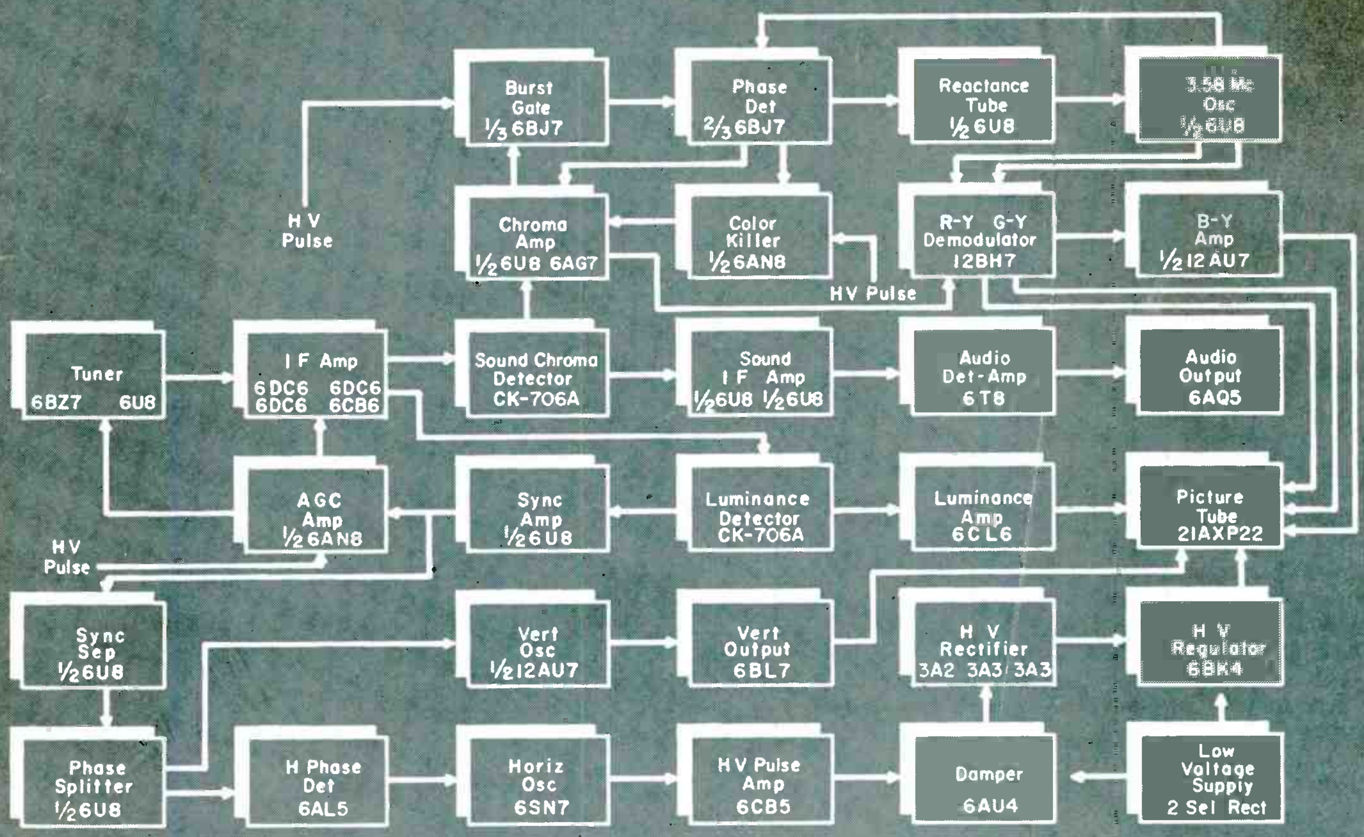
JANUARY, 1956

Bright Vertical Lines

SERVICE

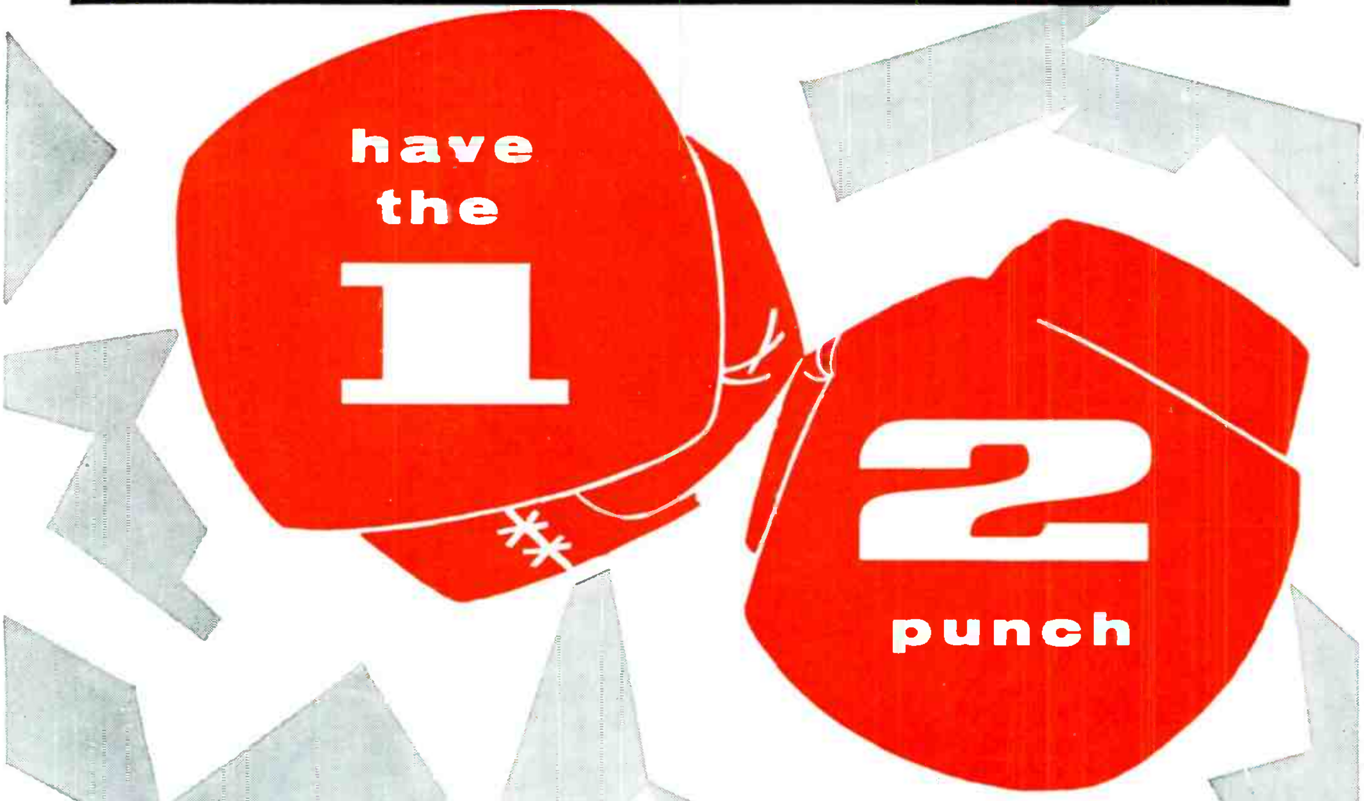
THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE



Block diagram of 21-inch vertical color-TV chassis. See circuit analysis, this issue

only

C·D·R Rotors



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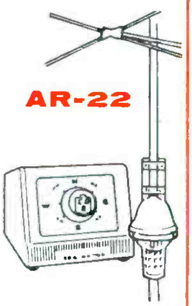
The CDR Rotor line is COMPLETE to every detail, with a model for every application! A distinct selling advantage because YOU can give your customer EXACTLY what is required! The RIGHT CDR Rotor for the RIGHT job.

2. Pre-SOLD For You on TV to millions of viewers

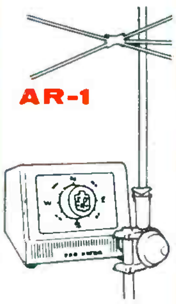
through an extensive coverage of audiences in every important TV market. Capture this pre-sold market by featuring these nationally advertised CDR ROTORS.

AR-22



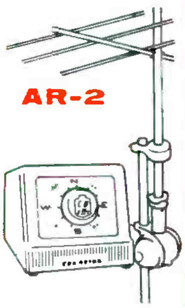
Completely AUTOMATIC version of the TR-2 with all the powerful features that made it famous.

AR-1



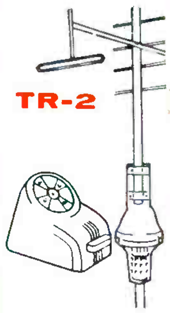
Completely AUTOMATIC rotor, powerful and dependable. Modern design cabinet. 4 wire cable.

AR-2



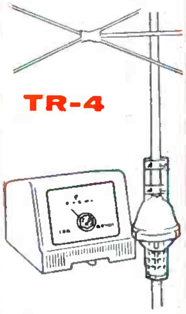
Completely AUTOMATIC rotor with thrust bearing. Handsome cabinet, 4 wire cable.

TR-2



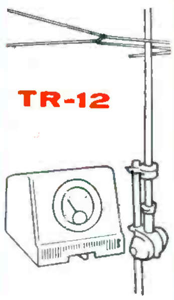
Heavy duty rotor with plastic cabinet, "compass control" illuminated perfect pattern dial, 8 wire cable.

TR-4



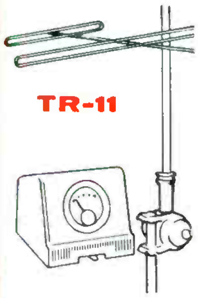
Heavy-duty rotor, modern cabinet with METER control dial, 4 wire cable.

TR-12



Combination value complete rotor with thrust bearing. Modern cabinet with meter control dial, uses 4 wire cable.

TR-11



Ideal budget all-purpose rotor, new modern cabinet featuring meter control dial, 4 wire cable.

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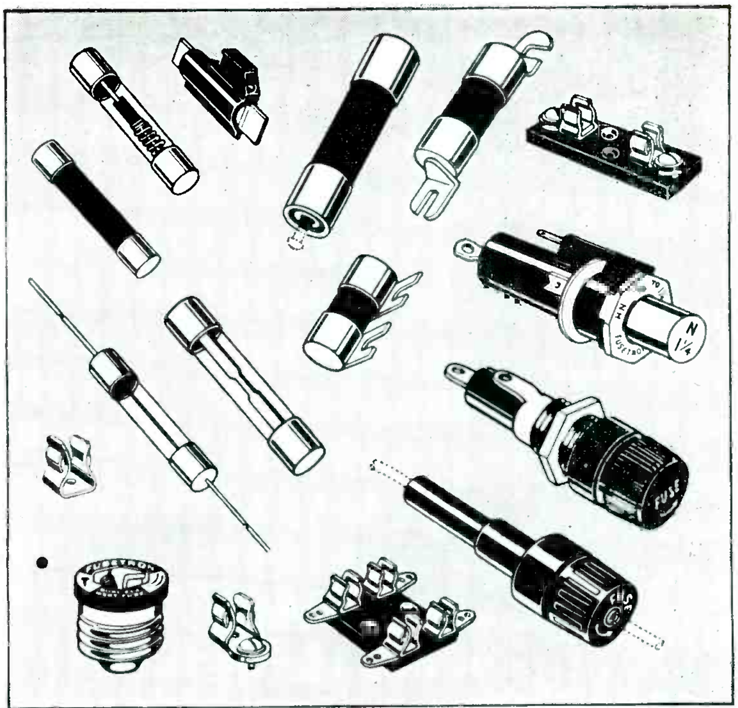

helps you keep customers satisfied !

By operating properly under all service conditions — BUSS fuses can help safeguard the reputation of your product or service against loss of customer good will.

When there is an electrical fault — BUSS fuses open and prevent further damage to equipment, saving users the expense of replacing needlessly burned out parts.

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S-156

BUSS FUSES ARE MADE TO PROTECT — NOT TO BLOW

Vol. 25 No. 1 **SERVICE** JANUARY, 1956

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The "K.O." is Fantastic!

Features the highest front-to-back ratios ever recorded for any TV antenna:

- **Low band:** from 20:1 to 50:1 relative VOLTAGE.
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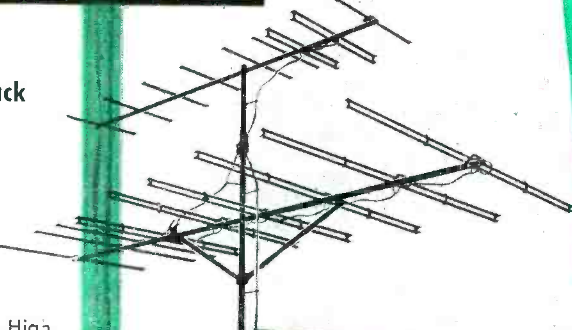
High gain: Low band, 7 to 9 DB. High band, 8.5 to 10.5 DB. (Single bay figures). Balanced for COLOR.

Ends co-channel interference! Knocks out "Venetian Blinds"!

Channel Masters "K.O." puts an INVISIBLE BARRIER in the path of rear signals, preventing co-channel interference. The "K.O." is completely preassembled with time-saving "Snap-Lock" Action. 100% aluminum.

LICENSED BY KAY-TOWNES ANTENNA CO., ROME, GA.



3 Powerful Models

Description	List Price
Low Band "K.O.", Model No. **1026** Covers ch. 2-6	40.97
High Band "K.O.", Model No. **1073** Covers ch. 7-13	16.67
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*In this model, High and Low Band sections are joined with a Tenna-Tie (furnished)

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CHANNEL MASTER now provides you

New expanded ACCESSORIES program! Channel Master now becomes the first and only manufacturer in the industry that can supply you with every-*thing* you need for an antenna

new the Glide-o-Matic INDOOR ANTENNA

with exclusive new 6-position low-loss gliding switch

If you've been looking for something "special" to supercharge your indoor antenna sales, the Glide-O-Matic is it! The Glide-O-Matic's unique gliding switch is a major improvement over ordinary "switch-type" antennas. Most convenient to use . . . highest electrical efficiency . . . new smart styling . . . weighted tip-proof base . . . and READY FOR COLOR!

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4 delightful color harmonies:

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Ivory *with brass*	model no. **3702**
Ebony *with aluminum*	model no. **3703**

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gets fast sales action at the point of sale. Convenient "carry-away" handle.

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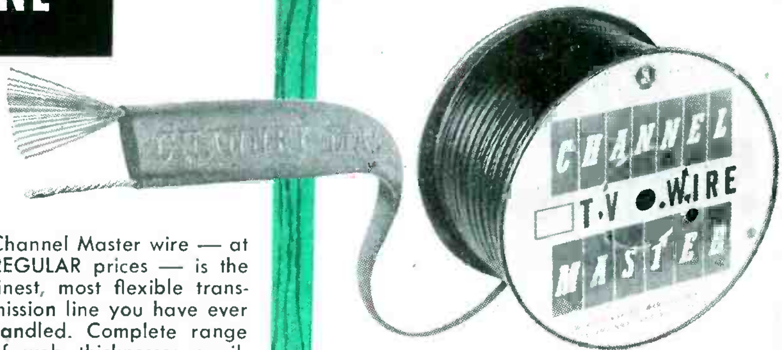
the world's largest manufacturer of television antennas and accessories

CHANNEL MASTER'S

new

TV TRANSMISSION LINE

The first TV wire to give you the benefits of **20** strands per conductor (20/33 pure copper).



it's got FLEX-APPEAL!

Channel Master wire — at REGULAR prices — is the finest, most flexible transmission line you have ever handled. Complete range of web thicknesses available. Colorful display packaging.

Two outstanding lines:
(both featuring exclusive 20-strand conductor):

"TWIN TWENTY"

- Marked every 10 feet. Saves time, ends waste.
- Full width.
- Available in silver or brown.
- Pure VIRGIN polyethylene.

"CHALLENGER"

Fine quality transmission line at today's VERY LOWEST PRICES.

with EVERYTHING but the roof!

installation. From now on, guarantee customer satisfaction with a *COMPLETE CHANNEL MASTER INSTALLATION — FROM TOP TO BOTTOM.*

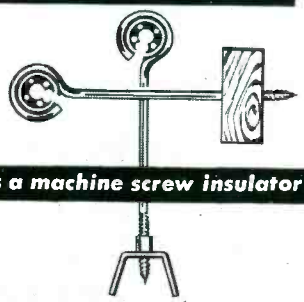
new

STANDOUT *insulators*

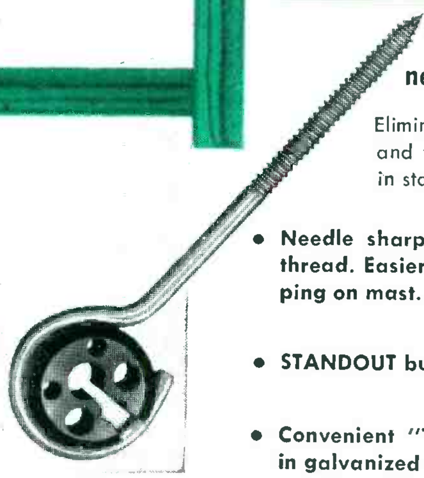
Featuring this revolutionary new 2 in 1 screw thread design!

Eliminates the need for stocking separate machine and wood screws. Cuts your inventory investment in standoffs by more than 65%.

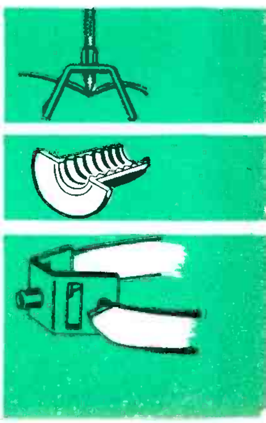
It's a wood screw insulator



It's a machine screw insulator



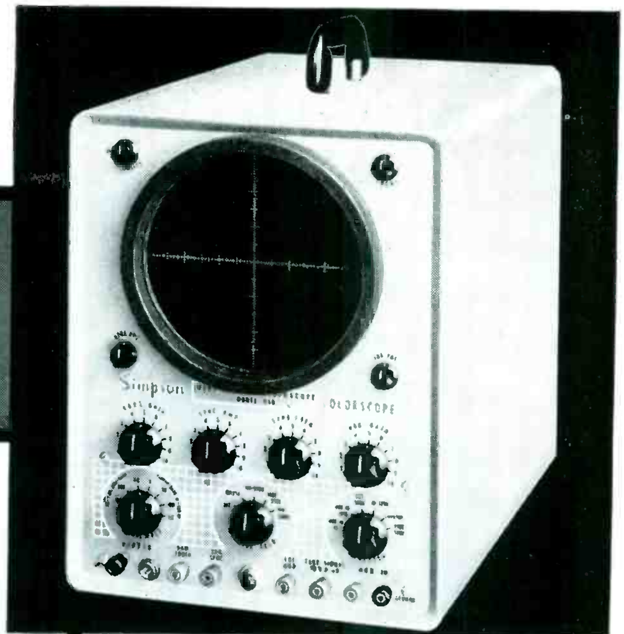
- Needle sharp point, made possible by finer thread. Easier to work in wood. Prevents slipping on mast.
- STANDOUT buckle has 8 machined threads.
- Convenient "Taper-Tip" strapping, available in galvanized or stainless steel.



All popular types and sizes available, including full assortment of specialized hardware. See your Channel Master distributor

new!

Simpson 7" COLORSCOPE



MODEL 458

$229.95 complete with shielded input cable and manual

100% response at 3.58 mc colorburst!

DUAL BANDWIDTH—NARROW OR WIDE

Compare the new Simpson Colorscope Model 458 with any oscilloscope on the market. It is an advanced, seven-inch, high-gain, wide-band scope especially designed for color-TV service. (Ideal for black and white, too.) A big feature of the Model 458 is its *flat* frequency response—within 1 db to 4.5 mc! With its accessory probes, Model 458 can do more color-TV testing jobs than any scope in its price range.

ADDITIONAL FEATURES

- Dual bandwidth provides extra testing versatility.
- Properly compensated wide band vertical amplifier stages.
- High sensitivity and very good transient response.
- Compensated step attenuator.
- Vernier vertical attenuator for *continuous control* of the signal voltage.
- CRT balanced deflection.
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- Very small loading of circuit being checked.
- "Tilt" and "Overshoot" carefully checked and minimized.
- Very stable sweep and synchronizing circuits.

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Voltage Doubler, No. 740 . . $10.95

Low Capacitance (input impedance of 10 megohms shunted by only 14 mmf), No. 741 . . $9.95

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Direct-Resistive Dual Purpose, No. 743 . . . . $9.95

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SPECIFICATIONS

VERTICAL AMPLIFIER FREQUENCY RESPONSE—Wide band position: *Flat* within ± 1 db from 20 c/sec to 4.5 mc/sec; *flat* within ± 2 db from 10 c/sec to 5.0 mc/sec.

Narrow band position: *Flat* within ± 1 db from 20 c/sec to 200 kc/sec; *flat* within ± 2 db from 10 c/sec to 300 kc/sec.

RISE TIME—Less than 0.05 microsecond (wide band position).

VERTICAL DEFLECTION SENSITIVITY—Wide band: 40 mv R.M.S./inch minimum. Narrow band: 15 mv R.M.S./inch minimum.

HORIZONTAL AMPLIFIER FREQUENCY RESPONSE—*Flat* within ± 1 db from 20 cycles/sec to 200 kc/sec.

HORIZONTAL DEFLECTION SENSITIVITY—Horizontal input "Hi", 115 millivolts R.M.S./inch minimum. Horizontal input "Low", 1.4 volts R.M.S./inch minimum.

VERTICAL INPUT IMPEDANCE—3.3 Megohms shunted by 20 mmf.

HORIZONTAL INPUT IMPEDANCE 1.1 Meg.

