

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

- SELECTING AUDIO AMPLIFIERS
- ADD SALES TO YOUR AUDIO SERVICE
- MAINTAINING PA MICROPHONES
- UPGRADING GUITAR AMPLIFIER SPEAKERS



JULY 1965



JERROLD BIG Summertime Specials!



THE BIG PRODUCTS...THE BIG PROGRAM... THE BIG BACK-UP...FOR BIG SUMMER PROFITS

Here's a strong, ready-to-work program that'll help you take advantage of the summer months for special savings and extra sales.

Old Man Winter, Color TV, and the new Jerrold Coloraxial reception system have given you a ready-made new market for summer antenna installations.

To make sure your summertime Coloraxial push is a BIG success, we've prepared a series of ad mats for you. Use them with co-op ad money that Jerrold and your distributor have reserved for you. These ads, in your local paper over your name, emphasize that service is even faster in the summer—and it costs less. With longer daylight time to make more outdoor installations, you can even pass on part of your savings to your customers.

In the new world of color TV, the Jerrold Coloraxial Reception Specialist will be a big man in his community. You can qualify now, and get shirt emblems and truck decals that proclaim you the Coloraxial TV expert in your area. Talk it over with your Jerrold distributor today, and start reaping the profits on our BIG SUMMERTIME SPECIALS.

BIG SUMMERTIME SPECIALS ON Coloraxial* • Powermate Paralog • Paracyl • Colorguard

- 1** August 15 is the deadline! See your Jerrold distributor today and take advantage of the great specials available on the popular Jerrold line... antennas, preamplifiers, amplified couplers, unamplified couplers, and Coloraxial conversion kits.
- 2** While you're there, make it a point to discuss how easy it is to place hard-sell Coloraxial ads in your local newspaper featuring you as the Jerrold Coloraxial Reception Specialist.
- 3** Summer business can be great for the dealer who promotes! New Jerrold Coloraxial reception systems and Summer Specials break tradition... give you the sales boosters you need for greater business and profits. *Trademark

JERROLD

DISTRIBUTOR SALES DIVISION

JERROLD ELECTRONICS CORPORATION

15TH & LEHIGH AVENUE ■ PHILADELPHIA, PA. 19132

Don't just stand there.

Do something.

Had that shrinking-sales feeling lately?—the sensation that you've been left out in the rain?

You have. By manufacturers who sell you the same electronic products they sell to national mail order catalog houses—which in turn, advertise these consumer products for sale at practically the same prices you pay for them.

The customer sees these prices and you've lost him—along with your reputation for honest pricing. In the face of this obstacle—how can you win?

Funny thing is, you can. How?

By buying from Channel Master—a manufacturer who is “permanently married” to the service dealer. And turns a cold shoulder on selling to outlets (and their captive chain discount stores) who advertise to consumers at dealer prices.

Granted every business has

some risks; but Channel Master does not believe that you, as a service dealer, should risk your profits and your reputation—any more than we think a consumer should risk his neck trying to install his own antenna, rotator, picture tube, or even a receiving tube.

That's why Channel Master alone offers a complete “No-Risk Package” to service dealers: consisting of absolute quality, and protection against competition . . . plus maximum profit.

We believe electronic products and their installation is strictly a service dealer's business. And what's good business for you, is good business for us. So why risk losing your profits and your reputation.

Don't just stand there. Come in out of the rain.

Get under our umbrella.



Quick.

CHANNEL MASTER

Antennas, accessories, picture tubes, transistor radios and tape recorders.

**ONE SOURCE
ONE QUALITY**

**TUNG-SOL
RECEIVING
TUBES**

Check your receiving tube stock, especially the TV types. Tung-Sol has a whole line engineered specifically for color TV! Include the types you need with your Tung-Sol "ET" order. The quality standards demanded by leading set manufacturers are built into every Tung-Sol component you get from your supplier. Tung-Sol Electric Inc., Newark, N. J. 07104.



**TUNG-SOL "ET"
SEMICONDUCTORS**

The Tung-Sol function-design approach helps you give big service with a small inventory and "service labeling" makes proper selection easy and accurate. You may never see the set you can't repair with the Tung-Sol "ET" line of transistors, diodes and rectifiers.

Low power PNP

- ET1
- ET2
- ET3
- ET4
- ET5
- ET12



Low power NPN

- ET8
- ET9
- ET10
- ET11



**Medium power PNP
ET6**



**Signal
Diodes**

- IN34A
- IN60
- IN64
- IN82A
- IN198
- IN295



**High power PNP
ET7**



**Silicon
Rectifiers**

- ET200
- ET400
- ET600



You can build a reputation on Tung-Sol quality



TUNG-SOL

TUBES

TRANSISTORS

DIODES

RECTIFIERS

JULY 1965
VOL. 82 No. 1

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

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Cover

See page 71 for details on our cover this month.

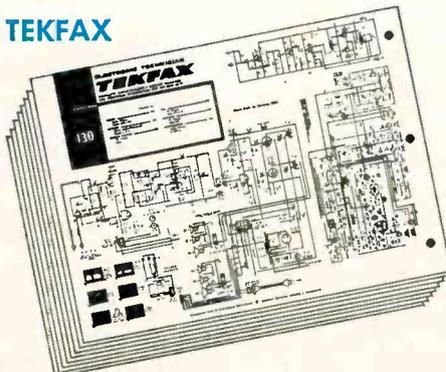
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TEKFAX



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CURTIS MATHES: TV Chassis TV-19-1
EMERSON: TV Chassis 120771
GENERAL ELECTRIC: TV Chassis SB
MUNTZ: TV Chassis Run Number T68A14 and T68A15
PACKARD BELL: TV Chassis 88-18C
PHILCO: TV Chassis N1052
RCA VICTOR: TV Chassis KCS149AA, AB, AD

LETTERS TO THE EDITOR

Shell Test-o-Matics

Can you advise if the manufacturers of Shell Test-o-Matic model S10 tube testers are still in business? Need schematic information and reference charts.

LESLIE MORGAN

N. Ft. Myers, Fla.

• See the letter from Bob Harding here.—Ed.

A 'Dilly'

You have a fine magazine but now and then your proof-readers overlook something. The word 'yellow' instead of 'red' in Fig. 3, page 46 of the excellent color article in the May issue, was a 'dilly!'

JOHN HOLMES

New York, N.Y.

• This would have been a good time for the editors to see 'red', eh?—Ed.

Please inform Gonty's of Oregon (ET letters to editor April) that Shell Company, 112 State Street, Westbury,

L.I., N.Y. is no longer in existence. It is hard to understand why they gave up because they made fine tube testers. We have three of them.

We have been able to obtain new charts from the GCS Company, 65-31 Fresh Meadow Lane, Flushing, N.Y. for all of our Shell "Testomatic" tube testers.

ROBERT E. HARDING

Yonkers, N.Y.

More Info Wanted

I need the names and addresses of distributors of Grundig, Kuba, Telefunken, Philips and Saba for parts and supplies, or the addresses of the factories themselves. I am having trouble getting parts and schematics for German-American conversions.

A. J. MATTHEWS

Lawton, Okla.

And Still More

We have a Precision tube tester, model 660, which needs a new tube roll chart. We have written two letters to the company and received no answer nor the returned letters. Could you help us with the proper address?

HOWARD WILLIAMS

Monroeville, N.J.

• Our directory gives the address as 70-31 84th St., Glendale, L.I., N.Y. The name is Precision Apparatus Co.—Ed.

Wants to Swap

Will any reader exchange his January through June 1957 ETs for new unused ET binder?

MAURICE LINDENAU

Pine Beach, N.J.

Another Disenchanted

In reply to the "disenchanted" TV technician from Baltimore, he is not alone . . . Have been giving some serious thought to industrial electronics . . . Can you shed some light on how to get into this field? I think you have a good magazine. Keep up the good work.

MIKE WINSTON

Fair Haven, N.J.

• Start studying industrial electronics . . . residence or home study. Jobs available for well trained men.—Ed.

Although it is impossible to personally answer every one of the thousands of letters we receive every year, keep writing — we may be able to help you solve a frustrating problem.

CAN THIS PICTURE TUBE BE SAVED?

Fading dull picture tubes bounce back pronto with **Perma-Power Briteners**

Give new life, new brightness to aging picture tubes—and watch your customer's confidence in you bounce back, too, when you sell a \$4.00 britener instead of a \$70.00 tube. (Then you're a cinch for the tube sale later.)

It's easy with Perma-Power's **Tu-Brite**. Handsomely packaged for instant acceptance, color-coded by base type for instant selection. The right voltage is assured. With Tu-Brite, if the base is right, the boost is right. Make sure you have all three models in stock.

Model C-202 for duodecal base CRT's.

Model C-212 for 110° button base CRT's.

Model C-222 for 110° shell base CRT's. Net \$2.25 each.

Write for free **Britener Selector Chart**, your guide to the base type of every picture tube now in the field.

YES! Perma-Power Brightens Color Sets, Too. **Color-Brite Model C-501**, Net \$5.85 each.



Perma-Power COMPANY

5740 North Tripp Avenue • Chicago, Illinois 60646

Phone: 539-7171 (Area Code 312)

Have you tried new **QUIG**[®] connectors?

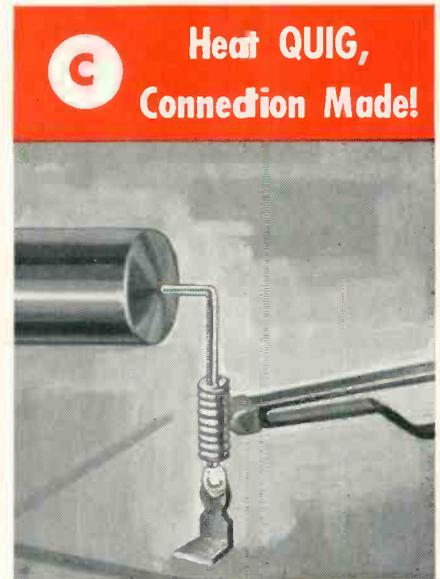
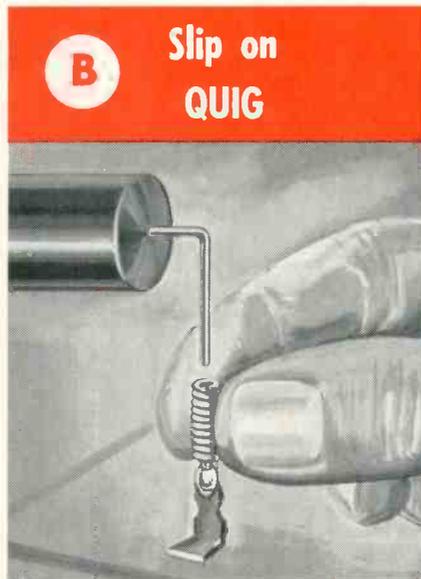
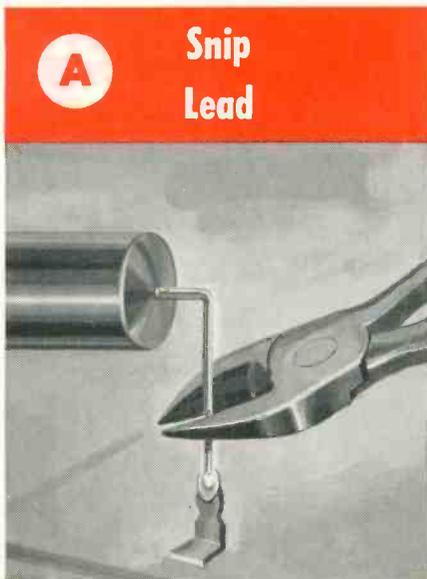
Not just another wire spring connector!
The 3-in-1 QUIG is brand new and different . . . Copperweld wire inner core, a layer of flux, and an outer jacket of solder . . . all you need is heat!
Makes one-handed soldering possible!

Once again, Sprague helps the TV-radio service industry by solving two increasingly serious problems . . . parts replacement in those "inaccessible" chassis nooks, such as crowded tube sockets, as well as soldering onto the delicate circuitry of printed wiring boards.

Mechanically sturdy and electrically reliable, the revolutionary QUIG provides fast, expertly-soldered connections as easy as A-B-C!



Ten times actual size



***NOBODY ELSE HAS QUIG CONNECTORS...
YOU GET 'EM ONLY FROM SPRAGUE PRODUCTS!***

QUIGS are now being packed with Sprague Atom[®] Capacitors *at no extra cost to you!* Whenever you need tubular electrolytics, insist on pre-packaged Sprague Atoms from your parts distributor and you'll automatically get your QUIG component connectors . . . the biggest boon to the service technician since the soldering gun!



WORLD'S LARGEST MANUFACTURER OF CAPACITORS

ES-4104

simplest
top
quality
modular
amplifier
system.



NEWCOMB
TOP QUALITY CUSTOM



Newcomb's finest, the Custom K Series is the climax of 27 years devoted to developing and producing the very best public address amplifiers. You quickly and simply get the combination of channels and power you need. A power output module is dropped into either a front-end or booster chassis. Two electrical plug-in connections; no soldering. Put a cover over the top or insert the chassis in a rack mount. You can plug in a transistorized VU meter accessory which has a sensitivity control and monitor jack for crystal headphones. The 4-channel models have provisions for a remote control accessory. There are 3 power amplifier modules: 40, 60, and 125 watts, and a power supply when you want to use a front end as a mixer-preamplifier only. There are three preamplifier modules: 3, 4, and 5 channels, and a chassis for making a booster amplifier out of any of the output modules. All in all, only 14 components permit 70 combinations. Performance is superb. Frequency response is ± 1 db 20-20,000 cps; distortion is extremely low. Custom K amplifiers run remarkably cool. Easy-to-trace, easy-to-service vacuum tube construction is used throughout. Colors are soft shades of gray-green. Write for Catalog K-15.

NEWCOMB AUDIO PRODUCTS CO., Dept. ET-7
6824 Lexington Avenue
Hollywood, California 90038

EDITORS' MEMO

Dedicated To Your Interest

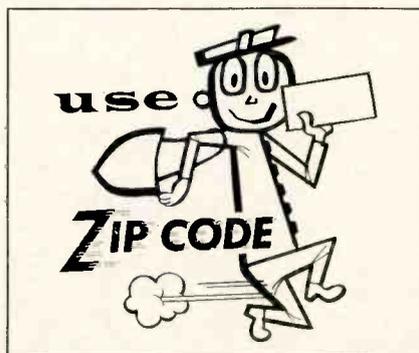
Hard working service-dealers and technicians do not have time to wade through truck loads of literature to keep their fingers on the pulse of rapidly changing times—on the vitally important scientific and technical space-age break-throughs that frequently become commonplace innovations in tomorrow's consumer electronic products. This is a job for well-equipped specialists—a full-time job that ELECTRONIC TECHNICIAN has been doing for almost two decades. It's not a job for fly-by-nighters.

Now we have completed the major portion of our lab expansion program—briefly mentioned in this column last April. We will soon be prepared to give you even more detailed technical information on modern test, measurement and troubleshooting instruments—with special emphasis on instruments that help you increase your troubleshooting efficiency on color and B/W TV, Hi Fi and two-way communications gear. And we plan to make it easier for you to select and use these instruments to handle more business and make more money.

We now have the facilities for making technical articles more helpful and useful too. We can soon begin to give you even more practical information on solid-state circuitry and the latest troubleshooting and repair techniques. But the lab expansion is only *one* of a series of improvements that we have either completed, have in process or plan for the future. Many of your thousands of letters received here during the past two years have noted and commented on previous improvements.

This entire upgrading program was planned to give you technical information in quantity and quality that you cannot get elsewhere—information to help you take competition and the "profit-squeeze" in stride.

And the program is dedicated to the interest of *professional* service-dealers and technicians.



Here's your **KEY**
to increased
sales and profits!

All tape heads do wear out. You can build profitable replacement business with Nortronics heads and mounting hardware—the "pre-sold" line for more than 700 popular tape recorders!

Nortronics offers a line of quality tape head replacements with:

- The *largest* variety of track and channel styles
- The *widest* selection of impedances and gap lengths
- The *greatest* versatility in mounting

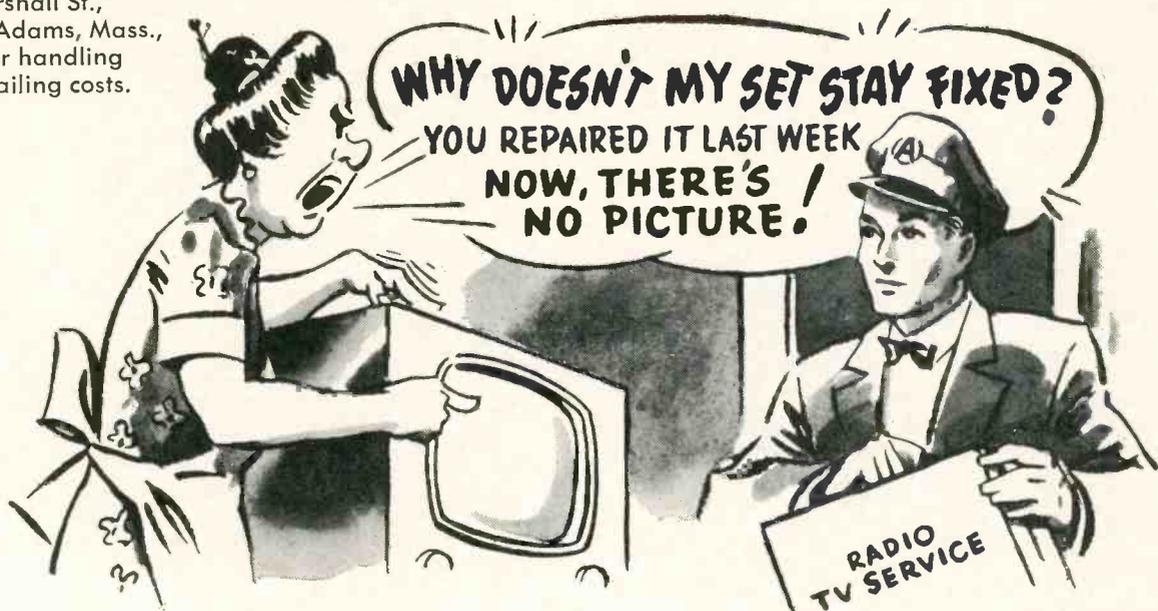
When you service tape equipment, if the output is down or the high frequency response is lacking, check the head for these obvious defects:

- Groove worn into head by tape . . . causes severe loss of highs, uneven gain between channels.
- Look for the gap. If you can see a vertical black line dividing the pole pieces, the head is definitely worn and should be replaced. **If any of these defects are found, replace with an easy-to-install Nortronics head. For complete information, contact your distributor, or—write to:**



Nortronics
8133-E 10th Ave. No., Minneapolis, Minn. 55427

For window-size blow-ups of this message, send 10¢ to Sprague Products Co., 65 Marshall St., North Adams, Mass., to cover handling and mailing costs.



HERE'S YOUR ANSWER, MR. AND MRS. SETOWNER!

999 times out of a thousand, when this happens . . . *don't blame your service technician!*

The repair to your television receiver made several days ago or even several months ago probably had no relation to the new trouble that developed today.

Actually, there are more than 300 electrical parts in even a small table model television receiver. Trouble in any one of them might cause the picture or sound to disappear or to be received poorly.

Take your automobile for instance. Tuning up the motor today is no guarantee against a tire blowout tomorrow!

Such a thing is easier to understand because most of us are more familiar with automobiles than with today's highly com-

plicated TV and radio sets. But such unconnected troubles occur in TV and radio nevertheless—and because they are so hard to explain in non-technical terms, it is always embarrassing to your service technician when they do.

His continued business existence is based on gaining the full confidence of you and other set owners like you. He isn't in business to "gyp" you or to overcharge you. His success is based on doing each and every job to the level best of his ability, at a fair price for his skilled labor. It's only when you patronize the shops that feature "bargains" at ridiculously low prices that you need worry. Good radio and TV service can't be bought on the bargain counter! Set owners who recognize this aren't likely to get "gypped."

**THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS, FOR . . .**

YOUR INDEPENDENT TV-RADIO SERVICE DEALER

65-5101

TECHNICAL DIGEST

GENERAL ELECTRIC

TV Chassis TA—Video Detector, 1st and 2nd Video Amplifiers Circuit Operation

The IF signal which is present across the primary of T107 is inductively coupled to the secondary winding and is detected by the germanium diode Y106. The detected composite signal which contains positive going sync and video information is dc coupled to the base of Q7, the 1st video amplifier, through L109.

The entire detector circuit is above chassis ground by approximately 1 v through the voltage dividing action of R132 and R133 to establish the base bias on Q7. The ac ground return path is supplied by C133 which is in shunt with R132. The diode load resistor is R134 which is in series with L109 across the secondary winding of T107. L109 presents a series impedance to any 45 Mc information that might be present across the diode Y106. C135 provides a low impedance path for this 45 Mc signal to chassis ground while it has little if any effect on the video signal that is present at this point in the circuit.

Q7, the 1st video amplifier, is a silicon NPN transistor. With its associated circuitry it serves as an emitter-follower. It has a relatively high input impedance while it is capable of supplying a low output impedance to furnish the necessary power at a low impedance source to drive the 2nd video amplifier, clipper and AGC circuits.

Since there is no phase reversal through an emitter-follower, the positive signal at the base of Q7 is also present at the emitter. Also, the dc component of the signal, which was preserved by virtue of the dc coupling between the detector and the base of Q7, is present at the emitter.

The composite signal which is present at the emitter of Q7, the 1st video IF amplifier, contains the 4.5 Mc FM sound signal as well as the video and sync information. This signal is coupled to the primary winding of T108, the audio take off transformer, by C137.

The primary winding of T108 is a series 4.5 Mc trap. It presents a low impedance path for the 4.5 Mc FM sound signal. The function of this trap is to re-

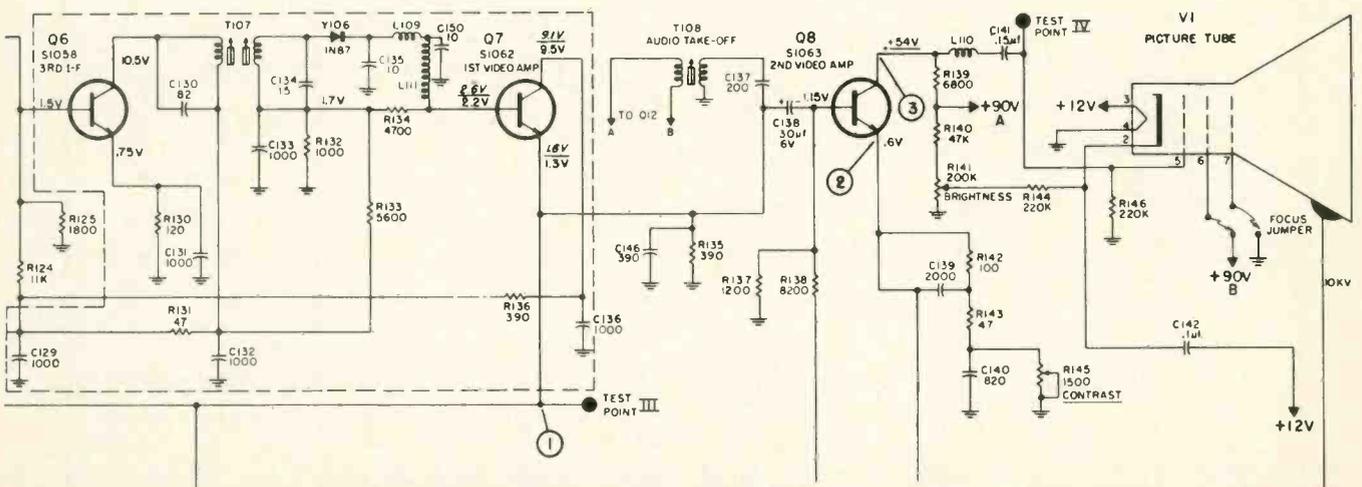
move the 4.5 Mc FM signal from the video information at this point, so that it does not reach the grid of the CRT. The 4.5 Mc FM signal which is across the primary winding of T108 is inductively coupled to the secondary winding to drive the audio circuits which will be discussed later.

