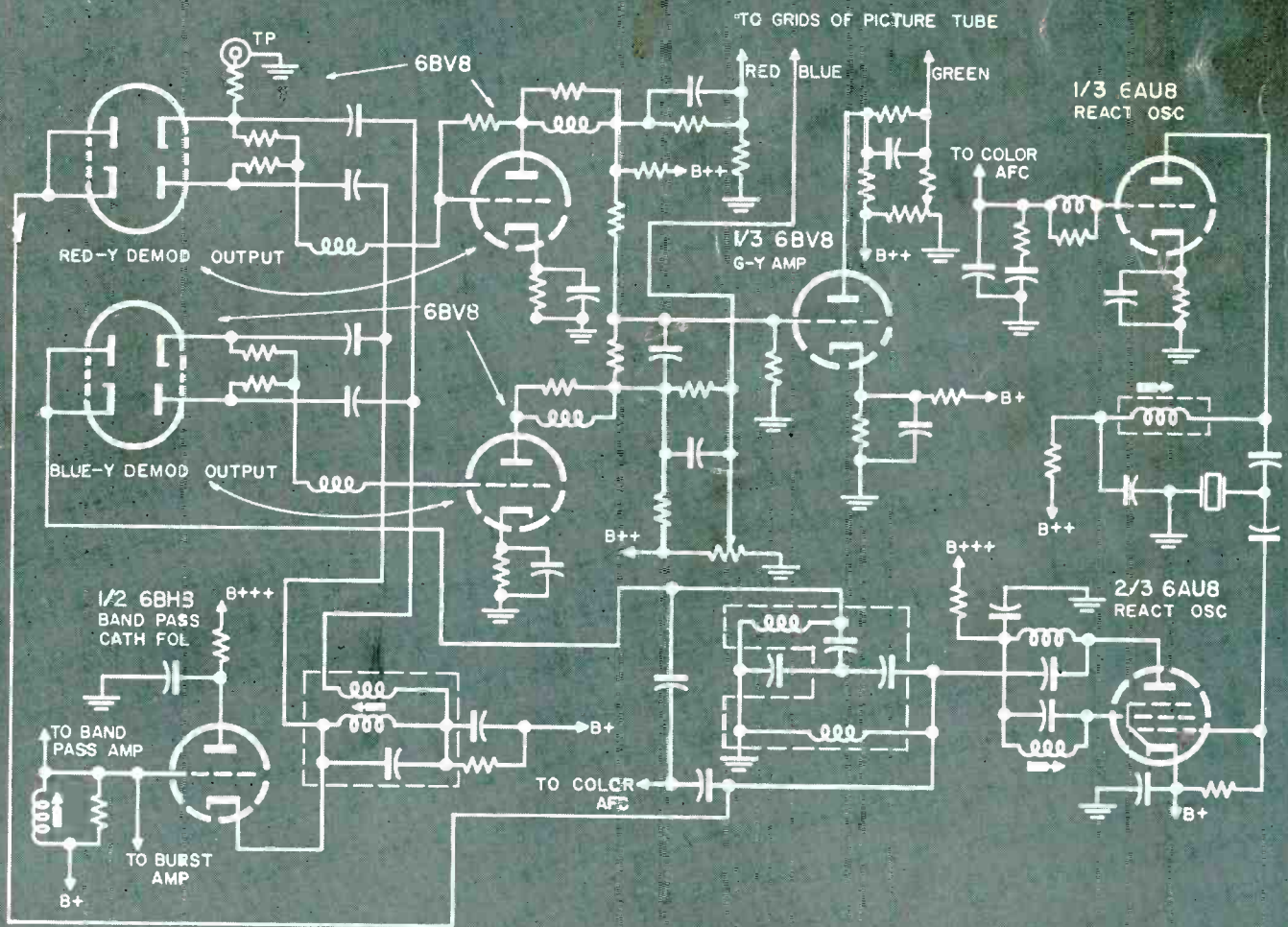


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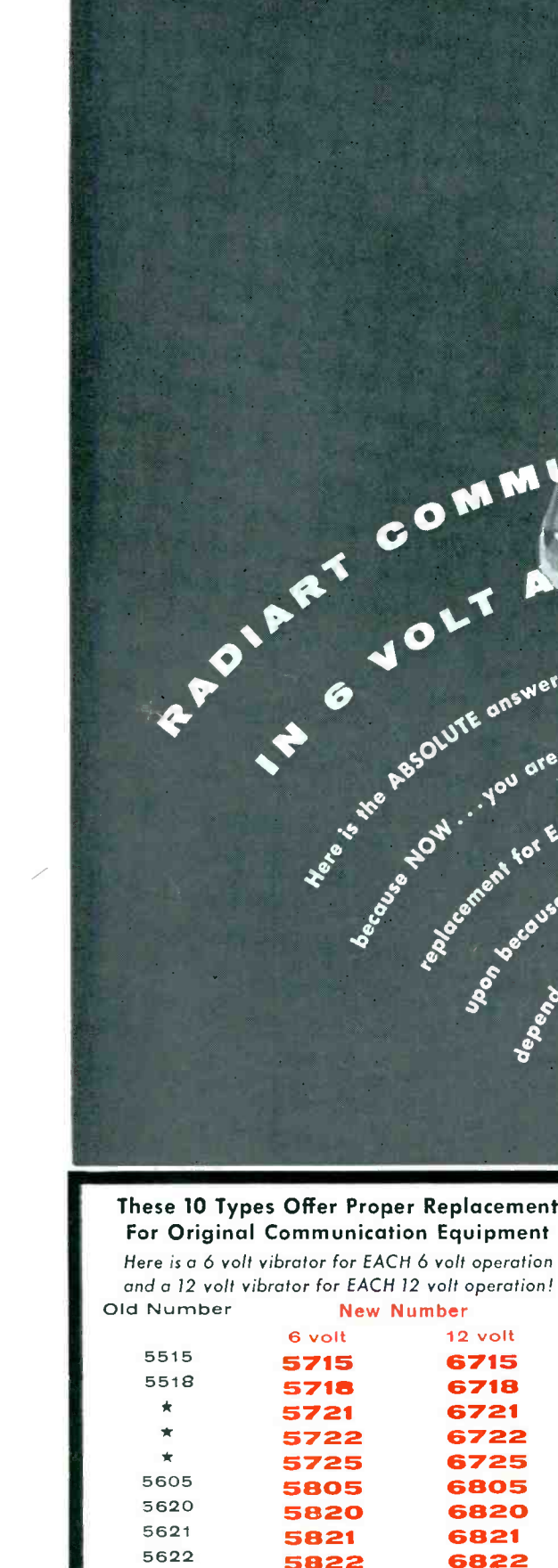
THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE



Color-TV vertical chassis color-demodulator color-difference circuitry using a double diode-triode.

See circuit analysis, this issue

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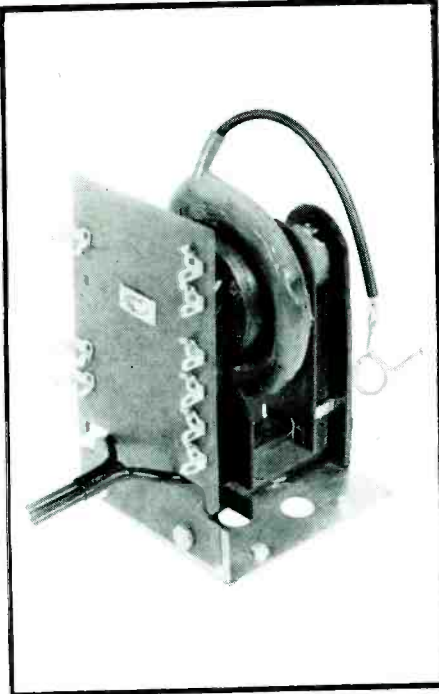
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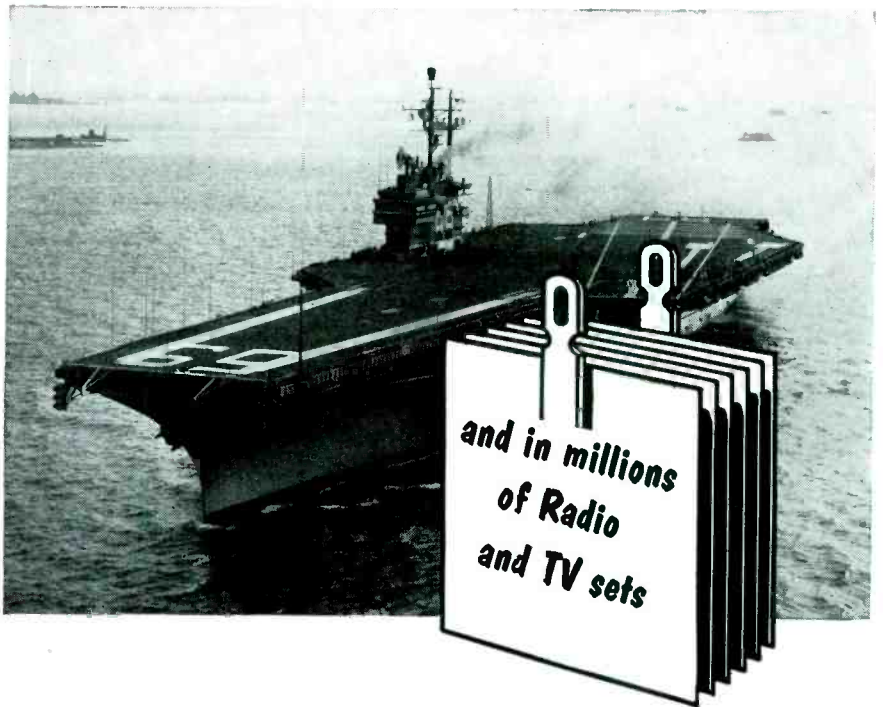
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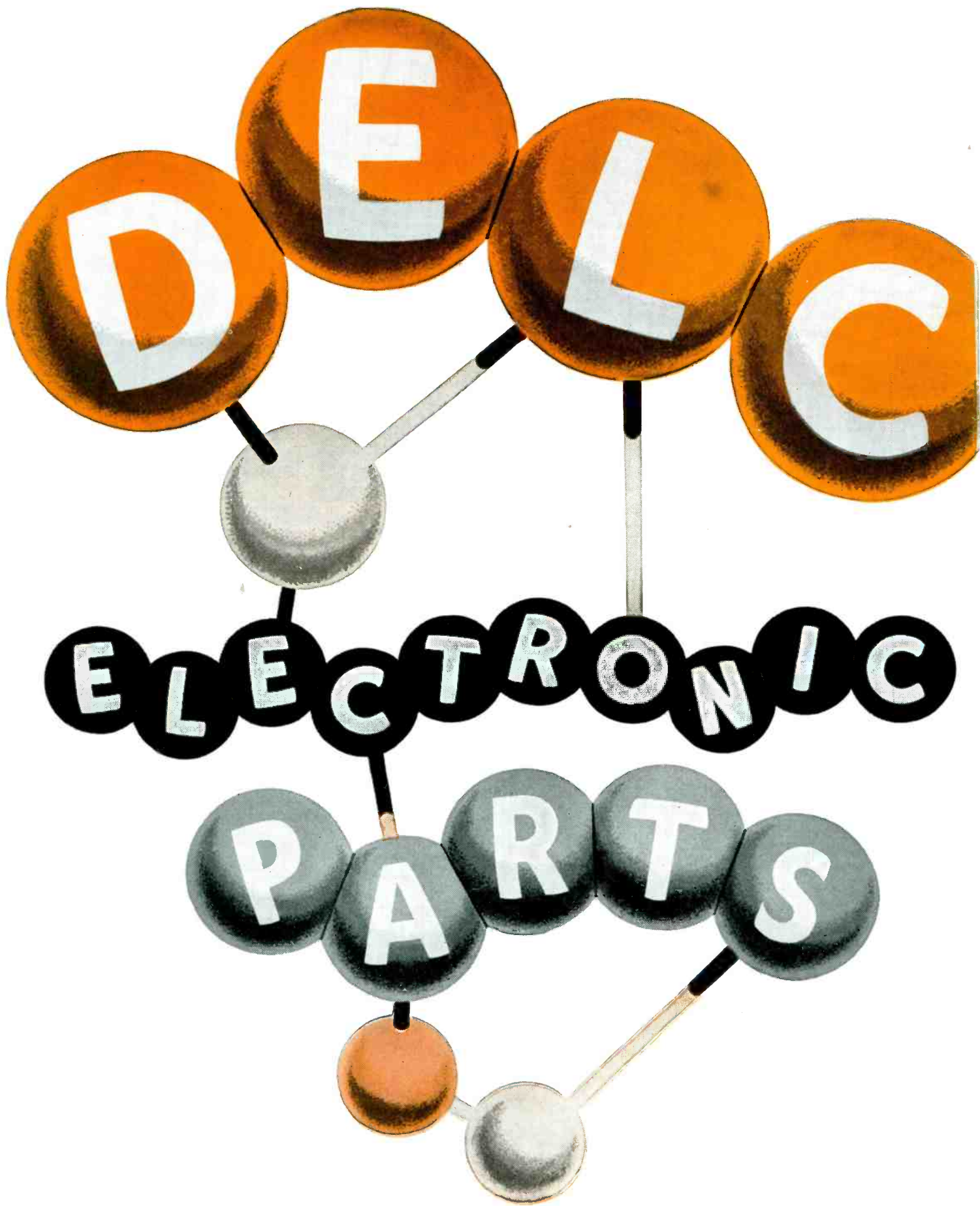
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LATEST SERVICE INFORMATION—The "Testing Tips" bulletin is another Delco service to the electronics industry. This handy information sheet keeps you up to date on parts revisions and common service problems—besides keeping you posted on interesting current events in the electronics industry.



THIS MONTH IN SERVICE

18-MILLION RADIOS IN NEED OF REPAIRS--Out of a total of 144-million installed car and home radios, 18-million are now out of order, according to a national check recently conducted by a broadcast agency in conjunction with the four radio networks. . . . About 12-million of the receivers that require attention are in homes, public places or businesses; the remainder are auto models. . . . In a breakdown of the total number of sets in operation, the study disclosed that there are now 83-million working-order models in about 46-million homes, or almost two radios for every radio family; 33-million auto radio sets, and 10-million radios in business establishments and public places.

ALMOST 75% OF NATION'S HOMES NOW HAVE TV SETS--An industry-wide report, released during the recent annual meeting of RETMA, revealed that about 75% of American households have one or more television sets and, based on the current rate of sale of receivers, this percentage will probably rise to over 90 within the next four years. High as this estimate is, it was noted, we are still far from the saturation point, because we must consider primarily the size of the market and saturation means only that the nature of the market is changing. . . . Set owners with only one set have now become customers not only for a second or third chassis, but replacements, too. For example, during '54 over 900,000 receivers were sold to those who already had one receiver in working order. Last year over a million and a half chassis were sold as the second set. . . . The replacement-set market is also booming. In '50, slightly over 100,000 replacement sets were sold; last year 2,366,000 replacement receivers were bought. . . . The report also disclosed that it is expected that TV set sales will surpass last year's record by at least 100,000; a new high of 7½-million unit sales are anticipated.

FCC ASKS INDUSTRY TO COMMENT ON UHF SHIFT PROPOSAL--A concerted program of research and development to increase the range of ultrahigh stations and reduce shadow areas, and bring about significant improvements in uhf receiving equipment, that would result in the expanded use of the higher bands, has been proposed by the FCC. . . . Specifically, the Commission said, if industry can show that uhf can do a national job, it will explore the advisability of either moving all TV to the ultrahigh band, or clusters of stations in a section of the country, such as east of the Mississippi, to the high bands. . . . Comments on this plan are to be submitted by industry to Washington by October 1st.

SINCE MANY YEARS would be required before an all-out ultrahigh TV system could be activated, the Commission offered an interim measure to improve competitive opportunities among TV stations. In one key move a number of cities would become uhf-only areas. The cities include Elmira (N.Y.), Evansville (Ind.), Fresno (Calif.), Hartford (Conn.), Madison (Wisc.), New Orleans (La.), Peoria and Springfield (Ill.), and Albany-Schenectady-Troy (N.Y.).

