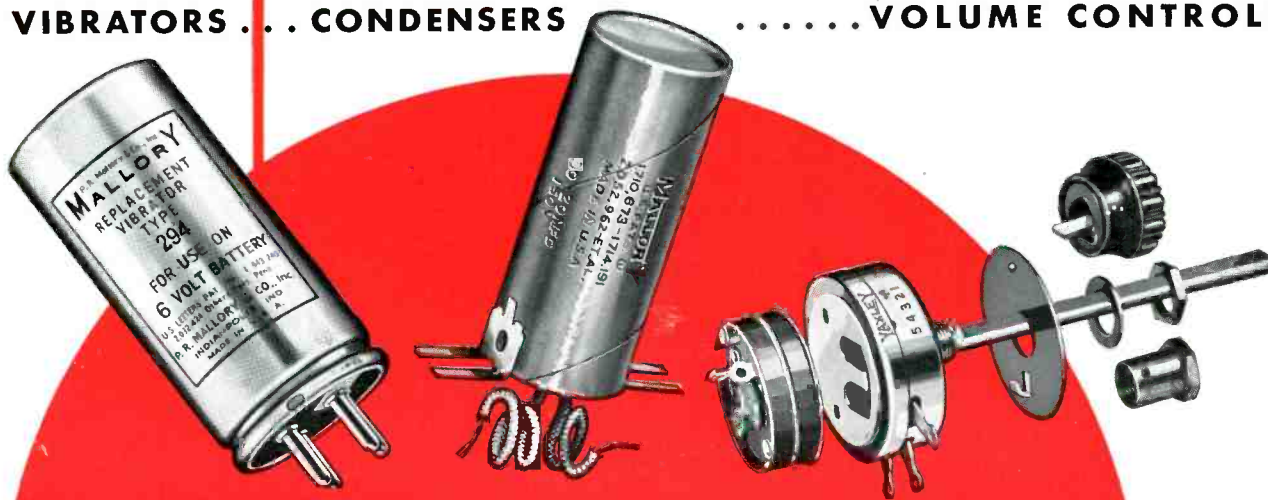
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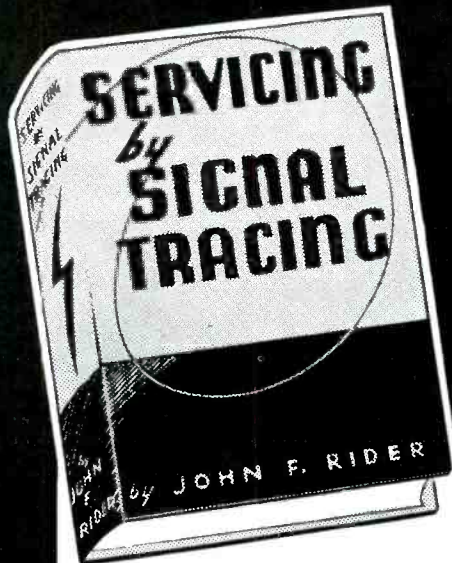
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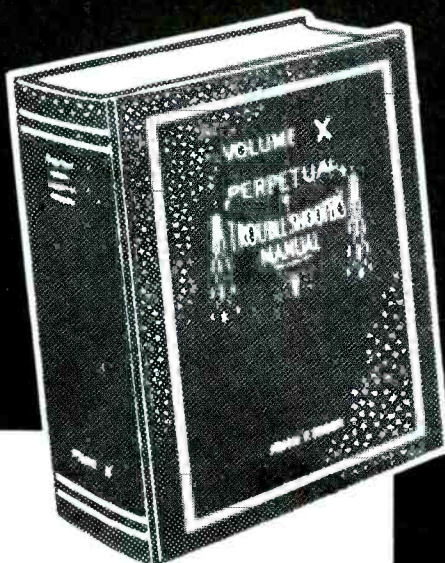
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2

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BOOKS**



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SIGNAL TRACING**

by JOHN F. RIDER

Although this book has been out only one month it is already in its second printing—evidence of the tremendous interest in this new method of servicing. Radio technicians, manufacturers, engineers, all have endorsed this system, which makes for quicker, easier, more profitable work. Written by John Rider, who developed the system, this book should be read by every serviceman interested in making more money today *and tomorrow*. For Servicing by Signal Tracing is a method for locating defects which can be applied to any receiver ever made, or any receiver that ever *will* be made. It is as applicable to sets of one type of circuit as another—to sets of any and all sizes. This book explains, step by step, this easy method of locating a defect that has caused the signal in a set to depart from normal. This method can be applied not only to receivers but to PA systems—frequency modulated receivers—and yes, television; in fact, any electronic equipment through which a signal passes. Get your copy of this book—it's a bargain!

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A Monthly Digest of Radio and Allied Maintenance

Reg. U. S. Patent Office

FEELING that the television industry had reached a "crucial stage" of development, the Television Committee of the Federal Communications Commission has recommended that the Commission adopt a more lenient policy towards the broadcaster. Specific recommendations were made towards the elimination of those regulations which may be interfering with proper business or economic processes. A definite suggestion in this respect was that under certain conditions the television broadcasters be permitted to obtain a specific amount of commercial sponsorship for their experimental broadcasts . . . to the point where operating expenses would be defrayed.

We believe this recommendation by the Television Committee to be a step in the right direction. Experimental television broadcasting is certainly a costly procedure, and a certain amount of commercial programs would do much to help these pioneers in television. An obvious objection, however, may be the costs of determining the operating expenses . . . a procedure which may be far from easy.




THE 1940 Radio Parts National Trade Show will be held at the Stevens Hotel, in Chicago, from June 11 through 14. The main exhibition will be held in the large exhibition hall in the Stevens Hotel, while the demonstration and conference rooms will be in both the Stevens and the Blackstone Hotels. From all indications the 1940 show promises to be bigger and better than the 1939 gathering.

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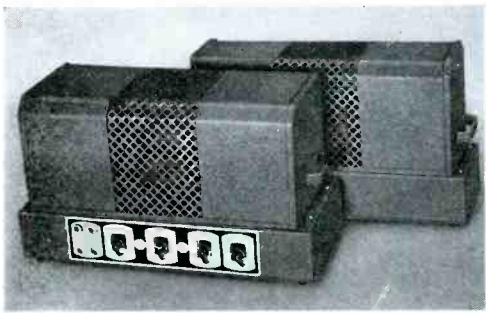
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BEAM POWER-COMPRESSOR AMPLIFIER KITS



The new improved UTC PA amplifier kits incorporate every advanced circuit feature desirable for PA and amateur work.

The kits are provided complete with panels, covers, resistors, condensers, sockets, jacks, etc. All components are completely mounted and ready to wire; complete constructional details and diagrams are furnished.

VOLUME LIMITING

Volume limiting in amplifier equipment is ideal for the home and PA application inasmuch as the equipment can be operated at high levels without any fear of blasting on peaks of power. In PA service the changes in level encountered when a speaker moves toward the microphone is minimized by the amplifier compression.

COMPONENTS

The new UTC PA amplifier kits are unusually trim in appearance, employing blackchrome etched panels contrasting with the gray commercial wrinkle finish of the chassis and perforated metal cover.

All kits are furnished with four input jacks providing for dual input (high or low gain) to both channels of the mixer. The mixing system is completely cross-talk proof. The unique UTC VARITONE equalizer is incorporated to equalize high frequencies or low frequencies, as desired. VARIMATCH output transformers are employed in kits for PA, modulator and driver service. The output impedances on PA kits are 500, 200, 15, 8, 5, 3, and 1½ ohms.

TECHNICAL CHARACTERISTICS

P-1A

PA kit, self bias, 30 watts output, audio and power units on separate chassis for rack or cabinet mounting. Four jack, dual channel, high impedance input, two high gain (120DB), two low gain (80DB). VARITONE equalizer and compression controls. Output impedances for line and voice coil as above. Weight, 60 pounds.

Net price.....\$52.50

Tubes required for P-1A are: two 6J7, one 6N7, two 6C5, two 6L6, one 83, one 6H6.

P-2A

PA kit, fixed bias, 50 watts output, audio and power units on separate chassis for rack and cabinet mounting. Four jack, dual channel, high impedance input, two high gain (120DB), two low gain (80DB). VARITONE equalizer and compression controls. Has output for line or voice coils, as specified. Weight, 64 pounds.

Net price.....\$58.50

Tubes required for the P-2A kits: two 6J7, one 6N7, two 6C5, two 6L6, one 83, one 88, one 6H6.

P-3A

PA kit, fixed bias, 100 watts output. Audio and power on separate chassis for rack or cabinet mounting. Four jack, dual channel, high impedance input, two high gain (120DB), two low gain (80DB). VARITONE equalizer and compression controls. Line and voice coil output. Weight, 110 pounds.

Net price.....\$85.50

Tubes required for the P-3A kit: two 6J7, one 6N7, two 6C5, four 6L6, two 6F6, three 83, one 5Z3, one 6H6.

P-4D

10 watt compressor driver amplifier, self bias. 10 watts output, sufficient to drive any class AB, or class B amplifier of 100 watt to

250 watt rating. The ideal driver, incorporating: compression, low reflected drive impedance, multi-channel input, high gain, and VARITONE equalizer. One chassis. Four jack, dual channel, high impedance input, two high gain (117DB), two low gain (77DB). VARITONE equalizer and compression controls. VARIMATCH driver transformer incorporated as output unit. Weight, 36 pounds.

Net price.....\$39.00

P-4A

Ideal 10 watt home amplifier. Same as above, but with PA VARIMATCH output transformer to 500, 15, 8, 5, 3, 1½ ohms. Weight, 36 pounds.

Net price.....\$39.00

Tubes required for the P-4D and P-4A kit: two 6J7, one 6N7, one 6C5, two 2A3, one 5Z3, one 6H6.

P-5A

PA kit, self bias, 15 watts output. One chassis. Four jacks, dual channel, high impedance input; two high gain (120DB), two low gain (80DB). VARITONE equalizer and compression controls. Output impedance for line and voice coils, as specified. Weight, 36 pounds.

Net price.....\$37.50

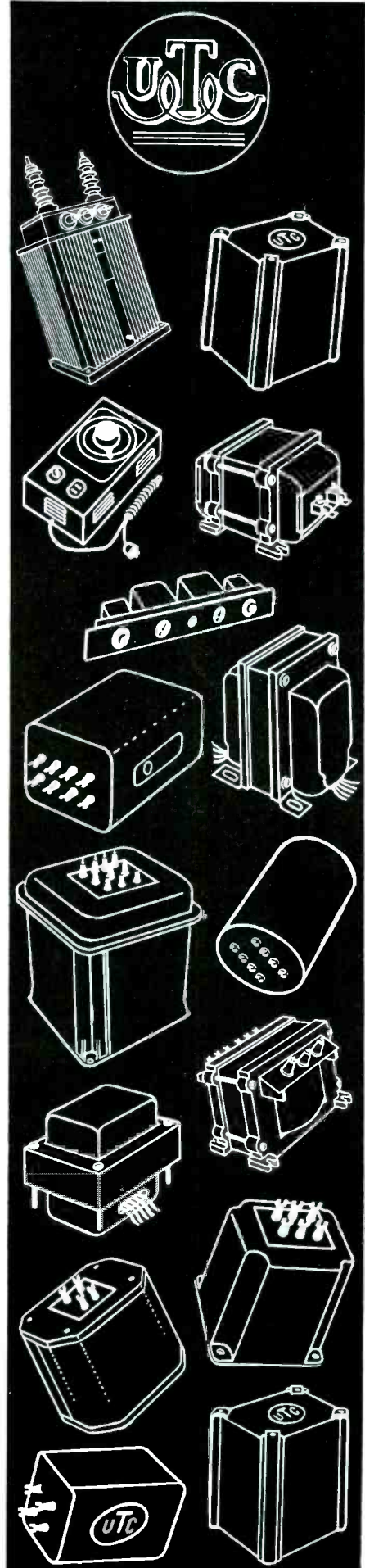
Tubes required for P-5A: two 6J7, one 6N7, one 6C5, two 6V6, one 83, one 6H6.

P-7A

AC operated pre-amplifier kit designed especially for amateurs and PA service. Very efficient filtering assuring freedom from hum. Has a gain of 70DB, and a two channel high impedance, high level mixer with jack input for each channel. Output impedances are 50, 200, and 500 ohms. Weight, 15 pounds.

Net price.....\$18.00

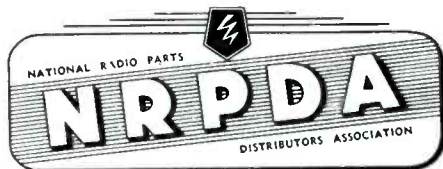
Tubes required for the P-7A: two 6J7, one 6N7, one 6X5.



UNITED TRANSFORMER CORP.

Write: SERVICE DIV. ★ 150 VARICK STREET ★ NEW YORK, N. Y.
EXPORT DIVISION: 100 VARICK STREET NEW YORK, N. Y. CABLES: "ARLAB"

INTEGRITY



SYMBOLS forever have led the way to Progress! The Rock of Gibraltar, the Statue of Liberty, the American Flag, all have symbolized strength, truth, justice, progress! And so, too, the NRPDA Emblem immediately suggests to thousands of Dealers and Servicemen the reputation for Integrity which it so richly deserves.

Jobbers who display the NRPDA Emblem are alive to their responsibilities under this banner and Dealers and Servicemen know that when they buy under this sign that they are protected against loss of profits which are legitimately theirs; that they are assured of quality, advertised merchandise backed by the reputation of the jobber as well as the manufacturer.

The NRPDA Emblem has done much to reestablish the bonds of mutual confidence, respect and understanding which is so important to the normal growth of an Industry so great as ours. Jobbers who SELL under this sign and Dealers and Servicemen who BUY under it never shall want. Their Integrity will keep them long after the fleeting shadow of a temporary, but ill advised profit has been spent.

Jobbers—Sell under the sign of NRPDA.

Dealers, Servicemen—Buy under the NRPDA sign for greater profit and understanding.

NATIONAL RADIO PARTS DISTRIBUTORS ASSN.

TEMPORARY OFFICE OF THE EXECUTIVE SECRETARY

5 WEST 86th STREET

NEW YORK, N. Y.

PROFITS IN MODERNIZATION

By **ARTHUR ROBERTS**

IN MAKING this field study we analyzed the business records of 31 Service Men active in the Middle Atlantic states. They had modernized their servicing equipment before June 1938. We took their profit and loss statement from June 1938 to June 1939, and compared it with the 12 month period just before modernization. This latter period (not exactly the same for each Service Man) was approximately from June 1937 to June 1938, when they were working with gay-ninety analyzers, oscillators and other test equipment.

The composite and condensed comparative statements accompanying this research visualize with X-ray clarity the profit-building power of modernization, and since many Service Men are trying to get by with obsolete equipment, it is time to give consideration to this research, which so definitely indicates that old service equipment causes losses and keeps profits at minimum. Before modernization, 8 of the 31 Service Men were in the red, after modernization, all were making profits.

sales building power

The large increase in net profit after modernization shows its tremendous sales-building power as well as overhead reducing effectiveness. It is also a stimulus to better business promotion. Just as a man feels spruced up when he puts on a new suit for the first time, so does the Service Man who has modernized. Quite naturally, he begins promoting sales of service and tubes with greater gusto.

average investment

The average investment in modernization was \$410, including instruments, tools, service bench, manuals, wiring and illumination. The average increase in net profit was \$1,282.54, indicating

INSOFAR as we know, the benefits of modernizing servicing equipment has never been definitely determined from a profit standpoint because no attempt has been made to do the research necessary to gather and analyze the figures in order to get sufficient data.

SERVICE has undertaken the task and the result provides important information for Service Men in connection with their everyday work in servicing radio receivers.

that modernization pays for itself 3 times the first year. Depreciation on equipment was figured on a 5-year basis. **net profit about 20%**

Before modernization the net profit on sales was 6.9 percent, after moderniza-

tion, 19.7 percent, and this is about what the Service Man should net. Too many Service Men are satisfied with too little net profit on sales. Authorities state that the profit should be around 20 percent. If your profit on service is below par, the way to bring it up is to modernize.

sales cost decreased

Cost of sales decreased 9.7 percent after modernization because Service Men could work faster with modern equipment. We found a tendency to cut price too much on tubes and parts before modernizing. After investing in new service labs, the modernizers apparently remodeled their business methods at the same time because the average gross on tube sales increased approximately 30 percent. The modernizers found it just as easy to get profitable prices on tubes as to slash prices, hence, the gross margin on sales increased after the streamlining.

WE SUM up our findings on the advantages of service equipment modernization as follows:

- 1)—Gives customers more confidence in your ability to do the work efficiently.
- 2)—Speeds up service, cuts costs and creates better customer satisfaction.
- 3)—Builds more profitable service sales because there is less tendency to cut prices.
- 4)—Reduces your idle time. Increases ratio of productive labor.
- 5)—Provides immediate and accurate estimates in shop or field.

- 6)—Minimizes material spoilage.
- 7)—With increasing circuit complexities, the need for modern, flexible test equipment is paramount. Modernization enables you to do more and better work in less time, hence, means more profit for you.
- 8)—Especially where a flat price is given to the customer, it cuts down time spent on job, hence, increases profits.

