ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

JUNE 1967

AN OJIBWAY PUBLICATION

SERVICING A MODERN COLOR TV

PROTECTING ELECTRONIC CIRCUITS

THE APPRENTICE AND THE PRO

JUNE 1967

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NEW YORK: Ron Kipp, 25 W. 45 St.
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ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

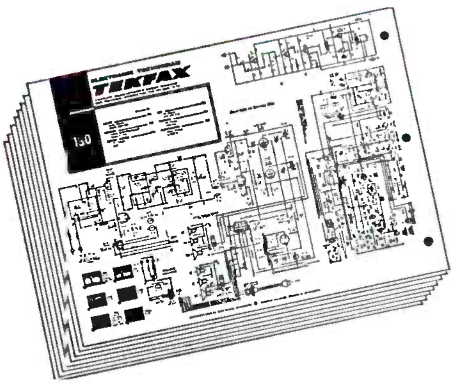
Cover

The electronic component distributor plays an important role in the economic lives of the nation's service-dealers. He is attending the National Electronics Week (NEW) show in Chicago this month.

FEATURES

DEPARTMENTS

TEKFAX — 16 PAGES OF THE LATEST SCHEMATICS



Group 178 — June • 1967

AIRLINE: TV Model GMW-14447A, 57A
MAGNAVOX: Color TV Chassis T911 Series
MOTOROLA: TV Chassis TS-460 Series
OLYMPIC: TV Chassis 9P59/60 Series
SYLVANIA: Color TV Chassis DO6-1, -2
WESTINGHOUSE: TV Chassis V-2652-2

LETTERS TO THE EDITOR

Clarifying the Formulas

On page 61 of the March, 1967, issue of ELECTRONIC TECHNICIAN the following formula is written, "$R_1 + R_2 + r_s < -r_d$." Should this formula be changed to read, "$R_1 + R_2 + r_s > [-r_d]$," where $[-r_d]$ is the absolute value of $-r_d$ or r_d? This observation is based on values of r_d calculated from table 1 on page 42 of the February, 1967, issue.

Calculations:

$A_V = 3.28$, $\Delta V_D = .105v - .117 = -.012v$, $\Delta I_D = .001a = .0009a = .0001a$, $r_d = \frac{-.012v}{.0001a} = -120\Omega$.

$A_V = 3.28$, $\Delta V_D = .117v - .129v = -.012v$, $\Delta I_D = .0009a - .0008a = .0001a$, $r_d = \frac{-.012v}{.0001a} = -120\Omega$.

$A_V = 3.22$, $\Delta V_D = .129v - .142v = -.013v$, $\Delta I_D = .0008a - .0007a = .0001a$, $r_d = \frac{-.013v}{.0001a} = -130\Omega$.

$A_V = 1.59$, $\Delta V_D = .142v - .157v = -.015v$, $\Delta I_D = .0007a - .0006a = .0001a$, $r_d = \frac{-.015v}{.0001a} = -150\Omega$.

In each case calculated (neglecting the positive resistance of the tunnel diode) the value of r_d is less than $60\Omega + 92\Omega$, which represents $R_1 + R_2$.

The articles on semiconductors are interesting.

JOHN HAMMER

Ashland, Nebr.

• *By carrying your calculations further, the following values can be obtained for r_d:*

$A_V = 0.78$, $\Delta V_D = .157v - .178v = -.021v$, $\Delta I_D = .0006a - .0005a = .0001a$, $r_d = \frac{-.021v}{.0001a} = -210\Omega$.

$A_V = 0.31$, $\Delta V_D = .227v - .295v = -.067v$, $\Delta I_D = .0003a - .0002a = .0001a$, $r_d = \frac{-.067v}{.0001a} = -670\Omega$.

Our last calculated value of r_d (-670Ω) is considerably larger than the 152Ω total representing resistances $R_1 + R_2$.

In the paragraph preceding the equation, "$R_1 + R_2 + r_s < -r_d$," we said ". . . a tunnel diode circuit is stable when the sum of the positive resistances in the circuit is smaller than the tunnel diode's maximum negative resistance." For clarification we could have changed the statement, "Circuit stable when $R_1 + R_2 + r_s < -r_d$," to read, "Circuit stable when $R_1 + R_2 + r_s < -r_d$, and r_d represents the diode's maximum negative resistance."

When dealing with the tunnel diode's maximum negative resistance, the following equations are basically the same. $R_1 + R_2 + r_s < -r_d$. $R_1 + R_2 + r_s < [r_d]$. If the maximum negative resistance was -800Ω, then $-r_d$ is $-(-800\Omega)$ or $+800\Omega$ while $[r_d]$ is $[-800]$ or merely 800Ω — a double negative being a positive, and an absolute number being without positive or negative sign.

Thank you for bringing this viewpoint to our attention.—Ed.

Needs Parts for FME Tape Recorder

Can any reader tell me where I can get parts for the Federal Manufacturing and Engineering Co. (FME) tape recorder? Answer via ET editor.

I. W. SOUTHERN

Silver Spring, Md.

Metz Address

For those who need the address of Metz, here it is: **Metz Apparatefabrik, Furth/Bayern, Germany.**

V. J. SIRANI

Brooklyn, N.Y.

LETTERS TO THE EDITOR

Another View of the Technician Shortage

You (and a lot of service-dealers, too) seem to think there is a technician shortage. I say there is only a shortage of technicians willing to work in this business. Why? Ask the ex-TV-radio technicians. Too low pay, too few benefits, too many hours, too many "charge its," too many abuses, too much ingratitude and too many headaches. When the manufacturers begin running interference for the independent service-dealer and help to re-educate the public regarding the job of keeping their equipment in top shape and when professional fees are charged for maintaining this equipment, perhaps some of the good technicians who have left this area of the industry will return. The technician's job is strictly technical and this means repairing the equipment. He is not a "goodwill ambassador," "company psychologist," "bill collector," "credit manager," "one-man grievance committee" nor is he a "record keeper." He needs someone to help him get the world off his back. I've been in this business for 20 years and I have seen them come and go. Too many of the good technicians have gone into industrial electronics. I have been called upon to repair everything from TVs to 2-way radios to electronic furnace controls. It wasn't easy. The reason I've stayed in this industry so long is simply that I love it. I went into the distributor end of the business 5 years ago after 14 years as a service-dealer. I want to say that ET helped me a lot during those years. Don't ever underestimate your value to the industry. Keep up the fine work.

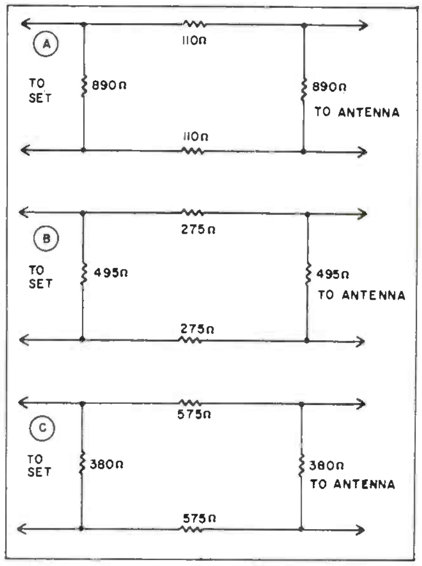
EDWARD CIMORELL (owner)
SESCO Electronic Supply Co.
Ashtabula, Ohio

Antenna Pads

I'm having trouble with a nearby station and a distant station where a high-gain antenna is used. The nearby station overloads on the high-gain antenna. How do you make antenna "pads" for reducing signal strength?

JOHN BURKE
Monroe, La.

• *You can buy variable pads. But here are three fixed pads we worked out some time ago. The one at "A" will*



reduce the signal about 6db, the one at "B" about 12db and the one at "C" will cut the signal about 18db Use a DPDT switch to cut the pad in and out of the antenna circuit.—Ed.

Will Give Old ETs

Am retired and will give my file of back issuses of ET to any newcomer in the business.

J. KWIATKOWSKI
487 10th St.
Brooklyn, N.Y.

EDITOR'S MEMO

It's About Time

We pioneered in the idea of upgrading electronics technicians' titles. The words "serviceman," "TV-radio mechanic," "repairman" and such degrading titles have been taboo in the editorial material of ELECTRONIC TECHNICIAN for years.

But we have been constantly amazed at those who have never "caught on" to the idea.

Now we observe that the concept has been grasped by a knowledgeable sector of the industry. We have just received a copy of the following resolution recently adopted by the National Electronics Assn. at their quarterly board meeting in Cincinnati:

"WHEREAS: There are presently several titles used to identify those performing installation, adjustment or repair of television, radio, electronic equipment;

"WHEREAS: There is a need for greater understanding between technicians and the public;

"WHEREAS: A proper public image is desired by those who have chosen electronics repair as a vocation;

"THEREFORE BE IT RESOLVED: That the terms used to describe those who install and adjust and repair electronic home entertainment equipment, communications equipment, electronically controlled or regulated devices and other similar equipment, be henceforth known as 'Electronics Technicians';

"FURTHER BE IT RESOLVED: That the terms 'repairman,' 'serviceman,' 'TV man,' 'radioman,' 'appliance repairman or serviceman' as they may be referenced to electronics technicians, be deleted wherever possible at the manufacturing, distributing or dealer-technician levels of the electronics industry and also in all publications where possible;

"FUTHER BE IT RESOLVED: That the terms 'electronics technician,' 'certified electronics technician' (or specialist), and 'service technician' be promoted as standard terminology."

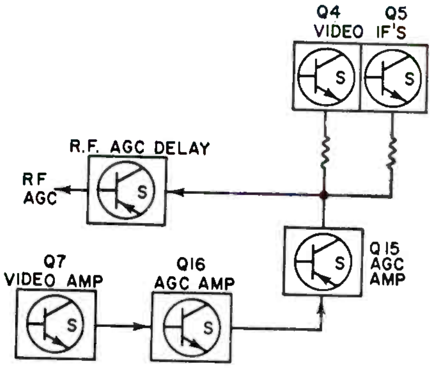
Some elements of the industry caught on to the idea years ago. Now it's about time for the stragglers to follow suit and help out in the upgrading program.

TECHNICAL DIGEST

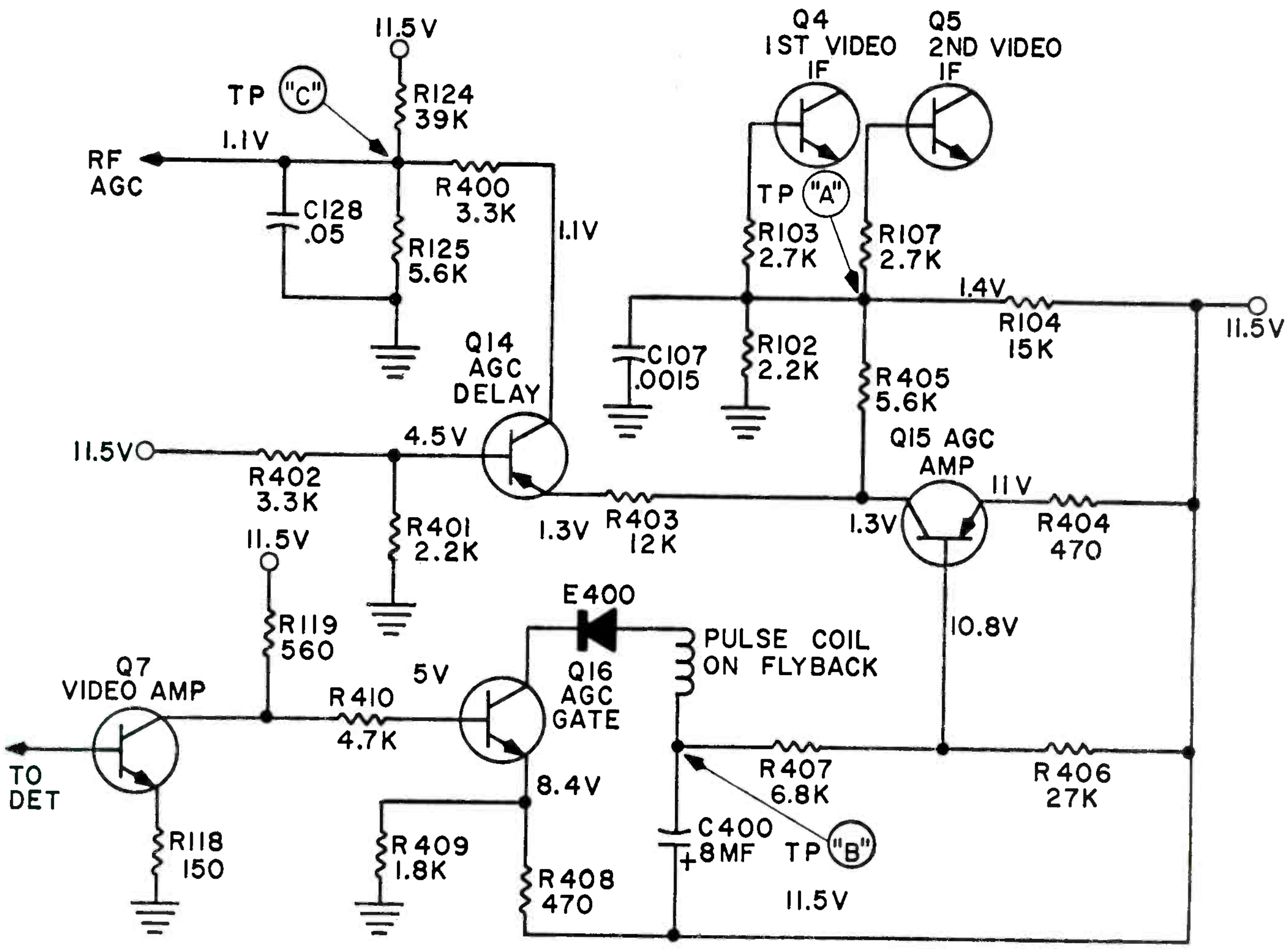
MOTOROLA

TV Chassis TS460—AGC Circuit Description

As we know, the RF and IF gain in a TV receiver must be varied in accordance with the relative strength of the received signal. A strong signal requires a gain reduction in both RF and IF amplifiers to prevent overloading. When a medium strength (snow-free) signal is received, only a reduction in IF gain is necessary, thus, allowing the RF amplifier to operate with maximum gain. If a weak signal (snowy picture) is received, no AGC is applied to either RF or IF stages. In short, the output of the system must be kept fairly constant regardless of the strength of the received signal. By not applying AGC to the RF amplifier during the reception of weak and medium strength signals, excellent signal-to-noise characteristics can be obtained in the tuner by virtue of the high RF-mixer-noise ratio. In essence, when a large RF signal is applied to the mixer, it overrides the noise generated within the mixer. The IF output signal from the mixer is now relatively noise-free and produces a noise-free picture on the TV screen. Hence, AGC applied to the tuner is delayed until the received signal is of such magnitude that any further increase in signal would cause the tuner to overload. The delayed RF AGC stage will then come on and allow a reduction in RF amplifier gain for any further increase in the received signal.



The AGC system in the TS460 is keyed (gated) and consists of three stages: AGC gate (Q16), AGC amplifier (Q15) and RF AGC delay (Q14 shown in block diagram). When tuned between channels, Q16 is reverse biased by low collector voltage of the video amplifier (Q7). Q7 produces a large voltage drop across R119 (see schematic). This voltage drop is sufficient to cause the base of Q16



Home or commercial? VHF, UHF or 82 channel?

Come up with the big plus in all MATV installations.

Start with a Channel Master Continuous MATV Color Amp. Add our Color-Duct 82.

When you install new Channel Master continuous MATV color amplifiers and coordinated UHF/VHF components, there's only one piece of equipment you'll ever need to change to convert any MATV installation to 82 channels. That's the antenna.

Why? Because Channel Master color amplifiers—and only Channel Master amplifiers—bring in all 82 channels directly on channel—in a *single broadband electronic circuit*. (Not merely two separate VHF and UHF sections in a little box as it is in all other MATV VHF/UHF amps.) And you get this total bandwidth without sacrifice of power. At tremendous savings.

No matter which channels you have in mind in your MATV setup, a Channel Master color amplifier is automatically ready to receive both VHF and UHF.

Choose from: 30 db Color Tandem Amp (Model 7261), shown above. Combination 75 ohm preamplifier and amplifier. Also available in 300 ohm (Model 7262). 15 db Color Booster, Model 7264. Mast-mounted 75 ohm preamplifier with separate power supply. Also available in 300 ohm (Model 0062). 15 db Color Distribution Amplifier (Model 7263). 75 ohm MATV Distribution Amplifier. Also available in 300 ohm (Model 7260).

Color-Duct 82 is the ultra-low loss UHF/VHF RG-59 type coaxial cable (Model 9537).

It's the first major improvement in 75 ohm coaxial cable since the introduction of braided shielding. And only Channel Master makes it.

It takes the 100% Total Shielding formerly used only on transmission cables in commercial and industrial applications; applies it to MATV-designed 75 ohm coaxial cable; and literally creates a direct line to color. Produces lowest loss in 82-channel coax without losing one iota of the flexibility and handling ease of ordinary coax. (Uses standard F-fittings).

Take the first step now toward installing the most efficient and economical MATV system anywhere. Use a Channel Master color amplifier and a Color-Duct 82 coaxial cable.

. . . for more details circle 116 on postcard

CHANNEL MASTER M A T V

Ellenville, N.Y.

TECHNICAL DIGEST

to be negative with respect to its emitter, thus reverse biasing its emitter/base junction which prevents conduction.

When tuned to a channel, the video amplifier, Q7, will be driven toward cutoff by the negative sync pulses and dc voltage introduced to its base from the 2nd detector, E100. As a result, the collector current of Q7 decreases, the voltage drop across R119 will then reduce. This, in turn, will elevate the base of Q16 to a higher positive voltage with respect to its emitter which will forward bias it and allow collector current to flow — if a positive voltage is applied to its collector that is higher than the emitter voltage.

A pulse coil wound on the flyback transformer will supply a 20v P-P positive pulse to the anode of E400. This pulse will forward bias E400 switching it on. The pulse will then appear on the collector of Q16. Q16 will now conduct, charging C400. The horizontal sync pulse on the base of Q16 and the horizontal gate pulse on the collector of Q16 occur simultaneously (with sync pulse varying in amplitude as a function of received signal strength). The magnitude of negative voltage (with respect to the 12.5v supply) developed at TP "B" is directly proportional to the amplitude of the received signal. This negative-going (less positive) voltage is applied to the base of Q15 increasing its forward bias. Its impedance lowers, causing a larger voltage drop across voltage divider resistor R104. This additional voltage supplements the existing 1.4v at TP "A" (IF AGC). Thus, the voltage at the IF AGC point will now increase to a more positive value and positive voltage is then coupled to the base of Q4 and Q5 through base current limiting resistors R103 and R107. The positive voltage on the base of the NPN IF transistors forward biases their emitter/base junction and causes a gain reduction by forward AGC.

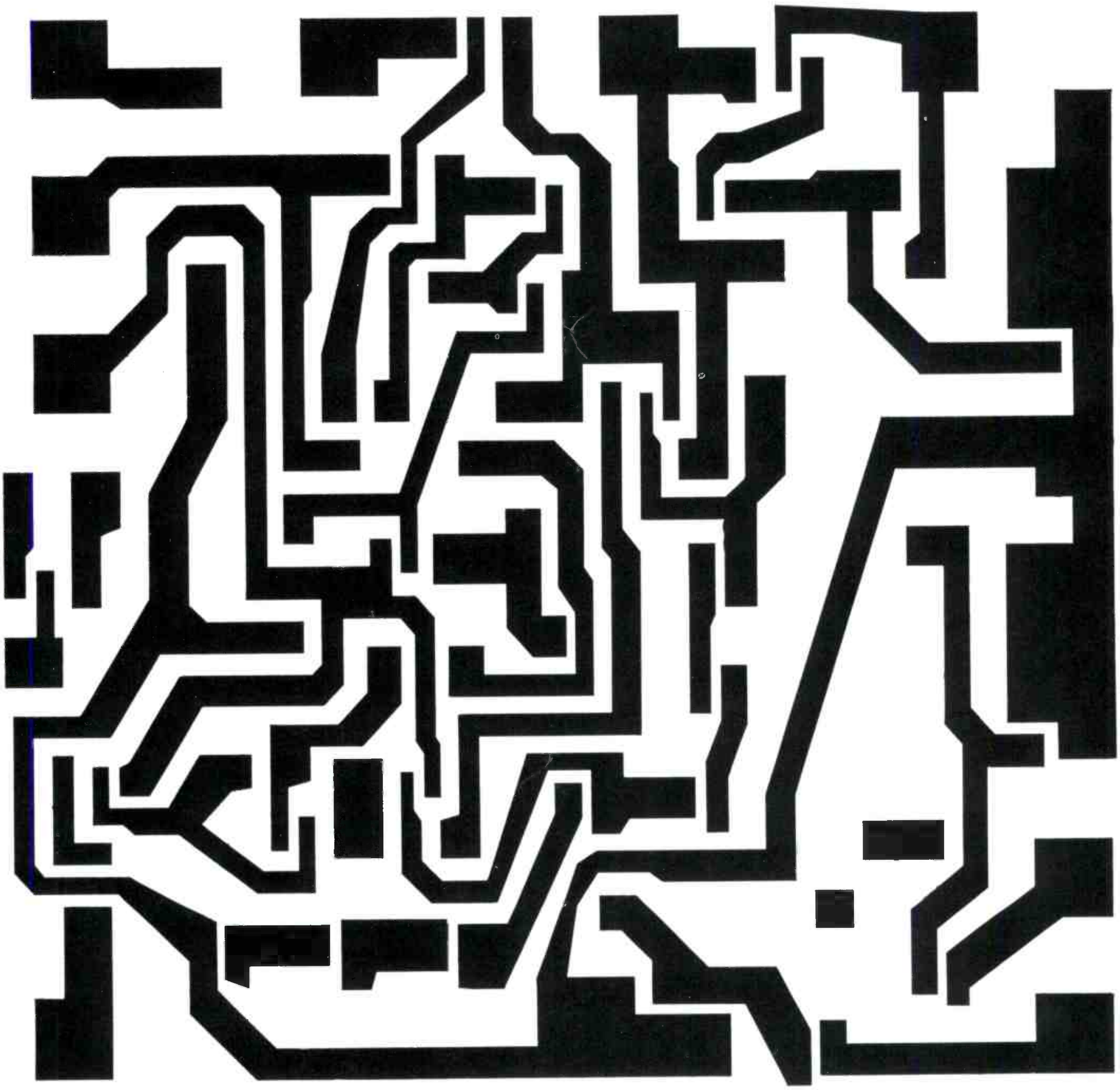
The function of the AGC delay, Q14, is to apply AGC to the RF amplifier just prior to signal overload in the tuner. This gives us the necessary RF AGC delay as previously explained.

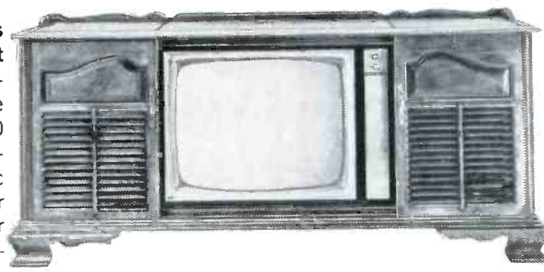
The RF AGC delay (Q14) is a PNP transistor and is held at cuttoff by its emitter voltage divider network, R401 and R402. If the received signal is strong enough to cause approximately 2.1v to be developed at the IF AGC (TP "A"), Q14 will then be forward biased by this voltage and switch on. Collector current of Q14 will flow through R125 and R400 and cause TP "C" to become more positive. This positive voltage will be applied to the RF amplifier to cause a gain reduction. Any further increase in signal strength will result in RF amplifier gain reduction providing the necessary RF AGC.

GENERAL ELECTRIC

Record Changers—Binding Turntables

The following information gives possible causes and cures for binding turntables. 1. **Cause:** Spindle and bearing are improperly lubricated. **Cure:** The spindle and bearing area must be lubricated in accordance with appropriate changer service manual. (If the turntable hub is cast zinc, use vaseline to lubricate the spindle and hub.) 2. **Cause:** Foreign material in the area of the turntable hub, the spindle or bearing. **Cure:** Clean hub, spindle or bearing area. (Lubricate Ref. Cure #1.) 3. **Cause:**





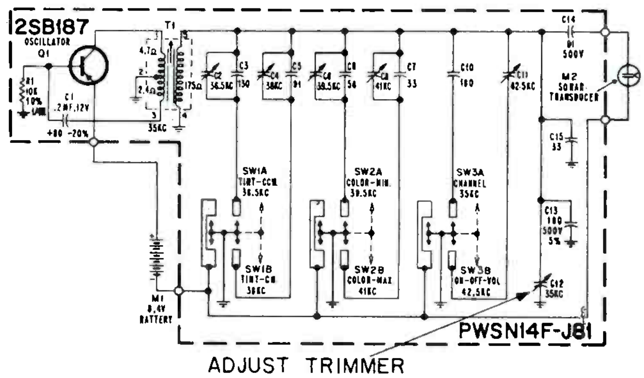
TECHNICAL DIGEST

Spindle bent. **Cure:** Replace spindle. (Lubricate Ref. Cure #1.) 4. **Cause:** Nicks or burred edges on the spindle. **Cure:** Remove burred edges and nicks with fine emery cloth. (Caution: Emery dust must be cleaned out of the bearing area.) (Lubricate Ref. Cure #1.) 5. **Cause:** Turntable hub frozen to the spindle because of shrinkage of the zinc hub. **Cure:** Replace turntable. (If zinc material from the hub has adhered to the spindle, it will be necessary to clean bearing surface of the spindle with fine emery cloth.) (Clean and lubricate Ref. Cure #1.)

ADMIRAL

Color Remote Control S366AN—Hand Transmitter Oscillator Adjustment

Reports have been received of the ON/OFF function being triggered when the color INCREASE function is activated. This trouble is caused by gradual drift of the S366AN hand transmitter oscillator circuit which can be corrected by a simple adjustment. Adjust only the over-



all trimmer, C12, (as shown in the schematic here) in the S366AN unit (next to transducer). This adjustment will correct all functions.

ADMIRAL

Record Changers Stalling in Cycle

Slippage of the idler wheel on the turntable rim, which takes place under change-cycle load, may cause a slower-than-normal turntable speed and, under some circumstances, complete stalling.

An investigation has led to improved specifications which will eliminate the problem on new changers. However, the study also disclosed that thorough cleaning will cure the condition in the field.

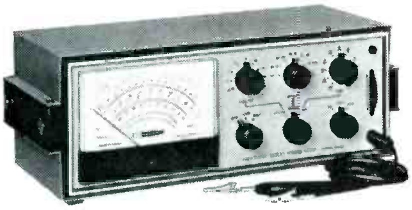
1. Firmly wipe the entire inside flange of the turntable with a clean white cloth wet with trichlorethane. Do not use any other solvent!