IN VIEW OF ENCOURAGING uhf experiments conducted at 4500 kw and higher, the FCC has said that it will allow a boost in maximum uhf power from 1000 to 5000 kw.

THE COMMISSION turned down proposals for squeeze-in vhf operations and rejected plans to create new vhf channels, noting that no additional channels from other services were available. But, the FCC pointed out, additional vhf channels for some cities (Mobile, St. Louis, Miami, Providence, Norfolk, and Charleston) may be authorized.

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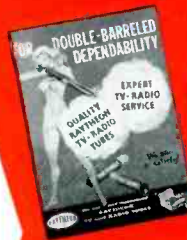
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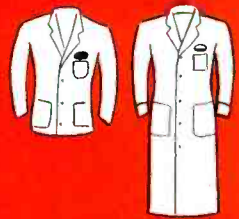
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Dynamic Changes in Mid-Year TV Models

TWICE A YEAR, in January and June, at annual industry conventions, a number of new *basic* TV lines are introduced. The mid-year crop of models that made their debut a few weeks ago displayed a variety of circuitry and system innovations that will require particularly careful study by the Service Man. For highlighted were new concepts of design involving many brand new tube types.

A striking illustration of the new tube treatments appeared in the picture network of a TV set using a decatron video system to up picture tube clarity. A team of special-type pentodes, serving as drivers and power outputs, have been worked into a circuit that can develop over 200 volts of video drive.

IN ANOTHER CHASSIS, a portable model, a high-gain dual-grounded-cathode triode (2BN4) has been included in a neutralized tuner feeding a multigrad mixer (half of a 5CG8), which in turn receives injection voltage from the other half of the tube, serving as a stabilized triode.

Also featured in this carry-about set is a quadrature sound detector, which is in essence a locked oscillator with a very high FM/AM ratio and with an output more than sufficient to drive an audio power amplifier. The behavior of this detector has been found to be such that in the absence of sufficient signal, there is no appreciable output, and once past the minimum, it provides automatic leveling, so that the sound output is substantially constant.

Included, too, in this streamlined receiver is a sync separator (half of a 6AU8), operating in conjunction with the recently-developed dual selenium horizontal *afc* rectifier in a tuning circuit that provides very stable pictures in the presence of noise.

ANOTHER UNUSUAL TUBE that serves as an *agc* amplifier and sync clipper, a 3/BU8, has been incorporated in a line of vertical receivers.

The physical construction of the tube is similar to a pentode in which the plate and grid 3 are split in half, forming two individual plates and two second-control grids. The cathode, control grid 1 and screen-grid elements are common to both halves of the tube. One section performs the function of an *agc* amplifier and the other as a sync

clipper. The *agc* voltage applied to the *if* and *rf* stages of the set is the resultant of two *dc* voltages of opposite polarity, one of them remaining constant, while the other changes with the signal level of the transmitting station.

Noise gating of the *agc* and sync clipper is actually a single function in the tube. It is accomplished by applying a negative-going composite signal (from the video detector) to the first control grid. A resistor (2.7 megohms) connected to the grid regulates the bias, so that any noise burst greater than the composite video signal will cut off the tube. This technique has been found to prevent noise from developing an erroneous *agc* voltage or erroneous signal information in the clipped sync.

COLOR-TV receivers also revealed new tube developments. To simplify wiring, shielding and circuit tracing, the design department of one set manufacturer, in collaboration with a tube maker, have developed a double diode-triode (6BV8) and incorporated the unique tube in a color-demodulation and color-difference amplification system.¹

The double diode sections of the tube serve to compare the phase of the incoming signal to that of the 3.58-mc local-reference oscillator, and to provide an output that is proportional to the phase difference. One of the demodulators is fed an oscillator-reference signal that is 90° out of phase with the other, so that when the oscillator phase is correctly adjusted, one demodulator will produce a *red-Y* signal and the other a *blue-Y* signal. These color-difference signals are coupled to the triode output sections of the tube through a 3.58-mc self-resonant coil, which serves both as a trap for the subcarrier frequency and as a peaking coil for the demodulated frequencies.

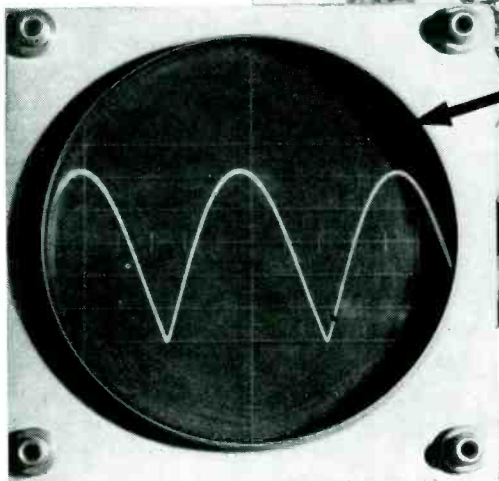
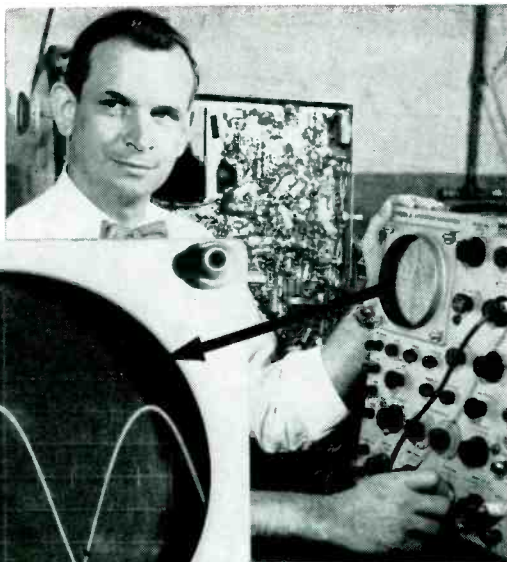
THE BROADENED APPLICATIONS of transistors also were headlined in the new TV receivers. The first fully-transistorized, wireless remote-control tuner showed up in one line.

The tuner, it was said, can change channels at distances up to 25 feet, and works in combination with a search-tuning circuit, which automatically adjusts the set for fine tuning.

COMPLETE EXCLUSIVE ANALYSES of the novel circuitry used in these new chassis will appear soon in SERVICE. Watch for these front-line reports.—L.W.

¹An exclusive field-engineering report on this new approach, featuring the complete color-TV set circuit diagram, appears in this issue on pages 10, 11, 14, 15 and 36.

MARLIN KROGER synchronizing a parabolic waveform on 'scope resulting from adjustment of vertical convergence coils on color receiver.



21-Inch COLOR-TV Vertical Chassis With 6BV8 Color- Demodulator / Difference Amplification Circuitry

by **MARLIN KROGER**, Senior Engineer, Motorola, Inc.

See Front Cover and Pages 14 and 15 for Complete
Circuit Diagram

IN DEVELOPING a receiver, it is necessary to consider not only the electronic aspects of the project, but the mechanical problems, too. This is particularly true in the design of a color chassis, where mount provision and availability of controls are extremely important.

In evolving our new line of color chassis,¹ it was decided to use the vertical mount structure, because this permitted location of the controls in the upper right hand corner along side of the picture tube facilitating tuning.

To simplify servicing, the low voltage power supply has been placed on a subordinate chassis, positioned under the picture tube. And to ease convergence adjustments, a third and smaller chassis has been located on the left side of the cabinet and mounted in a removable fashion, so that the chassis can be placed in front of the set during the convergence operation. The picture tube (21AXP22A) has been mounted directly to the front of the cabinet in an insulator designed to prevent corona.

Circuit Features

Electronically the 21-inch color set features wide bandwidth circuits throughout, and a complete color *afc* system.

Up front is a four-wafer tuner,² modified for color, with an improved

¹Main chassis is coded TS-905; models are known as the 21CT2 line.

²Motorola TT-83.

standing-wave ratio, which is important in maintaining color-signal stability.

The modified tuner, a cascode plug-in-wafer type unit, features tighter tolerance limits on bandwidth, tilt and dip.

The bandwidth has been widened slightly so that a minimum of 5 mc can be obtained; the limits on curve tilt and dip are 15%. The limit on standing-wave ratio is 3:1 on the high channels and 2:1 on the lows.

The oscillator adjustments can be made from the front of the receiver. This makes it possible to restrict the range of the fine tuning control which facilitates tuning of a color receiver.

The *if*, containing *hi-Q* traps, is a four-stage 40-mc gain-controlled circuit with a 4.1-mc bandwidth.

Remote cutoff tubes (6BZ6) are used in the *if* stages to minimize cross-modulation effects.

Separate Audio-Video Detectors

The audio and video detectors are separate, so that additional sound trapping can be accomplished prior to the video detection, to prevent audio sensitivity degradation.

The additional sound carrier trap assures freedom from 920-kc beat between the audio and chroma information carriers.

The video detector output is applied to the first video amplifier between grid and cathode, with the ground side of the detector circuit floating on the cathode load resistor.

This circuit splits essentially the plate load of the video amplifier into a cathode section and a plate section. A wide band, low gain (2 x) video signal is obtained from the cathode load resistor and applied *dc* coupled to the video output stage through the delay line. The *dc* level of this gain signal is about 12 volts positive. The same *ac* gain could be obtained by placing the load resistor in the plate circuit in the conventional manner, but then the *dc* level would be on the order of 150 volts, and *dc* coupling to the video output stage would be impractical.

The plate of the video output tube is *dc* coupled to the cathodes of the picture tube, and this *dc* level is varied to control the brightness. The brightness control is a bypassed potentiometer in the cathode circuit of the video output stage. Varying the value of the potentiometer varies the bias on the video output tube, since the first video amplifier controls the grid voltage. The bias on the video amplifier can be varied enough to change the picture brightness considerably, without greatly changing the *ac* drive. The picture-tube screen voltages are adjusted to put the brightness control in midrange, since picture-tube cutoff voltages vary considerably.

The picture tube cathodes are all driven with the same signal, since this has been found to give the best color tracking on a b-w picture. Color tracking is accomplished when the picture does not tend to show a color tint as

the brightness varies from dark to light.

The contrast control is a degenerative potentiometer in the cathode circuit of the video output stage. Since the video signal is *dc* coupled from the detector to the picture tube, most of the *dc* component is preserved; some is lost across the brightness control circuit. The loss of *dc* component is reduced by having a 33,000-ohm bleeder resistor between the plate and the top of the brightness control. The resistor is returned to the plate instead of the supply voltage, because the feedback produced is in the right direction to aid the *dc* component. Also, the bleeder action from plate to ground helps to reduce the change in brightness, as the contrast control is changed.

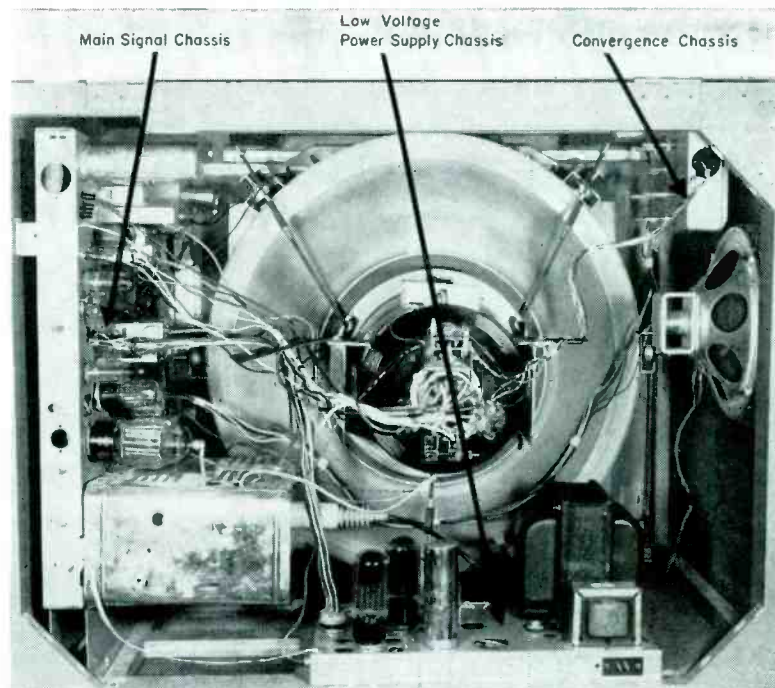
The load resistor in the plate circuit of the first video amplifier supplies amplified detector voltage for sync, *agc*, and chroma. The bandwidth in the plate circuit is considerably less than in the cathode, but the 2.5 to 4.1-mc portion of the signal present is of adequate amplitude to drive the bandpass amplifier.

The bandpass signal is taken off through a 4.5-mc trap and a high-pass filter circuit and applied to the grid of the chroma amplifier. Bandpass coils in the plate circuit of the chroma amplifier shape further the response and add skirt selectivity. Since the double-diode demodulators present a low-impedance load to the bandpass signal, they are driven by a cathode follower. The cathode coil in the cathode-follower circuit is a bifilar-wound coil to give the two phases of bandpass used. It is broadly resonant at 3.58 mc.

Gain control of the chroma amplifier is accomplished by variable grid bias, obtained by applying a positive horizontal frequency pulse to the grid during the burst interval. The grid draws current during the pulse, creating a bias voltage that is dependent on the amplitude of the pulse applied.

The pulse amplitude is varied by the chroma intensity control. The use of the pulse also insures that the burst will receive full amplification, even though the chroma amplifier is biased off. The bias of the chroma amplifier is also dependent on the action of the color killer and the automatic chroma level circuit.

The color demodulators use a new double diode-triode tube, the 6BV8, developed by our color engineering staff in collaboration with one of our tube suppliers. The double-diode sections of the tube are used to compare the phase of the incoming color signal to that of the 3.58-mc local-reference



REAR VIEW of 21-inch vertical color-TV receiver showing basic, low-voltage and convergence chassis.

oscillator and to provide an output that is proportional to the phase difference.

One of the demodulators is fed an oscillator reference signal that is 90° out of phase with the other, so that when the oscillator phase is correctly adjusted, one demodulator will produce a *red-Y* signal and the other a *blue-Y* signal. These color-difference signals are coupled to the triode-output sections through a 3.58-mc self-resonant coil, which serves both as a trap for the subcarrier frequency and as a peaking coil for the demodulated frequencies.

The triode amplifiers have a bandwidth in excess of 1 mc and can produce linear drives of over 180 volts peak-to-peak. Having the demodulator and color-difference amplifier in one tube simplifies shielding against 3.58-mc radiation. It also becomes easier to trace service problems, since there are no longer different channel functions in the same tube.

The *green-Y* signal is formed by matrixing the *R-Y* and *B-Y* signals and inverting them in the *G-Y* amplifier. When all the color difference signals are *dc* coupled to the picture-tube grids, the *dc* component is preserved and no *dc* restoration is required.

The color-sync burst is extracted from the chroma signal by a burst amplifier. The bandpass signal is coupled to the grid of the burst amplifier from the grid of a bandpass-cathode follower. The screen of the burst amplifier is gated with a positive

pulse derived from the flyback transformer and shaped to occur during the burst interval only.

The amplified burst signal is fed to a color *afc* detector, which is connected so that the *dc* voltage produced is twice that produced by conventional phase detectors. This additional *dc* output is particularly useful for automatic chroma level and color killer operation, because it makes their action more positive.

Balanced output from the *afc* detector, filtered to remove the horizontal frequency components, is connected to the reactance tube which controls the phase of the crystal-controlled oscillator in the conventional manner.

Automatic-chroma control is provided by feeding a portion of the negative phase-detector voltage back to the grid of the chroma amplifier. (Since the amplitude of this negative voltage is proportional to the amount of burst signal presented to the phase detector, the feedback loop tends to keep this level constant with changes in signal level, caused by tuning or other signal fluctuations such as airplane flutter.) This serves to keep the chroma intensity relatively constant for a given control setting. The effect on the tuning characteristic is quite pronounced and is very helpful to the viewer, since it reduces interaction between the tuning controls.

The color killer is also activated by the unbalanced negative voltage from

(Continued on page 36)

Three-Color Transparency Viewer Developed To Facilitate

COLOR-Bar Adjustments

by **B. D. LOUGHLIN**

Chief Engineer, Research Division
Hazeltine Corp.

