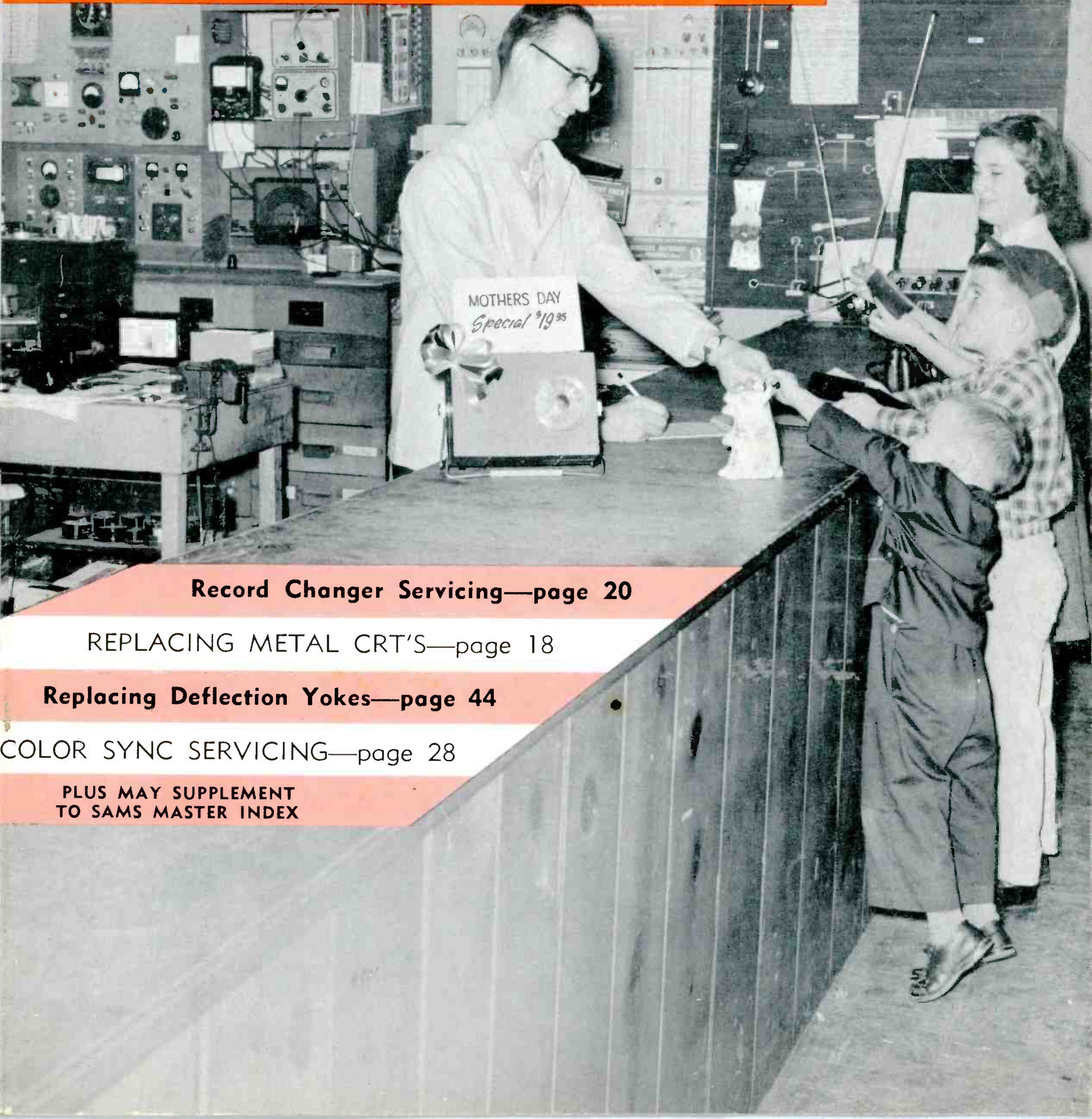
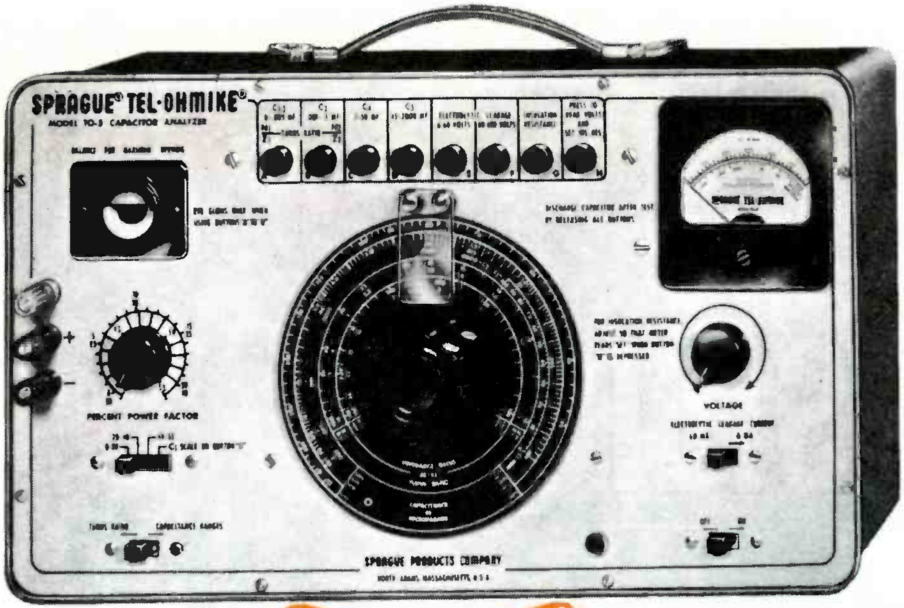
MAY • 1958 25 CENTS