Finally, this survey discloses that whether you make \$1,000 yearly or \$20,000 yearly, the adequacy of your equipment has a definite relationship to net profits. Profits rise when you modernize.

overhead dropped

The overhead dropped 3.1 percent on sales after modernization, although sales of service increased 31.2 percent and sales of tubes and parts increased 23.6 percent. When sales volume increases, the overhead-to sales percentage usually decreases, effecting a saving and larger net profit. After modernization, idle time decreased to a minimum, which also lowered overhead. (On statement the idle time was charged under overhead expenses and not cost of sales.)

time savers

Modern instruments save time in many ways. Some Service Men are making tests without removing the chassis from the cabinet. Others are finding that socket selectors are time-savers where space is limited, such as on auto radios.

For rural coverage, we found a number of Service Men using combination testers and analyzers with self-contained power supply for unwired areas, enabling the user to service-battery radios in the owner's home or car without taking the chassis to the shop. Such calls offer opportunities to sell wind chargers, tubes, batteries, etc.

accurate estimates

Service Men informed us that the big advantage of modern instruments is their adaptability in making immediate estimates in the home or shop with absolute accuracy. This is a business-builder and eliminates a loss hazard. With obsolete or inadequate equipment, estimates are often too high or too low, bad for business either way. Estimates made outside of the shop give many headaches to Service Men using obsolete and inadequate equipment. Prospects want to know prices at once, will not wait until sets are brought to the shop for examination. Delays lose sales. Modern portable instruments make outside estimating safe, save time and enable Service Men to get in more productive time. Service Men also reported that pocket testers for the trou-

ble-shooter's kit or carried in the coat pocket were handy tools to have around.

Since 85 percent of the instruments purchased by the Service Men reviewed were bought on time, the initial outlay was low. One Service Man, when asked how much his modernization cost him, replied, "Nothing. I paid as I made," meaning that he purchased the

graphs and other sound apparatus will be covered.

While the 1923-1937 period shows tremendous gains in quantity of production, the 1940 Census will report developments in the products themselves during the last two years which seem destined to have even greater significance. This coming Census, for example, will ask for the first time statistics under number and value of television sets, facsimile transmitters and



The insert in the lower left corner shows how Louis K. Sandor's shop looked before modernization. Another view showing the workbench alone (before and after) is on the opposite page.

equipment on installments, which he paid out of the increased profits resulting from modernization.

CENSUS SEEKS FACTS

WHILE the radio industry is busy casting its lines into the future by pushing television, facsimile, frequency modulation and other new developments during 1940, its progress through 1939 will be recorded by the United States Bureau of the Census, which in January begins taking nation-wide Censuses of Business and Manufactures. All manufacturers, wholesalers and retailers of radios, phono-

receiving sets manufactured.

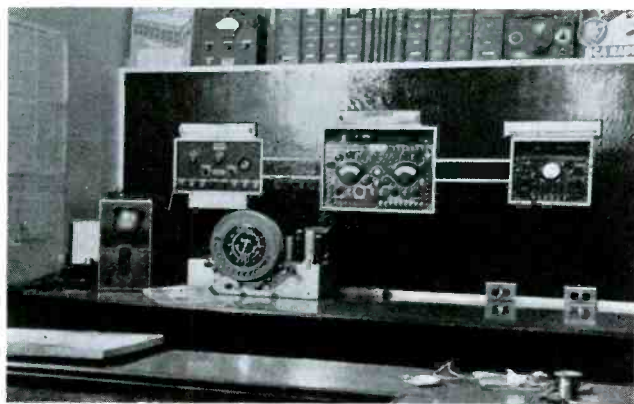
Among other new items included in the products schedule are central receivers, such as those used in hotels; battery portables, which have returned to popularity since the 1937 Census; automobile radios with range beyond the standard broadcast band; remote control units; automatic tuning devices; new transmitting tubes, and a breakdown of short-wave transmitters into relay, international and high frequency.

Data based on answers to a question on expenditures for plant and equipment will reveal factory expansion being undertaken in expectation of demand for production of these new lines.

Concurrently with the inquiry into radio manufacture will be taken the Census of Business, covering retail and wholesale distributors, and radio repair shops. Every establishment in the industry will receive from an enumerator a Census questionnaire, to which answers are required by law. The same statute provides that reports to the Census Bureau are confidential and cannot be used for taxation, investigation or regulation. Census material is made public only in the form of totals for states, counties, and cities, by each kind of business.

Valuable merchandising information will be made available to radio marketers through the Censuses of Business and Manufactures. Figures on production of sets by price range will reflect consumer demand, or at least manufacturers' anticipation of it. Size of inventories reports for the beginning and the end of the year will indicate how accurately the demand was gauged.

Data on value of other radio apparatus manufactured will show relative possibilities of sales revenue. How many dealers are aware, for example, that in 1937, according to figures reported to the Census



Modernization provided the X-Ray Service Laboratory with this simple but neat service bench. The various instruments can be removed from the panel for outside service work.

Bureau, value of public address systems produced was more than half the value of phonographs?

Directly bearing on radio retailers' problems will be figures gathered in the Census of Business. Comparative sales will be shown for independents, chains, utility-operated stores and department stores handling radios. Revenue from non-radio items often carried will be listed—household appliances, sporting goods, photographic equipment, etc. Receipts from repairs by radio stores and by service establishments will be reported.

Stability of radio retailing enterprises in various localities can be deduced from answers to questions on date of original establishment of business and date of acquisition or establishment under present ownership.

To what extent is credit given in the radio business? If installment plans are offered, what is the average down payment in cash and trade-in allowance? The Census of Business will reveal these significant facts.

Other important information to be gathered relates to stocks on hand at the year-end, employment by month and employment and pay roll by type of worker during a typical week.

The few minutes of effort by radio men in filling out Census questionnaires makes possible publication of these useful industry statistics, which will be compiled and released as soon as accurate returns are received from all firms. A free bonus, so to speak, will be the Census statistics on number of radio sets in each locality, and on number of employed persons, which measures the potential market for service work and set sales.

	12 MONTH PERIOD BEFORE MODERNIZATION		12 MONTH PERIOD AFTER MODERNIZATION	
Sales of service, tubes and parts.....	\$ 6,937.20	100.0%	8,940.13	100.0%
Cost of sales of service (including salaries), tubes and parts.....	3,392.29	48.9	3,504.53	39.2
*GROSS MARGIN ON SALES.....	\$ 3,544.91	51.1%	5,435.60	60.8%
Overhead expenses -- including rent, advertising, light, heat, power, depreciation, service car expense, office expense, social security tax, service manuals, magazines, bad accounts, idle time, miscellaneous:.....	3,066.24	44.2	3,674.39	41.1
*NET PROFIT.....	\$ 478.67	6.9%	1,761.21	19.7%

locations where the wiring may be open, and not in a steel conduit, a line antenna provides very good signal pickup. In a city home, where enclosed conduit wiring is employed, the line antenna is at a disadvantage. If there is some exposed wiring, such as extension cords, pickup with the line antenna may be quite good even if most of the house wiring is in conduit. On a dealer's floor where all the wiring is in conduit and there are a number of sets on the same line the line antenna will undoubtedly work very poorly.

A very important characteristic of the loop antenna is that it is directional and that either the set or aerial must be rotated so as to point to the station. This may prove an inconvenience, particularly in the case of non-portable sets, so that usually the listener won't do it, to the

In the upper right corner practically the same equipment can be seen crowded above the workbench before modernization. Mr. Sandor built the new bench himself from readily available materials.



LOOP AND LINE ANTENNAE

IN AN effort to simplify reception as much as possible by eliminating outside aerials, manufacturers have developed a number of special built-in antenna systems. The two most important of these are the built-in line antenna and the loop antenna.

A set with a built-in line antenna uses one side of the power line as the antenna and the other side as the ground. In rural

detriment of certain stations that are in the direction of minimum pickup. On the other hand, the directional feature may be of advantage in reducing interference in some cases.

Although the relative pick-up of the loop and line antennas will depend very considerably on such local conditions as described above, the situation is entirely different when an outside aerial is used.

Both loop and line antennas will usually provide excellent reception under average

Not only did actual service volume increase considerably after modernization, but the cost of this service decreased . . . adding more to profits.

conditions in the home. Unfortunately, conditions in a distributor's or dealer's demonstration room are far from average, and usually are such as to provide very poor reception. Thus, receivers with built-in antennas show up to decided disadvantage. To provide better set demonstrations in such locations, we suggest the following remedies.

On a dealer's floor or in a home where line antenna operation is poor, we suggest that you connect an outside antenna to the live side of the power line through a 0.01-mfd, 600-volt condenser. With an arrangement of this kind, the aerial picks up the radio signal and feeds it into the power line, where it is available for the line antenna set. This idea also works out very nicely in the home where a small line antenna set may be moved from room to room.

There is one other thing that will seriously reduce signal pick-up with a line antenna set. Practically all sets use a buffer by-pass condenser across the power line. This condenser will also by-pass any radio signal in the line, so that the line antenna of any set that may be plugged into the same line will get very little signal. In demonstrating line antenna sets it is therefore advisable to disconnect all other non-line antenna sets from the same power line.

If it is essential to demonstrate line antenna operation when other sets may be connected to the same power line, line antenna attachment units may be used as a line filter for the other sets. The filter built into this unit prevents the set from short-circuiting the radio signal in the power line. Since the line antenna unit is used as a line filter in this case, no connections need be made to its four terminals. It is simply plugged into the electric outlet and the radio set in turn plugged into the unit. If necessary, more than one set may be connected to the same attachment unit provided that their total power consumption is not over 300 watts.

Loop antenna sets operate under severe handicaps in buildings of steel construction, since the steel framework acts as a shield and permits very little signal to pass through. To demonstrate loop antenna sets under such conditions, an outside aerial may be connected to any large metallic object in the demonstration room near the loop sets. If a more finished installation is desired, the outside aerial may be connected to a large plate of metal or a copper screen fastened underneath the table on which the loop sets rest. The outside aerial serves to bring the signal into the building so that the loop antenna can pick it up.

M. J. Schinke,
STEWART-WARNER CORP.

PERMEABILITY TUNING

AIRLINE 93BR420A, -421A

(Figs. 1 and 3 on Cover)

By HENRY HOWARD

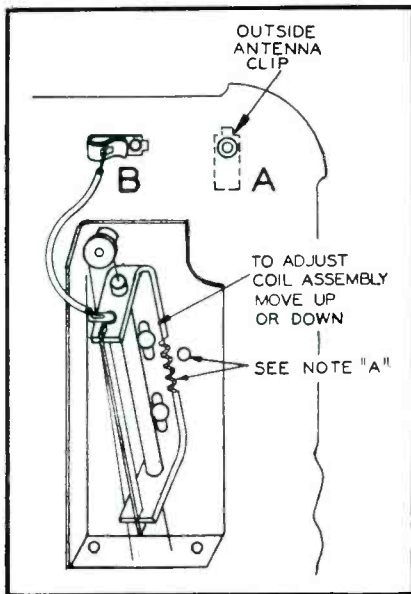


Fig. 4. The antenna coil assembly is made so that it is movable (up or down) for tracking with the oscillator.

HERE is a four-tube superheterodyne which makes use of the 70L7GT combination beam power output and rectifier tube and featuring permeability tuning, an antenna plate for antenna pick-up, a novel tracking scheme, provision for external antenna, resistance-capacity filter, p-m speaker, single-ended tubes and is approved by the Underwriters' Laboratories.

antenna plate

The antenna plate is interesting. It takes the place of a loop antenna which would not be feasible with movable iron core tuning. And, oddly enough, it seems to be almost as directional as most loops! The plate serves as the back of the set as well. It is insulated from the chassis and all other parts. Provision for an external antenna is made through the use of a small coupling

condenser formed by a Fahnestock clip insulated from the plate by a fibre washer. The clip, of course, is for the antenna.

tracking

Tracking has been a sort of bug-a-boo in permeability tuned sets. This model makes use of a clever job of coil design in which the tickler (cathode feedback coil) is wound over the grid coil for its full length. The coil is of much greater diameter than the grid coil and its positioning and pitch have been worked out to track with the antenna tuning at all points.

power consumption

This set is very economical in power consumption—only 30 watts for an undistorted output of 800 milliwatts. The features of a standard super are retained. There being no chokes, speaker field or others, in the B supply, it is necessary to use large capacity electrolytics. This leads to high charging currents and a surge when turning the set on and off would easily wreck the rectifier section of the 70L7GT were it not for the 30- and 50-ohm safety, or surge protecting resistors in the rectifier and filament circuits. The 50-ohm resistor

also serves as a buffer resistor for the heaters. The 0.05 condenser, connected after the 30-ohm resistor, is a line noise by-pass. It is assisted in this function by the resistor.

cathode grounding

The 150,000-ohm resistor connected to the chassis is a cathode grounding resistor which is made necessary by the design of the single-ended mixer-first detector/oscillator tube. This tube, a 12SA7 in this receiver, has its suppressor grid connected to the shield, which is connected to the receiver chassis. But the cathodes cannot be connected directly to the receiver chassis in a set that has Underwriters' Laboratories' approval since they must also be tied to one side of the power line. Underwriters' Laboratories do not permit connection of the chassis to the power line. Hence the high resistance (not at all critical) suppressor-cathode connection.

Specifications

- Cabinet: Plastic.
- Tuning: Manual.
- Range: 540 to 1720 kc.
- I-F peak: 465 kc.
- Sensitivity: 60 microvolts average for 0.05 watts output.
- Selectivity: 75 kc broad at 1000 times signal at 1000 kc.
- Power supply: 105 to 120 v, a-c or d-c.
- Power consumption: 30 watts.
- Power output: 800 milliwatts undistorted.
- Speaker: 4-in p-m.
- Pilot light: None.

Fig. 2. The output i-f transformer (to right of speaker looking into set from rear) should be aligned first. The trimmers can be reached through the tops of the shield cans.

ALIGNMENT PROCEDURE

The following equipment is required for aligning.

- Volume control—Maximum all adjustments.
- Connect -B of radio chassis to ground post of signal generator through .1 Mfd. condenser.
- Connect dummy antenna value in series with generator output lead.
- Connect output meter across primary of output transformer.
- Allow chassis and signal generator to "heat up" for several minutes.
- An all wave signal generator which will provide an accurately calibrated signal at the test frequencies as listed.
- Output indicating meter.
- Non-metallic screwdriver.
- Dummy antennas—1 Mfd., and 200 Mmf.

BAND	SIGNAL GENERATOR Frequency Setting	Dummy Antenna	Connection to Radio	Position of Iron Cores (Dial Setting)	Trimmers Adjusted (in Order Shown)	Trimmer Function	Adjustment
I. F.	465 Kc.	.1 MFD.	Terminal "B" (See Fig. 4)	Iron Cores All the way out	Two trimmers on top (See Fig. 1)	Output I. F.	Adjust to maximum output
	465 Kc.	.1 MFD.	Terminal "B" (See Fig. 4)	Iron Cores All the way out	Two trimmers on top (See Fig. 1)	Input I. F.	Adjust to maximum output
BROADCAST BAND	1720 Kc.	.1 MFD.	Terminal "B" (See Fig. 4)	Iron Cores All the way out	Trimmer (C6) (See bottom of Radio, Fig. 3)	Oscillator	Adjust to maximum output
	1720 Kc.	200 MMF.	Terminal "A" (See Fig. 4)	Iron Cores All the way out	Trimmer (C3) (See bottom of Radio, Fig. 3)	Antenna	Adjust to maximum output (See Note "A")
	1400 Kc.	200 MMF.	Terminal "A" (See Fig. 4)	Turn Dial to 1400 Kc.	Adjust position of antenna coil up or down (see Fig. 4)	Antenna Coil Adjustment	Adjust to maximum output
	1720 Kc.	200 MMF.	Terminal "A" (See Fig. 4)	Turn Dial to 1720 Kc.	Adjust trimmer (C3) (See Fig. 3)	Antenna	Check for tracking (See Note "B")

NOTE "A"—The antenna coil assembly is made so that it is movable up or down. When making the adjustment as given in the alignment procedure move the coil assembly very slowly. It can be moved by hand or by pivoting one edge of the blade of a screwdriver in the hole and engaging the blade in the gear teeth of the coil form.

NOTE "B"—After the antenna coil has been tracked at 1400 Kc. it is necessary to check the antenna trimmer (C3) adjustment again at 1720 Kc. If no appreciable change in trimmer adjustment is made the coil is in track, if the trimmer requires considerable change it will be necessary to again adjust the position of the antenna coil at 1400 Kc. These two adjustments should be tried several times until no change of trimmer adjustment is required at 1720 Kc.

Here's How!

- - A radio should
be tested - -
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One Probe
DOES IT ALL!



Instead of several cables to confuse the operator, the Audolyzer uses one cable with which over 75% of all work is performed. This probe is of such unique design that it can be used in making tests on any part of the receiver without affecting the receiver's operation. (Two other inputs are provided when the occasion demands two or more tests to be made simultaneously.) The one common probe is rapidly switched from circuit to circuit and has the following functions:

R. F. IN: The probe feeds a two stage amplifier tuned over the ranges of 95 K.C. to 14.5 M.C. in five bands. Its sensitivity is great enough to monitor signals in the first R.F. stage. With the aid of the Audolyzer's R.F. multiplier and attenuator its sensitivity can be reduced and used to monitor the strongest R.F. signal found on the second detector plate or the oscillator grid. The meter is used with the R.F. amplifier to compare signal strengths. For simple signal tracing through the R.F. stages, the speaker gives a quick audible check.

A. F. IN: When the signal has been traced to the second detector plate, simply set the "Probe Selector" to the "A.F. IN" position and finish the signal tracing job with the same probe. Starting at the

first audio grid, the signal is followed to the speaker's voice coil, the Audolyzer's speaker being used as a monitor.



A. F. OUT: When the "Probe Selector" is set in this position, the Audolyzer is set up as a receiver. When a station is tuned in, the audio signal is present at the tip of the probe for the quick checking of P.A. Amplifier and receiver audio systems.