2. With idler wheel lightly loaded against the rotating motor shaft, clean the circumference with 400 grit sandpaper until the working surface is uniformly black and all glazed surface removed.

3. Using a clean white cloth wet with trichlorethane wipe all surfaces of the motor shaft that contact the idler wheel (in any function).

4. Carefully replace the turntable, rotating it clockwise to ease installation.

The World's Best Values In Test



Kit IM-25 $80^{00}
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NEW! Solid-State High Impedance Volt-Ohm-Milliammeter

• Solid-state design for solid-state measurements • All-silicon transistors plus FET's • Full scale ranges down to 150 mv & 15 uA • AC plus battery power for portability • 6" meter with zero center scale for + & — voltage measurements without switching • Accuracy ±3% full scale on DC volts, ±5% full scale on AC volts • New styling & unitized construction • Separate range switches for each function. 10 lbs.

World's Most Popular VTVM . . . Heathkit IM-11

Kit IM-11 $24^{95}

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• 7 AC, 7 DC, & ohms ranges — easy-to-read scales • 4½", 200 uA meter • 1% precision resistors for high accuracy • Extended frequency response, ±1 db 25 Hz to 1 MHz • Measures RMS and Peak-to-Peak • Single test probe for all measurements • Easy-to-build, electronically stable circuit board construction • Costs just 45c more than its predecessor of 16 years ago. 5 lbs.

Kit IM-13 $32^{95}
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• Measures AC volts (RMS), DC volts, resistance & db • Separate 1.5 & 5 volt AC scales for high accuracy • Large, easy-to-read 6", 200 uA meter • Zero center db scale • Single test probe for all measurements • Gimbal bracket for bench, shelf or wall mounting • Smooth venier controls for zero & ohms adjust • 1% precision resistors. 7 lbs.

Mutual Conductance Tube Tester

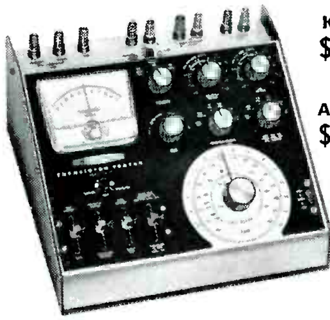
Kit TT-1A $149^{95}

• No finer tube tester anywhere • Indicates Gm to 24,000 micromhos • Ultra-sensitive grid current test • Built-in switch-operated calibration circuit for high accuracy • Built-in adaptor for testing Compactron, Nuvistor, Novar & 10-pin miniature tube types • Includes handsome, easy-to-carry cabinet with handle. 33 lbs.

Capacitor Checker . . . A Direct Reading Bridge

Kit IT-11 $29^{95}

• Tests all capacitor types • Low bridge voltage for safe testing of miniature electrolytics • 16 leakage testing voltages • Direct reading scales — no involved calculations • Measures resistance from 5 ohms to 50 megohms • Measures capacitance from 10 pf to 1000 uf • Comparator circuit — measures "L", "C", or "R" with external standard • "Eye" tube null & leakage indicator. 7 lbs.



Kit IM-30 $54^{88}

Assembled $84^{95}

Lab Transistor Tester Provides Complete DC Analysis

• Ideal for servicing, design work, incoming inspection, production testing, etc. • Provides complete DC analysis of PNP & NPN transistors to 15 amps • DC gain (Beta, Alpha) read direct on calibrated scales • 15 uA basic range for leakage (Icbo, Iceo) tests • Four lever switches for fast, easy test selection • Internal battery supply, provisions for external power. 10 lbs.

Kit IG-112
Was $99.00 Now Only $69^{00}

NEW LOW PRICE! Now Save $30 On FM Stereo Generator

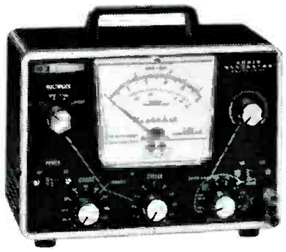
• Provides virtually all signals required for trouble-shooting & alignment of multiplex adaptors, FM tuners & receivers • Switch selection of 400 Hz, 1000 Hz, 5000 Hz, 19 kHz, 38 kHz and 65 kHz or 67 kHz SCA signals • Built-in marker oscillator for I.F. and dial tracking checks • 100 MHz sweep signal (adjustable ±2 MHz) for overall RF & IF alignment on clear area of FM band. 11 lbs.

General Purpose RF Signal Generator

Kit IG-102 $27^{95}

Assembled $54^{95}

• Covers 100 kHz to 220 MHz in six bands • Large, accurately calibrated dial scales • Factory wired and aligned coil and band-switch assembly • Modulated or unmodulated RF output up to 100,000 microvolts, controlled by both fixed-step or variable output attenuators • 400 Hz signal modulation and 400 Hz audio output for audio tests • 2% tuning accuracy. 7 lbs.



Kit IG-72 $41^{95}

Assembled $64^{95}

Switch-Selected Audio Generator for Near Perfect Sine-Wave Signals

• A near perfect output signal — ideal for servicing or trouble-shooting high fidelity equipment • Switch-selected output frequencies — 10 Hz to 100 kHz • Less than 0.1 of 1% distortion — 20 to 20,000 Hz • Panel metered output is calibrated in volts and db • Output level and frequency accurate to within ±5% • 200 uA meter plus precision resistors for high accuracy. 9 lbs.

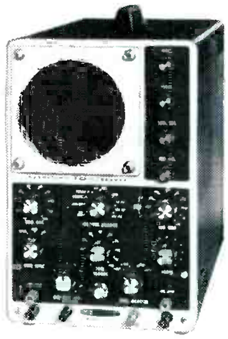
Instruments Come From HEATH!

Kit IO-14
Was $299
Now Only
$259.00

Assembled
$399.00

NEW LOW KIT PRICE! Now Save $40 On Professional 5" DC Oscilloscope

• A high stability 5" DC oscilloscope with triggered sweep • DC to 8 MHz bandwidth and 40 nanosecond rise time • Vertical signal delay through high linearity delay lines — capable of faithful reproduction of signal waveforms far beyond the width of the scope • Calibrated vertical attenuation • Calibrated time base • Forced air cooling • Input of Z-axis modulation. 53 lbs.

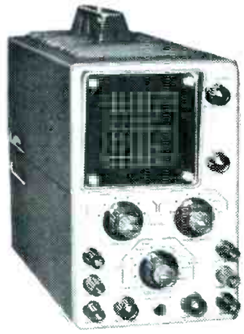


Kit IO-12
$81.95

Assembled
$137.50

Extra-Duty Wide-Band 5" Oscilloscope

• Ideal for TV trouble-shooting, professional & university labs • 5 MHz bandwidth for TV signal analysis • Heath patented sweep circuit — 10 Hz to 500 kHz • Two extra sweep switch positions which may be adjusted to often used sweep rates • Built-in peak-to-peak calibration reference • Combination of circuit board and wiring harness construction speed assembly time. 24 lbs.



Kit IO-10
$94.95

"Space-Saver" 3" DC Oscilloscope

• Identical vertical & horizontal DC or AC coupled amplifiers • DC to 200 kHz bandwidth — less than 5° phase shift • Recurrent sweep generator, 5 Hz to 50 kHz in four ranges • External capacitor binding posts for slower sweep rates • Small, compact, easy to carry from job to job • All critical voltages regulated for high stability • Transformer operated power supply. 16 lbs.

PKW-2
$12.00

NEW Low Capacitance Scope Probe

• Completely assembled, ready to use • Essential for high frequency wave-form analysis • Minimizes loss of gain, circuit loading or distortion • Designed for scopes with 1 megohm input, such as Heathkit IO-14 (above) • Switch for X1 direct or X10 attenuated operation • DC response to 25 MHz; max. DC voltage is 600 v. • Sliding, spring-loaded tip is notched for hooking to wires or terminals for hands-free use. 1 lb.

Kit ID-22
$23.95

Electronic Switch For Dual-Trace Scope Operation

• Permits display of two separate signals on CRT screen • Displays signal levels as low as 0.1 volt • ±1 db, 0-100 kHz response • Separate gain controls for each channel • All-electronic switching • Four switching rates — 150, 500, 1500 and 5000 Hz • Sync output to control scope sweep • Simple to use — just connect signal sources to "A" and "B" inputs & output to scope vertical input. 7 lbs.

Kit IO-21
$58.95

General Purpose 3" Oscilloscope

• Push-pull vertical and horizontal amplifiers for minimum trace distortion • Wide-range sweep — 20 to 100,000 Hz • Automatic sync • Retrace blanking • Compact, lightweight, versatile • Dependable, well-rated oscilloscope for general purpose requirements • Professional-quality components used throughout • Clean, open circuit layout for easy assembly. 12 lbs.

Kit IG-52
$67.95

TV Alignment Generator

• FM & TV coverage — Sweep oscillator covers 3.6 MHz to 220 MHz with 0-42 MHz max. sweep width • Stable, all-electronic sweep circuit • Built-in marker oscillators — 4.5 MHz crystal & 19 to 60 MHz variable. 14 lbs.

Color Bar & Dot Generator

• Produces 6 different patterns for picture adjustment • 10 vertical color bars — including special shading bar pattern • Crystal controlled for accuracy & stability • RF & video output. 13 lbs.

Kit IG-62
$64.95

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... for more details circle 125 on postcard

ELECTRONIC TECHNICIAN

JUNE 1967

A Look at the 20X1C38 Zenith Color Chassis

Learn how this set works and save time on home calls and shop repair jobs

TEKLAB REPORT

■ A few weeks ago a Zenith model X6520, using chassis 20X1C38, came into ET's TEKLAB and we wasted no time unboxing it and removing the chassis.

If you don't already know it, chassis numbers mean something. In this one, "20" indicates the number of electron tubes in the set — excluding the CRT and tubes in the tuners. The "X" identifies the model year, number "1" tells us that one transistor is used in the chassis, "C" means it's a color set and the "36" or "38" is an engineering design number indicating that some variations exist in the circuits.

We didn't need a screwdriver or hex wrench to remove the set's back cover. You quickly twist seven captive wing-type nuts, remove two clips and the back comes off. This arrangement saves technicians a bit of time.

A quick squint beneath the cabinet also revealed an easily removed heavy metal screen which exposes components in the bottom of the chassis and makes it unnecessary to remove the chassis from the cabinet when making checks or replacing parts. You just turn the cabinet on the side, with a padded mat on the bench, and work on the set.

Controls accessible from the back include set-up switch, buzz control, blue and green video gain; red, green and blue "G2" adjustments; vertical and horizontal centering; pincushion, HV and focus adjustments; and the color killer.

Controls located on the front include brightness range, picture peaking, contrast, brightness, vertical size and linearity. Some models include a tone control.

The HV cage is to the right, looking from the rear of the chassis, and the cage tilts back — permitting the two tubes in front of the cage to be removed easily. Plastic clips hold the HV heater wires away from the 3A3A HV rectifier (see Fig. 1).

When it becomes necessary to remove the chassis for servicing, the tuner assembly is easily detached

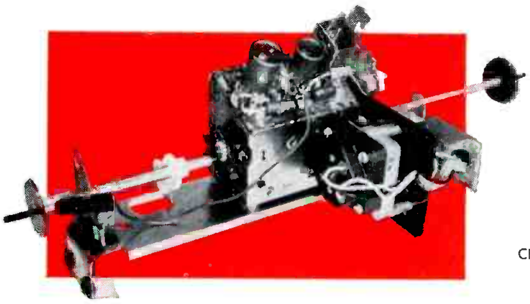

Fig. 2—The tuner assembly is easily detached by removing two mounting bolts.

by removing two mounting bolts (see Fig. 2). Two types of VHF tuners are used: rotary switch and "Gold Video Guard."

The chassis layout looks basically the same as the "N" chassis of 1966 (see Fig. 3), except for a few circuit changes which we will now summarize briefly but cover more fully when the various circuits are reviewed.

The automatic fine-tuning control (AFC) uses a pull-in correction (or "error") voltage to center the fine-tuning on the transmitted signal.

A bridge rectifier in the low voltage power supply develops 390v, permitting removal of the boost circuit from the "Y" amplifier plate circuit.

Specifications on the video preamplifier transistor have been upgraded with a new part number and an improved video gray scale range definition on the CRT.

The CRT bias potentiometer has been removed — resulting in one less operation when preliminary adjustments are made in a customer's home.

Several changes have been made in the vertical circuitry to improve interlace.

A new yoke mounting assembly has been installed to insure stability of purity adjustment.

New and important circuits used in the "XI" chassis will now be described more fully.

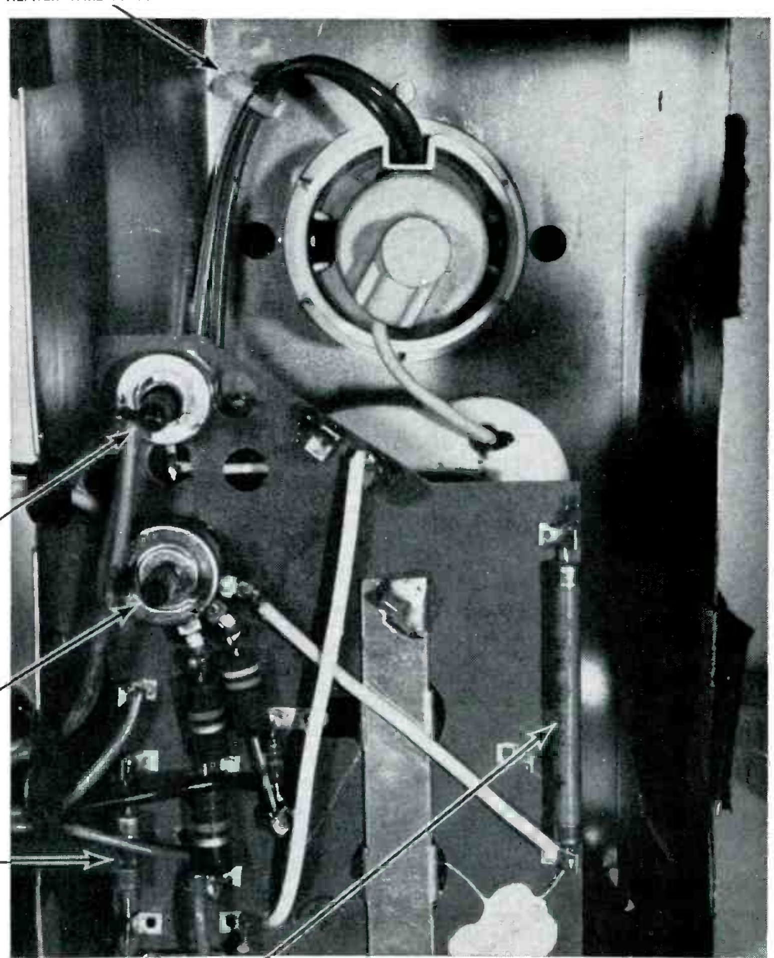

Fig. 1—Plastic clips hold heater wire away from the HV rectifier tube.

The Low Voltage Power Supply

The low voltage supply used in this chassis delivers 390v. As previously stated, this eliminates the need for B+ boost which was used in earlier chassis. A schematic of the bridge rectifier circuit is shown in Fig. 4.

Capacitor C155, 0.001μf, is used for parasitic suppression or for short circuiting any HF radiation which might otherwise cause interference on some RF channels.

The thermistor, R103, operates to short circuit the degaussing coils after a few seconds of operation when the receiver is switched on. The degaussing coils are symbolized by L42 and L43. Filtering is accomplished by electrolytic capacitors C32A, C57A and choke L44 for the 390v supply. C32D was added to the 250v supply following dropping resistor R104 — a 1K, 18w wire wound unit.

Two heater windings are shown as the bottom coils in the power transformer secondary. The CRT heater winding is on top and is connected through 220K to the 250v source. This places the heater potential of the CRT at a dc level similar to the cathode — minimizing cathode/heater breakdown.

The primary winding through the interlock, includes the ac switch and, for space-command sets, a tone-generator switch on the stepper.

Automatic Fine-Tuning Control

The AFTC circuit permits the

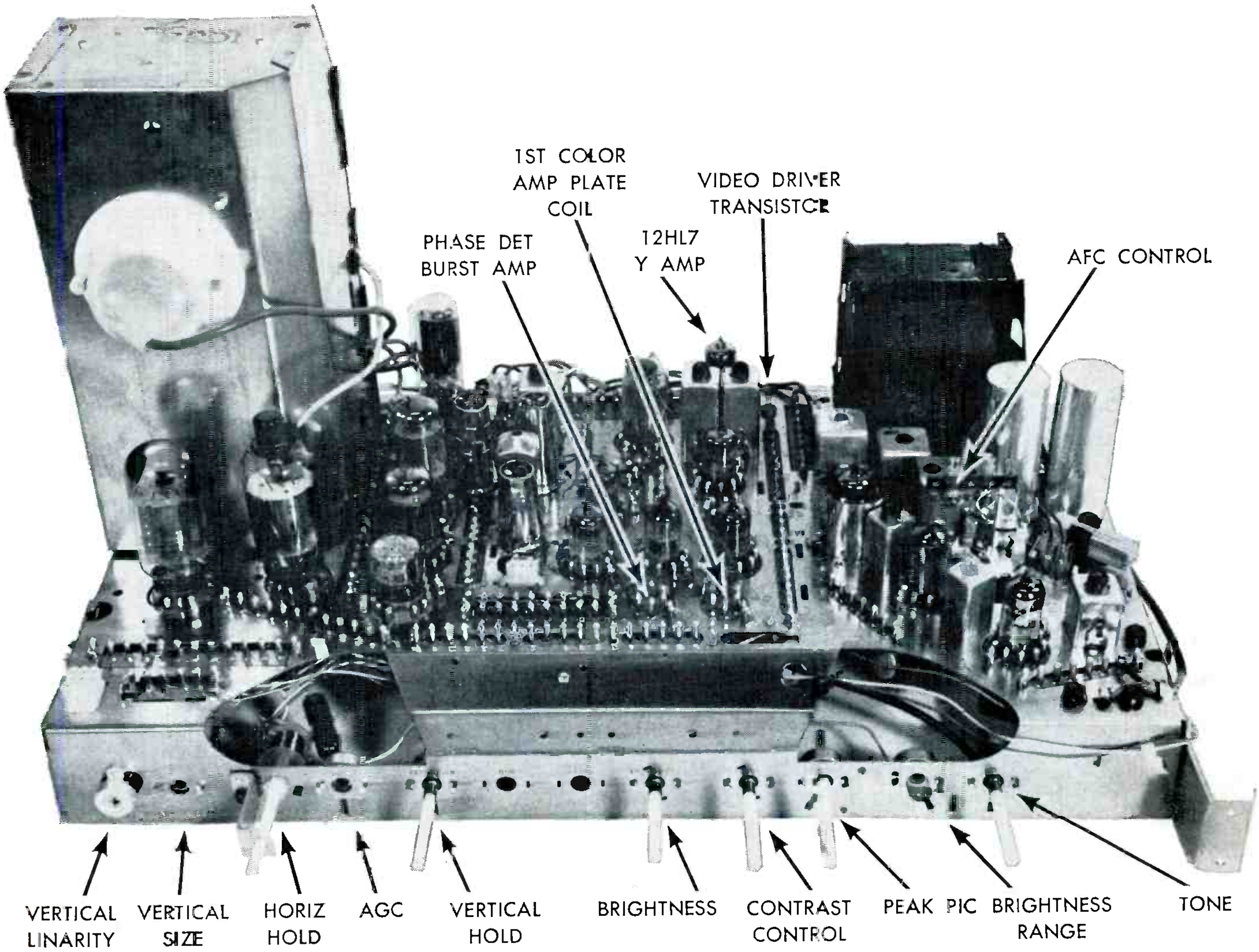

Fig. 3—Zenith's 20X1C38 looks basically the same as earlier chassis.

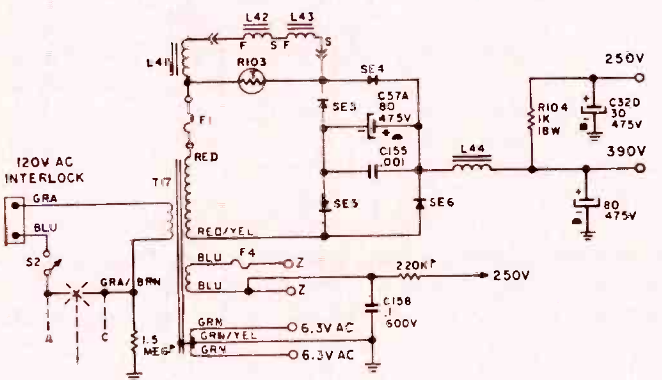

Fig. 4—The low voltage power supply delivers 390v eliminating B+ boost.

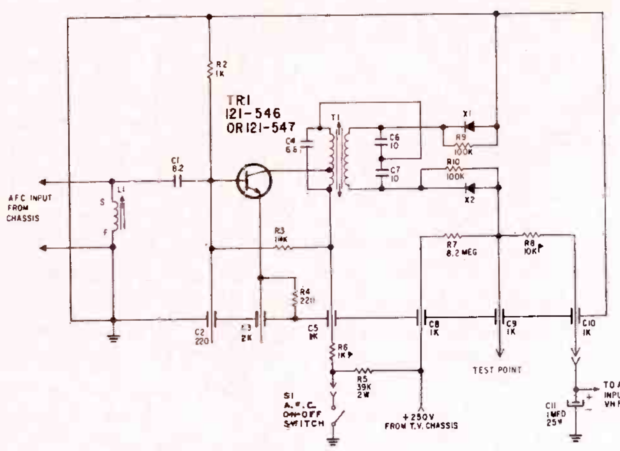

Fig. 5—Schematic of automatic fine-tuning control.

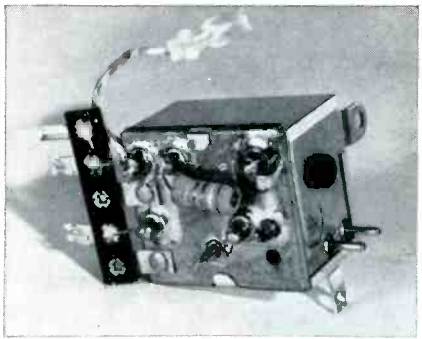

Fig. 6—The plug-in type AFTC unit shown removed from chassis.

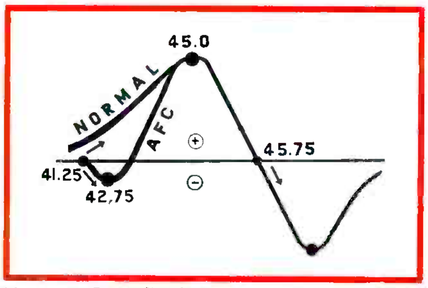

Fig. 7—AFTC discriminator response curve.

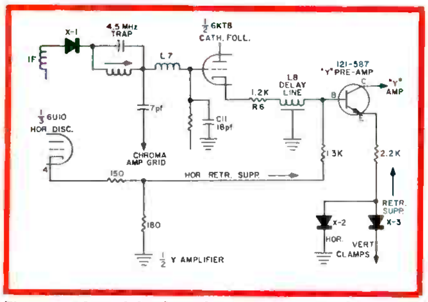

Fig. 9—Simplified schematic of Y-amplifier circuit from video det to transistor.

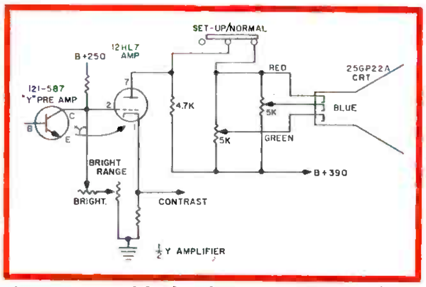

Fig. 10—Simplified schematic of Y-amplifier 12HL7 output to CRT.

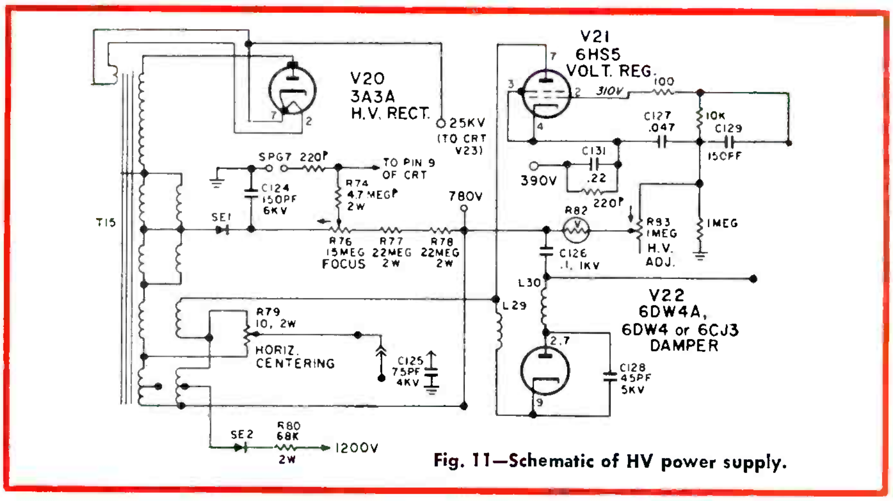

Fig. 11—Schematic of HV power supply.

receiver to lock on the proper color tuning when the fine tuning control is reasonably close to frequency.

This circuitry is basically an FM discriminator network of two diodes center-tuned to 45.75MHz at the output of a transistor (see Fig. 5). Since 45.75MHz is on the slope of the IF response curve, a correction has to be introduced in the form of L1, which is tuned above 45.75MHz — reacting with the IF curve to create a flat area between 45 and 46MHz.

The discriminator transformer is tuned so the primary (top) is on 45.75MHz. The secondary is properly adjusted when no shift occurs in tuning frequency as the AFTC switch on the front panel is switched from OFF to ON. The "perma-set" tuning must be previously adjusted for the best picture before the secondary is adjusted.

When making frequency adjustments of L1 and primary of T1, the AFTC output white lead is disconnected to improve sensitivity, then connected again while making the final "Zero Shift" adjustment of T1 secondary.

The AFTC unit is a plug-in type, with a mounting screw to obtain a firm ground contact (see Fig. 6). It may be removed from the set for servicing without upsetting receiver operation except to disable the AFTC function.

The discriminator response curve for the AFTC unit is typical, with one exception. The low frequency side of the response curve dips back below zero to the negative side in the vicinity of 42.75MHz (as shown in Fig. 7).

This was designed to operate in this manner for a good reason. Since there are two carriers involved in the transmitted TV signal — the picture carrier at 45.75 and the sound carrier at 41.25MHz — when 45.75MHz shifts upward in frequency on the normal curve it moves into the negative portion of the response curve. But the 41.25MHz carrier would then be riding up the far left portion of the positive skirt so the voltage would tend to counteract and cancel.

