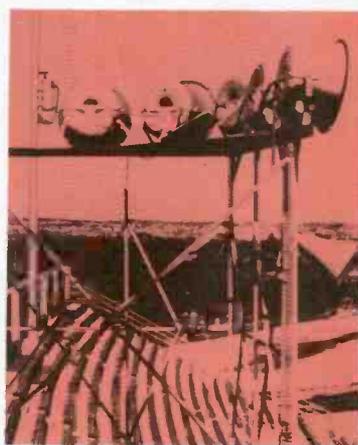
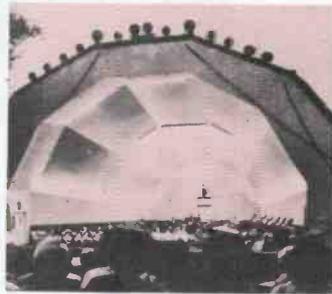
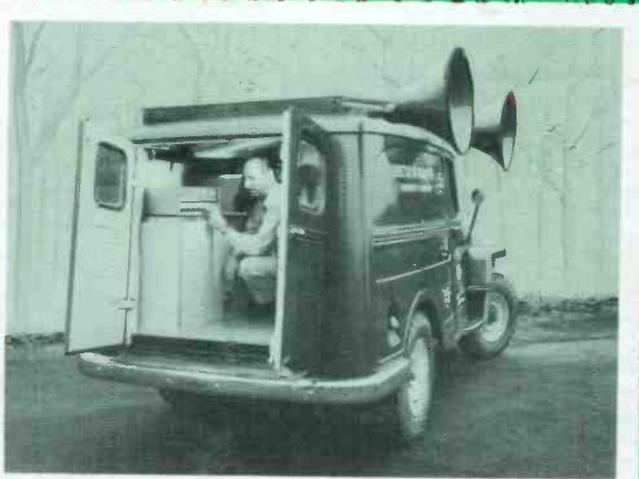


ELECTRONIC TECHNICIAN

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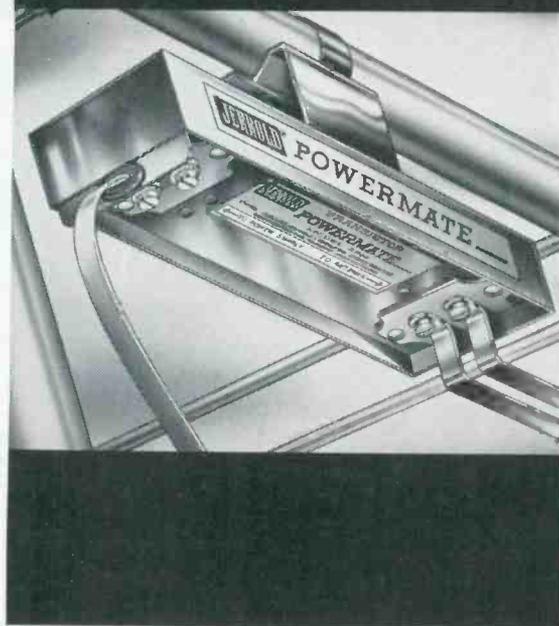
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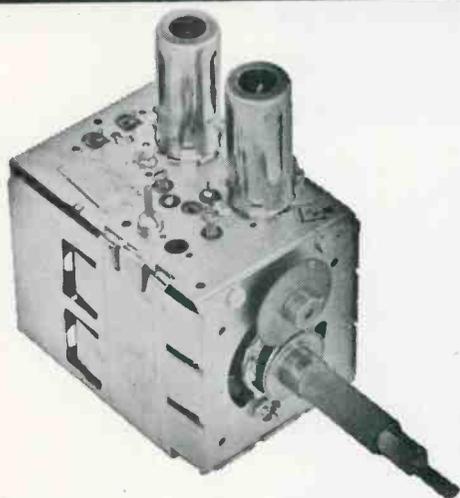
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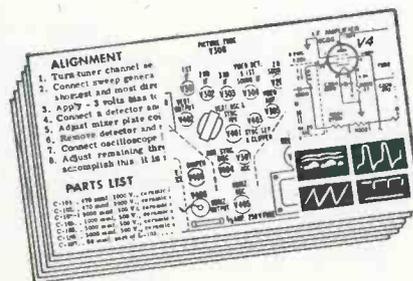
February • 1963

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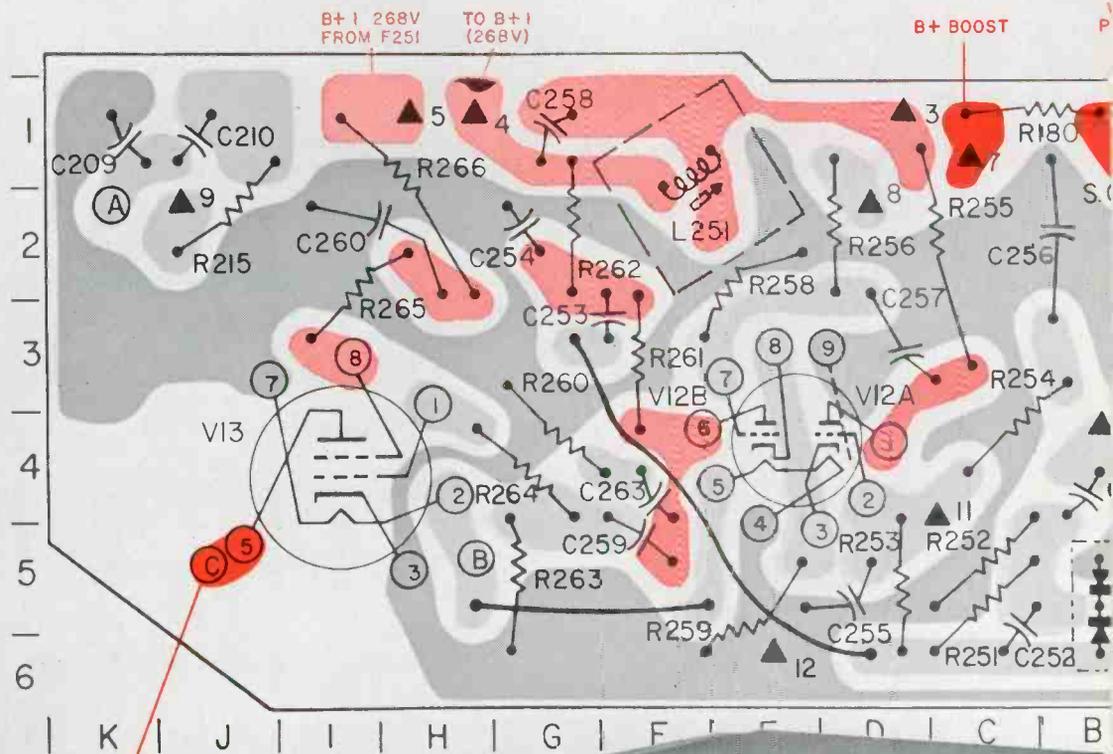
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There is a COLORGRAM Chart (like the sample shown) for each of these TV receiver functions: *IF, Video, Audio, Vertical* and *Horizontal*, (showing sync and sweep circuits), *B+* distribution and *AGC* circuitry.

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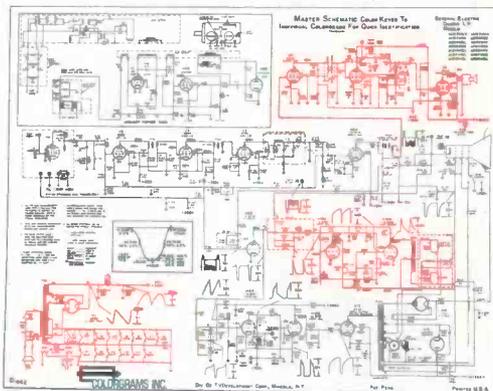
Each COLORGRAM Chart enables you to color-shoot with little or no reference to schematic or manual. If you have a video problem, refer to the Video COLORGRAM Chart—audio problem, the Audio COLORGRAM. The circuit is conveniently color-coded, localized and isolated. Even when a signal leaves the board and then returns, components and signal path are clearly indicated. You can concentrate on that small portion of the set most likely to be the cause of trouble. There's no time wasted working back and forth between schematic and set looking for test points—wading thru superfluous information—identifying components incorrectly.

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- R180-B1
- R215-J2
- R231-C5
- R232-C5
- R233-D5
- R254-C4
- R255-C2
- R256-D2
- R258-E2
- R259-E5
- R260-G4
- R261-F3
- R262-G2
- R263-G5
- R264-G4
- R265-I3
- R266-H2

DIODE

- Y251A/B-B5

CAPACITORS

- C209-K1
- C210-J1
- C251-B4
- C252-C5
- C253-F3
- C254-C2
- C255-D5
- C256-B2
- C257-D3
- C258-G1
- C259-F5
- C260-H2
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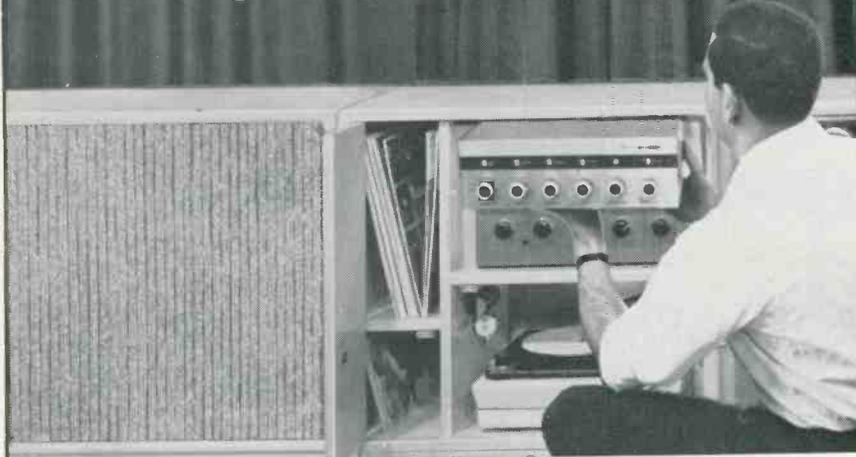
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CITY _____ ZONE _____ STATE _____

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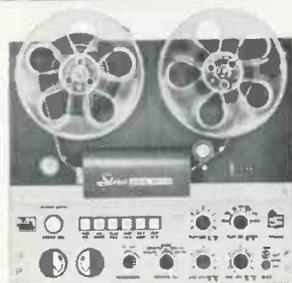
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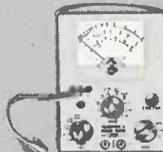


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LETTERS TO THE EDITOR

Transistorized Ignition

Editor, ELECTRONIC TECHNICIAN:

Could you send me the values and ratings of the resistors, transistors, diode and ignition coil of the transistorized ignition system that appeared in the March, 1961 issue of ELECTRONIC TECHNICIAN?

PAUL J. ROSA

Stamford, Conn.

• *The manufacturer refused to give component values when requested.—Ed.*

Indonesia Wants CATV Info

Editor, ELECTRONIC TECHNICIAN:

We have read a very interesting article in your February 1962 ELECTRONIC TECHNICIAN. As you know, TV has just started in Indonesia, so the existence of a relay station in a fringe area is very attractive. We would be very much pleased if you could send us the address of the maker of these installations . . . If it is not too much trouble, please request the maker to send us more detailed information . . .

P. N. "RALIN"

Bandung, Republic of Indonesia

• *We are requesting a number of CATV equipment manufacturers to send you further information.—Ed.*

More on O'Kelley Quotes

Editor, ELECTRONIC TECHNICIAN:

I have read page 25 of your November issue and I am compelled to remark on the situation of distributors as related by Mr. Fred M. O'Kelley. Let me say first of all that I agree with much of what Mr. O'Kelley has to say concerning the relationship of parts-to-labor charges and could add many more factors would space permit.

What I really do not completely agree with is the plight of the distributors or rather should I say how their dilemma was really achieved. Mr. O'Kelley wants to attribute most of the blame to the service trade and while I can only attest for what prevails in my area I would be much surprised if it was not typical of most other areas. Mr. O'Kelley states that we want instant service, credit, free delivery, premium merchandise, etc. I grant that most of us do but it was not our idea. We have distributor after distributor pursue us with these promises. Each one loudly proclaiming faster service, super-duper merchandise, liberal

ELECTRONIC TECHNICIAN



When is Big too Big?

When you "outgrow" your customers?

When you ration service according to their size?

When you put sales volume ahead of product quality?

When your service loses the *personal* touch?

When you become so self-important that you stop cooperating
with the service technicians who helped build your business?

In short, when you forget that your first and biggest job is satisfying your customers?

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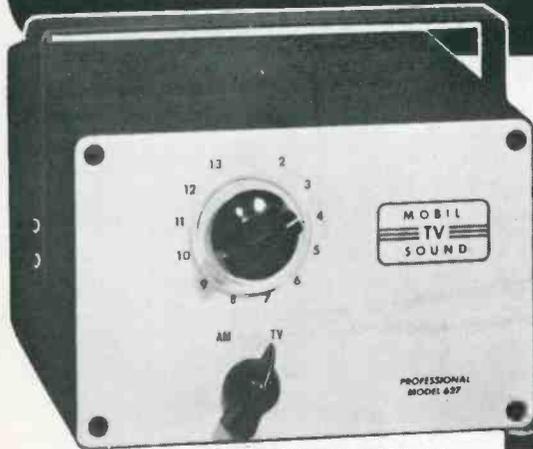
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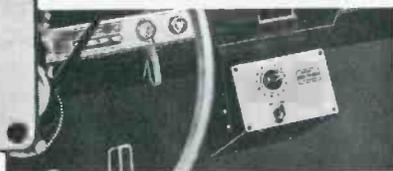
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Unit— Easily
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The MobilSound Corporation is now expanding sales to the general consumer market (50,000,000 car-owners) and is seeking Distributors, Dealers and Sales Tech-

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TECHNICAL DATA

The AudioMonitor is custom-manufactured to professional specifications by a leading West Coast Electronics firm. The tuner is specially designed, using premium grade transistors to provide extra-sensitivity for long range reception (up to 70 miles). No special antenna is required (uses existing car-radio antenna). Receives channels 2 thru 13. Uses audio-power and speaker of AM car radio (12V) to provide full, clear static-free reception in areas of normal signal strength. Use of car radio not impaired. Size 4x6x7". Installation is simple — fits neatly under dash and plugs into car radio antenna-socket. Warranty provided.

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credit and each one "scampering" to beat the other guy's price on tubes, antennas and what have you, just to keep the other fellow from getting the business.

I grant you Mr. O'Kelley we have been spoiled by this kind of molly coddling as you call it but I think that you have the cart before the horse or perhaps you are confused by "which came first the chicken or the egg." I do the bulk of my business with a distributor who does not quote the lowest prices on tubes and who is a little higher on his prices than most. He is fairly strict about credit and has the least number of premium offers and "deals." But I can rely on him to be at my shop on the day that he says he is coming. I can believe him when he relates the merits of a product and the orders are usually filled accurately and shipped within a reasonable time. In short, this distributor concentrates on service and delivers it which is contrary to the majority of others who only talk about it. With most of them the problem lies not with the salesman but with the help at the warehouse and what seems to be their utter disregard for their employer's interests.

Unions have fostered much of this attitude in a great many cases by making it nearly impossible for employers to fire help for indifference or neglect. Another factor is the same malady which plagues the service trade, the farmer and I imagine many other trades, and that is the lack of organization. As long as distributors and the service trade remain ungovernable the perverse element of each will tend to assure a situation such as described by Mr. O'Kelley.

BRUCE KING

Frederic, Wis.

Ditto On O'Kelley

Editor, ELECTRONIC TECHNICIAN:

I disagree 100% with O'Kelley's remarks . . .

J. B. LEACH, JR.

Linthicum Heights, Md.

Circuit Digest Indexes

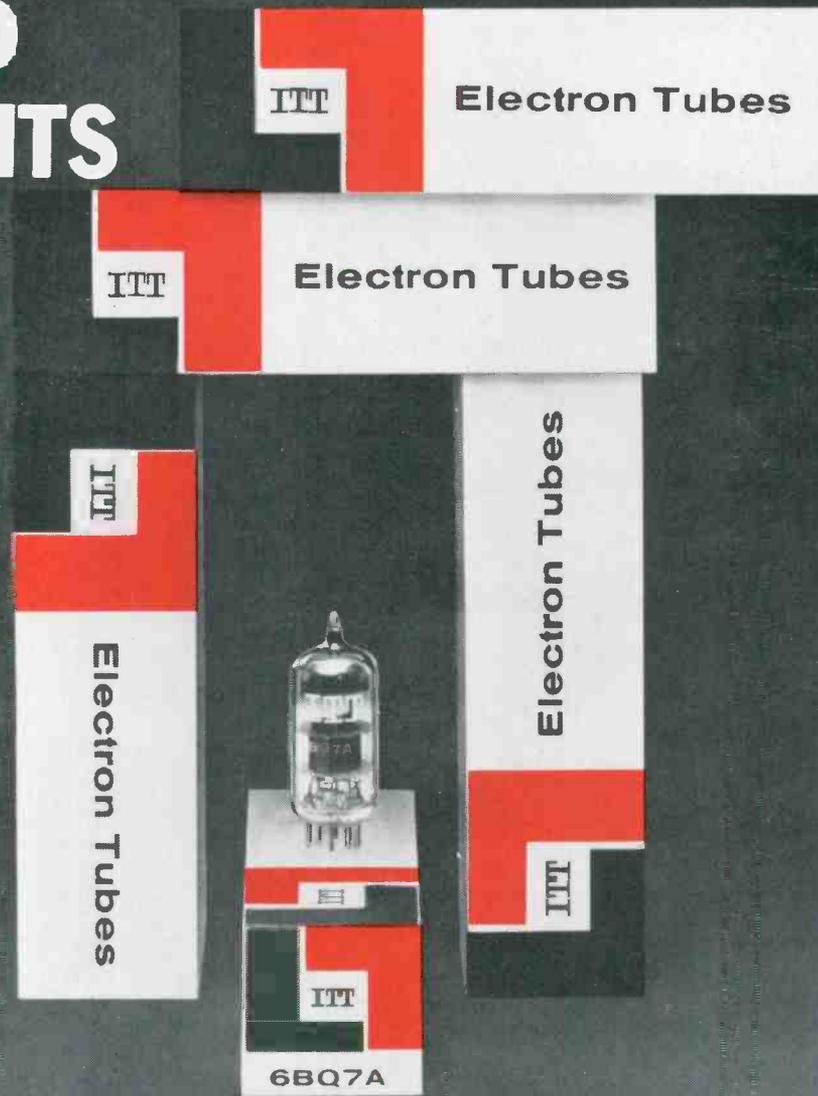
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PROFITS
WITH**



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confidence-builder, "**the ITT TUBE STORY**", pamphlet. Give one to your customers — they may give one to you (a customer, that is).



The next time you pick up ITT TUBES, ask your distributor to tell you the details of our Partnership in Prestige and Progress program — you can participate in this Dealer Award Plan.

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WITHOUT ADAPTORS OR ACCIDENTAL TUBE DAMAGE



the all NEW

Featuring Automatic
Controlled
Rejuvenation

\$69.95

SENCORE

CR125 CATHODE RAY TUBE TESTER

From SENCORE, designers of the famous Mighty Mite Tube Tester and other valuable time savers, comes another industry best. An all new method of testing and rejuvenating picture tubes. Although the method is new, the tests performed are standard, correlating directly with set-up information from the RCA and GE manuals.

Check these outstanding features and you will see why this money making instrument belongs on top of your purchasing list for both monochrome and color TV testing.

Checks all picture tubes thoroughly and carefully; checks for inter-element shorts, cathode emission, control grid cut-off capabilities, gas, and life test.

Automatic controlled rejuvenation. A Sencore first, preventing the operator from over-rejuvenating or damaging a tube. An RC timing circuit controls the rejuvenation time thus applying just the right amount of voltage for a regulated interval. With the flick of a switch, the RC timer converts to a capacity type welder for welding open cathodes. New rejuvenation or welding voltage can be re-applied only when the rejuvenate button is released and depressed again.

Uses DC on all tests. Unlike other CRT testers that use straight AC, the CR125 uses well filtered DC on all tests. This enables Sencore to use standard recommended checks and to provide a more accurate check on control grid capabilities. This is very important in color.

No interpretation chart. Two "easy view" neon lights clearly indicate shorts between any element. A chart is included for interpretation of shorts, if desirable. This chart is not necessary for normal testing on the CR125.

No adaptor sockets. One neat test cable with all six sockets for testing any CRT. No messy adaptors, reference charts or up-dating is required. The Sencore CR125 is the only tester with both color sockets. (Some have no color sockets, others have only the older type color socket.)

No draggy leads. A neat, oversized compartment, in the lower portion of the CR125 allows you to neatly "tuck away" the cable and line cord after each check in the home.



All six sockets, including latest color socket, on one neat cable.

SENCORE, INC.
426 S. WESTGATE DRIVE
ADDISON, ILLINOIS

SPECIAL INTRODUCTORY OFFER WORTH \$5.00

Most SENCORE products are sold by recommendation. So that you will be first in your area to buy and recommend the CR125, this coupon is worth \$5.00 on the purchase of the CR125 when presented to your parts distributor.

Why not save \$5.00 now?

Herb Bowden
President

... for more details circle 36 on post card

LETTERS

TO THE EDITOR

could still be able to start on his own file.

ROBERT L. STEVENS

Pittsburgh, Pa.

• Each issue of ET carries an additional Circuit Digest index on the title page (page 5) which can be clipped out to avoid mutilating the first Circuit Digest page.—Ed.

From the Philippines

Editor, ELECTRONIC TECHNICIAN:

We wish to congratulate your wonderful electronic trade magazine for its rare, direct and non-biased articles. Also America's Electronic-Market best advertised products are printed clearly to attract the buyer's eyes.

ALFRED B. CHEO

Davao Amusement Equipment
Davao City, Philippines

Kudos

Editor, ELECTRONIC TECHNICIAN:

Let me take this opportunity to congratulate you on the fine job you're doing with ELECTRONIC TECHNICIAN. . . .

LON CANTOR

Blonder Tongue
Newark, N. J.

Editor, ELECTRONIC TECHNICIAN:

I have been a reader of ELECTRONIC TECHNICIAN for five years. No other magazine gives me as much as this one. . .

CLARENCE M. FARRAND

Detroit, Mich.

Editor, ELECTRONIC TECHNICIAN:

. . . your Circuit Digest is of outstanding value; (it) means money in my pocket.

JAMES R. BALL

San Jose, Calif.

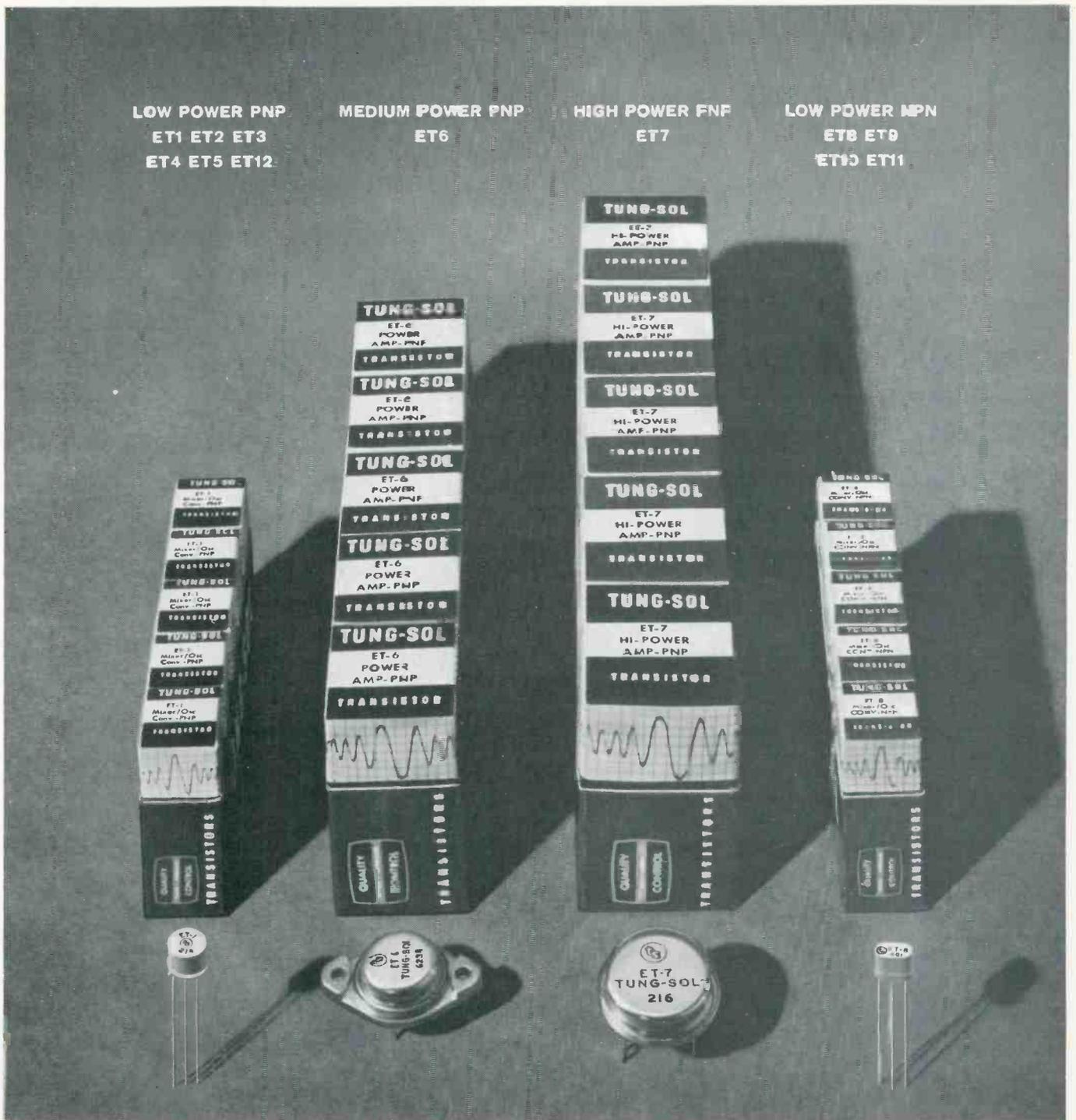
Editor, ELECTRONIC TECHNICIAN:

I certainly do enjoy your magazine. Almost always read it from cover to cover the first day it arrives. Of course I'd enjoy it more if there were more technical articles. One thing I have observed and appreciate: the articles are written in the language of the average technician. I can understand it. This is something many present-day magazines cannot boast of . . . your schematics have really been of great value to me. Sure wish I had a full set.

CASSEL D. TYSON

Rockville, Ind.

ELECTRONIC TECHNICIAN



THE EASY WAY TO SERVICE TRANSISTORIZED AUTOMOBILE AND HOME RADIOS

STOCK THE TUNG-SOL "ET" TRANSISTOR LINE. There are many reasons why more and more servicemen are buying the Tung-Sol ET transistor line ■ It's the industry's more comprehensive replacement line, with both PNP and NPN types for 6, 9 and 12 volt supply requirements ■ They are factory-designed for specific service, with the tube cartons plainly marked for functions ■ They are warranted by Tung-Sol to work interchangeably as specified ■ Speaking of interchangeable, the Tung-Sol Interchangeability Guide is the most useful for service work. Ask your supplier for a free copy. Tung-Sol Electric Inc., Newark 4, New Jersey.