LINEAR SWEEP OSCILLATOR—Saw tooth wave from 14 cycles/sec to 250 kc/sec. Sixty-cycle sine wave also provided.

INPUT CALIBRATION—18 Volt P-P test voltage available on panel.

INTENSITY MODULATION—Provision for internal, external and 60 cycles.

For ALUMINIZED TUBE PERFORMANCE, *plus* EXCELLENT TUBE LIFE... Replace with RAYTHEON

Thanks to LUMILAC, Raytheon Aluminized Picture Tubes provide sharper pictures, high light output and superior contrast — *plus excellent tube life.* LUMILAC, — a lacquer especially blended and used exclusively by Raytheon — is the secret of superiority. This amazing lacquer produces an extra smooth, unbroken surface for the pure aluminum coating, yet leaves no gas-producing residues which could impair cathode emission and shorten tube life.

What's more, the quality of Raytheon Aluminized Picture Tubes is safeguarded by Raytheon's great ultra-modern Cathode Ray Tube Plant in Quincy, Mass. — a plant designed and built solely for the manufacture of first quality picture tubes.

Replace with Raytheon Aluminized Picture Tubes — they are best for you and your customers, too.

RAYTHEON "Lumilac" ALUMINIZED PICTURE TUBE REPLACEMENT GUIDE

RAYTHEON "Lumilac" ALUMINIZED PICTURE TUBE	REPLACES STANDARD TYPE	NECESSARY ADJUSTMENTS OR CHANGES
12KP4A	12KP4	None.
	12QP4	Ground conductive coating. Remove ion trap.
	12QP4A	Ground conductive coating. Remove ion trap.
	12RP4	Ground conductive coating. Remove ion trap.
16KP4A	16KP4	None.
	16QP4	Ground conductive coating. Change ion trap.
	16RP4	Check conductive coating contact.
	16TP4	Space may not be sufficient in some cases.
	16XP4	Ground conductive coating. Change ion trap.
17BP4B	17BP4	Ground conductive coating.
	17BP4A	None.
	17BP4C	None.
	17JP4	Do not exceed voltage rating.
17HP4B	17HP4	None.
	17HP4A	None.
	17RP4	None.
17LP4A	17LP4	None.
	17VP4	None.
20DP4C	20DP4A	None.
21ALP4A	21ALP4	None.
	21ALP4B	None.
	21ANP4	Ground conductive coating.
	21ANP4A	Ground conductive coating.

RAYTHEON "Lumilac" ALUMINIZED PICTURE TUBE	REPLACES STANDARD TYPE	NECESSARY ADJUSTMENTS OR CHANGES
21AUP4A	21AUP4	None.
	21AUP4B	None.
21AVP4A	21AVP4	None.
	21AVP4B	None.
21EP4B	21EP4	Ground conductive coating.
	21EP4A	None.
21FP4C	21FP4	Ground conductive coating.
	21FP4A	None.
21YP4A	21AFP4	Ground conductive coating.
	21YP4	None.
21ZP4B	21ZP4	Ground conductive coating.
	21ZP4A	None.
24CP4A	24CP4	None.
	24QP4	None.
	24TP4	None.
	24XP4	Ground conductive coating.
24DP4A	24DP4	None.
27EP4	27GP4	None.
	27NP4	Add filter condenser.
27RP4	27GP4	Ground conductive coating.
	27NP4	None.

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Excellence in Electronics

SERVICE

The Technical Journal of the Television-Radio Trade

Technical Products Move Up Front

During the past months, industry has been called upon to solve a number of perplexing problems. Through the development of an outstanding collection of advanced technical products and systems, designed to meet the stiffest field tests, significant solutions have been found for practically every riddle.

Among the difficult situations that had to be resolved was noise in the compact, streamlined b-w TV chassis, and especially in color-TV models. One solution appeared in redesigned bifilar coils, used as interstage couplers in place of the single coils in stagger-tuned amplifiers. In their modified form, these unity-coupling type transformers have made it possible to simplify circuitry and up receiver efficiency. Specifically, the bi coils have served to eliminate the need for a coupling capacitor between the plate of one stage and the grid of the following stage, remove the *rf* choke from the *if* output stage and particularly, insure improved noise immunity, because of low impedance in the *if* grids. In the single-tuned amplifiers, we have a *dc* grid return through a load resistor, in which there is an appreciable time constant. Thus noise pulses of sufficient amplitude can draw grid current and develop a charge on the coupling capacitor. This condition develops a bias on the tube, until the charge leaks off through the grid resistor. Under these conditions, the amplifier's gain is reduced until the grid bias can return to normal.

One will find that severe noise impulses can be of sufficient amplitude to drive the tube into cutoff. Therefore the effect on the picture will be to modulate the carrier toward the black level. While this result will not completely damage picture quality, the trailing white tails caused by *if* grid-circuit cutoff are certainly objectionable. When bi coils are used, the grid time constant will be found to be nearly zero. And noise effects in the picture will appear only as black specks; the white tails caused by grid cutoff will disappear.

Approaching the problem of noise from another angle, a team of development engineers found that immunity could also be established in a tubeless noise-cancellation network, introduced between the detector, an extremely high-gain keyed *agc* system and the first video amplifier and sync separator, using a carefully-designed assembly of resistors, chokes and capacitors, with closely-controlled tolerance values.

In the new N-C system, a signal is fed into the *agc* circuit to maintain tight control of the signal level at the grid of the first video amp. Noise is clipped here without affecting video and sync signals; the sync and *agc* takeoffs are at the plate of the first video amplifier. Because of the clipping action, noise is not amplified, but we do have amplification of the video and sync signals. Negative-going information, obtained from the output of the video detector, is applied to the grids of the *agc* amplifier and sync clipper. This information contains negative-going sync pulses which cancel the noise remaining in the output of the video amplifier.

Additional performance improvements have been gained elsewhere in the TV receiver through the use of new families of components in modified circuitry, such as the plastic film dielectric capacitors.

In the *rf* coupling, bypass and filter stages, polyethylene film capacitors, using silicone as impregnants, have proved very effective. And in low-pass, bandpass and rejection filters, as well as the vertical sweep oscillator circuits, polystyrene-silicone type capacitors have served well. As high-voltage *dc* filters, mylar-film capacitors have been found to provide high-standard results.

Striking progress has also been achieved in the TV antenna labs. Unusually complex receiving problems, involving stubborn interference situations, like those found in troublesome co-channel areas, have been overcome through the application of completely new design principles.

Audio has also been able to capitalize on the current parade of technical component-circuit advancements.

The accent on multiple-speaker assemblies, which has highlighted the importance of cross-over networks, has resulted in a number of timely developments. Interesting examples are the new types of constant-resistance nets, found with increasing frequency in speaker systems coupled to variable-damping amplifiers and amplifiers with a wide range of different fixed damping factors.

The critical requirements of the growing sight and sound audience, which have become more and more acute and alerted industry to the continuing need for technological improvements, have certainly spearheaded an intense research-engineering drive with noteworthy results.—L. W.

SERVICE... The National Scene

INDUSTRY CHIEFS SEE MARKED RISE IN REPLACEMENT NEEDS DURING '56--More radio-TV tubes, picture tubes, components and accessories will be required during the next 12 months for repair purposes than ever, year-end reports have emphasized. It was estimated that the husky sum of nearly $700-million spent in '55 for replacements will be upped to more than $800-million during '56. And, as noted earlier, revenue for installation and service, which hit an all-time high of more than $900-million in '55 will push well up to more than $1-billion in '56. . . . The picture tube market alone will be a healthy one, the records show. It is expected that about $300-million will be spent for replacements in 6-million sets; this represents an increase of nearly a million tubes over shipments during '55. . . . In addition, it was felt that more than 150-million replacement tubes will be bought for TV, radio, audio and auto-radio receivers during the year, averaging about one for every man, woman and child in the country.

TV ANTENNA REPLACEMENTS will also move along at a snappy gait because of not only mechanical obsolescence, but pickup problems due to transmitter site and antenna changes. Experts believe that more than 50% of present TV set owners have weather-beaten antennas that will have to be replaced. And color, with its stringent broad-band requirements, will spark interest in new antenna installations too, it was noted.

PHONOS AND TAPE, which continued to climb in popularity during '55, will have a particularly prosperous year in '56, audio sources disclosed. A record-breaking sale of more than $122-million worth of phonos is expected during '56. Added to the millions of disc machines now in the field, there will be plenty of music boxes around that will have to be inspected and repaired during the year. . . . Tape production of about 450,000 units, rung up in '55, is expected to move up to at least 600,000 before the year is out and develop a lively need for maintenance and service.

THE BRIGHT OUTLOOK for '56 was also tied to the fact that this is an election year and, as a result, activity in all avenues of radio, TV and audio will boom.

HEAVY CAMPAIGN ON TO SHIFT ALL TV TO UHF--A blizzard of proposals, suggested the all-out use of uhf channels to solve the present allocation dilemma, has hit the FCC. The Commission was told that there is more room for a nationwide TV service in 70 uhf channels than in only 12 to 15 vhf bands. . . . If the upstairs move is made, it was said, a five to seven-year transition period should be allowed. During the time that comments on this plan were being reviewed, the Commission was asked to delay grants of vhf channels in uhf markets. . . . Deintermixing was offered as a solution in another statement filed in Washington. It was emphasized that such an approach, on a sufficiently broad basis, would help to create a nucleous of predominantly uhf service areas which would permit uhf to grow and expand. . . . The government was also told that it should encourage multiple owners with the resources and know-how to undertake the operation of ultrahigh stations in intermixed markets, encourage others to follow suit, and in addition, permit uhf stations to use directional antennas and on-channel boosters.

FCC RULES RADIATION-CONTROL SEALS REQUIRED FOR FM-TV SETS--To eliminate interference the Federal Communications Commission has issued an order, effective March 1, requiring all FM and TV receiver manufacturers to apply a seal to their chassis certifying compliance with the FCC's radiation rules. . . . Applicable to all sets operating in the 30 to 890-mc bands, the new rules prohibit greater radiation at 100 feet than 50 microvolts-per-meter on FM and TV channels 2 to 6, 150 microvolts-per-meter on channels 7 to 13, and 500 microvolts-per-meter for the ultrahighs. . . . An early set-manufacturers conference with the Commission has been scheduled to review plans for setting up of certification programs. . . . The latest rules also set restrictions on radiation from motors, ignition systems and switches that can cause interference to radio services; operators of radiating equipment will be required to curb interference through filters and other design adjustments.

FIELD REPORT NO. 9

FOR BEST BLACK AND WHITE, AND COLOR RECEPTION...

ELIO PURA
KING CITY-TV
KING CITY, CALIFORNIA

WE HAVE EIGHT POSSIBLE TV CHANNELS IN KING CITY. TWO ARE SNOW-FREE. BUT THE OTHERS ARE FRINGE. THEY ARE LISTED AS FOLLOWS:

- CHANNEL 3 SOUTH SANTA BARBARA, CALIF.
- CHANNEL 4 NORTH SAN FRANCISCO, CALIF.
- CHANNEL 5 NORTH SAN FRANCISCO, CALIF.
- CHANNEL 6 SOUTH SAN LUIS OBISPO, CALIF.
- CHANNEL 7 NORTH SAN FRANCISCO, CALIF.
- CHANNEL 8 NORTH SALINAS, CALIF.
- CHANNEL 10 N/E SACRAMENTO, CALIF.
- CHANNEL 11 NORTH SAN JOSE, CALIF.

STACKING A JFD STAR-HELIX ON ROTOR MAKES POSSIBLE VIEWING ON ALL EIGHT CHANNELS.

ANY PERSON WISHING A GOOD ANTENNA INSTALLATION, "WE RECOMMEND A JFD STAR-HELIX ANTENNA."

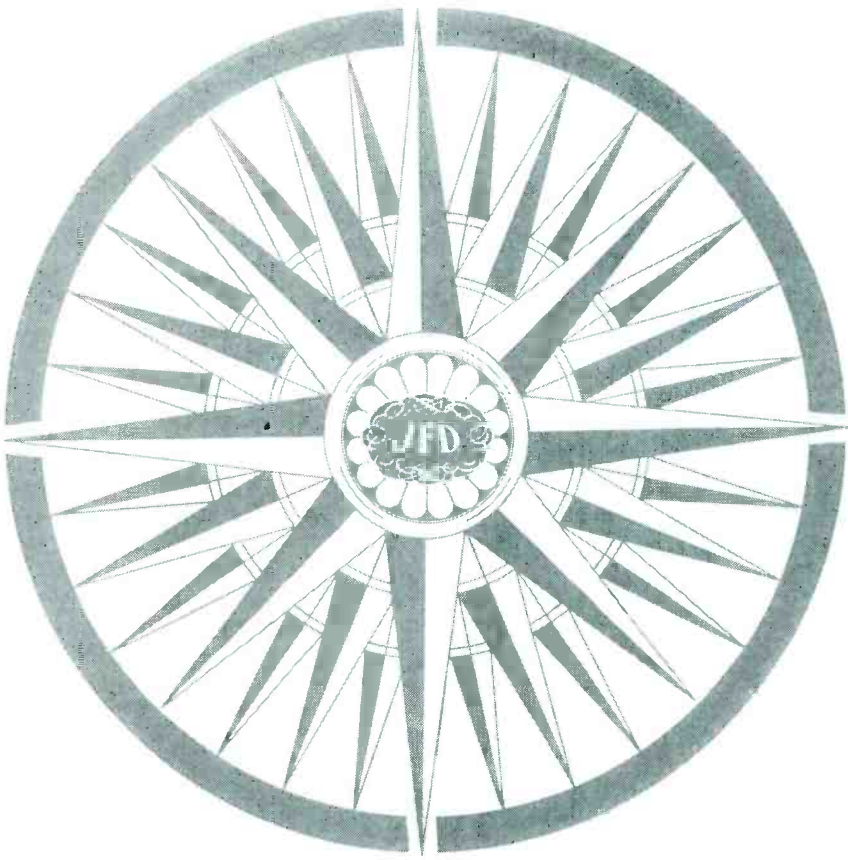
JAMES S. JEWELL
JEWELL TV-APPLIANCE CO.
DECATUR, MICHIGAN

I RECENTLY TRIED THE JFD STAR-HELIX ANTENNA WHEN INSTALLING MY FIRST COLOR SET AND WAS MORE THAN PLEASED WITH THE RESULTS. I HAD TRIED OTHER FRINGE ANTENNAS, BUT NOTHING WAS GIVING A CONSISTENT, SNOW-FREE SIGNAL, EVEN ON BLACK AND WHITE, FROM GRAND RAPIDS-CHANNEL 8, WHICH IS ABOUT 80 MILES AWAY.

NOW WITH THE JFD STAR-HELIX, EVEN COLOR SIGNALS ARE STEADY AND FREE FROM SNOW. WE ARE ALSO RECEIVING GOOD SIGNALS FROM FAR AWAY AS 125 MILES FROM CHICAGO ON CHANNELS TWO, FIVE, SEVEN AND NINE.

JOHN A. ETCHINSON
E. O. BROOKS APPLIANCES
FLORA, ILLINOIS

WE ARE USING THE NEW STAR-HELIX ANTENNA AND FIND THAT IT OUT PERFORMS ANY OTHER ANTENNA WE HAVE EVER USED. FLORA IS LOCATED APPROXIMATELY ONE HUNDRED MILES FROM STATIONS EAST, WEST, NORTH AND SOUTH AND WE REQUIRE AN ANTENNA THAT WILL SEPARATE THESE STATIONS AS WELL AS BRING IN RECEPTION. THE NEW STAR-HELIX WILL DO AN EXCELLENT JOB IN SEPARATING THESE STATIONS, THUS ELIMINATING CO-CHANNEL INTERFERENCE.



EARL FRAZIER
FRAZIER FURNITURE CO.
BLACKWELL, OKLAHOMA

"AFTER TRYING NUMEROUS ANTENNAS HERE IN A FRINGE AREA, WE HAVE SETTLED ON STAR-HELIX BECAUSE OF ITS FRONT TO BACK RATIO. WE FIND IT IS THE FINEST ANTENNA WE HAVE USED FOR NO BACK GAIN."

CHARLES M. BOLINGER
BOLINGER RADIO & TV SHOP
CARROLLTON, MISSOURI

FOR AN AVERAGE INSTALLATION WE SIMPLY USE A SINGLE STAR-HELIX. IN A VERY DIFFICULT SPOT WE STACK TWO OF THEM. IN EITHER CASE IT DOES AN EXCELLENT JOB FOR US ON BOTH MONOCHROME AND COLOR AS WELL AS CUT ABOUT ONE-THIRD OFF THE INSTALLATION TIME.

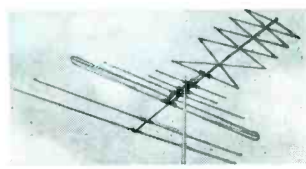
WE NOW USE THE STAR-HELIX IN MOST LOCATIONS WHERE PREVIOUSLY IT WAS NECESSARY TO USE A STACKED ARRAY OF SOME TYPE IN ORDER TO GET SATISFACTORY RECEPTION.

VIOLET M. HOYT
KINI POPO RADIO-TV SERVICE
KEALAKEKUA, KONA, HAWAII

"IT IS SO SIMPLE TO ASSEMBLE THAT EVEN I HAVE GONE OUT ON ANTENNA JOBS WHEN MY HUSBAND WAS BUSY IN THE SHOP, AND WITH A COUPLE OF UNTRAINED HELPERS, HAVE MADE PERFECT INSTALLATIONS. WE ARE LOCATED 100 MILES FROM THE NEAREST TV TRANSMITTER, AND THE STAR-HELIX ANTENNA PULLS IN A BEAUTIFUL PICTURE, WITH NO GHOSTS.

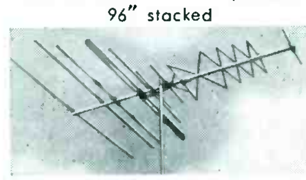
SERVICEMEN *EVERYWHERE* AGREE ON JFD ANTENNAS

EXPERIENCE IS THE BEST TEACHER. THAT'S WHY MORE AND MORE SERVICE-DEALERS, AT HOME AND ABROAD, ARE STANDARDIZING ON JFD TV ANTENNAS. THEY'VE LEARNED THAT A JFD ANTENNA ASSURES THEIR CUSTOMERS THE FINEST POSSIBLE RECEPTION IN BLACK AND WHITE TODAY, AND COLOR TOMORROW. THEY'VE SEEN HOW JFD INSTALLATIONS BUILD CUSTOMER CONFIDENCE–THE BEST INSURANCE FOR FUTURE BUSINESS. SO WHY COMPROMISE YOUR REPUTATION WHEN IT COMES TO QUALITY RECEPTION? ASK YOUR DISTRIBUTOR TO SHOW YOU THE JFD ANTENNA THAT SOLVES YOUR PROBLEM... FITS YOUR PURSE.



STAR-HELIX

SX711	single	$25.50
SX711S	stacked	$52.50
SX711-96* 96" stacked		$55.00



SUPER-STAR HELIX

SX13	single	$35.00
SX13S	stacked	$72.50

FIREBALL

FB500	single	$17.35
FB500S	stacked	$36.65
FB500S-68† 68" wide stacked		$36.65
FB500S-96* 96" wide stacked		$38.60

*for added ch. 2-6 gain
†for areas with co-channel and cross-channel interference

YOUR REPUTATION GOES UP WITH A JFD ANTENNA!

JFD OUR 26TH YEAR

MANUFACTURING CO. INC. BROOKLYN 4, N. Y.

INTERNATIONAL DIVISION: 15 MOORE STREET, N. Y. C.

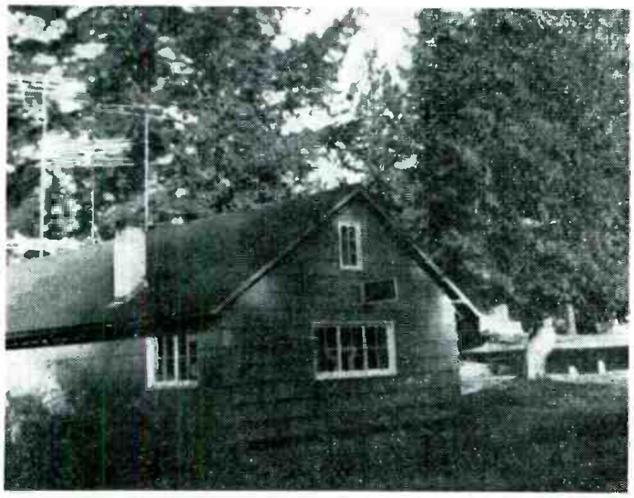
CANADIAN DIVISION: 51 MCCORMACK STREET, TORONTO 14, ONTARIO

GO FORWARD WITH JFD ENGINEERING!

Rural Roadside-Shop

A Field Report . . .

Partners Jack and Ted Eichelsdoerfer, operators of Jack's Radio Service, and assistant Stan Avery, in front of shop and trio of cars and trucks used for field work.



Another view of shop, showing variety of antennas used for test purposes.

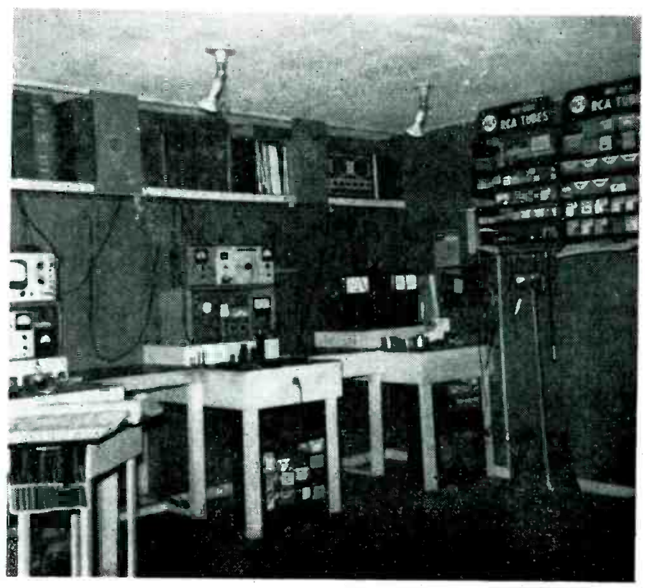
(Top, right) Closeups of test bench and auxiliary bench used to support diagram manuals.