With the negative dip designed into the response curve at 42.75MHz, we find the carriers work together. When the frequency shifts upward and the 45.75MHz picture carrier shifts into the negative voltage area, the 41.25MHz sound carrier also dips toward the 42.75MHz minimum and develops a negative voltage — to aid the AFTC error voltage.

If the frequency shifts downward and 45.75MHz moves into the positive voltage area, the 41.25MHz signal drifts out to the left into an area of no correction voltage so it has no effect and can be disregarded.

Y-Amplifier Circuit

The Y-amplifier circuit handles the basic composite information, sync and video, to create the B/W picture viewed on the CRT screen. The color portion of the receiver merely paints over the appropriate chroma hue to reproduce the transmitted information.

The primary change in this chassis is the relocation of the retrace suppression and blanking circuits (see Fig. 8). Blanking for the "N" chassis was performed in the 12HL7 Y-amplifier grid circuit. Blanking pulses are impressed on the base of "Y" preamp transistor.

The composite signal at the 4.5MHz trap input is set at 5.4v P-P. (See simplified schematic Fig. 9.) The trap removes the 920kHz beat between sound carrier and chroma

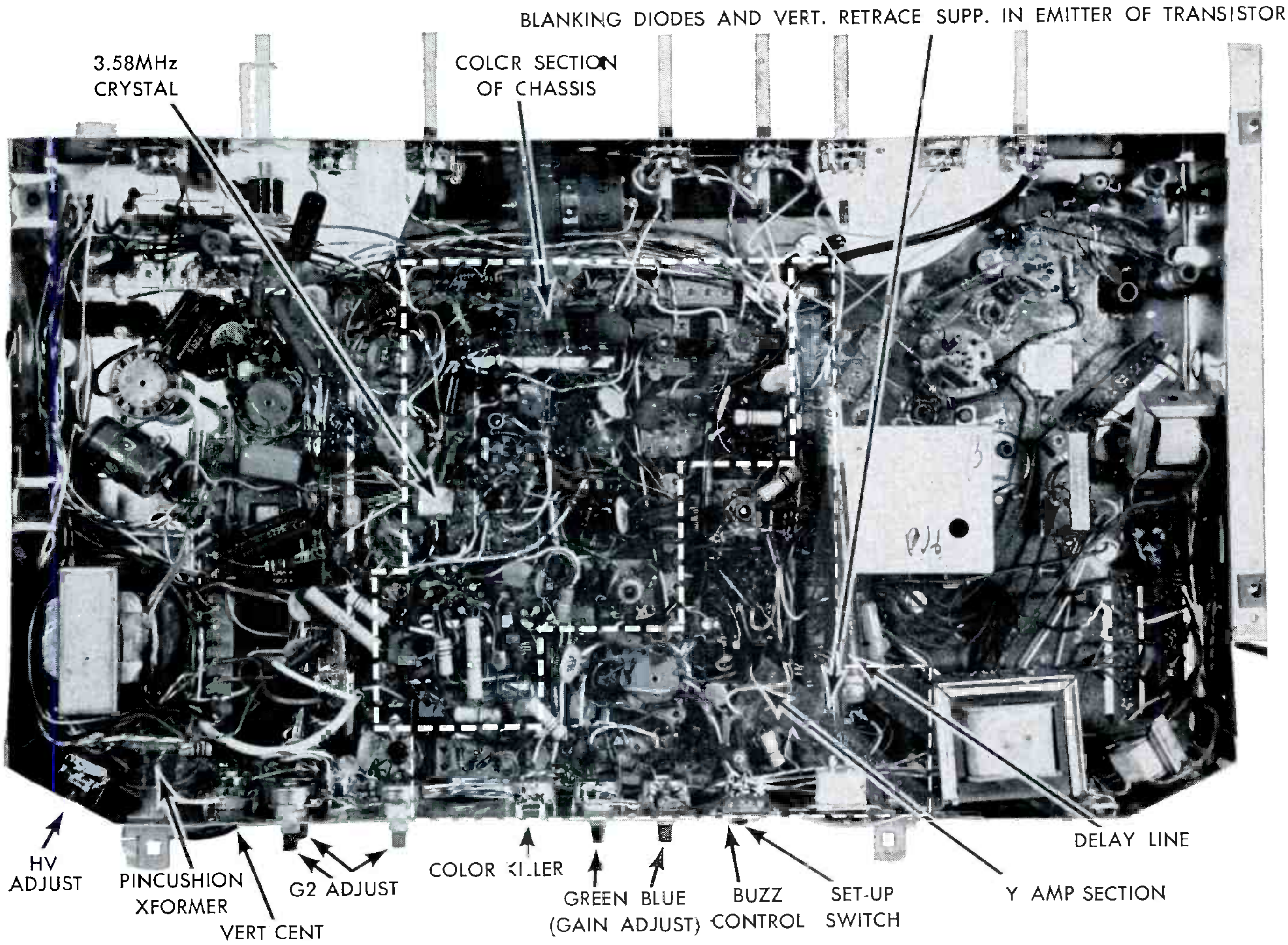

Fig. 8—Bottom view of chassis with color and Y-amplifier circuits outlined.

information by eliminating sound from the detector. The signal goes to the ½ 6KT8 cathode follower which is primarily an impedance matching system, transferring from the high impedance input circuit to the low impedance of the delay line. An amplitude loss occurs through the 1.2K resistor, R6, but a gain of 3v in the transistor delivers a P-P amplitude of about 8v to the Y-amp grid. Chroma information, through a 7pf capacitor, is sampled from the video detector.

L7, the input to the cathode follower grid, is a fixed-tuned trap in which the series-tuned capacity is C11 to ground (18pf) in parallel with 3pf of the cathode follower input. Its null is somewhat below 3.58MHz so chroma information slopes up on the far side, offsetting the downward slope of chroma data on the IF response curve — producing a flat region in the vicinity of 3.58MHz.

The transistor output drives the Y-amplifier grid (see Fig. 10). The brightness control and brightness range control are in the grid of the 12HL7. Contrast is controlled in the cathode. The 12HL7 output — through the "set-up" switch — then delivers composite P-P information to the CRT red gun and through the "gain adjustment" control to the blue and green CRT cathodes. The blue and green controls will be set at 80 percent full clockwise.

Here we see two changes from the "X" chassis: first, the CRT bias control from the blue and green "gain adjustment" controls has been removed. Second, the "B+ boost" circuit with its associated diode rectifier has been removed. This has occurred since the 117 vac power supply has been changed to a bridge rectifier network with B+ output of 390v.

In setting up the picture, 2-point video tracking is recommended to neutralize white highlights in bright areas: low level is set with the "set-up" switch and high level is adjusted with drive controls to minimize change between cut-off and highlight.

HV Power Supply

The "X" and "XI" chassis introduced a new circuit in HV regulation, a circuit in which the regulator tube is in the primary winding area, rather than across the 25kv output, dissipating less power and providing longer life.

Two important features in the operation of the circuitry are:

The flyback transformer has a

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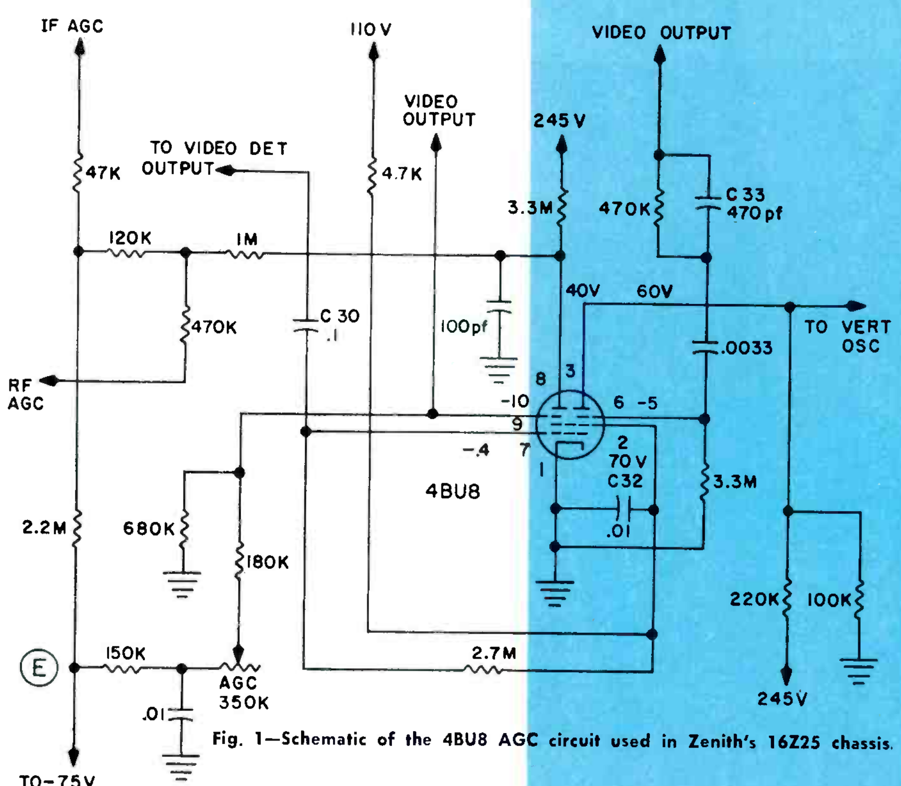


Fig. 1—Schematic of the 4BU8 AGC circuit used in Zenith's 16Z25 chassis.

You can't fix 'em if you don't know how they work

UNDERSTANDING

■ In the previous article of this series (ET May 1967) we digressed briefly to introduce some important basic considerations concerning solid-state AGC circuits — giving special attention to "forward AGC" techniques. We will now review the operating characteristics of the most notorious of all tube-type keyed AGC circuits — known to every expert bench-technician as the three-in-one, or "triple-threat" circuit.

The Triple-Threat

Every experienced technician is familiar with a group of 9-pin miniature sharp-cutoff twin pentodes which include the original 6BU8, the 3/4GS8's and the twin pentodes of the duodecar (compactron type) 6/8BA11's The high-mu triode, sharp-cutoff pentode 6/8KA8's, together with the 8LC8, may also be associated with this group. The triode section in the 'KA8 and 'LC8 types are generally employed as a sync-separator and the pentode, which has two control grids, is used as a gated-AGC-amplifier and a noise-inverter.

In the twin pentode group, one pentode is generally used as a combined sync separator/clipper and the other as AGC keyer.

The first 6BU8 sharp-cutoff twin pentode AGC circuit made its appearance about 9 or 10 years ago in Zenith sets. This circuit, however, did not use the gated or keyed system as later circuits did. No flyback transformer keying pulse was used. To understand modern 'BU8 circuits, it may prove helpful to review the original circuit design and how it functioned.

The circuit shown in Fig. 1 is used in a Zenith 16Z25 chassis — a 14in. portable which has a series-string 4BU8 as the AGC tube.

AGC voltage in this circuit, applied to both the IF and RF stages, is the resultant of two dc voltages of opposite polarity — one remaining constant while the other changes with the signal level received from the transmitting station.

A constant negative voltage is taken from the grid of the horizontal discharge tube and applied to point "E" shown in the circuit. A varying positive voltage, resulting from a drop through a 3.3M plate load resistor which is connected to a 245v B+ source, is applied to tube element 8 — the plate.

The 2nd control grid (element 9) receives a positive-going compos-

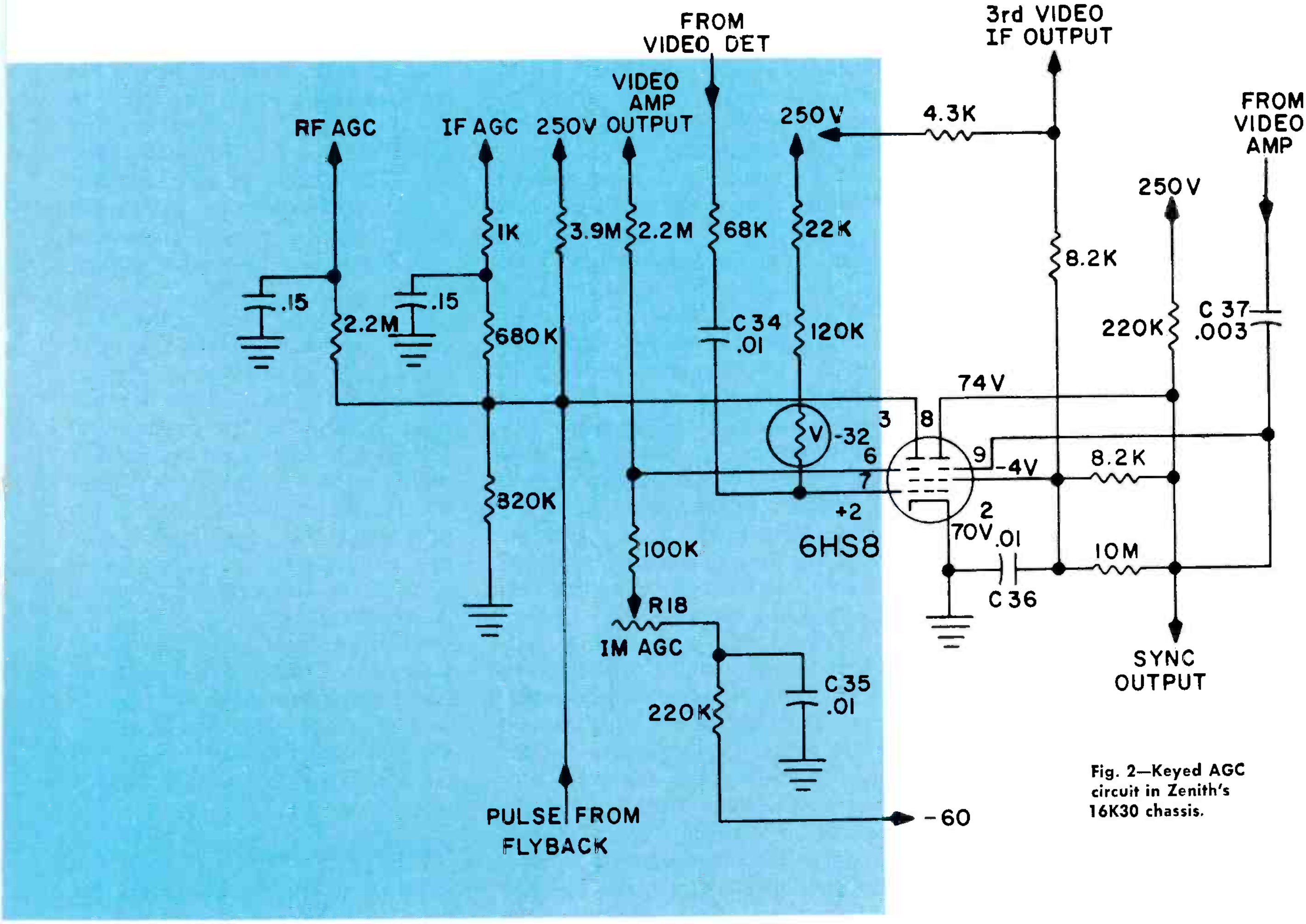


Fig. 2—Keyed AGC circuit in Zenith's 16K30 chassis.

MODERN AGC CIRCUITS

PART THREE OF A SERIES

ite video signal from the plate circuit of an 8AU8 video amplifier. This voltage is directly proportional to the strength of the received TV signal. In effect, the stronger the TV signal at element 9, the greater the current and the smaller the positive voltage at tube element 8. When the signal level drops, the opposite effect takes place. When the signal is zero, the +50v from the AGC tube plate and the –70v from the horizontal discharge grid combine across the 2.2M, 120K and 1M resistors so that the resultant IF AGC voltage is zero.

When a signal is received, the positive going composite signal at the 2nd control grid causes an increase in plate current and a greater voltage drop through the 3.3M plate load resistor. As an example, if the received signal is at a level to cause the plate voltage to drop to 45v, then the difference voltage on the IF AGC bus is –5v. A stronger signal would cause this voltage to become more negative and a weaker signal would cause it to become less negative.

Noise gating for both the AGC and sync is accomplished by applying a negative-going composite signal from the video detector to the 1st control grid, element 7. The 2.7M resistor connected to the grid regulates the bias so that any noise burst greater than the composite video signal will cut the tube off. Noise is prevented from interfering with AGC voltage or sync information.

The 2nd section of the 4BU8 is the sync clipper. A positive-going composite video signal from the video amplifier output is coupled to the 2nd control grid, element 6, of this section of the tube. The negative bias, as previously stated for AGC action and developed as a result of grid current flow through the 3.3M resistor, is held to a level that allows only the sync tips to appear in the output.

The 2.7M grid resistor regulates the bias at the 1st control grid, element 7, so that any noise burst greater than the composite video signal will cut the tube off. A strong noise pulse may occur on rare occasions at the sync pulse time and cut the tube off, but the flywheel action of the sweep oscillator will maintain sync during this brief period. Operation of this system is based on the principle that the loss of an occasional sync pulse is better than having the sweep oscillator triggered at the wrong time.

UNDERSTANDING . . .

Delayed RF AGC is also used in this circuit. This voltage is taken from the junction of the 120K and 1M resistors. AGC action to the tuner is delayed until the signal level reaches approximately 500μv. The 350K AGC control pot is used to adjust the bias on the 2nd control grid to maintain the detector output at approximately 3v P-P.

The original 'BU8 AGC, noise cancelling, sync clipping circuit has evolved into a number of different arrangements, but most circuits perform approximately the same. We will now look briefly at one of the modern 'BU8 "mutants."

Modern Triple-Threat Circuit

One modern version of the 'BU8 tube is the 3/4/6SH8. It was widely used in Zenith TV sets a few years ago. While tubes, circuit component values and voltages vary somewhat in most of the recent sets, the circuits all perform similar functions. Let's go over the operating details of this triple-threat circuit which performs the three functions of generating AGC bias voltage, eliminating noise and acting as sync clipper. It's a lot easier and faster to troubleshoot this circuit if you have a thorough knowledge of how it functions.

The schematic in Fig. 2 shows a 6HS8 keyed AGC/sync clipper circuit used in a Zenith 16K30 chassis.

The 6HS8, like the 6BU8, has two plates and two suppressor grids. It has one cathode, one control grid and one screen grid. The suppressor grids act as signal grids — element 6 for AGC and element 9 for sync. The outputs of the two halves are: plate element 3 for AGC, and plate element 8 for sync. The screen grid, element 2, is common to both halves of the tube. The control grid, element 7, performs noise cancellation for AGC and sync.

The control grid is connected to a B+ source and it also receives a negative-going composite video signal from the video-detector output through a 68K resistor and a 0.01μf capacitor, C34.

Note that a voltage dependent resistor (VDR) is in series with the control grid and the B+ source and is returned to the video amplifier screen grid. The VDR limits the voltage on the control grid to a certain critical value. When the video signals are strong and the voltage on the video amplifier screen is high, for example, the VDR acts as a low resistance.

Element 6, the suppressor grid, receives a dc coupled positive-going signal from the video amplifier output. The suppressor is prevented from being driven positive by the dc component from the video amplifier plate (through a 2.2M resistor) by having a –60v bias applied to it from the horizontal output amplifier control grid. The 1M AGC control, R18, determines the bias level. The dc voltage on the suppressor reflects the dc level variations at the plate of the video amplifier but is always maintained negative by the bias network to prevent the suppressor from drawing current. Approximately –32v is maintained on the suppressor grid to keep the plate cut off except when the positive horizontal sync pulses override the bias.

Once again, when the positive sync pulse at element 6 arrives coincident with a positive keying pulse from the HOT at element 3 (plate), the tube conducts for this brief instant. An AGC voltage is thus developed across the 3.9M plate load. This voltage is divided, filtered and fed to the IF amplifier grid and the grid of the RF amplifier. The grid of the AGC controlled IF amplifier is prevented from going positive by maintaining its cathode more positive than the grid. And the voltage supplied by the divider acts as delay voltage for tuner AGC.

It should be noted here that the AGC delivered by this circuit is positive with respect to ground because of action which takes place in the 3.9M and the 820K resistors which are in series across the 250v line. The current pulse at element 3 varies the voltage — reducing it more by larger current pulses and reducing it less by weaker current pulses.

Noise is suppressed in the AGC circuit as follows: When a large noise pulse is received, it appears simultaneously as a large negative signal voltage at the control grid (element 7) and as a large positive signal at the suppressor (element 6). The control grid is driven highly negative by the large negative voltage, cutting off plate current. This prevents development of excessive AGC voltage.

We have now completed a review of the basic circuits and functions of modern AGC circuits, including solid-state fundamentals. We will now consider circuit trouble symptoms and troubleshooting techniques.

Trouble Symptoms

Every technician who earns his daily salt already knows that a logical servicing procedure is the key to effective troubleshooting and repair — and this holds true for TV AGC circuit troubles.

AGC trouble symptoms are varied but we identify the trouble in this section primarily by symptoms that appear on the TV screen or in the audio output.

"Ah," you say, "but the same symptoms can be caused by defects in areas other than the AGC system —namely the RF section, the video detector or the IF circuits, for example."

This is true. But when we're not certain where the trouble lies, we can easily substitute an external bias source and make sure that the trouble is either in the AGC section proper or in some other section. For solid-state circuits we may have to vary this technique somewhat but the principle approach will remain the same.

Forthcoming articles in this series will be devoted primarily to AGC trouble symptoms and the techniques used in troubleshooting and repair. ■

THE APPRENTICE AND THE PRO

The critical shortage of technicians inspired this real-life, in-shop story of a wise service-dealer who anticipated the problem and did something about it

Part One of a Continuing Series

■ From coast to coast, from border to border, you have been hearing the wails of TV-radio service-dealers who have found it increasingly difficult to obtain adequately trained technicians. This was inevitable, considering the lack of proper directives and planning in the industry. And for almost two decades, some self-styled "leaders" in the industry were diverting attention with minor issues, like DIY tube testers, "moonlighting" and so-called "below-the-belt" practices of some manufacturers and distributors. Additionally, they were wasting a lot of valuable time being oversensitive to constructive criticisms and defending themselves from criticisms which were, for the most part, thoroughly justified.

Only in recent years — after the fact — have they become involved in apprentice training programs. In effect, until recently, they have "fiddled and fumed while Rome burned."

But some far-seeing service-dealers continued to read their professional trade journals carefully and refused to allow their attentions and energies to be diverted by minor issues. A few, for example, exerted considerable effort to establish and develop apprentice training programs and some have continued these programs throughout their successful operations — for up to 15 years. These service-dealers are now reaping valuable rewards from their past efforts.

"The Apprentice and the Pro" is a continuing story relating to one such operation and the story reveals the day-to-day trials and errors of an apprentice and the technicians under whom he worked and trained for four years — before the apprentice became properly skilled in the areas of TV, radio, Hi Fi stereo, two-way radio and audio communications servicing.

The Apprentice

Donald Jackson graduated from high school at age 18. With a little advice and direction he could have gone on to college, but he didn't get the help he needed. Instead, he went to a trade school for one year and

Training Centers Established

New York, N.Y., April 12, 1967—Permanent training centers to help cope with the serious shortage of experienced TV technicians are being established by the RCA Service Co. in six key metropolitan areas, A. L. Conrad, president, announced today.

Mr. Conrad said the project, first of its kind in the TV industry, will enable the company to train same 2500 technicians in the coming year—twice as many as it trained in 1966.

He estimated that 25,000 additional color TV service technicans will be required by the industry in each of the next five years because of the tremendous growth of color TV. There are more than 10 million color TV sets now in the United States and this number is expected to jump to more than 16 million by the end of 1967, it was said.

studied the basics of electronics. He later finished a correspondence course in TV-radio servicing, but before that he got a job as a helper with a 15-year-old TV-radio service-dealer operation in his home town. He helped with antenna installations, ran to the distributor for tubes and replacement parts, checked tubes in sets brought in for repair, cleaned the dust from chassis and sometimes watched the two bench technicians troubleshooting TV sets, radios, Hi Fi stereo amplifiers and various types of two-way communications equipment.

Then one day the boss called him aside.

"Don," the boss inquired, "how would you like to become a qualified service technician?"

"I think I would like it," Don answered.

"You'll have to be a little more definite," his boss said.

"Well, I really want to very much," Don said, more enthusiastically.

"It will probably take four years of hard work and study," the boss frowned.

"I'm ready to start now," Don smiled.

"OK. Continue with the work you're doing and beginning next Monday morning I want you to see Jim Barker. And he'll probably be sending you out with one of the house-call technicians, too.

The Pro

Jim Barker was 33 years old. He graduated from high school, served two years in the armed forces, studied radar while doing his stint, attended a resident electronics school for one year, served two years as an apprentice technician and had since attended two factory-sponsored training schools and many manufacturers' seminars. He had a 20 percent capital interest in the service company he worked for and his income, plus a slice of the annual profits, was well within the five-figure category. He now has a total of almost 7 years' experience as a qualified home-entertainment equipment technician. He also holds a first class FCC telephone license and is nominal "manager" of the service department where he works.

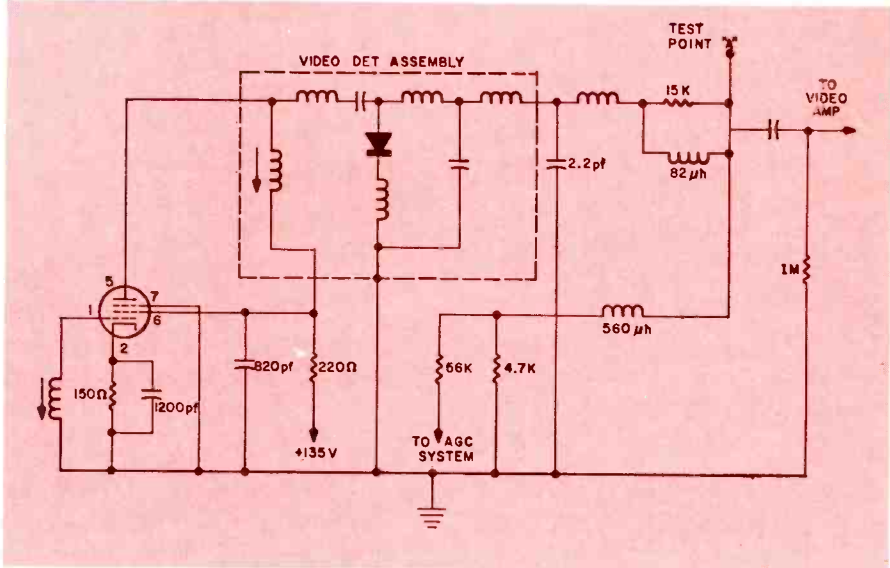


Fig. 1—Typical video detector circuit showing output at test point "A."

Learning by Experience

Don Jackson arrived at the shop 10 minutes early the following Monday morning. His boss was already there and the store's front door was open. Don said "good morning" to his boss as he hurried back to the work benches. He was surprised to find Jim Barker at the bench concentrating on a scope waveform. Jim glanced up and said "good morning, Don, have a cup of coffee," motioning to the coffee perculator at the other end of the bench. Don poured a cup of coffee and returned to Jim's side.