TELL YOUR SUPPLIER YOU'D RATHER HAVE  **TUNG-SOL**[®]

for more details circle 40 on post card

TEST INSTRUMENTS for Bench and Caddy



COLOR GENERATOR

B&K Color Generator model 850 at \$195.95. The B&K people have come up with an instrument which will help you technicians who were late getting on the color wagon catch up with those who started several years ago. And those of you who started several years ago would do well to look this instrument over to see how much easier you can make color alignment and troubleshooting. Regardless of the dial setting on the 850, a viewer on the front panel shows you what you should see on the TV screen.

Checks which previously required some degree of de-convergence by twisting the controls can now be made by fitting the de-convergence adapter on the neck of the CRT. Another cable connected to the CRT socket allows any combination of the color guns to be killed for purity adjustments, etc. The colors for these settings are also displayed on the test set viewer.

An RF output is connected to the antenna terminals of the set to simulate actual broadcast conditions. The amplitude of the video can be adjusted to check for video strength action on the color sync.

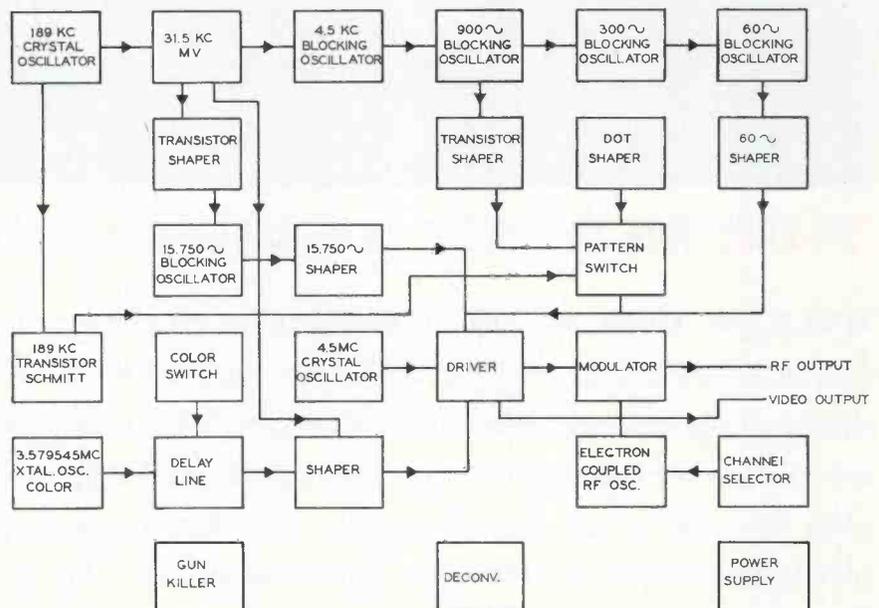
Without any change of connections to the TV, the color generator will produce dots, vertical bars, horizontal bars, crosshatch and color bars. In the color bar position,

various NTSC colors can be presented on the TV screen. If at the same time certain guns in the CRT are killed, the color presentation of certain color tones on the CRT screen will become the same—if the demodulators are properly adjusted. If not, each demodulator transformer is simply adjusted until they are the same. The demodulator alignment can actually be accomplished in less than 10 minutes! Although a scope can be used for this adjustment, when the CRT is used as an indicator all of the prior ad-

justments are also double checked.

To assure proper adjustment of the set's fine tuning, a sound crystal is provided to key the adjustment.

To the best of our knowledge, the model 850 performs more functions for color alignment and testing than any other test set. It is also the easiest-to-operate of any color generator we have tested. The generator is small and very portable. A removable hinged front cover protects the unit in transit. All cables are neatly tucked away in a rear compartment.



Block diagram of B&K's color generator.



RCA Senior Voltohmyst, model WV-98C at \$79.50 wired, \$57.95 kit. The 98C VTVM is truly a pleasure to use. Two simple controls, plus the zero adjustments (which rarely have to be touched) make it ideal for any service bench.

SENIOR VOLTOHMYST

A 6½ in. meter makes all the readings easy, and a 0.5 v scale puts troubleshooting transistor circuitry on par with vacuum tube circuitry.

We built the unit from a kit. It was neatly packaged in separate boxes which could be opened as the kit progressed. Although no trouble was encountered in building the kit, it wasn't the easiest kit we have assembled, either. Our construction time including calibration was about six hours.

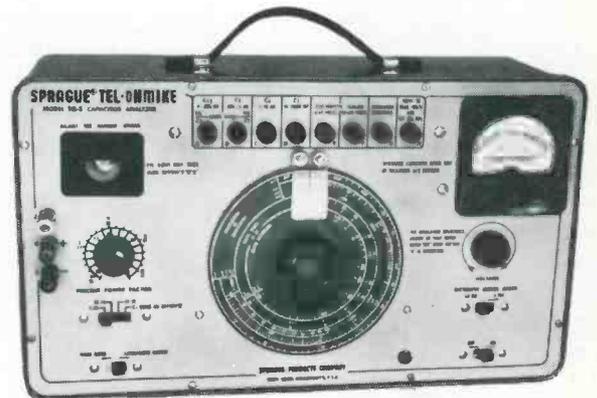
Precision components are used throughout the unit. The accuracy of the meter was outstanding — the meter is conservatively rated at 3 percent accuracy. In all our tests

we found the meter is as accurate as the eye can read it. The scales are color coded to differentiate between p-p and RMS readings. The actual measuring range is largely a matter of interpretation. The ranges claimed by RCA can easily be read; ac: 0.2 to 4200 v, p-p; 0.1 to 1500 v RMS. dc: 0.005 to 1500 v. And resistance: 0.2 ohms to 1000 megohms.

The single probe for the instrument comes completely assembled containing a switch for dc and ac-ohms functions.

The unit is well-built, attractive and a good buy for almost anyone's bench.

MODEL TO-5 TEL-OHMIKE ANALYZER



Sprague Model TO-5 Tel-Ohmike Analyzer at \$92.50 — How many times have you wondered whether or not you should change a capacitor that looks "funny" or one you think "could cause the trouble?" After changing some of these suspects, you often find you are exactly where you started. And worse, if you didn't change them you may have been faced with a callback—and when you did change them, you never knew if you saved yourself a call-back or wasted your time.

The TO-5 is a simple way around such problems. It is a high quality capacitor checker capable of measuring leakage in paper, ceramic

and mica types up to 20,000 megohms. Electrolytics can also be tested but, of course, are not tested for leakage. Power factor and value can be determined for any capacitor from 1 pf to 2000µf. In addition to checking capacitors, the unit's bridge will accurately determine transformer turns ratios from 1:1 to 100:1 and impedance ratios from 1:1 to 10,000:1.

Having been a standard for some time, the tester is not equipped to check low voltage type capacitors found in transistor radios. A Wien Bridge is used to determine capaci-

tor value and power factor. A "magic eye" tube is employed as a null indicator for the bridge. Up to 600 v is applied to capacitors for the leakage test.

Push buttons are used to select the type of test and the range to be used. Disengaging of the push buttons automatically discharges capacitor under test.

The unit is handsomely styled in a dark grey enamel case with a light grey panel. Operation is easy, and can be learned in a few minutes with the instruction manual supplied.

MANUFACTURERS TECHNICAL DIGEST

GENERAL ELECTRIC

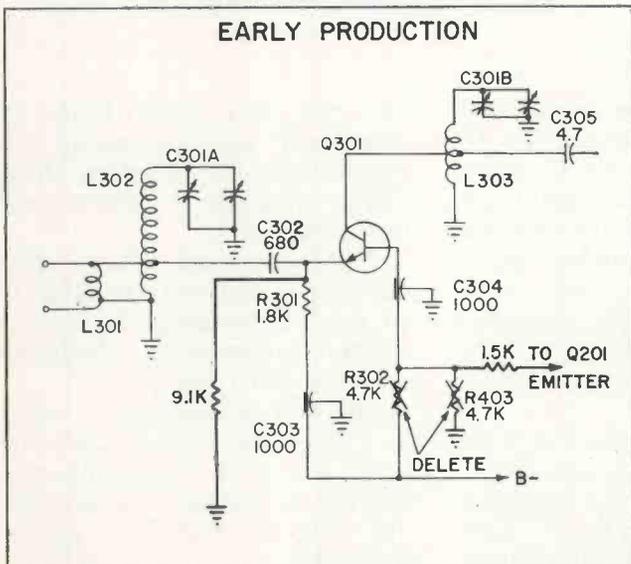
Models 69A33, -35 or 30T31 Stereo Phonographs —
Apparent Loss of Highs

In the event that a complaint is received indicating a "loss of highs" in the aforementioned Models, before checking for trouble in the chassis, check the expanded stereo switch at the receiver's back to see that it is in the "up" position. When in the "down" or expanded stereo position, the tweeters in the receiver are out of circuit and if satellite speakers are not being used, loss of highs may be apparent.

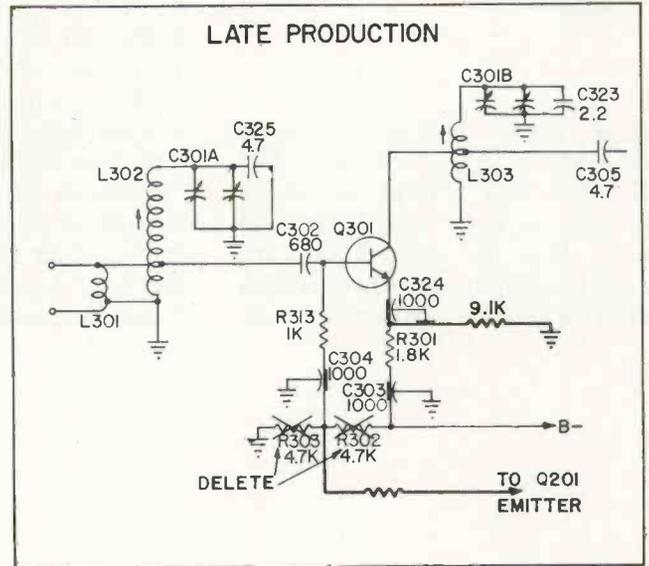
MAGNAVOX

R201 AM/FM Radio Chassis—Distortion of FM Stereo Reception

The cause of distortion in certain areas has been caused by an overload condition in the FM RF stage. This can be corrected in the field by adding AGC to the FM RF transistor. This change is being incorporated in production and will be identified by the chassis production code R201-01-10. Earlier chassis can be modified by adding a 1.5K, 1/2 w resistor and a 9.1K 1/2 w resistor and removing two 4.7K resistors. The 1.5K resistor is connected back to the 1st IF transistor emitter (Q201) and the voltage developed across emitter resistor (R202) is used as AGC bias. Details



FM stereo distortion can be eliminated in Magnavox R201 AM/FM radio chassis by making changes as shown.

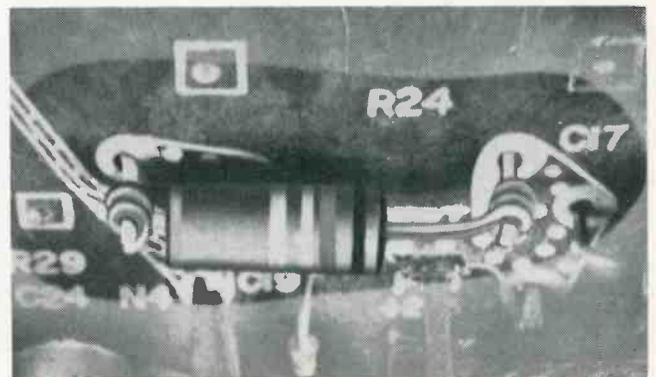


of the modification are shown here in two diagrams for the early and late productions.

PHILCO

Perma-Circuits — Component Replacements

Replacement of most components of these panels is best done from the top, *component side*, for the following reasons: 1 — Prevention of excessive heating of the foil which may cause it to break free of the panel, 2 — damage to the protective coating sprayed on the foil side of the panel is prevented, 3 — the repair is made completely from the panel top — in many cases eliminating the need for chassis removal. As shown, the defective component is clipped out leaving about



Belden

TV lead-in cables

give better pictures

(and cartoons, too!)

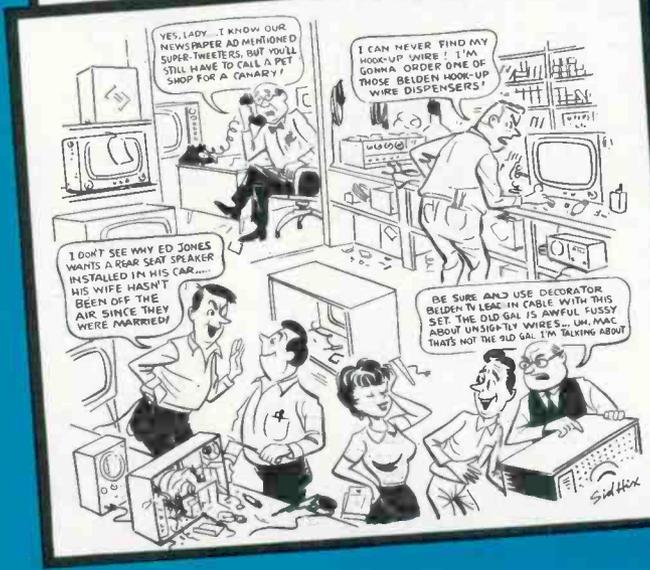
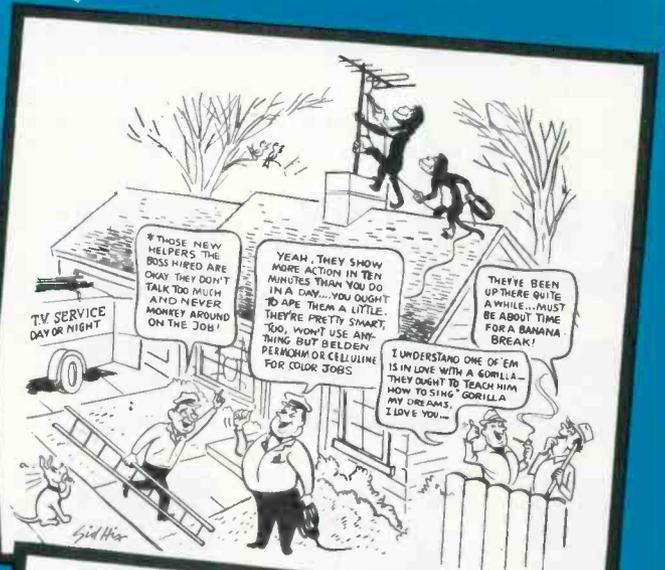
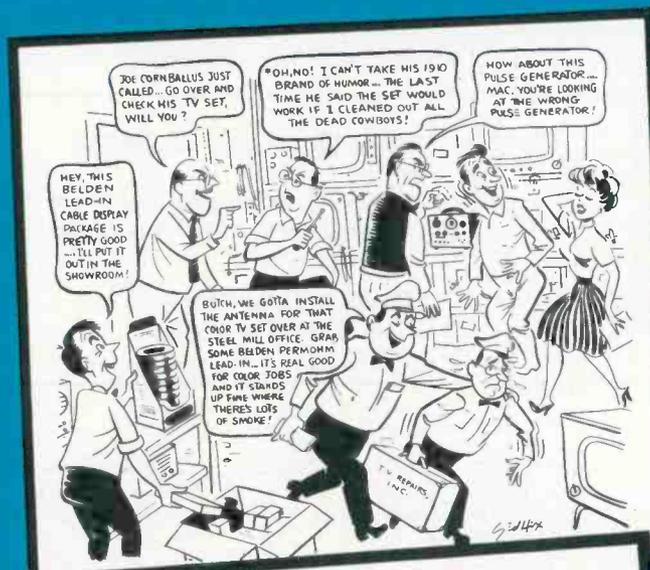
Instead of running an ad about how good Belden lead-in cables are, we thought you might enjoy re-reading some of the recent cartoons we have published. Besides, you already know that Belden Weldohm* is strong and flexible... Permohm[✓] and Celluline[✓] give better color TV pictures... and Permohm gives better signals in spite of industrial contamination and salt spray... don't you?

*Belden Trademark—Reg. U.S. Pat. Off.

✓Belden Trademarks and Patents—U.S. Patent No. 2782251 and 2814665

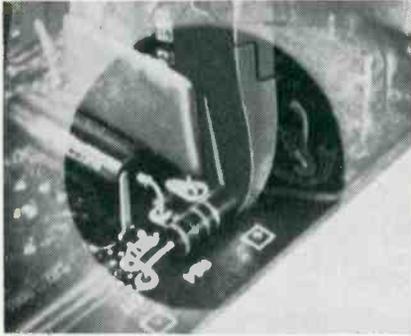


power supply cords • cord sets and portable cordage • electrical household cords • magnet wire • lead wire



8-13-2

MANUFACTURERS TECHNICAL DIGEST



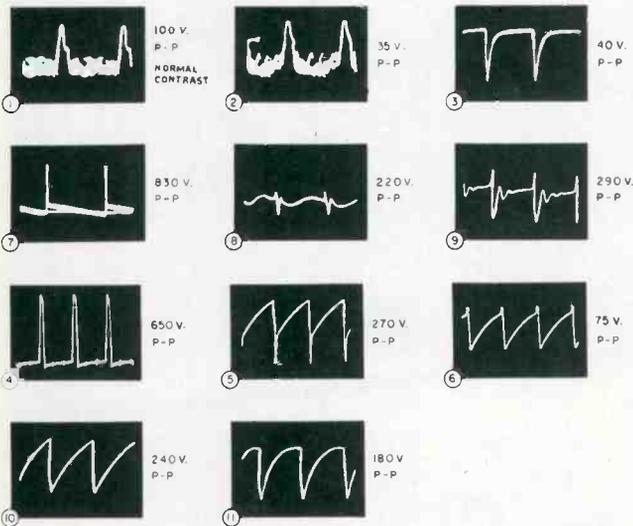
Method of replacing components in Philco's Perma-Circuit panels.

¼ in. of pigtail lead on either end. These leads, once straightened, serve as mounting points for the new replacement component.

RCA

Chassis KCS140 — Waveform Discrepancies

Certain waveforms shown on pages 13 and 14 in the 1962-No. T3 Service Data pertaining to this chassis are in error. Correct waveforms are shown here. Also in



Correct waveforms for RCA chassis KCS140.

1962-No. T3, captions for the marker generator and sweep generator on page 4 are reversed. The titles should be interchanged so that they conform with their functions.

WESTINGHOUSE

Remote Receiver V-2386 — Some Troubles and Remedies

Several shorted tubes have been found in these receivers and some had low gain. Shorted 40 kc ampli-

fier tubes caused no operation on any function. Weak tubes in the 40 kc amplifiers and relay amplifiers reduced sensitivity of one or all remote functions.

Bent or dirty relay contacts are another source of trouble. These troubles can be found by making a visual check of the relays.

To check the relays and their associated amplifiers: For Channel Up function — use an insulated jumper and short the grid (pin 2) of relay amplifier V6A to ground. The Volume Change circuit is checked by shorting the grid (pin 2) of the Volume Change relay amplifier V7A to ground. If the Volume Change relay amplifier grid is grounded at the same time as one of the Channel Change amplifier grids, volume will change either up or down, depending on which Channel Change relay is closed.

Note that relay K1 ground is in the circuit of K2 and K2 ground is in the circuit of K1. Do not forget to check the back contacts for proper grounding in the de-energized relay.

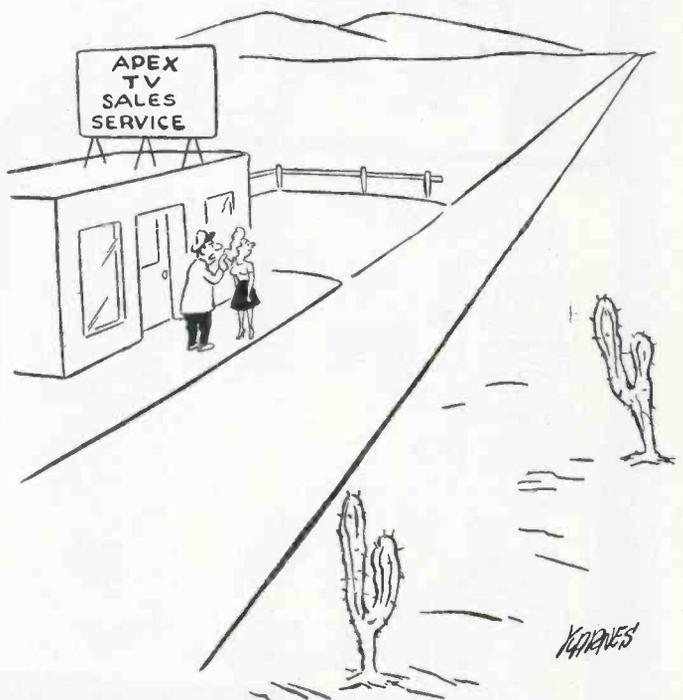
These checks do not eliminate the AGC or relay bias circuits as a source of trouble. Voltage and resistance measurements must be made here.

The only sure way to check the remote receiver up to the relay amplifiers is to use a signal generator capable of providing accurate 39 kc, 40 kc and 41 kc signals. Defective discriminator transformers, resistors and capacitors can be found in this manner.

IF YOU CHANGE YOUR ADDRESS

☆ Try to let us know in advance — (because 6 weeks should be allowed for the change to go into effect).

OJIBWAY BUILDING
DULUTH 2, MINNESOTA



"Won't make out? Why, there isn't any competition within two-hundred miles."

Find it and Fix it in 1/2 the time!

EASILY SOLVES "TOUGH DOGS"... INTERMITTENTS... ANY TV TROUBLE



B&K MODEL 1076 TELEVISION ANALYST BLACK & WHITE AND COLOR

By Easy Point-to-Point Signal Injection, You see the Trouble on the TV Screen and Correct it—Twice as Fast and Easy!

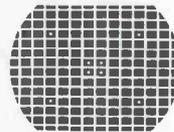
Simplified technique stops lost hours never recovered on "tough dogs", intermittents, and general TV troubleshooting. This one instrument, with its complete, accurate diagnosis, enables any serviceman to cut servicing time in half... service more TV sets in less time... satisfy more customers... and make more money.

With the Analyst, you inject your own TV signals at any time, at any point, while you watch the generated test pattern on the picture tube of the television set itself. This makes it quick and easy to isolate, pinpoint, and correct TV trouble in any stage throughout the video, audio, r.f., i.f., sync and sweep sections of black & white and color television sets—including intermittents. No external scope or waveform interpretation is needed. Checks any and all circuits—solves any performance problem. Gives you today's most valuable instrument in TV servicing—proved by thousands of professional servicemen everywhere.

Available on Budget Terms. As low as \$30.00 down.

Net, \$29995

SIMPLIFIES COLOR TV SERVICING, TOO



Enables you to troubleshoot and signal trace color circuits in color TV sets, or facilitate installation.



Generates white dot, crosshatch and color bar patterns on the TV screen for color TV convergence adjustments.



Generates full color rainbow display and color bar pattern to test color sync circuits, check range of hue control, align color demodulators. Demonstrates to customers correct color values.

Time-Saving, Money-Making Instruments Used by Professional Servicemen Everywhere



Model 960 Transistor Radio Analyst



Model 360 V O Matic Automatic VOM



Model 375 Dynamatic Automatic VTVM



Model 700 Dyna-Quik Tube Tester



Model 440 CRT Rejuvenator Tester

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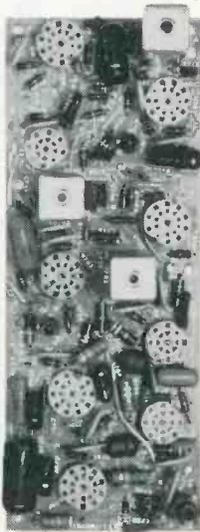
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*Every RCA Victor New Vista® TV uses
Space Age Sealed Circuitry...Circuits
that are dependable and...*

easy to service



Old-fashioned all hand-wired Circuitry



Precision Crafted RCA
Space Age Sealed Circuitry

Let your own TV
service records
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dependability
of RCA Victor
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SEE WALT DISNEY'S "WONDERFUL WORLD OF COLOR" SUNDAYS, NBC-TV NETWORK



The Most Trusted Name in Electronics

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FM Stereo Problems

It was obvious long ago (Editor's Memo ET May 1962) that all was not well with FM stereo. Now the Electronic Industries Association's AM/FM Broadcast Equipment Section has taken preliminary steps in a direction calculated to improve the situation. This action has come about only after rumblings of dissatisfaction from listeners who have invested their hard-earned cash in expensive receiving equipment.

FM stereo is faced with two major problems that must be solved quickly if stunted growth is to be avoided: (1) Unrefined transmission techniques, and (2) sub-standard reception conditions. The first is a responsibility of the FM stereo broadcaster and the second belongs to service-dealers and technicians.

The EIA section proposes that appropriate bodies of its engineering department develop informational material to help FM stereo broadcasters determine signal quality more accurately. Special monitoring equipment is urged. This equipment, not now in existence, must be developed. Instruments would be designed to adequately measure transmitted FM stereo signal parameters in accordance with FCC standards. The EIA section proposes that the FCC, in keeping with its usual procedures, issue a notice of inquiry to broadcast equipment manufacturers and others to

determine what type of monitoring equipment and techniques are needed to comply with FCC FM stereo broadcast standards.

EIA's Broadcast Equipment Section plans to ask FM stereo receiver manufacturers to institute a program to educate dealers and the listening public in the proper use of FM stereo sets. This job, including proper installation of equipment and outdoor antennas where necessary, will ultimately end up at the door of local TV-radio service-dealers and technicians. No other group can solve this problem.

Service-dealers will have to level with customers regarding differences in equipment quality and equipment costs. Good reception may require a well designed outside antenna. In some cases a high-gain antenna plus a mast-mounted preamplifier will be necessary. In still other situations a customer may have to be sold on the "works" — a top quality antenna, preamplifier and rotor — if good reception and adequate coverage is desired.

If you want to handle FM stereo business it will be necessary to make a thorough study of local conditions and bone-up quickly on the technical knowledge you will need to match competitive service standards in this profitable area.

Charging Enough for Your Services?

The Small Business Administration's Marketers Aid No. 81 effectively hammers home one point we have been harping on for years: People are buying more and more quality services and they are willing to pay for it. Some TV-radio service-dealers and technicians already know this — and the bacon-packages they bring home each day grow heavier.

The report points out that small businessmen in increasing numbers are recognizing that one of their greatest strengths is personal service. In fact, some of them are experiencing extraordinary growth by selling service. And indications are that people will continue to buy increased amounts of services.

TV-radio repair services have increased 60 percent since 1954. Why, then, do some technicians find it difficult to make adequate charges for their services? Some TV service organizations, for example, have been charging from \$5 to \$7.50 for house-calls for years — with additional charges after 30 minutes in

the home. None of these organizations appear to have suffered shrinking pains.