V. M.: Should any signal tracing step indicate trouble, a quick D.C. voltage check can be made at any point by setting the "Probe Selector" to the V.M. Position. With this set-up, A.V.C., GRID BIAS, SCREEN, PLATE, and POWER SUPPLY voltages can be measured without affecting the operation of the receiver.

Why hasn't this been thought of and developed before? To test a radio, what is more simple or logical than to substitute a stage or part that is known to be good for the defective stage or part, while the receiver is in operation. Use only one probe—just listen for the trouble. . . . That's AUDOLYZING.

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SERVICING TELEVISION SETS

By EUGENE TRIMAN

BEFORE any service process is attempted on Andrea receivers, the physical wiring should be examined. If the unit is not a factory wired one, check the layout of the heater and i-f section leads against that prescribed in the wiring diagrams. The wiring instructions and charts supplied by the manufacturer are important service accessories. No adjustments should be attempted if the wiring is slipshod or different from that recommended in the charts. Troubles which are caused by bad wiring layout are: the presence of spurious hum voltages causing stationary interference patterns on the screen, and poorly received images as a result of incorrect band pass in the video i-f stages.

• • • alignment

Because of the engineered simplicity which has been built into the Andrea receivers, the unit can be aligned by a method which does not require the use of a frequency modulated oscillator and an oscilloscope. However, it is very difficult to determine the alignment condition without these instruments. The writer recommends that the technician be well able to judge the condition of the receiver by inspection of a received resolution chart before attempting an alignment. The Service Man can judge the true condition by a careful determination of whether or not the cause of a stationary zigzagging of the long vertical lines in the pattern can be directly traced to incorrect alignment of the r-f unit. A curve to the entire pattern can be generally traced to bad alignment. The video i-f portion of this receiver is fixed and therefore leads to the fact that the phase shift which is causing the displacement of the pattern lines can more easily be caused by the r-f unit rather than the remaining other possibility of the video amplifier itself offending. With this estab-

The detailed wiring instructions and charts supplied by the television set manufacturer are very important service accessories.

SOME of the notes compiled herewith are applicable in general to other manufacturers' models than those mentioned. In applying them, a strict coherence to the fundamentals involved, will simplify what is depicted by some as a complicated procedure. The notes which follow are submitted in the spirit of helpful cooperation which must exist between those Service Men who are actively engaged in making television service a down-to-earth, common-sense, profitable, business

lished, the method of aligning which of necessity requires a complete alignment of the entire receiver, follows:

(1) *Sound alignment:* Perform this step in the usual way, feeding the 8.25 megacycle signal to the grid of the 1852 modulator tube. The contrast control should be turned three-fourths of full on. The two sound trimmers shown in the trimmer location chart should be adjusted for maximum output on an indicator.

(2) *Interchannel trap adjustment:* To prevent interchannel interference there are two 14.25 megacycle traps in the video i-f section. If these are not adjusted with the greatest of accuracy, poor sharpness of detail will result due to the reduction in high frequency response of the video band pass. It will be impossible to focus to a sharp picture if this exists. To adjust these traps feed a 14.25 signal to the grid of the modulator tube and adjust the trimmers shown in the chart for minimum output of the 6V6G video output tube. The output indication can be observed by the degree of brightness of the pattern then seen on the screen or also by means of a vtvm connected from the picture tube grid (heavy light-colored rubber lead) to the grid return top connection of brightness control. In making any measurements from the grid of the picture tube, take precautions against the accidental application of positive potential to the grid. If the grid is

made positive at any time, the screen of the picture tube will be damaged.

(3) *Video i-f alignment:* The alignment of this portion of the receiver can be changed only by changing the position of the grid and plate leads of the video i-f amplifier stages. If these wires are located in position strictly in accord with the wiring instructions, practically optimum results will be obtained. A costly way of improving the wire positions can be done by using a wobulated oscillator with a frequency calibration that can be seen accurately on an oscilloscope, moving the wires until the proper band pass is obtained.

(4) *R-f alignment:* A reasonably excellent alignment of the r-f stages can be obtained with no more than an accurate high frequency oscillator and a good output indicator. The indicator is connected to the output of the second detector 6SQ7 in the sound portion of the receiver.

Feed a 49.75 mc, amplitude-modulated signal to the antenna input of the receiver. Turn channel selector to the lower channel position. Set contrast control at 3/4 of full on. Set sound sensitivity control at midway position, which is 1/2 of full trimmer capacity.

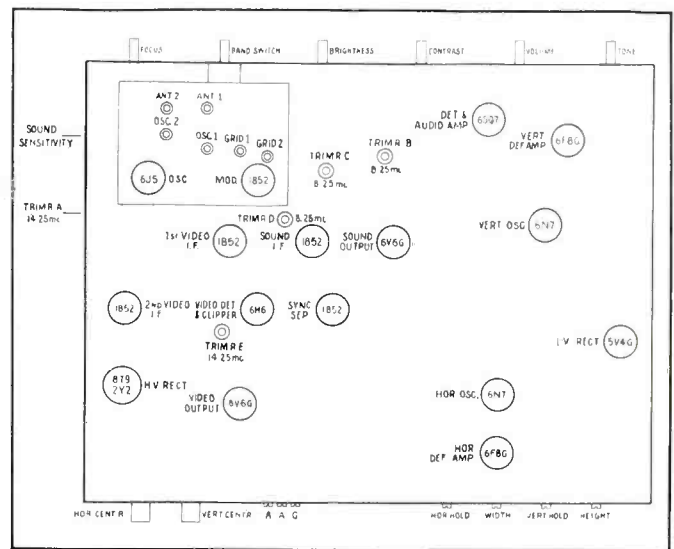
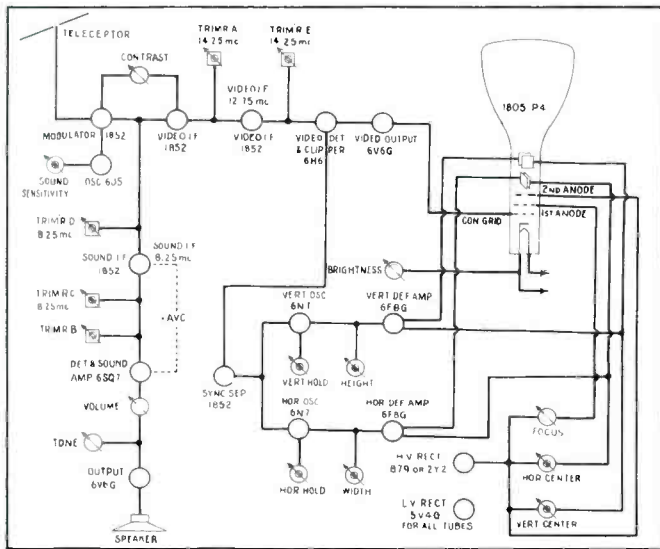
Adjust the 3 plunger-type trimmers for maximum sound output. These are shown in the trimmer chart and they should be adjusted, trimming first the oscillator, and then the detector, and then the r-f stage.

With the detector-modulator and r-f stage adjusted for maximum output, carefully pull the modulator stage trimmer out through resonance until the output starts to drop suddenly. Note the output meter reading. Push the plunger back through resonance until the output reading is the same as noted above. Then, once again pass through the maximum response section until the drop in output reaches the value noted above. Carefully mark the plunger shaft so that it may be reset to this value. (This position is the lowest capacity setting of the three positions discussed.) Adjust the marked plunger once again for center maximum response.

Repeat this entire procedure with the r-f stage plunger to the point where the upper side of the r-f channel response is found. When the lowest capacity setting is found, lock the trimmer in place. Reset

(Continued on page 572)

Because of the engineering simplicity built into the Andrea 1F5 receiver it can be aligned without the use of the oscilloscope.



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AUTOMATIC RECORD CHANGER

WEBSTER-CHICAGO 210

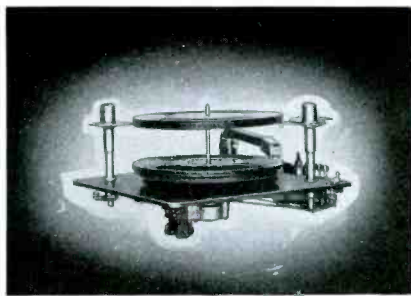


Fig. 4. The Webster - Chicago Model 210 automatic record changer plays 12 10-in. or 10 12-in. records.

THE changer plays twelve 10-in or ten 12-in records. To reload, revolve the two posts slightly, grasping them underneath the shelf plates. Turn them back after the played records are removed; they will fall and lock when they are in the proper position. Place the new records on the shelf plates and push button "R" to put changer in operation. To play the other size records, turn the knob at the top of each post until the proper figure is opposite the pointer. Press the "10" or "12" button, to agree with the pointer setting. To reject a record (or to start a change cycle as for testing purposes) simply press the "R" (release or reject) button, at any time while the needle is upon a record. To play manually, turn plates out of the way as for re-loading, and press button "M."

The photos illustrate all the vital parts of the changer. Letters are used alphabetically, to refer to points on the photos; thus, motor oiling holes AK are found by glancing down column A (left side of Fig. 1) to letters AK.

oiling

The changer should be lubricated once a year with about a dozen drops of good light machine oil at each of the following 6 points: (All points can be reached from above, through holes in the mounting plate.) Three oil holes on motor gear housing; reach all three through two holes AK; through hole marked AL, drop the oil upon the flat surface of the cam, it will distribute itself to the proper points; through the hole marked AM, see felt wick and drop the oil directly upon it; through the hole marked

AN, see felt wick and drop the oil directly upon it.

If squeaks are heard compare the squeak with and without a load of records; any stack of wax records in motion is likely to squeak a little against a pin through their center. See that all five wicks are in position, including three 1/4-in. round wicks in frame of motor, one washer-shaped wick on lift CV, and one on cam lever CS. See that each wick is thoroughly saturated (as it may not be if insufficient oil or too heavy oil has been used). Lift out all three motor wicks, with tweezers; see if old oil has become gummy (commonly due to use of low-grade oil or low-viscosity oil). If necessary, *clean gummed-up wicks with kerosene*. See that each is saturated with good oil; then, before replacing them, *drop* a little good oil into the holes. The gearbox of the motor is packed with a semi-fluid grease at the factory, and it should not be necessary to take it apart for lubrication purposes.

change cycle

An automatic record player for records of two sizes has three principal duties to perform. These duties are here performed by three mechanisms, interconnected and built together but largely separate in their operation.

(1) The record-changing mechanism—brought into operation originally by the contact of lifter cam DG with pawl DH—is the simplest of the three. It is driven by the cam groove (not visible) on *under* side (in Fig. 2) of cam gear DF. As cam lever CS is forced, by the pawl, out underneath lift CV (which is shown revolved to the right for visibility) the lift rises and forces roller DJ into the under groove in cam gear. The motion is transferred to rear

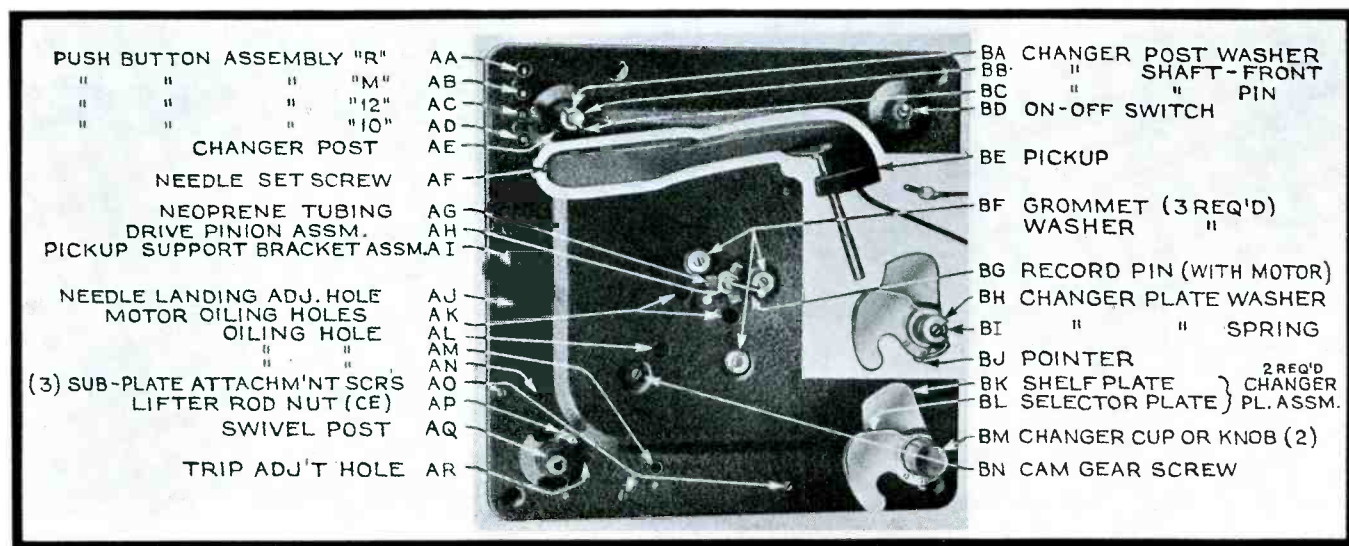
changer shaft (at ED) through cam connecting rod DE (EC), thence through changer connecting rod FD to front changer shaft BB.

(2) The pickup-operating mechanism—likewise brought into operation originally by the cam-and-pawl action upon cam lever CS is driven in part by the groove in *upper* (visible) side of cam gear DF. As cam lever is forced out, at the beginning of the change cycle, against link CG, it causes the link to push upward upon pickup plunger DA, thus lifting needle from record. The same pressure upon link CG works, through guide arm CD, to force stud DD down into the groove on the cam gear. This *rotates* the pickup arm, while pickup plunger DA *holds it up* off of record. It is rotated first out beyond the turntable until selector plates BL have dropped the next record, then rotated back to proper position to start playing.

(3) The mechanism for bringing needle into correct *starting* position must operate accurately for both 10-in and 12-in records. Partly due to this requirement, the starting position is *not determined by the cam action*. The upper groove on cam gear is designed so that it, acting alone, would carry the needle *farther* back toward record pin than would ever be desirable as a starting adjustment. Travel of pickup arm toward record pin is then stopped, at proper point for lowering onto the record, by action of lever hub CL. The stopping takes place as lug EW (upon the lever hub) strikes the shoulder on rod EX. This enables the entire mechanism rotated by cam action on guide arm CD to travel on *past* the proper point of rotation for record-starting, while the pickup arm itself, which is held rigid to lever hub CL, is accurately stopped at proper record-starting point.

Correct adjustment for starting position of needle requires therefore only correct adjustment of rods EX and FK; the radial difference of 1 inch between correct starting position for 10-in and 12-in records is

Fig. 1. The changer should be lubricated once a year through holes in the mounting plate.



FREQUENCY MODULATION

PART II

By CHARLES H. YOCUM

EARLY experimenters tried to produce f-m systems, but failed largely because they did not expand the frequency swing, but tried to compress it. However, they did prove that an f-m system could not make use of conventional a-m modulation methods.

It would be well to review the basic requirements of a successful f-m system before attempting to understand its operation. Major Armstrong lists these requirements as follows:

(1) The frequency transmitted by an f-m system shall vary alternately above and below a fixed frequency which is the assigned carrier. These variations should be symmetrical with respect to the mid-frequency, pass through it, and return exactly to this carrier when modulation stops.

(2) In the transmitter, the frequency deviation of the f-m wave at any instant must be directly proportional to the modulating current resulting from the program. This deviation in frequency, however, must be independent of the frequency of this modulating current.

(3) In the f-m receiver the detecting device, corresponding to the second detector in an a-m receiver, must respond to changes in frequency only. Changes in amplitude of the incoming signal must be prevented from affecting the detecting device.

(4) The transmitter carrier shall be considered 100% modulated when its output is such that a properly designed receiver is modulated 100%, or very

nearly so. A lower percentage modulation at the transmitter must produce a strictly proportionate and lesser modulation in the receiver.

(5) In the f-m receiver, the amplitude of the current produced by the de-

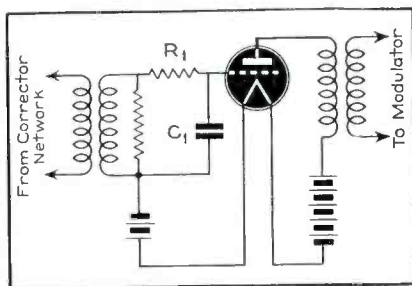


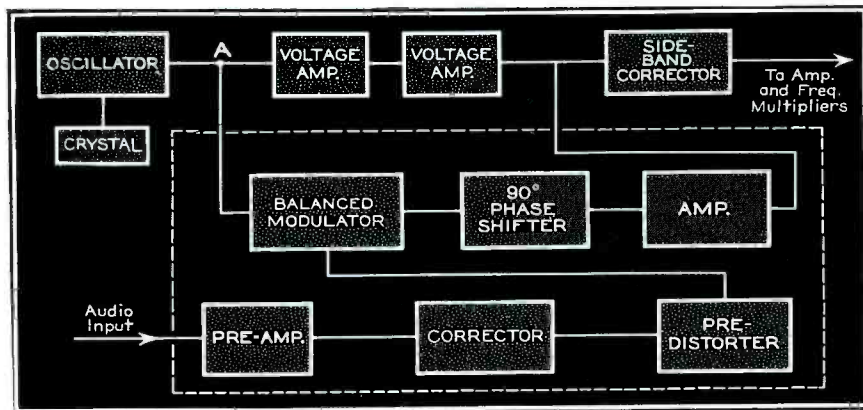
Fig. 6-b. The input from the microphone passes into a correcor network in which the higher audio frequencies are amplified more than the lower ones.

tecting device, as the result of the receipt of a signal, must be strictly proportionate to the change in frequency at the transmitter, but independent of the rate of change of this frequency.