"Don," Jim began, "we're not going to do this like they do in school. We don't have time to organize 'lessons.' But we do have a plan, and as the weeks, months and years pass — I hope quickly and interestingly — you'll meet every problem that arises in this business. When you've finished, you'll know as much as I do about it." Jim thought he observed an impatient expression flash across Don's face.

"In every skilled profession," Jim continued, "we need specialized instruments to help us with our work. Otherwise, no matter how much we know, we just can't do the work efficiently and fast enough. And we have to learn how to use these test instruments in a systematic way so the process eventually becomes automatic, fast and efficient.

"You are already familiar with the tube tester. But remember, a tube tester can only give us certain information. To make sure a tube is good, we have to substitute it with a known-good tube before we're absolutely certain. You'll learn this more thoroughly after you have gone out with the house-call technicians for a few months. Remember, too, a 'known-good' tube means just that. It doesn't mean just a 'new tube' off the shelf or out of the caddy. Some new tubes are defective — or become so the first time they heat up."

Don Jackson was all ears and he hadn't said a word since his good-morning greeting to Jim Barker.

Jim plugged the power cord of a VTVM into an ac outlet on the bench and flicked a switch on the meter front to the ON position.

"Now we'll wait a few minutes for the VTVM to get warm," Jim said. "And before we can use the meter we have to check the needle ZERO adjustment. We turn this control here until the needle is exactly on zero at the left side of the scale. It'll drift slightly until the meter reaches a certain temperature so we also have to remember to check and touch it up if necessary.

"Now we're going to set up the meter to read ohms. Notice this probe. It has a little push/pull

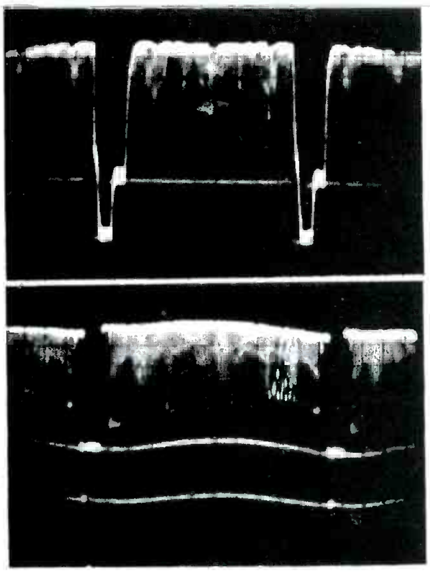


Fig. 2 (A)—Composite video sync-pulse negative signal at video detector output with scope set at 7.875kHz. (B)—Same signal with scope set at 30Hz.

switch on it. We push it forward to measure DC VOLTS and pull it backward for AC/OHMS." Jim pulled the switch back with his thumb.

"But we're still not ready to measure resistance. We must first determine approximately how much resistance we're going to measure." Jim reached up and pulled a resistor box drawer open and took a single 1w carbon resistor from the drawer.

"Do you know how to read the color-code on resistors?" Jim asked suddenly.

"I did once, but I've forgotten," Don frowned.

"Well, you'll learn again and this time you won't forget. This will be part of your home-work for the time being." Jim handed Don a card showing how resistors are color coded.

"You'll learn it more thoroughly by doing. See, this resistor has two red circles, one yellow circle and one silver circle. That means its resistance is 220K with a tolerance of ±20 percent. Now let's see what it actually measures on the VTVM."

Jim turned the right function switch on the meter to R OHMS and the meter needle moved to the right but stopped before it reached the far end of the scale.

"Ah, but we're still not ready to measure the resistor's value," Jim smiled. "We now have to 'balance' the meter for ohms."

Jim turned a control marked OHMS which moved the meter needle to the right where it rested on a line next to an INFINITY sign on the scale. He then clipped the COMMON, or GROUND lead to the probe tip and the needle swung quickly back near zero.

"Now, we touch up the ZERO control again," Jim said.

He disconnected the COMMON lead from the probe tip and the needle swung close to the INFINITY line. He touched up the OHMS control again slightly.

"Now we're ready to measure the resistor," Jim said. He clipped the GROUND lead to one end of the resistor and touched the probe to the other end.

"Look," Jim said, "at the top meter scale marked R. The needle splits the 200 marker. Since we're set on the Rx1K scale, the resistor measures 200K. It's barely within tolerance. Let's try the Rx10K scale." Jim turned the left function switch and then rechecked the meter balance. He then measured the resistor once more.

"Now look. The needle comes almost to the 22 marker on the scale. It's resistance is well beyond 200K — closer to 220K.

"Remember, Don," Jim continued, "always balance your meter for ohms each time you make a measurement and each time when you shift to a different Rx position. Incidentally, this meter has an input resistance of 11M and it will measure resistances from about 0.5Ω to 1G. That's up to 1000 million ohms, or 1000 megohms," Jim concluded.

"That's a lot of ohms," Don commented.

Jim flicked the right function switch to the OFF/TRANSIT position and handed the probes to Don. "Now you do it," Jim said quietly.

Don had already memorized each step in the procedure but it took him 5 minutes to carry out all the steps and measure the resistor.

"Don't let your slow speed bother you," Jim encouraged. "After you do it the same way a few hundred times it will become automatic and you'll do it within 30 seconds after the meter becomes warm. You'll be using that meter a few minutes every day from now on." Don switched the meter off and a pleased expression was obvious on his face.

"Now," Jim smiled, "I'd like to introduce you to this scope and a few waveforms. This chassis here is from an old set we took in trade. It needs some work before we can put it on the 'used-set' counter."

Jim picked up the scope probe from the bench and attached it to a test-point in the chassis.

"The scope probe is a high impedance type. It won't load the circuit and give distorted waveforms.

"We now adjust the scope's vertical gain, horizontal gain and set the frequency to about half the horizontal time, or 7.875kHz. Then a touch of the sync control, the focus control and we'll brighten up the display with a little more intensity.

"Now take a look at this schematic," and Jim pointed to the exact spot on the schematic where the scope probe was attached (Fig. 1, test point "A"). "The waveform you now see on the scope screen (Fig. 2A) is a composite video signal having a negative-going sync pulse which you can easily see. That's the horizontal sync pulse, of course, and we have two of them because we have the scope's time-base oscillator set at half the incoming horizontal frequency. If we adjust the scope's time-base frequency to 15.75kHz we'd get one horizontal sync pulse in the display. When we adjust the time-base to 30Hz, half the vertical frequency, we get the waveform shown here (Fig. 2B) and two vertical pulses are easily seen. Remember how these waveforms look because they are typically good composite video signal waveforms at the video detector output of any TV set. But, remember too — the signals *could* be turned upside down 180deg, sync-pulse positive — depending on the circuit design."

"That's all for now, Don," Jim concluded. "Here's Bob Morkin with a fist-full of house calls. I want you to follow him around until lunch time. Report back to me after lunch."

Don and Bob turned and walked away, Bob carrying a stuffed tube caddy, out the back door to the waiting service truck. ■

PROTECTING ELECTRONIC CIRCUITS

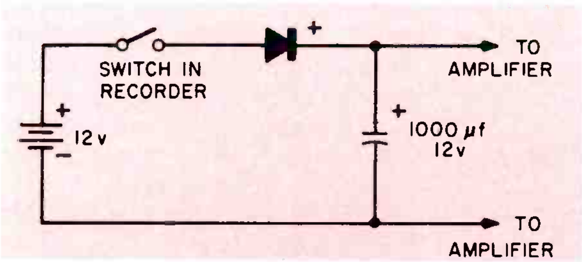


Fig. 1—Diode properly inserted in battery lead discourages do-it-yourselfers and prevents damage to equipment.

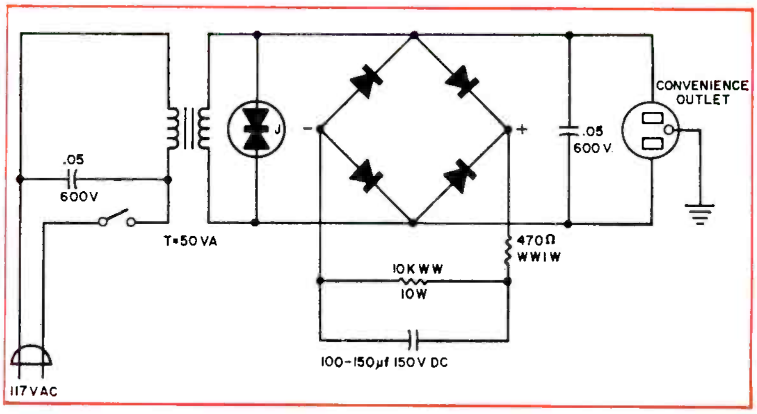


Fig. 3 — Circuit used to prevent phototimer from "tripping."

Know your fuses, circuit breakers, fuse-type resistors and learn how to 'innovate' protection for your customer's equipment

■ Components used to protect electronic circuits—regular fuses, circuit breakers and fuse-type resistors—have always been held in low esteem by amateur electronics buffs, hobbyists, do-it-yourselfers and many would-be technicians. But experienced service-technicians know the value of these components. What professional technician has not, at least once, come face-to-face with the classic example of this disregard—the well-known "fuse-abuse"—a piece of solder or copper wire wrapped around the two spring clips of a fuse holder?

We remember one specific call for service, made by a rather hysterical lady, who said her set was "smoking." We almost made a wise-crack about a 4-year-old set smoking, but decided against it. We arrived at her home two steps ahead of the fire department and quickly removed the line cord from the wall outlet. The two 5U4s in the full-wave rectifier had holes in their plates and the power transformer was hot enough to fry eggs. A subsequent investigation revealed that an electrolytic power supply filter had shorted and it, the 5U4s and the power transformer refused to give up easily. Yes, you guessed it, the 5a fuse holder had a piece of solder wrapped around its clips.

If you don't already know it—if you are not aware of the importance of circuit protecting components—let's get it straight: when circuit protecting components are called upon to perform the job they were designed for, they are the most important components in the gear.

The Regular Fuse

The most widely used protective component is the fuse. And if you think "a fuse is just a fuse," you'd better get this brain-boggling idea out of your head. There's a fuse for every purpose—and the various types are *not* interchangeable. You can't put a "slow-blow" fuse, for example, in a circuit which calls for a "fast-blow" type without inviting trouble. A good way to disable an expensive test instrument is to put a "slow-blow" fuse in it.

For test instruments, home-entertainment and CB communications equipment, we normally come into contact with three types of fuses—fast, medium and slow-blow.

The current rating of a fuse is expressed in amperes or fractions of amperes and indicates how much current the fuse will pass safely without blowing.

Voltage ratings are generally specified as 32, 125 and 250. Because fuses are sensitive to current changes and not voltage, we are not too much interested in voltage ratings—except in designing circuit protection for special equipment.

Quick- and medium-acting fuses are designed with medium to high melting temperature elements which are made as small as possible to reduce thermal inertia and shorten the blowing time.

Delayed action fuses are designed with compound elements having larger mass, low melting point alloy, which increases thermal inertia and slows down the blowing time.

In some equipment, especially mobile radio and audio communications gear, it is advisable to use specially designed anti-shock and vibration type fuses. These are made in various voltage and current ratings.

Fuses used in test instruments should be given careful consideration by technicians. This is especially true for fuses used to protect delicate meter movements from damage caused by sudden current surges, short circuits or accidental voltage overloads.

It should be noted that these special fuses do not blow when maximum current is reached. They are designed to blow faster than the time it takes for a meter's pointer to reach full scale—somewhere

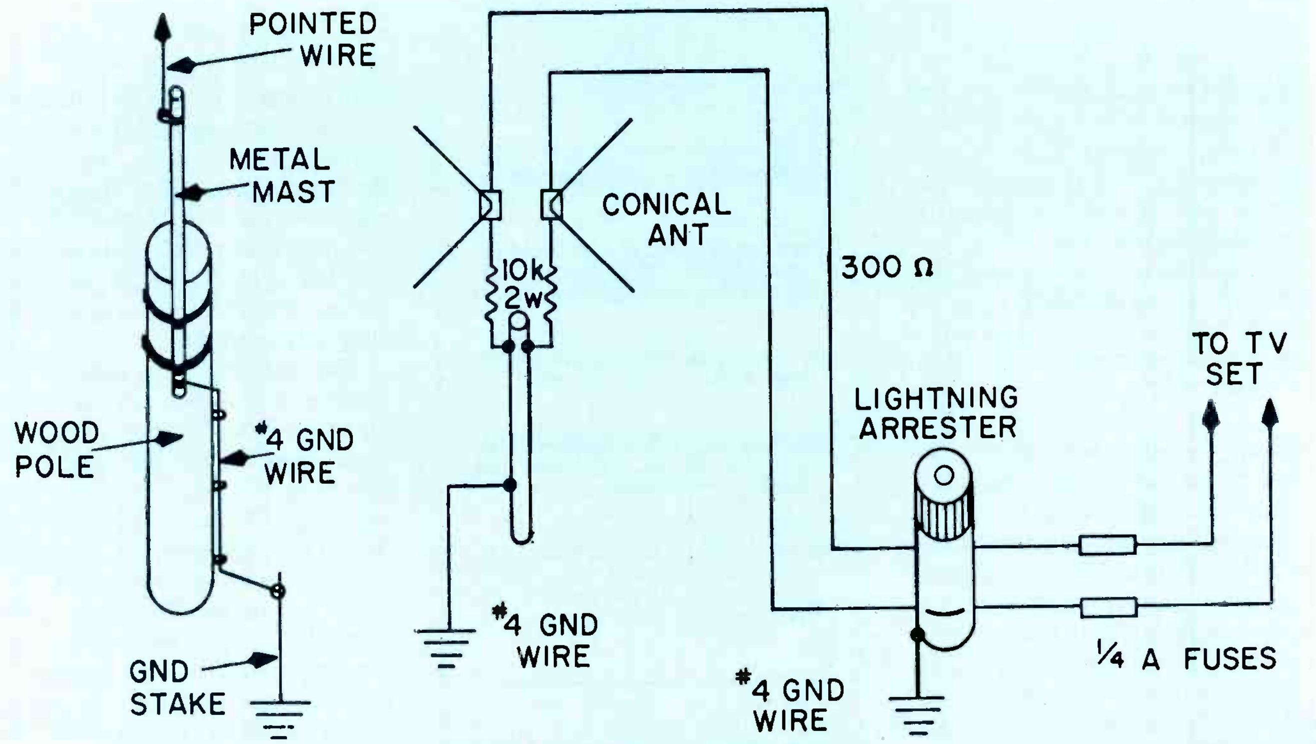


Fig. 2—Method designed to protect TV tuners from lightning strokes.

around 1/100 of a second. This is necessary because damage takes place before the meter coils can burn up. This prevents whiplash-bent pointers and twisted or burned out pointer-coil assemblies.

New and better circuit protective components are constantly being developed. In addition to the temperature-sensitive, voltage-regulating "Globar" and "fused-resistor" types which are more widely used in primary circuits of series-string type power supplies, the "Amp" and "Belfuse" are now being widely used in both the primary and secondary circuits of B/W and color power supplies. Some are even used in damper circuits. The reset-type circuit breaker is also being used in the secondary circuits of many power supplies. The thermistor, of course, is also used in place of Globar-type resistors to some extent.

The Amp and Belfuses are color coded for individual, specific ratings. The colors include black, gray, red, blue, pink, maroon, yellow and green. Technicians should be careful to replace the original part with a similar identical colored fuse.

Not every situation can be solved with fuses, however. Here are some practical problems which can be solved only by the ingenuity of expert technicians.

Protecting Solid-State Circuits

It has been estimated that more good semiconductors have been destroyed by voltage surges than any other cause. And every technician is constantly faced with the problem of protecting equipment and instruments against transient voltages. The protective components are seldom included in original equipment design, so it becomes the responsibility of technicians to figure out what protective components are needed and where they must be installed. This is an engineering job, of course, but the work of service technicians requires more and more engineering know-how as new semiconductor types are developed and circuits become increasingly more complex.

A few important situations where surge and other protective measures must be undertaken will be covered here.

Wrong-Way Batteries

A portable tape recorder came to our attention which had battery "polarity" troubles. Radio owners seem to have considerable trouble with these penlight cell recorders—when they insert cells backward.

In this particular case, we installed a la, 200 PRV silicon diode (see Fig. 1) in series with the positive battery lead. The voltage drop across this diode was not enough to affect the normal operation of the recorder, but the equipment was protected from those who seem to insist on inserting the cells backward. When they put the penlight cells in backward now, nothing happens, and they have to insert them correctly before the equipment will operate. The same principle can be applied to any solid-state equipment that operates from batteries. It's a good idea to add a large capacitor to the circuit as shown in Fig. 1. The capacitor may be omitted if one is already installed by the manufacturer. Check the equipment wiring diagram. Many better radios and tape recorders already have a capacitor installed to inhibit oscillation with partly run-down batteries. If this capacitor is less than 1kμf, replace it with a larger one.

'Electrocuted' Tuners

Electrostatic charges on the antenna were damaging the tuner on a customer's TV set. This is always a revolting development to both owner and service technician because it means an entirely new tuner assembly in many cases. This frequently results in considerable expense and time.

A preliminary inspection of the

installation revealed that the antenna was a conical type, installed on a metal pipe fastened to a wooden pole mounted in the ground. The location was excellent from a signal viewpoint—up and away from surrounding objects. The set was protected by a conventional lightning arrester installed outside the window just before the lead-in came into the house and grounded with size 14 wire to a piece of pipe. The lightning arrester was burned up internally. It did not save the tuner.

The first step in our solution was to ground the TV antenna mast (see Fig. 2). We drove a standard power-line ground stake close to the wooden pole and ran a size 4 wire up to the antenna mast. Additionally, we filed one end of a 3ft piece of size 4 copper wire to a sharp point and installed it atop the antenna mast with the sharp end pointing upward to act as a lightning arrester. We connected two 2w, 10K carbon resistors across the 300Ω lead-in at the antenna. After re-installing a good lightning arrester at the window, we went inside to the TV set and installed two ¼a, quick-blow fuses—one in each antenna lead just before it entered the cabinet. These fuses may blow during a thunderstorm, but they are cheaper than TV tuners.

The 'Tripping' Photo Timer

A phototimer used by a professional photographer tripped when his print dryer and furnace kicked on and off. The timer was a line-operated (transformerless) type having a solid-state timing circuit.

We mounted the components shown in Fig. 3 in a 3 x 4 x 5in. aluminum box. A standard outlet was provided for plugging the timer in. This circuit will solve most line surge problems that occur with equipment within a 50VA wattage rating. If a larger isolation transformer is used, of course, heavier power loads can be handled.

This circuit will clean up the most stubborn cases of power line noise, surges and other disturbances. For simple cases, the bridge rectifier and RC network may be omitted.

Blown Transistors

A CB transceiver was blowing transistors in its power supply—a rather common occurrence and one that many technicians "solve" by replacing transistors. This is no solution, of course. The same transistors will "pop" again within a matter of time—unless the cause is located and eliminated.

When the owner of this CB set was questioned, we determined that he was starting the vehicle many times daily while the CB set was on. Careful voltage checks made during the starting cycle revealed that a surge of about 38v appeared across the 12v system when the engine started.

Two factors must be considered here: The sudden release of a heavy load from the battery as the engine kicks out the starter, and the simultaneous cutting-out of the generator or alternator. There is often quite a bit of corrosion at the battery terminals. Starting voltage kick-backs will vary with different automobiles and trucks and the condition of their electrical systems. These kick-backs can run as high as 40v on a 12v system. Power transistors rated at 30v cannot absorb such starting voltage surges and survive.

We went to work on this problem by cleaning the battery terminals first and then we connected the CB set directly to the battery. To do this, we had to disconnect the transceiver from the cigaret lighter socket where it was originally "installed" and splice on additional wire to reach the battery terminals.

After cleaning and tightening the battery terminals, the surge across the battery dropped to less than 30v when the car was started. We then substituted 40v-rated transistors for the 30v types. This owner had no further trouble from blown power supply transistors.

The solution was simple, inexpensive and quick. It satisfied a customer and made a friend. We could have solved this problem by installing a 10w, 18v zener diode across the 12v input inside the radio. To do this, however, we would have had to remove the radio and find a place to mount the diode. Power transistors were replaceable from the outside of the set without removing the radio from the vehicle. Either solution would have been acceptable. Before it came to us, the CB radio had "devoured" a dozen power supply transistors.

Ailing TV

A series-string TV had been a constant source of trouble and annoyance for its owner. He lived in an area where power line voltage was notoriously bad. In early evening, the potential dropped to 90v or less when the load was high, but by midnight the potential would creep up to about 150v. Obviously, any surges over a power line already running at 150v were more than the set could take. A good voltage regulating transformer was recommended and installed — but this did not solve the midnight surge problem. It did help the low voltage condition and gave the owner good reception during the early evening hours. Surges were still coming through at late hours when the line potential was 150v.

This problem was solved by installing a "Thyrector" diode (essentially a zener but made of selenium and less expensive as symbolized in Fig. 3) directly across the power line inside the TV set. This diode should be installed in the line ahead of the switch and fuse. In this position, if the diode should short, the fuse will blow and when the set is in the OFF position, the diode will not remain across the line. The solution was permanent with no more trouble. ■

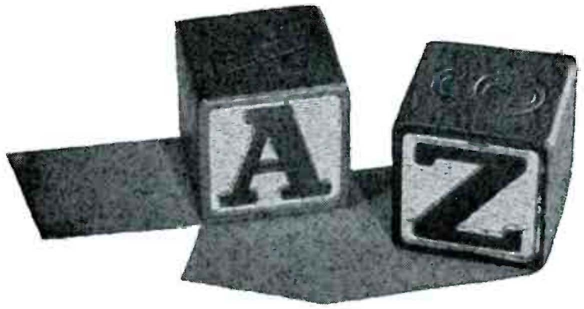
Manufacturers of Circuit Protecting Components

Bussmann Mfg. Div., McGraw-Edison Co., University at Jefferson, St. Louis, Mo. 63107. Fuses and fuse holders

GC Electronics, Div. of Hydrometals, Inc., Rockford, Ill. "Belfuses."

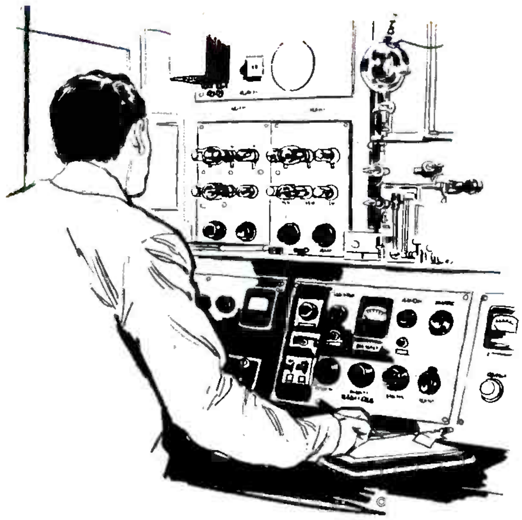
Littelfuse, Inc., 800 E. Northwest Highway, Des Plaines, Ill. Fuses, fuse holders, circuit-breakers.

Workman Electronics Products, Inc., Box 3828, Sarasota, Fla. 33578. "Amp" fuses, circuit breakers, Globar resistors, fused resistors.



Semiconductors from A to Z

MAINTAIN YOUR PROFICIENCY AS A TECHNICIAN BY KEEPING ABREAST OF CURRENT DEVELOPMENTS IN INTEGRATED CIRCUITS



The eleventh article in a continuing series

■ The ninth and tenth articles in this series described the principles of unbalanced and balanced differential amplifier circuits. These principles were then applied to the CA3005 integrated circuit.

An Integrated FM IF Strip

A similar integrated circuit, type μA703 (Fig. 1), has been designed for an FM IF strip. The manufacturer's diagram of this circuit is shown in Fig. 2. This diagram can be changed to a form that we are more familiar with (Fig. 3). A fourth transistor (Q_4) is used in the circuit in place of the diodes (D_1 and D_2) used in the other integrated circuit for temperature compensation. The temperature characteristics of transistor Q_3 should be quite similar to those of transistor Q_4. This additional transistor (Q_4) provides the same function as resistor R_6, described with Fig. 1 in the May article of this series. The collector-to-emitter voltage drop across transistor Q_4 produces the desired base-to-emitter bias voltage for the current-limiting transistor (Q_3).

Still another transistor Q_5 (Fig. 3) provides the same function as resistor R_5, described with Fig. 1 of the previous article. It is used as part of a voltage divider to supply transistor Q_2 with nearly constant base-bias current.

The manufacturer's schematic of the FM IF strip is shown in Fig. 4. A simplified version of the 3rd IF amplifier stage is shown in Fig. 5. Transistors Q_1 and Q_2, in this circuit (Fig. 5), function in nearly the same manner as transistors Q_1 and Q_2 described with Fig. 2 of the May article. When no current is developed across the secondary winding of transformer T_2, nearly all the dc bias current passes through the winding, and the base of transistor Q_1 has the same amount of bias as the base of transistor Q_2. Since there is very little dc resistance in transformer T_3, nearly the same amount of collector current from the two transistors flows through the common collector resistor and terminal 1. Both transistors (Q_1 and Q_2) are maintained at nearly iden-

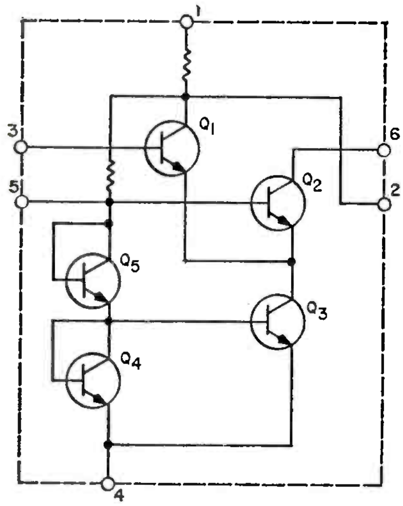


Fig. 3—A more conventional diagram of integrated circuit number μA703.

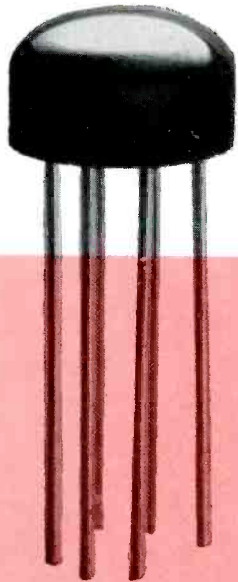


Fig. 1—An integrated circuit designed for an FM IF strip. Courtesy of Scott.