During the past few years, many working in the big cities have been moving out into the country to live. In many parts of the land, decentralization of industry has spurred interest in rural life. In the northwest, the exodus has been marked; most of the folks out here, who work in the city, live in the wide open spaces. As a result, our shop, a rural roadside operation, has been flourishing.

Our clientele, commuters to city jobs, live on tracts of land of from one to ten acres.

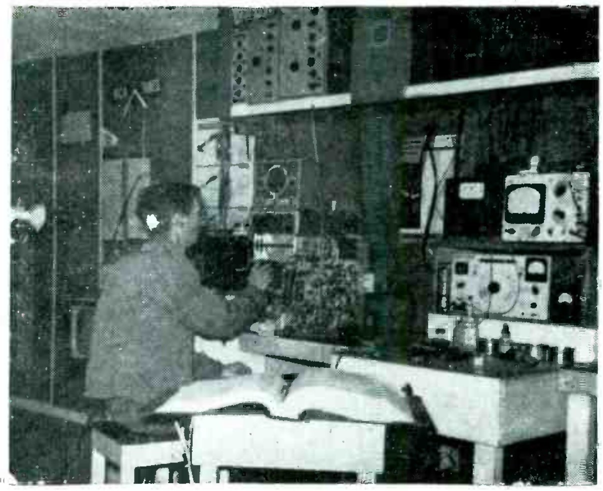
We are located midway between Seattle and Everett and two and a half-miles north of Bothell, a town of 1300. Our shop, which lies by the side of a black top road, with a drive-in to a parking area, was built and planned for the efficient handling of home and auto radio and TV repair

Left, below: Front office of shop. Right, below: individual test-equipment work benches, shelves for tube storage and reference manuals, and test instrument lead holders.



Servicing in Bothell, Wash.

by JACK EICHELSDOERFER



work, and for no other purpose; we have nothing to sell but service.

The shop proper is one large room divided in three sections, with 1000 square feet (20x50) of floor space and over 600 square feet of storage space upstairs. The center section is arranged for drive-in auto radio installation and repair work. Another section, devoted to TV, is equipped with no-lift type portable benches which roll into recesses of work benches.

To facilitate the roll of the portable tables from the car to their niche in the work bench, we installed a blacktop parking slab, which runs the full length of the building and has a slight incline to the shop floor.

For the convenience of commuters who bring their sets in from 5 to 8 P.M., and want to wait while we fix 'em, we set up a waiting room with plenty of chairs; this section is in a fenced-off portion of the radio room.

During the day, we have one man in constant attendance at the shop, while two are out on calls. Calls are scheduled to a maximum of six per day per man. Two men are used to cover antenna jobs.

We handle service for TV set dealers that do not have their own service departments. We also *troubleshoot* many toughies for other shops.

Our shop hours are from 9:30 A.M. to 8:00 P.M., with no outside calls after 5:00 in the afternoon. And we're closed on Sundays.

We have quite an array of test gear, including a duplicate set of instruments, for not only emergencies, but to expedite repair. Particularly popular in our shop is the vacuum-tube voltmeter with zero center, of which we have several. We also have a capacitor checker to find leakage, tube checkers and a few 'scopes. And we have a complete supply of circuit manuals, another must for the servicing of TV and radio; we feel that these are as essential as plenty of test equipment.

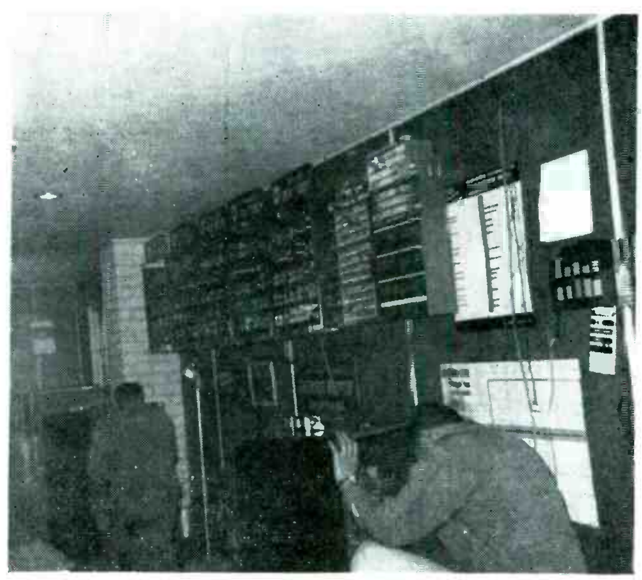
We do little advertising; we let satisfied customers carry this load for us. Often, we have been asked how a repair business, located on a country road, could keep busy. The automobile has eliminated distance; a shop by the side of a road is actually more accessible than a city parking lot or a curb meter.

Our overhead costs are low and our customers are not of the *switch* or transient type.

Parts are delivered direct to our door from distributors in Seattle and Everett. We always carry a full line of parts in stock; in fact, we buy in

(*Continued on page 54*)

Left, below: Testing and repairing a radio chassis in the shop. Right, below: Checking of chassis in consoles, a dealer service operation.



The Raytheon 21-Inch

See Front Cover for Block Schematic and Pages 15 and 16 for Complete Circuit Diagram

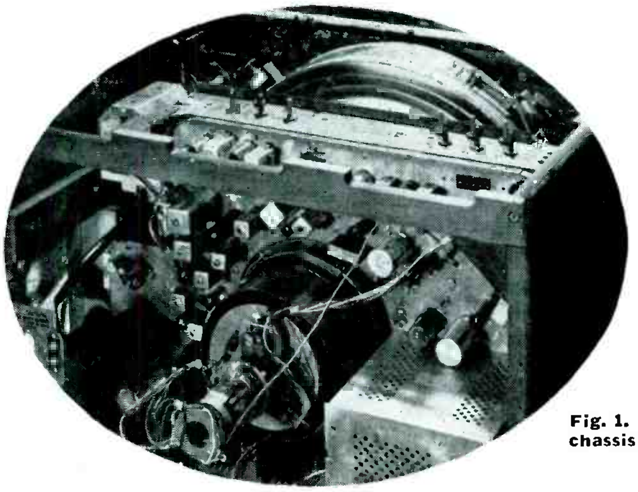


Fig. 1. Vertically-mounted color chassis and picture tube installed in cabinet.

Shortly after the NTSC color transmission standards were approved by the FCC, commercial color receivers using 15-inch three-gun color picture tubes and a multitude of receiving tubes, were introduced. A larger screen receiver, which employed a 19-inch picture tube and a somewhat reduced tube count followed, a short time later. A 21-inch three-gun tube is in use in present day color receivers and the number of tubes has been greatly reduced.

Due to the TV manufacturer's striving to simplify circuitry and reduce manufacturing costs, color receiver circuitry has changed drastically from the days of the 15-inch models.

A large percentage of the present black-and-white receivers being made employ vertical chassis design. The advantages of the vertical chassis are many from both the manufacturing and servicing standpoint and there is no reason why color receivers should not take advantage of this design. The color chassis‡ developed in our labs are exclusive in this feature. Fig. 1 illustrates our vertically mounted color chassis and picture tube installed inside the cabinet; only the cabinet back and top were removed when the receiver was photographed. Controls necessary for setup adjustment during installation, (convergence, screen and brightness) are available on a control plate at the top of the chassis near the front of the cabinet; they are available after removal of the cabinet top. As an added service feature, hinges are provided on this control plate for accessibility to a large percentage of the components behind the chassis.

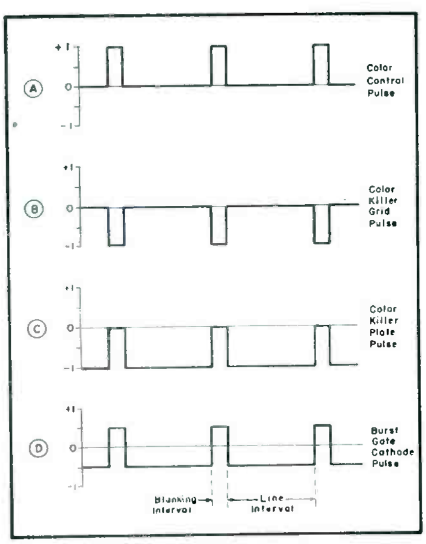
The receiver employs 27 tubes, plus a 21-inch three-gun color picture tube, two germanium crystals and two selenium rectifiers. Circuitry features separate luminance and chrominance detectors, automatic color killer, high level color demodulation, direct coupling to the picture tube, (eliminates need for *dc* restorers), automatic chrominance control, simplified convergence circuit, and a number of other circuitry improvements and refinements.

The transmitted signal is selected by the tuner, amplified and converted to an intermediate frequency. The signal is amplified by the *if* amplifier and then coupled to two separate detectors; the luminance detector and the sound-chroma detector. The luminance detector utilizes only the luminance (equivalent to monochrome video signal) and deflection sync signals. The luminance signal is amplified by the luminance amplifier and coupled to the picture tube identical to a b-w receiver. The sound, chrominance and color burst signals are detected by the sound-chroma detector and the sound signal is separated and coupled to the sound circuits.

The chroma amplifier receives the chrominance and color burst signals from the sound-chroma detector and amplifies these signals. The color burst signal is then separated and the chrominance signal is coupled to *R-Y* and the *G-Y* demodulators. The chroma amplifier circuitry, illustrated in Fig. 2, employs a two-stage amplifier of the staggered-tuned type similar to an *if* amplifier; the only difference is that the chroma amplifier amplifies frequencies in the vicinity of 3.1 to 4.1 mc. The response of the chroma amplifier is centered around the chrominance subcarrier frequency of 3.58 mc and extends 500 kc above and 500 kc below.

A unique difference in this circuitry from that found in previous color receivers is the application of *acc (automatic chrominance control)* and an unusual type chroma or color control. The *acc* is applied to the first chroma amplifier grid in the form of a negative bias voltage coupled from the burst phase detector. The negative bias voltage is dependent on the color burst signal amplitude. If the chrominance signal, which includes the color burst, is reduced in amplitude for any reason, the amplitude of the color burst signal is reduced ac-

‡*Raytheon 21CT1.*



(Left)

Fig. 3. Pulse amplitudes during operation of color chroma control.

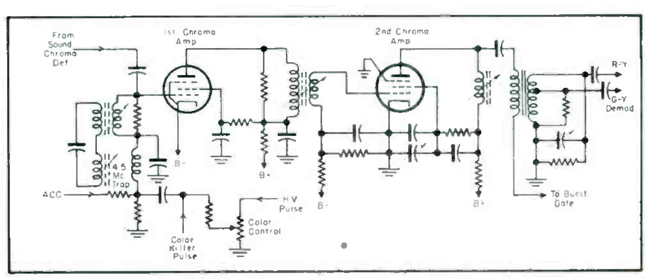
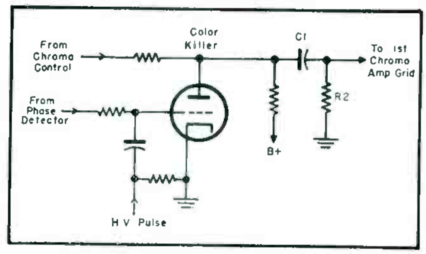


Fig. 2 (above, right). Circuit of chroma amplifier which receives chrominance and color burst signals from sound-chroma detector and amplifies them.

Vertical COLOR-TV Chassis

by KEN KLEIDON, *Color-TV Training Director*

Raytheon Manufacturing Company, Television and Radio Operations



(Above)

Fig. 4. Color killer circuit used in Raytheon's 27-tube receiver, which is automatic and serves to disable the chroma circuit during b-w reception.

cordingly and consequently the negative output of the burst phase detector is reduced. The negative bias voltage applied to the grid of the first chroma amplifier is therefore reduced; this results in an increase of the gain of the amplifier. The action is similar for an increase in chrominance signal amplitude; only the bias will increase to reduce the chroma amplifier's gain. The *acc* circuit is similar in operation to an *agc* circuit. In the same way that an *agc* circuit maintains a constant detector output signal amplitude, independent of signal variations, the *acc* circuit maintains a constant chrominance signal amplitude applied to the demodulators, independent of the burst or chrominance signal variations.

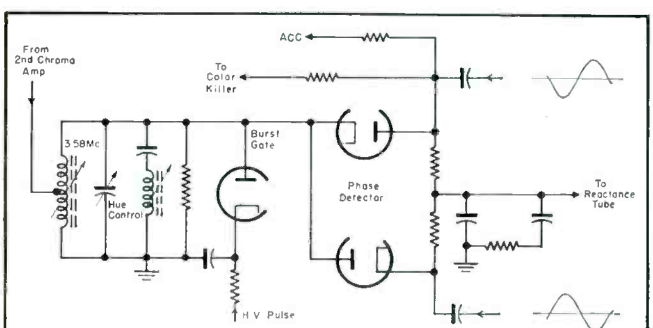
The color or chroma control varies the amplitude of a pulse, which is also applied to the first chroma amplifier grid. The pulse is positive during the blanking interval, as illustrated in Fig. 3*a*. This pulse will cause the gain of the chroma amplifier to vary, similar to an increase or decrease in burst signal amplitude due to the action of the *acc* circuit. Since the color burst signal is transmitted only during the blanking interval, the *automatic-chrominance-control* circuit will interpert the pulse as an increase or decrease in burst signal amplitude and vary the gain of the chroma amplifier accordingly.

Also shown coupled to the first chroma amplifier grid circuit (Fig. 2) is a color killer pulse. The pulse is coupled from the color-killer stage, which is simply an automatic circuit used to disable the chroma circuit during monochrome reception to prevent noise or other colored effects from being passed by the chroma circuit and appearing in the picture. During reception of a color signal, the color burst signal is present and provides a negative bias voltage at the burst phase detector which is coupled to the grid of the color-killer stage. This negative bias voltage is sufficient to prevent the color-killer stage from conducting. During monochrome reception the color-burst signal is absent and the negative-bias voltage at the burst-phase detector is reduced considerably, allowing the color-killer stage to operate. A negative pulse from the horizontal-deflection transformer is applied to the control grid of the color-killer stage, as indicated in the schematic of Fig. 4; the negative pulse is shown in Fig. 3*b*. The color-killer stage operates as a conventional amplifier and amplifies the pulse. Because of the phase reversal from grid to plate in an amplifier, a positive pulse appears at the plate, as illustrated in Fig. 3*c*; this is coupled to the control grid of the first chroma amplifier. This pulse prevents the chroma amplifier stage from conducting in the following way: When the pulse is going positive, during the blanking interval, capacitor C_1 in Fig. 4, charges and places a positive potential on the control grid of the chroma amplifier. The chroma amplifier draws grid current through resistor R_2 to ground. This places a negative potential at the control grid, which is sufficient to cut the chroma amplifier off. The time constant of R_2 and C_1 is long enough to keep the chroma amplifier cut off until the next positive pulse occurs. Therefore, the chroma amplifier is cut off during the line interval or scanning period.

The basic function of the chroma amplifier is simply to select and amplify the chrominance signal for application to the demodulators. Since the color burst signal is also amplified by the chroma amplifier, this signal must be separated from the chrominance signal and applied to the color oscillator for synchronization. The separation is accomplished by the burst gate. The burst gate circuit, illustrated in Fig. 5, is designed to conduct only during the line interval and effectively places a short circuit across the hue control, 3.58-mc coil, etc. The burst gate is prevented from conducting during the burst interval by a positive pulse from a winding on the horizontal-deflection transformer which is coupled to the cathode. The positive pulse occurs during the blanking interval (same time as color burst signal); this is illustrated in Fig. 3*d*. When the burst gate is prevented from conducting, the short circuit is removed and the color burst signal from the chroma amplifier is developed across the 3.58-mc coil and is applied to the burst phase detector.

The phase-detector circuit is similar to that of the horizontal-oscillator

(*Continued on page* 52)



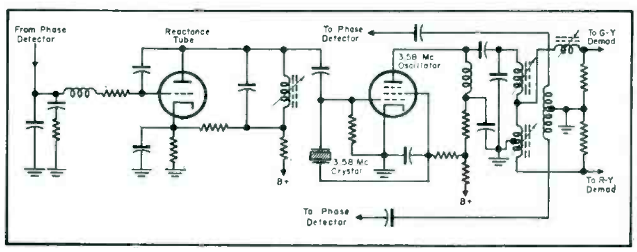
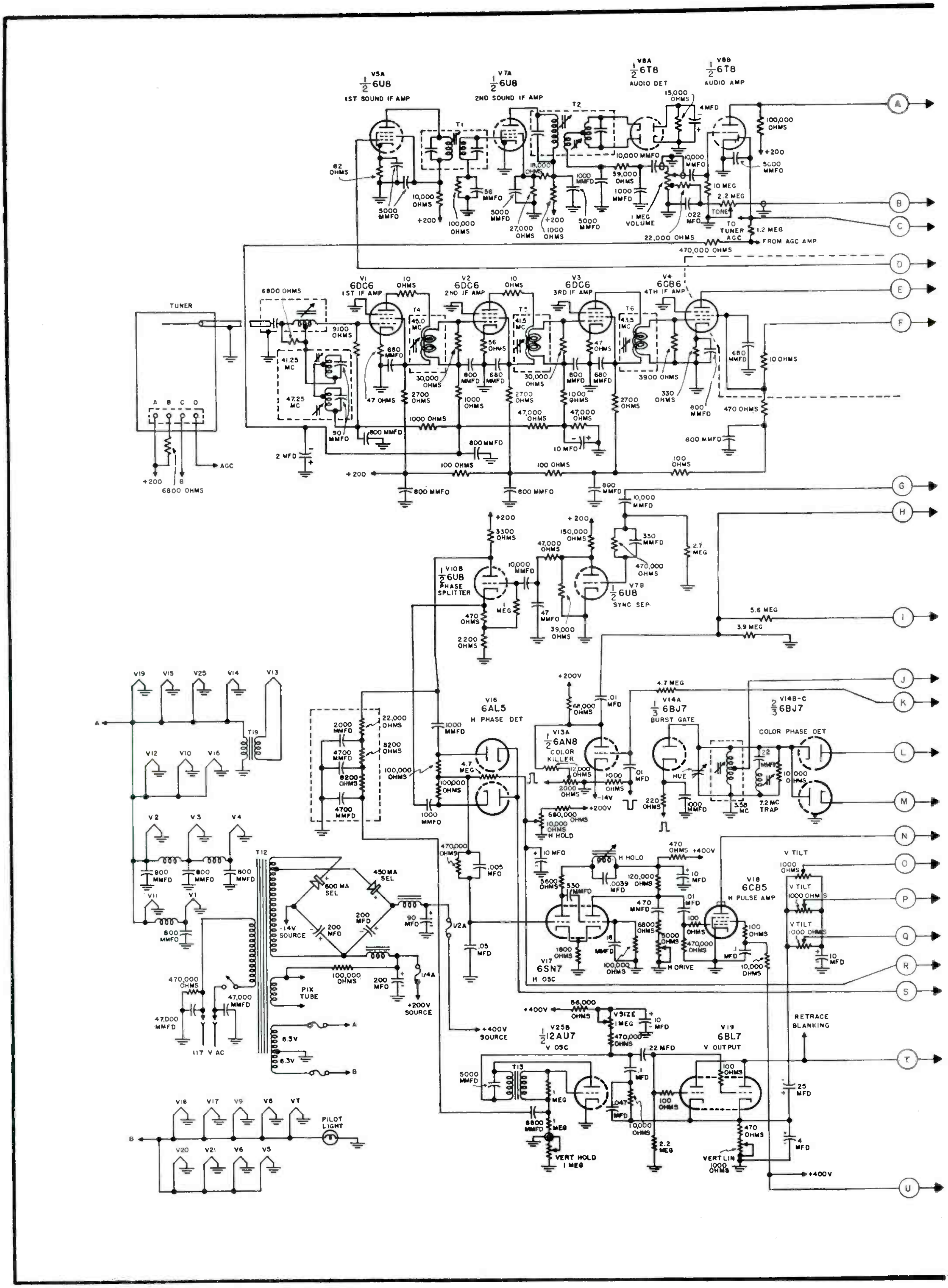
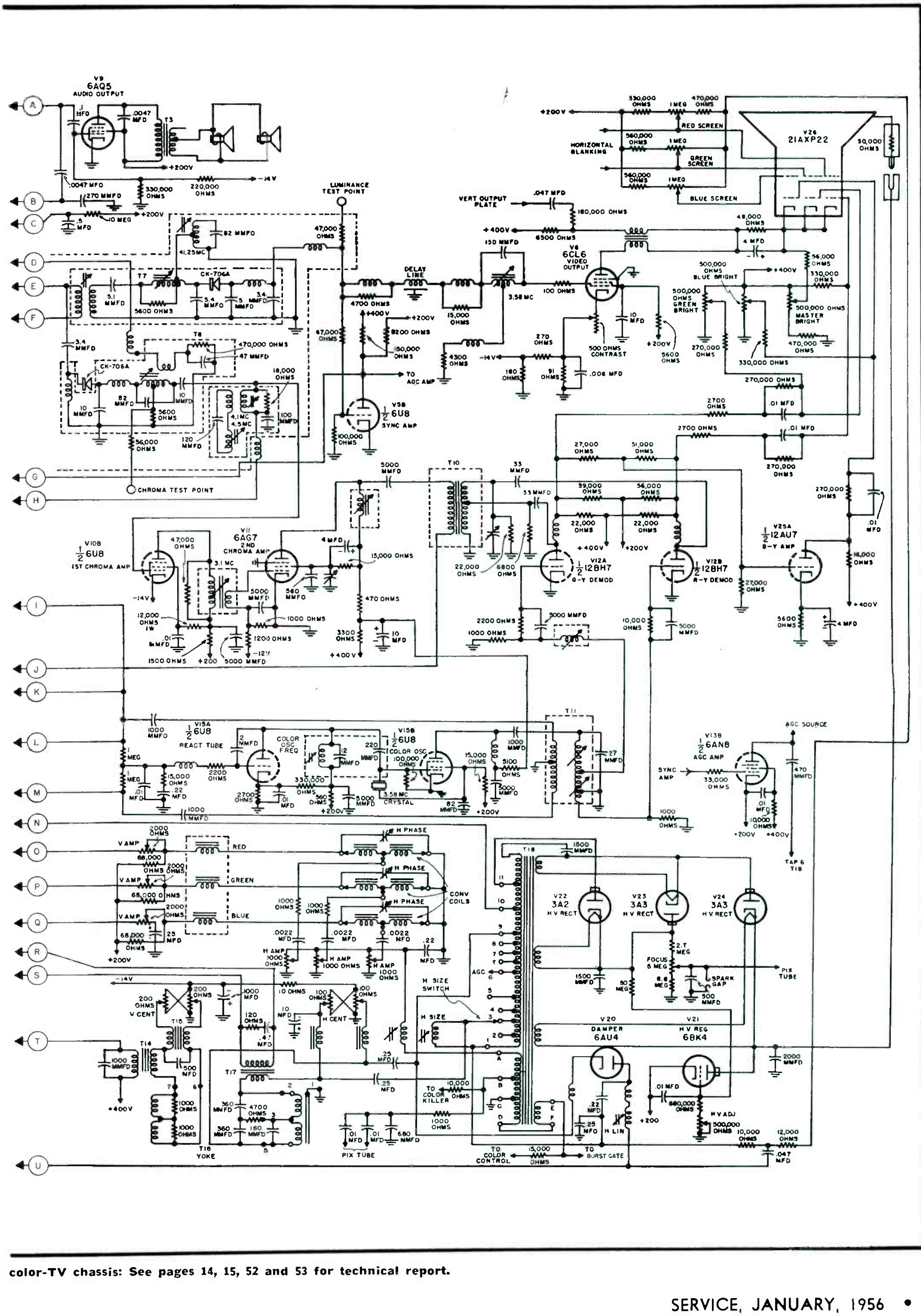


Fig. 5 (left). Burst-gate and color-phase detector circuit used in color chassis.

