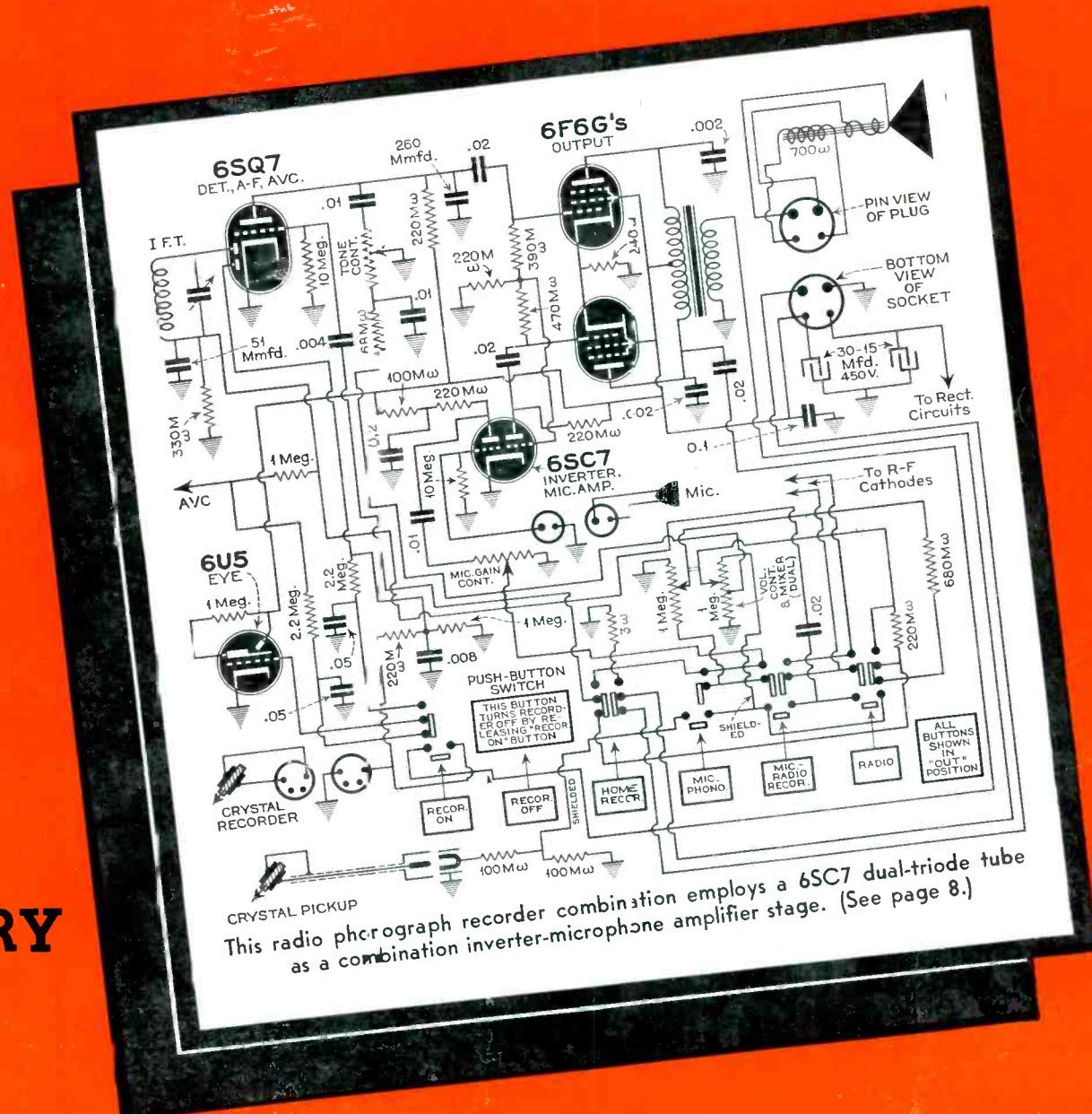


A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE

SERVICE



FEBRUARY
1941

RADIO - TELEVISION



PROVEN FOR PERFORMANCE
in millions of Auto Radios

PROVEN FOR PROFITS
by thousands of Service Men

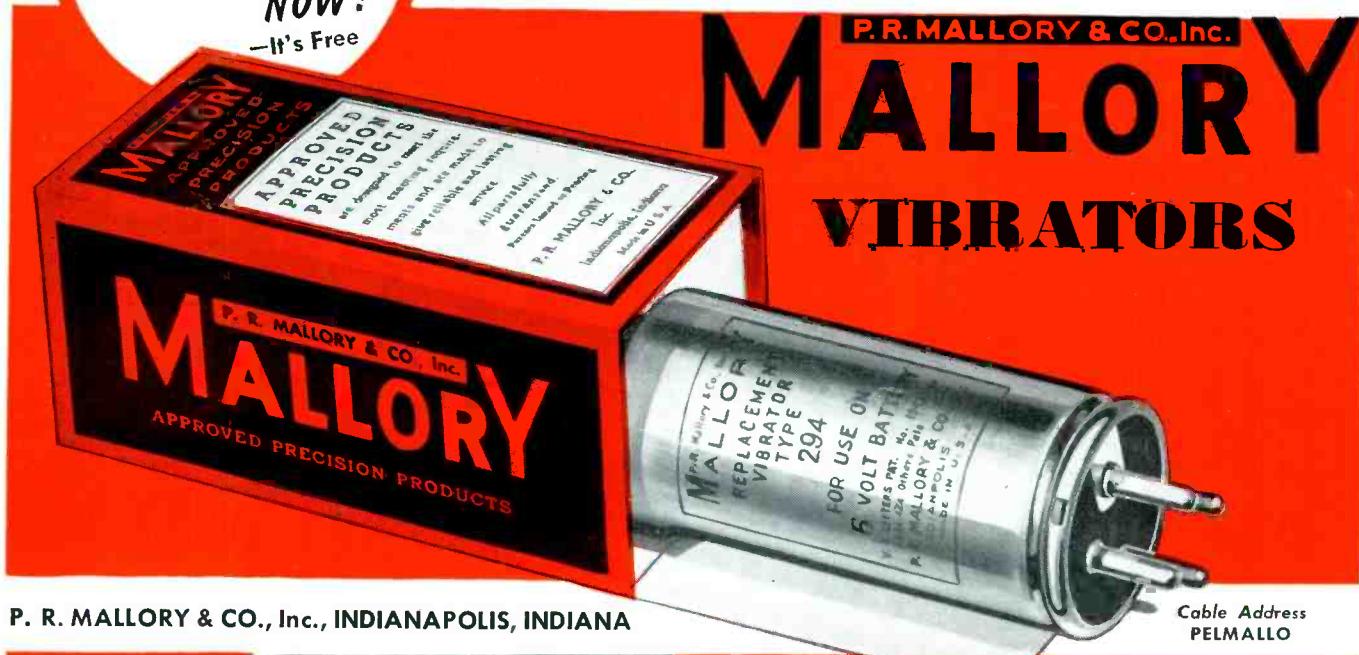


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WE SUGGESTED in these columns last month that you use the opportunity presented by reallocation as a door opener in a community wide house to house campaign. Armed with a log giving the new frequencies of local broadcast stations, you will be more than welcome.

To help you in preparing such a station log, we have published a complete and accurate list of these new frequency assignments on pages 18 and 20 of this issue.

In addition to these station listings, Lynne Smeby, Director of Engineering for the National Association of Broadcasters, points out four possible causes of troubles which may occur as a direct result of reallocation, on page 17. It is important that you read up on these.

Get to work right now! Line up your customers so that you can route your calls most efficiently to take the least amount of your time in traveling. With proper effort there is no reason but that you will be a very busy man right after March 29.

We repeat, there may never be another opportunity like this one. Don't let it catch you napping!

ON THE general subject of push buttons, H. E. Ward, Jr., President of RTA, Long Beach, California, brings up another question. Where will we get replacements for the push button call letter tabs if the first set are worn or lost. He offers the suggestion that Service Men's organizations in the East make arrangements with others in the West to exchange the unused tabs with each other, on some equitable bases (say pound for pound). What do you think of the idea?

WE RECENTLY took our watch to a local jeweler to have the crystal replaced. After squinting at it through his eyepiece, he said: "This watch needs a cleaning and oiling, too." After we protested strongly, offering the excuse that it kept time to the split second, he produced a booklet, printed by the makers of our watch, which stated in clear bold type that good watches must be taken apart, cleaned, and oiled every ten months, or else. It was all very convincing.

It is our opinion that receiver manufacturers should stress the necessity for periodic realignment and check-up of their sets in all advertising and consumer literature, much the same as the watchmakers, the auto manufacturers.

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BRYAN S. DAVIS
President

Published Monthly by the
Bryan Davis
Publishing Co.
Inc.

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1—AT1615	1—AT1645
3—T601	
4—T602	
3—T605	
5—T610	
2—T625	

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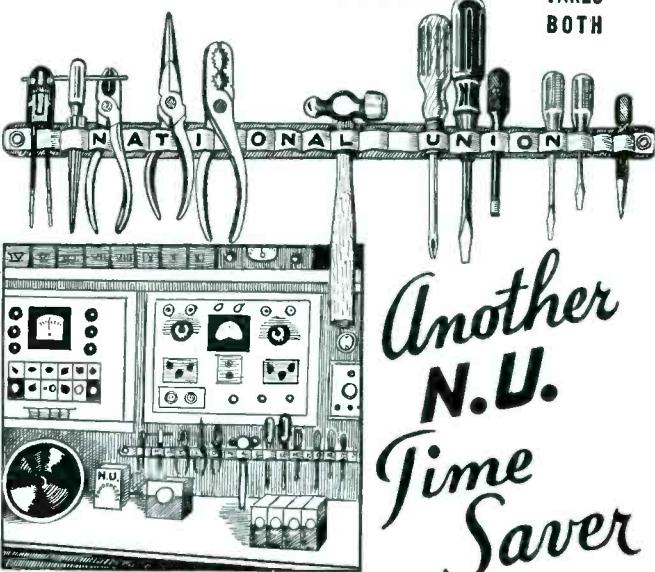
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1—AT1025 1—AT2015 2—AT8450 1—AT2215
2—T601 3—T605 3—T610 1—T625

1941 SOUND

By ROBERT G. HERZOG

EDITOR

WITH the country being geared to defense production, manufacturers of defense materials are amenable to investigate every possible means of improving their efficiency. Whereas, in the past, other methods of inter-plant communication may have sufficed, amplifiers are rapidly finding their rightful place in the modern factory setup.

Factory Intercommunication

J. H. Fentress, of Fentress Sound Equipment Co., Bell Telephone Building, Oklahoma City, Oklahoma, has taken full advantage of this trend. During the past year he has called upon a number of large firms that were constructing new buildings. The Beech Aircraft Corporation, located in Wichita, Kansas, was one of these firms. A large increase in their regular business as well as several U. S. Government contracts put them in the need for the most efficient type of intercommunication available. Fentress furnished them with information covering the size and

layout of wiring and the location of junction boxes to enable the installation of an extremely flexible system with provision for enlargement should the future need arise. The information was immediately worked into their construction plans.

This equipment was considered so necessary that even before the offices and engineering building was fully completed, Fentress Sound received an initial order to install six Webster Electric (Racine) Model 212S, twelve station, Teletalk intercommunicating units and one Model 5A45 loudspeaker

The seemingly endless line of legionnaires marching down Tremont Street, Boston, were saluted over the loudspeakers of the Erwood sound system installed in the bandstand opposite the Tremont Theatre.



Photo courtesy St. Louis Daily Globe Democrat

The crowd at ground breaking ceremonies for Curtiss-Wright airplane plant at St. Louis Lambert Airport had no difficulty hearing Mayor Dickmann speak. University trumpets carried his voice for miles. Right foreground, is motor and propeller of "Interceptor," fastest climbing fighting plane in the world.

unit. Since that time three additional Model 212S Teletalks have been added. As the various offices are completed, in the near future, other stations will be installed. The total time spent in installing the nine master stations and the loudspeaker unit took approximately twelve hours.

Outdoors

J. A. O'Niel of the Mueller-O'Niel Company, 5740 Bartner Street, St. Louis, Missouri, is another sound specialist who has taken advantage of the increased sound equipment requirements of our National Defense Program. At the ground breaking ceremonies for the new Curtis-Wright \$11,000,000 airplane plant at the St. Louis Lambert Airport, last November 19, he was on hand with a 150-watt public-address system, a Western Electric 633A microphone and four University Laboratory Model LH 4½-foot air column trumpets with four University Model SAH permanent-magnet dy-



Photo courtesy Boston Herald



Imagine dining in a famous night club and hearing the loudspeaker comment, "They scraped up the kitchen floor again," at the moment when the waiter emerges with a heavily laden tray of choice foods. Silly? Sure! But it's a brand of ad libbed comedy that keeps them coming back to the "18 Club." Several Amperite microphones spotted around the floor and band enable the MC Jack White (center), entertainer Pat Harrington (right) and members of the band to kid themselves, each other and the patrons.

namic driver units.

High company, city and state officials were present and their voices were easily heard above the multitude which packed the huge airfield, because of the efficiency of this type of speaker.

No installation difficulties were ex-

Crowd gathered at the Capitol to see President Roosevelt inaugurated for the third time heard the proceedings through a battery of six RCA loudspeakers. Numerous other speakers were used to cover the whole Capitol area. Inset shows control room.

perienced. The trumpets were mounted in pairs on poles erected on each of two corners of the speaker's stand, fanned out to cover the rear of the crowd, to avoid excessive volume for those in

the best elements of a p-a system in its efforts to produce intelligible volumes of sound. Parades are typical in this respect, what with the clamor of the noisy crowd, the tramp of marching feet and the hubbub of the military bands. At the American Legion Parade in Boston, last September, a number of Erwood sound systems were spotted along the parade route to broadcast speeches, reproduce patriotic music and salute the various units as they approached.

In the reviewing stand on Tremont Street, opposite the Tremont Theatre (shown in the accompanying illustration) four trumpets were used in conjunction with an Erwood Model 4575, 75-watt amplifier, equipped with National Union Sound X/tra tubes. A single microphone, used to announce the divisions as they came into view, was all the additional equipment that was required. Music and speeches heard



front. These spectators were amply covered by the spillover.

Outdoor requirements generally tax

Speedup of production needed to equip this "Arsenal of Democracy" in our national defense program is prodding industry to seek the most efficient means of interplant communication. The Setchell-Carlson Dorafone, shown, provides radio reception as well as intercommunication facilities.

over the system originated at a central point and were sent over lines that interconnected all the amplifiers along the parade route.

Inaugural Sound

An all important part in the historic third-term inauguration of President Roosevelt was played by one of the most elaborate outdoor amplification and distribution systems ever installed. Utilizing 1,200 watts of power and 65 loudspeakers located over a wide area of Washington, the system carried the ceremonies to a throng of more than 300,000 persons.

RCA microphones, amplifiers, and loudspeakers were used throughout the system. Although a number of smaller loudspeakers were taxed far beyond their rated capacity for much of the time, the system worked perfectly



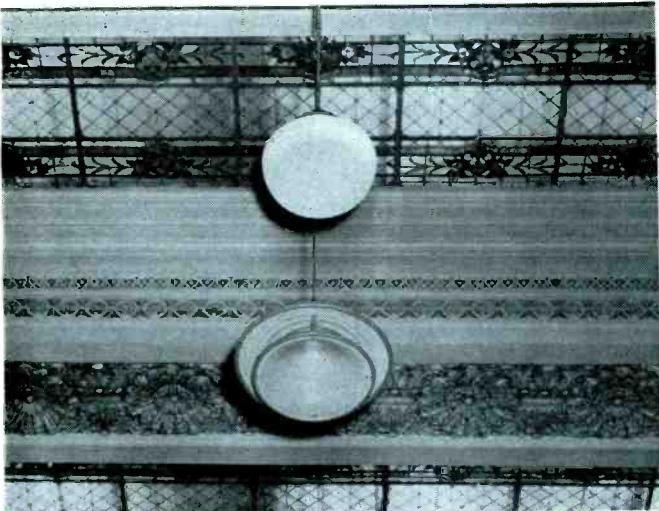


Photo courtesy The Daily Oklahoman

The scramble for seats in the Oklahoma State Capitol is no longer necessary since the installation of the chandlier-type, 360° baffle loudspeaker and its associated amplifying equipment.

without interruption of any kind.

The huge installation was concentrated principally at the Capitol, where 100,000 persons heard the ceremonies, and at the White House, where 200,000 spectators were covered. In addition, a number of blocks of Pennsylvania avenue along the parade route were covered by loudspeakers mounted on special poles.

The throngs in the Capitol heard the same word picture of the ceremonies as did the radio audience, for the sound system had tied in with the radio network microphones. The installation was made by the American Amplifier and Television Corporation, RCA Commercial Sound Distributor in Washington. C. H. Maher, president of AATC, directed the installation.

Twenty-four RCA reentrant trumpets were installed in the White House area, powered by 15-watt mechanisms. In addition, nine 25-watt units were used. These units, especially designed for outdoor use, have the trumpet compressed

Sound systems have even invaded the snow-covered mountain tops at Cannon Mountain and Mount Lafayette. An odd coincidence, the equipment used is Lafayette.

into about one-half actual length. They are said to be more efficient than former types, and more easily installed. Twelve 50-watt amplifiers provided the 600 watts of power used there.

Many of the loudspeaker units at that location were mounted on specially erected 35-foot telephone poles. Wires were stretched on poles, trees, and along buildings to cover the area from a control booth located in a corner of the yard of the Treasury building. Observers were placed at strategic points in the area to report to the control booth when volume adjustments or other changes were required.