A composite video signal from the emitter of Q7 is coupled to the base of Q8, the 2nd video amplifier, by C138. This signal is amplified by the transistor and appears in the collector circuit across R139. The negative vertical blanking pulse, which is supplied through R213 to the emitter of Q8, will also be amplified by the transistor and will appear in its collector circuit across R139.

The collector voltage for Q8 is supplied from the +90 v source through R139. The proper amount of voltage for the base of Q8 is taken from the junction of the voltage divider R137 and R138. C138 serves as a video coupling capacitor and is also a dc blocking capacitor. The series parallel connection of R142, R143, and C139 supplies emitter peaking for the 2nd video amplifier. R142 and R143 along with R145, the contrast control, provide the emitter dc path to ground. The gain of Q8 is controlled by changing the effective emitter-base bias voltage. This is accomplished by adjusting the contrast control R145.

The video signal which is present across the collector load resistor, R139, is coupled to the control grid of the CRT through L110 and C141. Positive horizontal blanking pulses are coupled from the top of the primary winding of T251 through R265 and C142 to the cathode of the CRT.

L110, in the collector circuit of Q8, functions as a series peaking choke while C141 serves as a coupling and dc blocking capacitor. The cathode voltage for the CRT is taken from R141, the brightness control, which is connected in series with the +90 v source to ground. R146 is the ground return for the control grid of the CRT. Grid number three, the focusing anode, may be connected to either +90 v or ground. The screen grid is connected to the +90 v supply. The 10 kv high voltage for the anode of the CRT is supplied by the high voltage supply.



G-E Chassis TA, Video detector, 1st and 2nd video amplifiers.

NOW! OVER 2700 REPLACEMENTS

with only 13 RCA Top-of-the-Line transistors

With RCA's "Top-of-the-Line" SK Replacement Series, you need only 13 transistors, including two matched pairs for ready replacement of more than 2700 types. In addition, RCA's two new SK-Series rectifiers—the SK3016 and SK3017—enable you to replace virtually any selenium or silicon rectifiers having comparable ratings.

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Accurate, comprehensive replacement information is given in the new 16-page RCA "Top-of-the-Line" Semiconductor Replacement Guide SPG-202. With it you have at your fingertips information on more than 2700 transistor types, including many of foreign manufacture—which the 13 RCA "Top-of-the-Line" types replace.

See your RCA Distributor about the RCA SK-Series, and be sure to ask for your copy of the RCA Semiconductor Replacement Guide.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.



The Most Trusted Name in Electronics

"Top-of-the-Line Replacement Transistors"

SK-3003 pnp type, AF Driver and Output Stages (9 V Supply)
 SK-3004 pnp type, AF Driver and Output Stages (15 V Supply)
 SK-3005 pnp type, RF, IF, and Converter Stages of Broadcast Receivers
 SK-3006 pnp type, RF, IF, and Converter Stages of FM and AM/FM Receivers
 SK-3007 pnp type, RF, IF, and Converter Stages of All-Wave Receivers
 SK-3008 pnp type, RF, IF, and Converter Stages of Auto Radios
 SK-3009 pnp type, Audio Output Stages of Auto Radios

SK-3010 npn type, AF Driver and Output Stages of Broadcast Receivers
 SK-3011 npn type, RF, IF, and Converter Stages of Broadcast Receivers
 SK-3012 pnp type, Audio Output Stages of Auto Radios
 SK-3013 Matched pair of SK-3009
 SK-3014 Drift Field type for Output and Driver Stages of Hi-Fi equipment
 SK-3015 Matched pair of SK-3014
 SK-3016 Silicon Rectifier for color, B/W TV, Radios, Phonographs
 SK-3017 Silicon Rectifier for color, B/W TV, Radios, Phonographs



the greatest—yet the smallest—
price-and-performance package
ever to hit commercial sound



INTRODUCING NEW COMPACT **MERCURY** PUBLIC-ADDRESS AMPLIFIERS 10, 25, 40 watts

Harman-Kardon's new compact MERCURY p.a. amplifiers put out clean, fully usable rated power from a tiny package and at a low price. You'll find wide use for MERCURY in motels, restaurants, small apartment houses, and other low- to medium-power installations.

Trim, metal-enclosed package (4½" x 5½" x 9½" on all three models) fits easily on shelf, under counter—almost *anywhere*. Universal microphone input on all models allows use of either high- or low-impedance microphones—no matching transformers necessary. All input and output jacks conveniently located on rear apron. Reliable push-pull circuitry on all three models delivers clean, full-rated power output. Compact MERCURY amplifiers—10 watts, 25 watts, or 40 watts—meet or exceed their rated specifications.

Send for complete information on MERCURY—the best dollar-for-dollar value in its price and power category.

harman kardon

A subsidiary of The Jerrold Corporation.

Commercial Sound Division
15th & Lehigh Avenue • Philadelphia Pa, 19132

TECHNICAL DIGEST

MAGNAVOX

Color TV Chassis 45 Series and 904 Series — HV Arcing or Corona

The following checks are suggested as preventive maintenance for high voltage arcing or corona:

1. Check the lead dress of capacitor C118 and be sure that the leads are dressed as far as possible away from the focus coil.

2. Check the focus coil and if there is any evidence of arcing on the coil, replace it.

3. Check the HV Transformer "tire" and if there are any cracks or breaks in the "tire," replace the transformer.

4. Check the spacing between the 6BK4 shunt regulator tube and the HV transformer tire. Spacing should be at least ⅝ in., if not, bend the tube mounting bracket to provide proper space.

5. Check the 3A3 HV rectifier filament leads and be sure that they are dressed away from the 3A3 tube and the HV transformer. If not, tape the leads to the 3A3 socket metal support to hold them away.

6. Check resistor R118 (4.7 M) dress it away from the ground point on the terminal board.

7. Check the spark gap terminal, which is a part of the focus lead terminal on the HV transformer board, and if necessary adjust it to provide a 3/16 in. gap between the terminal and the transformer core. To do this bend the end of the terminal away from the board and toward the transformer core.

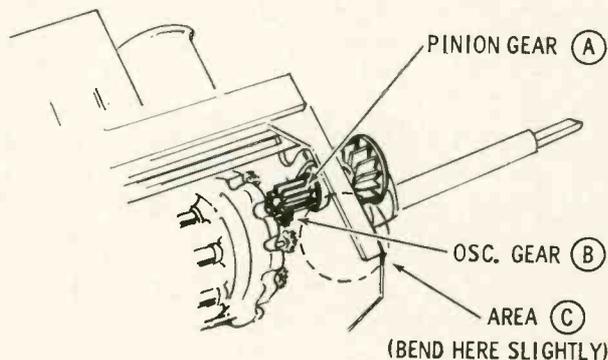
MOTOROLA

Color TV Chassis T5-912 — Service Experience Information

Symptom: No focus at low brightness. *Solution:* Focus diode lead broken off but touching lug.

Symptom: No color. *Solution:* Resistor R113, 3.9K in in plate circuit of V5A, 1st video amp open.

Symptom: Poor color sync. Oscillator coil L913, very critical to adjust. *Solution:* 3.58 Mc crystal had low activity. Should be replaced.

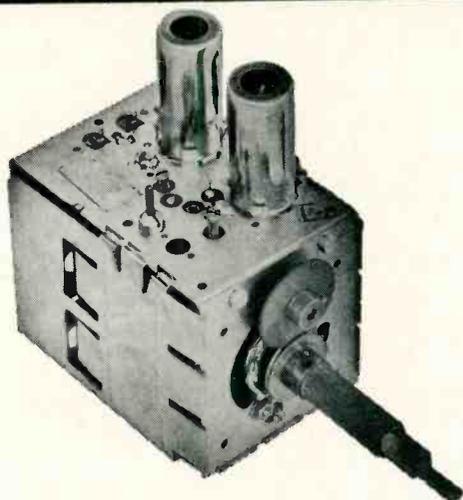


Symptom: Brightness slow to come up to normal. *Solution:* Video output tube, 15HB6, was slow to warm up. Replace tube.

Symptom: Series of vertical green bars on BW signals while color sync or color stripe is being transmitted. *Solution:* Defective 3.58 Mc crystal. Replace.

Symptom: Unable to fine tune any channel. *Solution:* (see drawing) Pinion gear (A) does not engage individual

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TECHNICAL DIGEST

oscillator gears (B). To correct this condition, the front housing of the tuner can be slightly bent in the area (C) with pliers in the direction necessary to bring the pinion gear closer to the oscillator gear.

PHILCO

Color Chassis 15M91 — Production Change Information

Run 1 — First Production. Run 2 — Focus rectifier (D8) changed from part no. 34-8053-2 to 34-8053-3. Reason: To improve focus quality. Run 3 — Horizontal hold and tone control (VR25) changed from part no. 33-5604-39 to 33-5618-2. Reason: To improve horizontal hold range. Run 4 — In the run 4 chassis a capacitor (C41) .01 μ f has been removed from the chroma panel. The chroma panel will be identified by a red slash on the panel. This will be a run 2 chroma panel. In addition a .001 μ f capacitor has been added between the tuner AGC feedthru and ground. The part number of the capacitor is 30-1238-13. Reason: To improve set radiation suppression. Run 5 — A run 3 chroma panel is used which is identified by an orange dot on the panel. The run 3 panel has a slight copper change which will not affect servicing or parts replacement. The part number of the run 3 chroma panel is 27-11018-2. Reason: To improve spark gap protection should the CRT arc.

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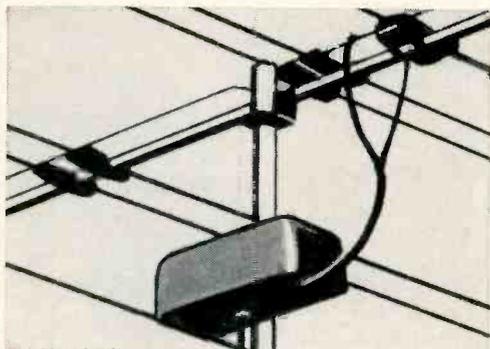
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285-05

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Model T5911M Transformer mounts on or near the mast. It matches any 300 ohm antenna to 75 ohm coax cable. The T73 transformer mounts conveniently behind any TV set. It trans-

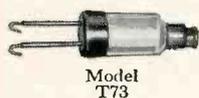
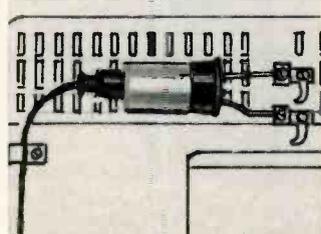
forms the signal back to 300 ohm impedance for a perfect match with the set. All mounting hardware and connectors are included.

When you use coax, be sure to use Winegard "Color-Match". Ask your distributor or write for spec. sheets. "Color-Match" is another convenience product for better TV reception from Winegard.

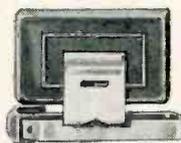
NOTE: When running 75-ohm coaxial cable in fringe areas, we recommend installation of Winegard 75-ohm Colortron Antenna amplifier Model AP275N—twin nuvistor, or model AP-275T—twin transistor to compensate for the line loss inherent in all coax installations.

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ANTENNA SYSTEMS

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SYNC ON BUSINESS

A replacement parts package, called "Benchmate," is an 18 x 24 in. board containing 35 assorted circuit breakers, rectifiers, resistors, chemical fuses and transformers. With each package you get a free rechargeable flashlight. The deal is made available by Workman Electronic Products, Box 5397, Sarasota, Fla.

Drawer planning kits for storing small products and parts are available postpaid direct from the factory at



\$7.50. The manufacturer is Akro-Mils, 1293 S. Main St., Box 989, Akron, Ohio. 44309.

Power transistors, DTB-110B, are designed for home entertainment applications. Through your Delco distributor.

UHF exact replacement transistors for TV antenna boosters are made by Semitronics Corp. Number TV1000's are available at your jobber.

Portable radio listening has increased 120 percent in the last two years, more than five times the gain reported for total radio listening, and more than 100 million portable radios are in use, according to Nielsen Surveys. In addition to portable radios, the battery market has grown to include literally hundreds of cordless devices: clocks, knives, TV sets, tape recorders, cameras, toys, shavers, kitchen utensils, typewriters, lighting equipment and many others.

Background music tape systems with 16 hour reel-to-reel pre-recorded quarter track monophonic tape is available from Viking of Minneapolis, Inc.

An electronics slide rule course, with a programed series of four lessons, is offered by Cleveland Institute of Electronics. If you want to keep up with fast-moving developments in electronics this appears to be a good \$20 investment toward your education.

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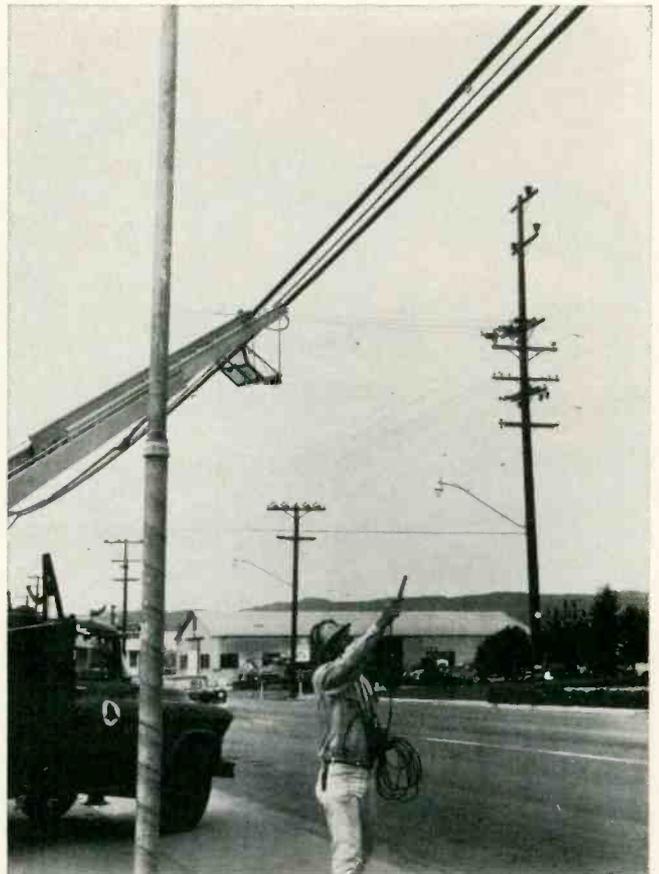
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Ultrasonic System Locates Leaks in Pressurized Communications Cable



Maintenance man probes for leaks with a compact ultrasonic detector manufactured by Delcon Corp.

■ An ultrasonic detector system is said to locate leaks as small as 0.0001-in in pressurized communications cable systems and reduce the man-hours for cable maintenance by more than 50 percent in some areas. It was said the instrument has already been field tested for two years by a number of telephone companies.

Air or nitrogen escaping from cable leaks collides with air molecules in the atmosphere and generates tiny, ultrasonic hissing sounds. These sounds are far beyond the range of human hearing. At 35,000 to 45,000 cps, they would be audible only to dogs, bats, other animals and some insects. The device, it was stated, can detect these high-frequency sounds from distances up to 50 ft on noisy streets. This faint ultrasonic energy is translated into audible sounds and amplified. As the telephone maintenance man moves the probe, he listens for pronounced hissing sounds which pinpoint the puncture.

Sensitivity of the device to leaks depends on the pressure of the cable, the diameter of the orifice, and the distance from the leak.

The system is already being used in industry for checking leaks in air pressure systems and boilers, for detecting corona, for maintaining pressure and vacuum systems, to check air brakes and for non-destructive testing. ■



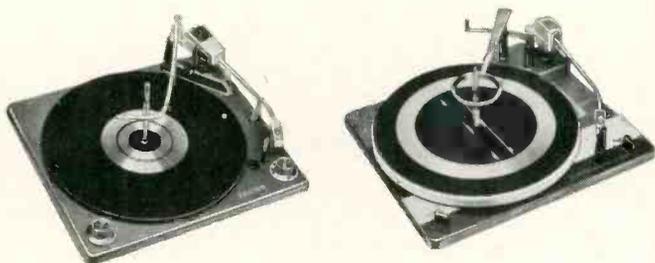
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ADD SALES TO YOUR AUDIO SERVICE

**Build your business and
increase profits by
selling equipment to
update and expand
existing installations**

by Irving Green

LTV University

■ Almost every service call made offers an opportunity for the audio specialist, service-dealer or technician to make added profits by selling equipment to expand or update the installation.

At the beginning, most audio system installations are planned to fill present and projected requirements. But, in time, they invariably have to be redesigned or enlarged to meet changing or expanding needs. A typical case in point is a factory installation that did not logically provide coverage for high noise areas or outdoor paging.

Less than two years after this particular system was installed, the manufacturer added a new 5000 sq ft wing to the building. The new wing housed machinery and equipment that generated a high noise level and it included a large outside loading and shipping platform. Both new areas required paging and talkback facilities. The local TV-radio service-dealer who was called to look at the system found existing amplifier power inadequate to handle the new areas. He updated the system by shifting original speaker positions to best serve the revised factory layout and sold the manufacturer a booster amplifier and a number of high level and outdoor speakers for the new wing. But many amplifiers *are* found adequate by technicians when they are called to "repair" a system. Amplifier power is often sufficient but the number of speakers and the dis-

tribution pattern is not efficient. In these cases, added speakers are the answer to the service problem.

More specifically, a system may have a 200 w amplifier that feeds a battery of five speakers mounted high above the work areas, and each speaker is placed to cover too large an area. Now, 200 w is sufficient power to handle the amplification job and the speakers used are the proper type for the application. But not enough speakers are properly positioned for adequate sound coverage of the building areas. You can easily solve this problem by placing existing speakers in a lower position for better sound distribution in the smaller areas. In addition, you can *sell* your customer the required number of additional speakers and matching transformers to complete the coverage in all areas.

Some Problems Solved

A completely obsolete audio distribution system is rare. Present day equipment permits adding-on booster amplifiers and speaker systems. Even the control facilities are flexible to permit addition of preamps and audio sources. Service technicians who find the equipment working, but not adequately, can easily show customers how to expand the system's power, distribution and functions. Here are examples of only two of the many possible situations and how they were solved.

Poor talkback facilities from a

remote point. This problem usually arises because a simple speaker is used to cover a wide area. The solution is to replace a single "large" speaker with a number of smaller paging-talkback speakers for better pickup. Paging will be improved too because the lower level in each of the smaller speakers will be less distracting to workers than the loud blast of a single large speaker, and the person responding to the page will not have to shout.

A feedback problem. In most feedback cases, the problem is caused by the type of speaker or microphone used. In one situation involving a school gymnasium, an omnidirectional rectangular horn cluster hung from the ceiling in the center of the gym. The system

used an omnidirectional microphone, and at low levels no feedback occurred. But this low audio level was insufficient to cover the large gym area. When the level was raised so everyone could hear, feedback occurred. The hard surfaces of the gym ceiling, floor and walls, caused reflections that easily set up acoustic coupling between the microphone and speakers, both of which were omnidirectional.

This problem was solved by (1) substituting a cardioid type microphone for the omnidirectional type; (2) substituting columnar type speakers, with similar omnidirectional characteristics but with a smaller vertical dispersion of 18 deg compared to 60 deg, for the rectangular horns in the center

cluster; (3) installing the horns used in the original cluster throughout remote parts of the gym.

With the horns as added area speakers, the new ceiling cluster was adjusted to work at a lower level. This changed the entire audio distribution pattern and dispersion, considerably reducing reflections to the microphone. The cardioid microphone further contributed to feedback elimination. This service call resulted in the sale of a cardioid microphone and a cluster of columnar speakers.

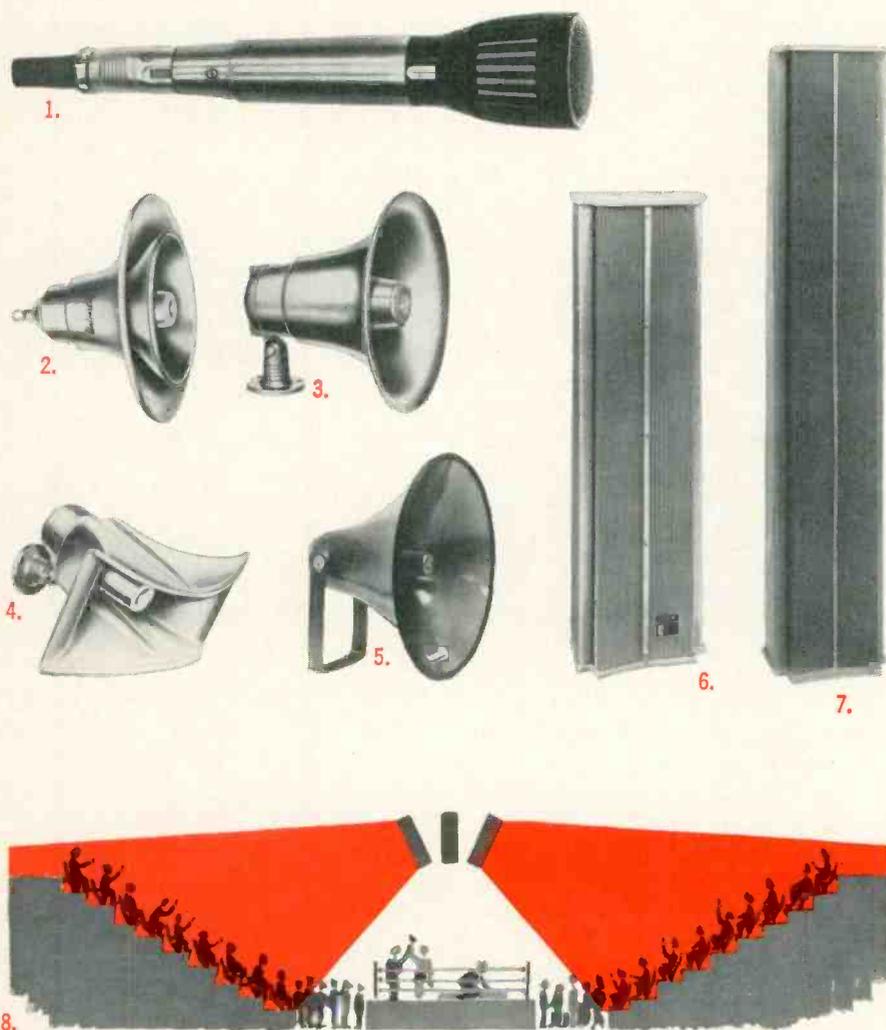
Know Your Equipment

TV-radio technicians and audio specialists should know the important characteristics of audio equipment and its application if a good selling job is to be done. Here are some of the things you'll need to know.