Fig. 6 (above). Circuit of the crystal-controlled color oscillator.



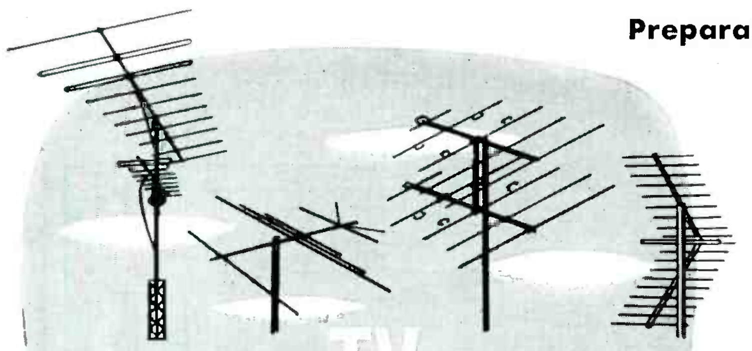
Complete circuit diagram of the Raytheon 21-inch vertical



color-TV chassis: See pages 14, 15, 52 and 53 for technical report.

See pages 14, 15, 52 and 53

Preparation and Use of Signal Coverage Data and Terrain Maps to Determine Best Antenna Types for Remote Areas



UHF-VHF TV ANTENNA DIGEST

DESIGN • APPLICATION • INSTALLATION • SERVICE

by KENDRICK H. LIPPITT

Vice President in Charge of Engineering, Technical Appliance Corp.

THE DAY IS LONG PAST when TV entertainment is limited to *city folks;* for, with some 36,000,000 TV sets already in use and still more to come, we must now provide good reception in rural areas, remote communities and even the wide open spaces far removed from existing TV transmitters. To provide such service, intensive engineering research and development is vital, not only by way of the antennas designed and constructed to handle the weaker signals, but also in studies of wave propagation, including transmitter location, elevation, power, nature of intervening terrain (especially hills and mountains as well as bodies of open water), and even the obvious but all-important matter of compass bearings.

In place of the customary cut-and-try method of achieving more or less satisfactory TV reception in remote or poor signal areas, it has been found necessary to prepare extensive compilations and evaluate carefully the factors entering into TV coverage and reception for many sections of the country.

The preparation of such significant information starts with the location of each TV transmitter, which is indicated on a sectional aeronautical chart, such as used in aircraft navigation and available from government sources. The chart shows topographical features, including contour elevations. It is important to spot each transmitter precisely, for it is often located some distance from its name city and in any one of four directions from same. A small triangle drawn on the chart points to the exact location of the transmitter tower, while the channel designation appears in a circle near the town which is officially the home of said station.

Since these aeronautical charts contain elevation information, of particular significance in hilly and even more so in mountainous terrain, it becomes possible to predict quite accurately the shadow area of TV, by observing the path of the TV signal from transmitter to receiver.

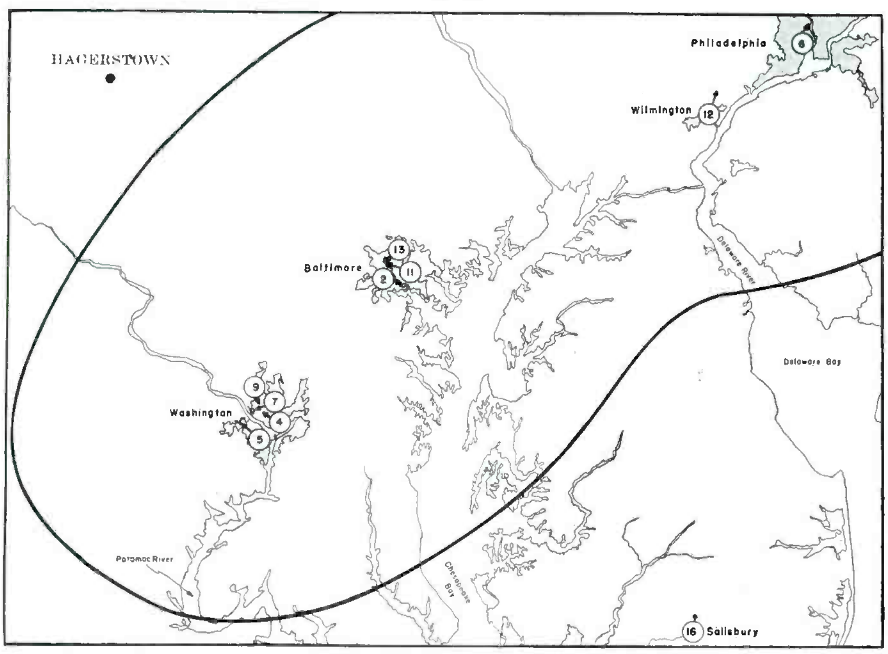
A wide black line of more or less irregular contour is plotted on the chart, thereby delineating that area where most of the all-channel antennas will perform satisfactorily and when price can be the basic sales factor for installations. But beyond the black line is the *fringe* area, with relatively weak signals, calling for adequately engineered antennas correctly installed to do a difficult job.

Here is where critical data are required. In our labs and in the field, we have spent a substantial amount of time and effort gathering facts and figures, and reducing them to handy tabulations used in conjunction with the aeronautical charts.

Tabular pages are available for each city, town or area surveyed thus far. Headed *Analysis of TV Signals at Hagerstown, Md.*, for instance, the tabulation includes columns labeled *Distance in Miles, Compass Bearing, Channel, City and State* (of given transmitter), *Theoretical Field Strength in Microvolts per Meter,* and *Networks* (indicating affiliations for outside programs).

For reception conditions in Hagerstown, let us take as an example, two channels; *9* and *13:* Channel 9, out of Washington, is 59 miles distant, has a compass bearing of 139°, and a theoretical field strength in microvolts-per-meter of 220. Channel 13, out of Baltimore, is 61 miles distant, has a compass bearing of 107°, and a field strength of 180 microvolts-per-meter; in this instance it is necessary to make the notation that *because of a mountain range east of Hagerstown, it may be that the Washington channels are as strong as the Baltimore channels, and Lancaster signals likewise will be attenuated by the mountain range east of Hagerstown.*

Typical sectional aeronautical map with a signal contour line and TV stations within area.



Distance In Miles	Compass Bearing	Channel	City and State	Theoretical Field Strength In Microvolts Per Meter	Networks
16	39°	61	Reading, Pa.	45,000	CBS
24	305°	8	Lancaster, Pa.	16,000	DuMont, CBS, NBC
25	267°	55	Harrisburg, Pa.	6,500	——
28	267°	27	Harrisburg, Pa.	4,800	——
28	267°	71	Harrisburg, Pa.	4,800	NBC, ABC
28	100°	33	Reading, Pa.	6,300	ABC, NBC
54	72°	67	Allentown, Pa.	360	——
55	68°	51	Bethlehem, Pa.	95	NBC
60	127°	12	Wilmington, Del.	250	NBC
64	69°	57	Easton, Pa.	200	ABC, DuMont
65	108°	6	Philadelphia, Pa.	120	ABC, DuMont
66	108°	10	Philadelphia, Pa.	300	CBS
68	108°	3	Philadelphia, Pa.	116	NBC
71	189°	13	Baltimore, Md.	63	ABC. DuMont
71	189°	11	Baltimore, Md.	63	NBC
73	189°	2	Baltimore, Md.	42	CBS

Chart offering an analysis of TV signals at Lebanon, Pa. From these data one learns that the best reception in Lebanon is definitely on uhf channels in Harrisburg and Reading. A four stack uhf model with reflector and rotator could be used here. Another possibility is to use two yagis for 21-36 and 56-83 for the Reading channels since the transmitters are in different directions. A coupler can be used to combine the two yagis for one down line. A very strong signal on channel 8 from Lancaster is also available in the Lebanon area.

(Above)

Author analyzing sectional aeronautical map preparatory to plotting transmitter locations and receiving antennas that will be required for area.

Simple as the compass bearing designation may seem, it is one of those simple things too often overlooked or considered quite unimportant. Service Men are prone to aim the receiving antenna by instinct rather than by compass. While it is true that in some locations the best reception may be obtained by the *bounce* off a mountain, hill or structure, the starting point should be the compass bearing, with subsequent deviations best judged by actual screen results. True bearings are used in our tabulations, so that 90° is East, 180° is South, and so on.

The field strength is obtained by using the charts and figures submitted by the FCC; it is computed by using the distance in miles, the effective radiated power, and the height of the transmitting antenna above average terrain.

The signal strength required for a *snow-free* picture is different for low-band, high-band, and *uhf*. The values which follow are one-half those specified by FCC, because today we have higher gain antennas and therefore require less signal. For *snow-free* pictures, the following signal strengths are required:

110 microvolts-per-meter—
Channels 2 through *6*

315 microvolts-per-meter—
Channels 7 through *13*

700 microvolts-per-meter—
Channels *14* through *83*

There are many areas of the country where signal levels are insufficient for a good quality picture. It is in such areas that the more elaborate and costlier high-gain antennas are so popular. With signals as low as 10 or 15 microvolts on the low band, and as low as 50 microvolts on the high band, the latest antenna types must be used.

From the channel information in these tabular pages, together with the

(*Continued on page* 38)

(Above)

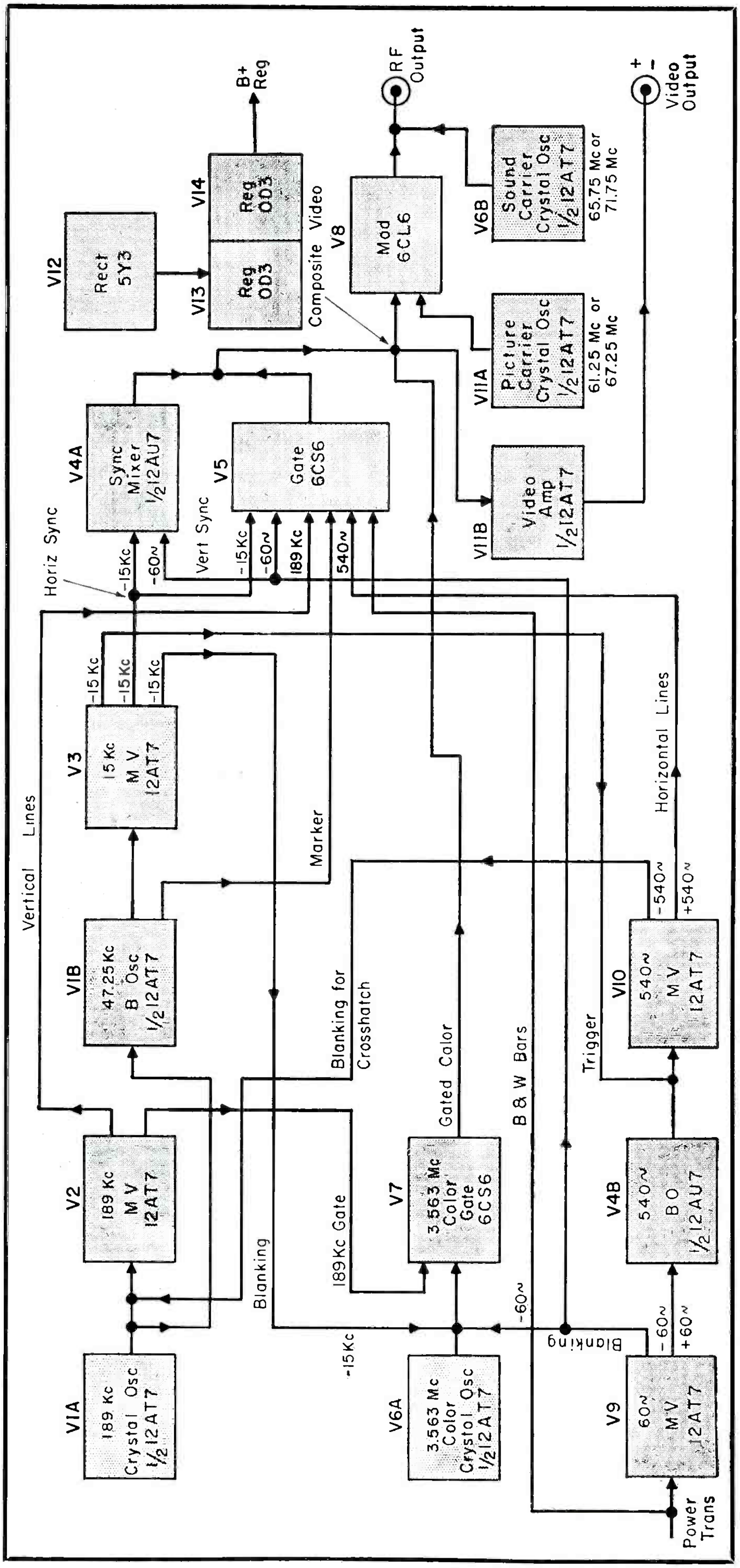
Orienting aeronautical map by lining up direction pattern with a compass.

(Below)

Paralleling cross-arm of the antenna, after map is oriented, with line running from point of installation to station site on map.

Distance In Miles	Compass Bearing	Channel	City and State	Theoretical Field Strength In Microvolts Per Meter	Networks
59	139°	9	Washington, D.C.	220	CBS
59	139°	7	Washington, D.C.	57	ABC
61	139°	5	Washington, D.C.	50	DuMont
61	139°	4	Washington, D.C.	110	NBC
61	107°	13	Baltimore, Md.	180*	ABC, DuMont
61	107°	11	Baltimore, Md.	180*	NBC
64	62°	8	Lancaster, Pa.	360*	CBS, DuMont, NBC
65	107°	2	Baltimore, Md.	65*	CBS
87	214°	3	Harrisonburg, Va.	38	CBS, NBC, ABC, DuMont

Antenna analysis chart for TV signals at Hagerstown, Md. *Because of the mountain range east of Hagerstown, it may be that the Washington channels are as strong as the Baltimore channels. The Lancaster signal likewise will be attenuated by the mountain range east of Hagerstown. A colinear yagi will be found very effective in this area; for this type of terrain, it should be used in most locations near Hagerstown. A 2-bay affair also is a good possibility.



COLOR-TV Instrumentation

Color Bar - Dot Bar Generators

by WALTER E. GILBERT

Chief Engineer
Accessory Division, Philco Corp.

To FURNISH SIGNALS required to service circuits peculiar to color TV receivers and, also, to supply signals for setting up convergence, a combination color bar and dot bar generator* has been developed.

The displays developed by the instrument are available at *rf* from crystal controlled oscillators, and also at *vhf* with either positive or negative sync. To avoid interference from local television stations, the unit is furnished for operation on either channels 3 or 4. Separate attenuators are provided for control of *vhf* and *rf* signals. The range of *rf* output has been found to be approximately 1000 to 100,000 microvolts; maximum video signal is approximately 5 volts peak-to-peak.

Horizontal patterns and vertical sync are developed from the 60 cycle power line; the vertical patterns and horizontal sync are derived from a counter chain that is controlled by a 189-kc crystal.

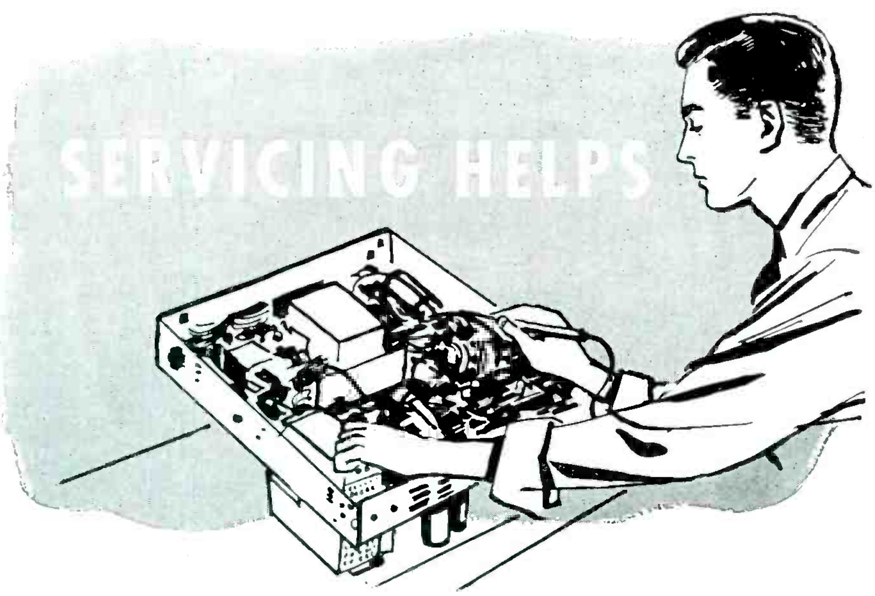
A 3.563795-mc crystal is used; it differs in frequency from the television transmitters' and receivers' *chroma* frequency of 3.579545 mc by exactly 15,750 cps. This frequency difference results in the generator's color oscillator delivering one less cycle of color carrier than is presented by the set's color oscillator in each horizontal scanning cycle. Considered another way, this corresponds to a 360° phase shift in the color information; the condition for creating the whole color spectrum. This modulation is broken into 10 *color bars* by the 189-kc gate. These appear on the TV receiver screen as orange at the left, through red and blue at the center, to green at the right.

More accurately, the horizontal scanning period is divided into 12

**Philco Universal model 7100.*

(*Continued on page* 28)

Fig. 1. Block diagram of Philco 7100 universal color bar and dot bar generator.



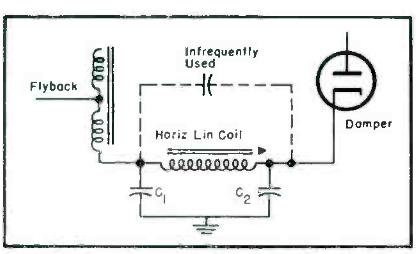
Curbing Excessive Drive Lines . . . Cures for Low Brightness, Narrow and Blooming Pictures . . . Removing Sync Bars Which Lock in Middle of Picture . . . Auto Radio Servicing

Bright vertical lines, rather sharply defined, with each successive line from the left less intense, are usually drive lines and are most frequently caused by maladjustment of the horizontal drive control. To curb this trouble one should try adjusting the drive control, the major cause of the drive lines. If this operation does not eliminate the drive lines, it will then be necessary to check the capacitors associated with the horizontal linearity coil and the linearity coil itself. In some circuits, capacitors shunt the linearity coil and in some instances a tapped linearity coil, with capacitors terminating in the tap of the coil, is used.

Capacitor inspection is necessary to determine if the units have lost capacitance or if they are leaking; if these conditions obtain, then filtration of the 15,750 horizontal synced B+ boost would be affected, resulting in drive lines. Although not commonly realized, the linearity coil and the capacitors form a filter for the horizontal frequency, very much like the choke-capacitor filters used in the low voltage B+ supply. To test for a possible loss of capacity, each capacitor should be shunted temporarily with a test capacity of about the same value noted on the schematic. One should not depart too widely from the cited values, even for test purposes.

The linearity coil itself is a part of the filter network, so it may result in trouble due to short circuited turns, etc. The best cure or test is direct substitution after having checked the capacitors.

Fig. 1. Circuit of the horizontal linearity section of TV chassis that must be checked to eliminate excessive drive lines.