At the Capitol grounds an additional 600 watts of power was provided for several banks of 100- and 15-watt speakers. Microphones were placed on the rostrum and on the Marine Band stand. The control room for this system was under the Capitol steps.

Legislative Halls

One by one our state capitols are installing sound equipment in their legislative halls. Connecticut . . . North Dakota and now Oklahoma. State

Bert Bowen, Oklahoma House of Representatives reading clerk, sits at his desk and reads into a Shure Brothers microphone. The equipment is rented from Fentress Sound, Oklahoma City.

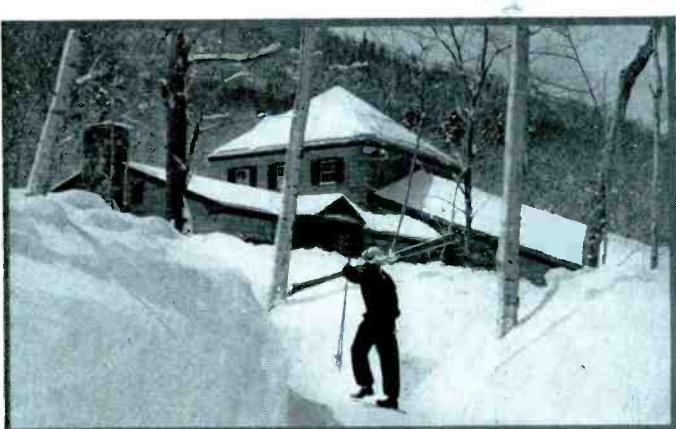
legislatures and city councils can put p-a installations to great advantage. Their meeting halls are usually of large size making it difficult for an individual speaker to be heard comfortably. They are often of outmoded design with acoustic conditions badly in need of correction.

Before the installation of the amplifying equipment in the Oklahoma Capitol, by Fentress Sound Equipment Co., Bell Telephone Building, Oklahoma City, Oklahoma, representatives in the rear of the house would complain that a bill could pass and the governor could sign it and they wouldn't even know about it.

The p-a system is somewhat simpler than that usually employed in legislative halls elsewhere. An Operadio stock Model 855 amplifier is used to drive a single heavy-duty 12-inch Operadio speaker mounted in the University Laboratory Model RCP12, 360-degree baf-

(Continued on page 21)

When Glenn Miller goes traveling next spring, the lovely Dorothy Claire will sing to his audiences through the Electro Voice microphone of a recently acquired Allied system.



TUNING INDICATORS

By M. HELLER

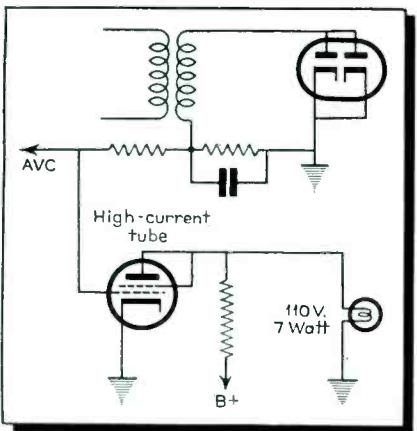


Fig. 1. An early type of tuning indicator was connected in the plate circuit of a high-current vacuum tube amplifier and increased its light intensity as the station was tuned to resonance.

IN THE days before avc, the listening public had to tune to stations on their receivers by judging the maximum volume. At times the very house would shake. In spite of avc, many still tune by judging maximum volume, but we are spared the other inconvenience. Many of the women folk would use the tuning control as a volume control. And, they still do! In some cases, stations were logged or, in other words, the dial was calibrated, stations were selected according to the logged setting, without tuning! With ganged tuning, illuminated dials were introduced, but this made little difference . . . the same evils continued.

AVC

With the introduction of avc, tuning trouble really started. The first sets appeared to have broad tuning due to the tendency of avc to maintain constant output, even when tuned to one side of resonance. The result was that most of the time the set was mistuned and distortion resulted. During periods when the station wasn't modulated only an experienced operator could tune in the station. Others would lose patience. So, visual tuning indicators filled a genuine need.

Early Indicators

The first indicators were standard milliammeters connected in the plate or cathode circuit of the r-f or i-f stages

(or both r-f and i-f). When in the cathode, by-passing was necessary to keep the cathode at ground potential, the meter acting as a bias resistor. Zenith had a meter in the form of a bull's eye.

Shadowgraph

The next type of indicator was the shadowgraph. This was a meter movement in which a shadow replaced the needle, the light of a pilot lamp showing through a translucent screen over which an arm was moved. Another type of shadowgraph increases light intensity in proportion to the avc voltage. The circuit is shown in Fig. 1. A high current vacuum tube voltmeter, or avc amplifier, has its grid connected to the avc bus. A plate voltage dropping resistor of such a value that the 7 watt,

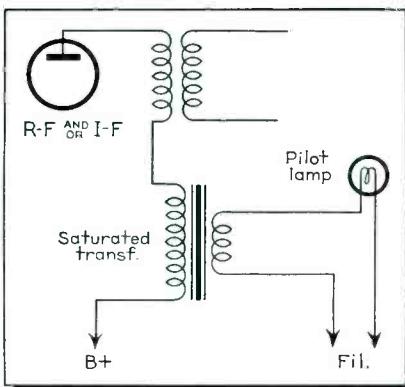


Fig. 2. Grigsby-Grunow employed a saturated transformer to accomplish dim-light tuning when station resonance was approached. The transformer was connected in the plate return circuits.

110-volt lamp gets normal voltage when a powerful signal is tuned in, provides sufficient IR drop to dim the lamp when no carrier is being received. A high plate voltage is imperative for a reasonable range. The lamp also serves as a dial light. The action is as follows: when no avc voltage is present the grid bias on the triode is zero, causing the tube to draw a heavy plate current. This causes a large IR drop in the plate resistor so the lamp burns dimly. With a signal as avc bias is developed, the tube draws less current, raising the lamp voltage in proportion to the

strength of the radio frequency carrier.

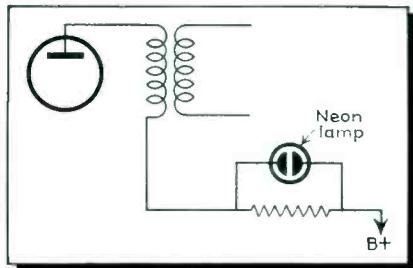
Neon Indicators

Another type of indicator giving a light proportional to the signal was the long neon tube type of flash tuning. This tube had electrodes at the ends of a long tube which caused the neon gas to glow in a length proportional to voltage across the electrodes. Atwater Kent and Fada were among the early manufacturers to use this scheme.

Dim-Light Tuning

Grigsby-Grunow, in their early Majestics, had a very satisfactory method of running a pilot light as a tuning indicator in an inverse manner; that is, as the signal was turned in, the lamp got dimmer instead of brighter. Their idea was to use a saturated transformer, the primary of which was in the r-f or i-f plate circuit and the secondary was in series with a pilot lamp connected to the filament winding of the power transformer. When no avc voltage was being generated, the stage or stages in question would draw maximum plate current which saturated the core of this transformer. The secondary, acting as a choke, would then offer a very low impedance to the flow of lamp current, so the lamp would burn brightly. As the avc voltage increased, the plate current decreased, the core became less saturated and the secondary impedance would increase, causing the lamp to dim roughly in proportion to the signal voltage. It wasn't exactly proportional because none of these core effects are linear. For just a few considerations, the eddy currents in the core increase as the square of

Fig. 3. A neon lamp connected across a dropping resistor in the r-f and i-f plate returns was another form of tuning indicator employed in earlier receiver models that used avc.



the flux density while the hysteresis effects increase by approximately the 1.6 power of the flux density. But the scheme was workable and diagram should be remembered for other possible applications which active experimenters may have. (See Fig. 2.)

Another type of inverse, or null indicator is shown in Fig. 3. This one uses a neon lamp across a plate drop resistor which acts as a proportional device until the plate current gets too low. At some definite current, the IR drop will not be sufficient to maintain ignition of the neon, so the lamp will go out.

Colorama Tuning

A combination red and green light indicating system was used by General Electric in some early models. A saturated transformer similar to the one previously described was used to operate a red light in the inverse manner so that, with no signal the red light burned brightly. A green light was connected in parallel with the transformer secondary. (See Fig. 4.) With no signal, this lamp was in parallel with a very low impedance winding, hence it had very low voltage across it.

As a signal was tuned in, the red lamp would decrease in brilliance and the green one would come up. With a strong signal, only the green was seen. This device was called "Colorama" tuning.¹

Relays

A few receivers were equipped with high resistance plate circuit relays which switched in different lights when a station of sufficient carrier level was tuned in. This device operated similar to the previous one except that there was no proportionality—no gradual effect. It was a straight switch. (See Fig. 5.)

A positive operating proportional neon or argon indicator is shown in

Fig. 4. General Electric utilized a system of red and green dial lamps and a special saturated core transformer in a system called Colorama Tuning.

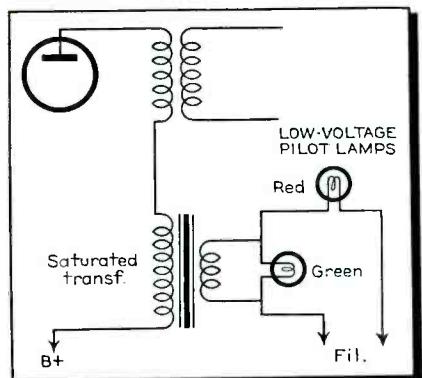


Fig. 6 in which the neon lamp is connected between plate and ground. The adjustable 10,000-ohm rheostate is set so that the lamp is just out when no signal is being received. When a station comes in avc bias increases and the IR drop in the rheostat decreases. This raises the voltage on the neon lamp and, when once ignited, the brilliance is proportional to the strength of the signal. Readjustment of the rheostat will probably be necessary when either the tube or the lamp ages or when the tube is replaced. Neon lamps also have photo sensitivity, being more or less affected by light. They also have temperature effects, changing breakdown voltage with changes in temperature. While neither of these may not be serious for many applications it is well to be aware of them.

AVC Action

When avc was first introduced, there were several systems which accomplished avc action—decreasing ampli-

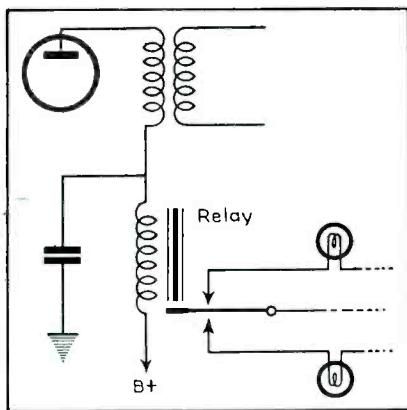


Fig. 5. Some receivers were equipped with a high resistance plate circuit relay which would light a pilot lamp when a carrier of sufficient intensity was being received.

fier gain as a signal increased in strength. Now, only one system survives and this system is too well known to warrant description. Although most receivers are designed to use the combination diode-triode or diode-pentode type of second detector-avc-first audio tube, some are using a separate triode or even a diode-triode for diode detection and avc only. Don't be fooled when servicing a set of this type. A 6H6 dual diode is sometimes used for detection and delayed avc action, allowing a signal to come up to a certain strength before avc action sets in.

Visual Indicator Tubes

The most familiar tuning indicator now in use is, of course, the electron-ray tube, better known as an "eye". This name probably started when RCA featured the tube when first developed,

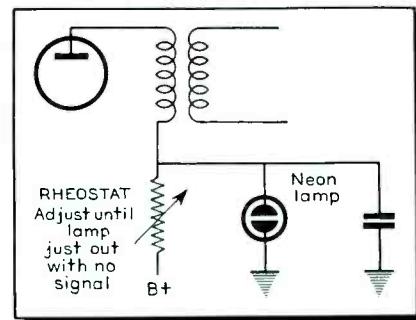


Fig. 6. Another form of neon lamp tuning indicator was connected between plate return and ground with a rheostat control for its action. Readjustment was required only if changes were made.

advertising it as a "magic eye" (which it certainly is). There are two general types, sharp cut-off such as the original 6E5 and remote, or extended cut-off, as exemplified by the 6U5/6G5. These tubes have standard 6.3 volt, 0.3 amp heaters. A 6N5 is available with 6.3 volts at only 0.15 amps and with an intermediate cut-off characteristic. These tubes have a triode operating as a d-c amplifier and an electron-ray indicator which produces a glow on a fluorescent screen similar to a regular cathode ray tube. An electron shield casts a shadow which varies from 100 degrees to zero degrees, depending on the voltage on the control electrode or, in avc practice, depending upon the strength of the received carrier.² A special bull's eye effect with an electron tube has been made to replace the bull's eye meter mentioned early in this article in a Zenith set.

Dual Indicator

A dual indicator tube is available which contains two separate ray-control electrodes mounted on opposite sides of the cathode and connected to individual base pins. This is the 6AF6G. No triode is included as in the other eye tubes. One section is used up to a certain avc level which almost closes the shadow angle at which time the other section takes over the carries on to the highest level. In this method of application, the eye is never called upon to work in a closed position and good sensitivity is maintained throughout the entire range of signal levels ever encountered.

A final note about other applications of the eye tubes may not be amiss. They are now very popular for measuring the proper recording level in many home recorders. Other uses are balance indicators in bridge circuits, indicators in vacuum tube voltmeters, modulation or over-modulation indicators in "ham" stations, etc.

²"Visual Indicator Tubes," by R. Lorenzen, SERVICE, Oct. 1938, p. 7; also Nov. 1938, p. 10.

CIRCUITS

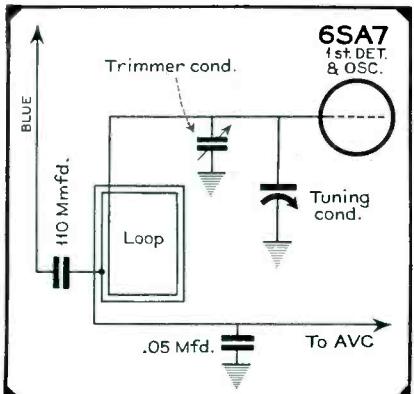


Fig. 2. Stewart Warner 11-5W.

THREE are two trends that are becoming more and more obvious each month, and it behooves the active Service Man not already aware of them to take heed. First, the immense growth in the popularity of record playing mechanisms has influenced those customers who would be expected to buy console radio sets to the extent that console sets, as such, are definitely on their way out. Phonograph combinations have taken their place!

The second is the phenomenal growth of f-m in such a short time. Yes, you've heard this one before, but do you know that many dealers are already refusing to handle any combination above \$150.00 that doesn't include an f-m band? The one exception to this refusal is the further trend to make f-m optional when the receiver is sold. Provision is made in these sets to allow the installation of an f-m section at a later date. This seems very feasible, at least in areas where no f-m stations are now in operation or projected in the near future.

Ansley has provided room for such an additional f-m chassis in many of their present models. Even the smaller manufacturers are coming along, with new f-m models and/or adaptors. The adaptor seems to us to have a doubtful future, not because it won't allow satisfactory f-m reception, but because one needs a high-quality audio end and an r-f end capable of passing the full audio range in order to obtain all the benefits that ultra-high-frequency f-m has to offer. An adaptor feeding a compact or even a typical console will leave much to be desired in most cases.

Then, where will the handsome flower vase or clock that formerly topped the radio set be put when the cumbersome f-m converter will have to sit there?

Stewart Warner 11-8R

The Stewart Warner 11-8R series are 7-tube, phonograph-radio recorder

See Front Cover

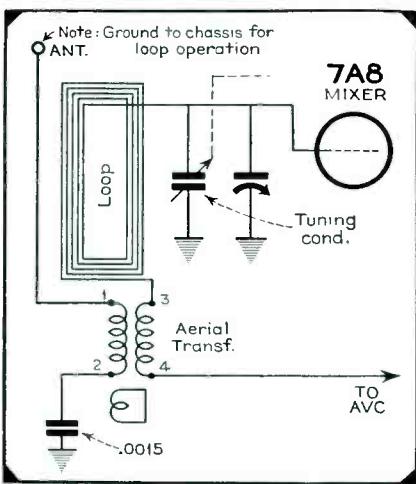
By HENRY HOWARD

Garod 4014

Garod's Model 4014 is a 13-tube, 4-band, a-c, d-c receiver that uses two banks of 300-ma tubes, with push-pull parallel 25L6s in the power stages fed by a 6SQ7 first audio and a 6J5 inverter. Three of the four 25L6 heaters, together with the two 25Z6 heaters, are wired in series and powered directly from the line. The other eight heaters and several No. 44 pilot lamps (one pair of lamps is switched into the circuit for each wave band, making 8 lamps in all) together with a L49DJ plug-in resistor form the second bank.

The 6SA7 converter tube is excited by a separate 6J5 oscillator by means of cathode coupling wherein the cathode, 2000 ohms above ground, feeds grid number 1 of the 6SA7 through a 0.001-mfd blocking condenser. The two 25Z6 rectifiers with parallel elements supply the high plate current. In order to divide the load evenly, a 30-ohm resistor is inserted in series with each tube. When the phonograph is in operation the B plus is cut from the entire r-f section. The only signal that could possibly get through in this set would be a ham phone station next door! One of the bands provided is a long-wave beacon and commercial, from 140 to 370 kc. A loop is used in the broadcast band only. A high Q, iron-core loading coil is used in series with the loop.

Fig. 3. Philco PT2, PT6 auto set.



Loop Circuits

The Stewart Warner 11-5W, 5-tube, single-band loop compact has a tap on the loop for an antenna connection. The loop thus acts as an autotransformer when an external antenna is used. (See Fig. 2.)

The Philco PT2 and PT6 have an antenna coupling transformer whose secondary is connected in series with the loop. The primary may be connected to an optional external antenna for greater pickup. (See Fig. 3.)

