RADIO • TELEVISION • ELECTRONIC

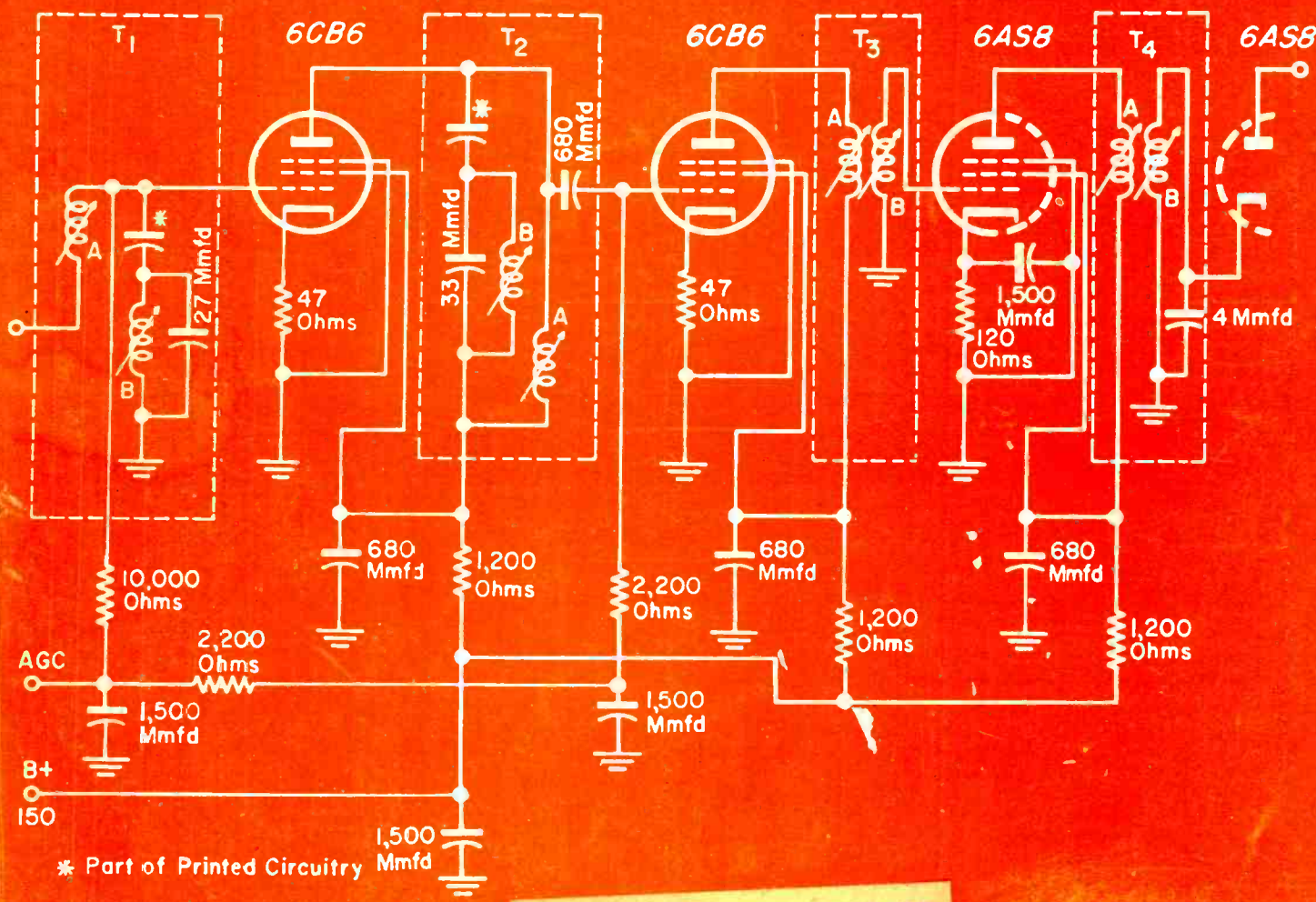
SERVICE

VOL. 24

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

In This Issue: AUDIO FORUM

MARCH
1955



Printed-circuit IF strip for 41.25/45.75-mc (sound/video). (See circuit analysis, this issue)

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Powerful beyond any need!

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model AR-2 . . . complete, automatic rotor with thrust bearing. Handsome modern design cabinet, uses 4 wire cable.

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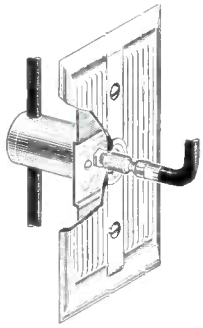
Effective Distribution

with B-T LABS Masterline TV TAP-OFFS

Type MTO-11 for Outdoors



Type MTO-59 for Indoors

TV set connections to the line have been the most critical and troublesome points in distribution systems. This is no longer the case. B-T Tap-Offs are the simplest means ever devised for connecting TV receivers to a feeder line or riser. Installation is practically automatic. There is no break made in the line and no splices are required. Precise impedance match is assured, and because the line is not damaged, B-T Tap-Offs may be removed at any time without affecting continued performance.

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Type MTO-11 ..... each **$7.00** list

Type MTO-59 ..... each **7.00** list

Packed 6 to the carton

For complete specifications and installation data, write to Dept. CC-8 ·

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Community TV Components

AMPHENOL today makes all of the cable types and all of the RF connectors that are used in Community TV Systems. These have always been made to the quality standards of AMPHENOL—standards that have demanded extreme care in all phases of production. RF connectors and coaxial and triaxial cables are manufactured with strict controls, are carefully inspected before shipment.

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Assure Longer Lasting Community TV Installations!

Vol. 24, No. 3

RADIO · TELEVISION · ELECTRONIC
SERVICE

March, 1955

LEWIS WINNER
Editor

D. E. PEARSALL II
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CIRCUITS

COVER

Index to Advertisers ... 79

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start right . . . in COLOR with RCA field-proved instruments!

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WR-36A DOT-BAR GENERATOR

If you want to get off to the right start in color-television servicing, add the RCA WR-61A Color-Bar Generator and RCA WR-36A Dot-Bar Generator to your present black-and-white equipment. These two units, used with proper test facilities for servicing black-and-white receivers, give you complete test equipment for trouble-shooting and servicing color-TV receivers.

Lightweight, compact and portable, both instruments are designed for accuracy and stability. See your local RCA Distributor for complete details.

The WR-61A Color-Bar Generator generates signals for producing 10 different color bars simultaneously —including bars corresponding to the R-Y, B-Y, G-Y, I, and Q signals for checking and adjusting phasing and matrixing in all makes of color sets. Crystal-controlled oscillators insure accuracy and stability. Luminance signals at bar edges facilitate checking color "fit" or registration. Adjustable sub-carrier amplitude permits checking color-sync action. The WR-61A which was designed for color servicing is now accepted as the standard for color-phasing accuracy in many TV stations and network operations. Suggested User Price **$247.50**

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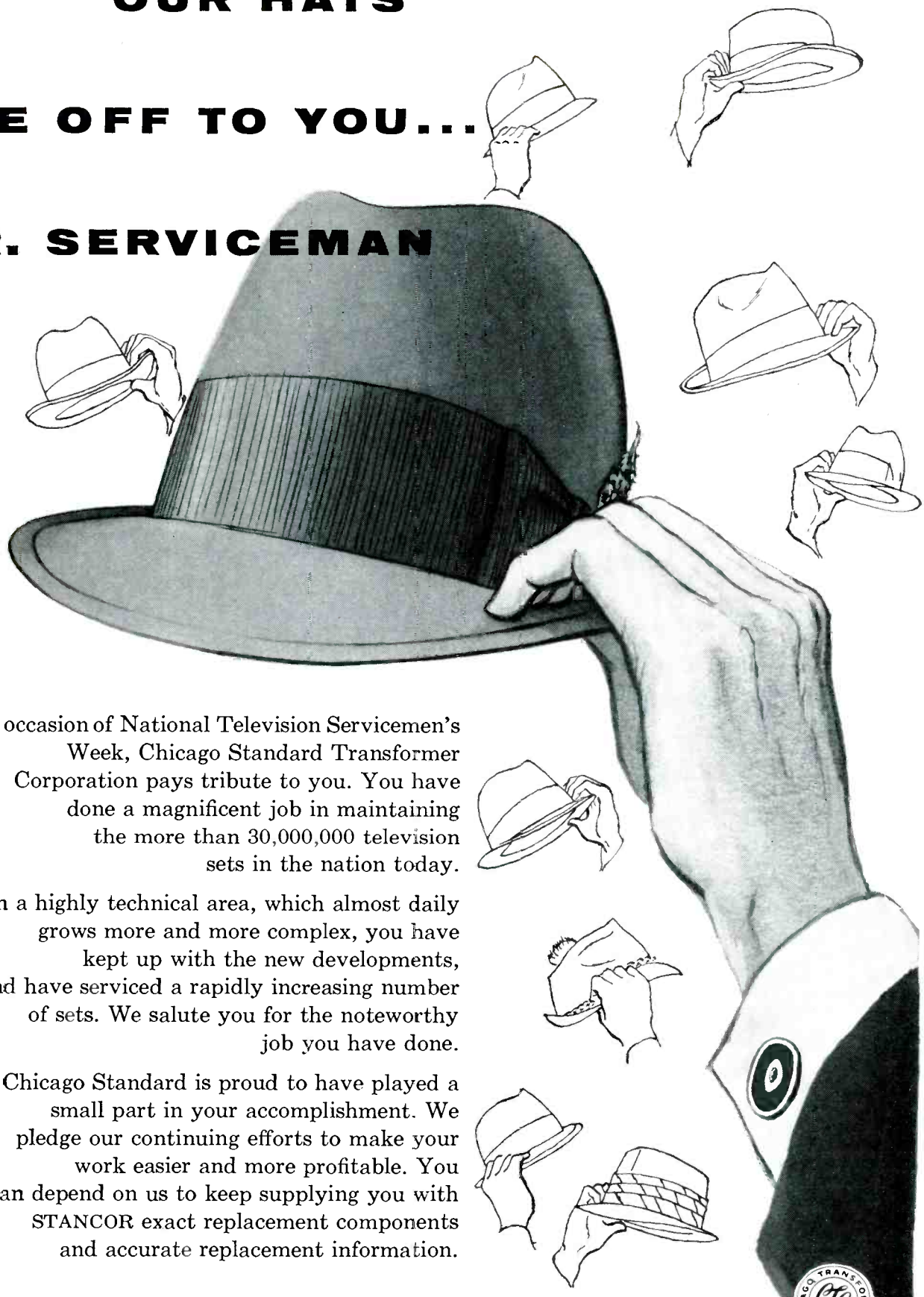
MR. SERVICEMAN



On the occasion of National Television Servicemen's Week, Chicago Standard Transformer Corporation pays tribute to you. You have done a magnificent job in maintaining the more than 30,000,000 television sets in the nation today.

In a highly technical area, which almost daily grows more and more complex, you have kept up with the new developments, and have serviced a rapidly increasing number of sets. We salute you for the noteworthy job you have done.

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NEW 12AU7A

—**shorter construction** reduces intermittent scan and heater cathode failures.

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—**twin-wing plates** provide greater heat dissipation.

—**wafer stem** strengthens construction. Increases ratings to 275 Ma at 44V drop with 1.0 amp. peak plate current.

Sylvania makes important NEW advances in

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Six "double-duty" tubes designed to lick TV service's costliest problems. More to come!

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Look for the new "double-duty" types in this yellow-and-black carton. It's your calling card of quality.

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—**longer life-test** under conditions well above ratings.

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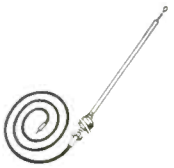

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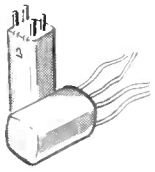

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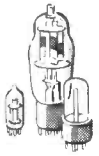
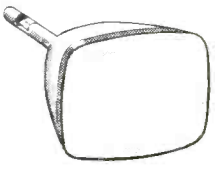
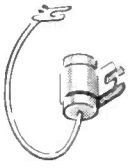


RECEIVING
TUBES



PICTURE TUBES



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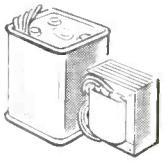

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SPECIFICATIONS

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- ★ 1 volt, peak-to-peak, built-in vertical voltage calibrator.
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- ★ Built-in 60 cycle sine-sweep phasing control.
- ★ Beam modulation input terminal at front of panel.
- ★ All 4 deflection plates directly accessible at rear.
- ★ Filter-type, removable, calibrated graph-screen.
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SERIES ES-520: In black ripple finished, rugged steel cabinet, 8¼ x 14½ x 16½". **Complete with all tubes,** including 5UP1 CR tube. Comprehensive instruction manual. Code: Quest. Shipping weight: 30 lbs. **Net Price: $127.50.**

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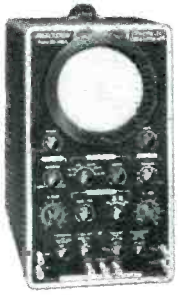

HIGH SENSITIVITY WIDE-RANGE 5" OSCILLOSCOPE

The famous ES-500A incorporates advanced engineering features and refinements so necessary to meet the more critical needs of modern electronic circuit analysis, AM, FM and TV.

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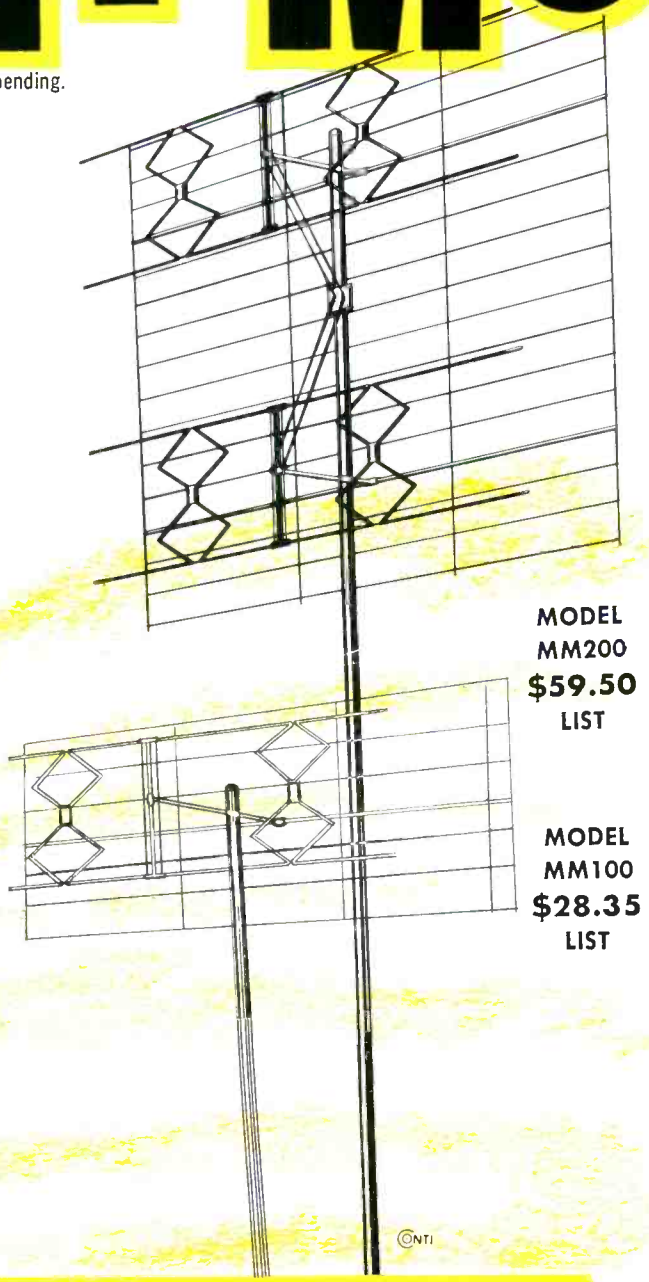
Mighty Mo . . . complete with DDP, an entirely new and revolutionary concept of phasing, will trap even the weakest signal and perk it up to a clear, brilliantly sharp, deep-toned picture. Tescon absolutely guarantees that each and every Mighty Mo will perform where other antennas have actually failed!

Theoretical ratings will never pay off. Rely on tested results . . . that's your real proof, that's your money in the bank.



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MODEL MM100 $28.35 LIST

Here's Mighty Mo's proof ...the results of ACTUAL FIELD TESTS.

- On channels 2 to 13, Mighty Mo outperforms every other antenna manufactured today.
- Higher uniform gain over all channels. Does not vary more than 1½ D.B. on any channel across band. Perfect on color TV.
- Clearer, sharper, deeper pictures on all channels.
- Higher average gain than 6 of the most advertised antennas.

MIGHTY MO'S FEATURES

- DDP (Double Diamond Phasing) precision-timed phasing regulator enables the weakest of signals to be trapped and then boosted to a clear, magnificently sharp, photo-like picture.
- Flat response . . . a must for color reception.
- Largest screen area . . . over 70 sq. ft. Screen elements spaced less than 1/10 wave length apart for maximum reflector efficiency. Highest front to back ratio ever achieved.
- Absolutely no rear pick up or co-channel interference . . . no "venetian blinds."
- ½ wave element spacing on all channels for super-gain.
- Completely preassembled . . . not an erector set type antenna.
- Uniform gain response . . . no erratic audio and video patterns.
- Thoroughly tested for mechanical stress and strain . . . exceptionally rugged.
- Guaranteed to perform where other antennas fail.

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TV PRODUCTS COMPANY

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IT'S THE CAT'S WHISKERS

"Compatible"

All Electronic SWEEP GENERATOR by RCP

LABORATORY PERFORMANCE

PRICED FOR THE SERVICEMAN

$189.50 net

Model 780

For Black and White and Color Television . . . plus FM and AM Radio . . .

Unexcelled in performance and versatility, the RCP model 780 is engineered as a completely electronic sweep circuit without motor or moving parts. Unique electronic unidirectional coupling provides for sweep in one direction only at a uniform output level (AGC). For use with any marker generator and oscilloscope, model 780 is the first laboratory type all electronic sweep generator priced reasonably enough for service use.

Service Designed for Ease of Operation:

- Built-in Detector/Comparitor Permits
  - (1) Visual observation and accurate settings of marker signals and sweep width of alignment of TV IF's and Wave Traps.
  - (2) Laboratory and service technicians to check their test equipment.
  - (3) Check of test set-up for improper grounding or long leads.
- Push button attenuator for rapid, precise alignment and measurements.
- Automatic internal blanking with straight line base generation for scope picture—eliminates return trace.
- 180° 60 cycle phasing voltage for use on all oscilloscopes available on front panel.
- Jack provided for modulation by external signal such as color generators (bar or dot) and is automatically mixed in the sweep circuit.

Features:

Anti-backlash dial—Electronically regulated power supply—Highly linear sweep to close tolerances of manufacturer's specifications—Range 3.2 megacycles to 800 megacycles — Wide sweep width control 0-30 megacycles—Automatic gain control—Precision, triple shielded attenuator.

SPECIFICATIONS

Sweep Linearity: Exceptional high degree of linearity nat passibly abtainable in mechanical sweeps.

Band	Linearity Sweep Width Within 2 DB	Linearity Sweep Width Within 4 DB
A	0- 8 mc	Max. 15 mc
B	0-10 mc	Max. 25 mc
C	0-10 mc	Max. 22 mc
D	0-8 M @ 70 mc	Max. 25 mc
	0-20 mc @ 200 mc	Max. 30 mc

See Your Local Parts Distributor or Write Dept. S-3 for Latest RCP Catalog

RADIO CITY PRODUCTS CO. Inc.
EASTON, PENNSYLVANIA

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THE TACO SUPER TRAPPER

The fringe area antenna with single bay gain up to 15 db! Employs Penta-Phase principle (5 driven elements). Aluminum throughout, including phasing line channels. Radiating traps in 4 driven directors give 24 working elements on the high band. Unrivalled gain and front-to-back ratio will positively lick the toughest interference problem. Single or stacked for fringe or sub-fringe problem areas. Completely factory assembled including transmission lines. Incorporates automatic spring lock assembly — characteristic of Taco's easy-up design.

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SERVICE...The National Scene

PESKY TV RADIATION PROBLEM TO BE AIRED AT IRE CONVENTION SYMPOSIUM--Six of the foremost authorities on the continent, representing industry, the Federal Communications Commission and the Canadian Telecommunications Division, have agreed to serve on a special panel during the annual IRE national convention at the Waldorf-Astoria in New York City, and discuss for the first time, as a group, man-made TV radiation and its control. . . . They will report on what has been done, what is being done and plans for the future to curb all forms of interference. . . . One member of the probe board, head of the electrical engineering department of one of the largest technical institutes in the nation, will describe the variety of measurement techniques and equipment now available and being developed to help rout the herringbones, jitters, swirls and squeals.

THE EXPERTS will review the work of the RETMA and JTAC task forces and cite what progress has been made to meet the recommended standards of oscillator radiation limits for the low and high bands of veryhigh TV sets; 50 and 150 microvolts, respectively. And the higher limits set for the ultrahigh chassis will also be surveyed.

ALSO SCHEDULED for presentation is an analysis of the self-imposed controls adopted by those who make commercial 2-way gear, to insure best results, and the beneficial effects that a similar policy adopted by TV set makers could have among set owners. Sanction of such a plan on a national scale would, it was said, prove to be quite a boon to sales. . . . Unless such a voluntary practice obtains, it is felt, government may have to step in and issue firm official rules. Washington can do this, attorneys say, because in the main, radiation is not a local matter; signals do hop over state borders. Thus, we have an interstate problem which could come under the jurisdiction of the FCC.

TWO PROFESSIONAL GROUPS of the IRE are cosponsoring this extremely important session; broadcast and television receivers, and broadcast transmission systems. Ye ed, as chairman of the broadcast group, served on the program committee, organizing the general agenda for the meeting.

SUBSCRIPTION-TV SERVICE-MAINTENANCE PROBLEMS PLACED BEFORE FCC--Asserting that they are deeply concerned about the broad effects that subscription-TV could have on home servicing and the TV Service Man, members of the Federation of Radio Servicemen's Association of Pennsylvania, petitioned the Commission recently to hear their views on the subject. The group notified the FCC that they would like to send a spokesman to the public hearings in Washington, when they are held, to testify in their behalf.

ELSEWHERE, SERVICE MEN, also cognizant of toll-TV problems, have organized and formed a service company to maintain and repair subscription TV equipment and the receivers to which they are attached. . . . According to the headman of the group, the independent Service Man will be the key man in this new medium. In his opinion, pay-as-you-go TV will be different from common-carrier service, as offered by the telephone company, since the receiver, certainly a major link in the pay-see chain, is personal property. Thus, it was said, it will be up to a private agency, such as the new group, to watch over the set and its attachments.

ANTENNA AD CLAIM CHECK PROGRAM UNDER STUDY--RETMA's antenna committee, according to its chairman, has begun to survey the possibilities of setting up a national body, recruited from service associations, to probe advertised claims of TV antenna makers and compare such claims against actual performance. . . . Mechanical and electronic standards that would serve as a measuring stick are being prepared. . . . Verdicts might be used in official reports circulated among all trade association members.

SERVICE...The National Scene

SET MAKERS URGED TO STOP SAYING PC-AUTOMATION MODELS DO NOT REQUIRE REPAIRS--Manufacturers of sets employing plated-board assemblies and fabricated on automatic machinery have been asked to kill all publicity and ads announcing that their chassis will never require service or maintenance. . . . The plea, from a dozen associations in Pennsylvania, warned that the glorified no-repair remarks could never be supported in the field. No one denies, it was noted, that the new models are extremely attractive and designed to provide top performance, but components and tubes (or transistors) are still required, and they are subject to the usual run of troubles caused by heat, natural elements, usage and general longevity problems. . . . And in view of the specialized construction of these chassis, association members noted that they must now become acquainted with entirely new repair techniques, that are time consuming and costly. Thus, for awhile, consumers will be faced by higher charges for service here. . . . PC circuit tracing at present, it was also emphasized, is particularly trying, because leads are not color coded, or identified. In simple chassis, the problem is not too acute, but in complex TV sets, the situation is far from a pleasant one. It was hoped, said the association boys, that soon some code would be developed to solve the lead riddle in pc sets.

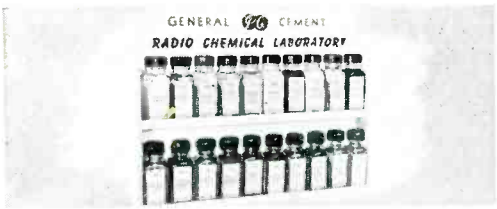
MALPRACTICE SERVICE BILL PLACED BEFORE N. Y. STATE ASSEMBLY--A bill, which would make it a misdemeanor for one who commmitted fraudulent acts in the inspection, installation, testing, and servicing of TV receivers, has been submitted by a New York State assemblyman. . . . The measure stipulates that it would be illegal to make any unnecessary repairs and remove any part not defective or install an inferior component; charge for any new part not actually used or needed in making a repair; or charge for any component, when a new part was not actually used in making the repair. The bill also proposes that consumers receive a detailed bill for all services and parts used. . . . A number of the curbs included in the proposed legislation stem from recommendations which appeared in a Kings County district attorney report on abuses by unscrupulous service operators.

$670,000,000 SPENT IN '54 FOR REPLACEMENT PARTS--Sales of receiving and picture tubes and general components for repairs amounted to $670,000,000 during '54; so reported a financial vice prexy associated with one of the nation's leading tube and set makers, recently. This year, he forecast, income would jump to about $800,000,000. And in '58-60, the billion-dollar mark will be hit; but in '64, the volume will really zoom, for then, he felt, we would see a market with a value that would be well over $2-billion. . . . Service charges, which are expected to add up to over $900,000,000, this year, it was revealed, should also become a billion-dollar business, ten years from now.

MAJORITY OF TV SET OWNERS SATISFIED WITH SERVICE, NEW SURVEY REVEALS--Most of the nation's TV set owners are more than pleased with the promptness, quality, prices and courtesy of the TV Service Man, a nationwide survey[1] has disclosed. . . . It was found that 90 per cent of those interviewed expressed complete approval of the Service Man. . . . These findings made public during the observance of National Television Servicemen's Week[2] were cited as a mighty tribute to the integrity and spirit of the vast army of highly-trained and skilled Service Men who install and maintain TV receivers today.

FRSAP PLAQUE TO BE PRESENTED TO YE ED--The prized FRSAP plaque, awarded annually by the Federation of Radio Servicemen's Associations of Pennsylvania, will be given to ye ed during a special ceremony on April 17, at the Hotel Harrisburger, Harrisburg, Pennsylvania. . . . In announcing the award, the Federation's secretary said that the plaque served . . . "to give recognition to the individual or corporation, who throughout the year, had done most to aid independent service. . . . And the books show that Lewis Winner has more than earned that recognition."

[1]Made by Elmo Roper for RCA Service Co., and RCA consumer products division. [2]March 7-12; established by RCA as a nationwide salute to the Service Man.



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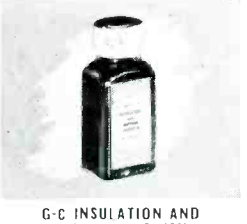

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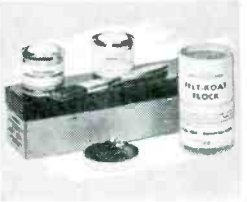

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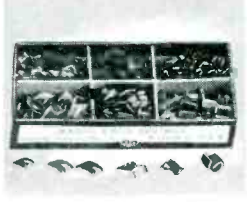

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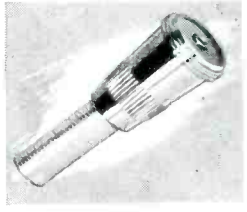

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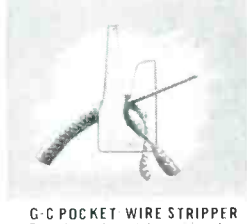

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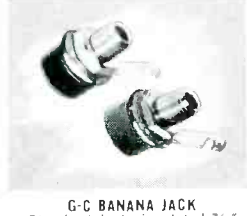

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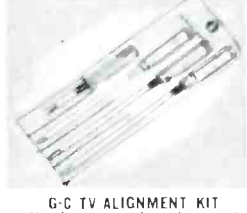

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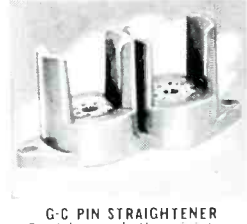

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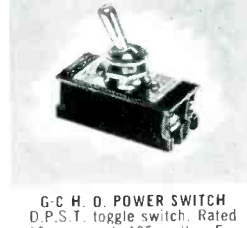

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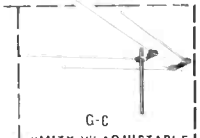

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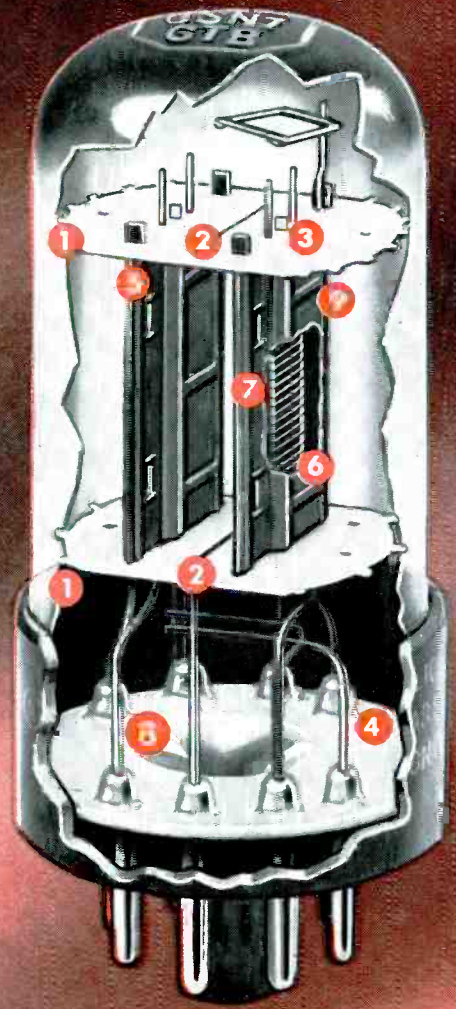

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Industrial Electronics and Service

THE POTENTIALS of industrial electronic equipment in the plant, business world and home, are towering, and it will not be long before the nation will be wholly dependent upon the magic of the tube, or its equivalent.