PF REPORTER

PHOTOFACT

FOR THE ELECTRONIC SERVICE INDUSTRY

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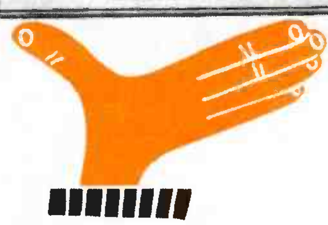

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next month

PHONO CARTRIDGE REPLACEMENTS

You need to know more than how to remove a couple of screws and unsolder some leads if you want to be a *real* technician. This article discusses the various factors to be considered if a replacement cartridge is to operate satisfactorily.

WALK-IN SALES ITEMS FOR THE SERVICE SHOP

Although service is the mainstay of your business, over-the-counter purchases of such commodities as batteries, phono needles, antenna kits, etc. can put many dollars in your pocket, particularly during the summer months. This picture story will help you to formulate your plans.

BENCH NOTES

A new bi-monthly column by an author well seasoned in the practical servicing of TV. For the first of this series, we've chosen "Current Capers," a couple of case histories which seem to defy Ohm's law until our expert gives you his analysis.

VOLUME 8, No. 5 MAY, 1958

PF REPORTER

FOR THE ELECTRONIC SERVICE INDUSTRY

CONTENTS

SUBJECT REFERENCE INDEX

Letters to the EDITOR

Dear Editor:

A 21FP4, the original picture tube in a Motorola Model 21K4W, shows a brown strip about one inch wide completely across the very bottom of the faceplate. This discoloration is internal and looks similar to an ion burn, but is not as dense as a typical ion burn. It looks more as if it had been painted on with a weak water color.

FRED K. NELSON

Cheviot, Ohio

You might get some customers to believe that it's just mud tracked in by the characters in all those Western shows. But from a technical viewpoint, it appears to us that the receiver must have been operated for an extended period with a slight vertical foldover at the bottom of the picture. This would have kept the strip of phosphor along the bottom at a relatively high brightness level, thus shortening its life.—Ed.

Dear Editor:

In regard to "Let's Talk Business" in the February issue, let's not forget that TV business is plain *rough* and overcomes quite a few *men* each year. Women are very capable and dependable in their woman's world, but seldom in a man's. A woman in the TV business is like a man at a typewriter—passable, but seldom if ever really good. I don't know of any shop that can make a living in the TV business if it is just passable.

BILL HENDRIX

South San Francisco, Calif.

Remembering the men's shoes that were filled by women during World War II, and also knowing several who are successful in business today, we're inclined to disagree. It's all a matter of personal opinion, however, in your case, why not train a man to take over.—Ed.

Dear Editor:

Why not leave an area on each month's cover where the reader can write in notes—for example, indexing data on articles of special interest? This clear area should be of such a color that the notes are legible, and it should be in the same place on the cover every month.

E. J. FLURE

Alton, Ill.

Why not just glue a piece of white paper on the cover? Other readers may prefer to use the Contents page.—Ed.

They're New... Smart... Attract Customers.
TV-RADIO SERVICE
tubes
JOHN J. JONES
TV-RADIO SERVICE
tubes
YOUR MESSAGE HERE
TV-RADIO SERVICE
tubes
Electronic tube
TV RADIO SERVICE
A. ILLUMINATED SIGN-A-RAMA. Visible for blocks. Brightly lit with six flashing lamps. Double-faced, large—48" by 24"—gives top identification to your store or shop. Mounting hardware is included.
B. ILLUMINATED SPECIAL-MESSAGE SIGN. Carries your name, or tells any brief message you select. Ideal for windows or interiors. 37" by 14". Uses two 30-watt bulbs. Kit of letters and numerals is included.
C. DISPLAY BACKDROP. Arrange this handy back-up display to meet your advertising needs. Material is flexible, can be curved or will mount flat. For window trim, walls, or counter fronts. Two 36" x 24" designs per strip.
D. GIANT TUBE CARTON. Eye-arresting... indicates the quality components you install and sell.
E. DOOR, WINDOW DECAL. Neat, attractive, new dry-apply type. 12" diameter.

..GENERAL ELECTRIC'S COLOR-KEYED SHOP SIGNS!

Color-keyed to the G-E tube carton—symbol of quality!

Here is your chance to give your shop-front and windows eye-appeal with "sell". Colors of all eleven new General Electric signs and displays match handsomely the famous G-E tube carton. Quality appearance is keyed to high quality of product—a message every passerby is sure to read.

Attractive and modern, General Electric's color-keyed signs and displays also stand for leadership. They identify your shop as a source for television repairwork done to professional standards, backed by up-to-the-minute facilities.