We notice several makes of loop sets with loading coils in series with the loop on the broadcast band. The combination of the coil and loop has less

distributed capacity than a large loop alone.

Wells-Gardner 7C15

Wells Gardner has an interesting auto set in the Series 7C15 7-tube automatic tuned job. The 6SQ7 second detector has a local distance switch which grounds the cathode in "local" position. In "distance" position, a 2000-ohm resistor, properly by-passed, is inserted in series with the cathode. The IR drop in this resistor bucks the avc bias making the net bias less negative and thus increases the gain in the r-f and i-f stages. One diode of the detector is connected to the avc bus at the input to the i-f stage on the far side of the avc filter.

Stromberg-Carlson's Model 535 15-tube phonograph combinations have four tuning ranges, the highest frequency range being for f-m. The record players are equipped with a 1-ounce sapphire pickup used in conjunction with special equalizer circuits. This very light weight pickup reduces record wear considerably and eliminates the frequent changing of needles. We might note here that it is generally impractical to go to much lighter weights because centrifugal force tends to lift the needle out of the groove, especially near the outer edge of 12-inch records. This receiver also has isolated avc using a 6SR7 second detector-first audio. A 6SC7 combined second stage and inverter follows and a pair of 6V6GTs does for the power output stage. Degeneration is obtained by connecting a 1.5 meg resistor from one of the 6V6GT plates to the plate of the first 6SC7 section.

Silvertone 6641

Sear's Silvertone Model 6641 is a 4-tube battery personal receiver in which it is really a pleasure to change batteries. (See Fig. 4.) After much squirming to replace batteries in other

personals we take our hats off to the maker of this one. You simply lift a cover, drop in the batteries and connect them. A spring automatically holds them in place. This set uses a 1R5 oscillator with screen grid feedback and two iron core i-fs, the first with double tuning, the second with only the secondary tuned. (See Fig. 5.)

Stromberg-Carlson 500

In the Series 500 Stromberg-Carlson 6-tube, a-c, d-c sets a low impedance untuned coupling is used between the r-f and converter stages. The plate resistor is only 1000 ohms and the following grid resistor only 18,000 ohms with 500 mfd as a coupling condenser. (See Fig. 6.) This provides uniform gain throughout the entire broadcast band and also keeps the noise down, especially when no i-f trap is used. Note also the grounded loop and the large grid leak on the r-f grid.

Garod Hi-fidelity

Garod's 14-tube high fidelity broadcast (only) receiver has quite a line-up. It features dual p-m speakers; a double-section, 10-kc, low-pass filter; two i-f stages and a whopper of an a-f system with multi-degeneration. The filter may be switched in when the 10,000-cycle beat of an adjacent channel station becomes objectionable. Separate chassis are used for the amplifier and tuner sections with individual power supplies incorporated in each section. A 6X5GT (with its own line transformer) supplies the B power for the r-f, i-f, second detector and that part of the audio amplifier included on the tuner chassis. Another transformer with a 5U4G rectifier supplies the power requirements for the audio section of the receiver.

The a-f section includes a 6J5 first a-f, with treble tone control; a cascaded dual triode 6C8G, with bass tone control and inverse feedback to the 6J5 cathode; another 6J5 feeding two more 6J5s in an amplifier-inverter relationship; and, finally, a pair of 6L6s. All

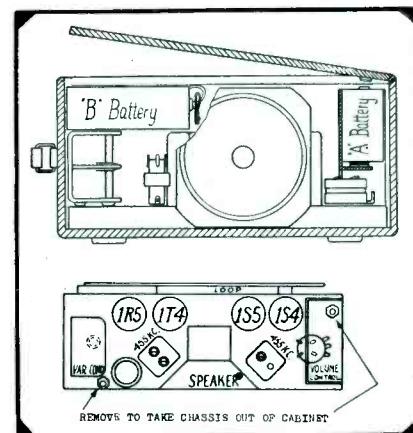


Fig. 4. Silvertone 6641 chassis.

the 6J5s have no cathode bypassing, giving a certain amount of degeneration in each of the stages. Also, the 6J5 third a-f stage receives feedback voltage from the low side of the output transformer. A 50-ohm resistor is inserted in each 616 control grid and the cathode bias resistor is adequately bypassed for increased stability and to cut any odd harmonics that might have sneaked through this elaborate lineup. The speakers are built for bass and treble of course.

Another Garod, a-c d-c Model 105, has an antenna in the line cord for local broadcast reception. A screw terminal is provided for an external antenna for weak signals.

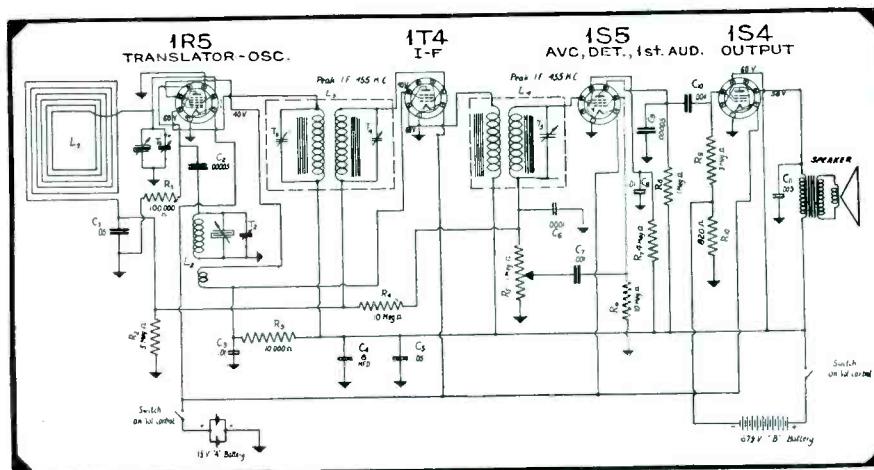
Emerson ER369, ER370

The Emerson Models ER369 and ER370 are 8-tube, 3-band phonograph combinations which use an antenna plate for the short-wave bands and a loop antenna for the broadcast band. A 6SQ7GT functions as first a-f and another as an inverter to feed a 6AE7GT wired in push pull. The latter is dynamically coupled to and drives a pair of 6AC5GTs for high quality output. In this receiver, the i-f cathode is opened for phonograph operation. (See Fig. 7.)

Wave Traps

In the old days when sets were built from theoretical considerations with little practical experience, wave traps were few and far between. Nowadays, they are as common as phase inverters. We have endeavored to pick out unusual methods of applying wave traps whenever we came across new data sheets and we have presented many of them in these articles. Traps don't ordinarily get along well in loop circuits, but someone always finds a new way to get them in. These traps, of course, are rejection circuits tuned to the intermediate frequency and are meant to

Fig. 5. Silvertone 6641 personal receiver.



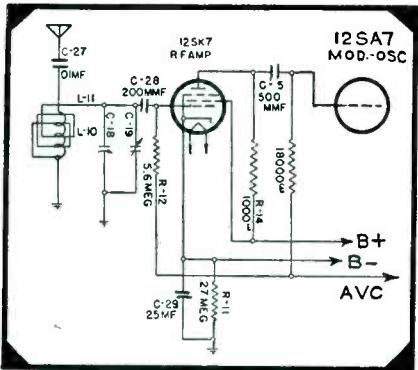


Fig. 6. Stromberg-Carlson 500.

prevent pickup of commercial code stations on that frequency. Model 1591, of Silvertone, is a 9-tube, 3-band super-heterodyne with one spread band using a loop for broadcast and a short-wave plate antenna. Six push buttons are provided for automatic tuning. A 6U7G tuned r-f amplifier acts as preselector in the manual broadcast-band position only. When automatic tuning is used, the r-f stage is by-passed and, as this cuts down the selectivity, a wave trap is switched in to attenuate i-f interference. This is a series trap running from the first detector grid to ground. For

short-wave reception many manufacturers have evidently found the electrostatic antenna superior to a small loop. Others, including RCA, use a wire draped around the console. It would seem that the old-time impressive outside antennas are becoming obsolete, although there is usually a terminal or wire labeled "ANT" just in case. . . .

Crosley, in their Model 49BZ, has installed a wave trap in a novel circuit which makes it particularly effective when an external antenna is used on either broadcast or short waves, although it is in the circuit at all times and does some good on loop pickup. (See Fig. 8.) The loop is used for broadcast only. The antenna is coupled to the loop by means of a 55-ohm high impedance coupling coil with the trap shunting this antenna primary. The loop and the short-wave antenna transformer are loosely coupled to the converter tube through a 50-mmfd coupling condenser. This permits more selectivity than a direct grid connection which is usually used.

* * *

Fig. 7. The Emerson Models ER369, ER370 employ a 6AE7GT wired-in push-pull to drive a pair of dynamically coupled 6AC5GTs. The receiver is an 8-tube phonograph combination.

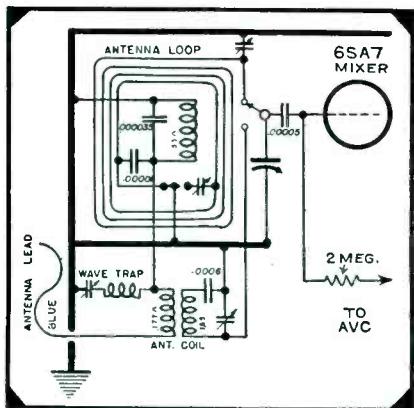
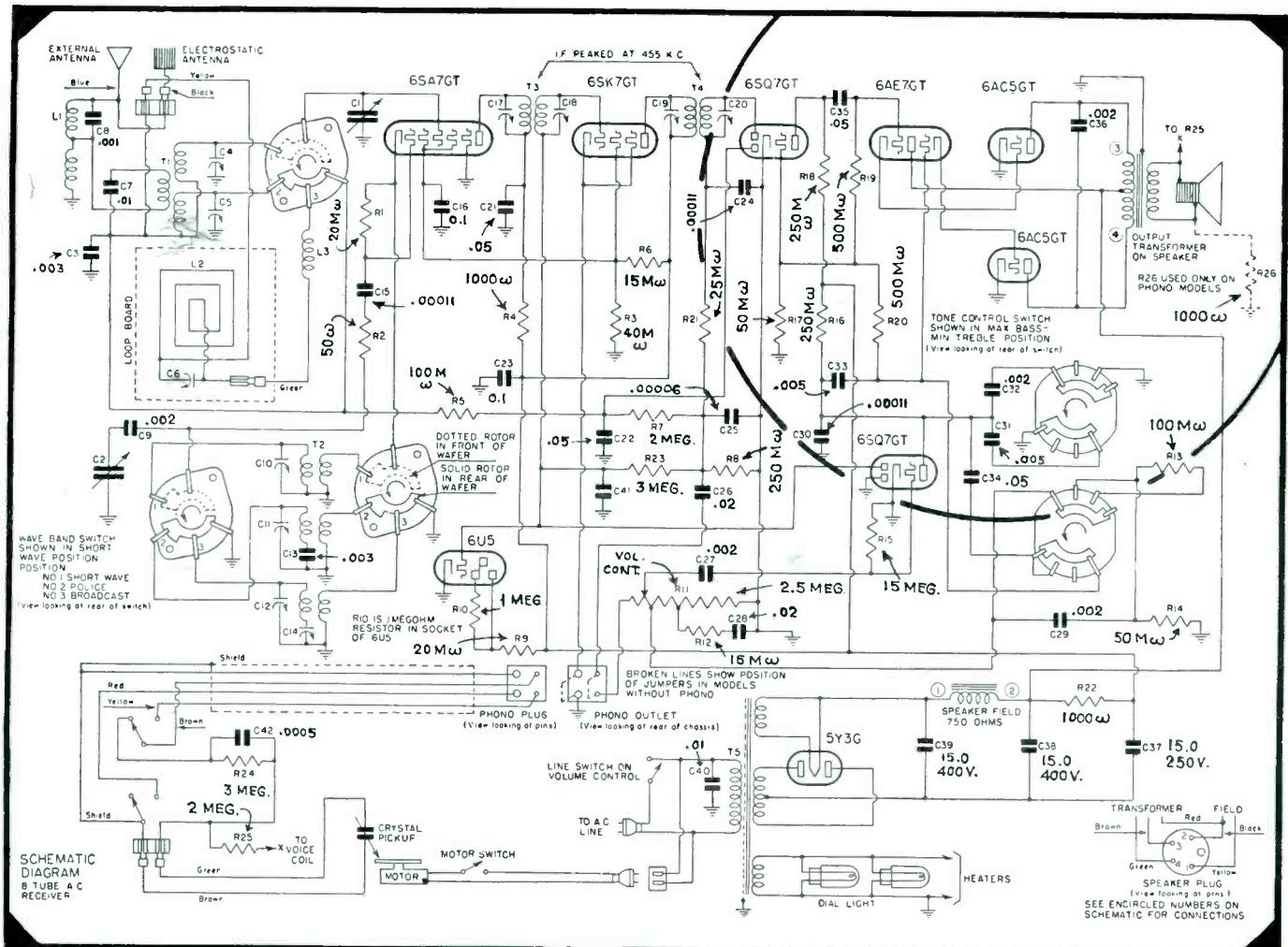


Fig. 8. Crosley 49BZ.

RCA 1941 RECEIVERS

Reducing sensitivity in noisy localities: It may be found necessary in certain localities to reduce the sensitivity of these receivers in order to reduce the effect of noise pickup in between stations. This can be done by adding larger resistors in the i-f cathode connected between the existing 100 ohms and ground with a 110 mfd in shunt with the added resistor. On the receivers which do not use a 100 ohm resistor in the i-f cathode, the resistor and capacity combination should be added between the cathode and ground. The value of the resistor could be anything between 500 and 3,000 ohms depending upon the reduction in sensitivity required.



PREACH WHAT YOU PRACTICE

By GEORGE B. MOREHOUSE

DURING the early days of radio, a great deal of pride was taken in the set built on the kitchen table, after the dinner dishes were cleared away, and the licensed ham was considered some kind of an authority in his neighborhood, as to what made the wheels go around.

From this point to a service business is more or less a natural evolution and some of us have learned things during this formative period which we have applied successfully in building and operating a service shop. This has probably been more evident in the smaller towns.

There is, however, no magic wand that one can wave while chanting some mystic phrases, that will produce success. Good common horse sense, a willingness to work and study, a realization that you are dealing with people like yourself who have impulses and prejudices, who are reasonable and unreasonable, should awaken one to the necessity of *becoming a student of human nature*. This subject is not learned in the class room or through a correspondence school course, but once mastered it pays dividends. It is an asset you cannot invoice, it may not be listed in your capital stock, but it forms, to my opinion, the most important part of your business.

How can we go about applying a knowledge of human nature, granting that we are able to acquire such a knowledge in a sufficiently short time to have it do us any good? In answer to this question, let me present a few practical rules which have proved successful in my own case.

Take a genuine interest in your customer's problem, no matter how trivial it may seem to you. Explain in language she can understand, without assuming an air

of superior knowledge.

Have the ability to render service in the minimum amount of time. This ability inspires self confidence and creates confidence in the mind of your customer besides it means more money.

Have the best test equipment you can afford. Become an expert in the use of the same, to the point of being a showman without appearing to do so.

Keep a complete set of service manuals and learn how to get the most from them.

Read two or three good radio magazines, study each issue, then keep them for ready reference.

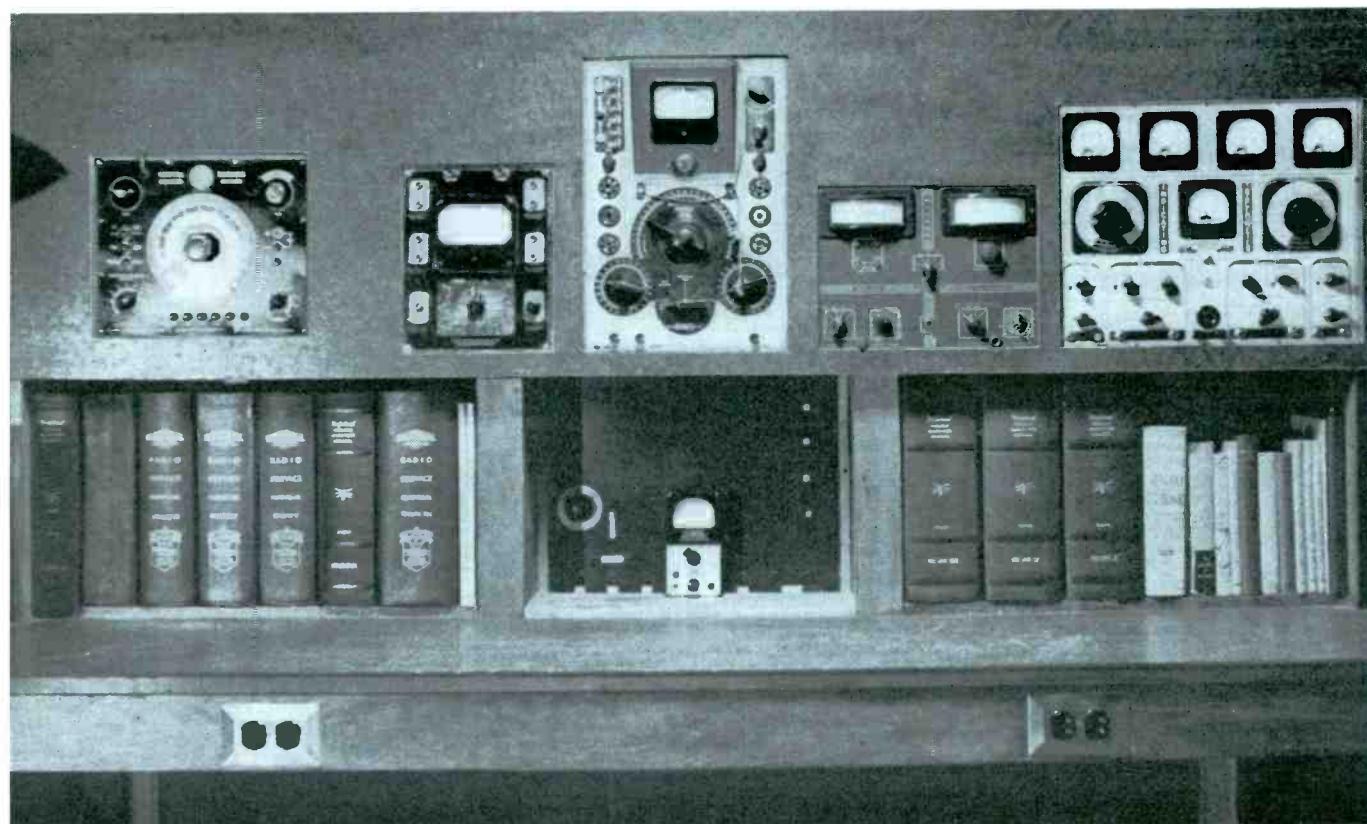
Create a demand for your services as a lecturer on radio. A good place to start is in the local high school before the science class. It should be taken for granted that you know your subject, but you will have to learn how to impart that knowledge to others in an interesting way.