So forecast a panel of the country's leading scientists just a short while ago, during a professional meeting. Today, their stirring prophecy has become a majestic reality. In bakeries, dairies, paper mills, printing-ink and oil-processing plants, tobacco and chemical labs and factories, to mention a few, ingeniously-conceived electronic gear are on guard, delivering uncanny precision control.

Whereas, not too long ago, many discounted the practicality and reliability of these automatic wonders, now a growing parade of enthusiasts have solidly acknowledged the amazing efficiency of these new tools. These electronic implements have become essential ingredients in the formula for business success.

The key role these machines have begun to play in modern plant production, has underscored the fact that their continuous performance is vital; breakdowns can be extremely costly. Thus, every effort must be made to minimize time lost, when trouble does occur. Accordingly, adequate service and maintenance facilities have been recognized as a basic requirement.

Often, plant personnel, never too familiar with the apparatus, have been called in to handle service or maintenance assignments. It was found that this did not represent an economic practice, for not only were other operations in the plant disrupted when these men were called away from this posts, but since their experience with the equipment was limited, hours were often spent effecting a repair that a specialist could complete not only in much less time, but more efficiently. To offset this, a number of industrial-electronic equipment manufacturers agreed to offer home-office service.

This was a forward step in the early days and did alleviate the situation. But today with spreading distribution of control units to contend with, it is being found increasingly difficult to supply expert help, particularly at that urgent moment it is so badly needed. The solution, it has been admitted, lies in the establishment of many local service depots, operated by independents, who would not only be able to provide readily speedy service, but a well-planned program of preventive maintenance.

Some have already become aware of this pressing need and begun to burn the midnight oil. They've been studying texts, engineering reports of the type featured in SERVICE, equipment basics in their lab, and attending industrial meetings and clinics.*

While all of the *i-e* systems have a significant job to do, the end results provided by some control and measurement chains, are unusual, indeed. It is possible, for instance, to prevent breaks in huge rolls of paper employed on newsprint presses, through a series of photocell-relay links. It's also possible to keep an accurate check on the condition of eggs through the use of ultraviolet rays, coupled to a filter-photomultiplier tube circuit. Here, tubes with their filters sample bands of fluorescence, and light output based on a standard operates an accept-reject relay.

Basically in every *i-e* operation, there are major components with which most Service Men are familiar. To illustrate, photocells, crystals, or bridge circuits are employed to convert something physical, such as temperature, pressure, velocity, acceleration, liquid flow or light, into electrical energy, to activate an amplifier or instrument.

Also having a field day in the industrial-electronics world is an oldtimer, which has become extremely popular today; ultrasonics. Here, too, some startling results can be obtained. In low-power applications, ultrasonics (technically a form of vibratory mechanical energy, with a frequency above the audible range, or above 20 kc) can be used to measure soundness, thickness, distance, viscosity or fluid flow. And in high-power work, ultrasonic energy can be used to process material, as in the acceleration of chemical reactions, degassing of liquids, soldering of aluminum, descaling of metal strips, cutting of hard, brittle materials, dispersion of small particles and cleaning of metals and other solids.

There appears to be no limit to the far-flung possibilities inherent in industrial-electronic systems, and equally no limit to the prospects in this field for those in servicing.

A tour around IRE's spectacle this year, at the Armory and the Palace, where there'll be scores of *i-e* gems, designed for the factory, the office and even the home, will convince even the most skeptical that *here* is electronic wizardy at its peak, that will gild the days ahead.—L. W.

*The first *Industrial Electronics Service Engineering* convention and exhibition, cosponsored by associations in Pennsylvania, is now being planned for the Fall. The show, expected to tour key cities, will feature illustrated-demonstration talks and active displays of equipment.

Making and Interpreting AC Measurements

by NORMAN CROWHURST

Service Engineering Consultant

Critical Analysis of Effects of Instruments on Circuits and System Performance . . . Corrective Measures Available

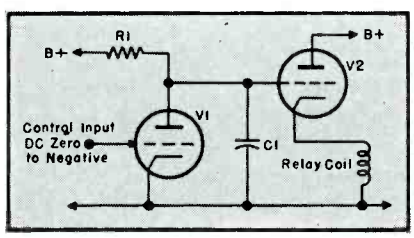
WITH THE EXTREMELY high-resistance and high-impedance meters that are now available for *ac* measurement, one is apt to think that it is possible to measure any voltage at any point with such an instrument, without considering its possible effect on the circuit. However, high as the instrument resistance or impedance might be, often a direct affect on the voltages that we want to measure in a circuit obtains.

In a *dc* circuit the resistance of the instrument can be low enough to modify considerably the voltage that was present before the instrument was connected. In measuring *ac* or signal voltages the connection of the instrument can either load the circuit due to the *ac* resistance or, where it is of the tuned signal circuit variety, alter the operation of the circuit, producing a detuning effect. It is true that it is possible to acquire instruments that minimize this effect, but often measurements are made with instruments that produce some effect.

In a recent lab project, it was found necessary to investigate the behavior of a relay operating circuit which used a stage of *dc* amplification, as shown at Fig. 1; here a coupling resistance (R_1), extremely high, served to connect an instrument from plate to ground. The voltage at that point was reduced to such an extent that the relay in the cathode of the tube ceased to operate at all. Measuring the voltage on the cathode of V_2, which of course follows to some extent the voltage on the grid of the tube, suggested that the time delay of the resistance-capacitance arrangement (R_1/C_1) was behaving correctly when the grid of V_1 was biased to cut-off, but for some reason the relay voltage ceased to rise at a certain point. This suggested that leakage was occurring either in the capacitor, C_1, or somewhere else in the circuit; so it seemed necessary to measure the voltage on the plate of V_1 and the grid of V_2.

Connecting a voltmeter from this point to ground dropped the voltage to a point where the leakage did not occur anyway. A simple method of making the measurement which did not interfere with the leakage, but which did considerably shorten the effective operating time was achieved by connecting the voltmeter across the plate-coupling resistor, R_1. In this way, the volt drop from $B+$ was measured and could be subtracted from the total $B+$ value to find the *dc* voltage from the plate of V_1 and the grid of V_2 to ground. With the voltmeter in this position, it was possible to remove various components from the circuit, until the source of leakage was found.

Fig. 1. Circuit illustrating dc voltage measurement problem caused by extremely high value of R1.



Finally the trouble was tracked down to a characteristic of the tube used in the V_2 position; leakage from grid to heater, which occurred above a certain critical voltage. This effect would not show up under more normal circuit conditions, but appeared due to the extreme high-circuit resistance employed in this particular circuit. This condition would have been difficult to trace, unless the voltmeter had been connected in the manner described.

A second example (and a much more common one) occurs where it is desired to check the dynamic voltages appearing at different points en route through a tuned amplifier. In this case, connection of any measuring equipment to an intermediate point of high impedance or where additional capacitance will produce a detuning effect, inevitably upsets measurement to some degree. A simple way of over-

coming this consists of putting a meter on the output end or some convenient point, which is at a reasonably low impedance and at a high enough level to be conveniently measured, and which is after the voltage to be measured. It is also advantageous, if possible, to connect a 'scope across the later point so that the output waveform may be observed. If an additional voltmeter for the second position is not available the 'scope itself can be employed, since it can be used as a voltage reference as well as a check of waveform.

In the foregoing study, one notes the level at the output and its waveform before the voltmeter is connected to the desired point; Fig. 2*a*. The voltmeter is connected to the point where the measurement is required and a drop will be observed in the output. To compensate for this drop in the output the input signal to the arrangement is increased until the original level and waveform are restored. A reading then taken will be identical with the value present at that point in the absence of the meter. The waveform is important for several reasons: Increasing the input level may cause distortion ahead of the point to be measured. In this case the waveform may change; hence although the output reading obtained may be adjusted to the same value, the waveform is different. Thus the reading at the high-impedance point is different from that which would be obtained if the voltmeter were not connected and an imaginary truly infinite impedance could be used to make the measurement.

A third example, where it is difficult to make a measurement, appears in the case of an oscillator where any disturbance of the circuit modifies the oscillating condition of the tube and hence the level changes. A simple reference point for determining oscillating condition, where the grid bias for the oscillator tube is obtained in the conventional resistance-capacitance method, is illustrated in Fig. 3. It is assumed that the oscillation is a close enough approximation to sinusoidal, to allow for calculation on this basis. A microammeter is inserted in the return lead of the biasing resistor. The average current flowing in the bias resistor is measured by the microammeter and by multiplying this current by the value of the resistance (this should be checked on a bridge), the average bias developed can be calculated. Since the excursion is sinusoidal, the peak-to-peak waveform will be twice the bias value, or the peak sinusoidal waveform approximately equal to the bias value. Thus the *rms* voltage on the grid is .707 times the calculated bias value. This calculation does not involve connecting a meter in such a way as to disturb the circuit, provided the microammeter is inserted in the cold end of the bias resistor.

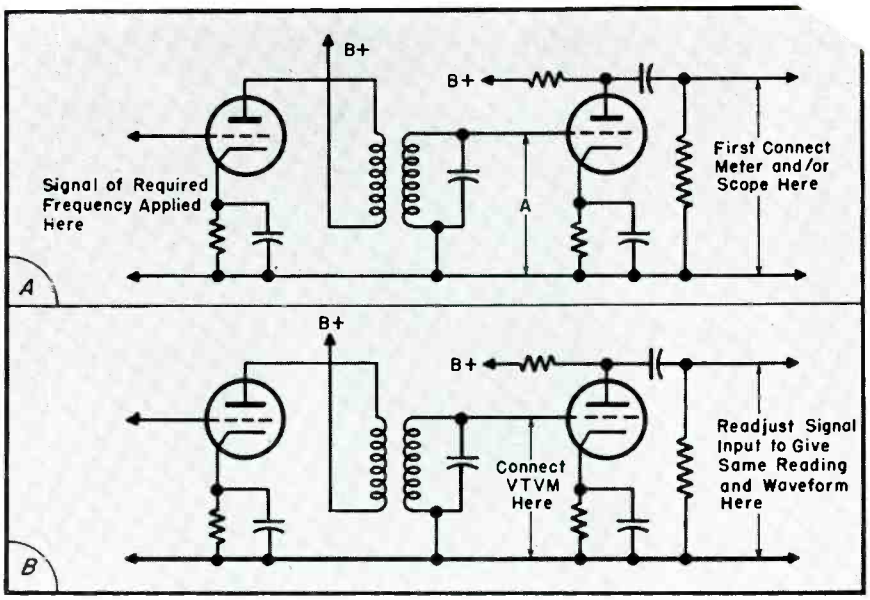


Fig. 2. Method of taking a reading at an intermediate stage in a tuned amplifier to avoid error. In *A* output voltage and waveform are measured before connecting a vtvm at A. After connecting the vtvm, input must be readjusted so that output voltage and waveform repeat (indicated in *B*), and then the vtvm can be read.

Measurement of *ac* voltages appearing at other parts of the associated oscillator circuit can be made using an appropriate *ac* voltmeter probe; if the microammeter is left in this bias lead return, any change in amplitude due to connection of voltmeter can be noted. If it is found that application of the voltmeter in any particular measurement makes a change, such a change can be noted and used to calculate the effective voltage present in the absence of the voltmeter by a simple ratio. This may not always be quite accurate, because loading of the voltmeter can reduce the voltage at the point measured to an extent greater than the reduction showing in the grid circuit. To show this change, a measurement of the output voltage at some point following a stage of buffer amplification would be desirable.

A final factor in understanding how to make and interpret measurements concerns the effects of waveform when taking *ac* readings. The value of an alternating waveform is usually referred to in *rms* terms, especially if the waveform is something approximating to sinusoidal. However, many of the waveforms measured in practice depart considerably from true sign waves, and hence the *rms* to mean

(*Continued on page 64*)

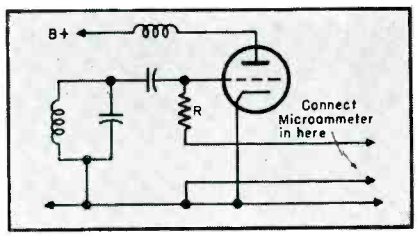
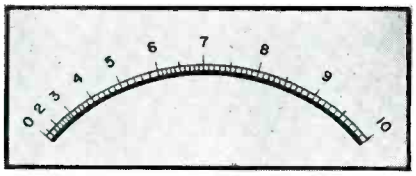


Fig. 3. An old but effective method of determining oscillator performance.

Fig. 4. Sample scale of a square-law instrument. Only an instrument of this type provides true rms readings when the waveform is complex.



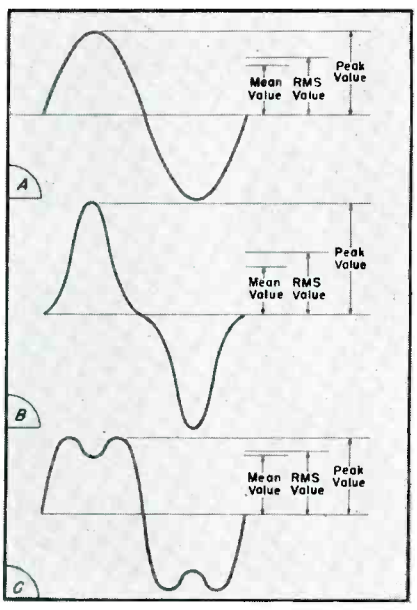


Fig. 5. Illustrations of the relation between peak, mean and rms values of waveform for a sine wave and two other waveforms.

Sweeping the TV Circuit

by ROBERT E. RICKETTS

Chief Engineer, Radio City Products Co., Inc.

THERE ARE FEW who will not readily admit that a sweep generator is a key instrument in any shop for b-w and color TV. The generator is a versatile instrument. It not only can be used for alignment, but for signal tracing.

In developing such an instrument[1] recently, it was found that the reluctance transformer could be used to provide sweeping in one direction only (forward—and thus higher in frequency) eliminating mirror images.

Continued experiments resulted in the inclusion of a continuous tuning system to provide coverage from 3.2 mc for color to 900 mc for the high bands; operating on fundamentals from 3.2 to 220 mc. To keep amplitude linearity constant, *agc* was introduced. And to permit attenuation of the sweep signal into the snow region, to avoid danger of overloading the receiver, triple-shielded push-button attenuators, that are additive, were included. A detector/comparator was also built in to insure an accurate setting for the marker and sweep width, and also serve for a test equipment check, improper grounding detection and monitoring of sweep signal. Provision was also made for the insertion of an external marker, or a color bar signal, automatically mixed in the output circuit.

General Procedure For TV Receiver Alignment

Before aligning a receiver, one should read the manufacturer's instructions on alignment procedure. Many set makers have included special circuitry to obtain band pass and a definite step-by-step procedure is necessary for perfect alignment. On any set it is important that one determine first whether or not alignment is necessary. This can be done by feeding a sweep signal directly into the antenna terminals and connecting a 'scope to the detector. Equipment necessary includes a 'scope and a marker generator (preferably an accurate turnable generator) and a detector probe. (A circuit of such a probe is shown in Fig. 1; the detector can be placed in a shielded can or a brass or copper tube.)

In this check, the sweep generator[1] is connected to the usual power line source, and the phasing control is turned clockwise so that a power switch is turned on.

To be sure a signal output obtains, one must connect the detector/comparator output to the vertical terminals of the 'scope and the horizontal cable from the sweep generator to the horizontal amplifier of the 'scope. The sweep control on the 'scope should be off, or the horizontal selector switch will be in the *external* signal position, rather than a sweep position. Then the *width* control on the sweep generator can be turned to its mid-point position. Now we can adjust the 'scope gain control (vertical) for a readable amplitude (towards maximum gain) and the horizontal gain control on the 'scope to spread the picture out horizontally. The phasing control on the sweep generator is then adjusted until the pattern is similar to that shown in Fig. 2.

When this step is finished, you may wish to set accurately the sweep width control. This can be done by using the signal generator as a marker generator.

Injecting Marker

The marker signal is injected through the marker input jack. One must be sure to keep the marker level low, otherwise the waveshape of the signal fed to the receiver will be distorted. This could cause improper alignment. Now we are ready to determine the sweep width. The progressive pips noted on the sweep signal on the 'scope when it is injected in this fashion are illustrated in Fig. 3. Here a .5-mc crystal oscillator was used for a marker signal.

Service notes should be consulted for the bandwidth desired for a particular circuit or receiver. Alignment time may be saved if the bandwidth is set on the sweep generator to in-

[1] *RCP Do-All Electronic Sweep Generator, 780.*

Fig. 2

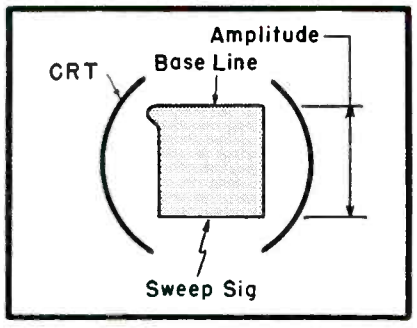


Fig. 1. (below) **Detector probe for use with sweep and 'scope to pick up signal in the if strip.**

Fig. 2. (left) **Scope pattern obtained when phasing control on the sweep generator is adjusted properly, during a test to see if a signal output is available for a TV chassis.**

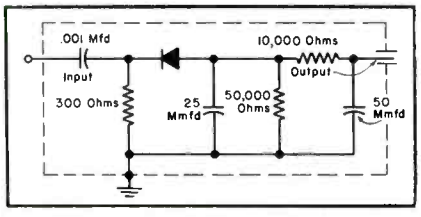
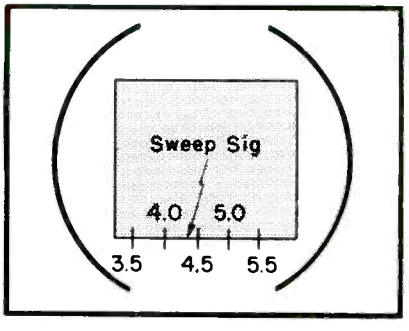


Fig. 3



clude the traps. Such a condition is shown in Fig. 4, where *pips* are noted, as the marker generator is tuned through the range desired.

The TV set manufacturer often supplies an illustration of what the detected signal should look like at the second detector; the illustration might appear as in Fig. 5.

A comparison of the two figures will reveal similarities. If you can see the trap frequencies in both Figs. 4 and 5 (19.7 and 27.3 mc) you can be sure that the sweep generator is properly set up to align this *if* strip. When the sweep *rf* output is fed into a TV receiver, or any circuitry consisting of tuned circuits, the band pass of that circuit can be observed on a 'scope if the signal is properly detected and the phase control of the sweep generator is properly adjusted.

Now, with this preliminary set-up completed, we are ready to connect the sweep generator to the receiver.

Four steps are involved in this set-up. First the marker generator connection is removed from the sweep output terminals. Then the detector/comparator cable is removed from the vertical 'scope input and the output of the detector probe is connected to the vertical terminals on the 'scope. Now the *rf* sweep output cable of the sweep generator is connected to either the antenna terminals of the receiver or to the location designated in the manufacturer's service notes. Finally, the detector probe is connected to the output of the circuit under test. The detector output is connected to the horizontal connections of a 'scope. If preferred, for video and for *if* alignment, the detector probe can be eliminated using shielded coax cable or wire to connect the 'scope horizontal input terminals to the load resistor in the video detector or sound *if* detector. In either case, one must follow the service notes on the receiver under test.

For all alignment except *rf*, one must disable the local oscillator by removing the tube or if this is not possible, the *B* lead to it should be disconnected, or its grid circuit shorted out with a clip lead, if there is no *agc* voltage connected to the grid lead.

The *agc* tube should then be removed, if the receiver has such a circuit, or a battery *dc* bias should be supplied to this circuit to nullify its effects. It is also wise to remove the high-voltage source by removing the horizontal oscillator tube in the receiver or the horizontal multivibrator tube. Many service notes suggest alignment of the trap circuits first; however, in receivers of intercarrier design, the 4.5 mc trap is not aligned until *after* the sound and video stages have been aligned.

Trap Alignment

For trap alignment, the tunable marker generator,[2] or any other suitable marker generator should be tuned to the trap frequency and its output connected as indicated below, without modulation, in any one of the methods suggested (One must *not* use modulation on the marker signal):

(a) Hot lead of marker generator is connected to receiver chassis or to

(b) Grid of *if* stage preceding trap through a .001-mfd capacitor or to

(c) Plate of *rf* mixer through a .001-mfd capacitor or to

(d) Marker input of sweep generator or to

(e) Any place designated in service notes.

Sufficient output from the marker generator should be obtained to see a *pip* on the detected sweep trace on the 'scope. Each trap should be tuned for minimum amplitude, or until the signal virtually disappears from the detected trace on the 'scope.

IF Alignment

Considerable time can be saved if the detected response curve is used for both peaking and overall adjustment. Each tuned circuit will affect this response curve, and while the curve will look more like Fig. 5, than the flat curve from the detector/comparator, a relatively flat curve is desirable, unless service notes indicate otherwise.

In stagger-tuned *if* systems, the peaking coils in the video system normally range from 21.75 to 25.33 mc. Each peaking coil contributes to the overall response curve. In addition, overall gain also is affected by each coil to a lesser extent. Let us assume that during a test, a curve noted on your 'scope indicates a drooping characteristic on the low (21.7 mc) side of the curve.

One should *not* rotate just any tuning slug, but first try slowly adjusting the tuning slug for 21.7 while watching the 'scope. Possibly no adjustment of this coil will completely correct the curve, but it may improve it. Then you can try adjusting the 22.35-tuning adjustment to give the desired response. After further improvement by this second adjustment, you can return to the 21.7-mc unit in the video circuit and make a slight additional adjustment to see if further improvement is possible. If the center portion now appears to have a droop in it, the final coil assembly should be adjusted for a flatter response.

While alignment of a trap is not discussed in this example, it is normal to adjust the trap for minimum amplitude, since the function of the trap is to keep out the undesired signal.

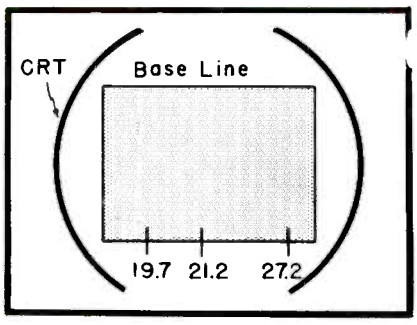
Before attempting to align overcoupled *if* stages service notes should be consulted. Such notes may recommend shorting-out the primary of the *if* transformers preceding the stage being aligned. Usually the alignment will proceed stage by stage from the picture tube detector to the *rf* mixer. Waveshapes are usually supplied. Tuning up these stages follows the general suggestions offered for a stagger-tuned *if* unit.

Discriminators, ratio detectors and gated-beam circuits are encountered in both b-w and color receivers, as

(*Continued on page* 71)

[2] *Such as the RCP 750 or 740A.*

Fig. 4



(At right, on page 22)

Fig. 3. Progressive pips noted on sweep signal on the 'scope, during sweep-width study. A .5-mc crystal oscillator served as a marker signal here.

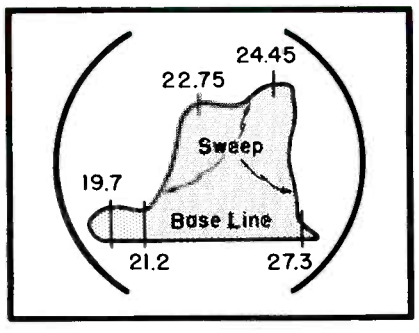
(Left)

Fig. 4. Pips noted as marker generator is tuned through range desired.

(Right)

Fig. 5. What a detected signal looks like at the second detector.

Fig. 5



COLOR TELEVISION

Bar Generator Applications

by JESSE DINES

THE COLOR BAR GENERATOR provides a simple way to determine whether a teleset is producing the correct color. Different bar generators produce different colors in different sequences and of different widths. Some generators provide only two colors at a time on the screen, with other colors being made available by controls on the generator.

On page 25 we have a chart which discloses the colors that appear as each stage becomes defective. However, one must bear in mind that the main function of the generator is to isolate a trouble to a specific section, stage, or control of the receiver. As noted earlier[1], components and allied circuitry in the color system affect color reproduction; a generator can be used to localize the fault which might occur in these areas.

The I and Q stages (V_{22}, V_{23}, V_{15B}, V_{24}, 0-0.5-mc low-pass filter and 0-1.5-mc low-pass filter in the CBS-Columbia 205[1]) produce I- and Q-pulses, of proper polarity, for use by the matrix. A study of a color phase diagram reveals that $+Q$, $-Q$, $+I$ and $-I$ stages extend into the magenta, green, orange and cyan regions, respectively. Thus, if any of the signals disappear, then the corresponding color will not be seen on the screen. For example, if a I-phase splitter (V_{24B}) was defective, there would be no $-I$ signal and the cyan would be missing from the receiver. The color bar generator would disclose that this same cyan would not appear as the sixth color bar. It is interesting to note that the absence of a Q-signal is not easily discernible by the TV viewer, or the Service Man, for that matter, unless there is another set nearby for comparison purposes. Loss of the I-signal is more noticeable than that of the Q-signal, because of the greater bandwidth of the former. However, the I-signal is still difficult to see; in either case, the bar generator provides the most accurate test.

The Hue Control

The hue control serves to permit the variation of the phase of the 3.58-mc oscillator which, in turn, allows the proper hue to be seen. The control is a manual adjustment which, very often, is difficult to adjust properly solely through the use of the naked eye. With a bar generator connected, a misadjustment of this control will be seen readily, since the colors observed will not be in their proper relative positions. For example, looking from left to right, one might see red-magenta-blue-cyan-white green-yellow instead of green-yellow-red-magenta-cyan-white; refer to normal color bar pattern. By simply turning the hue control knob, the colors appear in their proper sequence.

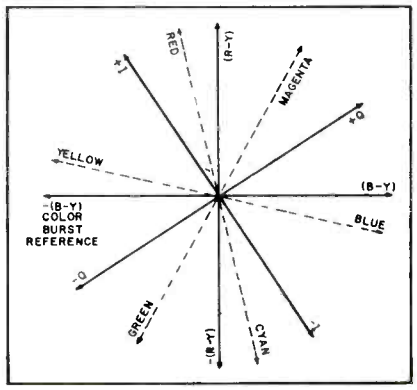
Let us now take up the case of the 90° phase-shift transformer. The purpose of this transformer is to provide a 90° phase difference between the I- and Q-demodulator inputs. If this transformer becomes defective or out of alignment, a phase shift other than 90° results and a false hue would be seen. This may be observed and easily corrected by the bar generator, if misalignment obtains.

It is interesting to note that if this transformer is completely misaligned, that is if the 90° shift is leading instead of lagging by 90°, then the positions of the color bars observed will be exactly opposite from their normal state. Specifically, the white bar would be on the extreme left and the green bar on the extreme right, with all of the other colors which fall between them appearing in their predesignated order.

If any of the *rf* and *if* stages are faulty, or misaligned, incorrect color rendition may result, perhaps accompanied by loss of color sync (or complete absence of color), since the color burst signal may be eliminated. To isolate this trouble, the generator should be connected to (*a*) the video detector output and then to (*b*) each preceding stage toward the antenna. If (*a*) reveals abnormal color pattern, then the trouble must lie in a preceding stage; the defective stage will be isolated in part (*b*). This method of troubleshooting is analogous to isolating a trouble in a radio receiver using a signal generator.

[1]Dines, Jesse, *Color TV Troubleshooting With a Bar Generator*. SERVICE; February, 1955.

Below: Color phase diagram.

