JULY 1966

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

Automatic Record Changers
Test Instruments For Color
Auto Radios and Tape Players

Small homes are saying "Yes" to big MATV business.

Walk right in with one of our 5 brand-new Channel Master MATV Amplifiers*

(They're priced fantastically low).

The color explosion has given birth to a gigantic new market. One that's left the door to multi-set homes wide open for big business opportunities.

When a family buys a color set, they don't throw the old black-and-white console away. They keep it. Chances are they also own a portable and even an FM set or hi-fi.

All this means one thing: Every one in your neighborhood who has, or buys, a color set becomes a hot prospect for the unique room-to-room flexibility offered by a Master Antenna Home System.

Here's where you cash in with our big line of Channel Master MATV amplifiers. They let you accommodate the **exact** need. For instance: Our new solid state VHF/FM Color Amplifier (Model 7035) provides 15 db across the entire band, flat color response, 1.5 volt output capability, plus a 75 ohm or 300 ohm input or output. It could be perfect for a home with a number of outlets in a weak to medium signal area.

Or the situation may call for one of our two new 75 ohm coaxial boosters: the single transistor Telstar VHF/FM (Model 0043); or the 2-transistor Twinstar VHF for areas with overload problems (Model 0041). Both models provide especially high gain (15 db) and low noise figures—and are the **only** coaxial amplifiers with both a 75 ohm and 300 ohm output.

Motels and garden apartments? Use our new outstanding 30 db VHF/FM Color Tandem Amps (Models 7041, 7043). Consists of mast-mounted pre-amps of models 0041 and 0043 cascaded with Model 7035 (contains power supply for pre-amps).

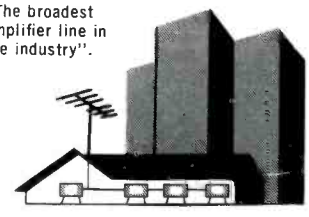
We have other amplifiers, including several for medium and large commercial systems. But the important thing is our flexibility. You're backed by the broadest MATV amplifier line in the business.

Like we said: The welcome mat is out. What are you waiting for?

Write for the facts!

* MODEL	GAIN	NOISE FIGURE		MAXIMUM INPUT SIGNAL IN MICROVOLTS		OUTPUT CAPABILITIES		LIST PRICE
		LOW BAND	HIGH BAND	LOW BAND	HIGH BAND	LOW BAND	HIGH BAND	
7035 Color Amp	15 db	2.5	5.4	300,000 total		1.5v total		Only $34.95
0043 Telstar	15 db	2.2	3.0	15,000	30,000	100,000	135,000	Only $34.95
7043 Color Tandem	30 db	2.2	3.0	15,000	30,000	1.5v total		Only $64.95
0041 Twinstar	15 db	2.5	3.7	150,000	190,000	850,000	600,000	Only $44.95
7041 Color Tandem	30 db	2.5	3.7	60,000	100,000	1.5v total		Only $74.95

"The broadest amplifier line in the industry".

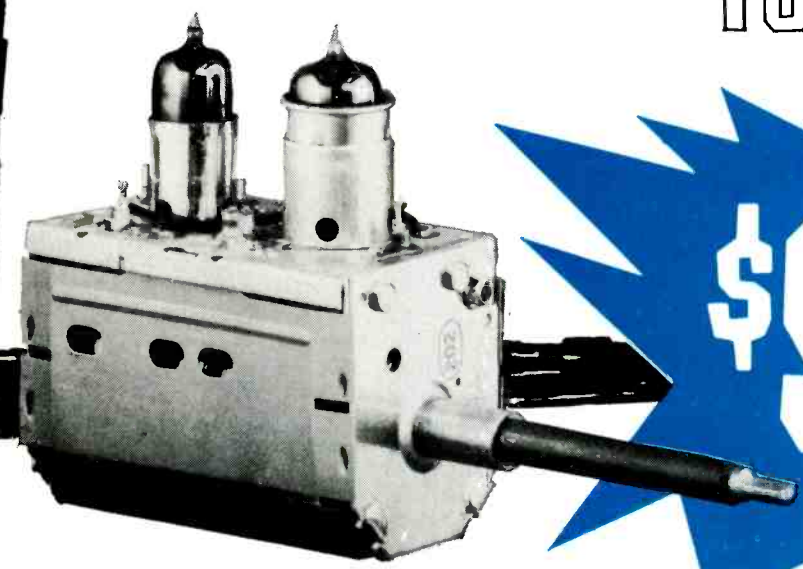


CHANNEL MASTER

ELLENVILLE, NEW YORK

. . . for more details circle 107 on postcard

Complete TUNER REPAIR for only



$9.50

Sarkes Tarzian, Inc., largest manufacturer of TV and FM tuners, offers unexcelled tuner overhaul and factory-supervised repair service. Completely-equipped and conveniently-located Service Centers offer fast, dependable and factory-supervised repair service on all makes and models. Centers are staffed by well-trained technicians, assisted by engineering personnel.

Tarzian-made tuners received one day will be repaired and shipped out the next. More time may be required on other makes. Every channel—not just the channels existing in any given area—is checked and re-aligned per original specifications. Exclusive cleaning method makes the tuner look—as well as operate—like new.

Cost, including ALL labor and parts (except tubes) is only $9.50 and $15 for UV combinations. No additional charge. No hidden costs. Too, you get a full, 12-month warranty against defective workmanship and parts failure due to normal usage.

Always send TV make, chassis and Model number with faulty tuner. Check with your local distributor for Sarkes Tarzian replacement tuners, parts or repair service. Or, use the address nearest you for fast, factory-supervised repair service.

TSC

TUNER SERVICE CORPORATION
(Factory-supervised tuner service authorized by Sarkes Tarzian)

MIDWEST — 817 N. Pennsylvania St.
Indianapolis, Ind., Box 1642
Tel: 317-632-3493

EAST — 547-49 Tonnele Ave., Jersey City, N. J.
Tel: 201-792-3730

SOUTH-EAST — 938 Gordon St., S. W.
Atlanta, Georgia
Tel: 404-758-2232

WEST—
SARKES TARZIAN, Inc.
Tuner Service Division
10654 Magnolia Blvd.,
N. Hollywood, Calif.
Tel: 213-769-2720

Getting a hernia and not getting paid for it?

Switch to Elmenco dipped Mylar®-paper capacitors and you won't have to worry about call-backs, lost profits, broken reputations or broken anything else.

The only ordinary thing about them is their price.

You get capacitors that meet the requirements of high-reliability computer and missile systems. You get capacitors that hold their rating at 125°C continuous operation. Yet you get them at TV set prices.

Elmenco dipped Mylar-paper capacitors come in just about any value you need from .001 mfd to 1.0 mfd. And just about any TV rated voltage you need, too, from 100V through 1600V.

Ask your Authorized Arco Distributor to put them on your next order. Without fail.

Tell him you're counting on his support.

(While you're at it, ask about other Elmenco types: padders and trimmers; high voltage dipped micas.)

Arco Electronics
A Division of Loral Corporation
Community Drive, Great Neck, N. Y.
Dallas, Texas, Pasadena, California,
Menlo Park, California.

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JULY 1966

VOL. 84 NO. 1

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

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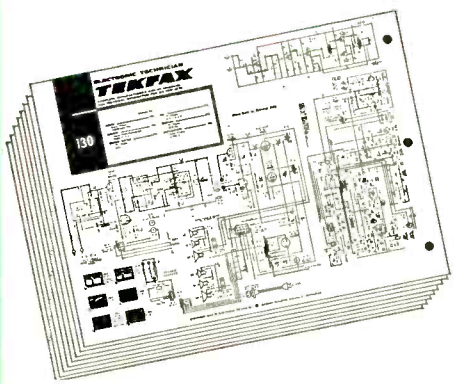
Cover

Service dealers and technicians have been presented with another money-making opportunity with tape players. Our photographers caught this technician in the act of trying one on for size in the front area of a fire-engine-red Cadillac. See page 55.

FEATURES

DEPARTMENTS

TEKFAX ____ 16 PAGES OF THE LATEST SCHEMATICS



Group 167 — July • 1966

ADMIRAL: TV Chassis H1-1A, H2-1A

GENERAL ELECTRIC: TV Chassis SC

MOTOROLA: TV Chassis TS-597

PHILCO: Color TV Chassis 16NT82, 16QT85, 17KT50

RCA VICTOR: TV Chassis KCS156

RCA VICTOR: TV Chassis KCS161

SEARS-SILVERTONE: TV Model 7122

LETTERS TO THE EDITOR

Switch Is Switched

I was asked to make a service call on an early model Crosley TV. Channel 4 was very weak and no signals appeared on 9 and 13. Tuner tube substitutes didn't help — neither did oscillator or mixer plate coil alignments. The set used a Sarkes-Tarizan tuner which showed signs of earlier repair. Test adapters were plugged in tube sockets and B+ voltages and grid bias were checked and found normal. With the shield off the tuner, close visual inspection revealed nothing unusual. Ohmmeter checks on band-switches, grid resistors and B+ dropping resistors revealed nothing out of the way. A signal from my "analyst" produced a snow-free picture on any channel, with no apparent difference between the high or low channels. Signals from the "analyst" were injected at the mixer plate, mixer grid (both IF and RF), RF amplifier plate and RF amplifier grid. No definite fault showed up but the RF amplifier stage didn't seem quite right, however. More voltage and resistance checks revealed nothing unusual. I then tuned to channel 9 and connected another antenna. With a test lead on one antenna terminal, I probed the RF antenna band-switch and grid input. Channel 9 came in! The same results were produced with channel 13! I now suspected the antenna transformer. Although ohmmeter checks showed it to be OK. Looking closely at the antenna input section, the RF antenna band-switch appeared to be on a low-band coil. Closer inspection showed the entire wafer was 180deg out of phase, as was the RF amplifier plate band-switch. Apparently during the previous repair, these two wafers were rotated 180deg. With all wafers in correct alignment, oscillator adjustment brought all channels in nicely. When the set was returned I questioned the owner and found that the set had just come from a metropolitan area. In a fringe area the lack of tuner gain showed up right away.

DON TROYER

Argonia, Kan.

Got Results

I wish to express my appreciation for putting me in touch with Ralph Gibby Electric, Roy, Utah. I was able to get a recording head for my Webster-Chicago wire recorder.

JOSEPH PETERSON

La Crosse, Wis.

Needs Signal Generator Part

I have a Precision E-200-E signal generator that needs a 400Hz modulation transformer. Could any ET reader help me obtain one?

WM. P. MEANY

North Syracuse, N.Y.

More On Log-Arithms

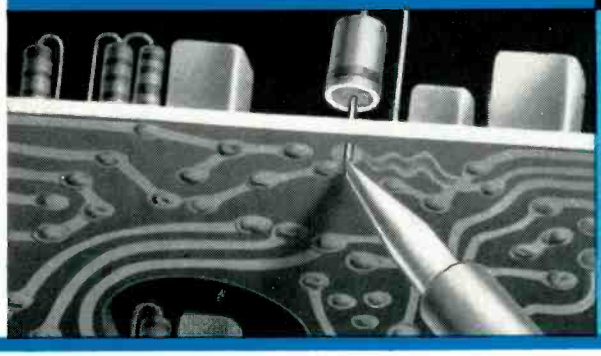
The log of 6 is .778 and not .802 as indicated in the article "Falling Off A Log-Arithm," page 84, February ET issue. Since the log of 6 is also the sum of the logs 2 and 3, the log of 6 need not be memorized. The log of 5 is also easy to determine since it is equal to the log of 10 minus the log of 2. Thus one need memorize only the logs for 1, 2, 3, 7 and 10. Because the logs for 1 and 10 are so easy to remember, one can neglect them and concentrate on 2, 3 and 7 and thus establish the logs for the digits 1 to 10. Integer fractions and multiple products can also be easily logged. The statement that the logs of 5 and 6 have no relationship to the other logs is also incorrect.

PAUL M. GERHARD

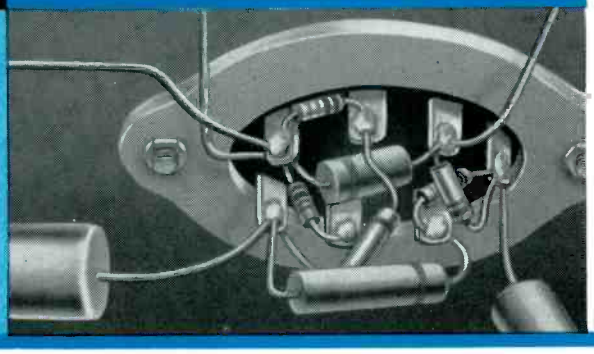
Beverly, Mass.

Did you ever...

...lift a wire-lead component from a printed wiring board for testing ?



...test or replace a capacitor or resistor on a crowded tube socket ?



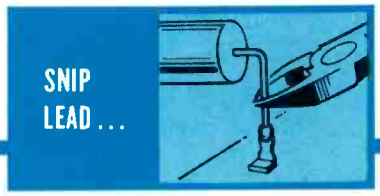
CUT YOUR TIME IN HALF with KWIKETTE* Soldering Aids ...the revolutionary

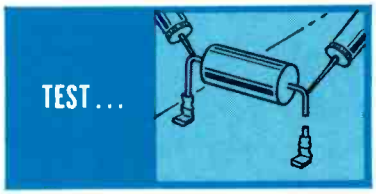
connectors that practically let you do "in-circuit" component testing!

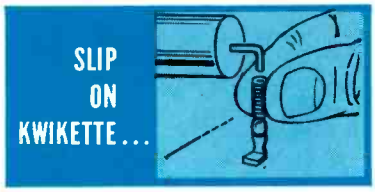
(six times actual size)

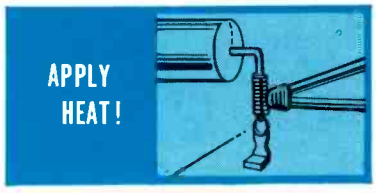
The KWIKETTE SOLDERING AID is not just another wire spring connector! It has a Copperweld wire inner core, an intermediate layer of flux, and an outer jacket of solder . . . *all you need is heat!*

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









FREE TRIAL PACKAGE!

10 free KWIKETTE Soldering Aids are yours for the asking! Simply send your postcard request to KWIKETTE Center, Sprague Products Co., 65 Marshall Street, North Adams, Mass. 01247. Don't forget to include the name of your Sprague Distributor.

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WORLD'S LARGEST MANUFACTURER OF CAPACITORS

65-6107

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LETTERS TO THE EDITOR

Our Face Is Still Red

I would like to call your attention to an error which appeared in your May 1966 issue. In the article "You and Your Oscilloscope," which began on page 62, the term for frequency, Hertz, was incorrectly used to mean "cycle." The term "Hertz" refers to frequency or cycles *per second* rather than to individual cycles of a cyclic waveform. The incorrect use of the term Hertz for cycles is perhaps a carryover from the fact that Americans have the unfortunate tendency to refer incorrectly to the frequency of a cyclic waveform as being X number of "cycles" rather than as being X number of "cycles per second." This error is a small point, perhaps; but since the terms Hz, kHz, MHz, GHz, etc., seem to be trickling down to the everyday levels of the electronics world in America, it would seem to be a good idea to avoid confusing those who are not used to the terminology yet.

JAMES C. GRUBS
Sylvania, Ohio

Likes Business Articles

I have recently received my first copy of your excellent magazine and find your business articles valuable.

CARL REETZ
Quinton, Okla.

Likes Test Instrument Articles

Please put me down for another two-year subscription to your fine magazine . . . I find it extremely interesting and informative. Your articles on the explanation and use of test instruments are excellent. I hope to see many more like them . . . .

J. R. COPPING
Winnipeg, Man., Canada

Hopeful and Helpful

I enjoy reading ELECTRONIC TECHNICIAN and feel that I can learn something from it. I also read Willey Le Coq's fine article on "A Toast To the Designers" in the January 1966 issue. I hope that some of these TV designers read this article and try to change their ways so they can make the technician's job easier. I read the "Letters To the Editor" and if Leo Smith of Sandy, Utah still needs a Solar Capacitor schematic I will lend it if I can get it back.

GEORGE HOBIZAL
Weimar, Tex.

What do you do for an encore after introducing the most exciting solid-state CB line in the business?

Tag it with a 10 year guarantee!

Start with typical Courier pricing. The 23-channel TR-23S at $169. The 12-channel TR-12 at $139. Solid-state. Feature packed.

Then add the biggest guarantee in the business—*10 full years!* The kind of guarantee that sales are built on.

Want more? Courier's sold through limited dealerships. Protected territories. Protected mark-ups. Courier CB is no football.

If you're interested in a CB line with profit, with a sales-clinching manufacturer's guarantee, quality and features, find out about a Courier CB dealership. The coupon brings you all the facts.

eci. **electronics communications inc.**
56 Hamilton Avenue, White Plains, N. Y.

Yes. I'd like to know all about the Courier CB line with the 10-year guarantee—and dealership opportunities.

Name _____

Firm _____

Address _____

City _____ **State** _____ **Zip** _____

. . . for more details circle 110 on postcard

EDITOR'S MEMO

You Can Help Us Help You

If you did not have to work, if you had plenty of money to pay traveling and living expenses — you could roam around the nation visiting other TV-radio shops. You could observe how they run their businesses, how they operate their sales and service departments. In effect, you could pick up a mass of information and helpful ideas that would no doubt make you a better businessman — a more efficient technician. It would cost you a lot of money, however, to accumulate all this information.

Every month now for some months ELECTRONIC TECHNICIAN has been taking you on this tour around the country, visiting other shops, showing you the behind-the-scenes action that takes place in one successful shop after another. We've shown you how they solve some of their problems, how they have upped sales, increased service efficiency, cut callbacks to a minimum and how they are making decent livings. We believe this is one of the best ways we've found yet to give you maximum aid — to serve your interests better. But we're not absolutely certain the articles cover everything you're interested in.

We know it is not always easy for you to find time to write. The daily grind is just too much. But we need you to do just that. Sit down for a moment — relax, think — and dash off a fast letter and let us know if these monthly shop tours are providing you with the maximum amount of helpful information. If not, tell us what else you would like to know about these operations. This may not be too easy for us to produce, but we'll try.

We've visited six shops already (the fifth is reported in this issue) and we'll be taking off shortly to look over another.

In the meantime, sit down right now, write that letter and let us know what you think.

Compare Color Generators

look at the rest... and you'll buy the best, new B&K model 1245

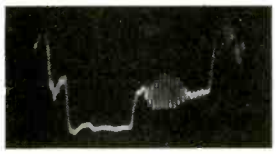
The all solid-state B&K Model 1245 Color Generator duplicates the waveforms transmitted by a color TV station.

Adherence to these waveforms makes it easy to converge the color tube, check sync and make other raster adjustments . . . and the color generator with station quality signal will be able to sync next year's sets. Generators with compromise waveforms do not give you this obsolescence protection.

Here are oscilloscope photographs from the outputs of two typical competitive color generators, one transistorized and one tube type, and the B&K Model 1245. The detailed analysis with each photograph shows a few of the reasons why you'll save time and effort with B&K.

COLOR **CROSSHATCH**

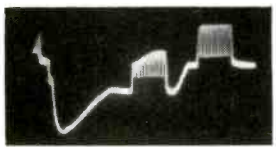
STANDARD STATION SIGNAL



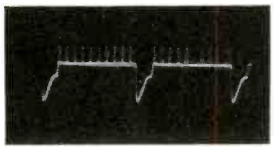
One horizontal sync pulse with its color burst.

Two lines showing horizontal sync pulse with black and white tv signal.

TRANSISTORIZED B&K MODEL 1245

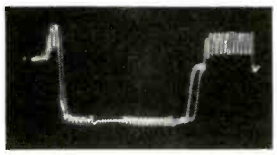


Good duplication of station signal including back porch. If the set won't sync, the set is defective.

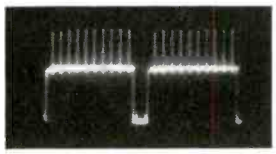


Well defined back porch on horizontal sync pulse permits accurately setting color killer and almost eliminates need to adjust brightness and contrast.

TRANSISTORIZED GENERATOR A



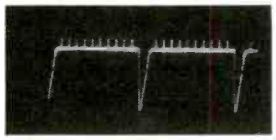
No back porch causes unstable color sync. Burst amplitude compression may permit sync on wrong color bar.



Square wave horizontal sync pulse with no back porch and poor dc coupling forces adjustments of brightness, contrast & fine tuning to obtain usable pattern.

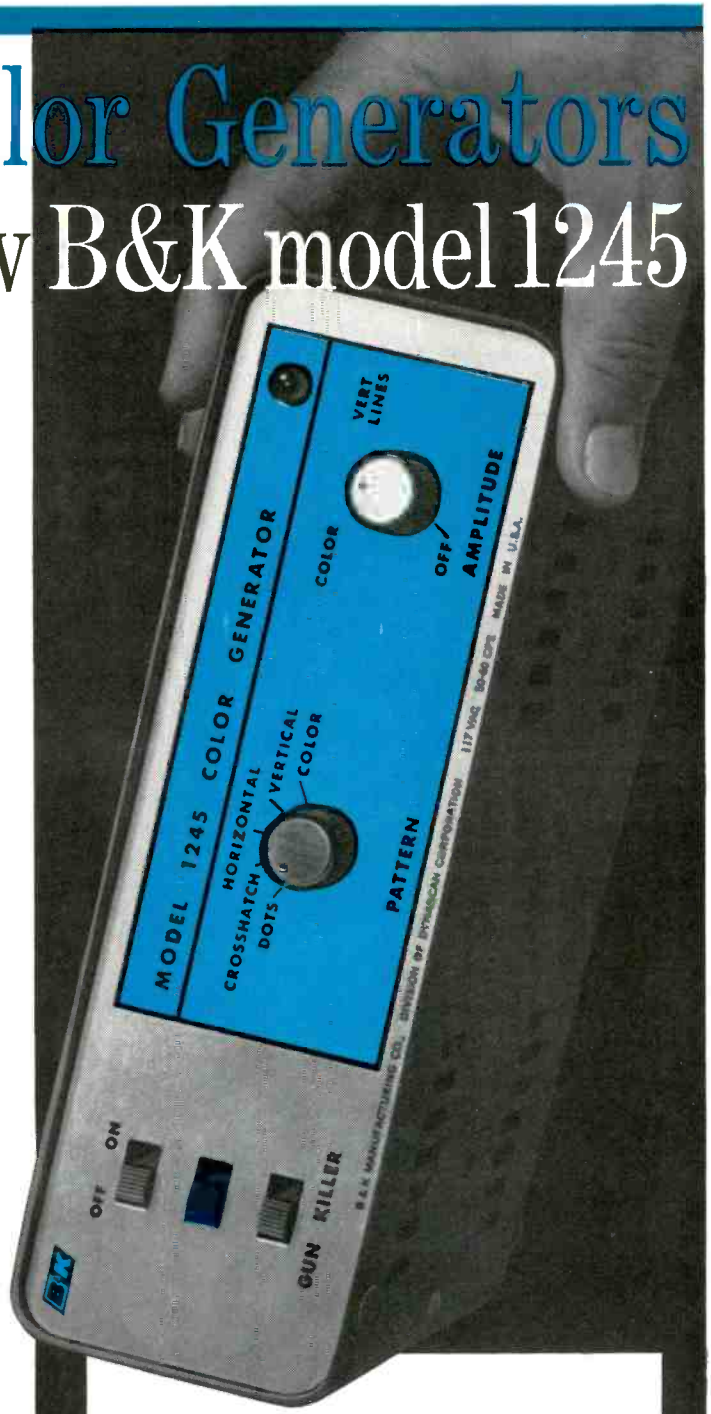
GENERATOR B

No back porch; color information on top of sync-pulse makes sync difficult on some sets.