Advertise in a manner that will keep your name, phone number and location in the mind of prospective customers, but do not neglect the grape vine method, because like "Old man river it just keeps rolling along."

No free inspections or service calls; no hesitation about setting a price for your labor that shows a profit and stay with those prices.

Take an active part in the civic life of your community, it may take some of your time, but it is time well spent.

George B. Morehouse, Box 161, Howard, Kansas, sets up a front to tell his customers and prospects exactly how good his services are. Close inspection will reveal not only a sensible array of test equipment but also an imposing collection of service texts.





COMMUNICATIONS RECEIVER

NATIONAL NC200

THE NATIONAL NC200 communications receiver is a 12-tube superheterodyne covering a continuous frequency range of from 490 kc to 30 mc and band-spreading 10, 20, 40 and 80 meter amateur bands. A new high frequency oscillator design has been developed which eliminates the detuning effect of the r-f gain control and the even more undesirable motor-boating or fluttering which occurs in most receivers when tuning in strong high frequency signals, it is said. Perhaps the best way to prove the exceptional performance of the new circuit is in the 10-meter band where a line voltage shift from 100 to 120 volts produces less than 1000 cycles change in tuning. This is a variation of less than 0.003 percent. Frequency drift has been reduced to minimum through the use

of temperature compensating capacitors not only in the high frequency oscillator circuits, but in the r-f and first detector circuits as well.

The sensitivity of the NC200 is such that an input signal of 1 microvolt will provide 1 watt of audio output. New r-f coupling circuits have made possible the maintenance of full sensitivity up to the highest frequencies covered by the receiver, it is said. Molded polystyrene coil forms are used in all circuits, both r-f and i-f, thus assuring the freedom from circuit losses or detuning which might otherwise be caused by

Individual coils, individually shielded is one of the unusual features of the National NC200 communications receiver. The band switch moves the entire bank of coils and the only coil connected in the circuit is the one being used.

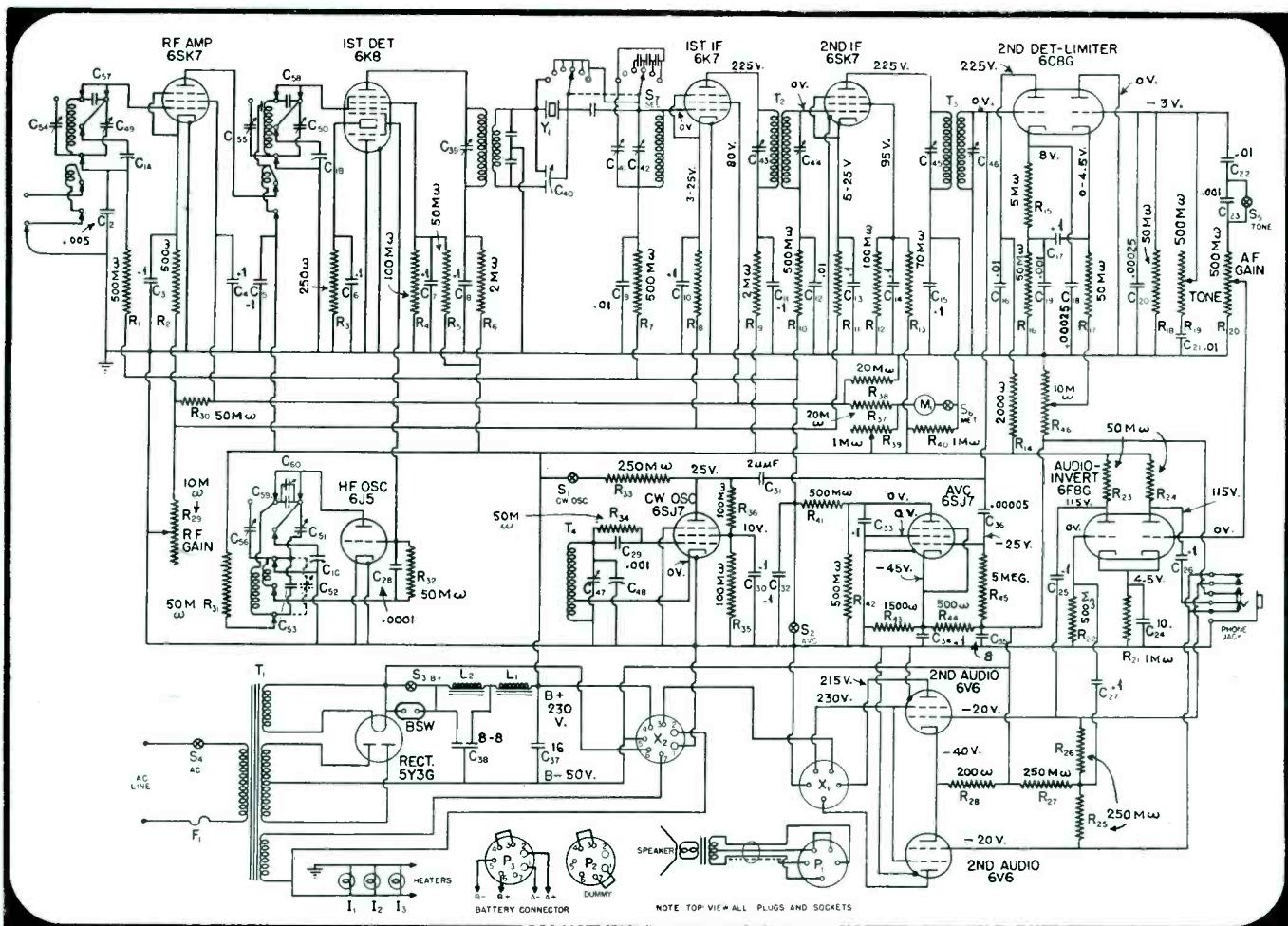
humidity effects. Variable condenser insulators, tube sockets, etc., are of Isolantite.

Circuit

The circuit employed on all ranges consists of one stage of radio frequency amplification, a separate first detector and stabilized high frequency oscillator, two intermediate frequency stages, an infinite impedance second detector, a self-balancing phase inverter and audio amplifier, and a push-pull audio output stage.

The second detector utilizes one set of elements of a dual triode; the other set of elements is utilized for a series valve noise limiter. Separate tubes are used in the automatic volume control and beat frequency oscillator circuits.

(Continued on page 14)



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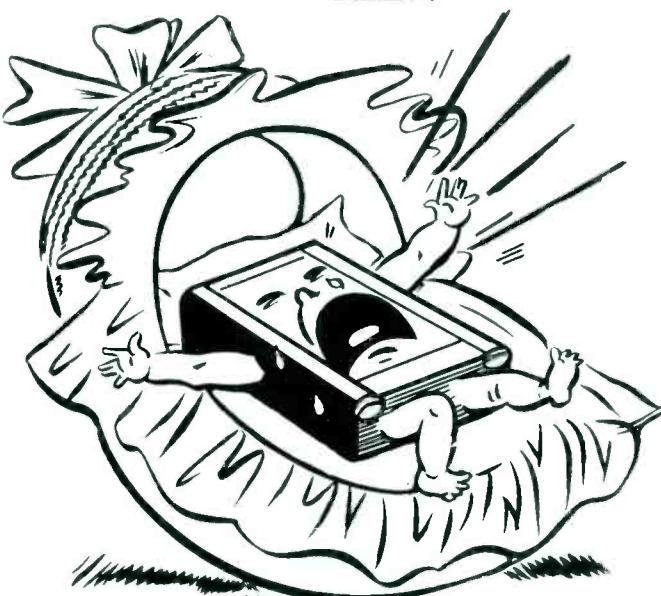
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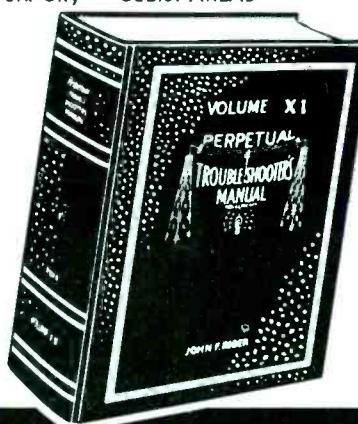
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THE TRIPPLET ELECTRICAL INSTRUMENT CO.
Bluffton, Ohio

COMMUNICATIONS

RECEIVER

(Continued from page 12)

The latter is coupled to the second detector for c-w reception.

A crystal filter is connected between the first detector and first i-f amplifier tubes.

Tuning System

The master tuning capacitor C-1 and six sets of coils are used to tune the 490 to 30,000 kilocycle range of the receiver. By means of a newly developed band change mechanism, four of these same coil sets are made to spread the 10, 20, 40 and 80 meter amateur bands uniformly over the major portion of the tuning dial (HRO system). All ten ranges are calibrated.

All transformer coils of the r-f amplifier, first detector and h-f oscillator stages with their associated padder and air-dielectric trimmer capacitors are mounted in a rigid aluminum casting which slides the length of the chassis, being moved by the main tuning control. The various coil assemblies are fitted with heavy contact pins which engage spring contactors mounted immediately under the variable tuning capacitor. This system permits thorough shielding of each individual coil while, at the same time, the coils in use are moved to the best position in the chassis, giving shortest leads to the tubes and master tuning capacitor, and all other coils are completely disconnected from the circuit.

Selectivity

Six uniform steps of selectivity and a variable phasing control allow the receiver to be adjusted to suitable operating condition, a desirable feature for both short-wave communication and broadcast-band reception. Any degree of selectivity between that of full single signal operation and wideband broadcast reception is available, the ratio between the two being almost forty to one.

Noise Limiter

The noise limiter of the NC200 receiver is of the series valve type. A threshold control on the front panel permits adjustment of the level at which limiting action starts.

Signal Strength Meter

A 0 to 1 milliammeter, serving as a signal strength meter, is front panel mounted. It is fitted with a scale graduated in S-units from 1 to 9 and in db above S-9 from 0 to 40 db. The bridge circuit, in which the meter is connected,

(Continued on page 27)



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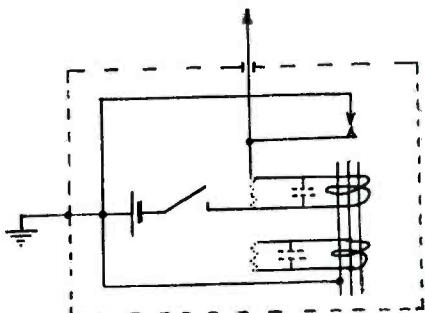
GENERAL PEN-OSCIL-LITE

THE General Pen-Oscil-Lite is a shielded, self-contained, self-powered signal generator of the impact excitation (multi-vibrator) type which generates a composite audio, r-f and i-f signal useful in trouble shooting, and for a large number of tests.

When viewed on the oscilloscope, the output of the Pen-Oscil-Lite is seen to consist of a square-topped wave, followed by an extremely steep wave-front



The General Pen-Oscil-Lite is a shielded, self-contained, self-powered signal generator of the impact excitation type.



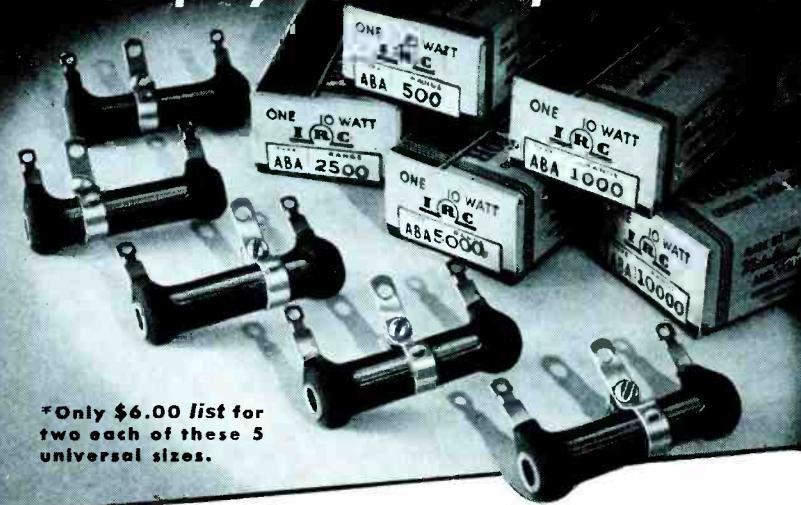
pulse. This pulse has a peak value in excess of 125 volts into a 10 meg load. Because of the steepness of this pulse, transients are created that cover the spectrum continuously from audio up to the ultra-high-frequencies. These transients are modulated at the interrupter frequency of 700 cycles.

Among the design and construction factors claimed for this device are: Special high-permeability alloys in the magnetic structure, heat treated after forming; special contact alloy material; proper relationship and adjustment of electro-mechanical resonances; factors to quench the spark at the interrupter contacts since sparkless operation is essential for proper wave form and stability.

A single small flashlight cell is used. The drain on the cell is approximately 20 ma.

Although the output of the unit is rather high for direct input to an antenna or r-f circuit, its effective input to the receiver can be attenuated by bringing the tip closer to or further from the circuit under test. The radiation occurs only from tip of the instrument and is rather directional. Increasing the effective length of the tip, by adding a piece of wire to it will, of course, increase the distance at which the signal can be picked up.

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Book Review . . .

THE MYSTERIES OF TELEVISION,
by Arthur Van Dyck. Published by
The House of Little Books, 156 Fifth
Ave., New York City, 55 pages, 8½ by
11 inches, illustrated, price \$1.00. Available
also from Bryan Davis Publishing
Co., Inc., 19 East 47th St., New York
City, for \$1.00 prepaid.

Written by one of Radio's foremost engineering authorities, this booklet presents in a simple lucid style the underlying principles of television transmission and reception, as well as a brief history of the art. Crammed full of facts, it will answer many puzzling television questions that be-

set the Service Man. Chapters on the future of television and also that of facsimile and the broader field of electron optics are also included in the book. These are followed by a dissertation on television studios and programming.

Other features are six pages of questions and answers on television, a section devoted to definitions of television terms, and a reading list of books on television for both technical and non-technical readers.

Because of its simple semi-technical style, this book is not only recommended as an easily read television information source for the Service Man, but also as one that he can readily recommend to his lay friends and customers who might express interest in the art.

L. M.

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all your eggs in one basket!*

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- ★ AC voltmeter 0/10/50/500/1000.
- ★ DC milliammeter 0/1/10/100/1000.
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- ★ AC amps 0/2.5/5/25.
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RADIO CITY PRODUCTS CO., Inc.
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Catalogs, Bulletins, etc. . .

Copies of the catalogs and bulletins discussed below may be obtained directly from the respective manufacturers mentioned. Write for them today!

• • • Practical application data and listings of electrolytic and oil motor-starting capacitors are contained in the 1941 edition of the Aerovox Industrial Capacitors Manual. Motor types, together with capacitor requirements are listed alphabetically.

• • • From Cinaudagraph, 2 Sellick St., Stamford, Conn., comes an 8-page, 2-color catalog illustrating and describing their radio and p-a speakers, horns and woofer-tweeter speakers.

• • • Volume 3 of Emerson Service Notes has just come off the press. It covers chassis BA to BY, containing circuit diagrams and service notes. From Emerson Radio and Phonograph Corp., 111 Eighth Ave., New York City, at a nominal charge.

• • • Three new catalogs are available from Howard Radio Co., 1731 Belmont Ave., Chicago. The No. 490 Technical Manual contains charts and schematics on the Howard 14-tube professional receiver as well as several pages devoted to receiver measurements. Folder 103 describes Howard re-

cording discs and needles. Folder 104 illustrates and describes communication receivers and accessories.

• • • • A brochure illustrating and describing limited quantity radio sets, parts and accessories specials from Lafayette Radio Corp., 100 Sixth Ave., New York City.

• • • • A brief brochure pointing out radio's contribution to American Democracy—with letters from both Franklin D. Roosevelt and Wendell L. Willkie—from the National Association of Broadcasters, Normandy Building, Washington, D. C.

• • • • From Philco Corp., Allegheny and A Streets, Philadelphia, comes their 52-page 1941 parts and accessories catalog which includes reference information in the form of listings, according to model numbers, of the parts, tubes and batteries required for replacement purposes in the 15 million Philco receivers.

In addition to listings of replacement parts several pages are devoted to test equipment, tools, p-a equipment and other items of interest to the Service Man.

• • • • A bulletin on replacement coils for r-f and i-f circuits from Radex Corp., 1733 Milwaukee Ave., Chicago.