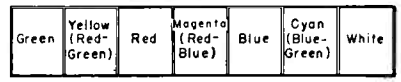


Right: Bar-Generator Chart Analysis For A 19-Inch Color-TV Chassis ▶

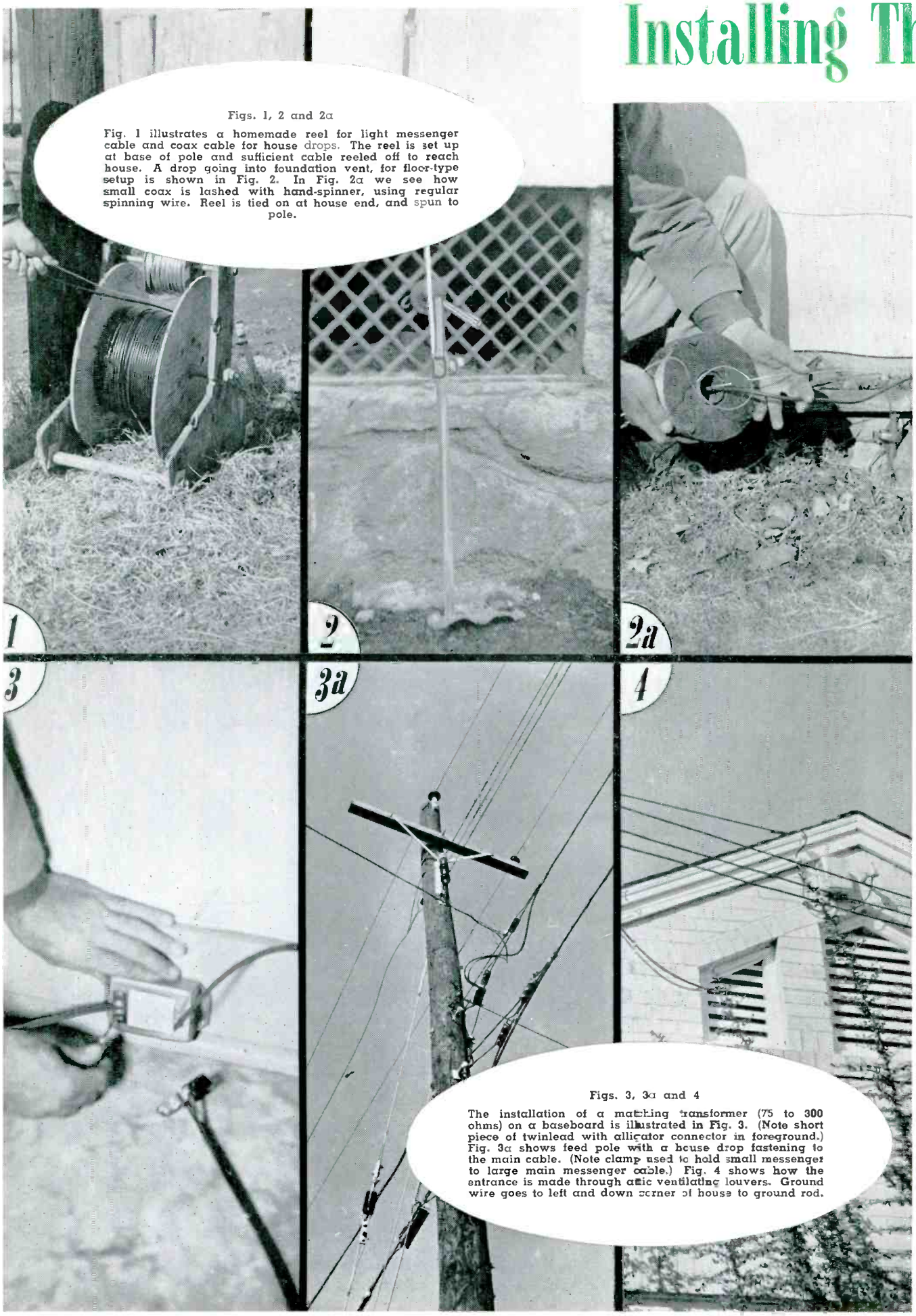
Tube Symbol	Tube Type	Stage	Function	Bar Pattern Indication (When Tube Burns Out)**	Other Abnormal Indications: General Comments	Reason for Trouble
V_{25}	12BH7	Green adder and green output	(*1*) Add *I* and *Q* signals to get green signal and (*2*) amplify green signal	Black; Light Magenta; Dark Magenta; Light Blue; Dark Blue; Medium Blue; Magenta	Greens and combinations of green are not seen	No green signal fed to pix tube
V_{26}	12BH7	Blue adder and blue output	(*1*) Add *I* and *Q* signals to get blue signal and (*2*) amplify blue signal	Dark Green; Light Green; Dark Magenta; Light Magenta; Black; Dark Green; Light Green	Blues and combinations of blue are not seen	No blue signal fed to pix tube
V_{27}	12BH7	Red adder and red output	(*1*) Add *I* and *Q* signals to get red signal and (*2*) amplify red signal	Dark Green; Light Green; Black; Light Blue; Medium Blue; Dark Cyan; Light Cyan	Reds and combinations of red are not seen	No red signal fed to pix tube
V_{28}	6BC7	Red, green, and blue *dc* restorers	Maintain *dc* level for red, green, and blue signals	Normal color pattern remains	All colors take on a *darker* appearance	The *dc* level for all of the color signals is lost
V_{29}	6AN8	*AGC* amp	Provide *agc* action for receiver	B-W raster (no bar pattern); faint diagonal color lines moving in background	Brightness control has to be turned to maximum before raster can be seen	Loss of *agc*
V_{31}	12AT7	Sync clipper	Provide *V* and *H* sync pulses to phase splitter	Loss of horizontal and vertical sync; bars change movement horizontally, vertically and diagonially	Only red, green and blue colors are seen when bars slow down in movement	Horizontal and vertical sync lost
V_{32}	6BL7	Vertical oscillator; vertical output	(*1*) Produce vertical sweep and (*2*) amplify vertical sweep	Horizontal thin line	Line is thick enough so that all of the colors of the bar pattern can be identified	Loss of vertical sync and sweep
V_{33}	6AL5	Horizontal phase detector	Provide proper phasing for horizontal sync pulse fed to horizontal osc	Diagonal bars moving in both directions with different rates	When bars slow down only red, green and blue colors may be seen	Horizontal sync lost
V_{34}	12AU7	Horizonal oscillator	Initiate horizontal sweep	No raster	.....	No high-*v*; *h*-osc inoperative
V_{35}	6CU6	Horizontal output	Amplify horizontal sweep	No raster	.....	No high-*v*; *h*-output stage inoperative
V_{36}	6AU4	Damper	Damp spurious yoke oscillations	No raster	.....	No high-*v*; loss of boost plate voltage for horizontal output tubes
V_{37} V_{38} V_{39}	3A3	HV rectifiers	To rectify and double *hv* pulses from flyback transformers	No raster	.....	No *hv*; *hv* rectifier(s) inoperative
V_{40}	6BD4	HV regulator	To regulate *hv* applied to pix tube	Normal color pattern	The pattern is bright and somewhat smaller	Increased *hv* to pix tube anode due to lack of regulation
V_{41}	6BL7	Blue conv output; conv sawtooth generator	To provide proper blue convergence when receiving a b-w picture	Normal color pattern remains	When receiving a b-w picture, *blues* are noted in picture	The blue fluorescent dots of the pix tube are not properly converged with respect to the red and green dots
V_{42}	6BL7	Green conv output; conv sawtooth generator	To provide proper green convergence when receiving a b-w picture	Normal color pattern remains	When receiving a b-w picture, *greens* are noted in picture	Green fluorescent dots of the pix tube are not properly converged with respect to blue and red dots
V_{43}	6BL7	Red conv output; conv sawtooth generator	To provide proper red convergence when receiving a b-w pix	Normal color pattern remains	When receiving a b-w picture *reds* are noted in the picture	Red fluorescent dots of the pix tube are not properly converged with respect to blue and green dots

*Troubleshooting chart for 19-Inch CBS-Columbia 205 color set, covering tubes V_1 to V_{24}, appeared in the February issue of SERVICE.

**Tests made with Kay Electric Chromabar generator; normal pattern obtained with this generator is shown at right.



Installing The



Figs. 1, 2 and 2a

Fig. 1 illustrates a homemade reel for light messenger cable and coax cable for house drops. The reel is set up at base of pole and sufficient cable reeled off to reach house. A drop going into foundation vent, for floor-type setup is shown in Fig. 2. In Fig. 2a we see how small coax is lashed with hand-spinner, using regular spinning wire. Reel is tied on at house end, and spun to pole.

Figs. 3, 3a and 4

The installation of a matching transformer (75 to 300 ohms) on a baseboard is illustrated in Fig. 3. (Note short piece of twinlead with alligator connector in foreground.) Fig. 3a shows feed pole with a house drop fastening to the main cable. (Note clamp used to hold small messenger to large main messenger cable.) Fig. 4 shows how the entrance is made through attic ventilating louvers. Ground wire goes to left and down corner of house to ground rod.

Community TV System

by T. C. MASTERS

Chief Engineer, Television Signal Service

Coax Cable Splicing . . . Metal Tower Installation Hints . . . System Design Factors . . . Handling Drops

LARGE COAX cables used for the main distribution system must, of necessity, be spliced, at intervals; as must all of the others. Extreme caution must be used, when making these joints, to prevent *lumps in the impedance,* leakage of signal, and mechanical weakness. Due to the large size of the cable, splicing is actually somewhat easier than the smaller types.

To splice, one removes the outer vinyl jacket for a distance of about 3", on each piece. A sharp knife may be used to *ring* the jacket, being careful not to cut the shielding braid beneath. Next, the braid is folded back over the jacket, exposing the insulation. One then *rings* and removes the polyethylene insulation, cutting about 2" from each end. One of the pieces of insulation removed should be saved; this will be used later. It should be about 2" in length. Holding this piece in a vise, a ¼" drill should be passed through it lengthwise, and then one side slotted with a hacksaw, cutting into the hole left by the bit. The two inner conductors (fairly heavy wire, about No. 6 or so) should then be cleaned and each end cut off to about 1" in length. A piece of copper tubing of a size that will slip snugly over the end of this inner conductor should then be cut to a bit less than 2", cleaned, and slipped over the two cut ends. This tubing is then soldered to the ends of the inner conductor, using enough solder to make a good joint, but wiping off any excess on the outside. When this is cool enough to handle, the piece of insulation previously prepared should be cut to a length that will fit snugly between the ends of the insulation, and slipped over the wire, pressing firmly into place. If desired, this may be secured with one wrapping of *high-frequency* tape, which is very thin and self-bonding. Now, one of the shields should be folded over the joint, smoothing down neatly; the remaining shield should be folded over the first, wrapping temporarily with a piece of small wire. The two shields should be soldered together, being careful to keep the entire cable from getting too hot, which would cause the polyethylene insulation to melt. The braid should be soldered lightly but firmly, at least six times, around its circumference, to maintain good *rf* continuity in the shield and give mechanical strength to the finished joint. When re-laying the shield, one must be very sure that none of the fine strands can get through the slit in the insulation; this would cause a short. To solder the braid easily, one should use a large iron, very clean and well-tinned, and a low-melting point solder, supplemented by non-corrosive flux. The splice should be finished off with a double wrapping of plastic electrical tape, pulled very tight.

Metal Tower Installation Hints

In setting up the first sections of the tower, standard TV antenna practices can obtain. The sections are assembled on the ground, guy wires attached, and the tower then raised into place usually by hand. For setting up a 60'-80' tower, erection in one piece would pose very special problems and demand the use of much special heavy equipment, such as a 50' gin-pole, for instance. Therefore, the sections are best set up one piece at a time. After the first 20'-30' section is set up and guyed, the installer can climb this section, attach a demountable *gin-pole* with a block and tackle, and hoist the remaining sections one at a time. A simple gin-pole may be made up out of two pieces of 1½" TV mast stock. These have special ends, which slip into each other, so that two or more may be used for longer masts.

Two sections of this, 10' long, will produce a gin-pole of at least 19', which is ample. On the bottom section two heavy *pipe-clamps* should be bolted, with the *hooks* down; these have only one screw-hole and resemble a coat-hook. The hooks are spaced a suitable distance apart, so that each one will engage one of the steps on the tower; they should be at least two steps apart, for greater safety. After one reaches the top of the first section, and fastens his safety-belt firmly, the first section of the gin-pole is then hauled up on a handline. This is fitted into place on the steps, leaving the top about level with the top of the tower. The second section, with its block and tackle for hoisting, is dropped into the lower; it is tied to the tower with short ropes, to prevent sideway slipping.

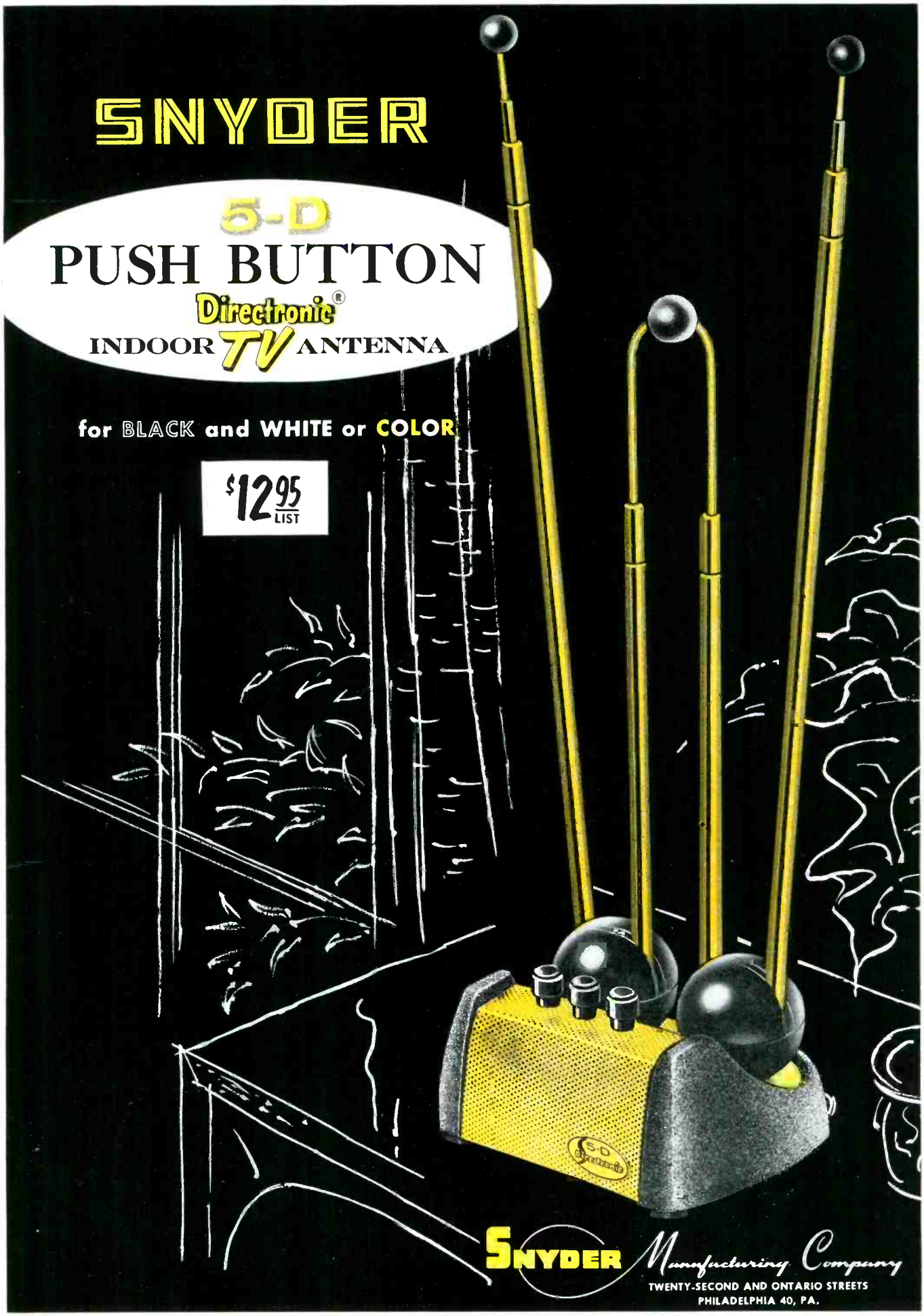
Two sections of the tower, for a total height of 12', may be assembled on the ground, the guy wires attached and hoisted up to the tower-top, with the ground-man supplying the motive power, and the top-man guiding it into place. With the mounting-bolts inserted and tightened, the guys are fastened, and the process repeated until the desired height is reached. If guys six-feet apart are not needed all the way up the completed tower, which is usually the case, temporary guys can be used, and taken off when the final adjustments and fastening is done. One should not attempt working atop a section of tower without firm guying. Temporary guys should be used, in whatever quantities needed, to secure the tower firmly, until the work is completed.

System Design Factors

When designing the complete community-antenna system, no detail, no matter how small, can be overlooked. The ultimate goal of the system is the delivery of a clear, undistorted picture into the subscriber's home, with as much assurance of reliable service as possible. Continuity of service is a vital feature, especially during the early days of the project; if the service is not continuous, the bad tidings will soon spread all over the community, and the inevitable doom for future sales will loom.

Therefore, the operator must pay strict attention to even the most minute details of the system, so that perfect reception will obtain over the longest possible periods. The decreased need for maintenance is another important consideration, for time spent

(*Continued on page 75*)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5-D
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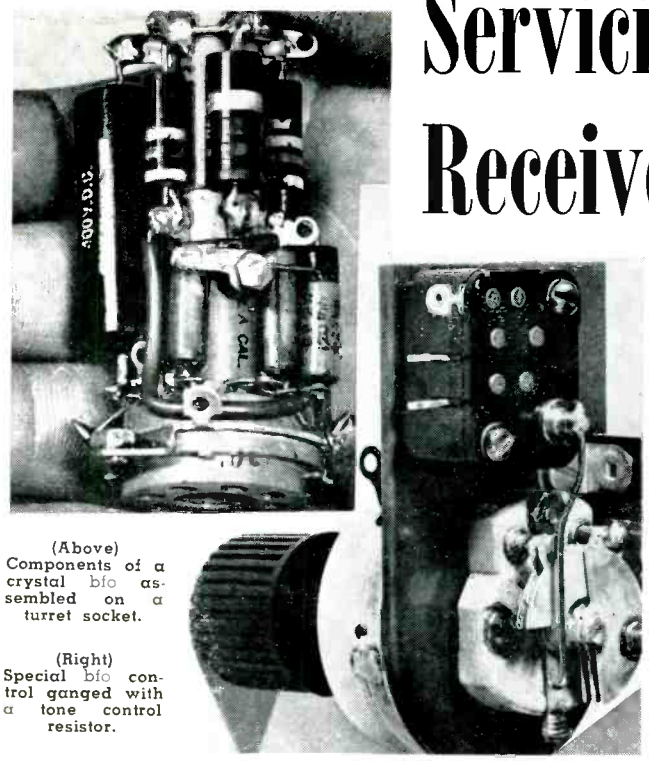
Servicing Communications Receiver BFO Circuits



(Above) Components of a crystal bfo assembled on a turret socket.

(Right) Special bfo control ganged with a tone control resistor.

by RONALD L. IVES

Circuitry Revisions Required for BFO Installations . . . Space, Control and Shielding Problems Involved in BFO Additions

WHEN INSTALLING A BFO, when the *if* is near 455 *kc*, one winding of an *if* transformer can be used as the inductance.

The circuit for this setup is (Fig. 1.) a fairly standard electron-coupled Colpitts oscillator. Component values are not at all critical, but special care should be taken to insure adequate shielding, so that the user will not mess up reception for his neighbors, who also have a receiver *if* of about 455 kc.

Receivers having two *if* frequencies require a somewhat more complicated *bfo*, if *cw* reception is desired on all bands; but the tuning problem can be simplified here by use of *if* transformer parts, which are immediately available in most localities, and are relatively inexpensive. The circuit of this dual-frequency *bfo* is shown in Fig. 2. At 455 kc, it functions as an electron-coupled Colpitts oscillator, while at 10.7 mc, it is a tuned grid-tuned plate electron-coupled oscillator. Frequency is changed from 455 kc to 10.7 mc by shorting the Colpitts' components completely. The switch line must be shielded to prevent unwanted coupling and radiation. In several instances, where shielding of the switch line was not practicable, *in-can* relay switching has been used, employing a Price radiosonde relay, powered from the filament circuit through a small germanium rectifier, with a low-voltage high-capacity electrolytic serving as a filter. A reversed diode serves as a spark absorber. For this purpose, the relay contacts must be modified from *spdt*, with armature grounded, to *ground two*. Circuit of this small *dc* supply is shown in Fig. 3; p. 72.

In a number of receivers of recent manufacture, the switching relay can be connected as a *free rider*, current-wise, by putting it in series with a voltage regulated circuit, as in Fig. 4; p. 73. In some instances, the compensating resistor, *R*, of Fig. 4*b* can be omitted. The 100-mfd capacitor between the relay circuit and the main-dropping resistor serves as a power reservoir, so that the voltage regulator tube does not go out during switching.

Within the last few years, crystal beat-frequency oscillators have found some favor with commercial and amateur operators. This type of oscillator is inherently costly; but installation labor is relatively slight, and only an

(*Continued on page 72*)

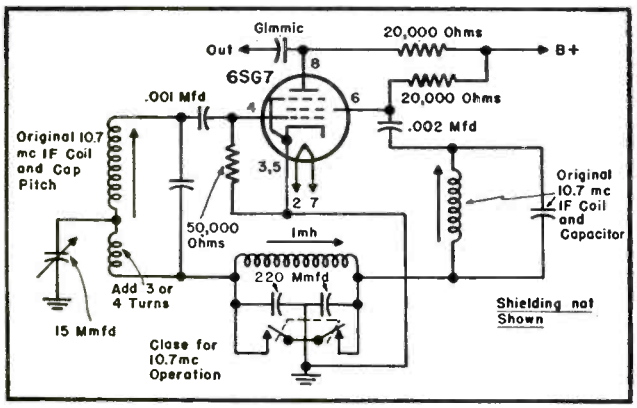
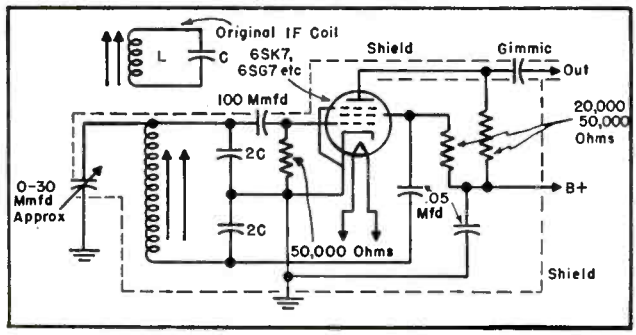


Fig. 2. A dual-frequency bfo circuit.

(Below)

Fig. 1. Circuit of electron-coupled Colpitts bfo for an if of about 455 kc.



Service Engineering — field and shop notes

by LEO G. SANDS

OFTEN, in intercom installations, one encounters areas where the noise level is high. In this instance a booster amplifier may be required at one or more remote stations. Fig. 2 illustrates how a standard public-address amplifier can be utilized for feeding a bank of high-level loudspeakers. Separate smaller loudspeakers are used for talk-back.

A single pair of wires may be used for connection of three remote units to a master unit by isolating the line from the master unit with a transformer, as shown in Fig. 3.

An external double-pole double-throw switch, with a neutral *off* position, is added for remote-unit selection. In one position, voltage which operates one relay, is applied; in the other extreme position voltage of opposing polarity is applied to operate a second relay and in the center or neutral position, no voltage is applied and neither relay operates. Selenium rectifiers, in series with the relay coils, permit current flow only when voltage of the proper polarity is applied.

Where the system is left turned on for many hours a day or continuously, tube and component life can often be materially increased by modification of the master unit so that the plate voltages are cut off, except when the equipment is in actual use. This can be accomplished by installing a new selector switch with extra contacts, which opens the power transformer center-tap lead when the selector switch is in the off or stand-by position.

A master unit with facilities for selecting five remote stations, for example, can be modified to handle more remote stations by replacing the selector switch assembly with a wafer switch, with a suitable number of positions. An external selector switch can be added. It is possible to devise an external selector system to handle 10, 20, 30 or more remote stations.

Intercom systems for industrial plants can become quite elaborate, since a variety of special conditions may have to be satisfied. In many instances, the wiring should be in conduit and rugged enclosures should be provided for call-back switches. Particularly in railroad yards and warehouses, installation requirements become rigid and utmost reliability of system operation is mandatory.

The pickup of electrical noise, hum and radio signals on intercom systems is a common occurrence and is generally caused by inadequate wiring, poor connections, improper grounds and badly-designed equipment. External causes sometimes are the root of such problems. For example, a steam pipe touching a water pipe 20′ away from the intercom master unit and inter-unit wiring was found to be the cause of hum that was so severe as to make the intercom system useless. By separating the pipes and inserting a piece of insulating material, the trouble was cured. Bonding the two pipes together electrically by putting ground clamps on each and connecting them together also served to eliminate the hum.

Balanced Lines

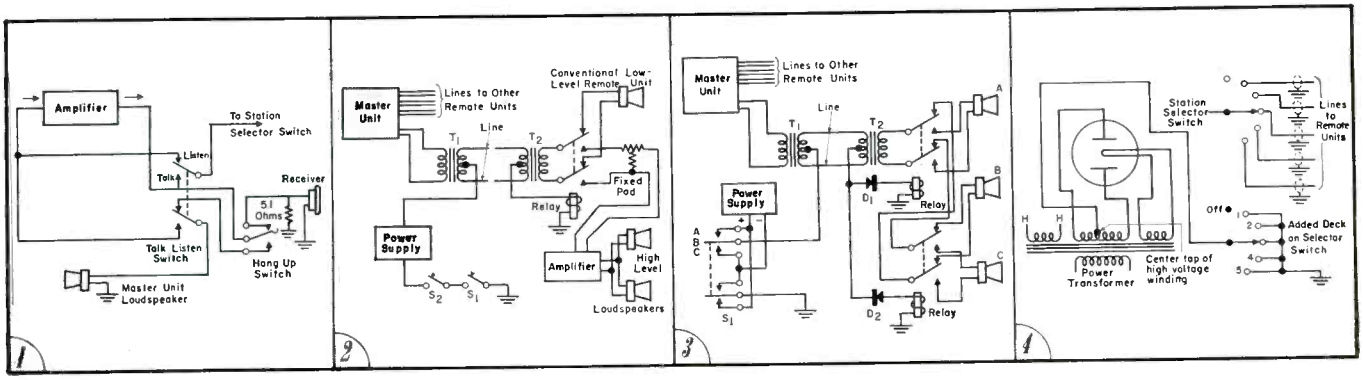
By using balanced lines, shielded or unshielded, but preferably shielded, hum and noise pickup can be kept at a minimum. Often a good ground is necessary. One ground at the master unit generally suffices. Grounding of a system in several places may induce rather than eliminate hum or noise in the system.

Dirty switch contacts often cause unsatisfactory operation; a good preventive maintenance program should include regular inspection and proper cleaning of switch contacts. Usually replacement of a cheap switch with one of better quality can save a lot of headaches.

As noted earlier, the sales and service of intercom systems can be a lucrative sideline or even full time activity for the enterprising Service Man. Almost

(*Continued on page 70*)

Figs. 1 to 4; left to right: Fig. 1 illustrates method of adding a privacy earphone to an intercom master unit. A booster amplifier addition at a remote station is diagrammed in Fig. 2. S1 can be an additional pair of contacts on station selector. S2 can be a foot-operated switch or a push-button setup for switching from normal to high level when necessary. Optionally, S2 can be an added pair of contacts on the talk-listen switch, if high level talk-out is required at all times. Low-level loudspeaker is used only for remote sound pickup. T1 and T2 represent the voice coil to 600-ohm line matching transformers. A layout illustrating how two additional remote units can be added to a system appears in Fig. 3. Modification also permits operation of three different remote units over a single line. T1 and T2 = voice coil to line-matching transformers (600 ohms). S1 = auxiliary station selector switch (dpdt, 3-position (with neutral off position). D1 and D2 = selenium rectifiers (half-wave). Fig. 4 shows how a switch can be added to cut off plate voltage when master unit is in standby position.



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a great Hi-Fi speaker

by Delco Radio

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DELCO RADIO'S Model 8007
A Terrific Value at Moderate Cost

Here is a sensational performer in the big Delco Radio line of speakers . . . a *Hi-Fi* replacement speaker for AM, FM, and TV receivers and phonographs that matches their service requirements with *a voice coil impedance of 4.1 ohms*—not too high, not too low, but just right! And it's ideal, too, for custom-built high-fidelity systems. Wherever installed, the model 8007 Delco Hi-Fi speaker will give new sparkle and life over the full tonal range.

Here are some of the reasons why:

• Its 8-inch curvilinear cone extends the Highs, gives maximum performance over a range of 50 to 12,500 cycles per second • A heavy Alnico-5 magnet provides peak damping action, high output with clean performance, light highs, heavy lows • Power rating of 10 watts • Input impedance of 4.1 ohms. • A 1 3/16-inch voice coil for excellent damping effect, high efficiency, minimum distortion • Total these features, add a rugged, zinc-plated, attractively painted basket, and you have the outstanding speaker in its price range . . . the Delco model 8007!

The Most Highs . . . the Most Lows . . . the Most Watts . . . in a Medium-Priced Speaker

A GENERAL MOTORS PRODUCT — A UNITED MOTORS LINE

DISTRIBUTED BY ELECTRONICS WHOLESALERS EVERYWHERE

DELCO RADIO

DIVISION OF GENERAL MOTORS, KOKOMO, INDIANA

Associations

PRSMA, Philadelphia, Pa.