Complete absence of any back porch necessitates readjustment of brightness, contrast and fine tuning to obtain a usable pattern.

See your B&K Distributor for a demonstration or write for Catalog AP22.



For the first time, with the no-compromise waveforms from the B&K Model 1245, it is possible to accurately set the color killer threshold control with a color generator.

The miniature size and convenience of the Model 1245 match its performance. It provides crystal-controlled keyed rainbow color bar display, and dot, crosshatch, horizontal line and vertical line patterns as well as gun killer controls that will work with any picture tube. Size only 2⅞ x 8½ x 8⅞". Net $134.95.

B & K MANUFACTURING CO.
DIVISION OF **DYNASCAN** CORPORATION
1801 W. BELLE PLAINE AVE. · CHICAGO, ILL. 60613
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Export: Empire Exporters, 123 Grand St., New York 13, U.S.A.

. . . for more details circle 102 on postcard

SYNC ON BUSINESS

A test instrument application contest is being sponsored by Simpson Electric Co. The grand prize winner of the contest will receive a week's trip for two at the famous Tropicana Hotel and Casino in Las Vegas, Nev. Known as the "Tester's Tournament," the contest requires entrants to submit new test applications for the company's 260 VOM. Applications must be different from those shown in the company's recently published "1001 Uses" book. The contest is now under way and will run to November 30, 1966. Besides the grand prize of a week's all-expenses-paid holiday for two, plus $200 spending money, six monthly awards will be made of a "Goof-Proof" 260-5P VOM. All entrants will receive a new 260 diode meter protector. Entries will be judged by a panel of engineer service directors from leading Chicago electronics firms. Contest rules and the "1001 Uses" book ($1 list) may be obtained from electronics distributors or directly from Simpson, 5200 W. Kinzie St., Chicago, Ill. 60644.

• • •

Three electrical motor modification centers have been established across the country by U.S. Electrical Motors. The company claims to provide same-day shipment of stock motors and shipment of non-stock ratings and modified units on fast schedules. The centers are located at Los Angeles, Calif., Chicago, Ill., and Milford, Conn. These centers are in telephone/telegraph contact with all U.S. Electrical Motors field offices and authorized distributors for immediate processing of confirmed orders. Stock motors, geared drives and variable speed drives, covering broad ratings, speeds, voltages and single to three-phase configurations, are shipped direct from inventories at the modification centers if the required motor is not in local inventory at U.S. Motors offices. Typical modifications include: Brakes, special voltages, special insulation, alternate bases, extra-heavy duty bearings, non-stock ratings, single-phase (where 3-phase is standard), special assembly positions, accessory controls and others. Complete information is available. Write to: U.S. Electrical Motors, P.O. Box 2058 Terminal Annex, Los Angeles, Calif. 90054.

• • •

A conversion-factors wall chart converts inches to centimeters, watts to H.P., cu ft to liters, microns to meters, etc. Write on your letterhead for a free copy to Precision Equipment Co., 4401 N. Ravenwood Ave., Chicago 40, Ill.

• • •

A coil replacement guide, catalog No. 166, lists about every TV and radio made. Covers B/W and color TV, home, auto and portable radios, CB and other equipment. Parts are referenced to manufacturers chassis or model numbers. At your jobber or write on your letterhead direct to J. W. Miller Co., 5917 S. Main St., Los Angeles, Cailf. 90003.

• • •

Two-way communications technicians may find the booklet "How To Make A Technical Value Analysis Of Mobile 2-Way Radio" helpful in promoting two-way sales. Copies are available from Motorola Communications and Electronics, 4501 W. Augusta Blvd., Chicago, Ill. The brochure is No. TIC-3134.

Steve Lovitch is too busy to wait a week for any part to arrive.

Steve Lovitch keeps on the go. He gets a lot of business because he is running a Philco Qualified Service Center. And the attention he gets from his Philco Parts Distributor helps to keep things moving.

99 out of 100 times that Steve needs a part, he finds that his Philco Distributor has it right on hand. That hundredth time, Philco's Lifeline Emergency Service swings into action, and Steve's part is on its way to him – by air – in 24 hours or less.

That's not all Steve likes about being teamed up with Philco. He's his own boss, but he still gets all the training, attention and benefits he could want.

Philco Tech Data Service helps him keep posted on how to service new Philco products. Steve knows that he gets the facts faster, fuller and at lower cost through Philco. And Steve's other Philco benefits include a complete accident insurance program for himself and his men and valuable advice on how to make his business more profitable.

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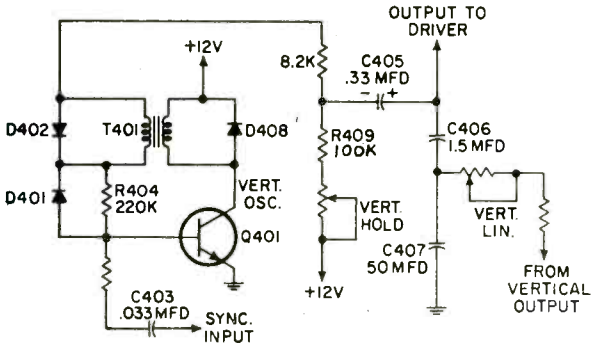
MAGNAVOX

TV Chassis T908 Vertical Sweep Circuits—Circuit Description

A blocking oscillator is used to generate the 60Hz vertical sweep voltage. Forward bias voltage is supplied through the vertical hold control, the 100K and 8.2K resistors, D402 and D401 to the base. When the receiver is turned on Q401 is forward biased and collector current increases. This increasing current flows through the transformer and induces a voltage into the secondary winding, minus at the top and plus at the bottom. The positive voltage is applied through D401 to the base and, since this



is an NPN transistor, further increases the bias so that more collector current flows. This action is very rapid and the transistor almost immediately goes into saturation.

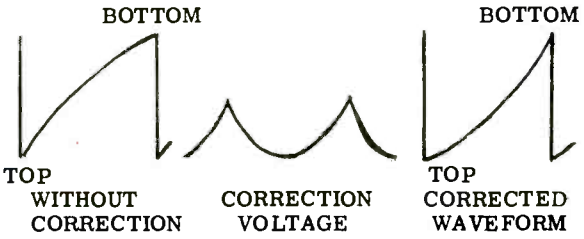
While this is occurring, the negative pulse at the top of the transformer charges C405 minus to plus as shown. As soon as the transistor becomes saturated, collector current ceases to change and the field in the transformer winding collapses. This produces a reversal of polarity across the windings which forward biases D402 and D403. These diodes act as a short circuit and dissipate the energy stored in the transformer.

C405, however, is still charged. The negative voltage on the capacitor reverse biases the transistor through R404 and Q401 remains cut off. The only other discharge path is through the 100K resistor and the vertical hold control. The capacitor then discharges toward the supply voltage and starts to take on a positive charge. When the positive charge becomes great enough to forward bias the transistor, Q401 again goes into saturation and the cycle is repeated.

The oscillating frequency is dependent on the time constant formed by C405, R409 and the hold control. The larger the amount of resistance in series with the capacitor the longer it takes for the capacitor to discharge and take on a positive charge. This represents a lower oscillator frequency. The vertical hold control varies the RC time constant and, therefore, the oscillating frequency.

The oscillator is free-running at a nominal frequency of 60Hz and must be synchronized to the received signal. The positive-going sync pulse formed by the integrating network is coupled to the base of the oscillator through C403. The pulse forward biases the base-emitter junction to start a new cycle. D401 acts as a high impedance to the sync pulse so that the full amplitude of the pulse is applied to the base. The free-running frequency of the oscillator must be slightly lower than the repetition rate of the vertical sync pulses; otherwise, the oscillator cannot be synchronized.

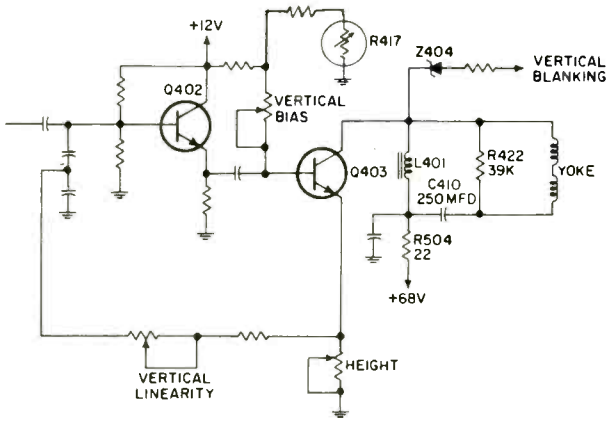
The output waveform from the blocking oscillator is not suitable, as yet, to produce a satisfactory vertical



sweep. Such a waveform would produce severe stretching at the top of the picture and compression at the bottom. C406 and C407 are used to modify the output waveform to produce satisfactory linearity. A sawtooth waveform from the vertical output stage is coupled through the linearity control to C407. This capacitor forms the sawtooth voltage into a parabolic waveform. The linearity adjustment controls the amplitude and the phase of the parabola. The parabolic waveform is then added to the oscillator waveform and changes the slope of the curve as shown.

The rate of vertical scan during the portion of the slope corresponding to the top of the screen is reduced to compensate for stretching. The rate of scan during the portion of the slope associated with the bottom of the scan is increased to correct for compression. This corrected waveform is then coupled to the base of the vertical driver.

The driver stage is connected as an emitter-follower. Its purpose is to present a high impedance to the oscillator signal and a low impedance output to the base of the output stage. This arrangement helps to isolate the output stage from the oscillator. The vertical output stage uses a power type transistor which operates as a class A amplifier. No output transformer is required since the low output impedance of the transistor permits connecting the yoke directly to the collector. C410 is a dc blocking capacitor which allows only ac voltages to produce yoke current. L401 is a relatively high impedance compared to the yoke induc-



tance. During retrace time, a large positive pulse is developed by L401 which reverses the current through the yoke and moves the beam from the bottom of the screen to the top.

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TECHNICAL DIGEST

The picture height is controlled by a potentiometer in the emitter. The more resistance in series with the emitter the greater the amount of degeneration which takes place and the smaller the vertical size of the raster. The sawtooth voltage drop across the height control is the signal applied to the waveshaping capacitors discussed earlier.

For good linearity and output power, it is important that Q403 be biased correctly. Beta characteristics can vary from one transistor to another. So that each individual transistor may operate correctly, a vertical bias control is used. This adjustment is made by placing a milliammeter across R504 and setting the bias control for 120ma collector current.

R417 is a thermistor which is used to compensate for temperature changes within the output transistor. As collector current increases, the temperature of the transistor also increases which allows more collector current to flow and so on. This is referred to as thermal run-away and can destroy the transistor. The emitter resistance, however, prevents run-away from occurring. In addition, R417 compensates for small changes in collector current by sensing temperature changes. The ground end of the thermistor is soldered to the chassis close to the transistor. Since the chassis acts as a heat sink for this stage, changes in chassis temperature are conducted to the thermistor through its ground lead. The resistance of the thermistor becomes less which lowers the forward bias applied to the base of the output stage, thereby, stabilizing collector current.

Vertical blanking for the picture tube is provided by coupling a portion of the positive retrace pulse through Z404 and R419 to the emitter of the video output stage. The zener diode is cut off until the positive pulse on its cathode reaches approximately 100v. At that point, the zener conducts and couples the pulse to the video output stage.

The retrace pulse tends to shock the deflection yoke into oscillation which would produce horizontal ringing bars across the screen. To prevent these ringing bars from developing, R422 is connected directly across the vertical yoke windings. The resistor reduces the "Q" of the deflection coils just enough so that the ringing voltage is damped out.

RCA VICTOR

TV Chassis KCS153—Sync Separator and Noise Cancellation—Circuit Description

This circuit provides noise free sync pulses of large amplitude to synchronize the vertical oscillator and horizontal oscillator. The sync separator will operate (separation of sync from composite video) on incoming signals with a minimum sync level of 18 percent. Most transmissions have at least 20 to 25 percent sync.

Sync pulses are produced with sufficiently short duration to respond to equalizing pulses following vertical sync pulses.

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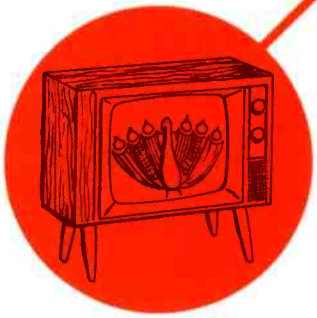

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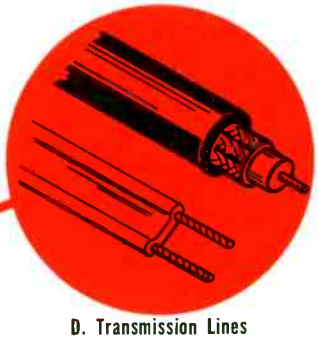

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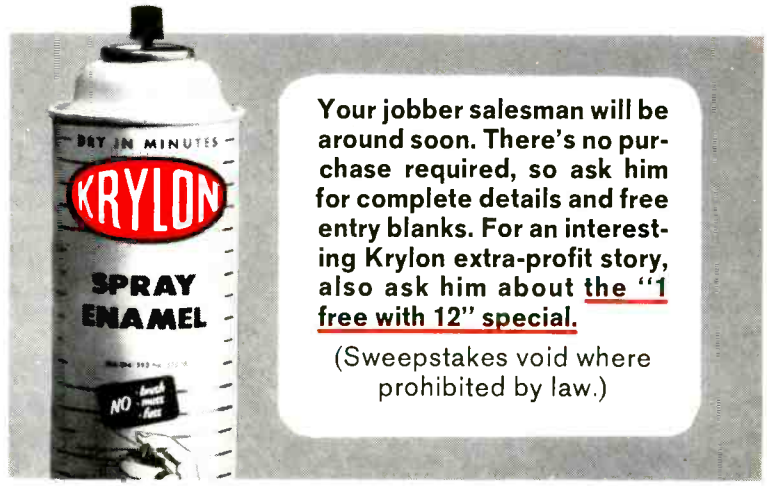

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ELECTRONIC TECHNICIAN

JULY 1966

What You'll Need For Color Servicing

Get out of the rut and keep up with the 'peacock parade'

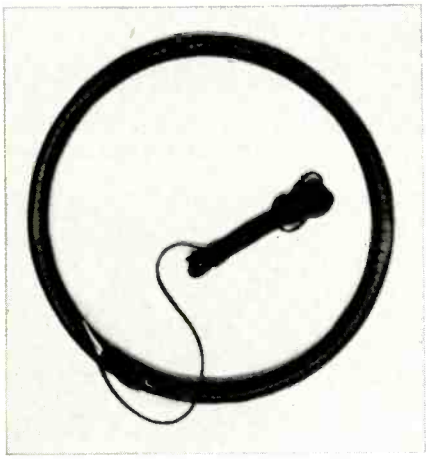


Fig. 1—Typical degaussing coil.

■ Color TV has offered new opportunities to service-dealers and technicians. But, despite the urgings of far-seeing people in the industry, many technicians are still cool to these opportunities and make little or no effort to upgrade their knowledge of color TV and avail themselves of the instruments required to properly adjust, troubleshoot and repair color TV equipment.

A "once-over" view of our industry will quickly show that a shortage of capable color TV technicians now exists. And this shortage naturally creates more work and more opportunity for those who have had the intelligence to be prepared and those who now prepare for color service and sales.

You need a fully instrumented shop today if you expect to take advantage of these opportunities. And you have to devote a few minutes every day to studying—to keep up with fast-moving technological developments. What do you know about color CRTs and their basic characteristics and adjustments, for example?

Color CRTs and Basic Adjustments

You already know that a color CRT is actually three picture tubes in one. Each of these three color CRTs responds, in effect, to one of three different color signals received from the color telecasting station. Proper test instruments are absolutely necessary if you are to *consistently* coordinate the action of each of the three sections of a color CRT—test instruments which you do not need to service B/W TVs.

Mass production methods eliminate the possibility of making color CRTs sufficiently uniform so the three electron beams land in exactly the correct spot in every tube. Hence, external adjustments are necessary to obtain color purity and properly converge the beams.

Color Servicing...

In earlier color CRTs, the red phosphor material was the least sensitive of the three phosphors. Because of this, we base purity adjustments on a red raster. We attempt to make the red raster "pure" red as possible. This is logical because the red beam current is greater than either the green or blue beams—for a given light intensity.

If any of the red beam current should hit a green or blue phosphor dot, it would be more readily apparent on the red raster. The purity error can then be corrected more easily. Although an improved red phosphor is now used in modern color CRTs, tradition dictates that the red screen be used for purity adjustments.

The three gun color CRT is very sensitive to variations in magnetic fields—especially the earth's magnetic field. If a color set is moved from one location to another, the CRT and other parts of the receiver may become magnetized. An instrument that's not required in B/W servicing must then be used—a degaussing coil to demagnetize the affected portions of the set (Fig. 1). The set must be thoroughly demagnetized before beginning purity or convergence adjustments. Many new sets have automatic degaussing provisions but it is still good practice to manually degauss a set before proceeding to make purity and convergence adjustments.

Another helpful accessory is a "gun killer" arrangement which makes it easy for you to disable any of the three guns—especially the blue and green guns—for purity adjustments. A gun killer may be obtained as a separate item, although most color generators have the gun-killing provision built-in.

What does "convergence" mean? As we know, a complete picture is produced by each of the three electron guns. The output of the three guns is combined to produce one composite picture. It is important then, for each beam—red, blue and green—to hit its corresponding color dot on the CRT face. If the red beam, for example, lands on a portion of a blue dot, color fringing will result. With a properly converged picture each beam hits its own color dot and a normal picture results.

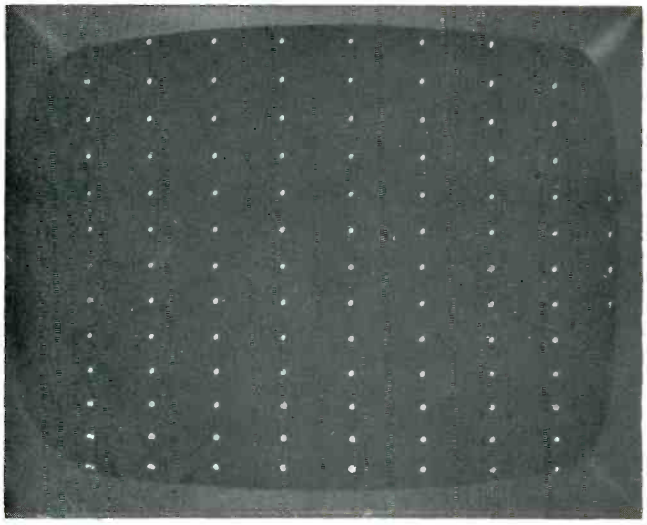


Fig. 2—Dot pattern for static convergence.

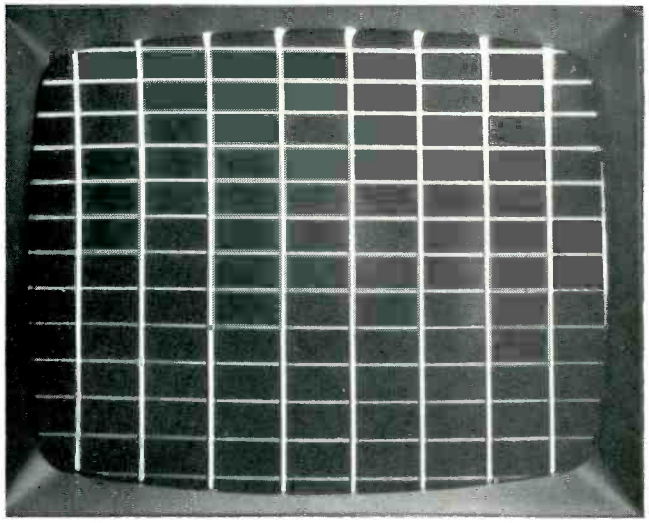


Fig. 3—Crosshatch pattern employed in dynamic convergence.