Modulation means the continuous and reversible change of the r-f output of a transmitter from one set of conditions to another. In the earliest stations this change was accomplished by keying. If the operation of the key interrupts the signal, we have a crude form of amplitude modulation. If the key causes detuning, we have a crude equivalent to f-m transmission.

True frequency modulation is not developed in present day f-m transmitters.

Fig. 6-a. In the Armstrong system a conventional crystal-controlled oscillator produces a voltage, part of which passes through normal voltage amplifiers and the other part through the circuit enclosed in the dotted lines. This represents a practical f-m design.



Actually phase modulation is produced, then converted to frequency modulation.

Late in 1931, Hans Roder, of General Electric, published a paper in which he developed the theory of three possible types of modulation. It was shown that the amplitude, or the phase, or the frequency of the emitted signal may be varied to convey intelligence. The mathematical derivation of his results is too lengthy for this discussion. Nevertheless, Roder's conclusions are the basis for present f-m designs and can be briefly summed up in the following statements.

Normal a-m transmission may be represented by a carrier of fixed frequency plus two side bands symmetrically located above and below the carrier frequency, in phase with the carrier. These side bands are proportional in amount to the amplitude of the applied program material.

In both phase and frequency modulation, however, an unlimited number of upper and lower side frequencies may be produced. With phase modulation, as long as the phase shift is kept less than 30°, the carrier and the first side frequencies predominate, while all the others are present in negligible amounts. Also, if this shift is kept small, the amplitudes of the important side frequencies are very nearly proportional to the impressed audio signal, and the percentage of energy in the undesired side frequencies of third and higher order is but a per cent or two of the total. (See Table 2.) In both phase and frequency modulation the carrier is 90° (or 270°) out of phase with the side frequencies at peak modulation. At peak modulation the side frequencies are in phase with each other.

Frequency modulation is merely one type of phase modulation, in which the amount of phase shift is inversely pro-

Table II. Roder's calculations for frequency-modulated amplitude variations. Phase modulation (last column) should be restricted to less than 30° to avoid serious distortion. Note that in phase modulation the phase shift varies inversely as audio frequency; in true frequency modulation the frequency deviation varies directly as the audio frequency.

AUDIO SIGNAL FREQUENCY (Cycles per Sec)	CARRIER AMPLITUDE	SIDE FREQUENCY AMPLITUDES								CORRES- PONDING PHASE SHIFT.
		1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	
10,000	100	2.5	-	-	-	-	-	-	-	2.9°
5000	100	5.0	-	-	-	-	-	-	-	5.7°
2500	99	9.9	-	-	-	-	-	-	-	11.5°
1000	93.8	24.2	3.1	-	-	-	-	-	-	28.6°
500	76.5	44	11.5	1.9	-	-	-	-	-	57.3°
250	22.4	57.7	35.3	12.9	3.4	-	-	-	-	114.6°
100	17.7	32.7	4.6	36.5	39.1	26.1	13.1	5.3	1.8	286°

Amplitudes are expressed as percent of unmodulated carrier.

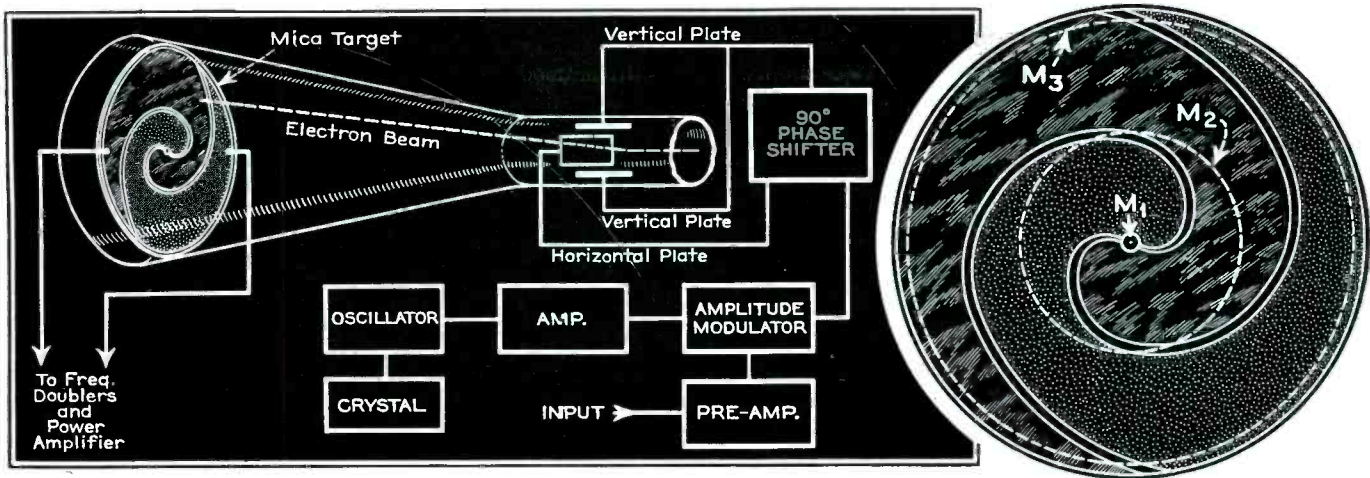


Fig. 8. In the system suggested by R. E. Shelby, a special cathode-ray tube is used to generate phase shifts in excess of 500°. A special target (shown at right) is used.

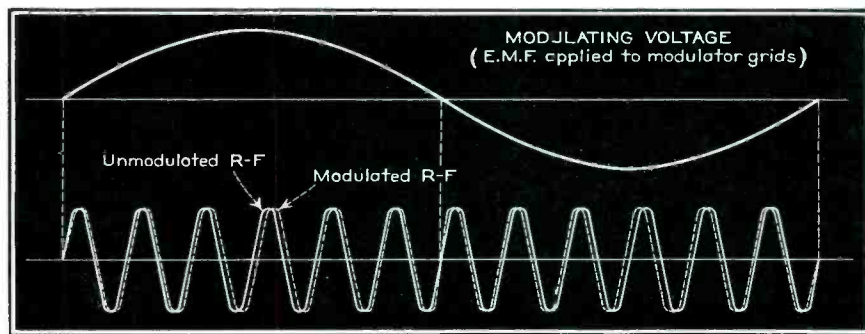
portional to the frequency of the audio signal presented to the modulating device.

It is well known that a phase shift of a wave may be developed if we beat or mix with this wave a second wave which is out of phase with it. The amount of phase shift resulting at any instant will be proportional to the phase difference between the two and their respective amplitudes. Therefore if we can set up a modulating device which will produce a carrier, then mix with it a second wave of like frequency (but whose phase relationship to the carrier depends on the amount of input energy and is inversely proportional to the audio frequency of that input) our problem will be solved.

Two modulators will be discussed. One is the Armstrong circuit used in most transmitters on the air today. The other has not been installed in any transmitter to date. It was described at the recent IRE convention in September by Mr. R. E. Shelby of the National Broadcasting Company, who developed it.

Let us consider the Armstrong system first. If we refer to Fig. 6-a, we note a conventional oscillator, crystal controlled, producing a voltage which is divided at point A, part passing through normal voltage amplifiers. This

Fig. 7-a. It can be noticed that when the modulating voltage reaches zero, there is no phase shift between the modulated and unmodulated r-f waves.



ultimately will be the carrier. The other branch of this circuit is enclosed in dotted lines and represents a practical f-m design.

The input from the microphone passes into a correction network in which the

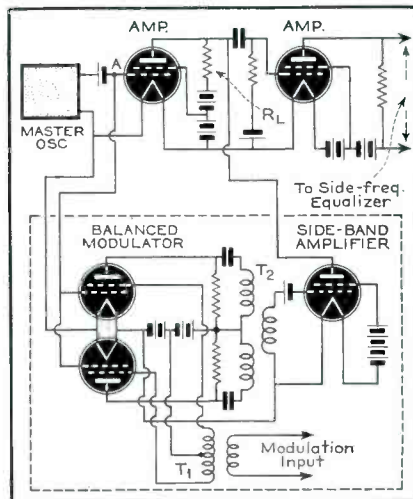


Fig. 7-b. The frequency-corrected microphone output is fed to a pair of balanced modulator tubes. The amplified output of these tubes as well as the amplified output of the oscillator appears across common load resistor R_L .

higher audio frequencies are amplified more than the lower frequencies. In any system the higher frequencies are at-

tenuated most in transmission. By use of the corrector we can overcome the attenuation and present a program to the listener in which both high and low notes are equally well reproduced. This is a common practice in a-m transmission as well as f-m. It is limited in a-m by the necessity of avoiding adjacent channel interference. There is no such danger in the f-m system.

The corrector network contains a resistor R_1 and a capacity C_1 . R_1 and C_1 are in series, and the voltage which drives the succeeding stage is that across C_1 . The impedance of C_1 even at low audio frequencies is negligible compared to R_1 . Consequently, the voltage presented to the succeeding stages is inversely proportionate to frequency. See Fig. 6-b.

This output is fed to a pair of balanced modulator tubes through a transformer T_1 . The plate circuits of these modulator tubes are nonreactive for the crystal frequency. Thus, their plate currents are in phase with the control grid voltages. When their screen grids are energized, by a voltage from the input transformer, T_1 , the output from the modulators is fed to the primary of T_2 , which has a natural frequency well above that of the master oscillator. The side frequencies generated by this network are shifted 90°, amplified, and fed into a resistive load R_L . The amplified output of the oscillator also appears across R_L . (See Fig. 7-b.)

At any particular frequency, the amount of phase shift in the resultant voltage appearing across R_L is proportional to the amplitude and inversely as that frequency. At any particular amplitude or per cent modulation, the time necessary to change from the normal phase arrangement to some new arrangement, and back to normal again, will be inversely proportional to the actual input frequency. The inverse of this time is called the *time rate of change*. The wave diagrams in Fig. 7-a

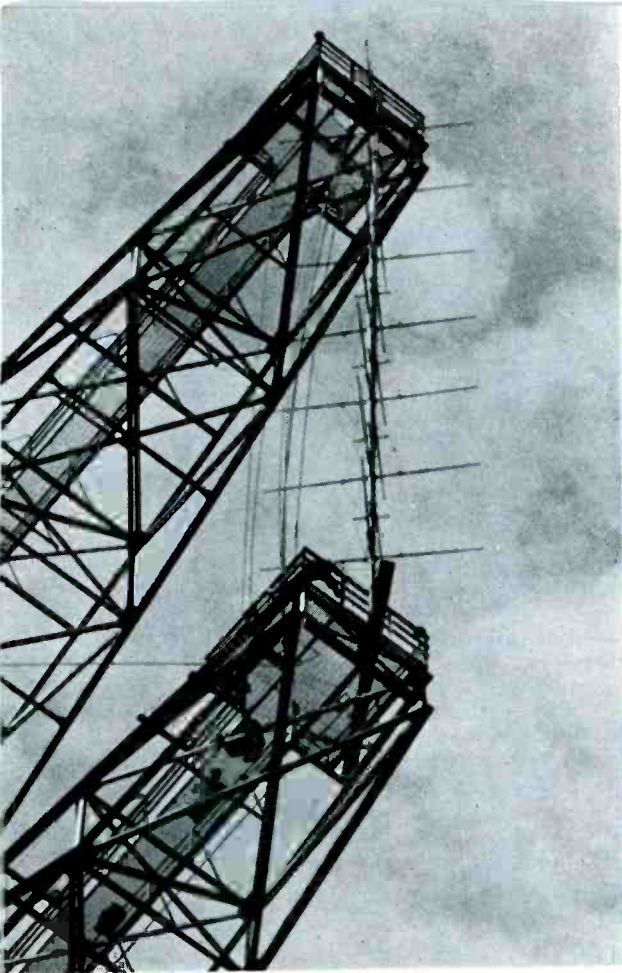


Fig. 9. Major Armstrong's Alpine, N. J., radiator is of special construction to transmit horizontally polarized energy.

will serve to make the progressive changes of the modulated energy more understandable.

In this method of modulation, if the maximum frequency swing of the modulator is large compared to the master oscillator frequency, the upper side frequency will be larger than the lower, due to the increased reactance of the primary of T_2 . If a 15,000 cycle band of frequencies is to be transmitted, and a master oscillator of 75 kc is used, the upper side frequency will be almost twice the lower one. This would produce serious distortion in the receiver. This is corrected by an R-C network which is the side frequency equalizer. This correction is accomplished after the side frequencies are combined with the oscillator output at R_L . The energy level is low, and little or no amplitude distortion has yet occurred. After equalization, amplitude linearity is of no importance. Conventional frequency doublers and triplers, modified sufficiently to pass the requisite band width may be used to convert the phase-shifted fundamental frequency of 100 or 200 kc to 14 or 15 megacycles. Here the output is heterodyned against a second crystal, bringing the fundamental frequency down to 1 or 2 megacycles, but leaving the phase shifts and side frequencies unchanged. This frequency is increased to 40 or 50 megacycles, which is the proper carrier. In this process

the original phase shift has been multiplied several thousand times, causing an apparent frequency shift or modulation of the carrier. The large number of frequency doublers is necessary to produce sufficient modulation in the receiver. Suppose a receiver were so built that it required 45° of phase shift to give 100% modulation, as a minimum. We are limited to a maximum phase shift of 30° in the transmitter. (See Table 2.) This phase shift will be inversely proportional to frequency. If we are to send an audio band of from 30 to 15,000 cycles per second, then 15,000 cycles would cause a shift of but $6/100$'s of one degree. Thus, in this assumed case, multiplication by about 1,000 would be required to correctly operate the receiver. Actually, to overcome losses with some safety margin, the original phase shift is increased about 3,000 times in commercial designs.

In the system suggested by R. E. Shelby regular amplitude modulation is produced, with or without high-frequency correction. This a-m energy is fed into a phase changing device, which divides the input into two equal parts, 90° out of phase with each other. These quadrature components are fed to a special cathode-ray tube which produces the necessary phase shift as follows: If two voltages, equal in amplitude, but 90° out of phase, are fed to the horizontal and vertical plates of a c-r tube the electron beam will scan a

circular path on the screen. The diameter of the circular path is proportional to the amplitude of the voltage. In place of the conventional c-r screen a mica target is used on which a spiral conducting ribbon is deposited. The spiral is of a particular type, known as the Archimedian spiral. In Fig. 8 it may be seen that as the input amplitude changes, the diameter of the beam path also changes. Zero modulation is represented by the spot M_1 , 50% by the circle M_2 and 100% by M_3 . If the metal ribbon on the screen were in a pattern of straight lines, no phase shift would occur in the output current. But a glance at the diagram will show that by virtue of the spiral form of the conductor, phase shift does occur, and it becomes greater as the modulating voltage increases.

Phase shifts of upwards of 500 degrees are claimed for this device. Thus a considerable saving may be effected in the modulator unit. Fewer frequency doublers and triplers are required to reach the transmitting frequency than in the Armstrong system. But the amount of signal that must be fed to a cathode-ray tube is large. The difficulty of balancing the voltages fed to the horizontal and vertical plates of the cathode-ray tube is somewhat greater than that of balancing the modulator tubes. The output from the cathode-ray tube is far less than that from the balanced modulators, requiring added power amplifiers,

(Continued on page 574)

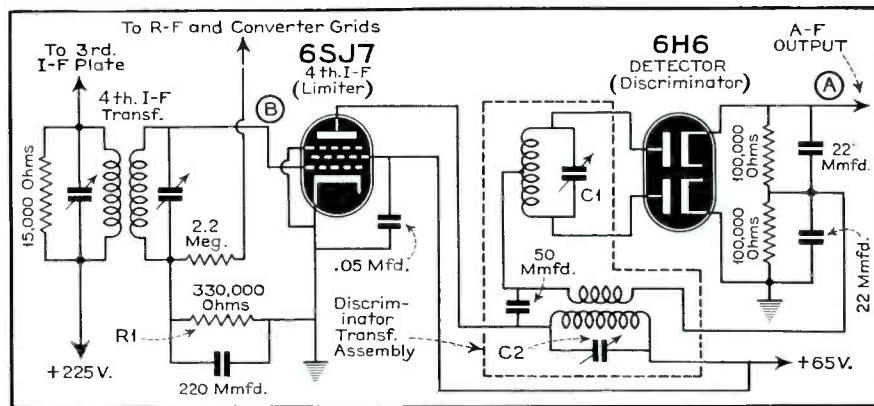
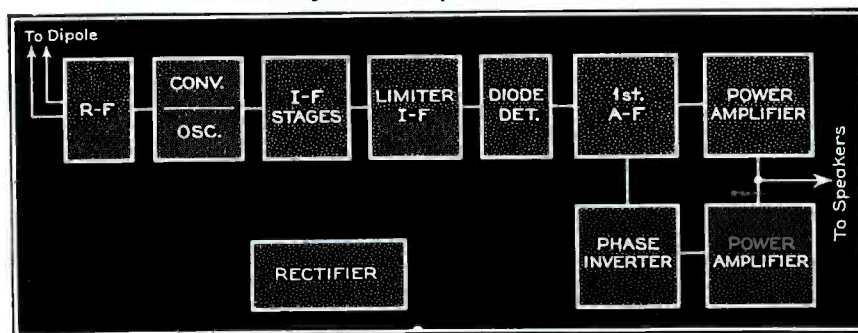


Fig. 11. The function of the limiter stage is to prevent changes in amplitude from reaching the discriminator.