RICHARD G. DEVANY has been elected president of the Philadelphia Radio Servicemen's Association.

Others on the '55 roster include *Sam Brenner,* vice president; *James T. Daly,* recording secretary; *William Humes,* corresponding secretary, and *Stanley Myers,* treasurer.

* * *

NLCESA, Lancaster, Pa.

MEMBERS OF THE Northern Lancaster County Electronic Servicemens Association have elected *Earle C. Good,* president.

Gilbert Sweigart was named vice president; *Harold R. Snaber,* secretary; *Raymond McCoy,* corresponding secretary, and *A. J. Yundt, treasurer.*

* * *

NATESA, Chicago, Ill.

VINCENT LUTZ, president of TISA, St. Louis, and vice president of the west central chapter of the National Alliance of Television and Electronic Service Associations, has received the NATESA president's cup for his contributions to the advancement of the national group and independent servicing.

Frank Moch, group proxy, presented the cup to Lutz at an award ceremony.

* * *

RTSA, Pittsburgh, Pa.

THE RECENT DRAGNET program, exposing TV Service Men who misrepresent, was promoted by the Radio-Television Servicemen's Association of Pittsburgh, in a series of advertisements in Pittsburgh papers.

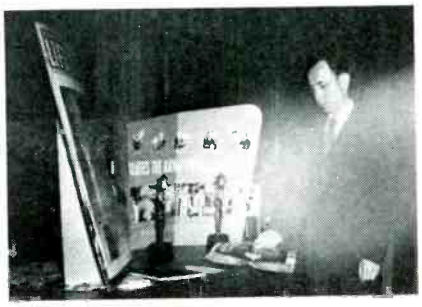
Local radio and TV columnists joined the campaign, urging everyone to listen. Said one of the writers: "Most Service Men, of course, are reputable, but it would be a wonderful thing for us if Sgt. Friday could be assigned to investigate some of the complaints we hear about."

* * *

TSDA, Philadelphia, Pa.

TELEVISION SERVICE DEALERS Association of Philadelphia, also campaigned for Dragnet viewers by running a display ad in the local newspaper. Said the ad, in part: "See . . . Dragnet . . . Exposing the Crooked TV Service Racket. . . . For Honest Service, Competent Service and Doubly Guaranteed Service . . . Call . . . TSDA."

Max Liebowitz, **ARTSNY prexy, looking over electronic symbol statuettes, signs and other material, prepared by RCA to promote** National TV Servicemen's Week, **displayed during a recent group meeting in New York City, when details of the country-wide program were described and illustrated.**



Newly elected chapter officers of the Radio Technicians Association, Long Beach, California, left to right, back row: Ken Summers, technical vice president; Lee Johnson, president; and Bob Bergman, vice president. Front row: P. N. Nibbelin, secretary, and Bob Whitmore, treasurer.

TISA, Chicago

TELEVISION INSTALLATION Service Association, Chicago affiliate of NATESA, has changed its name to TISA of Chicagoland. Change was made to distinguish the group from other national chapters bearing the TISA name.

Three new posts were created at the name-changing ceremonies. *John Cecich* was named NATESA delegate and *Sid Terman*, NATESA alternate. *Joe Issak* was named third vice president.

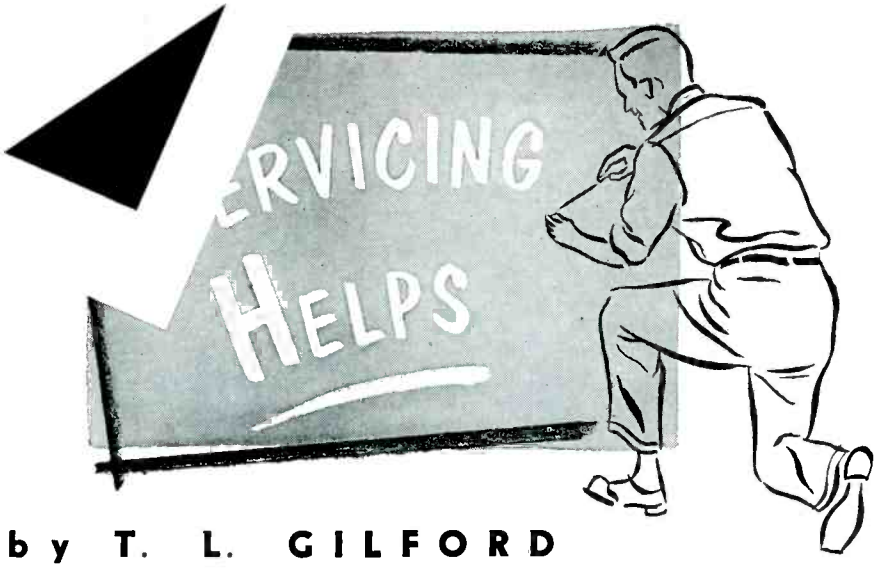
* * *

STTA, Syracuse, N. Y.

TWO BILLS, covering licensing, now pending in the New York State Assembly, appeared, in part, in a recent issue of the *STTA News*, published by the Syracuse Television Technicians Association.

TEN YEARS AGO

THE GROWING IMPORT of sound was emphasized in an editorial, which noted that: "Sound has introduced a new phase in business . . . *showmanship* . . . demanding top-flight performance. The Service Man can be of material assistance in providing that quality of service. For upon his specifications and maintenance capabilities, sound-system performance can rise or fall." . . . The past, present and future status of tone quality received a searching analysis by *Arnold Peters*. . . . *Wilmer S. Trinkle* was elected president of the Reps. and *Norman M. Sewell*, vice president. . . . Webster-Chicago Corp. purchased Webster Products. . . . *Dee Breen* became sales manager of the Universal Microphone Co. . . . *Tom Joyce*, general manager of the radio, phono and TV department of RCA, resigned. . . . *Ed DeNike*, formerly director of public relations of National Union, was appointed sales manager of the distributor division. . . . *John F. Rider* was promoted to Lieutenant-Colonel in the Signal Corps. . . . RCA demonstrated a 16" x 21" TV receiver. . . . *Ben Miller* was appointed general sales manager of United Transformer Corp. . . . *H. Z. Benton* joined the engineering staff of Amphenol, in Chicago. . . . The annual industry war conference, RMA membership meetings and parts show, were cancelled because of travel restrictions imposed by the government. . . . *S. I. Cole*, retiring president and *Samuel Siegel*, retiring vice president, of Aerovox Corp., were feted during a banquet held in New Bedford, Mass.



Color TV Reception in Strong Signal Areas Eliminating Possibility of Drive Lines on the Picture Tube

by T. L. GILFORD

ALTHOUGH IT would seem that a strong signal is very desirable for the best reception of color TV it is possible that a very strong signal may be detrimental to good color reception. A very strong signal can produce two effects in a receiver that are not too serious to black-and-white reception, but are important considerations in color.

First, the *rf* amplifier response changes. When the *rf* response changes to the point where frequencies carrying color information are attenuated. color will be weak or missing altogether. Poor response to the picture carrier can also be detrimental.

Secondly, the standing-wave ratio becomes higher. Standing waves on the transmission line become dangerous when the ratio becomes high enough to reduce portions of the signal.

Both of these conditions can be improved by reducing the signal input to the receiver. It is strongly recommended that a matching and attenuating pad be installed in all areas where the signal level is very high. A pad with at least 6-db attenuation should be used. This will help circumvent the possibility of an antenna problem.

The two effects mentioned are caused mainly by a rise in the input impedance of the *rf* amplifier. An increase in signal changes the bias on the *rf* amplifier (due to *agc* action) and increases the input impedance, which results in a slightly different *rf* response. When the *rf* response is such that the picture carrier is reduced in amplitude the carrier will also be low on the *if* response.

In *b-w* this is not a problem. The picture carrier may be moved up the slope of the *if* response curve by an adjustment of the oscillator frequency; fine tuning control. However, in a color-TV receiver, when the picture carrier is moved up the slope of the *if* curve, the frequencies containing color information will be moved off the shoulder at the other end of the curve into the region of the sound trap. This results in no color.

The increase in input impedance of the *rf* amplifier creates a high standing-wave ratio, because the 300-ohm line is no longer matched to the input. A ratio of 4 or 5:1 would probably be sufficient to cause cancellation of some components of the color signal.

The majority of color-chassis installations will probably be made utilizing the customer's antenna and transmission line formerly used for the reception of black-and-white signals. It is possible that the old antenna, the transmission line and the manner in which the antenna was installed will be adequate for color. But, when the color receiver is installed, the antenna system should be reviewed carefully. In very strong signal areas the signal voltage should be reduced by 6 db; (2:1) at least. This precaution should be taken even on *b-w* installations. It will not only help reduce color problems, but also eliminate the possibility of overload causing poor sync and sync buzz.

Eliminating Drive Lines[1]

In high line voltage areas, or when a *hot* horizontal output tube (6CU6) is in the receiver, drive lines (white horizontal line in center of screen) often appear. To eliminate, the horizon-

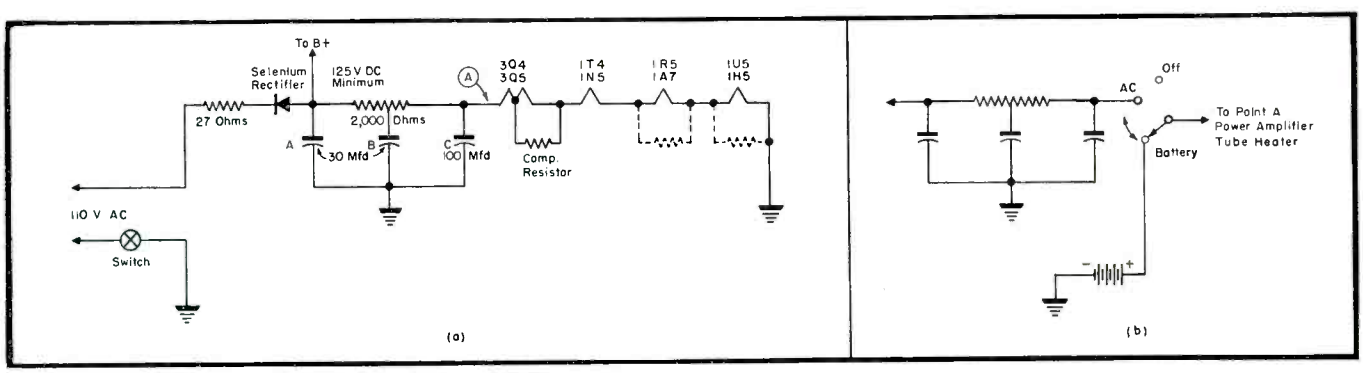
(*Continued on page 74*)

From service notes prepared by the* ***RCA Service Co.*

[1]For Sentinel models 701-11-14-21-24-52-55-58-62-65-68-91.

(Below)

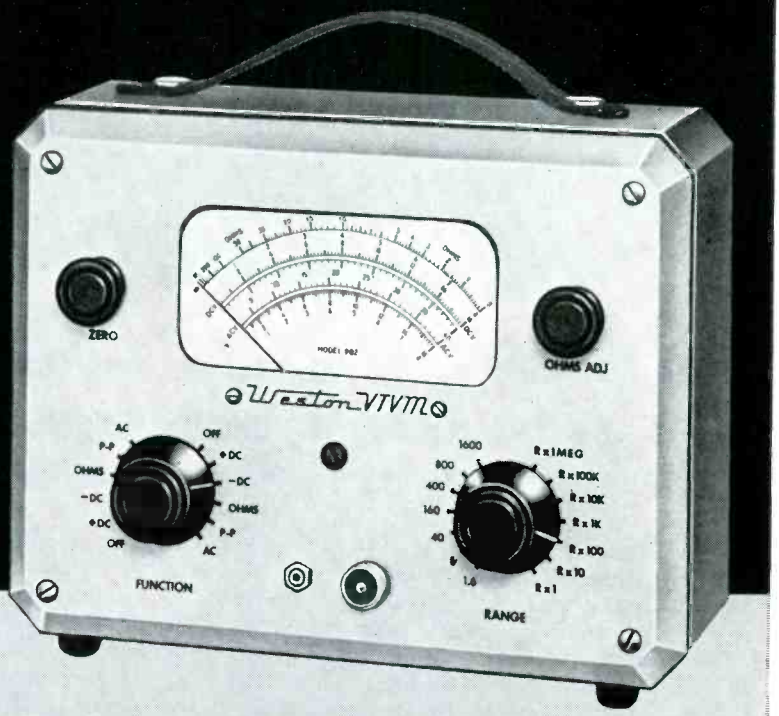
Battery AC/DC Filament Circuitry



Figs. 1a and 1b. At left (a) is a typical battery ac/dc portable filament circuit. Here the power tube (3Q5, 3Q4, etc.) is always at the high end of the circuit; second detector (1H5) always at low end. A battery-ac/dc switching arrangement for same set appears in (b). It is combined with the on-off switch. Other contacts on same gang switch are used for switching high voltage and ac line.

MINIMUM CIRCUIT LOADING...

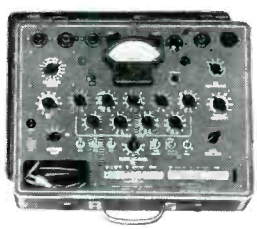
peak to peak measurement with input impedance of 10 megohms shunted by a capacitance of only *15 micromicrofarads!*



the 980 line VACUUM TUBE VOLTMETER

Model 982

Other 980 Line Instruments

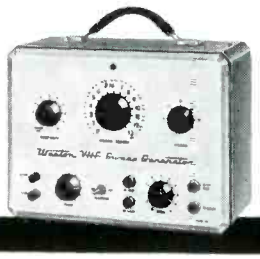


Model 981
Tubechecker

Model 980
Analyzer

Model 983
Oscilloscope

Model 985
Calibrator



Model 984
Sweep Generator

Here is the most convenient, most versatile and portable VTVM available. Battery operated, it is completely isolated from spurious response due to stray a-c fields and circulating ground currents. Accuracy is ±3% d-c, ±5% a-c RMS, sinusoidal wave form. Impedance 10 megohms d-c; 2.8 megs a-c RMS; 1 meg a-c at 130 mmf peak to peak; 10 megs at 15 mmf peak to peak with LC probe.

	RANGES:						
D-C and Peak to Peak Volts	1.6	8	40	160	400	800	1600
A-C Volts	1.6	8	40	160	400	800	1200
Low-C Peak to Peak Volts	16	80	400	1600			
Ohms	X1Meg	X100K	X10K	X1K	X100	X10	X1

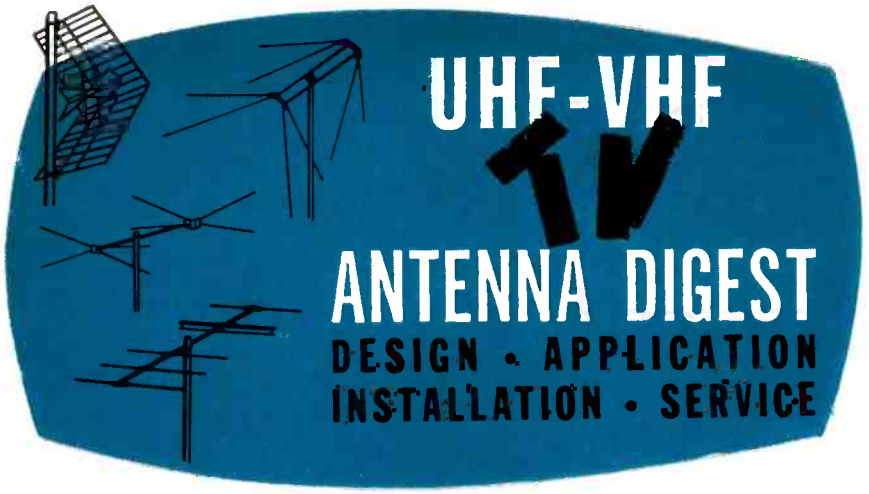
(10 ohms center)

Frequency Response—to 300 KC on peak to peak; to 2 KC on AC rms; to 300 MC with RF probe, (available as accessory).

Battery Life—Battery A, Approx. 90 days, 8 hours, easily replaceable. Battery B, Approx. 1 year, 8 hours per day.

For complete details see your distributor, or write for literature . . . WESTON Electrical Instrument Corp., 614 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON
980 line
test equipment



Inline Helical Yagi Construction and Operation

by **DOUGLAS H. CARPENTER***

Chief Engineer, Antenna Section, JFD Manufacturing Co., Inc.

DURING THE PAST two years, the nation's antenna requirements have gradually changed from single-channel arrays to high-gain broad-band types. As a result, the engineering considerations involved in the design of such antenna systems, to insure equal channel performance, have been multiplied many times. The so-called design secret of broad-band antennas has been found to lie in balanced circuit parameters, or the secondary function of individual elements.

When dealing with the split television spectrum of channels 2-6 and 7-13, it has been found impractical to use a single element to cover the entire range, since there is a gap between the two bands of 85 mc. Any single element, as presently utilized in the art, has a basic design resonant point, or frequency, at which the best results may be obtained. This means that when combining the basic dipole with other parasitic elements, attention must be directed to extending the frequency coverage, or bandwidth of the basic dipole receiving element. There are means of accomplishing this, but the problem has been complicated by re-radiated components; simply stated, reradiated components represent the amount of energy returned to space by receiving and parasitic elements. Each length and spacing in a broad-band and antenna is balanced against all other elements to achieve phase addition of the desired TV signal, and further to keep the component, returned to space, from interfering or reducing the value of the desired signal.

When it was decided to design an all-channel inline antenna, two engineering musts were specified. First, it was stipulated, the antenna should incorporate a low-channel driven element physically similar to a folded dipole to minimize tower installation problems. Second, it was noted, the antenna should have the highest possible front-to-back ratio on all channels, as co-channel and adjacent channel interference were becoming increasingly important factors. Development of an antenna along these lines resulted in a series of helix models.[1]

In designing any broad-band antenna one must select the type of individual dipole receiving elements to cover the two ranges; channels 2-6 and 7-13. Of course, one must choose the proper types so that in combination they perform secondary helpful functions in both ranges. If we look at Fig. 1, we find six types of broad-band systems, shown in order of efficiency. The first type, shown at *A*, obtains broad-band operation through the use of high-impedance stubs, effective on channels 7-13. These stubs isolate electrically the antenna ends and allow independent operation of the center section on the high TV channels. On channels 2-6 they may be disregarded, and the antenna operates as a half-wave dipole.

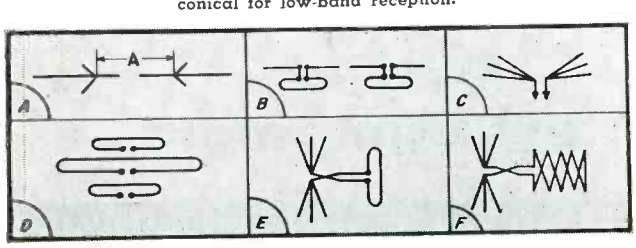
The limitation of this approach is that only part of the antenna operates on the high channels, and the center impedance is too low to match a standard transmission line. The dipole at *B* is the standard colinear element using phasing stubs to add currents in phase on channels 7-13. The total length of the element plus the length of the phasing stubs determine the resonant point in the low channels. Again, this element is good on channels 7-13, but lacks normal gain on 2-6, as the folded stubs do not collect any signal. On the low channels, about 60% efficiency is realized, as compared to a standard straight dipole.

Illustration *C* shows the familiar conical with fanned forward elements. This antenna relies upon the proper

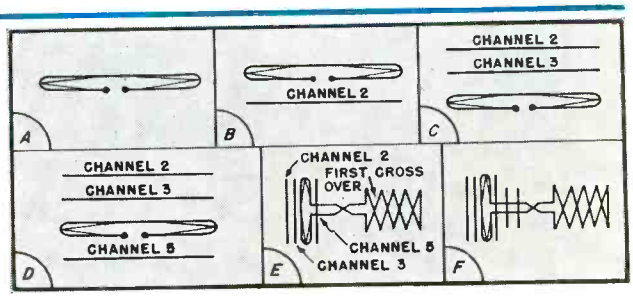
(*Continued on page 66*)

*Chairman, Antenna Section, RETMA.

[1] *JFD Star Helix Rainbow, model SX711 and stacked version, SX711S.*

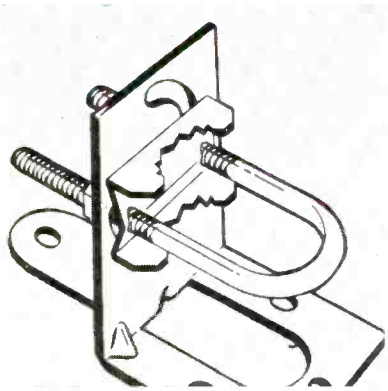


Figs. 1A, B, C, D, E, F. Broad-band operation on 7-13 through use of high impedance stubs is shown in A; center impedance is too low to match standard transmission line. In B a colinear dipole with phasing stubs for 7-13 is shown. A conical using enclosed angle versus element length to boost high band gain is illustrated in C. In D is a system employing a pair of high-channel folded dipoles and larger 2-6 center section. A high-channel dipole lying horizontally in front of a low-channel flat-plane conical dipole is shown in E. And F illustrates a center-grounded helix for high-channel response and flat-plane conical for low-band reception.

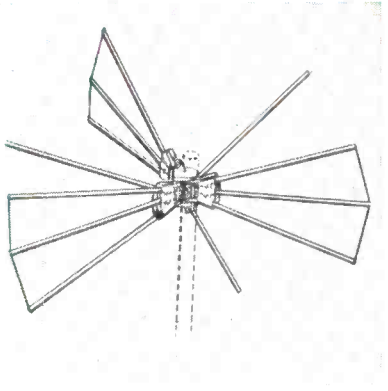


Figs. 2A, B, C, D, E, F. An electrically segmented folded dipole for 2-6, with broad-band design point slightly above 3 is shown in A. In B we have a channel 2 reflector. A reflector of channel 3 length which functions to change impedance back to transmission line value on channel 4 is pictured in C. In D a director serving as a phasing element in front of a folded dipole (dipole impedance on channels 5 and 6 changed) is shown. Basic helix[1] form with low-channel phasing elements is illustrated in E. Shown in F are two high-channel phasing elements for added gain on 7-13.

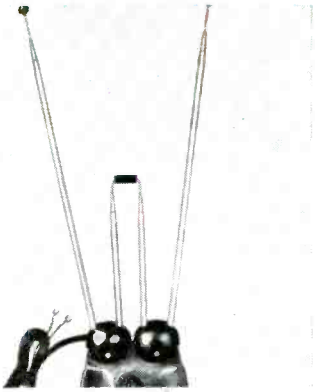
UHF/VHF TV Antenna-Accessory Review



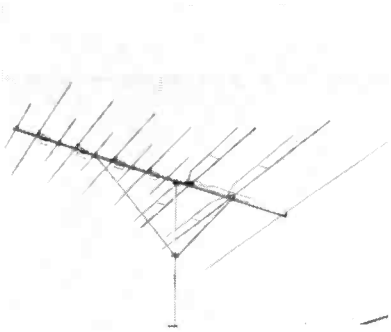
Antenna mast mount designed to fit all masts up to 1½" diameter. Has clamp and U-bolt construction, said to give the device all-angle versatility; has an extra leg for support from both sides, aided by reinforced ribs. (Telco Handy Mount (No. 8800 U); Television Hardware Mfg. Co. (Division of General Cement Mfg. Co.), 919 Taylor Ave., Rockford, Ill.)



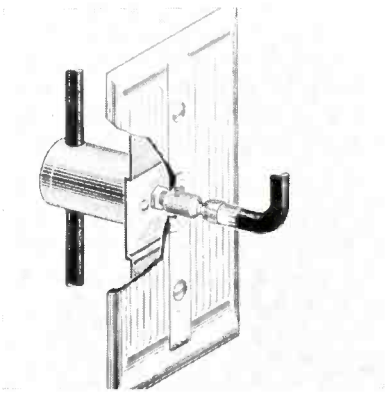
FM antenna designed for metropolitan and suburban areas. Model shown is constructed of crossed-folded dipoles. Also available is an S-shape model, said to be omnidirectional. A third model uses the yagi principle; and a fourth operates on the Snyder directronic principles. (Models X, S, Ultimate and Directronic; Snyder Manufacturing Co., Philadelphia, Penna.)



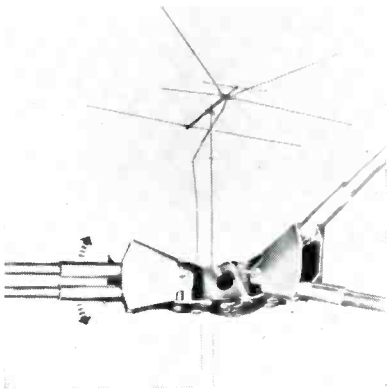
Indoor antenna with 6-position selector switch and an adjustable 3-section telescoping phasing bar. Antenna is molded around a base in which sit a pair of high-impact styrene balls. (Model B-29 Duoscopic; Radio Merchandise Sales, Inc., 2016 Bronxdale Ave., Bronx 62, N. Y.)



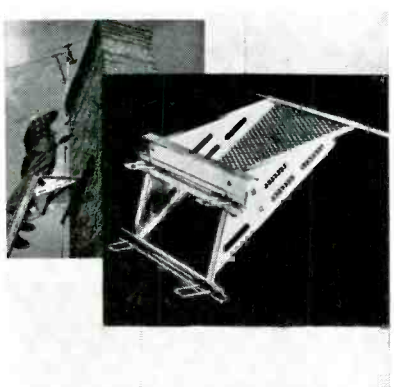
Extreme fringe area antenna, designed to give multi-element yagi performance on all 12 vhf **channels. Features** electro-lens focusing. **Other features claimed are** modified tee **matched-driven elements, so phased that they reinforce signals arriving from the front of the antenna and cancel signals from back and sides, and absence of resonant peaks and suck outs. Preassembled construction used throughout.** (Model SL 4; Winegard Co., Burlington, Ia.)



Spliceless tapoff designed for community TV and indoor use. Both feature air dielectric insulation to minimize shunt capacitance and provide uniform 17-db rf isolation. Positive electrical protection is said to obtain through a spring contact resistor-capacitor network. Community model handles RG-11/U line, with a clamp for messenger cable and RG-59/U fitting for the tapoff line. Indoor model taps into RG-59/U for TV outlets in hotels, motels, apartments and other multiple dwellings. A wall outlet plate and an RG-59/U receptacle are included. Each isolated tapoff is claimed to have less than ½ db insertion loss in the main cable. (Models MTO-11 and MTO-59 (illustrated); Blonder-Tongue Labs, Inc., 526 N. Ave., Westfield, N. J.)



Conical, one of a series of 22 models, featuring aluminum construction throughout. Available in both preassembled and non-assembled versions. In the preassembled line, all elements swing open and automatically lock into position. Non-assembled line features a notch-lock clamp plate which prevents elements from turning or twisting loose. Conical configurations available include 6-element and 8-element, fan-type head, standard X-type head, high band stubs, high band directors, X-type reflectors, and straight-bar reflectors. (Maverick 300 and 340 lines; Channel Master Corp., Ellenville, N. Y.)



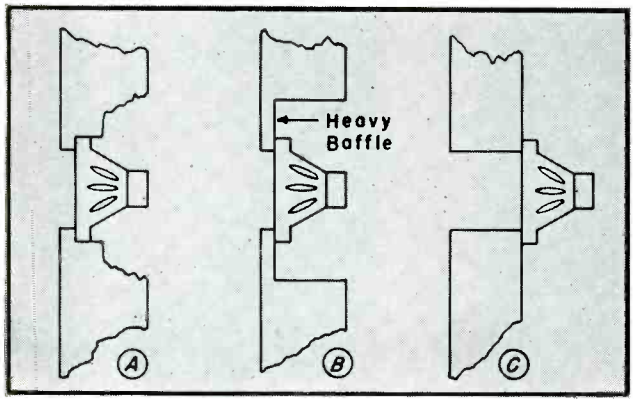
(Left)

Aluminum ladder offset adjustable to any ladder width. Has a spreader that is said to span an average window. Offset also makes it possible for one to be at eye level with his work. (Ladder Products, Inc., 31 Smith Place, Cambridge, Mass.)

(Right)

Transmission line package designed for 100' lengths of standard and heavier lead-ins. (Merchandise Division, Belden Manufacturing Co.)

Basic Concepts . . . The Acoustical and Physical Nature of Infinite Baffle and Totally-Enclosed Cabinets . . . The Acoustic Suspension Speaker System



Loudspeakers and Non-Resonant Enclosures

by MARK VINO

THE LOUDSPEAKER is generally considered to be the most critical link in the chain of reproducing components. What is often not as clearly understood is the fact that the enclosure is effectively part of the loudspeaker, and that its design is just as critical. The quality of *hi-fi* systems is probably marred more often by improper mounting than by any other cause.

The basic purpose of loudspeaker mounting is to separate the front and back of the cone acoustically. When this is done the vibrations of the cone do not merely circulate air back and forth across the speaker's edge, but radiate sound into the room. The air in front of the cone is compressed when the voice-coil moves forward, while the air behind the cone is simultaneously rarefied. The two areas of air at different pressures, one in front of the speaker and one behind it, would quickly neutralize each other if they were not separated, and unless the speaker is made to face its listeners through an opening in some type of baffle, it cannot perform efficiently.