It has been shown by a number of surveys that the \$3 service call is profitable only in heavily populated apartment-house areas where technicians frequently walk to eight or 10 calls a day within a four or five block area, sometimes covering two or three jobs in one house. It is generally conceded that those operations charging less than \$3 for a house call must make up the difference in other ways.

Service charges begin around \$5 in average populated areas where technicians employ cars or trucks for all calls and travel considerable distances. Five or six calls are made in a normal work day.

Every technician who is confident of his ability to give quality service should be charging enough to make a reasonable profit over and above normal salary and operating expenses. If not, it is doubtful if he will remain in the business very long.

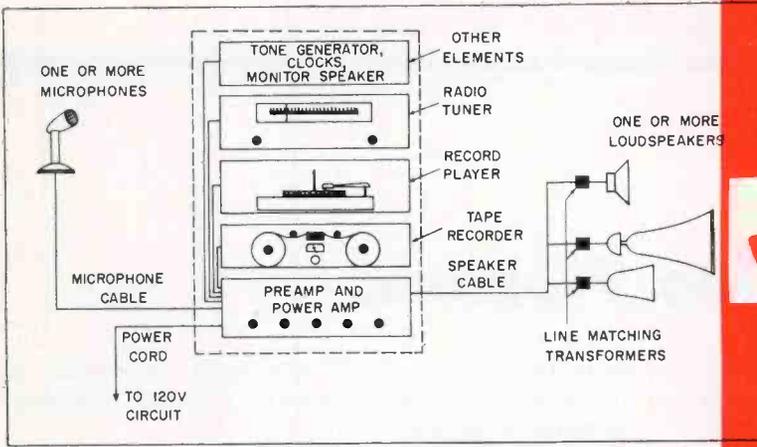


Fig. 1—Components in a typical basic sound system.

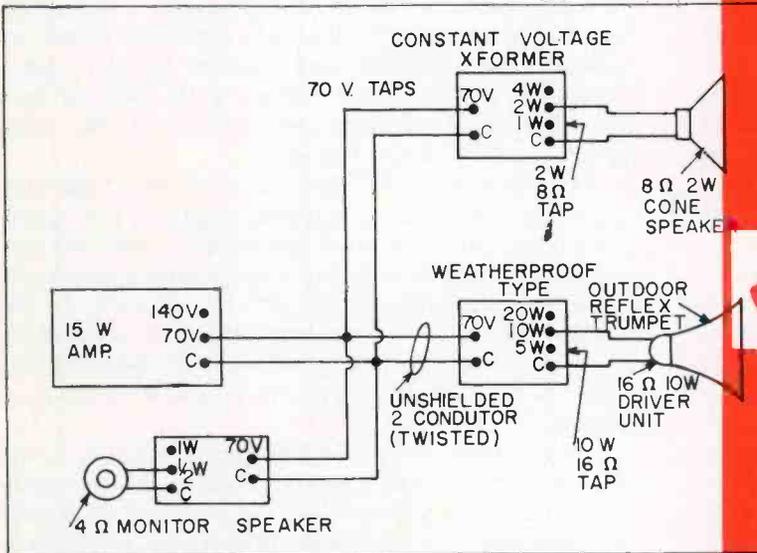


Fig. 2—Speaker hookup using constant voltage transformers.

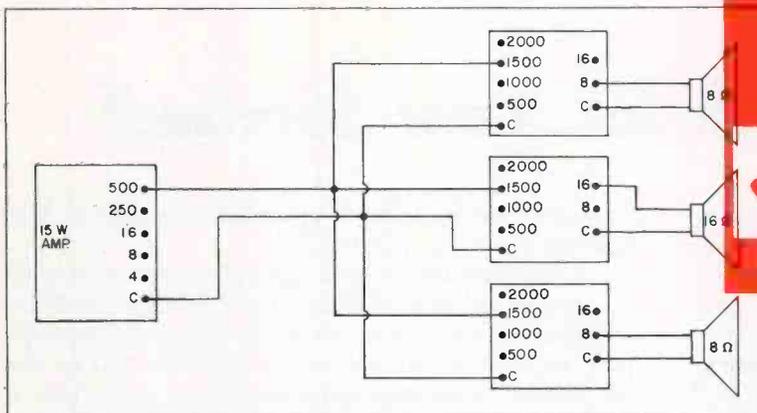


Fig. 3—Speaker hookup employing constant impedance transformers.

Universal 50 w transistorized amplifier used in a mobile sound system operates from 117 vac or 12 vdc.

SELECTING SOUND SYSTEM COMPONENTS

Understand selection factors and simplify your commercial sound installation problems

by Mortimer S. Sumberg

Bogen Communications Div.,
Lear Siegler, Inc.

Some technicians and service-dealers know how to select proper components for a sound system installation. They have made it their business to learn. But others don't know where to begin when an order comes in for a potentially profitable installation.

There is more to successful sound



Major illustrations by Bogen-Presto.

system merchandising, of course, than merely selecting components. But major components must be selected in the course of surveying a prospective sound installation location: sketching and measuring floor, walls, ceiling and attic areas involved; determining cable runs, amount and types of cable needed; preparing a detailed equipment list and cost estimate — including sufficient labor to allow for a reasonable profit. Improper component selection will ultimately result in an unhappy customer. The number and type of components selected will depend primarily on a customer's desires and physical characteristics of the location.

A basic sound system is shown in Fig. 1. It is designed for general public address use, for paging and music distribution. It is a packaged-equipment assembly from which audio information is distributed to loudspeakers. Program information may originate from microphone, radio tuner (AM or FM), record or tape player or tone generator — which may produce tones for fire and other alarm signals, or simulate church bells or chimes.

Amplifiers

The largest number of sound installations use equipment which combines both the preamplifier and power amplifier on a single chassis. The separate preamplifier is generally used in large installations — console or rack mounted. Combined units or packaged sound-system am-

plifiers are available from several manufacturers in various sizes and types. They are designed with features to satisfy all application requirements. A selection of power outputs in 10, 15, 30 and 50 w is generally available. Separate power amplifiers usually run 30, 50, 70, 100, 125, 250 w or higher.

Where higher output power or the requirement for special features dictates the need for a custom assembled console or rack incorporating preamplifier, several power amplifiers and various program input devices, an experienced sound specialist should be consulted. Most leading amplifier manufacturers provide engineering and assembly facilities and encourage inquiries.

Selection Factors

Many factors are involved in selecting the proper amplifier for a given installation. The most important considerations include: (1) Power output; (2) Number of inputs; (3) Output impedances; (4) Special functions; (5) Power source — ac or battery; (6) Amplifier mounting; and (7) Cost.

The output needed in an amplifier will be determined primarily by the number of loudspeakers in a system and the wattage level at which each will be operated. If an installation requires 10 loudspeakers, for example, with each operating at 3 w, a 30 w amplifier would be needed.

It is usually a good idea, however, to select a somewhat larger

amplifier to allow for possible higher loudspeaker sound levels and future speaker additions. The slight difference in amplifier cost is more than offset by increased flexibility to meet future demands. To determine the approximate total power amplifier requirements for typical installations, refer to Table I. Values given represent averages and are not particularly critical. Where questions arise regarding ratings, it is generally advisable to select the higher rated power amplifier.

Inputs

Standard packaged amplifiers are available with inputs for one to five microphones and a phono mechanism or radio tuner. A 10 w amplifier in one manufacturer's equipment line, for instance, has one microphone and one phono input; a 15 w amplifier has two microphone inputs and one phono input; 30 w amplifiers are available with one or three microphone inputs and one phono input. Rounding out the packaged line are two 50 w amplifiers, the lower priced unit having two microphone inputs and one phono input. The deluxe version has four microphone inputs and one phono input.

The number of microphones needed can be determined by checking with the purchaser. In most cases this is a relatively simple matter. For instance, a circus barker would require only one microphone. A two-point paging system in a store would obviously require two.



Factory phone operator uses 30 w amplifier (background) to page throughout plant.

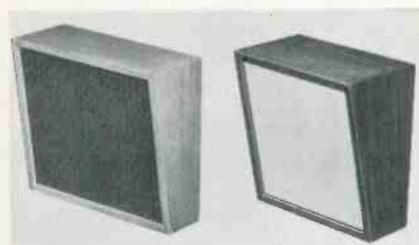


Multi-channel school console incorporates intercom and program distribution to all classrooms from microphone, tuner and phono.

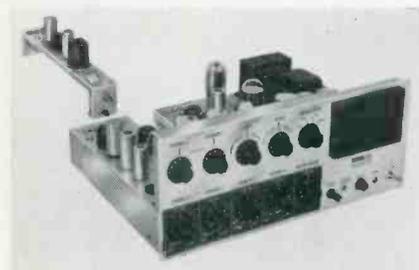
Output Impedance

Since the amplifier's output impedance must be closely matched to that of the speaker load, amplifiers with proper output impedance taps should be selected. Where the speaker lines are short and the number of loudspeakers is small enough to permit series, parallel or series/parallel connections, 4, 8, and 16 ohm outputs are frequently used. When a large number of loudspeakers are used with line-matching transformers, the constant voltage amplifier tap and constant voltage line-matching transformers should be selected to avoid the need for complicated mathematical computations. The constant voltage system permits changes in the number of speakers without recalculation of impedances and power delivered. Several values of constant voltage are used: 25, 70, 140 v, etc. To use this system the amplifier selected must have an output tap marked for one or more of these values.

The constant voltage transformer has secondary taps marked in "watts." It is only necessary to select a transformer to match the speaker's impedance. In addition, if the customer finds need for a more powerful amplifier, it can always be substituted at any time without having to recalculate the



Quam-Nichols wall baffles.



Harman-Kardon's 40 w modularized PA amplifier Model 40 GA-112.

load and source impedances. It will also not be necessary to change taps on the line matching transformers. So long as the total power consumed by the loudspeakers is equal to or less than the amplifier rating, a proper match will always exist. A speaker hookup with constant voltage transformers is shown in Fig. 2. A constant impedance transformer hookup is shown in Fig. 3.

Special Functions

Depending on the particular application, there are several special functions which may be desired in an amplifier. Typical of these are:

Phono-Top. In many cases, particularly in mobile and portable applications, an amplifier must have a built-in phono turntable. Standard packaged amplifiers are available with phono tops which permit 33- $\frac{1}{3}$, 45 and 78 rpm records to be used up to 12 in. in dia.

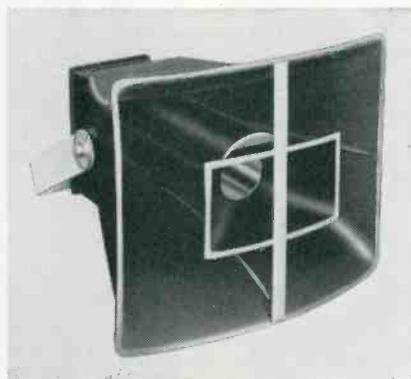
Portable System. Special carrying cases are constructed by amplifier manufacturers to house a complete portable sound system consisting of a microphone with cable and connector, two speakers each with 25 ft of cable and connector, and a 30 w or smaller amplifier. In selecting an amplifier to make up a portable system, consideration must be given to the availability of a suitable carrying case of proper dimensions. The amplifier weight is also an important factor.

Controls. Depending upon the installation's nature, an amplifier may need a control flexibility margin beyond individual input channel vol-

ume adjustment. If music reproduction is a major system function and high reproduction quality is important, separate bass and treble tone controls are essential to provide high and low frequency boost and attenuation. Some amplifiers provide only *reduction* of high and low frequency sound, and do not permit boost. Tone control flexibility should be considered too if the loudspeakers are very high quality or if reverberation and acoustic feedback problems are anticipated. Acoustic feedback (squealing) results when sound from the speakers is introduced into the microphone. This problem can be very severe in many indoor installations, but can be reduced in most cases by selecting an amplifier having speech filters and separate bass and treble controls.

Remote Volume Control. In sound systems used for churches, theatres, auditoriums, and comparable locations, it may be desirable to control output volume at some distance from the amplifier. Some amplifiers can be equipped with remote volume controllers which permit adjustment of microphone and phono input channels from a distance up to 2000 ft from the amplifier.

Standby Operation. Sound systems used primarily for paging are frequently operated only briefly and intermittently but must have power applied at all times for immediate use. Some amplifiers are designed to accept a plug-in standby controller relay. It is energized by a push-button in the microphone stand and places the amplifier in an operating



Altec's water and weather-proof 50A "Bi-Acoustic" horn for outdoor sound distribution. Horn handles 30 w.



Transistorized mobile 25 w amplifier operates from 12 v battery.

condition only when a paging announcement is made. The amplifier draws less power in a standby condition and tube life is increased.

Transistorized PA amplifiers now entering the market will eliminate these standby needs.

Power Source. Bus, car or other vehicles generally do not have 115 vac available. Several mobile type amplifiers are designed to operate on a 6 or 12 v storage battery. Outputs are generally rated from 6 to 50 w.

Amplifier Assembly Mounting. Most packaged amplifiers come with a protective cage for safe installation on a shelf or table. In many instances it may be purchased with a 19 in. panel and brackets for standard rack mounting. Spring-loaded bases are also available for mobile installations. This shock-mounting base is desirable in indoor installations too where the amplifier may be subjected to considerable abuse, shock and vibration.

Cost. In selecting an amplifier for any sound system, cost is not so important as it may seem at first glance. Usually the difference in price between the least expensive amplifier which will do the job and a much higher quality unit is relatively small when considered in relation to the over-all outlay for the complete sound system. Like all other commodities, amplifier cost reflects component quality, number of features provided, over-all performance and the degree of quality control exercised by the manufacturer.

Obviously a 30 w amplifier with four microphone input channels will cost considerably more than a similar unit with one microphone channel. If only one microphone is needed in the system, the cheaper unit is indicated.

A few manufacturers offer deluxe as well as economy priced lines. In some instances, there is no sacrifice of reliability in the economy line, but features are more limited and over-all performance is somewhat lower than in the deluxe line.

An amplifier should be selected only for its ability to fulfill a certain set of requirements. To select an amplifier with capabilities far

above the particular job requirements is uneconomical. Typical factors affecting amplifier costs are: (1) **Power** — Higher power amplifiers cost more because larger transformers and huskier components must be used; (2) **Frequency response** — If an amplifier is to have a very wide frequency response for high fidelity music reproduction, design calls for careful and sometimes elaborate circuitry, a costly output transformer and frequently, more expensive components; (3) **Distortion rating** — This is expressed as a percentage in manufacturers' data sheets. As a general rule, the amplifier price increases as the distortion figure de-

creases. Good amplifiers designed for commercial installations are rated at approximately 5% distortion at full amplifier output. Some deluxe amplifiers are rated as low as 2%; and (4) **Enclosure** — Aside from esthetic considerations, some installations require extremely heavy outer cabinets as protection against damage to the unit and injury to personnel.

Microphones

Carbon microphones are almost never used in commercial sound systems and should be rejected as a possible choice.

High impedance crystal micro-

Continued on page 46

TYPICAL SYSTEM DATA FOR VARIOUS APPLICATIONS

Application	Sq ft Area	Amplifier Rating (Watts)	Number of Speakers	Type of Speakers
Auditoriums	2000	15	2	12" Cone in Wall Baffles
	5000	30	2	12" Cone in Wall Baffles or
	15,000	50	4	12" Projector Horns
Ballrooms	2000	15	4	12" Cone in Wall Baffles
	4000	30	4	
	10,000	50	6	
Churches	1000	10	2	10" Cone in Wall Baffles
	4000	15	2	12" Cone in Wall Baffles
	15,000	30	4	
Classrooms, Offices and Stores	500	10	1	8" Cone in Wall Baffle
	2000	15	2	10" Cone in Wall Baffles
	8000	30	4	
Factories	1000	15	2	12" Projector Horns
	4000	30	4	
	8000	50	4	
	40,000	100	10	
Funeral Parlors	1000	10	1	12" Cone in Wall Baffles
	4000	15	4	
	10,000	30	8	
Restaurants and Night Clubs	1000	15	2	12" Cone in Wall or Ceiling Baffles
	5000	30	6	
	10,000	50	12	
Stadiums and Gymnasiums	3000	15	2	12" Cone in Wall Baffles
	10,000	30	4	Re-Entrant Horns
	50,000	100	8	

1. Values given in table are averages—not minimums or maximums.
2. Number of speakers and amplifier power rating should be increased where background noise is higher than normal for the type of area.
3. Although wall baffles are indicated for cone speakers, ceiling-recessed or suspended baffles are frequently advantageous.
4. Acoustically "live" areas generally require lower speaker sound levels.
5. Number of speakers will vary with shape of the plan view of the area.



A bi-directional paging and talk-back speaker built by University.

Preliminary sound survey eliminates post installation headaches

Installing

by L. V. Winston

■ Many technicians have found that PA installation and maintenance work can be an enjoyable and lucrative adjunct to their normal TV service business. Others, to their chagrin, have found that there are a lot of tricks to the trade which aren't naturally apparent from a good foundation in electronics.

Some of these problems are strictly mechanical, while others arise from echos, weak or loud areas and a host of other sound problems. Most of these problems are directly related to the fact that the installer did not carefully analyze the problems that might be encountered for the particular installation. A careful survey should be the first step in a successful PA installation.

Primary Considerations

The most experienced installers still rely on an actual test in the area to be covered by the PA system. A survey to determine the type of equipment, amplifier power and the number and type of speakers to be used may be conducted in a number of ways. Standard equipment is used for such tests, though it is helpful if the amplifier can be attenuated in known steps to determine the effect of power on the coverage in a particular installation.

Each installation will offer some problems unlike those in any other installations. A theatre, for example, which has upholstered seats and

draperies on the walls will be comparatively free from echos. A train station, on the other hand, will probably have tile or similar hard material on the walls. In this type of environment, echos must be considered when deciding what type of installation will be most suitable for the application.

When surveys are being made for an area where a great many people will be assembled it should be kept in mind that the audience will absorb a great deal of sound. Background noise, inherent with a gathering of people, should also be considered. A considerable increase in amplifier power will be necessary to overcome these two important factors. For this reason, charts showing the power required for a given volume to be covered can be misleading.

Generally speaking, wherever echos may present a problem more speakers operating at a lower level will prevent them. Echo problems will usually become apparent during the survey testing.

Amplifiers

In most sound systems for commercial application it is desirable to reduce power at lower frequencies. This protects the smaller projectors below horn cutoff and usually improves speech intelligibility. Provisions should be made in the amplifier for low frequency power

reduction — the amplifier manufacturer will suggest ways to accomplish this.

In an installation where flexibility is desired, or where it is necessary to install a large number of speakers, the 70 v system should be employed. An amplifier with a 70 v output must, of course, be selected in this case. Additionally, all speakers will have to be connected to the main amplifier line through a transformer. At least one manufacturer is now marketing a speaker with a built-in line matching transformer.

Speaker transformers are available with taps which permit adjustment of the sound level for each speaker without the necessity of changing the source impedance.

Higher voltage systems are sometimes used, though 70 v systems are most common. On high power amplifiers, 140 v outputs are sometimes practical and should be treated the same as 70 v systems. Depending on the amplifier the 70 v and 140 v taps may be labeled from 50 to more than 500 ohms. Unlike the low impedance lines, these lines may be compared to the parallel feed used in 115 v house wiring. All speakers are connected in parallel to the line through a matching transformer to match their low impedance to the main line.

Where only one or two speakers are employed, however, low imped-

Projectors find wide use in both indoor and outdoor applications.

PA Systems

ance taps will perform as well with no increase in installation problems unless the speaker lines are exceptionally long. Impedance matching must be observed, however. The main advantage gained by using the low impedance outputs of the amplifier is a reduction in the cost of necessary equipment.

Other than the standard PA amplifier, you should be familiar with the booster amplifier. Booster amplifiers require a relatively large input and are usually driven from another amplifier. In existing installations where it is necessary to increase the coverage, the booster amplifier may be employed to drive the additional speakers. The existing system may then be left intact with no modifications. Power required to drive the booster amplifier is considered negligible.

Whether or not the system is to be used indoors or outdoors will also affect the type of installation as well as the choice of equipment. Each of these must be considered separately.

Outdoor Systems

In a typical outdoor installation such as a stadium or ballpark, listeners are concentrated into specific areas. Concentrating the entire speaker system in one array facing the audience high up at a position where every listener can actually see the array is generally best. Poles

mounting or mounting on top of score boards, etc. are logical locations.

Remember that the sound pressure level decreases for angles off the axis of any projector; choose a sufficient number of projectors in the array to provide overlap in the sound pattern. Allow overlap of about 30 percent. If the stated coverage angle is 75° , consider the effective coverage angle as 50° in an array.

If coverage is desired for higher noise levels, increase the total amplifier power and driver unit power capability accordingly.

It can be assumed that the speaker system will not be required to over ride extreme noise conditions of short duration — the cheering for a home run will soon die down to moderate noise level conditions. The signal level from the speakers must be at least as high as the noise level and preferably 3 db greater for comfortable speech listening. Wind conditions may require a further increased power.

Think of the speaker array as a group of spotlights. If the listener cannot see the projectors he will be in a "shadow." Sound shadows occur under balconies and behind obstructions. Position the array so no listener is "shadowed" or supplement the shadowed area with



Columnar loudspeakers are becoming increasingly popular in PA installations. Several cone-type speakers are stacked vertically to reproduce with quality similar to a single one but with better directivity.



Altec's 683A cardioid microphone employs a sintered bronze filter to prevent water, dust and other foreign elements from damaging the microphone.

additional loudspeakers. Avoid projecting sound into areas not occupied by listeners to prevent echoes. Careful layout and study prior to the installation will pay good dividends in any comprehensive installation. The power to each projector should be carefully adjusted for the particular area to be covered and in general will be different for each projector in the array.

Large areas, such as race tracks, may use distributed projectors rather than a concentrated sound source to reduce speaker-to-audience distance.

For industrial areas such as freight classification yards projectors can be distributed to cover important areas or placed closer to high noise locations.

Indoor Systems

For indoor systems the power requirement can usually be approximated on the basis of the seating capacity. Suggested power requirements for motion picture theaters are conservative and offer the best figures available for indoor systems; the usual installation is in a more

“live” room where less power might be needed although noise levels may be higher.

A recommended figure of 20 w of amplifier power per 100 seats is taken from data shown in a Technical Bulletin of the Academy of Motion Picture Arts and Sciences, Research Council. The relative speaker efficiency must be taken into account, however; low efficiency speakers may require considerably more power.

Typical low ceiling installations are found in the office, restaurant, or lobby where background music is the main objective. Flush mounted ceiling speakers are usually the best solution. Speaker enclosures may be necessary — use a plaster ring with grille or false perforated acoustic tile for each speaker location and simply place the speaker in the clearance space above the ceiling. Assume a coverage angle of 90° for most of these speakers; the coverage can then be considered to be circular, with a diameter twice the ceiling height. The power requirement for these speakers is about 1 w or less per unit.

Typical auditorium installations may require “stage illusion” for high quality reproduction of stage presentations. The recommended speaker system is a single array located directly over the front center of the stage as high as possible. Aim each speaker of the array to cover a specific portion of the audience area taking special care that sound is not directed against the ceiling or sidewalls thus, creating reflections. Choose total amplifier power as mentioned above (no less than 20 w per 1000 seats) and distribute the power to each speaker in the array

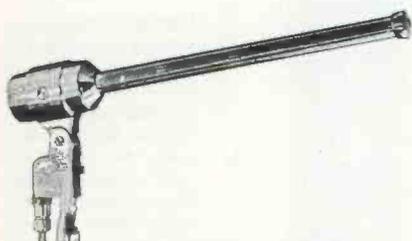
in proportion to the seating area it covers.

A typical solution would be one speaker to cover the rear two thirds of the auditorium and two speakers to cover the front one third. The angle covered by each speaker is the same but the area covered is proportional to the distance squared.

This accounts for the large area covered by the one speaker; the power to the one speaker should be two thirds of the total with one sixth of the total power to each of the speakers covering the close-up, smaller front areas. Remember that the speaker array should actually be seen from every seat for adequate coverage; drop the array or use supplementary speakers to cover “shadow” areas.

Gymnasiums differ from auditoriums only because they are extremely reverberant with highly reflective walls, ceiling and floor. Also they are often combination auditorium-gymnasium facilities requiring many different kinds of sound coverage. The same procedure as described for auditoriums is suggested for gymnasiums, but with greater care in the location of the speaker array and in “aiming” the individual speakers. A most useful arrangement provides for the largest audience but employs cut-out switches so certain loudspeakers can be disconnected when not needed. The basketball floor may be used for audience seating for a stage presentation and therefore must have sound coverage along with the side bleachers and balcony areas. Loudspeakers covering the floor area should be disconnected to reduce

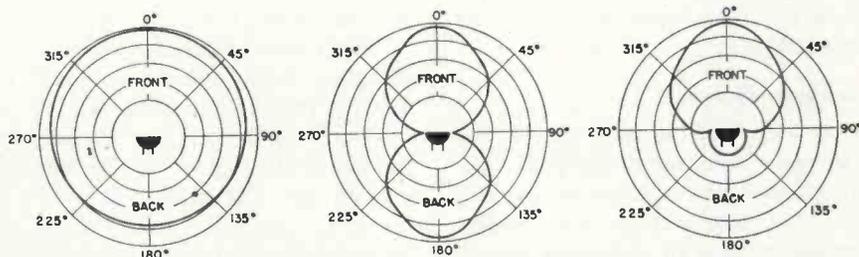
Continued on page 46



An exceptionally directional microphone built by Electro-Voice is their model 644 Sound Spot.



Shure's model 777 is designed to be used on a stand, hand-held, or as lapel microphone.



Relative directivity of three basic microphone types. (Left)—Omnidirectional has almost equal pickup from all directions. (Center)—The bi-directional microphone has equal sensitivity at the front and back, with least sensitivity at the sides. (Right)—Uni-directional or cardioid microphones have usable pickup in one direction only.

PROFITS on Pre-War Radios Run High

by John Olds

■ The pre-World War II radio is far from being out of circulation. Most technicians, while not soliciting old radio repair, almost weekly have customers ask if their 1935 "Trans-Earth" radio can be "fixed." Customarily, the answer is no.

Although these old-timers are not really a joy to work on, they do have their merits and can be repaired without too much trouble. Circuit diagrams for old radios are available from several sources—since radios of this vintage are not often "only sets" the customer is usually quite understanding if he is told he will have to wait a couple of weeks so service literature can be obtained.

Radios manufactured in the late twenties and early thirties were all transformer powered and employed parallel filament circuits. Later sets utilized newly developed tubes for series string sets and some even did away with the transformers.

The TRF circuits were still going strong then, and in localities where the broadcast isn't crowded still perform admirably. In these sets, instead of heterodyning, the RF was amplified through multiple tuned amplifiers and detected without conversions.