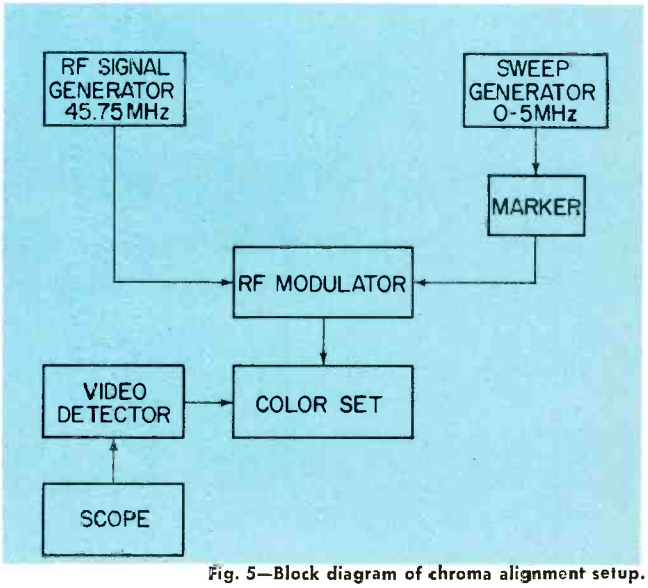
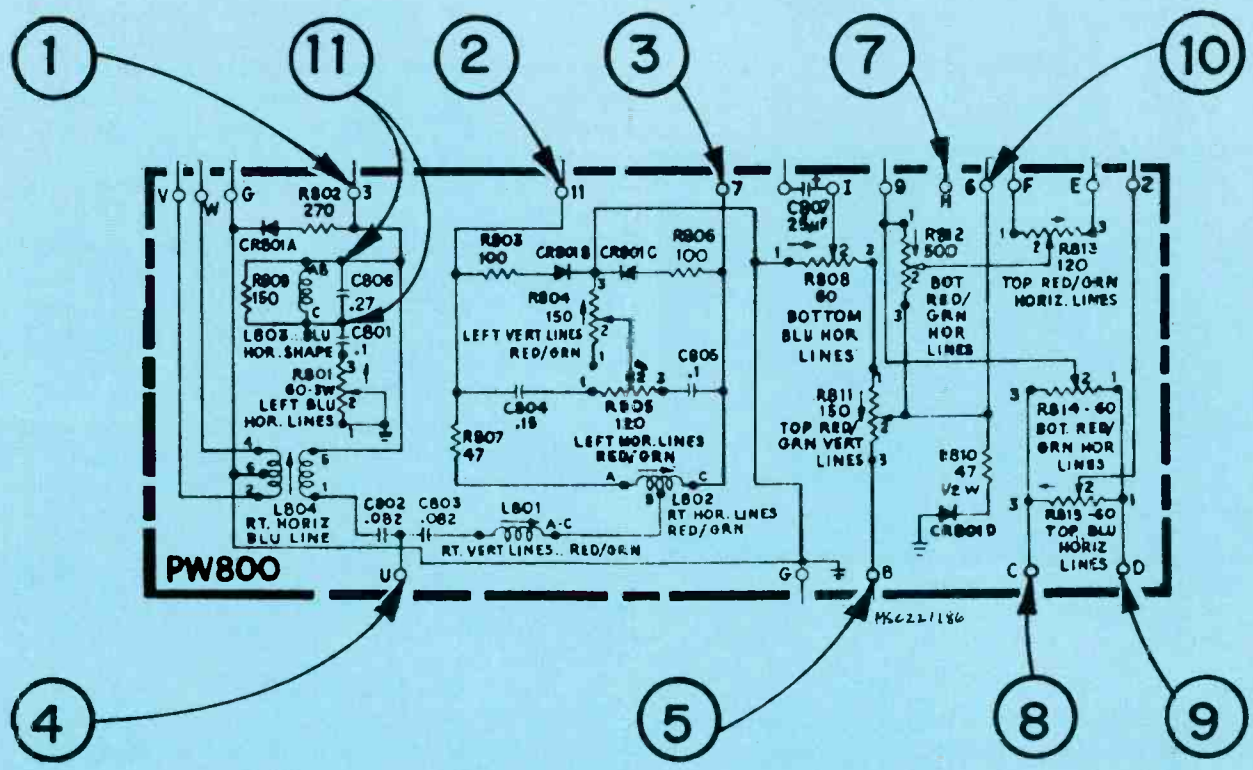
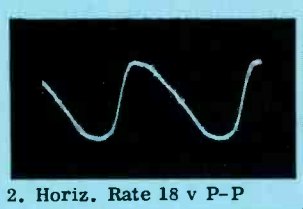


Fig. 5—Block diagram of chroma alignment setup.

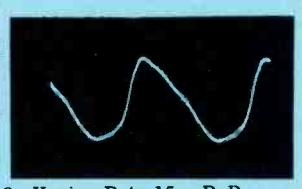
Fig. 4—Typical convergence board waveforms



1. Horiz. Rate 45 v P-P (10v/CM) Term "3" (White/ Blue lead) Blue Horizontal. Voltage Waveform

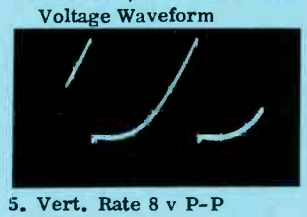


2. Horiz. Rate 18 v P-P (5v/CM) Term "11" (White/ Red lead) Red Horizontal, Voltage Waveform

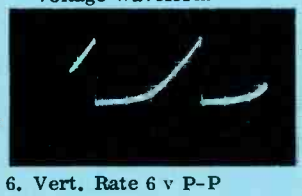


3. Horiz. Rate 15 v P-P (5 v/CM) Term "7" (White/ Green lead) Green Horiz. Voltage Waveform

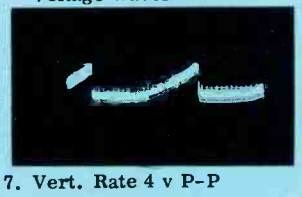
4. Horiz. Rate 235 v P-P (100 v/CM) Term "U" (Red lead) Horiz. Input Voltage Waveform



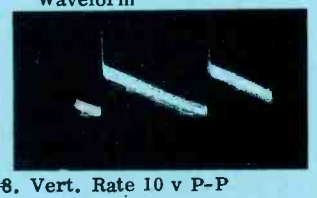
5. Vert. Rate 8 v P-P Term "B" (Yellow lead) Vertical Input Voltage Waveform



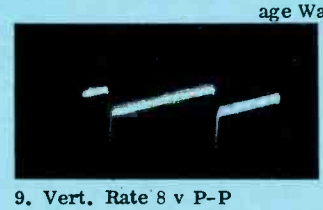
6. Vert. Rate 6 v P-P Term "6" (Green/White lead) Green Vertical Voltage Waveform



7. Vert. Rate 4 v P-P Term "H" (3 leads Green, White, Red/White) Red Vertical Voltage Waveform

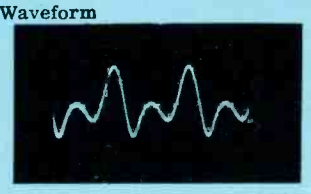


8. Vert. Rate 10 v P-P Term "C" (Gray lead) Positive Vertical Tilt



9. Vert. Rate 8 v P-P Term "D" (Brown lead) Negative Vertical Tilt

10. Vert. Rate 10 v P-P Term "F" (Green/Yellow lead) Green Vertical Voltage Waveform



11. Across L803 Horiz. Rate (5v/CM) Term "A""B" & "C" 15 v P-P Blue Horiz. Shape Coil

Color Servicing...

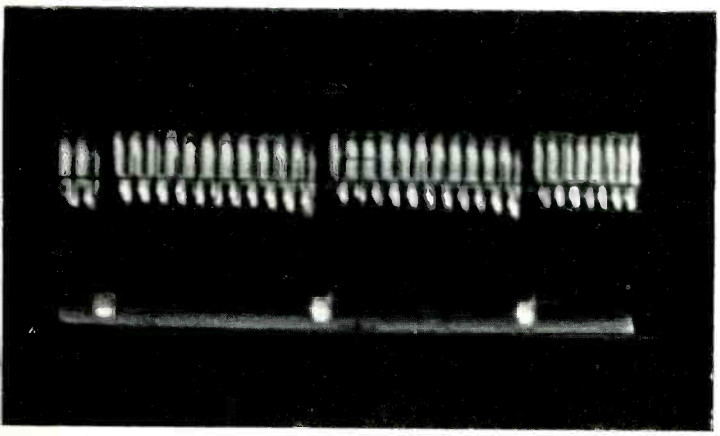


Fig. 6—Chroma signal at first video amplifier.

Here again, instruments unfamiliar to the B/W technician, are necessary. A color dot and crosshatch generator is needed to facilitate convergence of the three beams. A dot pattern (Fig. 2) is used to converge the beams at the *center* of the screen; the crosshatch pattern (Fig. 3) aids in converging the *edges* of the screen. Many generators have provisions for producing separate vertical and horizontal lines. Some technicians prefer to use the separate lines and others favor the crosshatch pattern.

Most color generators made today will furnish dot, crosshatch and line patterns in addition to a color bar pattern. The color portion of generators will be discussed more fully later.

If a set cannot be properly converged, then we should suspect trouble in the convergence circuits. Here we bring in another indispensable test instrument, valuable for both color and B/W—the wideband scope. Normal waveforms for a typical convergence board are shown in Fig. 4. The voltage configurations shaped by this circuitry are fed to the convergence yoke which in turn affects electron beam landing. The controls necessary to insure correct edge, or dynamic convergence, are located on the convergence board.

Convergence procedures vary for different color chassis and the best source of information is manufacturers' service manuals.

Chroma Alignment

Another application of a wideband scope is in chroma section alignments. This applies to both bandpass and color phase stages. For bandpass alignment you also need a sweep generator, unmodulated signal generator, marker generator, VTVM and RF modulator. The block diagram shown in Fig. 5 illustrates a typical setup for making bandpass alignments.

An alignment system called video-sweep-modulation, a term unfamiliar to some technicians, is employed to check the overall receiver response to color frequencies. Here an unmodulated RF signal at 45.75MHz is modulated by the output of a sweep generator. The sweep generator is set to sweep the range from 0 to 5MHz. This results in one sideband sweeping from 40.75 to 45.75MHz—the video IF range. This signal passes through the video system and is detected at the bandpass amplifier output and the response curve is viewed on the scope.

As previously stated, the generator used should be able to sweep from 0 to 5MHz. An RF modulator (RCA WG304A or equivalent) and video absorption marker (RCA WG295C) are items not normally used for B/W alignment.

Another color-only adjustment is the AFPC (automatic frequency and phase control) circuit alignment. This circuit is very similiar to the horizontal AFC circuitry of B/W sets and requires special alignment treatment. Test instruments required here include a color bar generator, a scope and VTVM.

A number of color bar generator types have been designed and made available over the years, but with the passage of time, the keyed rainbow generator has become the industry standard.

The keyed rainbow generator operates on a gated offset carrier principle. It generates a frequency which is 15.75kHz lower than the reference subcarrier frequency. This appears as a 360 deg phase shift to the color set's demodulators, and with a keying pulse fed every 30 deg, a series of ten color bars appear on the screen—covering the color spectrum. Twelve bars are actually generated but only ten finally appear on the CRT screen. One bar is removed for the horizontal sync pulse and the other bar, following immediately after the horizontal sync pulse, serves as the color sync burst. This bar signal is usually available as a composite video signal or is used to modulate an RF carrier which can be fed directly into the antenna terminals of a color receiver. The output signal of a keyed rainbow generator, as it appears at the video amplifier grid, is shown in Fig. 6.

The color generator used in conjunction with the scope is also an indispensable instrument for isolating troubles in malfunctioning color TVs.

An important VTVM accessory for color servicing is a high voltage probe. Consisting mainly of a multiplier resistor, this probe is used to adjust the high voltage to the recommended value. To insure proper high voltage and maximum life of the horizontal output tube, manufacturers' instructions for horizontal deflection alignment should be followed explicitly.

And finally, one other indispensable instrument which can be used for both B/W and color servicing, is a flying spot scanner. A unit of this type acts as a miniature TV station, enabling technicians to work with a signal of constant shape and amplitude.

Troubleshooting is established and you are able to recognize abnormal waveforms, the time you spend isolating color problems can be held to a minimum when these instruments and accessories are used. ■

Growing in a Competitive Market

Effective control over this operation has helped improve the profit picture year after year

■ How does a small-to-medium service-dealer survive and grow in one of the nation's most competitive TV-radio markets?

By making sales and service a personal business, then establishing effective control over the service operation to guarantee its efficiency and profitability, says Dick Weber.

For the past several years, Weber's has shown an 18 to 20 percent increase in net profit each year over the previous one. In 1952, when Dick Weber bought the business from his father, Weber's was averaging about $2,500 a month with a 2-man operation. Today, the business averages $25,000-plus per month, a 900 percent increase.

Service is 30 percent of the total, Mr. Weber notes, and is the bedrock on which sales rest.

"Seeing the big population explosion, we moved in the direction of a chain operation," Dick continues. "We opened a second store in West Covina, but closed it out in 1955. We decided our business should be a personal one. We now operate one store in South Pasadena, concentrating on service within a 5-mile radius. We seldom take a service call outside that radius unless it's a devoted customer of long standing."

One Brand Dealer

Dick decided that additional concentration was necessary to compete more effectively. Consequently, seven years ago he went exclusive on one brand of TV, selecting a top brand after careful consideration of possibilities.

"That's the best single business decision I ever made," he declares. "First, we got to know the product thoroughly and became experts on it in our territory. Then, according to our agreement, the distributor won't place the line with others in our territory as long as we do the sales job for them.

Business—Under Control

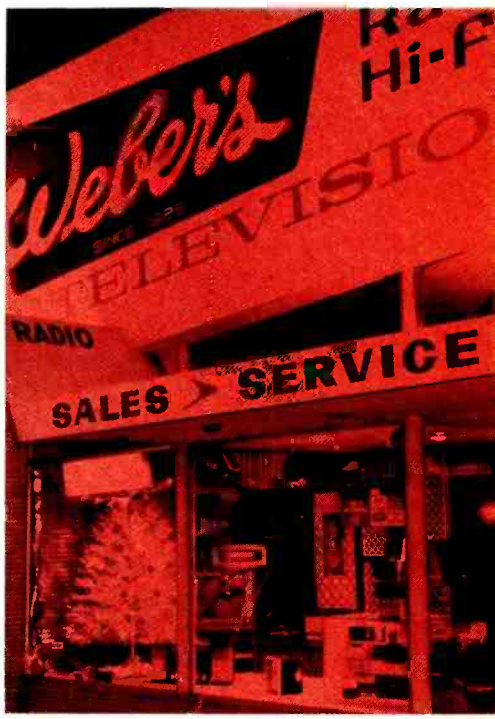
To establish effective control over the service operation, Mr. Weber installed a unique control system. A single bookkeeping form follows through the whole service procedure from the customer's telephone call for service to completion of the transaction, including billing charges.

The four-part form, designed by Mr. Weber, is a shop work order, a customer's claim check, a repair tag to go on the set, a customer invoice or receipt, a statement and office file copy — all rolled into one. A register book, keyed by code to a number at the top right corner of the four-part form and a unique visual work-in-progress file supplement the form to establish a total system.

The merits of the system cut down on non-productive writing and paper work and give *complete,* fingertip control over the service operation, Mr. Weber emphasizes. Good control, he believes, is a major factor in obtaining an 18 to 20 percent net profit figure over each previous year.

Provides Total Information

The comprehensive service form



Small store, big business in sales and service, topping $25,000 monthly.

Dick, left, and his father, Harry Weber (now retired) look at the record. Dick has increased sales of sets and service by 900 percent in the 14 years he has owned the business.

Competitive Market...

provides total information required for a complete service job.

At top left, the form provides spaces for customer information — name, address, city, home and business telephones and date service was requested. Below are boxes for checking the item to be serviced, opposite which are spaces to identify the equipment by make, color, model number, etc. At top right, taking up the space at the top of the form, are boxes to indicate terms (cash, COD, etc.) and service information (item to be picked up, estimate quoted, etc.)

The rest of the form is divided into two parts. The left side carries the information on parts replaced, accessories purchased and prices. The right side provides spaces for warranty and delivery instructions, service charges, and the guarantee statement. A box at lower right summarizes all charges— total charges for parts, accessories, sales tax, service, service call — and the grand total.

Spaces are provided, also, for signature of the person authorizing the service and for the signature of the shop technician performing the service.

The original (white) of the quadruplicate form is the cash register copy or the customer's month-end statement. The second copy (blue) is the office copy and is filed numerically, 500 to the book, after the transaction has been completed. The third copy (yellow) is the customer's receipt (if paid) or the first invoice (if charged to his account), given on delivery of the serviced equipment. The fourth copy (hardback) is the shop work card.

A perforated extension of this hardback is again perforated, down the middle, so it can be torn into two parts to provide the customer's claim check and the repair tag for attaching to the equipment.

When the four-part form is written up, the customer's name is entered in the register book. Columns are provided in the register to show the invoice number, customer's name, date the equipment came into the shop and the date the equipment is to be picked up or delivered.

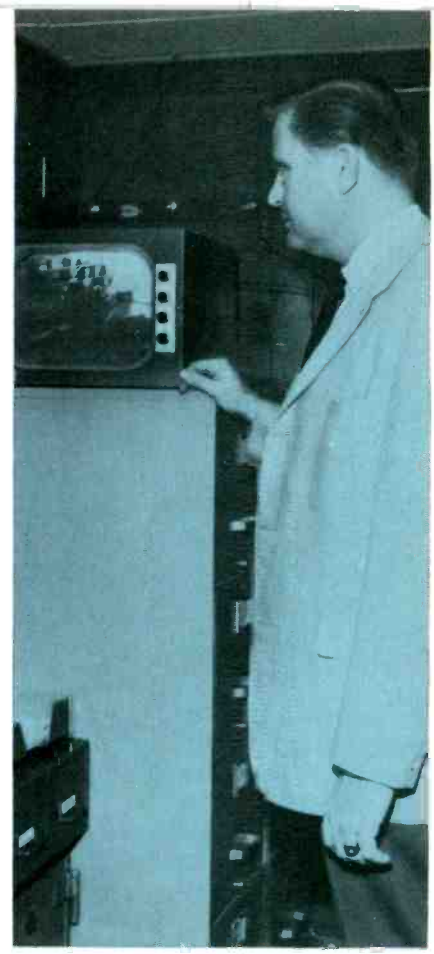
To identify equipment on warranty or contract, a pink mimeographed "No charge work order" is used. It is attached to the face of the four-part form to signal that no charge is to be made for the service and it has a space for writing in the number of the four-part form to provide complete identification. Entering the cost information on the four-part form provides the necessary cost records on warranty and contract maintenance service.

"We worked out the comprehensive, all-in-one form when we noticed that basic information: the customer's name and identification, account terms and other information was being written and re-written four or five times," Mr. Weber explains. "Not only was this nonproductive work, but additional pieces of paper, separately compiled, included only part of the total transactions. If some piece of paper was misplaced or lost, records were incomplete."

The visual work-in-progress file is located above the service department desk. It is constructed of wood and has 65 pockets set in five vertical rows of 13 pockets per row.

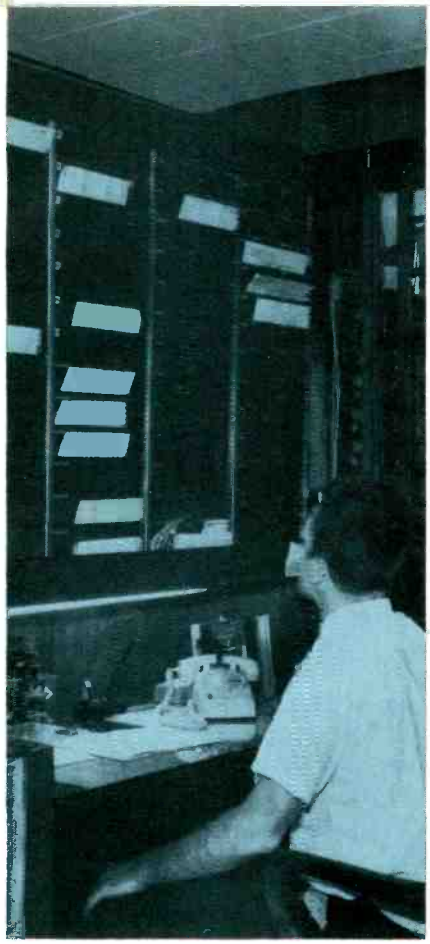
Service forms are held in the visual file except when they are taken out to complete some stage of the service operation, after which they are returned immediately to the proper place in the file. No hunting around through file baskets, spindles or on desk tops is required. Records are in plain sight and are quickly located.

Pockets on the right of the visual file are used for service calls. These



Dick Weber today. He's viewing his sales floor on closed-circuit TV. He doesn't sell CCTV but has a good sideline business in background music—supplying equipment and leased music to 55 accounts.

Service technician, Ralph Trujillo, makes a minor adjustment at the service counter. Minor adjustments and repairs, made on the spot and without labor charge, are a big source of good will for Weber's.



Service technician, Jim Elmore, views Weber's open-display work-in-progress file that guides the work flow from the customer's first telephone call to final delivery of the set.

pockets are keyed to the day of the week — Monday through Saturday. Two pockets are assigned for each day, one for morning service calls, the other for afternoon calls. Each pocket is clearly identified "Monday a.m.," "Monday p.m.," etc., on a red metallic-tape background.

Center pockets hold service delivery orders. They are similarly identified according to the day of the week, for morning and afternoon delivery, but the identification is printed on a green background.

Color coding thus reinforces location in the visual file (right side of the board and red background for service calls, center of the board and green background for deliveries) to differentiate between service calls and deliveries. A glance at the board clearly shows service activity for every day of the week.

Pockets at the left side of the board are numbered for the day of the month (1 through 31) and are used to accumulate the various parts of the form until the transaction is completed and can be billed. The forms are filed in this section according to the day the set came into the shop.

The two bottom compartments on the left side are used to show when a set needs a part before the shop can complete the job. The service technician working on the set drops his shop copy (the hardback copy of the four-part form) into one of these pockets when he discovers his need, thus indicating that the part is to be immediately ordered from the supply source.

How The System Works

When a customer phones for service, the person taking the call writes the customer's name, address, telephone number, etc., at the top of the four-part form and checks the service information — time the call was promised and other pertinent details — in the appropriate boxes.

The four-part form then goes into one of the red-labeled pockets at the far right on the visual file, according to the day of the week the service call is to be made — if a.m., in the top compartment for that day, if p.m., in the one directly beneath it.

The service technician making the call takes the form with him. After repairing the set, he fills in the necessary columns.

If the set is to come into the shop for overhaul, he tears off the perforated section of the hardback, gives the customer the claim check and attaches the repair tag to the set. When he returns to the shop, he tears off the hardback, which then becomes the shop work card and he files the other three copies in one of the left pockets of the visual file, according to the day of the month he picked up the set.