Rectangular vs round horns. The one you should select will depend on the application. The round horn is capable of penetrating longer distances because it has a uniform dispersion pattern and the audio energy is equal in both vertical and horizontal planes. Its dispersion pattern (Fig. 1) resembles a teardrop, but the actual audio configuration on the ground surface is a circle. The change in pattern shifts from circle to teardrop as the penetration distance increases. Likewise, depending on size (diameter of mouth), the round horn has a dispersion angle ranging from 65 to 95 deg. Applications where round horns are best suited include railroad yards, parking lots, construction sites, docks and piers, factories with high ambient noise levels and where deep audio penetration is required in a selected area.

Rectangular horns have a wider horizontal dispersion characteristic (Fig. 2). Generally, the horizontal dispersion of a rectangular horn is 120 deg with a 60 deg vertical dispersion angle. The relationship of the vertical to horizontal dispersion angle makes the rectangular horn more versatile.

Where the area to be covered is wide but not too deep, for example, the horn can be used with the horizontal plane on axis. On the other hand, if the area is narrow and deep,



1. Cardioid dynamic microphone. 2,3,4. Paging and talk-back 25 w speakers with built-in driver units. 5. A round directional horn. 6,7. Outdoor type columnar speakers with steel case, nylon mesh screen and expanded metal grills. 8. Artists' concept of an omnidirectional battery of columnar speakers located in an arena boxing ring set up on the main floor area.

the horn can be used with the vertical plane on axis. Thus, each dispersion pattern can be used to advantage, depending on the particular application. The rectangular horn does not have the penetration of round horns, but it has the advantage of covering a much wider angle. It is ideal for installations where ambient noise level is not extreme and a wide area is to be covered.

Columnar speakers. The columnar speaker is a fairly recent addition to audio communications applications. These speakers have been designed to provide complete audio coverage in large outdoor and indoor areas — solving difficult microphone and speaker placement problems by eliminating or diminishing the possibility of acoustic feedback and reverberation.

Dispersion characteristics of the columnar speakers are similar to the rectangular horn, except that the vertical dispersion is much narrower. The columnar speaker is a "point" sound source, in effect, and it can be "beamed" to suit a specific application. When used with the narrow dispersion in a vertical plane, it is ideal for auditoriums and theatres and minimizes the feedback problem to the microphone on the stage. When used with the narrow dispersion on a horizontal plane, it is ideal for beaming at wide areas. More important, a uniform audio level exists within the beam and the speaker is capable of handling high power with excellent frequency response for full range music reproduction.

Paging speakers. Smaller in size and lower in power (25 w or less), paging speakers provide the greatest versatility for planning or designing an audio system in a factory, office, warehouse, school building or other commercial structure. They are also excellent for mobile public address use where speakers must be small for fender or roof mounting. In building installations, the smaller paging speaker (also used for talk-back) can be placed strategically to cover a designated area, even to overcome high ambient noise levels in that area. Paging speakers are available in three types — the round horn, the rectangular horn, and the

radial horn. The difference between the round and rectangular horns are the same as noted previously. The radial horn is mounted like an electrical chandelier, hung from the ceiling to cover a wide area in a high ceiling room. Another feature of the paging speaker is a built-in driver unit and it is also fitted with a swivel, mounting bracket or both for easy installation. Round horn, paging speaker mouth-diameters range from 5½ to 11½ in., and the rectangular type ranges from 9½ to 14 in. wide.

Most sales converted from audio system service calls will probably be for added speakers. This is true because many systems are not planned for adequate speaker coverage from the beginning. When the

customer complains that the audio is too loud in one area and too low in another, the answer is usually another speaker, and a lower audio level in most cases. The type, number and speaker location are actually the criteria of the system's performance.

So, when you are on a service call, it is important to observe how the speakers are installed, and whether or not they are correct for the job. You may find the amplifier is being driven too hard and the speakers too loud in an effort to get some audio out to a distant area—but at the expense of areas closer in. You may find that a round horn is being utilized where a rectangular horn should be used and vice versa. ■

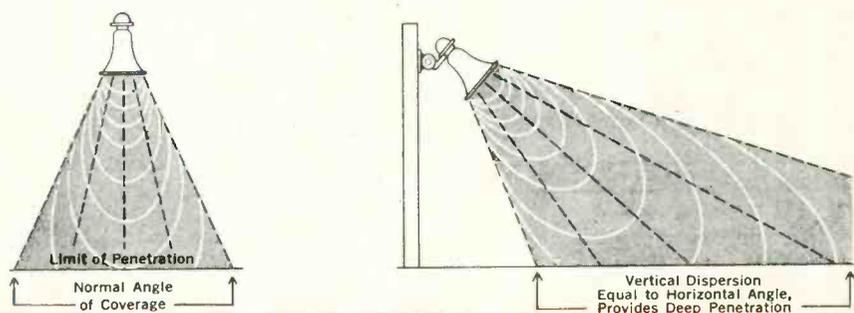


Fig. 1—Typical sound dispersion pattern of round directional horns. Angles range from 65 to 95 deg depending on horn size.

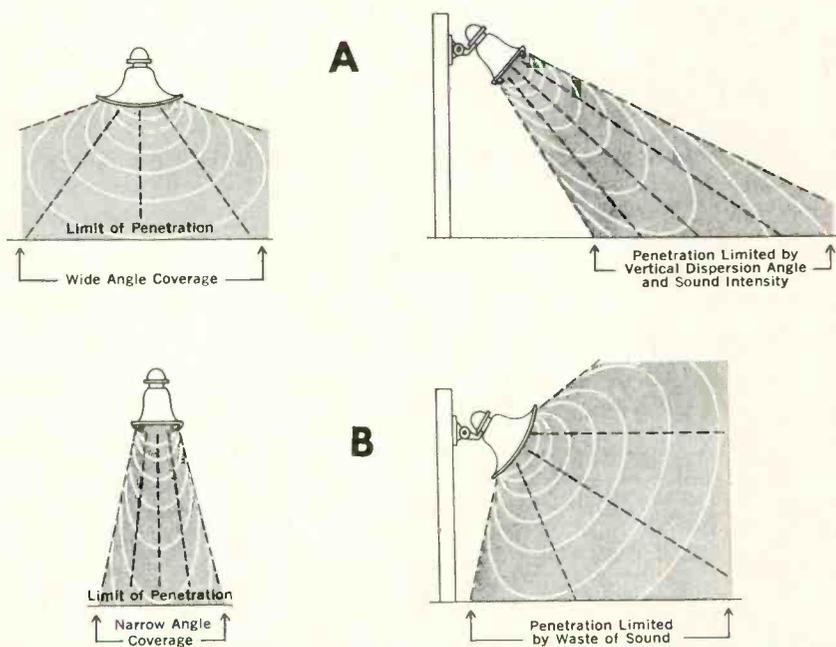


Fig. 1—Typical sound dispersion pattern of round directional horns. Angles range from 65 to 95 deg depending on horn size. (B)—Pattern of horn with long dimension in vertical plane.

INTERCOM INSTALLATION PRINCIPLES

Know your circuitry and how to use switches and wire pair combinations

by Don Dudley

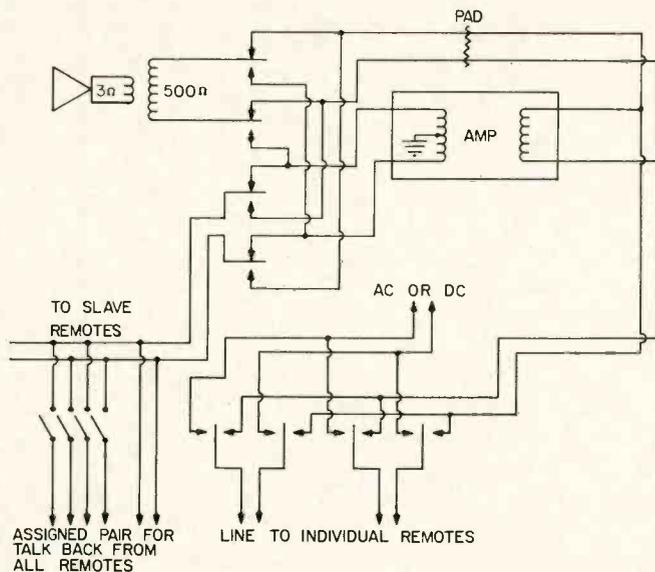


Fig. 1—A single master to remotes or to slaves.

■ The first thing to consider in setting up an intercom system is station locations and how the wire pairs are to be run between them. Of course, the best time to do this is when the building is being framed — then the cable can be run between the studs. Normally, however, the wires must be run externally.

A bulky multipaired cable is somewhat difficult to conceal and difficult to run, hence, in some instances, the versatility of the intercom depends on the amount of pairs that can be run to each location. Each pair run is assigned to one slave, remote or master.

I once ran a full 15 pair cable to each room while a building was being constructed. The cable was terminated in a recessed plug, fastened by headers to the studdings. The cover on the plug is a filed-out, three-receptacle metal type. The intercom can be expanded wherever the need arises by merely plugging a remote or master into it. Three hundred feet of cable was used, but no noise of any consequence was picked up on the cable. If you are in a noisy area, however, individual shielded intercom cable should be used. A minimum system would be one master and a single pair of wires to a slave (nice for monitoring home nurseries).

A remote, if it monitors all the time, is called a slave. If it can't monitor all the time the remote will

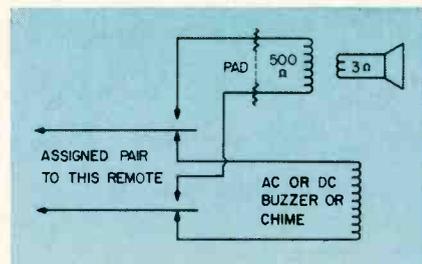


Fig. 2—Circuit used with one line pair and no monitoring remote.

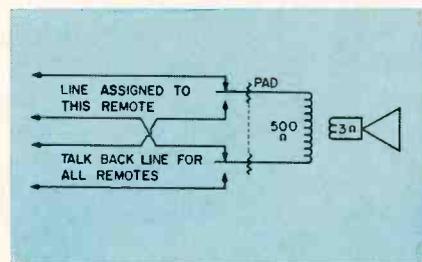


Fig. 3—This remote cannot be used as a monitor.

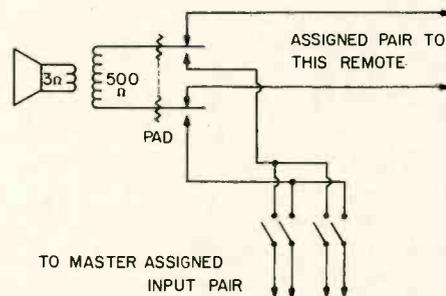


Fig. 7—Switches on remotes allow selection and contact with any master.

be called simply a remote. A volume control is usually not needed, but if it is, a pad may be installed in the line.

A simple single master to slaves or remotes with a slave, is shown in Fig. 1. The person at the slave need only answer when paged by the master. There's no switch at a slave. If communications facilities are required in an office and the person at the desk doesn't care to be monitored, and only one pair of wires are available, the remote shown in Fig. 2 can be used. The buzzer, or chime, is used when the master station wants to contact the remote. The three position switch at the master is held in the dc position allowing the chime or buzzer to alert the desired remote. After a short "buzz" the switch is then placed in the down position to await acknowledgement. Then the person

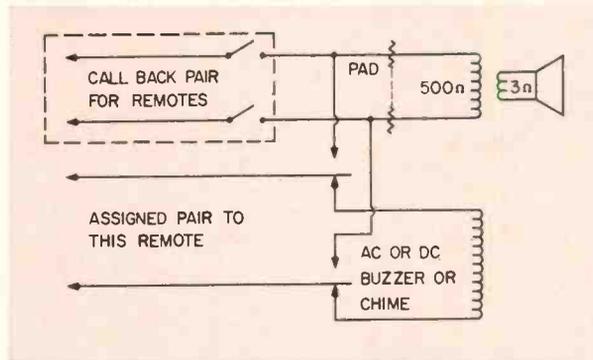
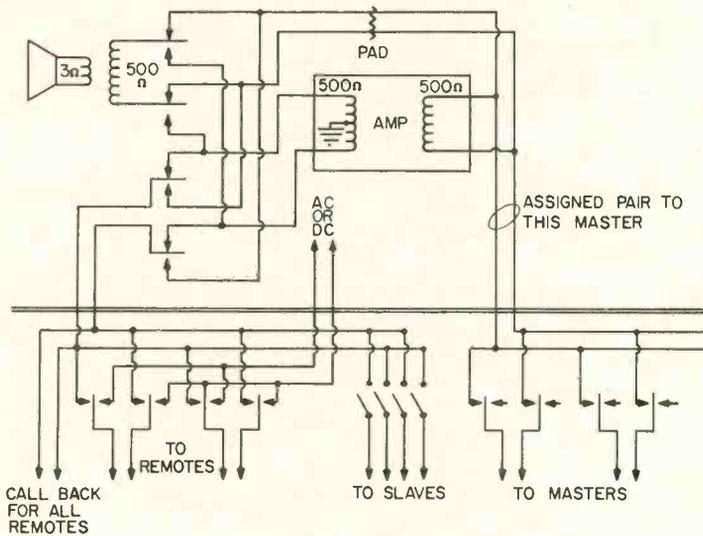


Fig. 5—Remote for more than one master and with call back feature.

Fig. 4—Combination of masters and remotes.

Fig. 6—Master to be used with selective call-back feature from remotes.

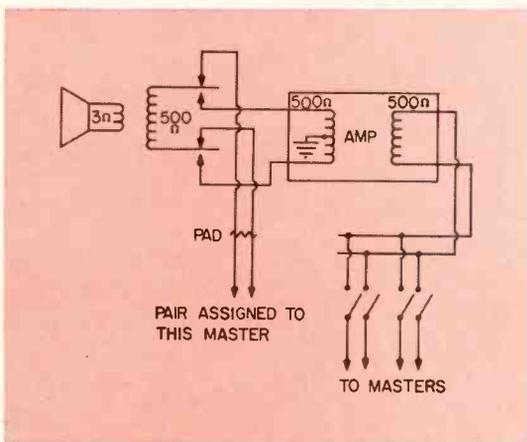
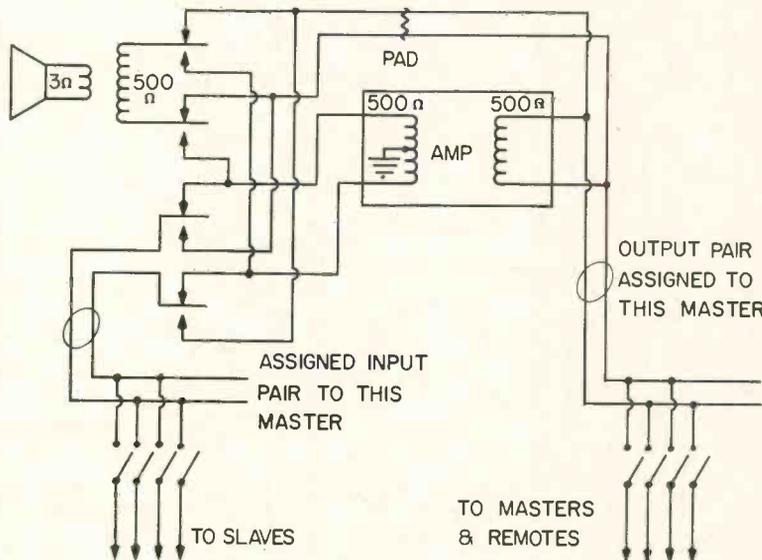


Fig. 8—An all master system.



at the remote holds down the spring-loaded talk switch and speaks up. No switching is done at the remote other than holding the talk switch down and it will be held down throughout the conversation. All switching is done at the master. The remote cannot initiate a call to the master.

If two wire pairs are available for the remote, it can be connected as shown in Fig. 3. One pair of wires is connected to the master's output. The other wire pair is used by the remote to talk back to the master but the master will not be able to monitor the remote.

The master, through the proper switch, can alert the remote. And the remote holds down the switch and replies. The remote then holds the talk switch down throughout the conversation. This remote can originate a call to the master by simply

holding the talk switch down and speaking up.

Any two wire remote may talk to another similar remote. The hitch is, the person at the master will have to act as a switchboard operator. A remote calls the master, for example, identifies himself and asks to be connected to another remote. Both remote switches at the master, the one calling and one called, are pulled down. Now both remotes may talk with each other using a push-to-talk operation. Both sides of the conversation will be heard at the master, however. This system can and will handle a lot of traffic, but if expansion is needed, with a little change, the schematic shown in Fig. 4 can be used. This is a combination master-and-remote system.

Again, depending on the number of pairs available to any remote, any

remote system shown here can be used. If only one wire pair is available, the system shown in Fig. 2 is used. Of course, this remote can't initiate a call; it can only answer when called.

If the system shown in Fig. 3 is used, whenever that remote talks back, the conversation will be heard on all the masters in the system. To overcome this, the masters are wired as shown in Fig. 5 and two wire pairs are used. This allows the remote to initiate a call. One wire pair is assigned to the remote. The second wire pair (in dashed lines) is connected to only one particular master — a receptionist or switchboard operator. This line is common to all remotes. The remote is alerted and used as stated previously. When the remote wishes to initiate a call, however, the button on the remote is

Continued on page 69

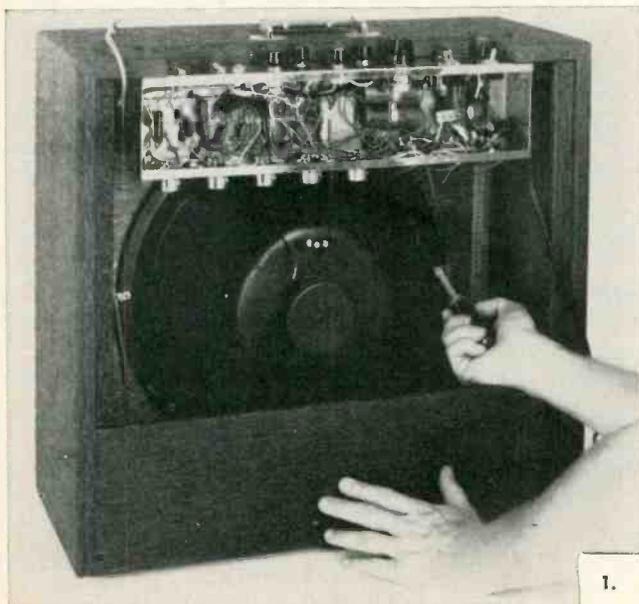
UPGRADING GUITAR AMPLIFIER SPEAKERS

Sell up on replacements in this
area and give your customers
maximum satisfaction

By H. E. Seymour

James B. Lansing Sound, Inc.

Photo 1—Ground wires and other connections are removed to allow amplifier to be removed from the enclosure. 2—The old speaker is removed. 3—New speaker is installed. 4—The amplifier is reinstalled and connections made to speaker. Tubes were removed from amplifier before photos were made.



■ Electronic guitars are a ten-million-dollar-a-year business and are selling at an ever increasing rate. On the heels of the rise in popularity of this instrument comes an opportunity for potentially higher profits for service technicians — upgrading guitar systems.

A guitar system may be broken down into five major components: The guitar itself, the pickup or pickups, the amplifier, the loudspeaker and the enclosure. Normally, the amplifier and speaker are housed in one enclosure—called a “guitar amplifier.”

If you look at a typical mail order catalog, you will see that a complete electric guitar outfit can be bought for “as little as \$49.95.” At the other end of the scale, elaborate guitar systems are available at over \$1000. Obviously, a wide variation in quality exists between the two ends of the scale and between the various components used in systems of different prices. The weakest link in a guitar system often proves to be the speaker. As in any system, an overall improvement may be made by replacing the weakest link with a component of higher quality.

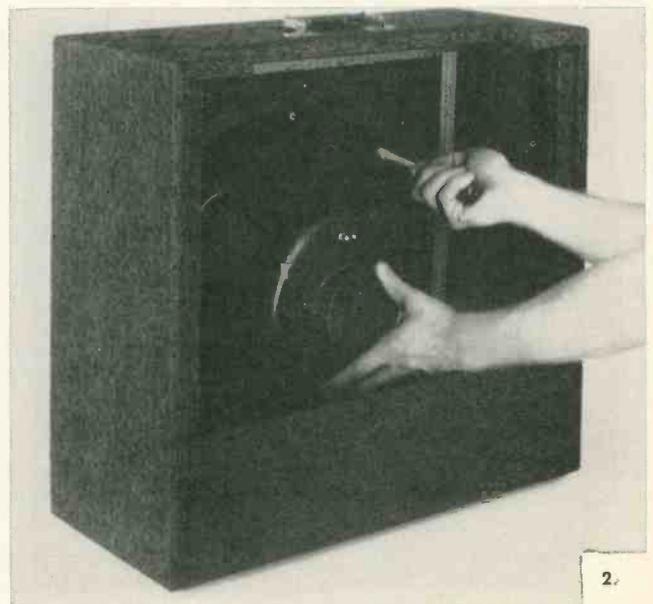
Recognizing that a top quality speaker designed for the purpose can improve an electronic guitar system, the leading manufacturers now offer such speakers as extra cost options with some of their instruments.

A noticeable difference exists in audio quality between different guitar speakers, as with high fidelity speakers. And even greater differences are noticeable between a standard entertainment-type speaker and one specifically designed for guitar use. These differences can be heard. These differences are also reflected in the ability of the speaker to stand up.

Three basic requirements strongly influence the design of a guitar speaker — loudness, tone brilliance, and resistance to overload.

Loudness

Most guitarists demand a high audio level from their instruments. If you have ever heard Rock & Roll guitarists at work in a noisy night club, you can appreciate



ciate the incredible amounts of power these speakers must put out without falling apart. The better the ability of a loudspeaker to convert electrical power to acoustical power, the louder it will sound with a given amplifier. Hence, high conversion efficiency is generally designed into guitar speakers.

The efficiency range of speakers typically found in "guitar amplifiers" varies greatly, depending on the manufacturer and model. Among speakers used in guitar amplifiers it would be no problem to find one which is four times as efficient as another. If a guitar amplifier were brought into the shop with a low efficiency speaker, replacing the speaker with one of higher efficiency would result in an immediately noticeable increase in volume.

Beware of Hi Fi speakers, though, when making replacements. Some Hi Fi units available today have efficiencies as low as ½ percent, while top quality *guitar speakers* have efficiencies approaching 20 percent. Apart from other characteristics which may make them unsuitable for guitars, most Hi Fi speakers do not have adequate conversion efficiency to be good guitar speakers.