Most pre-war radios are fairly simple. In fact, so simple that in looking at their schematics you may wonder what could possibly go wrong. The most confusing thing about looking under the chassis on one of these beasts is the bundle of wire, and the huge resistors and capacitors that were used in those days. The resistors were color coded differently then too—in learning the order to read the color code, most technicians simply remembered the word bed, for body-end-dot. This then, could be equated to the over-

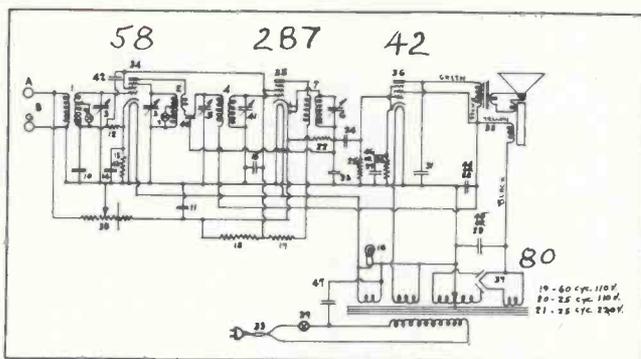
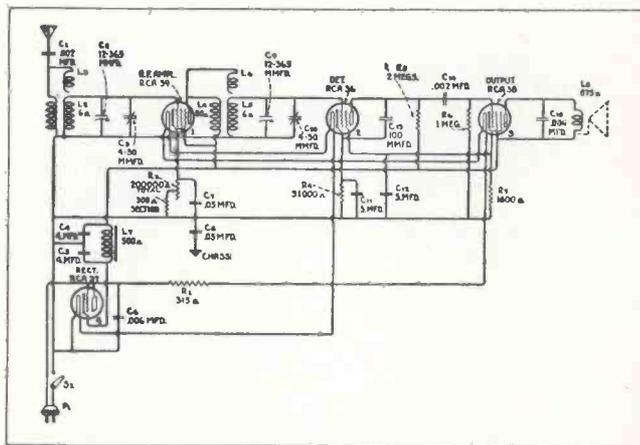
all or *body* color of the resistor, a different color on one *end* and a color *dot* in the middle of the unit.

If you'd like to get into this business to increase your income, simply set an old console radio in your show room or window. It will at-

tract a lot of attention and more radios than you might believe.

Some typical old radio schematics accompany this article. They may seem funny now—then again you may wonder why we don't still do it that way. ■

RCA
Model R-17-M



Crosley
Model 169

Airline
Model 62-425
and 62-265

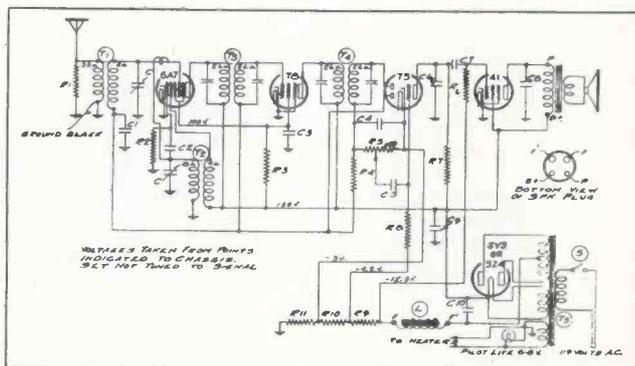


Illustration Credit:
Supreme Publications.

Take a CLOSER LOOK

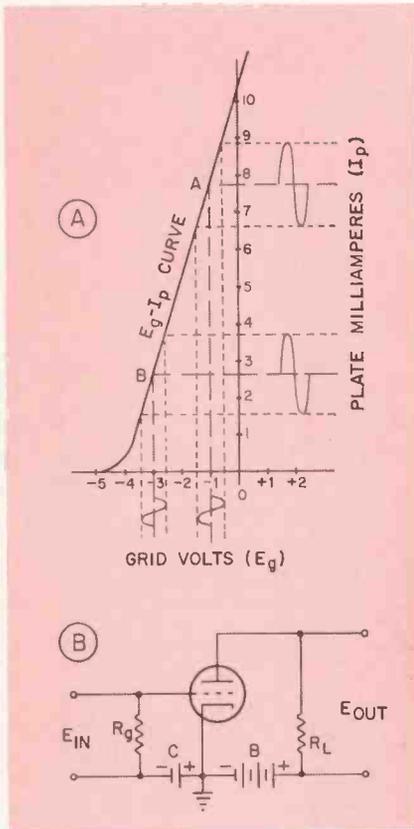


Fig. 1 (A)—Linear characteristic curve of a sharp cutoff tube produces a constant gain, even when the bias is varied. (B)—Circuit connections for measuring gain vs bias.

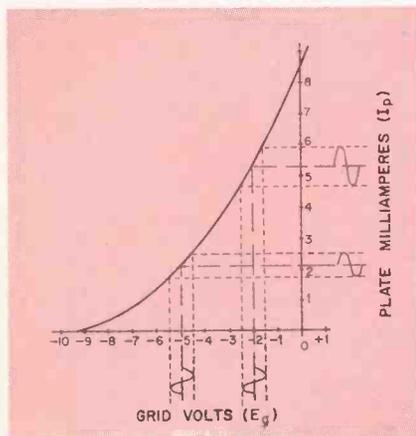


Fig. 2—The non-linear characteristic of a remote cutoff tube causes the gain to vary when bias is varied.

■ In many ways the vacuum tube is a fascinating device. Its control grid exhibits an interesting behavior not too clearly understood by many service technicians.

Technicians usually think of grid bias as affecting an amplifier tube's gain: the more negative the bias, the lower the gain. This is not true of all tubes, however. As a matter of fact, sharp cutoff tubes exhibit very little change in gain with varying bias. It is well known that a tube amplifies because of the ability of its grid to control plate current flow. For example, if a 1 vac signal is applied between grid and cathode and causes 5-ma swings in plate current through a 10K load resistor, the output voltage will be $E = IR = .005 \times 10,000 = 50$ v (ac); thus we have a voltage amplification (gain) of 50.

Gain Control

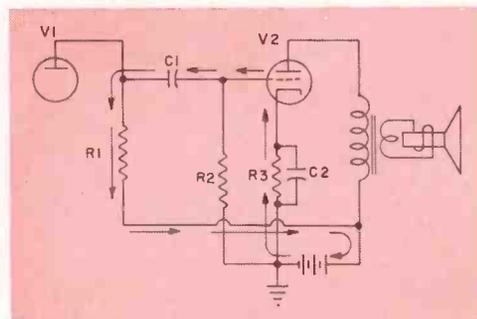
To be more specific, Fig. 1A shows the E_g-I_p characteristic curve of a sharp cutoff tube connected as shown in Fig. 1B. The operating point on the curve is determined by the bias voltage supplied by the C-battery. If a 1-v battery is used,

setting the operating point at -1 v (point "A"), a quiescent plate current of 7.8 ma results. With an input signal of 1 v, P-P, the instantaneous grid voltage varies between -0.5 and -1.5 v, resulting in plate current variations from 6.7 to 8.9 ma, or a plate current of 2.2 ma, P-P.

Now, by changing to a 3-v C-battery (increasing bias to -3 v), the new operating point "B" results in a quiescent I_p of 2.7 ma. With the same 1-v input signal as before, the I_p now swings from 1.55 to 3.75 ma, an ac component of 2.2 ma, as before. If this similar ac current flows through the same value of R_L in both cases, the same output voltage will obviously be developed; in other words, changing the grid bias did not alter the gain. The sharp cutoff tube has an essentially linear characteristic curve which results in this constant gain. The situation is quite different with a remote cutoff tube, as shown in Fig. 2. Here, with a 1-v signal applied to the grid, an ac plate current signal of 0.75 ma (P-P) results when the bias is -5 v, while a -2 v bias results in a 1.2 ma output signal; therefore gain varies with bias in a remote cutoff tube.

The most common application of variable bias to control amplification is automatic gain control (AGC) in TV receivers and automatic volume control (AVC) in radios. Obviously in such applications remote cutoff tubes must be used, otherwise gain would not be controlled properly. Typical tubes are IT4, 6BA6, 6SK7; replacing

Fig. 3—Arrows show path followed by electrons in ordinary grid current flow.



Reduce troubleshooting time to a minimum by understanding the fundamentals of gain, bias, grid current flow, emission and the 'Miller Effect'

at the Control Grid

by Lambert C. Huneault

these with sharp cutoff pentodes would adversely affect AVC operation. It should be noted, however, that certain types listed as sharp cutoff pentodes in receiving tube manuals are in reality semi-remote in characteristics, and these provide satisfactory operation in some circuits (6AU6 for example).

Grid Current

The second interesting phenomenon is grid current. When does grid current flow? What effect does it have? In which direction does it flow? An example will answer these questions. A typical audio frequency amplifier operating class A is shown in Fig. 3; no grid current normally flows. Assume capacitor C1 becomes leaky, allowing enough positive voltage to leak through to the grid and cancel out most of the negative bias produced by the cathode bias resistor R3. The operating point becomes such that the grid swings positive during at least part of the positive half-cycles of the signal, attracting electrons emitted by the cathode. These electrons will follow the path shown by the arrows, from the grid through C1, R1, the power supply, R3, back to the cathode. This causes rectification to take place at the grid, and the input signal waveform is highly flattened on its positive-going peaks. It should be noted that the distortion is "born" at the grid, not at the plate.

It is often the practice of textbook writers to illustrate plate current saturation as soon as the E_c - I_p curve penetrates into the positive

grid voltage area; this tends to create the false illusion that the distortion is generated at the plate, as shown in Fig. 4A.

Grid Emission

With this information as a background, let's observe the strange phenomenon of grid emission, sometimes called reverse grid current. The word "strange" is used here because technicians usually balk when asked to explain in detail the action taking place in a gassy tube. And yet a gassy IF tube upsetting AGC or AVC circuits is a very common service problem.

An AVC controlled IF stage is shown in Fig. 5. Assume the signal develops an AVC bias of -4 v at point "A", the detector load resistor. This -4 v bias will be impressed on the IF amplifier tube's control grid, through the AVC filter resistor R2, the decoupling resistor, R1, and the IF transformer secondary. No voltage drop normally occurs between point "A" and the control grid, because no grid current flows. Should V1 become gassy, however, the AVC bias voltage at its grid may drop considerably, causing overloading of the stage; hence distorted sound in the radio.

In the case of a video IF tube, this would result in excessive contrast, sound buzz and/or unstable sync. One is normally tempted to credit this effect to grid current caused by the gassy tube. But grid current, as seen in the preceding section, would flow from the grid, through L1, down through R1, etc.,

causing the top of R1 (and hence the grid) to become more negative. Obviously this is not the proper explanation as the grid becomes *less* negative in this case.

Keeping in mind that random gas atoms fill the space inside a gassy tube, the following step-by-step account of the action taking place inside the tube and in the external circuit will clear up the problem:

1. An electron (negative charge) is emitted from the cathode by normal thermionic emission, leaving a "void" (positive charge) on the cathode.

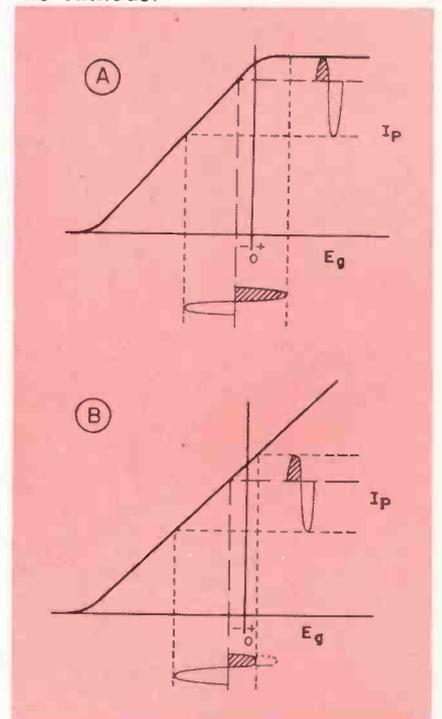


Fig. 4 (A)—"Fictitious" plate saturation suggests distortion generated at the plate. (B)—Plate current waveform distorts because the grid voltage waveform is initially distorted through grid rectification.

2. On its way toward the plate, the electron collides with a neutral gas atom, knocking an electron out of the atom; the atom thus becomes a positive ion. We now have two electrons on their way toward the positive plate: the original one from the cathode and the new one knocked out of the gas atom.

3. The positive ion drifts toward the control grid (negative) where it robs the grid structure of one of its electrons on contact, thus becoming a neutral atom again; it then drifts at random inside the tube and we can now forget about it. Having lost an electron, the grid is now less negative than previously, and is in need of a new electron to return to

its normal potential; where will this electron come from?

4. Let us take another look at our two friends, the pair of electrons seen heading toward the plate in step 2. After being collected by the plate, these two negative charges travel through L2 and through the power supply to ground. One of them now travels up from ground directly to the cathode of V1, filling the "void" created when it left the cathode in step 1. The other electron goes up from ground through R3, R2, R1 and L1, to the control grid where it satisfies the grid's "hunger" for an electron, created in step 3. On its way through R2 and R1, this *reverse* grid current,

known as grid emission, causes voltage drops with the polarity shown, thus making the grid less negative than point "A", the source of AVC.

When servicing similar circuits with a VTVM, grid emission caused by a gassy tube can be suspected if voltages measured at points "A", "B" and "C" (in that order) get progressively less negative. A leaky filter capacitor C1 could cause point "B" to be less negative than point "A", but point "C" would not be less negative than "B".

Miller Effect

Another grid phenomenon that frequently comes as a surprise to the unexpected is related to the variable input capacitance of an amplifying tube under certain conditions. As shown in Fig. 8, the triode's input capacitance consists of its grid-to-cathode capacitance C_{gk} and its grid-to-plate capacitance C_{gp} in parallel (the power supply being effectively by-passed to ground by C_B). Therefore $C_{in} = C_{gk} + C_{gp}$.

If we connect a resistive load in the plate circuit, however, the dynamic conditions producing voltage amplification (gain) in the stage also produce a phenomenon which changes the effective value of input capacitance C_{in} . With the input signal E_r being amplified A times, it can be shown mathematically (based on the fundamental capacitance formula $Q = CE$) that the input capacitance becomes $C_{in} = C_{gk} + (A+1)C_{gp}$. If a tube has a C_{gk} of 2 pf and a C_{gp} of 1 pf, for instance, its static input capacitance would be 3 pf. But under dynamic conditions producing a gain of 50, for example, the same tube would now have an input capacitance of $2 + (50+1)1 = 53$ pf, a considerable increase from 3 pf!

Implications of this "Miller Effect" become obvious when AGC or AVC is applied to an IF amplifier similar to that in Fig. 6. The plate load being an LC circuit tuned to resonance, it behaves as a purely resistive load and the input capacitance becomes modified according to the aforementioned formula.

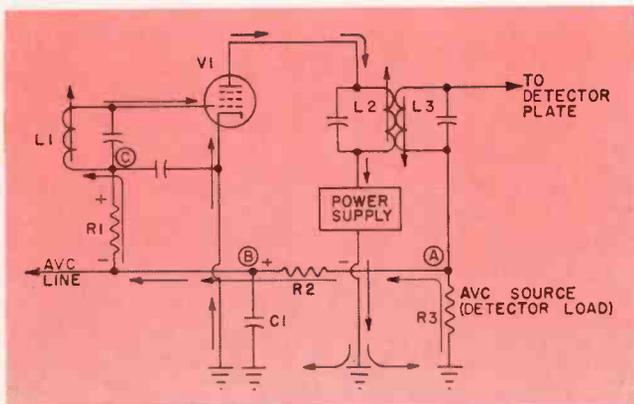


Fig. 5—Arrows show path of electron flow when a gassy tube causes grid emission.

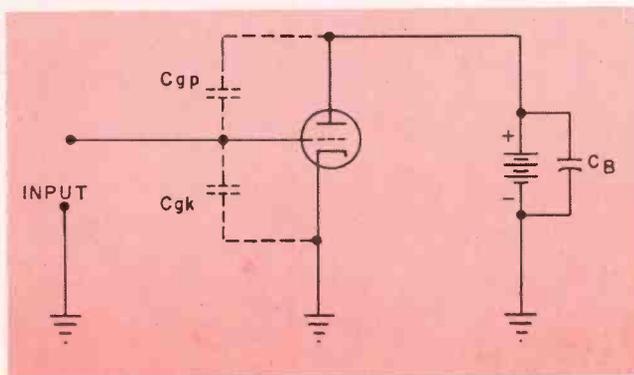


Fig. 6—Grid-to-plate and grid-to-cathode capacitances combine to form the total input capacitance of a tube.

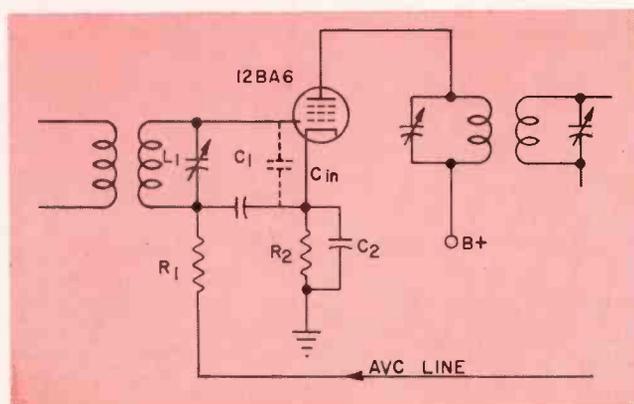


Fig. 7—Varying AVC bias causes a change in tube input capacitance which detunes the IF circuit.

Continued on page 48

A few security techniques will help you keep your hard earned \$\$\$\$

HOLD ONTO

■ Are there service shop owners in the country whose accounting systems provide for yearly payments to hold-up men, for mislaid or lost cash?

Few readers will answer this question affirmatively, yet many of us know a number of business firms who have lost sizeable sums of money through some unhappy experience.

We've studied hundreds of news reports covering instances where small business owners lost money during the past year and from this mountain of data we have garnered some pointers that may help technicians hang onto their money.

Bank often: Don't carry over sums of money from day to day. Deposit each day's receipts. If your bank has after-hour depositing facilities, use them. After-hour deposit drops are featured in most banks, including "drive-in" banking services. Use this convenience even if a service charge is made, since service charges are so small that they become an excellent "insurance" investment against loss of accumulated funds, large or small.

Don't hide money in the shop: If the day's receipts can't be banked and it isn't feasible to take them home, don't hide the money in the shop. Utilize a safe, even if it is a small or inexpensive one.

Confine responsibility of cash register handling to one person: It's never wise to let too many people handle the shop's money; and it is particularly wise to always have one person responsible for the contents of the cash register.

Don't brag about business: This includes talking about the amount of money the shop is taking in, the amount one carries, or for that matter, any money or business details. You're just asking for trouble, since the wrong party may overhear your bragging.



THAT MONEY!

by Ernest Fair

Carry no large sums: Flashing large sums of money exposes anyone as an "easy mark" for a mugging, rolling, stick-up, or the fast-talking short-change artist who is constantly on the alert to "take" someone.

Don't tempt anyone: Many shop owners have lost considerable sums through petty pilfering by employees simply because the owner made it easy for them to "get away with it." The best way to avoid such unpleasantness is to avoid tempting circumstances.

Keep cancelled checks in a safe place: Many costly forgeries have begun when a "penman" picked up a cancelled check from a waste basket or garbage can. And such little slips of paper laying around offer temptation to the amateur who can hurt the bank account just as easily. When checks are no longer needed for tax records or for other purposes, make certain they are completely destroyed by burning.

Check your daily receipts privately: It's no one's business how much money you're taking in. If

you can't check receipts in privacy at the shop, do it at home. Here again it's simply a matter of avoiding a tempting situation, not only for employees, but more particularly for any dishonest individual who can catch you in a very vulnerable position at such times.

Vary banking habits: This is one of the most repeated pieces of advice from police officials. The man who goes to the bank at the same time every day is asking for trouble. By being so prompt he could walk right into an ambush.

Keep cash register contents at a minimum: A bulging cash register is always an open invitation for trouble, including a change-making mistake. Get into the habit of removing surplus funds from the register at various times during the day.

Install a burglar alarm system: If any sizeable sum is left in the shop overnight, a burglar alarm system should be installed. They are relatively inexpensive, they lower insurance rates, and pay for themselves when just one hold-up has been prevented. ■

Peak alignment takes only minutes using injection-type tester or BC signal

by Enrique Shaw-Galvez

Solving TV SOUND and ALIGNMENT

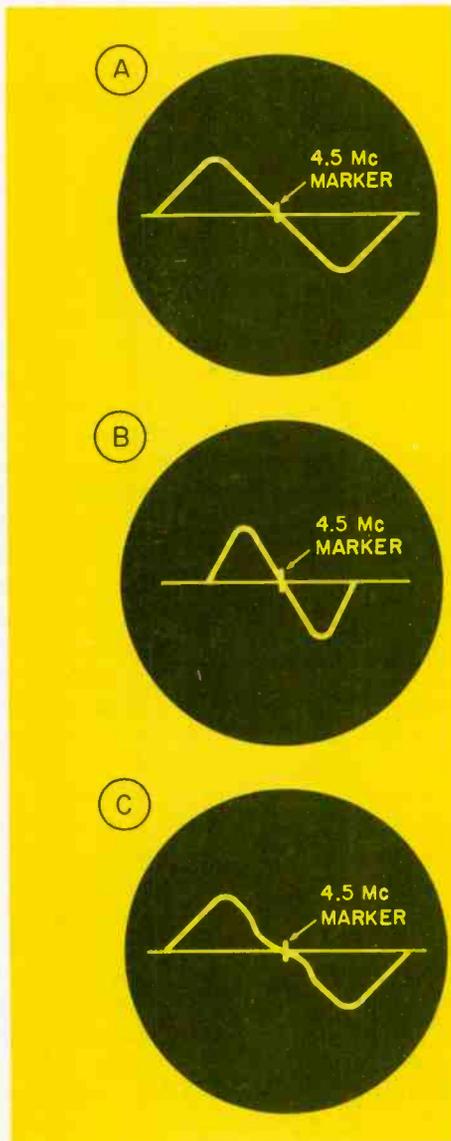


Fig. (A)—Normal discriminator response curve obtained with a sweep generator input to the sound IF. (B)—Response curve due to a faulty discriminator transformer. Be sure to standardize your scope's horizontal gain to prevent misinterpretation from incorrect set-up. (C)—Distortion in the detector output from a faulty transformer.

■ The sound section is probably the most overlooked portion of the TV receiver. As long as the customer can understand what is coming out of the speaker it's considered good enough. As the TV specialist, you gain your livelihood from repairing TV sets.

In working with the TV sound problem, remember two things: 1. Most of the sound problems you get will need more than a single part or tube. 2. You need to sell "optimum performance" to your customers.

Knowing that you're probably looking for more than one fault will help you solve an otherwise tough dog. This is true in any section of the TV set. If the set is kept in good shape, your job becomes easier and the owner will have more enjoyment from his set. Although the owner should not expect Hi Fi sound from a modest TV, he has the right to expect good sound and you are obligated to know how to achieve good results.

No Sound

Just about every technician would rather see a complete failure than lingering or intermittent distortion of some type. A new tube will usually make the dead set operable again. At this point, any noticeable distortion or weak sound should be pointed out to the owner. Selling

Problems

the customer on a more complete check will help avoid callbacks, makes you more money and at the same time give the customer more listening enjoyment.

After tubes are substituted, the dead set can be "finished off" in any of several ways. Signal tracing or signal injection is the quickest method to locate the defective stage; the VOM or VTVM is then used to locate the faulty components.

While signal tracing can be very meaningful, a great deal of experience is required to interpret results. Some signal injection devices, on the other hand, supply a signal which produces a tone at the receiver's speaker. Injection may begin at the speaker and progress backwards through the output stage, the voltage amplifier, detector, and IF strip.

A switch selects the test set's mode of operation as the injection progresses through the various stages. The type of test equipment you use to locate the problem stage depends on what equipment is available or what type of equipment you want to buy. If you are planning to purchase new test equipment, keep this in mind: An unused \$2 tester is more expensive than one costing \$200 which is used regularly.

When the dead stage is located, voltage and resistance checks will be the most meaningful course to

locate the defective part. Troubleshooting in the audio frequency stages shouldn't offer any problems that can't be licked in a few minutes. If you're not sure of yourself, dig into a few good TV amplifiers and make a note of the normal voltages in typical circuits. This practical experience pays off later when the sets are stacking up faster than you can fix them.

The IF strip and detector stages are treated similarly, though more precise measurements may be necessary to localize the fault.

A little common sense goes a long way toward finding the malfunction. Analyzing the circuit functions is the best way to visualize why you find an incorrect voltage or what the voltage should be. Obviously, a large positive voltage should not be present on the grid of the output tube. The most probable path for such a voltage is through a coupling capacitor. Smaller positive voltages (which may cause distortion or total loss of sound) may be caused by a leaky capacitor or an open grid return.

Incorrect plate voltage is usually only an indication of the current being drawn through the tube which in turn may reflect faulty grid bias.

A thorough visual inspection will, as a general rule, uncover as many faults as a meter; don't be too quick

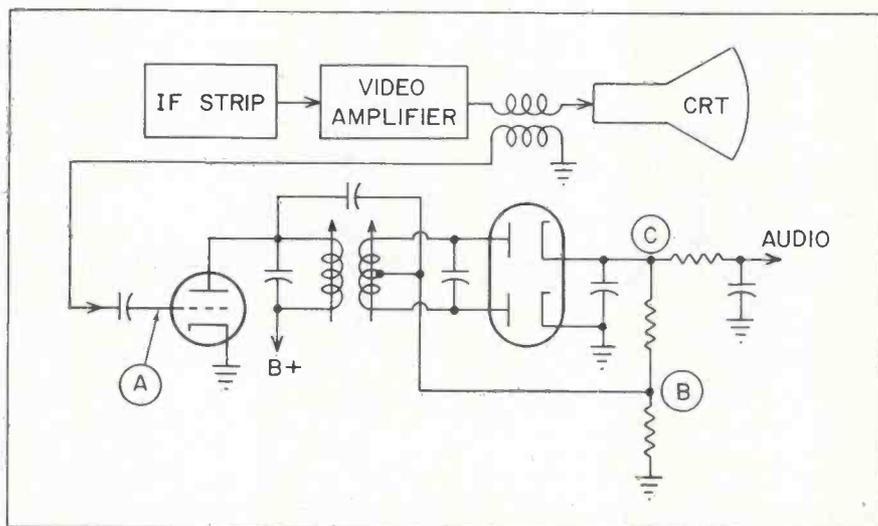
to pick up the test equipment.

TV sets invariably need alignment after they have been in service a few years to put them in top shape again. If you have to pull the chassis for other audio work, give the set a sound alignment. It only takes a few minutes of your time. And you can charge the customer for it with a clear conscience. You may, in the course of alignment find other borderline parts and save yourself a recall.

Detector Alignment

Often there are no traps used in the sound section of the TV receiver, thus the alignment is simplified and much less critical. Although it is desirable to use a sweep generator and accurate marker generator, the marker generator may be used alone. On rush field calls, the broadcast signal can be used. Some technicians even use one of the good injection type testers and achieve good results. This is accomplished in the same manner as when using a broadcast signal for alignment. The injection tester is connected at any point prior to the sound IF. All IF transformers are then peaked for maximum output from the speaker. The detector is adjusted for clear undistorted sound with minimum noise.

With a marker generator, the sig-



Typical single-stage sound IF and discriminator showing peak alignment test points. Signal injection (A); (B) Connecting point for VTVM for primary coil adjustment (top slug adjusted for maximum meter deflection); and (C) test point for zero voltage adjustment (transformer secondary).