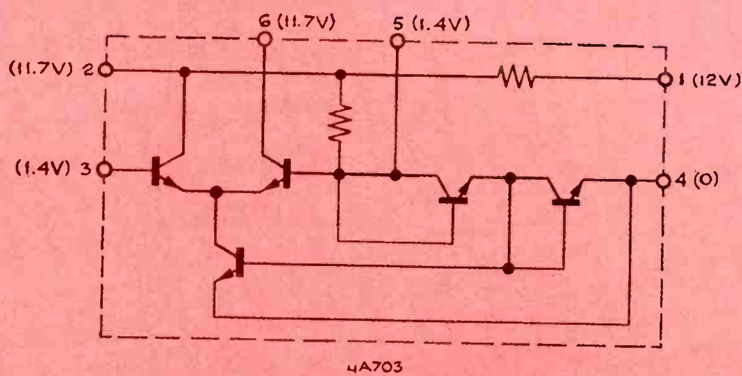
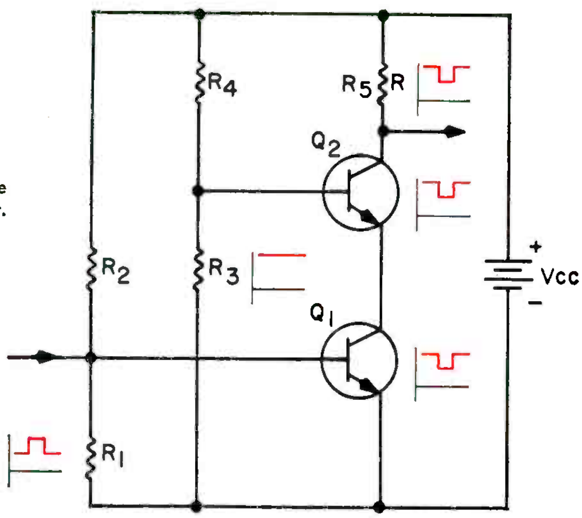


Fig. 2—The manufacturer's schematic of integrated circuit number μA703. Courtesy of Scott.

Fig. 7—A simplified cascode amplifier circuit.



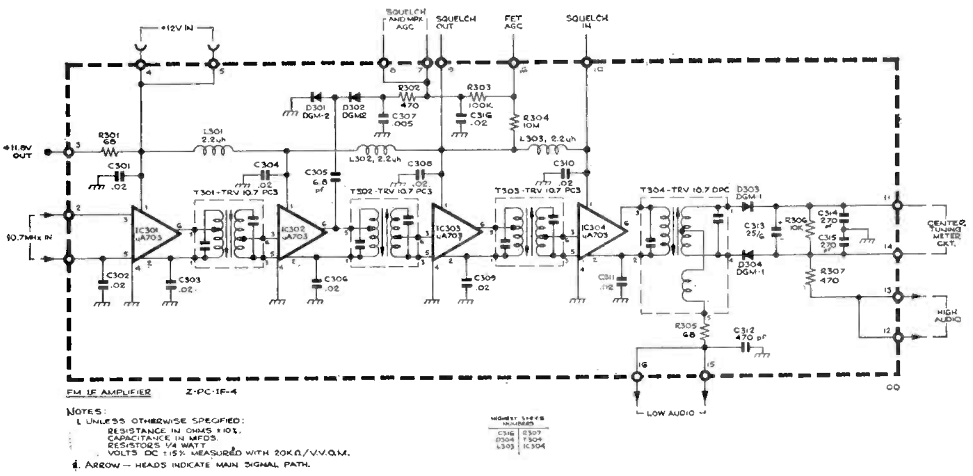


Fig. 4—The manufacturer's schematic of the FM IF strip. Courtesy of Scott.

tical dc collector-to-emitter voltages.

When a radio-frequency (RF), positive signal current is induced into the secondary winding of transformer T_2, the base of transistor Q_1 becomes more forward biased, the transistor conducts more current and a reduction occurs in its collector-to-emitter voltage. The RF portion of the collector current from transistor Q_1 is shorted to ground by the 0.02μf capacitor connected to terminal 2 of the integrated circuit. This capacitor prevents an ac signal from developing across the common collector resistor. The RF change in collector-to-emitter voltage across transistor Q_1 can result in a RF change in the potential of the emitter only — the ac potential of the collector being shorted to ground.

The RF positive signal present at the base of transistor Q_1 results in an amplified RF positive signal at the emitter of the same transistor. Since the emitter of transistor Q_2 is connected to the emitter of transistor Q_1, there is also an RF positive potential developed at its emitter. Since the base of transistor Q_2 remains at a constant potential, the transistor is less forward biased as the emitter becomes more positive, and the RF positive potential at the emitter results in an RF decrease in current flowing through transistor Q_2. Because of the impedance of the primary winding of transformer T_3 (Impedances were discussed in the March 1966 article.), the winding has a relatively high ac resistance, compared to its dc resistance, and a signal voltage develops across the primary winding of the transformer.

The RF positive signal present at the emitter of transistor Q_2 induces an RF positive signal across the primary winding of transformer T_3. The RF reduction in current flow through transistor Q_2 does not result in an RF change in potential across the common collector resis-

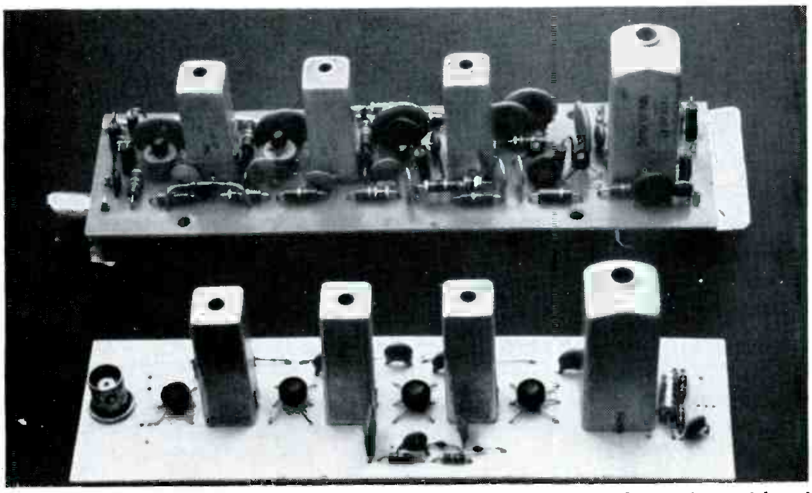


Fig. 6 — A comparative photograph showing the FM IF strip with transistors (above) and with integrated circuits (below). Courtesy of Fairchild.

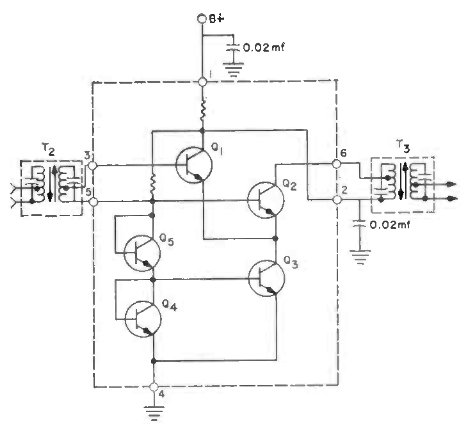


Fig. 5—A simplified diagram of the 3rd IF amplifier stage.

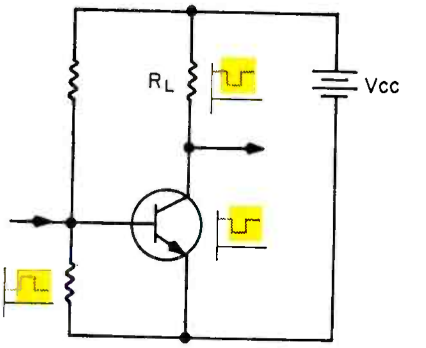


Fig. 8—A simplified common-emitter circuit.

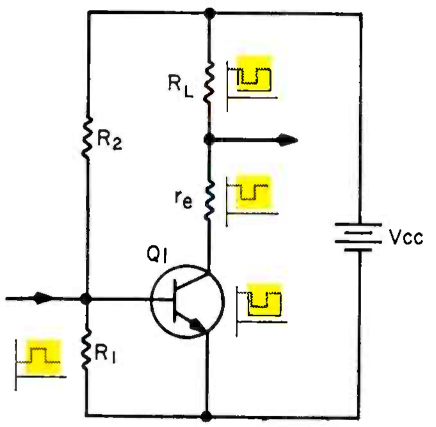


Fig. 9—An equivalent to the simplified cascode amplifier circuit.

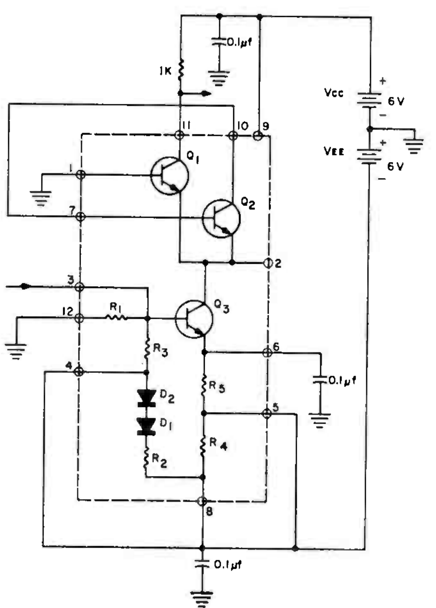


Fig. 10—A cascode amplifier using the CA 3005 integrated circuit.

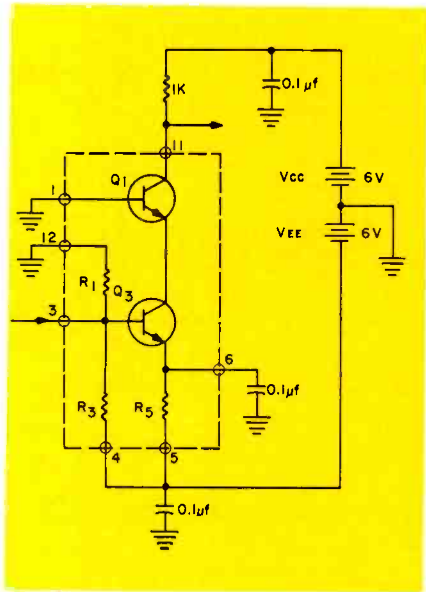


Fig. 11—A simplified diagram of the CA3005 cascode amplifier circuit.

tor. The portion of the RF decrease in current through transistor Q_2 — not neutralized by the RF increase in current through transistor Q_1 — is shorted to ground by the 0.02μf capacitor connected to terminal 2 of the integrated circuit.

An RF negative pulse present at the base of transistor Q_1 causes an RF decrease in current flow through transistor Q_1 and an RF increase in current flow through transistor Q_2. This results in an RF negative signal across the primary winding of transformer T_3. Again, any portion of the RF increase in current through one transistor, not neutralized by the RF decrease in current through the other transistor, is shorted to ground through the 0.02μf capacitor, and no signal is developed across the common collector resistor.

Transistor Q_1 functions in this circuit as a common-collector transistor, while transistor Q_2 functions as a common-base transistor. Common-collector and common-base transistor circuits are discussed in the August and September 1966 articles.)

Because of the constant-current-source characteristics and the method of temperature compensation — with transistors said to operate up to 900MHz — the integrated circuit reportedly has a stable bandwidth greater than 150MHz.

The manufacturer indicates that each five-transistor integrated circuit has a minimum gain of 26db at the 10.7MHz IF. With four of these integrated circuits in series, the IF strip has a total maximum gain capability of 104db. Since the integrated circuits are capable of so large a total gain, some of the gain can be sacrificed in the tuned circuits to insure high-loaded "Q's."

The integrated FM IF strip has been compared by the manufacturer with its predecessor, a transistor FM IF strip (Fig. 6). Not only does the integrated FM IF strip require fewer components than the other strip, it is reported to have better specifications. The manufacturer's comparative specifications are as follows:

Transistor IF	Integrated Circuit IF
Sensitivity	
1.7μv	1.5μv
Capture Ratio	
3db	1.75db
Selectivity	
45db	46db
AM rejection	
—46db	—52db
Distortion at 400Hz	
0.3 percent	0.3 percent
Stereo separation	
35db at 400Hz	41db at 400Hz
19db at 15kHz	30db at 15kHz

A Cascode Amplifier

The April article in this series indicated that the integrated circuit, sold as part number CA3005, contains a balanced differential-amplifier circuit having a controlled, constant-current source. The major portion of the April and May articles explained how this integrated circuit functioned as a differential amplifier.

It was also indicated that this integrated circuit could be used as a cascode amplifier. The function of a cascode amplifier differs considerably from that of a differential amplifier.

A simplified cascode amplifier circuit is shown in Fig. 7. Here, the base of transistor Q_1 is forward biased with resistors R_1 and R_2, while the base of transistor Q_2 is forward biased with resistors R_3 and R_4. Since transistors Q_1 and Q_2 are connected in series, and a collector-to-emitter voltage drop will occur in transistor Q_1, the emitter of transistor Q_2 must be more positive than the emitter of transistor Q_1. Hence, if the same amount of forward bias is to be applied to both transistors, the base of transistor Q_2 must be biased more positive than the base of transistor Q_1.

When a positive signal is applied to the base of transistor Q_1, the transistor conducts more current, and a reduction in its collector-to-emitter voltage occurs. Because of the reduction in the voltage drop across transistor Q_1, the emitter of transistor Q_2 becomes less positive. The base of transistor Q_2 is then more positive with respect to its emitter, and since the transistor is now more forward biased, it also experiences a reduction in its collector-to-emitter voltage. Transistor Q_2 functions as though it were in a common-base circuit.

In a simple common-emitter circuit (Fig. 8), a reduction in the transistor's collector-to-emitter voltage results in a corresponding increase in the voltage drop across the load resistor ($\Delta V_{CE} = -\Delta I_C R_L$). (Voltage drops within a circuit are discussed in the October 1966 article of this series.) This relationship is not true for transistor Q_1 in the cascode amplifier circuit (Fig. 7). There, the increase in the voltage drop across the load resistor (R_5) is greater than the decrease in the collector-to-emitter voltage drop of transistor Q_1 ($\Delta_{CE} < -\Delta I_C R_5$). Instead, it is equal to the sum of the collector-to-emitter voltage changes in the two transistors (Q_1 and Q_2).

Transistor Q_2 functions (Fig. 9) as a negative resistor (r_e) in series with a load resistor (R_L). When a positive signal is applied to the base of transistor Q_1 (Fig. 9), the transistor conducts more current. The transistor's increased collector current results in a greater voltage drop across the load resistor (R_L) and a reduced voltage drop across the effective negative resistance, r_e. (Although the voltage drop across resistor R_L increases as the voltage drop across resistor r_e decreases, the squarewave pulses developed across both are shown as negative pulses. A greater voltage drop across resistor R_L will make the output less positive with respect to the positive supply-voltage lead, while the reduced voltage drop across the effective negative resistor r_e will make the output less positive with respect to the negative lead.) Transistor Q_1 in Fig. 9 requires a smaller change in its collector-to-emitter voltage, than the transistor in Fig. 8, to produce the same output signal across an equal load resistor (R_L).

The May article in this series showed integrated circuit CA3005 as a standard transistor circuit (Fig. 6 in the May article). By attaching external circuitry to the integrated circuit (Fig. 10), it can be used as a cascode amplifier. This diagram can be simplified without actually changing the circuit (Fig. 11). The unused leads and components are no longer shown.

The collector and emitter voltage sources (V_{CC} and V_{EE}) supply power to the circuit and act as a voltage divider. Since the common battery terminal and the base terminal of transistor Q_1 are both connected to ground, one voltage source (V_{CC}) serves to make the transistor's collector more positive than the base while the other voltage source (V_{EE}) serves to make the transistor's emitter more negative than the base. The corresponding transistor (Q_2) in Fig. 7 received the same base bias current through a resistor voltage divider circuit (R_3 and R_4).

We indicated earlier in this article that the base of Transistor Q_1 (Fig. 7) is biased at a more negative potential than the base of transistor Q_2. The corresponding transistor in Fig. 11 (transistor Q_3) is biased at a more negative potential than transistor Q_1 and ground with a resistor voltage divider (R_1 and R_3).

Resistor R_5 and the $0.1\mu f$ capacitor connected to terminal 6 serve as an "emitter swamping" circuit to improve the stability of the integrated circuit. (The September 1966 article describes emitter swamping circuits.)

The two other $0.1\mu f$ capacitors in the circuit (Fig. 11) shunt to ground any portion of the ac signal that would otherwise appear across the emitter- and collector-voltage sources (V_{EE} and V_{CC}).

Transistors Q_3 and Q_1 (Fig. 11) function in the same manner as transistors Q_1 and Q_2 described earlier (Fig. 7). A positive signal applied to the base of transistor Q_3 (Fig. 11) reduces the transistor's internal resistance and thereby reduces its collector-to-emitter voltage and increases its collector current. Transistor Q_3 is connected in series with transistor Q_1 and the 1K resistor, and when a current increase occurs through transistor Q_3, an increase in current also occurs through transistor Q_1 and the 1K resistor. This results in a reduced voltage drop across the effective negative resistance of transistor Q_1 and an increased voltage drop across the 1K resistor. (The effective negative resistance of transistor Q_1 provides amplification in the same manner as the negative resistance of the tunnel diodes described in the February and March 1967 articles.)

Cascode amplifiers have a greater gain than differential amplifiers. When connected in a circuit designed to operate at 100MHz, the CA3005 integrated circuit reportedly has a 20db power gain (G_p) when operating as a cascode amplifier and a 16db power gain when operating as a balanced differential amplifier.

When operating as a cascode amplifier, the integrated circuit no longer has the temperature compensation provided by diodes D_1 and D_2. Since transistor Q_3 is not operating in a current-regulating circuit, and increases in current through one portion of the circuit are not balanced by virtually equal reductions in current through another portion of the circuit — as in the balanced differential amplifier circuit described earlier — the current drawn by the cascode amplifier is not entirely independent of the signal applied to the circuit. The signal amplified by the cascode amplifier is, therefore, not as isolated from the voltage source as the signal amplified by the balanced differential amplifier.

The next article in this continuing series will describe the function of an integrated circuit currently being used in the audio circuit of several TV sets. ■

TV SALES THRIVE ON GOOD

Texas service-dealer uses two-way communications system and all-night automatic answering service to speed customer service

Guy Nelson, owner, gives customer an estimate on TV repairs.

■ "Good service is the key to our success here," says Guy Nelson, 30-year-old president of the family-owned Dwight TV Sales & Service Co. in San Antonio, Tex.

The business was started in 1951 by Guy's father, Bill Nelson. By 1962 it was doing a gross business of $134,000 and last year topped $288,000.

"I believe we service more TV sets than any other independent service-dealer in San Antonio," Mr. Nelson observes.

From what our reporter saw, Dwight TV's 25 by 50-ft air-conditioned service shop appeared to be the largest and best instrumented in the city.

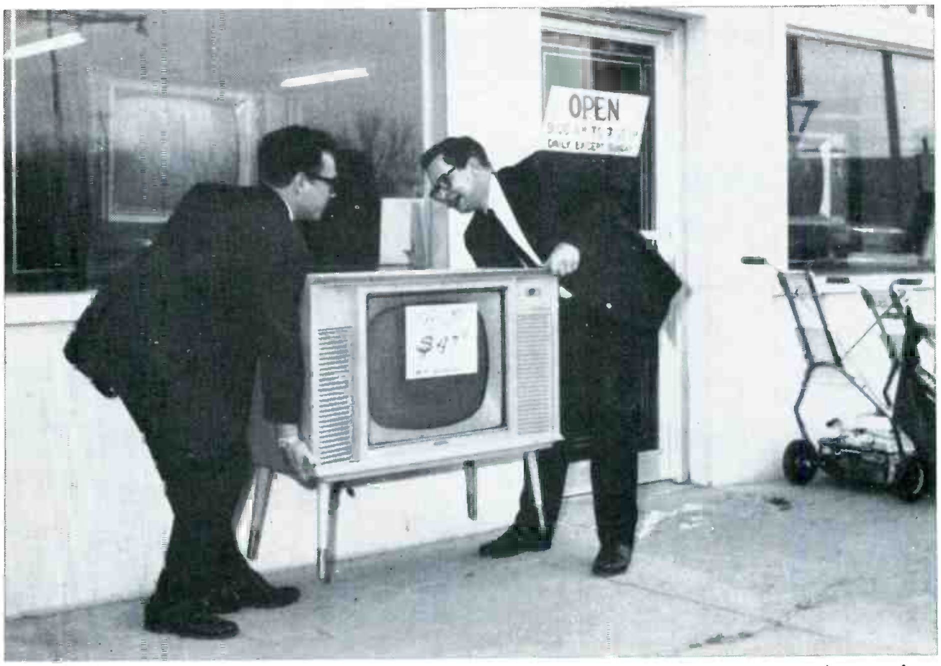
Mr. Nelson's pretty wife, Linda Marie, is secretary and treasurer of this 14,000-sq ft operation and she also "mans" the two-way radio base station used for dispatching service trucks.

Service Stance

Guy Nelson believes his business has prospered because of the company's motto: "Fast and dependable service."

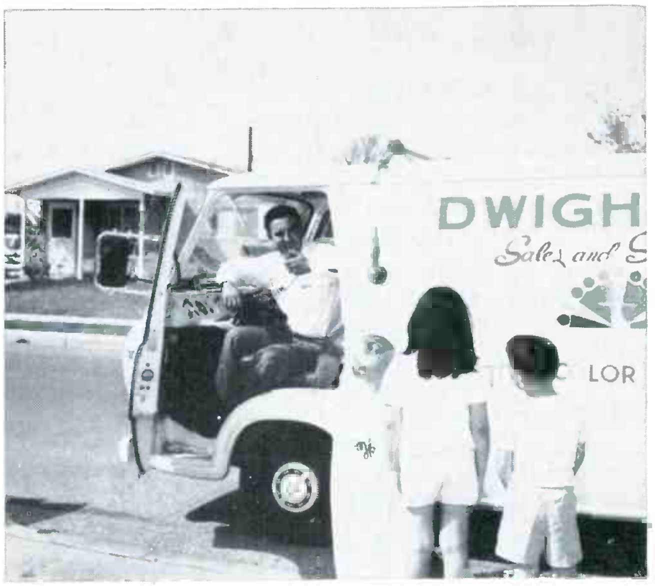
"This has always been our

SERVICE



Dwight TV puts a low priced used set on the sidewalk in front of the store to attract price-conscious customers.

Mrs. Nelson dispatches a two-way radio equipped service truck to a customer needing fast service.



A home-call technician "checks in" at the office from his two-way radio-equipped truck as neighborhood children watch.

promise to customers," Mr. Nelson emphasizes. "And we do whatever is necessary to keep that promise," he adds.

He stressed the importance of speed in expediting a service call. "TV is the average person's main entertainment these days. When the TV set is out, the customer wants it fixed 'yesterday.' And we try to fix it 'yesterday,' " he smiles.

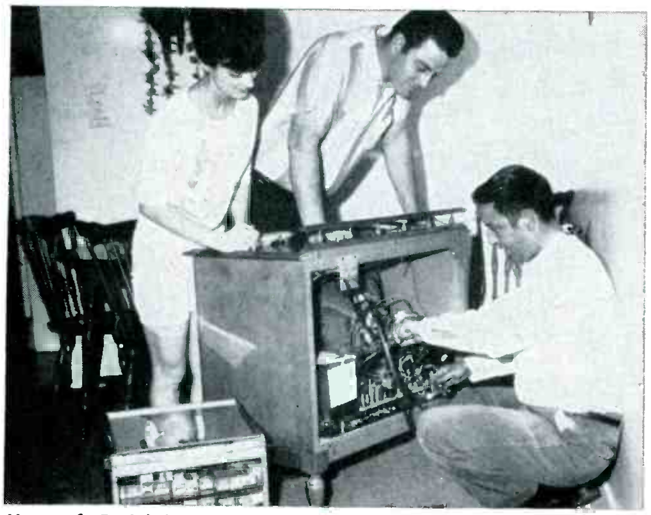
As this alert service-dealer warmed up to his subject, we learned about some of the important things that had to be done to give customers this kind of service.

"Our two-way radio system speeds the service technician's arrival at the customer's home," Mr. Nelson says. "As the service calls come in, they are scheduled and routed so each customer will receive the fastest possible service.

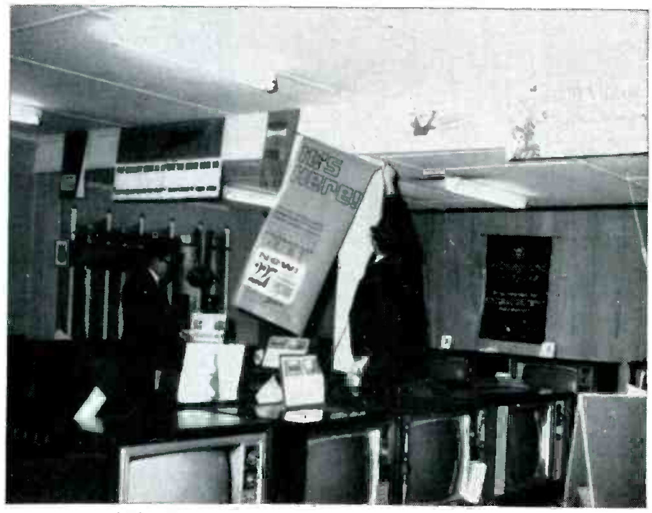
"All service calls within a certain area are assigned to the technician who has that area," he explains.

Mr. Nelson assigns each technician to a certain area each morning of each working day. And after the day's service calls are scheduled and a list given to each technician, the technician must "check in" with the office when arriving at a home and again just before leaving.

"In this way," Mr. Nelson says, "we can take care of all the service calls that come in after the technicians leave in the morning. We have been able to give same-day service to 80 percent of our customers by using this system. Many service calls that come in as late as 4 p.m. in the afternoon are handled the same day since our outside technicians work until 7 p.m. Even if a set has to be brought into the shop, we frequently return it, depending on the age of the set and type of re-



Most of Dwight's customers are friendly, cooperative and loyal.



A section of the floor display where almost 200 sets are in constant supply.

pair, by 7 p.m. that same evening."

When the store is closed, all calls for service are recorded on an automatic "answering service" so the calls can be processed, scheduled and handled in the morning.

Mr. Nelson also points out that this kind of service has been instrumental in bringing about a high level of customer satisfaction and has created a large group of hard-core, loyal customers.

All service technicians wear a standard uniform while they work. And they put on a fresh uniform every morning. The uniform consists of a white shirt and gray slacks. The name of each technician is on the front of his shirt and the company's name is on the back. The lettering on the shirts is in the same bright colors as that on the company's white-bodied service trucks.

Repair work done by house-call technicians includes replacement of tubes, switches, speakers and necessary adjustments.

"Any circuit work has to come into the shop," Mr. Nelson explains. "This includes replacement of transformers, resistors, capacitors and controls."

Handling the Technician Shortage

Paul Bazan, Jr., Dwight's manager, had something to say about keeping technicians happy and reducing turnover.