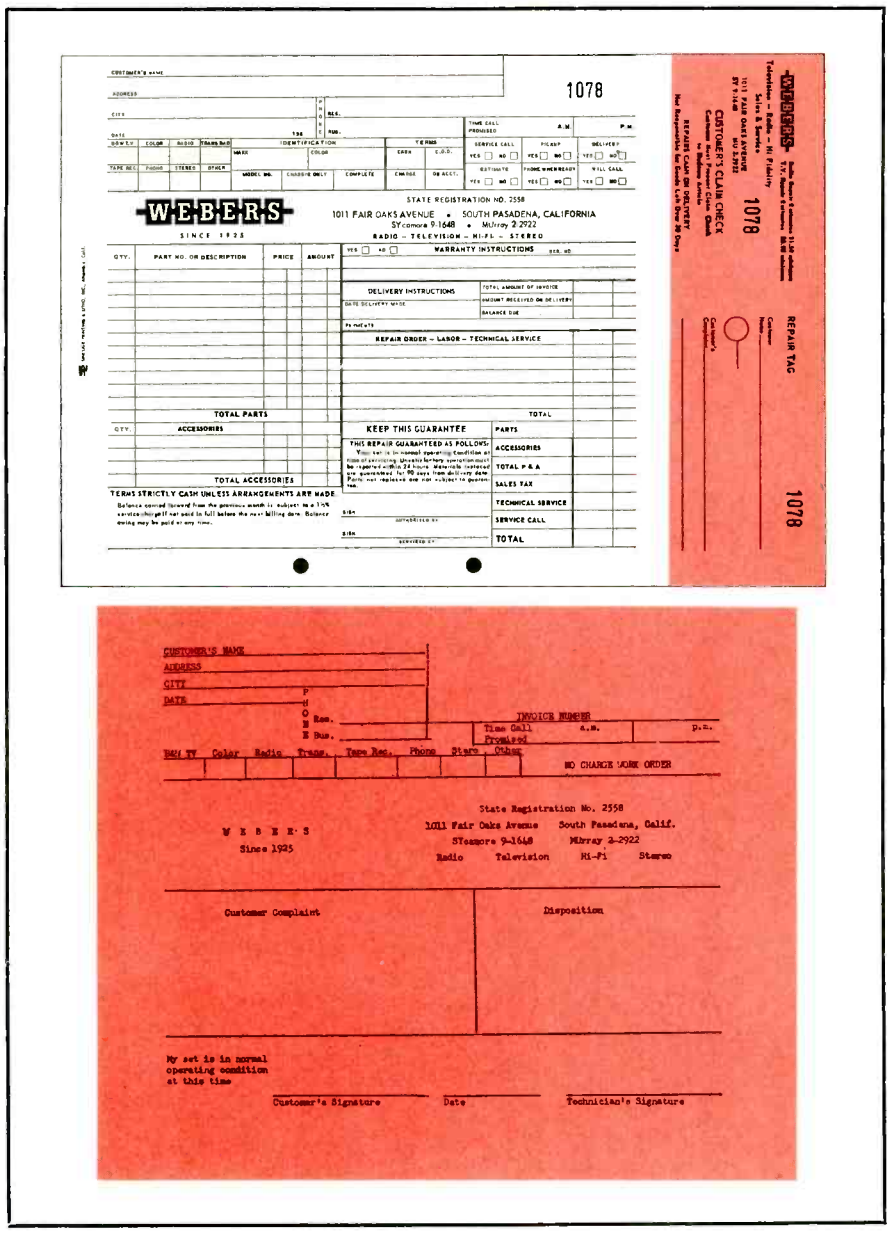
When the estimate is ready, the customer is phoned. When the estimate is approved, "OK to repair" is stamped on the face of the form.

When the set goes into the shop, it is entered in the register book, which has spaces for 100 names per page. Each space carries a number, for example, 1001 through 1100, 1101 through 1200, etc. The name of the customer is entered beside the number that corresponds to the number on the four-part form, plus the date the set came into the shop.

After the set has passed through the shop — then parts replaced, labor charges and other pertinent information, are entered on the other three copies of the form and all the forms go into one of the green-labeled pockets, either a.m. or p.m., signalling the day of delivery. At the same time, an entry is made in the register book to show the date of pickup or delivery.

The technician who makes the de-

Competitive Market...



livery gives the yellow part of the four-part form to the customer as his receipt, if paid, or as his invoice, if charged. The remaining parts of the form are turned over to the office for follow-through on bookkeeping procedures.

This visual filing system, together with the register book, affords a complete guide to service work flow, Mr. Weber says. When a customer comes in or calls in about a set being serviced, a quick look at the board will tell what stage it is in, and if not, the register is checked by ascertaining the customer's claim check number, and everything is accounted for.

This comprehensive form streamlines office procedures and provides all essential service and bookkeeping forms. No office time is required for making up and mailing out invoices. The customer gets his invoice when the set is delivered and at the first of the month the white copy of the four-part form is inserted in a window envelope and mailed to him.

"This complete control system sounds more complex to describe than it is in actual practice," Mr. Weber smiles. "It gave me a lot of headaches to set up, but once it went into effect we found we'd eliminated our headaches in control of the service department operation."

Service Charges

Mr. Weber has three regular service men and adds a fourth man during the busy season, the latter generally being a trainee, or apprentice, who works around the shop on small jobs and helps with antennas. The minimum service charge on TV is $6.95 for black and white, $8.95 for color. Minimum shop rate for TV is $22.50.

Except for service advertising in the yellow pages of the telephone book, Weber's no longer uses any form of advertising. Discount prices, Mr. Weber says, seem to be the only thing that get any newspaper attention in his hotly competitive area and he doesn't intend to take that road.

"One thing we've found important in building a personal identity — we give a lot of free telephone advice. In this respect, being a service technician is something like being a doctor. People want to be reassured. Very few people understand any more about television than they do about their own bodies. When something goes wrong, they need expert consultation.

"Telephone consultation keeps our customers from running down here and us from running out on a service call every time a little something goes wrong.

"Another way we build the strong service identity is not to write out a job ticket every time a radio is brought in. We average about fifteen customers each day who bring in a radio that's not working. In more than twenty percent of the cases, all the set needs is batteries, a new tube, or some small adjustment. We fix it right in front of the customer at no charge for labor.

"A little free radio repair and service advice brings in the big repair jobs and sales. We've had customers so impressed with this that they've come back and bought a color TV from us. If you take care of their little problems, chances are they'll purchase their major home-entertainment items from you." ■

The ABCs of Automatic Record Changers

Understand the basics of a few mechanical operations and you can make good money adjusting and repairing this equipment

■ Approximately 45,000,000 automatic record players are now operating in this country. And more than five million were made in 1965.

This equipment offers considerable repair business to TV-radio technicians who take the small amount of time necessary to learn how to do the work efficiently and profitably.

Every automatic record player is built around the turntable. But the turntable is only one of several critical parts of a changer. From the mechanical viewpoint, the motor, motor drive shaft and linkage—which connects the turntable to the motor—is important, too.

Many of the mechanical parts listed in service data on changers are known by more than one name. The leveling arm, for example, is also a stabilizer. A rejector is also called a push-off finger. A center post is likewise a spindle. The trip link may be called a trip lever. Regardless of the name given for a component, its function remains the same.

Motors

The record player motor is obviously an important item. This is true because its accuracy, in respect to speed, will be reflected in the music reproduction. It is important that the speed be kept correct and constant —regardless of the record load or variations in line voltage.

The motor is the heart of the record player. The turntable relies on the motor to give a continuously smooth supply of power to the linkage.

It is not always easy to determine why a motor is not operating at the proper speed. Before the incorrect turntable speed can be blamed on the motor, however, the turntable and linkage assembly must first be checked carefully. Either one of these components can produce the same effect.

The motor rarely needs replacement. Usually friction or drag in the motor (resulting in slow speed) can be caused by dirty bearings or misalignment of the armature. In some cases, a lack of lubrication on the bearings can also be the cause.

If the bearings are dirty—have rust pits or they are gummed up because of the wrong kind of lubricant —the bearing plates can be removed and placed in a container of cleaning fluid to soak. They are then wiped, reassembled and lubricated.

In reassembling bearing plates, care must be taken to align the bearings so the armature will turn or float freely and noiselessly several revolutions after the motor power is switched off. Loosen or tighten the screws as required (Fig. 1).

Bearings can be cleaned in many cases without the necessity of removing the motor from its mounts (Fig. 2). Cleaners used for TV turners, when applied sparingly, are very effective. Care must be taken not to splatter the cleaner on the idler pulley or associated components. After cleaning, a drop or two of new lubricant should be added to the bearings.

The Drive Assembly

The purpose of the drive assembly is to couple the rotary power of the motor to the turntable. Four main drive assembly systems are generally employed: (1) Three separate direct-step drive wheels; (2) belted drive wheels; (3) a variable diameter drive wheel and (4) the stepped-diameter motor shaft drive. Regardless of the type of drive the method used for proper servicing is basically the same.

Technicians should be more concerned with the stepped-diameter shaft drive system because of its wide use by most manufacturers who make automatic record changers.

It is probably the drive assembly—the linkage system that connects the motor to the turntable—that gives more trouble than any other component or group of components in a record changer.

The stepped-diameter motor shaft drive appears to be the most trouble free of the four systems used, however. The rubber rim intermediate (linkage) between the motor and the turntable makes a simple and direct drive. The various speeds are created by moving the speed control lever to the position desired—corresponding to the proper record speed. In turn, the speed selection lever moves the idler pulley (linkage) up or down on the motor shaft.

ABC Record Changers...

This type of system must always be accompanied by a dis-engagement spring or a neutral setting so the rubber tire will not become compressed or indented by pressing against the motor shaft or turntable when the changer is not being used.

The motor shaft drive will need only minor attention. The motor shaft, as well as the rubber rim of the idler pulley, should be cleaned with alcohol. Do not use carbon tetrachloride as a cleaner or the rubber may become swollen. In fact, besides the dangerous fumes it gives off, carbon tetrachloride leaves a film on parts and is not recommended as a cleaner for precision parts. Petroleum derivitives, alcohol or specially developed synthetic chemical cleaners are better.

Regardless of the system used, clean each movable part of the linkage assembly and oil lightly.

Trip Mechanism

The trip mechanism is the brain of the automatic record player. If the trip mechanism becomes defective, the automatic operation of the changer is completely disrupted. It indicates when the record being played is finished and then connects the change cycle for the next operation.

Three basic trip mechanisms are in general use: (1) The mechanical trip; (2) the mechanical velocity trip and (3) the electrical velocity trip. The two velocity trips depend on the quick movement of the tone arm as the stylus enters the eccentric lead-out groove at the end of a recording. The mechanical trip is actuated by the slow inward movement of the tone arm. All trips can be adjusted slightly by bending the tabs on the ends of the levers or by screw adjustment.

Several variations exist in the trip mechanisms as well as the method of adjustments. The main difference will be in the adjustments. Careful attention must be given to adjusting this mechanism because of the possibility of creating other problems.

When a trip mechanism problem arises, manual operation is preferred to prevent additional damage that may develop if the changer is allowed to operate under power. If the turntable is rotated by hand, this operation can be observed in slow-motion and can be easily adjusted.

The trip link functions in conjunction with the tone arm. For this reason, the trip link must be as light and sensitive as possible. Because of this sensitivity, the trip lever is probably the most troublesome next to the linkage assembly.

While the pickup arm is riding the modulated record groove—slowly moving toward the center post (lead-out grooves)—the trip lever moves with it. As the arm enters the lead-out grooves, the trip link engages the pawl, which in turn actuates the cam gear to engage the turntable hub and change the cycle.

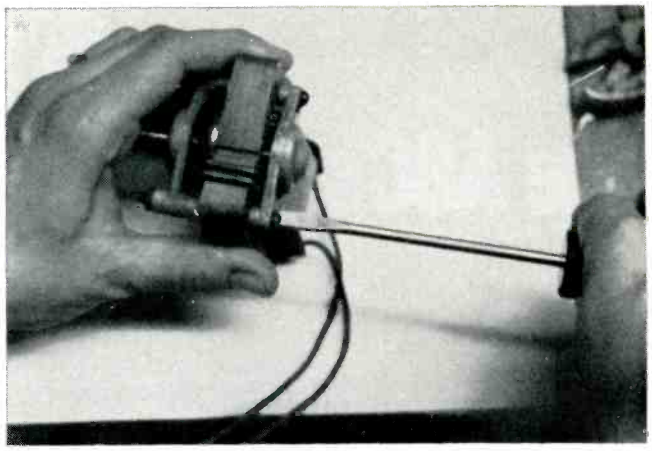


Fig. 1—The screws holding the bearing plates can be adjusted for correct alignment.

If the trip lever works at maximum efficiency, little or no friction can exist at its pivot point. This component must never be lubricated and if found lubricated, it should be cleaned. Experience shows that this mechanism will operate trouble-free over long periods of time if it is polished with a fine grade of steel wool and re-installed free of lubrication.

In many cases where the tone arm is sticking or repeating in the record groove, the cause was found to be a defective stylus. In other cases, it was caused by insufficient stylus pressure. But this fault can also be caused by too much friction in the trip mechanism.

Some technicians have increased stylus pressure in an effort to overcome trip mechanism friction. This has proven disastrous in some cases. Increasing stylus pressure can cause either or both excessive stylus wear and damage to the records.

Tone Arms

Tone arms made today are not causing as many problems as they did some years ago. Easy tone arm removal and adjustment, accessibility of setdown and stylus pressure adjustments, have made servicing a snap.

Considerable emphasis must be placed on stylus force adjustment. Most tone arms will track properly with a pressure between 2 and 7g. If maximum stylus life and minimum record damage is desired, no more than necessary force should be applied to the stylus. Sensitivity of some cartridges has also been damaged by excessive pressure.

Leveling Arm

The leveling arm, or stabilizer, is used to keep the records in a level position on the spindle. It also actuates the automatic shut-off mechanism.

When the last record is finished playing, the downward thrust of the leveling arm shaft applies an upward thrust to the trip link in its backward motion. The trip link engages the OFF/ON switch tab to switch off power to the motor.

The leveling arm has been troublesome usually be-

Fig. 2—Motor bearings can frequently be cleaned without removing the motor from its mounting position.

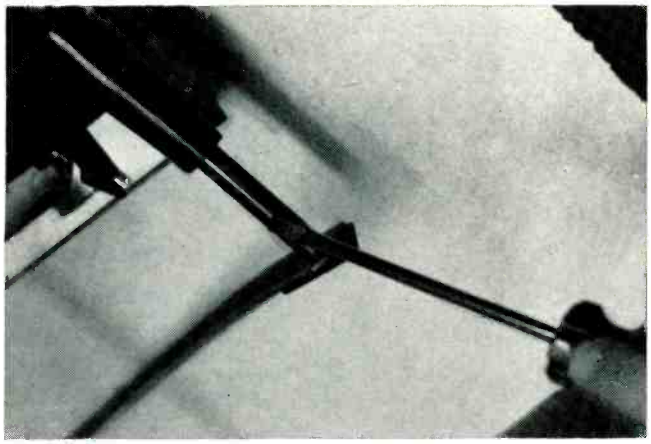


Fig. 3—The leveling arm is always moved by grasping it at the rear—not near the spindle end.

cause of mishandling. This component should be moved by grasping it at the back portion and not near the center post, or spindle (See Fig. 3).

Various problems may arise if this part of the changer is not functioning properly. The changer may not switch off or it may switch off before the last record has been played. Improper indexing can occur if the tilt of the record should impede the inward travel of the tone arm.

The leveling arm may become sluggish after a time and not slide downward after each record is rejected. Lubricating the stablizer shaft appears to be a ready solution to the problem. But experience has proven this to be a poor choice!

It is better to remove the leveling arm and polish the shaft with a fine grade of steel wool. Lubrication is not always recommended because of the tendency of the lubricant to pick up and retain lint which will again cause the stabilizer to become inoperative.

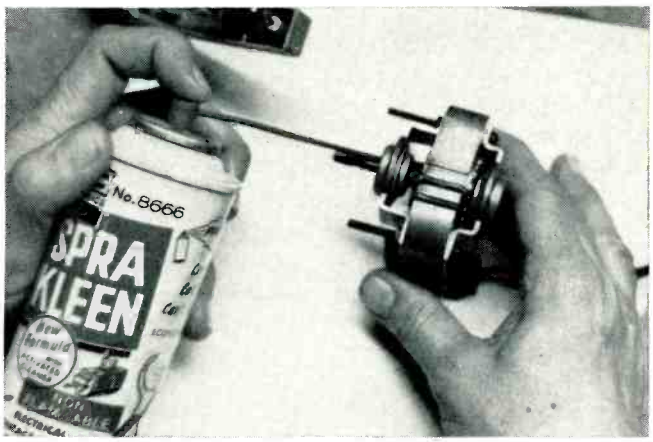
Lubrication

Perhaps the third largest number of problems arise because of over lubrication. The automatic record player requires very little lubrication.

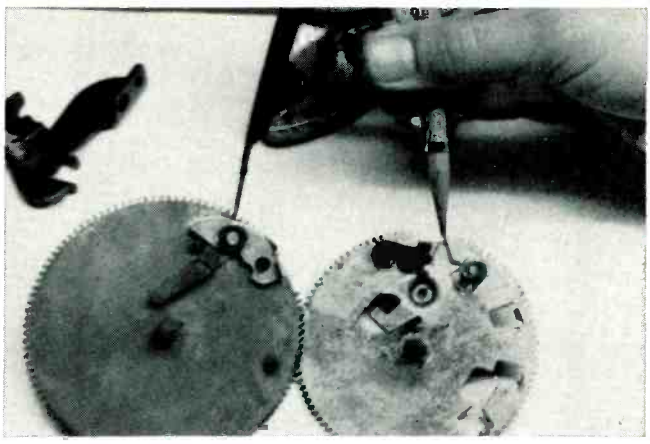
Do not use too much lubricant. Do not use a lubricant that's either too light or too heavy. One drop of oil is, in many cases too much. On any slide mechanism it is better to wipe on a slight oil film. This can be done by putting the lubricant on the tip of the finger and then wiping the slide. Lubricant in the motor bearings should not exceed one drop until it is definitely confirmed that another is needed.

An excessive amount or too light a grade of lubricant will have a tendency to splatter on sensitive parts while the machine is operating. Lubricant that's too heavy will retard motor speed and slow down other moving components. It is essential that the correct type of lubricant be used on the mechanism that requires it.

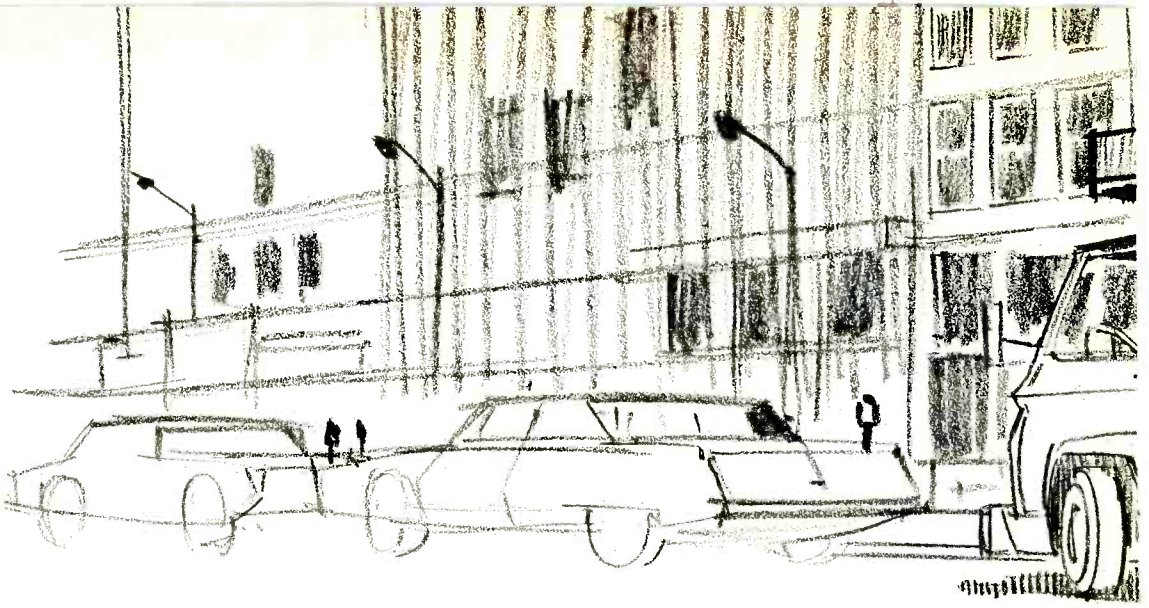
Applying lubricant on components that do not require it—trip links and pawls, for example—may correct a fault temporarily. But dust and lint accumulation on the oiled surfaces will cause a recurrence of the problem. ■



Cleaning motor bearings with bearing-plate removed.



Pawls must be kept free of lubricant. Kept free of all foreign matter these mechanisms will operate for long periods with little attention.



'RUMBLE' IN THE SHOP

Stereo feedback—coffee and pie a la mode

■ "Hey Bob," Scoot yelled as he flung the shop door open. "Give me a hand with a stereo I've got in the truck."

Bob went to the door and Scoot had already begun to open the truck doors. Bob looked into the truck at the unit.

"That's a big one, Scoot. How'd you get it in the truck in the first place?"

"It's Gerineau's set, he helped me with it."

"I'd rather you left those big jobs for a later pickup when we can send a helper, Scoot. If one of our customers should hurt himself helping, we might be in for a law suit."

"Well, it's too big for the 'cart,'" Scoot said, changing the subject. "I guess we'll have to use brute force and carry it in."

"Brute's is right," Bob quipped. "Let's go."

Bob and Scoot wrestled the set out of the truck and carried it to the middle of the showroom floor.

"I guess we'll have to leave it here. There's no room in the service area. What seems to be the trouble with it?"

"Well," Scoot drawled, "I'm not too sure. You see, Gerineau has a bunch of those 'long-hair' records and the darn thing will start to rumble right in the midde of some of them."

"Only on the classical stuff?"

"Yep! His daughter has some Rock 'N Roll records and they sound alright or as well as could be expected, anyway. Actually, it seems like the rumbling usually starts when there's not much going on — you know how some of that 'long-hair' stuff is."

"Hook it up, Scoot. I'll get some records."

Scoot busied himself with the line cord and Bob went to the service area. He came back with three records: A jazz record, an album of Brahms' and a test record.

"Has volume got anything to do with it, Scoot?"

"Sure, at low volume everything sounds fine."

"I'm beginning to understand this problem then. I'll bet you a cup of coffee and a piece of pie a la mode that you could have fixed this one in the home in five minutes."

"You're on!"

Bob put on the test record and selected one of the bands. The record turned silently a few times and Bob advanced the bass control to maximum. Still silence. Now he advanced the volume control and at half volume the speakers began to rattle. Bob stopped turning the volume control and the sound became louder. He turned the volume down and the sound stopped.

"How do you like that," Scoot announced, "The darn thing has quit altogether now."