The nature of sound is such that in the treble frequencies, where the wavelength is short, the cone itself acts as its own baffle. At the low frequencies, however, performance is very poor with an unmounted speaker.

The Infinite Baffle

One of the best methods of providing the proper mounting for a loudspeaker (and, when it is feasible, one of the simplest methods) is to use a true *infinite baffle*. The speaker is mounted in a wall, stairwell, or large closet.

Several elementary precautions must be taken with such a procedure. The mounting must be solid mechanically, and the speaker should not face the room through a long, pipe-shaped opening, such as might be formed by the hole in the wall. Several ways, both correct and incorrect, of wall mounting, are illustrated in Fig. 1.

When the back of the speaker unavoidably faces a pipe-shaped structure, the possibility of standing-wave formation can be lessened by filling the opening behind the speaker with sound absorbent material.[1] Fiberglas may be used safely with most speakers, where the voice-coil gap is protected by the bellows-type spider. If, however (as is the case with certain British units), the speaker has an open spider, fiberglas should be avoided, since it tends to get into the magnet gap. When the door of a closet provides the mounting surface for a speaker, clothes hanging in the closet perform a similar function to fiberglas in damping out standing waves, and are all to the good.

In all cases of infinite baffle mounting, two basic conditions must obtain:

(1) The separation between the front and back of the speaker cone is complete.

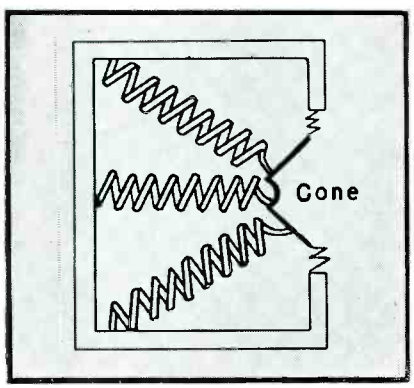
(2) The volume of air which is enclosed behind the speaker is very large; so large as to have no appreciable effect on the elastic stiffness of the moving system. This requirement may be stated in another way; the elastic stiffness of the entrapped air does not raise the bass resonant frequency of the speaker.

Totally-Enclosed Cabinets

This last infinite-baffle mounting requirement is extremely important, because below the speaker's resonant

(*Continued on page* 43)

[1]Such as *kimsul* or *fiberglas*.



(Above)

Fig. 1a, b and c. Two methods of properly mounting a loudspeaker in a wall are shown in a and b. The method illustrated in c shows the improper mount for a speaker. The air column into which the speaker faces will tend to resonate at its own natural frequency.

(Left)

Fig. 2. Illustration of the effect of a small enclosure on the speaker cone; analogous to attaching extra springs to the moving system.

Table I. Volume of totally-enclosed cabinet required for various sizes of loudspeakers. The exact value depends upon the resonant frequency and mass of the speaker's moving system, and the middle of the range shown may be taken as typical.

Loudspeaker Size	Cabinet Volume (*Resonant frequency increased no more than* 10%)	Cabinet Volume (*Resonant frequency increased no more than* 5%)
Inches	Cubic Feet	Cubic Feet
15	12—18	16—21
12	7—10	10—14
8	2½—5	4—7

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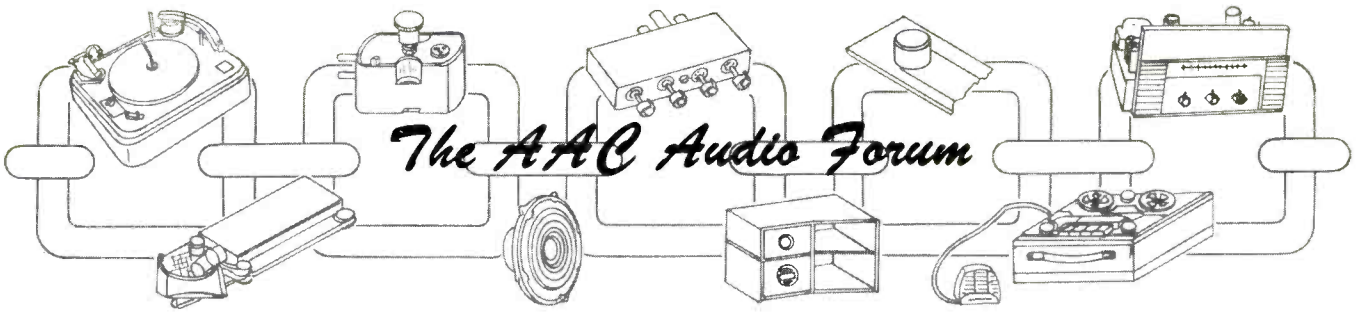

Part VIII of a Series of System-Component Evaluation and Progress Reports

Crystal Pickup Cartridge Replacement †

IT IS IMPORTANT to be thoroughly familiar with all of the problems involved in cartridge replacement during a service call, or on the bench.

Experience has disclosed that it is not always best to make an exact replacement of the cartridge originally supplied with a phono. Often the crystal pickup cartridge will have undergone substantial improvement since the original was installed by the set manufacturer. We know that receiver makers themselves do not use the same cartridge year after year. Their engineering departments constantly test new cartridges and select the best of the improved models. In this way, set owners are assured of the improvements made in cartridges. Service Men should give their customers the same advantages of improved performance; and merely installing the exact replacement is not always smart servicing.

Replacement Factors

Four factors should be taken into consideration when replacing a crystal cartridge:

(1) Mechanical Fit—The replacement cartridge should have the same mounting centers and fit into the same arm, and be approximately the same weight. It need not always be the same physical size as the one it is replacing.

(2) Output Level—The replacement cartridge should have at least the same output level as the original one. To replace a crystal pickup cartridge with one of lower output will mean that the owner of the phono must turn up his volume control higher. This is usually unsatisfactory; it may even lead to new complications, such as excessive hum pickup.

(3) Needle Force—The replacement cartridge should track properly at the same pressure *or less* than the original cartridge. This means that if the cartridge is being used in an arm with 1-ounce pressure, the cartridge must be designed for use with minimum pressures of 1 ounce or less. If the cartridge is being used in a microgroove arm where the tracking is at 7 or 8 grams, the cartridge must be designed to track at 7 or 8 grams.

The technical feature of the cartridge that determines the needle force is called needlepoint compliance. This refers to the freedom with which the needle point can follow the contour of the grooves of the record. It is part of the basic design of the cartridge.

Prewar/Postwar Cartridges

Prewar cartridges were designed to track at pressures of 2 and 3 ounces. Early postwar cartridges were made with greater compliance and tracked with needle forces of 1 to 1½ ounces. Today, the requirement for cartridges, which play microgroove records, is compliance which will permit the cartridge to track at needle forces as low as 5 grams.

With the introduction of microgroove records, needlepoint compliance has been one of the most important factors in the design of the crystal-pickup cartridge.

(4) Frequency Response—The response of the pickup cartridge is important to this extent; certain cartridges which sound best with the ordinary records on the average table model and console radios have early cutoff in frequency response. This is because early cutoff eliminates a great deal of distortion and noise which occur in some records above 4,500 cycles. To replace an original cartridge with an earlier cutoff with a so-called extended range cartridge, will probably lead to dissatisfaction on the part of the owner of the phono.

Cartridges for Standard Sets

In home radios it is well to use the early cutoff cartridges rather than to attempt improvements by using cartridges of greater range. For *hi-fi* sets or custom-made quality installations, of course, extended range cartridges may be used.

†*From data prepared by* ***Shure Brothers, Inc.***

The *AAC Audio Forum* is being presented as a service to industry, in cooperation with the Audio Activities Committee (through its Promotion and Public Relations Subcommittee) of the Sales Managers' Club, Eastern Division, who have arranged for members of the audio industry to contribute authoritative data on all phases of audio in which they are most expert. Comprehensive reports feature technical and merchandising information on amplifiers, preamps, speaker enclosures, speakers, turntables, record changers, cartridges, needles, arms and accessories, recording discs and tapes and accessories, tape recorders, special output transformer kits and tuners.

Professional Turntable Design ††

IN EVALUATING a turntable, there are seven basic points to consider.

(*1*)—Freedom from rumble, or low-frequency noise, caused by the mechanical connection with the drive motor. This is not only disturbing to the listener, but can overload the amplifier.

(*2*)—Isolation of the turntable and pickup assembly from room and floor vibration.

(*3*)—Elimination of the magnetic

(*Continued on page 42*)

††*From notes supplied by the engineering department of* ***Components, Inc.***

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Audio Forum

(*Continued from page 40*)

field which causes induced hum in some magnetic pickups.

(*4*)—Wow (that slow-speed variation usually associated with once-around rotation of the turntable to which the ear is very sensitive) which must not be noticeable.

(*5*)—Flutter (a faster subsonic speed variation caused by poor motor pulley or idler) which should be almost non-existent.

(*6*)—Speed of rotation; this must be accurate.

(*7*)—Maintenance; a minimum should obtain.

To reduce rumble in some models, it has been customary to use a rubber idler between the drive motor and the turntable. It has been found, though, that cold flow, flattening, hard spots, and uneven wear, can cause trouble here. Accordingly, in one design* a belt drive has been used to couple the motor to the turntable. To provide mass for filtering the vibration down the belt from the motor, a 25-pound turntable has been installed. This combination has been found to prevent rumble, wow, and flutter. The turntable rotates in a non-metallic sleeve bearing and on a single thrust ball to support the weight.

To reduce vibration conducted through the floor, it was decided to use long coil springs and adjustable felt dampers as a damped low-pass filter with a cutoff at 3 cps; thus walking across the floor will not cause the pick-up to jump out of the groove.

To reduce wow in this turntable, an adjustable center hole spindle was incorporated; it was found that this design centers the record accurately.

Accurate speed of rotation requires that a constant speed motor drive the turntable. Synchronous motors have frequently been used in the past for this reason, but some run quite hot; the hysteresis synchronous motor draws a constant power regardless of the load connected to it. Generally an oversized hysteresis motor is used to assure rapid starts, but here the light loading means that the motor must dissipate extra heat. A capacitor-run motor** has been found to solve this problem. This motor has been found to run at only 1% slip (1780 rpm) in contrast to the shaded pole motors (used in the average turntable) which run at approximately 1500 rpm; about 17% slip.

The accuracy of turntable speed in this instance, has been found to exceed

*Professional turntable model PBT; *Components Corp.*
**Bodine.

actually the usual line frequency accuracy; this limits the accuracy of any sync motor also. This result is obtained because the inertia inherent in the 25-pound turntable filters out sudden, sharp changes which occur in power line frequency as a result of application of heavy line loads. Such short time surges can affect turntables of lightweight construction.

•

Speakers—Enclosures

(*Continued from page* 38)

frequency, bass response falls off rapidly (at the rate of 12 db per octave, to be exact). It means that we cannot simply take a speaker, enclose it in a small box to separate the front and back waves, and expect good bass reproduction. The air in the enclosure is a springy cushion, and its effect is precisely the same as though we had attached additional springs to the back of the speaker cone, as illustrated in Fig. 2 (p. 38). The resonant frequency can be raised so high, that there is little output below 100 cps.

Thus we can see that when a conventional speaker is mounted in a totally-enclosed cabinet, there is a minimum cabinet volume that can be used. The value of this minimum volume depends on what the resonant frequency is to begin with, and on the area of the speaker cone. It will also vary with the mass of the speaker's moving system. Exact values cannot be listed, but the general order of cabinet volume required for various types of speakers has been determined; these data appear in *table I*; p. 38. In no case, of course, can performance suffer because of too large a volume.

The method of checking to see whether an enclosure is large enough for it's speaker is to measure the resonant frequency of the speaker in and out of the enclosure. A cabinet of sufficient volume will not raise the speaker's original resonant frequency appreciably, while a true infinite baffle will lower it. The resonant frequency is determined by sweeping through the bass-frequency range of the speaker with an audio signal generator (keeping a 100-ohm resistor between the speaker and amplifier), and noting that frequency at which the voltage across the speaker is maximum. The test set-up is shown in Fig. 3; p. 46.

The typical console radio leaves the back of the speaker enclosure open. While this prevents the acoustic springiness of the air from affecting bass reproduction, the effect of reso-

(*Continued on page* 46)

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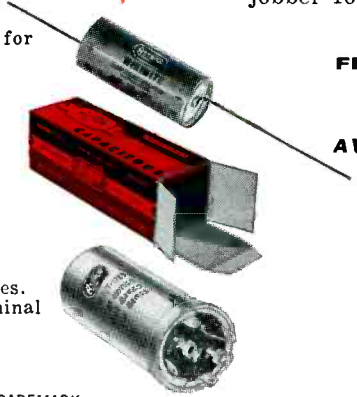

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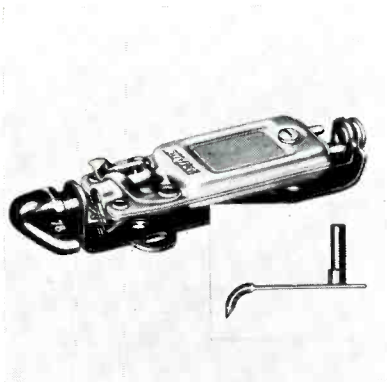
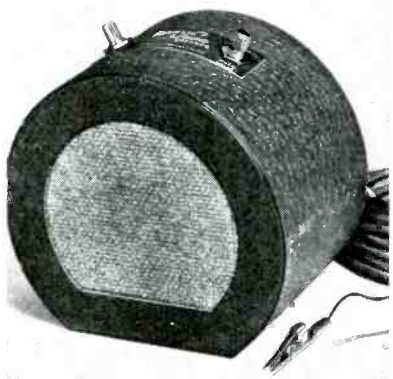
Hi-fi preamp control unit and power amplifier. Preamp-control unit (self-powered) has two low-level and three high-level inputs with individual gain controls, selection for either conventional volume or loudness control, choice of 25 recording characteristics, separate wide-range bass and treble controls and tape monitoring facility. Styled in a furniture type cabinet with a hinged door that hides all controls except on-off volume control. Power amplifier delivers 35 watts and is said to have a range within 1 db from 5 to 100,000 cycles. It is equipped with variable output impedance and gain control. (Models A-440A and A340A; Altec Lansing Corp., 161 Sixth Ave., N. Y. 13.)

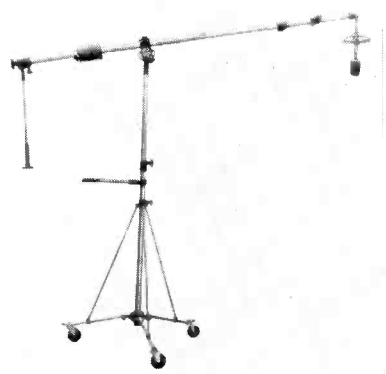
Ultra preamp with separate controls for bass boost, volume, record compensation and separate treble boost and roll off. Has a main selector switch connecting to phone, microphone, radio-TV and an auxiliary position. Four separate input jacks are mounted on rear chassis. Available in kit or wired form in two circuits. (Model UPA-1P, with own transformer operating directly from 110 volt line—available in kit form as UPA-1P and as UPA-1PW wired. Model UPA-1N, without separate power supply, operating directly from main amplifier, listed as kit UPA-1NK and wired as UPA-1NW; Precise Development Corp., Oceanside, L. I., N. Y.)



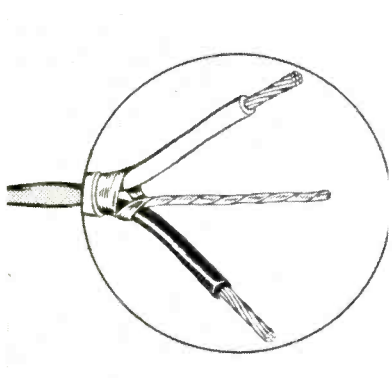
Crystal phono pickup cartridge, said to feature a high compliance needle design. Cartridge available with 3-volt output at 1000 cps, 1 meg load and 4 v output. Types are made in single needle and double-needle turnover styles. There are single needle models with a 1-mil needle tip for slow speed records, 3-mil tip for 78 rpm records and 2-mil tip for all record grooves. Crystal elements have a moisture-proof coating. (Models 66 and 68 with K needle; Astatic Corp., Conneaut, O.)



Remote speaker with a pair of dust-sealed wire-wound potentiometers, with full-off position, which enables the listener to control independently the volume at the instrument, speaker, and also at the remote speaker by his side. The unit contains 4" pm speaker with 1-ounce Alnico V magnet. Screen face is of woven wire. Has a 25' plastic-encased 3-wire cable of lamp-cord size. (Private Sound, First-American Products, Inc., 1717 Wyandotte St., Kansas City, Mo.)



Boom stand with a brake-show type clutch assembly and a piston air-check mechanism, adjustable pneumatic orifice valve in the base, and a two-position dual-control microphone gunning device which rotates mike through a 360° arc. Noise-free microphone suspension and automatic positioning is said to obtain regardless of boom angle. Upright, retracted, is 5¼'; extended, 9'. Boom, retracted, is 7'; extended, 18'. (Model BS-37 Porto-Boom; Atlas Sound Corp., 1451 39 St., Brooklyn 18, N. Y.)



(Left)

A pa and sound system cable; a balanced color-coded twisted pair, which features a spiral wrapped tinned copper shield. The spiral, it is said, can be unwrapped, twisted, and soldered. Has an over-all chrome vinyl plastic jacket that is waterproof. Size is .225" od. (Type 8790; Belden Manufacturing Co.)

(Right)

A 10½" magnetic tape reel of glass-reinforced plastic. Features a 5/16" center hole. Reel holds 2400' of Scotch brand 111 or 120 magnetic tape, or 3600' of Scotch brand 190 tape. Other features include V-slot threading, raised beads around the hub and rim of the reel to prevent scratching of the reel surface. (Minnesota Mining and Manufacturing Co., 900 Fauquier Street, St. Paul 6, Minn.)

Speakers—Enclosures

(Continued from page 43)

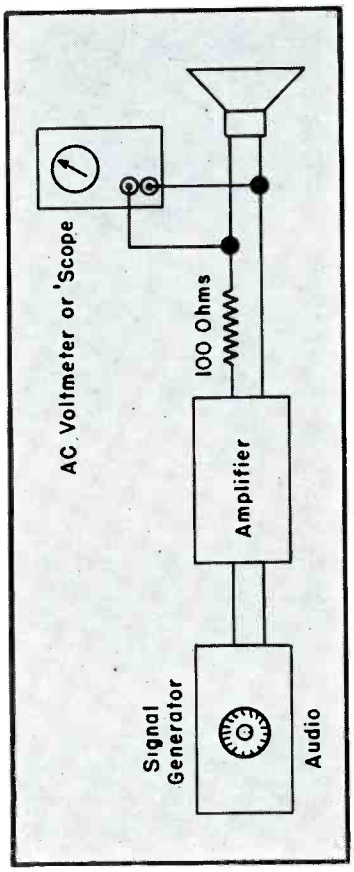
nance of the enclosure itself tends to give the sound a boomy quality.

Speaker cabinet construction must be very solid, but the standards of construction strength are not quite the same as for ordinary furniture. We are interested in rigidity against vibration, more than in pure mechanical strength, and ribs screwed and glued to the cabinet walls are more important than super-strong construction. Three-quarter inch plywood used for all walls, *including the back,* reinforced with ribs every foot or so, does an excellent job.

Need for Lining

Although a closed cabinet does not exhibit the same acoustic resonances as an open-backed enclosure, it is necessary to line the walls with sound-absorbent material. *Kimsul, fiberglas,* or ordinary rug cushioning, when tacked to the inside walls, serve to break up the sound reflections that form air column resonances. The absorbent material should be tacked loosely to the walls, and air spaces

Fig. 3. Method of measuring the resonant frequency of a loudspeaker. The signal generator is swept through the bass frequency range; the voltmeter will register a maximum at speaker resonance.



between the material and the wall are beneficial.

There is one measure that can be taken to reduce the required volume of an *infinite baffle* type of speaker enclosure. This is to *fill* loosely the enclosure with the sound-absorbent material, instead of merely lining the walls. Although it might seem that the volume of air is being used up in a wasteful manner, the fact is that the elastic properties of the air are changed in such a way, that a given acoustic springiness is associated with a smaller enclosure. The required cabinet volumes indicated in table *I* (p. 38) can be reduced in this way, by a factor of as much as 1.4, depending upon the kind and amount of absorbent material used. In addition, the possibility of internal cabinet resonances, due to standing waves, is reduced to the vanishing point, and the bass resonant peak exhibited by many speakers tends to be damped out.

The Acoustic Suspension Speaker System

One speaker-enclosure combination[3], that has appeared recently, reconciles the apparent contradiction between infinite baffle mounting and small cabinet size. A system that includes a twelve-inch woofer is enclosed in a cabinet whose interior volume is only 1.7 cubic feet, and it is claimed that it is possible to obtain bass response down to below forty cycles with this design. It is further stated that the small cabinet, rather than being a disadvantage, makes possible a much lower percentage of distortion in the reproduction of bass frequencies. To understand these statements, which on the surface appear to contradict everything that has been cited thus far, it is necessary to examine the construction of a special speaker that is used.

Modern loudspeakers employ a suspended moving system that contain given amounts of mass and elasticity. The elasticity is supplied by the voice-coil and suspensions, which center the coil in the magnetic gap and supply restoring force to the cone.

Anyone who has handled loudspeakers knows that if you push down on the cone and then release it it will spring back to its normal rest position. This elastic restoring force is a necessary ingredient in speaker design; without it the voice-coil would tend to travel out of the uniform magnetic field in which it is immersed, or would actually *bottom* against the pole piece. Either of the foregoing results

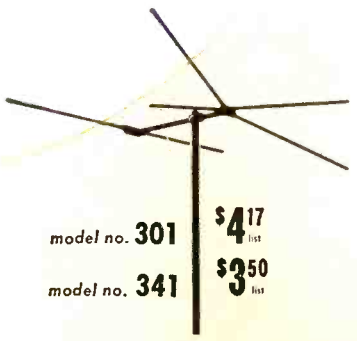
(*Continued on page* 60)

CHANNEL MASTER

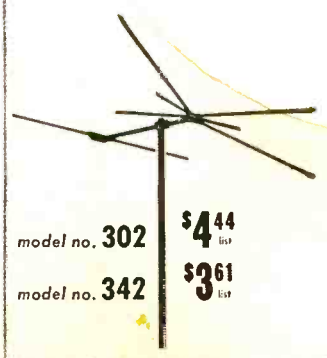
steers you to the greatest conical values ever offered!

the New

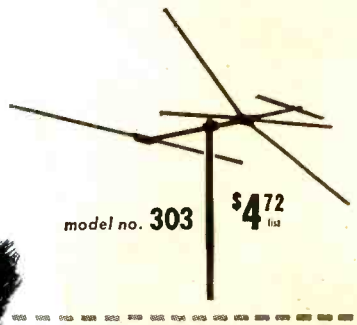
"MAVERICK"



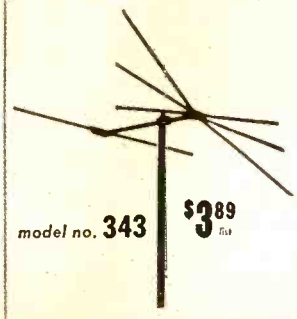
model no. 301 $4.17 list
model no. 341 $3.50 list



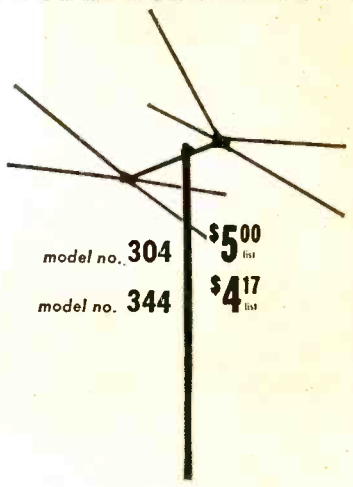
model no. 302 $4.44 list
model no. 342 $3.61 list



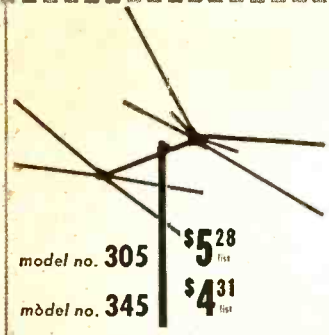
model no. 303 $4.72 list



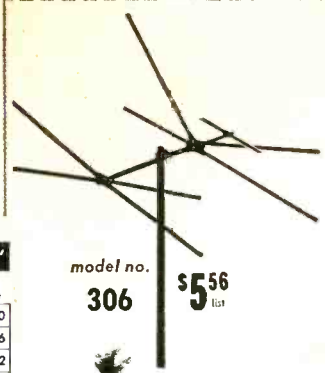
model no. 343 $3.89 list



model no. 304 $5.00 list
model no. 344 $4.17 list



model no. 305 $5.28 list
model no. 345 $4.31 list



model no. 306 $5.56 list

Never before such a complete line of conicals at such fabulous LOW PRICES!

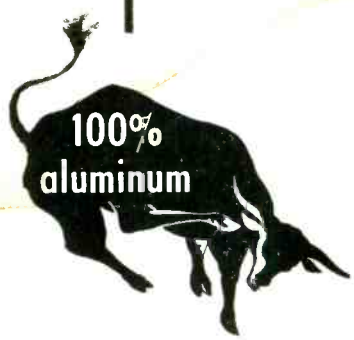
Low-priced conicals? Here is the LOWEST-PRICED, fullest conical line you've ever seen—a complete series of 22 different models. Checked out and approved by the Channel Master laboratory, every "MAVERICK" antenna provides outstanding Broad Band reception wherever conical antennas find application. Available both "Super-sembled" and non-assembled, the "MAVERICKS" are, without doubt, today's most sensational antenna buy.

"MAVERICK 300"

model no.	desc.	pack'd	list
301	1-Bay	6	$4.17
301-2	2-Bay	3	8.75
301-8	2-Bay	1	9.31
302	1-Bay	6	4.44
302-2	2-Bay	3	9.31
302-8	2-Bay	1	9.86
303	1-Bay	6	4.72
303-2	2-Bay	3	9.86
303-8	2-Bay	1	10.42
304	1-Bay	6	5.00
304-2	2-Bay	3	10.42
304-8	2-Bay	1	10.97
305	1-Bay	6	5.28
305-2	2-Bay	3	10.97
305-8	2-Bay	1	11.53
306	1-Bay	6	5.56
306-2	2-Bay	3	11.53
306-8	2-Bay	1	12.08
301-3	Conn. Rods		.56

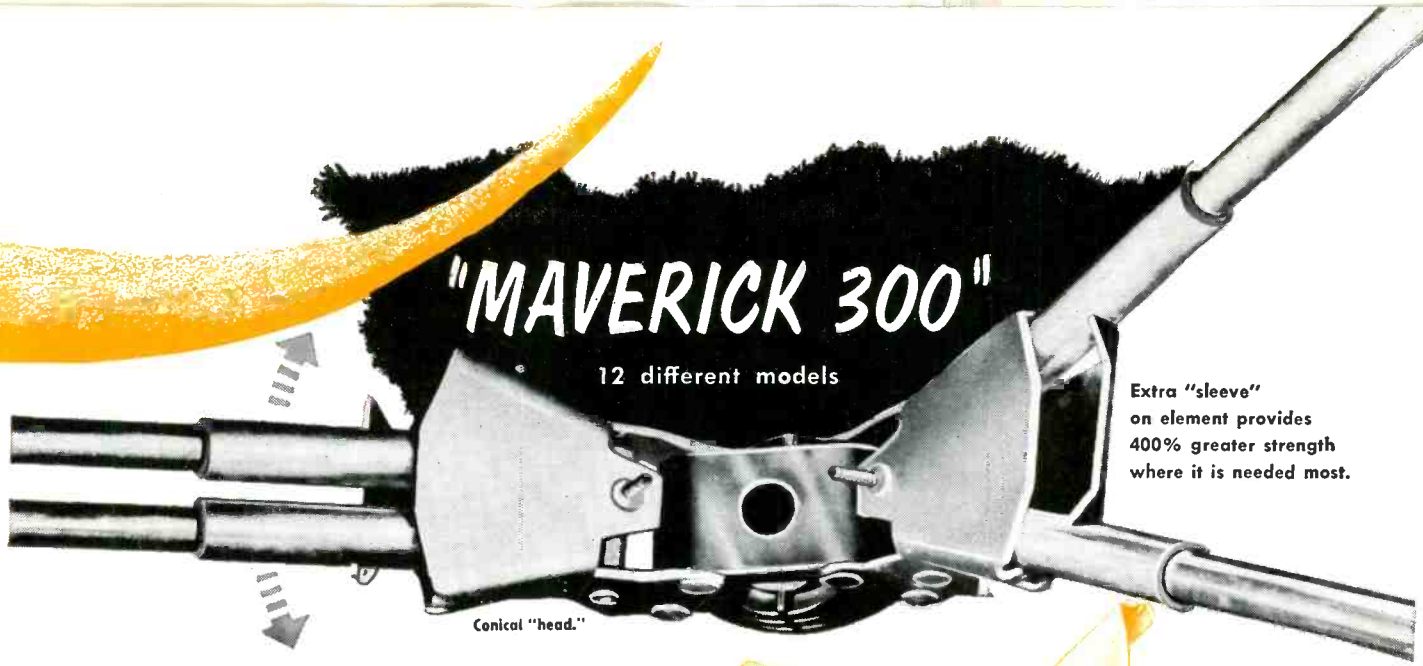
"MAVERICK 340"

model no.	desc.	pack'd	list
341	1-Bay	6	$3.50
341-2	2-Bay	3	7.36
341-8	2-Bay	1	7.92
342	1-Bay	6	3.61
342-2	2-Bay	3	7.64
342-8	2-Bay	1	8.19
343	1-Bay	6	3.89
343-2	2-Bay	3	8.19
343-8	2-Bay	1	8.75
344	1-Bay	6	4.17
344-2	2-Bay	3	8.75
344-8	2-Bay	1	9.31
345	1-Bay	6	4.31
345-2	2-Bay	3	9.03
345-8	2-Bay	1	9.58
341-3	Conn. Rods		.56



"MAVERICK 300"

12 different models

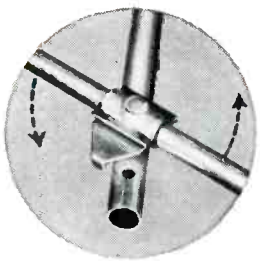


Extra "sleeve" on element provides 400% greater strength where it is needed most.