Solving TV SOUND and ALIGNMENT Problems

Continued



nal is fed into the first IF at the sound IF frequency, usually 4.5 Mc. The generator should be 400 cps modulated so a tone is heard from the speaker or can be measured with a meter. All of these methods are called peak alignment.

Sweep alignment is most acceptable and most accurate. There is a difference of opinion as to whether this great accuracy is required, however. The generator should be coupled to the IF stage prior to the detector and swept as recommended by the manufacturer. The scope should be connected across the au-

dio output of the detector. Typical waveforms are shown in Fig. 1.

The scope's horizontal input should be connected to the 60 cps sweep output on the generator. Adjustments for sweep alignment are similar to those for peak alignment except the transformer's primary is adjusted for best waveshape symmetry and the secondary is adjusted until a 4.5 Mc marker is exactly in the middle of the curve. The marker is usually injected by clipping the marker output lead on the insulation of the sweep generators output lead. The outputs of

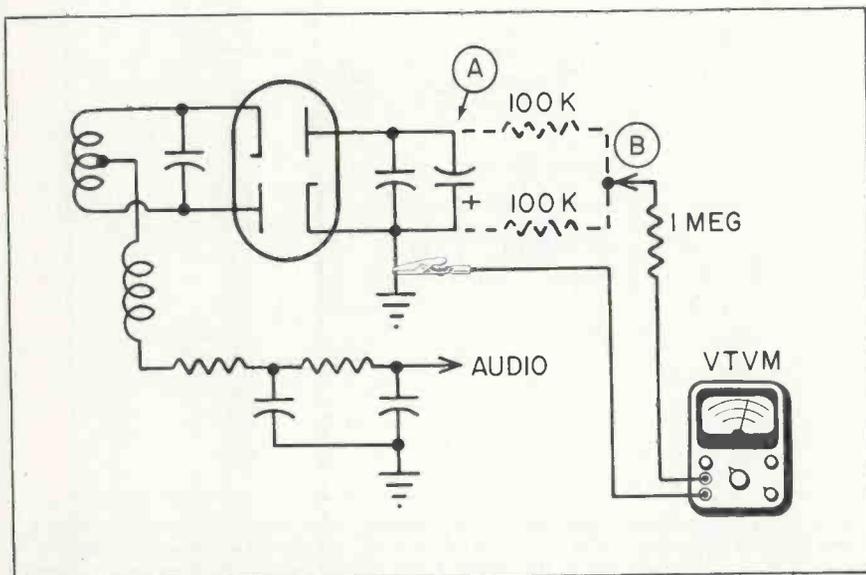
both generators should be as small as possible to prevent waveform distortion.

Sweep Alignment

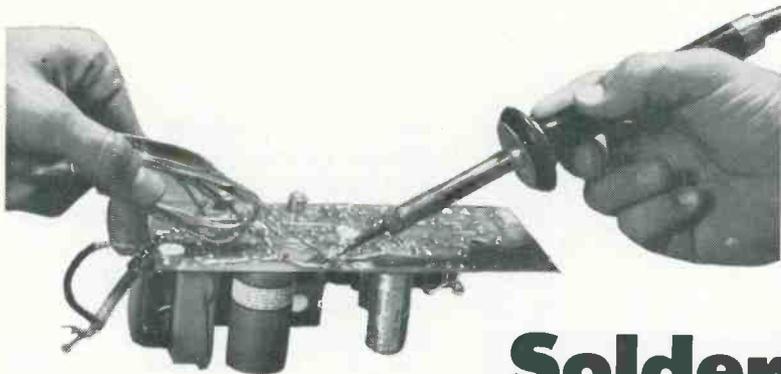
As mentioned earlier, the IF may be peak aligned easily at the same time signal injection troubleshooting equipment is connected to the set. This method will fail to turn up defects, however, that may be apparent if sweep alignment is used.

The most important part of any alignment is the test equipment set up. Long leads, poor connections and flimsy grounds all cause undesirable results. A normally aligned IF strip may appear to be very badly aligned; noise and stray signal may make the adjustments almost ineffective because of a poor setup. Be sure you have the equipment connected in the way the TV manufacturer recommends. If you want to turn out the best possible alignment (you should) don't start without all available manufacturer's literature.

IF sweep alignment is not employed often, being held in reserve by most technicians for those dogs we all run into on one occasion or another. The technician planning to go into Hi Fi, however, should purchase equipment which is compatible with his TV equipment as much as possible. Peak alignment for the Hi Fi tuner is definitely out. ■



The ratio detector can be identified by the tertiary winding in the detector transformer. Primary is adjusted for maximum deflection at (A). The secondary is adjusted for zero volts at the outer output or through a two-resistor jig if the electrolytic is grounded (shown with dotted lines).



Bit leakage is important consideration for soldering in current sensitive circuits

Soldering Irons for Transistor Circuitry

by Alvin B. Kaufman * Electronic Research, Consultant Engineer

■ The selection of a soldering iron for use with printed circuit boards, and in particular transistorized circuitry, is based on many factors not formerly considered.

At first glance it would appear that any soldering iron with a small tip (or bit) size is adequate for soldering transistor and semiconductor devices. Unfortunately, it just isn't so. Line to iron tip leakage and proper iron bit temperature combined with its heat capacity¹ are two parameters that should be determined in selecting a soldering iron.

This article is primarily concerned with tip leakage which until recent times, had not been given much attention. The importance of this problem may be realized with the fact that some companies now specify a three-wire ac line system to employ grounded iron bits. The National Underwriters Laboratory is also considering such a specification. A grounded iron bit, however, is not necessarily the correct approach to this problem.

¹ "Solder Joint Reliability" by Alvin B. Kaufman, *Electronic Technician*, April 1959

*Mr. Kaufman is a member IRE, Professional Group on Electron Devices, Professional Group on Microwave Theory and Techniques, Professional Group on Electronic Computers. A graduate of UCLA, he did his graduate studies in basic feedback control systems, linear system solutions by transform methods.

Leakage Measurements

Underground, floating, or line transformer isolated transistor circuits cannot be injured by soldering iron leakage, since no ground loop exists. In order for the soldering iron to pass the UL (Underwriters Laboratory) dielectric test² of 900 rms, it would appear that the leakage current is below that hazardous to personnel. An exact level of allowable leakage current is not specified. Leakage current tests should, therefore, be conducted as the user or manufacturer and must indicate a current level low enough to negate personnel shock or damage to sensitive components.

The capacity conducted current between elements and tip (or its housing) is a negligible leakage (generally under $15 \mu\text{a}$) as versus straight resistive electrical conductivity leakage caused by ionic or electron paths.

Current leakage is the only parameter. The reason for this is simple. If 100,000 ohms dc leakage existed between the ac line and soldering bit, and 100 vac was the impressed differential EMF, a current of 1 ma would flow in an external loop of zero ohms resistance. This would be insufficient to damage most electronic components or be a hazard to personnel. However, a 1000 ohm/v

² Underwriters Laboratories
Bulletin UL 499,
Electric Heating Appliances

meter on the 10 v scale would indicate 9.1 v; on the 100 v scale, 50 v. A VTVM would indicate approximately 100 v also. The voltage indicated, however, is as can be seen, practically meaningless. An immediate retort, however, is that these levels of voltage could damage semiconductor devices exceeding, as example, piv ratings. This could occur only if the device to which this voltage was impressed maintained a high value of resistance. In practice this does not occur with most semiconductor devices. Before the voltage level approaches a damaging area, the device is conducting current (even back-biased diodes) such that the impressed voltage decays similar to the characteristics of the 1000 ohm/v meter.

The capacitors used with these circuits may be paper or electrolytic. In the case of the electrolytic condenser sufficient leakage exists to hold down the applied voltage. However, in any case, with either condenser the RC charging time is sufficiently long to present a build-up of condenser voltage capable of injuring it in the short time soldering is taking place. It must be remembered that no damage can occur, regardless of leakage, where the circuit undergoing repair or construction is not grounded.

Operating line or grounded transistor circuits have been damaged by iron bit line leakage. It is obvious that if the iron leakage is

Soldering Irons *Continued*

greater than a specific value, the current limiting leakage resistance in the soldering iron is inadequate to protect personnel or components in the external loop. For this reason it is essential to establish a maximum allowable bit-line value of ac current leakage or conversely bit-line impedance. This measurement must reflect conditions in actual use or be even more stringent.

A prime requirement is that the iron must be up to operating temperature. A full scale meter voltage drop must be specified not to exceed 1 RMS, i.e., the meter internal resistance which forms the external loop must be low enough to not influence the current indication excessively. The meter to ac line return must be switched alternately to both sides of the ac lines so that an element short near one of the ac lines will not be overlooked. The highest current reading should be assumed to equal the worst leakage condition under either direction of line plug polarization. A maximum leakage current of 250 microam-

peres ac RMS may be allowed. This is a low enough value to prevent damage to semiconductor components, and is harmless and shockless to personnel.^{3,4}

The hazard of electric shock should not be treated lightly. In many cases non-lethal shocks have been fatal or have caused severe damage by side effects: Falls off ladders, involuntary throwing of tools, etc.

Electric shocks produce different effects depending upon the structure through which the current passes, and the magnitude of the current.

The reader at this point may inquire, why not use a soldering iron in which the soldering bit is grounded through a three wire line system. While this is the best insurance we can provide against harm to the operator, it is not a cure-all against potential compo-

³ "Effects of Frequency on Let-Go Currents" by C. F. Dalziel, E. Ogden, C. E. Abbot; *Transactions of AIEE: Dec. 1943; Volume 62*
⁴ "Dangerous Electric Currents" by Charles F. Dalziel; *Transactions of AIEE: August-September 1946, Volume 65*

nent damage for an intentional ground system in the equipment may be at the same potential as the iron tip ground. This is particularly true when changing components while equipment is in operation.

Normally, however, any potential difference between the neutral grounded iron tip and any other ground is negligible. Care must be taken that the building electrical installation is by code such that the neutral pin of wall outlets are actually wired to the neutral line.

It is interesting to note that the high quality insulation materials used in soldering irons, i.e., mica and ceramics, etc., possess an intrinsic resistivity as a function of temperature. The mode of conduction varies with the class of material, but in all cases increases with increase in temperature. Ceramic insulators are assigned an important parameter: T_e . T_e is the temperature at which one cubic cm of the material exhibits one megohm resistance.

At the T_e temperature of ceramics, conduction is not by electrons, but is due to ionic migration. Complete understanding of this phenomenon is not at hand. Nevertheless, this conductivity phase produces the upper temperature limitation of many insulators. In these pure ceramic materials there are no materials to carbonize, and therefore, the resistivity at an elevated temperature is a constant, not affected by time of operation. The resistivity is voltage sensitive, but not to a significant degree for the use noted.

Table I lists leakage found with a variety of commercial soldering irons. In as much as these tests were made on small quantities of soldering irons, they do not necessarily represent true quality, and hence, trade names are not presented.

It is suggested that soldering irons for the transistor use noted be factory certified as meeting the ac current leakage test noted (at operating temperature). Alternately, the receiving inspection group of a company or the user should check this parameter. ■

Table I

Typical Leakage Current of Soldering Irons

Soldering Iron Type	Description	Leakage μa ac RMS
Pencil	Transformer to separate resistive heating element in pencil	5 — 15 μa
Gun	Transformer to copper wire which is heating element and iron bit	5 μa
Pencil Type	Screw in iron bit with integral heating element	47½ w 6 μa 37½ w 1 μa 30 w 10 μa
Pencil	Single unit soldering iron	5 μa — 5 ma ¹

1. Defective or poorly designed soldering irons of any make may have excessive leakage of this nature.

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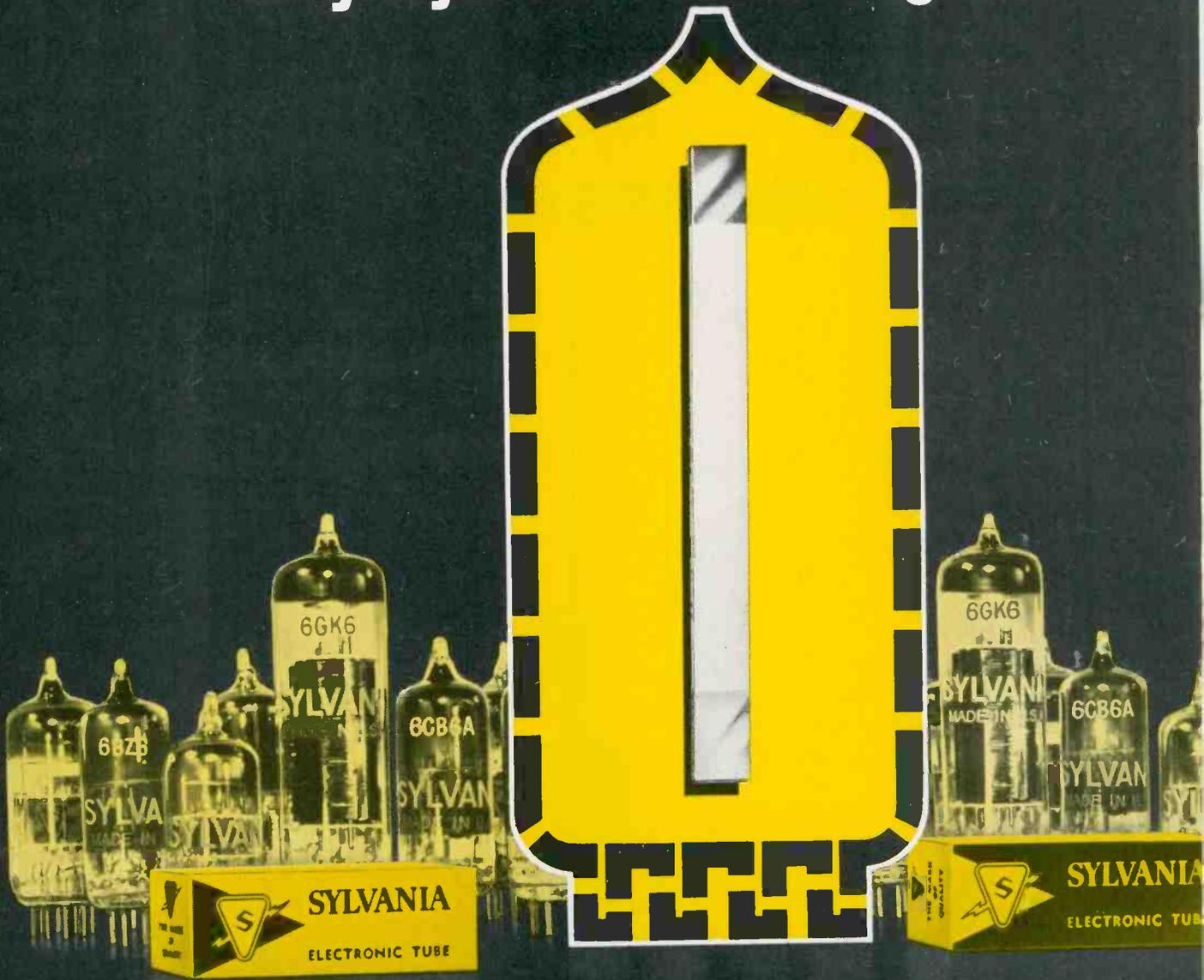
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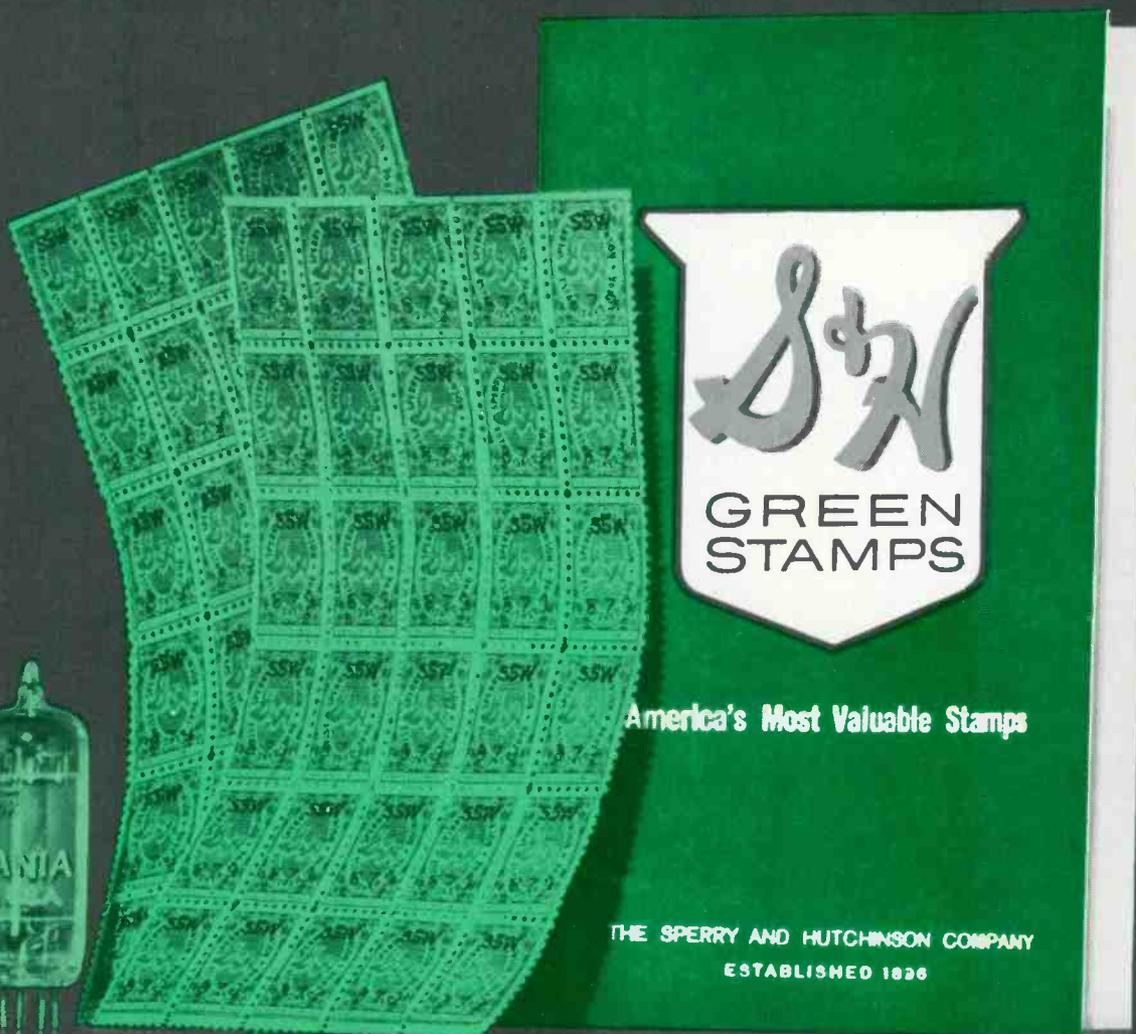
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Difficult Service Jobs Described by Readers

'Floating' Ground

I had a complaint of vertical rolling with a GE 21C349 recently. Manipulation of the vertical-hold control revealed that the picture, which was normal in all other ways, could be made to roll in one direction only. A few simple repairs in the grid circuit of the vertical oscillator cured this condition. But two intense black, horizontal bars now appeared across the picture. Removing the antenna caused the hum to disappear, so the defect was diagnosed as modulation hum. Having discovered that a similar case had been caused by poor grounding of the tuner, this possibility was checked out and all tubes in the video path were substituted with no results. The hum appeared most strongly across C47. Bridging C47 directly with a good capacitor did no good, but connecting the ground end of C47 to chassis with a jumper lead caused the hum to disappear from the scope trace. Resistance between hollow rivet (used to ground C47) and the chassis was found to be one ohm. Sweating this rivet to chassis with a heavy soldering gun tamed this dog. — *Glen H. Bryant, Hoistington, Kan.*

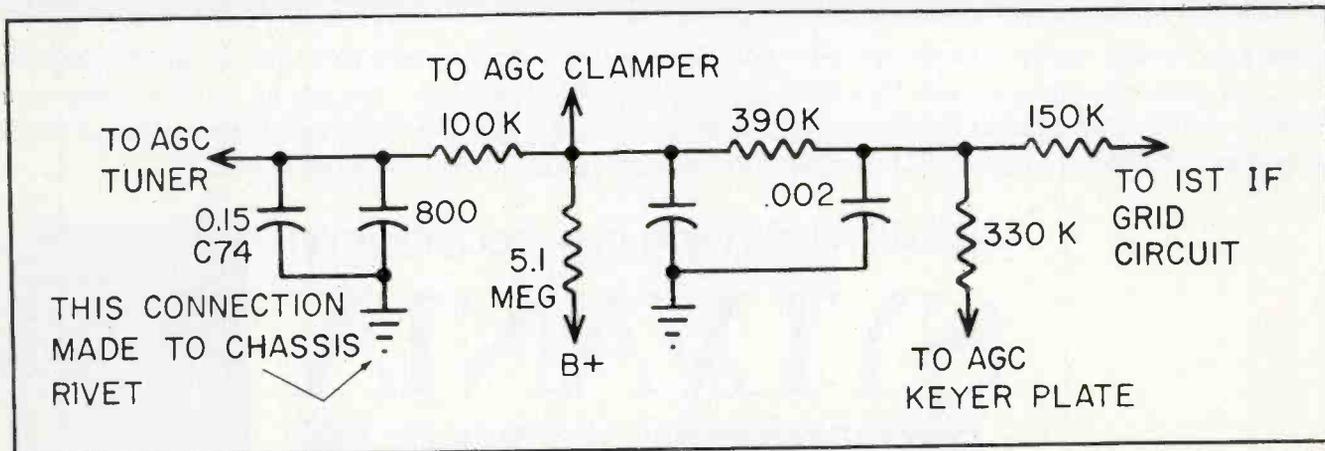
Arc Shorts Video Detector

On a Motorola TS551 chassis we had a call for no picture and garbled sound. We found the video diode shorted; replacing it cured the trouble. Three weeks later we had the same complaint. The diode had shorted again. Since this was a direct coupled set the 8EB8 was changed and a new diode installed. After three weeks, the customer called again — no pix and garbled sound. This time the set was taken to the shop. The diode was shorted again. After monitoring the wave form and voltages for a couple of days no trouble was found. So we changed the interstage transformer, in which the diode is located, and after a couple more days of fruitless checking, the set was delivered. Bingo, two weeks later, we had the same trouble again. This time the diode was open. After considerable checking we found that the 1B3 socket was arcing to the chassis when the set was first turned on. The insulation on wire feeding the noise gate control was crystalized and was feeding the arcing through the noise gate control and through 8EB8 to the diode. Changing the 1B3 socket, the noise gate control,

and the wire to and from this control cured the trouble. — *E. R. Hayles, Jr., Mobile, Ala.*

Dirty Board

An Airline portable, Model GTM-4201A was brought to the shop with no vertical sweep. It had been to another shop and they had given up on it. The set has a printed circuit and uses a 6CN7 as a vertical multivibrator. Upon inspecting the set I found that the other shop had changed all the capacitors and resistors in this circuit with no success, the work was neat and well done. I also noted that C-54, across the power line interlock, had shorted at some time with the flash evidently leaving a thin film of carbon on the bottom of the printed board. Using contact cleaner and a small brush I washed off the film and operation was restored to normal. This thin film of carbon was acting as a resistance path across several points in this circuit. In this case it affected the vertical circuit but it could have affected any other circuit had this film been elsewhere on the board. — *N. N. Jones, Lebanon, Indiana.*



Bad electrical connection to chassis caused hum bars in picture.



TUBE TESTER 88, \$69.50 NET—locates all tube faults quickly, accurately with patented Seco grid circuit test that checks tubes 11 ways—also cathode emission test.
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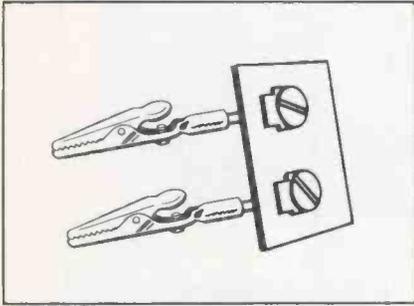
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SHOP HINTS

TIPS FOR HOME AND BENCH SERVICE

Antenna Adapter

To attach an antenna lead to sets that are on the bench I use a special rig. Solder two alligator

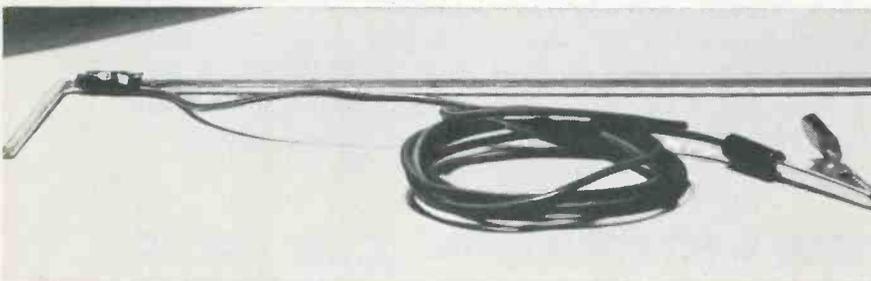


Alligator clips soldered to an antenna terminal board simplifies hookup on a variety of connectors.

clips to the lugs of an antenna terminal board. The clips then can be snapped to the lead from the tuner and the "clothes pin" can be snapped over the opened screws of the board. The screws should be soldered open so they won't close up. — *Norris B. Cozort, West Plains, Mo.*

Portable Ground

Often during the summer small portable TV's are taken into the yard or set on the back steps to watch the world series or some particular baseball game. If the grass has just been watered down it is very easy to get shocked by touching a metal cabinet. This also applies to portable radios. Simply make a handle and attach to the ground stake and connect a flexible wire to it with a large alligator clip



Ground rod prevents dangerous shock when ac sets are operated outside.

that can be fastened to the TV or radio cabinet. — *H. L. Davidson, Fort Dodge, Iowa.*

Cleaning the Unknown

To clean faded or greasy resistors, try rubbing a little speaker service solvent on it. I have used this many times to restore color band brightness. It saves a lot of time when a schematic is not available. — *Forrest Townsend, Birmingham, Ala.*

Removing Tube Shields

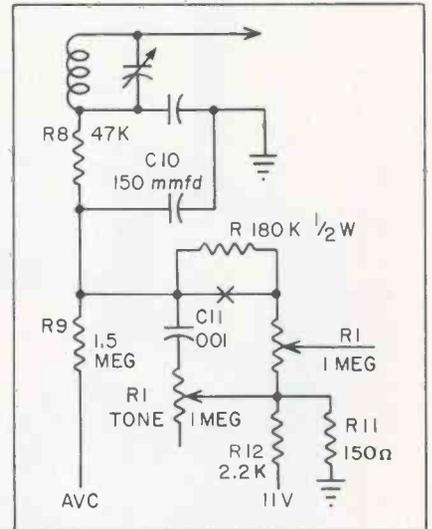
I have found an easy way to remove tight fitting shields from miniature tubes. Use a socket wrench and push down on the top of the tube with the socket while holding the shield. About a $\frac{3}{8}$ in. socket works best. — *Lee D. Fortun, Viroqua, Wis.*

Dead Tubes Useful

Save a few bad tubes with intact filaments; clip all except heater pins and use in series to kill various stages while testing. — *Albert S. Lombard, Windham, N. Y.*

AVC Overload

We have encountered distortion with a Stromberg Carlson auto radio, model number VA 60 M, on a local radio station. We have found the following AVC circuit change to eliminate this distortion problem.