Fig. 10. Two types of f-m receivers are already on the market. One is exclusively for f-m signals; the other is for both a-m and f-m. The diagram below pictures one for f-m only.



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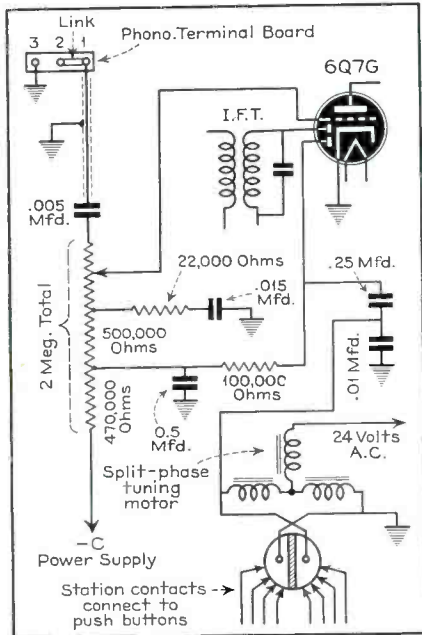
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Zenith 15S308, 15S346, 15S372, 15S373 (Chas.		

WESTINGHOUSE 366, 368

Noisy: These models are very similar to many of the RCA sets in their electrical and mechanical construction. It has been noted that the set will often become very noisy or that merely touching the push buttons will set up considerable racket. The fault lies in the 6Q7G muting circuit shown in the accompanying illustration. The remedy is to replace this tube when it is found



defective. This data also applies to RCA models which use the same muting circuit. Any other defect in the muting circuit will also have the same effect upon the performance of the receiver.

When the electric tuning mechanism is in operation the motor voltage (approximately 24 volts) is applied to the diode plate of the 6Q7G and the resultant rectified potential is utilized to bias the grid of the triode section of the tube to cut-off, thereby muting the set. The second diode plate functions as the second detector in the usual manner. If the circuit is operating properly its action is very smooth and quiet.

Williard Moody.

Book Review

PROCEDURES IN EXPERIMENTAL PHYSICS, by John Strong in collaboration with H. Victor Neher, Albert E. Whitford, C. Hawley Cartwright and Roger Hayward, published by Prentice-Hall, Inc., 70 Fifth Ave., New York City, 1939, 642 pages, price \$5.05.

Prof. Strong says in his preface: "The ideal way to learn the procedures of experimental physics is by direct contact with them in the laboratory. Realizing this, we have endeavored to bridge the gap between laboratory demonstrations and experience on the one hand, and exposition on the other, by the liberal use of figures."

In this avowed purpose the book has been highly successful. The expositions are written in clear, often non-technical style, yet with full mathematical formulae. The working directions and laboratory procedure are set forth in a simple unmistakable manner, aided by excellent illustrations. These illustrations are unique in that they label every part of the illustration with its full name, with arrows pointing to the part indicated; a great relief to the reader who is accustomed to wade through a labyrinth of legend.

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S-1239

While the book is written for the science student and engineer, the Service Man will find many chapters of especial interest. There is a valuable chapter on amplifier tubes with additional material on photocells. The latter is accompanied by a chart (on page 404) which lists various types of these devices and their characteristics.

In addition to the above there are chapters dealing with the operations of glass-blowing, optical work, gauges and pumps, coating of surfaces, counters, vacuum thermophiles, photography, optics, thermostats, and moulding and casting. There is also a concise description of the principal metals and elements, as well as alloys.

C-D HIGH CAPACITIES

There are numerous low-voltage radio and electrical applications, including A eliminators, rectifiers, and dynamic speakers which require extremely high capacity for maximum operating effectiveness. For such services Cornell-Dubilier offers the type FA capacitor in a variety of capacity values. These units are made up in cylindrical aluminum cans with bakelite terminal caps into which screw terminals are molded. FA units are available with working voltages of 12, 15, 18, 25, and 35 volts and in capacities of 500, 1,000 and 2,000 mfd. Additional information may be obtained directly from Cornell-Dubilier Corp., S. Plainfield, N. J.

When you see the "Magic Ring" you'll know it's a RADIART AERIAL



*** CORONA DISCHARGE EQUALIZER**
(Patent Pending)

SERVICING TELEVISION SETS

(Continued from page 560)

the modulator trimmer to the mark made for the lowest capacity setting and lock it in place.

Turn the channel selector to the higher channel position and repeat operation on the other three trimmers in the same order, using a 55.75 megacycle signal on the input.

• • • **picture size**

The voltage swing of the deflection generators govern the size of the picture, and also, to a slight degree does the strength of the signal received. The deflection tubes in these receivers were found to be operating at maximum efficiency and the only possible way of getting more deflection was to hunt for a hot tube for the generator circuit. The problem was solved by increasing the deflection sensitivity of the picture tube rather than by increasing the deflection amplitude. Recalling the simpler theory of the ordinary cathode-ray tube used in oscilloscopes we find in review that the deflection sensitivity of the tube is affected by the level of second anode voltage. This voltage governs the velocity of the electron beam and thereby determines the degree of inertia of the beam. By lowering the voltage on the second anode, the inertia is reduced together with the velocity, and the deflection sensitivity is increased. Of course if this is done to a sufficient degree the beam will become harder to focus and the fine spot of the beam will be lost. Therefore, limitations are in order.

The principle of reducing the second anode voltage can be applied to the Andrea receiver with success. In the high-voltage power supply, there should be found in

series with the plate of the 879 rectifier tube, a resistor whose value is 100,000 ohms. If the measured value is found to be less than 100,000 ohms the resistor should be discarded for one whose value is at least that. The size of the resistor can be increased to 150,000 and if necessary, up to 200,000 ohms in order to get satisfactory picture size.

We mentioned that the signal strength had an effect on picture size. This is true where the receiver is operated on the limit of its sensitivity. An accompanying effect of low signal strength is the lateral shifting of the picture across the screen. This is caused by sixty cycle hum in the deflection circuits. The curve to the picture can be eliminated by increasing the signal strength.

Demonstration will show the folly of using steel or iron dipoles and twisted No. 12 110-volt house wire in the television antenna. The criterion for judging good high-frequency transmission line has come to be the large size of the conductor and the heavy waterproof covering, *but the quality of the insulating material on the conductors should also be considered.* This eliminates the false merits of appearance. The use of copper tubing of large diameter will increase the signal strength available from a dipole. The increase will be definitely noticeable. Inspect so-called high-frequency transmission line for good live rubber insulation and other real qualifications such as additional insulating materials around the conductors. Servicing the set should include a close inspection of the television antenna.

• • • **audible hum**

The presence of disturbing hum was encountered in some of these receivers. This

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was traced to defective tubes in practically all cases. These were characterized by the raw hum which increased as the volume control of the receiver was turned to *minimum* volume position. Inter-element leakage in the 1852 tubes in the modulator stage and the first sound i-f stage will cause this condition. These tubes will not be troublesome if used in other positions but it is recommended that they be replaced.

• • • **regeneration and microphonics**

Microphonic tubes in these receivers will be especially noticeable by the presence of audio bands appearing on the picture pattern. These tubes are agitated by playing the set with a high volume level and it is necessary to remove them from all video circuits.

Regeneration in the sound portion of the receiver leads to an extreme sensitivity to microphonic action. It can be eliminated by grounding the lugs which are fastened to the chassis for that purpose. It is necessary to solder these lugs to the chassis. Where ground leads running from metal tube shells are used, it is necessary to shorten these as much as physically possible. Leads an inch in length will be just as troublesome as the longer ones. It is, therefore, absolutely necessary to shorten all of these. The socket prongs of the shell terminals should be cleaned as a final precaution against regeneration.

• • • **focus control**

In cases where the size of the picture has been increased to where the focus control does not turn up enough, or where a very strong signal is received to render the control too little to cover the necessary

range, the action of the control can be extended. The change in circuit necessary for this is not recommended unless the action of the control is entirely insufficient. Rather than an improvement in design, this change is bluntly a doctoring of the set to meet the condition, which will have to be changed again if the forementioned conditions change. To extend the range of the control to a higher level, it is merely inserted in the high-voltage divider system one section closer to the high end of the divider. This places it 3-meg above ground. It originally was between the second and third 1-meg section above ground.

AIRLINE 62-308

(Also Models 62-226; 62-228; 62-259; 62-318; 62-408 and 62-418)

Very weak or no reception: Cause usually shorted or very leaky screen by-pass condensers (C7, 0.05-mfd and C14, 0.1-mfd). Replace with 600-volt units.

Insufficient deflection on Magic Eye: Remove resistor R22 (grid of 6G5 tube to ground) and replace with 0.05-mfd, 600-volt condenser.

D. C. Sprong

PHILCO P1617, P1630, P1635, L1660

Automatic tuning cannot be adjusted to low frequency (about 550 kc) stations: Occasionally, shorted turns on the coil will decrease the inductance so as to prevent tuning to the lowest frequency stations. If all other parts seem in perfect order try replacing the coil. A close inspection will often reveal the fault and repairs can be made with suitable coil dope.

Allan Siepman

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● Yes, by all means let's have a look at both these 1940 servicing instruments. The local Jobber will gladly show them. Ask for descriptive literature—or write direct.



FREQUENCY MODULATION

(Continued from page 566)

Each circuit has disadvantages but certainly each is extremely ingenious. Hence, further simplification would seem to be inevitable.

The balance of the transmitter is of conventional design, except that in the 50 kw types certain problems had to be solved which were peculiar to the production of such power at 40 megacycles. These were not due to f-m, but were simply u-h-f considerations. The radiator is of special construction, built to transmit horizontally polarized energy. See Fig. 9.

An f-m transmitter has a wide frequency range. Reasonable care in design and construction results in a system capable of handling frequencies from 30 to 15,000 cycles with ease. Consequently, program material must be carefully presented to the f-m transmitter since distortion which would be of little importance in other transmitters might be quite objectionable with an f-m system.

Present recordings and wire services are flat to about half the above audio range. This is not objectionable if the transmitter likewise cuts off at about 7 or 8 kc. In f-m stations, however, only the best recordings may be used and many wire services are unsatisfactory because the higher audio frequencies are lost. Wire lines flat to 15 kc can be built, but are very costly. It again becomes apparent that the change from a-m to f-m cannot come overnight. Not only must we change the transmitter, but the microphones, pre-amplifiers, disc recordings and pickups must also be of the finest type if full benefit is to be desired from f-m.

In this connection credit should be given to the Yankee Network. At their Boston studios they are operating a 250-watt, 136-mc transmitter. This is the first such relay to be used for fixed service. This u-h-f transmitter covers an airline distance of 41 miles to the main transmitter at Paxton, Mass., where the program is rebroadcast from a 2-kw transmitter. Soon, however, it will be rebroadcast by a 50-kw transmitter now under construction.

Two types of f-m receivers are on the market. One is for f-m only, one is for both f-m and a-m.* Fig. 10 shows the block diagram of a typical f-m receiver. One or more stages of r-f of conventional design are generally used. The oscillator and mixer circuits are not at all different from those used in a-m

receivers. However, the i-f transformers are similar to television types. They are really band-pass filters capable of passing a band width of 200 or even 300 kc. One mark of an f-m receiver is the resistance loading always present in these inter-stage transformers. Several problems are solved by this arrangement. These resistors broaden the pass width of the coupling. Also in these circuits, composed of L, C, and R, the rapidly changing frequencies passing through the network may cause the generation of a number of harmonics. These must be dissipated lest they cause frequency or amplitude distortion. Loading resistors, of proper value, serve to absorb and dissipate these unwanted effects.

A radical departure in the f-m receiver is the use of a current limiter stage. This limiter follows the i-f amplifiers and is extremely important to the correct operation of the f-m receiver. The function of the limiter is to prevent changes in amplitude from reaching the discriminator. Such changes would appear in the speaker as noticeable distortion. A typical limiter starts to limit with an r-f input of about 3 volts peak, levels off at 5 volts and is reasonably flat to 100 volts or more. This tube is operated as a grid cathode rectifier, and the negative voltage developed across the resistor in the grid circuit from coil to ground may be used for a-v-c. This voltage may likewise be used for manual gain control by applying part of it to the r-f amplifier grids. If a magic eye is to be used as a tuning indicator, it may be located at this point. Note that both the screen and plate voltages of a limiter tube are equal and less than normal to secure sharp cut-off with zero bias.

The device corresponding to the second detector in an a-m receiver is known as the frequency discriminator. This circuit must be so designed that it transforms the frequency swing of the transmitted wave into variations in amplitude in the audio system of the receiver. Depending upon the set, between 20 and 80 volts will be developed when the transmitter frequency swings 75 kc above or below the carrier. From this point to the loudspeaker the audio system may have any or all of the features associated with present models.

The most sensitive adjustment required in the servicing of the f-m re-

*Circuit diagrams of commercial frequency-modulation receivers will be found in the following articles: "F-M Receivers", p. 518, Nov., 1939, *Service*; "Receiver Trends for 1940", by Henry Howard, p. 476, Oct., 1939, *Service*; "Frequency Modulation Receiver", p. 388, Aug., 1939, *Service*; "Frequency Modulation", by J. Snivas, p. 340 (circuit on front cover), July, 1939, *Service*. Also of interest is "A Receiver for Frequency Modulation", by J. R. Day, p. 32, June, 1939, *Electronics*.—Editor.

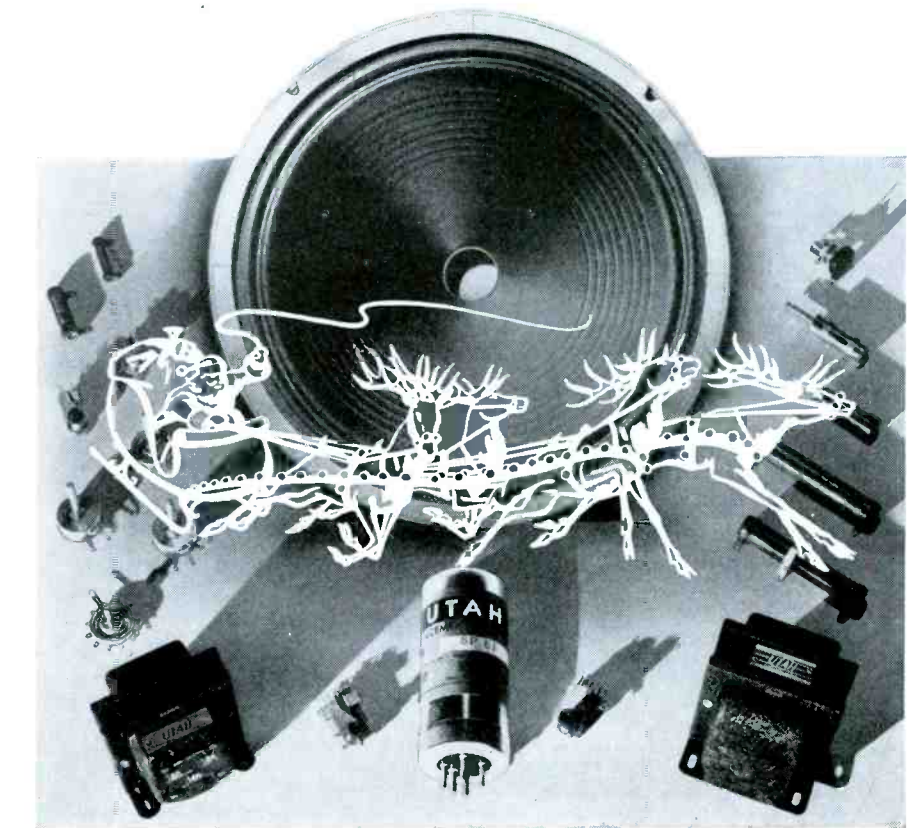
ceiver is that of the discriminator network. Condenser C_1 in the primary of the transformer linking the limiter to the discriminator, insures that the receiver is correctly tuned to the exact carrier. If this adjustment is poorly made, the output will be distorted because the wave form fed to the audio system will accentuate the plus frequency changes, limiting the others, or vice versa. Condenser C_2 in the secondary of the same transformer insures proportional voltage output for various amounts of frequency swing.

These two condensers should be adjusted by feeding into the first i-f stage a signal from a service oscillator of the exact i-f of the set. The oscillator should produce as flat an output as possible, over the working range. Connect a v-t voltmeter between Point A and ground (Fig. 11). Now vary the frequency fed to the i-f by swinging the oscillator over a band at least 200 kc wide, 100 kc each side of the i-f. The voltage between Point A and ground should be zero at the exact carrier frequency and should be equal in amount, although of opposite electrical sign when the frequency is set equal amounts above or below the i-f. Not more than 3 db variation should occur, over the range +100 kc to -100 kc.

The limiter may be checked by connecting a milliammeter in the limiter plate circuit, meanwhile varying the input voltage supplied by the signal generator. A v-t voltmeter between Point B and ground should indicate an input voltage from 1 or 2 volts to about 100. The limiting action should correspond to that described above.

Observe caution in aligning the i-f transformers. It is theoretically possible to widen the pass band of the i-f's by double peaking them. Nevertheless, the need for absolute linearity of phase shift throughout a band 100 or 200 kc in width suggests that a single peak will introduce less possibility of distortion. This may best be checked by putting a milliammeter in the limiter grid circuit in series with the grid resistor. An oscillator should be connected to the last i-f stage. This stage should be so adjusted that it passes the entire band width with a change in reading of the milliammeter of not more than 1 ma. The same adjustment should then be made for the next i-f and so on, until the mixer tube is reached.