All your display needs are met by smart new G-E designs — from an eye-catching, easy-to-apply door or window decal, to metal and illuminated outdoor and indoor signs... plus colorful utility items like the electric clock and thermometer.

These brand-new signs and displays are waiting for you *now* at your General Electric tube distributor's. Ask him how to obtain them! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

◀ **SERVICE CLOTHING**, smartly styled, also is available. Garments are color-keyed to new G-E signs and displays—give that professional look. Durable, launder easily.

◀ **SERVICE CASES** in three useful sizes—small, medium, and large—match color-theme of General Electric displays. Now you can carry with you neatly, compactly, everything you need for making home service calls!

Progress Is Our Most Important Product

GENERAL ELECTRIC

11-11-102

METAL FLANGE SIGN. A display workhorse. Double-faced. Mount it anywhere! Compact—15" by 12"—handy for building corners, delivery entrances, and other side locations.

COUNTER-WALL-WINDOW SIGN. Illuminated. Use it anywhere in your shop! Wrap-around cover has the attractive display on both sides. 15" by 11½" by 5".

OUTDOOR-INDOOR THERMOMETER. Tells temperature accurately. Every viewer will see your advertising message. Replaceable front. 12" diameter.

ILLUMINATED CLOCK, electric. Both useful and advertises your business. Easily read—16" diameter—with long-life bulbs. Hang on a wall, or mount on a counter (easel is provided).

HANGING METAL SIGN. For shop front or service entrance. Message both sides, plus your nameplate. Large—48" by 36"—easily seen. Hanging hardware is included; lights are available.

METAL TACK-ON SIGN. Narrow, smart dimensions — 14" by 42". Fasten against building, or mount as a free-standing display.

Letters

(Continued from page 4)

Dear Editor:

I found the article *Do-it-Yourselfers are Soldering Now* in your March issue very interesting and true-to-life. My experiences along these lines have been similar. I would like, however, to get an idea of how others charge for this type of work.

My policy has been to "average out" bench charges, using a more or less fixed price regardless of whether it is a "quickie" or a "toughie." What should you do when you spend hours or even days to solve what is not really a TV problem, but a "people" problem?

MURRAY SCHOEN

Murray's TV
Saddle River, N. J.

Our main reason for publishing the article, Murray, was to make technicians aware of the "menace" so that you wouldn't have to spend "hours or days" on the job. If you don't charge for the time, you lose; if you do, the customer may never forgive you. Flat-rate bench charges for any set are used by many TV service shops, which is in contrast with the flat-rate and hourly-rate charges used by others for specific repairs like alignment, tuners, etc. Some shops even use a combination of the three.—Ed.

Dear Editor:

In reading "Letters to the Editor," March, 1958, I noted that two pamphlets on TV Service, "TV Without Tears" and "Safeguard" are available from the Better Business Bureau—but I don't know where to send for them. To whom should I write?

CHARLES C. GRECO

Brant Lake, N. Y.

Dear Editor:

Where do I write to get pamphlets "Safeguard" and "TV Without Tears?" Your answer to James Ivey in the March issue does not give address of the Better Business Bureau.

MIKE SMOLICH

Radio & Television Service
Ramsay, Michigan

Dear Editor:

Please send me "Safeguard" and "TV Without Tears" as mentioned in March "Letters to the Editor."

FRANCIS CUNNINGHAM

Hillside TV & Radio
Holbrook, Mass.

The Better Business Bureau Association has district offices in most major cities, or you can write to the National Better Business Bureau, Chrysler Building, New York 17, N. Y. While you may be able to obtain single copies, the booklets are primarily intended for bulk distribution to your customers.—Ed.

DUMONT POSITIVE QUALITY

40% FEWER CALLBACKS*

A positive fact about
Du Mont Positive Quality . . .

Du Mont Picture Tubes cut callbacks due to tube failure by 40%. Consider what this means to you — fewer callbacks, greater profits.

Ask your distributor about Du Mont Positive Quality Picture Tubes and Electronic Tubes.

● *Send name and address for your free copy of the Du Mont Replacement Tube Chart.*

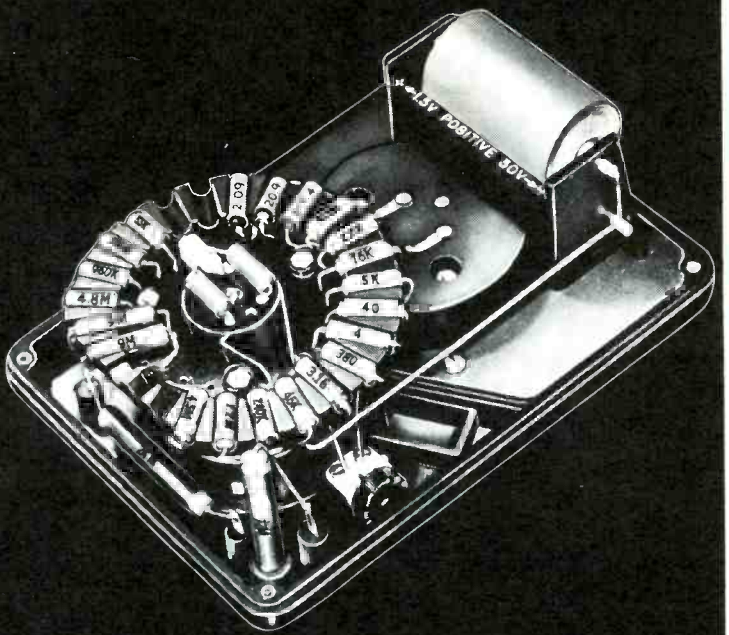
*Based on actual engineering figures.