• • • • The 16-page Turner vibrator manual describes and illustrates Turner push-pull vibrators as well as listing replacement requirements for 2-, 4-, 6-, 12- and 32-volt receivers.

Personnel . . .

Mr. A. J. Foute of Drake Manufacturing Co., Chicago, announces the appointment of his son Kenneth, as sales engineer.

Promotions at the Hygrade-Sylvania Emporium, Pa. plant announced by H. W. Zimmer, general manufacturing manager, bring M. D. Burns to the position of factory manager and C. R. Razey to that of factory superintendent. At the Salem, Mass., plant, J. J. Jackman, factory manager, announces the promotion of C. A. Haines to factory superintendent. Hygrade Sylvania Corp. regrettably notifies us of the death of W. Clyde Mahoney, radio tube salesman in the Chicago area.

C. E. Moore, 3118 Linwood Blvd., Kansas City, Mo., has been appointed district sales representative for Ken-Rad tubes for the surrounding territory.

Ed Kirby, formerly director of public relations for the National Association of Broadcasters is on an indefinite leave of absence to take up a tour of duty at the War Department in Washington, D.C., for the purpose of assisting the army in its use of radio throughout the present emergency.

Solar Manufacturing Corp., Bayonne, N.J., have appointed Harry A. Lasure, 2216 W. 11 St., Los Angeles, Cal., as district manager for the State of California. The Ambos-Jones Co., 1085 The Arcade, Cleveland, become industrial sales engineers for Solar in the State of Ohio.

Herb Erickson, 14 Biltmore Ave., Asheville, N. Carolina has been appointed district sales representative for Turner Vibrators and also for Ken-Rad tubes for the surrounding territory.

REALLOCATION

By LYNNE SMEBY

NATIONAL ASSOCIATION OF BROADCASTERS

THE reallocation of the frequencies of most of the broadcast stations brings out four problems in connection with receivers. These four are discussed in this article.

The ten-bay turnstile antenna array of station WIXOJ, Paxton, Mass.

910 Kilocycles

KLX—Oakland, Cal.
KPOF—nr. Denver, Col.
KFK—Greeley, Col.
WSUI—Iowa City, Iowa
WFDF—Flint, Mich.
WCOC—Meridian, Miss.
WGBI—Scranton, Pa.
WQAN—Scranton, Pa.
WJHL—Johnson City, Tenn.
KRRV—Sherman, Texas
WRNL—Richmond, Va.
KVAN—Vancouver, Wash.

920 Kilocycles

KARK—Little Rock, Ark.
KTKC—Visalia, Cal.
WGST—Atlanta, Ga.
WBAA—West Lafayette, Ind.
KFN—Shenandoah, Iowa
WJAR—Providence, R. I.
KUSD—Vermillion, S. D.
KFPY—Spokane, Wash.
WMMN—Fairmont, W. Va.
1,520 Kilocycles
WMEX—Boston, Mass.

WLAC—Nashville, Tenn.
KGA—Spokane, Wash.

1,530 Kilocycles

WHIP—Hammond, Ind.
WKBW—Buffalo, N. Y.
KOMA—Oklahoma City, Okla.
WPRP—Ponce, Puerto Rico.

1,530 Kilocycles

KFBK—Sacramento, Cal.
WCKY—Cincinnati, O.

1,560 Kilocycles

WQXR—New York, N. Y.

1,590 Kilocycles

WBRY—Waterbury, Conn.
WALB—Albany, Ga.
KITE—Kansas City, Mo.
WAKR—Akron, O.

1,600 Kilocycles

KPMC—Bakersfield, Cal.
WCNW—Brooklyn, N. Y.
WWRL—Woodside, N. Y.

I-F Beat

If a station with a strong signal intensity happens to be operating on double the frequency of the intermediate frequency of a receiver there is liable to be a heterodyne whistle. The frequency of 455 kc has been used as the standard intermediate frequency on receivers manufactured in the United States. One main reason for selecting this frequency was that the broadcast frequency of 910 kc was assigned to Canada and, therefore, the possibility of a heterodyne note being produced on a receiver in the United States was at a minimum.

Under the terms of the reallocation several American stations will be moved to 910 kc, thus producing a problem in the cities where these stations are to be located. If a heterodyne note is heard due to this cause the remedy is to shift the i-f to one side or the other slightly. The stations that will move to 910 kc are listed above.

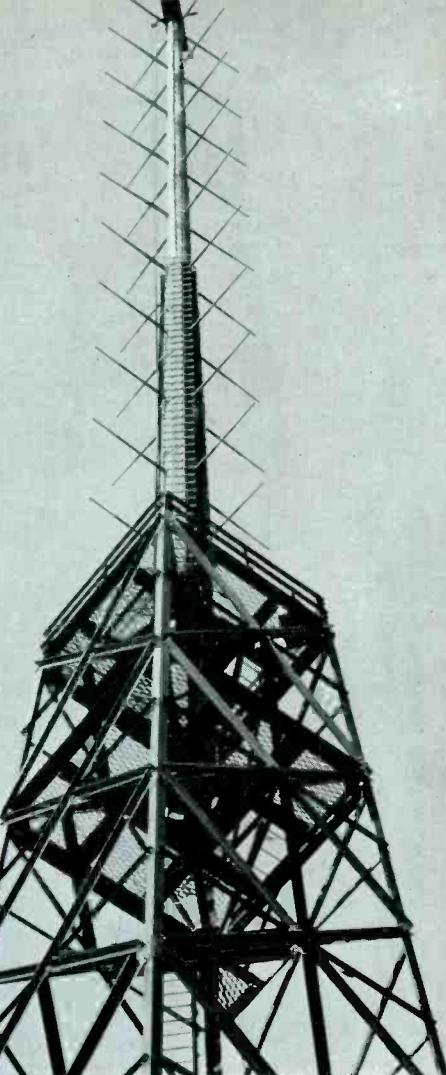
Even though a receiver is designed for an intermediate frequency of 455 kc, the heterodyne oscillator may be off enough so as to cause the type of trouble discussed above on a station operating with a frequency of 920 kc. The remedy for this situation is the same. The stations that will move to 920 kc are also listed above.

Stations Below 1,500 Kc.

In order to provide enough broadcast frequencies so that a logical broadcast allocation structure could be set up among the North American countries it was necessary to extend the standard broadcast band from 1500 to 1600 kc. It is estimated that the percentage of receivers that will not tune to 1600 kc is not very large. It is important where a receiver is within the range of one of the stations that will be in the 1500 to 1600 kc range that the receivers be converted to accept these stations. It is recognized that in some cases it may be uneconomical to attempt to extend the range of an old receiver and in some cases it may be difficult to do so. In most cases it is probable that the range can be extended satisfactorily by shifting the intermediate frequency and by changing the padding condensers on the tuning condensers. The stations that will be between 1500 and 1600 kc are listed above.

Push Buttons

It is estimated that there are ten million push button receivers in use in the country and it will be necessary to reset the buttons on these receivers to the new frequencies. This should be done after March 29 so that the reset can be



accomplished using the broadcast stations' signals rather than using a test oscillator.

The Service Men should make every effort possible to obtain advance orders for resetting push buttons so that after March 29 they can layout regular call routes to follow, thereby making several calls on each trip out of the shop.

Call Letters on Dials

The fourth problem deals with changing the call letters on push buttons and dials. The call letters of push buttons can easily be changed because these are usually a paper insert. Many dials, however, have the call letters of some stations stamped on them. In some cases it may be possible to obliterate the call letters of stations on dials where they do not conform with the station's operating frequency.

REFERENCES FOR P-B INFORMATION

- Mallory Yaxley Radio Service Encyclopedia, Volume 2.
- John F. Rider's Vest Pocket Push-Button Guide.
- RCA's booklet of push-button frequency ranges.
- Manufacturer's Service Notes.
- Perpetual Trouble Shooter's Manuals, by John F. Rider.

(Please turn to next page)

REALLOCATION FREQUENCY LIST

Present New
Frequency Frequency
in kc Mar. 29, 1941

Present New
Frequency Frequency

(CONTINUED)

Note 1—WAPI, Birmingham, Alabama, station to operate on 1170 kc pending adjustment of domestic problems in U. S.
Note 2—KTHS, Hot Springs, Arkansas, at present divides time with KRLH nights on 1040 kc. and operates full-time on 1060 days.

Note 3—KGZK, Kalispell, Montana, may be moved to 1460 kc. instead of 1340 as listed.
CP—Construction permit.
SA—Special authority.
Present frequencies as of January 1, 1941.

• COURTESY - NATIONAL ASSOCIATION OF BROADCASTERS •

(Continued from page 5)

the shown in the accompanying diagram. Only four microphones are used in connection with the system. A Shure Model 55C dynamic is on the reading clerk's desk and an American Model D5T dynamic is on the speaker's desk. The floor leader uses an American Model D9T dynamic. At times the speaker employs an additional lapel microphone which is cut in when he calls for order, etc.

Dance Bands

The gay side of life is not without its need for sound reinforcing equipment. Dance bands and the like present a long overlooked prospect for such apparatus. In fact, better known bands and dance halls purchase new sound equipment as often as twice a year.

Glenn Miller, "America's Number 1 Band," has recently replaced his seven-months-old portable system with a Knight DeLuxe 50-watt Master System designed for portable service. The features of this stock amplifier give a good example of what the typical dance orchestra requires. Flexibility of input connections is one of the most important prerequisites. This amplifier provides six input channels, four high gain and two low gain, with individual volume control for each channel. A master control is also provided for overall volume level. Glenn uses three Electro-Voice microphones during an average evenings routine. A Type V2 velocity is located for best pickup of the entire band, with a 630 dynamic stationed in front of one particular player, to be cut in when needed, enabling him to solo without leaving his place in the bandstand. A Cardak, with an adjustable pickup pattern, is employed in addition, for vocalists, soloists, announcements and general use.

Early in the evening, before the players have taken their stations, and during rest periods, a record player incorporated in the amplifier case top, is utilized to offer pleasing phonograph reproductions.

Another desirable feature of this system is the provision for connection of a remote control device which permits adjustments of the overall volume level at a point as far as 75 feet from the amplifier proper. This allows the control operator to sit among the patrons and make frequent adjustments as the house fills up, and to maintain a suitable level at all times. In the absence of such an operator on the dance band staff, one can be borrowed for a single night, to make such adjustments. Suitable notations can then be kept of the



● Yes sir, Mr. Radio Parts Dealer and Mr. Service Man, here is a comer! It can't miss! Astatic's Low Pressure Crystal Pickup with built-in, permanent sapphire stylus has so many advantages over conventional models that every new installation or replacement can be a low pressure pickup with "low pressure" selling. Here is a pickup that eliminates practically all wear on records, dispenses with the necessity for changing needles and improves reproduction by reducing surface noise and distortion. Made in two models, FP-18 and FP-38, Astatic Low Pressure Crystal Pickups have a stylus pressure on the record of only one ounce, scarcely more than one-third the conventional weight. Under this low pressure, records will retain their newness for years. Permanent sapphire stylus, incorporated in these Pickups, does away entirely with the necessity for changing needles. Reproduction is noticeably improved.

Astatic Low Pressure Crystal Pickups are being nationally advertised and sold and are being used by many leading set manufacturers in new models. Make every replacement sale an Astatic Low Pressure Crystal Pickup and your customers will be more than pleased. All Pickups are wired for quick and easy installation.

Literature is available.

In Canada:
Canadian Astatic Ltd.,
Toronto, Ont.

Licensed Under
Brush Development Co.
Patents

ASTATIC

ASTATIC MICROPHONE LABORATORY, Inc.
YOUNGSTOWN, OHIO

SHURE CARDIOIDS

* LICK FEEDBACK! PERMIT MORE VOLUME! *

In Night Clubs, Theatres,
Auditoriums, Ballrooms,
Bowling Alleys, Churches,
Outdoor Sports and many
other applications.



UNIDYNE
DYNAMIC

On every job—Shure Cardioids give you better audience coverage—with more volume—free from feedback, reverberation, background noise! These amazing microphones are dead at rear. They simplify microphone placement, solve difficult sound problems on the spot! "Unidyne" Dynamic (illustrated) in high and low impedance models. List Price, \$42.50 and \$45.00. "Uniplex" Crystal (not illustrated), List Price, \$32.50.

See Your Jobber or Write for Catalog 153S.

Shure Patents Allowed. Crystal Microphones licensed under patents of Brush Development Co.

SHURE

SHURE BROTHERS
225 W. Huron Street Chicago, U. S. A.

VI level, as read on the meter provided, as necessitated by different numbers of people in the house. In later use the amplifier may be adjusted to these same readings as required.

Traveling throughout the country, the dance band often is required to play in hotels and auditoriums that generate their own direct current. To cope with such conditions Glenn has a medium sized d-c to a-c rotary converter.

Another Gay Spot

Although one of New York's brightest and best known hot spots, the "18 Club" on West Fifty-second Street is not what one would consider a logical prospect for the usual dance-band sound installation. Occupying the parlor floor of a former private residence, it is so relatively small in size that its 5-piece band finds no need for sound reinforcement and the unaided voices of entertainers have little difficulty in being heard at every table. Yet a sound system consisting of a 15-watt amplifier, two speakers in wall baffles and five microphones has contributed very importantly to the success of this establishment.

The "18 Club" is one of these intimate spots where informality is the rule. Many of its patrons are known personally to Master of Ceremonies Jack White and he takes advantage of the fact to kid them unmercifully by means of the sound system—and they take to it like ducks to water. Not only that, but members of the band, also equipped with microphones, kid him, each other and the public, with the result that a continuous fare of repartee, bubbling with good humor, is tremendously enjoyed by all. And it is this spirit of good-natured banter that distinguishes this from the host of other night spots in New York's famous Fifties.

To make this all possible the simple sound system employs five Amperite streamlined velocity mikes—one for the Master of Ceremonies, one for entertainers, and three distributed among the band where they are accessible to all the members. All the microphones are operative at one time so that when the Master of Ceremonies is talking, for instance, any member of the band can break in on him or those at the different mikes can kid back and forth and so on.

It all adds up to a lot of fun for everyone concerned. It isn't the sort of idea that could be used in every night club. But it does illustrate how a progressive sound man can develop sales by careful analysis of the individual prospect. To try to sell Jack White a sound system for the conventional purpose of amplifying the musical output



Old Man Centralab
reminds you to always "specify Centralab" when ordering parts.



**FIXED
RESISTORS**



**CERAMIC
CAPACITORS**



**VOLUME
CONTROLS**



**WAVE CHANGE
SWITCHES**



**TOGGLE
SWITCHES**

Centralab
DIVISION OF GLOBE UNION INC.
MILWAUKEE, WIS.

of his band would have been hopeless in a room of this size. But to sell him a system which would ease the strain of his long hours of Master of Ceremonies was logical. To add the other microphones was a stroke of genius which just about doubled the profits to the p-a man, at the same time greatly increasing the usefulness of the system to the buyer.

Stadium

Sound Man E. O. Reinhardt, of the Radio Service and Supply Company, Colorado Springs, Colorado, mounts eight speakers on a wooden tower, as



Colorado College events at the Washburn Stadium were covered by Atlas Sound loudspeakers centralized on this wooden tower.

shown in the accompanying illustration, to cover the Washburn Stadium for Colorado College events.

Four Atlas Sound Model RA72 six-foot trumpets with PM25 permanent magnet units are employed for projection across the field. Four Type DR42 Atlas Morning Glory projectors, which also employ PM25 p-m units to insure complete coverage of the West stands, are mounted on the same tower. The high-power amplifier was located in a locker room nearby.

Centralization of the speakers near the amplifier in this manner made for an easy inexpensive installation problem, important in such rental jobs. Because the available power from the speakers was more than ample, the system worked very well throughout the season, in spite of extremely high winds.

Aerial Tramway

The Cannon Mountain Aerial Tramway, owned and operated by the State of New Hampshire and located at Franconia Notch, N. H. employs two public-address systems for a rather unusual purpose.

This tramway, utilizing cars suspended from an overhead steel cable, makes the ascent of Cannon Mountain,

MILLION ZERO CENTER VACUUM TUBE VOLTMETER

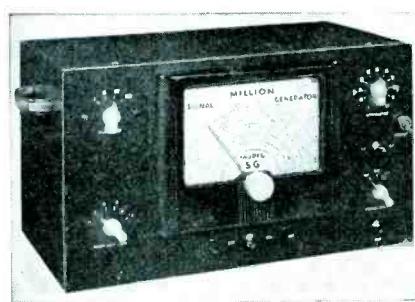


For streamlined, high speed servicing. A time saver on all types of receivers—and made to order for FM. Accurate, dependable. Features an oversize, easy to read meter with ZERO center.

- Tests 1000 megohms insulation leakage.
- Tests oscillator grid bias while in operation at 3,333,333 ohms per volt.
- With 22 scales.

INDISPENSABLE FOR FM TESTS
MODEL J
SPECIAL NET PRICE ONLY

\$29.95



SIGNAL GENERATOR NO. SG

A Signal Generator of Laboratory quality. An indispensable piece of equipment for modern, accurate service work. Loaded with high price features. Covers 55-30 KC on fundamentals and 30-90 KC on harmonics. Real attenuation on all bands. With Microvolt attenuator for RF and 400 cycle AF. Should form part of every serviceman's test equipment.

Special Net Price, Only \$34.95

TEST AND SOUND EQUIPMENT

MILLION equipment is guaranteed to be mechanically and electrically perfect. Complete literature on all MILLION test and sound apparatus is yours for the asking.