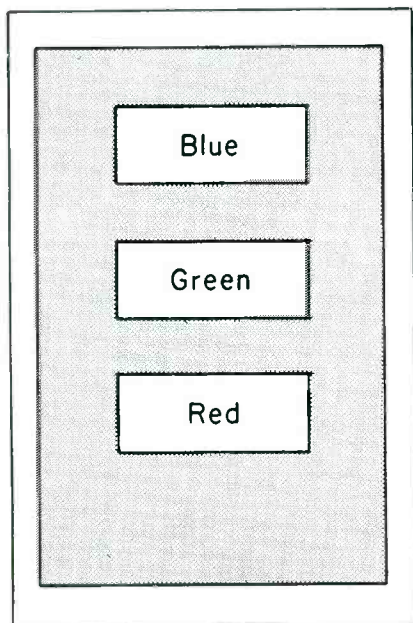


FIG. 1 (Below)

EFFECT of chrominance-channel errors observed with color-bar test signal that has cyan, blue and magenta as adjacent bars, providing a blue color signal pulse with a width of three bars. Equality in amplitude of the three parts of this bar provides a check of decoding action, which can be seen by viewing display through blue filter of viewer shown above.

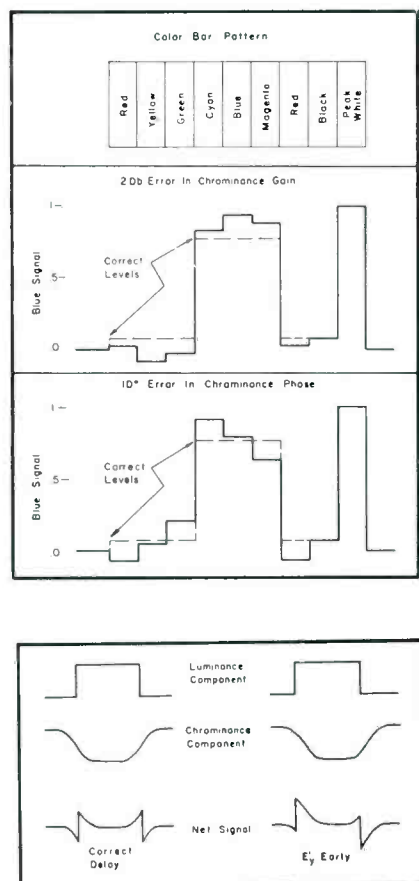


FIG. 2 (Left)

EFFECT of delay equalization errors for luminance and chrominance components. It will be noted (at left) that the transients produced at the starting and stopping of the bars are symmetrical if the delays of the respective chrominance components and the luminance component are correct.

blue, and magenta as adjacent bars, and thus has a blue color signal pulse with a width of three bars, as shown in Fig. 1. The quality in amplitude of the three parts of this wide bar gives a check of correct decoding action which can be seen by viewing the display through the blue filter of the viewer. Errors in phase of decoding can be distinguished as a general slope across the wide blue bar, and errors in gain as a peak or valley in the wide pulse, as shown in the drawing. By using the red and green viewing filters, the uniformity of the derived red and green color-bar pulses can be observed, giving a quick check on the matrixing operation and on the quadrature phase relation between demodulators.

Beyond checking the overall color coding operation of the color TV system, the viewer can, of course, be used for any testing in which a visual separation of the red, green, and blue reproduced images is desired. Delay equalization and color-purity checking represent examples of tests which can be assisted through the use of these color separation filters. While it is true that such tests can be conducted on receivers using three-gun displays, by adjusting the biases so that two of the guns are cut off, in certain cases it may be desirable to leave the normal bias adjustments untouched and instead to separate visually the rasters by using the viewer.

The delay equalization test signal at Hazeltine has two color bars, both bars having no blue signal, but having suitable amplitudes of green and red signals so that one bar produces a plus E_r' component with no E_g' component and the other bar produces a E_g' component with no E_r' component. If the derived blue color is observed, it should have zero value at all times except during transients. These transients produced at the starting and stopping of the bars are symmetrical, such as shown in Fig. 2 (left) if the delays of the respective chrominance components (E_r' for one bar,

(Continued on page 36)

¹This viewer was illustrated and briefly described in the R. C. Jansow report on color servicing which appeared in the June issue of SERVICE.

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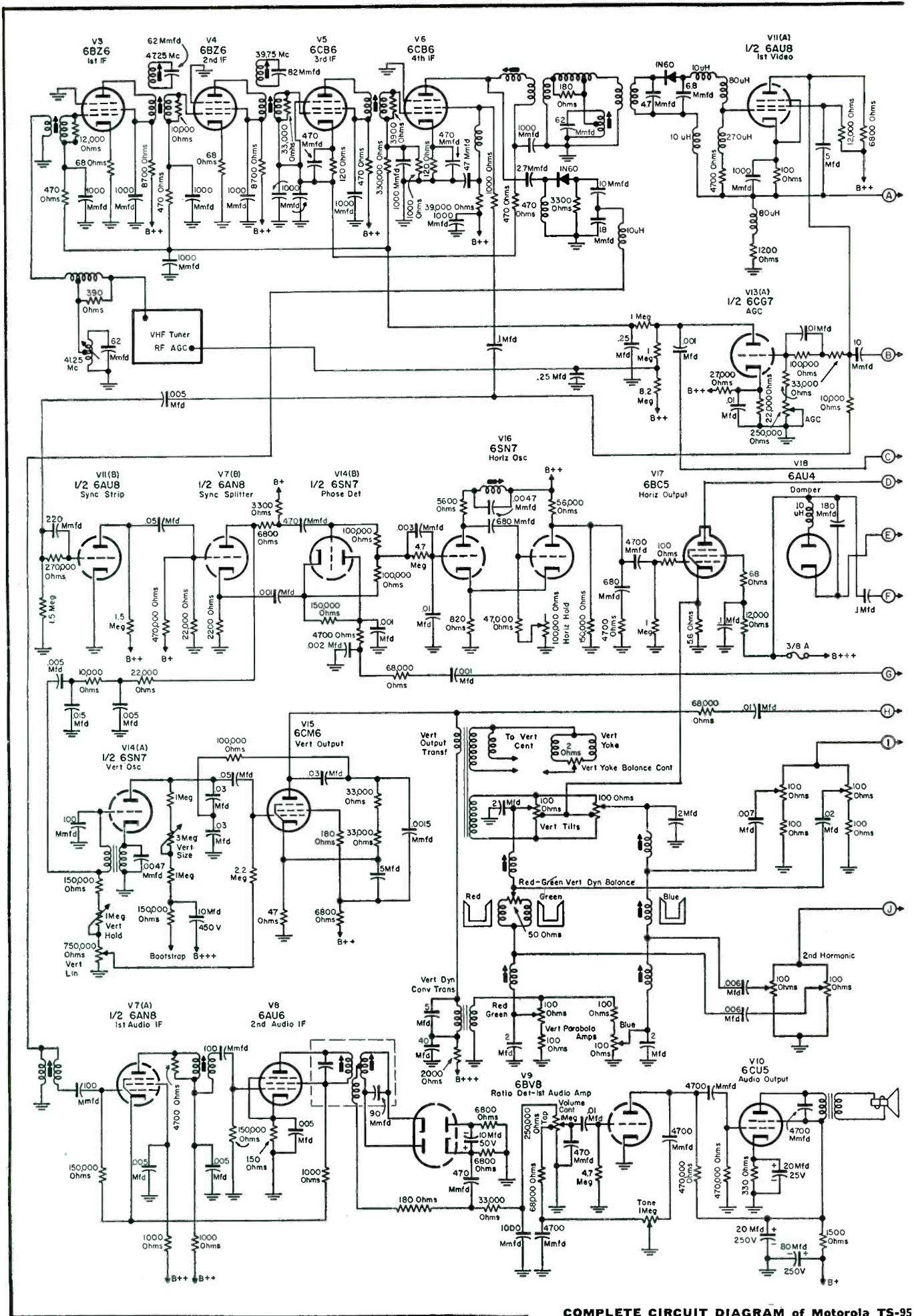
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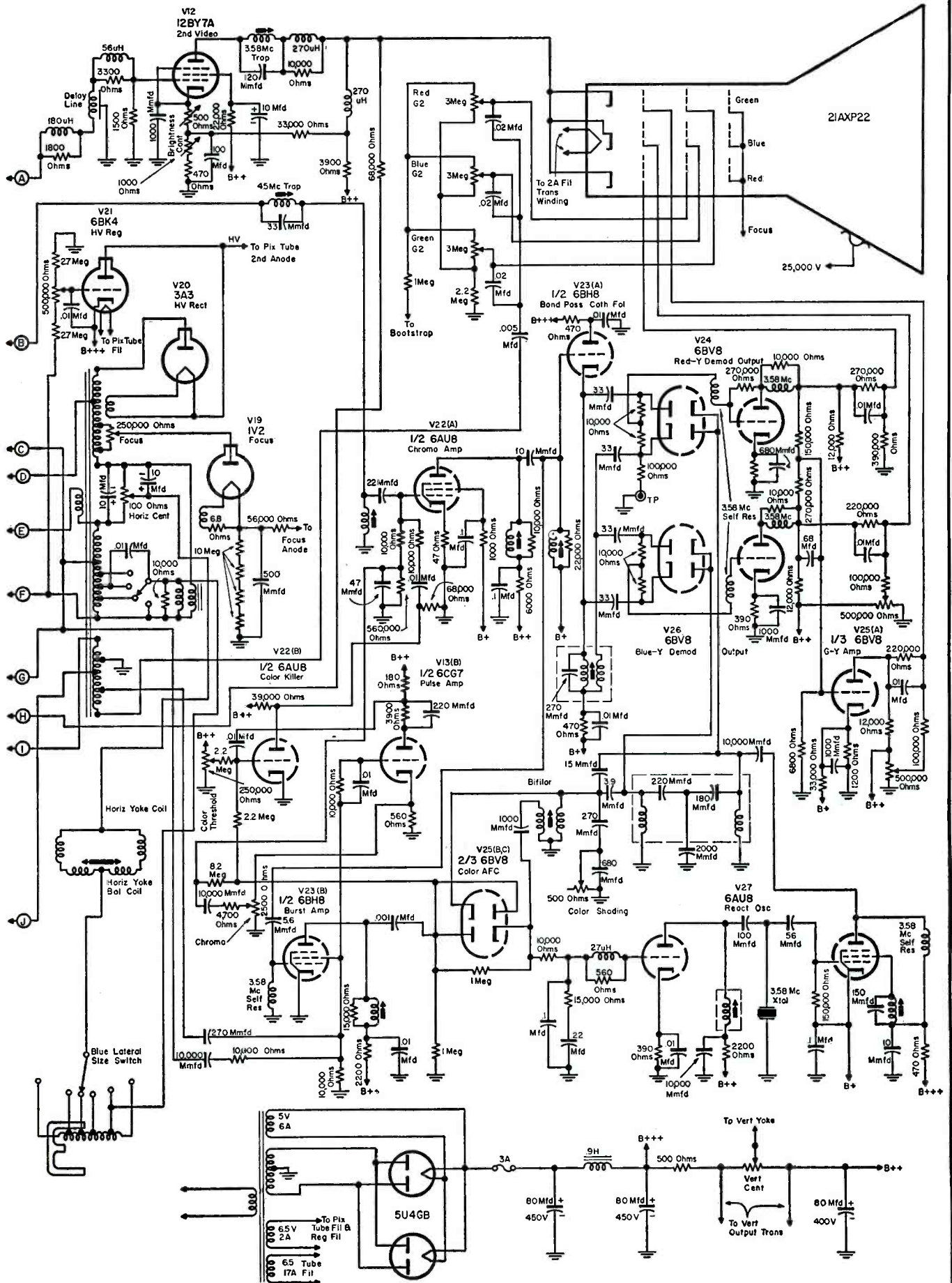
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COMPLETE CIRCUIT DIAGRAM of Motorola TS-95



Color-TV receiver which employs a vertical chassis.

Curbing TVI Caused By Cross Modulation and Other Mixing Effects in TV-Set RF and IF Stages

by HAROLD R. RICHMAN

Associate Advisor, Washington, D. C. TVI Committee*

TV RECEIVERS may be subjected to interference from a great many sources, such as:

(1) Strong signals from nearby radio stations, including FM broadcast, amateur, police, taxi, government, airways and military services.

(2) Radiation from local oscillators of nearby TV and FM broadcast sets.

(3) Diathermy, industrial heaters, etc.

(4) Image interference (This situation exists when a strong signal occurs at the oscillator frequency plus or minus the *if*).

Interference can affect either the audio or the picture, and possibly both.

In the audio portion, signal distortion can obtain, and unwanted audio signals can ride along with the desired audio.

Problems that can occur in the video include distorted, non-linear and unstable pictures and the presence of interference patterns.

When two signals are introduced in a non-linear circuit, they mix and

cross modulate. The non-linear condition may be brought about by the overloading of one or more circuits by a strong signal.

This difficulty usually occurs in one or two places in the receiver: *rf* input or tuner circuits, and *if* circuits. Any extremely strong signal, even though it is entirely out of the TV channels, can produce this condition if allowed to reach one of these two circuits.

Cross modulation occurring in the *rf* circuits may be due to the voltage of two strong signals reaching the grid of an *rf* stage and causing the tube to operate in a non-linear manner. Mixing of the two signals takes place with the tube acting as a converter or mixer. From here on the interference is incurable. Once the cross modulation has occurred it is impossible to separate the desired from the undesired signal.

Cross modulation occurring in the *if* stages of a receiver is also usually due to a strong signal reaching the grid of one of the *if* stages, causing it to operate over a non-linear range,

or to draw grid current, become non-linear and function as an inverter or mixer.

The undesired signal finds its way to the grid or grids of either *rf* or *if* stages because it is not opposed by sufficient rejection circuits. This may mean inadequate *rf* tuned circuits ahead of the *rf* stage, or insufficient shielding of the *rf* and the *if* stages, or both. An undesired signal may be thousands of times stronger than the desired signal, because its source is closer to the receiver. To eliminate the undesired signal some means of adding rejection circuits, shielding or both is necessary.

To prevent cross-modulation effects, an appropriate filter on antenna input or power line, or both, can be introduced.

In a very heavy *rf* field caused by a strong signal the *rf* energy can reach critical stages without being conducted along wires leading to the receiver. Direct pickup of this type is particularly likely to occur in unshielded coils, especially when located above the chassis. Shielding components above and below the chassis from this type of pickup can often be accomplished by the judicious use of ordinary copper screen or other suitable, easy to handle, shielding material. Sometimes, it is easiest to shield the entire inside of the TV cabinet, rather than to individually shield suspected points of pickup. One precaution is necessary in this latter case. All leads going through this shielding must be suitably filtered in order for the shielding to be fully effective.

A signal in the intermediate frequencies picked up in the first *if*, but possibly not causing cross modulation until the second or third *if* stage, can usually be cured by more adequate shielding.

Reorientation of antenna may help. Two purposes may be served by relocating or reorienting the antenna. A stronger desired signal and a minimum undesired signal may be had. A TV receiver, when provided with a strong desired signal, will ignore an interfering signal of an intensity that otherwise under weak desired signal conditions would cause interference. When the desired signal is strong the receiver is operating usually with *avc*; its sensitivity to other signals is reduced.

A higher-gain more selective antenna system in weak signal areas has also been found effective, giving more

(Continued on page 36)

The Washington TVI Committee*

THE WASHINGTON TELEVISION INTERFERENCE COMMITTEE, formed in February, '52, was initially composed of a representative from each of seven active amateur radio clubs in the Washington area. Eleven clubs are represented at present.

In addition to these committee members many associates and advisors attend regularly-scheduled meetings of the committee. The Radio-Electronics-Television Manufacturers Association, Electric Institute of Washington, FCC, manufacturers' service reps and local independent Service Men, local power companies, telephone companies, all four Washington area TV stations, Armed Forces communications, Civil Air Patrol, NARTB, ABRL, and many others have contributed to the success of WTVIC.

The committee has published several bulletins for Service Men, with the support of RETMA and the Electric Institute: A pamphlet introducing WTVIC to Service Men, acquainting them with the purpose and function of the committee; a poster outlining the most commonly encountered types of interference and cures; and a detailed analysis of interference causes, dealing specifically with audio rectification. A second pamphlet in this series, on cross-modulation problems and cures, on which the article on this page is based, will be in distribution soon.