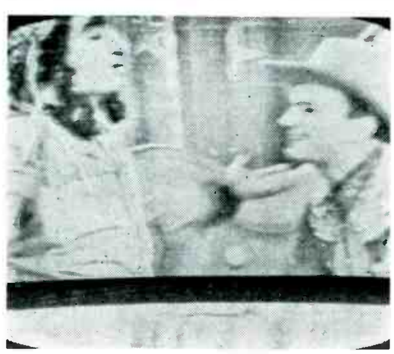


Low Brightness, Narrowness and Blooming Intermittent Symptoms

In checking an Admiral 21B chassis recently, that was afflicted by intermittents, and assorted picture quirks, involving blooming and low brightness, monitoring was used to pinpoint the trouble. The blooming suggested some variation in the B+ or the high voltage with respect to each other. Monitoring of the B+ boost at the cathode of the damper showed a higher than normal voltage at the time of the intermittency. At the other end of the horizontal linearity coil, the B+ boost was lower than the normal voltage. These observations led to the conclusion that the linearity coil had produced an excessive voltage drop.

Replacement of the linearity coil cured the complaint. Subsequent twisting of the defective coil (after removal), while connected to an ohmmeter, revealed that one side had a high resistance; the value of the resistance was up about 600 ohms. This additional resistance caused the blooming due to lowered high voltage; the decreased width was due to lowered B+ boost. Low brightness was also due to the lowered high voltage.

Fig. 2. Problems of sync bar locking in middle of picture, due to leaky coupling capacitors, is illustrated in this photo.



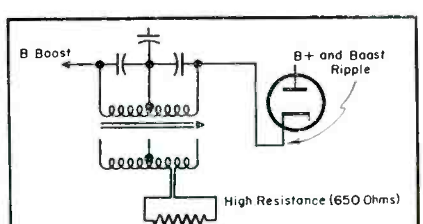
Sync Bar Locks in Middle of Pix

On occasion, one will find the vertical sync bar dividing the picture into two parts, and the vertical will lock into sync normally, at low settings of the contrast control, but with too low a contrast for satisfactory viewing. Advancing the contrast control produces the locking at some other position.

It has been found that usually the trouble is due to leaky coupling capacitors causing a high-resistance circuit. The problem appears in the sync stages, and is associated with a clipper, or stripper. This condition obtains because clipping action does not take place normally with an increase in the sync signal above a certain level, but is normal prior to that point; at least, the action is satisfactory insofar as the operation of the

(*Continued on page 24*)

Fig. 3. Schematic of B-boost portion of Admiral chassis 21B involved in checking blooming and low brightness with narrow width. Trouble in this instance was due to defective linearity coil with too high a resistance on one side of winding.



5 Megacycles Bandwidth
10 Millivolts per Inch Sensitivity
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5 inch OSCILLOSCOPE

Engineered to cover a wide range of modern electronic applications including
MONOCHROME and COLOR TELEVISION

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★ **Push-Pull, Wide-Band Vertical Amplifier:** 10 MV/inch sensitivity
Input Characteristics: 2 Megohms, 22 mmfd.
Response: One DB from 10 cps. to 3.5 MC—3 DB at 5 MC.
Attenuator: 3 step freq. compensated plus a continuously variable gain control in cathode follower circuit.

★ **Direct Reading, Peak to Peak Voltage Calibrator**

★ **Vertical Pattern Reversal Switching Facility**

★ **Push-Pull, Wide-Range Horizontal Amplifier:** 100 MV/inch sens.
Input Characteristics: 2 Megohms, 25 mmfd.
Response: One DB from 10 cps. to 1.0 MC—3DB at 2 MC.
Attenuator: 3 step, freq. compensated, plus a continuously variable gain control in cathode follower circuit.

★ **Linear, Multi-vibrator Sweep Circuit:** 10 cycles to 100 KC plus automatically synchronized 30 cycles and 7875 cycles sweep for TV sync-pulse analysis. Amplified sweep retrace blanking.

★ **Amplified Auto-Sync Circuit** active on all internal sweep ranges.

★ **Four Way Sync. Selector Switch** provides for Internal Negative, Internal Positive, External and Line Synchronization.

★ **3,000 Volt Intensifier Power Supply** assures utmost visibility of 'scope traces. Essential to high frequency and pulsed waveform analysis.

★ **"Z" Axis Input Terminal** for blanking, timing and marking.

★ **Built-in 60 cps Phasing and Blanking Controls** especially designed for more convenient FM, Monochrome and Color TV alignment and sync pulse analysis.

★ **All 4 Deflection Plates Available** with full beam centering facilities.

★ **Tube Complement:** 12AV7 "V" Cathode Follower-Amplifier. 6U8 "V" Amplifier-Phase Splitter. Two 6CL6 Push-Pull "V" Drivers. 6U8 "H" Cathode Follower-Amplifier. 6C4 "H" Phase Splitter. Dual 12BH7 Push-Pull "H" Driver. 12AV7 Linear-Sweep Multivibrator. 6BH6 Auto-Sync Amplifier. 12AU7 Sweep Retrace Blanking Amplifier. OA2 Voltage Regulator. 5V4 Low Voltage Rectifier. Two 1V2 High Voltage Rectifiers. 5CP1/A CR Tube.

★ **High Contrast, Filter Type, Removable Calibrating Screen**

Model ES-550 Deluxe: (Illustrated) In custom-styled, blue-grey ripple finished steel cabinet; 2 color satin-brushed aluminum panel and contrasting dark blue control knobs. Case Dimensions 8¼ x 14½ x 18½ inches. Complete with all tubes, including 5CP1/A CR tube. Comprehensive Instruction Manual......**Net Price: $215.00**

Model ES-550 Standard: Electrically identical to above but in standard black cabinet with black anodized aluminum panel. Case dimensions 8¼ x 14½ x 18½ inches. Complete as above......**Net Price: $210.00**

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for TV Signal Tracing, Alignment, Trouble-Shooting and Waveform Analysis

Engineered for use with all *PRECISION* Cathode Ray Oscillographs, Models ES-500, ES-500A, ES-520 and ES-550.

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Export: 458 Broadway, New York 13, U. S. A. Cables: Morhanex
Canada: Atlas Radio Corp., Ltd., 50 Wingold Ave., Toronto 10

Servicing Helps

(*Continued from page 22*)

sync is concerned. Tube substitution could be tried prior to capacitor replacement since gassy tubes can cause similar symptoms.

Auto Radio Servicing‡

HASH IN auto radios is frequently caused by the *rf* amplifier tube which should therefore be checked. One should also examine the *rf* tube socket for a short between the cathode and filament.

If hash remains, the vibrator should be checked; other items that should be checked include the input electrolytic, hash capacitor in the power transformer, hash chokes and capacitors, and all the grounds in the power-supply circuit.

If hum is present, one should check for an open electrolytic or a short between the cathode and filament in audio tubes or sockets.

Microphonism is almost a thing of the past, especially in auto radios, because the biggest offender, the gang tuning capacitor, is no longer used in most car radios. Permeability tuning has taken its place. Microphonism can still be experienced though, especially in tubes. The elements of some tubes may start vibrating under the influence of the audio signal emanating from the speaker or random noise in the tube itself. These vibrating elements will result in either a loud squeal on strong stations or a series of pings when the tube or radio is jarred.

The oscillation category of objectionable noises encompasses a multitude of sins, but one thing that should be remembered in troubleshooting an oscillation complaint is that any stage that is oscillating will have a fairly high negative voltage with respect to ground at the grid of that stage. With the *avc* circuit tying two or more stages together, oscillations in one stage can cause a high negative voltage to appear at the grid of the other stage. This must be remembered when troubleshooting an oscillation complaint. Usually the oscillating stage can be isolated, when two or more stages are connected by an *avc* line, by removing one tube at a time and noting if the high negative voltage disappears.

Hash is a complaint or condition that is peculiar to auto radios or any radio that uses a vibrator power sup-

‡*Based on copyrighted data appearing in* ***Delco Radio*** *Training Manual 551.*

ply. The hash is a result of the vibrator contacts making and breaking at a frequency of 115 cycles per second. Troubleshooting a hash complaint is usually just a matter of checking the parts inside the radio that have the specific purpose of suppressing hash.

Hum in an auto radio is usually caused by the same defects that would cause hum in a home radio. Many times hum in an auto radio is fed into the signal path through the filaments of tubes. One interesting angle is that if a short between the cathode and filament of the *if* amplifier tube should occur, the result is what would be termed a tunable hum. In other words, the hum only appears when a station is tuned in.

TV Rectifier Tube Replacements

In Stromberg-Carlson X 21-22 and K 21-22 series chassis, the 5U4GA and 5U4GB are 275 *ma* rectifier tubes. The 5U4G, a 225-*ma* rectifier, cannot be used to replace these *A* or *B* type tubes due to the danger of exceeding the current rating of the tube. Similarly, the 6CU6 which is similar to the 6BQ6, has higher rating characteristics than the 6BQ6, and thus cannot be used as a 6BQ6 replacement.

Improving Horizontal Sync on Strong Signals

In field testing Stromberg-Carlson model *X* chassis it was found that it is possible to make an improvement in horizontal sync stability on strong local signals through a shift in resistor values.

Effective with serial number T47706. R_{215} has been changed from 15,000 ohms/1*w* to 27,000 ohms/1*w* and *R* has been changed from 1 megohm/½*w* to 1.5 megohms/½*w*.

UHF Strips Installation

A Standard Coil type *TD* tuner is incorporated in Sparton's 23V5 chassis. Basically its appearance and *uhf* conversion is similar to the Standard Coil tuners used in the past with one exception. A single mixer crystal serving all *uhf* channels is mounted on top of the tuner chassis and must be purchased separately and installed at the same time the *uhf* strips are inserted in the tuner drum assembly. Recommended mixer crystal is Sylvania IN82A. The *uhf* conversion strip type *TD* equipped with harmonic generating crystal has been designed for specified single-channel operation.

Tube News

Multi-Element 600-Ma Miniatures for B-W and Color TV. . . . Transistors for Power, Auto Radio and Portable Uses.

A VARIETY of 9-pin miniature 600-ma series-heating string tubes, which can be used in black-and-white and color TV chassis, have been introduced recently. Two multi-element types, the 6BH8 and 6AU8‡, embody a medium-mu triode and a sharp-cutoff pentode in one envelope.

The pentode units of these tubes feature individually transconductance value of 700 micromhos, and are intended for use as video amplifier tubes. They may also be used as video *if* amps, sound *if* amps, or as *agc* amplifiers.

The triode unit of the 6BH8 is said to have an amplification factor of 17, and be particularly suited for use in low-frequency oscillator circuits. The triode section of the 6AU8, with an amplification factor of 40, is intended for use in sync-separator, sync-amplifier, sync-clipper and phase-inverter circuits. Coupling between pentode and triode units in both types is minimized by shielding.

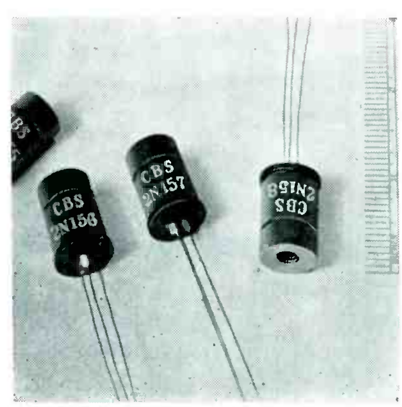
Twin-Triode Miniatures

A 9-pin twin-triode miniature equivalent of the 6SN7GTB, the 6CG7‡‡, has also been announced for 600-ma applications.

Within its maximum ratings, the 6CG7, like its prototype, can be used

‡*RCA* ‡‡*G.E.*

Power transistors, said to feature a broad range of current gain and operating supply voltage. (CBS-Hytron)



as a vertical and horizontal oscillator. It may also be used as a blocking oscillator, phase inverter or multivibrator.

Sharp-cutoff pentodes of the 7-pin miniature type, intended particularly for use as FM detectors in TV receivers, 3DT6 and 6DT6‡, have also been developed recently. The 3DT6 is like the 6DT6, except that it utilizes a heater having controlled heating time for series-heater string arrangements.

Separate base-pin terminals are provided for grid *1* and grid 3. Each of these grids has a sharp-cutoff characteristic and can be used independently as a control electrode.

Because of the sharp-cutoff characteristic of grid 3, the tubes are said to be especially suitable for use in locked-oscillator, quadrature-grid FM circuits. In such circuits, they can perform the combined functions of detector and limiter and provide an audio-output voltage adequate to drive a medium-power output tube such as the 6AQ5.

In a typical locked-oscillator, quadrature-grid FM detector circuit, the tubes are said to be capable of providing a sensitivity of 5 millivolts *rms* with ±7.6-kc deviation and 15 millivolts *rms* with ±25-kc deviation.

The tube labs have also produced a 600-milliampere controlled warm-up horizontal deflection amplifier, the 12DQ6, with high perveance, permitting the design of high efficiency 90° deflection systems.

Power, Auto-Radio Transistors

A NEW SERIES of power transistors featuring use of a copper base, bolted to the chassis, which it is said allows the heat to flow from the power transistor to the chassis, providing a large area of heat radiation, has been developed.

One type, 2N156[a], when used in a radio can furnish 8.5 watts of audio power output to a speaker with less than 85 milliwatts of drive power input.

All (2N155, 2N156, 2N157, and 2N158[a]) are *pnp* germanium-alloy junction types. Electrical characteristics include high gain at high current levels and low saturation currents.

Two transistors (2N139 and 2N140[b]) intended for use in the *if* and converter stages of transistorized portable and auto radio receivers, have also been announced. The transistors are germanium-alloy *pnp* junction types, housed in insulated metal envelopes.

‡*RCA* [a]*CBS-Hytron* [b]*RCA*

(Right)

Batteries for transistor applications. At right is model designed for voltages of 3, 6 and 9 volts from a small four-hole socket mounted flush with the battery case. In center is a 9-volt type designed for transistorized personal portables. Snap fasteners on both ends act as terminals. At left are two views of a special type of transistor battery, featuring 15 separable 1.4-volt alkaline-type dry cells enclosed in a plastic sleeve. Voltage required for any experimental transistor application is obtained by slicing off the number of cells needed, as illustrated in the photo at extreme left.
(RCA)

Color TV Instruments

(*Continued from page* 20)

parts by the 189-kc multivibrator. Two of these occur during blanking, and 10 appear as color bars. Electrically, the centers of these bars are 30° apart, and the bars are 15° wide. Since the phase angle changes from the start to the finish of each bar, the color of the individual bars is not uniform.

The angles corresponding to bar centers in some cases correspond closely to the angles of the transmitted color difference signals. The display from left to right is: Bar 1—*yellowish orange;* bar 2—*orange (+I);* bar 3—*red +(R-Y);* bar 4—*bluish red;* bar 5—*magenta (+Q);* bar 6—*blue +(B-Y);* bar 7—*greenish blue;* bar 8—*cyan (—I);* bar 9—*bluish green —(R-Y)* and bar 10—*dark green.*

The color bar pattern is generated in the first two positions of the pattern selector. In the first position, the sound carrier is present so that the receiver fine tuning control can be properly adjusted. This setting is correct when the approximate 900-kc beat between the 3.579545-mc *chroma* frequency and the 4.5-mc sound carrier is just *extinguished.* In this *sound* position, no *sound modulation* will be delivered to the sound channel. There is an identification marker in the form of a white line between bars *2* and *3* and between bars *6* and *7.* This marker has been found to simplify operation because the bars can be identified despite over-scanning and color errors.

Next on the pattern switch is the *black-white bar* position. This signal is used for setting white balance.

The patterns developed in switch positions *4, 5,* and *6* result from combining the voltages developed by the 189-kc and 540-cycle multivibrators. The vertical line pattern in position *4* is used to check and adjust horizontal and vertical dynamic convergence. Position *5* produces white dots used for convergence adjustments, and the crosshatch position *6* is used to check and adjust both static and dynamic horizontal and vertical convergence.

Seven 12AT7s are used; they're in the 189-kc and 47.25-kc blocking oscillators, 189-kc multivibrator, 15-kc multivibrator, 3.563795-mc oscillator and sound-carrier oscillator, picture carrier oscillator and video amplifier, 60-cps multivibrator, and 540-cps multivibrator.

A 12AU7 serves as the sync mixer and 540-cps blocking oscillator. A pair of 6CS6s are used in a gate circuit and as a 3.563795-mc color gate.

NEWS

IRC PREXY WEYL HONORED

Charles Weyl, president of the International Resistance Co., Philadelphia, has been awarded a *Centennial Citation* by the University of Pennsylvania, "for stimulating advocacy of the humanities in the engineering curriculum, for pioneering work in radiologic physics, and for responsible administration in the graphic arts and electrical manufacturing industries."

° ° °

HAYDU TV TUBE INTERCHANGEABILITY CHART

A TV tube chart, listing popnlar types of picture tubes plus the corresponding tube types made by Haydu, has been released by Haydu Brothers of N. J., subsidiary of Burroughs Corp.

Charts include tube types and a description of face type, external conductive coating and ion trap magnet.

Haydu replacement tubes are said to be available in all sizes of glass, metal and aluminized types; round, rectangular, cylindrical, spherical; electromagnetic and electrostatic focus.

° ° °

RADIO RECEPTOR TO UP SELENIUM PRODUCTION

Radio Receptor Company, Inc., Brooklyn, N. Y., has announced that it is expanding its selenium production facilities and installing new equipment; adding an additional 24,000 square feet of space at its plant at 84 North 9th St., to increase its output by about 40% in '56.

To assist in reclaiming selenium, due to shortage, company is offering distributors ten cents each for the return of used selenium rectifiers.

° ° °

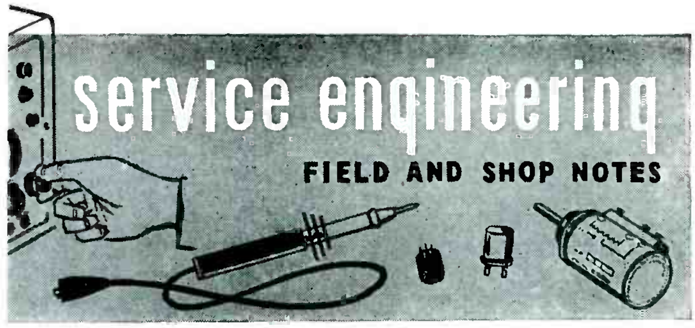
SPENCER-KENNEDY EXPANDS

Spencer-Kennedy Laboratories, Inc., has moved into a new plant on 1320 Soldiers Field Road, Boston, which it is said will more than double its existing manufacturing and engineering space.

° ° °

SELENIUM DIODE CONTEST WINNER

Dr. Lee de Forest, presenting keys to 56 Ford, first prize in the recent International Rectifier Corp. selenium diode contest, to the winner, Harry J. Kayner, senior research engineer at the Advance Plant of North American Aviation. Looking on are: J. T. Cataldo (right), assistant general manager, and F. W. Parrish, the company's chief design engineer. Award was made at a luncheon held in the Hotel Statler, Los Angeles.



SERVICE ENGINEERS, engaged in servicing two-way mobile radios, must be particularly alert and resourceful, and have broad technical and mechanical know-how. They must be able to deal with personalities involved in varied industries such as manufacturing, transportation, taxi, public safety, or, just the plain public. They must have a good knowledge of the automotive industry, be familiar with the physics of a body in motion, and of course, above all, be a good radio service engineer. It is this variety of life that makes *mobile radio service engineering* one of the most interesting occupations and one of the most lucrative.

The manufacturers of mobile radio equipment have long recognized the problems involved in servicing of mobile equipment, and evolved simplified systems. In some cases, for example, they have designed package units which can be interchanged quickly with other units, or any portion of the unit may be interchanged; the transmitter, receiver, or power supply can be interchanged with similar units. The importance of this feature is obvious when we consider that most vehicles equipped with radio earn money only when they are on the move.

In one line of low-band mobile equipment* these design characteristics have received headline attention. For example, individual circuits can be monitored at the circuit stage itself, which provides quick isolation of individual stages. Point-to-point component layouts have been adopted to ease reading of circuit schematics and simplify changeability of components.

Equipment Variables

The service engineer involved in servicing low-band mobile units is faced with a variety of equipment. Examining one of the package units we would find three fundamental strips; transmitter, receiver and a power supply.

The transmitter may be a 30, 60 or 100-watt crystal controlled phase-modulated unit. The modulation may be set at ± 13 to ± 15 kc or ± 14 to ± 5 kc, depending whether or not the unit is to be used in a wide band or narrow band system.

The receiver will be found to employ a double conversion superhet circuit in which both oscillators are crystal controlled. Whether or not the receiver was a wide- or narrow-band would not be apparent unless the *if* stages were closely examined; the selectivity of the receiver depends upon the bandwidth of the low *if*. In modern-type mobile communication receivers this means that the spacing of the *if* transformer coils must be changed and coupling capacitors must be deleted or added.

The power supplies are 6/12-*v dc* input units; these are required because of the variations in ignition systems used in the automotive industry. The power supply may be a straight vibrator or vibrator dynamotor; the determining factor is usually dictated by the output power rating of the transmitter.

The problems service engineers face, start the day the customer places the order. Planning and evaulation of the

G.E. Progress Line of communication equipment.

Repair and Maintenance of Low-Band Mobile Communications Equipment

by GEORGE W. VASS

Supervisor, Communications Field Engineering
General Electric Company

type of installation to be made determine, to a great extent, the efficiency of the system and the amount of maintenance the future operating system will need.