Faults, normally not objectionable will frequently appear in an f-m receiver. Ripple in the power supply, particularly to the plates of the tubes, must be avoided. Microphonics, due to insufficiently rigid mechanical support of coils and condensers, may cause frequency modulation in the receiver itself. Distortion at times may be due



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to insufficient d-c bias between heater and cathode in the r-f stages. In some cases, it may be necessary to filter the r-f heater leads at the sockets to remove r-f.

In those sets which are adapted to both f-m and a-m reception, it will be found that two general designs are available. In each case a conventional second detector is used for the a-m programs and a limiter-discriminator for the f-m. Either one of these is chosen by means of a switch. In order to prevent broad tuning on the a-m position, some designers use two sets of i-f trans-

formers with their outputs ganged with the above switch. An alternate method involves the use of but one set of i-f transformers with a 10 or 20-kc filter connected in series with the No. 1 grid of the second detector. If this filter is efficient, good results may be obtained on both types of programs.

Bibliography

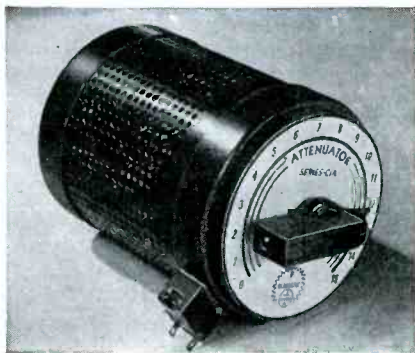
Proc. IRE., Dec., 1931, Roder, Ampl., Phase, Freq. Mod.; Proc. IRE., May, 1936, Armstrong, FM.; G. E. Review, May, June, July, 1939; Electronics, June, 1939; Service, July, 1939; Service, Aug., 1939; Service, Oct., 1939; Q. S. T., Aug., 1939; Fortune, Oct., 1939.

P-A

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576 • SERVICE, DECEMBER, 1939

THREE NEW TUBE TYPES

Arcturus Radio Tube Co., Newark, N. J., have announced the addition of three new tube types to their production. The type 3A8GT diode-triode-pentode, for use in receivers operating from a low-voltage bat-



tery filament supply; the type 117Z6GT, a midget high-vacuum full-wave rectifier with heater designed for operation directly across the power line; and the type 117L7GT midget rectifier-beam power amplifier for service in the output stage of portable battery-line powered receivers. Complete engineering data on all three types is available directly from Arcturus.

RADIO CITY MULTITESTER

The 25-ounce Model 413 a-c and d-c Radio City multitester provides 23 ranges for 6 functions. The unit uses a D'Arsonval meter which allows a sensitivity of 2,500-ohms per volt on d-c and provides current ranges as low as 400 microamperes



full scale. Range selection is by means of a rotary switch. Additional information may be obtained directly from Radio City Products Co., 88 Park Place, New York City.

MOLDED SOCKET

Designed to fit the new all-glass tubes announced by RCA at the Rochester IRE meeting. Socket is of molded high-dielectric black bakelite with seven contacts arranged in a 3/8" diameter circle, mounts in a plain 5/8" diameter clearance hole, and is held in place with a spring steel retainer ring. Floating contacts won't break seal between glass and .040" tube prongs. Center sleeve shields contacts from each other, and has a hole in lower end for grounding. Overall diameter of socket is no greater than that of the tube. Adapters for these tubes for use with tube testers and analyzers are also available. American Phenolic Corp., 1250 W. Van Buren St., Chicago.

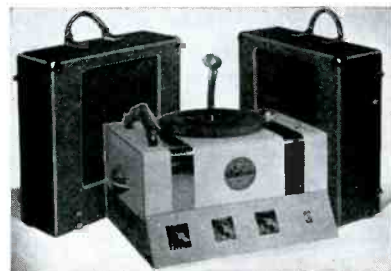
SPRAGUE HIGH VOLTAGE CONDENSERS

New high capacity, high voltage condensers in working voltages of 600 volts and 800 volts and in both round and square can and square cardboard types have been introduced by the Sprague Products Co., North Adams, Mass. They are specifically designed for public address and theatre applications where working voltages are high and where surges run over 600 volts. The high capacities and high voltages are obtained by the use of dry electrolytics connected in series.

Known as Sprague Types AP, AD and RC, these new units are described and illustrated in the new Sprague catalog. A copy will gladly be supplied by the manufacturer upon request.

MECK AMPLIFIER

The John Meck Audiograph Model AMR25C amplifier provides 25 watts from either 6-volt storage battery or from the 110-volt a-c power lines. Phono player top with crystal pickup is optional. An economy switch is provided for 6-volt operation which saves half the battery cur-



rent during announcements, it is said. Additional information may be obtained directly from John Meck Industries, Randolph & Elizabeth Sts., Chicago.

WARD AUTO AERIALS

Ward Products Corp., Ward Bldg., Cleveland, Ohio, have developed their 1940 line of auto aerials which are said to conform with the streamlined design of the newer model automobiles. The new aerials can be mounted either vertically or streamlined to the wind shield of these cars. A counter display to hold 3 different models has also been announced coincidentally with the new aerial line. Additional information on these and other Ward products may be obtained directly from the manufacturer.

TACO POWER ANTENNA

The Taco Power antenna utilizes the electric wiring of the building for an an-



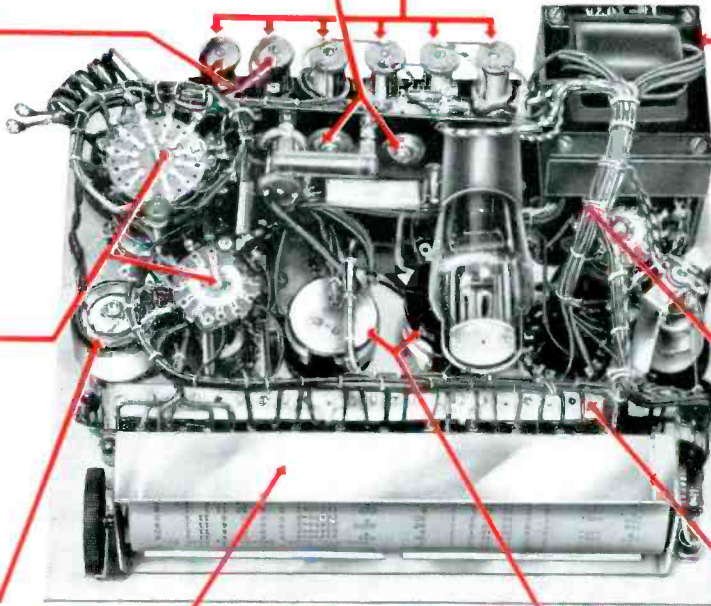
tenna. The power antenna is small enough to mount inside the average receiver cabinet and thereby permits the set to become independent of its antenna and ground connections, it is said. Additional information may be obtained directly from Technical Appliance Corp., 17 E. 16th St., New York City.

The "INSIDE" Story

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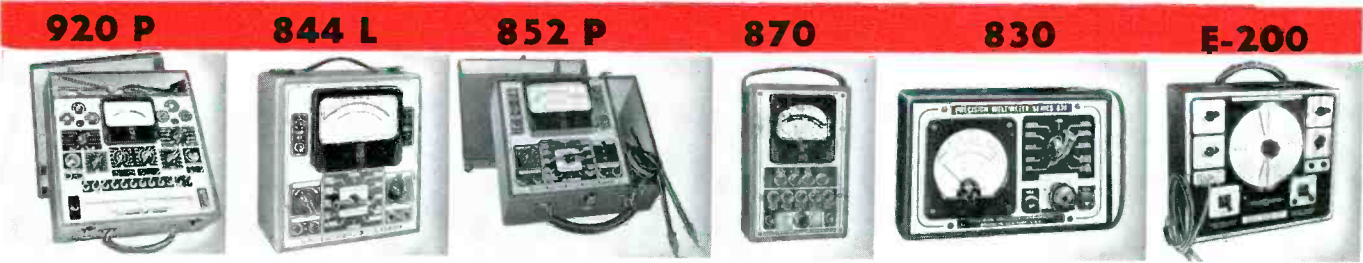
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AUTO-RADIO DATA

(Concluded from November)

Stewart Warner Stewart Warner Corporation

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
1121, -22	5	1934	6/1	CCW	456
1171, -72	6	1934	8/1	CCW	177.5
1181, -82	6	1934	8/1	CCW	177.5
1311, -14	6	1935	8/1	CCW	177.5
1322	7	1935	8/1	CCW	177.5
1332	5	1935	8/1	CCW	456
1431	6	1936	8/1	CW	177.5
1601	6	1936	8/1	CW	177.5
1781	6	1937	16/1	CW	262

Stromberg Carlson Stromberg Carlson Telephone Mfg. Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
33	6	*	3/1	CW	260
33A	6	*	3/1	CW	260

Tiffany-Tone Herbert H. Horn

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
535	5	1935	6/1	CCW	465
536	5	1935	6/1	CCW	465
537	5	1936	6/1	CW	465
538	5	1936	6/1	CW	465
557	5	1937	12/1	CCW	465
1934	5	1934	*	*	172

Trav-ler Trav-ler Radio & Television

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
54, 54A	5	1934	6/1	CW	456
64	6	1934	6/1	CW	456
542	5	1936	12/1	CCW	456
601	*	1937	12/1	CW	262.5
642	6	1936	12/1	CCW	456
660, 670	*	1937	12/1	CW	262.5
710	7	1938	16/1	CCW	456.5
711	7	1938	16/1	CCW	456.5
770	*	1937	12/1	CW	262.5

Truetone Western Auto Supply

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
670	6	*	*	*	175
1312	6	*	*	*	177.5
D734	5	1936	12/1	CW	465
D743	6	1936	12/1	CW	465
D744	6	1936	12/1	CW	262.5
D745	*	1936	12/1	CW	175
D746	5	1938	²	-	465
D747	6	1938	²	-	465
S740	6	*	*	*	262
S743	6	*	*	*	177.5

Truman Truman Radio Shop

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
E6	6	*	*	*	175
E6RC	6	*	*	*	175
E7RC	7	*	*	*	175
TE7	7	*	*	*	175

United Motors United Motors Service, Inc.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
2035	5	*	*	*	262
4037	5	*	*	*	262
4036, 4038	5	*	8/1	CW	262

Warwick Warwick Mfg. Company

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
511	5	1935	6/1	CCW	456
559	*	1938	²	-	*
560	5	1936	8/1	CCW	456
592	*	1936	8/1	CCW	456
611	*	1935	6/1	CCW	175
646	6	1937	12/1	CW	262
659	*	1938	²	-	*
660	6	1936	8/1	CCW	262.5
746	7	1937	16/1	CW	262
747	8	1938	16/1	CW	262
846	*	1937	16/1	*	*

Westinghouse Westinghouse Electric Supply Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
WR25	6	*	6/1	CCW	172.5
WR26	6	*	*	*	175
WR500	6	*	6/1	CCW	175
WR501	5	*	*	*	172.5
WR502	6	*	16/1	*	175
WR503	7	*	16/1	*	175

Wings, Goodyear Goodyear Tire and Rubber Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
580	5	*	*	*	175
661	6	*	*	*	465
667	6	*	*	*	262.5
670	6	*	*	*	175
O1500	5	1938	²	-	456
O1501	6	1938	²	-	262
O1502	6	1938	²	-	465

Zenith Zenith Radio Corporation

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
5M90	5	1936	8/1	CW	456
5M191	5	1937	12/1	CW	252.5
5M291	5	1938	3.66/1	CCW	455
5M294	5	1938	3.66/1	CCW	455
6M90	6	1936	12/1	CW	252.5
6M91	6	1936	12/1	CW	252.5
6M92	6	1936	12/1	CW	252.5
6M192	6	1937	16/1	CW	252.5
6M193	6	1937	16/1	CW	252.5
6M194	6	1937	16/1	CW	252.5
6M292	6	1938	16/1	CW	252.5
6M293	6	1938	16/1	CW	252.5
6M295	6	1938	16/1	CW	252.5
6M390	6	1939	*	*	455
7M91	7	1936	12/1	CW	252.5
8M195	8	1937	16/1	CW	252.5
460	7	1934	6/1	CCW	485
462	6	1934	6/1	CW	252.5
664	5	1935	8/1	CW	456
666	6	1935	8/1	CCW	252.5
668	6	1935	8/1	CCW	252.5

Zephyr Radio Zephyr Radio Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
A5	5	*	*	*	456
B102	6	*	*	*	456
J80	8	*	*	*	252.5
2577	*	1938	²	-	456
2677	*	1938	²	-	456
3M5	*	*	*	*	456
3M7	6	1937	16/1	CW	262.5
3M8	7	1937	16/1	CW	262

¹CW denotes clockwise rotation. CCW, counterclockwise. By clockwise rotation is meant that receiver is being tuned to a higher frequency when the dial scale or pointer rotates in a clockwise direction when viewed from the front of the control head.

²No remote control is used.

*Information not readily available.

CHARLES E. SEMPLE, JR., DIES

Mr. Charles E. Semple, Jr., died suddenly on Nov. 27. The loss of Mr. Semple, who was vice-president and general manager of the Astatic Microphone Laboratory, Inc., of Youngstown, Ohio, is deeply regretted.

SOUND AIDS ROAD SAFETY

An interesting application of sound is introduced by the Shell Oil Co. in its present national war on unsafe drivers. In addition to its national and local advertising campaigns in newspapers and magazines,



the Shell Co. has equipped a truck chassis with a complete marionette theatre in which adventures of a puppet motorist of the screwdriver variety are shown. Sound for the theatre is supplied by a Lafayette Model 269T mobile amplifier, a product of Radio Wire Television, Inc., 100 Sixth Ave., New York City.

TEST REPORT FORM

National Union Radio Corp., 57 State St., Newark, N. J., is providing N. U. Service dealers a new form known as "Official Radio Service Analysis and Test Report." The form is patterned after shop check-up and service report sheets used successfully in the automotive industry. It provides for complete analysis and testing under 13 separate headings and more than 40 subheads. These forms may be obtained directly from National Union.

BURSTEIN-APPLEBEE CATALOG

The 1940 catalog of the Burstein-Applebee Co., 1014 McGee St., Kansas City, Mo., includes pages on home, auto and communications receivers; p-a systems and accessories; wire, cables, resistors; condensers; volume controls; transformers, test equipment; batteries; chargers; tubes; electrical goods; tools and service aids. The book is thoroughly illustrated and contains a total of 160 pages of items exclusively for the Service Man. Copies may be obtained directly from Burstein-Applebee.

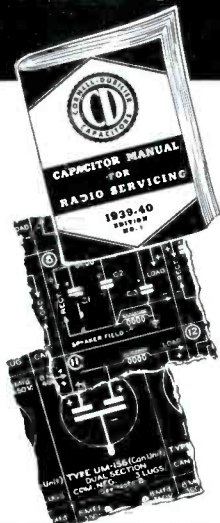
WINDOW DISPLAY

A new radio tube winter window display, lithographed in 8 colors, is being distributed by Hygrade-Sylvania Corp., Emporium, Pa., to its dealers and Service Men. The central figure is a radiant American girl cutting a graceful curve on ice. The display stands 40-in high and can be used as the focal point for a complete window display. Further details may be obtained directly from Hygrade-Sylvania.

SOLAR CATALOG

Solar's new catalog, 10A, features their line of dry, wet, paper, mica and trimmer condensers as well as Solar capacitor analyzers. Copies of the 16-page illustrated book may be obtained directly from Solar Manufacturing Corp., Bayonne, N. J.

FREE This handsome, handy MANUAL FOR RADIO SERVICING Worth several dollars!



Now, without cost, have at your fingertips all the latest data on servicing defective capacitors (includes circuits shown in new Rider Vol. X) in one handsome, sturdily bound volume. Concise, stripped of all non-essentials, this new C-D Capacitor Manual for Radio Servicing is nevertheless complete, containing everything you need to know about capacitor selection for replacement. Over 240 pages—a wealth of information it took months to gather!—yet Cornell-Dubilier has arranged the material so simply and in such orderly manner that reference is surprisingly quick and easy.

Contains all this!

Set manufacturers names listed alphabetically. Model data covers capacitor values, working voltages and standard C-D capacitor types required for replacement (number of standard types reduced to absolute minimum), references to illustrative circuits (over 165 are given in back of Manual), manufacturers original part numbers, and the Volume and page of Rider's in which complete schematic circuit is to be found for general checking purposes.

Here IS something for nothing! Get your FREE copy of Cornell-Dubilier's new "Capacitor Manual for Radio Servicing" today. Discover how this reliable source for all capacitor stock requirements saves you time, speeds service work, increases stock turnover. See your C-D Distributor at once!

TYPICAL PAGES FROM THE C-D MANUAL

NO STRINGS TO THIS OFFER



CORNELL-DUBILIER ELECTRIC CORPORATION

1026 Hamilton Boulevard, South Plainfield, New Jersey

Cable Address: "CORDU"

NEW PARTS SUPPLY

The H. C. Baker Sales Co., 19 Franklin, Roanoke, Va., have opened a wholesale radio parts department catering to the needs of Service Men in southwest Virginia. The officers of the new company are Alfred B. Geer, president, and James H. Davie, secretary and treasurer. Additional information may be obtained directly from H. C. Baker Sales Co.

KEN-RAD PAPER

A technical paper on "Radio Tubes and How They Function" was given by Curtis B. Hammond of the Ken-Rad Tube & Lamp Corp., Owensboro, Kentucky, at a meeting of the Chicago Area Radio Club Council held at the Sherman Hotel, Chicago. More than 200 amateurs and Service Men of the Chicago area were in attendance.