Approximately 2,000 copies of each issue of this educational literature have been distributed to Service Men in the Washington, D. C. area, and nationally, and in addition forwarded to manufacturers and reps throughout the country as examples of the work WTVIC is undertaking for the mutual benefit of all concerned.

The committee has completed recently a film primarily for TV broadcast, and for showing before community and other civic groups, dealing with TV interference and designed to reach the *general viewing public*. The film is available to any TV interference committee, and TV service organizations.



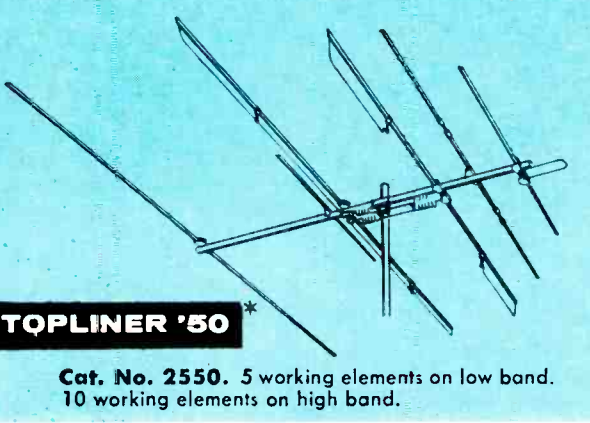
TOPLINER '40 *

Cat. No. 2540. 3 working elements on low band.
9 working elements on high band.



TOPLINER '60 *

Cat. No. 2560. 6 working elements on low band.
13 working elements on high band.



TOPLINER '50 *

Cat. No. 2550. 5 working elements on low band.
10 working elements on high band.



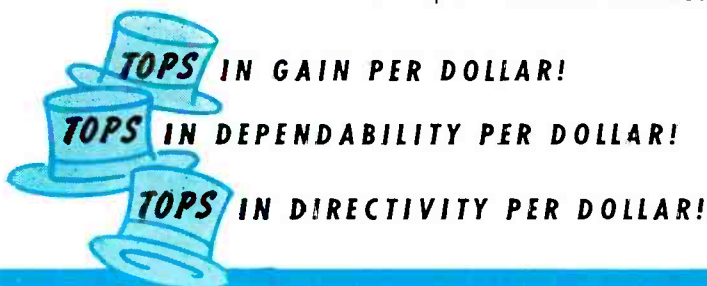
TOPLINER '70 *

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IN CANADA: Hackbusch Electronics, Ltd., Toronto 4, Ont.

* Pat. Pending

NEW TUBE PACKAGING PLAN

A new tube package, *Ten Top Tubes*, featuring 50 of the 10 highest-volume types of receiving tubes packed in one unit, has been announced by the electronic tube division of Westinghouse Electric Corp.

Package contains five each of the following tubes: 6BZ7, 6CB6, 6AU6, 6BQ7A, 6AL5, 12AU7, 6J6, 6SN7GTB, 1B3GT and 5U4GB.

SERVICE PARTS CAMPAIGN

A promotional program, designed to increase sales of service parts at distributor and shop levels, has been announced by the RCA tube division.

Campaign features basic stock, dealer parts package, and distributor-dealer identification programs. Basic stock program utilizes a quick-turnover inventory of 164 most-called-for stock numbers, inventory control guides, promotional price lists and technical information. Dealer parts-package program consists of three separate packages of assorted parts.

COLOR-TV HOME STUDY COURSE

An 11-lesson color-TV home study course, compiled originally by RCA Institutes and augmented with advanced data and servicing techniques prepared by *John R. Meagher*, has been introduced by the RCA tube division.

Course is being offered in combination with the purchase of RCA receiving tubes. Students who complete the course will receive certificates.

INDUSTRY PLAQUE WINNER

A gold plaque was presented to *Charles Golenpaul*, vice president and head of the distributor division of Aero-vox, and retiring president of the Radio Old Timers Club, as the first annual award of the group, at its annual get-together during the recent show in Chicago. The award is for the most outstanding contribution to manufacturer, distributor and representative relationship in the electronic industry.



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AMPHENOL

NEW COAXIAL CABLE CONNECTORS

Two new time-saving, reusable, field-workable coaxial connectors are now available. The 83-850 is a *completely solderless* connector that can be assembled to RG-11/U or RG-59/U cable with a screwdriver and a pair of pliers! The 83-851 is *semi-solderless*, may be used wherever an 83-1SP has been used. Only the contact is soldered—the braid is locked mechanically by a positive-action cable clamp as in the 83-850. Both plugs are plated with corrosion-resistant cadmium.

features

COMPLETELY SOLDERLESS

83-850—no solder, no crimp
83-851—semi-solderless

FULLY RE-USABLE

attach and detach, use again and again

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applications

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speeds work, saves money

COMMUNITY TV INSTALLATIONS

for every field application

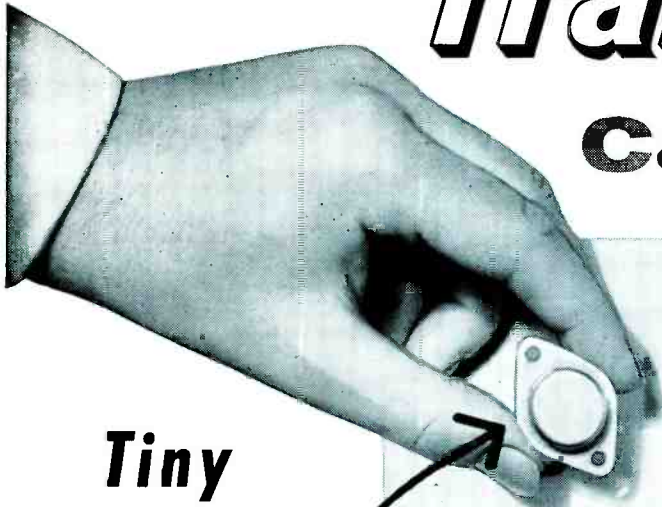


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Watch for this solderless
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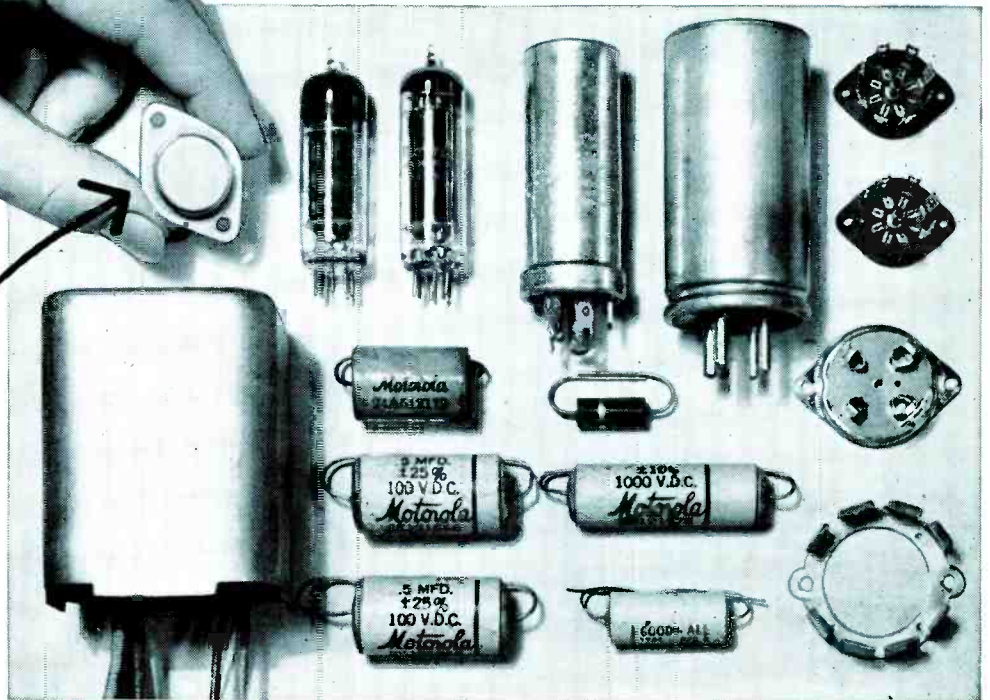
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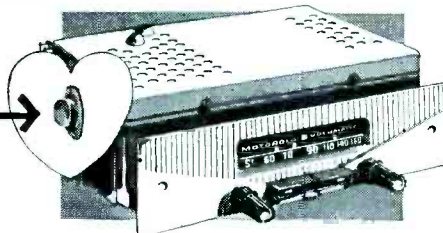
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Tiny transistor replaces 15 vital car radio parts



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Motorola Transistor-Powered Car Radio. (Model 6TAS-8, 12 volt) \$99.95. Other new models from \$39.95

PLUS—NEW TWIN BAR STATION FINDER Most automatic tuning of all! Electronically picks and pinpoints any station. Twin Search Bars move station selector either right or left from any point on the dial.

Most trouble-free car radio ever built—The amazing transistor heart won't ever wear out. And it replaces 15 parts that do wear out in conventional sets. (Including the vibrator and vacuum tubes.)

Cuts battery drain 50%—Transistors use hardly any power. Even with the engine off, this radio can play for hours without running down the battery.

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Here's how you fit in—Every fourth car lacks a radio. Car radio sales are up 30% . . . and still growing. And now, Motorola has produced the hottest car radio ever. Advertised in *Reader's Digest* (to reach every third American). Now's the time to get into the plus-profit car radio business. Send this coupon today. No obligation.



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A Report on the 5th Annual COMMUNITY-TV Convention

THE VARIETY OF COMPONENTS, equipment and accessories, specially developed for community TV applications, received key attention at technical clinics during the fifth annual convention and trade show of the National Community Television Association, recently held in Pittsburgh.

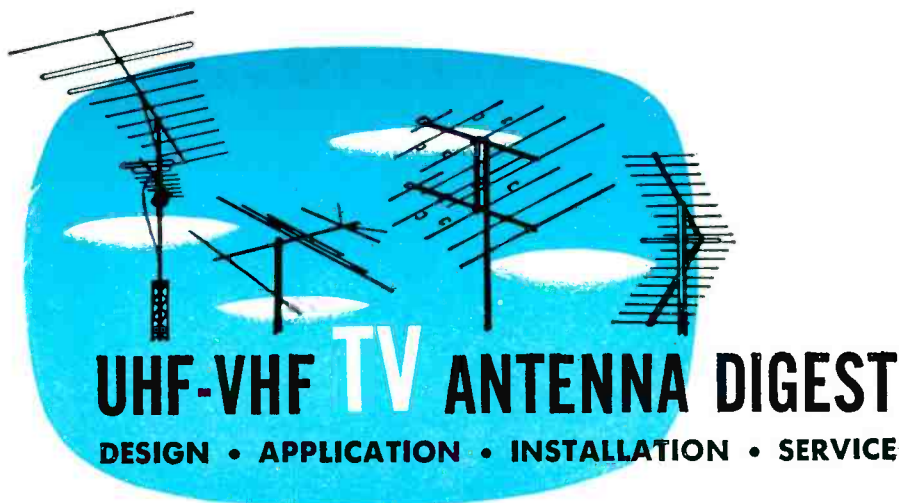
It was revealed that there are now available low-noise single-channel preamps with a minimum gain of 30 db, that can be either directly or remotely powered, and mounted on towers, masts, telephone poles or crossarms.

When the units are directly powered, 115 volts are supplied by a power line; they can be remotely powered by 19 volts fed over the rf transmission line from a power supply (a remote supply which combines rf signals and ac power on a coax transmission line).

Low band of the preamp, it was noted, utilizes a 6BK7A and a 6CB6; high band a 6BK7A and a 6AK5. Impedance is 75 ohms in and out.

The remote power unit was described as a supply which can provide from 19 to 28 volts ac in eight steps, 1 ampere maximum.

Also detailed were variable attenuators (3 to 50 db) designed to provide stable control of signal level in the 50 to 250-mc band. A 3 to 30-db variable attenuator, in conjunction with a switchable 20-db pad, it was claimed, serves to provide a continuously variable output in two ranges. Applications of the units include use with fixed gain broad-band amplifiers; for checking TV receiver *agc* action; as an auxiliary low leakage attenuator for test equipment; and as a variable attenuation broad-



band antenna matching transformer.

Adjacent-channel interference, caused by excessively high sound carrier levels, can now be eliminated, it was revealed with sound limiting amps. They serve to stabilize control of the sound carrier level; a reserve gain eliminates loss of sound, it was claimed, even when signals drop to 10 *uv* at the antenna due to selective fading. Six tubes used; four 6DC6s and a pair of 6AU6s.

Sharp-cutoff, high-attenuation units, known as notch filters or traps, that afford a means of improving band-edge response of broad-band filters or amplifiers, were also reviewed. Their narrow bandwidth were said to allow them to eliminate narrow-band cochannel interference caused by spurious signals or beats, without noticeably affecting picture quality. Two bandwidth range mod-

els (200 kc and 400 kc) have been developed.

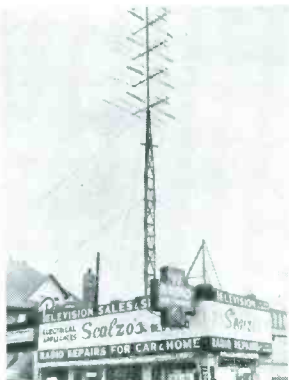
Also discussed were ruggedized yagis with from five to ten elements in twin and triple-driven designs. One series, with 8 elements, were described as having four directors, three driven elements and a reflector. The driven elements, serving as folded dipoles, and fed with parallel transmission lines, featured a coax feed point from the rear driven element. Balance to unbalance transformation of the rear folded dipole was accomplished, it was said, by means of a coax cable within the dipole tubing.

Bandwidth requirements were claimed to be met by using stagger-tuned triple-driven dipoles.

A unique feature of this antenna was a dampening device located at

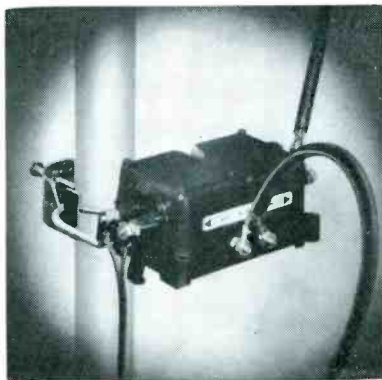
(Continued on page 36)

Array of five JFD antennas mounted on a self-supporting tower 70' above ground level, installed recently to feed signals to TV sets on sales floor and receivers being serviced.

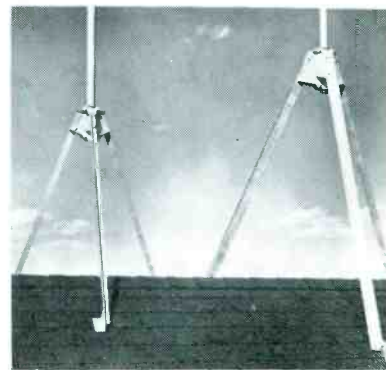


Uhf-vhf interaction filter designed to link vhf and uhf antennas via a single transmission line of any length.

(Ultra-Tie: Channel Master.)



A 5' tower developed to eliminate guy wires on antenna installations up to 20' above the roof. Base is 48". Tower is hot-dipped galvanized; fits pitch roof and assembled except for one leg that is detached for shipping and storage. (Yug: Baker Manufacturing Co.)