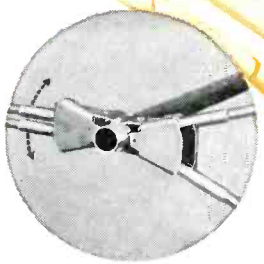
Conical "head."

The **first** and **only** full line of conical antennas completely "Super-sembled"

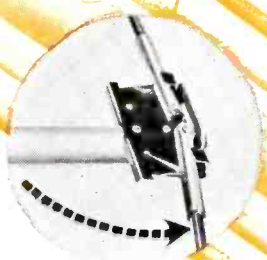
No hardware, no tools, no tightening— pops open, ready for the mast!



Director bracket.



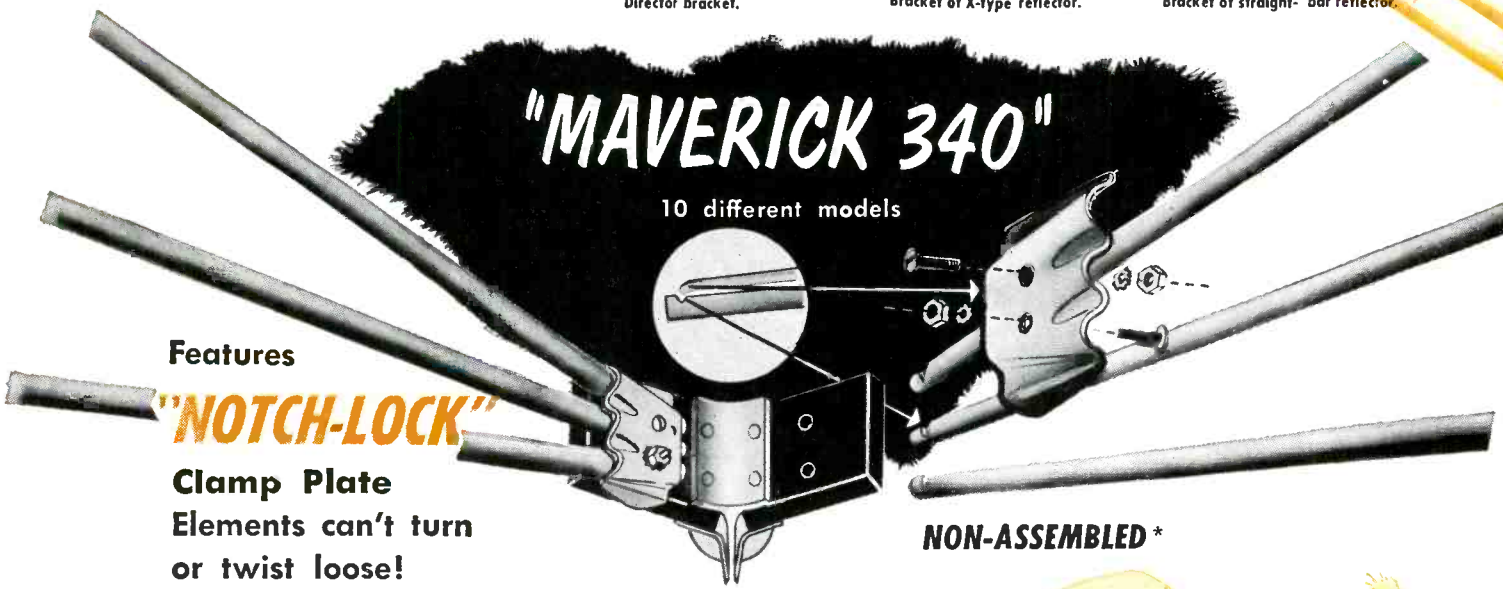
Bracket of X-type reflector.



Bracket of straight- bar reflector.

"MAVERICK 340"

10 different models



Features "NOTCH-LOCK" Clamp Plate

Elements can't turn or twist loose!

This exclusive feature, until now, has been available only in much higher-priced models.

NON-ASSEMBLED*

This **quality** line carries the lowest price-tags ever seen on conical antennas!

- Installs in a matter of minutes.
- Most popular conical arrangements.
- Finest materials; durable, rugged construction.

*** Extra Preassembly Feature!**

On all models with straight-bar reflectors, the reflector element is completely *preassembled* for snap-open installation.

CHANNEL MASTER CORP.

ELLENVILLE, N. Y.

WORLD'S LARGEST MANUFACTURER OF TELEVISION ANTENNAS

Write for complete technical literature

TUBE News

by A. M. KELWOOD

P-N-P germanium type transistors,[1] ¼" in diameter and 11/16" in overall length, hermetically sealed for moisture protection in a plug-in type insulated metal envelope, have been developed.

Design-Operating Features

Design and operating features of the transistor are said to include a low base-lead resistance which minimizes ohmic losses, improves frequency response, and insures high input-circuit efficiency. Has a maximum noise factor of 12 db; and, when used in a common-emitter circuit, this junction transistor has a collector-to-base current amplification ratio of 44, a matched-impedance, low-frequency power gain of 40 db, and a collector-to-base alpha frequency cutoff of 13.9 kilocycles. On the basis of usual transistor ratings, the collector dissipation of this transistor is in the order of 35 milliwatts.

Miniature 9-Pin Dual Triode

A MINIATURE 9-pin, medium-mu dual triode with semi-remote cutoff characteristics, the 6BC8, is now available.[2]

The tube is said to lend itself to applications as a cascode amplifier in *vhf* television tuners, and also give more satisfactory performance in *agc* systems under both strong and weak signal conditions.

In addition to these features, it is reported that the tube provides relief from objectionable cross modulation effects when reception of a weak signal is degraded, because of strong adjacent channel station interferences. This effect is minimized because the transfer curve of this tube approaches

(*Continued on page* 65)

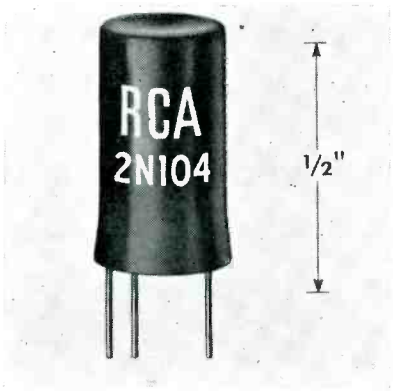
[1]RCA-2N104.

[2]Sylvania Electric.

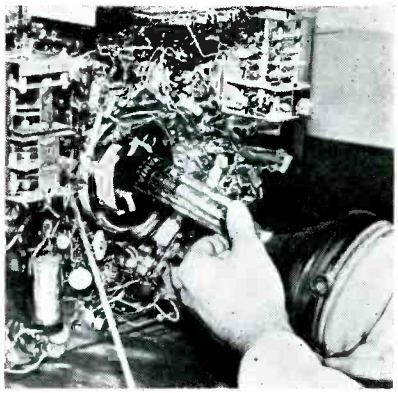
Tiny hermetically-sealed transistor, said to be the smallest commercially available for use in hearing aids. It is produced in three types: HA-8 and HA-9, which are low-level, high-gain units for the first and second stages of hearing-aid circuits; and HA-10, for the power output stage. (CBS-Hytron)

Robot device for assembling experimental tetrode transistors. In less than one minute, the machine takes a tiny bar of germanium or silicon, examines it carefully for electrical characteristics and accepts or rejects it. If the bar is accepted, the machine fixes a fine gold wire to a critical point on the bar within an accuracy of 1/20,000". Then, still within one minute, it connects this wire to one of the four wires leading out of the transistor, flips the bar end over end, repeats the entire operation with another wire on the opposite side, and finally runs a series of electrical tests on the completed transistor. (Bell Telephone Labs)

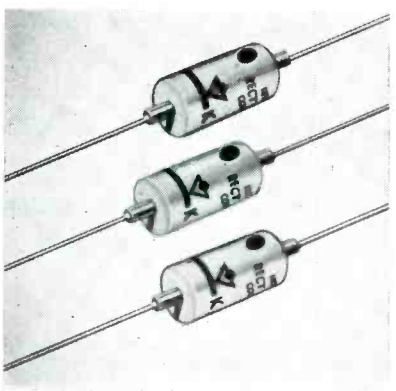
Hermetically sealed p-n-p alloy-junction transistor for low-power audio applications. (RCA)



Checking a TV chassis with 5-inch, round, magnetically deflected check tube, using electrostatic self-focusing. (Sylvania)



High temperature germanium diodes. Designed for clip-in or solder-in application. (Types 1N265, 1N266, and 1N267 International Rectifier Corp.)



by M. W. PERCY

SER-CUITS

[*See Front Cover*]

*Printed-Circuit 41.25/45.75-Mc IF Strip Circuitry**

THE USE OF THE printed-circuit or plated-board technique in producing TV-radio-audio equipment, has become a major task in a number of plants. Some have developed complete receivers using *pc* units, as noted last month, and others have designed a variety of special components.

On the cover and in Fig. 1 appears a dynamic illustration of a *pc* component, an *if* strip[1], designed to operate in receivers having the sound carrier *if* at 41.25 mc and the video carrier *if* at 45.75 mc.

According to those who developed the unit, an input of less than one millivolt at the grid of the first stage will provide a detected output of 1 volt *dc* across the diode load resistor. The specs also state that the *if* bandwidth is greater than 3.25 mc; traps are provided to control the attenuation of the accompanying sound carrier frequency and to provide substantial attenuation of the adjacent-channel sound-carrier frequency. The center of the pass-band has a *droop* of approximately ½ db.

The *if* strip has been designed to work from a tuner using a 6U8 converter. The output of the strip feeds into the video amplifier.

Printed Circuit Material

In formulating the design of this *if* strip, first consideration was given to the dependability and uniformity of printed circuit elements.

In applications where absolute minimum costs must be maintained, XXXP phenolic has been found to provide a satisfactory base material for printed chassis and coils. Careful treatment during and after processing can assure protection from moisture and other environmental effects.

However, for applications where maximum electrical and mechanical dependability is required, there is an improved base material called *Epocard II*. Its dielectric strength (perpendicular to lamination) is 800 *kv*, compared to 650 *kv* for the phenolic.

Tests have disclosed that the new material's flectural strength has been increased up to 5 times, over other compositions. Its operating temperature has been raised over 150°*F*, and it offers a great reduction in deformation during soldering.

The chassis base of this *if* strip is made from $\frac{1}{16}$" thick laminate with one-ounce copper on one side. After etching, the chassis base is treated to remove all traces of the etching solution and then protected to prevent deterioration during storage and to aid in the later soldering process.

The strip is available with either the standard or special laminate, as the chassis base.

The detector in the *if* strip consists of the diode half of a 6AS8 diode pentode. The use of a tube instead of a germanium diode was found to simplify servicing and minimize variations in detector properties.

The coils are printed on both sides of the plastic laminate. This practice was found to permit fewer turns on each side, than if they were printed only on one side. Actually, fewer turns per side means wider, thicker turns and more spacing between turns, simplifying the etching process and resulting in more uniform coils which have greater *Q*. Printing coils on both sides of the laminate was also found to result in an increase in temperature stability, due to a compensating effect of a reduction in mutual coupling between the two coils, at the same time that there is an increase in self-inductance of each coil as the temperature increases.

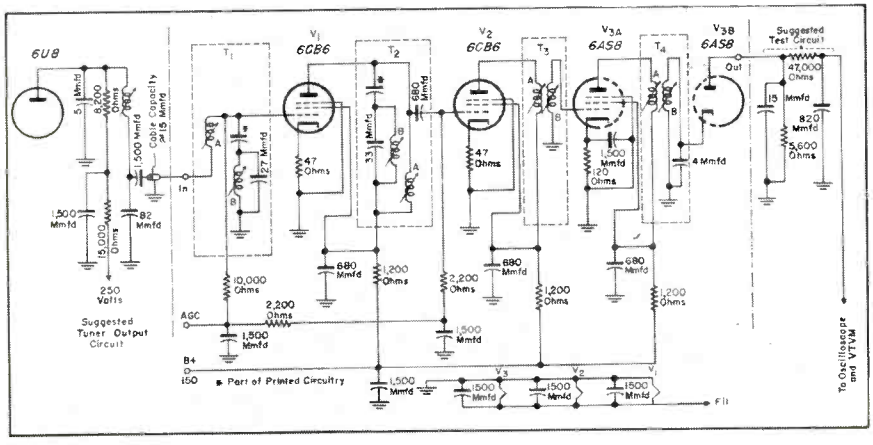
Coil inductance is varied by means of an adjustable, eddy-current disc mounted close to the winding. This disc is mounted with a special nylon nut which is located in the center of the coil.

Each coil assembly is housed in an aluminum shield can which is secured

(*Continued on page 54*)

[1]Cardwell PC-4.

Fig. 1. Schematic of the Cardwell C-4 printed-circuit if strip, connected to a suggested tuner output circuit. Capacitance in T_1 and T_2 indicated by asterisks, is actually a part of the printed circuit panel. (See cover.)



From a report prepared by the engineering department of the* ***Allen D. Cardwell Electronics Productions Corp.*

Ser-Cuits

(*Continued from page 52*)

to the chassis base during dip-soldering. Before assembly, each coil is impregnated to minimize humidity susceptibility. After assembly, the base is treated to complete the humidity protection.

Circuit Design

To minimize regeneration in the strip, large ground areas were used, where possible. The physical location of bypass capacitors was found to be important in securing proper decoupling. By using 1,500-mmfd bypass capacitors, series resonance was obtained in the pass-band; this was found to provide a low impedance path for decoupling.

Printed-circuit lead width on the base is $\frac{1}{16}$" or more. By using wide conductors, bond to the base material was improved and greater mechanical strength of the circuitry obtained. The tuning capacitors in the trap circuits are located on the coil form containing the trap inductances. This served to fix lead length in these critical circuits to a more uniform value, than if the tuning capacitors were located on the base.

The amplifier has been designed to work from the tuner output circuit. Interstage coupling between the tuner and the first *if* amplifier consists of a double-tuned circuit. Primary tuning is accomplished at the tuner output coil, and secondary tuning at the top of T_1. The mutual element between these coils is the 82-mmfd capacitor in the tuner, plus the capacitance of the connecting cable. This serves to provide a non-critical low impedance method of connecting the tuner to the strip. The 41.25-mc accompanying sound carrier frequency trap is located in the bottom of T_1. The use of this particular type of circuit has been found to provide a sharp trap with minimum influence over the pass-band frequencies.

The use of the interstage coupling circuits between the first and second stages, and between the second and third stages comprise a combination which combines high gain and flat response. It is achieved by the use of an overcoupled, double-tuned circuit between the second and third stages; this provides high gain and large bandwidth, but has very pronounced response peaks. These peaks are filled in with a single-tuned interstage circuit between the first and second stages.

Included in T_2 is a 47.25-mc adjacent-channel sound-carrier frequency trap. The decoupling between the third *if* stage and the detector is a double-tuned transformer, T_4.

The circuit is designed to work into a 5,600-ohm load. A thermionic diode is used to minimize variation in bandwidth between different diodes, and to permit easier servicing if the diode must be replaced. In addition, tests have disclosed that the stability of a thermionic diode is superior to that of a germanium crystal.

The strip requires a $B+$ source of 150 v at a current drain of 28 ma at 3 v *agc*. The filament requirement is 6.3 v at 1.05 amps. Sensitivity at the grid of the first tube at 0 v *agc* is 1,000 microvolts for 1 v dc at the diode resistor, and 100 microvolts at the converter grid for the same output.

Adjustment Procedure

The *if* strip leaves the factory completely aligned. But when the set manufacturer puts the strip into his receiver, it is necessary to align the output coil of the tuner. This corresponds to the last step of a complete alignment procedure.

To align the strip completely, it is necessary to have a TV sweep generator, 'scope, and marker generator.

Throughout the alignment, a 1,500-mmfd capacitor is used in series with the sweep generator output to prevent shorting the *agc* circuit and adjusted to give 2 *v* bias. The sweep generator output is applied to the grid of the third stage, and the 'scope is connected to the diode load resistor. The T_{4A} and T_{4B} discs are adjusted for maximum gain. By adjustment of the signal generator, level at the 'scope input is kept at about 1 *v*.

Next, the output of the sweep generator is moved to the grid of the second stage and T_{3A} and T_{3B} is adjusted for maximum gain. At this point, two prominent peaks should show up in the response curve if the strip has been properly aligned.

Now, the output of the sweep generator must be connected to the grid of the first stage, the marker generator modulated and set to 47.25 mc. T_{2B} should be adjusted for minimum modulated output on the 'scope. The marker generator output should be reduced to prevent distortion of response curve, the modulation removed from the marker generator and T_{2A} adjusted for maximum gain.

Finally, the sweep generator and marker generator should be coupled to the converter either by coupling to the grid or by coupling through stray capacitance to the wiring of the tuner.

The marker generator should then be modulated and set to 41.25 mc, T_{1B} adjusted for minimum modulation output on the 'scope, and modulation removed. The output of the marker generator should be reduced to prevent distortion of response curve. The tuner output coil and T_{1A} should be adjusted for maximum gain. This constitutes the overall pass-band of the *if* system.

•

50-MILLIONTH VIBRATOR

K. M. Schafer (second from right), manager of the P. R. Mallory vibrator division (celebrating its 25th aniversary this year), presenting Ray F. Sparrow, executive vice president (second from left), with the 50-millionth radio vibrator recently produced. Others at the ceremony were, left to right: Albert B. Tollefsen, chief engineer; Leo J. Hemelgarn, head of cost department; and Bert Whisler, manufacturing superintendent.

New Instrument Developments

SECO TUBE TESTER

A portable grid-circuit tube tester, *GCT-5*, that is said to detect condition of tubes in *agc, rf, if* and sync circuits, and permit customers to see weaknesses in defective tubes, has been developed by the Seco Manufacturing Co., 5015 Penn Ave. S., Minneapolis, Minn.

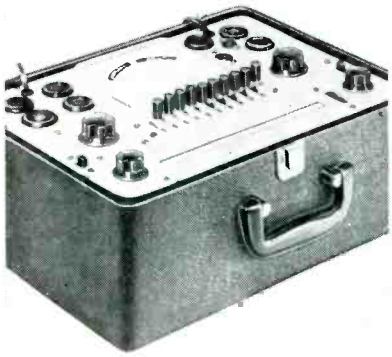
Tester, which is equipped with a filament voltage selector for 3, 4, 5, 6, 7, and 12-*v* tubes, has been designed to determine grid-to-cathode shorts, gaseous condition in tubes, cathode-to-heater shorts and control-grid emission. Tester also serves as a continuity checker of series-string heaters.

* * *

KNIGHT TUBE TESTER KIT

A Knight tube tester kit, that measures tube performance by the cathode-emission method, checks for shorted elements, open elements and heater continuity, has been introduced by the Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill. Unit can be used for testing 4, 5, 6 and 7-pin large, regular and miniature types, as well as octals, loctals, 9-pin miniatures and pilot lamps.

Features 4½" meter, plus a line voltage compensator and a operating roll chart, as well as universal socket pin selectors which permit testing tubes with new bass arrangements without any need for wiring changes. Roll chart can be removed for addition of testing data on new tubes; a blank socket is provided for future use. Incorporates a single-unit, 10-lever function switch.



NRI WIDE-BAND 'SCOPE

A 'scope, designed for TV and industrial applications where square-wave and pulse type signals must be observed, has been announced by the Supply Division, National Radio Institute, 16th and You Sts., N.W., Washington 9, D. C.

Instrument is claimed to have vertical amplifier response flat from 10 cycles to 4.5 mc (± 3 db); four-step frequency-compensated vertical attenuator calibrated for direct peak-to-peak voltage measurement; sensitivity of .014 volt (*rms*) per inch of deflection; linear sweep range 10 cycles to 100 kc; average vert-amp input impedance of 2 megohms, and 25 mmfd; positive and negative sync; and voltage-regulated power supply.

* * *

KIRBY R-C SUBSTITUTION UNIT

An *r-c* substitution unit, containing 12 resistors and 12 capacitors, has been announced by Kirby Products Corp., 20 E. Herman St., Philadelphia 44, Pa.

Resistors and capacitors are connected to a double-wafer 12-position rotary switch; has three test jacks, one being common to both circuits, which allow selection of either capacitor or resistor group in value desired.

* * *

TEL-INSTRUMENT SWEEP GENERATOR

A video sweep generator, *1106*, designed for the observation of frequency-versus-amplitude characteristics of wide-band circuitry, has been introduced by Tel-Instrument Co., Inc., Carlstadt, N. J.

Instrument features a sweep of 50 kc to 6 mc, with output adjustable from 1 *mv* to 2 *v p-p* into a 75-ohm load. Front panel switches control a maximum of 10 optional crystal markers.

* * *

CBS-COLUMBIA TUBE TESTER

A mutual conductance and plate current electronic tube tester, *VT T-1* for all tubes including those normally used in electronic work, including commercial, TV, subminiature, ruggedized and hearing-aid types, has been developed by the special contracts division of CBS-Columbia, Inc., 170 53rd St., Brooklyn, N. Y.

Tester features independent adjustments of plate, screen, filament, signal and bias voltages, enabling tubes to be tested under operating conditions as determined by circuit applications.

HEATH VAR-VOLT POWER SUPPLY

A variable voltage power supply kit, *PS-3*, providing *dc* output for *B+*, and 6.3 *vac* at 4 *a* for filaments, is now available from the Heath Co., Benton Harbor, Mich.

Unit features output continuously variable from 0 to 500 *v dc* at no load; linear from 0 to 10 ma at 450 *v dc* and 0 to 130 ma at 200 *v dc*. High voltage *dc* and low voltage *ac* are isolated from ground for use with *ac-dc* circuits, or to furnish a negative voltage value with respect to a test chassis.

* * *

PRECISION VTVM-OHMMETER

A *vtvm*-ohmmeter, *88*, featuring peak-to-peak voltage ranges, has been announced by the Precision Apparatus Co., Inc., 70-31 84 St., Glendale 27, L. I., N. Y.

Instrument provides seven separate functions with forty ranges:

All-zero center *dc vtvm*, said to eliminate need for test lead reversal or polarity switching; six overlapping 0-center *dc* ranges from ± 1.2 to ± 1200 *v*; ohmmeter covering values from 0 to 1000 megohms in 5 decimally-related ranges with 10-ohms center scale on the *R x 1* range; p-p reading *ac vtvm* for measurement of symmetrical and pulsed voltages; six ranges through 3200 *v* p-p with separately calibrated 3.2 volt meter scale; and a *hf* vacuum tube probe (*RF-10A*), available as an accessory to provide *hf ac-rms* reading facility to 300 mc.

from KAY-TOWNES comes America's 3 LEADING ANTENNAS

SUPER KATY
A Proven Performer

REAR GUARD
For Pin Point Reception

BIG JACK
America's Most Copied Antenna

For the best in televiewing pleasure America's TV audience looks to Kay-Townes Antennas. The pace-setting BIG JACK, originated and patented by Kay-Townes, leads in sales across the nation. In fringe and problem areas the SUPER KATY has become a "proven performer" giving top-quality pictures where good reception had been next to impossible without it.

And now Kay-Townes is *first again* with the answer for TV fans living *between* two powerful stations. The Kay-Townes REAR GUARD refuses signals from the rear to give pin-point directivity and photo-clear reception in areas where reception has been practically impossible because of interference from near-by stations.

Use the K-T line of television accessories

Manufactured and Distributed in CANADA by DELHI METAL PRODUCTS, LTD., DELHI, ONTARIO

THE FIRST NAME IN TV ANTENNAS

KAY-TOWNES ANTENNA COMPANY

BOX 593C • ROME, GEORGIA

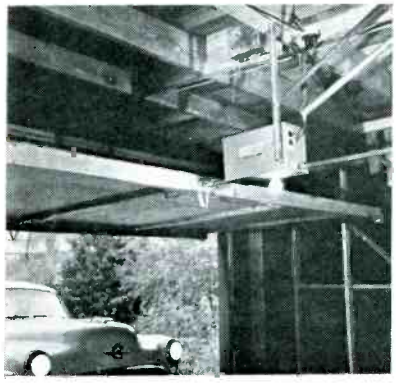
Industrial Servicing Components.. Equipment

DV AUTO DOOR CONTROL

An *Autodor control* utilizing *rf* signals to actuate, by remote control, garage doors or estate gates, has been produced by Engineered Instruments, Inc., DV Controls Division, 952 Soto St., Hayward, Calif.

Unit is designed to mount against garage ceiling rafters; contains ¼-horsepower motor, operating, through a silent chain drive, a drawbar which is mechanically attached to the door. A friction clutch included in the drive permits overriding the door in either direction at any time.

Control is housed in a sheet-metal box 7¼" wide by 15" long by 9" deep. An external light for illuminating the garage when the door is opened is included in the unit.



* * *

RCA HIGH-VOLTAGE THYRATRON

A three-electrode, mercury-vapor thyratron (5563-A) designed primarily for high-voltage *dc* power-control applications, has been developed by the tube division, RCA.

The thyratron which has a negative-control characteristic, is suitable for use in load-circuit protection applications; it replaces and supersedes the 5563 thyratron, but has greater power-handling capability.

In power-control applications, the thyratron is operated so that its *dc* output voltage to the load is controlled by changing the time of firing during the *ac* input cycle. With this arrangement, three thyratrons, connected in a half-wave, three-phase circuit, are capable of handling up to 45 kw at a *dc* output voltage up to about 9500. Six of the thyratrons in a series, three-phase circuit, can handle up to 143 kw at a *dc* output voltage up to about 19,000.

When used in circuit-protection applications, the thyratron can be operated as a grid-controlled rectifier to remove the *dc* load voltage by blocking the action of the grid. It can also be employed as an electronic switch across the rectifier output to remove the load voltage instantaneously in case of a fault in the load.

RCA INDUSTRIAL SERVICE TV

A closed-circuit TV system (ITV-6) for *heavy duty* industrial applications, has been announced by the engineering products division, RCA.

System is said to afford 550 to 600-line resolution pictures. Can be used in steel plants to provide closeup viewing of pouring, slab charging, and blast furnace and open hearth operations. In power, production, and chemical plants, it can be used for remote observations of furnace combustion, critical water levels, and smoke stack discharge.

Heart of the system is a monitor which combines a 10-inch monitor with an aluminized tube, power supply, and all monitor and camera controls in a dust-tight metal case. The ITV camera, built around a Vidicon TV pickup tube, can be located up to 500' from the monitor-control unit. Auxiliary viewers can be used to relay the pictures thousands of feet from the camera locations.

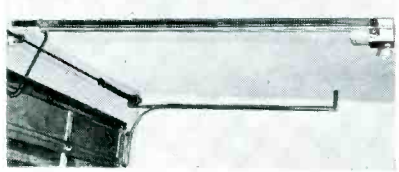
* * *

ALLIANCE AUTO-GARAGE OPENER

A line of radio-controlled garage door openers, which it is said can accommodate the more popular types of overhead doors on the market, both curved and straight track, is now being offered by the Alliance Manufacturing Co., Alliance, O.

One of the models (*A*) is completely automatic, radio-controlled; it opens and closes the door, turns the light on and off, locks and unlocks the door. It is operated from the dash of the car and set with an individual transmitter.

The radio-controlled straight-track and curved-track models are coded RCST-1 and RCCT-1, respectively.

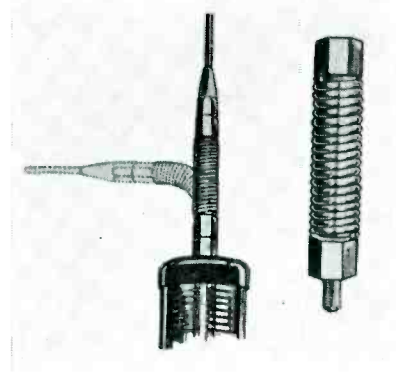


VAARO-DAVIS WHIP FLEXOR

Signal fading, while traveling at high speeds, often has been found to be caused by swaying of the lower section (voltage portion) of mobile antenna, in relation to the car body; this affects loading and therefore varies output and receiving signals tremendously. To solve the problem, a *whip flexor* has been designed by the Vaaro Division of Davis Electronics, Box 1247, Burbank, Calif., to keep the mobile receiving antenna in a perpendicular position while the car is moving.