"To begin with, a technician is not hired here unless he has a good five-year experience record," Mr. Bazan says.

After a technician is hired, both Mr. Nelson and Mr. Bazan spend a few days to give the technician a thorough orientation. Mr. Bazan explained it this way: "We go over our system of operation, shop procedure, the work load, our method of charges, preparation of our repair invoices, our company policy regarding warranties on repair jobs and on call-backs."

He explains that technicians get an average salary of about $125 a week, plus an average of $40 additional as incentive pay. Mr. Bazan went into details about this.

"We train our technicians to 'trade' in the customers home. If the cost of repairing a set exceeds what we believe to be the set's value, for example, then the technician explains to the owner that money would be wasted on repairs. The technician recommends that the money be invested in a new set. But technicians are cautioned not to 'pressure' customers.

"We give our technicians $4.50 for each B/W lead turned in which results in a sale," Mr. Bazan continues. "And we give $20 for a color TV lead that results in a sale."

Follow-up work on these leads is done by Mr. Bazan or Mr. Nelson. The technician does not become involved in the sale or any of its details. In the event a technician does close a sale, however, he receives two percent of the total sale in addition to the "lead" money.

Mr. Nelson reports that one-third of new TV sales originate through leads supplied by service technicians.

Dwight's TV has six technicians and they receive paid vacations and sick pay after one year with the company. There are two house-call men, four benchmen and two men who specialize in antennas and installing new TVs in the home. Outside technicians are expected to make 14 service calls a day. This is not difficult when calls are dispatched by two-way radio.

Dwight's charges $13.50 to $16.50, plus parts, for B/W sets repaired on the bench. Similar charges for color run from $18.50 to $22.50, plus parts.

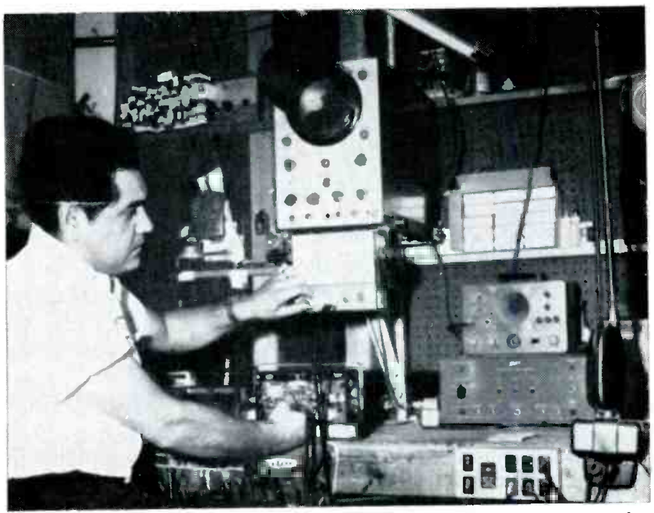
Credit Policy

Mr. Nelson says "credit is given on all repairs if the customer asks for it. We even give the customer a year to pay for a major repair job."

Despite this liberal approach to credit, Mr. Nelson indicates that credit losses are small. "Only about 5 percent," he explains. The reason for this is twofold:

"On each work order, our serv-

Paul Bazan, Jr., is Dwight's manager.



One of the four in-shop technicians is seen working in one section of the large repair shop.

ice technician adds a dollar. Then he explains to the customer that if the bill is paid before the due date, the dollar will be deducted. This encourages the customer to pay his bill before the due date," Mr. Nelson says.

To cut delinquencies further, a paragraph at the bottom of the work order is, in effect, a chattel mortgage on the TV set. If the repair bill is not paid, the set can be possessed by court order. This precaution has proven very effective for this service-dealer.

"At one period we were about to go broke because of bills outstanding—about 45 percent. Now we lose only about 5 percent in bad debts," Mr. Nelson says.

This holds true even though Mr. Nelson often approves credit after closing time—when he cannot check a customer's credit rating with the local Retail Credit Assn. When we showed surprise about his small credit losses, Guy Nelson shrugged his shoulders and said, "I guess it's intuition based on experience."

The service-dealer is aided, however, by a very detailed credit application form which tells a lot about the customer, including his employment record and whether he owns a home. Additionally, Guy Nelson has lived here all his life and knows practically everyone in town.

"Besides," Mr. Nelson smiles, "this is a military town. A man won't risk having his rank fouled up just for the price of a TV set."

The service-dealer gives his wife much of the credit for this happy state of affairs. "I would be lost without her," he concludes.

Advertising, Promotion and Expansion

Guy Nelson believes that his service policies have generated much word-of-mouth advertising which results in a continuous stream of new customers. But he is spending a modest amount on advertising.

"In 1962 we spent $100 for advertising," Mr. Nelson says. "During the past year we've spent $850 a month—somewhat less than 4 percent of gross. We also shifted from neighborhood newspapers to the metropolitan dailies. We also added one-minute radio and TV spots."

Mr. Nelson estimates that this advertising has brought an increase in store traffic of about 33 percent.

"We have also gone from two TV brands to five," Mr. Nelson says. "And where we used to have 30 color sets on the floor in 1962, we now have 80. We also keep about 100 B/W sets on the floor."

In addition to these sets, Guy Nelson points out that he has a substantial number of both B/W and color sets in "backroom stock."

To attract passing motorists, Mr. Nelson keeps a huge electric sign on all night. It tells the prospective customer what major brands of TV sets the store handles.

Another attention getter is the electric lights which are left on in the entire store all night. "It helps our customers to window shop. It is also inexpensive burglar insurance," Mr. Nelson says.

Guy Nelson plans to open a second store in the new Lone Oak shopping mall soon. And he believes that this expansion will pose few risks. He believes increased color sales will guarantee success.

"We sold three color sets a month in 1962," Mr. Nelson says. "We are selling 30 a month today," he adds. He believes that the present 10 percent market penetration is only the beginning.

"Color TV is in its infancy here," he emphasizes. "And after color, we'll probably have three-dimensional color and video tape recorders to sell.

"I doubt if any alert service-dealer who remains sincere and loyal to his customers can look forward to anything less than success today," he concludes.

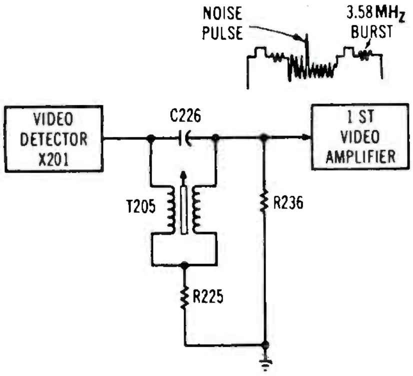
Guy Nelson confides that he loves his work and that it is the only job he ever had. And we believe that a man who feels as he does about the business can't help but succeed. ■

COLORFAX

Video Circuits in Westinghouse V2655 Color Chassis

The signal waveform at the video detector output is shown in the block diagram. Diode, X201, is connected so a rectified sync-positive output will be developed. The signal appears across the detector load consisting of R236 in parallel with trap, T205 and resistor, R225.

The waveform may appear to be the same as a B/W signal at first, but

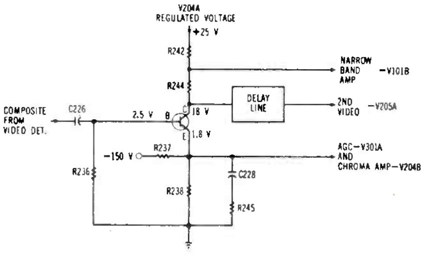


closer examination will reveal a "burst signal" on the back porch of the blanking signal. This is an eight cycle burst of the 3.58MHz signal, transmitted along with the composite signal, to maintain color sync between the receiver and transmitter. This is essential for correct reproduction of colors.

Another difference that may be seen in the composite signal — if viewed on a scope during color telecasting — the video information will appear somewhat more dense. This is caused by the presence of color sidebands and depends on the contents of the picture being televised.

T205 is a 4.5MHz trap used to eliminate any possible 920kHz beat that may develop between the 4.5MHz sound IF and the 3.58MHz color subcarrier.

An NPN transistor, Q200, is used for the 1st video amplifier. It is shown in the schematic here. To conduct and



amplify, the elements of an NPN transistor must be biased so the emitter will be at the most negative potential, the base slightly positive with respect to the emitter and the collector at the most positive potential. Since the emitter is at 1.8v, the base at 2.5v, the collector at 18v, the dc operating voltages are in correct relationship for an NPN transistor. Forward bias between base and emitter is plus .7v which will allow the transistor to conduct. The dc electron current path through the transistor will be from ground, through R238, transistor emitter to collector, R244, R242 and to the regulated source potential of 25v. The 25v source voltage is taken from the cathode of V204A, the low voltage regulator. It acts as a regulated supply voltage which is very important for operating stability in transistor amplifiers.

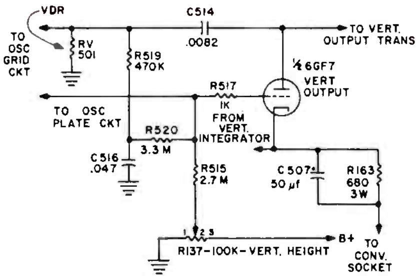
The sync positive composite video waveform is applied between the base and emitter of transistor Q200. Two output signals are produced, one at the emitter which has the same polarity as the one at the base and the amplified output at the collector which is a sync pulse negative composite video signal. The signal from the emitter—an emitter follower arrangement—is applied to the chroma amplifier, V204B, to produce all chroma information and to the AGC keyer stage, V301A.

The amplified composite waveform as produced in the collector circuit is passed on to two sections—through the delay line to the 2nd video amp, V205A and through resistor R244, to the grid of the narrow band amplifier, V101B.

In summary, transistor video amplifier, Q200, amplifies the composite video signal. Since the output signal produced is passed on to four separate sections of the receiver, it is essential that this stage function correctly.

VDR Application in RCA CTC17X Color Chassis

A "varistor" (VDR) is a component which exhibits the characteristics of decreasing its resistance as the voltage across it increases. This characteristic is used to advantage in TV deflection circuits where regulation of sweep output amplitude is desirable.



A typical application of a VDR is in the vertical output stage—to maintain uniform vertical sweep over a wide range of line voltages (from low to high). The vertical circuit used in the CTC17X color chassis (see schematic) employs a VDR for this purpose.

In this circuit, RV501 conducts during the large positive retrace pulse which appears at the vertical output plate. This conduction charges C514 during retrace. During the scanning interval the resistance of the VDR is extremely high, so no loading is presented to the vertical output tube. R519 and C516 form an RC filter so a relatively clean negative dc voltage is developed across C516. Part of this negative voltage is applied to the vertical output tube grid through a voltage divider network consisting of R520, R515 and part of the height control resistance from the arm to ground.

As the line voltage increases, a larger positive pulse appears on the plate of the output tube during retrace. The additional pulse amplitude further reduces the effective resistance of the VDR during retrace and increases the charge on C514. More negative dc voltage is developed at C516 increasing bias on the output stage grid, lowering the output of the 6GF7 vertical output tube.

An open circuited VDR would cause vertical overscan and some loss of vertical sync. The loss in vertical hold is noticed with excessive overscan, the output tube grid is driven positive and plate saturation occurs. This attenuates the sync pulse which is normally amplified before it's fed back to the oscillator grid.

In the case of a shorted VDR, a loss of vertical deflection would result and feedback from the output to oscillator section is shorted to ground through the VDR.

ZENITH . . .

continued from page 41

strong flyback pulse at the 15.75-kHz rate, after which the windings "ring" during the remainder of the horizontal scan interval.

The 6HS5 voltage regulator grid is hit with a flyback pulse at the beginning of each cycle (from the cathode of the horizontal oscillator) and then "floats" during the remainder of the cycle.

If the circuit is operating at a set value of 25kv, during a portion of the horizontal scan, a bright area appears, requiring more current. This is an added load on the 3A3A HV rectifier which draws more current and loads down the tertiary HV winding. This additional loading reduces the HV output and ringing. The tertiary winding reflects back into the primary winding through mutual coupling so voltage in the primary drops, as does the ringing.

The 6DW4 damper is connected to the primary winding, so the ringing to its cathode is reduced, but the damper thrives on ringing so its output reduces. You will note that the damper plate, through the high voltage adjust pot, delivers the output voltage to the regulator grid (see Fig. 11). When ringing is reduced, damper output drops, this in turn reduces the effect of the regulator, reducing its plate load — which is on the primary winding of the flyback. This reduction in load permits the ringing to recover and thus the primary voltage recovers.

When the primary winding recovers and brings back the ringing level, this is immediately reflected mutually into the tertiary, or high voltage winding, bringing up its ringing, and thus its voltage level which recovers the HV to the original 25kv level.

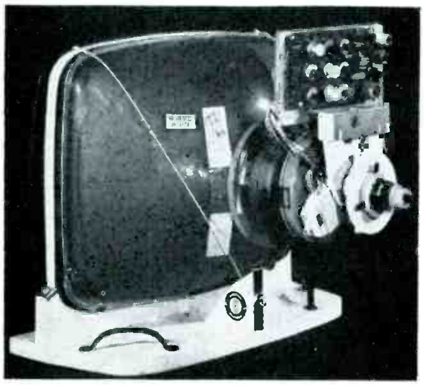
Then, any additional loading by the CRT during brightness level increase in the scan line loads the tertiary through the 3A3A, which cuts down the ringing and mutual coupling reduces the ringing in the primary — in turn cutting down the output of the damper. This reduces the control of the regulator and lightens the load on the primary, which brings the pulse and ringing, delivering the high voltage at the 3A3A. ■

NEW PRODUCTS

For additional information on any products in this section, circle the numbers on Reader Service Card. Requests will be handled promptly

Color CRT Pedestal **700**

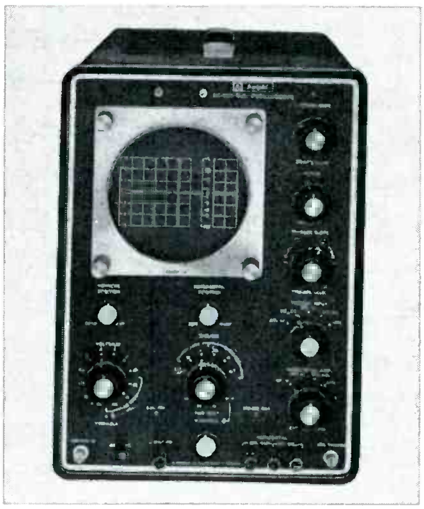
Announced is a pedestal designed to secure a 19-in. color test CRT, deflection yoke and convergence panel in position for direct hookup — exactly as in the customer's cabinet. The pedestal reportedly permits



bench service of the chassis in a horizontal or vertical position without extension cables. Weight 45 lb. Net Price $14.50. Eight Ball.

Oscilloscope **701**

Announced is a dc to 5MHz, triggered-sweep oscilloscope designed to permit viewing stable waveform presentations even at upper frequency limits. Specifications indicate that signals, of various amplitudes and frequencies, as small as ½cm on the CRT face will permit triggering. The manufacturer indicates that the dc vertical sensitivity is 0.05v P-P/cm while the ac vertical sensitivity is 0.005v P-P/cm over a 1M input resist-



ance shunted by a 40pf capacitor. Kit price $249.94. Wired price $349.95. Allied.

Stereo Headphone **702**

Announced is a pair of stereo headphones that reportedly have a fre-

quency response of 40Hz to 15kHz and a 2w power capacity. The manufacture indicates that they come with plastic ear cups, a 7-ft four-conductor cable and a standard stereo plug. Price $19.95. Superex.

Color Bar Generator **703**

Announced is a new solid-state signal generator designed to provide dot, crosshatch and color bar patterns with

video and RF outputs. Gun-killer controls are supplied for fast purity checks and a 4.5MHz crystal-controlled sound carrier output reportedly permits accurate fine tuning settings. Price $159.50. Hickok.

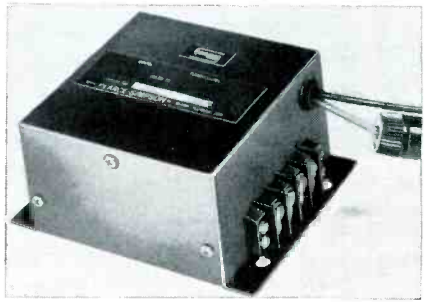
FM Tuner **704**

Announced is an FM tuner that, ac-

cording to specifications, has 2 RF stages, containing 5 tuned circuits, coupled with a 4-stage, double-tuned, IF circuit. The solid-state tuner reportedly has a sensitivity of 2.4μv for 30db quieting and 40db channel separation for FM stereo. Kit price $89.95. Wired price $119.95. EICO.

Voltage/Polarity Converter **705**

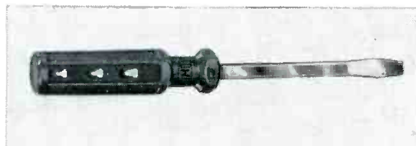
Announced is a converter designed to invert polarities and permit negative-ground-only equipment to be operated from positive-ground battery



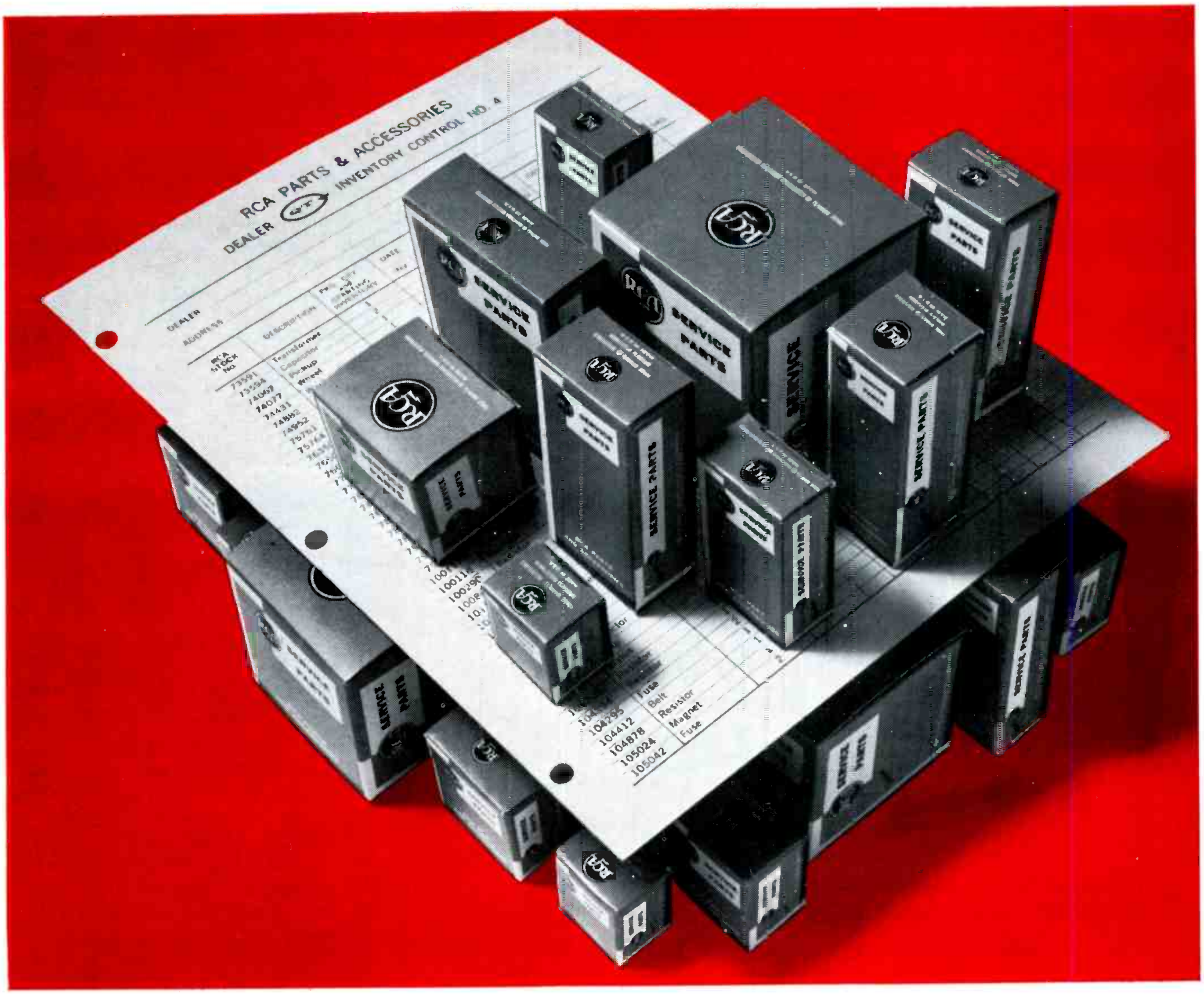
systems. The unit is also designed to convert 6v systems to 12v, 12v systems to 24v and 6v systems to 18v. Specifications indicate that the converter can handle loads of up to 30w. Pearce-Simpson.

Stripping Screwdriver **706**

A two-in-one tool is announced that serves as both a screwdriver and a wire stripper. Three blades in the



screwdriver handle are marked for stripping no. 20 through 12 solid or stranded wire. The tool is available with a 3/16- and ¼-in. wide blade and has an over-all length of 8½in. Prices range from $1 to $1.49. Holub.



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RCA PARTS AND ACCESSORIES, Deptford, New Jersey

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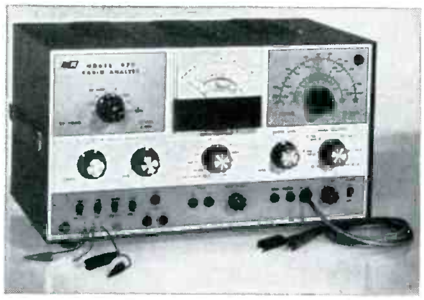
NEW PRODUCTS

Radio Analyst 707

An analyst is announced which is designed to check FM or AM auto, home and portable radios, transistorized TV sets and audio amplifiers. Specifications indicate that it can be used to make in-circuit and out-of-circuit transistor checks. Its built-in power supply is designed to provide 5amp output, with low ripple, at 1.5 to 15v in eight 1.5v steps. A bias supply is designed for continuously variable 1.5 to 15v output of the same



polarity as the power supply. The AM and FM signal generator has vernier tuning that covers 250kHz to 2MHz with AM modulation, 10MHz to 11.4MHz with AM or FM modulation and 88MHz to 108MHz with FM modulation. The dc VOM has a function switch for transistor test; 0 to 20ma, 200ma, 2amp, 5amp, 2v, 20v, 200v, 500v; and x1, x10 and x100 ohm scales. A 400Hz audio signal has an adjustable output that can be used to check speakers or modulate AM or FM signals. The manufacturer indicates that the instrument contains only solid-state circuits and measures 15½ x 8½ x 9in. Price $199.95. B&K.

CB Transceiver 708

A solid-state CB transceiver is announced that reportedly comes complete with all 23 channels operative. Specifications indicate that the re-

ceiver has a selectivity of 5kHz at 6db and 20kHz at 60db, has a sensitivity of $0.7\mu v$ at 30 percent modulation and $0.3\mu v$ at 100 percent modulation. The transmitter is designed for 3.2w power output from a 12.6vdc source. Sonar.

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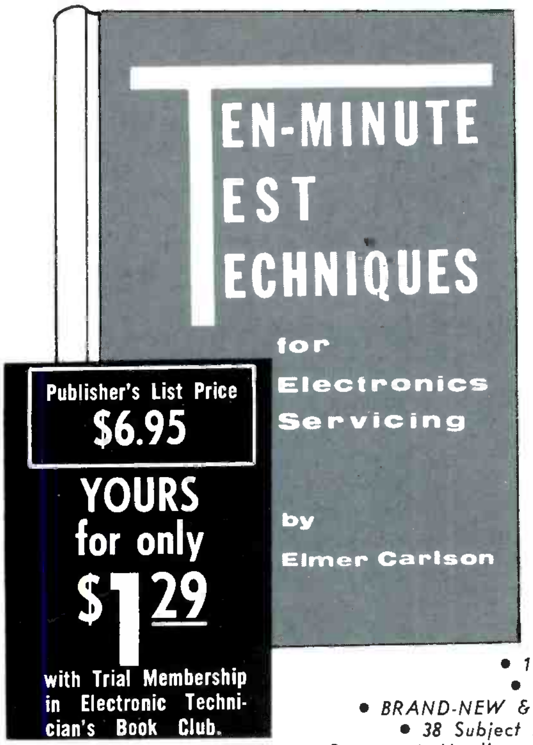

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PARTIAL LIST OF CONTENTS

TEN-MINUTE TEST TECHNIQUES for Electronic Servicing, by Elmer C. Carlson, contains 176 pages — over 125 illustrations — 8 BIG CHAPTERS — 38 separate subject headings. Includes the type of **practical** servicing data **every** electronics technician should have . . . step-by-step techniques for localizing trouble to an improperly operating stage, and then to the defective component itself . . . using a minimum of test equipment. Truly an authoritative servicing guide which will help you solve "tough-dog" troubles fast and eliminate costly call-backs.

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- Locating Defective Stages

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- Push-Pull and Single-Ended Amplifiers
- Sawtooth Testing
- The Scope as a Voltmeter

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- Signal Tracing
- AM-FM-TV Local Oscillators

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- Neutralizing
- Filter Selectivity
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- Antenna Loading

May we send you this unique time-saver as part of an unusual offer of a Trial Membership in Electronic Technician's Book Club?

A Massive, Authoritative Compilation

Now you can have at your fingertips, this brand-new book, especially written for service technicians, outlining simple troubleshooting procedures that can be applied to any type of electronic circuit.

Without delving into involved theoretical discussions, this practical new handbook describes how trouble in any piece of electronic equipment may be pinpointed quickly and easily. Especially written for practicing technicians by an accomplished and well known author, the book approaches circuit troubleshooting from a new and unique slant—that every circuit is basically either an amplifier or a rectifier which can be easily tested and analyzed using simple servicing procedures.

Step-by-step techniques are outlined for pinpointing troubles to a specific improper stage, and then to the defective component itself, using the minimum amount of test equipment. Profusely illustrated, the content describes several specific troubleshooting methods which can be used to analyze the performance of various types of circuits—tube or transistor—in any kind of equipment. Contains just the kind of practical, down-to-earth information you can *immediately* put to use in your everyday service work! Many invaluable "Time and Temper Savers" are included, offering shortcuts and practical hints which will increase your servicing efficiency and cut down on troubleshooting time.

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NEW PRODUCTS

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According to the manufacturer, it can be left on trickle charge position continuously to insure ready-to-go operation. Price of pack $59.95. Price of charger $12.95. Courier.