Tone Brilliance

A guitar produces strong harmonics, in the 500-2000 cps range, which determines, to a great extent, the *timbre* of the instrument. A speaker which is particularly efficient in this range has a "brilliant" sound and satisfies guitarists' demands for good reproduction of complex melodies played on their instruments. Guitar speakers are designed to have this "tone brilliance."

Resistance to Overload

This is perhaps the most stringent requirement of guitar and bass speakers. Because of the powerful signal generated by the initial "pluck" of the guitar string on each note, speakers are actually called on to handle transients many times more powerful than the

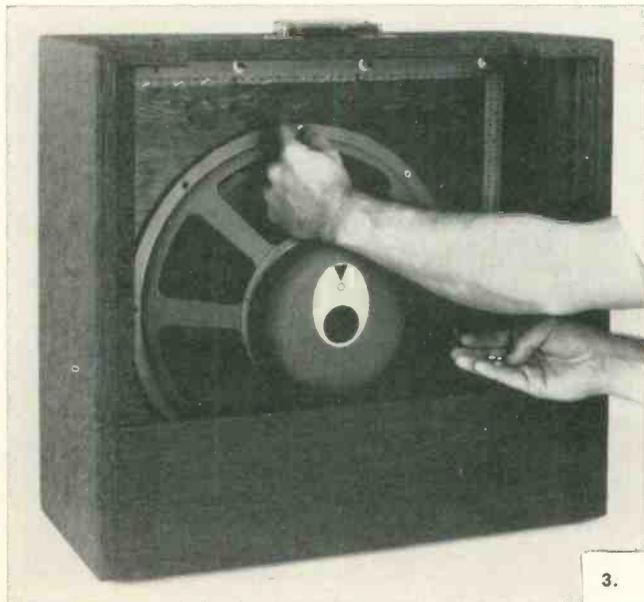
actual musical tone which follows. At the volume level used by guitarists, these strong signals usually drive the amplifier into clipping and well beyond its rated power output. 50 w or more of transient power can easily be fed to a guitar speaker from an amplifier rated as low as 25 w.

Such transients cause long cone excursions, often enough to drive the voice coil beyond allowable limits of travel. In fact, a voice coil driven completely out of the gap is often the reason for guitar amplifiers finding their way into the repair shop. The only way to restore such an instrument to operation is by re-coning the speaker or replacing it completely. Typical Hi Fi speakers with soft suspensions and long-throw voice coils are particularly susceptible to this common failure and as such are generally unsuitable as guitar speakers.

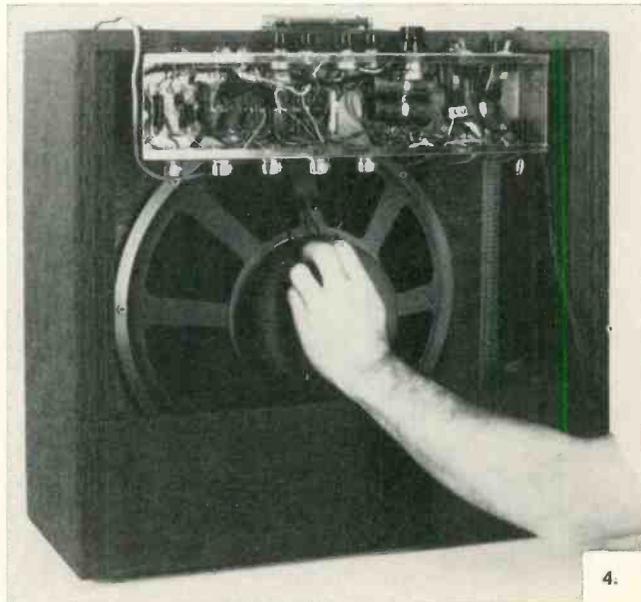
Another common type of damage to speakers driven by powerful guitar transients is cracking of the cone or "surround" caused by repeated long-cone excursions which result in weakening of the cone or surround materials. Guitar speakers are designed specifically to resist this type of mechanical breakdown.

The way a guitar speaker is designed to meet these requirements is often evident in its physical construction and may be seen by examining the speaker. Some of these physical features are:

1. A large voice coil diameter to permit higher efficiency and greater power handling capacity.
2. A heavy magnetic structure to permit greater flux density in the gap, in turn, permitting higher efficiency.
3. A reasonably stiff cone and suspension to limit the cone's excursion and to lower the likelihood of driving the voice coil from the gap.
4. A cone of low mass because it requires less energy to be driven than a heavier cone, and is therefore, more efficient.
5. An edgewound aluminum ribbon copper voice coil, because it is lighter in weight than a copper coil of



3.



4.

the same size, and can be more efficient in the mid-range. (A speaker designed specifically for bass instruments will often have a copper voice coil since efficient reproduction of high frequencies is not required.)

Selecting and Installing

The first step in upgrading by speaker substitution is to determine if an improvement can be made. Does the existing speaker have the attributes or characteristics outlined previously? If it is lacking in any one, an improvement can generally be made by substituting a speaker that meets all requirements.

Selecting the replacement speaker is the most critical step in the upgrading process. Since it is impractical to use a trial and error method with the customer evaluating each possible speaker installed in the guitar system, other methods must be used to select the substitute speaker. Even though a speaker exhibits some or even all of the design features listed here, it would be advisable to select one specifically designed for guitars. Ultimately, the most successful substitutions will result from using speakers *which already have attained good reputations* among guitarists.

Even properly designed high quality guitar speakers can be blown out if they are consistently overdriven. A good way to prevent this is to advise the guitarists how to set their volume controls. (Play some loud passages, slowly increasing the volume settings while looking at the speaker cone, until the speaker cone reaches a total travel of about 1/4 inch. Then note the settings of the controls and not exceed them in using the instrument.) A few minutes spent with the customer explaining this will result in fewer callbacks and greater customer satisfaction.

Installing the speaker is generally a relatively simple job since most original equipment and replacement speakers have standard EIA mounting dimensions. (The replacement should be made with the same size speaker as in the original equipment — going to a different size speaker seldom achieves the kind of results wanted short of rebuilding the enclosure.) The illustrations show a replacement which involved re-

moving a back panel, amplifier, and reverberation unit, yet the speaker substitution took about 45 minutes. Seldom will it take longer.

The enclosure in which the speaker is used determines the way the speaker is coupled to the air behind it. This in turn affects the excursion of the cone and the effective sound radiated by the speaker. It is generally best not to modify the enclosure unless the bass characteristics of the new speaker are radically different from those of the speaker it replaced. Completely closing or carefully porting an open-back cabinet might help the low frequency output, but putting a back on may cause ventilating problems.

A few words of caution to those who value your watches. Big magnets generally mean strong magnetic fields which watches do not like. Well designed speakers concentrate the magnetic field in the "gap" but many speakers have strong fields at the rear of the speaker which can damage watches. Remove your watch while working on these units.

The Profit Picture

Upgrading speakers can be profitable for service-dealers and technicians because good guitar speakers are generally more expensive than low quality guitar speakers and much more expensive than standard replacement speakers. The percentage markups being the same, (which they usually are) the more profit you make. The high markup on the sale of the speaker, together with the small amount of time necessary for the replacement, combine to give "upgrading" a higher net profit per hour than most repair jobs.

Most musicians are appreciative of any improvement in their instruments and a successful upgrading will mean a very satisfied customer. Since musicians are generally interested in improving their instruments they are likely to be receptive to the word-of-mouth advertising of a satisfied customer.

To get upgrading business, the easiest place to begin is with guitar amplifiers brought in for repair. Soliciting this business may be done through window displays or signs, mailers, or other advertising depending on how aggressively you wish to do it.

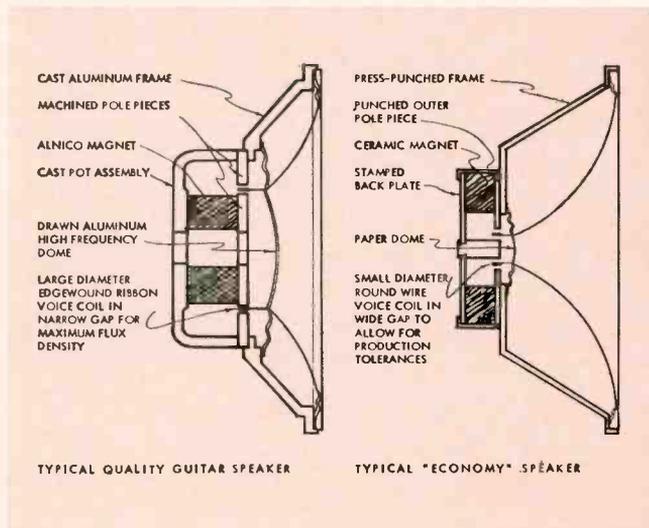
Selling the customer once he is in the shop depends on his budget and on your persuasiveness in pointing out the possible improvements. It will be easier to sell "upgrading" to the customer who has a damaged speaker when he comes to the shop. His arguments to the apparent high cost of upgrading will often dissolve when you show him that the proper speaker will make more frequent repairs of cheaper speakers unnecessary. In short, upgrading has to be *sold*.

Remember these points:

1. Good Hi Fi speakers are not necessarily good guitar speakers.
2. Efficiency, tone brilliance and resistance to overload are essential qualities for good guitar speakers.
3. The best choice will probably be a speaker that already has a good reputation among guitarists.

As you become more familiar with upgrading guitar speakers, this business can become very satisfying and profitable. ■

Major differences between guitar speaker and typical 'economy' type.

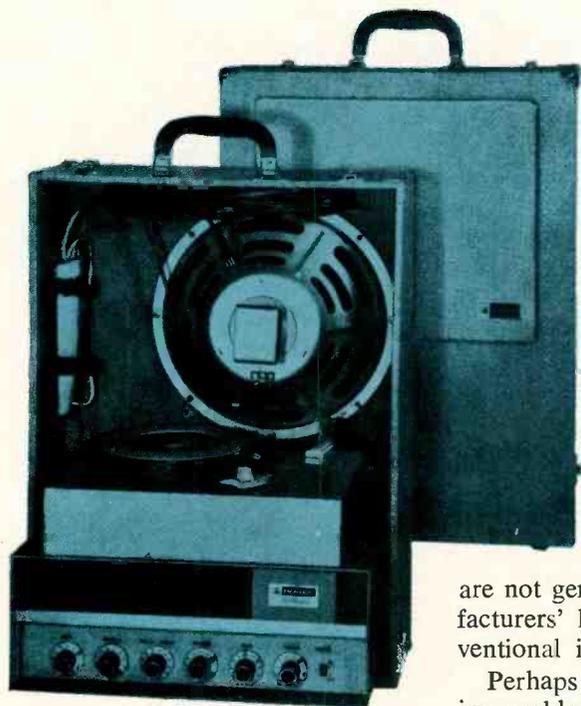


SELECTING AUDIO COMMUNICATIONS AMPLIFIERS

Simplify your installations
by understanding the most important
factors involved

by *M. S. Sumberg*

Bogen Communications Div.
Lear Siegler, Inc.



A 35 w packaged amplifier in a complete portable audio system with two speakers, a microphone and carrying case.

■ Some audio specialists, TV-radio technicians and service dealers are encountering technical problems in the rapidly expanding audio communications and music distribution field. Many of these problems

are not generally covered by manufacturers' literature and other conventional information sources.

Perhaps one of the most perplexing problems is the selection of an amplifier to meet a specific installation. One catalog, for example, lists no less than eight 30 w amplifiers. Since this is a widely used power rating, we are sometimes faced with what appears to be a bewildering choice—a choice which is hardly simplified by the almost overwhelming mass of technical data available.

Fortunately, the problem is not nearly as complex as it initially appears. The eight amplifiers previously referred to are distinctly different in several respects and one can be selected to fit the particular installation. If we exclude here those very large, complex, custom installations handled exclusively by the audio specialist, a definite procedure can be established which will assure selection of an amplifier to properly satisfy all requirements.

The most important factors to be considered in amplifier selection are as follows:

(1) Amplifier output power required. (2) Number and types of inputs (mikes, tuner, etc.). (3) Power source (117 vac or battery). (4) Cost. (5) Special features. (6) Output impedance. We will cover each of these factors in detail.

Amplifier Output Power Required

The number of speakers in a given system, and the wattage level at which each speaker will be operated, determines the amount of output power required of the amplifier. A system using five speakers, each driven to approximately 3 w, for example, will require a 15 w amplifier. Since it is frequently difficult to determine the exact number of speakers required or the exact level to which each will be driven, the usual practice is to select an amplifier that exceeds the apparent system load requirement.

Hence, in the previous example, it would probably be a good idea to select a 25 w amplifier. The larger amplifier will accommodate additional speakers (which may be needed later) to cover areas not serviced in the original installation. The difference in cost between the two amplifiers is more than offset by added flexibility for future demands. We have been speaking about maximum output and it should be clearly understood that the amplifier's adjustable volume control will enable the speakers to be driven at lower levels. At maximum volume control settings, of

Transistor amplifier installed in boat, powered from 12 v battery, has 35 w output. Accessory generator attached to amplifier top produces a fog-horn or siren tone signal.

Universal-mobile 50 w amplifier can be operated from either 117 vac or 12 vdc sources. Phono top is optional.



course, the amplifier will provide only its maximum rated output and this figure cannot be exceeded by manual adjustment.

In smaller installations, it is a relatively simple matter to determine the exact number and the level of each speaker. Larger installations do, however, require broad specialized audio experience and test setups. A typical test setup might consist of a 10 w amplifier brought to the installation site and connected to a speaker temporarily mounted at the top of a ladder. The amplifier volume control is then advanced until the speaker appears to be providing the desired sound level for its particular area. By using a meter and simple calculations, the speaker's level in watts can be computed, and it can be determined at what levels the other speakers will be driven. As a rule, however, experience will decide where speakers are required and how much power must be fed into each. Where questions arise regarding ratings, it is advisable to select the higher value—remembering that the amplifier volume control (or one of the several speaker line-matching transformer primary taps) may be used for the desired audio level.

Amplifiers are readily available with the following output ratings: 10, 15, 20, 35, 50 and 100 w. Where large amounts of output power are called for, any number of booster amplifiers (with ratings of 60, 100 or 200 w) may be incorporated in a single audio system and driven from a single preamplifier or a lower power "packaged" amplifier.

Number and Types of Inputs

Standard packaged amplifiers are available for systems needing from one to six microphones and a phono mechanism or radio tuner. In one manufacturer's line, it was found that a 10 w amplifier provided one microphone and one phono input; a 15 w amplifier provided two microphone inputs and one phono input; 30 w amplifiers were available with one or five microphone inputs, plus one phono input. Rounding out the packaged line were two 50 w amplifiers, the lower priced model with two microphone inputs and one phono input, and one version had five microphone inputs and one phono input.

The number of microphones needed for a given installation can be determined after carefully check-

ing to determine the exact features required by the user. In most cases this is a relatively simple matter. For instance, a barker in a circus midway requires only one microphone. Paging announcements made from two points in a store would obviously require two microphones.

When the length of microphone cable does not exceed 50 ft, a high impedance microphone may be used. On the other hand, if the microphone cable must run beyond 50 ft, a low impedance microphone with low impedance cable will be required. And the amplifier input must be altered to accept the low impedance signal. Altering the input from high to low impedance is a relatively simple matter with several amplifier lines by removing a shorting plug from the top of the amplifier chassis and substituting a plug-in transformer. This technique permits the microphone channel to be reconverted from low to high impedance at a later date. It also provides flexibility to set up a four microphone channel amplifier, for example, with two high and two low impedance microphones.

The phono input on most amplifiers requires a much higher signal level than provided by a micro-



A 30 w amplifier with only one microphone input.



Economy type 10 w amplifier.



A deluxe 30 w packaged amplifier features five microphone and two auxiliary signal inputs, variable speech filter and monitor panel.

phone and is intended for a radio tuner, automatic record changer or tape recorder.

In larger installations requiring simultaneous operation of more than five microphones, standard practice calls for separate preamplifiers and one or more booster amplifiers—the several chassis being suitably mounted in a vertical cabinet rack or console. One manufacturer offers amplifiers which may be easily paralleled to offer 10 to 15 microphone inputs.

Power Source

The characteristics of available amplifier power sources must be considered. For instance, we may need to mount a unit in a car or bus where 115 vac is not available. Several mobile amplifiers, specifically designed to operate on a 12-v battery, provide a choice of power output from 20 to 50 w. And universal amplifiers which may be powered from either 117 vac or 12 vdc are good choices for rental work since they can be installed indoors or in vehicles.

Cost

In selecting audio amplifier systems, cost is not so important as it

may seem. 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.

The amplifier cost reflects component quality, number of features, over-all performance and the degree of quality control. Obviously, a 30 w amplifier with five microphone input channels costs considerably more than one with a single channel. If only one microphone is needed, the less expensive unit is indicated. A few manufacturers offer deluxe as well as economy lines. In some instances, the economy line does not sacrifice reliability, but the features are more limited and the over-all performance is somewhat lower. Reliable manufacturers provide complete data for all amplifier models and comparisons can be made with the lower priced units. It is not economical to select an amplifier with capabilities far above the job requirements. Typical factors that affect the cost of amplifiers are as follows:

Power. Higher power amplifiers cost more because larger components are used.

Frequency response. If an amplifier is to have a very wide frequency response for Hi Fi music reproduction, circuits are more complicated and components more expensive. And it is important to remember that if the installation budget calls for an inexpensive speaker to handle frequencies from 100 to 7500 cps, there's no reason to select a wide frequency response amplifier, for instance, to handle 30 to 25,000 cps. An amplifier which closely approximates the speaker's frequency response should be selected if cost is important. It is foolish to pay for something that is not being used.

Distortion. This is expressed as a percentage and may be considered the undesired difference between the input and output signals. As a rule, the amplifier price increases as the distortion figure decreases. Typical good audio amplifiers designed for commercial installations are rated at approximately five percent distortion (for full output). Some deluxe amplifiers are rated as low as two percent. It is interesting to note that the best home Hi Fi component amplifiers, designed for extremely expensive speakers, carry ratings as low as one-tenth of one percent.

... Audio Communications Amplifiers

Special Features

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

Phono-Top. In many cases, particularly in mobile and portable applications, an amplifier must be equipped with a built-in phono turntable and tone arm. A wide range of standard packaged amplifiers are available with phono tops.

Portable System. Special carrying cases are constructed by amplifier manufacturers to house a complete portable audio system consisting of a microphone with cable and connector, two speakers with cable and connectors, and a 35 w or smaller amplifier. When used, the two halves of the portable carrying case are unlatched and the amplifier and microphone cables are then simply connected to the amplifier. After the amplifier has been plugged in to a source of 115 vac, the system is ready for operation.

Controls. In some installations an amplifier may need control flexibility over and above volume adjustment for the individual input channels. If Hi Fi music reproduction is

a major function of the system, separate bass and treble controls are essential to provide boost and attenuation at both the high and low frequency ends of the audio spectrum. Some units provide only reduction of high and low frequency audio, and do not permit boost. The increased flexibility in tone controls should be considered when 10 w quality speakers are used or if reverberation and acoustic feedback problems are encountered. As we know, 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 remedied in many cases by using cardioid microphones and by carefully orienting the speakers.

Remote volume control. In many church, theater and auditorium installations it is desirable to control the audio output at some distance from the amplifier. Some amplifiers can be equipped with remote volume controllers for this purpose.

Standby operation. Frequently, audio systems used primarily for paging are operated only briefly

and intermittently, yet the power must be applied at all times for immediate use. To reduce electric power and increase tube life during consumption periods when the amplifier is not actually used, some amplifiers are designed to accept a plug-in standby controller relay. This device is energized by a switch in the base of the microphone stand to place the amplifier in an operating condition for the interval.

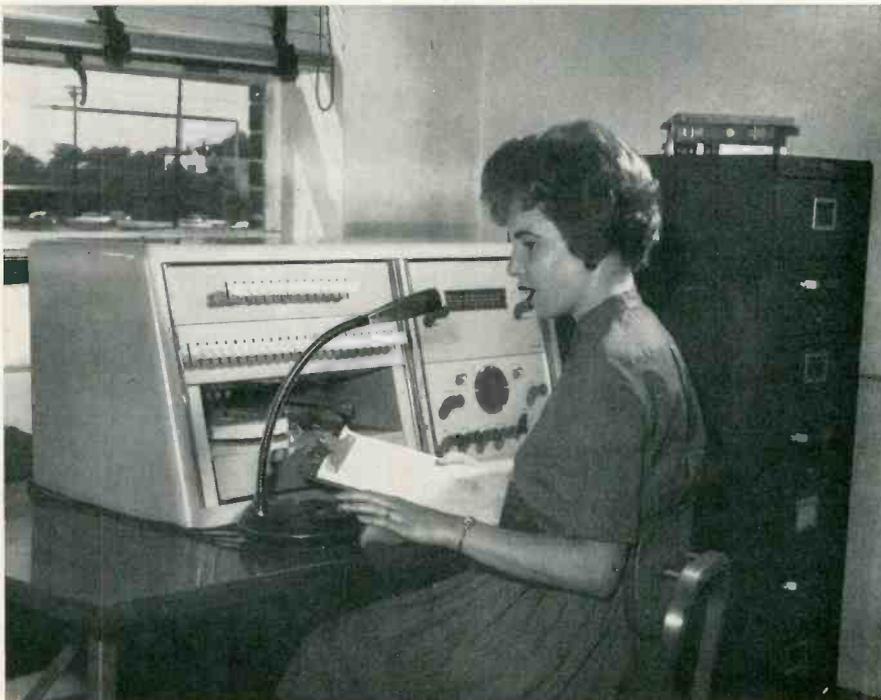
Output Impedance

The output impedance of an amplifier must be closely matched to the speaker load if the amplifier's total output power is to be used. Most audio amplifiers provide a relatively wide selection of output impedance taps. But some so-called high fidelity amplifiers—designed specifically for home radio/phono music systems — frequently offer only 8 and 16 Ω output taps which might be inadequate for a commercial audio installation which requires speaker line-matching transformers.

As noted in the specifications from one manufacturer's catalog, the output impedance values available considerably simplify impedance matching problems. Almost certainly one value will be found correct for maximum transfer of energy from the amplifier to the speakers. Output impedance taps of 4, 8 and 16 Ω are frequently used where the speaker lines are relatively short and the number of speakers small enough to permit series, parallel or series/parallel connections. When a large number of speakers are used with line-matching transformers, the constant voltage amplifier tap and constant voltage line-matching transformers should be used to avoid the need for complicated computations.

Some audio equipment manufacturers maintain departments which solicit inquiries on perplexing or simple installations. If you send a fairly accurate statement as to what the buyers' requirements are, they will recommend the proper amplifier and accessories required. ■

Packaged school console with built-in tuner, phono, intercom, amplifier.



COLOR BAR/DOT GENERATORS

One important test instrument required for color TV servicing is a color bar/dot generator. As a group they offer a variety of patterns for troubleshooting, alignment and adjustment of color TV sets. Most generators provide dot, crosshatch, vertical and horizontal line patterns for convergence procedures.

The instruments can be divided into four basic types. Because most generators offer similar convergence patterns, the division into basic types is made according to the type of color signal furnished. The four basic signals are: rainbow, keyed rainbow, NTSC (offering individual colors) and full NTSC (both chroma and brightness component).