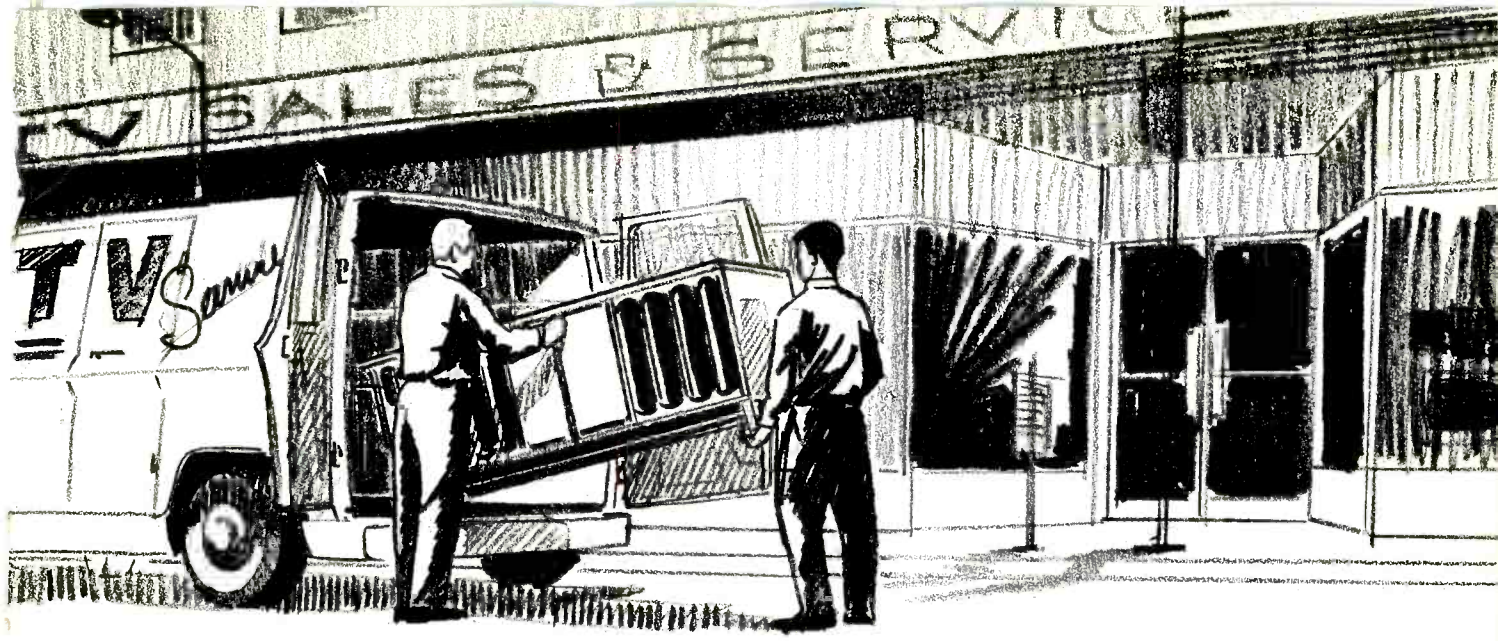
"No, Scoot. This is a test record and this band is called a 'quiet grove' band. There's nothing recorded on it. What we've got here is a feedback problem."

"Well, feedback means there's an oscillation between the speakers and the tone arm doesn't it? And if there's nothing on the record groove how can anything get fed back?"

"Scoot, the fact that there's nothing on the record groove actually makes the feedback worse. You see, there are a lot of places the stylus can pick up low frequency noise: flats on the idler wheel, bearing noise or normal room vibrations. No turntable is completely quiet or totally isolated.

"Let's assume this changer is normal — small bearing vibrations, and idler wheel imperfection vibrations are transmitted to the stylus. If the unit has good bass response, the vibrations are turned into a kind of rumble and fed to the speakers. Now, the speaker sound should be isolated from the changer but if it isn't, the sound adds to the initial stylus vibration and an uncontrolled rumble results."

"I think I'm beginning to see the light. If the stylus is playing in a normal groove, the irregular sound



of the music from the speakers tend to break up the oscillation."

"Very good. So it looks like our problem here is one of poor isolation. Sometimes the springs these changers ride on get 'cocked.'

Bob lifted one edge of the changer with one hand and felt under it with the other; first on one side then the other.

"It looks like the springs are OK. Pull the back off, Scoot, so we can see if anything is touching underneath."

"What do you want me to do the work for—you're the one that's supposed to get this thing done in five minutes."

Bob ignored Scoot as he went to work. When the back was off Scoot peered inside.

"I don't see anything wrong in here, Bob."

"Well I do," Bob said looking over his shoulder. "See this shielded audio lead? It's too tight. It looks like it's caught under this tie-down."

Bob loosened the twists on the tie-down and pulled a little slack from the amplifier.

"Now let's try it, Scoot."

Scoot moved to the front of the set and turned it on while Bob plugged in a cheater cord. He put the tone arm on the quiet groove of the test record and began to turn the volume up.

"It's full up, Bob. I still hear some rumbling, though. It sounds like it still wants to take off."

"That's normal, Scoot. This quiet groove test is pretty tough. Even the best ones sometimes break down under it."

"Well if that's all that's wrong with this set—and it was obviously that way when it was new—how come it took so long for it to show up?"

"It was probably that way right along, Scoot. But customers usually get more critical as time goes by. Gerineau probably never played those critical records that loud when the set was new."

"OK. I guess you did it in less than five minutes. Let's take a break and I'll buy you that coffee."

"You've forgotten the pie a la mode already?"

"No, but I thought maybe you did—let's go."

Bob and Scoot left the shop and went next door to the diner. Both remained silent as they sat down.

"Aren't you going to start your lecture—I never really get a coffee break, you know."

Bob laughed and they gave their orders to the waitress.

"Scoot, you know you shouldn't have brought the set in so I won't say anything about that. I would like to tell you a little more about this feedback business, though."

"OK, shoot."

"Well, as you saw, one of the best ways to check a rumble complaint is with the quiet groove in a test record. Actually, the run-in groove or the run-out on a regular record will work just about as well. One thing you have to watch for when you're working with a rumble problem is that you don't let the rumble get too loud or stay on too long. You may be picking the woofer cone off the wall if you do. You see, a lot of power is developed with a rumble problem and you aren't always aware of just how much because some of the low frequencies may really be too low to hear.

"Some manufacturer's recommend maximum settings for no-rumble conditions. For example, they might read 'All controls maximum except volume which should be at 50 percent rotation.'

"In addition to this kind of problem, you can also run into a more direct feedback: feedback through the air. This one can be tough to find since most technicians don't know it exists. The symptoms are about the same: loud rumbles increasing in magnitude. This sort of direct feedback was never a problem a few years ago when mechanical

continued on page 75

Dos and Don'ts of Solid-State

Know what you can and cannot do with transistorized equipment

■ The days of "tube-snatching" and indiscriminate parts substituting are nearing an end. Techniques of troubleshooting home entertainment equipment are changing fast. And "DIY" tube testers and "do-it-yourselfers" will eventually become only a bad dream. As the old saying goes, "it's indeed an ill wind that blows no good."

And the solid-state servicing process will eventually separate the "men" from the "boys" and the service business will be exclusively in the hands of those who know how. Those who do not know how or who do not learn how to quickly and efficiently troubleshoot and repair solid-state equipment won't be in the home-entertainment service very long. We have to use our heads and proper test instruments.

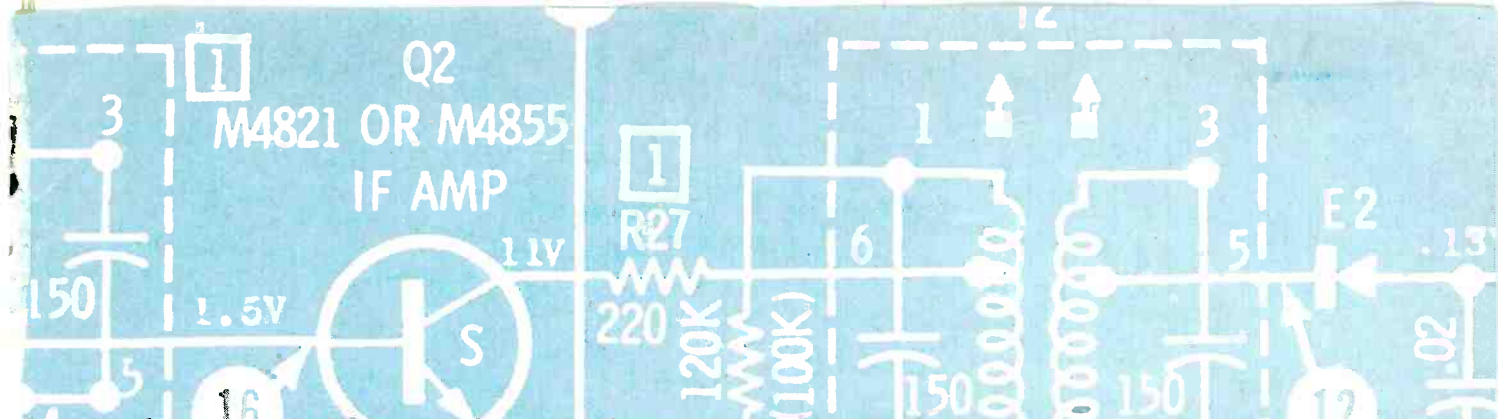
In addition to knowing transistor and diode theory — how these components work in practical circuitry — you must also know what you can and cannot do. An entirely new set of rules and procedures must be learned before solid-state equipment can be handled successfully. The approach is different.

The Dos

The first "do" is to remember: You can make money, more money than you ever made before in this business, if you can make fast and effective repairs on solid-state equipment.

If you don't have a good scope, VTVM or VOM, you'll need them. You will also find a good transistor tester and noise generator helpful at times.

Do make sure the VTVM and scope probes are insulated right down to the tips. An accidental short between the base and collector of a transistor will usually destroy the transistor. Other transistors may even be destroyed in direct coupled circuits.



Do know your test instruments intimately. The open circuit voltage at your VTVM, VOM or scope probes may be sufficiently high to damage a component under test. Additionally, the ground lead of any ac operated test instrument may have a hum amplitude exceeding that of the component being checked. This may create problems in measuring small voltage differences from one solid-state element to the other. Voltage measurements should be made from each element to ground.

Do use a low capacitance probe with your scope at all times. It should not exceed 15pf.

Do consider resistance readings on transistors as strictly approximate measurements. Transistors being tested can be biased to various levels of conduction by meter currents.

When using a capacitor tester to check electrolytic capacitors make sure the tester does not apply a voltage to the capacitor which exceeds the capacitor's voltage rating.

Do watch out for over-warm-transistors. They may be defective or have incorrect biases.

Do apply a thin film of silicone grease to both sides of the mica insulators (or to the bottom of the transistor case — depending on circuit or mounting mode) and make sure the insulators are perfectly free of metal particles before applying grease. A small metal shaving can pierce the insulator or prevent proper heat transfer to the heat sink.

Do hold transistor and other low-wattage component leads with a pair of long-nose pliers when soldering or unsoldering leads. Hold the leads near the iron tip.

Don'ts

Don't work on transistorized equipment with the power on except when necessary to signal trace or make voltage or current measurements.

Don't use test instruments which are not well isolated from the power line. Make sure the equipment you're working on is also isolated from the line. Use a one-to-one isolation transformer.

Don't operate a transistorized TV, Hi Fi or other solid-state equipment with the speaker disconnected. Place a comparable resistive load across the equipment's audio output.

Don't be careless when working with transistorized equipment. Tubes can take moderate overloads over a long period of time — but transistors can be destroyed instantly under similar conditions.

Some equipment manufactured today requires that meters and other test instruments be isolated from ground. Check manufacturers' service instructions carefully.

"Shunting" capacitors is a common practice in tube-equipment servicing. Do not shunt capacitors in solid-state circuitry. In many situations a surge can destroy a component.

The aforementioned precautions are only a few things you'll have to learn to observe in modern solid-state troubleshooting and repair.

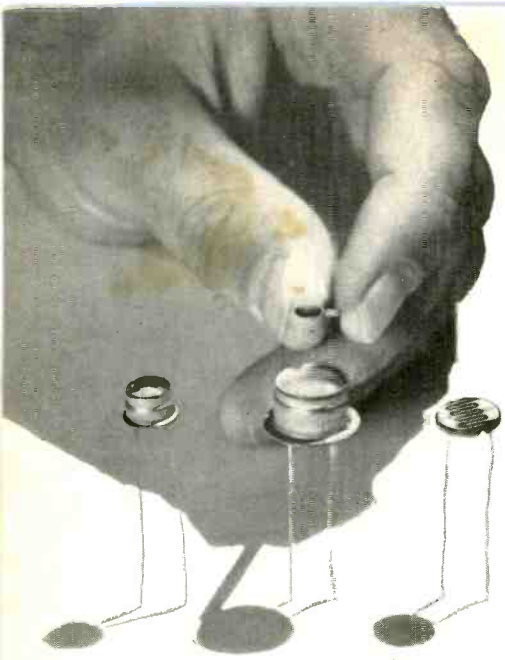
Get Started Properly

Look what one manufacturer recommends regarding the service approach to transistorized equipment:

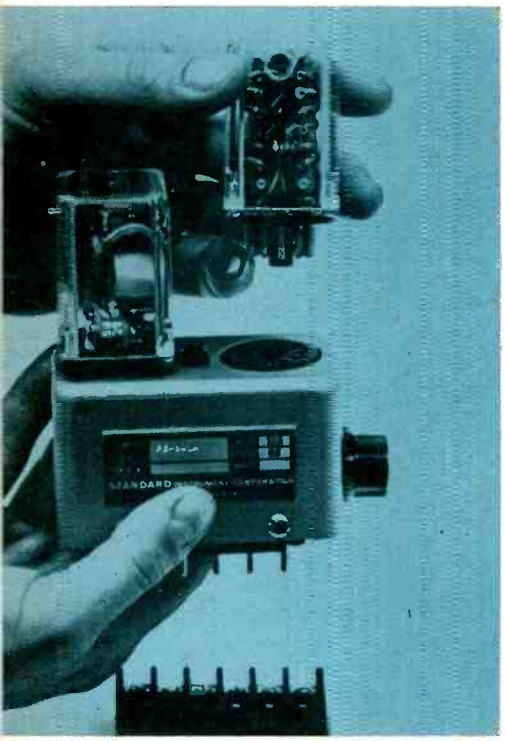
1. Use the proper test instruments.
2. Know what your test instruments can do.
3. Know how to use them.
4. Study the physical chassis layout.
5. Study the equipment block diagram.
6. Know how transistors work.
7. Know the trouble symptoms.
8. Use an accurate schematic as found in the factory service manual.
9. Use the service test points in the service manual.

The procedure recommended for initial checks on one transistorized television chassis follow:

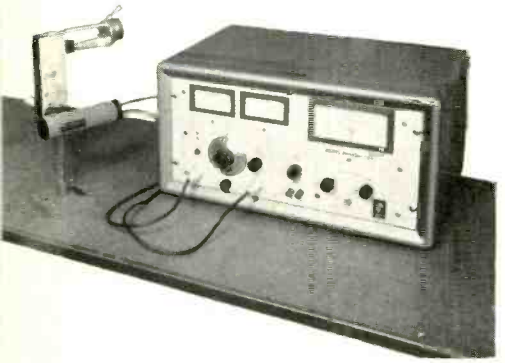
1. Leave the set switched off. See if the fuses are blown. If a fuse is blown, do not replace it expecting the set to be repaired.
2. If the fuses are OK, or even blown, make a dc resistance check of the 60v and 12v supply sources. The dc resistance check of the 60v source should normally read approximately 800Ω. If a short exists in either the horizontal, audio or any circuit supplied by the 60v line, the resistance will be lower.
3. The dc resistance of the 12v source should normally read 400Ω. If the reading is low, a short exists somewhere on the 12v line.
4. If the fuses are OK and the dc resistances checks normal, switch the receiver on.
5. Make checks of the 12v, 60v, and 240v sources. If all voltages are within normal tolerances, then an open circuit can be suspected, rather than a short.
6. Depending on what symptoms are observed and what circuit is involved, troubleshooting can now begin.
7. Voltage measurements on the transistors may be necessary. One method is to measure the forward bias voltage directly across the base and emitter. Except for the polarities, NPN and PNP types will have similar forward bias voltages. The voltage depends on the circuit application and whether the transistor is made of germanium or silicon material. Germanium types normally carry approximately 0.2-0.4v bias while those using silicon have from 0.4 to 0.8v.
8. It may be necessary to use a scope to isolate the defective stage. Other instruments, including a transistor tester, capacitor tester and signal tracer may also prove valuable. ■



Highly-sensitive cadmium selenide photo-conductive cell by General Electric.



Transistorized 'plug-in' photo-electric control by Standard Instrument.



A photometer, one of many instruments that use photoelectric sensing. Courtesy Modern Eelectronics.

Photoelectric

Take a brief look at another area of electronics

Many ELECTRONIC TECHNICIAN readers now install and service photoelectric control equipment as a sideline. A rather large number of additional technicians have indicated plans to diversify by servicing a wide variety of electronic equipment now being used in business, in industry and in many modern homes. It should be mentioned also that a significant number of other readers work exclusively on electronic equipment used in business, industry and other areas.

As most technicians already know, tremendous expansion has taken place in photoelectric controls during the past few years. New solid-state equipment has been developed and designed. More sensitive photoelectric cells have been made. Applications have been increased to keep up with the continuously rising automation-wave within business, industry and the home.

Much old equipment, employing photoemissive and electron tubes, has been replaced by equipment having photoelectric cells, transistors and other solid-state components. Hence, our brief reference to basics will be confined to photovoltaic and photoconductive cells.

Photovoltaic Cells

The photovoltaic, or "solar" cell, is widely known as a semiconductor component that develops useful amounts of dc electricity from sunlight or, at reduced power, from artificial light. Photovoltaic cells can close or open sensitive relays without the necessity of applying external power. They can also be easily converted to photoconductive cells (light dependent resistors, or LDRs) by supplying a small dc voltage to the semiconductor.

Most photovoltaic-type cells made today, other than those used for generating useful amounts of dc power, are employed in a wide range of military, scientific and industrial control and measuring equipment. Most of these cells are designed to function well into the infrared region. They are frequently used in equipment for monitoring industrial process temperatures, for use in burglar alarms, "hot-box" detectors for fast-moving trains, medical equipment to detect and locate cancer, slipped disks and broken bones. In fact, a number of additional manufacturers have entered the business during the past few years and all have designed equipment for many applications.

A simplified photovoltaic relay circuit is shown in Fig. 1. In practice, a number of cells plus one or more transistors may be used in the circuit—depending on the particular application.

Photoconductive Cells

A simplified photoconductive cell relay circuit is shown in Fig. 2. This cell is also known as a photoresistive, or light dependent, component. Its resistance varies inversely with the light intensity to which it is exposed. We probably know it best as the component used in TV automatic brightness control circuits but it is widely used in photoelectric control systems. In effect, besides being a variable LDR, it can be used as a switch under "dark" to "light" conditions. Its resistance under light conditions is low and under dark conditions it is high.

Control Techniques

Since photoelectric control involves a photosensitive component and a radiant-energy source, the beam between the component and light source may be varied a number of ways to perform useful automatic functions.

Control Equipment

which you may have 'shrugged-off' to the hobbyists

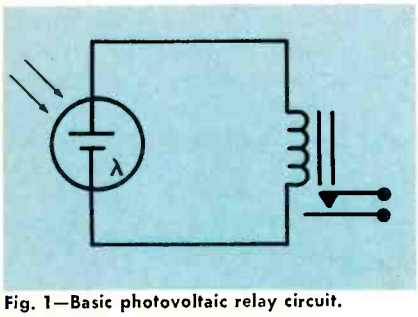


Fig. 1—Basic photovoltaic relay circuit.

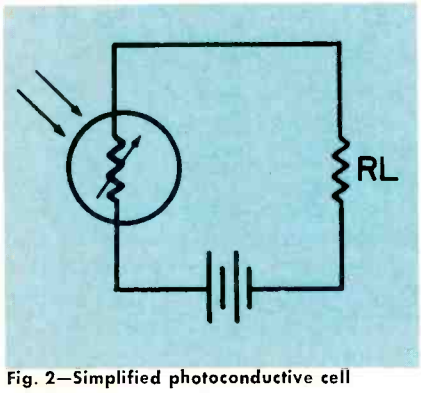


Fig. 2—Simplified photoconductive cell relay circuit.

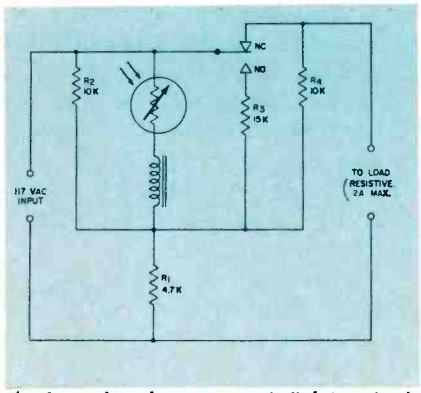


Fig. 3—Dusk-to-dawn automatic lighting circuit using photoconductive cell. Courtesy of Sylvania Electric.

Light, for example, can be reflected from various object-surfaces to the cell, or receiving head. This method is used for coded-lable reading, character recognition in data processing, surface-flaw detection and end-of-tape sensing. Other functions include color matching and measuring, surface character measurements, temperature measurements, sorting and counting.

Self-variation in light-source intensity and color are also methods used in street, factory and home lighting controls, laser modulation and fiber optic translations.

Opaque and transparent objects passing between the light source and the cell also provide signal variations. This technique is used to control smoke density and analyze purity in quality control operations. Opaque objects passing between the light-source and the cell can be counted, sorted and compared in size and shape.

Solid-State Photoelectric Relays

Photoelectric equipment is set up to function in a variety of ways. The output relay may be electrically energized during normal conditions and de-energized when the abnormal condition—the condition to be detected—occurs or when equipment failure takes place.

Some circuits energize the output relay when the light beam is broken, others when the light beam is restored. Still others are designed to operate either way.