DUMONT®

Television Tube Division

Allen B. Du Mont Laboratories, Inc., Clifton, N. J.

New Triplett Model 630-PL. $44.50 net.



New Triplett Model 630-APL. $54.50

...the new triplett twins!

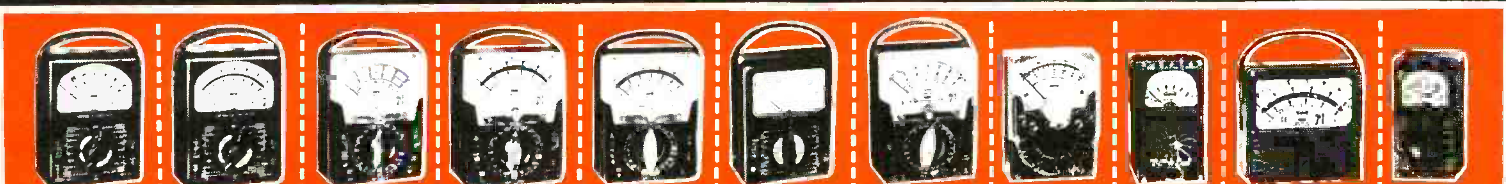
Not one but two most advanced VOMs.

- Most easy to read — clear, unbreakable, shadowless front for instant wide vision.
- 5 to 500,000 cps on A.C.
- Continuous resistance reading from 0.1 ohm to 100 megohms.
- Polarity reversing switch.
- Only one (king sized) switch selects both circuit and range — minimizes wrong settings, burnouts.
- 630 APL — 1½ % accuracy D.C.
- 630 APL — Mirror scale eliminates parallax.

Only Triplett affords you such a wide choice of VOMs. Whatever your application — broad or limited — there is a Triplett VOM particularly suited for it.

TRIPLETT

the mighty nine...plus two



TRIPLETT ELECTRICAL INSTRUMENT COMPANY • BLUFFTON, OHIO

Shop Talk

MILTON S. KIVER

Author of . . .
How to Understand and Use TV Test Instruments and Analyzing and Tracing TV Circuits

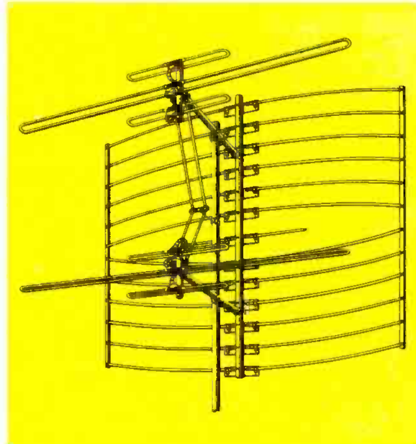


Fig. 3. Clear Beam "Tri-King" stacked array has three dipoles in each section.

Complex, multielement antennas, like complex, multielement circuits, can usually be shown to be combinations of simpler, more familiar configurations. Sometimes the shape of the basic structure is recognizable immediately; at other times, the outlines are quite indistinct and it takes considerable probing before a familiar pattern is uncovered.

One of the difficulties experienced in attempting to design a single all-band array is the breakup of the figure-8 pattern at the high frequencies. Last month, it was shown that a conical antenna partially overcomes this multilobing effect by veering the arms of the array forward, causing some of the side lobes to combine with the main lobe.

To understand some of the other methods which have been employed to overcome this multilobing, let us see how the effect arises in the first place. A half-wave dipole, operated at its resonant frequency, possesses the current distribution shown in Fig. 1. Note that the current rises to a maximum at the center, gradually. tapering off to zero at the ends. The response pattern follows the same distribution, receiving signals best when they arrive broadside and poorest when they approach the antenna from the ends.

If we employ the same antenna at three times its original frequency, however, we find that the current distribution assumes the form shown in Fig. 2. There are now three half-cycles, with the center one 180° out of phase with the other two. The radiational effect of the out-of-phase section works in opposition to the other two sections, with the result that the pattern shown in Fig. 2 is obtained. In place of a single figure-8, we have now a pattern with 6 lobes, all pointing in different directions.

What we have just described happens when a half-wave dipole, cut for the low VHF band, is employed to receive high-band VHF stations. Center frequencies of both bands are roughly in the ratio of 3 to 1. Hence, where we have a half-wave current distribution on the low band, we obtain three half waves on the high band as shown in Fig. 2. If we could somehow reverse the phase of the center current section, then a figure-8 pattern would be obtained for the high frequencies.

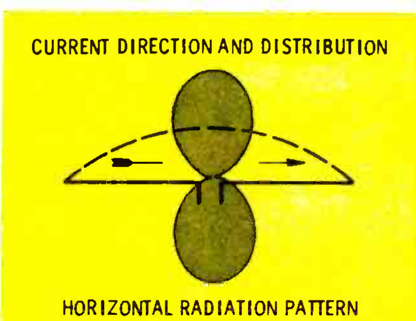


Fig. 1. Half-wave dipole with current distribution and radiational pattern.