Cost, portability and individual preference are important considerations when selecting a color bar generator for your requirements.

Because of the importance of color bar/dot generators, ELECTRONIC TECHNICIAN is beginning a new monthly series which will be devoted exclusively to these instruments until all brands are reviewed. A different brand will be covered each month. This is the first article of the series.

SENCORE

CG135 Color Generator

Functions, controls, signals and circuit descriptions

■ This color generator is fully transistorized. It is small, compact, weighs 8 lb and measures 9½ x 10¼ x 4 in. It is classified as a *keyed rainbow* type.

The generator's output, after passing through the receiver, applies a varying phase chroma signal to the demodulator circuits. This is done by the offset carrier method.

An oscillator operating at a frequency of 3.563795 Mc (15750 cps less than the 3.579545 Mc color sub-carrier frequency) is used to modulate an RF carrier on channel 4 (adjustable to 3 or 5). This signal, with horizontal sync pulses added, is fed into the antenna of a color TV set and when it reaches the demodulators the 3.563 Mc signal beats with the 3.579 local oscillator signal in the receiver. A difference frequency which completes one cycle every horizontal line is thus formed. A complete range of colors is then produced during each horizontal line. Each line will display the same colors because there is no phase difference between the beginning of each sweep line. The result is a series of vertical bars which cover the color spectrum.

This instrument gates the 3.56 oscillator at a fre-



Sencore CG 135 Color Generator.

... COLOR GENERATOR

quency of 12-times the horizontal sweep frequency. This provides 12 color bars, with a phase difference of 30 deg between each. Only ten color bars are visible on the TV screen because one is blanked out during horizontal retrace and another is used as the burst pulse. The color pattern of the CG135 is shown in Fig. 1.

The color pattern of this instrument can also be fed into the video stages of a color TV set. This signal is taken off at the COMPOSITE VIDEO jack of the unit.

The dot pattern which the instrument generates has 117 size-adjustable dots. These adjustments can be made from the front of the unit.

In addition to the color and dot patterns, the generator has a crosshatch, vertical line and horizontal line pattern available. Nine vertical bars and 13 horizontal bars are formed and in the crosshatch position these bars are shown simultaneously.

An important feature of the instrument is the 4.5 Mc audio carrier which is necessary to insure proper receiver tuning. This 4.5 Mc carrier is switched on and the receiver fine tuning control is adjusted until a herringbone pattern (a 920 kc beat) is observed. The fine tuning control is then backed off until the herringbone effect just disappears.

A COLOR OUTPUT control is provided which varies the percentage of color signal fed to the modulators.

This control can be varied from zero percent to 200 percent. A setting of 100 percent is considered normal. The control is used primarily to check the color sync capabilities of the receiver. The 200 percent setting is used to force a defective set into sync while troubleshooting.

A necessary aid to efficient purity and convergence adjustments is the COLOR GUN INTERRUPTER switches provided. A 100K resistor is built into each grid interrupter lead to reduce the effects of lead capacity to provide less possibility of picture smearing.

A COMPOSITE VIDEO signal at either plus-or-minus 2 v P-P can be selected for injection into the video stages. This signal consists of video information selected by the pattern switch and vertical and horizontal sync information.

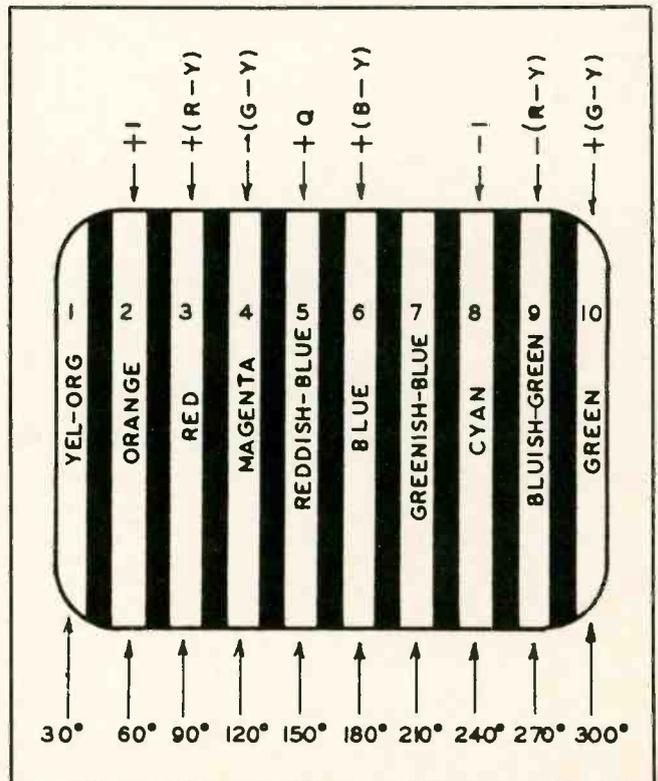
A COMPOSITE SYNC signal is available for use in color sets designed to remove sync information before the video detector stage. This sync signal is used to lock the picture on this particular type of set when the composite video signal from the instrument is being used to troubleshoot the video stages.

A complete circuit diagram of the CG135 is shown in Fig. 2. The five outputs of the generator consist basically of a series of horizontal, vertical and video pulses. To generate proper patterns these pulses must be timed to appear on the CRT at the correct instant.

Circuits and Circuit Functions

The heart of the timer is the 189 kc crystal controlled Pierce oscillator, (TR1). All other frequencies, 15,750 cps horizontal, 60 cps vertical and 900 cps used for horizontal lines, are derived from this 189 kc

Fig. 1—Keyed rainbow pattern.



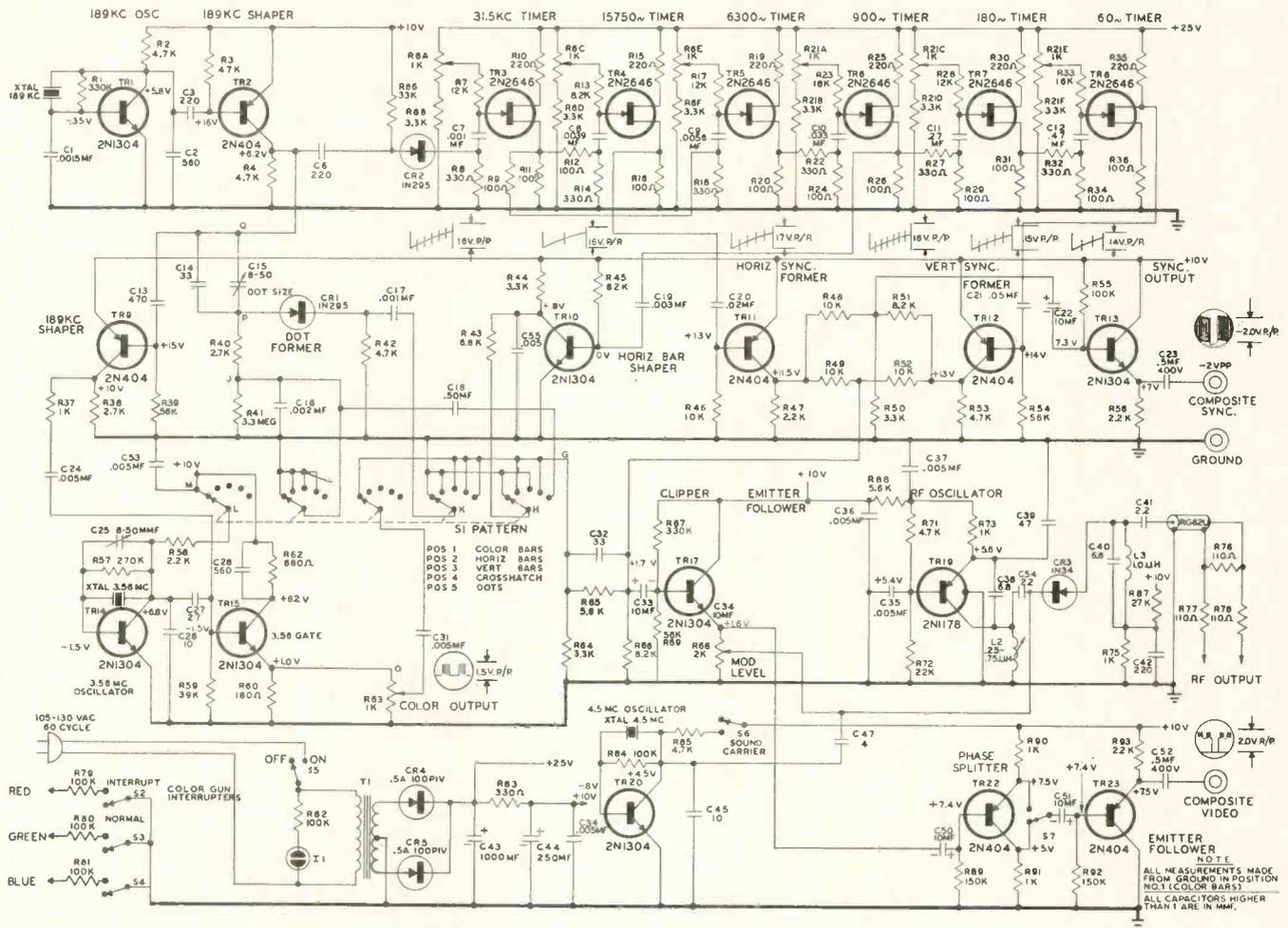


Fig. 2—Schematic of Sencore Model CG 135 Color Generator.

oscillator by counting down with unijunction counters. Vertical lines are generated directly from the 189 kc signal and the color subcarrier (3.56 Mc) is gated by the same 189 kc signal.

All the timers are identical and operate in the same manner except for the basic frequency differences controlled by the resistor and capacitor timing components in the transistor emitters. Each timer circuit uses a unijunction transistor (2N2646) which functions like a thyatron tube.

The color bar signal is generated in a two stage network composed of two transistors (TR14 and TR15). One acts as a crystal controlled Pierce oscillator operating at 3.56379 Mc. The oscillator output is gated at a 189 kc rate by a signal from the 189 kc shaper circuit.

The instrument's RF oscillator is a Colpitts type which is tunable over the range from 60 to 82 Mc (channel 3 to channel 5). Its output is coupled to a diode modulator where it is modulated with the composite video signal. The video signal varies the diode impedance at the video rate and since the diode is in series with the RF signal, the RF signal is amplitude modulated.

A 4.5 Mc sound carrier signal, unmodulated, can be inserted into the RF signal with a switch. This supplies voltage to a crystal controlled Pierce oscillator

operating at 4.5 Mc. The output of the oscillator is capacitively coupled to the previously mentioned diode modulator.

Positive pulses are taken from the transistor base of the 15,750 cps timer, inverted and shaped in the horizontal "sync-former" circuit. Negative pulses are taken from base 2 of the 60 cps timer and shaped by the vertical sync-former circuit. Negative pulses from the collectors of the horizontal and vertical sync former circuits are mixed in resistor network (R48, R50 and R51) and the combined output is fed through the sync output emitter-follower to the COMPOSITE SYNC jack. Negative pulses from the collectors are also mixed in a second resistor network (R49, R52 and R66) and then combined with signal pulses.

A composite video signal is developed across R66 and the negative going sync pulses are clipped in TR17 to remove unwanted signal pulses that occur during the sync pulses. The output taken from the emitter of this clipper feeds the modulator diode. It is also fed to a phase splitter circuit, through the emitter-follower to the COMPOSITE VIDEO jack.

It is highly recommended that technicians study service manuals which come with all instruments and develop, from the beginning, an organized procedure which will eventually become "automatic" and save valuable time. ■



Maintaining PA

by Eugene M. Mohr

Development Engineer
Shure Brothers, Inc.

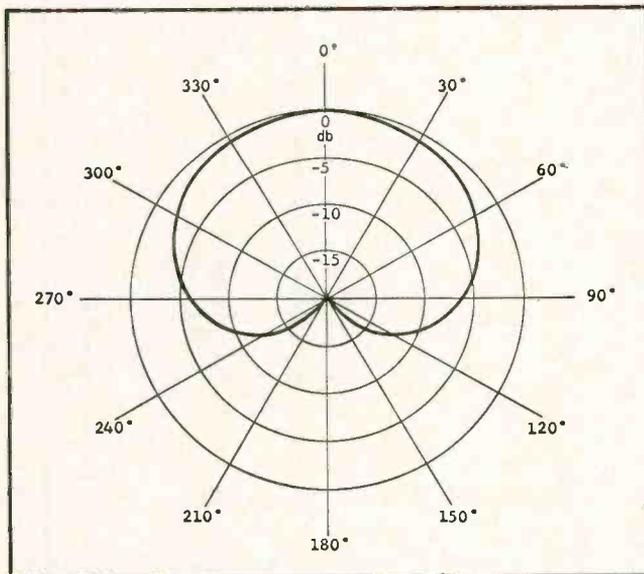
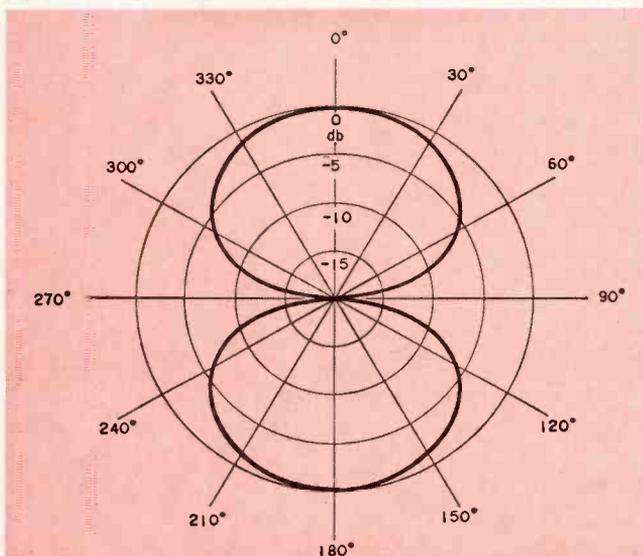


Fig. 1—(above) Cardioid microphone pattern.

Fig. 2—(below) Bidirectional microphone pattern.



■ Maintaining microphones used on PA systems should be a cooperative effort between service technicians and manufacturers. Field repair and good preventive maintenance is strongly encouraged but some repairs should receive factory service department attention. Microphone-cartridge repair involves special techniques, for example. Whether a microphone is repaired by the factory or the technician, however, the technician's responsibility is to determine whether the unit requires factory attention or repairs can be made on the spot.

Your most frequent contact with complaints about microphones will involve public address type systems or tape recorder performance. In analyzing each situation, it is necessary to remember that many problems are caused by selecting the improper microphone type or poor installation, instead of equipment malfunction.

Good Practice

A review of some factors associated with good practice in microphone installation may be helpful. It has been learned, through years of experience, that directional microphones which have smooth frequency response and uniform directional characteristics offer a significant increase in "talk power" without feedback, compared to omnidirectional microphones. The cardioid pattern (Fig. 1), if truly uniform about the microphone axis, is suitable for a wide variety of situations.

The microphone should be mounted and oriented so maximum feedback rejection is obtained. Feedback occurs most often when the cardioid null is pointed toward the loudspeaker or the center of the reverberant area into which the program is being amplified. With bidirectional microphones, the nulls at the sides (Fig. 2) should be pointed toward the loudspeakers. In installing the microphone some experimentation is helpful in determining the best microphone orientation for minimizing feedback.

Cabling Precautions

When the cable run from the microphone exceeds about 25 ft, a low impedance microphone connection

Microphones

should be used. This prevents high frequency roll-off caused by cable capacitance, and reduces susceptibility to hum pickup. It is also helpful in reducing RF pickup from nearby transmitters. The low impedance configuration allows a balanced line to be used because the voice coil or transformer secondary of most low impedance microphones is not connected to the ground shielding. This results in a three-wire connection as shown in Fig. 3B.

Sometimes the amplifier input transformer has a grounded center tap. If the signal circuit is connected to the ground shielding at the microphone it would short out part of the amplifier input transformer. It is essential, then, for the low impedance microphone to have an ungrounded output. In any given situation it is necessary to determine the way in which the system is wired by actual ohmmeter continuity checks or by reference to the data sheet, since no standard method of color coding microphone cables and plugs has been established.

If the microphone is used outside in the wind or subject to much handling, windscreen accessories and shockmount isolators are useful in reducing the extraneous noise.

Troubleshooting

When the source of complaint involves "dead," "noisy," or "distorted sound," the microphone and cable should be inspected to determine if field repairs are possible or a new microphone cartridge is needed.

Continued on page 70

Fig. 5—Microphone test facility. A, B microphones to be compared. Level controls must present constant load to mikes. Switch under control of listener. "A" is suitable amplifier.

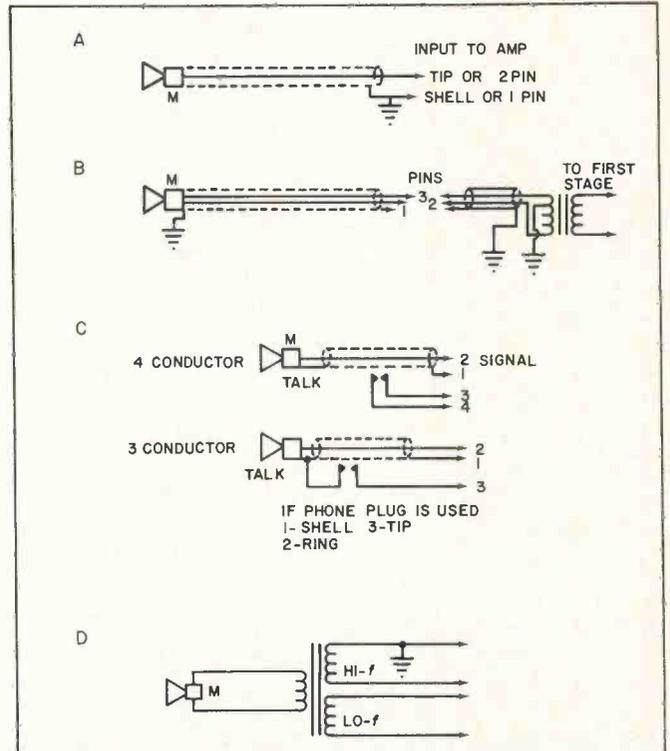
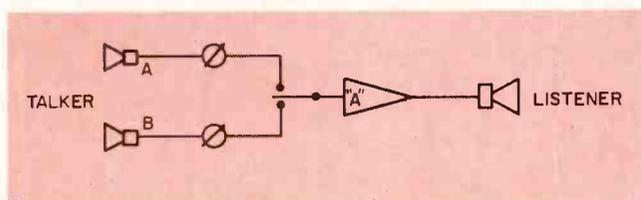
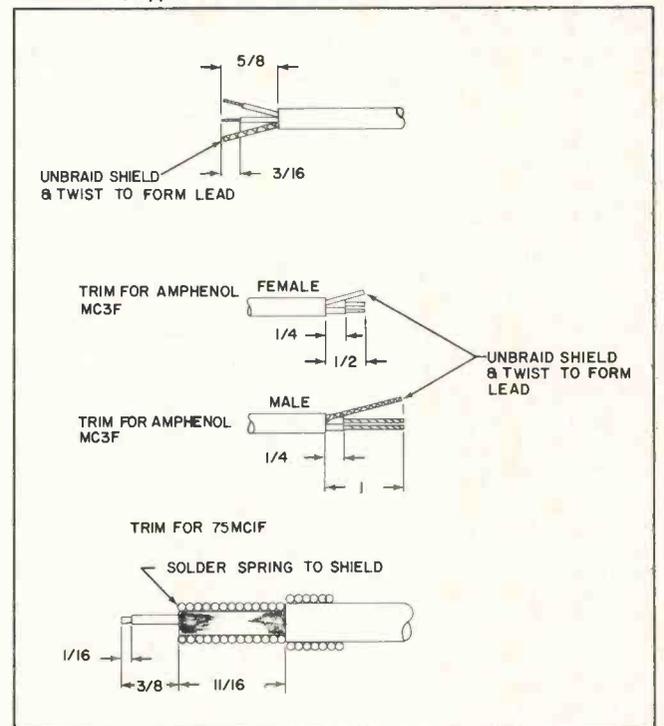


Fig. 3—(above) Common microphone connections. (A)—Single connector shielded. (B)—Two conductor shielded. (C)—Four and Three conductor push-to-talk circuits. (D)—Dual impedance microphone.

Fig. 4—(below) Approved methods for connecting typical microphone connectors. (Top) Trim for Cannon XLR.



Color, Color Everywhere —

by Joseph A. Hayes

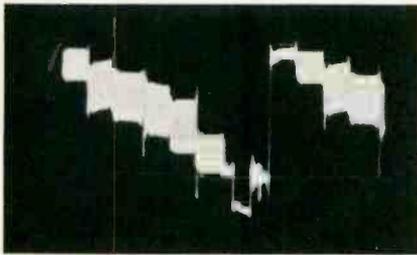


Fig. 1—. . . Scoot shouted, 'it looks like stair steps.' The bottom of the 'stair steps' is the horizontal sync pulse and immediately after it is the burst signal.

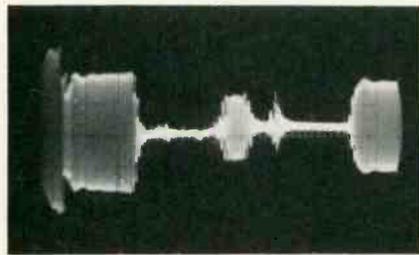


Fig. 2—The burst (center) with chroma information on both sides. The low frequency component has been removed at this point through capacitor coupling.

■ "It might be easier for you to work on these new color sets than the old ones but it's the same old grind to me," Scoot suddenly said to Bob. "As long as trouble's in the black and white section, I'm fine. But when trouble develops in the color section I'm stumped. How do you get through these color sets so fast?"

"For one thing, Scoot, I've been at it longer than you. Of course, old age is no substitute for youth, but there's no substitute for experience either—except *more* experience. And the most important thing is, I use my head—most of the time."

"I resent that," Scoot pouted.

"I'll take it all back if you can show me one intelligent thing you've done on this set."

"Forget it, Bob—just help me out of this mess I'm in. I've got lots of chroma and no sync. I've grounded the reactance tube grid and tuned the reactance coil for lock to a color station but when I pull the ground connection off I'm right back where I started—the set just won't color sync."

"How about your burst oscillator output transformer, have you checked that?"

"I don't know anything about aligning these things—it takes me hours just to set up the equipment."

"Hold on there, Scoot. You don't have to set up a fancy array of equipment just to adjust the oscillator output transformer. All you have to do is connect a dc voltmeter to the cathode or plate of the killer detector—on the output side

But Not a Bit in Sync

Scoot tackles a tough sync problem and Bob explains the facts about the burst signals

—and adjust the coil for maximum meter reading. If you connect the meter to the cathode, you'll get a positive reading. If you connect it to the plate side, you'll get a negative reading. Now, is that so hard?"

"Well, no. But I thought there was more to it."

Scoot busied himself following Bob's instructions. He connected the meter probes from cathode to ground and peaked the oscillator output transformer. Still the color signal would not sync.

"It's no use, Bob. The output transformer was off quite a bit but that didn't correct the sync trouble."

"Try adjusting the reactance coil now. I think you'll find the output transformer adjustment has given you a little more range."