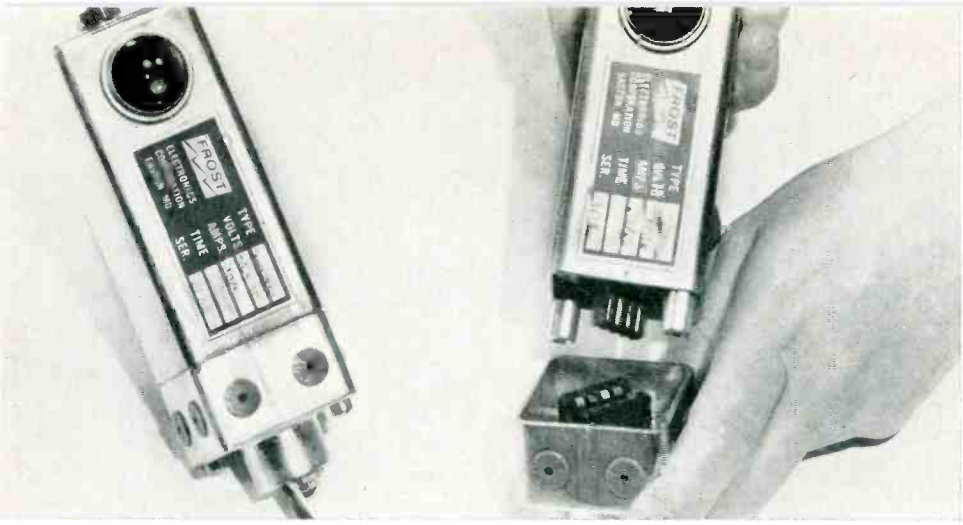
Suppose, for example, an application requires that a machine be shut down when a hole or tear appears in the material passing through the light beam. A relay that's energized when the light beam is restored would stop the machine only when a fault appeared in the material. Should the light source, the relay or receiver fail, the fault might pass without causing the machine to stop. But a relay that's energized when the light beam is interrupted would drop out when a hole or tear appeared and also when the photoelectric equipment failed. This should be remembered by technicians when they specify and install equipment required for fail-safe operations.

Most of the equipment used today in security and protective systems employ infrared filters on standard light sources to make the light beam invisible. Similar filters may also be used over the cell to minimize stray, or ambient light. This arrangement reduces the maximum effective distance between light source and cell, however. Of course, some units are designed which have infrared light sources for specialized needs.

Equipment is made for both indoor and outdoor applications and having various operating speeds—generally specified in operations per minute. Pickup and dropout times are usually specified in fractions of seconds. Equipment categories range from medium-speed, high current; through heavy-duty, medium-range; limited-range high-speed; to long-range, outdoor/indoor types. Most are designed to operate on either 115 or 230vac.

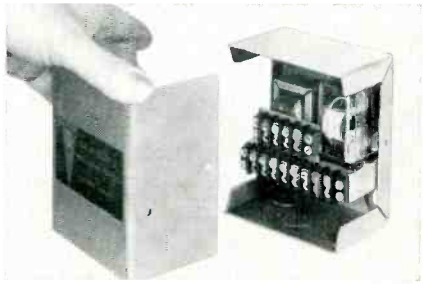
A number of companies furnish specific photoelectric relay types for various specialized purposes. One popular unit available today is employed in dusk-to-dawn automatic lighting systems, for home and business, to control yard, sign, window display and night safety lights. The circuit of an automatic lighting control system is shown in Fig. 3. This photoelectric relay switches on lights automatically at dusk and switches them off again at dawn.

Some equipment has been designed having a common chassis



Interchangeable plug-in photoelectric controls by Frost Electronics.

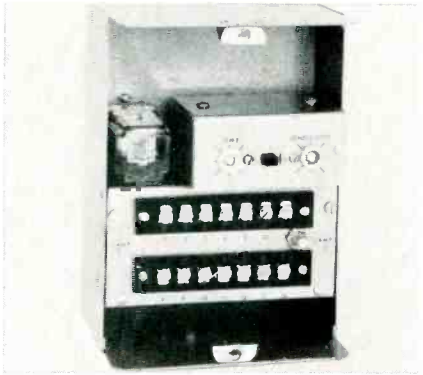
Photoelectric panel mounting tachometer by Metron Instruments.



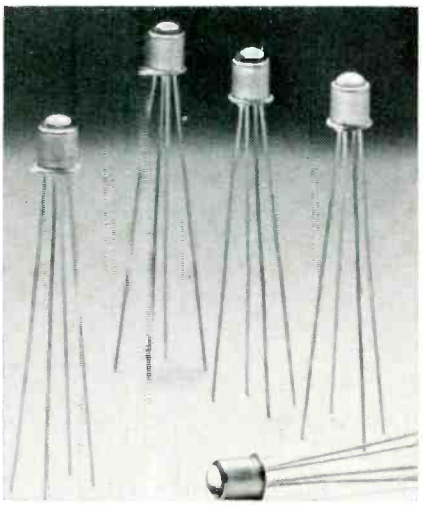
Transistorized photoelectric relay by Farmer Electric.

High-speed photoelectric counter is capable of 12,000 counts per minute. By Standard Instrument.

High-speed cadmium selenide photoconductive cell by National Semiconductors Ltd.



Modularized photoelectric control system by Photomation.



Light sensitive field-effect transistors by Crystalonics Inc.

and a number of plug-in modules so the same photoelectric scanner relay can be used for general ON/OFF operations, relay latch-in, one-shot pulse output, high-speed registration control and jam-up protection for moving conveyor lines or stop-motion control.

Maintenance

Modern solid-state photoelectric controls require very little repair. The equipment responds well to periodic preventive maintenance. Photocells should be checked regularly. This is done simply by disconnecting photocell leads and checking its resistance with a VOM or VTVM. Don't forget to remove the power cord before doing this. The resistance of a photoconductive cell should be relatively low with the normal light shining on it and very high (some cells will run up to 2M) when in total darkness. Cell or equipment manufacturers' data should be used as a guide here.

Relay action should also be checked. This is done by rapidly breaking the light beam with a finger. If the relay appears sluggish, ambient light may be striking the photocell.

Photocell and light source lenses should be cleaned periodically and checked for proper alignment. Cables should be checked to see that they are not frayed and all connections should be checked.

Some equipment is provided with a switch for changing over from dark operation (DO) to light operation (LO). Some units are provided with a "change-over" plug for this purpose. A sensitivity control with lock-nut will also appear on some units. This control may require adjustment or resetting under certain conditions. Some equipment is provided with time-delay facilities for certain types of scanning operations. In this case, a TIME control, also with lock-nut, will require adjustment to obtain the desired delay interval.

Photoelectric equipment is generally fused and when total failure occurs, this is the first component that should be checked. The power cord should be removed, of course, before any effort is made to check the equipment. ■

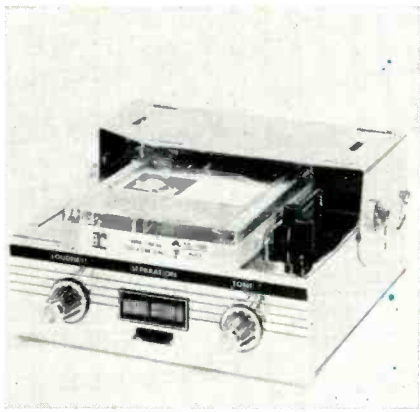
Lear Jet 8-track auto stereo player and FM auto radio model ASFM-850-H.

A REPORT

Auto Radios and Tape Players

Here's another opportunity for alert service-dealers and technicians

Muntz model A-80 auto tape player.



■ At a time when the color TV sizzle is rising to a profitable crescendo, things are also "sizzling" in the automotive entertainment accessory field. What with nubbin-sized portable TVs for back-seat viewing, regular AM/FM radios— with front and rear-seat speakers —stereo-type tape systems will probably convert the family car into a mobile "home-away-from-home." Many service-dealers and technicians have recently been hard-pressed to stay with the little cartridge-tape sizzle now superimposed on top of the big color-TV fry.

No less than a baker's-dozen manufacturers are already providing car tape-players. Some manufacturers are making comparable units for the home — generally using the speakers, amplifiers and audio controls of fixed stereo equipment already in the home.

The plug-in cartridge systems generally use the endless-loop 4- and 8-track pre-recorded tape. And it is reported from some areas that these units have been going like hot cakes for the past year. More recent reports indicate that major auto manufacturers are either offering or planning to offer the units as accessories in 1967. Of course, some auto manufacturers have been offering tape-players for the past year or so. The 1967 promotion, however, will no doubt increase unit-sales, to say nothing of tape-cartridge sales.

What effect will tape-players have on AM/FM car radio sales? Most "crystal-ballers" say they will offer no competition. It is explained that tape-players will be used for music only and the car radio will provide music, news, weather, traffic conditions and market reports, sports, etc. Besides, a lot of equipment is being made as combination radio and tape player, and one unit plays through existing radios. Approximately 7 out of every 10 new cars are bought with radios installed and many additional car-owners also get radios installed eventually. Close to 50 million car radios are now in operation. About 9 million new radios were made in 1965. This figure will no doubt slowly increase as the number of cars increase.

Equipment

The 1966 Motorola contract line has 30 models covering sets built for Ford, Chrysler, American Motors and others. This total includes both radios and tape players. It should be noted that all models are fully transistorized. About 17 of the total number of models use NPN silicon transistors except in the output stage where germanium transistors are used. The two schematics in Fig. 1 compare a PNP RF amplifier stage used in the 1965 Dodge radio and the NPN silicon RF amplifier stage used in the 1966 Dodge. The model T6SMM tape-player is shown in Fig. 2 and the radio/tape player, model T6SMZ, is shown in Fig. 3. This is an 8-track player and the tape-drive and head-positioning equipment is shown in Fig. 4.

A foreign import tape player, supplied by Craig Panorama, Inc., uses existing front- and rear-auto radio speakers. It's 4-track, 2-head.

The stereo div., Lear Jet Corp., is making a combination 8-track continuous loop cartridge player and FM radio, model ASFM830H. This unit has a magnetic head that switches automatically from one track to the next and automatically repeats at the end of the tape. The FM radio has AFC, FM/stereo indicator light and FM multiplex switch for FM stereo reception. The FM multiplex adapter is an accessory. This company also makes a tape player unit for home use on existing stereo systems — using speakers, amplifiers and audio controls on the home equipment.

It was recently reported that a new company, Steejay, Inc., has been organized to handle Lear Jet's 8-track stereo cartridge players designed for car and home use. This new company will initially distribute the equipment in metropolitan New York and Northern New Jersey.

Auto Radios . . .

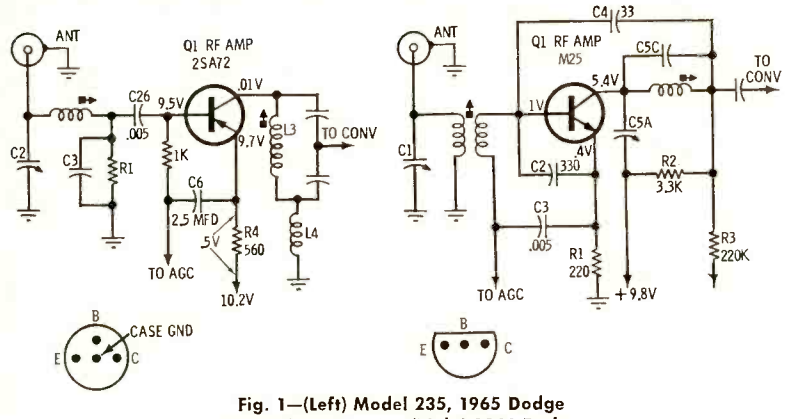


Fig. 1—(Left) Model 235, 1965 Dodge germanium RF stage. (Right) 1966 Dodge silicon RF stage from model 2355 radio.

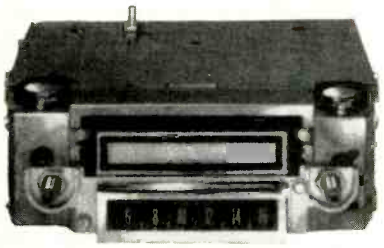


Fig. 3—Motorola combination radio/tape-player, model T6SMZ.

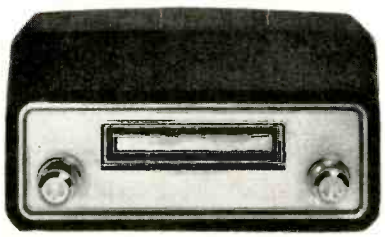


Fig. 2—Motorola T6SMM tape-player.

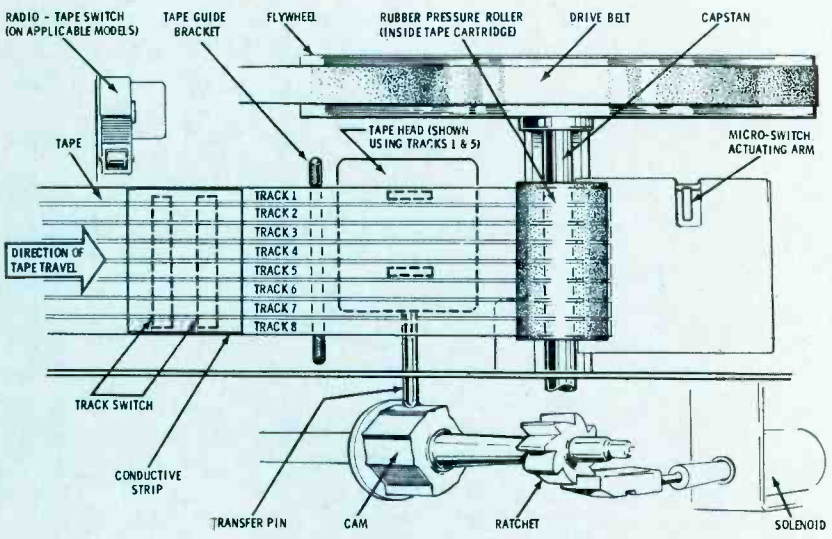


Fig. 4—Tape drive and head positioning details of Motorola tape-player.

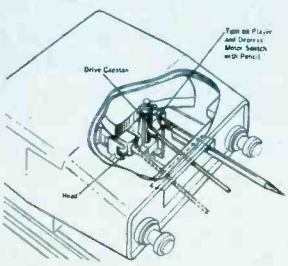


Fig. 5—Details on tape-head and capstan cleaning.

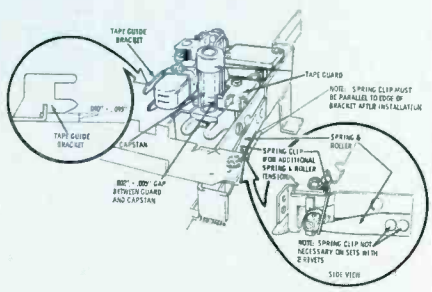


Fig. 6—Details for adding spring clip if additional tension is required to detent cartridge properly.

Muntz also has a line of car stereo units which we will review in a forthcoming article when technical data, specifications and service literature is obtained.

The Tenna Mfg. Co. has brought out a stereo tape player that plays both 4- and 8-track cartridges. Further information is forthcoming on this unit.

Service Problems

Service problems in auto radios have not varied much since the advent of solid-state equipment. The AM/FM units posed a few problems, but not unlike those which arise in regular AM/FM solid-state home radios.

Tape-player service techniques approximate those of tape recorders — with some slight differences. Some new transistor circuits are involved, notably the 1- and 2-transistor motor speed regulator circuit.

Most tape-player problems can be handled with a minimum of time and effort if manufacturers' service data is obtained. Complete details are generally furnished.

One major cause of improper tape player operation (regardless of the type) will be oxide build-up on the head. During normal operation, iron oxide particles are loosened from the tape and build up on the head. This accumulation can cause poor playback and up-and-down tape travel. The head and drive capstan must be cleaned regularly. This can be done in the car as shown in Fig. 5. Use a cotton swab as shown, moistened in head cleaner or isopropyl (rubbing) alcohol, then wipe dry. Do not use carbon tetrachloride as a cleaner under any circumstances.

You should always avoid using magnetized screwdrivers or other tools near the head because these can magnetize it. If the head acquires residual magnetism over a period of time, it will cause a loss of high frequency response and possibly a higher noise level. Use a regular head demagnetizer and follow instructions that come with the demagnetizer.

Head adjustments are normally required for cases of cross-talk, loss or noisy frequency response or if

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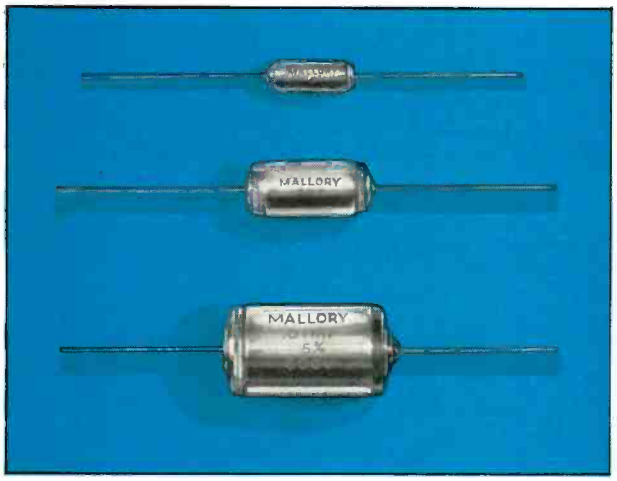
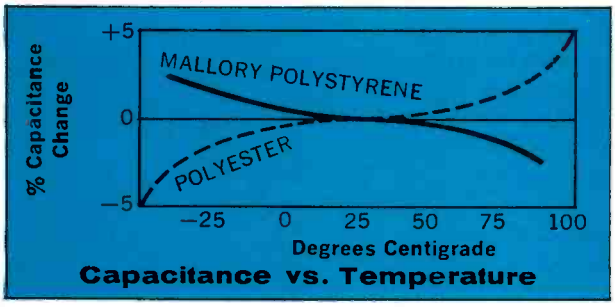
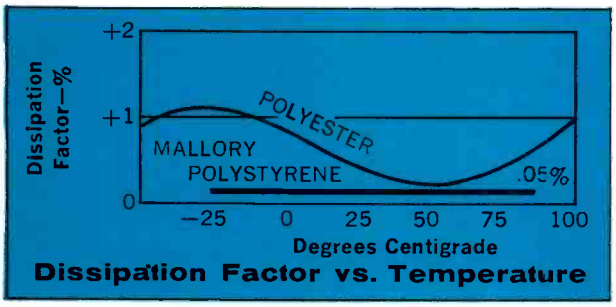
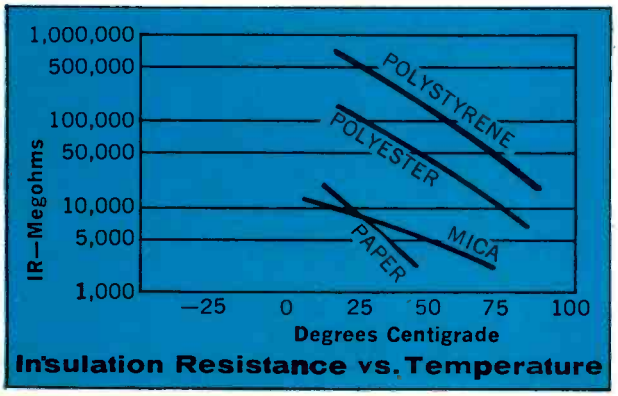
When you need a stable capacitor...









Temperature makes most capacitors wander. For electrolytics, capacitance goes down when temperature gets colder, goes up when things get hot. But this usually doesn't cause trouble, because most electrolytic applications are in filtering—and as long as you have low enough AC impedance, you get the filtering you need. Where drift can bring problems is in tuned circuits, timing and differentiator circuits; here you've got a paper, film, ceramic or mica capacitor, in the fractional-microfarad range. If it changes value due to temperature variations or just plain old age, you're going to have some headaches.

Today's tip: when you need extra stability, try the *new* Mallory polystyrene capacitors. They're the most stable you've ever seen. They look different, and they act different. They're made of a unique kind of stretched polystyrene film and high purity aluminum foil, wound up in a compact roll and then fused together in a self-sealed case of solid clear plastic.

What's extra special about these new capacitors is the way they hold their original microfarad value while temperature varies all over the lot. Temperature coefficient is considerably lower than that of polyester film capacitors—under 150 parts per million per degree C. And it's negative—which means that instead of going up with temperature, capacitance goes down. This is the direction you need to change capacitance in order to compensate for the effect of temperature on the inductive part of a tuned circuit. From −10°C to +70°C, their *total* capacitance change is less than 1.3%. And brother, that's *stable!*

And that's not all. These little dandies don't grow old. They hold their characteristics month after month. You just connect 'em and forget 'em.

One more thing. Mallory Polystyrene Capacitors have the lowest dielectric loss in the business. Their dissipation factor (similar to power factor, a measure of efficiency as a capacitor) is extremely low . . . only 0.05%, which is a small fraction of that of other capacitors. And it stays at this low value over the whole temperature range. This means that they're high Q capacitors, ideal for tuned circuits. And their insulation resistance is way higher than polyester, mica or paper capacitors.

In case you were wondering how much dough you would have to lay out to get such wonderful capacitors—here's the best news of all. They are really low priced. You can get them in values from 5 pF to .01 mfd, all rated 600 volts, from your Mallory Distributor. See him soon—and ask for your copy of the 1966 Mallory General Catalog. Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

50th ANNIVERSARY

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COLORFAX

Motorola Remote Control Color TV System

A remote control receiver, TRR-6, is used in 1966 Motorola color TV receivers. It contains 6 transistors and 3 relays and the system operates in the 40kHz range.

The microphone amplifier input stage is shown in Fig. 1.

A high impedance microphone, resonant in the 40kHz range, is connected to the base of transistor Q1.

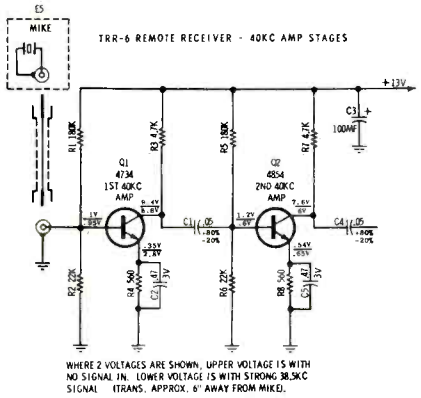

Fig. 1

Forward bias for transistor Q1 is provided by resistors R1, R2 and R4. This sets up approximately 0.6v forward bias on Q1's base and establishes a class A operating condition. If the static current of the transmitter tends to change, the voltage drop across emitter resistor R4 will also change in a direction to oppose the current change. Capacitor C1 couples the signal from the collector of Q1 into the base of the following stage.

The output signal from the 1st 40kHz amplifier, Q1, is RC coupled into the base of the 2nd 40kHz amplifier, Q2, as shown.

These two stages (Q1 and Q2) are identical in circuit design.

Type 4734 and 4854 NPN transistors were selected for the microphone and first amplifier stage because of their stable characteristics under conditions existing inside the TV cabinet.