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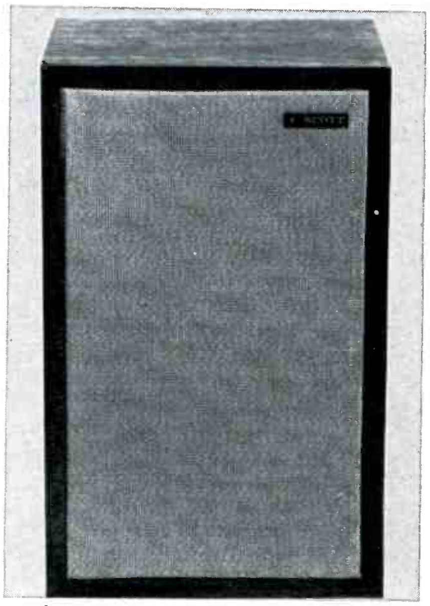
A speaker system has been designed to have a limited impedance range and is said to be more effective when



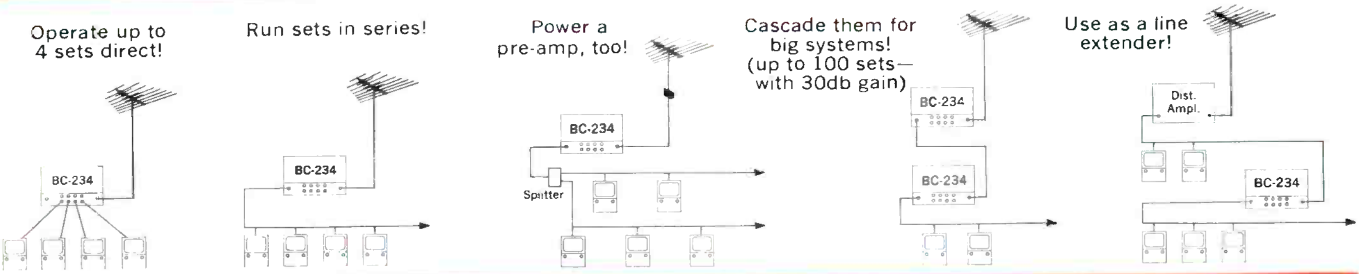
used with solid-state audio equipment. It measures 14 x 8¾ x 5in. and contains a two-way system that includes a woofer, tweeter and crossover system in a walnut finish air suspension enclosure. Price $39.95. Scott.

It's a sensational home system TV amplifier!

It's a great amplified 4-set coupler!

It's an amazing amplified splitter!

It's an ingenious line extender!



. . . the first solid state, high gain COLOR TV Booster/Coupler/Amplifier with complete flexibility and no overload problems!

IT'S WINEGARD'S NEW VHF/FM BC-234

We say there's never been anything like the BC-234. But don't take our word for it. Just try to find another solid state Booster/Coupler/Amplifier capable of producing up to 3,000,000 (3-million) microvolts of signal output—and capable of operating more TV sets than any other home system amplifier on the market.

The sensational BC-234 does it all. And always with exceptionally high gain and *no* overload problems.

Check the features for yourself, including the rugged steel housing (not plastic) that's comparable to housings used on the most expensive commercial amplifiers.

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- Both 75 ohm and 300 ohm inputs... no switches or transformers needed.
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- All metal housing construction for positive electrical shielding.
- Four 300 ohm outputs and one 75 ohm output. Extremely high isolation—no interaction between sets—no need to terminate unused output terminals.
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- No-strip malco terminals for all 300 ohm connections.
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Now admit it. That's a lot of Booster/Coupler/Amplifier for any price. And especially for only $34.95. In fact, there's nothing else like it—anywhere! Better call your Winegard distributor today, or write for Fact-Finder #250 for all the facts about the BC-234 and BC-274, plus complete information about Winegard's sensational new *82-Channel* Booster Couplers.

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1. Amphenol CRT Commander tests, rejuvenates both color and black and white tubes. Captivated socket assembly reduces lost sockets. 11 filament steps to 20 v give wide range for future CRT development. Built-in high impedance voltmeter 0 to 1000 v, 0 to 5000 v, 0 to 50 KV.

2. Amphenol Signal Commander is battery operated, easily held in one hand. Plug-in frequency modules—840-13 VHF and FM, 840-83 UHF, to cover entire TV Spectrum. Meter accurately reads direct db or mv.

3. Amphenol Color Commander cuts alignment time 40%. Nine test patterns—five are exclusive Amphenol timesavers. Three-color-bar test pattern adjusts demodulators without scope—in the home. Single dot pattern simplifies static covergence—returns to the same dot. Squares for horizonal/vertical linearity.

4. Watch this space for a new timesaver coming soon from Amphenol.

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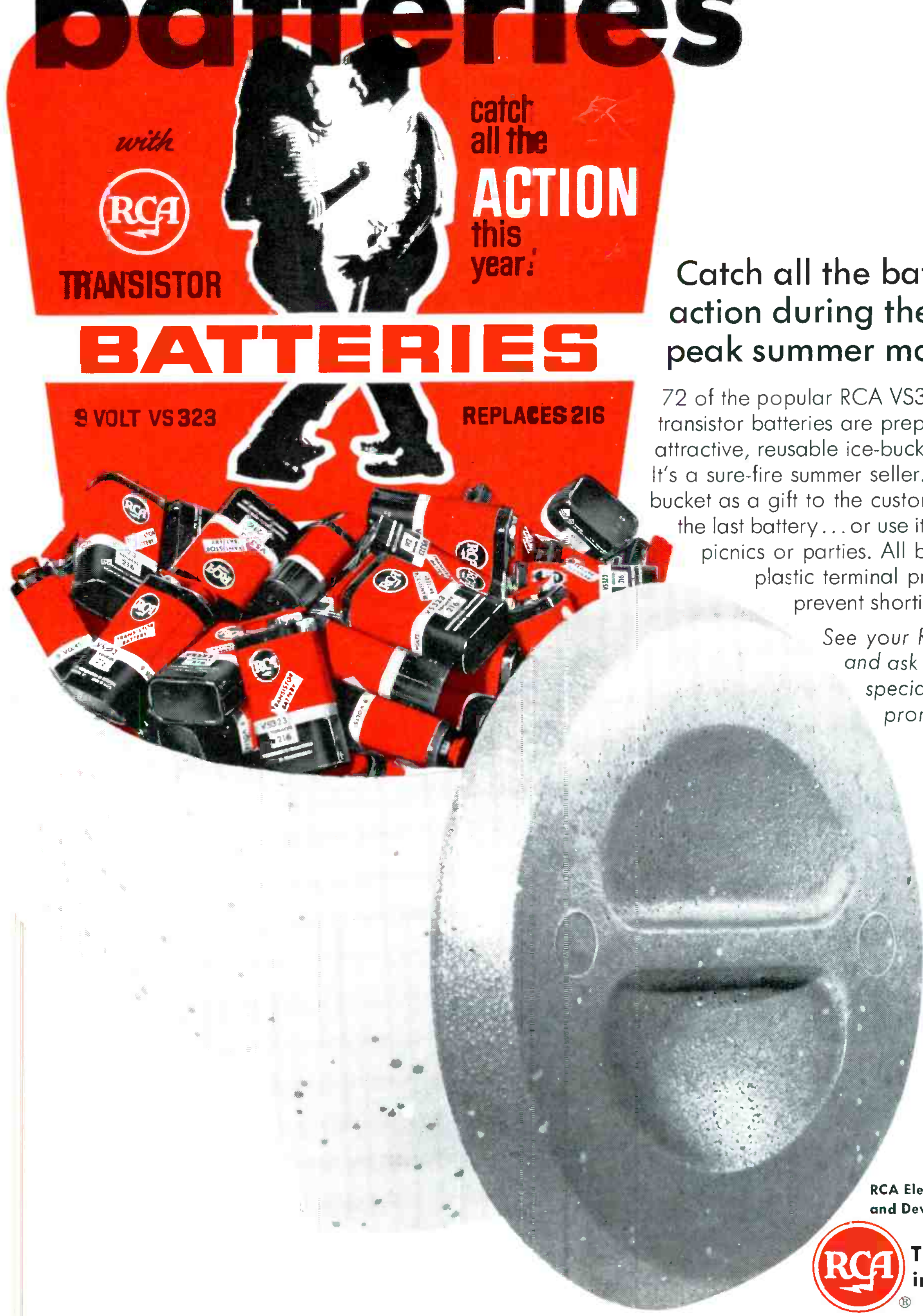
Order RCA's 9-volt summer special

"A bucket of batteries"



Catch all the battery action during the peak summer months

72 of the popular RCA VS323 9-volt transistor batteries are prepacked in this attractive, reusable ice-bucket merchandiser. It's a sure-fire summer seller. Offer the bucket as a gift to the customer who buys the last battery...or use it at home for picnics or parties. All batteries have a plastic terminal protector to prevent shorting.

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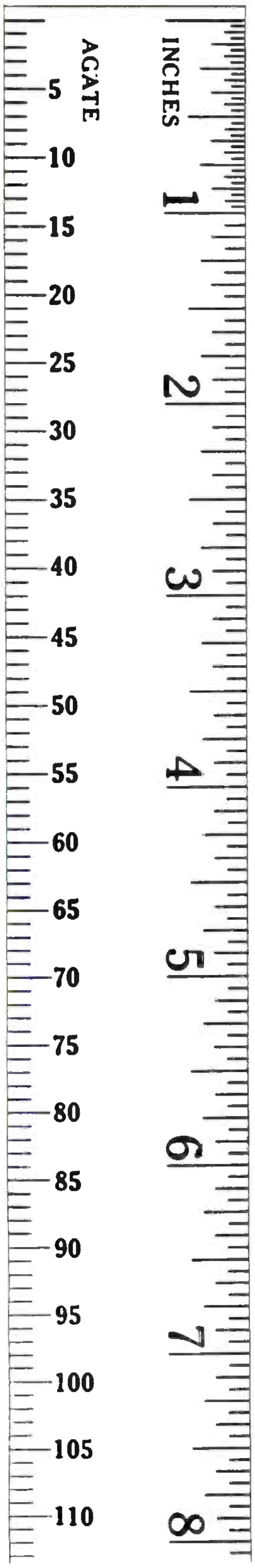

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Lance Antenna 1730 1st St San Fernando Calif 91340
Lansing Sound James B 3249 Casitas Ave Los Angeles Calif 90039
Lavoie Labs Morganville NJ 07751
Leach Corp 18435 Susana Rd Compton Calif 90221
Lectrotech Inc 1221 W Devon Ave Chicago Ill 60626
Ledex Inc 123 Webster Dayton Ohio 45402
Leeds & Northrup 4907 Stenton Philadelphia Pa 19144
Lesa of America 11 W 42 St New York NY 10036
Littelfuse Inc Des Plaines Ill
Litton Industries 336 N Foothill Beverly Hills Calif 90210
Los Angeles Turner Exchange 4611 W Jefferson Los Angeles Calif 90016

M

3M Electrical Products Div 900 Bush Ave St Paul Minn 55106
McIntosh Labs 2 Chambers St Binghamton NY 13903
Magnavox Co 2131 Bueter Rd Ft Wayne Ind
Magnecord Div Midwestern Instrument PO Box 7186 Tulsa Okla 74105
Magnetrack Box 147 Caroline Puerto Rico USA
Majestic Int'l 743 N LaSalle St Chicago Ill 60605
Mallory & Co PR 3029 E Washington Indianapolis Ind 46201
Marantz 25-14 Bdwy Long Island City NY 11106
Marconi Instruments 111 Cedar Lane Englewood NJ 07631
Mark Products 5439 W Fargo Skokie Ill 60076
Matsushita Electric Co 200 Park Ave New York NY 10017
Mercury Electronics 315 Roslyn Rd Mineola NY 11501
Mercury TV Tuner Service 890 River Bronx NY
Merit Coil & Transformer Merit Plaza Hollywood Fla
Methode Mfg 7447 W Wilson Ave Chicago Ill 60656
Metrex (UXL Corp) 819 Blake Ave Brooklyn NY 11207
Metritape Controls 33 Sudbury Roard Concord Mass 01742
Michigan Magnetics Vermontville Mich 49096
Microflame Inc 7800 Computer Ave Minneapolis Minn 55424
Midland Int Corp 1519-21 Atlantic N Kansas City Mo 64116
Milgray/NY 136 Liberty St New York NY 10006
Millen Mfg James 150 Exchange Malden Mass 02148
Miller Co JW 5917 S Main Los Angeles Calif 90003
Milo Electronics 530 Canal New York NY 10013
Monarch Elec Int'l Inc 7035 Laurel Canyon Blvd N Hollywood Calif 90028
Monitoradio Div Idea 7900 Pendleton Pike Indianapolis Ind 46226
Mosley Electronics 4610 N Lindberg Bridgeton Mo 63042
Moss Electronics 2435 White Plains Rd Bronx NY 10467
Motorola Communications Div 4501 W Augusta Chicago Ill 60651
Motorola Consumer Prods 9401 W Grand Ave Franklin Park Ill 60131
Motorola Training Int 4545 W Augusta Chicago Ill 60651
Mueller Electric 1583 E 31 St Cleveland Ohio 44114
Mullard (see Int'l Electronics New York NY)
Multicore Sales Corp Westbury NY 11590
Multitron Corp 309 Queen Ann Rd Teaneck NJ 07666
Mura Corp 380 Great Neck Rd Great Neck NY 11021
Muzak Co 220 4 Ave New York NY 10003

N

National Radio Institute Washington DC 20016
Neshaminy Electronics Neshaminy Pa
Newark Electronic 223 W Madison Chicago Ill 60606
Newcomb Audio Products Co 12881 Bradley Ave Sylmar Calif 91342

NEW!

JFD®

COLOR SHIELD-82
COAXIAL CABLEMATCH SOLVES THE 75 OHM INSTALLATION PROBLEM

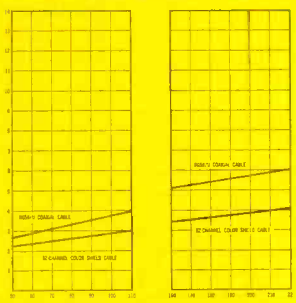
If you've been vexed by the questionable need for a 300-75 ohm matching transformer at the antenna when installing coaxial cable, here's good news. The new JFD 75-ohm Color Shield-82 Coaxial Cablematch comes with the **matching transformer already attached** to the cable and ties directly to the 300 ohm output.

Solves two big antenna installation problems: (1) When you want to use coaxial cable simply connect JFD Color Shield-82 (with the "built-on" transformer) directly to the JFD LPV antenna terminals—for minimum possible loss, and, (2) save time and money by having the transformer as part of the 75 ohm cable (instead of the antenna).

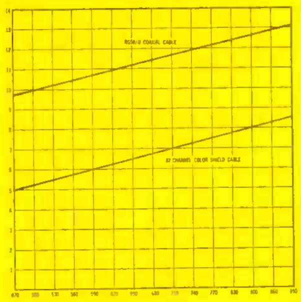
No waste. No work. No separate parts or fittings to connect or disconnect. No losses through fittings and connectors. Simply beautiful! Beautifully simple! Great for color, too!

Available in three lengths at your JFD distributors, complete

WITH ATTACHED 300-75 OHM MATCHING TRANSFORMER



VHF INSERTION LOSS – JFD 82-CHANNEL COLOR-SHIELD CABLE VS RG59/U CO-AXIAL CABLE



UHF INSERTION LOSS – JFD 82-CHANNEL COLOR-SHIELD CABLE VS RG59/U CO-AXIAL CABLE

Whether you install antenna system in homes, motels, stores or multiple dwellings—rely on the new JFD 82-channel Color Shield-82 with pre-assembled matching transformer for the clearest pictures in sight—color, and black and white.

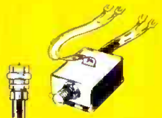
Model	Length	List
CS82-50	50 ft.	**$11.25**
CS82-75	75 ft.	**$14.25**
CS82-100	100 ft.	**$17.00**

TO INSTALL COLOR SHIELD-82 COAXIAL CABLEMATCH DIRECTLY TO TV RECEIVER, USE A JFD 82-CHANNEL COLORMATCH/SPLITTER MATCHING TRANSFORMER . . .

Model **MT54** List **$3.50**

VHF, UHF, FM Indoor 75-ohm-300 ohm Matching Transformer. With coaxial cable "F" fitting.

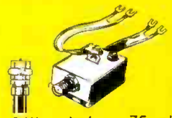
Accessories Included
1 "F" Connector



Model **MT56** List **$7.50**

2-Way Indoor 75 ohm-300 ohm Matching Transformer with separate VHF and UHF outputs, plus coaxial cable "F" fitting.

Accessories Included
1 "F" Connector



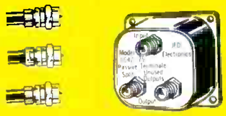
Model **MT58** List **$8.95**

3-Way Indoor 75 ohm-300 ohm Matching Transformer with VHF, UHF and FM outputs. With coaxial cable "F" fitting.

Accessories Included
1 "F" Connector

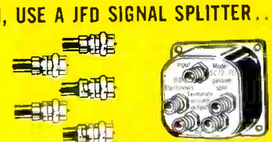
ATTRACTIVELY PACKED ON CONVENIENT CLEAR-PAK CARD

TO INSTALL COLOR SHIELD-82 COAXIAL CABLEMATCH DIRECTLY TO A 75 OHM AMPLIFIER OR SYSTEM, USE A JFD SIGNAL SPLITTER . . .



Model **SC42-75** List **$7.95**

75 ohm VHF/UHF/FM single input—75 ohm VHF/UHF/FM two-set signal splitter. Includes coaxial cable "F" fittings.



Model **SC72-75** List **$10.95**

75 ohm VHF/UHF/FM single input—75 ohm VHF/UHF/FM four-set signal splitter. Includes coaxial cable "F" fittings.

See your distributor—or write for Form 6735.

JFD ELECTRONICS CO.
15th Avenue at 62nd Street, Brooklyn, N.Y. 11219
JFD International, 64-14 Woodside Ave., Woodside, N.Y. 11377 JFD Canada, Ltd., Canada
JFD de Venezuela, S.A., Avenida Los Haticos 125-97, Maracaibo, Venezuela

JFD®

. . . for more details circle 127 on postcard

Newtronics Corp 3455 Vega Ave
Cleveland Ohio 44113
North American Philips (Norelco) 100 E 42 St
New York NY 10017
Nortronics Co 8133 10th Ave N
Minneapolis Minn 55427
Nutone Inc Cincinnati Ohio

O

Oak Mfg Co Crystal Lake Ill 60014
Oaktron Industries Monroe Wis 53566
Oelrich Publications 4308 Milwaukee Ave
Chicago Ill 60641
Ohmite Mfg 3673 Howard St Skokie Ill 60076
Olson Electronics 464 S Forge
Akron Ohio 44308
Olympic Radio & TV 34-01 38 Ave
Long Island City NY 11101
Ortron Electronics 29 Lincoln Ave
Orange NY
Oxford Transducers 3911 S Mich Ave
Chicago Ill 60653

P

Packard Bell Electronics 12333 W. Olympic
Blvd Los Angeles Calif 90064
Pace Communications Corp 24049 Frampton
Ave Harbor City, Calif 90710
Palmer Electronics Laboratories Lowell Rd
Carlisle Mass 01741
Parker Metal Goods Co 85 Prescott St
Wooster Mass
Parts Unlimited Inc 1 State St
Bloomfield NJ 07003
Pearce-Simpson 2295 NW 14 St
Miami Fla 33142
Perma-Power Co 5740 N Tripp Ave
Chicago Ill 60646
Phaostron Instruments & Electronics 151
Pasadena Ave S Pasadena Calif 91105
Phelps Dodge Communications Products Div
Route 79 Marlboro NJ 07746
Philco Corp "C" and Tioga Sts
Philadelphia Pa
Philharmonic Radio & TV 235 Jersey Ave
New Brunswick NJ 08901
Pickering & Co Sunnyside Blvd
Plainview NY 11803
Pilot Radio 100 Electra Lane Yonkers NY
Pioneer Electric & Research
Forest Park Ill 60130
Planet Mfg Corp 225 Belleville Ave
Bloomfield NJ 07003
Pocket Socket Inc 17415 Ecorse
Allen Park Mich 48101
Pomona Electronics Co 1500 E 9th St
Pomona Calif 91766
Potter & Brumfield 107 N 10th St
Princeton Ind 46017
Precise Electronics 76 E 2 St
Mineola LI NY 11501
Precision Apparatus Div of Dynascan 1801 W
Belle Plaine Ave Chicago Ill 60613
Precision Electronics Inc 9101 King Ave
Franklin Park Ill 60131
Precision Tuner Service PO Box 272
Bloomington Ind 47401
Pyramid Electronic Co Darlington SC 29532

Q

Qualitone Industries 102 Columbus Ave
Tuckahoe NY 10707
Quam-Nichols 234 E Marquette Rd
Chicago Ill 60637
Quan-Tech Labs 60 Parsippany Blvd
Boonton NJ 07005
Quietrole Co 395 St John St
Spartanburg SC

R

Radar Devices Mfg Corp 22003 Harper Ave St
Clair Shores Mich 48080
RCA Components and Devices Div 415 S 5 St
Harrison NJ 07029
RCA Institutes 350 W 4 St New York NY 10014
RCA Parts and Accessories 2000 Clements
Bridge Rd Deptford NJ 08096
RCA Set Div 600 N Sherman Dr
Indianapolis Ind 46201
RFS Industries 102 Harbor Rd
Port Washington NY 11050
RMS Electronics Inc 2016 Bdwy
New York NY 10023
Radiart Co 2900 Columbia
Indianapolis Ind 46205
Radio Receptor 240 Wythe Brooklyn NY 11211
Radio Shack 730 Commonwealth Boston Mass
Rauland Corp 4245 N Knox Chicago Ill 60630
Rawn Co Spooner Wis 54801
Ray-O-Vac Co 212 E Washington St
Madison Wis 53703
Raytheon Communications Prod 213 Grand S
San Francisco Calif
Raytheon Distributor Products Div 55 Chapel
Newton Miss 39345
R-Columbia Products 305 Waukegan Ave
Highwood Ill 60040
Recoton Corp 52-35 Barnett
Long Island NY 11104
Reeves Soundcraft Great Pasture Rd
Danbury Conn 06810
Regency Electronics 7900 Pendleton Pike
Indianapolis Ind 46226
Rego Insulated Wire 830 Monroe
Hoboken NJ 07030
Rek-O-Kut Co 38-19 108 St Corona NY 11368
Roberts Electronics 829 N Highland Ave
Hollywood Calif 90028
Robert Bosh Corp Blaupunkt Car Radio Div
40-25 Crescent Long Island City NY 11101
Robins Industries 1558 127 St
College Pt NY 11356

This *Remington* PREMIER PORTABLE TYPEWRITER

FREE

WHEN YOU BUY THIS RCA WR-64B COLOR BAR/DOT/CROSSHATCH GENERATOR...THE ESSENTIAL COLOR TV TEST INSTRUMENT

Here's a deal you can't afford to miss! A FREE Remington portable typewriter—yours when you purchase the most essential color-TV test instrument—the RCA WR-64B!

Just imagine how handy your new typewriter will be—in the shop or at home. You'll use it almost as much as you use the RCA WR-64B—standard of the color TV servicing industry.

Here's how to get your FREE Remington Typewriter. Mail in the warranty card plus the gold label from the shipping carton of your new RCA color bar generator to RCA Test Equipment Headquarters, Bldg. 17-2, Harrison, N.J. We will ship your new Remington portable typewriter to you direct, freight prepaid. But remember—this offer covers only equipment purchased between February 1, 1967 and July 15th, 1967. To allow for postal delay, we will honor cards postmarked up to July 31st.

Plan NOW to take advantage of this BIG offer—a FREE Remington portable typewriter with your purchase of an RCA WR-64B color bar/dot/crosshatch generator.

The standard of the Color-TV Servicing Industry. Generates all necessary test patterns—color bars, crosshatch, dots plus sound-carrier. *Only* **$189.50***

*Optional Distributor resale price. All prices subject to change without notice. Price may be slightly higher in Alaska, Hawaii, and the West.

Ask to see it at Your Authorized RCA Test Equipment Distributor

RCA Electronic Components and Devices, Harrison, N.J.