Scoot did—and the set locked in and looked good.

"By the way, Scoot, if you happen to be using a scope instead of a meter, there's another way to peak the output transformer. Just connect the scope probe to one of the demodulator 3.58 Mc input grids, normally pin seven, and peak the transformer for maximum vertical deflection. One way seems to be just as effective as the other."

"Another thing that may have to be adjusted after the 3.58 Mc transformer is the killer control. More 3.58 Mc signal to the killer detector may change the detector output and require a different setting."

"That's the trouble with color sets, everything you touch causes six other things to go off adjustment," Scoot complained.

"No Scoot, that's not exactly true.

It's mostly a matter of knowing what adjustments affect others. This is true in B/W too. If you'd bone up on color and then *think* while you work on it you wouldn't have any more trouble with color than with B/W."

"Well, one thing I don't understand is this burst business. Everything you read is full of burst this and burst that. Where does the burst come from and what does it do?"

"That's not as difficult as it sounds, Scoot. Here, let's take a look at the burst and what it does in *this* set. Make sure of one thing when you work with a scope in these circuits: use *this* scope. It has a very high frequency response and

you can see all the things you need to see. Actually, the vertical response on this scope is flat to more than 5 Mc and the horizontal sweep frequency goes quite high so we can get a good look at the burst.

"First of all, the burst is a 3.58 Mc frequency which is telecast with the color signals from the transmitter. It is the same frequency used to encode the color signal. Consequently, we need the same frequency and even the same phase to decode the color signal. Follow?"

"Yeah, I guess so."

"Good! Actually, the 3.58 signal is sent only during horizontal retrace time so it doesn't get mixed up in the signal."

Bob fed a signal into the set

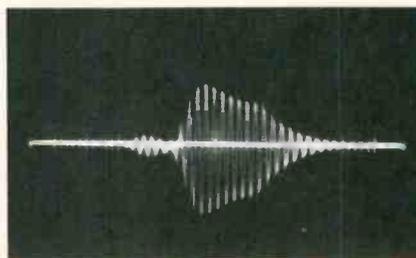
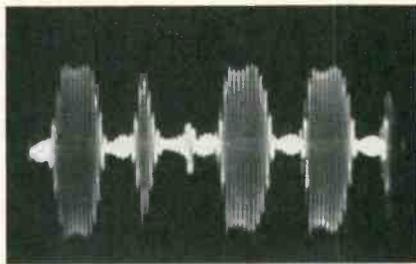


Fig. 3 (Top)—The burst signal again with a different color generator driving the set.

Fig. 4 (Bottom)—Only the burst portion of the same signal but amplified to show detail.

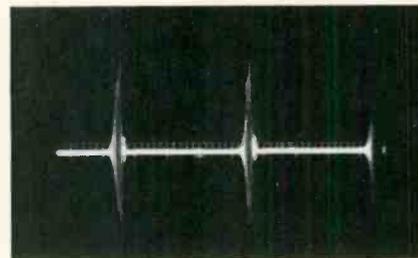
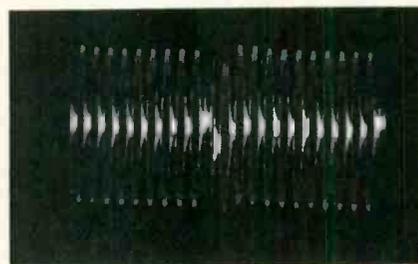


Fig. 5 (Top)—Chroma signal at the burst amplifier grid showing burst in the middle. (Bottom)—At the plate of the amplifier the chroma has been gated out leaving only the amplified burst.

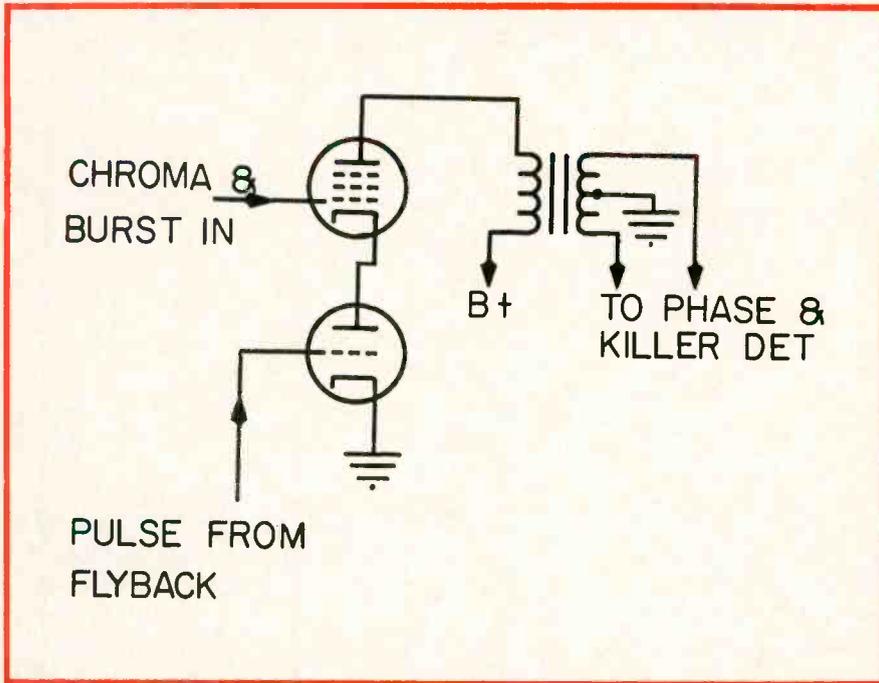
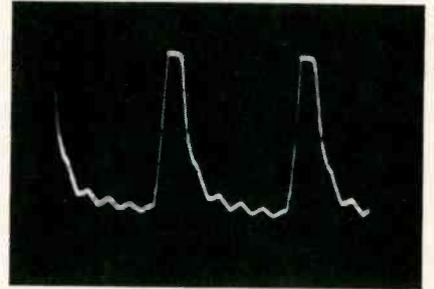


Fig. 6—Simplified schematic shows how gated burst amplifier is cut off by a pulse from the flyback—except when the burst is present—during retrace.

Fig. 7—Flyback pulse which gates the burst amplifier and allows only the burst signal to pass and be amplified.



from a color bar generator and connected the scope at the first video amplifier output.

"Holy smoke," Scoot shouted, "it looks like stair steps." (Fig. 1.)

"That's because the generator we're using puts out that kind of signal. But that's not what we're interested in. Down at the bottom of the stairs you can see the horizontal sync pulse."

"And I suppose the little mess on the other side of the sync pulse is the burst?"

"Precisely, Scoot. That's the part a regular service scope won't show. As a matter of fact, we can even get a better look. Let's connect the scope to the burst amplifier input. (See Fig. 2.) This is the same signal, but it has gone through some chroma amplification."

"It doesn't look like the same thing, Bob."

"That's because I expanded the sweep so we could get a better look at the burst."

"No I don't mean that. Look at the ends of the color information just ahead and just behind the sync. They're not 'stair-stepped' now."

"I see what you mean—the stair-steps are gone at this point because the coupling capacitors in the circuitry lose the low frequency component. If we looked at the entire waveshape at this point, it would be all on a common axis. Clear?"

"Sure. Does the station burst signal look like the one we have?"

"Yes, it does. Let's use our old rainbow generator so you can see a different-looking burst."

Scoot bounded away to get the rainbow generator as Bob disconnected the newer unit. Then the rainbow generator was connected. (See Fig. 3.)

"It looks like the burst is more peaked with this generator."

"It is, Scoot. If we expand the waveform, we can get a better burst. (See Fig. 4.) Notice how the burst is 'dragged out' too. Now let's consider something else—notice that the name we've been calling the burst amplifier is actually the burst gate and amplifier."

"I get it; the tube is actually a gate that lets only the burst part of the signal through and amplifies it at the same time. Right?"

Bob ignored Scoot's mock seriousness and continued.

"And if we observe waveforms at the burst gate and amplifier we can see what happens to the signal." (See Fig. 5.)

"Aha! I told you, the only thing that gets through is the burst."

"You're right Scoot. And no one is arguing with you—you don't have to yell. You should also notice that the burst amplitude is much greater than it was. In fact the signal could be confused with the one

on the grid if the frequency weren't different."

"OK—so where's the signal that blanks or gates the burst amplifier? I figure that's what you have in mind next."

"Right again. Notice the other half of the burst gate is 'in series' with the amplifier. And its grid is tied to a tap on the flyback. Anytime the bottom portion of this circuit is conducting, the top half can conduct as well."

Bob sketched the circuit rapidly on a scrap of paper. (See Fig. 6.) "See here," he continued, before Scoot could interrupt, "when the high voltage pulse from the flyback appears, the amplifier is turned on and the burst pulse is passed and amplified. Naturally, the turn-on pulse occurs at the same time as the burst pulse—during retrace. Here, we can look at the turn-on pulse from the flyback too."

Bob connected the scope to the gate amplifier grid. (See Fig. 7.)

"Very clear, Bob. But I've read that the chroma signal is blanked during burst time—where does all this take place?"

"Hold on Scoot — I think we should save that lecture for the next color set you get tangled up with. I think you've had enough for this session."

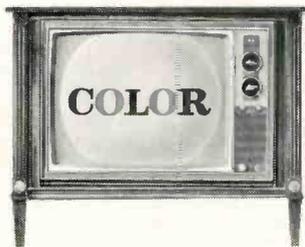
"OK Bob. It's time to take off anyway—I'll see you Monday." ■

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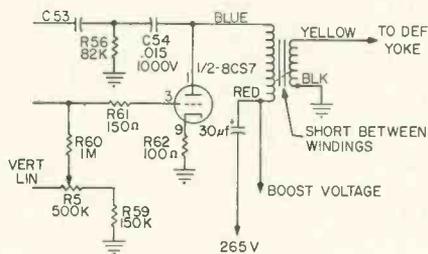
Difficult Service Jobs Described by Readers

Intermittent Cable

A Truetone TV Model 2DC1150 had fading sound after about 1½ hours of operation. Tube substitution in the home when the sound was gone did not correct the problem so the set was brought into the shop. Preliminary checks on the bench with the sound normal did not reveal anything out of the ordinary. The set was left to cook and after about 2 hours the sound disappeared. An audio signal injected at the grid of the audio output tube was heard loud and clear in the speaker. The generator lead was then placed on the plate of the detector. With the signal fed here, there was no output. This isolated the problem to the coupling circuitry between the stages. The signal probe was then moved to the volume control side of the coupling capacitor, still no output. The set was switched off and resistance and continuity checks were made in the volume control circuit. All readings were normal and the volume control checked out OK. The set was switched on and the audio tone applied to the plate of the detector with a fairly loud output at the speaker. After about five minutes the sound faded away. Upon reaching in to check signal presence at the volume control with the scope probe, the wire bundle from the chassis to the tuner and control assembly was moved and the sound then returned. I noticed that the volume control cable was laying against the 5U4. When the tube became hot the insulation of the cable would soften causing the center conductor to short to the shield. When the set cooled the fault cured itself and the set would operate normally for awhile. I replaced the cable and tied the bundle of wires to a CRT bracket and the problem was solved. —Stuart V. Scheffel, Santa Barbara, Calif.

Shorted Transformer

I recently had a Westinghouse Model H-93312 portable, with no vertical sweep, come into my shop. Although the owner said he had the tubes tested, I substituted a new 8CS7 without results. I have found that vertical troubles are generally easy to repair but this set took more time than usual.



Shorted output transformer caused lack of vertical sweep.

The voltage on pin 3, the control grid of the vertical output tube, was only -1.5 v and was varying somewhat. The correct voltage should be around -25 v. The voltage at the plate of the oscillator was only 15 v and the grid voltage was -9 v. The boost voltage, normally at 520 v was down to 250 v. Resistance checks in the output stage were normal and the resistance of the output transformer was very close to the values indicated on the schematic diagram. The blue lead was removed from the plate of the 8CS7. The voltage on the lead was still only 15 v. C54 was removed and no change was noticed. The output transformer felt very warm but when the set was switched off the resistance of the transformer checked normal. Because of the extremely warm operation of the transformer I replaced it and the set resumed normal operation. The old transformer when placed under a heat lamp had a resistance of about 200 Ω between the primary and secondary windings — so when voltage was applied the transformer shorted out. Daniel Benincase, New Castle, Pa.

Hidden Short

The complaint on a Coronado combination model TV2-9677A was "station drift on the FM tuner of the radio section." At times the FM signals would cut out completely. A new 6AQ8 FM oscillator tube was installed but no improvement in operation was noticed. When we moved the capacitor connected to the grid (terminal 7) of the oscillator socket, the set would act up. We changed the capacitor but the trouble remained. We made a number of resistance measurements in this stage but all resistors checked out normal. The set would act up inter-

mittently so that abnormal voltage readings were difficult to spot. I finally decided to change the tube socket because of the reaction to movement of the capacitor connected to the grid. I had only removed the wires and components from two of the socket terminals when I noticed something glittering between terminals 7 and 8 of the tube socket. With a small screwdriver I flicked out a very thin wire about one quarter inch long that was lodged between terminals 7 and 8 of the tube socket. A closer look showed that this piece of wire was held firmly in place by a blob of hard rosin. It was making solid contact with the cathode terminal but only intermittent contact with the grid. For this reason, definite voltage indications were difficult to obtain. I replaced the parts and loose wires which I had previously disconnected from the socket and the FM radio now worked fine when we switched the set on. Probing around the socket did not disturb the signals. We cooked the set and it showed no drift or cutting out of the signal.

During the preliminary troubleshooting, the tuner was subjected to considerable vibration but this fine wire remained in position and was not dislodged because it was being tightly held by the blob of hard resin. After the cooking period we reassembled the set and delivered it to the owner. He said the set had "acted up" for a long time. About a month after the set was returned, the customer came to the shop and told us that his combination was still working perfectly. He was happy with the job.

Made me forget those that complain no matter what kind of job you do. —Virgil Zieg, Fremont, Neb.

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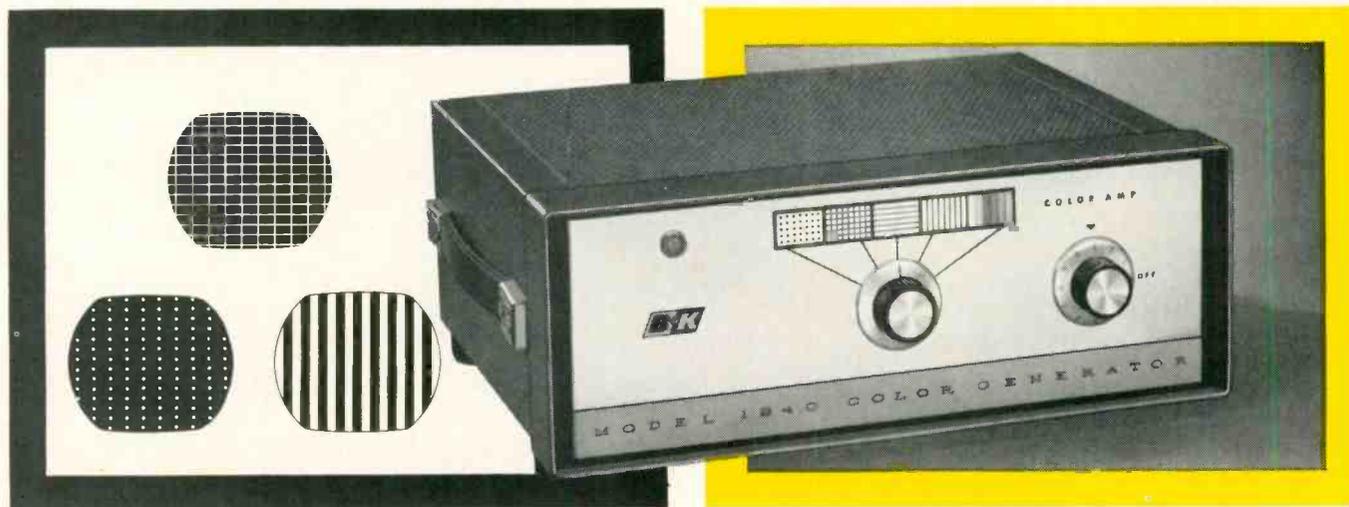
\$10.00 paid for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photographs are desirable. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to "Tough Dog" Editor, ELECTRONIC TECHNICIAN, 1 East First St., Duluth, Minnesota 55802.

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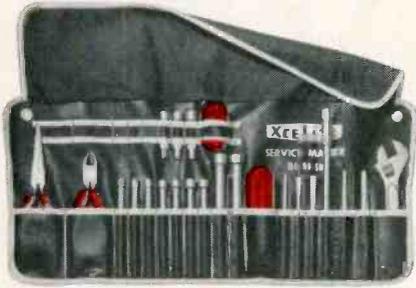


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COLORFAX

RCA Color TV Line

Thirty-seven 21 in. and 25 in. color sets ranging in price from \$379.95 to \$1500 comprise the 1966 RCA Victor color TV line. Bryce S. Durant, president, RCA Sales Corp., said the size and diversity of the new color line "will produce a sharp rise in RCA Victor color set sales through the balance of 1965." He noted that color TV receivers "now account for over 55 percent of RCA's rapidly expanding home entertainment dollar sales total."

The company's new color line includes 15 models in a price range below \$600. Fourteen 25 in. rectangular screen receivers are in the 1966 line, including six console models and eight combination units. Optional retail prices of the 25 in. receivers begin at \$699.95.

Hoffman To Offer Color TV

Hoffman Electronics Corp., who withdrew from the TV industry in 1960, will be offering color TV receivers and solid state stereophonic phonographs to the public this fall.

The West Coast TV manufacturer will begin offering its new products to the public directly through franchised dealers, Robert L. Jablonski, general manager, said. Initial products will be color television receivers utilizing the shallow-depth, rectangular, color picture tube and solid state stereophonic consoles.

In appraising the color television market, Jablonski stated that only 5.4 percent of the households in the US had color TV receivers in January 1965, and that dollar volume for color TV is already surpassing that for B/W sets. "It is important to note," he said, "that the TV market today is 50 percent larger in units and 65 percent greater in dollars than in 1960.

Portable Color TV

General Electric introduces the first US personal portable color TV receiver, a set weighing 24 lb that will carry a suggested price under \$250 when available in late fall.

William E. Davidson, general manager of the company's TV receiver department, Syracuse, N. Y., said the portable — which GE calls "Porta-Color" — will use an 11-in. rectangular tube manufactured by the company. The G-E receiver measures 16½ in. deep full front to back, 11¾



in. high and 17 in. wide. Its polystyrene cabinet with walnut grained finish is topped by a retractable carry handle plus dipole antenna. Davidson attributed the product development to "a number of mechanical and electronic design improvements that for the first time allow major reductions in the cost and physical size of a color receiver." One of these design factors is the G-E picture tube. "It is an improved, simplified G-E version of the standard aperture mask type that is less costly to produce and install in the receiver," he said.

Davidson declined a detailed technical discussion of the TV set but said that this information would be released when the receiver became available to consumers. The executive added that G-E expects to have sufficient patent protection on the color portable to give a distinct competitive advantage. He said the set is scheduled to reach retail stores "in time for Christmas selling."

Commenting on the place of G-E's portable in the booming color TV set market which up to now has been only a console business, Davidson said, "Porta-Color will not replace big-screen color sales. Our portable color TV set is the next logical step in the opening up and the expansion of color television and it will complement and supplement the sale of large-screen color, G-E's and others," Davidson stressed.

The set will carry a suggested retail price of \$249.95.

RCA 19-Inch Color CRT

RCA announces that sample commercial quantities of its new 19-in., 90-deg. rectangular color TV picture tube are being made available to the nation's set manufacturers. The new tube is currently in pilot production at the company's plant in Lancaster, Pa. John B. Farese, vice president and general manager, RCA Television Picture Tube Div., revealed these prices for the 19-in. color tube to set makers: \$106 for the 19EYP22 laminated

tube with a glare-free safety window and \$99.50 for the 19EXP22 non-laminated tube.

Zenith Awarded Color Patent

Zenith Radio Corp. has been issued a patent on a basic color TV development originated in the company's research laboratories and widely used throughout the industry in the manufacture of color receivers. The patent, which was awarded to Zenith after extensive litigation with RCA, covers an active matrix for providing red, green and blue color control signals necessary to produce color TV pictures.

NBC Releases Estimate On Color Sets

As of April 1, 1965, color television sets in the United States totaled 3,280,000, according to NBC's second quarterly estimate. In announcing the figures, Hugh M. Beville, Jr., vice president in charge of planning, noted that continuation of the current growth rate will mean 5,000,000 color TV sets in use by the end of 1965. The latest set total represents a 76 percent boost over April 1 of last year when there were 1,860,000 sets in use, and 15 percent over the Jan. 1 estimate of 2,860,000.

Motorola Color Sales Move Up

Motorola officials claim that as a result of public acceptance of the 23-in. rectangular color tube they are now in third place in color TV sales, behind leader RCA and Zenith (No. 2). The limiting factor in production has been lack of CRTs from their supplier. Motorola will be producing color tubes in the near future so they will be able to supplement their present source of 23-in. tubes.

The major share of Motorola's color output has been 23-in. sets. But, because of distributor and dealer demand, they have also built some 21-in. models.

Zenith Announces New Model

Zenith Sales Corp. announces shipments of the Prentiss, a lo-boy console model with a manufacturer's suggested retail price of \$699.95, now added to the company's series of 25-in. rectangular color TV receivers. L. C. Truesdell, Zenith Sales Corp. president, said that in line with "stepped up deliveries of previously announced 25-in. models, we have begun shipments of this new receiver, introduced to broaden our line of color sets in the 25-in. category." The set uses a 25-in. rectangular CRT with a rare-earth phosphor.



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**WINEGARD
HOT-SHOT**
Super Compact All-Band
(UHF, VHF, FM)
Color Antenna...

*Eliminates Ghosts
Better than any
other Metropolitan
Type Antenna*

Here's the antenna that replaces Conicals, Twin Vees, In-Lines and all Indoor antennas. It's Hot-Shot, the new antenna from Winegard that outperforms the others... yet lists for only \$8.80!

Designed specifically for all-band (UHF, VHF, FM) reception in metropolitan areas, Hot-Shot has a very high front to back and front to side ratio to eliminate ghosts more effectively than other antennas. Works on all bands to deliver life-like color, sharper black and white and distortion-free FM stereo. Easily installed, too, on roofs or in attics—you work with just one download. It even has Winegard's new Gold Vinylized finish to triple antenna life.

So don't give your customers the limited performance of an indoor or old fashioned outdoor antenna when for no more money than indoor types (\$8.80), you can give them the outstanding results of the all new Winegard Hot-Shot.

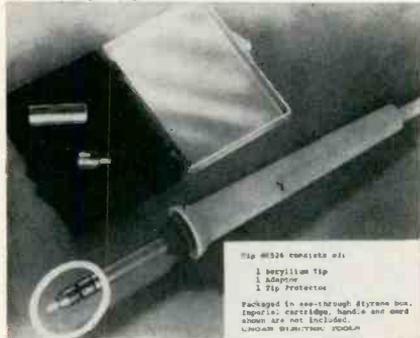
Ask your distributor or write today for Hot-Shot Fact-Finder #241. It's the hottest new all-band antenna for metropolitan and suburban reception areas.