Attachment also permits the whip to be brought down in a horizontal plane for storage in a garage or for passing through low, thickly wooded areas, etc.

Also available is a *whip clamp,* which fastens the whip securely down to the car roof level for storing car in garage or holding the whip down when passing through low wooded areas, etc. Can be fastened to roof water-drain of car.



* * *

ESI POTENTIOMETER

A high-resolution potentiometer, *Esipot,* said to offer the equivalent of a 10-turn potentiometer, although any setting can be made within less than two revolutions of a single control shaft, has been announced by Electro-Measurements, Inc., 4312 S. E. Stark St., Portland 15, Ore.

Assembly, which consists of a high-resolution single-turn pot, actuates a ten-position attenuator switch as the single turn potentiometer reaches the end of its travel in either direction.

Pot, it is said, can often replace a pair of controls where both *coarse* and *fine* adjustment steps are desired.

* * *

N.J.E.C. 4-WAY POWER CONTROL

A switching arrangement between isolated elements of dual power supplies which permits front panel selection of four modes of operation has been evolved by New Jersey Electronics Corp., 345 Carnegie Avenue, Kenilworth, N. J.

Switching provides *series aiding* (400-1000 v, 0-300 ma, grounded either polarity or anywhere between two ends); *parallel* (200-500 v, 0-600 ma, grounded either polarity, with an internal connection automatically made to control all pass-tube grids from one of two error amplifiers); *series bucking* (0-300 volts at 0-300 ma, grounded either polarity, with a factory-adjusted load resistor drawing full rating from one supply, to permit pump-back and hum cancellation); and isolated.

Superior's new Model 670-A SUPER METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. Volts: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. Volts: 0 to 15/30/150/300/1,500/3,000 Volts
Output Volts: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. Current: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
Resistance: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
Capacity: .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers.)
Reactance: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
Inductance: .15 to 7 Henries 7 to 7,000 Henries
Decibels: −6 to +18 +14 to +38 +34 to +58

ADDED FEATURE:

Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

The Model 670-A comes housed in a rugged crackle-finished steel cabinet complete with test leads and operating instructions.

$28.40 NET

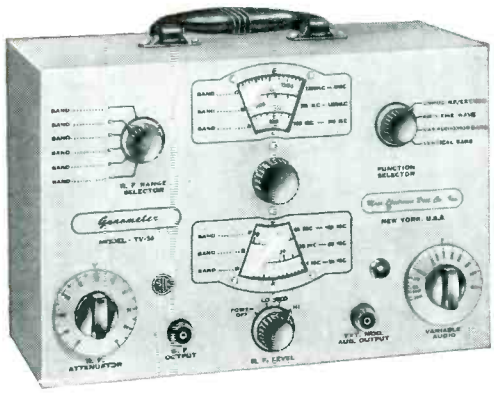
Superior's new Model TV-11 TUBE TESTER

★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron, Miniatures, Sub-Miniatures, Novals, Sub-minars, Proximity fuse types, etc.
★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because *all elements are numbered according to pin-number in the RMA base numbering system*, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.
★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus *it is impossible to damage a tube by inserting it in the wrong socket.*
★ Free-moving built-in roll chart provides complete data for all tubes.
★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.
★ NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRA SERVICE—The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

The Model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

$47.50 NET



THE NEW MODEL TV-50 GENOMETER

A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:

A.M. Radio • F.M. Radio • Amplifiers • Black and White TV • Color TV

7 Signal Generators in One!

- R. F. Signal Generator for A.M.
- R. F. Signal Generator for F.M.
- Audio Frequency Generator
- Bar Generator
- Cross Hatch Generator
- Color Dot Pattern Generator
- Marker Generator

R. F. SIGNAL GENERATOR: The Model TV-50 Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: In addition to a fixed 400 cycle sine-wave audio, the Model TV-50 Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

BAR GENERATOR: The Model TV-50 projects an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars.

CROSS HATCH GENERATOR: The Model TV-50 Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting, horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

DOT PATTERN GENERATOR (FOR COLOR TV): Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.

MARKER GENERATOR: The Model TV-50 includes all the most frequently needed marker points. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

The Model TV-50 comes absolutely complete with shielded leads and operating instructions.

ONLY $47.50 NET

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NO MONEY WITH ORDER — NO C. O. D.

Try any of the above instruments for 10 days before you buy. If completely satisfied *then* send down payment and pay balance as indicated on coupon. **No Interest or Finance Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-106, 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

Name .....
Address .....
City ..... *Zone* ..... *State* .....

☐ Model 670-A . . . Total Price $28.40 $7.40 within ten days. Balance $3.50 monthly for 6 months.

☐ Model TV-11 . . . Total Price $47.50 $11.50 within ten days. Balance $6.00 monthly for 6 months.

☐ Model TV-50 . . . Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

Speakers—Enclosures

(*Continued from page 47*)

would create high percentages of harmonic distortion.

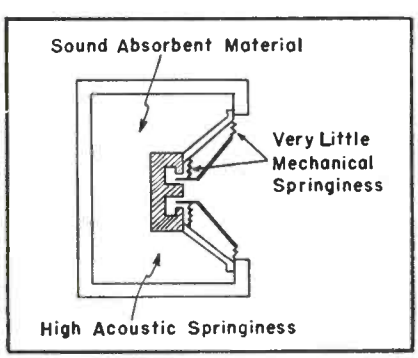
The acoustic suspension speaker was purposely designed with most of the required elastic restoring force left out. This means that for the reasons just detailed the speaker cannot be used in the conventional way. The resonant frequency of the unmounted speaker mechanism is of the order of ten cycles, below the frequency range of human hearing.

If we look again at the illustration of acoustic elasticity (Fig. 2; p. 38), we can see that the air of the enclosure has a springiness, just like the mechanical springiness that is lacking in the speaker itself. Thus the *acoustic* elasticity of the cabinet (provided that the cabinet volume is small enough) can be used to supply the missing restoring force, as a substitute for the mechanical restoring force of the speaker suspensions. This is illustrated in Fig. 4. When the cone is driven towards the cabinet by the input signal, the air cushion is compressed and presses against the cone's rear surface; when the cone is driven forward, the air cushion is rarefied or stretched, and applies suction to the rear of the cone. A pulling force is exerted on the cone because the acoustical pressure inside the cabinet has been made less than the atmospheric pressure on the front of the cone.

We have already seen that enclosing a speaker in a small cabinet raises the resonant frequency, and we can expect that the same thing occurs here. However, the resonant frequency has been made too low, to begin with, so that the final resonant frequency is raised precisely to the desired value; in the case of the commercial model of this speaker about 45 cycles.

The question might be raised as to whether the substitution of acoustic

Fig. 4. The acoustic-suspension speaker system, in which a deliberate lack of springiness in the mechanical suspensions is compensated for by the high acoustic springiness of a small enclosure.



for mechanical restoring force affects the quality of reproduction. Acoustic elasticity is different from mechanical elasticity in that it tends to be much more linear; the force constant does not increase as the amount of compression or stretch is increased. Therefore, the peaks of high-amplitude bass signals will not be clipped, and distortion can be severely reduced.

Other than this advantage, with regard to distortion, acoustic elasticity does exactly the same job as the old mechanical suspensions.

Control Requirements

The properties of the enclosed air are subject to a certain amount of control, and the enclosure is made less *springy* by a complete filling of the cavity with sound absorbent material. We have already seen the effect of such material on standing-wave resonances.

The acoustic suspension speaker has three terminals labelled *common, 4 ohms*—Use when amplifier has damping factor of 1, and *8 ohms*.

Damping Factors

Certain amplifiers have fairly low damping factors, and recently there has appeared an amplifier[4] which has a variable damping factor. The magnetic damping of the acoustic suspension speaker is so great (the speaker uses a 54-ounce Alnico V magnet) that when the amplifier has too high a damping factor the system is overdamped, and there is a loss of bass.

Therefore, two choices are given to the user; he can connect the four-ohm terminal to an amplifier of the correct damping factor, and take advantage of the full efficiency of the speaker, or he can connect the eight-ohm terminal to an amplifier having a higher damping factor (as most commercial amplifiers have), and get the same quality but lower efficiency. Thus, the volume control must be advanced a little farther for the same acoustic power, when the eight-ohm terminal is used.

Adjusting Via Listening Tests

If the damping factor of the amplifier is not known, the correct terminal can be determined from a listening test, as providing the correct level of bass reproduction.

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[2]F. Langford-Smith, *Radiotron Designers' Handbook*, 4th ed.

[3]Acoustic Research, Inc.

[4]Bogen.

Reducing RF Pickup in Audio

by DOUGLAS STEVENS

THE PROBLEM of *rf* pickup by the *af* system often can be solved through the use of a screen mesh cover placed over the entire audio amplifier area. It might even be necessary to go to the extent of shielding the second audio amplifier or output tube and circuit.

Inadequate shielding of the audio tube has been found to be a cause of pickup. Therefore, the tube shield for the audio amplifier should make positive contact with the chassis. Where a shield is not employed over the audio amplifier tube, one should be obtained and installed.

Rf signals also present at the audio circuit, since they are feeding through the power line, through the transmission line of the antenna, or the surrounding fields, may be so strong that a voltage is induced in the chassis and leads. Anything that can be done to eliminate or reduce the passage of the interfering voltage through the antenna transmission system and the power line will be of some help. High-pass filters in the transmission line and filter chokes in the power line should certainly be temporarily employed to determine their helpfulness.

Bypassing of the *ac* line with micas of 600-volt rating should be tried and installed if they are not already in the receiver. Values up to .1 mfd can be used, but it is not usually desirable to employ values larger than this.

The filament heaters of the audio amplifier should be bypassed to chassis with .01-mfd capacitors, and *rf* choke coils should be installed in series with the filaments for the audio tubes. Bypassing of screen and suppressor grids should be ascertained as proper and sufficient.

Audio rectification difficulties often occur in circuits where a triple purpose tube is used for detection, *avc* and audio amplification. The common cathode permits the tube to couple one circuit to another, as well as the interelectrode capacitances of the tube, and thereby hangs a more difficult problem.

If the foregoing modifications have not been found sufficient, a separate audio amplifier stage can be assembled on a sub chassis, aside from the existing circuit. This audio circuit should have all the suggested changes such as *rf* chokes and bypass capacitors in the filaments and $B+$ circuits to the separate tube. All other modifications can be included such as shielded cables and complete sub-chassis shielding. In extreme cases, this approach will be the only solution.

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TV TUNER CONFERENCE

Oden F. Jester **(right), distributor sales manager, Standard Coil Products Co., Inc., discussing characteristics of new tuner with** James P. Cody, **executive vice president of Burton Browne Advertising, Chicago agency recently appointed to handle the account.**

Rep Talk

NEARLY 5,000 copies of a comprehensive *rep* directory, listing manufacturers and products represented by participating members of the New England chapter, have been distributed in the New England area. Directory committee was headed by *Henry P. Segel*. . . . *Burton Browne* has been appointed director of a publicity committee formed to celebrate the 20th anniversary of The Reps this year. . . . *Edward Robinson*, formerly sales manager of Espey Manufacturing Co., Inc., has organized a sales company, Robinson Associates, 1058 2nd Ave., N. Y., to represent hi-fi equipment made by Espey and the Sightmaster Corp. in the metropolitan New York area. . . . *Barrett Border*, president; *Mel Levison*, first vice president; *Dick Gentry*, second vice president; and *Wally Shulan*, secretary-treasurer, have been elected to serve as '55 officers of the New York chapter of The Reps. . . . Empire State chapter has elected *John Stone*, president; *Gordon LeRoy*, vice president; *Joseph Marsey*, treasurer (reelected) and *Marshall T. Ball*, secretary. . . . *Jack Mahoney*, president; *David Quinlan*, vice president; *Ken Randall*, secretary; and *Don Brown*, treasurer, are the new officers of the Mid-Lantic chapter. . . . Buckeye chapter has chosen *Walter J. Brauer*, president; *W. R. Weller*, vice president; and *Ernest P. Scott*, secretary-treasurer. . . . In the Wolverine chapter elected officers include *R. C. Nordstrom*, president; *Sid Lohmann*, vice president; and *Jack Thorpe*, secretary-treasurer. . . . *Allen Williams* is now president of the Rocky Mountain chapter; *Gordon Moss*, vice president; *Dick Hyde*, secretary; and *Bill Peyser*, treasurer. . . . *Gordon Dougherty* has been appointed sales manager of Brenna and Browne, manufacturers' reps in Hawaii. . . . *Albert Engelman and Co.*, 3205 Crump Ave., Memphis, Tenn. (Alabama, Louisiana, Mississippi and northwest Florida); *Frank Nickerson*, 1133 Ponce De Leon NE, Atlanta, Ga. (the remainder of Florida—except N.W.—Georgia, North and South Carolina); and *John S. Plewes Co.*, 52 Humbercrest Blvd., Toronto, Ont. (Canada) have been appointed reps for Winston Electronics, Inc. . . . *R. J. Gibbons Electron Sales Co.*, 3051 NW 4th St., Miami, Fla., is now representing Peerless Products Industries, in the state of Florida.

Burton Browne (left), a member-at-large of The Reps, discussing group's twentieth anniversary plans with Wally B. Swank, national rep president, and Marjorie Kent, administrative assistant for the group.

AC Measurements

(*Continued from page 21*)

conversion, or any other conversion that may be implied in the calibration of the instrument, may not be quite true in the measurement being made. For example, the average voltmeter employs a rectifier device with series resistors for *ac* measurements.

A rectifier instrument measures the mean value of the rectified waveform, known as a mean reading. In the case of a sinusoidal waveform this mean reading is .637 of the peak value; the *rms* reading is .707 of the peak value. So, although the reading given by the instrument should be .637 of the peak-waveform value, the calibration marked on the instrument scale usually corresponds to .707 of the peak value. In other words, the reading indicated is approximately 1.11 times the value the instrument actually measures, to give a reading in *rms* terms, although the meter is actually sensitive to mean value of the waveform.

The foregoing analysis also applies to readings obtained on a number of *vtvm's* as well; however some circuits are designed to give a reading based on the peak, or peak-to-peak, value of an *ac* waveform. They may also be calibrated in terms of the *rms* value, so that the voltage measured may really have a peak reading of 1.414 times the scale reading, regardless of waveform. Another form of measurement law used, which is not quite so common, is the square law, employed in thermal-type instruments such as a hot-wire ammeter or an instrument employing a thermocouple. These instruments have a square-law scale (Fig. 4, p. 21); they are not very popular because the range covered by the scale usefully is rather restricted. However, the square-law instrument does offer an advantage; the readings will always be true *rms* readings, since the square root of a quantity bears a fixed relationship to the square of that quantity.

It is not feasible to give any rules for converting readings from one waveform to another or for finding what the reading should be, if the waveform deviates in some specific manner from true sinusoidal. The important thing is to realize that a deviation does exist and hence make allowance when measuring waveforms that may depart from sinusoidal. For example, when the overload characteristic of an amplifier is being measured, although the instruments may be accurate beyond dispute, the readings may not be what they appear to be.

The best way to rate readings of this nature is to take a peak reading,

which can be done by means of a 'scope. The 'scope can be readily calibrated by applying a sinusoidal voltage to the input terminals, measuring the voltage, and adjusting the gain of the 'scope amplifier to give some specific deflection. The peak-to-peak voltage will be 2.83 times the measured *rms* value; this can be measured with any kind of instrument, provided the waveform is sinusoidal. Having calibrated the 'scope in this manner, it may be used for measuring any desired voltage, without altering the setting of the 'scope amplifier gain control; and the peak-to-peak waveform may be evaluated accurately by the use of a celluloid squared sheet in front of the screen.

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Tube News

(*Continued from page* 50)

the desirable square law characteristic, which is the optimum shape for minimizing cross modulation.

TV Check Tube

A 5-INCH, round, magnetically deflected tube[2] (the 5AXP4) using electrostatic self-focusing, that can be used for chassis checking, is now being made.

The check tube, intended primarily for the TV Service Man and TV equipment manufacturer, permits a cabinet-mounted picture tube to be left in the cabinet, while the receiver is being serviced in the shop. The tube, a universal type, can be inserted into any TV chassis while the set is being serviced.

Since the tube has a focus system built into it, one does not have to use a focus mechanism, nor is there need for the installation of an iron trap while making tests. The tube is so light, it is said, that the yoke of the receiver can support the tube. Only electrical connections required are the high-voltage lead and the picture tube socket of the receiver. The tube, it is claimed, can be used in any receiver regardless of the deflection angle.

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PROFESSIONAL ACHIEVEMENT MEDAL WINNER

William Dubilier, founder of the Cornell-Dubilier Electric Corporation, recently awarded the Gano Dunn medal by his Alma Mater, Cooper Union, during a Founder's Day dinner in N.Y.C., for his inventions and development of hv capacitors.

TV Antennas

(*Continued from page 36*)

enclosed angle versus element length to boost gain on the high TV channels.

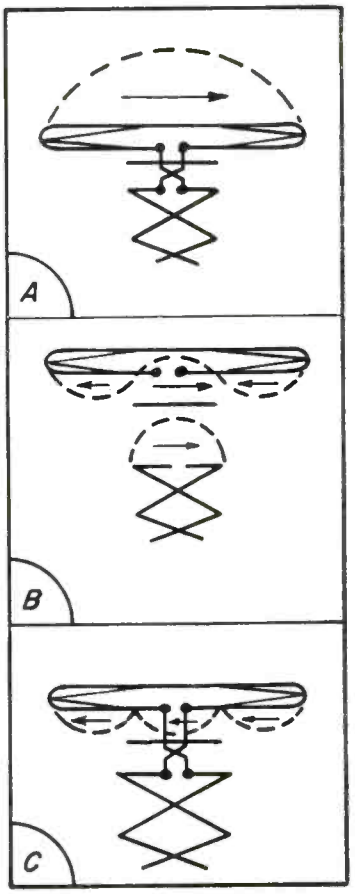
In *1D* (p. 36) we have a vertical dipole system using two high-channel folded dipoles and a larger center element for channels 2-6. Here, the two small dipoles are connected in reverse phase versus the larger dipole through a harness arrangement. Two limitations have been found to exist with this system. The two electrically-parallel paths to the small dipoles are in shunt presenting a loading effect on channels 2-6, thus reducing efficiency. The two small dipoles are electrically exposed when incorporated in any array, reducing front-to-back ratio. The electrical operation of antenna systems *D*, *E*, *F* and the *helix* are similar.

Antenna systems *E* and *F* have been found to be very effective. The high-channel element in *E* is a folded dipole, located horizontally in front of the low-channel flat-plane conical dipole. In *F*, the high-channel element is a center grounded *helix*. Here both ranges were found to be improved due to the longer shunt path from the first crossover point of the *helix* to the take-off points of the conical. Although both systems represent a stride forward, the exposed tips of the flat-plane conical were found to limit the amount of back rejection that may be obtained.

With the foregoing information at hand and the original considerations in mind, it was felt that another approach to the problem was in order. And accordingly a new electrically segmented folded dipole (illustrated in Fig. 2, p. 36) was evolved.

Broad-Band Operation on Channels 2-6

It was stated that any folded dipole has a resonant point, determined by its length. It is also a fact that the gain of any dipole will remain fixed for a much greater frequency range above, than below the resonant point. For broad-band considerations of channels 2-6, a design point slightly above channel-3 was chosen. The next element that was added was a channel-2 reflector, as shown at *B*. Between the channel-2 reflector and the folded dipole a reflector of channel-3



(Right)
Fig. 3A, B, C. Current distribution on low channel dipole for 2-6 is pictured in A. Shown in B is current distribution pattern for a dipole operating independently on 7-13. In C appears a transposed connection between helix and folded dipole, eliminating undesired current components.

length was added, but not to boost channel-3. The object of this addition was to change the impedance, as seen at the dipole terminals, back to transmission line value on channel-4, and the gap between channels 4 and 5. The resultant is shown in Fig. *2C*.

Fig. *2D* shows what might be considered a director placed in front of the folded dipole. This element does not function as a director, but rather much in the same manner as the channel-*4* phasing element added in step *2C*. Because of its proximity to the dipole, the dipole impedance on channels *5* and *6* was changed. The desired low-channel gain curve had almost been achieved, but there was no room for additional phasing elements to boost the high end of the low channels, because of the blocking action of the lower frequency elements already added.

At this point, it was necessary to resort to another means to increase channel-*6* response. The method chosen was that of stub action of the high-channel *helix* section. Here the harness length connecting the *helix* and the length of the back section of the *helix* to the first crossover point on the crossarm, are used as a closed stub to reflect an impedance close to line value at the high end of channels *2-6*. However, it was found that the effect of such stub action was not restricted to the high end. Low channel pickup of the high channel *helix* has been found to be practically nil, and transposition of the interconnecting harness does not appear to create any measurable low-channel loss.

In the basic form of Fig *2E*, it was found that an all-channel antenna with high gain obtained, and, because of the high-back rejection of the *helix* and the low-channel phasing elements, one with high-back rejection. One other consideration was important at this point, and that was increased gain in channels *7-13*, to equalize normal propagation losses. Two high channel phasing elements were added for this purpose; Fig. *2F*. The element behind the *helix* acts as a 7-13 reflector, while the element in front of the channel-5 phasing element serves to block high channel energy from being received by the center section of the large folded dipole.

Earlier, it was mentioned that the large dipole was electrically segmented because of the antenna-end additions. If we consider only the elements that determine the dual range performance; we are left with those of Fig. *3A*. The *helix* and the high-channel phasing element nearest to the large folded dipole have no function on channels

(*Continued on page 70*)

Catalogs-Bulletins

ASTRON CORP., 255 Grant Ave., E. Newark, N. J., has issued a 16-page, pocket-size replacement capacitor-estimating and pricing-guide for Service Men. Available from distributors or direct.

* * *

JENSEN MANUFACTURING CO., 6601 S. Laramie Ave., Chicago 38, Ill., has released bulletin *1001*, describing the miniature loudspeaker being used in the Regency transistorized radio.

* * *

COLUMBIA WIRE AND SUPPLY CO., 2850 Irving Park Rd., Chicago 18, Ill., has published a supplement to catalog *104*, listing TV transmission line, rotor cables, outdoor intercom and telephone wire, new connectors, cords and cables.

* * *

CHICAGO STANDARD TRANSFORMER CORP., Addison and Elston Sts., Chicago 18, Ill., has released an 8-page auto-radio transformer replacement guide, listing both vibrator power and audio output replacements for more than 540 car radios. Includes all models used by major auto manufacturers as well as private label brands. Cross-referenced by manufacturers. . . . A separate catalog lists detailed specs on 25 vibrator power transformers and 19 audio outputs.

* * *

RADIO CORPORATION OF AMERICA has published brochure *3R2468* describing an *Antenaplex* broadband amplifier for multiple TV distribution systems recommended for use with from 2 to 50 sets.

* * *

CBS-HYTRON, Danvers, Mass., has issued the second edition of its reference guide for TV picture tubes, listing all magnetically deflected tubes for both black and white and color. Basing diagrams for 242 tubes are included.

* * *

SOUTH RIVER METAL PRODUCTS CO., INC., 377-79 Turnpike, South River, N. J., has released a 20-page catalog, describing and illustrating antenna mountings and accessories, including chimney mounts, wall brackets, eave mounts, peak and flat roof mounts, vent pipe mounts, guy wire rings, grounding equipment, replacement banding kits, and stand-off insulators.

* * *

JERSEY SPECIALTY COMPANY, INC., Little Falls, N. J., has published a foldout brochure covering its new silver aluminum *strip-easy* TV transmission wire.

* * *

RADIO MERCHANDISE SALES, INC., 2016 Bronxdale Ave., New York 62, has issued catalog *55A*, detailing its line of rotors, rotor hardware, indoor and outdoor *uhf-uhf* antennas, TV couplers, switches, and assorted installation accessories.

* * *

ATLAS SOUND CORP., 1451 39th St., Brooklyn 18, N. Y., has issued two catalog sheets; one on the model *CJ-30 Cobra-Jector* loudspeaker; the other on the model *BS-37 Porto-Boom* microphone boom stand.

* * *

CENTRALAB, 900 E. Keefe Ave., Dept. A-17, Milwaukee 1, Wis., has released a revised 48-page catalog, *29*, with a thumb index for reference to the five CRL complete lines of stock component. Some of the developments contained in this catalog are *snap-tite controls, Senior Compentrol*, complete line of 1000-volt rated disc capacitors, and *pec* kits, negative 330 and 1500-*TC* tubulars, switches, etc.

On Book Row

ELEMENTS OF RADIO SERVICING . . . BY WILLIAM MARCUS AND ALEX LEVY: A revised second edition, with a comprehensive review of radio theory combined with a step-by-step analysis of troubleshooting and repair of radio receivers. Utilizing a practical approach, each service problem is broken down into logical stages and then probed from the Service Man's viewpoint. Covers superhet receivers and phono combinations, either *ac* or *ac/dc* operated; installation and repair of auto radios, and the use of test equipment. Includes data on latest types of receivers, battery-operated and 3-way portables, and AM-FM receivers. Also provides information on the business aspects of servicing, basic equipment, and on the construction of a service bench. *—566 pages, 5¼" x 9¼", priced at $6.00; McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y.*

* * *

THE REVERE TAPE RECORDER GUIDE . . . BY DR. KENNETH J. TYDINGS: A practical, non-technical book detailing practical uses of the tape recorder at home, as well as in business and educational institutions. Author explains how to use recorder for dictation, voice training, music practice, making of sound effects, and sound tracks for silent pictures. While primarily a book for Revere tape owners, much of the information is basic and can be used as a guide for other recorders.—*127 pages, pocket size, priced at $1.95; Tydings Book Publishing, Inc., 64 W. Park Ave., Long Beach, N. Y.*

* * *

TRANSISTOR AUDIO AMPLIFIERS . . . BY RICHARD F. SHEA: An earthy report covering specifications, performance curves and specific design data. Offered are a wide range of material, including information on the variation of transistor parameters with operating point, with temperature, and between units. Data are interpreted in terms of variations in input, and output resistances and power gain. Methods of coupling transistor stages are analyzed, and examples of a number of amplifiers intended for varied applications, ranging from hearing aids to a high-power amplifier, are offered.—*219 pages, priced at $6.50; John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y.*

* * *

TV SERVICE TIMESAVERS . . . BY MILTON S. KIVER: A handy reference summarizing service techniques that have been found profitable from actual experience. Prepared in five sections: General Servicing Timesavers; Sectional Servicing Timesavers; Test Instruments and Alignment; Timesaver Tips on Servicing Tools, and Odds and Ends for Quicker Servicing. Includes photographs and drawings to illustrate over fifty timesaver tips, including causes and cures for the narrow picture; tuner sensitivity—how to increase it; vertical retrace blanking, checking horizontal output transformers; touch-up alignment, and remedy to corona problems.—*124 pages, 5½" x 8½" paper bound, priced at $1.50; Howard W. Sams and Co., Inc., 2201 E. 46th St., Indianapolis 5, Ind.*

* * *

BASIC ELECTRONICS . . . BY VAN VALKENBURGH, NOOGER AND NEVILLE: A picture-course training series, in five volumes, covering basic electronics. Volume one covers diodes and power supplies; volumes 2 and 3, amplifiers and oscillators; and volumes 4 and 5, transmitters and receivers. Features over 100 show-how illustrations.—*550 pages total, in five volumes, 6" x 9", paper bound, priced at $2.00 per volume, or $9.00 for set; John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y.*

TV Antennas

(*Continued from page 67*)

2-6, except *helix* stub action as previously explained. The direction of current flow is indicated by the arrow. In Fig. *3B* (p. 67) channel *7-13* operation is illustrated, and here all elements play a part. If, as shown in *B*, the harness were eliminated, the current distribution on the folded dipole and the *helix* would be as drawn; current direction shown by the arrows. It will be noted that the amplitude of the current flowing in the center section of the folded dipole, is considerably less than in the end sections. It will also be noted that the direction of current flow in the center section is opposite to the end sections, but in the same direction as the *helix*. The end sections, because of their design, have a greater voltage collecting area on channels *7-13* and a different inherent impedance, further increasing their current amplitudes and reducing that of the center section.

The Transposed Harness

The object then is to eliminate the small amount of out-of-phase current flowing in the center section, and to replace it with a component that is in phase with the two end components. Here is where the transposed harness plays its part. Since the direction of current flow in the *helix* is initially the same as the undesired center component of the large folded dipole, it becomes simply a matter of cross connection between the *helix* and the folded dipole, to insert the *helix* current in the same direction as that flowing in the end section of the folded dipole. The resultant distribution pattern is shown in Fig. *3C*.

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Service Engineering

(*Continued from page 30*)

every commercial enterprise can enjoy economic benefits through the use of modern communications facilities. The market, although cultivated for many years, has been but barely scratched.

Correction

The captions for Figs. 1 to 4, in the intercom report, published in the February issue, should have read as follows: Fig. 1—Block diagram illustrating how an intercom system functions as a two-way sound system. Fig. 2—Typical intercom system. Fig. 3—Types of lines used in intercom work. Fig. 4—Method of adding an auxiliary volume control for incoming signals only.