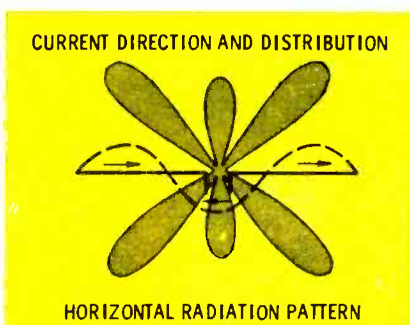


Fig. 2. Dipole response when operated at three times its resonant frequency.

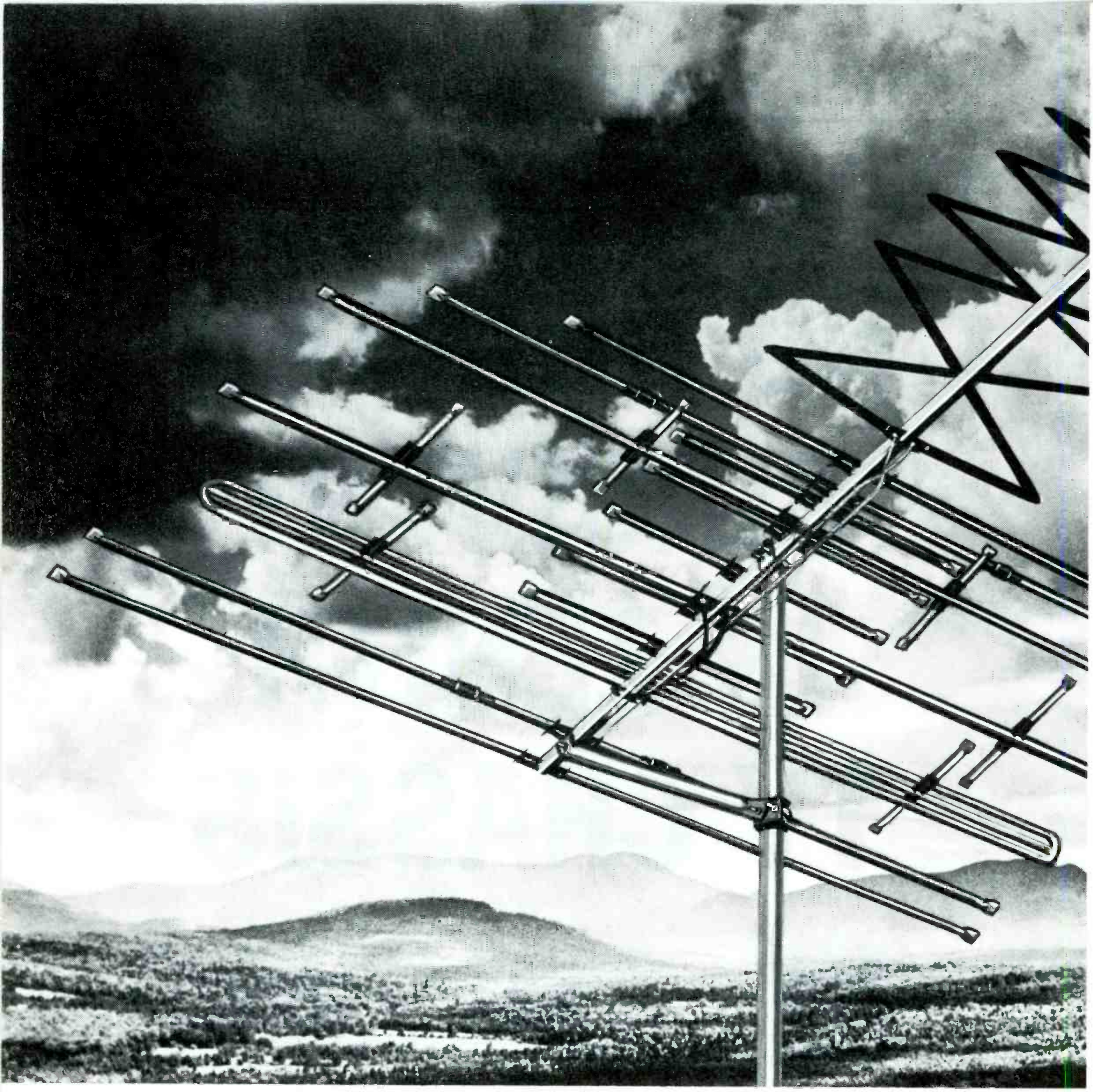
How It's Done

The "Tri-King" array (Fig. 3), being marketed by Clear Beam Antenna Corp., achieves such a reversal in the manner shown in Fig. 4A. Another small dipole, designed for half-wave current distribution, is connected to the large dipole in reverse manner so that the current wave it develops is opposite in phase to the current wave produced by the center section of the large dipole. Because of the close physical proximity of the two units, their fields will cancel. Since this would leave a gap in the response of the large dipole at the high frequencies, another small dipole is added to the combination. (Fig. 4B.)

This second dipole is connected in parallel with the first, so its current distribution possesses the same phase. Now the over-all system possesses three half-wave current sections, all having the same phase and thereby providing a close approximation to a figure-8 response on the high band. Low-band performance is relatively unaffected.