Winegard Co.
ANTENNA SYSTEMS
3019-I Kirkwood • Burlington, Iowa

NEW PRODUCTS

Soldering Tip

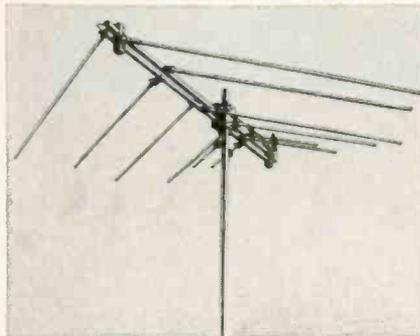
A tip made of beryllium oxide which eliminates solder contamination is announced. The beryllium oxide tip repels solder, making a "tin-



ning bridge" unnecessary, the announcement said. Because of its ability to repel solder, the new tip forces the operator to heat the joint, not the solder. Write: Ungar Electric Tools, 2701 W. El Segundo Blvd., Hawthorne, Calif. 90252.

Log Periodic Type Antenna

A series of log periodic Type TV/FM antennas is announced. The manufacturer reports that increased high band directivity and gain is ob-



tained by having capacitors at proper locations along the dipoles. The antenna uses a twin-boom feeder and an open-wire transformer brings the impedance up to 300 Ω . Write: JFD Electronics Corp., 15th Ave. at 62nd St., Brooklyn 19, N. Y.

Flood Light

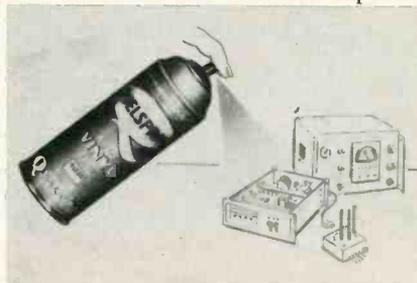
A high-intensity work-area light source, designed for industrial work-task illumination is announced. Arm and lamp housing extend 12½ in. beyond the base which measures 2¾ x 4¼ x 2¾ in. Sponge rubber pad on base bottom insulates lamp from work bench vibrations. Bulb operates at low voltage through step-



down transformer. Cord provided for connection to any 115 vac outlet. Three-prong grounded plug optional. Power input is 25 w. Bulb life approximately 200 hr. Directly accessible ON/OFF side switch on base. Write: EdnaLite Research Corp., 210 N. Water St., Peekskill, N. Y.

Vinyl Spray

A tool-kit aerosol spray device is introduced. The vinyl coating will prevent corrosion under severe exposure



conditions, the manufacturer claims. The spray is useful in quick touch up and product repair. Write: Quelcor Inc., Box 33, Media, Pa.

Soldering Gun

A soldering gun which delivers the proper heat from light to medium/-heavy duty jobs up to 200 w is introduced. Two single post tips are avail-

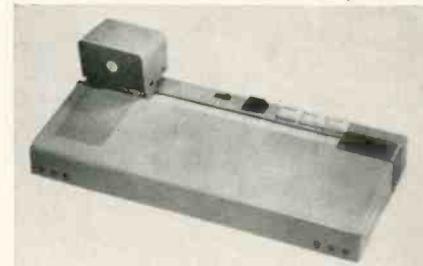


able, plus a kit with tip accessories. The standard tip is designed for splicing heavy electrical wires, appli-

ances and toy repair. With the fine line tip, the soldering gun is suitable for printed circuit board work, television and radio hookup and stranded wire splicing. Write: Wen Products, 5810 Northwest Highway, Chicago, Ill.

Interwriter

A communications system, specifically designed to permit the instantaneous transmission of written as well as oral communications, is in-



troduced. The unit can send and receive written messages on paper. An ordinary pencil is used to send messages which may be stored for future reference. The Intercom portion is a conventional push to talk tape. Transmission is performed over a standard two wire circuit, with conventional power of 117 v 60 cps, 100 w. The height of the writing surface is 2½ in. Write: Concord Electronics Corp., Los Angeles, Calif.

Over-Floor Wiring

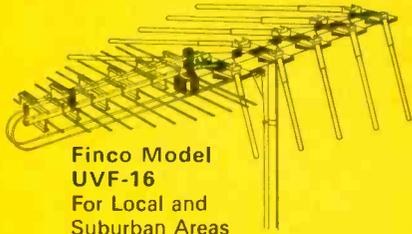
A line of two and three wire units of over-floor wiring is announced. One end of the unit is plugged into a wall outlet and the other end has



a duplex outlet rated at 15 amp and 125 v. Various standard lengths, which are UL approved, as well as custom (special layouts with multiple outlets) are available. Write: Ideas, Inc., 118R Grand Ave., Laramie, Wyo. 82070.



Finco Model
UVF-10
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Areas
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UVF-24
For Near Fringe
and Deep
Fringe Areas
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- Lock-tite no-tilt saddle bracket
- Finco's exclusive double contact to drive line
- Continuous one-piece drive line and exclusive air insulated polystyrene cross-over spacer

Finco's new All-Band Color Ve-Log Antenna does the work of three — gives startlingly clear black and white pictures and beautiful color on *both* UHF and VHF television channels. Its superlative design also assures the finest in stereophonic and monophonic FM sound reproduction. Comparison tests have proved the superiority of the All-Band UVF Series — superiority backed by Finco's guarantee of supremacy and unquestioned warranty.

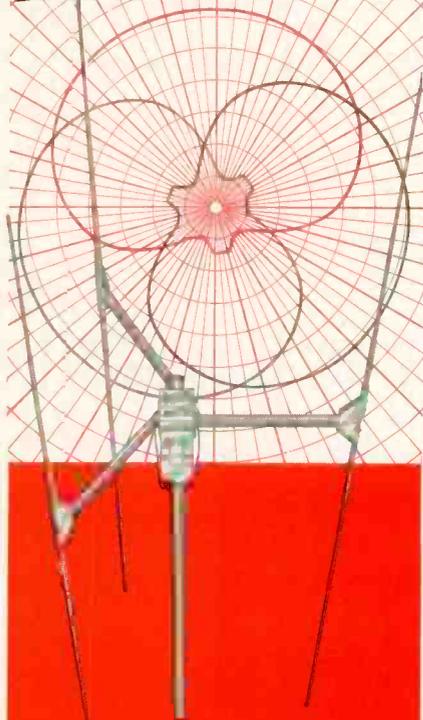
Prices and specifications subject to change without notice.

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NEW PRODUCTS

Tape Splicer

A line of tape splicing and editing products is announced. The device is a tape splicing block that can be fastened to tape machine. It enables the



user to splice standard 1/4 in. tape. The KP2 editing kit contains a block for splicing and editing tape, three sheets of 10 ea of ab tape splices, a marking pencil and a demagnetized razor blade together with complete instructions. Write: ELPA Marketing Industries, Inc., New Hyde Park, N. Y.

Blower

A blower with a motor that is integral with the impeller is announced. The unit measures 10-13/16 x 12 1/2 x 7 1/4 in., weight is 14 lb. Rated capacity



of the blower is 550 cfm at free delivery, and 200 cfm at 3/4 in. wg. Operating temperature range is -20°C to 85°C. Write: Rotron Mfg. Co., Woodstock, N. Y.

Sweep Circuit Analyzer

A sweep circuit analyzer is announced. The SS137 contains hori-



zontal and vertical substitute oscillators with a variable output from 0 to 280 v P-P. The horizontal oscillator can be synched to the TV set under test with the sync signal from the TV set under test. In-circuit checks of the flyback and yoke can be made with the TV set on, the announcement said. It has a built-in VTVM/VOM that provides the following ranges: 0 to 30 Kv, 0 to 10 Kv, 0 to 300 and 1000 vdc, 0 to 300 and 1000 v P-P, 0 to 300 ma dc, 0 to 3 vdc and 0 to 3 ma dc. Write: Sencore, Inc., 426 South Westgate Dr., Addison, Ill. 60101.

Tape Deck

A tape deck for Hi Fi systems is announced. The unit has a four-track stereo plus monophonic playback, three tape speeds — 1 7/8, 3 3/4 and 7 1/2



ips, digital index counter, fast forward and rewind controls, and jack connections ready to plug into stereo equipment. The deck accepts three, five and seven in. reels. Dimensions are: 12 1/4 x 8 3/8 x 5 5/8 in. Write: Califone/Roberts Electronics, 5922 Bowcroft St., Los Angeles, Calif. 90016.

Amplifier Speaker

A broadcast monitor amplifier/speaker intended for broadcast offices is announced. The unit contains its own solid state amplifier, power supply and volume control. The amplifier/speaker can stand either vertically or horizontally. Write: Lang Electronics Inc., 507 Fifth Ave., New York, N. Y. 10017.

Wireless Intercom

A two channel wireless solid state intercom system for home or office use is announced. Two channels (160 & 200 Kc) are available. When two pairs are used, simultaneous, but independent communications are possible. Has a press-to-talk bar with lock to free hands for baby-sitting purposes.



Other controls include ON-OFF/VOLUME and channel selector switch. Power supply is transformer operated. Has pilot light indicator, ivory and silver trim high impact plastic case. Dimensions: 5 x 6¼ x 3 in. Circuit components include five transistors, three diodes, selenium rectifier and one themistor. Write: Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, L.I., N. Y.

Jack Boxes

A line of three jack boxes for group listening is announced. Three models are available: the J10 with 8 headphone outputs plus jacks for voice or music source and connection to additional units; the JV6 (shown) has 6 headphone outputs plus 6 volume controls. Also offered is the JV1, a single



output station with volume control, source and interconnection jacks. Write: Plastic Mold & Engineering Co., Inc., P.O. Box 4265, 265 Wampanoag Trail, East Providence, R. I. 02914.

CB Transceiver

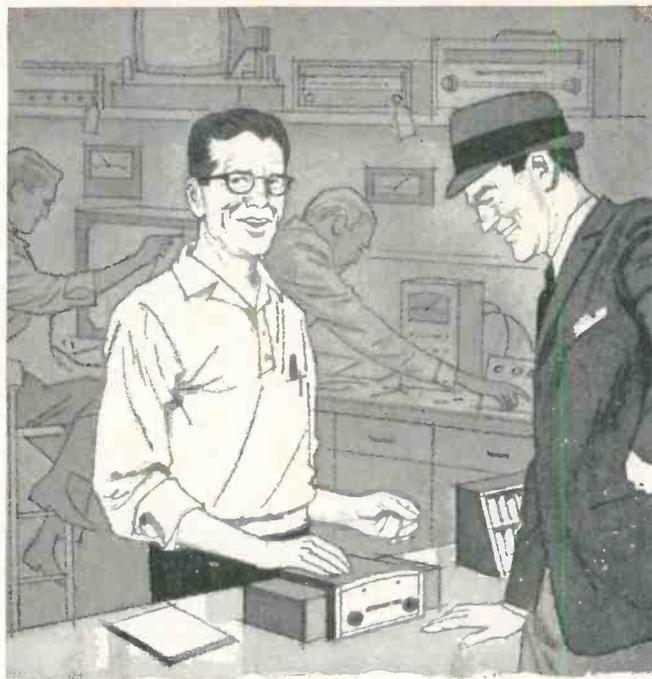
A twenty-three channel mobile unit is announced. The main unit contains all control functions. Separate units are: power supply, modulator, and speaker. The receiver has a built-in crystal filter. The transmitter provides a minimum of 3½ w output, with 100% modulation through keyed audio compression, the manufacturer says. The XL100 has 13 tubes and 9 diodes. It has provision for locking the unit to the mounting bracket, and a key locking power-on switch. Write Tram Electronics, Inc., Lower Bay Rd., Box 187, Winnisquam, N. H.



manufacturer says. The XL100 has 13 tubes and 9 diodes. It has provision for locking the unit to the mounting bracket, and a key locking power-on switch. Write Tram Electronics, Inc., Lower Bay Rd., Box 187, Winnisquam, N. H.

Base Station CB Antennas

Two rotatable base station antennas for citizens band are announced. Both models employ horizontally stacked twin-driven beams, each with its own director. One model, the 114DB, uses two-element beams and multiplies the effective radiated power of an efficient 5 w CB transceiver to 42 w, the announcement said. The other model, the 116DB, uses 3-element beams which raise the effective radiated power of an efficient 5 w transceiver to 93 w, it was said. Write Hy-Gain Electronics Corp., 8700 N. E. Hwy. 6, Lincoln, Neb. 68501.



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NEW PRODUCTS

Intercommunications Network

A plant intercommunications system that provides hands-free operation for both calling and responding parties is announced. The system allows as many as 9000 master units to be in communication with each other, by touch-digit button calling, the announcement said. The system provides for public address, secretarial intercept, paging, and privacy

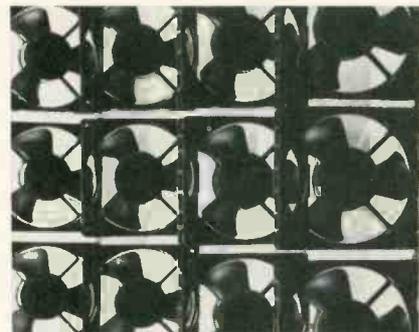


facilities. Stations, all identical in operation, are designed for desk-top, wall-mounting and heavy-duty industrial applications. All stations can be

moved from location to location, as they are connected into the system by a single cable terminating in a standard wall plug. Write: Centrum Electronics, Inc., 820 2nd Ave., New York, N. Y. 10017.

Fan

A muffin type fan is introduced. Static air delivery is 100 cfm, according to the company's announcement. The unit has a totally enclosed stator,



lubricated for life sleeve bearings and a built-in heat sink. Dimensions are 1½ x 4½ x 4½ in. Write: Rotron Mfg. Co., Woodstock, N. Y.

Outdoor Columnar Speaker

An outdoor columnar speaker is introduced. The SD-1082 is an all-weather speaker for installations



where cold, heat, humidity, salt spray, rain, sand and dust are factors which could affect performance. Write: Argos Products Co., Genoa, Ill.

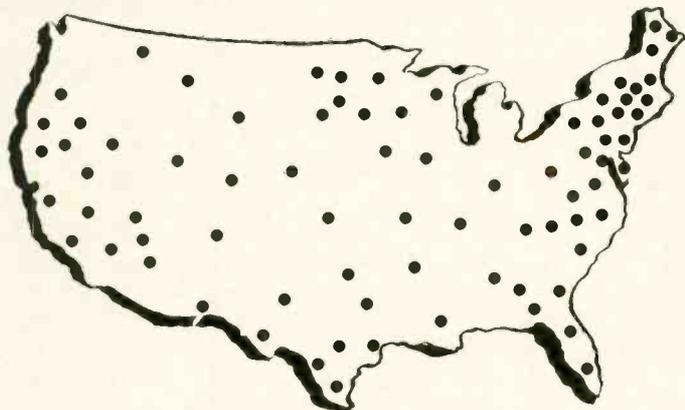
Turntable

A turntable which plays single records manually or automatically and stacks up to ten records in automatic sequence is announced. The turntable



is 12 in. in dia., weighing about six lb. Wow and flutter are less than 0.1%; and rumble, better than 50 db below average signal level, the announcement said. Write: Benjamin Electronic Sound Corp., Westbury, N. Y.

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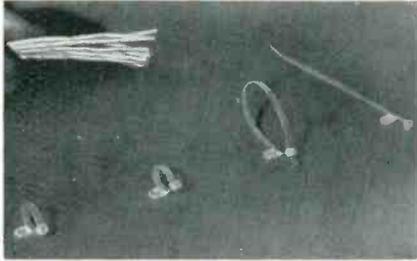
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Harness Tie-Clamp

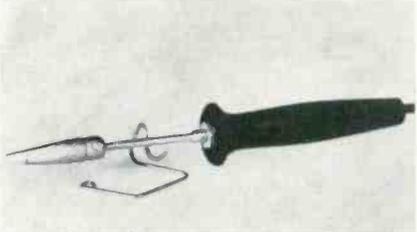
A plastic harness tying strap with an offset hole is announced. The straps, TY-F15 (twist type) and TY-F35M (self-locking type), will ac-



commodate a wire bundle range from 1/8 to 3/8 in. They are both fabricated of molded nylon. The straps are 0.184 in. wide. Write: The Thomas & Betts Company, 36 Butler St., Elizabeth 1, N. J.

Soldering Iron

A soldering iron is announced which was designed for production soldering applications where irons of up to 200 w capacity normally are



required. Rated 12 v, 100 w, the seven oz iron has a 1/2 in. chisel tip. Write: General Electric, 5504 S. Brainard Ave., La Grange, Ill. 60525.

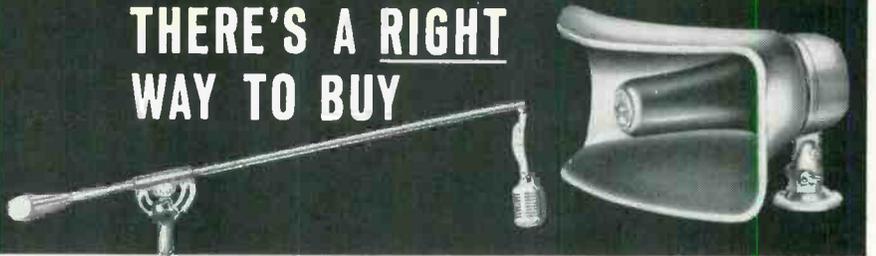
Bookshelf Speaker System

A four-speaker bookshelf system is announced. The speaker components include a 12 in. woofer with a 3 1/2 lb ceramic magnet, a horn-loaded mid-



range unit, a super-tweeter and a spherical radiator ultra-tweeter. Cross-over frequencies are 600, 4000 and 10,000 cps. Two balance controls adjust output in the midrange and super-tweeter/ultra-tweeter range for accurate tonal balance, the announcement said. Power rating is 40 w; input impedance 8Ω. Write: Jensen Mfg. Co., 6601 S. Laramie Ave., Chicago, Ill. 60638.

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Permaline is the only television transmission cable durable enough to be guaranteed, in writing, for 15 or 25 years! Because of its extremely high quality, Columbia Wire has never had to replace as much as one foot of Permaline.

This is why it is preferred by technicians who recognize the economies of using quality products having an initial cost slightly higher than others. With quality products, such as Permaline, costly call-backs are eliminated while customer satisfaction and repeat business increases. Ideal for color television.

On your next antenna installation, do yourself and your customer a favor—use Columbia Wire's Permaline television transmission line.



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University reduces everything but the sound!



REVOLUTIONARY NEW UNIVERSITY SHORT HORN & ID-75 DRIVER —75-WATT SYSTEM, ONLY 10" DEEP!

It's happened to you. Half-way through a new installation, you're in trouble. Client wants plenty of power, but space is tight. Here's the solution—the ultra-compact, super-efficient, Model SH Short Horn. Use it with the new ID-75 driver—or with any University driver. It will provide maximum power conversion and clear, intelligible, High 'A' (high audibility) sound, comparable only to costlier and larger systems! And, with the ID-75 driver you'll overcome the toughest ambient noise problem! So efficient, it makes any amplifier more powerful.

So rugged, you can use it anywhere—in P.A. installations and special applications such as fire and police vehicles or ship-board use as a fog horn. Whatever the need, look to University to fill it. And remember, University's exclusive five-year warranty is your guarantee of unexcelled performance and reliability!



Desk ET-A, 9500 W. Reno, Okla. City, Okla.

NEW PRODUCTS

Screwdriver Set

A screwdriver set consisting of a regular size 4 1/8 in. screwdriver handle, nine interchangeable 4-in. Bristol multiple spline blades with major di-



ameters from 0.048 in. to 0.183 in. and a 4 in. extension shaft is introduced. All items are contained in a pocket-size, see-through, plastic carrying case which also doubles as a bench stand. Write: Xcelite Inc., Orchard Park, N. Y. 14127.

Portable Record Tree

A portable record tree is announced. It is free-standing, 52 in. high and rests on a heavy, round,



enameled base. It is equipped with four record holders in which records are stored vertically. Write: Snyder Mfg. Co., Philadelphia, Pa. 19140.

Fluorescent Lamp

A miniature-sized fluorescent lamp is announced. The lamp can be fas-



tened to walls, tables, desks or head-boards. Special clamps, brackets and convenience outlets are available as optional accessories. Write: Swing-O-Lite, Inc., 13 East Moonachie Rd., Hackensack, N. J.

Business/Industrial Radio

An all-transistor business/industrial two-way radio transceiver is introduced. The Messenger "303" is adaptable for base station, mobile or portable field pack use — and with accessory weatherproof speaker may also be used as a public address system. Unit is designed for business/indus-



trial frequencies between 25 and 50 Mc AM, and is FCC type accepted. Write: E. F. Johnson Co., Waseca, Minn.

Paging Speaker

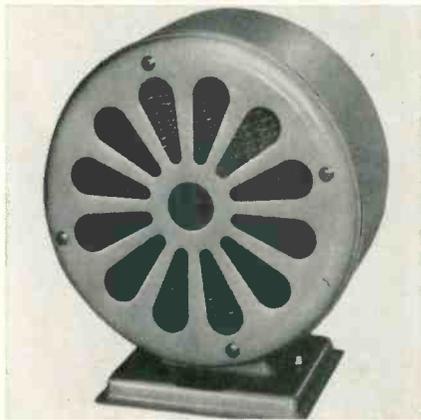
A paging and talkback speaker is introduced. Model HU15NT includes a weatherproof line transformer with



impedance taps, and 70.7 and 25 v power taps. HU15NT specifications are: Power, 25 w. Impedances, 45, 90, 180, 325, 670, 1000, 2000, 4000, 8000 Ω . 70.7 v line power taps, 15, 7.5, 2.5, 1.25, .65 w. 25 v line power taps, 14, 7, 3.5, 1.9, .92, .3 w. Frequency response 250-13,000 cps. Audio level, 123 db measured four ft on axis at rated power. Dispersion, 100 deg. Dimensions, 9 $\frac{3}{4}$ x 9 in. Write: Atlas Sound, 1419-51 39th St., Brooklyn, N. Y. 11218.

Directional Speaker

A speaker and baffle combination for audio distribution in corridors and outdoors is introduced. The TW11 is equipped with a 5 x 6 in. mounting



bracket and concealed universal mounting plate for flat surfaces and electrical outlet boxes. Specifications are: Power, 8 w. Impedance, 8 Ω . Magnet, 3.16 oz. Alnico V. Dimensions, 9 x 5 in. Write: Atlas Sound, 1419-51 39th St., Brooklyn, N. Y. 11218.

ATTENTION ALL T. V. TUNERS

Beware of T. V. Tuner Service as they will replace all of your defective parts, align you to exacting original specifications and warranty you for 90 days.

All This For Only **\$8.95** plus major parts

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... INTERCOM

Continued from page 41

pressed to call the master and the button may be held down throughout the conversation. But only one master will hear the call, the one the call line is assigned to. One button and one switch is used on this remote — the button to initiate a call, the switch to answer one. In this setup the remotes will not be able to talk to each other.

More versatility can be built into a system by using the circuit shown in Fig. 6. In this case it is assumed that all the needed pairs can be run to each station. Switches to each master are provided on the remotes. The remotes will then be able to call any master by throwing the switch for that master (Fig. 7).