MULTI-METER MODEL GM

Just look at these expensive features.
* Giant 8 1/2 inch meter * 1000 ohms per volt DC *
800 ohms per volt AC * 0-6-120-300-1200-3000 volts
DC * 0-6-120-300-1200-3000 volts AC * 0-500 ohms
* 500-500,000 ohms * 0-5 megohms * 0-1-3-30-300-
600 Milliamperes * 0-12 amperes * -10 +10 Decibels.
An unbeatable value by any standard of comparison.

Complete with Leads and Batteries, Only \$22.95

If Your Jobber Cannot Supply, Write Us Direct

MILLION RADIO and TELEVISION

1617 No. Damen Ave.

Chicago, Ill., U. S. A.

a ride of over a mile with a rise of more than 2000 feet in this distance. Each of the two cars carries twenty-seven passengers. Year-round operation is maintained—for tourists in summer and for those who wish to take advantage of the ski trails in winter. The altitude of about 4000 feet insures an extended snow season for such winter sports.

Because the carrying capacity of each car is limited, it was found necessary to sell only reserved seats in order to control traffic and avoid confusion. Thus each ticket calls for passage on a specified car and the public-address

systems, one at the valley station and the other at the station atop the mountain, are used to call ticket holders to the loading platforms prior to the departure of their car. It is thus possible for visitors to roam freely around the indoor and outdoor observation areas on the mountain without fear of missing their car.

The speaker system at the valley station also serves for refined ballyhoo. This station located just off U. S. Route No. 3 (Daniel Webster Highway) offers light luncheons and attracts many passing tourists. To these are told the scenic attractions of the

NEW

"ALL ANGLE" all purpose
AERIAL
that FITS ALL CARS

Model A-5 shown

Get in early on this season's HIT ORDER NOW — SELL NOW

Only 2 styles to stock — A-3 — 3-section ALL-ANGLE and A-5, the 5-section Aerial that fully collapses below the line of vision. Both have Waterproof Shielded Lead. BOTH FIT ALL CARS on FENDER, COWL or UNDER HOOD

Write for Bulletin 197

Radiant "EXACT DUPLICATE"

Guaranteed VIBRATORS

THE RADIANT CORP. CLEVELAND, OHIO

ride and of the observation platform at its other end, as well as facts of interest concerning the tramway itself. Not the least important feature of these talks is the emphasis on the precautions taken to insure absolute safety, allaying fears engendered in the mind of the timid at the sight of the slender steel strands which support the cars.

A thirty watt amplifier at the valley station drives three speakers, one located in the lobby and sandwich bar, the other two outdoors in the areas from which visitors watch the ascending and descending cars. At the summit house one speaker is in the lobby and another out on the observation platform. The equipment used in both locations is Lafayette. Coincidence or otherwise, one of the cars is named "Lafayette" and one of the most prominent nearby mountains visible from the summit of Mr. Cannon is Mt. Lafayette.

New Test Equipment

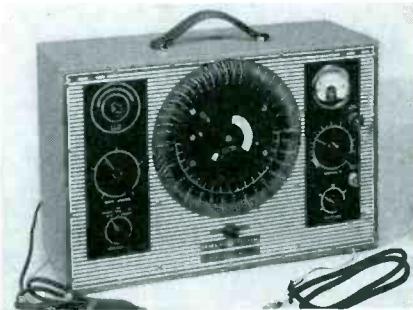
Additional information and prices of the equipment described below may be obtained, without obligation, from the respective manufacturers.

PRECISION AMMETER

Precision Apparatus Co., 647 Kent Ave., Brooklyn, N. Y., announce a popularly priced multirange a-c ammeter for use on line frequencies from 25 to 60 cycles. 300 milliamperes, full scale, to 60 amperes; 8 a-c ranges; special scale for direct readings on 25 cycles. 4½-in square type meter. Available in 3 models.

SIGNAL GENERATOR

The General Electric Model SG3 signal generator is designed for the Service Man's bench and provides a calibrated output that



can be read directly in microvolts. Five bands are included, with a continuous range from 100 kc to 32 mc. A vtv monitors the output of the modulated amplifier to the attenuator and constant level can be maintained by means of a panel control. Output through the attenuator is from ½ to 100,000 microvolts. General Electric Co., Bridgeport, Conn.

DETECTOR FOR INTERMITTENTS

Fade-Ometer Co., 1027 S.W. Broadway, Portland, Oregon, are marketing an instrument which is said to locate open, intermittent, leaking or shorted condensers in elec-

tronic equipment without disconnecting the units from their respective circuits. A feature, termed "Magic Eye Lock," permits the Service Man to do other repair work while waiting for the set to fade, it is said.

STATION ALLOCATOR

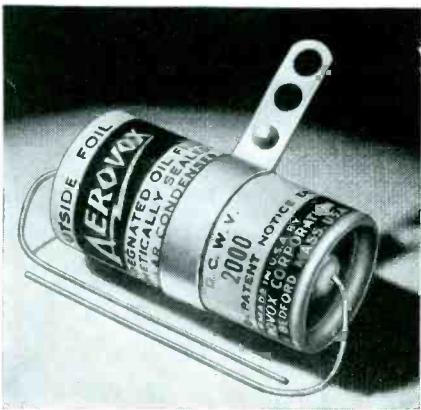
A signal generator unit, called the RCA station allocator has been made available to assist the Service Man in the job of resetting the nation's push-button radio receivers after Radio's Moving Day . . . March 29.

The station allocator has eight push buttons that can be set to the frequency of any eight stations in a given locality. The instrument then generates a signal which is applied to the receiver as a guide in the resetting of push buttons, or in tuning the buttons in periodic checkups. It operates from the a-c line or from self-contained batteries. The unit is said to have a maximum frequency drift of only 0.05 per cent. RCA Mfg. Co., Inc., Camden, N. J.

Parts, etc. . . .

TUBULAR OIL-FILLED CONDENSERS

The Aerovox 89 Series of oil-filled condensers have a cadmium-plated brass can for hermetic sealing, covered by a var-



nished-paper jacket with spun-over ends, and a center mounting strap. Available in 400 v, 600 v, 1,000 v and 2,000 v ratings in capacities from 0.006 to 0.5 mfd. Aerovox Corp., New Bedford, Mass.

MIDGET MERCURY SWITCH

A small mercury switch measuring 7/16 in. by 3/8 in. diameter has been announced by Littelfuse, Inc., 4748 N. Ravenswood Ave., Chicago. The switch is designed for use in circuits up to 25 volts at 3 amp. (or 10 amp. at 6 volts) on either a-c or d-c.

TUBE PRICES UP

Several tube manufacturers have announced that list prices of tubes have been increased an average of 5¢ per tube because of increased raw material costs.

AUTOMATIC BATTERY-LINE RELAY

A relay, introduced by the Amerite Co., 561 Broadway, New York City, will automatically shift the combination receiver to line operation if it is connected to the power lines and the switch is turned on. In normal use the receiver will operate immediately on batteries, as soon as the switch is turned on, but will automatically switch over to line power as soon as the rectifier heats up.

Sound News . . .

HOWARD RECORDING NEEDLE

Howard Radio Co., 1731 Belmont Ave., Chicago, have announced a permo metal tip recording needle and two new playback needles which are said to have properties that give them considerably longer life than the average needle now available.

RECORDENE

Walter L. Schott Co., 5264 W. Pico Blvd., Los Angeles, Cal., announce Walsco



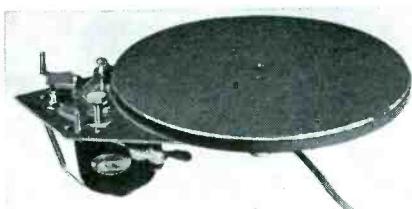
Recordene, a product designed to clean and recondition the surfaces of transcriptions and recordings.

LAFAYETTE AMPLIFIER

Designed for low-power installations of the better class, the Model 406T amplifier offered by Lafayette Radio Corp., 100 Sixth Ave., New York City, has an output of 6-watts. One microphone and one phono input are provided with a frequency response from 50 to 8,000 cycles. Parts and construction are husky to insure long dependable service, it is said.

PRESTO RECORDING TURNTABLE

Presto Recording Corp., 242 W. 55 St., New York City, are marketing the 12-in., dual-speed turntable formerly sold only as part of their Model K commercial recorder.



This new turntable employs a cast aluminum turntable precision machined to dynamic balance. The table revolves on a single ball bearing at the base of a bronze shaft well. A heavy, live rubber tire is fitted to the rim of the table. A metal pulley on the motor shaft drives directly against the tire eliminating idler wheels, rubber tired pulleys, etc. A slip over pulley is removed to change speed from 78 to 33½ r.p.m.

NEEDLE PRICES REDUCED

A price reduction of 30 per cent on Walco sapphire needles has been announced by the Electrovox Co., 424 Madison Ave., New York City.

AMPERITE
2 GREAT MIKES!

AMPERITE VELOCITY
with exclusive
ACOUSTIC COMPENSATOR

Actually a combination Velocity-Dynamic, having best features of both types.

Model RBHk, hi-imp: (RBMc, 200 ohms); LIST \$42.00

Model RBSHk, hi-imp: (RBSk, 200 ohms); LIST \$32.00

AMPERITE KONTAK MIKE

Puts musical instruments across. Beautiful results with any amplifier, record player, and most radio sets.

MODEL SKH (hi-imp) LIST \$12.00

MODEL KKH, with hand volume control, LIST \$18.00

Plug extra LIST \$1.50

WRITE FOR FREE SALES AIDS
561 BROADWAY
NEW YORK

AMPERITE



★ If you're a juggler or magician, then skip this. You already know that any control can somehow be juggedled or tricked into a set as a replacement. But, confidentially, that's not the kind of servicing that keeps you in business.

Clarostat replacements are designed and designated for specific sets. They fit—mechanically and electrically.

For simplified stock or for rush jobs, Clarostat standard types will often do.

★ See how simple and satisfactory this all is, by asking your jobber for the Clarostat Service Manual. Or write Clarostat Mfg. Co., Inc., Dept. S1, 285-7 N. 6th St., Brooklyn, N. Y.



Preferred
... BY U. S. GOVERNMENT AGENCIES
IN THE NATIONAL DEFENSE PROGRAM



ATLAS SOUND Equipment is preferred by the U. S. Army, Navy, and Coast Guard for all conceivable applications under the severest operating conditions. Such recognition is outstanding evidence of high quality standards.

★ **ATLAS SOUND PREFERRED** ...
by Sound Engineers for the greatest selection of speakers, projectors, baffles, microphone stands, and connectors for all p. a. purposes. You can rely on Atlas Sound for the latest engineering improvements, for rugged construction, and top-flight performance.

★ **ATLAS SOUND PREFERRED** ...
by Radio Parts Jobbers for a consistent record of quality and service. Jobbers confidently recommend Atlas Sound Equipment with full assurance of dependability and satisfaction.

★ FREE CATALOG F-40 describes 101 speakers and accessories for every p.a. use. Send for your copy today.



ATLAS SOUND
CORPORATION
1449 39TH ST., BROOKLYN, N. Y.

Wet ELECTROLYTICS



Type PG600—Max. 600 v. D.C. Surge: 1 $\frac{1}{2}$ " and 1 $\frac{1}{2}$ " dia. can, 3 $\frac{1}{2}$ " to 16" high, 4 to 16 mfd., \$0.81 to \$1.20, your cost.
 Type PG500—Max. 500 v. D.C. Surge: 1 $\frac{1}{2}$ " and 1 $\frac{1}{2}$ " dia. can, 3 $\frac{1}{2}$ " to 4 $\frac{1}{2}$ " high, 4 to 40 mfd., \$0.48 to \$1.14, your cost.
 Type PG350—Max. 350 v. D.C. Surge: 1 $\frac{1}{2}$ " and 1 $\frac{1}{2}$ " dia. can, 3 $\frac{1}{2}$ " to 4" high, 8 to 40 mfd., \$0.54 to \$1.08, your cost.
 Type PGM500—Max. 500 v. D.C. Surge: 1" dia. can, 3 $\frac{1}{2}$ " to 4 $\frac{1}{2}$ " high, 4 to 16 mfd., \$0.48 to \$0.81, your cost.
 Type PGM350—Max. 350 v. D.C. Surge: 1" dia. can, 3 $\frac{1}{2}$ " and 4 $\frac{1}{2}$ " high, 8 to 20 mfd., \$0.54 to \$0.84, your cost.
 Type PGM250—Max. 250 v. D.C. Surge: 1" dia. can, 3 $\frac{1}{2}$ " and 4 $\frac{1}{2}$ " high, 8 to 40 mfd., \$0.48 to \$0.72, your cost.
 Type PGM150—Max. 150 v. D.C. Surge: 1" dia. can, 3 $\frac{1}{2}$ " and 4 $\frac{1}{2}$ " high, 8 to 40 mfd., \$0.42 to \$0.69, your cost.

- High capacity in minimum bulk; ability to take severe punishment; instant self-healing or reforming of dielectric film following breakdown due to excessive voltages—these factors account for the growing popularity of wet electrolytics.
- Meanwhile, the elimination of such draw-backs as leakage and seepage, and inadequate venting, heretofore associated with this type, accounts for AEROVOX "wets" as the first choice. A trial will soon convince you.

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- Ask for these AEROVOX "wets." Try them in that new assembly. Use them in place of "drys" that have failed due to serious surges or peaks. Ask for latest catalog—or write us direct.

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CORPORATION
NEW BEDFORD, MASS.
IN CANADA: AEROVOX CANADA Limited Hamilton, Ont.

Sound News . . .

Additional information on the products described below may be obtained, without obligation, directly from the respective manufacturers.

SHURE CARDIOID CRYSTAL

Shure Brothers, 225 W. Huron St., Chicago, have announced their 730S Uniplex cardioid crystal microphone. This unit is



said to combine true cardioid uni-directional performance with high-efficiency speech characteristic. Output is 33 db below 1 volt for a 10 bar speech signal.

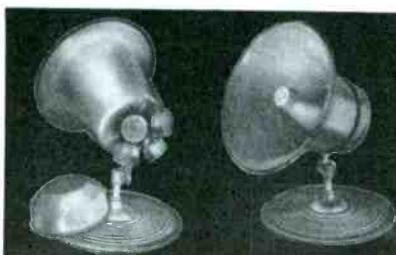
OHMITE T AND L PADS

T and L pad attenuators for use between the amplifier and speaker, to permit the control of speaker volume without changing the impedance of the total load connection to the amplifier, are available from Ohmite Manufacturing Co., 4835 Flournoy St., Chicago, Ill.

T and L Pads are supplied with knob and perforated cage, for line impedances of 15, 50, 200, and 500 ohms.

SUPER BULL HORN

The University Laboratories Model 4YR Super Bull reflex speaker employs a cluster of 4 Model PAH driver units which are fitted into a multiple acoustic channel from



which the sound is reflexed three times in such a manner that the speaker, while only 27 in. long overall, with a bell diameter of 21 in., is acoustically equivalent to a 6-ft. exponential horn. All the acoustic passages are smooth machined surfaces and spun tubings. The power handling capacity of the 4YR is 100 watts, continuous. University Laboratories, 195 Chrystie St., New York City.

RCA DYNAMIC MICROPHONE

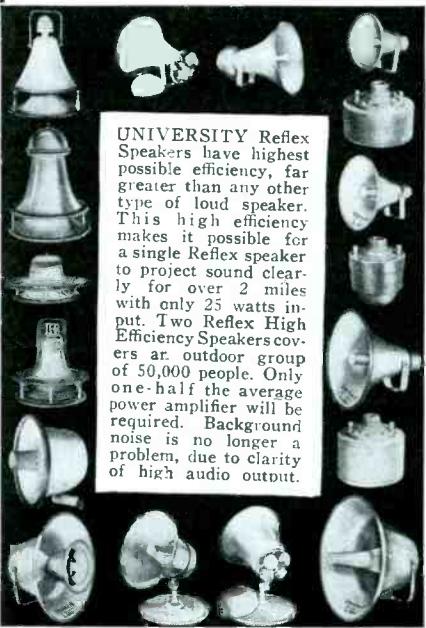
A new aeropressure microphone whose directional characteristics may be changed by the use of the "Paracoustic" reflector

If your Sound Problem calls for:
 ★ Long Distance Sound Projection
 ★ Large Area Sound Coverage
 ★ Very Clear Voice Reproduction
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Then Specify

UNIVERSITY REFLEX

HIGH EFFICIENCY SPEAKERS



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UNIVERSITY LABORATORIES

195 CHRYSIE STREET - NEW YORK CITY

baffle attachment, has been announced by George Ewald, manager of the Commercial Sound Division, RCA Manufacturing Co., Inc., Camden, N. J. The microphone is of the bullet-shaped type and has a frequency response from 60 to 10,000 cycles.

The Paracoustic baffle changes the directional characteristics of the microphone. With the concave face of the circular, dish-shaped baffle toward the grille, the directional characteristics become sharpened, and feedback is reduced. When the baffle is reversed, so that the convex face is toward the grille, the opposite directional effect is obtained. Without the baffle, the microphone becomes a normal pressure microphone.

The microphone is available in low (250 ohms) and high (40,000 ohms) impedance models.

HOWARD RECORDING DISCS

Howard recording discs, available in 6 $\frac{1}{2}$ -8- and 10-in. sizes, are constructed from a soft steel base coated with a special lacquer. The discs are said to have several desirable qualities that permit better recordings and longer life. Howard Radio Co., 1731 Belmont Ave., Chicago.

ERWOOD AMPLIFIER

An 8-watt portable sound system weighing less than 28 lbs. is available from Erwood Sound Equipment Co., 223 W. Erie St., Chicago. The system includes a 10-in. p-m speaker, a desk type crystal microphone and a 5-tube amplifier. Provision is made for phonograph pickup connection.

The entire assembly is contained in a tweed finish carrying case 14 by 11 by 12 $\frac{1}{2}$ inches.