In the final design of this array, all dipoles are of the folded variety, properly interconnected to present a 300-ohm impedance to the transmission line. Two sets of dipoles are stacked for greater gain, and a screen-type reflector is positioned behind the array to kill any response to signals arriving from the rear. The reflector bars are bent to strengthen the screen structurally.

• *Please turn to page 63*



replacing METAL

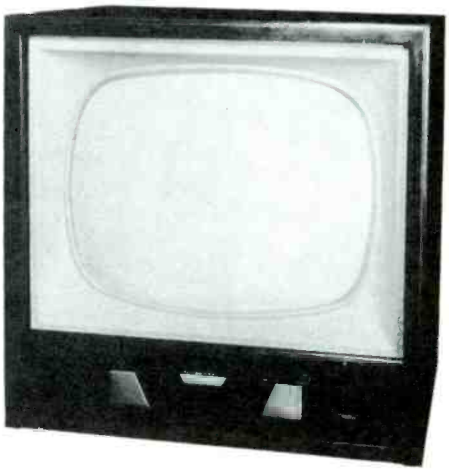
Replacing a metal CRT with one of glass is more practical than you might think. First of all, metal tubes have generally proved to be short-lived and a nuisance to the servicing technician. On service calls, the substitution of tubes with power on is like picking the teeth of a lion who is awake and slightly hungry—you're apt to get bit at any time. Other considerations are the high cost, unavailability, and lack of aluminized screens on metal CRT's. An aluminized glass CRT and a mounting adapter kit such as the one used in this article are very often no more expensive than the metal CRT replacement.

Since it would be impossible to cover considerations for all of the TV receivers that have used metal CRT's, and since sets employing round metal tubes are quite old and should be retired from service, we are presenting a sample installation involving a 21" Arvin. Many other manufacturers have also used 21" metal CRT's.

Metal to Glass Conversion Chart

ORIGINAL TYPE	NEW TYPE	NOTES
17CP4	17BP4A	Aluminized
	17JP4	
17GP4	17FP4-A	
17TP4	17HP4 A/B	
	17KP4	Automatic Focus
	17RP4	
	17HP4/17RP4	
21AP4	21AWP4	
	21WP4	
	21ZP4A/B	
21DP4	21AUP4A/B	Typical Operation Anode = 14KV
21MP4	21AVP4 A/B	Anode = 14KV
	21AYP4	Anode = 16KV
	21ASP4	
	21AFP4	
	21BCP4	Built-in Ion Trap & Focus Magnet
	21BDP4	Internal Ion Trap
	21XP4	16KV
	21YP4	16KV
27AP4	27SP4	Typical Anode = 18KV
27MP4	27GP4	
	27EP4	
	27RP4	
	27NP4	
Always Ground External Coating if Tube Is so Equipped		

In addition to the contour of the face plate, the electrical design of the tube must be considered. In this chart, each metal tube is cross-referenced with glass units which are electrically and physically suitable.

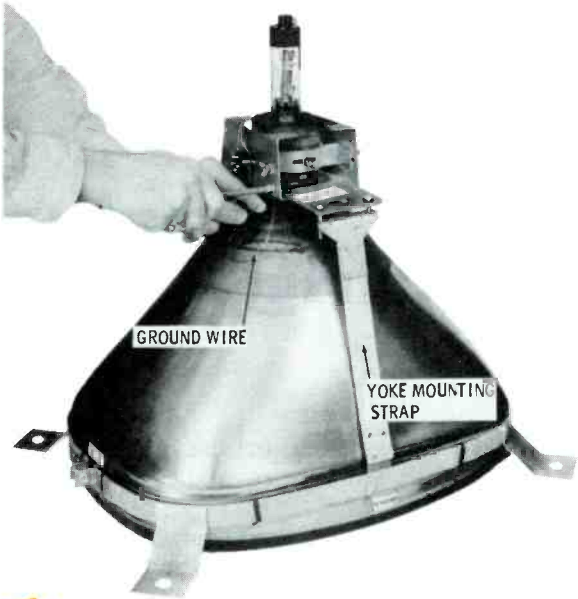


1 **Match Between CRT and Mask.** *One of the first things which must be considered when replacing a metal CRT with one of glass is the match between the mask and the tube face. All rectangular metal tubes have a spherical face shape, so the glass tube selected must also have this shape.*

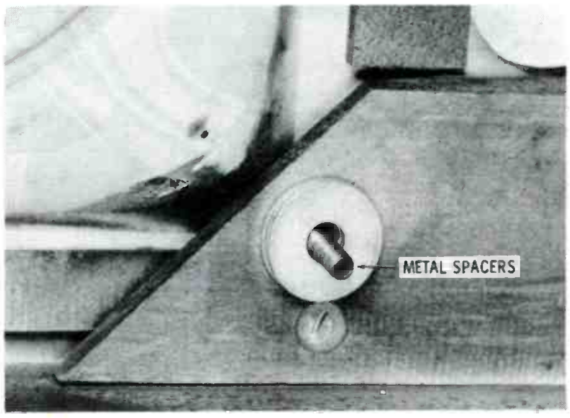
2 **Mask Modifications.** *In many cases, no changes in the mask will be necessary; however, RCA and some other makes use the type of mask shown, requiring that it be modified slightly. These changes are not visible from the front and permit the slightly larger glass bulb to fit snugly in place.*