For example, there are five possible ways that a unit can be mounted in the trunk of a normal car and one mounting that can be used for the front. However, since there are as many different types of automobiles, trucks and jeeps as there are types of package units, we have variations in type of operation. If the vehicle is to be used in rough service, then the study of motion is important. Every point of contact between the unit's component parts and between the vehicle are potential trouble spots. To illustrate, the control cable between the control unit and the mobile radio package has three points of contact; one at the control unit, one along the body of the vehicle, and one at the mobile radio itself. Care must be taken to see that, at the control unit there is sufficient cable, so that the control unit may be easily removed for service, and yet the cable must be dressed so it is not in the way of the operator. Loose or excess cable will frequently result in problems when the leads tangle with a pair of working boots. As the cable is dressed along the vehicle's body, one must avoid sharp angles or corners which through vibration may cut into the cable; or where heavy tools or sharp objects may be dropped or laid on the cable. At the mobile unit care also must be taken to avoid excess cable which may be damaged when heavy objects are placed in the trunk. The cable should be securely fixed in position, but with enough slack to permit the unit to be removed from its unit for service. The same precautions must be taken with the power leads and battery cables. The importance of the installation cannot be overemphasized.

One of the early problems, which affect the over-all operation of any low-band system, is encountered in the installation of the antenna, which must be cut to the proper length. The length of course depends upon the frequency of operation. The mixture of 25 to 50-mc low-band signals and ignition noise from the vehicle can be expected to produce a situation; this can be expected more in low band range, than in the 150 or 450-mc bands. This has been established not only by experience but also by tests; several years ago during a series of tests, it was found that at approximately 30 mc the curve humped and then tapered off down to the 150-mc band.

The ignition noise problem is another area where there are almost as many cures as there are causes. However, some generalization can be applied. The first step is isolation, or in this case, finding the source of the problem. The source may be determined with the aid of loop stick and indicator, such as 'scope or by the trial and error method. The important fact is to determine the source. In general, ignition noise is caused when the distributor contacts close, when the spark plug fires, or each time there is a break down between the gap of the rotor electrode and the cap insert of the distributor. There is also transient noise, which is picked up in the secondary of the coil transferred to the primary of the coil and may well appear at any point in the vehicle which has contact with the battery.

IF RESPONSE Curves

How to Interpret Them . . . Application During Installation and Repair

by ROBERT D. WENGENROTH

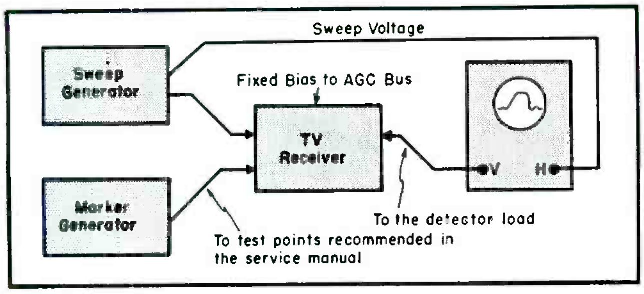


Fig. 1. Setup of test equipment required to align a TV receiver.

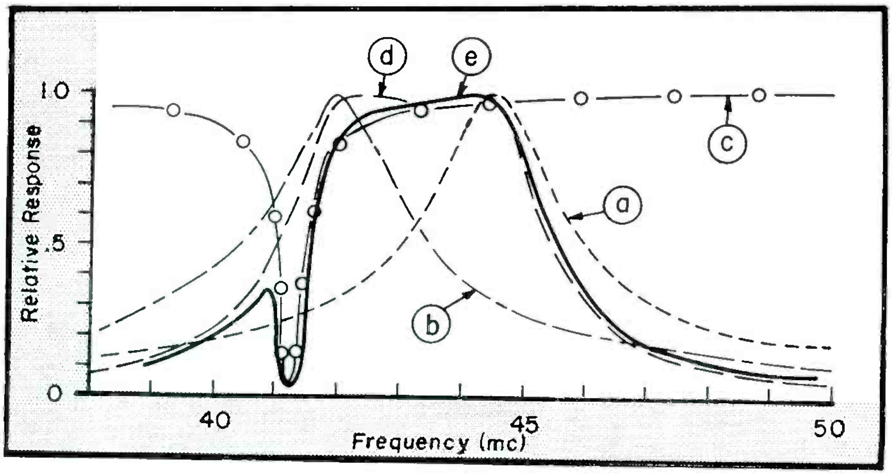
The *if* response curve of a TV or FM receiver can supply not only valuable performance information, but reveal where defects exist and what components are at fault. After the normal servicing routines have apparently returned the set to its proper operating condition, a bench check of performance often indicates that difficulties still exist. Typical indications are poor definition, *ghosts*, or, in the case of FM, distortion of sound. The troubles may be due to simple misalignment; however, changed part values, which make proper alignment impossible, may also obtain. A knowledge of the factors affecting the *if* response enables one to locate the defective components with a minimum of difficulty.

The *if* response of a TV receiver is established by a group of tuned circuits functioning together as a band-pass filter. The response is correct only if each circuit is tuned to the correct frequency and has the proper *Q*. In aligning a receiver, only the frequency of the circuit is changed; the *Q* is fixed by the loading resistors, by the resistance of coil itself, and by the resistances of the tubes connected to the circuit. However, when a part of the tuned circuit is replaced, in repairing a set, the *Q* can be changed if the component is not an exact replacement. Therefore, great care must be taken to ensure that replacement parts in an *if* system have the proper values; otherwise it will be impossible to maintain original performance values.

Three pieces of test equipment are required to align a TV receiver *if* amplifier, as indicated in Fig. 1. One is the sweep generator which must sweep the entire pass band of the receiver, plus a little more; a 12-mc range is desirable. For the standard 40-mc *ifs* a sweep of from 38 to 50 mc is preferred; 40 to 48 mc will be barely enough. The output should be constant throughout the sweep; the maximum variation should be not more than 1 db (10 per cent in voltage) within the 12-mc band. The second item, the marker generator, should be well calibrated and cover the same frequency range. Its output amplitude should be readily adjusted over a wide range, and should be kept at the minimum which will make a visible marker on the trace. Too much marker will distort the trace, making alignment impossible. If crystal controlled, the following frequencies should be available: 45.75 mc (visual carrier *if*); 41.25 mc (aural carrier *if*); 45 mc, 42.75 mc, 41.75 mc (response-curve check points); 47.25 and 39.75 mc (adjacent-channel carrier *ifs*). Not all of these are always used; only the 41.25 and 45.75-mc values are critical. However, all the other frequencies should be accurate to within .25 mc.

The 'scope, the third unit in the test chain, should have a frequency response down to about 6 cycles; the high-frequency response should be above the audio range. A very wide bandwidth can cause marker beats to be broad on the display; response above 100 kc is undesirable and can be eliminated in a wide-band 'scope by bypassing the input with a capacitor. The capacitor should not distort the response display, but it should reduce the marker beat width so that the center of the marker is apparent; its value should be determined experimentally, but will be about 500 mmfd.

Fig. 2. Achieving a TV-type response curve in a stagger-tuned amplifier; this is an exaggerated illustration for only two stages and not an actual receiver curve: a = response of first tuned amplifier, b = response of second tuned amplifier, c = response of trap, d = response of first and second tuned amplifiers (no trap), and e = response of first and second tuned amplifiers, with trap.



Because the response changes with *agc bias*, the automatic-gain control of the receiver must be disabled. This is normally done by connecting batteries to the *agc* bus. Instructions for this, and for the proper points to connect the sweep generator, marker generator and the 'scope, together with any special precautions or instructions, normally appear in the receiver's service manual. It should be remembered that the set manufacturer has a reason for each suggestion offered in the manual; deviations from the instructions may lead to difficult or improper alignment. On a properly aligned receiver the response curve will look like that in the manual, similar to the plot in Fig. 2a; p. 36. If the response does not fall with-

(*Continued on page 36*)

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in the limits illustrated in the manual, the receiver needs alignment or repair.

The rapid interpretation of the 'scope display of the *if* response requires considerable experience. However, without experience but with a knowledge of the tuning requirements of the *if* system, one can determine the cause of such distortions of the response as peaks, too great bandwidth, inadequate trapping, or *jumping* displays. Basically, a television *if* consists of several amplifier stages tuned to slightly different frequencies to provide wide-band response, and traps which provide sharp reductions in response to eliminate undesired parts of the signals. Fig. 2 (p. 35) shows the development of an *if* response type curve, involving two cascaded stages with one trap; values are exaggerated to show the effects. The response of the two stages without the trap can be compared to the curve showing the effect of the trap. The *Qs* of the two stages are shown equal; if they were unequal the responsive curve would be unsymmetrical even without the trap. In practice, four tuned circuits, rather than the two illustrated here, are employed to produce an acceptable responsive curve. Each part of each amplifier circuit affects the over-all response; it is important that the contribution of each part be known when a distorted *if* response curve must be corrected.

The important components in an *if* stage are shown in Fig. 3. The plate circuit of the first tube appears as resistance and capacity in parallel. Stray wiring capacity is also in parallel with the tube. Together they form

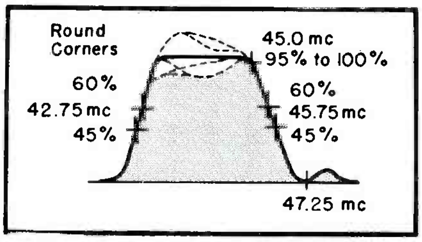


Fig. 2a. Typical if **response curve, showing acceptable limits on response.** (Magnavox models CTA475AA and CMU475AA through CTA481AA and CMU481AA.)

the tuning capacity for the transformer. The plate-bypass capacitor is in series with these tuning capacities; because it is large compared to the tuning capacities; its size is not critical. The primary of the transformer has both inductance and resistance; it tunes with the capacities indicated. The secondary is similar, with both inductance and resistance; the grid circuit also has capacity and some resistance. The damping resistance, with both inductance and capacity, loads the tuned circuit to provide proper *Q*. Because tubes are similar and are only part of the capacity and resistance presented to the circuit, their replacement is not critical. The transformer and damping resistor, however, are critical and care should be taken in replacing them.

The replacement of *if* transformers in the picture *if* amplifiers will not cause difficulty when replacements having exactly the same characteristics are employed. Replacement with other than an electronic duplicate should be made only if the proper transformer cannot be obtained; a change in bandpass can be expected. This can sometimes be corrected by changing the damping resistance; however, the process is often difficult and unsatisfactory.

The replacement of damping resistors is simple, but may lead to trouble. These resistors adjust the *Q* of the circuit to the proper value for the required response. Since they are part of the tuned circuit, the inductance, capacitance, and resistance of the replacement unit should be the same as that of the unit replaced. If the replacement resistor has too high an inductance, the *Q* of the circuit will be too high, even though the circuit can still be tuned to the proper frequency. The result will be too high a response near the frequency to which the circuit is tuned. Extra capacity across the resistor will also detune the circuit; when it is retuned, the *Q* will be low and the response will be broadened. If the resistance value is too high, the *Q* will be too high; too low, the *Q* will be too low.

The relation between resistance and *Q* is a clue when proper response cannot be obtained during receiver alignment. It is not easy to locate which damping resistor is off-value, especially if the error is small. However, when a particular tuning adjustment is very sharp or very broad, compared to that on other receivers of the same type, it is likely that the associated damping resistor is in error. An ohmmeter will check this out. An ohmmeter check of all the damping resistors may indicate several values near the tolerance limit; this can

(*Continued on page* 53)

(Below)

Fig. 3. Schematic (a) **and equivalent circuit** (b) **of one stage of a typical video** if **amplifier system,**

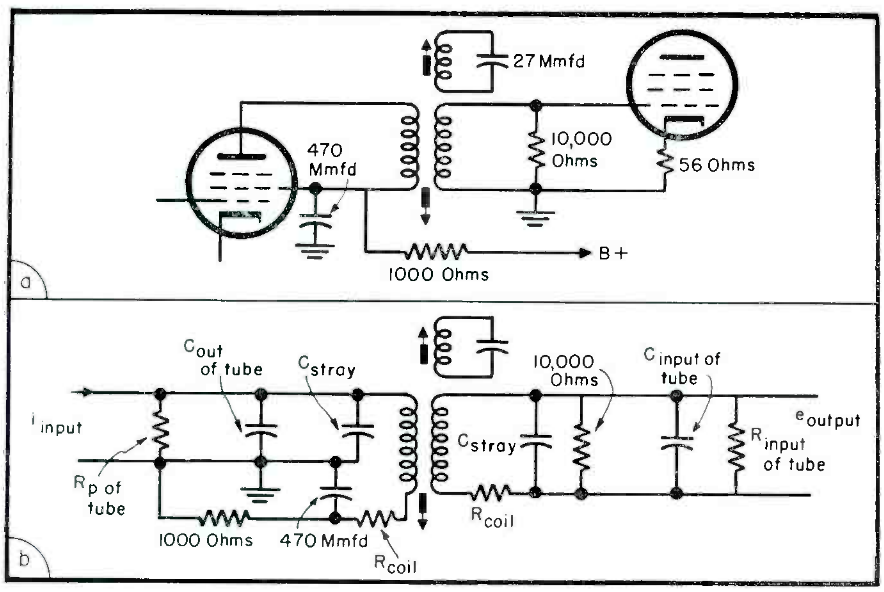
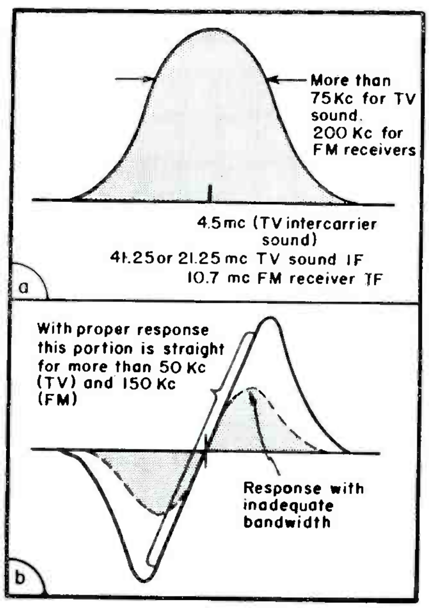


Fig. 4. FM response curves for TV sound or FM receivers: a = **response at limiter,** b = **response at discriminator or ratio-detector output.**



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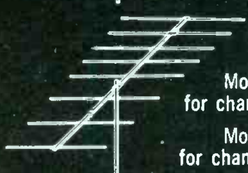

Model Y8X1 (10-11) for channels 10 and 11.

Model Y8X1 (12-13) for channels 12 and 13.

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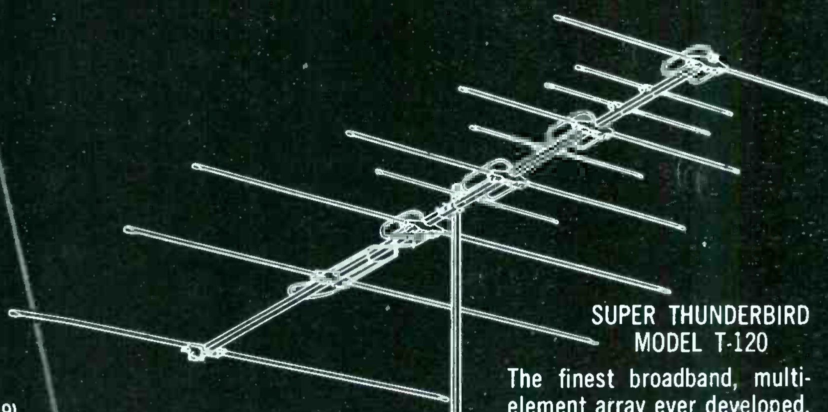

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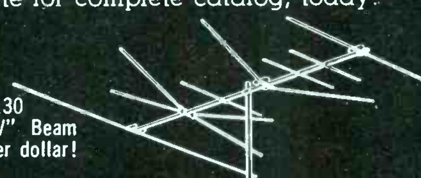

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TV Antenna Digest

(*Continued from page 19*)

aeronautical charts, it becomes feasible for our engineers to engage in the long-distance diagnoses and treatments already mentioned. Not only can they recommend the type antenna that should be suitable for the given location, but also its proper installation. It must be pointed out, however, that there may be local terrain and building conditions which may not figure in the statistical procedure, but which also enter into the antenna selection and installation. However, the statistical procedure is at least a sound starting point.

Another group of data deals with transmitter coverage in given areas. Metropolitan New York, for instance, has seven channels. The corresponding tabular page gives the channel, network affiliation, power of transmitter, transmitter antenna height, and field strength in microvolts-per-meter at distances from 10 to 120 miles. Knowing the distance from the given transmitter, it is possible to note the average available field strength in a given locality and be guided accordingly in the selection of the antenna and its installation.

All of which accounts for those long-distance diagnoses and recom-

Channel	2	11	13
Network	CBS	NBC	ABC DuMont
Power	100 kw	316 kw	316 kw
Antenna height; average above terrain	380'	543'	550'
Distance from station	Field Strength In Microvolts-Per-Meter		
10	12,000	40,000	40,000
15	5,600	19,000	19,000
20	2,700	11,000	11,000
25	1,600	6,500	6,500
30	1,000	4,200	4,200
35	675	2,700	2,700
40	500	1,700	1,700
45	300	950	950
50	210	600	600
55	140	320	320
60	95	200	200
65	65	110	110
70	50	68	68
75	35	42	42
80	26	25	25
85	21	17	17
90	17	11.5	11.5
95	16	10	10
100	14	8	8
105	12.5	7.3	7.3
110	11.5	6.4	6.4
115	10	5.8	5.8
120	9.5	5.2	5.2

Coverage chart for Baltimore, Md., TV stations.

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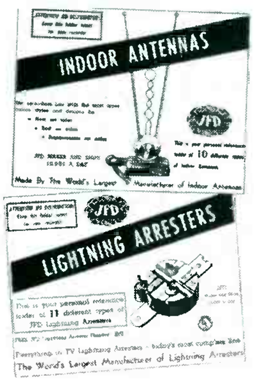
mendations based on sound facts. Much of the guesswork is eliminated. Better results are assured because we now have a basic working knowledge of what we are up to in trying to bring satisfactory reception to those remote localities, and what we can do about it.

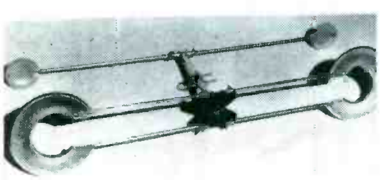
•

Antenna Developments



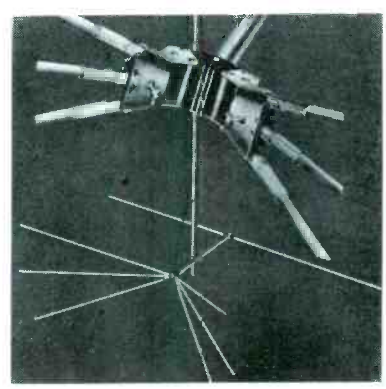
Above: Portfolios covering indoor antennas and lightning arresters. Indoor antenna folio presents reference material on 10 different types of indoor antennas. Lightning arrester folder covers eleven different UL approved types. Presentation sheets are accompanied by a price schedule and marketing information. (JFD Mfg. Co., Inc., 6101 16th Ave., Brooklyn, N. Y.)

Below: Conical antenna with aluminum reflector discs on larger leg die-cut with holes to withstand high velocity winds. (Torque-Tenna model AX-100; Snyder Mfg. Co., 22nd and Ontario Sts., Philadelphia 40, Pa.)



Left: Towers featuring streamlined design incorporating taper and 1¼" electrically-welded steel tubular uprights. Towers are shipped nested to ease storage. (Models 200, 240 and 400; Jontz Mfg. Co., 1101 East McKinley, Mishawaka, Ind.)

Right: Vhf all-aluminum antenna featuring elements that snap out and lock into place automatically; no hardware, tools, or tightening are said to be necessary. All elements are reinforced with ½" diameter external aluminum sleeves, 3½" long, claimed to absorb vibration and prevent breakage caused by crystallization of the metal. Available in 2 series, offering a choice of either seamless or butted aluminum tubing. (Super-Fan series 313A seamless tubing and series 713A butted tubing elements: Channel Master Corp., Ellenville, N. Y.)



Evolution of the Modern Radio

A Field Research Program Report: Part II

by GEORGE HATHERSON

When ac-dc receivers first appeared, during the late 1930's, before tubes designed to utilize the full line voltage for their filaments became available, we find that circuits were basically similar to those used today. One typical receiver* included a 6A7 converter, 6D6 *if* amplifier, '75 detector and audio amplifier, '43 audio output amplifier, and a 25Z5 rectifier. The tubes required .3 amp heater current, with a 6.3-volt drop across the 6A7, 6D6 and the '75, and 25 volts across the '43 and the 25Z5. The total of 69 volts required a ballast tube to drop the remaining 50 volts. One of the most noticeable differences between this and the modern chassis is the additional components utilized in decoupling and filtering leads. In part this was required by the use of fixed bias on the audio amplifier and output stages.

The 6A7 pentagrid converter used in this earlier model was designed for a tuned-grid plate-feedback oscillator. The cathode was grounded, the first grid circuit tuned, and feedback was supplied by a feedback coil in the second grid circuit. The third and fifth grids formed a screen around the fourth grid to which the incoming signal was applied; this tube had no suppressor grid. However, except for the feedback being from the second grid rather than the cathode, the circuit is recognizable as electrically the same as the circuit in today's receiver.

Another common converter circuit, often found in older receivers, included a 6L7 converter tube and a separate oscillator tube. The oscillator was capacitively coupled to the oscillator injection grid of the 6L7, grid 3. The incoming signal was applied to grid *one* of this pentagrid mixer.

In another converter circuit, which has disappeared, a 6K8 triode-hexode converter was used. This tube included a triode and a hexode mixer oscillator; the cathode and first grid were common to both sections. The triode oscillator was operated in a tuned-grid plate-feedback circuit; injection was accomplished by the portion of the common grid which was in the hexode section. The second and fourth grids of the hexode were screen grids; the third grid was the signal grid. The cathode and plate were the two remaining elements of the hexode section.

From the time the superhet receiver replaced the tuned-radio amplifier receiver, the circuits have changed only to accommodate the slightly different characteristics of improved tubes. The pentagrid converter, in its present form was accepted slowly, so several forms existed for the converter section of the receiver; however even there the similarity was strong.