After the confab at Radiolab, Kansas City, Mo., the photographer got to work. Reading from left to right: Frank J. Kysela, Thordarson representative; Douglas Fortune, Thordarson broadcast engineer; Guy Wilson, Radiolab purchasing agent; A. O. Grey, Radiolab salesman; Robert Smith, owner of Radiolab; and E. J. Rehfeldt, advertising manager for Thordarson Electric Manufacturing Co.



Only **AMPERITE**
gives you **THE ACOUSTIC COMPENSATOR**
and these **5 VITAL FEATURES**

- (1) It's a **VELOCITY**
- (2) It's a **DYNAMIC**
- (3) It's **UNI-DIRECTIONAL**
- (4) It's **NON-DIRECTIONAL**
- (5) Gives **HIGH or LOW PITCH**

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.

AMPERITE KONTAK MIKE, Model SKH, IDEAL FOR MUSICAL INSTRUMENTS. CAN BE USED WITH ANY AMPLIFIER, AND WITH RECORD PLAYERS AND RADIO SETS . . . List \$12.00; Plug extra, \$1.50 list.

Specify **AMPERITE** C. 561 BROADWAY, N. Y. U. S. A. CABLE ADDRESS ALKEM, NEW YORK

AUTOMATIC RECORD CHANGER

(Continued from page 563)

pin between changer posts.

See that motor frame is well grounded by wire soldered to lugs, as shown on bottom view photo.

trouble shooting

1) Mechanism is slow in starting, or stalls during a change cycle, but a slight forward push with the hand starts it again. May be caused by:

- a) Failure to lubricate properly. Oil thoroughly, per instructions above.
- b) Loose setscrews.
- c) Weakness of drive: line voltage may be abnormally low, or motor windings damaged. If windings are found damaged, remove motor and return it to factory for repair or replacement.

2) Motor fails to run, even when it is entirely disconnected from other wiring and proper voltage is applied directly to the two ends of its windings. This indicates trouble in motor windings. Unless the damage is easily seen and repaired, replace motor, as above described.

3) Motor is slow in starting.

- a) Check oiling, as directed above. It may not have been properly done; old oil may have become gummy.
- b) Changer may have been in a very cold place, and may not yet have reached room temperature. Give it a fair chance to get warmed up before concluding that motor is defective.

4) Squeaks or other noises, during playing of records.

- a) Check oiling.
- b) See that all setscrews are tight.

5) Motion of pickup toward record pin will not trip changer mechanism.

a) (Only on models not having trip adjustment hole AR.) It may be found that, instead of trigger being actuated, there is stretching of swivel spring CK, allowing the spreaders to open. Increase tension of the spring, by bending the lug on either spreader slightly. If this increased tension causes needle to jump across the record, needle may be a little out of vertical, radially—it may lean toward center of record. To remedy this, grasp pickup arm and twist it, very slightly, in a clockwise direction (looking from needle end) so that it stands vertical, or even leans a little in outward direction.

b) If trigger is being properly actuated, probably cam lever CS is binding against subplate CU. Look for dirt or obstructions: see that pawl DH and trigger CP are working freely on their rivets. If the lever engages the pawl so that lift CV forces roller DJ up into the under groove on cam gear, and if setscrews are tight, the change cycle must operate, as cam gear turns.

6) Pressing button "R" doesn't trip changer mechanism.

a) Check key control unit FM: see whether there is an obstruction or a bent part which prevents operation of button "R" clear down to the end of its travel.

b) Examine reject rod FI. If it does not trip, even when properly revolved by complete depressing of button "R," the rod has probably been bent, and must be restored in same way. Grasp the two ends and twist it slightly.

c) If trigger CP is being properly actu-

ated but without starting a change cycle, see directions above.

7) Pressing button "M" fails to put changer mechanism out of action so as to enable manual operation. First see that button goes clear down; then follow its action through manual rod FH.

8) Motor stops immediately when changer switch is turned off during a change cycle (instead of continuing to run, as it should, until needle is again upon a record, and then stopping). Or—

9) Turning on-off switch fails to stop changer at all. Either of these two conditions would indicate failure of cycling switch EH. Cycling switch operates normally to short-circuit the manual on-off switch (which may be located in position shown at FA or elsewhere) during change cycle only. Such damage to cycling switch (not likely to occur) would necessitate returning either the subplate assembly or the entire changer to factory.

10) Needle lands properly on record but fails to move over into record groove. Pickup arm is normally impelled toward center of records by lead spring ER. Should a slight increase in its tension be found necessary, this can be easily obtained by bending the lug, to which it is attached, down against main plate. If tendency then appears for needle to jump across record, check angle of needle.

11) Records fall unevenly upon turntable. Seldom objectionable (some unevenness may even be advantageous); this is due to record pin not being correctly centered between changer posts. If necessary, it can be corrected as described above.

12) Last record drops on one side only. This suggests a changer post bent out of perpendicular to main plate. Test as directed above. If post must be straightened, be careful not to bend other parts.

13) Changer continues cycling. Probably due to failure of lift CV to be drawn back out of engagement with cam gear. Check the various rivets at which motion occurs, to find the point where friction or binding is interfering with freedom of motion.

14) Record is driven, but not heard, or not heard with proper volume. See that pickup cord is plugged in. Check amplifier and speaker and connections to them, thoroughly. If then trouble is still suspected in pickup, test its output with a vacuum-tube voltmeter. Playing an average record, output should test 1 to 2.5 volts if pickup cartridge is of crystal type, or 0.5 volt if of magnetic type. If pickup cartridge is found not to deliver proper output, remove it and install another.

15) Selector plate fails to separate bottom record from stack. This is due either to a badly warped condition of the record, or to its being of a thickness very considerably different from those now in standard use. The design of both selector and shelf plates is such as to accommodate a maximum variation in thickness and flatness of records, but certain records may be found which are so far out as to be impracticable for use in automatic changers.

If necessary to disassemble the changer

First detach the entire changer mechanism (except changer connecting rod assembly FD and cam connecting rod assembly DE, also seen at EC) from main plate EB. To do this, first take out shoulder screw CT, to free the rest of the mechanism from assembly DE. Then remove the three screws AO, which hold subplate assembly DI to main plate EB. Also remove screw BN, which holds cam gear DF. Pull off the four key control buttons. Remove

the two screws that hold key control unit FM to main plate. Now remove control unit truss bar FO, rejection rod support EP, and extension rod bracket FQ—this means taking out five screws. Remove flat spring FJ, by taking out one screw. Rods FH and FI can then, with due care, be extracted without bending. Free the cam connecting rod assembly DE, by loosening setscrew holding spreader hub EE to rear changer shaft. In reassembling, reverse the procedure, taking care to get all springs properly connected as shown in the photos, without stretching any of them.

MOVE TO STANDARDIZE TUBE TYPES

A plan to standardize the use of receiving tubes by the radio industry to a relatively small list of 36 standard types, which perform virtually all basic tube functions, as against the more than 450 overlapping tube types now existent, has been advanced by the RCA Radio Tube Division as a stabilizing influence that will benefit the entire industry and work to the best public interest.

A survey conducted under the supervision of L. W. Teegarden, RCA tube and parts sales manager, revealed that although 453 different types are produced by the industry, 90% of all sales are centered in only 90 tube types. And, for these 90 types, only 20 basic functions exist. The use of so many different and overlapping tube types has complicated manufacturing, stocking and selling problems to the detriment of all concerned, it is said.

With these facts in mind, RCA tube engineers have selected a "preference list" of 36 tube types which fill the needs of design

PREFERENCE LIST

METAL		GLASS			
		Non-Octal	GT (6.3-50v)	GT & G (1.4v)	G
6.3v	12.6v		6J5-GT	1A7-GT	5U4-G
6H6			2A3	6K6-GT	5Y3-G
6J5			6U5/6G5	1D8-GT	6B8-G
6SA7	12SA7		35L6-GT	1G4-G	6F6-G
6SC7	12SC7		35Z5-GT	1G6-G	6N7-G
6SF5			50L6-GT	1H5-GT	6R7-G
6SJ7	12SJ7			1N5-GT	6V6-G
6SK7	12SK7			3Q5-GT	6X5-G
6SQ7	12SQ7				
	12C8				

engineers for practically every type of radio receiver, including a-c and a-c, d-c receivers, auto radios, battery instruments, and the majority of applications in which vacuum tubes are required. Mr. Teegarden emphasized that the preference list is offered as a helpful suggestion and a constructive beginning and is not intended to be rigidly inflexible.

WIRED FOR TELEVISION

A NUMBER of radio manufacturers have issued literature to the effect that their radio receivers are wired for television.

Broadcast radio receivers that are wired for television are simply sets that have phonograph terminals. These terminals may be labelled "Phono," "Television," "Pick-up" or anything else the manufacturer chooses, and they may consist of two wires, two screw type terminals or a special jack. The fact remains, however, that they are nothing that is new and different, and that all radio receivers that have phonograph terminals are also wired for television in exactly the same sense.

In the very lowest priced television receivers, in order to save money, no audio

TRIPLE SHIELDED ... for HAIR-LINE SERVICING TO 30.5 Mc.



SIGNAL GENERATOR

Model 1232-A

Only ...
\$29.84
DEALER NET PRICE

LINE FILTER—Filters RF between oscillator and the line. Six Trimmer Calibrated Coils—For accuracy well within servicing requirements on all bands. 400 Cycle Audio Note obtained from panel jacks.

This new model is made with full vision dial having six scales with total length of over 50 inches. Improved accuracy, shielding and attenuation equal to oscillators for which you would pay much more.

● TRIPLE SHIELDING

and completely NEW design. Top panel is insulated from R. F. Main wiring is beneath double shielded panel. Coils and the band switch are individually shielded.

● IMPROVED ATTENUATION

Zero for all practical purposes.

● LARGE DIAL OPENING

180°—Improves readability. Scale is 345°. Dial is direct geared, permitting quick and accurate settings.

● SIX BANDS

cover frequencies from 115 Kc to 30.5 Mc. All frequencies are fundamentals. Total scale length over 50 inches.

Model 1232-A, complete with accessories . . . Dealer Net Price . . . \$29.84

Model 1231 . . . Same as above, but Battery operated. Complete with batteries and accessories . . . Dealer Net Price . . . \$27.50

WRITE FOR CATALOG!

Section 1712 Harmon Ave.

THE TRIPLET ELECTRICAL INSTRUMENT CO.
Bluffton, Ohio

frequency amplifier or speaker is provided. Instead, the television receiver is used to pick up the television sound signal and carry it only as far as the second detector. From there it can be fed into any standard broadcast set where it is amplified and put through the speaker in exactly the same way as the output of a phonograph pickup.

M. J. Schinke,
STEWART-WARNER CORP.

ALLIED APPOINTMENT

Mr. A. D. Davis, President and General Manager of the Allied Radio Corporation, Chicago, Illinois, announces the appointment of J. W. Rubin as Manager of Advertising. Mr. Rubin comes up from the ranks, having started as a clerk in Allied's shipping room.

MALLORY CATALOG

The new 1940 Mallory-Yaxley Catalog is now available from P. R. Mallory & Co., Inc., Indianapolis, Indiana. This 40-page catalog contains considerable technical data on their line of controls, switches, potentiometers, special switches, dial plates, jacks, plugs, cable connectors, terminal strips, dial lights, knobs, resistors, condensers, vibrators, vibrapacks, dry disc rectifiers, grid bias cells, etc.

CROWE CATALOG

Crowe Name Plate & Manufacturing Co., 3701 Ravenswood Ave., Chicago, have issued a 16-page catalog, in full color, of their line of knobs, dials and escutcheons. Copies may be obtained directly from Crowe.

ASSOCIATIONS

RADIO SERVICEMEN OF AMERICA

SOME 25 chapters have been participating in the NAB-RSA Joint Promotion for selling the American system of broadcasting, and incidentally, bettering the service business. Gratifying results have been reported in a large number of cities and the plan is being expanded as rapidly as possible to take in all of the chapters of the RSA. The second step in this year-round promotion of the NAB-RSA will go into operation shortly, it concerns itself with Radio Christmas promotion. Members of the RSA will undertake to pick up and repair radio sets in the various chapter cities throughout the nation and present these sets to the local Charities for distribution during Christmas week.

The purpose of this plan is two-fold. First, to continue to sell RSA and the NAB to the American public, to improve listening conditions by removing old and obsolete radios from the market; second, it provides more contacts for RSA Service Men and to permit the sale of radio sets.

Complete details of this promotion are available to all interested parties from the National Office of RSA.

More and more chapters are completing the necessary work under the Guarantee Service Plan.—This is the first constructive step in the history of the industry which guarantees the work of the individual Service Men and protects the public from unscrupulous operators. Members are enthusiastic about the plan and are reporting increased business as a result of their efforts.

RSA Headquarters is pleased to announce the addition of three new chapters to the ever growing family of RSA. Local chapters have been established in Amsterdam, N. Y., Marinette, Wis. and Minneapolis, Minn.

The Amsterdam group has for its

officers: Joseph Tallman, president; Samuel English, secretary; A. R. Kindl, treasurer. Marinette has elected the following officers: A. E. Meissner, president; Ed. J. Kehoe, secretary. Minneapolis will be guided by Orville C. Mason, president; Auther Lane, vice president; Sears Milnor, secretary-treasurer.

boston

Monday, Oct. 30. Boston R.T.G. and R.S.A. met in a brotherly spirit to enjoy one of the finest and excellent technical lectures on condensers and resistors so far recorded. Leon Poldolsky of Sprague Products Company, North Adams, Mass., was the speaker.

In spite of the inclement weather the turn-out was gratifying and we are hoping to have a return lecture of this outstanding speaker for our New Bedford and Lawrence Chapters in the new year.

R. T. G. News.

reppers

Manufacturers representatives resident in Minneapolis and St. Paul, who have organized themselves into an organization known as *The Reppers* recently tried out a unique idea. These representatives formed a caravan of ten cars to visit Duluth, Minnesota, Fargo, North Dakota; and Sioux Falls, South Dakota, which left Minneapolis on Nov. 5 and made its first stop in Duluth.

OTHER GROUPS

nrpda

I have just returned from a trip covering Richmond, Virginia; Baltimore, Maryland; and Washington, D. C. The following concerns in this territory became new members in the National Radio Parts Dis-

tributors Association.

Wholesale Radio Parts Co., Baltimore, Md.

Rucker Radio Wholesalers, Washington, D. C.

Columbia Radio Supply, Washington, D. C.

Johnston-Gasser Co., Richmond, Va.

Jobbers everywhere were enthusiastic over the new set-up in the replacement tube market. A local chapter of NRPDA Jobbers is being formed for the territory of Virginia, Maryland, and the District of Columbia. This chapter will meet at various times to discuss problems facing the Jobbers in this territory.

Arthur Moss, exec. secretary.

psrma

In the past year our organization has gained technical knowledge on such subjects as television, facsimile and frequency modulation. We have also distributed thousands of service notes to our members. At this time we have a weekly class on tele-

This is the audience John F. Rider addressed at Los Angeles on his RCA sponsored cross-country series of service lectures.

vision given by outstanding engineers in the field.

At our November meeting we have had General Electric's engineering staff with lectures on frequency modulation. The following month we will have facsimile, receiving and broadcasting lectures given by one of the largest radio manufacturers.

To all local groups of radio Service Men in surrounding counties we offer since co-operation in obtaining service information and lectures from our group.

For this information write to Dave Krantz, 711 Snyder Ave., Philadelphia, Pa., chairman technical committee.

TRADE SHOW

At the annual meeting of the Board of Directors of Radio Parts Manufacturers National Trade Show, Inc., held at the Stevens Hotel, in Chicago, Dec. 4, the following officers for 1940 were elected:

A. A. Berard (Ward-Leonard), president; H. E. Osmun (Centralab), vice president; and J. J. Kahn (Standard Transformer), secretary-treasurer. S. N. Shure (Shure Brothers), president of the Trade Show for the past three years, remains on the Board as a Director at large.



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RCP TESTERS



MODEL 801 — COMBINATION TUBE AND SET TESTER

Combines in compact portable case both a complete tube tester and a set tester—furnishes you with a broad background for profit. Model 801 tests all new and old tubes, and ballast tubes. 4 1/2" Meter ALNICO MAGNET (only the very finest and most sensitive meters employ Alnico). Meter is fused against burnout, supply-line double fused. Impressive panel in frosted silver, black and maroon. AC voltage measurements have linear scales to coincide with DC—practically eliminating temperature errors—an RCP exclusive. Line regulation 103 to 137 volts; direct meter indication. Noise test. Reversing switch.



- DC voltmeter 0/10/50/500/-1000 at 1000 ohms per volt.
- Four Range AC voltmeter 0/10/-50/500/1000.
- DC milliammeter 0/1/10/100/-1000. DC Ammeter 0/10.
- Ohmmeter 0/500/5000/-1,000,000/10,000,000. Low ohm center scale 5 ohms and each of first ten divisions 0.1 ohm.
- D.B. meter -8 +15/15 to 29/29 to 49/32 to 55 decibels. Compact, light, with slip hinge cover case. Complete with battery, and test leads. You couldn't buy these two test instruments individually at anywhere near the low RCP price! **\$27.95** Net

JUST ONE OF RCP's

complete line of test equipment values. Write for FREE catalog No. 121. Get to know this quality line with the low price tag. Send at once.