3 **Mounting Kit in Place.** *Once the proper glass tube has been selected, a mounting adapter kit (the one shown is made by Colman Tool and Machine Co.) is installed on the tube. Some set manufacturers also market kits specifically designed for their particular sets.*

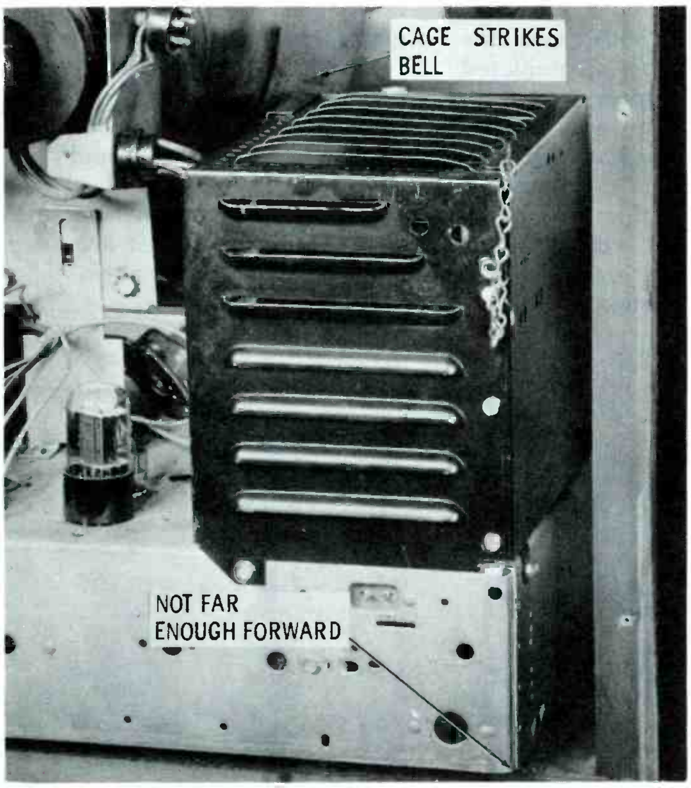
CRT's with GLASS



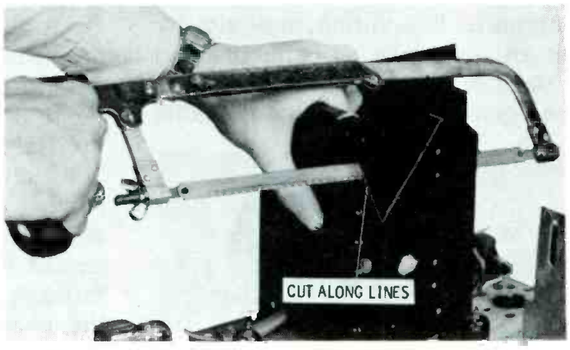
4 **Grounding the Outer Coating.** *The yoke mounting is installed next and the grounding spring, furnished with the kit, is attached. Other necessary mounting hardware is usually supplied, including that for attaching the yoke mounting bracket.*



5 **Mounting Bolt Spacers.** *Spacers are supplied in the kit so that the thicker face of the glass CRT will not exert excessive pressure on the mask when the mounting nuts are installed.*



6 **Chassis Won't Fit.** *Without any changes to the high-voltage cage assembly, this chassis won't go all the way into the cabinet due to the larger size of the glass bulb. Instructions for altering the high-voltage cage were included in the kit.*



7 **Cage Alterations.** *The corner of the cage is removed and the top cover is then bent to cover the opening. This won't be necessary in all cases, but you should check for such unforseen changes before talking conversion with the customer.*

8 **Back Cover.** *After cage modifications are completed, the chassis can be installed and, if necessary, the back cover adapted as shown to provide clearance for the neck (usually 1 to 2" longer) of the glass tube.*

hints on record changer servicing

by Calvin C. Young, Jr.

One of the first problems that arises in the servicing of changers is that of holding or supporting the changer. It must be held level and allow for clearance of all moving parts; in addition, accessibility to all necessary adjustments and points requiring lubrication must be considered. The adjustable phono stand shown in Fig. 1 meets all of these requirements.

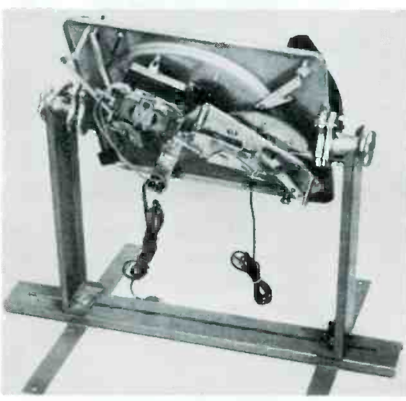


Fig. 1. General Cement phono stand being used to hold changer during servicing.

Another problem is determining which terminals should be used to apply power to the changer motor. Even though electrical diagrams aren't included in changer service data, it is a relatively simple matter to determine the proper hookup. Refer to the drawings in Fig. 2, which are the electrical circuits of the Admiral and V-M units, and note that, in both cases, the circuit to the motor is completed through the AC power switch on the changer. If, for any reason, you aren't sure just which two terminals should be connected to the AC line, connect an ohmmeter between one set of terminals and then another while operating the on-off switch. The right set of terminals will produce a reading of approximately 30 ohms (motor winding resistance) with the switch in the on position, and infinite resistance in the off position.