The relatively high values of the emitter resistors stabilize transistor operation to prevent performance change over long periods of time. Capacitors C2 and C5, across the emitter resistors, prevent loss of amplification caused by degeneration of the signal across the resistors.

Frequency Detector Limiter

The signal is coupled from the 2nd untuned RC amplifier stage into the frequency detector limiter stage by C4.

Forward bias for this stage is provided by voltage divider resistors R10 and R11 in the base circuit and resistor R14 in the emitter. This stage acts as a limiter because of the high value of the 10K collector load resistor, R13 and the fact that the signal having passed through the previous amplifying stages now has sufficient amplitude to drive transistor Q3 from cut-off to saturation on alternate half cycles. R15, the 10K pot, operates as a range control by changing Q3's collector voltage and in turn its output voltage. With the arm at ground, the control is set for maximum output and range.

As stated, Q3 acts as a very effective limiter and since the collector signal voltage never exceeds the stage supply voltage, the output signal will never exceed 14v P-P. Because the stage is biased on the cut-off side of class A operation, it quickly goes to

TRR-6 REMOTE RECEIVER LIMITER & DETECTOR STAGES

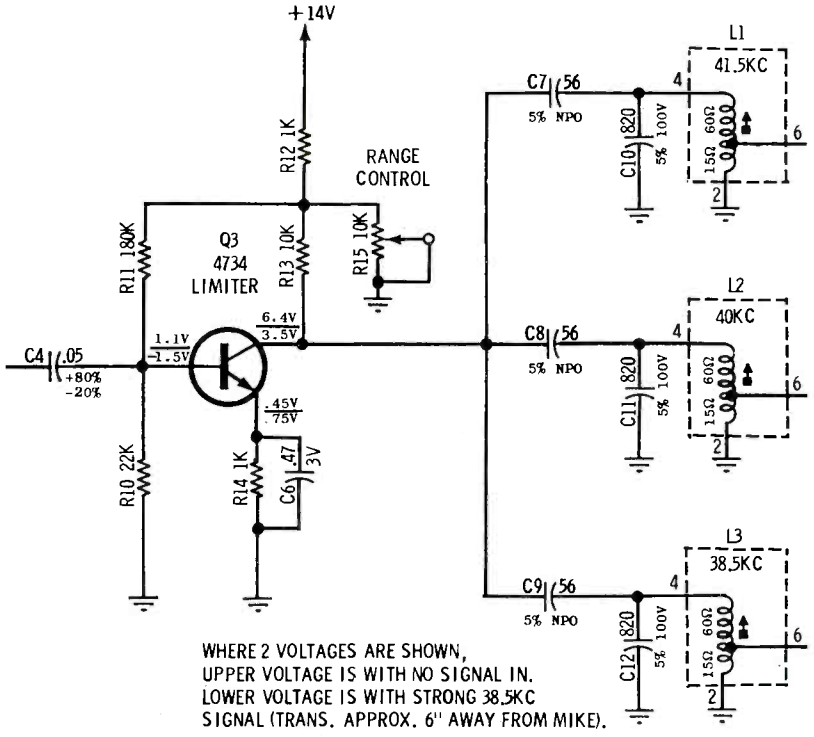

Fig. 2

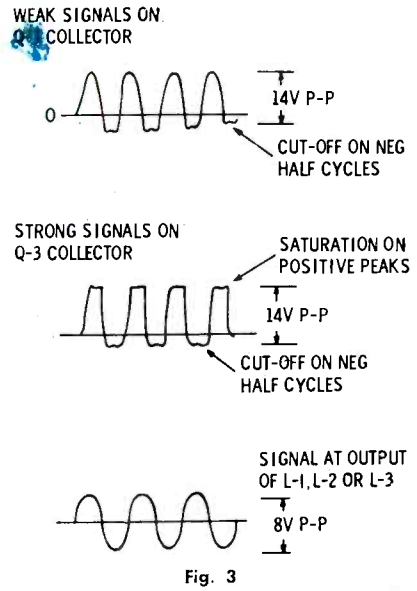

Fig. 3

cutoff on the negative half cycles of incoming signals and into saturation on the positive half cycles of stronger signals (see Fig. 2).

The wave shapes at the collector of the stage are restored to a sinewave because of the inductive flywheel effect of the transformers. The output signal from the transformers will have a P-P potential of approximately 8 to 10v because of the step-down ratio of the output tap.

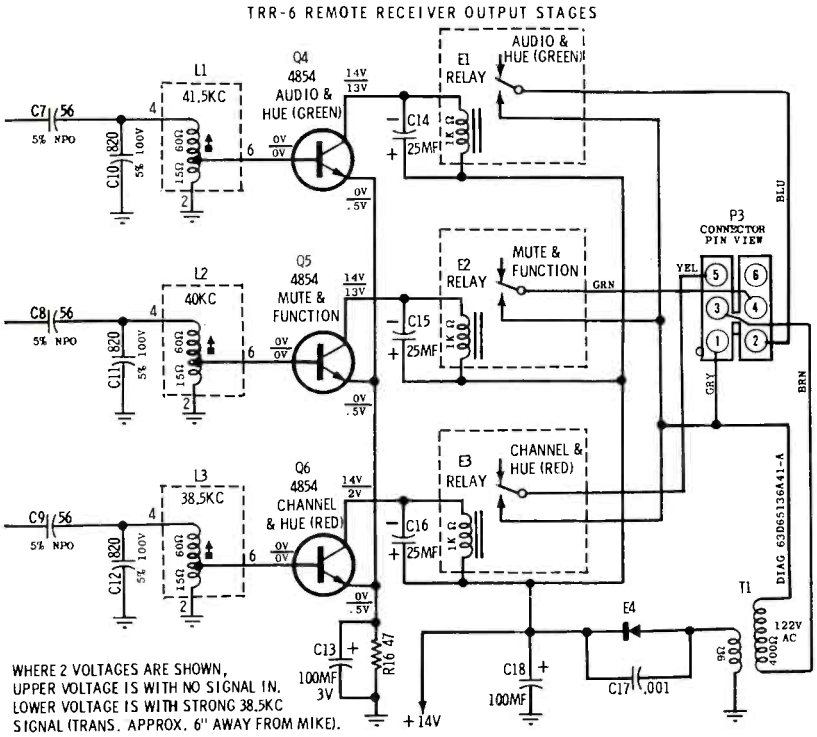

Fig. 4

In normal operation, it is important to remember that only one of the coils will have output at any one time since the 38.5kHz, 40.0kHz and the 41.5kHz frequencies are never used at the same instant.

Audio Relay Stages

The collector of Q3 feeds the output signal to coils L1, L2 and L3 through coupling capacitors C7, C8 and C9. These coils are parallel resonant — L1 at 41.5kHz, L2 at 40.0kHz and L3 at 38.5kHz.

Notice that the output connections of these coils are tapped down from the top end of the windings. This provides a better impedance match to the output transistors' bases and also removes the dc base current from most of the winding. Actually, the dc current passes through only about ¼ of the coil windings which increases the "Q" and hence the coils' selectivity — improving their off-frequency signal rejection.

In normal operation, the three signals are fed to the base of transistor Q3. Output signals will be developed in the appropriate coil, L1, L2 or L3.

Output Stages

From the output tap on coils L1, L2 and L3, the signal is passed on by direct coupling to the bases of relay

transistors Q4, Q5 or Q6 (Fig. 4).

Notice that the base of these transistors go directly to ground through the taps of the coils. The emitters also return to ground through the bypassed emitter resistor, R16. Thus, under no signal conditions, the transistors have no forward bias, are cut off and insensitive to small signals on their bases.

When a signal is impressed on one of these transistors, half cycles cause the transistor to conduct. The collector current will initially flow through and begin to charge the 25μf electrolytic capacitor across the relay. Remember here that the combination of capacitor charging time, inductive and mechanical lag in the relay and the time delay in the previous RC amplifier stages, add up to a total of approximately 0.1 second delay before the relay closes and initiates the operating change. This delay prevents the relays from closing on random noise pulses which are usually only a few μs long. Approximately 5ma must flow through the relay windings before the contacts close and the current reaches 8ma under steady signal conditions (see Fig. 5).

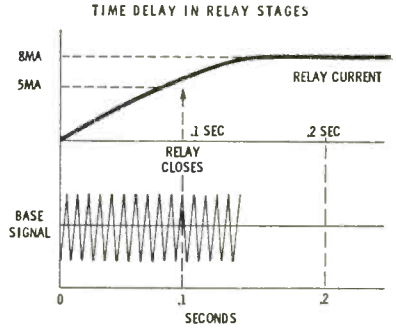

Fig. 5

Collector-emitter current flows through R16, the 47Ω emitter resistor which has a 100μf electrolytic connected across it. Under steady signal conditions, emitter current develops a potential of approximately 0.5v across this resistor with the positive polarity connected to the emitters. This reverse biases the transistors and conduction will only take place on positive half cycles of signal that exceed 0.5v (see Fig. 6).

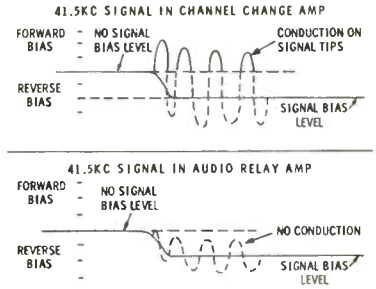

Fig. 6

If a 41.5kHz signal is being transmitted, for example, some small amount of this signal finds its way into the base circuit of Q5 or Q6. Without reverse bias on these stages, enough current may flow in the 38.5kHz or 40.0kHz relay to close their contacts. The current through Q4 and relay E1 causes a large dc voltage drop across the common emitter resistor, R16, which further reverse biases all three stages. The 41.5kHz signal voltage from L1 is large enough to exceed this bias while the signal on Q5 and Q6 is lower in amplitude and not able to overcome the reverse bias.

For this same reason, random noise pulses and interfering signals which usually consist of a wide band of frequencies are not normally able to trigger a relay.

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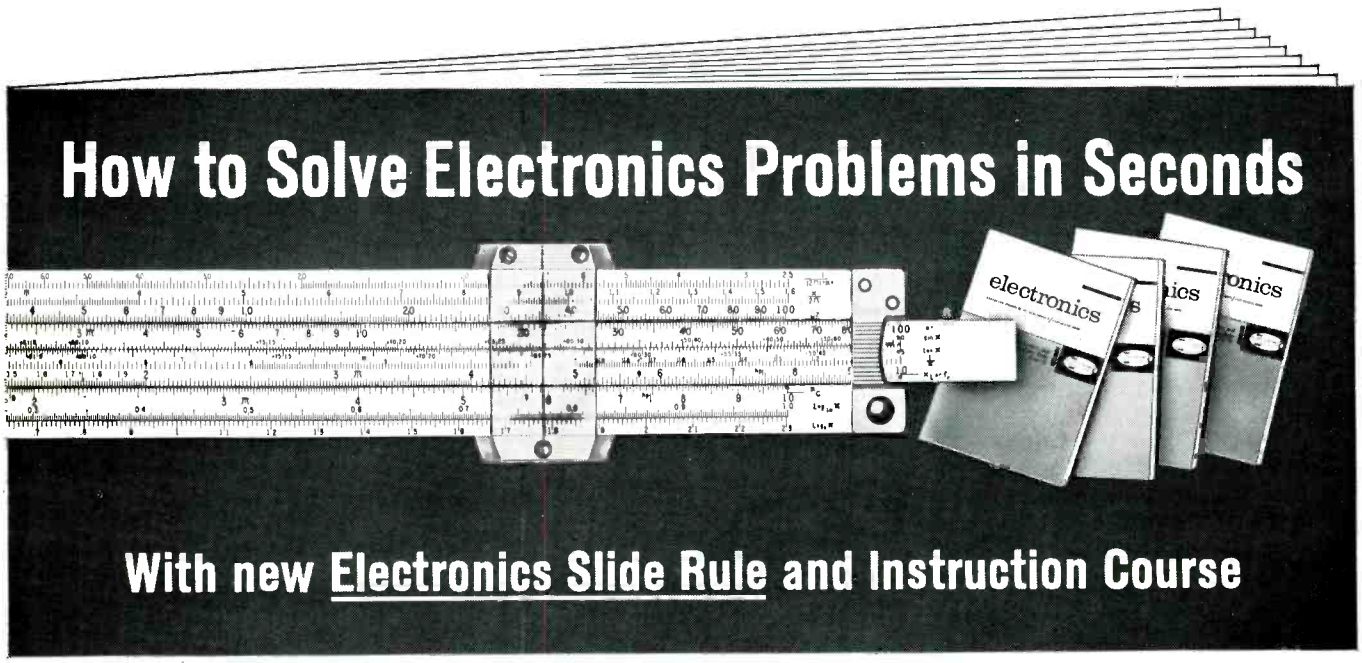

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NEW PRODUCTS

FOR MORE INFORMATION CIRCLE NEW PRODUCT NUMBERS ON POSTCARD INSIDE LAST COVER.

Capacitor Kit 700

A #30 kit featuring dip mylar-paper capacitors, designed for all color TV servicing, is introduced. The kit includes the 10 most popular replacement values as specified in leading na-

tional brand and private brand color sets. They are rated at exact original equipment capacitance values, to assure proper operation, are moisture proof for maximum reliability and are said to be easy to install. Net price $6.95. Arco.

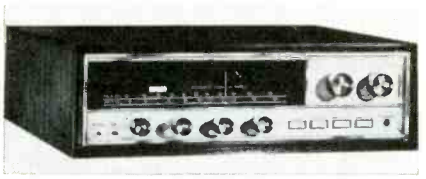
Matching Transformers 701

A line of indoor and outdoor matching transformers, used to convert home TV or FM antenna systems from 300Ω twin-lead to 75Ω shielded

coaxial cable, is announced. Matching transformer kit model No. 7512-AB, lists at $8.95 and includes both indoor and outdoor matching transformer baluns, weather boot and mounting hardware. Finney.

AM/FM Stereo Receiver 702

Announced is an AM/FM stereo receiver, which uses silicon transistors exclusively. The receiver is rated at 130w music power at 4Ω and 100w at 8Ω with only 0.3% total harmonic



distortion, the announcement said. IM distortion below 10w is specified at 0.1%. The receiver also features noise-gated FM/STEREO/MONOPHONIC switching, instant indicator-light identification of FM stereo programing, a professional-type zero-center FM tuning meter, a front panel stereo headphone jack, and rocker switches for tape monitor, noise filter. Sherwood.

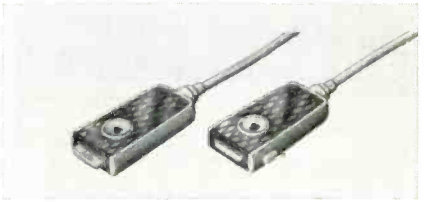
Music/Paging System 703

A background music/paging system, said to be easy-to-install and

operate, is announced. The amplifier permits convenient adjustment of background music and paging volume level separately. Complete unit includes an all-transistor amplifier, two speakers, and a paging microphone. Any music source—tape recorder, phonograph, FM or AM tuner or radio—can be used with the system, the announcement said. Perma-Power.

Pendant Cord Switches 704

Two series of switches are introduced for remote control of projectors, cameras and a variety of industrial instruments plus direct manual control of audio and control equipment such as intercoms, radios, Hi Fi systems and other audible and visual signaling and control equipment. The series 42000 top-operated pushbutton switch has four switching actions to choose from: non-locking, locking, push-to-lock/push-to-release and locking with remote electrical release. An



internally contained solenoid assembly in the latter switching action is of value for equipment applications where an automatic cutoff is desired or when more than one switch-control operating position is desired. The series 42000E edge-operated pushbutton switch offers locking and nonlocking switching actions and a choice of illuminated and non-illuminated pushbuttons. Internal construction and choice of contact styles and contract materials are the same as for the series 42000. Switchcraft.

Soldering Iron Stand 705

A soldering iron stand is introduced for miniature irons. The stand features a gravity-controlled receptacle which opens and closes automatically to safeguard against accidental burns and contribute efficiency to production soldering. The operator can lay the iron on the stand without looking up from his work. He removes the iron fram the stand by lifting straight up.

The stand is made of cadmium plated heavy-gage steel and may be permanently mounted on the workbench. Weight 8 oz. American Beauty.

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NEW PRODUCTS

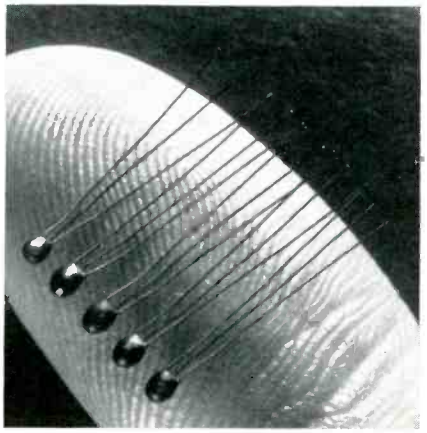
Paperback Bookrack 706

A bookrack that holds between one and thirty paperbacks, is introduced. It can be turned around to become a full sized bookrack or handle 45rpm

records or tapes. Adjustable, self locking bookends fold flat when not in use. The bookrack has a brass plated finish with non-marring legs. Price $1.49. C E L Products.

Miniature Amplifiers 707

Microminiature plastic-encapsulated transistors are components in the silicon "microtab" line of high-gain, low-noise amplifiers. The new amplifiers are designed for use in hearing aids, in-



strumentation, hybrid circuits, linear and analog circuits, miniature operational amplifiers, or any other application where small size is important. The amplifiers are color coded for type number and lead configuration. Package size is 0.07 x 0.07 x 0.085in. G-E.

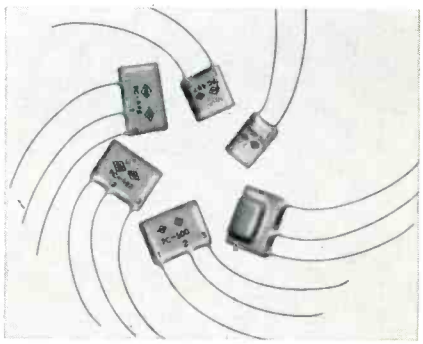
FM Receiver 708

A 36 transistor combination tone alerting and monitoring FM receiver

is announced. As an FM alerting receiver, the unit remains on silent standby until activated by a tone signal transmitted from headquarters. It can then receive voice messages at full sensitivity. The receiver is offered in the low (30 — 50MHz) or high (150 — 174MHz) bands with other frequencies available on special order. A number of optional features are available. Viking Inst.

Integrated Circuits 709

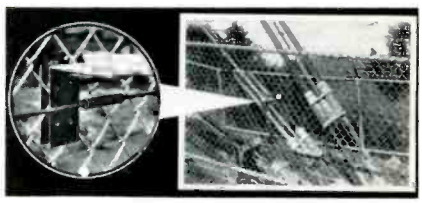
Ten replacement integrated circuits for television receivers are an-



nounced. They consist of three terminal retrace suppression networks containing two resistors and two capacitors of various values and combinations; four terminal sound IF networks containing three resistors and two capacitors; and two to five terminal networks for sync coupling and take-off. Centralab.

Fence Alarm System 710

Introduced is a perimeter chain-link fence alarm system designed to pinpoint any attempted intrusion. It is said that at the control center, an instant audio or visual check can tar-



get the exact trouble spot within 10ft regardless of whether the protected fencing is 10ft or 10 miles long. A sensing unit is placed between each fence post. Radac Eng.

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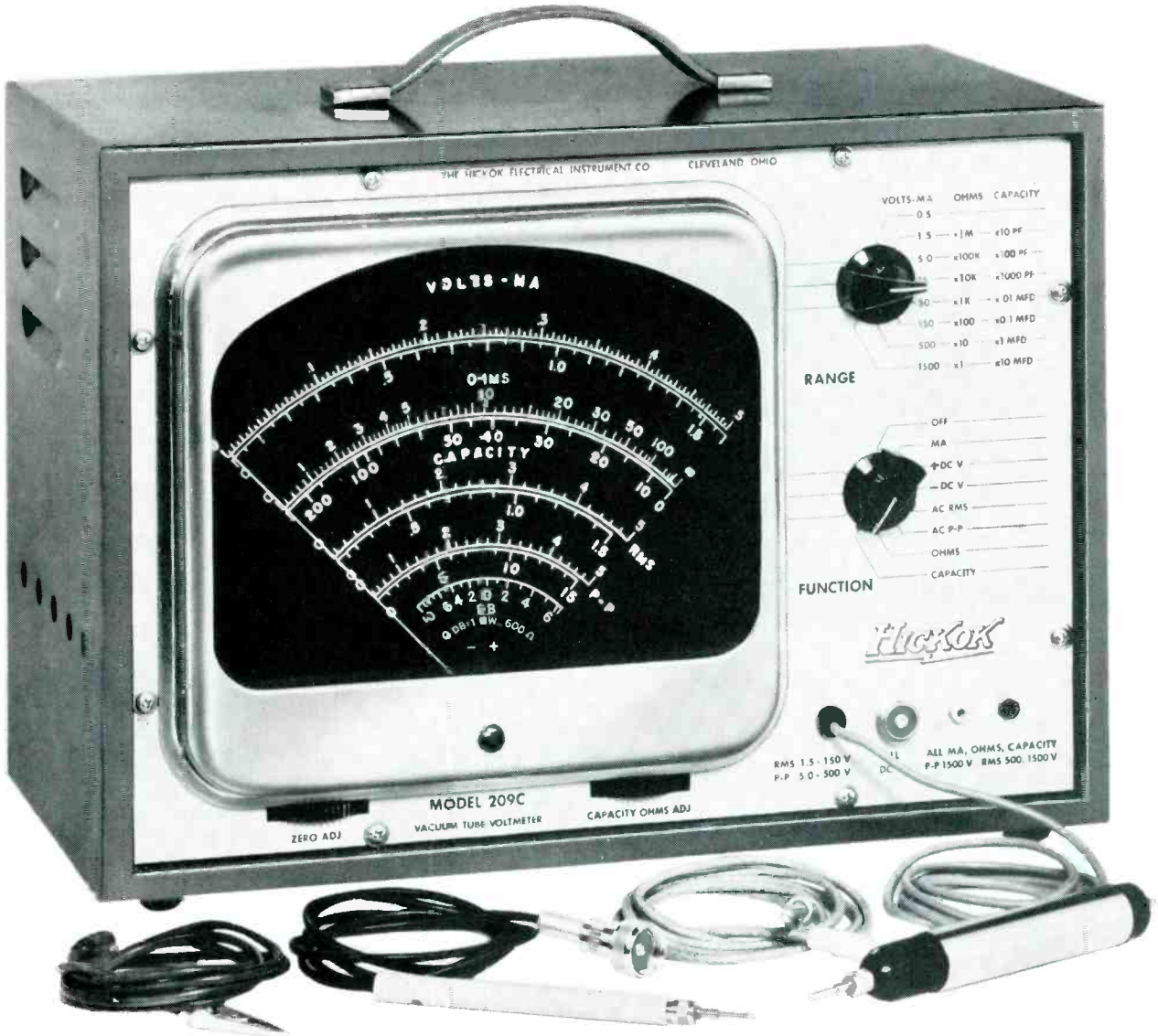

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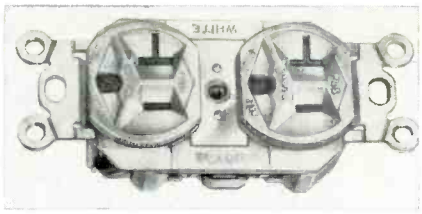
NEW PRODUCTS

Grounding Outlet 711

A 3-wire, 20a, grounding receptacle for heavy duty installations in dust and moisture problem areas is introduced. Fabric reinforced "Neoprene" gaskets in the receptacle are said to provide positive closure and a wiping action on the blades to prevent penetration by dust or moisture. A cellular "neoprene" mat installed under the wall plate is designed to seal the



unit from hazardous penetrating elements. Phosphor-bronze, steel-reinforced contacts are enclosed in individual recesses. The contacts are a double-grip type designed for 8 lb pull without detent. This device is not recommended for installation in unprotected outdoor areas. Pass and Seymour.