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The Most Trusted Name in Electronics

Rockbar Corp 650 Halstead Mamaroneck NY 10543
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Sadelco Inc 601 W 26th St New York NY 10001
Sampson Co 2244 S Western Ave Chicago Ill 60608
Sangamo Electric 1301 N 11 St Springfield Ill 62702
Sargent Gerkhe Co 323 W 15th St Indianapolis Ind 46202
Sarkes Tarzian Tuner Service 537 S Walnut Bloomington Ind 47401
Sarkes Tarzian Tuner Service 547-49 Tonnele Jersey City NJ 07307
Sarkes Tarzian Tuner Service 10654 Magnolia N Hollywood Calif 90028
Schematic Library 809 N 7th St Phoenix Ariz 85006
Schober Organ 43 W 61 New York NY 10023
Scott Inc HH 111 Powdermill Rd Maynard Mass 01754
Seco Electronics 1201 W Clover Dr Minneapolis Minn
Semitronics Corp 265 Canal St New York NY 10013
Sencore Inc 426 S Westgate Dr Addison Ill 60101
Sentry Electronics Inc 707 S Okfuskee Wewoka Okla 74884
Setchell-Carlson New Brighton St Paul Minn 55112
Sherwood Electronic Labs 4300 N California Ave Chicago Ill 60618
Shure Brothers 222 Hartrey Ave Evanston Ill 60202
Simpson Electric 5200 W Kinzie St Chicago Ill 60644
Slep Electronic Co Automotive Div PO Box 178 Ellenton Fla 33532
Smith Inc Herman H 2326 Norstrand Brooklyn NY 11210
Snyder Mfg 22 & Ontario Philadelphia Pa
Sola Electric 1717 Busse Rd Elk Grove Village Ill
Sonar Radio 73 Wertman Ave Brooklyn NY
Sonotone Corp Elmsford NY 10523
Sony Corp of America 580 5 Ave New York NY 10036
Sorensen Prods Div Raytheon S Norwalk Conn
Soundolier Inc PO Box 3848 St Louis Mo
South River Metal Products 377 Tpk Rd South River NJ
Sprague Products Marshall St N Adams Mass 01220
Stockpole Carbon Electronics Div St Marys Pa
Stancor Electronics 3501 W Addison Chicago Ill 60618
Standard Instrument Corp 657 Broadway New York NY 10012
Standard Kollsman Industries 2085 N Hawthorne Melrose Park Ill 60160
Stromberg-Carlson Div General Dynamics 1400 N Goodman St Rochester NY 14609
Sturtevant Co PA Addison Ill 60101
Superior Electronics 208-212 Piaget Ave Clifton NJ 07011
Swing O Lite Inc 13 Moonachie Rd Hackensack NJ
Switchcraft Inc 5555 N Elston Chicago Ill 60603
Sylvania Electronic Products 730 3 Ave NY NY 14304
Sylvania Electronic Tube Div Seneca Falls NY

13148
Symphonic Radio & Electronic 10 Columbus Circle N New York NY 10023

T

TACO Sherburne NY 13460
TRX Electronic Corp 200 Park Ave S New York NY 10003
TV Tuner Service 2103 W 3 St Bloomington Ind 47401
TV Tuner Service 118 3rd St W Twin Falls Idaho 83301
Talk APhone Co 5013 N Kedzie Ave Chicago Ill 60625
Tandberg of America 83 Ave Pelham NY 10803
Tap A Line Mfg PO Box 563 Pompano Beach Fla 33061
Tech-Master 75 Front St Brooklyn NY 11201
Techni-Parts Corp 156 Hempstead Tpk W Hempstead LI NY 11552
Techpress Inc Brownsburg Ind 46112
Tektronix Inc PO Box 500 Beaverton Ore 97005
Telerad Div Lionel Corp Route 69-202 Flemington NJ 08822
Telex Inc Inc 3054 Excelsior Minneapolis Minn 55416
Telex/Aemco Div Telex Inc Mankato Minn 56001
Teleonic Industries 60 N 1 Ave Beech Grove Ind 46107
Tenatronics Ltd 1011 Power Ave Cleveland Ohio 44114
Tenna Mfg 19201 Cranbrook Pkwy Cleveland Ohio
Tennalab 10 & State Sts Quincy Ill 62301
Terado Co 1068 Raymond Ave St Paul Minn 55108
Texas Crystals 1000 Crystal Dr Ft Myers Fla 33901
Thomas Electronic Organs 8345 Hayvenhurst Ave Sepulveda Calif 91343
Thordarson-Meissner 7 & Belmont Mt Carmel Ill 62863
Thorens Div Atlantic & Stewart Aves ELPA Mktg Ind New Hyde Park NY 11040
Toshiba Mitsu & Co 530 5 Ave New York NY 10036
Tram Electronics Lower Bay Road PO Box 187 Winnisquam NH 03289
Trav Ler Radio 571 W Jackson Chicago Ill 60606
Triad Transformer 4055 Redwood Ave Venice Calif 90291
Trio Mfg Griggsville Ill 62340
Triplett Electrical Instrument 286 Harmon Rd Bluffton Ohio 45817
Tung-Sol Electric 1 Summer Ave Newark NJ 07104
Turner Co 918 17 St NE Cedar Rapids Iowa 52401

U

Ullman Devices Ridgefield Conn 06877
Ungar Co Sid 1880 Rayford Dr Los Angeles Calif 90045
Union Carbide 270 Park Ave New York NY 10017
Useco Div Litton Industries Inc 13536 Saticoy St Van Nuys Calif 91402
Utah Electronics 1123 E Franklin St Huntington Ind 46750
U.Test M Mfg 4325 W Lincoln Milwaukee Wis 53219
Ungar Electric Tools 2701 W El Segundo Blvd Hawthorne Calif 90250
United Transformer 150 Varick St New York NY 10013
University Loudspeakers Div Ling Temco Vought 9500 W Reno St Oklahoma City
Up Right Towers 1013 Pardee St Berkeley Calif 94710
Utah Radio & Electric Corp 1123 E Franklin St Huntington Ind 46750
Utica Drop Forge & Tool 2415 Whitesboro Utica NY 13502
Utica Electronic Communications 2714 W Irving Pk Chicago Ill 60618

V

V M Corp 4 & Park Sts Benton Harbor Mich 49022
Vaco Products 510 N Dearborn Chicago Ill 60610
Valley TV Tuner Service 5641 Cahuenga Blvd N Hollywood Calif 90028
Vector Electronic 1100 Fowler St Glendale Calif

Precision Apparatus

introduces 5 new models; now a complete line of quality test equipment for service technicians

For over 30 years, professionals in industry, service, laboratory and educational fields have relied on Precision Apparatus Test Equipment. Today, through the experience and marketing know-how of Dynascan Corporation, Precision Apparatus offers even greater reliability and performance—maximum versatility—in all applications. By every standard, they are the hallmark of quality in test equipment.

NEW! A MUST FOR COLOR TV ALIGNMENT
MODEL E-410C—SWEEP GENERATOR AND MARKER ADDER

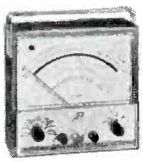
Wide range, frequency modulated signal source combined with Marker Adder circuitry designed for the alignment of color TV, FM and other high frequency wide-band receivers and circuits. Solves marker visibility and overloading problems. Furnished with a 4.5 mc crystal and 5 output cables. $169.95

NEW! MODEL B-12—REGULATED POWER SUPPLY

A reliable source of variable, regulated DC plate voltages, and bias plus AC filament voltages . . . with exclusive 6.3 VAC and 12.6 VAC supply. Perfect for service bench and circuit development, it offers regulated DC voltages from 0 to 400 volts, and a bias supply from 0 to —150 volts. Each output is variable throughout its range. Rugged, double-jewelled, D'Arsonval meters mounted on the front panel. $99.95

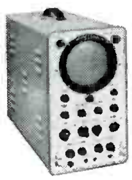
NEW! MODEL B-10—BATTERY ELIMINATOR & CHARGER

Twice the filtering provides .15% ripple! Designed to meet rigid, low-ripple output requirements of modern transistorized automobile radios and other electronic equipment of 6 and 12 volt ratings. Does not require additional investment for external filter adapters. Functions as an efficient, reliable battery charger with special high-current output at separately labeled terminals. $59.95



NEW!
MODEL V-95 PROFESSIONAL VTVM
More accurate readings on huge 7″ mirrored scale. Special 0.5 VDC scale for precise transistor circuit analysis. Zener controlled internal power supply obsoletes ohmmeter batteries. Two-way protection: transit switch position and anti-burnout shunts prevent meter damage on the job or on the road. Single test probe eliminates cable tangles and lead shuffling. Rugged walnut-grain metal case; name-personalized handle stops "borrowing." $79.95
MODEL V-75 with 4½″ meter. $59.95

NEW!
MODEL S-55 PUSH-PULL OSCILLOSCOPE
Wide band amplification, DC coupled, zero to 5 MC. High vertical sensitivity and large CRT screen give more than 6″ undistorted deflection. Automatic horizontal synchronization includes 60 Hz sinusoidal sweep for TV and FM alignment. Special 500 KHz sweep makes it easy to see complete 3.58 MKz burst signals; ideal for color TV. Exceptionally low distortion. $169.95



ES-550B WIDE-BAND OSCILLOSCOPE
Deluxe scope; extra brightness; extra high sensitivity. Unique calibration voltage makes measurement easy. $279.95

E-200C MULTI-BAND SIGNAL GENERATOR
Unique AVC substitution system for total accuracy. 88 KHz to 400 MHz, hand-calibrated. $119.95

120M VOM
1½% DC accuracy. Exclusive extra-low R x 1/10 scale reads to 0.1 ohm. Transit and burnout protection. Mirrored scale. $65.00
ALSO: MODEL 120 with 2% DC. $56.00

E-310 SINE & SQUARE WAVE GENERATOR
Only moderate-cost, low-distortion, 5 Hz to 600 KHz wide band generator. $199.95

The Complete Line That Sets Industry Standards

PRECISION APPARATUS
hallmark of quality in test equipment

Division of Dynascan Corporation
1801 W. Belle Plaine Avenue
Chicago, Illinois 60613
Where Electronic Innovation Is A Way Of Life

Tube supplement information now available for all Precision and Paco Tube Testers.

. . . for more details circle 138 on postcard

Victoreen Instrument 5806 Hough Ave Cleveland Ohio 44103
Vidaire Electronics 365 Babylon Tpk Roosevelt LI NY 11575
Video Industries Co 242 Madison Ave Port Chester NY 10573
Viking Cable Co 400 9th St Hoboken NJ 07030
Viking of Minnesota 9600 Aldrich St Minneapolis Minn
Viking Electronics 830 Monroe Hoboken NJ 07030
Vitramon Inc Box 544 Bridgeport Conn 06601
Vocaline Co of America 133 Coulter St Old Saybrook Conn 06475
Volkswagen of America 476 Hudson Terrace Englewood Cliffs NJ 07632

W

Waber Electronics 200 N 2nd St Philadelphia Pa 19106
Walco Electronics 60 Franklin St East Orange NJ 07017
Waldom Electronics 4625 W 53 St Chicago Ill 60623
Wall Mfg Co P Grove City Pa 16127
Waller Corp Crystal Lake Ill 60014
Wallin-Knight Industries 3321 McKinley St NE Minneapolis Minn 55108
Walsco Electronics S Wyman St Rockford Ill 61101
Ward Leonard Electric 115 McQueston Pkwy Mt Vernon NY
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Webcor Inc 5626 Bloomingdale Ave Chicago Ill 60639
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Wells-Gardner 2701 N Kildare Ave Chicago Ill 60639
Wen Products 5810 Northwest Hwy Chicago Ill 60631
Western Electric Co Inc 195 Broadway New York NY 10007
Western Tuner Rebuilders 1140 N Vermont Ave Los Angeles Calif 90029
Westinghouse Electric Radio TV Dept Metuchen NJ 08840
Westinghouse Electric Corp Tube Div PO Box 284 Elmira NY 14902
Wilco Co 4425 Bandini Blvd Los Angeles Calif 90023
Windsor Electronics 999 N Main St Glen Ellyn Ill 60137
Winegard Co 3000 Kirkwood Burlington Iowa 52601
Workman Electronic Products Box 5297 Sarasota Fla 33579
Worner Electronic Rankin Ill 60960
Wuerth Tube Saver Corp PO Box 66 Hollandale Fla
Wurlitzer Co N Tonawanda NY 14150

X

Xacto Inc 48-41 Van Dam St Long Island City NY 11101
Xcelite Inc 12 Bank St Orchard Park NY 14127

Y

Yeats Appliance Dolly 1313 Fond du Lac Ave Milwaukee Wis 53205

Z

Zenith Radio Parts & Accessories 5801 W Dickens Chicago Ill 60639

MOVING?

Be sure to let us know your new address. Please enclose a complete address label from one of your recent issues.

CATALOGS AND BULLETINS

Audio-Visual Equipment 400
A 116-page catalog lists a variety of stereo equipment, video tape recorders, closed circuit TV equipment and accessories such as speakers, microphones and tapes. Sonocraft.

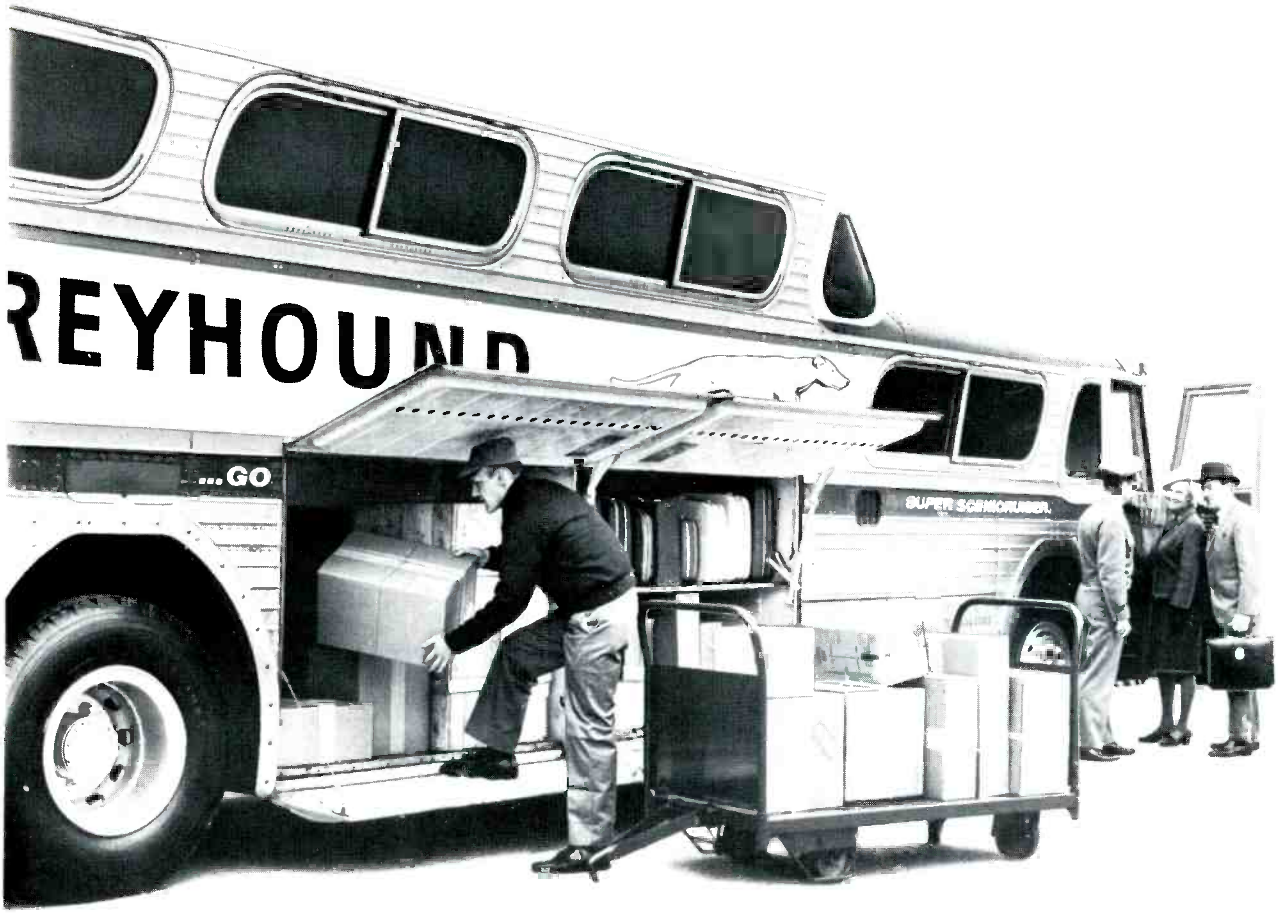
Test Instruments 401
A line of test instruments including color generators, tube testers, capacitor testers and meters is described in a 10-page catalog. Mercury.

Electronics Catalog 402
A 124-page spring catalog lists high-fidelity components, tape recorders, amateur and CB equipment, test instruments, tools and kits. Allied.

Embossed Signs 403
An eight-page catalog contains pictures of a wide assortment of embossed steel signs bearing the proper wording for many situations. Seton.

Coils 404
A catalog lists general and exact coil replacements for radios and TV sets. Schematic drawings illustrate all coils. Workman.

Packages that travel on "people" schedules!



Your packages go everywhere Greyhound goes. Same bus, same fast, frequent schedules, when you ship by Greyhound Package Express

"People" schedules *are* package schedules when you ship by Greyhound Package Express. Got a hurry-up shipment? Put it on a Greyhound...the same Greyhound bus that carries passengers. When the passengers arrive, your shipment arrives. Schedules are regular, fast and frequent. You can ship anytime at your convenience... day or night, 7 days a week, 24 hours a day. Weekends and holidays, too. Greyhound travels the most direct routes, via the newest super highways, serving thousands of cities, towns and villages all over America. And GPX is a money-saver you can't afford to overlook. Next time you've got a shipment ready to go, look into GPX. Take your choice of C.O.D., Collect, Prepaid, or open a GPX Charge Account. For complete information about service, rates and routes, call Greyhound, or write: Greyhound Package Express, Dept.53-F, 10 South Riverside Plaza, Chicago, Ill. 60606.

For Example	Buses Daily	Running Time	20 lbs.	30 lbs.	40 lbs.*
BOSTON NEW YORK	28	4 hrs. 15 min.	2.20	2.60	2.90
LOS ANGELES SAN FRANCISCO	22	9 hrs. 15 min.	2.10	2.45	2.80
PITTSBURGH CLEVELAND	12	2 hrs. 45 min.	2 00	2.25	2.65
INDIANAPOLIS CHICAGO	10	4 hrs.	2.10	2.45	2.85

*Other low rates up to 100 lbs. Lot shipments, too.

GPX
GREYHOUND PACKAGE EXPRESS

One of a series of messages depicting another growing service of The Greyhound Corporation.

. . . for more details circle 124 on postcard

NEWS OF THE INDUSTRY

General Electric Urges Strong Local Promotions

General Electric urges retailers handling its radios and portable tape recorders to make the most of the upcoming "gift season" by initiating strong local promotions.

Included are ad mats, suggested copy for radio spots, displays and promotion ideas for brides, grads and Dads. But besides these traditional gift occasions, G-E points out that June 11th is Kamehameha Day, giving retailers all over the United States a reason to decorate their departments in Hawaiian motif. It was also pointed out that June 17th is Bunker Hill day.

Federal Trade Commission Advises On Price Discrimination

The Federal Trade Commission (FTC) recently advised a manufacturer, who had requested an advisory opinion, that nothing is inherently illegal about area price lists that make only due allowance for differences in the cost of shipment and delivery.

The FTC advised the manufacturer further that price discriminations in sales to customers, located in different areas and, who in fact compete with each other, could amount to conduct in violation of Section 2(a) of the Clayton Act, unless cost justified the price or unless the lower price was a good-faith meeting of a competitor's equally low price.

The FTC also pointed out that it could be unlawful if area price lists permitted sales-producing monopoly profits in one area to subsidize sales at much lower prices in another area or to a particular customer or group of customers to the competitive injury of a competitor of the seller.

FEC Awarded New Contract For Job Corps Center

Federal Electronic Corp. of Paramus, N.J., is awarded a $21,687,000 renewal contract by the Office of Economic Opportunity for the operation of the Kilmer Job Corps Center.

The 17-month contract takes effect immediately and ends June 30, 1968. It covers academic and vocational training for resident corpsmen and non-resident enrollees in four schools at the Kilmer Center.

In addition to work-skill training, the center provides citizenship training, vocational, recreational and social opportunities and general education development leading to high school equivalency certificates. Federal Electronics also provides food, lodging and other services for the trainees.

The Kilmer center has been in operation since Feb. 11, 1965, and it was said that the center has graduated more than 1900 corpsmen and placed more than 1600 in confirmed jobs.

Computer Network To Provide National Job Placement Service

James R. Bradburn, vice president and general manager of RCA Electronic Data Processing predicts that the day is rapidly approaching when a jobless worker will enter a state employment office and, at the flick of a switch, receive a nationwide list of employment opportunities that match his qualifications.

"In dozens of states, computers already are keeping track of statewide job openings and matching them with unemployed workers," Dr. Bradburn said. "As more states employ computers to untangle the gigantic snarl of paperwork involved in unemployment insurance programs and job placement services, the next logical step is to form a nationwide network."

In New Jersey, Commissioner of Labor and Industry, Raymond Male, pointed out: "Much of the unemployment problem could be solved by a fast, efficient method of matching available jobs with the jobless."

New Jersey's Labor Dept. will join the swelling ranks of computerized state unemployment services this year with the installation of one of the nation's most extensive systems. It consists of a computer connected to remote data transmission terminals at each of the state's 37 local unemployment offices.

The growing use of computers in unemployment administration is understandable in view of the mammoth job involved, Mr. Bradburn said. For example, in 1965, a year when unemployment actually dropped from a January high of near five percent to around four percent by the year's end, more than six million insured claimants throughout the United States collected benefits averaging $36.56 a week for a total of more than $2.5 billion.

In the same year, the nation's more than 2000 state unemployment offices placed applications in nearly 6.5 million non-farm jobs and more than 6 million year-around and seasonal farm jobs. About 2.5 million job qualification tests and 2 million employment counselling interviews were administered.

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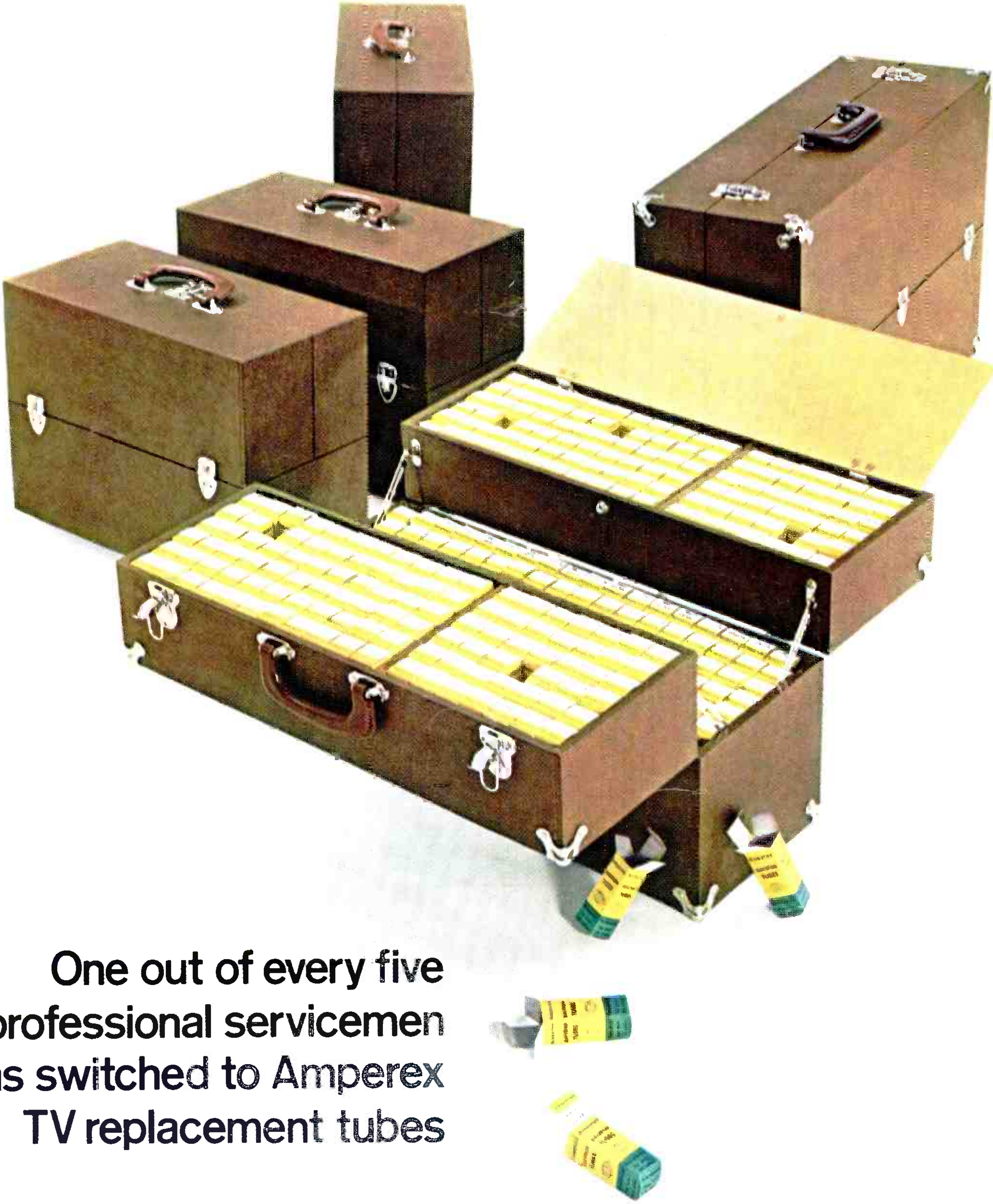

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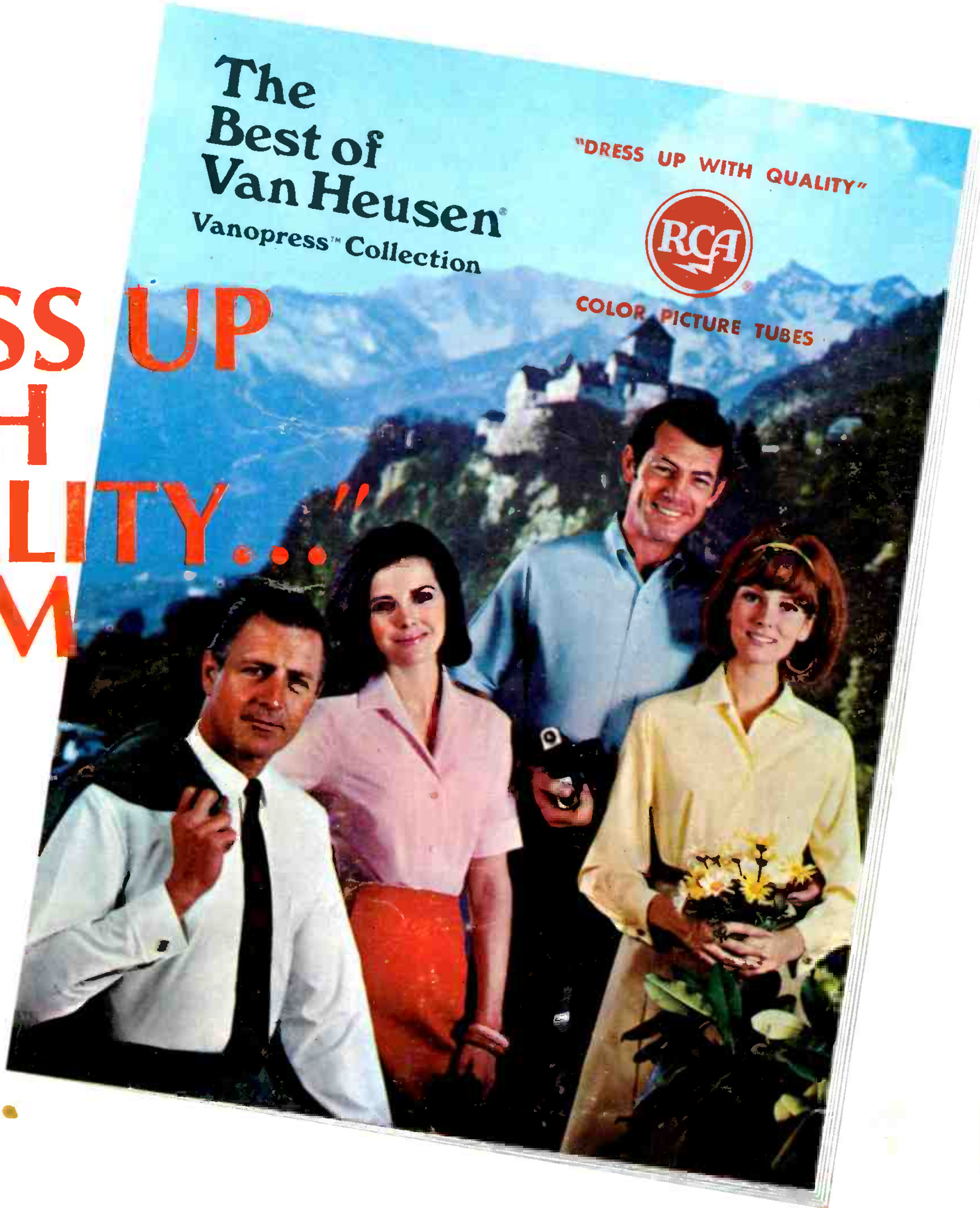

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