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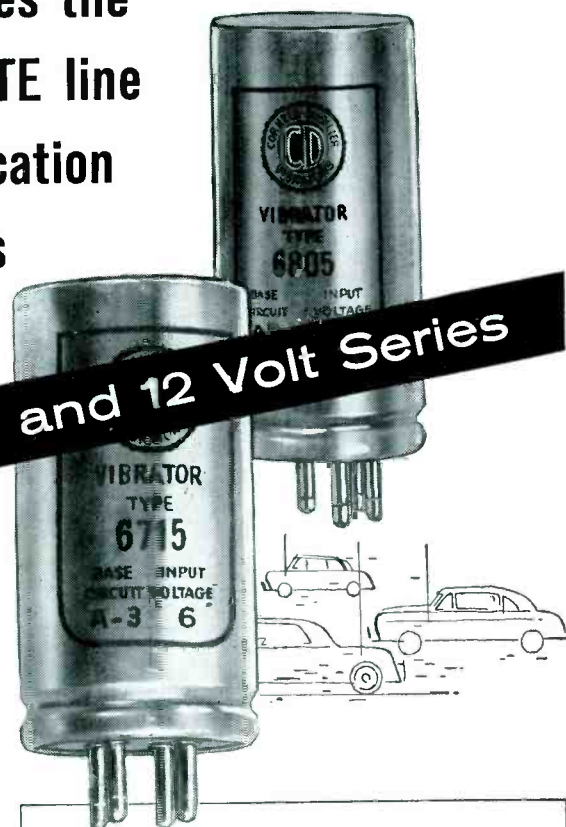
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5820	6820	5620
5821	6821	5621
5822	6822	5622
5824	6824	★

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SUBSIDIARY: THE RADIART CORPORATION, CLEVELAND, OHIO

Service

APPROXIMATELY 15,000 MOBILE radio units have been authorized for use by the railroads. Almost every major railroad uses a radio system. Some have very elaborate setups, while others are still experimenting. Typical of the more progressive railroads is the Northern Pacific which runs from St. Paul to Seattle and Portland and which operates 460 radio units including 48 base radio stations and 273 mobile units. The NP radio system includes an up-to-date line-of-road communications net across North Dakota and Montana, as well as in the mountainous areas farther west.

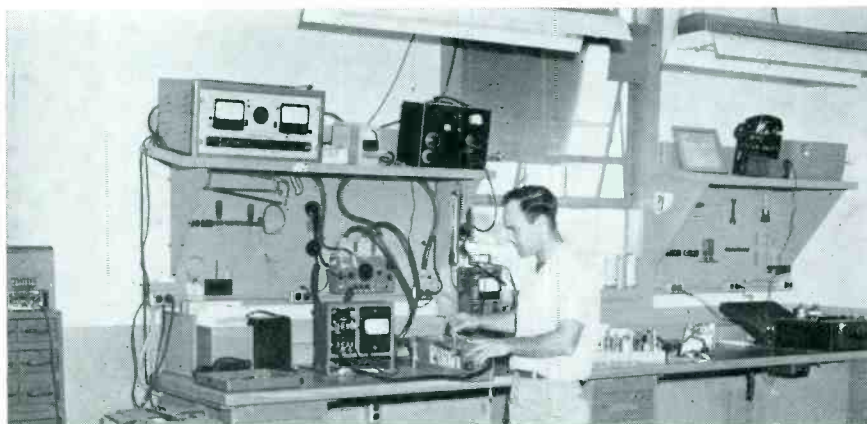
Two-way railroad radio is used to provide direct communication in yard and terminal operations from the yardmaster's office to engine crews and supervisory personnel on foot in the vicinity of locomotives. It is also used by personnel on foot carrying compact one-way transmitter units and two-way walkie talkies for communicating with yard offices or engine crews. In line-of-road operation, two-way radio serves to establish continuous and immediate contact between the crew in the caboose and the crew in the locomotive. In addition, train crews keep in touch with crews of other trains and with wayside operators and sometimes with the dispatcher.

Railroads also use two-way radio in their freight pickup and delivery trucking operations, on fork-lift and other material - handling vehicles, police cars and supervisory cars. Point-to-point radio in the form of microwave radio relay systems is being used by two railroads, the Santa Fe and the Rock Island, and is being installed by the Southern Pacific.

Walkie-talkies are widely used in yards by car checkers who report car numbers by radio to clerks inside an office building. In some yards one-

(Left)

ALIGNING A vhf receiver using a test set as indicator in a shop equipped for servicing railroad radio. At left is a rack similar to that used on trains into which transmitter, receiver and power supply can be plugged in for operational testing. On top shelf (extreme left) are a frequency and deviation meter, an rf-power output wattmeter and a vhf signal generator. At extreme right is a vhf monitor receiver and below a tube tester. (Courtesy, Southern Pacific Company)



¹Bendix MRT-6.

Engineering

Railroad Radio 2-Way Fixed, Train-Car-On-Person Mobile Equipment-Accessory Servicing: Part I of An Exclusive Series

by LEO SANDS

way transmitters are used for calling the yardmaster who replies over a paging system.

All domestic railroad radio systems operate in the 152-162 mc *vlf* band, except in a few motor vehicle applications where the 450-470 mc *uhf* band is used. All employ FM, although AM is making a comeback in other fields and may be used in some future railroad applications.

The equipment used in railroad rolling-stock applications is very similar to two-way radio equipment for motor vehicles. Transmitters and receivers are fixed-tuned and crystal controlled. Some manufacturers use identical basic equipment for both applications. In most instances, the difference appears in the power supply chassis, audio amplifier and accessories. Originally, railroad radio equipment was much huskier in design than equipment intended for motor vehicle installation. By improving the automotive product and easing up a little on railroad specs, a compromise has been affected.

For motor vehicle applications, the railroads have a choice of about a dozen different makes of equipment, all of it basically similar in appearance and in operation. The main differences lie in the manner in which each manufacturer has met the present and growing need for adequate selectivity and stability.

Until two years ago, practically all auto mobile units were designed for operation from a 6-volt battery. A few 12-volt sets were made for special truck installations. Now that many automobiles are equipped with 12-volt batteries, most mobile radio equipment manufacturers build sets which will work on either 6 or 12 volts.

On locomotives, cabooses and other flanged wheel vehicles, mobile radio units must be mounted on shockmounts. In automotive installations, shockmounts are not used and are considered as detrimental. The shock and vibration conditions encountered on railroad cars are different from those experienced with rubber-tired vehicles and the use of shockmounts is mandatory.

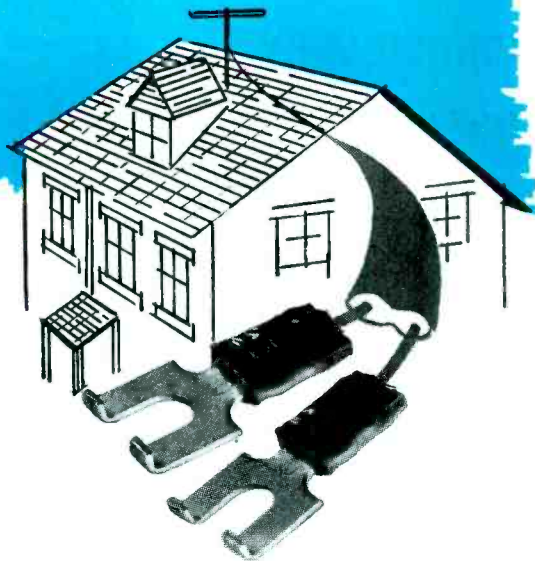
More audio output is required in locomotive and caboose applications than on motor vehicles. The typical mobile radio unit delivers one watt of audio. In rail applications four to ten watts are available for driving the loudspeaker. The ambient noise level on a locomotive or caboose can be extremely high. Thus, marine-type loudspeakers combined with higher audio output are used to produce very loud voice reproduction, particularly within a confined space.

In one series,¹ for example, the transmitter, receiver and power supply are separate chassis, which are bolted together and housed in a single sheet metal enclosure. The audio amplifier is on the power supply deck. For automotive installations a 6 or 12-volt power supply chassis contains a one-watt audio amplifier. For use in a caboose, a 12-volt power supply with a four watt audio amplifier is specified, and for use in a diesel-electric locomotive, the power supply is directly operable from a 64-volt starting battery.

A variety of power supply-audio amplifier combinations is available. The same type of receiver chassis is used in almost all applications. The basic transmitter chassis is the same, too, except that it employs interchangeable sub-chassis, so that the same basic unit will suffice whether 2 or 60-watts of output are required.

For two-frequency operation, an additional plug-in crystal and sealed plug-in relay are used in the fixed-tuned, crystal-controlled transmitter and receiver.

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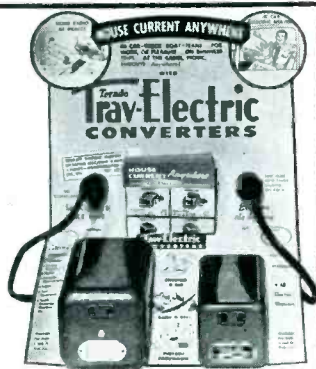
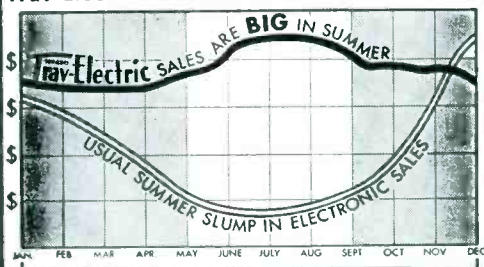
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Servicing Helps

Troubleshooting TV-Phono Relays¹. . . Variable AGC Control Hints*

IF ARMATURES fail to open when the power is removed from a relay, the voltage across the coil must be checked to make sure that no voltage exists there. As a double check, the coil should be shorted out with a jumper (if it is in series with the source voltage), or opened by disconnecting one of its leads (if it is in parallel with the source voltage). If the coil is not at fault, then the trouble is internal. There are cases where the armature will *stick* to a contact, due to a *gummy* deposit (caused by iron filings, oil, sulphur, etc.), which may exist at the armature and contacts. To determine whether this is the cause of the trouble, a thin piece of paper should be inserted between the armature and pole face, the armature gently held closed by hand, and at this time, the paper withdrawn and examined for any gummy deposits.

The cause of chatter may be internal or external. If it is external, it is

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WORLD'S LARGEST CAPACITOR MANUFACTURER

Chan- nel	Video Carrier (mc)	¼ Wave- length Open Stub (Inches)	½ Wave- length Shorted Stub (Inches)
2	55.25	44.3	88.7
3	61.25	40.0	80.0
4	67.25	36.4	72.9
5	77.25	31.7	63.4
6	83.25	29.4	58.9
7	175.25	14.0	28.0
8	181.25	13.5	27.0
9	187.25	13.1	26.2
10	193.25	12.7	25.4
11	199.25	12.3	24.6
12	205.25	11.9	23.9
13	211.25	11.6	23.2

CHART 1: Stub lengths to reduce signal inputs on strong local stations. For optimum results the exact stub length will require some experimentation.

probably caused by a coil voltage which is much lower than normal. This may be due to a heavy load connected to the line which decreases the line voltage; more often it is due to physical vibrations and shocks. Obstruction of proper operation of the armature, due to foreign matter or a defect in the construction of one of the elements of the relay, is the internal cause of relay chatter.

It was mentioned in earlier reports¹ that improper source voltage across the coil could cause hum. Where a hinged- or swinging-armature is used, a relay which is not designed properly (that is, if the elements comprising it do not fit properly) may develop hum at the armature hinge. This type of fault can be checked by applying slight pressure to the various parts of the armature or to the defective relay element. If hum occurs when the armature is lifted from the hinge, a part of the frame may be bent out of shape. Loose laminations may also cause hum. Gently squeezing the laminations together will disclose the trouble, since the hum will disappear. This defect may sometimes be corrected by tightening a loose bolt, rivet or screw, or by taping the laminations tightly together; if these do not correct the trouble, the relay should be replaced.

It will sometimes be found that the armature of a relay operates sluggishly. This type of trouble occurs when the relay is not used for long periods of time. Generally, sluggishness is due to one of two reasons: excessive strength of the retractile spring or binding at the hinges.

Variable AGC Control Service Hints*

THE INFINITE number of settings available with a variable *agc* control is advantageous as it permits a re-

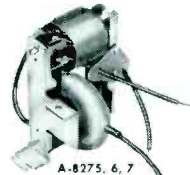
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**Specify
Stancor**
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When you need a flyback
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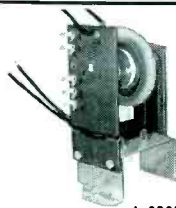
JUST RELEASED... 11 NEW EXACT
REPLACEMENT FLYBACKS FOR
ZENITH - G.E. - ARVIN



A-8266



A-8275, 6, 7



A-8282

Stancor Part No.	Replaces Part No.
A-8266	G. E. RT0-161
A-8273	Zenith S-19408
	Zenith S-20099
A-8274	Zenith S-21317
A-8275	Zenith S-22130
A-8276	Zenith S-22154

Stancor Part No.	Replaces Part No.
A-8277	Zenith S-21219
A-8278	Arvin E-40117
A-8279	Arvin E-41024
A-8280	Arvin E-42721
A-8281	Arvin E-24681
A-8282	Arvin E-41852



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ceiver to be adjusted for optimum performance in any area.

Strong Local Station Problem

One limitation to this, however, is an area that has a strong local station and still receives signals from one or more distant stations. If the local station transmits a signal of sufficient power, it may be impossible to utilize a single setting of the *agc* control and still maintain maximum sensitivity on the distant stations. This situation

may be overcome by attenuating the signal of the local station, thus permitting the use of maximum sensitivity in the receiver for all channels.

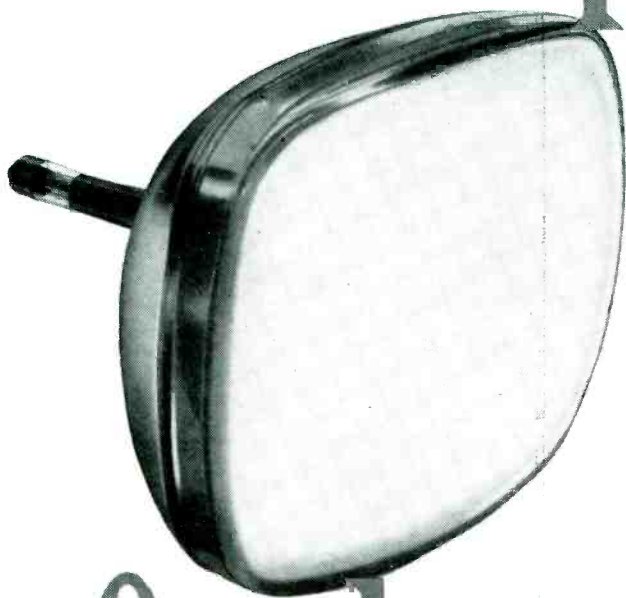
This can be accomplished by using a stub on the antenna terminals to reduce the signal input on the strong local station.

Using 300-ohm twin lead, chart 1 (above) can be used to determine the wavelength necessary to attenuate the signal.

¹See Lee Scott report on relays in June SERVICE.

*Based on Bendix service department field notes.

IT'S Blue Chip



Quality

Tung-Sol Magic Mirror Aluminized Picture Tubes mirror twice the light to create a picture twice as bright. They bring out the best in every set. Install these superior tubes and see the difference . . . the difference that pays off in smooth, callback-free service and satisfied customers. Tell your supplier you'd rather have Tung-Sol Tubes.

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PICTURE TUBES

TUNG-SOL ELECTRIC INC., Newark 4, N. J. Sales Offices: Atlanta, Columbus, Culver City, Dallas, Denver, Detroit, Melrose Park (Ill.), Newark, Seattle.

CATALOGS — BULLETINS — BOOKS

ROHN MANUFACTURING CO., 116 Limestone, Bellevue, Peoria, Ill., has announced new dealer and distributor catalogs covering TV and communication towers, accessories and allied products.

WARD PRODUCTS CORP., 1148 Euclid Ave., Cleveland 15, O., has issued an illustrated 8-page catalog describing front, rear and side mounting chrome and fiberglass auto radio antennas, accessories and merchandising materials.

SARKES TARZIAN, INC., 415 N. College Ave., Bloomington, Ind., has released a 20-page illustrated brochure, *Silicon Rectifier Handbook*, covering theory of operation, manufacturing processes, characteristics, construction, coding, electrical ratings, mechanical dimensions and engineering and design notes on silicon rectifiers. Copies are available direct at \$1 each.

SWITCHCRAFT, INC., 1328-30 N. Halsted St., Chicago 22, Ill., has published a 28-page illustrated catalog, S-57, with descriptions, specifications and application data on connectors, phone jacks, phone plugs, jack panels, cable assemblies and jack covers.

TRIAD TRANSFORMER CORP., 4055 Redwood Ave., Venice, Calif., has released a 52-page catalog, TV 56, listing TV replacement transformers for more than 100 set manufacturers and 6,000 models. Units are listed alphabetically by make and model number. Also available is a 32-page illustrated catalog, TR-56, listing specifications on miniature, low level audio, power, hi-fi output, pulse, photo-flash, instrument, filament, rectifier, line and audio transformers. Includes information on toroidal coils, hi-fi amplifier kits, chokes and TV components.