Business Dispatcher 712

A 450MHz two-way FM mobile radio with completely transistorized exciter, receiver, and power supply is introduced. Only three tubes are used in the unit's 15w power stage. Audio

output is 5w with less than 5% distortion. Plug-in channel elements provide one through four channels. The tone-coded squelch option reduces the possibility of hearing other systems that share a channel. The radio is also designed for easy field conversion to split-channel operation when such changes are required. Motorola.

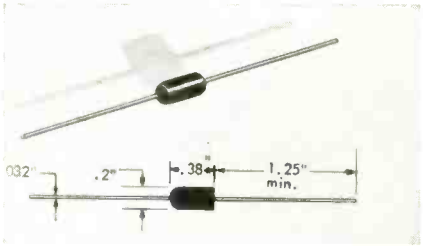
Two-Way Radio 713

A high-band mobile two-way radio with solid-state circuitry is introduced. It is designed to reject off-channel frequency interference by 80db with a sensitivity of .35μv, stability of $\pm 5 \times 10^{-6}$ parts and an internal FM noise factor of −75db. To prevent

possible lock-up of the radio channel, a time-out-timer automatically limits any transmission to one minute before cutting off transmitter power and sounding an alerting tone in the unit's speaker. At 30w of output RF power the battery drain is 8.7a. Motorola.

Silicon Rectifier 714

A molded axial lead rectifier with a peak inverse rating of 6000v and a



forward current of 150ma, in a ⅜in. length and 0.2in. diameter is announced. Price $2.80. Electronic Devices.

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NEWS OF THE INDUSTRY

Closed-Circuit Intercontinental Stockholders Meeting

A communications satellite linked stockholders and corporate executives on two continents during their annual meeting via closed-circuit TV. Warner-Lambert Pharmaceutical Co.'s president, Alfred E. Driscoll, conducted the New York end of the transmission and Mr. Robert Gleckner, vice president of Warner-Lambert International, was the principal spokesman on the London end. The live video and audio transmission allowed questions and answers from stockholders and executives. It was produced and coordinated by TNT International, a Div. of Theatre Network Television, Inc.

The origination point in London was the BBC Broadcasting House where corporate executives from England, France, Germany and Italy gathered to deliver brief reports on Warner-Lambert activities in their various countries.

At the New York Statler Hilton Hotel, a projection system focused the picture from London on a large screen enabling everyone to see the overseas executives.

The video coverage was provided by linking the BBC Studio to the Goonhilly earth station by land line, transmitted up to Early Bird and then to the United States earth station at Andover, Maine. From there, land lines carried the signal to the TNT control center in the Statler Hilton. Two-way audio transmission was carried by submarine cable across the Atlantic.

Goodyear Markets Lear Jet Stereo 8 Equipment

The Car and Home Div. of The Goodyear Tire and Rubber Co. has begun marketing Lear Jet Stereo 8 tape cartridge players through dealers. A complete line of auto units and home deck tape cartridge players are offered through regional warehouses servicing stores and franchised dealers across the country. Plans are now being completed for regional and district service and installation training sessions on the equipment. Service personnel in both companies will coordinate the training sessions. As the 1967 model cars are introduced, Stereo 8 tape players will be heavily promoted by car manufacturers. They felt that the rapidly increasing promotional activity on Stereo 8 should create a booming sales opportunity for dealers.

Listen!

Jensen rear-seat speaker kits sound great—sell easy!

Jensen rear-seat/rear-deck speaker kits will let you grab a bigger share of the 10 million car market.

Jensen performance extras like whizzer cones, heavy duty magnets and oversize air-gap clearances, plus solid domes and dust drain holes help reduce call backs.

Installation—it's a cinch! Jensen's new *solderless* universal connectors install faster and easier than any other kit, fit all car makes, too. Each kit includes speaker, grille, cable, fader control with annodized aluminum escutcheon mounting bracket, mounting hardware and simple instructions.

Nine models in Deluxe and Standard kits are attractively displayed on rugged plastic see-through packs to help you earn more profits. Kits also available individually boxed. Deluxe grille and harness kits are also available in see-through pack. Ask your Jensen representative about them. Or write Jensen Manufacturing Division, The Muter Company, 6601 S. Laramie Ave., Chicago, Illinois 60638

Jensen

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NEWS OF THE INDUSTRY

TV, Home Radio, Phono Sales Show Increases in February

Distributor sales of television sets, home radios and phonographs showed increases in February as compared to February 1965, Electronic Industries Assn.'s (EIA) marketing services dept. reported.

Total sales of TV receivers in February reached 891,248, an increase of 14.6 per cent over 777,998 in February 1965, and up 1.0 percent from the 882,142 total for the previous month of January 1966. Total TV sales for the first two months reached 1,773,390, up 14.0 percent from 1,555,701 in the same two months of 1965.

Of total TV sales in February, monochrome sets accounted for 589,186, down 3.3 percent from 609,538 in February, 1965, and down 9.5 percent from 650,904 for the previous month of January 1966. Monochrome TV sales for January-February combined were 1,240,090, a drop of 0.1 percent from the 1,241,547 in the same two months of 1965.

Accounting for the increase in total sales of TV sets was the rise in color TV set sales which reached 302,062 in February, up 79.3 percent from 168,460 in February 1965, and up 30.6 percent from 231,238 in the previous month of January 1966. The cumulative total of color TV sets sold in January-February reached 533,300, an increase of 69.8 percent from 314,154 in the same period of 1965.

Distributor sales of home radios in February totaled 1,103,561 units, up 23.7 percent from 891,017 in February 1965 and up 32.7 percent from 831,350 in the previous month of January 1966. Sales of home radios for the first two months of 1966 totaled 1,934,911, up 22.1 percent from the 1,585,022 total for January-February 1965.

Of the home radio total, FM radios accounted for 329,319 units in February, up 66.4 percent from 197,905 in February 1965 and up 61.9 percent from 203,430 the previous month. FM sales in January-February 1966 totaled 532,749, a rise of 55.2 percent from the 343,258 units for the same period of 1965.

Sales of automobile radios in February totaled 786,602, a drop of 1.5 percent from 798,834 in February 1965, but up 5.4 percent from 746,152 in the previous month of January 1966. January-February auto radio sales totaled 1,532,754, down 3.0 percent from 1,579,415 units in the comparable period of 1965.

Total phonograph sales reached 415,841 in February, an increase of 7.9 percent from 385,512 in February 1965 and up 17.9 percent from 352,835 in the previous month of January. Total phonograph sales in January-February reached 768,676, an increase of 10.7 percent from 694,136 in the months of January and February 1965.

Of the total phono sales portable/table models accounted for 248,358 in February, down 8.9 percent from 272,533 in February 1965 but up 26.3 percent from 196,584 units the precious month of January. Portable/table models in January-February totaled 444,942, down 4.1 percent from 463,851 in the corresponding period of 1965.

Console phonograph sales in February totaled 167,483, an increase of 48.2 percent from 156,251 in the previous month of January 1966. January-February sales of consoles totaled 323,734, an increase of 40.6 percent from the 230,285 total for the first two months of 1965.

Daryl H. Rutherford Appointed District Sales Manager

Daryl H. Rutherford has been named district sales manager in Hollywood, Calif., for Motorola Semiconductor Products. In his new position, Mr. Rutherford is responsibile for the sale of semiconductor components in the Los Angeles area.

Prior to joining the company, Mr. Rutherford was a sales engineer for the Semiconductor Div. of Hughes Microelectronics. Previously he was a project engineer for AC Spark Plug. He has more than a decade of experience in the field of electronics.

Acoustic Products Moves

The Acoustic Products Div. of The Telex Corp. will move into a major new manufacturing facility in Glencoe, Minn., on Aug. 1, 1966.

Construction of the 36,000 sq ft plant has already begun. It is situated on a 4½-acre site southwest of the city and provides space for doubling the facilities there. The Co. will lease from Glencoe Development Co., a non-profit, civic organization devoted to the area's industrial and economic growth. The structure will include complete air-conditioning and heating, dust and humidity controlled atmosphere, and high intensity lighting for assembly. It will contain equipment for high speed coil-winding, molding and toolmaking.

Random House, Inc.

One of the nation's leading book publishing companies, Random House, Inc., is now a wholly-owned subsidiary of RCA. The merger was effected through the exchange of 0.62 share of RCA common stock for each outstanding share of Random House common stock.

The publishing Co. will continue to function as a separate entity with complete editorial autonomy in the hands of its own board of directors. No changes are contemplated in the publisher's present personnel and management.

Philco Distributors Set Sales Records

During a recent convention held in Philadelphia orders from Philco distributors for its 1967 consumer electronics line and certain appliance models set an all-time company record. Orders taken were 50 percent greater than the next best convention in the company's history. Color television sales accounted for much of the increase but there was also a strong showing in black-and-white television sales.

RMS Boosts Antenna Volume

The nation-wide upsurge in outdoor antenna sales to meet the growing market for color TV and UHF has resulted in a record-breaking year for RMS Electronics, it is announced by Sidney Pariser, president. "With color TV here," Mr. Pariser said, "more antennas are being sold than in the past two years."

Sylvania's Grant Program

Outstanding administration and technical personnel of Sylvania Electronics Systems will study at a college or university of their choice for one year under a company Fellowship Grant Program.

Hiring Engineer Costs $3500

Arnold Reilly, personnel director of Genge Industries, Inc., a technical support service for government and industry, reports that hiring engineers now costs corporations about $3500 each.

In return for this high acquisition expense, employers are seeking prospects with higher degrees, enthusiasm, teamwork spirit, a high level of loyalty, lots of drive and the desire to stay with one company for a long period of time.

Mr. Reilly indicates engineers and scientists are interested in more than pay, security and future. They want work that provides a sense of fulfillment and a feeling of gratification. Present skilled technicians can be choosey and this places the responsibility on the employing firm.

They will be adding at least one hundred technical personnel to their staff next year. To do this, the management goes all out to provide a congenial, stimulating setting. After an appropriate checkup has been made on a prospective employee, the decision is made with a minimum of delay. Frequently, the corporate president will welcome the new employee personally by telephone upon receipt of the report. When an employee receives such a phone call, he realizes his affiliation is very personal and human.

Even before they are ready to hire an employee a considerable effort is made to make the candidate feel wanted. After the first interview, he is accompanied to the job location for the final interview. By the time he comes to work, he feels comfortable with the company.

This humanized personnel policy has been so effective that they have been able to expand swiftly during a time when most corporations are pleading for able engineers.

CATALOGS AND BULLETINS

Alarm Systems 400
A photo-montage showing how ultrasonic equipment—transmitters, monitors, master control units, batteries and battery chargers, local control instruments and receivers—are connected in ultrasonic alarm systems is contained in this 4-page brochure. Walter Kidde.

Transformers 401
This 40-page catalog gives technical data and specifications of a complete line of over 1500 standard transformer types, including commercial, military and TV-radio replacements. A numerical part number index and price schedule have been included to simplify selection. Stancor.

Tools 402
A comprehensive line of specialized tools for microelectronics work is described in this 12-page catalog. Hammel, Riglander.

Shrinkable Tubing 403
A short form heat shrinkable tubing catalog, with complete specifications and application information on three tubing products, is available. Alpha.

Phono Cartridge 404
This 21-page booklet details specifications of a small semi-conductor phono cartridge, performance checks and application notes. Sonotone.

Test Instruments 405
This 4-page short-form catalog describes a line of commercial and lab-type signal generators, FM deviation meters, bridges and "Q" meters, voltmeters, AM/FM/SSB receivers, etc. Marconi.

Test Instruments 406
A 4-page brochure describes the "Econoline" group of test instruments designed for color and FM/stereo servicing. Sencore.

Silicon Rectifiers 407
A 14-page silicon rectifier replacement and selection guide, includes data on case dimensions, molded assemblies, and other silicon rectifier information. Motorola.

Selective Call System 408
This 6-page brochure describes a line of two-way communications encoders, decoders and details equipment specifications and operation. Ledex.

AUTO RADIOS . . .

continued from page 56

the head has been replaced. A regular test tape is used for azimuth and height adjustments.

If slow motor or tape speed is encountered in Motorola tape-players, check the cartridge first, by substitution. Make certain the tape head, capstan, outer edge of flywheel and motor drive shaft are cleaned with isoprophyl alcohol. Check the rubber pressure roller inside the cartridge to make sure it is clean, rotates freely and does not have flat spots. The drive belt should be replaced if it has become stretched, is not 0.015 to 0.020 in. thick or has become banana shaped. The belt should be installed with the rough surface of the belt against the motor shaft and flywheel. Belts having one or more stripes should be installed with the stripe or stripes outside.

Make sure spring and roller has enough tension to detent cartridge properly; that is, with the cartridge inserted, no end play should be present on the right side of the cartridge. If more spring tension is necessary, add the spring clip (part number 41A40656B01) as shown in Fig. 6. The clip is not necessary on spring and rollers having two mounting rivets.

RUMBLE . . .

continued from page 49

feedback was more of a problem because the air feedback is much less noticeable than through-the-cabinet feedback."

"How do you tell if it's coming through the cabinet or through the air, Bob?"

"It's usually fairly simple. Through-the-air feedback will generally be lessened when the cabinet lid is closed. But if closing the lid makes it better or worse don't stop there. Sometimes the lid acts as a sounding board and increases the energy to the record. This can be checked out by simply placing a hand on the lid to deaden it.

"I never realized records were that sensitive to sound."

"They sure are, Scoot. In fact, you can demonstrate it by turning the stereo on and, with the tone arm on the record, turn the changer switch off. This way the cartridge will be ready to reproduce but the record won't turn. If you snap your fingers over the record, you'll hear the sound from the speakers just like the record-cartridge was a microphone.

"I'll have to admit this 'air feedback' symptom is rarely a problem, though. In fact, probably the only time you'll ever see it is when some one is using a warped record. A warped record causes the symptom to be much more pronounced."

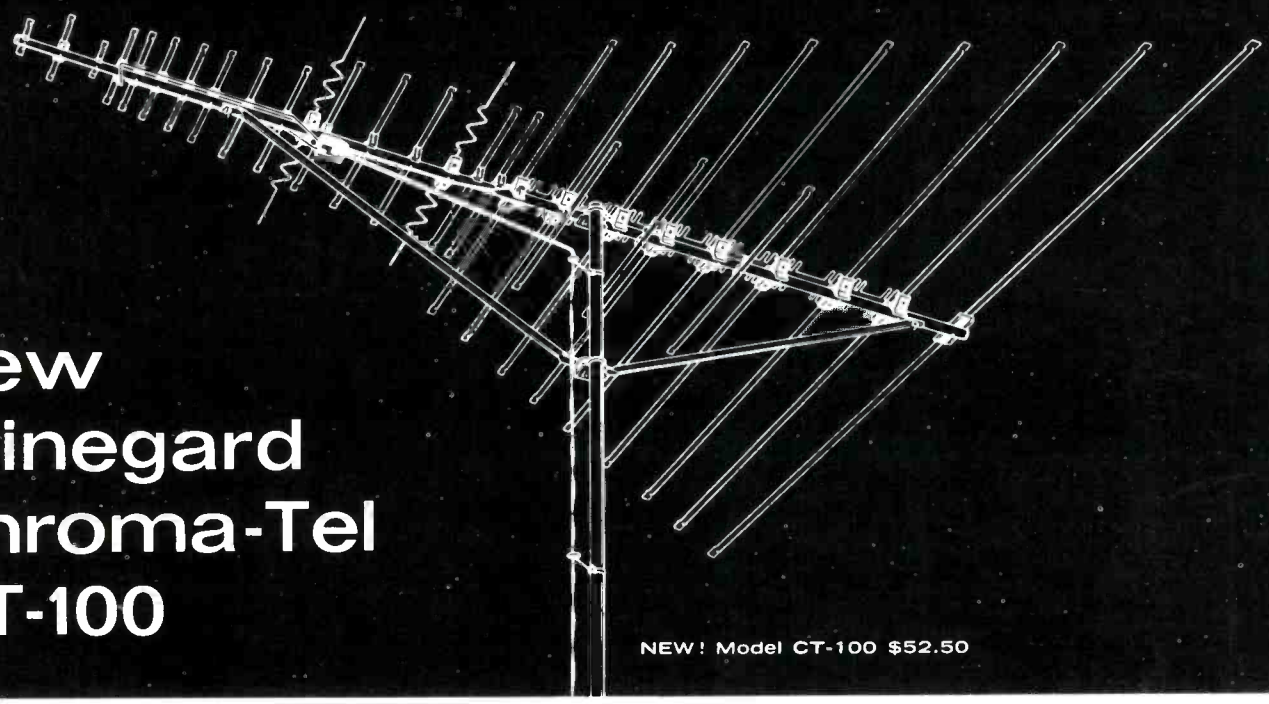
"Well, I'll be darned. Hey, now that we're on the stereo stuff, maybe you can tell me something about hum in this transistor equipment—I didn't think it was supposed to have any hum and I've been running into all kinds."

"Not now, Scoot. I've got an appointment with the distributor. He wants me to take on their new TV line.

"Let's take up this hum problem tomorrow. And right now there's an RF interference problem in the shop I want you to tackle." ■

ADVERTISERS INDEX

First UHF/VHF/FM 2-83 antenna that really works in fringe areas



New Winegard Chroma-Tel CT-100

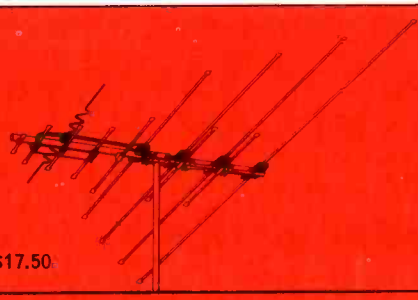
NEW! Model CT-100 $52.50

Wingard's sensational new CT-100 Chroma-Tel has 29 elements in all. And they're all working to provide the finest all-band reception (UHF-VHF-FM) even in difficult fringe areas.

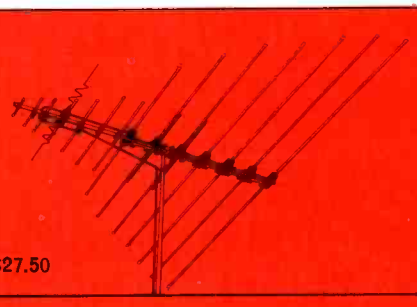
In addition to those 29 elements, the CT-100 incorporates a unique matching network that guarantees maximum signal transfer to the downlead—and on all channels 2-83 plus FM. Gives sharpest color and black & white reception.

And like all Chroma-Tels, it has Winegard's exclusive Chroma-Lens Director System (intermixes both VHF and UHF directors on the same linear plane without sacrificing performance) . . . and our Impedance Correlators (special phasing wires that automatically increase the impedance of Chroma-Tel's elements to 300 ohms).

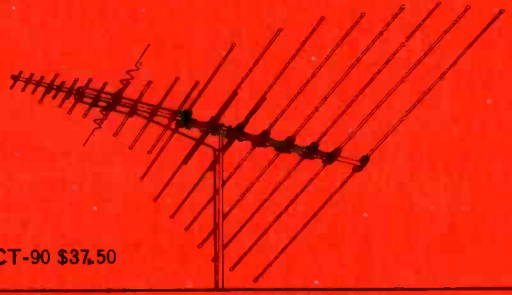
That's Winegard's new CT-100 Chroma-Tel. Bigger and better. But not too big. The full-line of Winegard Chroma-Tels still offers half the bulk; half the wind loading; half the truck space; and half the weight of all other all-band antennas—and at much lower prices. No wonder Winegard Chroma-Tels (now 4 models) are the hottest performing, hottest selling all-band antennas on the market! Better call your Winegard distributor or write for Chroma-Tel Fact Finder 242.



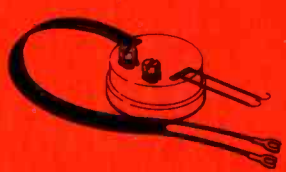
Model CT-40 $17.50



Model CT-80 $27.50



Model CT-90 $37.50



FREE!

Every Winegard Chroma-Tel, including the new CT-100, comes complete with free CS-283 UHF-VHF Signal Splitter. Hangs behind set and separates UHF and VHF signals coming from antenna to the two pairs of set terminals.

Winegard ANTENNA SYSTEMS Winegard Co. • 3000 Kirkwood • Burlington, Iowa 52602

. . . for more details circle 131 on postcard

Are you ready for today's color?

RCA offers you a replacement color picture tube that meets OEM specs

RCA Hi-Lite picture tubes are all-new... glass, gun, the works! They're RCA's best... the same quality... the same tubes... that go into original equipment sets. And because they incorporate the latest technological advances of the world's largest color picture tube manufacturer, you literally "up-date" your customer's color set each time you install one. Here is picture brightness and color fidelity at its finest, available for the service trade in 19-inch and 25-inch rectangular and 21-inch round tube types.

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

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