Adding resistor, R, allows AVC to swing further avoiding distortion on strong stations.

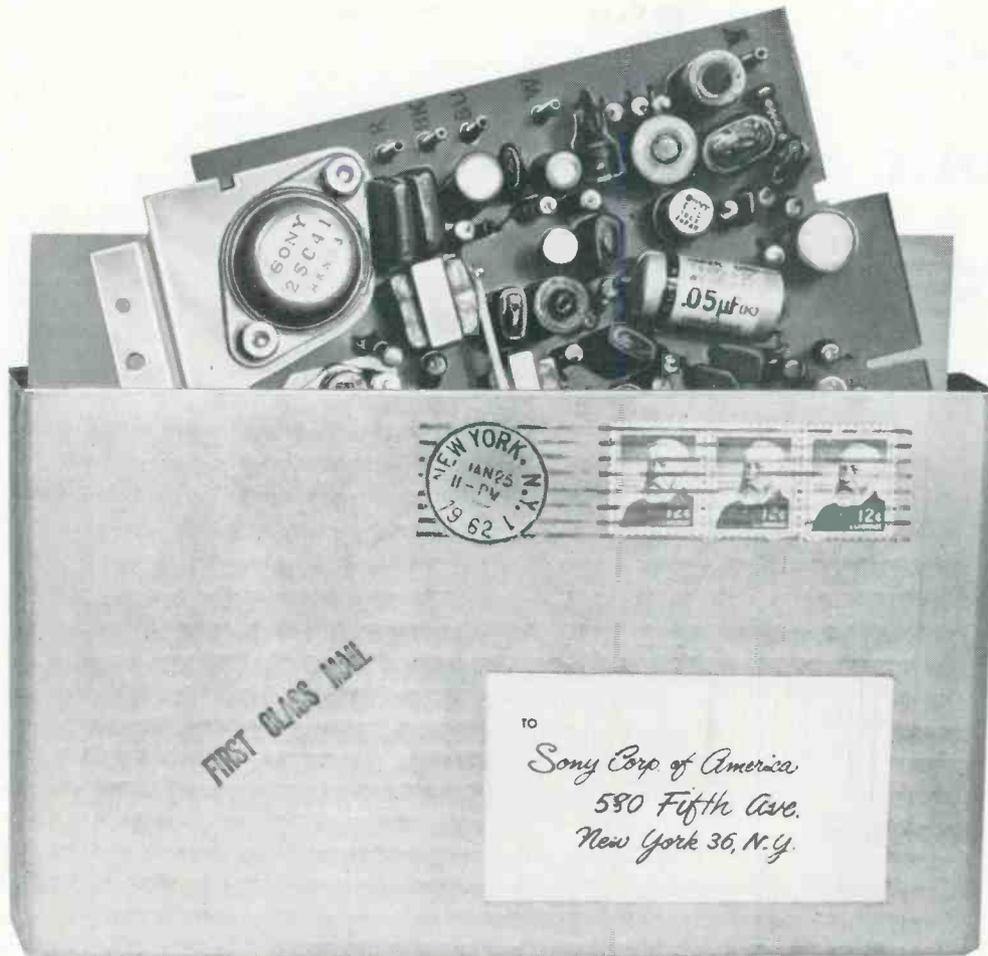
Insert a 180 k ohm $\frac{1}{2}$ w resistor in series with R1 and R8 to allow AVC voltage to swing more negative on strong local signals. — *Ken Miller, Adrian, Mich.*

Zenith Cheater Adapter

Soldering a common male cheater connector, terminal-to-terminal, to a female Zenith-type connector allows you to get by with only one cheater cord in your caddy. When you run into a Zenith TV requiring the special jack, simply plug the adapter into the regular cheater cord and you're in business. — *T. F. Edmonds, Blue Mound, Kan.*

SHOP HINTS WANTED!

\$3 to \$10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photos are desirable. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to Shop Hints Editor, ELECTRONIC TECHNICIAN, 1 East First St., Duluth 2, Minnesota.

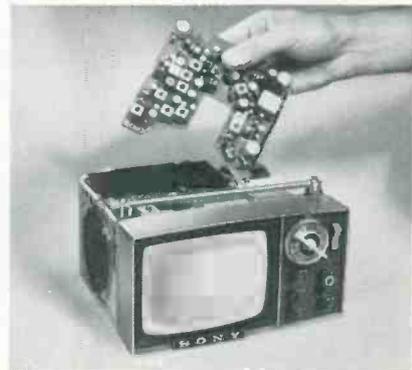


Easiest way to service a TV

THE REMARKABLE NEW SONY MICRO-TV

The easiest way to service a TV is to drop it in the mail, and SONY will take it from there. Not the whole set, of course. Just the circuit board with the defective component, which you simply snap out of the new SONY Micro-TV, the remarkable 25-transistor television set that weighs only 8 lbs., and can operate on its own rechargeable battery pack, 12v auto/boat system and AC. Once the board, on which practically all components are mounted, is received by SONY, it will be serviced promptly and shipped back to you at a reasonable charge, to allow you room for a full markup. Micro-TV \$229.95. Rechargeable battery pack, accessories extra.

SONY
RESEARCH MAKES THE DIFFERENCE



SONY CORP. OF AMERICA

580 Fifth Avenue, New York 36, N.Y.

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Please send full details on the remarkable SONY MICRO-TV.

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ELECTRONIC TECHNICIAN

Ojibway Building,
Duluth 2, Minnesota

. . . SOUND SYSTEM

Continued from page 25

phones are very economical and capable of excellent performance. They should not be used in areas where temperatures rise to 125°F, however, or the microphone may become inoperative. Obviously, a crystal microphone would not be a wise choice for outdoor use in mid-summer, in boiler rooms, or similar places.

Dynamic microphones are probably the most popular type used today for commercial sound systems. Some high impedance dynamic microphones are assembled with a small switch at the instrument's rear which permits selection of high or low impedance output as desired.

In some rare cases requiring highest possible sound quality, a ribbon velocity microphone may be required. This microphone is more fragile than the dynamic, is not recommended for outdoor use and is usually the most expensive instrument in manufacturers' lines.

For indoor voice use where the microphone is to be located relatively close to the amplifier, the high impedance crystal microphone is an excellent choice. For outdoor use and for pickup at points greater than 35 ft from the amplifier or in locations where ambient temperature runs well over 100°F, a low impedance dynamic microphone should be selected. Where feedback or audience background noise presents problems, the cardioid microphone should be given top consideration. If the microphone needs to be placed at a considerable distance from the performer or announcer, the uni-directional microphone will work out better than the omni-directional type.

Speakers

There are two basic loudspeaker types used in paging and music systems: Horn and cone speakers. Horn speakers are available for practically every type of environment. They are capable of high-power sound output. They are particularly suited to outdoor application — playgrounds, athletic fields, stadiums, etc. — and indoor applications where high sound power is required to cover large areas. They require no auxiliary enclosures or

baffles. The trumpet type is singularly effective in projecting sound over several hundred feet. Wide-angle dispersion horns and radial reflex projectors are used for broad coverage. They are not capable of wide-range frequency response characteristic of better cone loudspeakers. For this reason horns are generally not used for music reproduction.

Cone speakers are used in music distribution systems wherever possible. Although they lack the long distance penetration of trumpets and large area coverage from a single unit, their characteristics are ideal for paging and voice reproduction in applications where the general noise level is not high. They are generally used in indoor paging and music system applications where no severe acoustic problems exist. And even for outdoor applications where Hi Fi reproduction is required, cone speakers are often used in special weatherproof enclosures.

Refer to Table I for number of speakers and types generally required for average locations. ■

. . . PA SYSTEMS

Continued from page 28

reflections when sports or other presentations take place.

In factory areas, voice reproduction or paging may be most important; smaller projectors will be satisfactory in these areas. High noise levels usually prevail and therefore high amplifier powers may be needed. Distribute the speakers where most needed, thus, keeping distances smaller.

A projector can be located close to the operator of a noisy machine to solve an otherwise troublesome situation. In quieter areas, the use of extended range speakers in suitable enclosures provide excellent economical coverage suitable for speech or music reproduction.

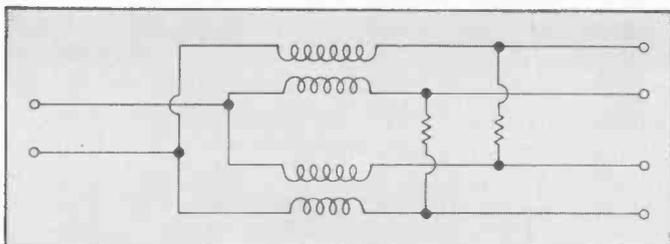
Microphones

Selection of the proper microphone may be the most trying problem for any installation. Often, even after a careful analysis, of the problem, trial and error must be employed to achieve optimum results.

THE SECRET'S IN THE CIRCUIT

BLONDER-TONGUE TV/FM COUPLERS

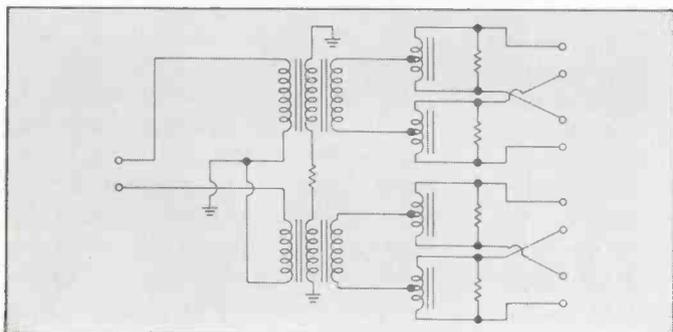
You can't tell a coupler by its case. However, a view of what's inside can tell you why a coupler will deliver clean, interference-free signals to a multi-set installation. Examine the circuitry of Blonder-Tongue couplers. Compare them with ordinary units. It's easy to see why they are the best selling quality couplers on the market.



THE TIME TESTED BLONDER-TONGUE A-102

This is the champion performer among all 2-set couplers judged on the basis of its popularity with technicians and TV viewers. The A-102 offers 12 db isolation *with only 3 db insertion loss*—half the insertion loss of the average 2-set coupler! Designed for both TV and FM, it is especially effective in weak signal areas. For FM stereo, this low loss hybrid type unit is the answer. A look at its circuitry will tell you why.

- patented bifilar transformers
- backmatched for precise impedance match
- heavy conductors end burnouts. List \$3.20



NEW COLOR-ENGINEERED COLOR-4

Where a color TV set is one of the sets receiving signals from a single antenna, the Color-4 is the only answer. This super deluxe 4-set coupler offers maximum interset isolation (16 to 24 db), excellent impedance match and only a 6.5 db insertion loss. The Color-4 uses ferrite broadband transformers in balanced bridge design and it has a voltage standing wave ratio of less than 1.5. Result: Lower inherent insertion loss, less smear and ghosts, sharper pictures than any other 4-set coupler.

- Ferrite broadband transformers in balanced bridge design
 - VSWR of outputs and inputs no greater than 1.5.
 - Backmatched
- List \$9.95

BLONDER-TONGUE TV & ANTENNA COUPLERS

NEW BLONDER-TONGUE ALL CHANNEL SET-2. The SET-2 is one of the few couplers available today that can deliver full power signals to two UHF, or a VHF and UHF receivers operating from the same antenna. Effective straightforward resistive circuit provides 12 db interset isolation with 6 db loss. While it's effective on VHF and FM, the low loss A-102 is a better choice for FM stereo. List \$3.20

BLONDER-TONGUE A-104 FOUR SET COUPLER. Inductive — resistive coupler for VHF and FM. Feeds 4 VHF receivers from one antenna, or mixes 4 antennas into one line. Isolation: 12-20 db. Loss: 7.5 db. List \$4.50

BLONDER-TONGUE A-105-HI-LO COUPLER. Combines low and high band VHF antennas and provides separate low and high outputs from a common line or antenna. Less than 0.5 db loss. List \$4.10

BLONDER-TONGUE A-107 UHF-VHF ANTENNA COUPLER. The choice in UHF areas throughout the country. It combines VHF and UHF antennas, or provides separate VHF and UHF outputs from a common line or antenna. Less than 1.0 db loss. List \$4.75



INDOORS OR OUTDOOR. Blonder-Tongue couplers are the easiest to install. Patented striplless connectors assure rapid, positive installation—no stripping, no splicing twinlead. Weatherproof, *non-breakable* case permits installation indoor or outdoors.



For the right coupler at the right price, contact your Blonder-Tongue parts distributor or write Dept. ET-2
engineered and manufactured by

BLONDER-TONGUE
9 Alling St., Newark, 2 N. J.

Canadian Div: Benco Television Assoc., Ltd., Tor., Ont.
home TV accessories • closed circuit TV systems
UHF converters • master TV systems

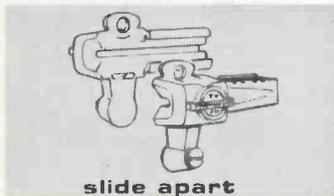
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TRANSCCEPTOR



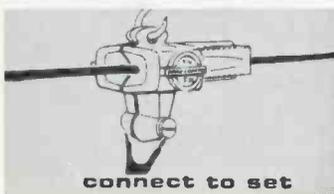
THE ONLY INDUCTIVE SET COUPLER



slide apart



slide on line



connect to set

ANYONE CAN INSTALL IN SECONDS

Any number and combination of TV and FM sets can be run off one antenna with foolproof, simple, rugged TRANSCCEPTOR. Because it uses electromagnetic pickup, TRANSCCEPTOR simply snaps on main antenna line without tools, stripping, splicing or soldering. Line is not cut, signal loss is minimized, set-to-set isolation is improved (12 db).

Impedance is matched automatically. Uses standard 300-ohm flat line. Operates up to 20 sets without amplification in normal signal areas. Easy to sell, easy for customer to use, TRANSCCEPTOR is guaranteed for life of the set.

As an inexpensive impulse purchase, accessory sales builder, or give-away on larger purchases—you'll build sales and profits with TRANSCCEPTOR.

AEROGAP CORPORATION
1680 VINE STREET HO 6-7385
LOS ANGELES 28, CALIFORNIA

\$2.98 RETAIL

— for more details circle 10 on post card

The microphone has a sensitivity to sounds more in one direction than another. In most PA installations a uni-directional or cardioid type microphone is best. In any case, the sound emitted from the speaker should not be allowed to easily re-enter the microphone. Obviously, this is most easily accomplished with the uni-directional microphone.

The microphone you select for a particular installation will depend on the distance, direction and broadness of the area from which it will be necessary for you to pick up sound.

When it is necessary to use a bi-directional or omni-directional microphone, speaker feedback may present a problem. Re-orienting the speakers or increasing the negative feedback in the amplifier may be the only solution. Trying several different microphones and selecting the one with best characteristics is also recommended.

If it is necessary to cover very broad areas, several microphones may be employed. The amplifier gain may then be reduced, decreasing the possibility of feedback squeals and whistles.

Of course, if only one person is to use the microphone, the lapel type microphone should be investigated. These units are particularly good where the speaker must be free to move around. ■

Information Credit: Jensen Manufacturing Co.

... CONTROL GRID

Continued from page 32

When the amount of AVC bias voltage changes, the cutoff pentode's gain also varies, as explained previously. The factor A changes in the equation, thus resulting in a different value of input capacitance.

Since this C_{in} is effectively in parallel with the tuned circuit L_1C_1 , applying AVC bias results in tank circuit detuning. This detuning is sufficient to seriously affect the receiver's sensitivity. The circuit designer sometimes leaves the cathode resistor R2 unbypassed (C_2 not used), thus introducing negative feedback which tends to partially offset the Miller Effect.

Think about some of these phenomena the next time you get puzzled in a grid circuit. ■

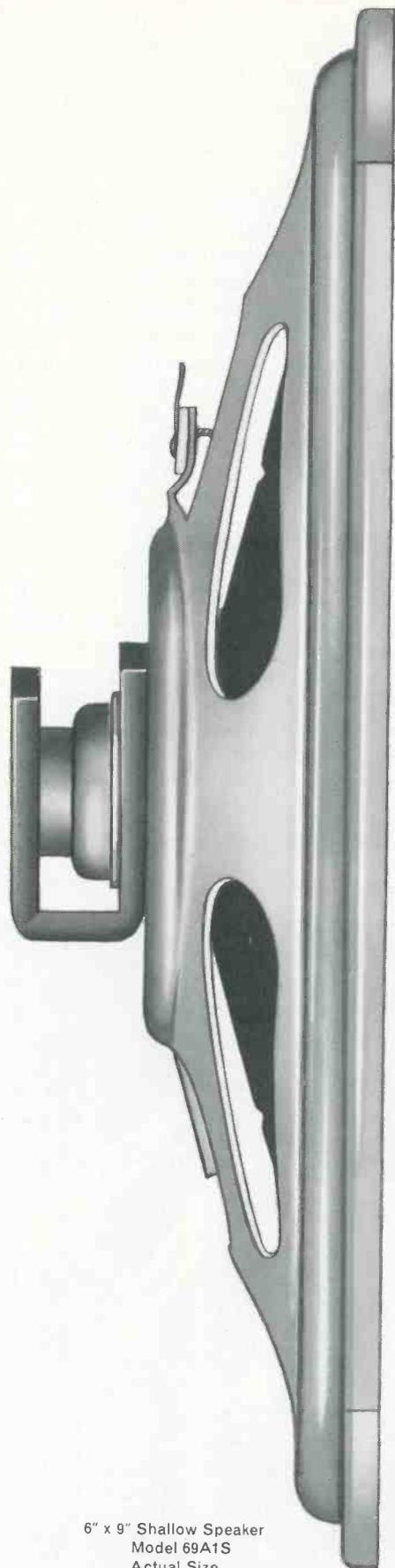
NEWS OF THE INDUSTRY

The Average Hi Fi Fan

The average Hi Fi fan played his set 547½ hours during 1962, reports Jensen Industries of Addison, Ill., leading manufacturer of phonograph needles. That boils down to 10½ hours a week — or an hour and a half a day. Actually, it's an average for everybody from the dedicated audiophile who rarely turned his Hi Fi off to comparatively disinterested citizen whose Hi Fi came with the TV, explains Karl Jensen, president of Jensen Industries. The average fan wore out one diamond stereo needle or 12 sapphire needles during the course of the year just ended, Jensen adds.

1963 Zenith Line

Zenith Sales Corp. announced recently that its wholesale distributors are now showing a new, broadened line of television receivers for 1963. Highlighted receivers are The Attache described by Zenith as "the first handcrafted, lightweight 16-in. portable in TV today," 10 new basic model color television sets including an ebony color table model, and in stereo, a slim, "space-saver" console in a contemporary, furniture-styled cabinet with a "drop-door" panel. These, include the handcrafted chassis, with no printed circuits; 16,500 v at the CRT and an automatic "fringe lock" circuit, a horizontal linearity adjustment, and a "gated beam" sound system that screens out noise interference. The remaining black-and-white TV sets include 10 19-in. portables, two 19-in. Decorator Convertibles with a dual speaker Cine Sound system; five slimmed 23-in. table models; 13 consoles and four console combinations. Zenith has expanded its color TV line to 19 basic receiver models. Starting at \$495 suggested retail, all 19 color sets have the same handcrafted basic chassis, and use Zenith-designed and Zenith-developed color circuits throughout. Included is the Zenith-patented, two-tube system color demodulation. Other features include the only automatic color level circuit in television today, according to



6" x 9" Shallow Speaker
Model 69A1S
Actual Size

For those special applications choose a Quam speaker

When you need a $2\frac{1}{4}$ " unit for a transistor radio—or a shallow 6" x 9" for a Thunderbird replacement—Quam has it!

When you need a special voice coil impedance or special field resistance—Quam has it!

Quam gives you the widest selection and the highest quality in the entire speaker industry! Ask for Quam, the Quality line, for all your speaker needs.



$2\frac{1}{4}$ " Transistor Radio Speaker
Model 22A0628
Actual Size

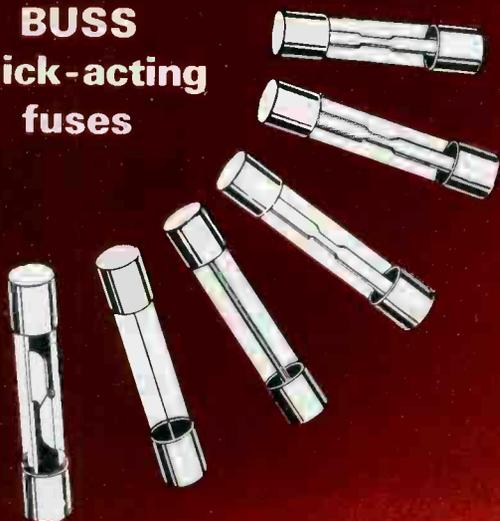
QUAM

QUAM-NICHOLS COMPANY

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BUSS quick-acting fuses



Quick-acting fuses for protection of sensitive instruments or delicate apparatus—or normal acting fuses for protection where circuit is not subject to starting currents or surges.

BUSS

Write for BUSS
Bulletin SFB.

BUSSMANN MFG. DIVISION, McGraw-Edison Co., St. Louis 7, Mo.

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nishings Show. The consoles feature AM/FM stereo radios and four-speed deluxe automatic record changers with a diamond stylus. The 19-in. portable television models are fashioned in simulated animal hides.

Buys Tube Firm

American Video Corporation has purchased the majority of the assets of Calvideo Electronics, Inc. American Video Corp. has investment in other tube firms serving industrial, government as well as commercial markets throughout the United States. Gil Sherman, vice president in charge of sales, confirmed that all picture tubes will be manufactured in the same Compton facilities. American Video will continue to supply picture tubes to over 300 distributors in the western states under the Calvideo and Dumont A.B.D. labels as well as many of the nation's largest T.V. manufacturers under their own Brand.

Philco Equipment

A new 16-in. Courier portable TV receiver has been introduced by the Consumer Products Division of Philco Corp. during the company's national distributor meeting held recently in Chicago. The new portable Courier, Model 2600, is identical in performance to the Courier models introduced last fall. The ornamentation on the cabinet has been changed and the set is available in blue trimmed with white. Five new radios, including a nine transistor model,

BUSS: the complete line of fuses.

NEWS OF THE INDUSTRY

Zenith; a superior "color killer" circuit, and a color threshold control that permits the TV serviceman to key operation of the "color killer" circuit to the specific reception of the set itself.

New Products Coming

First quarter sales of Regency Electronics, Inc. and its divisions are up 50% over last year's like period. Second quarter sales are also running better than 50% ahead of the second quarter of last year, according to Dwayne Berner, president. Mr. Berner, further made known that Regency will soon introduce new product lines for Monitoradio FM Emergency Band Communications equipment, for Citizen's Band use and also new television accessories.

Olympic's New Line

Five decorator stereo radio-phonograph consoles in genuine woods and two 23-in. TV console leaders head a list of 12 new TV and phonograph models introduced by Olympic Radio and Television Division of Lear Siegler, Inc. at the recent Chicago Home Fur-

FUSETRON dual-element fuses time-delay type



"Slow blowing" fuses for circuits where harmless surges occur. These fuses prevent needless outages by safely holding starting currents or surges... yet they provide safe, positive protection against short-circuits or continued overloads.

BUSS

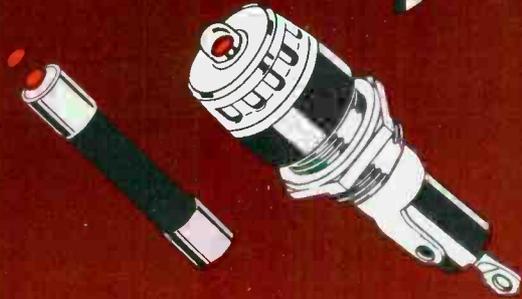
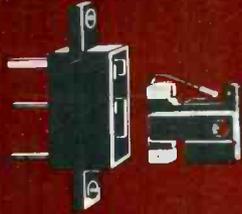
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ELECTRONIC TECHNICIAN

signal or visual indicating fuses



Indicating fuses provide quick, positive identification of a faulted circuit. There are fuses that give a visual signal; fuses that activate an alarm;— and fuses that give a visual signal and activate an alarm.

BUSS

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Philco on an application field after the date of the agreement.

In turn, RCA will pay \$9 million for the rights.

New Tube

Westinghouse Electric Corp. reports that a new 23-in. 94-deg television picture tube features brighter highlights, blacker dark areas, small spot size, reduced halo, sharper edges and more distinct corners. The tube, designated 23DCP4, uses a low-power filament rated at 6.3 v and 450 ma. This is 75% of conventional filament power.

Expansion

Sylvania Electric Products, Inc. will close its plant in Fullerton, Calif. and concentrate all production of black and white television picture tubes in Ottawa, Ohio. There are about 90 employees in Fullerton, and more than 1000 in Ottawa.

CB Users Get Extension

A request by the Communications Equipment Manufacturers Association (CEMA) to the FCC for a 45-day delay in the change of Part 19 rules governing CB broadcast service has been approved. The extension gives the country's more than 350,000 CB users and manufacturers until March 1 an opportunity to voice their opinion.

... of unquestioned high quality

were also introduced. The transistor set is Model T-90 which has nine transistors including one diode chassis. It has full range power and is equipped with a private listening jack. All radio models are immediately available, reports B. R. Lambert, sales manager of radios and phonographs for Philco.

A Merger

Euphonia Corp., manufacturer of phono cartridges, phono needles and milliammeters for tuning and level control indicators, has merged with Euphonia Acoustics, Inc., producer of microphones and ultra-components. The new company is combining both operations in a single, 10,000 sq ft modern air-conditioned plant in Puerto Rico. Approximately one-third of the facility is devoted to engineering laboratories and machine shop.

RCA and Philco Agree

Radio Corp. of America and Philco Corp. have reached agreement on patent licenses covering radio and television, transistors and data processing equipment, ending a dispute dating back to 1957.

Under the agreement RCA will receive non-exclusive licenses under all present Philco and Ford Motor Co. U. S. Patents and patent applications relating to radio purpose apparatus, including color television.

In addition, RCA for the next five years will be able to use any domestic color TV patent issued to

Let BUSS Fuses Help Protect Your PROFITS

To make sure BUSS fuses will operate as intended under all service conditions, each and every BUSS fuse is individually tested in a sensitive electronic device.

This is your assurance that when you sell or install BUSS fuses, you are safeguarded against complaints, call-backs and adjustments that might result from faulty fuses and eat away your profit.

It is just good business
to sell fuses the BUSS way.