COMMUNICATIONS RECEIVER

(Continued from page 14)

makes possible signal input readings from below 1 microvolt to 1,000 microvolts.

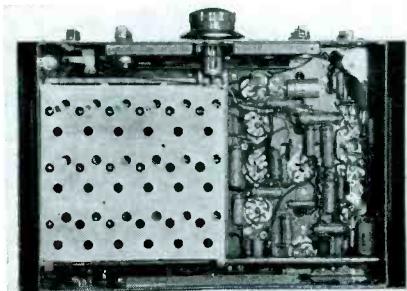
Antenna Input

Antenna input terminals are located at the rear of the receiver chassis near the center. The input circuit is suitable for use with a single wire antenna, a balanced feed-line or a low impedance concentric transmission line. Average input impedance is 500 ohms.

Audio Output

Two audio output circuits are provided:

(1) A headphone jack is mounted on the front panel and is wired so as to



The large perforated shield, shown at the left in this underchassis view, contains the individually shielded coils. As a particular wave band is selected, the entire bank moves toward the right.

silence the speaker when the phone plug is inserted. The correct load impedance for the headphone output is 20,000 ohms, this being the usual impedance of phones having a d-c resistance of between 2000 and 3000 ohms. Maximum audio output available at the phone jack is 15 milliwatts.

(2) A five prong speaker socket (X-1) is provided at the rear of the receiver chassis. To this socket are brought the audio output leads. The proper load impedance (total) for the output circuit is 10,000 ohms. Maximum undistorted audio power output available is 8 watts.

Power Supply

The standard NC200 receiver is designed for operation from a 110/120 volt, 50/60 cycle power source. Normal power consumption is approximately 100 volt-amps. The built-in power supply delivers all voltages required by the heater and B supply circuits—4.5 amperes at 6.3 volts and 100 milliamperes at 250 volts, respectively. One side of the a-c input line is connected through a 2 ampere fuse.

All NC200 receivers are equipped with a seven-prong plug and socket combination to permit portable or emergency operation from batteries.

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MODEL 530C—Counter Tester—Neat and Compact.
MODEL 530M—Display Tube Merchandiser with 9-inch Illuminated Dial.



TUBE AND SET TESTER MODEL 510-X

This combination unit in addition to testing tubes as indicated has a Set Tester Section which measures:

Volts—4 ranges 0-1000 A.C. and D.C. 1000 ohms per volt for all ranges.
Ohms—1/10 ohms to 25 megohms in 3 ranges.
D.C. Milliamperes—0-20-200.
Capacity—To 24 microfarads in overlapping ranges.
Leakage—Checks leakage of electrolytic and paper condensers.
Inductance—Checks inductance or choke coils with or without D.C. component of current.
Decibels—for checking output.
Checks hum in any stage of receiver.

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Sylvania's Silent Salesmen

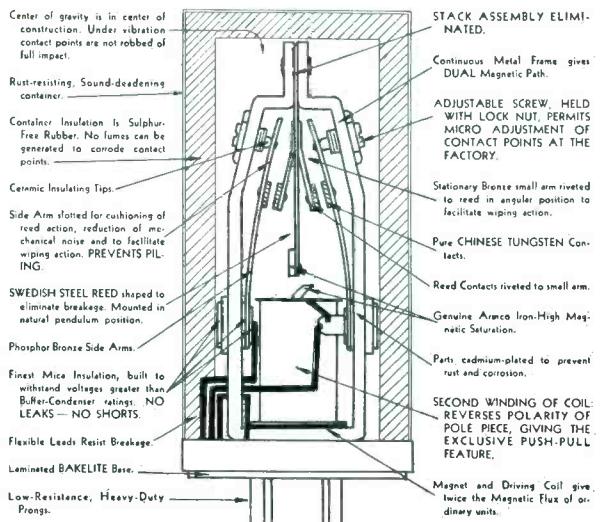
1. Window Displays.
2. Counter displays
3. Electric Clock signs
4. Electric Window signs
5. Outdoor metal signs
6. Window cards
7. Personalized postal cards
8. Imprinted match books
9. Imprinted tube stickers
10. Business cards
11. Door knob hangers
12. Newspaper mats
13. Store stationery
14. Bill heads
15. Service hints booklets
16. Technical manual
17. Tube base charts
18. Price cards
19. Sylvania News
20. Characteristics Sheets
21. Interchangeable tube charts
22. Tube complement books
23. Floor model cabinet
24. Large and small service carrying kits
25. Customer card index files
26. Service Garments
27. 3-in-1 business forms
28. Job record cards (with customer receipt)

SYLVANIA

Set-Tested Radio Tubes

Also makers of Hygrade Lamp Bulbs, Hygrade Fluorescent Lamps, and Miralume Fluorescent Light Fixtures.

Turner Company, Cedar Rapids, Iowa, are in full production of vibrators, the latest addition to their line. Featured in this line is the push-pull vibrator shown to the right. In this type of unit a second winding on the actuating coil reverses the polarity of the pole piece, thus giving the reed a push on each return stroke. It is said that this reduces the tendency to stick and also reduces wear and pitting of the one contact. A screw and lock nut arrangement permits close adjustment of the contacts before the vibrator leaves the factory.



Studies of line noises and their elimination are constantly being made in the shielded booth (shown at the right) in the Cornell-Dubilier laboratory. The results of these investigations are among the data presented in a series of articles now appearing in the C-D Capacitor.

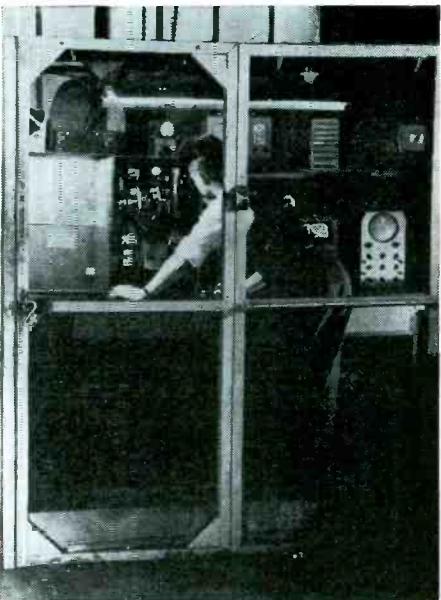
S-W PROGRAM

On Jan. 6, 1941, *Reader's Digest* began a series of radio programs for South America over WGEO, the General Electric short-wave station in Schenectady. The programs consist of a reading of dramatization of articles in the magazine's Spanish edition in that language, and will be heard at 7:30 p.m., EST, Mondays. WGEO, operating on 31.48 meters, is then beamed on Buenos Aires, Argentina.

TRADE SHOW

Helen Staniland, vice president of Quam-Nichols Company, at the drawing for space allotment, in the Radio Parts National Trade Show, took the first capsule from the bowl, and gave it to Eddie Riedel (Raytheon), of the Show Committee in charge of the drawing. Irving Kahan (Sprague) opened the capsule and announced the number identifying the exhibitor—John Rider.

As booths were assigned, the selections were posted on the large floor plan in the background.



A part of the group that assembled at the Annual Drawing for Space in Radio Parts National Trade Show (below) on the afternoon of Feb. 3, 1941, at which time 137 booths were allotted. Booths for those who were not represented were assigned by the Show Committee.



Case Histories

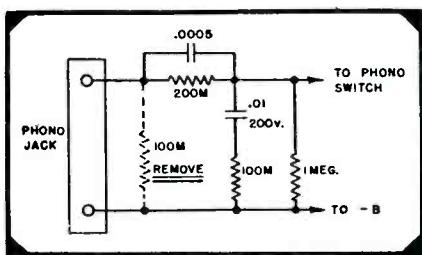
RCA R98

Hum at maximum volume: Wherever hum is apparent, the dress of the pilot lamp lead should be checked. It should be positioned to the rear of the chassis base, well away from the audio circuits.

SILVERTONE 6336, 6436

Improving bass response for record reproduction: Bass response can be increased and record reproduction tone improved when this receiver is used in conjunction with a record player, by inserting the network shown schematically below.

The 100,000-ohm resistor at present across the phone jack terminals is to be removed. As shown below, the lead going to the high side of the phono jack is to be



broken and a 200,000-ohm resistor shunted by a 0.0005-mfd. mica condenser is to be inserted in series with it. The 100,000-ohm and the 1-megohm resistors and the 0.01 mfd. condenser are to be connected as shown.

Because of the increased bass response, there may be a greater tendency toward microphonics. For this reason, the record player should not be put directly on top of the receiver cabinet.

Reducing microphonics: In case of complaint due to microphonism, the following things to be checked, are listed in the order of their importance:

1) Be sure that the two shipping bolts and the wood spacer strips have been removed.

2) See that knobs, control shafts, and dial lights or dial mechanism do not touch the cabinet.

3) See that the rubber bumpers at the rear of the chassis do not press on it more than enough to prevent shifting.

Although the foregoing three points are simple, and commonly known, very often insufficient attention is paid to them. *It is very important* that the points mentioned be *very thoroughly checked*.

4) Any means of reducing the signal input will help, such as using a shorter antenna or connecting a small mica condenser (0.0001 to 0.0002 mfd.) in series with the antenna lead.

5) All but initial production cabinets have two bracing strips added under the chassis mounting shelf at its ends as follows:

Turn the cabinet upside down. (Be careful to protect the cabinet finish.)

Clamp one of the cleats along the under side-edge of the chassis shelf. The end of the cleat should be against the cabinet back rail.

Using the cleat as a template, drill three

SERVICING by SIGNAL SUBSTITUTION As Simple As A-B-C

Alert service engineers acclaim this simplified method of dynamic receiver analysis...

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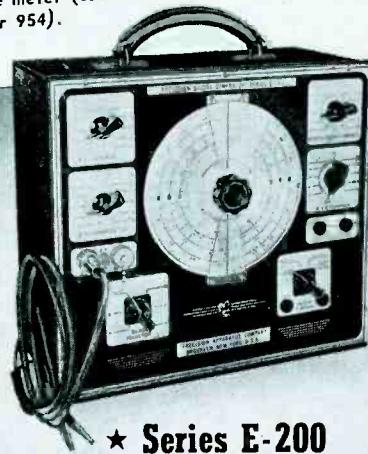
★ Series 954 Combination Dynamic Mutual Conductance Type Tube Tester and 20,000 ohms per VOLT Multi-Range AC-DC Set Tester

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★ Series E-200 Modern Laboratory Type Multi-Band Signal Generator

Not only an unsurpassed Signal Generator for purposes of receiver alignment, but SPECIFICALLY DESIGNED as the key to "Servicing by Signal Substitution" . . . Nevertheless priced within the easy reach of every progressive radio service engineer.

E-200—(illustrated)—in heavy gauge metal cabinet, complete with tubes, coaxial output cable and FREE copy of "Servicing by Signal Substitution" \$35.95

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9/32" holes in the chassis mounting shelf. Be careful that none of the dirt from drilling gets into the speaker or chassis.

In the same manner, drill three holes at the other end of the chassis mounting shelf.

Clean off any splinters and bolt the cleats tightly to the underside of the chassis mounting shelf, with the bolt heads on the top side of the shelf. The flat washers go under the nuts.

6) If the predominant microphonic tone is of low frequency, improvement can be had by reducing the capacity of the coupling condensers in the audio amplifier. These are C27 and C29, which should be reduced from 0.01 mfd to 0.006 mfd, 600 v. Both condensers must be changed to avoid unbalancing the push pull circuit. This change will reduce the low frequency re-

sponse and is not recommended except for extreme cases.

WELLS GARDNER 5C16-7

Motor noise: In order to reduce motor noise pickup from passing cars and to reduce microphonics, the following changes have been made: (On chassis having these changes, the issue letter should be advanced to B.)

The previous input circuit has been replaced by a new antenna input circuit using a 35-mmfnd and 300-mmfd condenser and 1.0-megohm resistor not previously used in the circuit.

The interstage and oscillator trimmer condenser and a terminal strip in the same coil can have been mounted on rubber grommets.

TRIPPLETT 1632 SIGNAL GENERATOR

THE Triplet Model 1632 signal generator contains an r-f oscillator calibrated in ten fundamental bands, covering a frequency of 100 kc to 120 mc. It also has a buffer amplifier and modulator stage, a metering system, a crystal oscillator stage, and a self-contained heterodyne detector. The wide frequency range of this unit makes possible its use not only for broadcast and standard short-wave, but also the newly allotted frequency modulated and television channels.

Features

The heterodyne detector allows direct calibration of an external signal within the frequency range of the r-f, the harmonics of the crystal oscillator, or direct calibration of the r-f oscillator against the harmonics of the crystal oscillator stage.

The voltage output attenuator and metering system are calibrated in output units which are closely related, but not absolute microvolts. The output range provides a maximum output of

0.3 volts direct reading, on the first seven bands with somewhat lower output on the last three bands. Output voltage is available at the end of a coaxial cable with a terminating switch providing three selections of output.

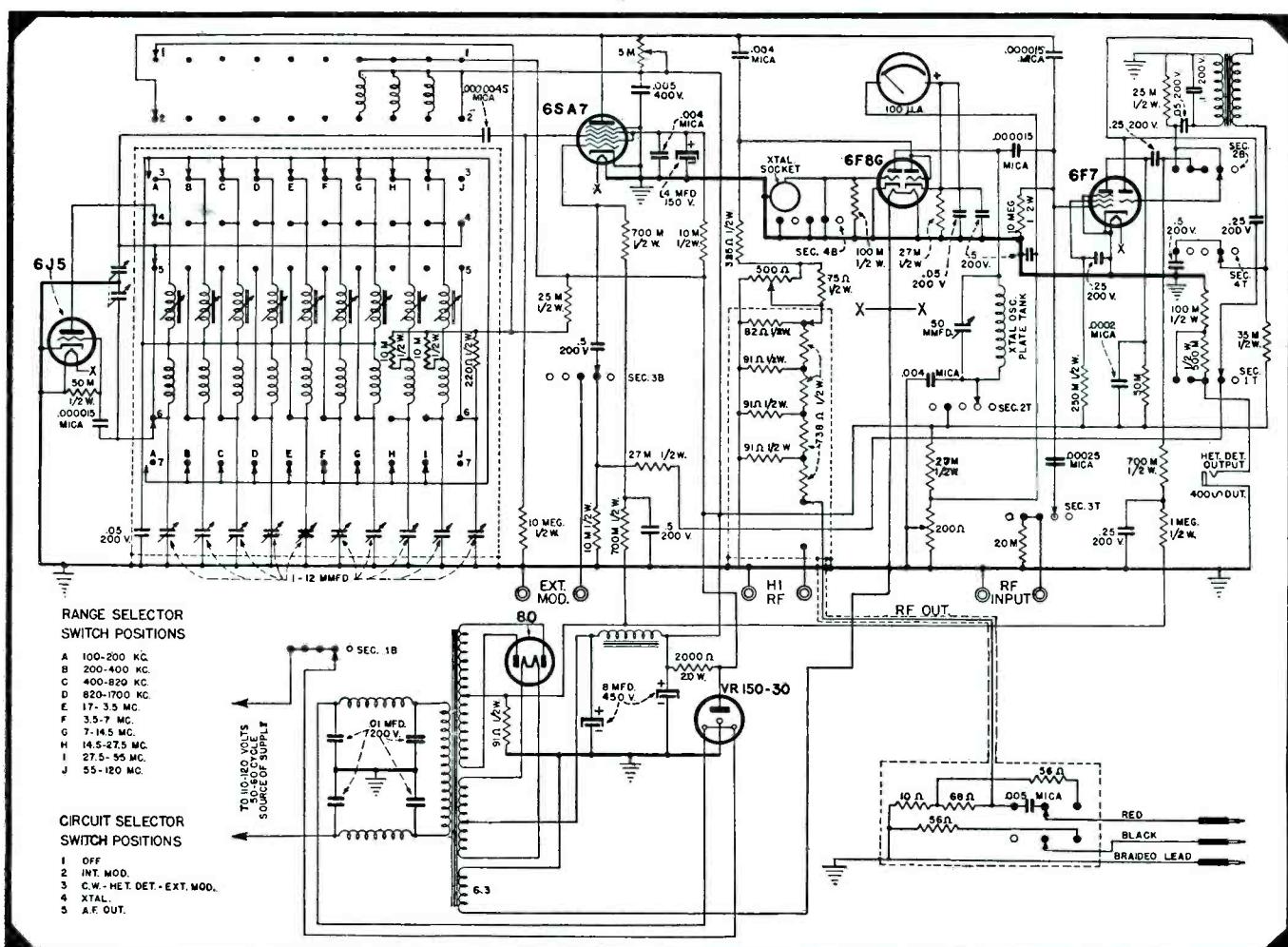
Circuit

The r-f oscillator uses a 6J5 tube in a two-circuit arrangement, with bands A to G inclusive, operating as tuned grid with plate feedback and bands H to J inclusive as a Colpitts oscillator. The r-f coils are of the permeability tuned type and all bands are trimmed with air dielectric condensers. The entire r-f coil and trimmer assembly is enclosed in a separate shield housing. On band J the inductance consists of a short length of wire and peaks broadly at the low end of the band. At some points of band J greater output may be obtained by decreasing the r-f level control.

The Triplet 1632 signal generator provides measured signals in the frequency range between 100 kc and 120 mc in ten fundamental bands.

The output of the oscillator is capacity coupled to the injector grid of a 6SA7 tube employed as a buffer amplifier and modulator. For bands G, H and I a plate choke is used in the buffer plate circuit, these chokes being resonant near the low frequency end of each band. By means of the circuit selector switch, modulated voltage, either of the 400-cycle, generated by the internal audio oscillator, or at any frequency up to 5 megacycles from an external source is introduced into the control grid of this modulator. The internal modulating voltage when employed is adjusted to a value which gives approximately 30% modulation. On external modulation, any desired percentage modulation may be obtained by adjusting the value of the applied voltage. A potential of 1.4 peak volts will give approximately 30% modulation.