HOWARD W. SAMS AND CO., INC., 2201 E. 46th St., Indianapolis 5, Ind., has published the seventh volume in its series *Audio Amplifiers and Associated Equipment*. Volume is numbered AA-7 and presents complete data on 3 preamps, 28 audio amps and 16 custom AM-FM tuners produced in '55. Information includes photos, schematics, parts list, voltage and resistance measurements and servicing data for each unit. Price—\$3.50.

WESTINGHOUSE ELECTRONIC TUBE DIVISION, Elmira, N. Y., has announced publication of the 1956 *Westinghouse Baseball Handbook*, containing 44 pages of major and minor league schedules, averages and statistics and pennant predictions. Included are chapters on baseball's hall of fame, all-star games and World Series. Booklet is a dealer giveaway included as part of a merchandising program which features a kit containing ad mats, radio and TV commercials and return-card direct mail letters to be sent to customers offering the free booklet.

THE ASTATIC CORPORATION, Conneaut, O., has issued a 14-page catalog, S-442, describing the complete line of professional, general purpose, and amateur microphones and microphone accessories. One section is devoted to the *Futura* series of dynamic microphones, specifications, features, performance, accessories, plus architect's and engineer's specifications.

SIMPSON ELECTRIC CO., 5200 W. Kinzie St., Chicago 44, has published an 87-page technical manual describing their line of electrical indicating instruments and test equipment. One section covers complete descriptions and illustrations of more than 800 different kinds and sizes of panel meters. The Simpson line of electronic test equipment for radio-TV and refrigeration Service Men, and factory analyzers, is described in the second section of the catalog, including new additions designed specifically for color television servicing.

Associations

ARTS, Chicago, Ill.

STEPHEN JACYNA has been appointed trade and press representative of the Associated Radio and Television Servicemen, Chicago, Illinois.

ANTHONY MALLIN has been named association historian.

RTG, Long Island, N. Y.

THE RADIO AND TELEVISION GUILD of Long Island, N. Y. has announced that they will sponsor an electronics fair December 6, 7, and 8, at the New York State University in Farmingdale, N. Y.

The fair will feature a component-equipment exhibit and technical symposium. On the exhibit floor, booths will be set up for the display and demonstration of transistorized radios, printed circuit radio-television receivers and amplifiers, test equipment, color receivers, and non-entertainment type and other electronic devices.

Approximately twenty technical papers will be presented on such topics as the latest color tube developments, radio-TV-audio circuits, test equipment, alignment techniques, and service-engineering projects.

A complete closed circuit color camera chain will be in operation to permit continuous demonstration of color chassis.

TV-ES, Houston, Texas

THE HOUSTON ASSOCIATION of TV-Electronics Servicemen, Inc., an affiliate of NATESA, has completed drafting of a Texas state licensing bill, which will be submitted to the next session of the Texas legislature.

The measure, it was said, is not a control, nor a regulatory bill, but provides only for the appointment by the Governor of a state electronics commission who would be authorized to examine any person who services, repairs, or maintains electronic equipment for gain, hire, or profit. Upon completion and passing of a civil service type or style of examination, an association spokesman said, the applicant would receive a license corresponding to the classification applied for, namely: *apprentice*, *journeyman*, or *electronics engineer*. Upon being licensed, a *journeyman* or an *engineer* would be permitted to service electronic gear anywhere in Texas. An *apprentice* would not be permitted to service equipment without the presence and supervision of at least a *journeyman*. Licenses could be revoked upon proof of damage, fraud, or other loss suffered by the consumer, and fines provided for violations of the Act.

TEN YEARS AGO IN SERVICE

THE LIVELY PROSPECTS in sound-system installation, repair and maintenance were highlighted in an exclusive series of technical reports, the first to appear in industry. Disclosed, for the first time, were the design and application characteristics of all types of speakers, microphones and amplifiers adaptable to *pa* work. A complete tabulation of sound-system speakers, showing comparative uses and limitations, was featured in the reports. . . . Quantities of reprints of the sound-system articles were distributed nationwide to associations who, in turn, circulated them at special audio clinics and exhibit meetings. . . . A series of phono needles with spring shanks were introduced by Electrovox, makers of Walco products. . . . Brush Development announced the design of a flexible paper magnetic recording disc. . . . The first pocket-type five tube superhets, using subminiature tubes, were announced. . . . The first line of polyethylene leadin for FM and television for 100, 200 and 300-ohm inputs was introduced.

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Quality

Tung-Sol receiving tubes for TV, radio and Hi-Fi replacement are exactly the same as those supplied to leading independent set makers. This one quality—Blue Chip Quality—is your assurance of long, trouble-free service that keeps customers with you year after year. Tell your supplier you'd rather have Tung-Sol Tubes.

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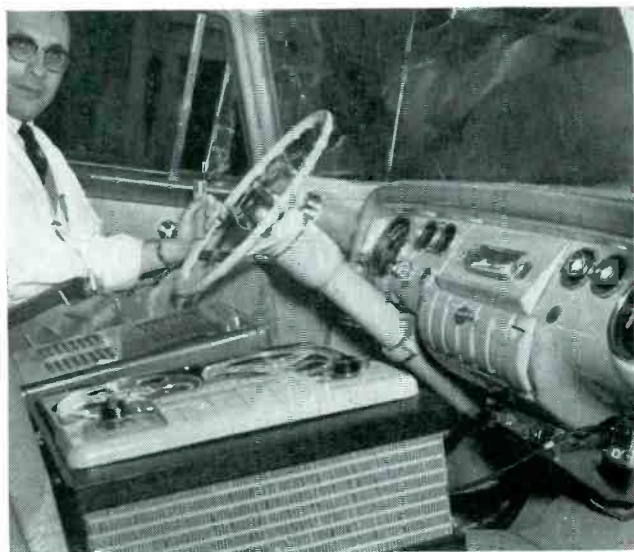
TUNG-SOL makes All-Glass Sealed Beam Lamps, Miniature Lamps, Signal Flashers, Picture Tubes, Radio, TV and Special Purpose Electron Tubes and Semiconductor Products.

Installing and Operating

On-Location Outdoor- Indoor Sound Systems

Using Mobile-Stationary Facilities

ON-LOCATION PORTABLE sound system equipment: Tape recorder, phono, amplifier, mikes, and cabinet-type speakers. (Courtesy Leece-Neville)



(Above and Below)

STATION WAGON MOBILE SOUND TRUCK installation utilizing a tape recorder¹ and pa² system, both operating from an inverter. Amplifier³ is a 30-watt model. Inverter⁴ is rated at 200 watts continuous and 250 watts intermittent. To operate, tape recorder and amplifier are plugged directly into a remote control unit⁵ underneath dashboard of automobile; the heavy duty inverter is mounted in the deck of the station wagon. At sound system controls: Sidney Zweig, manager of Lew Bonn sound department.

WHERE SOUND SYSTEMS are on location for the duration of a meeting, the rules set up for mobile equipment requirements and installation procedures require some modification. As an example, loudspeakers can be set out in more favorable positions for feeding sound more uniformly to the audience, than is possible when the units are mounted rigidly on a sound truck. The stress on mobility is shifted to one of suitability for presenting particular program material required at a fixed station.

For interim outdoor locations, the most useful and versatile kind of speaker to use is the reentrant horn type, mounted on portable tripod type stands. These can be erected and adjusted quickly to meet the audience distribution needs.

Rectangular horns have been found particularly effective for on-location activities. One type,⁶ recently announced, permits stacking in plane or circular array fashion. Eight units, each with a geometric sector angle of 45°, form a complete circle with a diameter of 5' 9½", providing 360° horizontal coverage. A single unit has been found to provide 80° coverage. Other horizontal coverage angles for two to six speakers are: two—125°; three—170°; four—215°; five—260°, and six—305°. Horns also may be double decked to permit concentration of sound in vertical plane; a 2-unit stack will provide a

(Continued on page 30)

RIGHT: VOICE MIKE (pressure-actuated diaphragm type carbon) in action on-location. (Courtesy Shure)



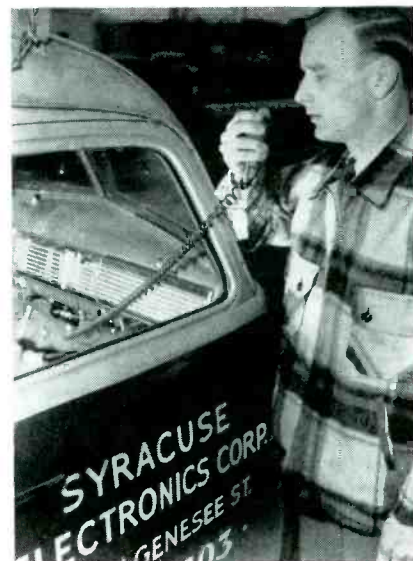
¹Webeor 2611

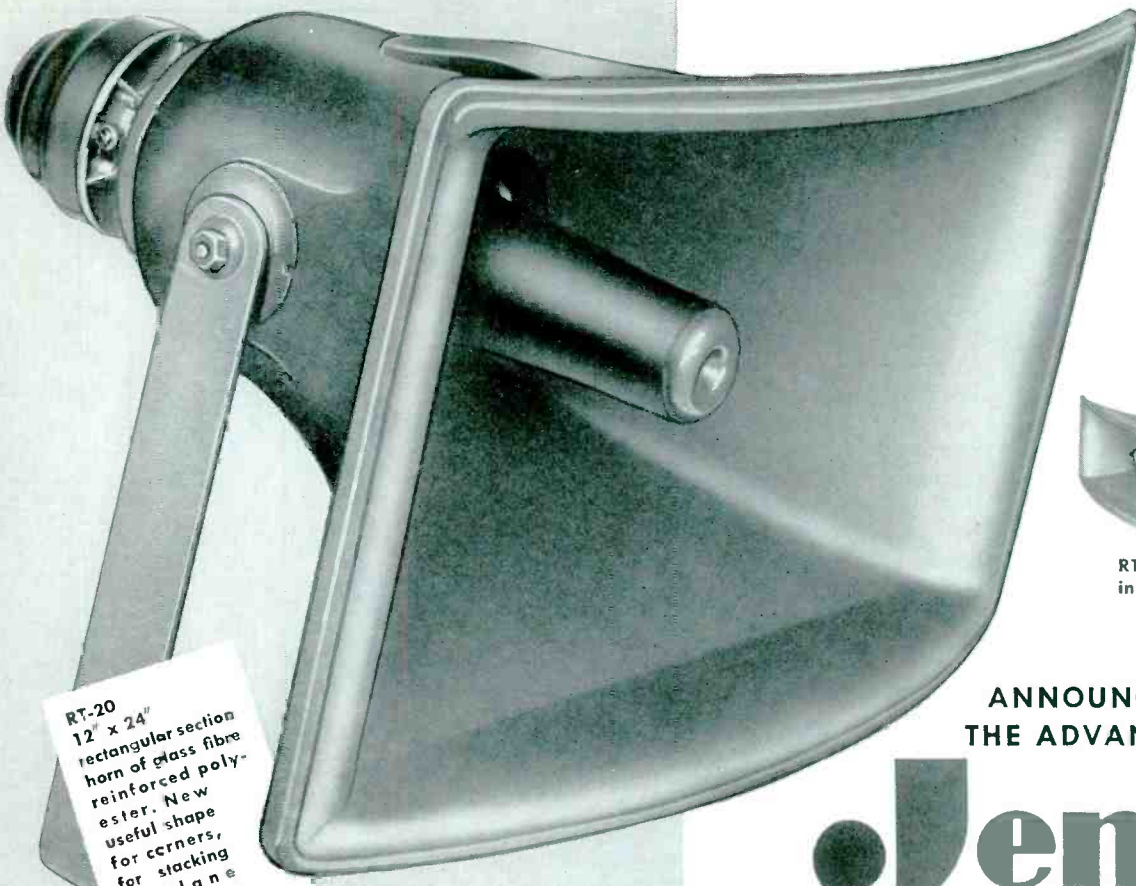
²Using University P11 speakers

³Bogen J130

⁴ATR 12T HSH

⁵ATR





RT-20
12" x 24"
rectangular section
horn of glass fibre
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useful shape
for corners,
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or circular
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RT-20's
in plane array



RT-20's
in circular array

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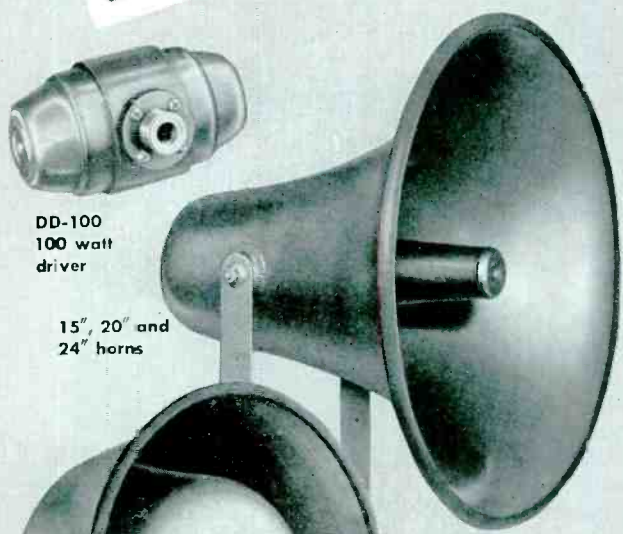
Jensen

PROFESSIONAL SERIES LOUDSPEAKERS

FOR INDUSTRIAL, COMMERCIAL, INSTITUTIONAL, CIVIL DEFENSE, AND MILITARY SOUND SYSTEMS

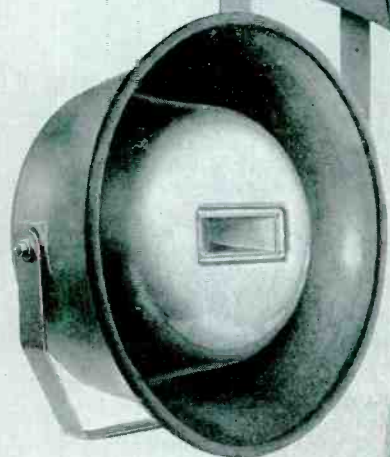
If sound is your business, here is big news for you . . . a complete new line of loudspeakers to meet for the first time every sound system need for both entertainment and efficient, effective communication. From a fraction of a watt to 1600 watts or even more . . . for high fidelity or high efficiency coverage . . . for distributed or concentrated source projection . . . indoors or out—there is a Jensen Professional Series loudspeaker that will do the job *better, more dependably, and more economically* than ever before. Just as an example, the new Hypex Lifetime Driver Units are *guaranteed indefinitely against failure under normal use!*

Three years of product design and a background of nearly 30 years of field experience and manufacturing know-how come to you in Jensen Professional Series loudspeakers. We can't begin to illustrate or describe all the items here—nor tell you about all the new features for convenience and performance which we've built into them. Catalog 1070 tells the whole story, including valuable information on sound system design. Send for your free copy today.



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100 watt
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24" horns



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weatherproof
2-way HI-FI
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D-30 and D-40
30 and 40 watt
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Four 12" and 15"
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Audio

(Continued from page 28)

vertical coverage angle of about 30°; due to the restricted angle of radiation, a gain of 2.5 db in sound pressure on the axis will obtain.*

A problem involved in *one-night-stand* operations, where equipment must be taken to different places and set up quickly, are the contacts made with connectors. It must be remembered that loudspeakers operate at a low impedance; the voltage is comparatively low, with a relatively large current. Where permanent connections are made no problem appears, but in temporary installations connector plug and socket arrangements must be made and very carefully. Plugs and sockets with heavy capacity non-corrosive connections must be used.

It is also sound practice to select non-reversible types; these resolve the phasing problem once and for all, an important factor when setup time is at a premium.

For mobile work, hand microphones are best; for stationary applications a stand microphone is naturally better. Speakers should not *have* to hold on to the microphone, although many speakers like to do so. Lapel or lavalier-type mikes are excellent too for fixed-station work.