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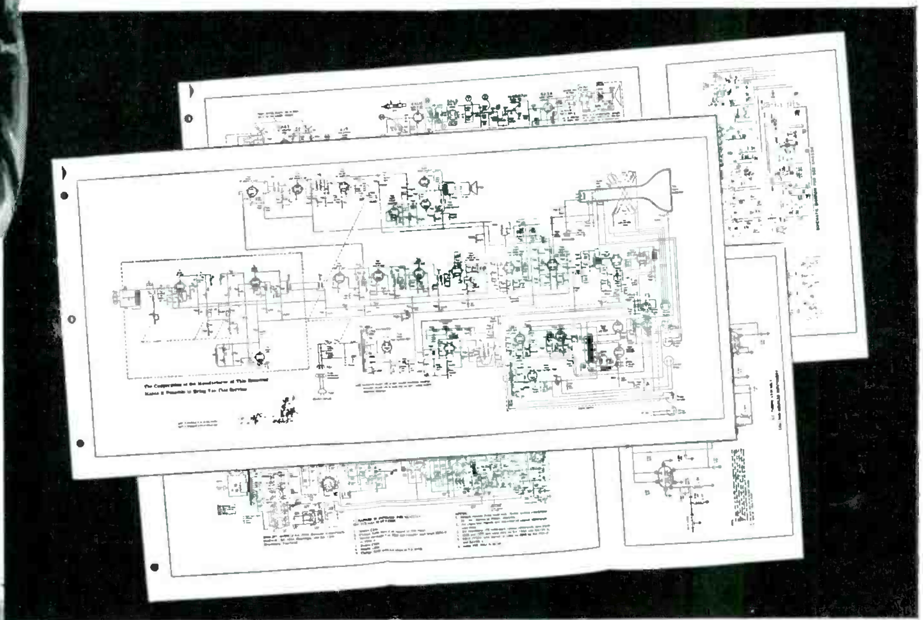

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AUDIO INSTALLATION AND SERVICE

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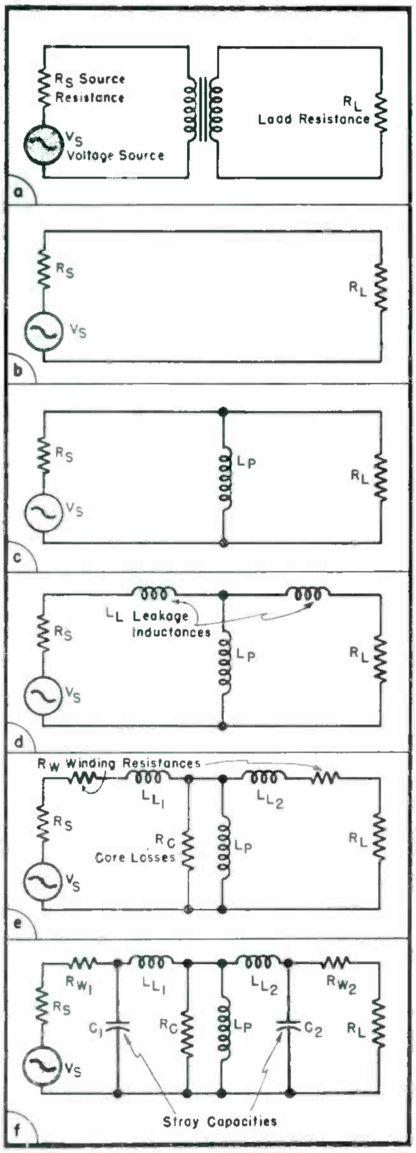
Audio Transformers for Output Coupling: Their Design and Relation to Circuit, Tubes and Components, and Performance



A COMMONLY USED but seldom appreciated component in audio systems is the audio transformer. While it is one of the most reliable components in a system, it also has many restrictive design factors with which to contend. In high quality amplifiers the transformer is the limiting element for frequency response, and often contributes a considerable part of the distortion which is present. In amplifiers with a large amount of feedback, an improper transformer may introduce phase shift which causes instability.

The transformer ideally transfers power from one set of terminals to another, usually changing the ratio of voltage to current, but keeping their product constant, and not introducing new frequency components. Put in a different way, the ideal transformer may have a transformation ratio, is 100 per cent efficient, and has no distortion. Because it is 100 per cent efficient, it has no frequency sensitivity. In practice, no transformer meets these requirements. Single-frequency power transformers attain high efficiencies (near 99 per cent), but transformers for wide-frequency ranges such as audio transformers do not. This is due to a number of conditions; the amount and kind of core material, the wire and the way it is wound all are limited by requirements for wide-frequency response, and for a practical unit which can be built and sold.

A practical transformer can best be understood by comparing it to an ideal transformer, using other basic components, resistors, capacitors, and inductors to represent its deficiencies. To illustrate, let us start with an actual circuit shown in Fig. 1*a*. The source is pictured as a generator, V_s, with an internal resistance R_s; this can represent a vacuum tube with its plate resistance. If the load resistance is multiplied by the square of the turns ratio of the transformer, we get its apparent value as seen in the primary. For a perfect transformer the circuit of Fig. 1*b* would represent this load connected directly to the generator.

However, a real transformer draws some magnetizing current to set up the magnetic field in the core. The effect of this magnetizing current is the same as that of an inductor across the circuit; this is shown as L_p in Fig. 1*c*.

Because all of the magnetic flux of the primary does not link the secondary winding, the transformer appears to have a small inductance in series with it. Similarly the sum of the flux of the secondary fails to link the primary, so another inductance appears in series with the secondary. These two inductances, L_{L1} and L_{L2} are indicated in Fig. 1*d*.

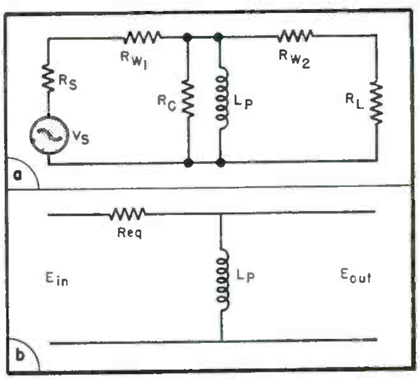
The core of the transformer is made of a ferromagnetic material which has a hysteresis loss. This loss can be represented by a resistor in parallel with the primary inductance; it is represented by R_c in Fig. 1*e*.

Another loss in the transformer results from the transformer's windings which have resistance; these resis-

(*Continued on page* 44)

(Left)

Fig. 1. The development of an equivalent circuit: a = **actual circuit,** b = **circuit for a perfect 1:1 transformer,** c = **circuit when the inductance is finite,** d = **circuit when coupling is not complete,** e = **circuit with losses included, and** f = **complete circuit with stray capacities.**



(Right)

Fig. 2. Transformer equivalent circuit at low frequencies: a = **complete and** b = **simplified.**

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7 **A.C. VOLTAGE RANGES:** (At a sensitivity of 5,000 Ohms per Volt) 0 to 15/75/150/300/750/1500/7500 Volts.
3 **RESISTANCE RANGES:** 0 to 2,000/200,000 Ohms. 0-20 Megohms.
2 **CAPACITY RANGES:** .00025 Mfd. to 30 Mfd.
5 **D.C. CURRENT RANGES:** 0-75 Microamperes, 0 to 7.5/75/750 Milliamperes, 0 to 15 Amperes.
3 **DECIBEL RANGES:** — 6 db to + 58 db.

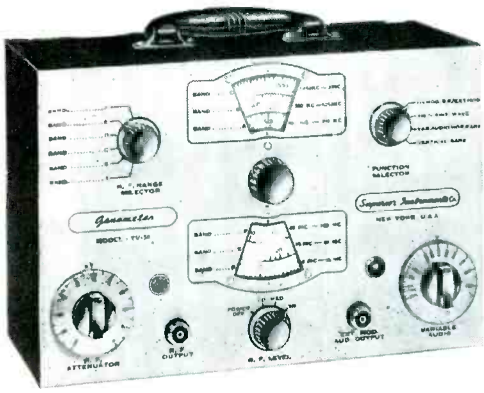
R.F. SIGNAL TRACER SERVICE: Enables following the R.F. signal from the antenna to speaker of any radio or TV receiver and using that signal as a basis of measurement to first isolate the faulty stage and finally the component or circuit condition causing the trouble.

AUDIO SIGNAL TRACER SERVICE: Functions in the same manner as the R.F. Signal Tracing service specified at left except that it is used for the location of cause of trouble in all audio and amplifier systems.

Model TV-60 comes complete with book of instructions; pair of standard test leads; high-voltage probe; detachable line cord; R.F. Signal Tracer Probe and Audio Signal Tracer Probe. Pliofilm bag for all above accessories is also included. Price complete. Nothing else to buy. ONLY **$52.50 NET**

Superior's New Model TV-50

GENOMETER



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

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

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

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

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

7 Signal Generators in One!

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

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

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

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

THE MODEL TV-50 comes absolutely complete with shielded leads and operating instructions.

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

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

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☐ Model TV-12.........Total Price $72.50 $22.50 within 10 days. Balance $10.00 monthly for 5 months.

Audio

(*Continued from page* 42)

tances are represented by the two resistances R_w in Fig. 1*e*.

Both the primary and secondary windings have capacity to ground. Capacity also exists from one winding to another in simple transformers. In most units, however, shielding is employed to eliminate this capacity; it is actually replaced by a similar amount of capacity to ground. These capacities are represented by C_1 and C_2 in Fig. 1*f*.

It should be noted that the actual values of the secondary leakage inductance, winding resistance, and stray capacity are multiplied by the square of the turns ratio, as was the load resistance, to give their apparent effect, as shown in the equivalent circuits of Fig. 1.

In practical transformers the primary inductance is large enough and the leakage inductances and stray capacities are small enough so that three separate frequency ranges can be considered. There is the mid-frequency range where only the resistances need be considered. There is a low-frequency range where only the resistances and the primary inductance are important; and there is a high-frequency range where the resistances, the leakage inductances and the capacities are important. In the mid-frequency range the transformer appears as a *T* attenuator pad; its loss sets the efficiency of the transformer. Typical values of efficiency of transformers are about 60 per cent for medium quality transformers and near 90 per cent for high quality transformers.

Fig. 2*a* is the equivalent circuit for low frequencies as described. This can be simplified to the circuit in Fig. 2*b*, where R_{eq} is the series-parallel combination of the resistances. The resultant frequency response is indicated in Fig. 3; f_1 is the frequency where the inductive reactance X_L (which equals $2\pi fL$) equals the resistance R_{eq}. The loss at this frequency is 3 db more than the loss in the mid-frequency range.

HF Equivalent Circuitry

The equivalent circuit for high frequencies is shown in Fig. 4*a*. In the case of output transformers the capacities are usually small enough to be ignored. The resistances can be combined into an equivalent resistance, R_{eq}, and the inductances can be combined into the equivalent L_L as shown in Fig. 4*b*; the frequency response of this circuit is shown in

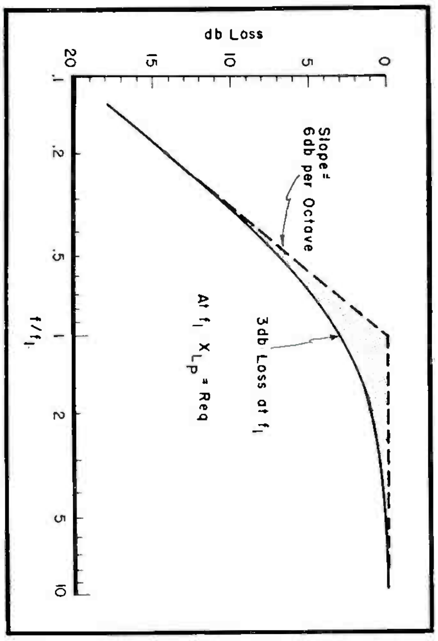


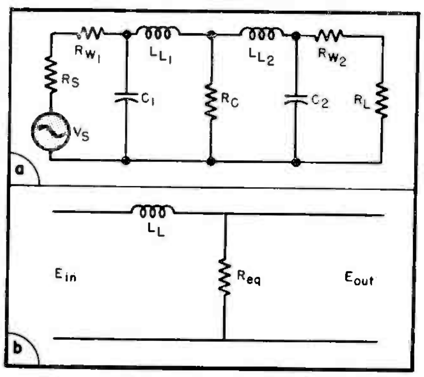
Fig. 3. Low-frequency response of transformer.

Fig. 5 (p. 46). In this case f_2 is the frequency, where the reactance of the equivalent leakage inductance is equal to the resistance R_{eq}, and the loss is 3 db greater than midband loss. While this simplified circuit is adequate for describing an output transformer, the capacities must be considered for input or interstage transformers. In this case, the analysis is more complicated; the capacities resonate with the leakage inductances giving a response curve which may have a large peak if the equivalent resistance is high enough.

In the foregoing discussion we assumed that each component of the equivalent circuit was a fixed-value element. For power levels well below rated power levels of the transformer this is true. However, at high power levels several components appear to change value. This is so because the magnetic material of the transformer core tends to saturate. As a result, a

(*Continued on page* 46)

Fig. 4. Transformer equivalent circuit at high frequencies: a = complete and b = simplified for output transformers.



Audio

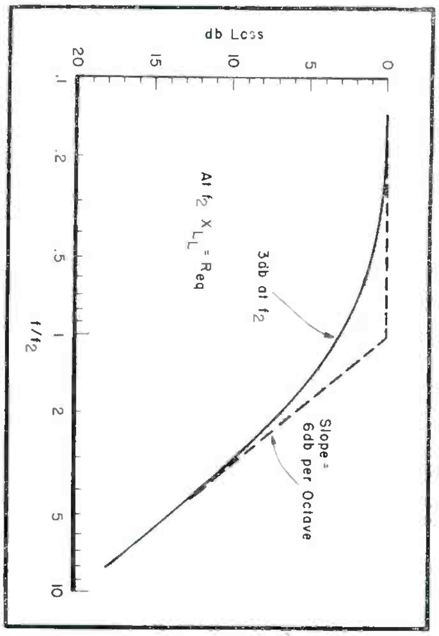
(*Continued from page 45*)

greater percentage of the applied power is lost in the core, more of the primary flux fails to link with the secondary winding, and much more current must flow to provide magnetization of the core. Therefore the resistor R_e, which represents the core losses appears to be small, the inductors L_L which are the leakage inductances appear to be larger, and the inductor L_p, which draws the magnetizing current, appears to be smaller. When we check the effects of these changes on the frequency response, we find that both the high and the low-frequency response falls off, and that the mid-frequency efficiency decreases. This is why two frequency-response curves are often shown for audio transformers; at normal levels the response is better than the response at the maximum rated power levels.

The effect of high power is not only on the frequency response; the more important effect is on distortion. The change in values of the equivalent circuit components occurs continuously within one cycle of the audio signal. As a result, the peaks of the signals tend to be flattened; this means that distortion is introduced. The distortion is usually the factor which limits the power handling abilities of a transformer.

We have discussed how a transformer performs; now let us analyze the applications of audio transformers. In modern home-type equipment, the

Fig. 5. High-frequency response plot of output transformer.



only common audio transformers are output transformers. Only a few high-power amplifiers require driver transformers, and input or interstage transformers are almost never seen.

Obtaining quality or power capacity in a transformer is expensive; it is desirable that the proper transformer be included in a system so that the best response can be obtained for the price of the unit. This is as true in replacing a transformer when a set is being serviced, as when a set is being designed. For the typical moderate-cost receiver, one should select transformers that have the proper power capacity, the proper transformation (turns) ratio and work between the proper impedance levels (have proper values of L_p and L_L). Suitable units can readily be selected from transformer catalogs. The quality of the unit should be consistent with the value of the receiver or amplifier. When a transformer is to be selected for a high quality amplifier, great care should be exercised. This is especially true when feedback is taken from the secondary of the transformer.

The selection of a transformer for a high quality amplifier requires consideration of a number of factors. The circuit of Fig. 6 is an example of a quality amplifier* for which a quality transformer must be selected. Because the frequency response is within 1 db from 10 to 40,000 cps, a very high-quality transformer is required. Feedback from the transformer secondary both improves frequency response and decreases distortion. However, it puts severe requirements on the performance of the entire amplifier. Improper design could cause an amplifier with so much feedback to oscillate; it is necessary that the response of each stage of the amplifier be designed so that the over-all response is flat, with negative feedback over the entire operating range. Since the transformer is included within the feedback loop, its response must also

(*Continued on page* 48)

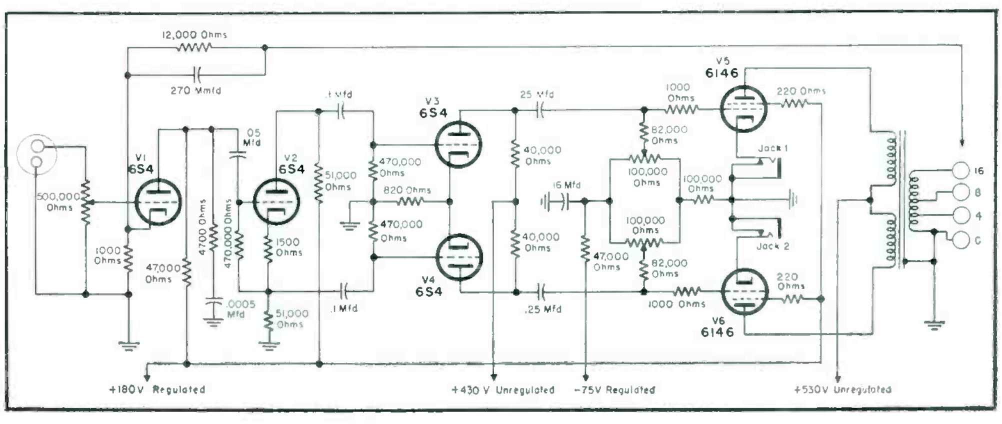


Fig. 6. Schematic of a quality amplifier with feedback from the output transformer secondary, which requires careful selection of output transformer. (Triad amplifier kit HF-40.)

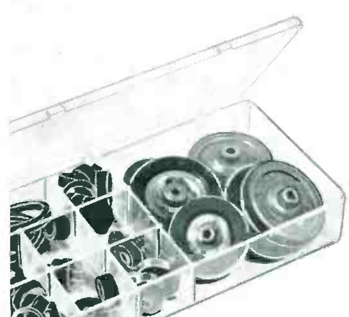
*Triad *HF-40 kit amplifier, for 40 watts output with less than 1 per cent distortion at full power output.*

Audio

(*Continued from page* 47)

be controlled. When the transformer in an amplifier with a large amount of feedback, such as is employed in the Fig. 6 unit, is to be replaced, an identical replacement is imperative. Both high and low frequency response must be the same as in the original unit or the feedback may no longer be negative and the amplifier may oscillate. Quite commonly the oscillations are in the ultrasonic frequency range and can only be detected by a lamp across the output leads or by a 'scope.

Some of the audio amplifier troubles which can be caused by a defective transformer include intermittent sound, loss of sound, sizzle in the sound, and loss of low-frequency response. The first difficulties usually result from a broken wire which may occasionally make contact. An ohmmeter check usually locates these difficulties. The sizzle can be caused by a near short which arcs over as high audio peak voltages are applied, or a broken wire making a poor contact and arcing as the signal is applied. Poor low-frequency response usually indicates shorted turns in the transformer. The shorted turns reduce the primary inductance, typically moving f_1 of Fig. 3 to near 1000 cycles. In general, these troubles can be cleared only by replacing the transformer. The precautions indicated should be observed in selecting the replacement unit.



Phono and recorder drive kit containing 51 exact replacement drives. Reference chart, suitable for wall mounting, is packed with each kit. (Catalog No. P400; General Cement Mfg. Co., 400 S. Wyman Ave., Rockford, Ill.)

COMPONENTS

ARKAY 21-INCH VERTICAL TV CHASSIS KIT

A 21-inch vertical chassis kit, *14T21*, featuring a 12-channel turret type tuner, has been announced by Radio Kits, Inc., 120 Cedar St., New York, N. Y.

Tuner employs a 3BC5 *rf* amplifier and a 5U8 triode-pentode mixer-oscillator. Separate oscillator frequency adjustments are provided for each channel; can be adapted for *uhf* reception with insertion of *uhf* strips in the turret drum. Chassis uses series string-heater type tubes, vertical retrace blanking and reflex sound *if* amplifier.

* * *

MALIN TV REMOTE CONTROL

A TV set remote control unit, *Select-o-vision*, has been developed by Malin Enterprises, 3733 E. Olympic Blvd., Los Angeles 23, Cal.

Unit features on-off control, speaker selector (either unit or set speaker), volume and brightness and contrast controls. Comes with a 20′ cord.

* * *

TELE MATIC ELECTROSTATIC NEUTRALIZER

An electrostatic neutralizer, *No-Fog*, for application to TV picture tubes and masks to eliminate dust, has been announced by Tele Matic Industries, Inc., 16 Howard Ave., Brooklyn 21, N. Y.

Anti-static agent is sprayed on tube or mask which can then be wiped off with a dry cloth, leaving a microscopic film that is said to act as an insulation against static. Can also be used for cleaning phono records.

* * *

JENSEN SPEAKER KITS

A series of eight loudspeaker system kits has been introduced by Jensen Manufacturing Co., 6601 S. Laramie Ave., Chicago 38, Ill. Also available is a 36-page manual with instructions for building 18 enclosure designs.

Speaker system kits feature same matched components used in commercially available models; include frequency division units, controls, mounting brackets and wiring materials.

* * *

RESISTANCE PRODUCTS PC RESISTORS

Miniature precision wire-wound resistors, *P*, for use with printed wiring boards, have been announced by Resistance Products Co., 914 S. 13th St., Harrisburg, Pa.