BUSS

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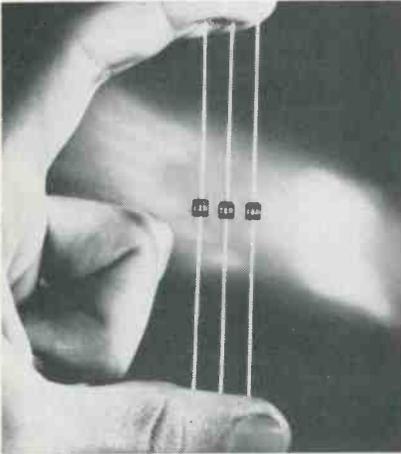
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NEW PRODUCTS

FOR MORE INFORMATION CIRCLE PRODUCT NUMBERS ON POST CARD FOLLOWING PAGE 66

SUBMINIATURE RECTIFIER 200

A series of 1000 ma at 50°C silicon rectifier powerpacks are so small (0.150 in. by 0.150 in. dia.) that more than



200 units will fit into a cubic inch (not counting leads), yet reportedly provide higher current ratings for their size than any device in the field. The devices incorporate advanced diffusion and encapsulation techniques to provide full-rated 1000 ma dc output at 50°C over a peak reverse voltage range from 200 to 1000 v PRV. Their low reverse current (to 2 μ a at 25°C at rated PRV) and low forward voltage drop (0.90 v at 25°C at rated current) assure highly efficient operation. Pure silver 0.032 in. dia leads increase heat dissipation. Price: 90c to \$3.25. Delivery: From stock. International Rectifier Corp.

CAPACITOR KIT 201

Adding extra value to a newly-offered kit of auto radio electrolytic capacitors, are two service tools and a 12-page replacement guide. The kit (K-202) consists of ten of the most popular types of



twist-prong electrolytics, a magnetic service light, tab adjuster tool, and a pocket-size booklet (ETR-3378A) listing replacements for all makes of auto radios. The kit is offered at no extra cost to service dealers through authorized tube distributors. General Electric Co.

WIRE CADDY 202

The "Wire Caddy" reportedly reduces waste and spoilage, keeps the wire clean, prevents tangling and keeps the sloop under control at all times. A "footage-used" chart on the case provides the serviceman with a means of keeping an accurate record on the amount of wire which is on the spool at all times. The 300 ohm twin lead wire, model 20-A1, which is being furnished with the unit, consists of two paralleled conductors of



pure copper. Each conductor consists of 20 strands totaling 20 AWG. The insulation is of pure polyethylene 0.1 in. thick and 0.4 in. wide. A full 1000 ft layer-wound spool of wire is provided. South River Metal Products Co.

WORK BENCH 203

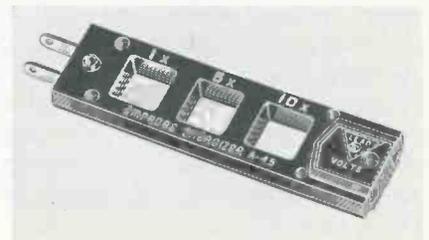
This line of heavy duty industrial work benches reportedly has been designed to keep tools and equipment immediately at hand, and at the same time to provide full knee room for efficient working. The 12 in. deep upper cabinet contains both shelf space and adjustable compartment drawer storage for small tools and gauges. Each drawer has two adjustable cross dividers for maximum utilization of space. Extra shelves and drawer dividers are available. Bench top is either laminated maple, solid wood core faced with tempered pressed board or impervious. Provision for no-drilling installation of electric outlet on leg is included. All parts except bench top are steel finished in gray baked enamel.



Benches are 74 in. high overall, 30 in. deep, and available either 5 ft. wide or 6 ft. wide. Bay Products.

SNAP-AROUND PROBE 204

This device multiplies the sensitivity of snap-around volt-ammeters. Called the Model A-45 "Energizer," it aids in the taking of current voltage readings at outlets and on fractional horsepower motors and small appliances. To use the unit for taking amperage readings with a snap-around volt-ammeter, the technician simply plugs the line cord of the equipment being tested into the Energizer's female receptacle. The Energizer itself is then plugged into an outlet. The Energizer, in effect, "splits" the double-conductor circuit. When the jaws of the test instrument are then inserted through one of the three "holes" in the body of the Energizer (two halves of a split-core transformer) they actually are



being snapped around only one of the two conductors, thus permitting readings to be taken by induction. Amprobe Instrument Corp.

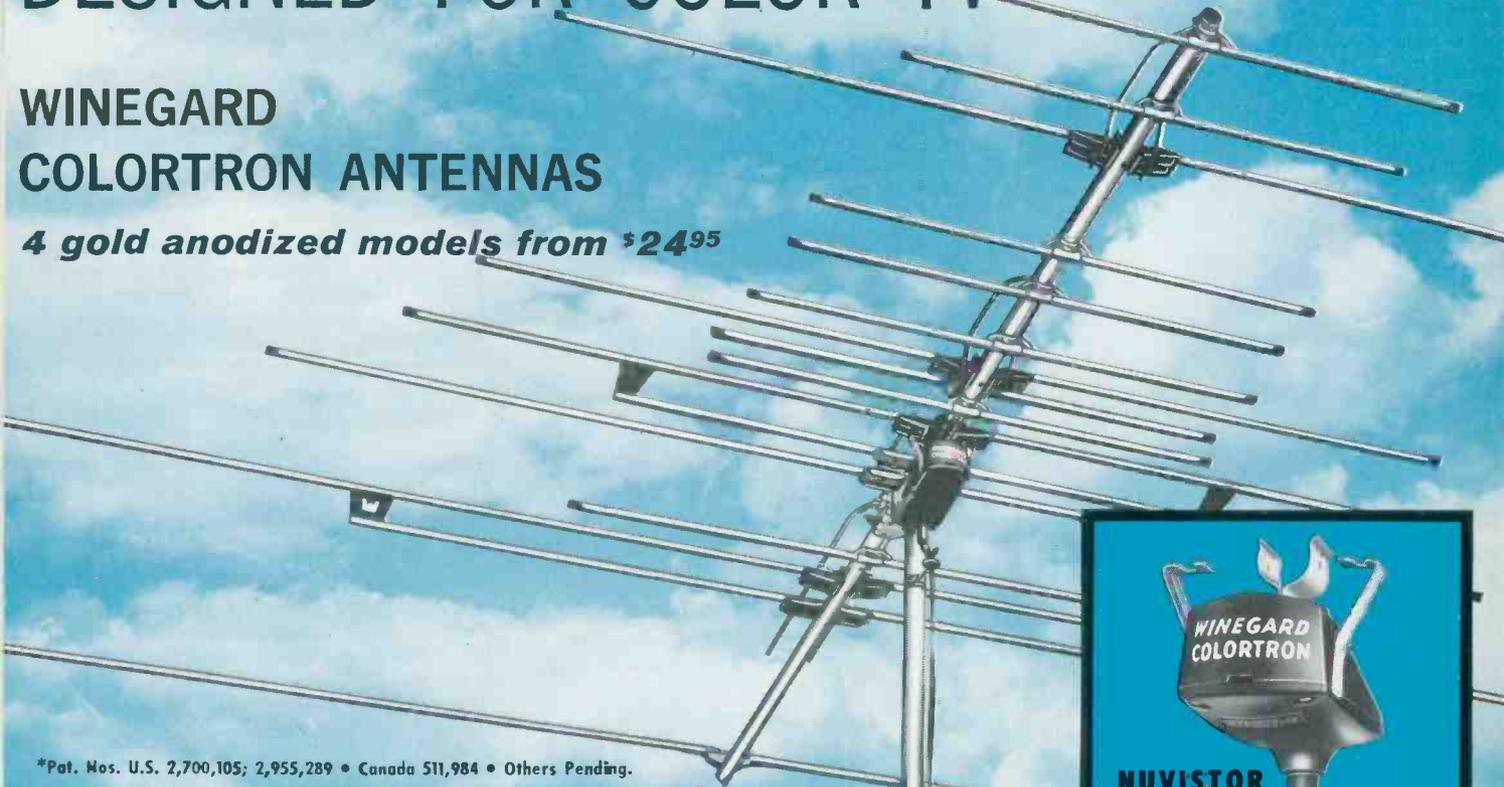
SELF-SERVICE TESTER 205

The Model 202-LB tests all tube types including the latest "Nuvistors," "Novars," "Compactrons" and Sylvania 10-pin tubes. Also included are provisions for the test of 6 and 12 v vibrators, fuses and pilot lights. The circuitry of the #202-LB allows it to accommodate new

DESIGNED FOR COLOR TV

WINEGARD COLORTRON ANTENNAS

4 gold anodized models from \$24⁹⁵



*Pat. Nos. U.S. 2,700,105; 2,955,289 • Canada 511,984 • Others Pending.



AVAILABLE WITH REVOLUTIONARY NUVISTOR COLORTRON AMPLIFIER...

**NUVISTOR
AMPLIFIER**
\$39⁹⁵

Now, through continuous Winegard research, a new, improved Electro-Lens yagi has been developed—the NEW WINEGARD COLORTRON—PERFECT ANTENNA FOR COLOR TV!

Colortrons have a flat frequency response (plus or minus 1/2 DB across any 6 MC channel), no “suck-outs” or “roll-off” on end of bands . . . accurate 300 ohm match (VSWR 1.5 to 1 or better) . . . unilobe directivity for maximum ghost and interference rejection. They deliver today’s finest color reception, give a new picture quality to black and white. Colortrons are the only outside antennas that carry a WRITTEN FACTORY GUARANTEE OF PERFORMANCE.

And Colortrons are built to last. High tensile aluminum tubing for rigidity and stability, insulators with triple moisture barrier, GOLD ANODIZED for complete corrosion-proofing.

There are 4 Colortron models to cover every reception need, from suburbs to distant fringe areas . . . \$24.95 to \$64.95 list.

New Winegard Colortron twin-nuvistor amplifier perfectly matches Colortron antennas. Gives added gain and sensitivity on both color and black and white. Ultra-low noise, high

gain Colortron Nuvistor Amplifier can easily drive 6 or more TV sets.

With revolutionary twin-nuvistor circuit, Colortron amplifiers can handle up to 400,000 micro-volts of signal without overloading. *This is 20 times better than any single transistor amplifier.* The Colortron Amplifier will bring the weakest signals up out of the snow, yet strong local TV & FM signals will not overload it. A special life saver circuit gives the two nuvistors a life of 5 to 8 years.

This amplifier is completely trouble free and the finest performing antenna amplifier you can own.

Completely weather sealed, nothing is exposed to corrode and cause trouble . . . has all AC power supply with 2 set coupler. (Model No. AP-220N, \$39.95 list). Twin transistor model also available up to 80,000 micro-volts input. *New type circuit protects transistor from static electricity built up in lightning flashes.* (Model No. AP-220T, \$39.95 list).

Colortron Amplifier can be added to any good TV antenna for sharper, clearer TV reception.

Ask your distributor or write for technical bulletin.

World's most powerful TV antenna

MODEL C-44
GOLD ANODIZED \$64.95

MODEL C-43
GOLD ANODIZED \$51.90

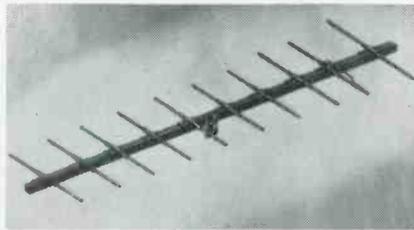
MODEL C-42
GOLD ANODIZED \$34.95

MODEL C-41
GOLD ANODIZED \$24.95

NEW PRODUCTS

HEAVY DUTY ANTENNAS 206

The "J" series are available for every VHF channel (2-13) as well as for FM. The antennas, which provide a minimum

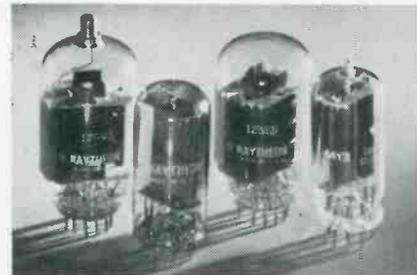


10.5 db gain in the high band, and an approximate 8 db gain in the low-band, feature 75-ohm output. A built-on 75-ohm coaxial cable fitting, with cable connector and weather boot provides the highest possible degree of electronic continuity. Irridited aluminum is used in the over-all manufacture of the antennas, except for the steel mast mounting bracket. Elements are composed of 1/2 in. .062 seamless 6061T6 aluminum tube. The high-band yagi has 10 elements. Low-band and FM models have five elements. All elements, as well as boom, are completely sealed to prevent internal moisture build-up. Price: \$62.50. TACO.

TV TUBES 207

Twelve TV receiving tubes are designed for wide-angle kinescopes. New damper service tubes, the 6AX3, 12AX3, 17AX3, 6AY3, 12AY3 and 17AY3, are unipotential cathode-type diodes in T-9

glass envelopes having insulated heaters with 5000 v peak ratings and integral all-glass button bases. The 12-pin AX tubes' maximum ratings include peak inverse plate voltage of 5000 v, steady-state peak plate current of 1100 ma, and d-c output current of 175 ma. Deflection amplifiers, the 6GV5, 12GV5, 17GV5, 6GE5, 12GE5 and 17GE5, are cathode-type, beam power pentodes having 12-pin integral all-glass bases and T-12 envelopes. The GV5 tubes are double ended and the GE5 tubes are single ended. Design maximum ratings of both the GV5 and GE5 tubes include



dc plate supply voltage of 770 vdc cathode current of 175 ma, peak cathode current of 550 ma, screen voltage of 220 v and plate dissipation of 17.5 w. Raytheon Co., Industrial Components Div.

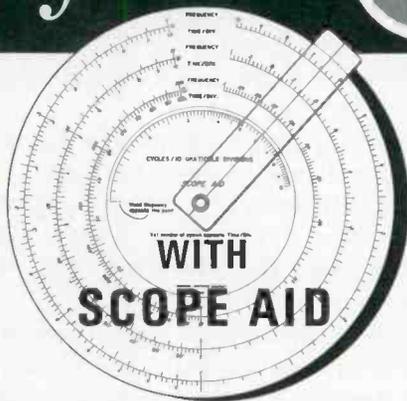
AVALANCHE RECTIFIERS 208

The 31, 32 and 33 diodes are the second of a series of avalanche type silicon power rectifiers. The avalanche phenomenon, provides protection against



tube types as they come out. The modern lo-boy cabinet design is finished in a light green and white color combination with gold trim. The tube compartment has three sliding drawers with tube dividers and drawer sheets for automatic inventory control. Easy-to-read quick flip tube charts list over 1200 tube types with new tube charts available periodically. A multi-color illuminated display sign tops the cabinet. Price: \$184.50. Mercury Electronics Corp.

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voltage transients (generally eliminating the use of surge suppressors) by limiting the voltage across the rectifying junction. This reduces electrical stress and subsequent breakdown, typical of non-avalanche diodes. Another advantage of the avalanche characteristic is said to be the elimination of shunting resistors when diodes are connected in series in high voltage application. Syntron Co.

WIRE STRIPPER 209

This thermal wire stripper reportedly eliminates nicking of wire during stripping operations. There are no sharp



edges cutting the wire as this specially designed heating element melts the wire covering and anneals the inner copper wire, making it more flexible and eliminating wire breakage. In the melting process a bead is produced reportedly giving the wire cover additional strength at that point, plus preventing the unraveling or tearing sideways of the wire cover. The length of the wire to be stripped can be regulated for production stripping. Price: \$11.95, postpaid. Bench model, \$19.95. Sentry Electronics Inc.

CB TRANSCEIVER 210

This compact unit permits crystal controlled transmit/receive on all 23 CB channels. Features include a ± 3 kc vernier tuning control for the receiver



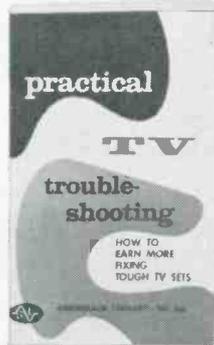
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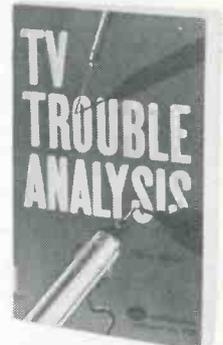
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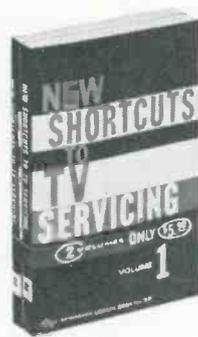
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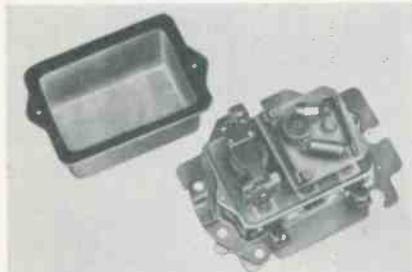
ET23

NEW PRODUCTS

section to permit peak tuning while preserving crystal stability and complete interchangeability, without modification, for 115 vac current or 12 vdc power supplies. Peak "talk power" of the transmitter is bolstered by a dual conversion superheterodyne receiver employing 262 kc IF for high selectivity, the CB-23 requires no other accessories. Equipment includes all crystals, built-in S-Meter, microphone, two sets of power cables, and built-in speaker. Price: \$229.50. Hammarlund Mfg. Co.

TRANSISTOR REGULATOR 211

A transistor regulator is designed for use on marine and land vehicle engines equipped with 12 v, negative ground, self-load limiting 40 amp and 60 amp



alternator systems. The Model 5003RA transistor regulator is approximately 40% smaller than ordinary regulators of the same rating, and can be installed wherever space permits, using existing regulator wiring. Radio interference is virtually eliminated by the new transistor regulator, since its solid state components cannot arc or produce noise. Leece-Neveille Company.

CB TRANSCEIVERS 212

The "Globe Master" will provide extensive coverage of the Citizens Band with provisions for eleven crystal con-



trolled channels for transmitting using fundamental type crystals. Special features and specifications of the receiver section include: Sensitivity, minimum of 10 db signal plus noise to noise ratio with 0.5 μ v. input to the antenna, selectivity, 6 db points — 6 kc and 60 db points at 5 kc, Squelch circuit at threshold, receiver will open for carriers of 0.1 μ v. or greater, crystal controlled fre-

quency stability 0.005% or greater and audio output is at least 3 w into a 3 in. by 5 in. speaker with a 2 μ v., 30% modulated, signal input at the antenna. Image rejection is 50 db or better. The transmitter provides maximum plate power input of at least 25 w with a frequency stability of 0.005% or better. Price: \$229.95. Globe Div., GC Electronics Co.

DISPLAY STANDS 213

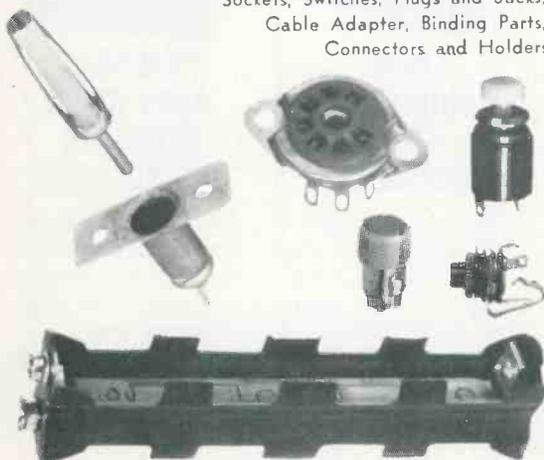
Island display stands are designed to present four categories of products: tape and phono accessory kits; tape recording accessories; patch cords and adaptors; phono accessories. Each display carries approximately \$400 (at list price) worth of accessories. These display stands are available to distributors who purchase the preselected merchandise assortments they contain. The displays can be placed



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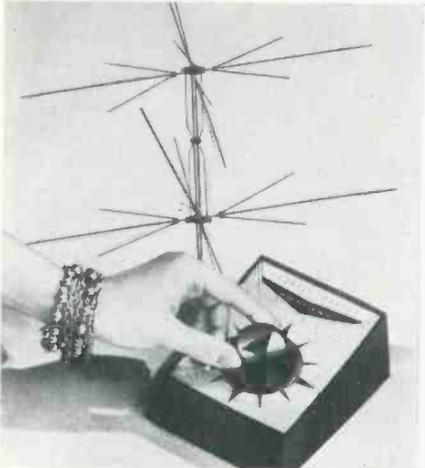
SHOW

(formerly the IRE Show)

against a wall, used as individual islands, or back-to-back to form an accessory island. Robins Industries.

TV/FM ANTENNA 214

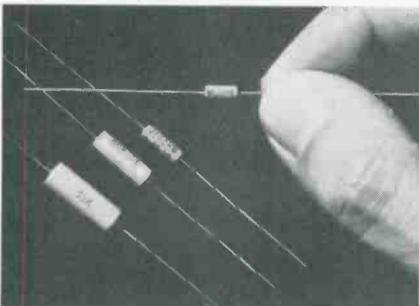
The "Omni-Ray," Model 3620-G, is a TV/FM outdoor antenna with an indoor switch that is claimed to provide



complete directivity control without rotating the antenna. This is accomplished by a crossed-dipole system which gives the antenna a figure 8 reception pattern with deep nulls at each side. The front-to-side interference rejection ratio is 10:1. This figure 8 pattern is rotatable in 22-1/20 steps, and is maintained on every channel, low and high bands, and in every direction selected. Model 3620-G is a fully assembled stacked antenna, with the connecting rods already in place. Model 3621-G is a single bay kit, and Model 3622-G is a complete stacked antenna kit. Price: \$34.95, 3620-G; \$26.95, 3621-G, and \$39.95, 3622-G. Channel Master Corp.

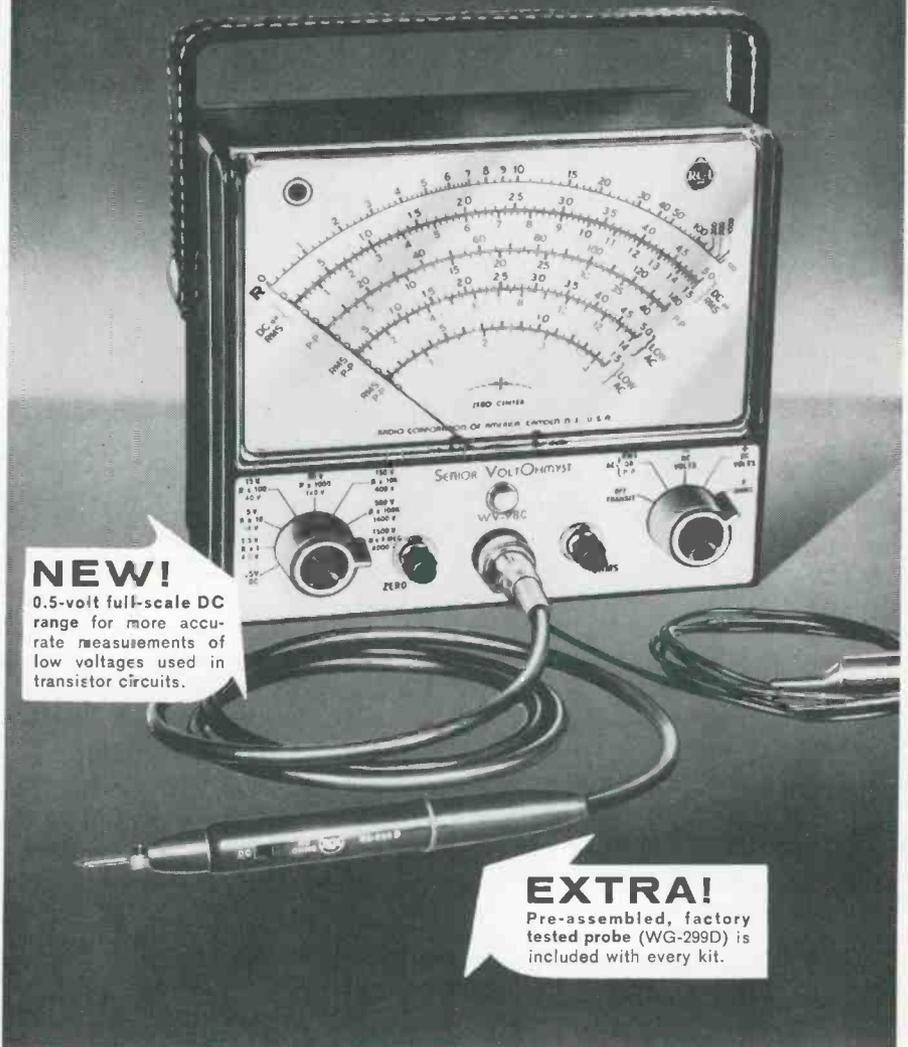
FILM RESISTORS 215

A 1/10 w metal film precision resistor, tradenamed "Metohm" is intended for use in precision equipment. Complementing existing 1/8, 1/4 and 1/2 w sizes (types RN60, 65 and 70 respectively), the 1/10 w Type RN55 is designed to exceed MIL-R-10509C specs. These miniaturized precision resistors are for applications where high reliability, high stability, close accuracy and low temperature coefficients are vital. Metohm 1/10 w resistors are manufactured in ten TC codes including T-9 ($\pm 25\text{PPM}$), with tolerances from the standard $\pm 1\%$ down to $\pm 0.05\%$, and in a wide range of resistance values. Ward Leonard Electric Co.



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Checklist for buying a full-power CB 2-way radio

look for these features:

- TRANSMITTER POWER** — For longest transmission range possible, choose a 5 watt unit, the maximum authorized power input for Class D CB radios.
- SENSITIVITY**—A greater sensitivity rating indicates a better ability to reproduce weak signals. Look for a sensitivity rating below 1 microvolt to capture signals transmitted many miles away.
- SELECTIVITY**—A radio's ability to reject interference from channels not tuned in, is largely determined by the type of circuit used: superregenerative, superheterodyne or dual-conversion superheterodyne. The latter circuit, the dual-conversion superheterodyne, is acknowledged by experts to be the best circuitry for clearest reception. Says Len Buckwalter, noted communications author, in *Electronics Illustrated* May 1962. "... Look for the dual-conversion feature if you wish to get top receiver performance."
- CRYSTAL-CONTROLLED CHANNELS**—Fixed crystal controls assure accurate, fast communications contact. They enable users to switch quickly from one channel to another to contact different persons, to find a channel that isn't busy. It is best to choose a CB unit with multiple crystal-controlled channels for an efficient, flexible 2-way radio system.
- POWER SUPPLY**—A power supply should be an integrated part of a CB radio. Since full-power CB radios are most often used in vehicles and base stations, a CB radio's power supply should be able

to operate from both 12-volt auto battery and 110-volt AC line.

- AUTOMATIC SQUELCH** — This automatically eliminates annoying background noise when a CB radio is on 'standby' (not transmitting and ready to receive any radio calls). Thus, hisses, crackles and other noises can't distract workers, drivers, etc.

- AUTOMATIC NOISE LIMITER** — An effective automatic noise limiter is necessary, especially in heavily populated areas, to shut out extraneous interferences such as ignition noise. Makes messages more intelligible.

- RELIABILITY** — CB radios must withstand vibration and shock which occurs during mobile use. Solid-state components—transistors and diodes—are less susceptible to damage than fragile tubes.

- PORTABILITY** — Some full-power CB radios may be used in the field as portable units when equipped with a portable case-battery accessory. These units are generally lightweight, compactly designed and offer greater operating flexibility.

- INSTALLATION** — Compact CB radios with simple mounting provisions don't steal leg room in vehicles, lower installation and maintenance costs.

Cadre Industries has two 5-watt models that rate high in every category. Each is supplied with a press-to-talk microphone, set of matched channel crystals, universal mounting bracket and AC & DC cords.