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RECEIVER ALIGNMENT SIMPLIFIED



A Crystal Calibrator cannot be beat for rapid accurate receiver alignment—it is indispensable for a quick check of sensitivity and alignment. Your Bliley Distributor can supply the SMC100 Crystal Unit for only \$7.75. Bulletin E-7 (free) contains complete information. Bliley Electric Co., Erie, Pa.

BLILEY DUAL FREQUENCY CRYSTAL

A GOOD NAME GOES A LONG WAY



The good name of Ken-Rad Radio Tubes is the result of expert engineering, tested materials and constant checking to maintain the highest standards.

KEN-RAD TUBE & LAMP CORPORATION
Owensboro, Kentucky

KEN-RAD
DEPENDABLE RADIO TUBES

AEROVOX BULLETINS

Aerovox Corp., New Bedford, Mass., have issued an industrial condenser manual as well as their 1939-40 catalog covering condensers, resistors and test equipment. Both bulletins may be secured from the above organization.

N. U. HANDBOOK

The National Union Official Handbook is a 38-page booklet listing, in chart form, National Union receiving type tubes and their characteristics. Interchangeable types are also included as well as base connections and several charts of useful data. Copies may be obtained directly from National Union Radio Corp., 57 State St., Newark, N. J.

OXFORD-TARTAK CATALOG

Oxford-Tartak Radio Corp., 915 W. Van Buren St., Chicago, have issued their bulletin 391, an 8-page, 2-color catalog of their electrodynamic, magnetic and Permag speakers. Copies may be obtained directly from Oxford.

SPRAGUE INTERFERENCE MANUAL

Sprague Products Co., North Adams, Mass., have published their Manual of Radio Interference Elimination. Described and illustrated are filter circuits and parts needed and the procedure for connecting them to electrical devices of all types. Copies may be obtained directly from Sprague for 25c net.

WESTON TUBE BASE CHART

Tube base data connections and chart, issued by Weston Electrical Instrument Corp., Newark, N. J., assembles in one convenient folder the element connection and base layout of over 500 different tube types. Originally designed for use with the Weston methods of selective analysis this folder permits rapid socket selection for practically any tube now in commercial use, it is said.

Tube base connections are illustrated by diagrammatic sketches of the bottom view of socket or base of tubes. A tube base chart on the back page indicates the proper base to use for any of the various tubes listed. Copies may be obtained by writing directly to Weston.

N. U. FOTOLOG

National Union's Fotolog for 1940 is full of human-interest pictures, European short-wave stations, U. S. broadcast and television stations, etc. The Logs may be obtained, imprinted, at a nominal cost directly from National Union Radio Corp., 57 State St., Newark, N. J.

C-D CAPACITOR MANUAL

The Cornell-Dubilier "Capacitor Manual for Radio Servicing" contains over 200 pages of replacement capacitors for use in practically all existing types of receivers, it is said. Set manufacturers' names are listed alphabetically and model numbers are given under each. The data listed includes capacitor values in each circuit, working voltages, C-D standard capacitor types recommended for replacement, references to basic filter and by-pass circuits (given in rear), manufacturers' original parts numbers and the volume and page of Rider's manuals in which circuit information may be found. Copies of this manual may be obtained without cost by writing directly to Cornell-Dubilier Electric Corp., S. Plainfield, N. J.



Type for type National Union Condensers are as small or smaller than leading competitive makes.

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NU Midget
Aluminum Tubular

All Popular Types

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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-1239

FEATURES

HIGH BREAKDOWN VOLTAGE—
 Uniformly aged and tested considerably above their rated operating voltages.

UNIFORMITY—
 Double checked to insure reliability and uniformity of characteristics.

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

LOW LEAKAGE—
 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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 National Union Tube Deals*

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Here in this one big book you will find everything you need in radio including radio sets, parts and supplies . . . newest public address systems . . . latest amateur equipment . . . testers and kits . . . your nationally known favorites at lowest possible prices. Best of all, our service is better than ever. Most orders are shipped the same day they are received. Be sure to write today for your copy of this big FREE CATALOG and save money. Not only do you save money but you also save valuable time by sending in one order for your entire needs selected from this big valuable catalog of the radio industry. Join the thousands of others who now buy their entire needs from B. A.

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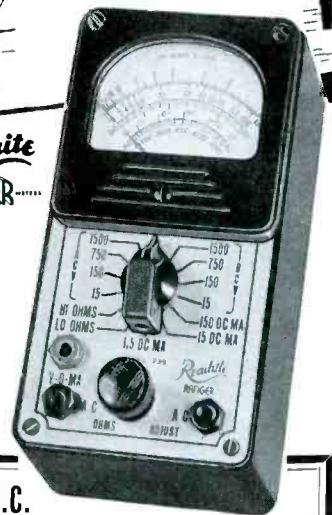
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MODEL
739

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A.C.-D.C.

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WRITE FOR CATALOG

SECTION 1217.

COLLEGE DRIVE

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Get more sales, with less inventory, with this new Multi-Impedance Dynamic U-9! 50 ohms, 200 or 500 ohms or hi-impedance—whichever requirement is needed, is filled with this microphone. Adjustable to semi- or non-directional operation. Removable 25-ft. cable set easily changed. Level -52DB at high impedance, remarkably free from feedback. Range 40 to 9000 cycles. Works indoors or out. Packed with wiring diagrams. Smooth, trouble-free performance.

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Engineering Style
Deep Battleship
Gray Finish. 25 Ft.
Cable Set.

\$35.00
List

MINIATURE TUBES

RCA Radiotron Division, RCA Manufacturing Co., Inc., Harrison, N. J., have recently announced to equipment manufacturers a new series of 1.4-volt miniature tubes as follows: RCA-1R5 pentagrid converter RCA-1S4 power amplifier pentode, RCA-1S5 diode-pentode, RCA-1T4 super-control r-f amplifier pentode. These new tubes provide a complete complement for the design of compact, light-weight, portable equipment. They are small in size (only about 2" in length by 3/4" in diameter) and highly efficient in operation with 45-volt B supply. The high operating efficiency of these new types has been attained by a new design which provides compactness without decreasing the size of essential electrode parts. Compactness has been achieved by replacing the conventional base with a new glass "button 7-pin" base sealed to the glass envelope and by mounting the electrodes directly on the glass button.

CONSOLIDATED CONDENSERS

A new method of sealing both dry-electrolytic and by-pass units is employed on all Consolidated condensers, according to an



announcement made by Consolidated Wire & Associated Corp., 518 So. Peoria St., Chicago. All consolidated condensers are now end sealed with a specially developed material which the manufacturer states offers great resistance to moisture and assures long life. The condenser illustrated is an inverted type, lock nut mounting, dry-electrolytic in drawn metal container.

SMALL WIRE-WOUND RESISTORS

A new and compact design of Ohiohm ceramic-insulated wire-wound resistors is now being manufactured by The Ohio Carbon Company, 12508 Berea Road, Cleve-



land, Ohio, in addition to their line of carbon resistors. The wire-wound units are applicable to a wide range of uses, such as original and replacement equipment for radio sets, broadcasting station apparatus, railroad block signaling systems and general industrial plant uses such as motor-starters and relays and on photo-electric safety and counting devices. Standard units are from 5 watts to 20 watts in a range of resistance values; all being guaranteed accurate to plus or minus 5%.

AMPERITE KONTAK MIKE

Any number up to 4 of the Amperite Model KKH Kontak mikes can be connected in parallel to the input of a single



amplifier. The volume of each instrument can be varied without affecting the others, it is said. The unit is designed for attachment to such instruments as the violin, the bull fiddle, guitar, piano, harmonica or accordion. Additional information may be obtained directly from Amperite Co., 561 Broadway, New York City.

VELOCITY MICROPHONE

Universal Microphone Co., Inglewood, Calif., is now producing its new M4 series, a new 4-magnet velocity microphone that was formerly catalogued as RH. This model is an all-purpose unit for p-a, amateur and semi-professional use. Frequency range is said to be from 40 to 10,000 cycles, output level -64 db. It is furnished in standard output impedances. Further information may be secured from the manufacturer.

LAFAYETTE CONSOLE

The Lafayette Model BB-7 radio-console has just been introduced by Radio Wire Television Inc. (formerly Wholesale Radio Service Co., Inc.) of 100 Sixth Avenue, New York City. Contributing to installation convenience are built-in broadcast and short-wave loop antennas which



eliminate external connections to antenna and ground and thus permit the console to be placed anywhere in a room.

Operating features are: (1) push-button tuning of any six stations, (2) a large and fully calibrated "slide-rule" dial to facilitate manual tuning of short-wave and other broadcast stations, (3) horizontal positioning of both the record player and radio control panels at table height inside the console top to allow good visibility and avoid stooping to operate, (4) inclusion of a fully automatic record player which plays up to eight 10 or 12-inch records without attention.

BRUSH PRODUCTS

New products recently announced by Brush include the Models QO and QOM microphones, and the Type BJ headphones.

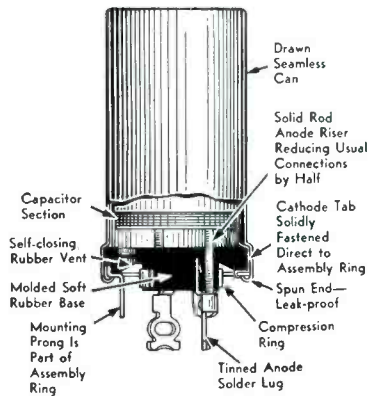
Both the QO and QOM microphones have a fidelity response of 30 to 9000 cycles per second. For close speaking the outputs are sustained in the lower register without booming, it is said. Output levels are -54 db.

The BJ headphones feature: a soft rubber jacket encasing the cartridge to assure ruggedness, comfort, good ear seal and safety from shock; a hermetically sealed aluminum cartridge construction to protect the phones against adverse climatic conditions; a yokeless cord design to allow more freedom and comfort to the operator.

Additional information may be secured from the Brush Development Co., 3311 Perkins Ave., Cleveland, Ohio.

ELECTROLYTIC CAPACITORS

Solar Manufacturing Corp., Bayonne, N. J., has just announced a dry electrolytic capacitor, type DY, incorporating new features of construction. The base is a novel soft rubber molding through which all terminals are brought and sealed under com-



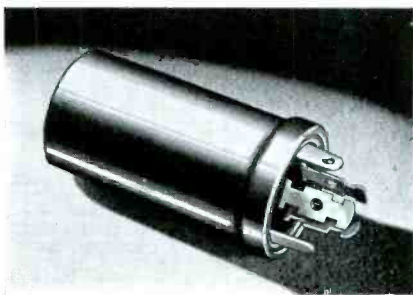
pression in a manner similar to that used in wet electrolytic practice. Low contact resistance, improved r-f characteristics, thorough sealing, freedom from the cause of intermittents, and the advantages of the wet electrolytic type of vent are claimed as features. A special engineering data sheet is available.

FIRE DETECTION SYSTEM

Fyre-Scout, manufactured by Technical Appliance Corp., 17 E. 16 St., New York City, is said to give warning of a fire at its very inception—while still a flickering flame or smoldering ember. The system can be installed by the Service Man for the average household, farm, shop or factory. Additional details may be obtained directly from Technical Appliance.

PRONG-BASE ELECTROLYTICS

Prong-base midget can electrolytics are announced by Aerovox Corp., New Bedford, Mass. Compact, economical, simply mounted, these dry electrolytics are for compact assemblies and replacements. Mounting prongs slip into an elliptic fibre



supporting washer (insulated can) or metal washer grounded can) riveted or eye-letted on chassis, and bent over. Terminal lugs slip through hole in washer, for soldered connections.

PHONO MOTOR

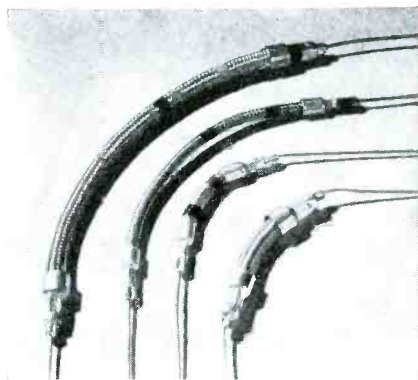
The General Industries Co., Elyria, Ohio, have recently announced a 78 rpm, gear drive, governor-controlled phonograph motor for heavy duty work. The motor is identified as Model RG and is furnished complete with mounting plate, 10 or 12" weighted turntable. Operates on 110-volt 60-cycle a-c. Complete data may be secured from the manufacturer.

TURNER MICROPHONE

The Turner Co., Cedar Rapids, Iowa, offer the industry their Model U9, finished in battleship grey, which will fill 4 impedance requirements. It is called the Turner Multi-Flex and makes it possible to work at 50 ohms, 200, 500 or high impedance all with the same microphone. A tapping arrangement in conjunction with a shielded transformer built into the microphone head allows selection of impedance connections. The U9 is adjustable to semi- or non-directional pickup positions and has a removable cable set. The output level is -52 db at high impedance with frequency response from 40 to 9000 cycles, it is said. Additional information may be obtained directly from the manufacturer.

FIBER-GLASS RESISTORS

Wattage ratings of inexpensive and handy flexible resistors are now being stepped up several hundred percent through the use of fibre-glass cores and braided coverings of the same material. Appropriately named Glassohms, these tiny power resis-



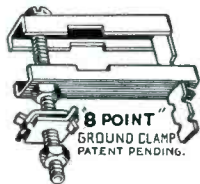
tors are now announced by Clarostat Manufacturing Co., Inc., 287 N. 6 St., Brooklyn, N. Y. Additional information may be obtained directly from Clarostat.

CLARION SOUND SYSTEM

The Clarion Model C410 has an output of from 10 to 15 watts with an overall gain of 110 db for mike input and 80 db for phone input; the hum level below 10 watts is -47 db; frequency response 40 to 9,500 cycles, it is said. Push-pull 6V6Gs are used with a full range tone control. Output positions for 8 or 16 ohms are provided. Additional information and prices may be obtained directly from Transformer Corp. of America, 69 Wooster St., New York City.

GROUND CLAMP

A newly developed "8 point" ground clamp has been announced by the Accessories Mfg. Co., 4612 N. Clark St., Chi-



cago, Ill. The ground clamp provides a connection with 8 solid points of contact. It is made to fit any size rod from 3/8" to 1 1/16" or any size pipe from 1/4" to 3/4". Literature is available from the manufacturer.



Sweet and
 (WITH ACCENT ON THE)
LOW

"When the organ plays at twilight" can you still hear the LOW notes when the volume is turned down?

With Old Man Centralab at the console you get true tone compensation . . . for his Standard and Midget Radiohms are available with 1, 2, or 3 taps to match the original control.

Wherever tapped controls are indicated be sure to use Centralab with the long straight resistor strip that gives smooth accurate attenuation throughout the entire circumference.

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With short wave listening on the up, Centralab Wave change switches do the trick . . . better.



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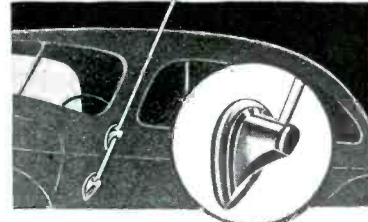
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New
Model
245*

**Tests all dry batteries the
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● This latest addition to the broad Simpson line fulfills a vital need supremely well. It measures only 5 1/2" x 2 7/8" x 1 3/4", and weighs only a pound, but it incorporates a means of introducing a load into the circuit, so that the battery can be tested under actual working conditions—the only correct way. Ranges have been selected so that the useful limits of all "A" batteries fall within a green sector of the top arc and the useful limits of "B" batteries fall within a green sector of the lower arc. Readings are highly legible.

Also a sensitive voltmeter

The load is thrown on and off with a convenient toggle switch. When off, the tester becomes an accurate voltmeter with ranges of 0-2, 0-4, 0-8, 0-50, 0-100, and 0-150 volts having a sensitivity of 1,000 ohms per volt. Here is Simpson quality, accuracy, and beauty at **\$7.85** the remarkably low price of..... (Net price to dealers and service men)

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INSTRUMENTS THAT STAY ACCURATE

Probably the most popular
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ever introduced



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*Cannot be
Equalled*

Capacity, power factor, leakage, resistance — directly on the panel, quick as a wink! Small wonder that service men everywhere have voted YEA for this precision instrument with the MAGIC TUBE! Indispensable!

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to the
Rider Chanalyst
and
Rider VoltOhmyst

Coming Soon...

THE RCA SIGNALYST

To Top the Test Oscillator Field



Frequency Range...
100 KC to 120 Megacycles!

Ladder Type Attenuator...
5 position
direct reading!

Output Voltage read
directly on a meter!

Iron Core RF Coils!

Frequency Range
shown is fundamental

This is one time when you can see into the future... to your advantage. RCA will introduce to the service industry shortly after the first of the year, a new signal generator with a range far greater than any test oscillator has ever had. Though it is priced below most high quality signal generators, the new RCA Signalyst holds its own in accuracy, stability, and range.

Built by the organization that knows what the trends are in radio and television design... because it makes the trends... the RCA Signalyst will minimize the factor of obsolescence. You can

buy with real assurance that it will be a money maker for years to come.

Why it will pay you to wait

Every feature that will help you... every feature that will make your operations easier, more accurate, and more profitable is being built into the RCA Signalyst. This is an instrument that will dominate its field as do the Rider Chanalyst and Rider VoltOhmyst and the other fine instruments in the line of RCA Test Equipment. You can't afford to buy until you investigate the RCA Signalyst... remember, it's coming soon!

Over 335 million RCA radio tubes have been purchased by radio users... in tubes, as in parts and test equipment, it pays to go RCA All the Way



Test Equipment

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OF AMERICA

RCA MANUFACTURING COMPANY, INC., CAMDEN, N. J.