The modulated or unmodulated voltage appearing in the plate circuit of the buffer amplifier is applied to the output attenuator and metering circuit. The metered circuit consists of one section of a 6F8G dual-triode tube serving as a diode rectifier and d-c microammeter. The output attenuator consists of a variable control calibrated in output units and a sectional shielded resistance



ladder network in ten to one output steps. The last shunt resistor of the output multiplier terminates the 5-foot coaxial transmission line. For low output voltage, up to approximately 50,000 output units, the multiplier section of the output attenuator is used with a fixed level indicated by the red line on the output meter with the output voltage being subdivided by the variable output control and the multiplier switch. The r-f level control is used in adjusting the voltage level at the meter.

A separate jack is provided for obtaining voltages above 50,000 output units and the meter circuit is connected across this jack when the multiplier is placed in the high r-f position. When the high r-f output jack is used, the voltage is read directly on the meter and is the voltage appearing between the jack and ground. The variable control is left at maximum position when the high r-f output jack is used and the impedance of this output connection is 500 ohms.

A 6F7 tube is employed as an audio oscillator and heterodyne detector. The triode section of this tube is used as an audio oscillator when the selector switch is in the modulated or audio output position and is used as an amplifier for the heterodyne detector when the selector switch is set for heterodyne detection. This audio oscillator is capacity coupled to a resistor network when used for modulation or audio output and approximately four peak volts is available at the phone jack. The pentode section of the 6F7 is used as a grid-leak detector with the radio frequency voltage from the buffer modulator, external r-f jack, and crystal oscillator output permanently connected to the control grid. This permits an external r-f signal or the crystal oscillator harmonics to produce a beat note with the signal generator r-f oscillator, thereby permitting calibration of either the signal generator or the external r-f signal. This beat note signal is heard with a headset connected in the phone jack.

The crystal oscillator stage is provided for the convenience of checking the calibration of the r-f oscillator and consists of a variable condenser, and coil combination which resonates at 1000 kc and is permanently capacity coupled to the control grid of the 6F7 heterodyne detector. A 5-prong socket is available on the top side of the oscillator chassis to accommodate any standard crystal mounting and the fibre condenser shaft is located near by for adjustment of this circuit. If a crystal with a frequency other than 1000 kc is used, it will be necessary to provide a coil that will resonate at the crystal frequency when connected in place of the 1000 kc coil across the 50-mmf_d varia-

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- Turner Vibrators employ an equal amount of magnetic power to push, then pull, the reed and its contacts. Eliminates piling and chattering.

- Contact points are micro-adjusted at the factory, assuring precision adjustment and sure-fire operation without extra servicing.

- Stack type assembly is eliminated. Instead, Turner Vibrators offer 100% closed dual magnetic path, with its increased efficiency.

The 10 engineering advancements employed in Turner Push-Pull Vibrators free you from customer-complaints and costly extra servicing. Yet, Turner Vibrators cost no more than ordinary units.

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Turner Push-Pull Vibrators give a harder, faster swing of the reed, offering cleaner, more positive contact. The self-cleaning contact points are micro-adjusted at the factory. Elimination of the old fashioned stack type assembly makes you safe from leakage caused by deterioration or slipping insulation, common to that old type assembly. You'll appreciate the low drain and high output of these new Vibrators. Each unit is packed in a factory-sealed carton with open terminals for testing the Vibrator without opening the carton. Guaranteed for One Year by the manufacturer who produces the famous Turner Microphones. Available in models to meet all replacement calls. Ask your Jobber for prices or write The Turner Co., Dept. S, Cedar Rapids, Iowa.

ble condenser. The crystal oscillator is in operation when the selector switch is turned to the point marked "XTAL."

Output termination is at the end of the coaxial cable and consists of the last shunt resistor of the multiplier, output condenser, resistor network for doublet antenna connection, and selector switch enclosed in a shield. Red, black and braided leads project from the side of shield with the selection switch at the end. With the switch in the D position the red lead is connected directly to the end of the coaxial cable and resistor network and is used with standard receiver antenna connection. With switch

in C position a 0.005-mfd condenser is connected in series with the red lead so that connection may be made directly to the grid circuit of the i-f stages without removing the grid lead or affecting d-c voltages existing thereon. This condenser also serves as a protection for the multiplier attenuator circuit when working with d-c circuits. In the D position both the black and the red leads are connected to the doublet network for use on receivers having a balanced antenna circuit. The braided ground lead should be connected to the chassis ground with all three switch positions.

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MUTUAL CONDUCTANCE

By J. R. BARNHART

HICKOK ELECTRICAL INSTRUMENT CO.

IN THE early twenties when the soft 200-tube sold for \$6.00 and eager fans were lined up two or three deep before the retail counter waiting to exchange their money for just one tube before the shipment was exhausted (and many went away disappointed) a tube was considered pretty good if its filament lighted up. This was, however, pretty near the truth . . . for many a six-dollars worth went up in flash before the tube had a chance to be paralyzed.

Even before the public began to storm the retail counters, engineers had been investigating this new wonder. Volumes covering the many properties and characteristics of vacuum tubes have since been published in great number.

Three characteristics were found to be intimately related. These are the amplification factor, the plate resistance and the mutual conductance.¹

Amplification Factor
Amplification factor is the ratio of the greatest voltage output to a given voltage input. This does not refer to plate voltage and grid bias. It is the ratio of output to input. For example, one-tenth volt at 1,000 cycle, is applied to the grid of a tube and the plate circuit is adjusted to receive the greatest 1,000-cycle voltage which the tube is capable of producing. If the voltage ripple in the plate circuit is then one volt, the amplification factor is 10. Would testing a tube for amplification factor, then, be a good way to judge its merit? It might be if there were no other variable. But the output also depends upon plate resistance. Some tubes have an amplification factor of several hundred. But that does not mean that the output will be several hundred times the input. For amplification factor to mean anything the plate

¹A more detailed discussion of tube characteristics may be found in the receiving tube manuals published by the tube manufacturers.

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resistance of the tube must be known.

Plate Resistance

Plate resistance does not mean plate voltage divided by plate current. In the example given above, where a tube produced a 1,000-cycle ripple of one volt, the plate voltage might be 250 volts and the plate current 30 milliamperes. That has nothing to do with plate resistance. But if you had a milliammeter in the plate circuit that would measure nothing but the 1,000-cycle ripple in the current, and this milliammeter registered one-tenth millampere, then the plate resistance would be one (volt) divided by 0.0001 (ampere), or 10,000 ohms.

Would testing a tube for plate resistance be a good way to judge its merit? Yes, it would if there were no other variable. But amplification factor must be known to have the test mean anything. In a great many triodes the amplification factor is practically constant. In that case, plate resistance would be an excellent measure of merit. It would have one disadvantage, however, because high plate resistance would mean a poor tube and low plate resistance a good tube. The meter would read backwards, so to speak. But for screen grid tubes the plate resistance method would be worthless.

You may ask, if amplification factor depends upon plate resistance, and plate resistance depends upon amplification factor, why not build a tester that will measure them both at once and have a sort of interlocking device that will cause the meter to give just one reading? That is what has been done in the mutual conductance tube testers. The meter gives just one reading, and that reading is dynamic mutual conductance which is read on a scale divided in micromhos.

Dynamic Mutual Conductance

Engineers recognize the importance of mutual conductance and it has become a permanent expression in electronic literature. Mutual conductance can be defined in a couple of ways. First, let us see how amplification factor divided by plate resistance gives mutual conductance as a quotient.

Amplification Factor

= Mutual Conductance

Plate Resistance

Another way to look at mutual conductance which may make more clear to you the value of this term is this: As we told you above when describing amplification factor and plate resistance, a ripple voltage of 0.1 volt on the grid of a tube produced a ripple current of 0.1 millampere in the plate circuit. Here

is how grid volts and plate milliamperes are tied together:

Plate Ripple Milliamperes

Grid Ripple Volts

Mutual Conductance (Mhos)

In the example given above, where 0.1 volt ripple on the grid produced a plate current ripple of 0.1 millampere, the mutual conductance would be

0.0001

— = 0.001 mhos or 1,000 micromhos

0.1

A dynamic mutual conductance tube tester would read 1,000 micromhos. The 30 millampere steady plate current would not affect the reading.

Steady plate current cannot produce a sound in a radio receiver. The current must continually change in value. Let us call that change a ripple on the steady current. In looking at the equations above it is obvious that the greater the ripple in the plate current the louder will be the sound in the speaker. Also, the greater the ripple in the plate current for a given ripple in grid volts the greater the mutual conductance; the greater the mutual conductance, the greater the amplification.

In closing we would like to quote from an eminent engineer, Dr. H. J. Van Der Bijl. In his book, "The Thermionic Vacuum Tube," page 166, he says in speaking of mutual conductance:

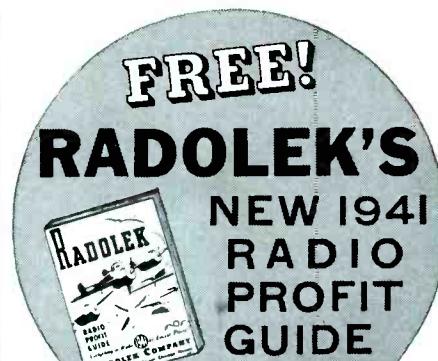
"This is a very important quantity and is involved in all expressions giving the degree of merit of the tube when functioning as amplifier, detector, oscillator, etc. It is always desirable to have the mutual conductance as large as possible."

RADIO INTERFERENCE CONFERENCE

The University of Illinois is planning a radio interference conference to be held in Urbana, Saturday, May 10. The purpose of the conference is to inform radio Service Men, radio amateurs, public service interference trouble shooters, and radio engineers of the sources of radio interference and their correction. It is hoped through this conference to clear up many misunderstandings which have caused much friction in the industry.

Some of the topics to be discussed by outstanding engineers is the generation of combination frequencies in a non-linear element, diathermy interference, receiver design to minimize strong signal interference, panel discussion on interference between radio amateurs and the broadcast listeners, the adjustment of transmitters to reduce spurious emissions, reduction of appliance interference and other kindred topics.

A. James Ebel, Chief Engineer



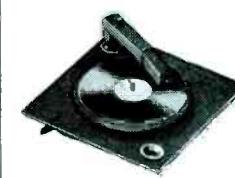
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ASSOCIATIONS

Allentown, Pa.

Over 125 members of the Lehigh Valley Radio Service Association, Allentown, Pennsylvania, were present at the third annual banquet held at the Hotel Allen, Monday Evening, February 27. Joe Marty, Jr. and George Duval of the RSA were our honored guests, and speakers for the evening. A five-act floor show and roast turkey dinner carried through the early part of the evening. After demitasse, jobbers and distributors from cities through the East exhibited new equipment. The evening was a decided success from every angle (and besides we made a small profit).

At the regular monthly meeting, February 10, the annual auditors report was submitted and approved. A parts and equipment show was discussed as a September possibility. At this meeting the association voted to affiliate with the RSA.

We expect to have a bang up meeting February 17, with Bruce Burlingame and the Supreme Vedolyer . . . See you uns all there.

Ray Abbott, Secretary

New Bedford, Mass.

The officers for the coming year were installed at the January meeting of the Whaling City Chapter of the Radio Technicians Guild, New Bedford, Mass.

These officers are: William Pedro, president; George Cadorette, vice president; Walter England, treasurer; James L. Shepley, secretary; and Louis Senra, Ernest Doyon and George Millette, advisory board.

James L. Shepley, Secretary

Pacific Coast

Solutions to profitable problems in servicing were explored for Service Men on the west coast by George C. Connor, Hygrade Sylvania commercial engineer, addressing the California, Washington, and Oregon sessions of the January "Sylvania Service Schools."

Of special interest to the Service Men attending the Fresno and Oakland, California meeting, sponsored by DeJarnatt Wholesale Radio Parts Company, was the innovation of writing with fluorescent chalk on a white board by Mr. Connor to illustrate wiring of radio circuits. The room was totally dark and the board illuminated by ultra violet ray beams which

activated the fluorescent particles in the chalk. The drawings stood out clearly in detail to the entire audience and eliminated glare and eye fatigue usually consequent to peering at a white chalk marked blackboard in a brightly lighted room.

Sylvania West Coast "Service School" meetings were held in Riverside, Los Angeles, Fresno and Oakland, California; Eugene and Portland, Oregon; and Bellingham, Seattle and Spokane, Washington. The meetings were sponsored by Sylvania jobbers in each locality. The jobbers were represented at the meetings by members of their respective organizations, namely; Frank A. Nelson of the Frank A. Nelson Company, Paul Hanson of E. M. Nelson Company; Ed Manzfield of Cook Nichols Company; Howard Taylor of Radio Supply; Larry Lynde and George Mason of Fred S. Dean Company; Lloyd Wacaser, Tom Walters, Stewart Richmond and DeJarnatt Wholesale Radio Parts Company; W. D. Brill, Ralph Seitz, Al Syles, Paul Seitz of W. D. Brill Company; Mr. Hay of Carlson, Hatton & Hay Company; Tom Morgan of Northwest Radio Supply Company; Virgil Cowen of Stubbs Electric Company; Jim Waitkus of Waitkus Supply Company; L. G. Reynolds and Frank Wedel of Northern Radio Company; and Morris Willis of Spokane Radio.

In commenting on the business outlook for 1941 and the impression of national defense spending on radio servicing, Frank A. Nelson, Sylvania Riverside, California jobber, observed that his January 1941 business was almost double that of January 1940.

In Fresno, California, DeJarnatt Wholesale Radio has noted a healthy increase thus far in 1941, and the past three month period is well over the comparable period of a year ago in both units and dollars. Jobbers in California, Oregon and Washington unhesitatingly prognosticated a banner year for 1941. This, despite the fact that large numbers of Service Men in these areas have joined Navy and Army forces.

At each "Service School" session door

John K. West, RCA District Sales Manager at Cleveland, addresses the "Know Your Stuff" meeting at the Hotel Carter, Cleveland. The group comprises the RCA jobbers and their salesmen. The meeting is one of a series being held in principal cities of the country.

prizes were donated by the jobber.

Representing Sylvania and assisting Mr. Connor in conducting the classes were Western sales representative of Hygrade Sylvania, Perry Demarest, his assistant W. G. Patterson, Pacific Northwest Sylvania representative Art Detsch, and his assistants Don Brown and Al Willoughby.

Despite the flu epidemic raging in that section of the country at the time of the meetings, attendance was exceptionally good and visiting Service Men were eager to study the new problems in radio servicing.

Henry C. L. Johnson

Spokane West Coast Meetings

William Coon of Portland, Oregon, was retained by the Spokane Radio Company, Inc., of Spokane, Washington, to go on tour to all Northwestern centers. Starting October 7, Coon appeared at the meeting in Yakima, Washington. Then, in daily succession, he appeared at meetings in Walla Walla, Pullman, and Spokane. Missoula, Kalispell, Great Falls, Helena, Butte, Bozeman, and Billings were Montana cities visited in that order. Pocatello, Twin Falls, and Boise, Idaho meetings preceded the closing session on October 24 in La Grande, Oregon.

Meetings, held in the evenings, were initiated with a door prize card planned on a ballot layout in step with the spirit of the then-approaching national election. All meetings began promptly at 7:30 p.m.

Mr. Coon's thoroughness in covering his subjects and the high interest developed in presenting them brought all meetings to a close with enthusiasm pitched to an intensive degree. The volume of questions asked and thoroughly answered, warrants us to the opinion that Mr. Coon may well be a candidate for the year's most popular quiz program.

Morris H. Willis, Manager

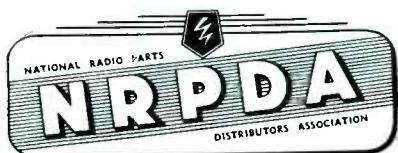
RCA Special Courses

A special course of demonstrations and lectures for parts jobber salesmen on the use of the RCA Dynamic Demonstrator in merchandising test equipment has been arranged by the RCA Tube and Equipment Division, in cooperation with RCA tube and equipment jobbers in many sections of the country.

Bill Bohlke, RCA's director of test equipment merchandising, is conducting the meetings for the entire personnel of parts distributors in the New York, Chicago, Cleveland and Kansas City areas. Gatherings are planned for other sections of the country, particularly the southwest and the west coast, before Spring.



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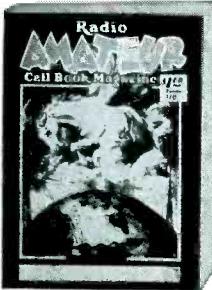
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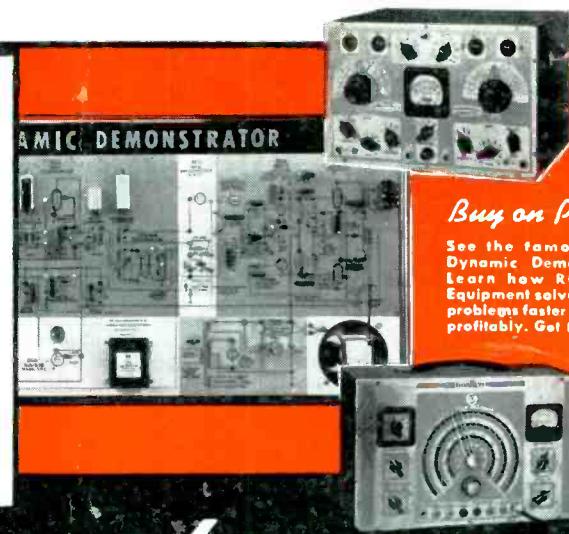
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