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NEW PRODUCTS

PA DRIVER

216

An average of 20% increase in the power handling capacity of all this firm's loudspeaker driver units is said to result

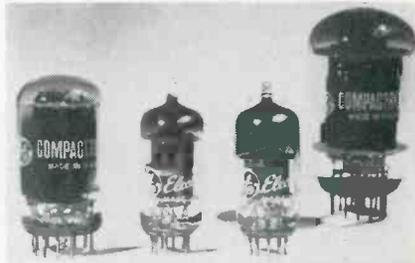


from improved production techniques and maximum use of the latest materials, such as high efficiency alloys, fatigue resistant metals, phenolic resins, thermal setting and epoxy adhesives. For example, the Model PD-60 is rated at 60 w, the Model PD-5VH at 40 w and the Model PD-4V at 30 w. Atlas Sound.

TRANSMITTING TUBES

217

A compactron and two 9-pin miniature transmitting tubes are specifically designed for reliable and economical



high-band mobile communications, according to the manufacturer. The new registrations complement the high power 46 w at 175 Mc, mobile compactron type 7984 announced earlier this year. The compactron, type 8156, is a medium power transmitting tube with 15 w plate dissipation at 175 Mc. A multiplier-driver tube, type 8106, is rated a 6 w plate dissipation. The 8106 can double and drive the 7984, can drive two 7984's in push-pull, or can double and drive a pair of 8156's. For frequency tripling and FM modulator, the triode-pentode type 8102 now is available. All units employ 13.5 v heaters. General Electric Co.

TUBE TESTER

218

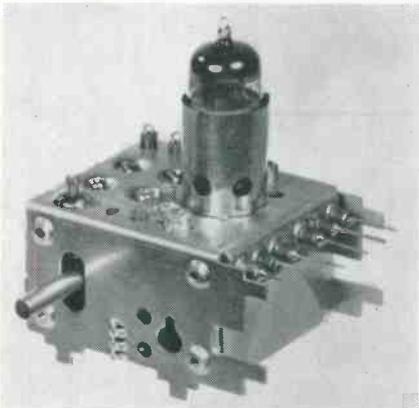
The model 752A "Industrial and Communications Portable Tube Tester" tests the new tubes to handbook specifica-



tions, no elements are paralleled. VR tubes are tested to manufacturers specifications including firing point, regulating voltage and current range. The Model 752A incorporates features for testing dual section tubes. The second section test can be made by pressing a button on the panel. This permits rapid selection of tubes for balanced or matched characteristics. The Model 752A replaces the Model 752 used widely in servicing communication equipment and in other industrial maintenance assignments. Price: \$355. Hickok Electrical Instrument Co.

FM FRONT END 219

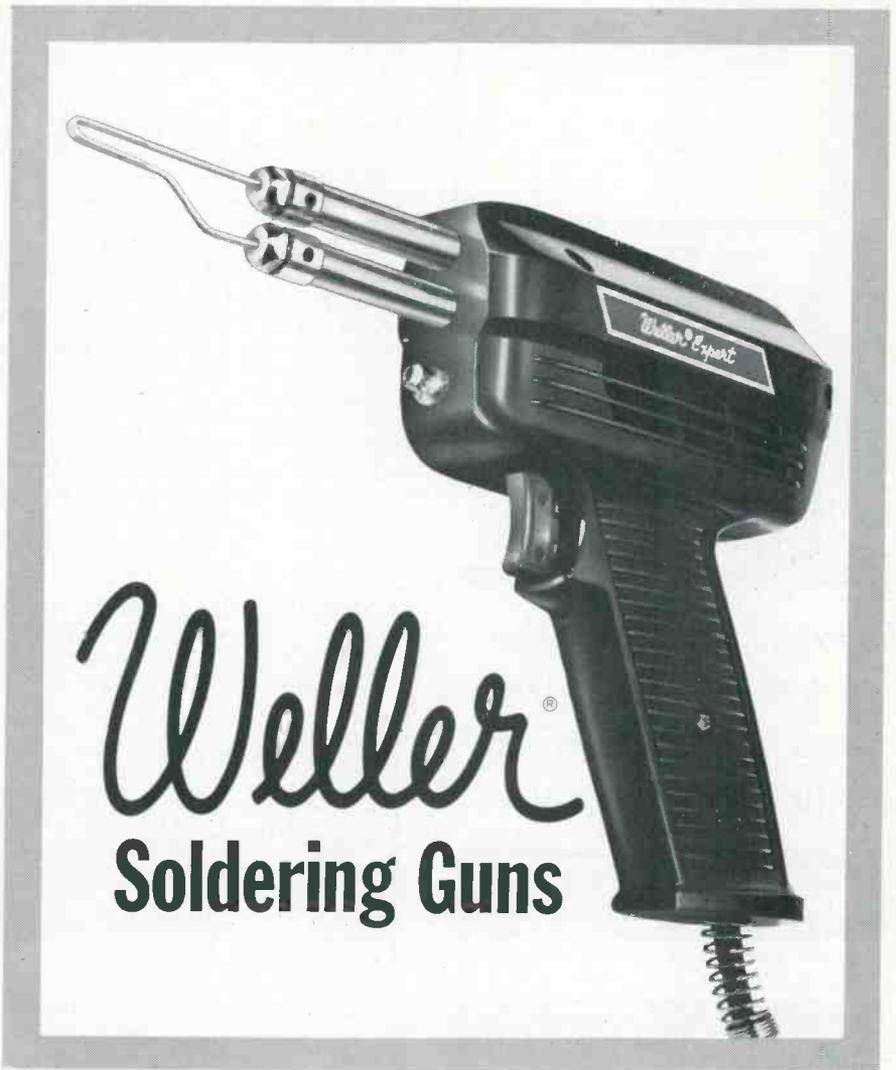
This FM tuner front end reportedly is priced about 20% below the average cost of tuners now on the market. The



model FM-2 combines low drift, low oscillator radiation and highest usable gain according to the manufacturer. In operation, the balance in performance between these desired features reportedly creates maximum efficiency and maintains highest industry standards. In addition, the tuner is used with standard 12DT8, 6DT8 or 6AQ8 tubes available in most tube outlets. Waller Corp.

LOUDSPEAKER 220

This new loudspeaker, according to the manufacturer, offers, for the first



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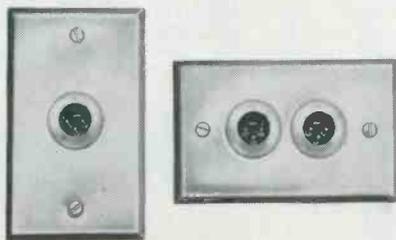
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NEW PRODUCTS

time, a combination of high fidelity speaker characteristics and a price structure competitive with that of quality replacement-type loudspeakers. Features of the MC8 loudspeaker, first model in the new "Michigan Line," include extra-slim styling, a rugged, die-cast frame and an edgewise-wound voice coil that reportedly provides 18% more efficiency than ordinary coils. The dual-cone "Radax" design is said to permit wider range and wider dispersion than single-cone types. The MC8 has a frequency response of 50 to 13,000 cps and power handling capacity of 12 w, program and 24 w, peak. Electro-Voice, Inc.

CONNECTOR WALL PLATES 221

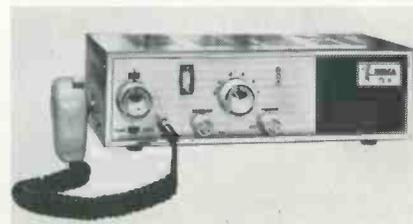
The B3M, 3 contact, male receptacle features "Captive Design" insert screw and "Ground Terminal," mounted on



new single and two gang wall plates. The wall plates are available in two finishes — brushed brass or stainless steel. Four models are available: Part No. G3M, brass finished single gang wall plate. Part No. H3M, same as above, except two gang. Part No. G3MS, a stainless steel single gang wall plate and Part No. H3MS, same as G3MS, except two gang. All feature the B3M, 3-contact male receptacle. The receptacle mounting holes in these wall plates are "D" shape punched to lock the receptacles in place, preventing them from shifting or turning in plates when mating connectors are engaged. Switchcraft, Inc.

CB EQUIPMENT 222

The T & C II, features 6-channel crystal-controlled transmit & receive, plus manual tuning of all CB channels. It has a transmit crystal socket on the front panel. The dual-conversion superhet has a high-gain RF stage for maximum sensitivity with equal response on all 22 channels. Universal power supply

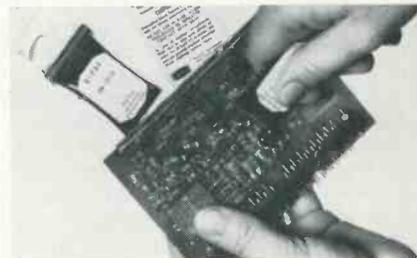


provides 6 vdc, 12 vdc and 110 vac for fast, easy transfer from car or boat to home or office. A calibrated "S" meter with output power modulation indicator auxiliary speaker terminal and one set of crystals are supplied. Utica Communications Corp.

EPOXY

223

An epoxy staking adhesive, "Tra-Bond 2112" is a 100% solid epoxy resin system which is a putty-like, thixotropic adhesive specially developed for the many electronic applications that require "stay put" components and assemblies. Tra-Bond 2112 is used to stick or "stake"



resistors, capacitors and other heat sensitive electronic parts to selected positions on metal or laminate chassis and circuit boards. Supplied in the accurately proportioned "BIPAX" package as a complete resin system, it is claimed to be convenient to store, easy to mix and use. It will cure in 6 hr at room temperature, or within 2 hr at 65°C. Tra-Con, Inc.

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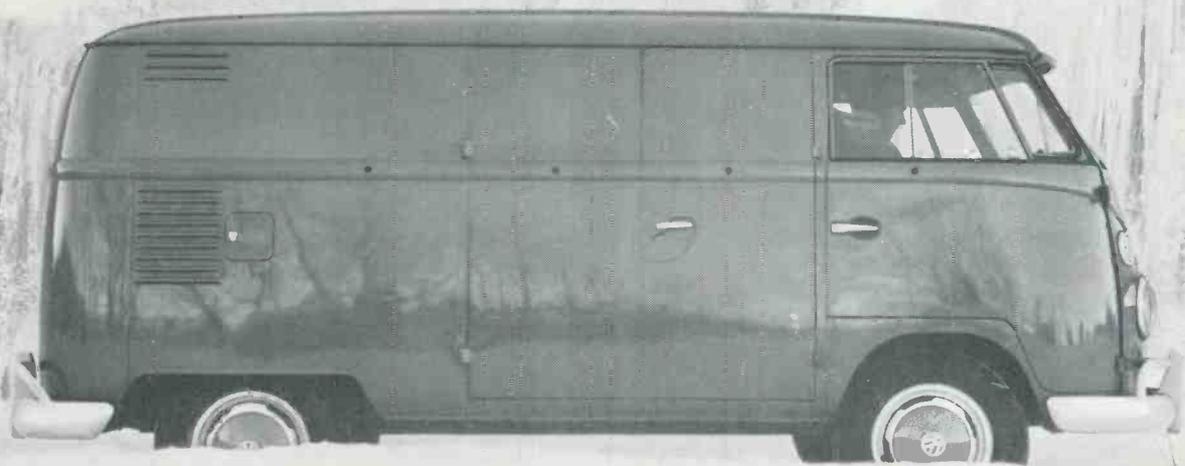
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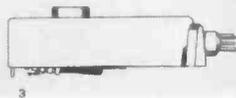
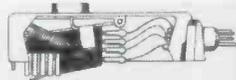
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NEW PRODUCTS

NO-SCRATCH CARTRIDGE 224

A "Stereo Dynetic" cartridge assembly provides a safety suspension system. Designed for use with Garrard "Auto-



matic Turntables" it is claimed to feature scratch-proof and bounce-proof operation. Called the "Gard-a-Matic," the new cartridge assembly includes a Dynetic cartridge installed in a tone arm head. These cartridge assemblies are designed to track at 2 to 2½ g. When pressure on the arm equals or exceeds 3 g, the cartridge retracts into the head, with no increase in tracking force. Excessive pressure on the arm results in a small, plastic, non-scratching "lip" on the cartridge head making contact with record. The suspension system also reportedly prevents record scratching or needle damage should the tone arm be dropped or dragged across the record grooves. Both the M99/A and the M99/AT6 are claimed to have been designed to provide record safety without sacrificing any of the performance characteristics of the standard Stereo Dynetic cartridge. Price: \$49.50, audiophile net. Shure Brothers, Inc.

SHRINKABLE TUBING 225

This irradiated heat shrinkable PVC tubing, FIT-105 is claimed to greatly simplify the jacketing of custom cables. FIT-105 tubing is a modified PVC tubing that shrinks down to one-half of its expanded diameter upon application of heat of approximately 325°F. Because of this shrinkage in diameter, cable cores may be pulled through with relative ease and the tubing can then be shrunk down to form a tight-fitting flexible jacket with the strength and characteristics of



the finest extruded plastic jackets. The shrinkable tubing is packaged in continuous lengths. Other specifications include: operating temperature 105°C continuous; low temperature flexibility, -35°C. and maximum dielectric constant 4.1. Longitudinal shrinkage is less than 10%. Alpha Wire Corp.

TUNNEL DIODE ANALYZER 226

This transistor and tunnel diode analyzer is said to provide a medium priced semiconductor test set with accuracy and testing features found only in more expensive units. Called Model 250, the instrument reads both collector-to-base (Icbo), and collector-to-emitter (Iceo) leakage currents. It operates as a comprehensive transistor circuit analyzer and tests both tunnel and Zener diodes. With the Model 250, transistors can be tested in or out of circuit. Instrument can be set to indicate: transistor leakage and gain, tunnel diode negative resistance characteristics, diode forward conduc-



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ELECTRONIC TECHNICIAN

tance and reverse current leakage. Price: \$86.50 for a-c model, \$74.50 for battery unit. Seco Electronics, Inc.

CARTRIDGE AND ARM 227

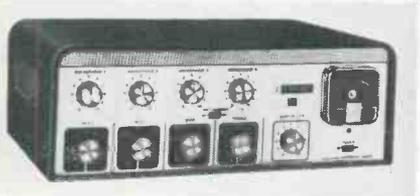
The improved stereo cartridge DST-62, is available with a matched STA-12



tone arm. The cartridge incorporates a metal underside in place of the rubber of the previous model which tended to deteriorate in use. It is sealed against dust and dirt and is permanently aligned for maximum separation. The Stereo Tone Arm STA-12 reportedly keeps extraneous resonances at an inaudible level through an improved rubber damping which separates the arm from the counterweight. An integral calibrated gage permits adjustment of the tracking force from 0 to 7 g. Gotham Audio Corp.

PA AMPLIFIER 228

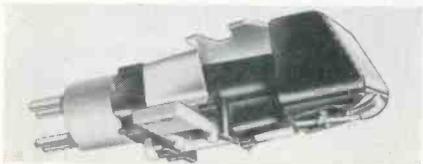
A professional quality 50 w public address, the KN-3050, reportedly will meet most public address requirements



and may be used effectively in halls, school auditoriums, churches or other large gathering areas where maximum audio-fidelity is required. Response is given as ± 1 db, 30 to 20,000 cps at rated output. Hum and noise are 75 db below rated output and input required for Rated Output is Mic. 0.006 v; auxiliary, 0.25 v and mag phono, 0.012 v. The KN-3050 has an aluminum and black case. Its size is 6 $\frac{7}{8}$ x 17 $\frac{1}{2}$ x 11 in. and weighs 29 lbs. The unit is offered for \$129.50. Allied Radio Corp.

CERAMIC CARTRIDGES 229

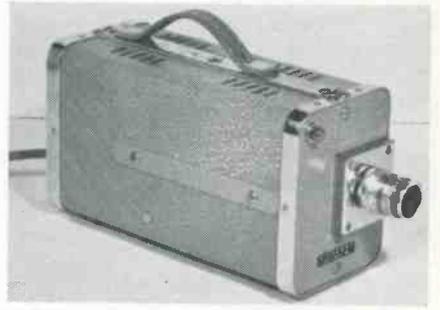
The "16TA" and "18TA" cartridge models are revised versions of two of the



firms budget-priced stereo cartridges. Audio channels of the 16TA are separated by 25 db and are said to reproduce the entire high fidelity range. The flat response, ± 1 db from 20 to 10,000 cps with smooth rolloff to 12,000 cps, is tailored for RIAA characteristics. The compliance figure of 2.4×10^{-6} cm/dyne allows for increased output voltage and lower tracking forces of 4 to 6 g in professional arms and 5 to 7 g in changers. The voltage output of the 16TA is 0.65 v. The 18TA is recommended where more output voltage is desired. Its specifications are the same as the 17TA except for the voltage output, which is 1 v. Both units are turnover type cartridges which play all speeds, stereo and mono. Price: \$6.00 with sapphire tips, \$9.75 with diamond-sapphire styli. Sonotone Corp.

INDUSTRIAL TV 230

This system consists of a matched camera and monitor especially designed for the executive desk or surveillance location. The resolution of the system exceeds that of commercial television and it will make useable pictures wher-



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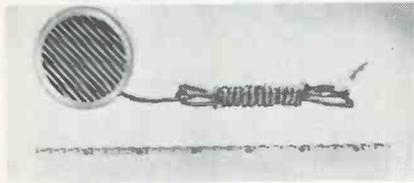
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NEW PRODUCTS

ever the human eye can see. A complete line of accessories is also available. This system can be installed and operated by untrained personnel. Industrial Television Div., Pierpont Industries, Inc.

LAPEL SPEAKER 231

Designated the LS8, this miniature device measures only 1 3/4 in. outside dia with a depth of 15/16 in. Weighing less than 2 oz, the LS8 clips onto the users lapel, shirt or blouse eliminating the necessity of cumbersome earphones. The unit features a miniature magnetic 8 ohm speaker contained in an acoustically engineered high impact polystyrene casing. The cords connect the speaker to the jack. The third cord is designed to supplement as an antenna when used in conjunction with 27 Mc. "Pagefones" or walkie-talkies. Price: \$9.95. U. S. Communications Corp.



CRT BRIGHTENERS 232

Value-conscious electronic technicians may be especially interested in a special offer on television tube brighteners. A



ball-point desk-pen set, valued at \$2, is currently being offered free with each package of 12 "Vu-Brite" television tube brighteners. The set is a follow-up to the firm's previous bonus, which was a clipboard. Perma-Power Co.

COLOR GENERATOR 233

This color bar and white dot generator in kit form, the G-36, is said to be



designed for the busy, up-to-date service technician. Compact and simple-to-use, the Model G-36 incorporates such features as: crystal control, voltage regulated, only one simple cable connection to the antenna input of receiver under test; no external sync signals needed to lock in test patterns and three front-panel controls. Outputs are color bars, white dots, cross hatch, vertical and horizontal bars. RF Output is available on channel 3 or 4. Picture carrier 50 mv max. Sound carrier 10% of picture carrier. Output impedance is 300 ohms. Paco Electronics Co., Inc.

COMING EVENTS

- Feb. 4-10:** Western Electronic Week, Shrine Exposition Hall, Los Angeles, Calif.
- Feb. 7-10:** Pacific Electronic Trade Show, Shrine Exposition Hall, Los Angeles, Calif.
- Feb. 18-20:** American Standards Association, Biltmore Hotel, New York City
- Mar. 24-28:** IRE International Convention, Coliseum & Waldorf Astoria Hotel, New York City
- Apr. 17-19:** SWIRECO (Southwestern IRE Conference & Electronic Show) Dallas Memorial Auditorium, Dallas, Tex.
- Apr. 17-19:** International Special Technical Conference on Non-Linear Magnetics, Shoreham Hotel, Wash., D. C.
- Apr. 23-25:** Eleventh National Conference on Electromagnetic Relays, Student Union Building, Oklahoma State University, Stillwater, Okla.

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HEADPHONE PRODUCTS

300

Brochure MH covers stereo headphones and headphone accessory equipment. The 2-color brochure describes and illustrates HS-1 Stereo Headphones; the new CC-1 Headphone Remote Control Center which features "Space-Perspective"; and the CFN-1 Cross-Feed Network which provides "Space-Perspective" without the remote control features. Jensen Mfg. Co.

TEST EQUIPMENT

301

This catalog lists 25 major items and their associated accessories. The catalog includes VOMs, VTVMs, tube and transistor analyzers and many other instruments for the professional electronic technician. Photographs and complete detailed specifications accompany each major item listed. The Triplett Electrical Instrument Co.

POWER RESISTORS

302

Just published is an 8-page, 2-color Catalog, D130, describing a complete line of stock vitreous enamel wire-wound power type resistors for electronic and industrial application. Stock listing, prices and dimensions are given for eight types of power resistors including axial lead, fixed, adjustable, strip, disc, plaque, non-inductive and intermittent duty. Mounting hardware data is also included. Ward Leonard Electric Co., Electrical Distributor Div.

THERMOSTATS

303

This six page color booklet affords pertinent information concerning the application and specifications of a line of thermostats. Chatham Controls Corp.

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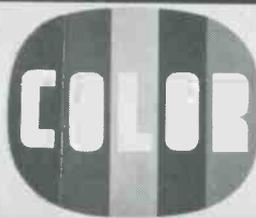
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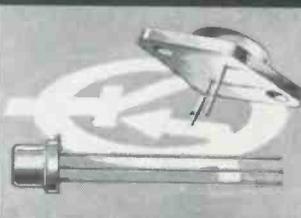
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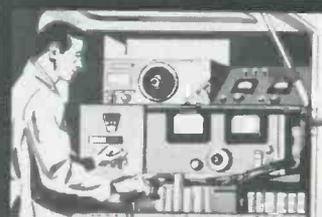


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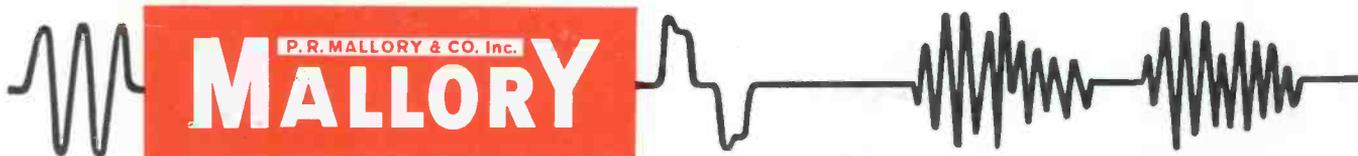
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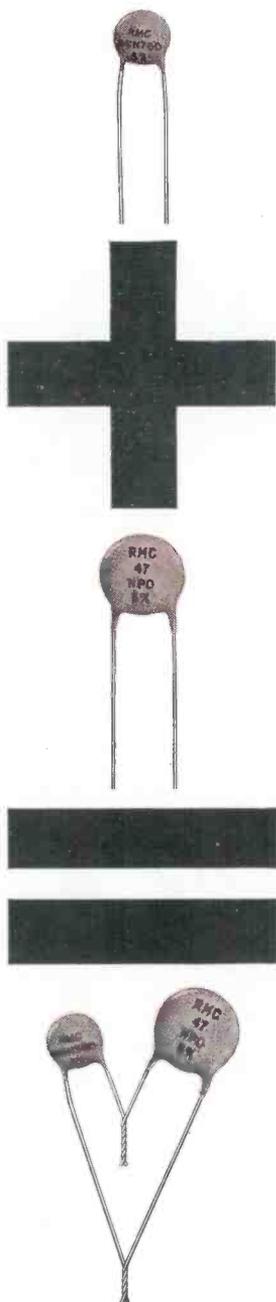
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Tips for Technicians

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Getting "unusual" coefficients in temperature compensating ceramics



When you're putting a temperature stabilizing ceramic capacitor in an oscillator circuit to eliminate frequency drift during warm-up, you'll find sometimes that the standard negative coefficient of the capacitor just doesn't match what your circuit needs. Instead of an N750—the usual standard value—you may need an N150 or N300. But you just can't get those odd values every time you look for them.

There's a simple way to tailor-make your own compensating capacitor, by paralleling standard NPO (zero coefficient) and N750 (negative 750 parts per million per degree) units.

Here's how it works. Multiply the capacity you need in mmfd by the desired temperature coefficient. Then divide the answer by 750. The result is the mmfd value of the N750 unit in the parallel combination. To find the value of the NPO unit, subtract the N750 value you've just calculated from the total capacity you need.

Suppose you're looking for 100 mmfd with a temperature coefficient of N330. The calculations go like this:

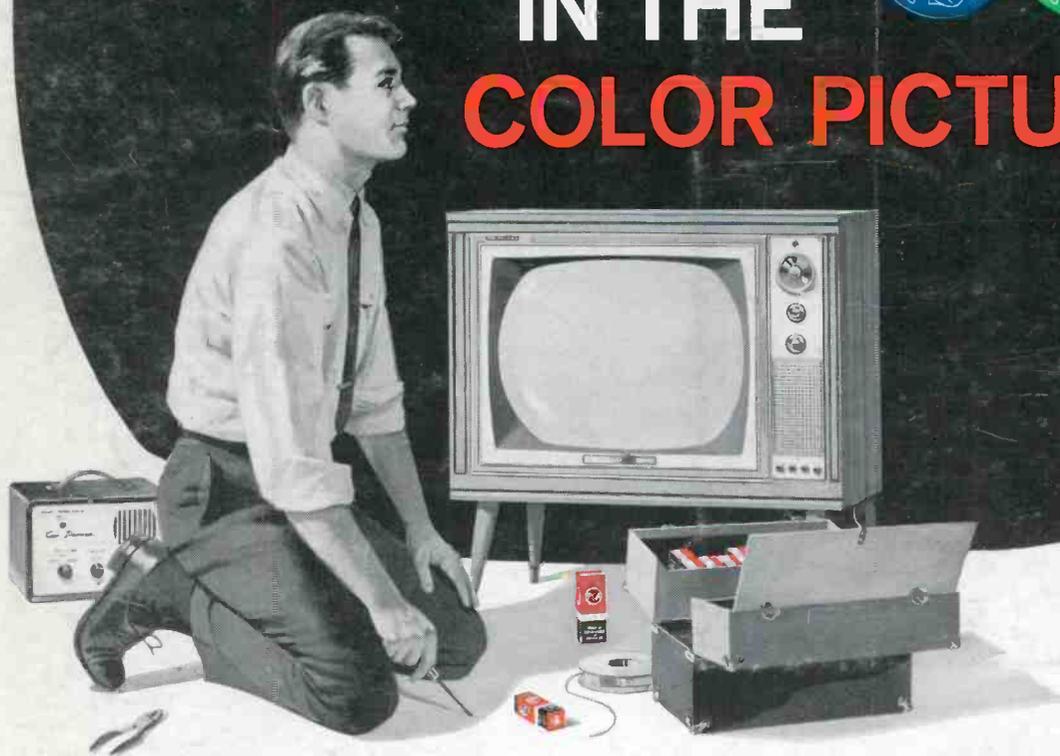
- (1) Multiply: $100 \times 330 = 33,000$.
- (2) Divide: $33,000 \div 750 = 44$ mmfd; this is the N750 value.
- (3) Subtract: $100 - 44 = 56$ mmfd; this is the NPO value.

Get yourself a standard 47 mmfd NPO (Discap[®] CNO-447), the nearest standard value to 44 mmfd, and a 56 mmfd N750 (Discap CN7-456). Twist the leads together, solder them in place . . . and you're in business.

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