Available in ratings from .10 to 1 *w*. Resistance values range from .4 to 3 megohms; tolerances from 1 to .05%; sizes from ¼″ diameter x ⅜″ long to ⅜″ diameter x ¾″ long.

* * *

INSULINE HI-FI CONNECTING CORD

A dual connecting cord, *2394*, for interconnecting hi-fi equipment, has been developed by Insuline Corp. of America, 186 Granite St., Manchester, N. H.

BENCH-FIELD TOOLS . . .

AIRPORT TV TUBE PIN LOCATOR

A tube pin locator, for determining what each tube pin signifies at the socket base, has been introduced by Airport Television & Radio Co., 188 Airport Rd., Reno, Nev.

Locator operates by turning dial on a chart. When set to tube number, pin locations are automatically selected. Covered are receiving tubes for radio, TV, audio and industrial electronic devices.

° ° °

INSULINE NYLON HANDLE TEST LEADS

A pair of flexible type test leads with nylon handles, *481*, featuring one 1" red and one 4" black nylon barrel, have been introduced by Insuline Corp. of America, 186 Granite St., Manchester, N. H.

Both leads have 1" prod tips of silver-plated heat-treated beryllium copper. Tips fit standard .080" diameter jacks.

° ° °

PROTO RUBY SCREWDRIVERS

A complete line of 37 *Ruby* screwdrivers has been announced by the Plomb Tool Co., Los Angeles, Calif.

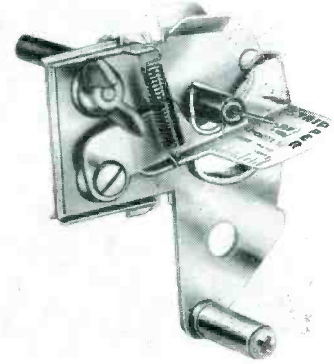
All drivers have ruby-red flame-resistant plastic handles. Sixteen of the drivers feature standard keystone bits in widths from ⅛" to 5/16" and blade lengths from 1½" to 9¾". Nineteen cabinet models with straight bits have bit widths from ⅛" to ¼" and blade lengths from 1½" to 9¾". Two are Phillips type with *1* and *2* bits and blade lengths of 2⅞" and 4".

° ° °

B-T ROTARY CABLE STRIPPER

A rotary cable stripper, S-*1*, for stripping coax and other shielded cable (up to ½" in diameter) used in TV, audio, industrial and electrical work purposes, has been developed by Blonder-Tongue Laboratories, Inc., 526-36 North Ave., Westfield, N. J.

Strippers, machined from heavy gage steel, employ a single edge razor blade for cutting action. Depth of cut and degree of spring tension may be varied. Measuring scale on unit insures correct amount of stripping of insulation and braid.



INSTRUMENTS

RCA VTVM

A *vtvm, WV-98A Senior VoltOhmyst,* for testing of TV, FM, AM and hi-fi sets, has been developed by the Tube Division, RCA, Harrison, N. J.

Unit measures *p-p* voltages directly and features a single-unit *ac/dc*-ohms probe with built-in switch for function selection. Accuracy on *ac* and *dc* voltage scales is ±3% of full scale. *Dc* voltages from .02 to 1500 *v* can be read on two scales in seven overlapping 3-1 ranges. By use of high-voltage accessory probe, range may be extended to 50,000 *v*. *Ac* measurements can be read on seven overlapping scales, extending to 4200 *v, p-p*.

° ° °

RI-M VIDEO PROBE MINI-METER

A broadly-tuned probe and absorption meter, *Video Probe Mini-Meter,* for TV and radio applications, has been announced by Research Inventions and Manufacturing Co., 617 F. St., N.W., Washington 1, D. C.

Instrument supplied with attachable pickup coil for 22 or 44 mc *if*. In use, signal coil is plugged on to end of probe and slipped over each tube in suspected oscillator, *if*, or video circuit.

Device can also be used to check audio circuits, gated *agc*, crystal diodes, and horizontal sweeps.

° ° °

EMC VOM

A pocket-size *vom,* model *102 Volometer,* with a 3½" meter, has been announced by Electronic Measurements Corp., 280 Lafayette St., New York 12, N. Y.

Unit features 5 *ac v* ranges from 0-3000; 5 *dc v* ranges from 0-3000; 3 *ac* current ranges from 0-600 *ma;* 2 resistance ranges from 0-1000 ohms, 0-1 megohm, and 4 *dc* current ranges.

° ° °

CENTURY PIX TUBE REJUVENATOR

A pix tube tester-rejuvenator, Testivator, has been announced by Century Electronics Co., 111 Roosevelt Ave., Mineola, N. Y.

Unit is said to activate cathode by removing surface contamination, restore emmission and clear interelement shorts and leakage. Will test for cathode emission and shorts and leakage.

21-Inch Color Chassis

(*Continued from page* 15)

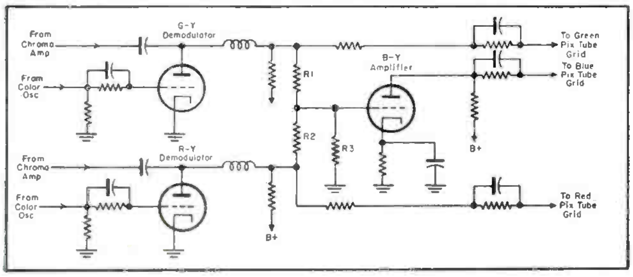


Fig. 7. Matrix network employed in Raytheon color set which provides the B-Y signal for the blue grid of the picture tube.

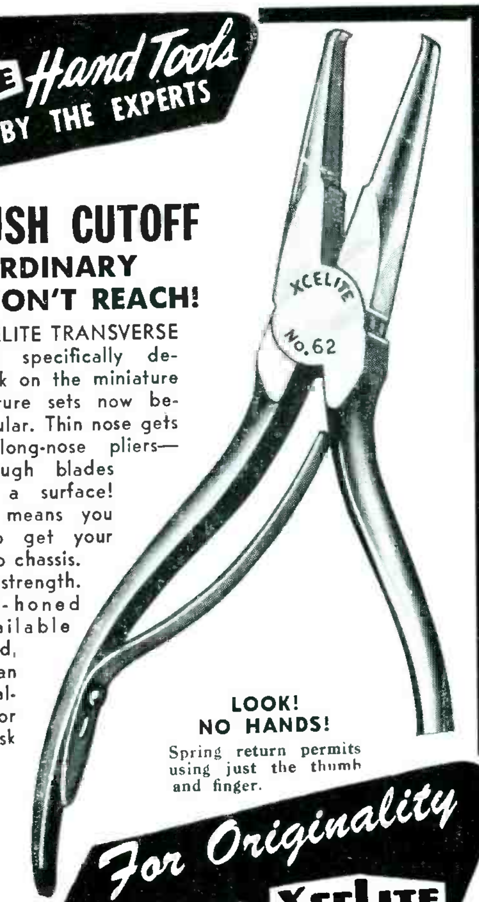
control circuitry in many b-w receivers. Two horizontal signals of opposite polarity and equal magnitude are usually coupled back to the phase detector from the horizontal oscillator. The incoming sync pulse is also coupled to the phase detector. The discriminator action of the phase detector produces a *dc*-bias voltage, when the oscillator is slightly off frequency, which is applied to the horizontal oscillator for frequency correction. The same action basically results in the color-phase detector circuitry shown in Fig. 5 (p. 15). The transformer in the plate circuit of the oscillator (Fig. 6; p. 15) couples back two signals 180° out-of-phase to the phase detector. The color-burst signal from the chroma amplifier is also applied to the phase detector. The color-burst signal is compared to the two feedback signals, so that any phase difference results in a *dc* correction bias voltage which is coupled to the reactance tube.

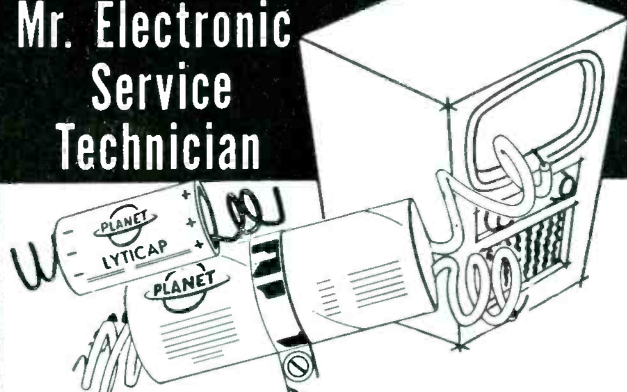
The reactance tube, for simplicity, can be considered as a variable capacitor in parallel with the crystal oscillator. The resulting or effective capacitance presented by the reactance tube varies according to the polarity and magnitude of the *dc*-bias voltage from the phase detector.

The crystal-controlled oscillator generates a 3.58-mc signal which is coupled to both the phase detector and color demodulators. The oscillator-output transformer supplies the two feedback signals, 180° out-of-phase, to the phase detector and two subcarrier reference signals, 146° out-of-phase, to the *R-Y* and *G-Y* demodulators. A *G-Y* demodulator is employed in place of the *B-Y* demodulator used in many previous color receivers and a phase difference of 146° is required between the subcarrier signals rather than 90°.

The chrominance signal from the chroma amplifier is coupled to the plate circuit of each high-level triode demodulator through the chroma-output transformer. The chroma-output transformer is tapped to enable a greater chrominance signal amplitude for the *R-Y* demodulator as compared to the *G-Y* demodulator. This compensates for the difference in transmitted amplitudes of the *R-Y* and *G-Y* signals and provides proper chrominance signals to each demodulator. The subcarrier reference sig-

(*Continued on page* 53)





(*Continued from page* 52)

nal from the color oscillator is coupled to the grid circuit. The demodulator action is equivalent to an amplitude detector which is gated by the grid circuit. The chrominance signal is demodulated and color difference signals of *R-Y* and *G-Y* are obtained with amplitudes equal to approximately one-half the peak-to-peak amplitude of the chrominance signal. Thus, the demodulated outputs are of sufficient amplitude for direct coupling to the picture tube grids.

Since *R-Y* and *G-Y* signals are available from the demodulators, the *B-Y* signal must be obtained for application to the blue grid of the picture tube. This is accomplished by the matrix network of resistors R_1, R_2 and R_3 in Fig. 7. The *G-Y* signal is developed across resistors R_1 and R_3, while the *R-Y* signal is developed across resistors R_2 and R_3. Since both the *R-Y* and *G-Y* signals are developed across resistor R_3 and are in the correct ratio, the *B-Y* signal is obtained with a negative polarity. The *–(B-Y)* signal is amplified, and due to the phase reversal from grid to plate, a *B-Y* signal is applied to the blue grid of the picture tube.

The luminance or *Y* signal from the luminance amplifier is coupled to the cathodes of the picture tube, which are connected in parallel; the *Y* signal is of a negative polarity. The *R-Y*, *B-Y* and *G-Y* signals are coupled to the picture tube grids. The three-gun color picture tube acts as a matrix circuit due to the polarity inversion from cathode to grid. Applying a negative *Y* signal to the cathode is identical to applying a positive *Y* signal to the grid. The signals add in the picture tube giving $R\text{-}Y + Y = R$, $B\text{-}Y + Y = B$ and $G\text{-}Y + Y = G$. The negative and positive *Y* signals effectively cancel, and the red, blue and green video signals, equivalent to the output of each station camera signal, are obtained.

IF Response Curves

(*Continued from page* 36)

cause difficulty in obtaining a proper *if* response curve. The resistors should be replaced with units having the proper value.

A completely-detuned set often causes trouble; when tuning is attempted, oscillations occur. Whenever sudden *jumps* in the display occur while a set is being tuned, oscillation should be suspected. If a receiver is so badly detuned that oscillations occur before proper tuning is reached, and it is believed the receiver is otherwise operating properly, it can be tuned by loading each tuned circuit, except one, by a resistor of 330 ohms. The response of the loaded stages is reduced and broadened so that no oscillations occur and the response of the unloaded stage is apparent. It can then be tuned to its proper frequency. After each stage has been roughly tuned in this way, the damping resistors can be removed and alignment completed in normal manner.

The sweeping technique, described for TV visual *if* alignment, is also useful for sound channel alignment and for the alignment of FM receivers. The two responses which should be observed are illustrated in Fig. 4 (p. 36).

PERSONNEL

Harry A. Ehle has been elected executive vice president of International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa. . . . Jesse Marsten is now senior vice president.


Harry A. Ehle


David T. Schultz

David T. Schultz, formerly senior vice president and treasurer of the Raytheon Manufacturing Co., has been elected president of Allen B. DuMont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N. J.

° ° °

I. I. Ser has been appointed sales manager of the Astron Corp., 255 Grant Ave., East Newark, N. J. Herman C. Bloom has been named assistant jobber sales manager of the company.


I. I. Ser

° ° °

John D. Van der Veer has been appointed general sales manager of Tung-Sol Electric, Inc., 95 Eighth Avenue, Newark 4, N. J. . . . John M. Malone is the new manager of initial equipment tube sales.


J. D. Van der Veer


John M. Malone

° ° °

Rural Roadside Shop

(*Continued from page* 13)

quantity lots and pay cash to take advantage of the additional cash discount.

We have limited our call area to a 10-mile radius. However, many of our best customers are drive-ins, who live way beyond that circle, up to 100 miles away from the shop.

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G. F. Wright Steel & Wire Co.	49
Xcelite, Inc.	53

Catalogs-Bulletins

John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y., has released a catalog describing books on electronics, TV, hi-fi, radio and electricity.

* * *

Bud Radio, Inc., 2118 E. 55th St., Cleveland 3, O., has issued an illustrated catalog describing sheet metal products and electronic components.

* * *

Plastic Capacitors, Inc., 2511 W. Moffat St., Chicago 47, Ill., has published catalog *155*, with charts diagrams and technical information on mineral oil and synthetic oil impregnated paper-dielectric capacitors and Aroclor-*ac* capacitors.

* * *

Magnetic Shield Division of Perfection Mica Co., 1322 N. Elston Ave., Chicago, Ill., has released technical data sheets on *Fernetic* and *Conetic* magnetic shielding.

* * *

Triplett Electrical Instrument Co., Bluffton, O., has issued a 16-page illustrated catalog with detailed information on test equipment for radio and b-w and color TV, including *voms,* tube testers, color-bar generator, sweep signal generator, dot and *rf* signal generators.

* * *

American Television and Radio Co., 300 E. 4th St., St. Paul 1, Minn., has published a service manual covering the ATR 2600 b-w TV chassis.

* * *

Radio Receptor Co., Inc., 251 W. 19th St., New York 11, N. Y., has released a 28-page selenium rectifier replacement guide, *213*, listing specifications and replacement requirements for radio and TV sets; cross referenced by manufacturers.

* * *

Precision Apparatus Co., Inc., 70-31 84th St., Glendale 27, N. Y., has issued a 12-page catalog, 23, with illustrations and descriptions of its complete line of test equipment for radio and b-w and color TV.

* * *

United Transformer Corp., 150 Varick St., New York 13, N. Y., has published a 34-page illustrated catalog with descriptions, charts and specifications of filters and hermetic, dot, subouncer, ouncer, plug-in, linear standard, hipermalloy, ultracompact, commercial, special series and replacement transformers.

* * *

Todd-Tran Corp., 156 Gramatan Ave., Mount Vernon, N. Y., has released replacement guide sheets covering yokes and flybacks in Philco and Admiral TV sets.

* * *

Aerovox Corp., New Bedford, Mass., has issued a 52-page illustrated catalog, *DC-359,* with specifications on electrolytic, paper, metallized-paper, ceramic, mica and *ac* motor capacitors, filters and resistors.

JOTS and FLASHES

A CLOSED-CIRCUIT TV LINK between Idaho State College and eleven public schools is now being installed in Pocatello, Idaho. Tie will enable one teacher, standing before a TV camera in TV studio of college, to instruct over 300 students in the schools at the same time. College studio also will be connected to community antenna system in Pocatello so that educational programs can also be watched by youngsters in their own homes. . . . An RCA sound system, installed for storewide coverage, has been installed by Gimbel Brothers in its suburban Cheltenham, Pa. department store. Installation provides a 160-speaker dual-channel sound system for storewide public address, music distribution, and paging; two separate remote systems for broadcasting special programs; and facilities which link the country outlet with the main Philadelphia department store, 15 miles away in the heart of the downtown business district. The communications link enables each store to receive and distribute programs originated by the other. . . . Philco Corp. has acquired an additional plant at Spring City, Pa., which will be devoted exclusively to the manufacture of transistors, diodes and other semi-conductors. Plant contains approximately 100,000 square feet of manufacturing floor-space. Heretofore, Philco's transistor work has been carried on at the Lansdale Tube Company, Lansdale, Pa.; these operations will be moved to Spring City during the first quarter of '56 and all of Philco's transistor work will be centralized in the new plant before April 1. . . . Distributor sales office and warehouse of Oxford Electric Corp., have been moved to 556 West Monroe St., Chicago. . . . An electronic tube warehouse and commercial service office has been established by the G.E. tube department at 220 Dawson St., Seattle, Wash. . . . A new manufacturing plant for the production of electrolytic capacitors has been opened in Huntsville, Alabama, by P. R. Mallory (Huntsville) Inc., an affiliate of P. R. Mallory & Co., Inc., Indianapolis. Located on a twenty-one acre site, and completely equipped with modern equipment, the plant is said to represent an investment of $2,000,000. . . . Penn-Texas Corp. has completed negotiations for the purchase of the business and all of the assets of the Hallicrafters Co., Chicago. . . . *Jack Berquist* has been named Magnavox's field service engineer for the southeastern territory. . . . A 25% increase over last year's contribution to the employees' profit sharing retirement fund was announced recently by Harry Resnick, president of Channel Master Corp., Ellenville, N. Y. . . . Snyder Mfg. Co. has announced that it has completed construction of an 80,000 square foot warehouse adjacent to its plant in Philadelphia. . . . The review of *Dave Rice's Official Pricing Digest*, published in the December issue of SERVICE, should have noted that the guide contains information on over *60,000 items*.

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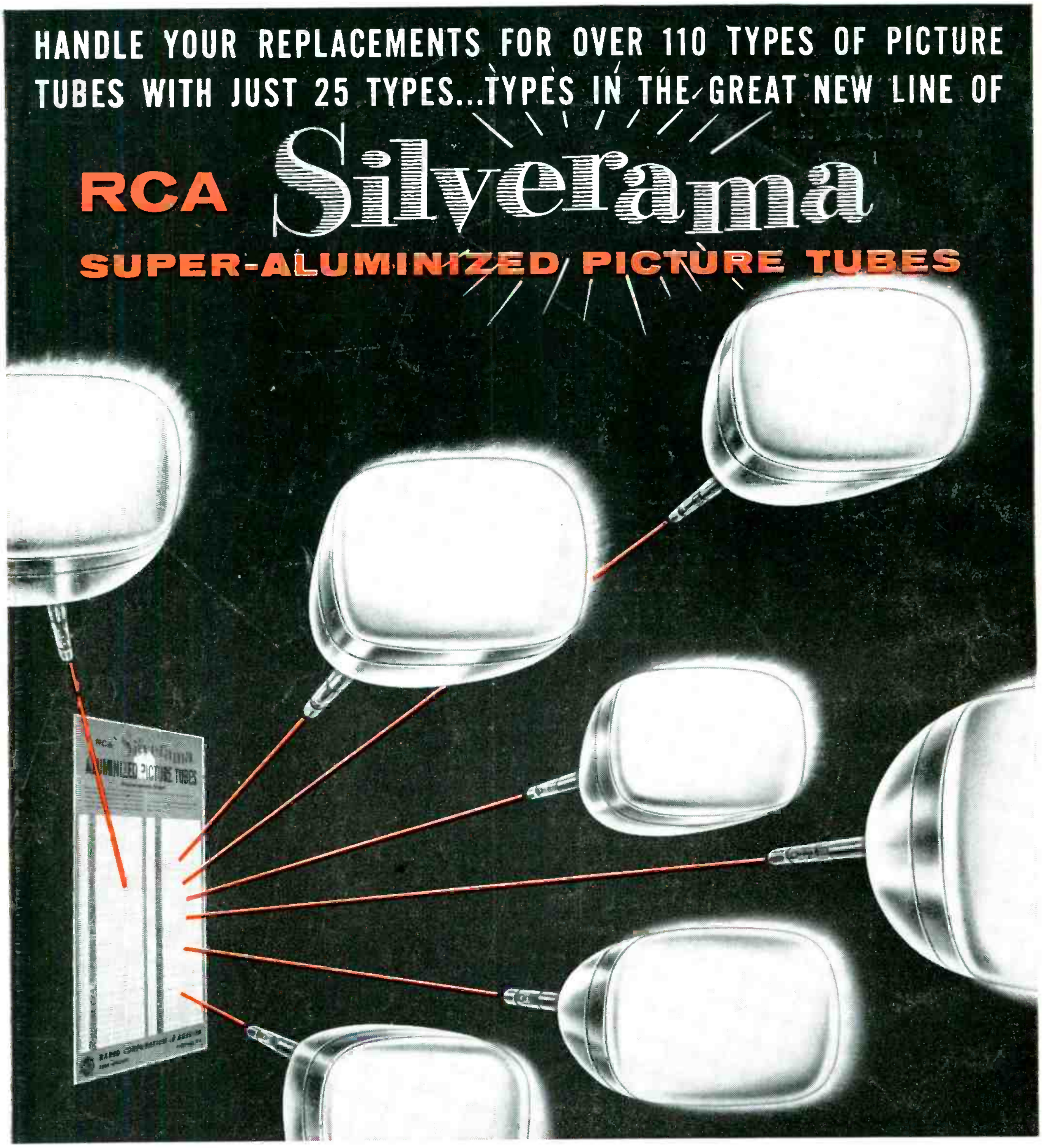

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