Sweeping TV Circuit

(*Continued from page 23*)

well as in FM models. Adjustments on the *gated-beam detector only* are generally made on an actual received broadcast following service notes.

The procedure for discriminator and ratio detector alignment is similar; however, the point at which the 'scope or detector is connected is different for both cases. For the discriminator circuit, the tunable marker or a crystal oscillator (4.5 mc crystal for intercarrier) is set at the *if* center frequency, and a symmetrical waveshape output on either side of the marker should be observed as the discriminator transformer is tuned. When this step is completed, the 'scope is connected to the volume control or the opposite end of the isolation resistor attached to the volume control. One adjusts the transformer to maximum amplitude and straightness of the slanted detected curve.

With a ratio detector, the 'scope, or the detector, is connected to the plate of the detector diode. This terminal usually is also a junction for a stabilizing capacitor, which should be disconnected to make the *if* transformer adjustments. After alignment of the *if* stages, this capacitor is reconnected and your 'scope should be connected to the hot terminal of the volume control; the adjustments are then made for the ratio detector using methods suggested for discriminators.

Intercarrier type receiver service notes often recommend use of a *vtvm* and a standard signal generator. This procedure is then followed by checking the overall response and checked with the sweep generator and 'scope. The output of a sweep generator is connected to the mixer stage and the 'scope is connected to the video detector. The *if* adjustment should be touched up to receive the waveform shown in service data.

The sound *if* stages can be aligned using the sweep generator as previously mentioned. However, here a 4.5-mc signal for the marker should be used exclusively. After this step, alignment of the 4.5 mc traps can be completed with the detector probe or vertical input of the 'scope connected to the cathode or grid of the picture tube, and the trap aligned for minimum amplitude of the waveshape on the 'scope.

The FM receiver can be aligned utilizing the general techniques given for the stagger-tuned receiver. However, before proceeding to this alignment, one should read carefully the manufacturer's service notes.

Communications BFO

(*Continued from page 29*)

off-on switch is needed as a control. Most convenient form of crystal *bfo* consists of two crystals, one *n* cycles above the *if* center frequency, and the other *n* cycles below it; *n* is any convenient figure, such as 600. Construction is relatively noncritical here, except that the unused crystal must be removed from the circuit completely and short circuited with short leads, to prevent some rather peculiar and undesirable circuit misbehavior at frequencies close to that of the unused crystal.

The circuit normally used is an electron-coupled Pierce crystal oscillator, in which the crystal almost invariably oscillates at its fundamental frequency.

Beat-frequency oscillators employing multivibrators, where frequency adjustment is possible by use of resistors only, offer a number of interesting possibilities, but are not encountered in commercially-built receivers now on the market. Some recent experimental work indicates that beat-frequency oscillators employing either a saturable core reactor or a reactance tube as the frequency-control element, offer some interesting possibilities, particularly in equipment where the beat-frequency adjustment must be remote from the actual oscillator.

Space, Control, and Shielding Problems

Whenever a *bfo* must be added to an existing receiver, or the operation of the existing *bfo* has changed appreciably, space problems arise. In general, a *bfo* consists of a tube, tuned circuit, and a frequency-adjustment element. Whenever possible, the tube and tuned circuit should be physically and electrically close to the point of injection, which is usually the last *if* plate. The frequency adjustment must be placed on the panel, and is usually some distance from the oscillator position.

Some of the space problems can be solved by substituting a dual-purpose tube for a single-purpose tube now in the circuit. Thus, a 6AQ7GT can be substituted for a 6H6 and a 6C5, freeing one socket for *bfo* use; or a diode-pentode such as a 6SF7 can be used in a socket which formerly held only a diode, provided both the diode and the pentode can share the cathode

Fig. 3. Power supply and relay circuit for in-can switching.

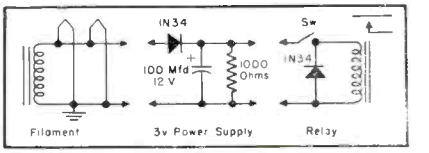
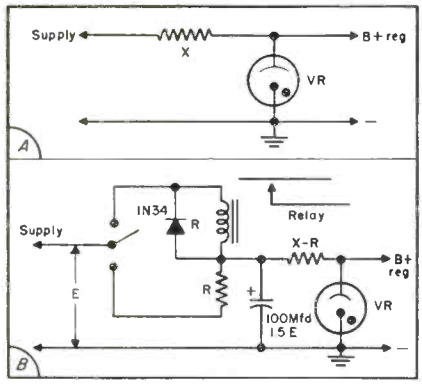


Fig. 4. Switching relay operated as a free rider on a voltage regulated system.



of the tube without introducing circuit difficulties.

When resocketing is necessary, either to modify an existing *bfo*, or in making a new one, use of a turret type socket, will greatly expedite wiring of components, and, by concentrating the circuit in a small bulk, will simplify shielding. Many socket turrets are small enough so that a 1½" square shield can 2½" high will slip over the parts assembly easily.

Placement of controls for a new *bfo* is particularly troublesome, as most commercially-constructed equipment has every square inch of the panel already in use. Most satisfactory solution, in most instances, is to gang the *bfo* pitch control with some other control that will not be used when the *bfo* is on (such as a tone control). Use of commercially-available dual controls is recommended where that is possible, as construction of special tandem mountings is quite costly in hours of labor. One such control that was made up consisted of a variable resistor (bottom), which served to control receiver tone; a small trimmer, operated by the same shaft, to control *bfo* pitch; and a microswitch, which served to cut in a crystal *bfo* when the pitch control was turned a few degrees past minimum capacitance (105° *ccw* in this case). By taking special care with alignment, so that the axes of rotation of the resistor and capacitor coincided, this control was very satisfactory, with no backlash of *stiff spots*.

Shielding of the capacitor lead from the oscillator coil to the pitch control capacitor on the panel is desirable not only to prevent unwanted beat frequency injection into early *if* stages, but also to prevent radiation at approximately intermediate frequency. Ordinary braid-shielded grid wire, firmly fastened in place by use of cable clamps or equivalent supports, is quite satisfactory for this purpose; or rubber insulated hookup wire can be run inside lengths of spring curtain rod, tacked to the chassis with solder at strategic locations.

Beat-frequency oscillators should be aligned according to the manufacturer's instructions, when they are available, unless the customer specifically requests some other alignment. The beat-frequency oscillator is customarily aligned after the main *if* system is aligned; and the zero-beat position of the *bfo* should be in the center of its adjustment range, so that substantially equal adjustments of the pitch control knob, in either direction from zero beat with a signal centered in the *if* passband, will produce beat notes of equal frequency, and also, in a majority of instances, of equal amplitude within less than 1 db.

Adjustment and routine repair of beat-frequency oscillators is well within the range of capabilities of the average Service Man. Although communications receivers require a somewhat higher grade of workmanship than home amusement receivers, this standard is easily attainable, in most instances, because of the initial use of high grade components and good workmanship in communications equipment.

Modification of beat-frequency oscillators by conversion from plate-coupled to electron-coupled (and providing for an adjustable power output) is a fairly straightforward operation.

Servicing Helps

(*Continued from page 34*)

tal size should be increased slightly with the horizontal width control. And the 6CU6 or 6BQ6 horizontal output tube should be replaced. If the foregoing does not correct the trouble, following circuit revisions must be made.

The value of R_{86} (a 120,000-ohm, ½-watt plate-load resistor connected to pin *5* of the horizontal oscillator V_{10}), should be changed to a 150,000-ohm ½-watt resistor.

The value of R_{90} (a 12,000-ohm 5-watt wirewound 6CU6 screen-load resistor), should also be changed to a 15,000-ohm 5-watt wirewound resistor.

And a 470-ohm ½-watt resistor should be added between the junction of R_{90} and C_{90}, and terminal *4* of the horizontal output tube.

To make the foregoing connections, the 12,000-ohm 5-watt resistor (R_{90}) should be replaced with a 15,000-ohm 5-watt wirewound resistor, but the resistor should be connected to pin *3* (dummy pin) instead of pin *4*. The .1-mfd, 400-volt capacitor (C_{90}) should be disconnected from pin *4* and connected to pin *3*; the 470-ohm ½-watt resistor should be added between pins *3* and *4*.

The latter changes have been made in present production.

Focus Instructions for Electrostatic Focus Tubes

The ion trap (beam bender) magnet should always be positioned for best focus and maximum brightness.

It may be possible to obtain better focus with replacement picture tubes, if the electronic focus anode is connected to a point other than the 270 volt B+ line. Suggested points to try are: Chassis ground, 140 volt B+, 530-volt *B* boost; pin *3* 6W4 damper rectifier.

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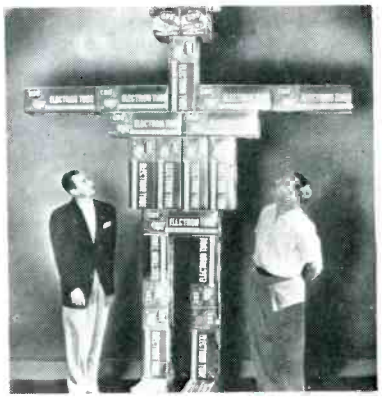
TUBE CARTON ROBOT



A king-size robot, dummied up out of CBS-Hytron cartons, on display on the West Coast. At left, Bert Tappe, Electronic Shack, San Francisco; at right, E. H. Earl, Earl's Radio and TV, Concord, Calif.

Community TV System

(*Continued from page 27*)

hunting trouble affects productive income.

The smaller coax used to connect the main lines into the subscriber's homes is probably the only part of the system that the subscriber will ever see at close hand; therefore, the utmost care, in making each installation a workmanlike job should prevail.

One piece of equipment that has been very useful for coax installation has been a lightweight, home-made rack, just large enough to accomodate a small reel of coaxial cable, and a spool of messenger cable; Fig. 1 (p. 26). If the drop to be installed is not over 150′ in length, RG/59U coax is recommended. If a longer length is involved, RG/11U coax should be used. For the small cable, 6-20 guy wire may be used as a messenger cable; if the larger cable is used, 6-18 guy wire is recommended. This cable is used in the same manner as the main runs, described earlier. Although in some systems the messenger line is not used, and the drop-cable is self-supporting, it has been found that the messenger method is much better since it serves to increase the life of the coax cables, and above all, prevents crushing of the coax at points of support; the pole, and the house-entrance. This condition could cause a short, during the excessive heat of the summer, or a change in the characteristic impedance of the line, thus upsetting balance. While this factor might not appear too important at present, when the system is used for color these small changes in impedance could prove disastrous.

For rapid installation of a drop, the reel holding the coax cable and messenger strand should be placed at the base of the pole, where it is to be tied into the system. Enough of both cables should be unreeled to reach the house, at the point of connection. The coax must be run inside the house, either through the wall, if the house is of frame construction, or beneath, if the walls are of masonry or brick construction. Foundation ventilators are very convenient for this purpose. A majority of the installations using our system have been made from under the floor, for appearance and convenience. From the location previously selected for the TV receiver, a ¼″ hole should be drilled through the floor. Going under the house into the crawl-space, coax cable is then fed up into the room, where an assistant secures it. The cable should be stapled to the underside of floor joists, and so on, to keep it up off the ground.

[**To Be Continued**]

TV Parts... Accessories

COLUMBIA COLOR-TV DELAY CABLE

An ultrahigh impedance flexible delay cable, *HH-4000*, that is said to provide higher gain, making it feasible to eliminate a stage of a two-stage video amplifier in color TV receivers, has been developed by Columbia Technical Corp., 5 E. 57th St., New York 22, N. Y.

Cable has a characteristic impedance of 4000 ohms and a time delay of 1 microsecond per foot. Attenuation for a 1 microsecond delay is .2 db at 1 mc, 1.2 db at 4 mc and 3 db at 6 mc, resulting in a bandwidth of 6.2 mc. Pulse rise time is 0.06 microsecond for a delay of one microsecond. Phase characteristic, it is claimed, compensates for delay errors introduced through filter circuits.

Cable is built around a low-loss magnetic core which carries a closely-wound inner conductor of No. 38 wire; heat resistant tape is wrapped around inner conductor helix. Spirally-wound outer conductors consist of individually-insulated wires held in place by overlapping tape. Has a polyvinyl chloride jacket. Cable *od* is .32" and can be bent around a minimum radius of three inches.

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RADIO CONDENSER UHF TUNER

A *uhf* tuner, *T-90*, said to meet *rf* interference requirements of RETMA and FCC, has been introduced by Radio Condenser Co., Davis and Copewood Sts., Camden 3, N. J.

Tuner is claimed to feature a rearrangement of components and shielding which combine to act as oscillator-radiation fixes.

WORKMAN FUSIBLE RESISTORS

Replacement TV fusible resistors, *R7 WTV*, have been introduced by Workman TV, Inc., 309 Queen Anne Rd., Teaneck, N. J.

Resistor, said to provide protection in TV sets using selenium rectifiers, is so constructed that it will burn out when current in circuit exceeds safety point. Supplied with standard installation pins.

WHEN YOU CHANGE YOUR ADDRESS

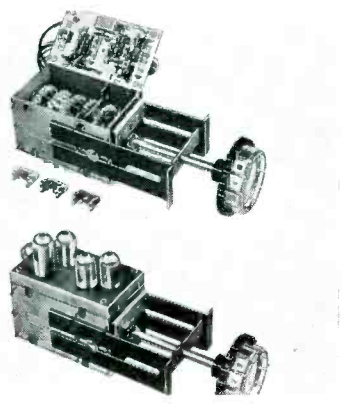
Be sure to notify the Subscription Department of SERVICE at 52 Vanderbilt Avenue, New York 17, N. Y., giving the old as well as the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies mailed to the old address. We ask your cooperation.

ANCHOR VHF-UHF TUNER

An 82-channel tuner, *TV 901*, designed to give instant *vhf/uhf* station selection, has been announced by Anchor Radio Corp., 2215 S. St. Louis Ave., Chicago 23, Ill.

Tuner, no larger than normal *vhf* unit, uses channel segments to suit local station requirements. Segments, which can be snapped into turret in 12 positions, in any desired order, consist of factory-tuned circuits, said to require no further adjustment in the field.

A single conversion circuit is used throughout. A 6AN4 *rf* amplifier operates in both the *vhf* and *uhf* sections. Also employs a 6AN4 mixer-amp, 6T4 oscillator, and 6CB6 *if* amp.

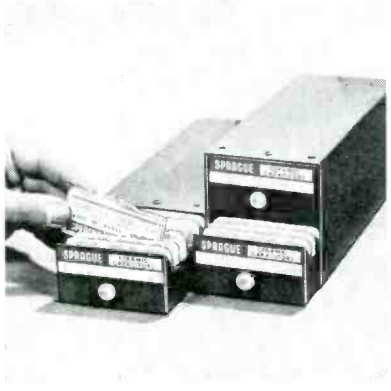


Tools . Parts

SPRAGUE DISC CAPACITOR KITS

Two ceramic-disc capacitor kits, Ceramikit *CK-2* and *CK-3*, for Service Men, have been introduced by Sprague Products Co., 61 Marshall St., North Adams, Mass.

Kit cabinets, made of heavy-gage steel, are pre-stocked at plant with the most frequently used ratings; capacitors are packaged in plastic boxes and indexed with stand-up file separators. One kit, *CK-2*, contains 150 capacitors in 27 ratings; the other kit, *CK-3*, has 75 capacitors in 12 ratings.



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PACKARD TVRS CABLE KIT

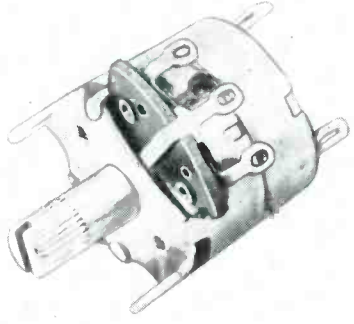
Interference suppression ignition cable (TV and radio), *Packard TVRS*, in kits, with auto distributor clips, terminals and brass screws, are now available from United Motors Service Division of General Motors, GM Building, Detroit, Mich.

Cable can be used to make automotive and marine installations.

CLAROSTAT TWISTED-TAB CONTROLS

Twisted-tab controls, *Series 47*, which can be mounted without bushings, mounting nuts and lock washers, have been introduced by the Clarostat Manufacturing Co., Dover, N. H.

Controls, without power switches, use plastic shafts, which can be adjusted from the front or rear. Power-switch models use metal shafts.



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TACO FM ANTENNAS

A twin-driven yagi, *664*, designed primarily for FM fringe, conflicting signal and interference areas, has been announced by the Technical Appliance Corp., Sherburne, N. Y.

Antenna has three directors, two driven elements and a reflector. Available as a single, or stacked array.

Also available from Taco is an omnidirectional FM antenna, *621* (single) and *624ST* (stacked array). Antenna is a folded dipole formed into an *S*; has a circular pattern resulting, it is said, in equal gain in all directions. Stacked array, with antennas installed at 90° to each other, is said to afford improved circular gain pattern.

ASTRON MINIATURE TUBULARS

A metallized paper, molded plastic, miniature tubular, the *Comet*, has been introduced by Astron Corp., 255 Grant Ave., E. Newark, N. J.

Capacitor is said to offer extra protection against overloads and momentary surges, and has low *rf* impedance, high dielectric strength and improved insulation resistance. Operates up to 125° *C*.

PERSONNEL

IRVING GREENE has been appointed advertising and sales promotion manager of University Loudspeakers, Inc., 80 S. Kenisco Ave., White Plains, N. Y. . . . FRED STEINER, formerly assistant s-m of the Arrow Electronics Audio department, has joined the sales staff.

Irving Greene

Fred Steiner

* * *

HUGO COHN has been elected president of the Radio Receptor Co., Inc., 240 Wythe Ave., Brooklyn, N. Y. He succeeds LUDWIG ARNSON, who is retiring from that post which he held for the past 31 years; he will continue to serve as director and consultant.

Hugo Cohn

John K. McDonough

* * *

JOHN K. McDONOUGH, formerly general manager of the radio and TV division of Sylvania Electric Products, has joined the General Instrument Corp. as vice president of the F. W. Sickles division and as sales director of the division and the parent company.

* * *

DON G. MITCHELL, chairman of the board of Sylvania Electric Products, Inc., has been elected president of the company to fill the vacancy caused by the recent death of H. Ward Zimmer. He will serve in the dual capacity for an indefinite period.

* * *

CHARLES H. GRIFFITH and JOHN M. ZIMMERMAN have been elected vice presidents of the International Resistance Co., 401 North Broad St., Philadelphia, Pa. . . . NORMA L. TESTARDI has been named advertising manager.

* * *

JOSEPH H. GIBBS has been promoted to the post of assistant sales manager of Blonder-Tongue Laboratories, Inc., 526 North Ave., Westfield, N. J. . . . BERNARD A. COLER has been named sales engineer.

Left to right: Joseph H. Gibbs, assistant sales manager; Bernard A. Coler, sales engineer; and Joseph H. Kerner, sales manager.

ADVERTISERS IN SERVICE

MARCH, 1955

NEWS

JENSEN INDUSTRIES DISPLAY CARD

A card for counter use display with 32 three-speed phono-needles is now available from Jensen Industries, Inc., 7333 West Harrison, Forest Park, Ill.

A selection of high, medium and low output needles is included to meet demand for children's and economy-priced phonos.

* * *

NEW COLOR MOVIE PRODUCED BY CHANNEL MASTER

A 30-minute color motion picture, *Up She Goes!*, has been produced by the Channel Master Corp., Ellenville, N. Y.

Film is said to present information about TV antennas, rotators, masting and couplers never before filmed. Movie was made to be shown to TV dealers and Service Men at a series of TV installation clinics sponsored and conducted by Channel Master distributors throughout the country.

Available on loan to radio and TV schools, associations, and other educational institutions.

* * *

EICO TUBE TESTER ROLL-CHART

A '55 tube tester roll-chart, *625-04*, has been released by the Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y.

Chart contains listings of latest tubes released. Printed on 6' long continuous sheet of white paper. Fits on present Eico roller merchanisms.

* * *

JSC LAUNCHES SALES CONTEST

A March-August sales contest among distributors, dealers and TV service organizations and salesmen, has been announced by the Jersey Specialty Co., Inc., Burgess Place, Mountain View, N. J.

Contest, entitled *Time of Your Life* vacation, encompasses grand awards for distributors, salesmen and Service Men consisting of trips to Bermuda on the Furness Line, *Queen of Bermuda*.

Free awards consisting of a coil of 100', 20 gage, 70 mil-web, polyethylene lead-in wire, will be given to the first 5000 entries. Service Men will be asked to write letters stating their best TV wire installation techniques.

* * *

QUARTER-CENTURY ANNIVERSARY

The first and latest edition, 25 years later, of the Sylvania News, said to be the oldest continuous publication of its kind in the electronics industry. The first News, published on March 1, 1930, had a circulation of some 30,000. Today the publication is reported to have a circulation of 130,000. The present editor of the News is C. J. Luten, who has held this position since '51. Immediately preceding him as editor was Robert Penfield; '47 to '51. The first editor, 25 years ago, was Hal Wagner.

JOTS AND FLASHES

TAPE RECORDING-playback equipment and technique standardization, that it is felt will simplify design, streamline operation and lower costs, is now being sought by several component manufacturers. Pointing out that the question of standardization represents one of the chief obstacles faced by prerecorded tapes, one industry spokesman said that there are too many variables in tape machines, such as direction of tape winding, number of tracks, placement of the recording head, and speed of recording. . . . *George Miller,* president of Vidaire Electronics Manufacturing Corp., 576 W. Merrick Rd., Lynbrook, N. Y., has purchased all outstanding shares in the corporation. . . . *J. Howard Allison and Co.,* Atlanta, Ga., agency for Kay-Townes, has moved from 1112 Peachtree St., N.E., to larger quarters at 680 W. Peachtree St., N.W. . . . *Kenneth C. Prince,* who has been exposition manager for International Sight and Sound Exposition, Inc., has sold his stock in the corporation to *S. I. Neiman,* show president. . . . Approximately 1,500 west coast purchasing agents and buyers attended the *R. V. Weatherford* annual electronic industrial show held recently at the Hotel Biltmore, Los Angeles, Calif. . . . *George Learned, Jr.,* has joined Sands Associates, marketing and sales promotion consultants. . . . A $1,500,000 radio-TV-electronic components plant is now being completed at Statesboro, Ga., for General Instrument Corp. . . . A 478-mile microwave radio system linking key compressor stations of the El Paso Natural Gas Co., El Paso, Texas, has been completed by the engineering products division, RCA. . . . The sales department of the Ward Products Corp., a division of the Gabriel Co., has moved operations to 4710 State St., Ashtabula, Ohio. . . . At a meeting of the Phonograph Manufacturers Association, Inc., *A. D. Adams* was reelected executive secretary. . . . *Lee-Muiron Rousseau* has been appointed public relations manager of Jersey Specialty Co., Inc., in charge of publicity, advertising and news releases. . . . *Sangamo Electric Co.,* Springfield, Ill., has acquired assets of the Gothard Manufacturing Co. Latter will operate under the name of Sangamo Generators, Inc., at 2110 Clear Lake Ave., Springfield, Ill. . . . A vibrator dealer-labeling program, which allows a dealer to label his own vibrator components, has been introduced by the James Vibrapower Co., 4038 N. Rockwell St., Chicago, Ill. . . . Purchase of American Microphone Co., Pasadena, Calif., has been announced by the Elgin National Watch Co., Elgin, Ill. . . . Executive offices of Jerrold Electronics Corp. have been moved to 23rd and Chestnut St., Philadelphia, Pa. . . . *Allen Sommers* has been appointed by Snyder Manufacturing Co. to coordinate an overall public relations campaign in cooperation with Brooks and London, the company's ad-agency. . . . Hot-dipped galvanizing process equipment has been installed in a new plant of the Rohn Manufacturing Co., 116 Limestone, Bellevue, Peoria, Ill. . . . *Milton Binstock* has been appointed vice president and sales director for the Sheldon Electric Co. division of Allied Electronics Products, Inc., 68 Coit St., Irvington, N. J. . . . *Howard S. Orcutt,* formerly senior engineer in the rectifier department at FTR, has joined the Pyramid Electric Co., 1445 Hudson Blvd., North Bergen, N. J., as chief engineer of the rectifier division.

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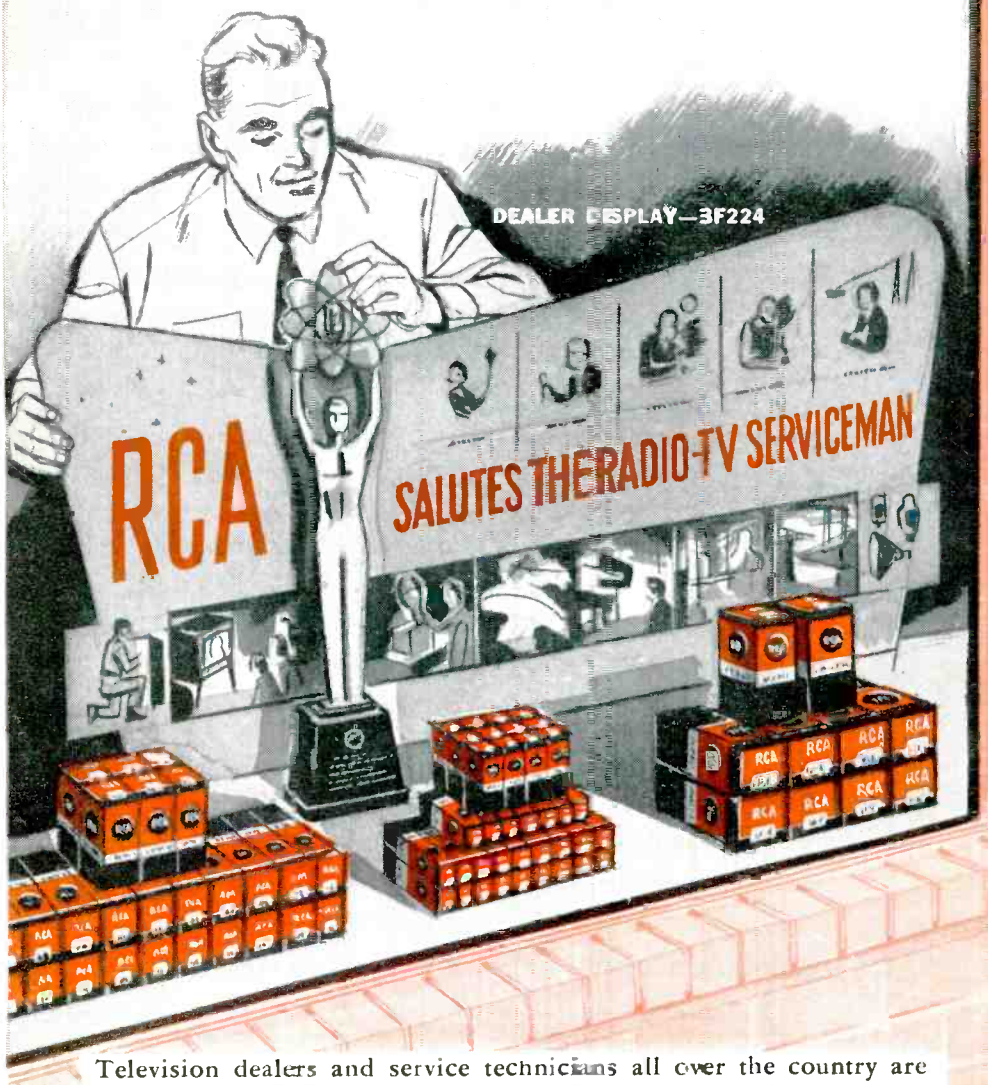
GET READY FOR . . .

NATIONAL TELEVISION SERVICEMEN'S WEEK MARCH 7-12



Television dealers and service technicians all over the country are preparing to tie-in with a great promotional event. It's National Television Servicemen's Week, March 7-12, sponsored by the RCA Tube Division and registered officially with the Chamber of Commerce of the United States.

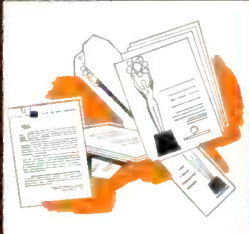
You can use this unique merchandising plan right in your own neighborhood to meet and sell more television service prospects than ever before. Your RCA Tube Distributor offers you excellent promotional materials to help you identify yourself and your store with this nation-wide consumer promotion.

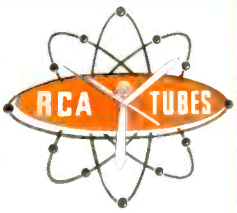
Plan an active participation in National Television Servicemen's Week now. Act today! See your RCA Tube Distributor for full details.

RADIO CORPORATION of AMERICA
ELECTRON TUBES — HARRISON, N.J.

Use These Promotional Materials


ELECTRONIC STATUETTE (3F220)

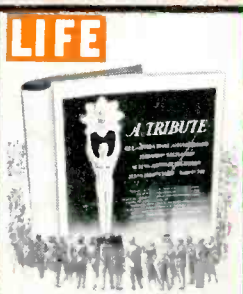

PROMOTION KIT (3F223)



ELECTRONIC SYMBOL CLOCK (3F226)

TV SERVICE SIGN (3F230)


TEST EQUIPMENT AWARDS



A "TRIBUTE" IN LIFE