Microphones for stationary assignments must be rugged and able to withstand substantial abuse. Reasonable fidelity and freedom from peaks are desirable, so that the *personality* of individual speakers is more effectively presented; most speakers rely on their mike personality.¹

In adjusting the amplifiers, it is important to work the controls at the correct level. One should be careful and avoid distortion by keeping an adequate balance on the volume control. Sufficient power should be used to enable all the audience to hear comfortably, without stepping up the power so that distortion occurs.

Often hum can prove to be a problem. It may be due to the method

¹Microphones that have been found effective for this application include Electro-Voice 920, Brush BA-109 and Shure 777.



"It's the serviceman—
he forgot to bring a
JENSEN NEEDLE!"

Don't just say CAPACITORS

• Ask For Sprague By
• Catalog Number

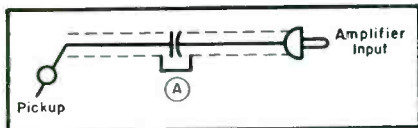
• Know what you're getting . . .
• get exactly what you want.
• Don't be vague . . . insist on
• Sprague. Use complete radio-
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• **SPRAGUE**®

• WORLD'S LARGEST
• CAPACITOR MANUFACTURER

Input resistor	Capacitor	Input resistor	Capacitor
10,000 ohms	.04 mfd	100,000 ohms	.004 mfd
20,000 ohms	.02 mfd	250,000 ohms	.0016 mfd
47,000 ohms	.008 mfd	500,000 ohms	.0008 mfd
68,000 ohms	.006 mfd	1 megohm	.0004 mfd

TABLE 1: Values of components that can be used to provide 400-cps bass cut.



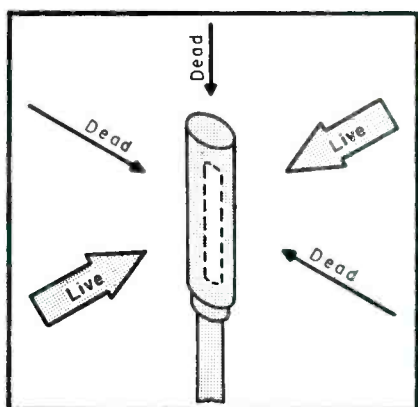
CAPACITOR in series with the input to an amplifier to provide a 400-cps bass cut, and reduce record hum and rumble effects from poor recordings. Appropriate values (A), according to amplifier input, appear in table 1 at the bottom of page 30.

of connection, but sometimes it can even be due to a poor transcription recording. Discs made from an original tape recorded on a home recorder with a higher hum level than is acceptable by professional standards can be troublesome; when these recordings are transferred to disc the hum level is more noticeable than when played back on the home recorder. When this hum is amplified along with the program material, especially with a normally equalized pickup input, the result may be hum modulated, even though the hum itself is not audible over the system, and thus the quality will suffer.

For this reason, it is advisable to incorporate a 400-cycle rolloff (a capacitor in series with the input to the amplifier) so that the lower frequencies are not amplified to the same extent; this will also remove any rumble frequencies that often ride through. To install, it is necessary to determine the value of input resistance the amplifier uses and then use the appropriate capacitor to provide the required 400-cps rolloff; see table 1 for component values. This circuit revision will improve speech intelligibility and also help minimize the effects of bangs and rattles oc-

(Continued on page 32)

DIRECTIONS in which a ribbon microphone is sensitive and dead.



*Jensen RT-20.

3+3=410

when you use
the **NEW**



SHURE RK-56

LIST PRICE \$22.95 Including technical data, replacement chart and 5" x 3" x 1 1/4" plastic box.

REPLACEMENT CARTRIDGE KIT

as a companion to the RK-54

The 3 CARTRIDGES in the RK-56 Kit provide dependable, quickly-installed replacements for 218 cartridges of seven manufacturers.

When used with the RK-54 Kit (where 3 cartridges replace 192) you will have profitable replacements for 410 of the most frequently used phono cartridges!

Here is broadest coverage for the lowest investment.

The RK-56 Kit contains:

Cartridge	Application	Type	OUTPUT LEVEL		Needle Force	Net Weight	Response To
			MG	78			
WC10	Extended range, Improvement- Replacement cartridge for 132 3-speed, plastic-cased cartridges, crystal or ceramic, single needle or turnover.	CERAMIC	.78v	1.0v	7 grams	7 grams	12,000 cps
W70	All-Purpose Single-Needle cartridge. For Webster C and CX series.	CRYSTAL	3.0v	3.8v	10-15 grams	16 grams	5,000 cps
W72	Dual-Voltage 3-speed Turnover cartridge for Webster FX and Astatic LQD series cartridges.	CRYSTAL	4v or 2v*		8-12 grams	7.5 grams	5,000 cps

*Model W72 has a slip-on capacitor furnished as an accessory. With the capacitor, output is 2 volts without the capacitor, output is 4 volts.

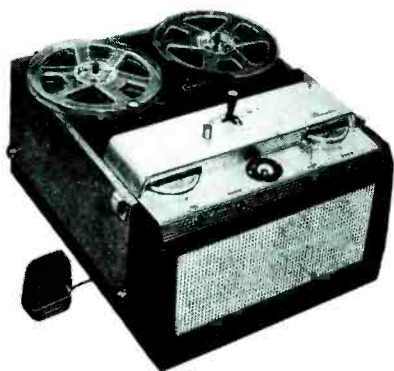
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PENTRON PACEMAKER TAPE RECORDER it's "ruggedized"

Pentron's mighty Pacemaker recorder is perfect for sound truck use, or any application where ability to "take-it" is necessary.

There's no skipping, jumping, or needle scratch to interfere with the smooth operation of this Pentron. Uni-magic single lever control makes it easy to operate. Amplifier and speaker output jacks are located right up front. You can use either the built-in amplifier and speaker system, or plug in for external amplifier and speaker.

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PENTRON CORPORATION
777 S. Tripp Avenue, Chicago 24, Ill.

Rush details on the "ruggedized" Pacemaker recorder.

NAME

ADDRESS

CITY & STATE

Audio

(Continued from page 31)

caused by rough handling of the microphone.

Indoor Sound Locations

For indoor installations robust cabinet-mounted portable speakers are recommended. Single or dual concentric units can be used. Cabinets must be husky for they must withstand a lot of heavy handling and moving.

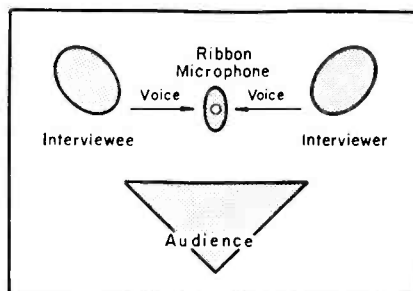
The 400-cycle bass cut recommended for outdoor use need not be used indoors; it may still be good on transcribed material to eradicate hum, and the full range enables a more intimate approach for the speaker, allowing him to get close to the microphone and talk quietly. This technique is much more effective with a wide-range system. Microphones that are particularly adapted for indoor applications are the dynamic or ribbon type.

Microphone Preferences

Many prefer the unidirectional or cardioid variety of microphone; some prefer the ribbon because its overall response when used properly is often more free of resonant effects, and sufficient directional margin can usually be obtained to avoid acoustic howl feedback.

A ribbon microphone does present a problem when it is used for interview purposes; its directional properties limit the flexibility of mike positions. Because it is equally sensitive in all directions the dynamic mike is excellent for interview setups. A cardioid usually has a fairly wide area of sensitivity in front and therefore is relatively easy to use for this

HOW TO USE A RIBBON microphone for interviewing, by partly shifting positions to face one another and the audience, so that both interviewer and interviewee can be picked up.



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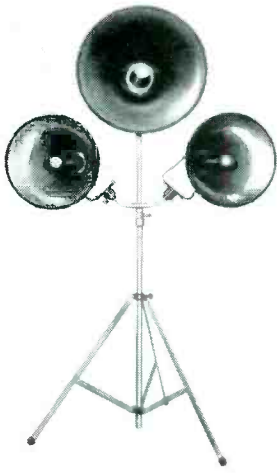
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purpose. A ribbon microphone must be placed between the interviewer and interviewee so that the two can speak across the microphone.

If one is faced with a hall having particularly bad or peculiar acoustics, it is important to make sure that the chairman of the meeting is acquainted with the technical situation involving the types of mikes and speakers

Miniature omnidirectional lavalier dynamic microphone; 2 11/16" long x 3/4" diam. Employs Alnico V and Armco magnetic iron in a nonwelded circuit. Equipped with a pop-proof wire-mesh grille to minimize wind and breath blasts. (Model 649; Electro-Voice, Inc.)





PROJECTOR SPEAKERS mounted on support stand equipped with double-lock vertical adjustment to prevent accidental release. Horn-mounting assembly permits setting of speakers in vertical or horizontal planes.
(Courtesy Atlas Sound.)

in use and their delivery properties, so that he will cooperate and familiarize the speakers to get the best results.

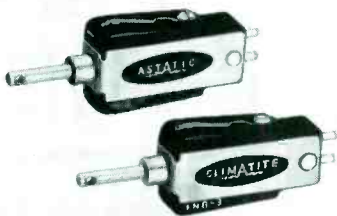
Input Arrangements

Input arrangements also demand careful consideration in a sound system, whether separate preamps and mixers or single units are used. If separate units are involved the coupling problem between the two units must be resolved.

The input arrangements of the pre-amp or mixer, or the front end of a single unit, must be suitable for all kinds of microphones. If low level types, such as ribbon are to be used, one must make sure that the ampli-

(Continued on page 34)

High-compliance cartridges, said to be weatherproofed, containing separate, removable, one and three mil-synthetic sapphire needles. Models available for 3 and .8-v outputs with frequency response of 50-12,000 and 30 to 15,000 cps; also for 45 changers.
(Climatite models 420ts, 310T, 312T and 414-1; Astatic Corp.)



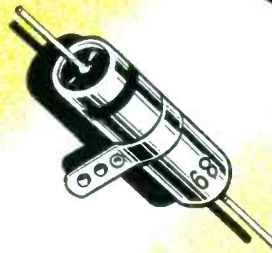
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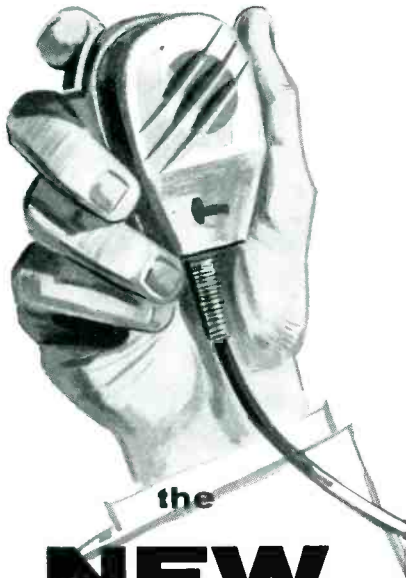


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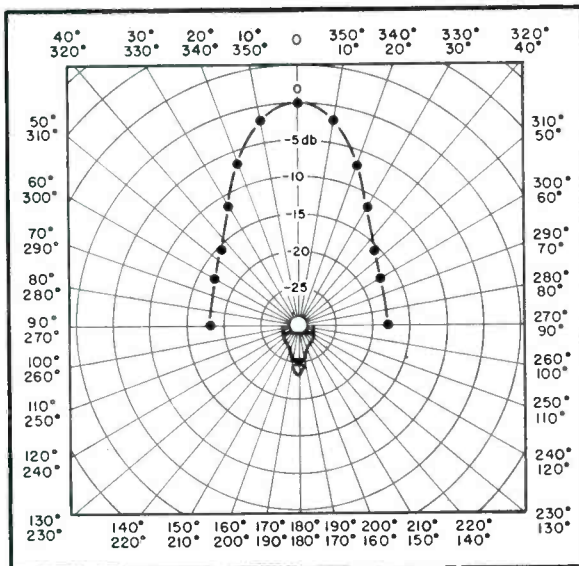
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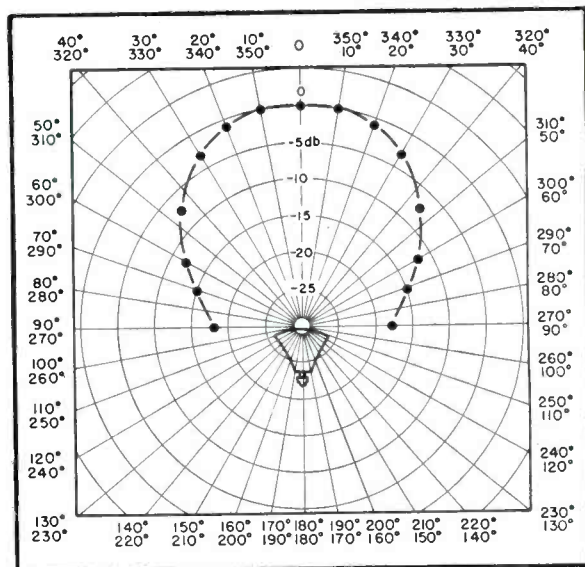
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370 South Fair Oaks, Pasadena, California

Audio
(Continued from page 33)



RECTANGULAR HORN horizontal and vertical plane polars. Measurements, made with a 800-1250 cycle warble tone, illustrate the sharpness possible in vertical plane, shown at left. On a 6-db down basis, the horizontal coverage angle (below) is 80°, while in the vertical plane it is about 36°. (Courtesy Jensen)

Jensen RT-20 using a D-40 driver.
See pages 28 and 30 for further details on rectangular speakers.



fier will give full output with the input level that this microphone supplies. If a crystal mike is to be used, the amp will have to accept a bigger input without overloading some stage of the amplifier. Inputs must be suitable for the impedances of the various microphones used.

Separate amplifiers and preamps provide application flexibility, since they permit amplifiers to be paralleled, or a number of mixers can be used to feed the same power amplifier. However, one must know the precise level and impedance at which the transfer is made from one to the other. It is also necessary to determine whether the matching arrangement between the two is such that the same preamp will handle a load of more than one power amplifier.

For example, if the impedance between the two units is 600 ohms, a

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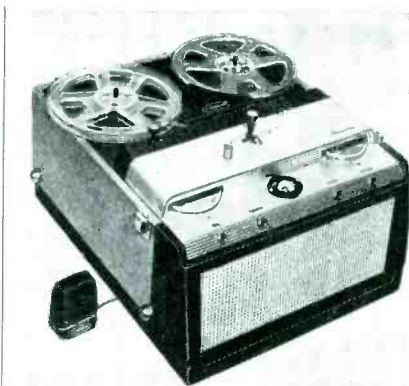
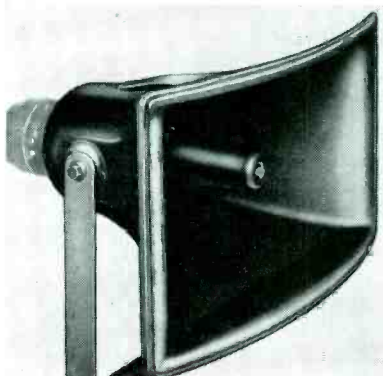


600-ohm output is involved. If the power amplifier input also has an impedance of 600 ohms, then the preamp can only feed the single power amplifier. Connection of another 600-ohm amplifier would produce a mismatch.

However, a high-impedance input could be paralleled across this arrangement (or more than one) without interfering with the matching, provided that the voltage level is right for each power amplifier input.

Alternatively, it is probably a little better if the preamp or mixer ar-

RECTANGULAR HORN that can be stacked in plane or circular-array. (RT-20; Jensen)



DUAL-SPEED DUAL-TRACK portable tape recorder featuring an automatic index counter to locate any selection on recorded tape and a single-lever three-operating position control for play-record, fast forward and fast rewind. (Pacemaker model T-90; Pentron.)

range comes out at 600 ohms but feeds the power amplifier at high impedance, possibly through a high-resistance potentiometer to grid. Using power amplifiers with this arrangement, any number of them can be connected in parallel on the same preamp or mixer arrangement.

Paralleling mixers and preamplifiers is an involved project. However, if the amplifier is such that it will successfully meet the other versatile requirements mentioned, it will generally be possible to find a way of paralleling up two or more to accommodate a larger number of microphones.