Two wire pairs are assigned to each master — an input and an output pair. Any master, of course, can talk to any other master and any remote. The master throws the switch to the remote he wants and tells the remote who is calling. The remote throws that switch for the master which called, holds the talk switch down and answers. Again the master will do all the switching. Any remote can call any master by simply throwing the switch to the wanted master, holding the talk switch down and talking. These remotes may also talk to any other remote. The master who switches will hear the conversation.

An all master system is shown in Fig. 8. This system affords the privacy and ease that remotes do not enjoy. The disadvantages of an all master system are additional pairs that must be run, plus an ac outlet. The remotes do not need outlets.

No amplifier schematic is included here because any audio amplifier will do. When using an audio amplifier, however, both the output and the input impedance must be the same. Usually intercoms use a 70 or 25 v line. But if the leads are short, transformers at the remotes or slaves may be dispensed with. The speaker is then connected directly into the line and the line into a 4- Ω -grid transformer.

An intercom system is only as complicated as the number of switches used and the functions they're required to do. Any amount of switches may be used that can be physically mounted in the cabinet chosen. ■

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**REVOLUTIONARY
NEW UNIVERSITY
DUAL HORN &
ID-75 DRIVER
—150-WATT SYSTEM,
ONLY 17" DEEP!**

The new Model DH is another unique technical advance from University. The most efficient ultra-compact dual short-horn made—engineered to "punch" through the noisiest environments—provides absolute and uniform intelligibility over a wide area—and it's only 13 $\frac{3}{8}$ " deep!

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the service business**



NEW IMPROVED SENCORE CR133 CRT CHECKER & REJUVENATOR

The new, improved CR133 CRT Checker is designed to test all present picture tubes — and it's ready for future tubes too! Two plug-in replaceable cables contain all sockets required. The compact, 10 lb., CR133 checks CRT emission, inter-element shorts, control grid cut-off capabilities, gas and expected life. Checks all tubes: conventional B&W, new low drive B&W, round color tubes and new rectangular color picture tubes. Exclusive variable G2 Volts from 25 to 325 Volts insures non-obsolescence when testing newly announced "semi-low" G2 CRT tubes. New Line Voltage Adjustment insures the most accurate tests possible. Uses well-filtered DC for all checks to avoid tube damage and reading errors. Color guns are individually tested as recommended by manufacturers. Exclusive automatically controlled rejuvenator applies rejuvenation (ACR) voltage as required by individual tube condition; precisely timed to prevent over-rejuvenation or tube damage. The ACR feature is most useful for color tube current equalization to insure proper tracking. Hand-wired and steel-encased for protection of meter and panel in truck or shop, the new improved CR133 is only . . .

\$89⁹⁵

The famous CR128 CRT Checker and Rejuvenator is similar to above, but with a three position G2 slide switch and without Line Voltage Adjustment at \$69.95

professional quality — that's the difference!

SENCORE

426 SOUTH WESTGATE DRIVE • ADDISON, ILLINOIS

. . . MICROPHONES

Continued from page 53

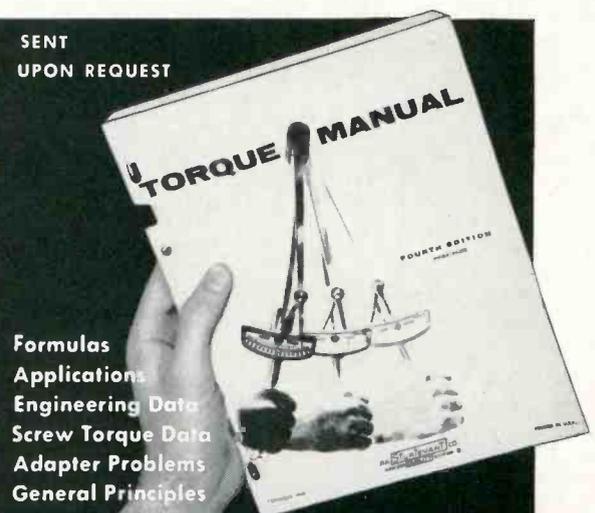
Cables and plugs are the most common trouble source because they are subject to flexing and handling. Cables subjected to repeated and unusual bending can become noisy and intermittent.

Common microphone connections are shown in Fig. 3. Recommended methods for installing two microphone connector types are shown in Fig. 4. Microphone cables can be checked by actual talk-testing (using earphones so that sufficient gain without feedback is possible) while the cable is being flexed. This method is often more revealing than ohmmeter continuity checks.

If the microphone appears to be dead, a continuity check of the signal terminals may identify the problem. For dynamic and controlled reluctance microphones, check the signal terminals for continuity. Ribbon microphones should *not* be checked with an ohmmeter, since the current surge may stretch the ribbon. Dynamic microphones will measure a dc resistance which is 0 to 30 percent lower than the nominal impedance — usually measured at 1 kc. When dc voltage is applied, an operating dynamic, controlled reluctance, or ceramic microphone will emit a click. In some cases a dynamic microphone cartridge may be operative, but the transformer may have become defective. In this event, if normal continuity is measured on the signal terminals but no click is heard, the transformer is suspect. If there is no

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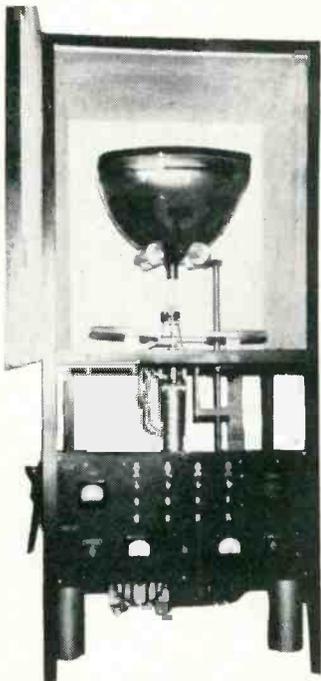
continuity, the transformer secondary circuit is open.

When a microphone seems to be deficient in frequency response, the best way to confirm any difficulties is by an A-B listening test, (Figure 5). A listener, able to switch back and forth between the suspect microphone and a new one of the same type, may compare the microphones, listening for any possible deterioration of frequency response, or existence of distorted sound. Adjustable gain controls for each microphone and a wide range speaker system, along with means for switching rapidly between microphones, are recommended. The microphones may be placed an equal distance from a talker, who should be unaware of the time of switching. ■



Our cover picture this month shows two technicians from Thomson Sound Systems in Norman, Okla., installing a leased-operation public address system. This system installation is not an outright sale—it is part of a highly profitable public address leasing operation. The photo was furnished by LTV University.

TECHNICIANS . . . Open the Door to Greater TV Profits



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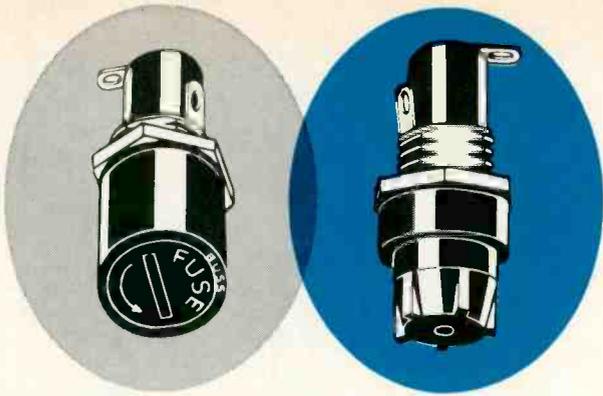
COMPARE THESE FEATURES: SEE WHY THE CG135 IS IN A CLASS BY ITSELF

- Solid state construction employs high priced GE "Unijunctions" to develop six "jump out proof counters" that guarantee stable patterns at all times with no warm-up
- Standard RCA licensed patterns as shown on schematics throughout the industry
- Handy universal color gun interruptors on front panel
- Lead piercing clips insure non-obsolence
- CRT adaptors optional
- Crystal-Controlled 4.5mc Sound Carrier Analyzing Signal to insure correct setting of fine tuning control
- RF output on Channel 4 adjustable to Channel 3 or 5 from front of generator when Channel 4 is being used
- No batteries to run down; uses 115 V AC
- Less than one foot square, weighs only 8 lbs.

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Screw type slotted knob that is recessed in holder body and requires use of screwdriver to remove or insert it.

Screw type knob designed for easy gripping, even with gloves. Has a "break-away" test prod hole in knob.

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Fuseholder only 1 3/4 inches long, extends just 2 3/32 inch behind front of panel. Takes 1/4 x 1 1/4 inch fuses. Holder rated at 15 ampere for any voltage up to 250.

Military type available to meet all requirements of MIL-F-19207A.

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NEWS OF THE INDUSTRY

Bob Dunn Appointed Sales Manager

Carl Korn, president of B&K Manufacturing Co., and the Dynascan Corp., Chicago, announces that Bob Dunn, formerly a field sales manager, has been appointed to the position of sales manager, test equipment products.

District Sales Manager Appointed

Kenneth G. Crocker has been appointed district sales manager responsible for Bendix Semiconductor division sales in New York City, Westchester County (N.Y.), and Long Island, it is announced by James E. Harrison, marketing manager. Crocker will report to Richard Shaughnessy, Eastern regional sales manager with headquarters at Holmdel. Crocker replaces William Webster, who will now be responsible for sales in northern New Jersey and southern New York. Previously Crocker was district sales engineer with ITT's Semiconductor division.

NAB Requests More Time

The National Association of Broadcasters has asked the FCC to grant a further extension of time for filing comments on proposals by Zenith Radio Corp. and Teco, Inc., to establish a nationwide pay-television service. NAB, which traditionally has opposed pay-TV, asked in

a petition that the filing deadline be pushed back to July 14 to give the NAB board of directors an opportunity to study the proposals at its semi-annual meeting on June 22-26. The NAB petition said the board study and evaluation of the highly-complex proposals should be "beneficial to the Commission in the determination of the important questions involved."

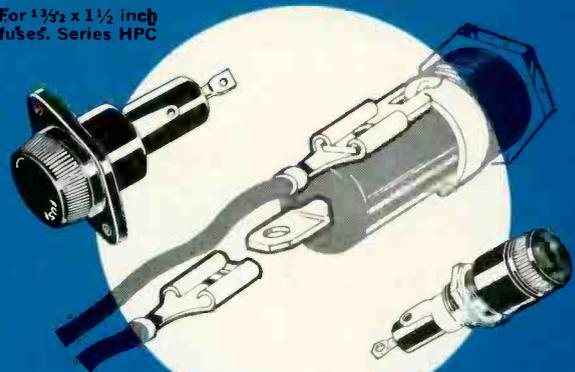
Electro-Voice Earnings Up

Electro-Voice, Inc. in its Annual Report to Shareholders, reports improved net earnings of \$508,255 for the fiscal year ended February 28, 1965, as compared to \$227,451 the previous year. Per share earnings climbed to \$1.02 from 46 cents for the same period last year, while sales rose 6 percent to \$12,035,372.

Volkswagen of Mexico

New Volkswagen sedans are expected to begin rolling off the assembly lines at the rate of 2500 a month when Volkswagen de Mexico S.A. completes a new manufacturing plant in Puebla early next year. Representing an investment of about \$80,000,000, the 1,450,000 sq-ft factory, located about 75 mi east of Mexico City, will employ nearly 5000 workers as actual VW manufacture gets underway in Mexico. Until then, the company will continue to build vehicles with parts made partially in Mexico and in Germany and shipped to its assembly plant in Xalostoc a few miles outside Mexico City. First vehicles made in the new Puebla plant will have a Mexican-made content of about 70 percent with plans to increase that percentage in the future.

For 1 3/2 x 1 1/2 inch fuses. Series HPC



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manager of United Radio, says that his company has branch offices in Medford and Eugene.

Battery Plant in Japan

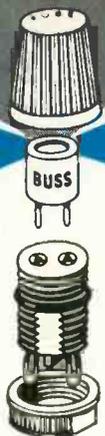
The formation of a new company to manufacture batteries in Japan is announced by Leon Robbin, president of P. R. Mallory International Inc. The new company, known as National Mallory Denchi Kabushiki Kaisha, is a joint venture of Matsushita Electric Industrial Co. and P. R. Mallory & Co. It will manufacture a complete line of mercuric oxide, manganese oxide and silver oxide batteries.

TI Granted Patent

A patent covering the process used to make silicon planar transistors was recently issued to Texas Instruments Inc. by the US Patent Office. The patent, Number 3,184,823, describes the widely-used steps of diffusing impurities using silicon oxide masking and photolithographic techniques for defining diffusion masks and metal contacts. Transistors made by the patented process have base-collector and base-emitter junctions extending to the upper surface of the silicon wafer to avoid contamination of the junctions. These features also are used by the semiconductor industry in making monolithic integrated circuits. The US Patent Office issued four basic integrated circuit patents to TI in June, 1964. The inventors of the newly patented planar method are Stacy B. Watelski of Dallas and William A. Little of Richardson, Tex. Both are on the technical staff of TI's Semiconductor-Components division.

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**SUB-MINIATURE
FUSEHOLDER COMBINATION**

For space-tight applications. Fuse has window for inspection of element. Fuse may be used with or without holder.

Fuse held tight in holder by beryllium copper contacts assuring low resistance.

Holder can be used with or without knob. Knob makes holder water-proof from front of panel.

Military type fuse FM01 meets all requirements of MIL-F-23419. Military type holder FHN42W meets all military requirements of MIL-F-19207A.

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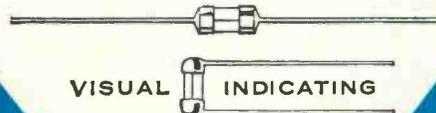
Phonevision Decoder Production

Following FCC approval of a three-year extension of the Hartford, Conn., subscription TV test, Zenith Radio Corp. disclosed that it is tooled up and is preparing to produce the Phonevision decoders required to meet the expansion plans announced for the operation by RKO General. Joseph S. Wright, Zenith president, said that his company will be producing in quantity additional home set decoders to be installed on new subscribers' sets to unscramble the over-the-air subscription TV programs and provide convenient billing records. Shipments of the units, which incorporate further technical improvements, are slated for early August. "As the pioneer of broadcast subscription TV, we are pleased that the FCC has renewed the license of the successful Hartford test which uses Zenith's system and equipment and that the test will soon be expanded," he said. "We will continue to offer technical and other cooperation to RKO General in its plans to broaden the scope of its box office TV service to an increased number of families." Wright stated that his company is hopeful that its petition for nation-wide authorization of subscription TV, based on the results of 2½ years of Hartford operations and filed in March with the FCC, will lead to early approval of regular supplemental subscription broadcast service in other communities.

Fidelitone Distribution

H. A. Prince, sales manager of Fidelitone, Inc., a Chicago-based manufacturer of phonograph needles and small precision components for the electronics industry, announces the appointment of United Radio Supply of Portland, Ore., as its distributor. Charles Douglas, general

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ERRATUM

The caption of Fig. 9, page 60, June 1965 ET should have read as follows: A small dimple, made with a center punch, on the outer shaft will provide the necessary drag for friction-clutch controls.

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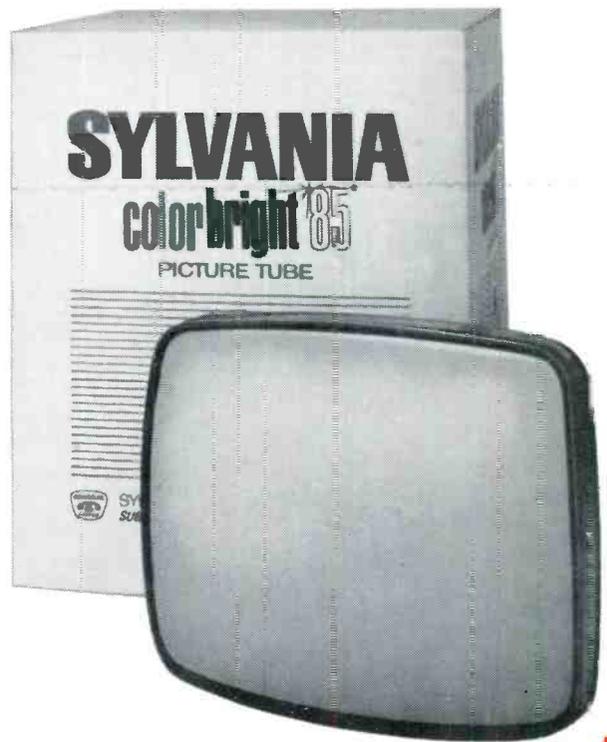


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Picture Tube A	6.9	9.8	8.9	7.4
Picture Tube B	9.5	13.7	13.4	7.1
Picture Tube C	7.5	9.9	9.7	7.8

Test made under supervision of John J. Henderson and Associates, N. Y. Note: Not all people answered all questions—votes tabulated for 100% of answers to each.

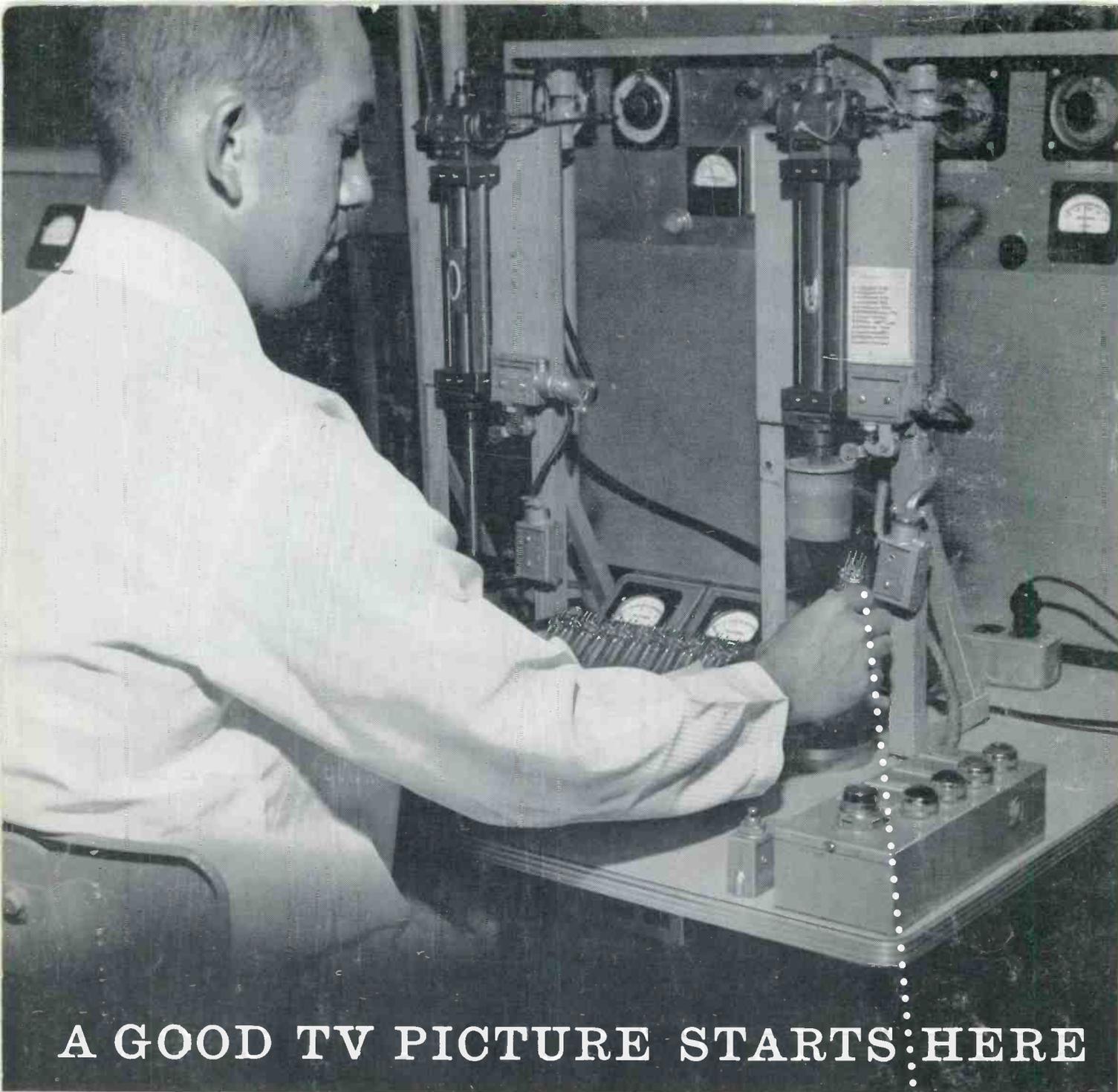
In six major cities from coast to coast, 9,789 consumers compared the new *color bright 85*TM picture tube to ordinary non-rare-earth color tubes in three leading brands of TV sets. Sylvania's new tube, the first with rare-earth phosphors, was the overwhelming choice.

Here's why.

The vivid colors, derived from europium rare-earth compounds, are unexcelled for true color fidelity. In monochrome, the picture is noticeably brighter; there's better contrast too. And today this extraordinary tube is still the performance leader. Sylvania's new air-spun screening process gives *color bright 85* picture tubes the competitive difference in the sharpest images ever displayed.

The *color bright 85* tube is available to you now for today's growing color TV market. It is a product of Sylvania Electronic Tube Division, Electronic Components Group, Seneca Falls, N. Y.

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A GOOD TV PICTURE STARTS HERE

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The slightest leakage of air weakens the high vacuum of a TV picture tube... resulting in a costly callback and a dissatisfied customer for you. This is why RCA takes extra precautions to maintain the vacuum in Silverama picture tubes.

Potential trouble spots are the glass-to-metal lead-wire seals in the electron-gun stem assembly (below). At RCA, stem assemblies are batch tested for leakage in a supersensitive leak detector *before* they go into electron guns.

So sensitive is this detector that it can pinpoint a leak that would not affect tube performance for years... a leak so tiny that no other inspection method could hope to find it.

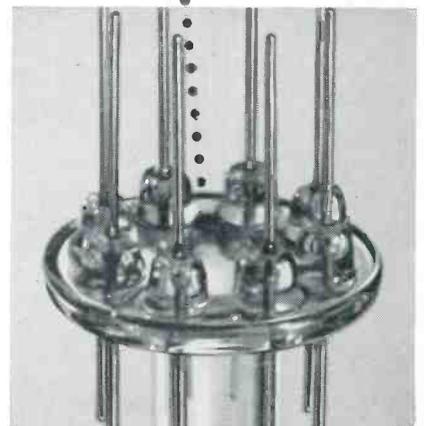
Yet the slightest sign of a leak is cause for rejection of a stem. This extra precaution is one more example of the care that goes into every phase of Silverama manufacture... and one more reason why RCA Silverama should be your first choice in replacement picture tubes.

Silverama is made with an all-new electron gun, finest parts and materials, and a glass envelope that has been thoroughly cleaned and inspected prior to re-use.

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The Most Trusted Name in Electronics



Stem assemblies are tested on a special high-vacuum leak detector. Detector is a helium mass-spectrometer, detecting passage of helium "tracer" gas through any of the glass-to-metal seals. A stem assembly passing this rigorous test is ready to become a vital part of an RCA Silverama® Picture Tube.