Importance of the Tone Control

Another feature to look for in any sound system is the tone control. A public address setup should provide some degree of tone control facility for compensating both the low and high frequencies to take care of the varied voice ranges directed to a microphone, and also, if more than one microphone is used, the variation in individual microphone characteristics. Often, too, careful adjustment of tone control facilities can help considerably in achieving greater pickup range by avoiding the frequencies of acoustic feedback.

Rolloffs For Bass and Treble

So one must be sure that there is a good degree of bass rolloff and boost, and also treble rolloff and boost. The simple tone control, which merely provided a treble cut, that is (or was) commonly provided on radio receivers, is certainly not adequate for public address application.



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WRITE for Catalog 200—Lists Specifications on Stock Items

21-Inch Color-TV

(Continued from page 11)

the color phase detector. The negative voltage is used to bias off the color killer tube when a color signal is being received.

When no color signal is being received, the killer tube conducts and amplifies a horizontal frequency pulse which is applied to the grid of the chroma amplifier to bias it off by the same method used in the chroma gain-control circuit. A threshold control is provided by varying the positive delay voltage applied to the control grid of the color killer.

Major advancements have been made in the yoke and convergence circuitry. The yoke has a balance coil to correct red-green horizontal tilt errors and a balance potentiometer to correct red-green vertical size errors. It also has red-green keystone correctors, which consist of pieces of a special metal inserted into the yoke windows. Dynamic correction voltages have been applied to the blue lateral pole piece to control the blue raster size. Thus controls are available to correct all yoke errors.

To get a more accurate parabolic waveform for the horizontal dynamic convergence, second harmonic waves are generated and added to the normal sine wave voltages. Separate amplitude and phasing controls are available for the fundamental and second harmonic waves.

Color-Bar Adjustments

(Continued from page 12)

E_q' for the other bar) and the luminance components are correct.

The unsymmetrical transients, for the case of the luminance component having less delay than the chrominance components, are illustrated at right in Fig. 2 (p. 12). By using the blue filter of the viewer, the degree of symmetry of these transients reproduced on the blue raster can be observed without upsetting the normal adjustments of the receiver.

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Curbing TVI

(Continued from page 16)

favorable desired-to-undesired signal ratio minimizing interference.

Several methods are available to determine if interference is due to internal cross modulation or other causes.

First, a high-pass filter should be installed. If the interference disappears the difficulty is probably cross modulation from an interfering signal whose frequency is below approximately 45 mc. In another check, the *rf* amplifier tube can be removed from its socket. If the interference disappears, it is either cross modulation in the *rf* stage or an undesired signal directly on channel. If the interference persists, with the *rf* tube removed, the interference is due to pickup and cross modulation in a later stage, probably an *if* stage. A check on several nearby receivers will usually indicate whether the interference is directly on the TV channel. It is also important to make certain that the interference is not direct pickup by the audio amplifier.

Pickup similar to audio rectification can occur in the video amplifier which has a much greater pass band and for that reason is more susceptible than an audio amplifier.

Severe interference may result from inadequate image rejection of the TV receiver. In this case the cross modulation occurs in the regular mixer stage, but is caused by a signal equal in frequency to the normally received channel plus twice the receiver *if*.

A signal on this image frequency beating with the local oscillator produces the exact *if*, in addition to the desired signal, and both pass through the receiver and show as video or audio interference. A high-pass filter is not effective. A sharper tuned trap or stub must be used to eliminate the undesired signal without attenuating the desired signal.

Nearby FM broadcast signals are the most common causes of image interference affecting the lower TV channels. The best check is to use a tunable filter designed to cover the FM band; 88–108 mc.

Service Men can make their job materially easier if they are familiar with the operating frequencies of nearby transmitters.

TV Antennas

(Continued from page 19)

the extremities of all parasitic elements. These dampeners were said to prevent vibration of the elements in the wind. The elements have been designed to be bolted to the cross-arm.

To prevent entry of water, the antenna engineers noted that they designed two special housings; an insulator housing, filled with a silicone compound, and a feed-connector housing, filled with plastic foam.

Channel converters using one-half of a 6U8 as a mixer, and the other half as separate oscillator were also highlighted.

Its input and output circuits are of the double-tuned band-pass type. Both the input and the output are matched to 75 ohms, so that the converter can be added to a matched system without producing reflections.

At the annual election meeting, held during the convention, Bill Daniels of Community Television Systems of Wyoming, Inc., Casper, Wyoming, was elected president succeeding Martin F. Malarkey, Jr., one of the original association founders and president since its organization in 1951. Other new officers include George J. Barco, Meadville Master Antenna Co., Meadville, Pa., vice president; A. J. Malin, Community TV Corp., Laconia, N. H., secretary; and W. Randolph Tucker, Muscle Shoals TV Cable Corp., Florence, Ala., treasurer.

SENCO BIAS SUPPLY

A TV bias supply, *Align-o-pak BE3*, providing voltages from 0 to 18, positive or negative, has been introduced by Service Instruments Co., 171 Official Rd., Addison, Ill.

Unit can be used for both *b-w* and color sets.

8-Millionth Auto Antenna



JOHN H. BRIGGS, president of the **Gabriel Co.** (left), with 8-millionth auto antenna, gold plated and mounted, produced by **Ward Products**, a division of **Gabriel**. Presentation ceremony, made at the Chicago parts show, was witnessed by (left to right): **Donald Blech**, Ward sales manager; **Robert Hood**, plant manager; **Muggs Pugh**, Ward sales rep; **Pat Leone**, vice president of manufacturing, and **William Rickards**, director of engineering.

INSTRUMENTS

TUBE-TRANSISTOR TESTER

A dynamic conductance tube-transistor tester, *666* (kit or factory wired), for checking receiving tubes (including series-string types), and *npn* and *ppn* transistors, has been introduced by the Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y.

Transistor check utilizes a two-step test using internal *dc* power supply; leakage measurement of collector current and direct reading of current amplification factor. Unit is said to provide a composite indication of mutual conductance, plate conductance and peak emission.

POCKET-SIZE VOM

Two pocket-size *voms*, *100* and *110*, have been announced by Precision Apparatus Co., Inc., Glendale 27, N. Y.

Model *100* has a sensitivity of 1000 ohms volt *ac* and *dc*; 6 *dc* and *ac* voltage ranges from 0-6000 *v*; 5 *dc* current ranges from 0-300 ma/ 0-1.5 amps; 3 resistance ranges from 0 ohms to 2 megohms and 6 *db* ranges from -6 to +77. Model *110* features sensitivity of 20,000 ohms/ volt *dc* and 5,000 ohms/ volt *ac*; 6 *dc/ ac* voltage ranges from 0 to 3000 *v*; 5 *dc* current ranges from 0 to 600 μ a/ma; 3 resistance ranges from 0 ohms to 20 megohms; and 6 *db* ranges from -20 to +71.

JUNCTION TRANSISTOR TESTER

A junction transistor tester for measuring collector leakage with base grounded; collector current at zero base current (base open); and base-to-collector current gain at 4.5 *v* on the collector, has been announced by Instant Circuits Div., Alfred W. Barber Laboratories, 32-44 Francis Lewis Blvd., Flushing 58, N. Y.

PA Promotion Meeting



RALPH P. GLOVER, vice president of **Jensen Manufacturing Co.**, discussing plans to promote 100-watt driver unit, introduced with the company's line of commercial, industrial and institutional loudspeakers, with (left to right) **Phil Williams**, chief engineer; **Karl Kramer**, technical service manager; and **Ed Shaver**, ad and sales promotion manager.

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FM Radio: Range 80-120 mc with fundamental frequency output of 1.0 V rms into 75 ohms. Sweep width variable 100 kc to at least 20 mc. 10.7 mc IF band pass with beat frequency output of 0.25 V rms into 75 ohms sweep width variable 100 kc to 2 mc.

VHF Band: Range 30 to 220 mc with fundamental frequency output of 1.0 V rms into 75 ohms. Sweep width variable to at least 15 mc. Video: Range 100 kc to 12 mc with beat frequency output 0.25 V rms into 75 ohms. Sweep width variable 100 kc to 12 mc.

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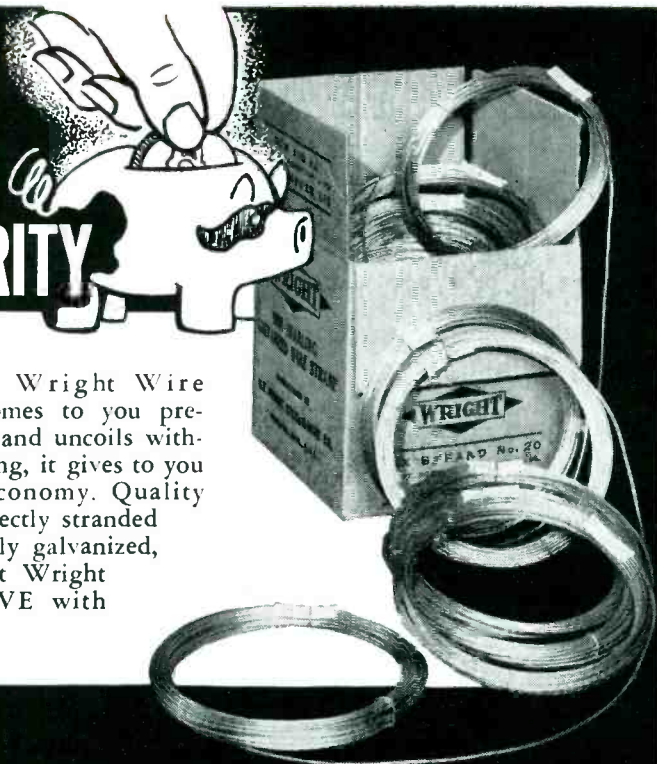
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TV PARTS... ACCESSORIES

DEFLECTION YOKE AND VO REPLACEMENTS

A deflection yoke, *DY-23A*, and vertical output transformer, *A-8150*, have been announced by Chicago Standard Transformer Corp., 3501 W. Addison St., Chicago 18, Ill.

DY-23A is an exact replacement for RCA 972459-2/-3, used in 27 models of the KCS 96 and 97 series chassis. *A-8150* replaces RCA 0971798-1 in 6 chassis and 89 models. Further details in bulletin 516.

ROLL-AROUND TV-SET PLATFORM

A caster platform, *TV Roll-Around*, for installation under console TV sets, has been announced by the Television Hardware Manufacturing Co., 919 Taylor Ave., Rockford, Ill.

Unit legs extend to proper distance and are secured in place with a wing nut.

FLYBACK REPLACEMENTS

Flyback replacement transformers, *XO709*, have been introduced by Ram Electronics Sales Co., Irvington, N. Y.

Units replace Trav-Ler flybacks *TVX-104*, -105, -106, -107, -108, -109, -110, -111, -112, -113, and -114 in 10 chassis and 73 models.

LOW-BAND LINE AMPLIFIER

A broad-band chain amplifier, *211*, for TV distribution systems, has been developed by Spencer-Kennedy Laboratories, Inc., 1320 Soldiers Field Rd., Boston 35, Mass.

Unit covers low *vhf* and FM bands and a number of sub-*vhf* channels. Unit is said to continue to function even after tube failure.

Rotator Prize Awards



RAY BUHRMAN (left), ad manager of Alliance, and George Gemberling, general district sales manager, holding a jeweled antenna rotator that was awarded, along with a trip to Bermuda, to the distributor who registered at Chicago parts show booth and guessed the date of manufacture of the jeweled antenna rotator, the 3,000,000th model.

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PERSONNEL

DONALD J. HUGHES has been named ad manager of the electronic products sales department of Sylvania Electric Products Inc. In his new post, Hughes will be responsible for ad plans and programs for electronic products, including both distributor and equipment sales.



Hughes



Hosterman

CHARLES W. HOSTERMAN has been appointed general manager of the electronics division of Sylvania Electric Products, Inc., Woburn, Mass.

CHARLES E. BALZ has been named vice president for sales of Burgess Battery Co.



Balz

GEORGE A. SVITEK has been named to a newly-created position of national service manager for the communication equipment section of General Electric.



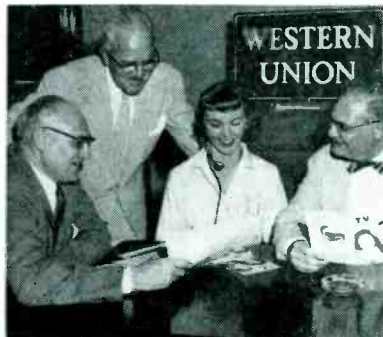
Svitek



Hoyne

ARCH T. HOYNE has been named sales manager of General Cement Manufacturing Co., 400 S. Wyman St., Rockford, Ill.

WU Listing Program



F. E. ANDERSON, distributor sales manager and E. I. Montague, of Raytheon's receiving and cathode ray tube operations, with Western Union Operator 25 and F. E. Moran, Western Union superintendent Greater Boston area, inaugurating new listing-contact service. Set owners who call Operator 25 will receive the name and telephone number of the nearest Raytheon bonded TV-radio Service Man.

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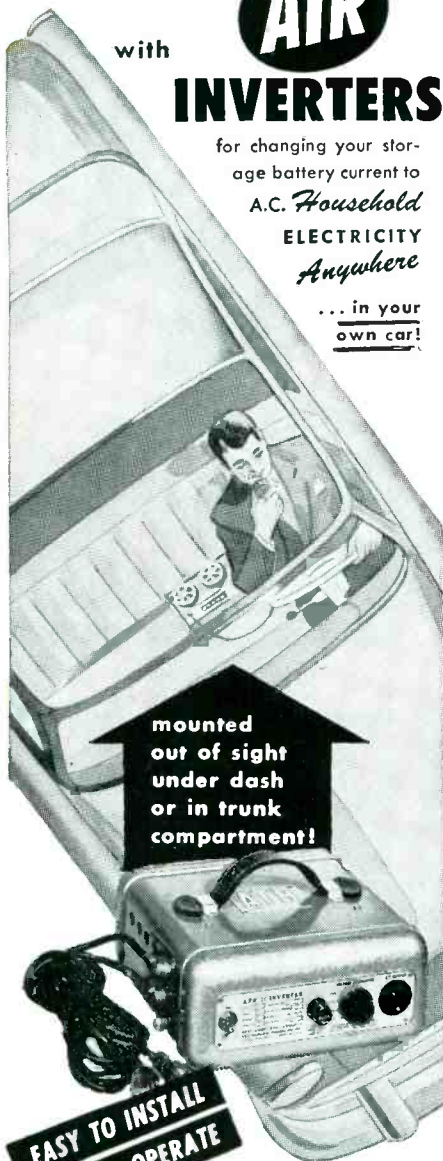
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**Tube . . . Transistor
Developments**

Beam Power Tube: A high-perveance beam power tube of the glass-octal type, 6CB5A, designed for use as a horizontal-deflection amplifier tube in color-TV receivers, is now available from RCA. Utilizes a button-stem construction in a T-12 envelope.

Tube has a maximum plate dissipation of 23 watts and a maximum grid-No. 2 input of 3.6 watts. These ratings, in addition to a peak positive-pulse plate voltage rating of 6800 (absolute), it is said, enable a single 6CB5A in suitable circuits to provide full deflection for the 21AXP22A color picture tube.

Auto-Radio 12-V Tubes: A line of 12-v tubes, designed specifically for auto radios, has been announced by Raytheon. One, the 12AC6, a heater-cathode type remote-cutoff pentode with a unipotential cathode of miniature construction, was designed for use as an *rf* or *if* amp.

Another, the 12AD6, is a heater-cathode type pentagrid converter, that can be used as a combined oscillator and mixer.

A third type, the 12AE6, is a heater-cathode type combined double detector and medium-mu triode. The triode section has been designed for use as an *af* voltage amp.

Also available is a heater-cathode combined double detector diode and remote cutoff pentode, 12F8, whose pentode section has been designed for use as an auto-radio *af* voltage amp.

Auto Radio Power Transistor: A *pn*p power transistor, 2N155, designed especially for the audio output stage of auto radio receivers, is being manufactured by CBS-Hytron.

Designed to operate from a 12-v battery, this transistor (germanium-alloy junction) features a heavy copper flange mounting said to permit flow of heat from the power transistor to the chassis, providing a large radiating area.

POWER TRANSISTOR designed especially for the audio output stage of auto radios. (CBS-Hytron).



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