The next problem is how to make the AC power connections, since the plugs are not all of the same size and type. An AC cord equipped with insulated alligator clips and a dpst switch (Fig. 3) solves this problem nicely. The switch permits the alligator clips to be connected or disconnected without having to unplug the cord.

Let us now consider the extra tools and equipment required in changer servicing. Sets of small wrenches, screwdrivers and cross-slot drivers are required, as is an assortment of cleaners and lubricants. Sizes of the tools are as follows: open-end wrenches—1/4" to 7/16"; screwdrivers—1/8" × 8", 1/8" × 12" and 3/16" × 10"; cross-slot drivers—No. 0, 1 and 2. In the cleaner category, carbon-tet and

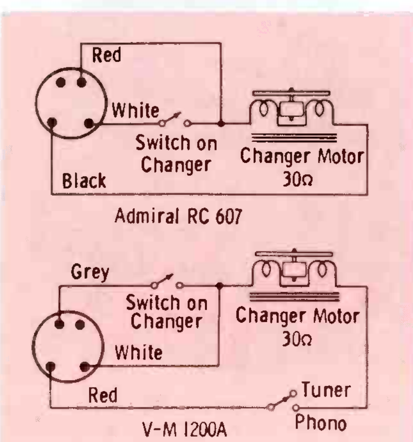


Fig. 2. Electrical circuits of Admiral and V-M changers showing AC connections.

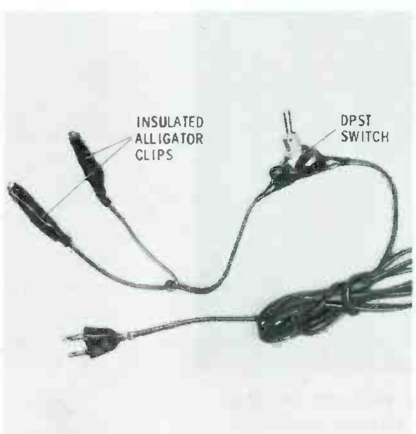


Fig. 3. AC cord with dpst switch and insulated clips for power connection.

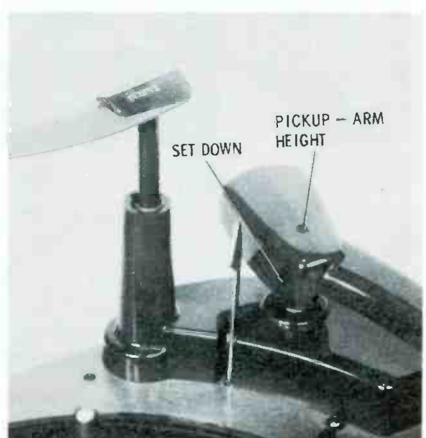


Fig. 4. Set-down and pick-arm height adjustments on Admiral RC 607 changer.

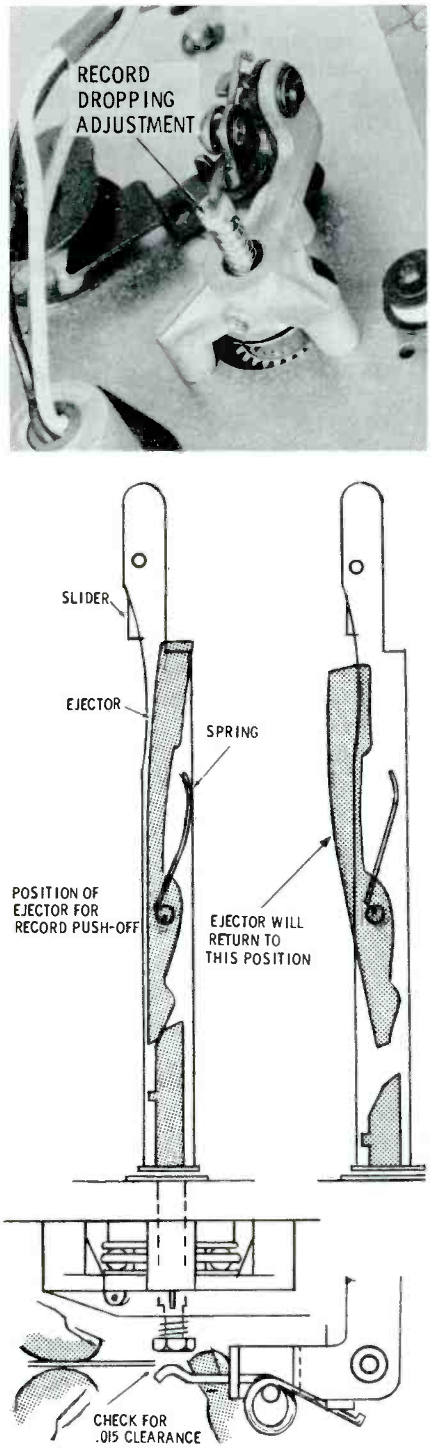


Fig. 5. RC 607 record-dropping adjustment. Drawing outlines setup procedure.

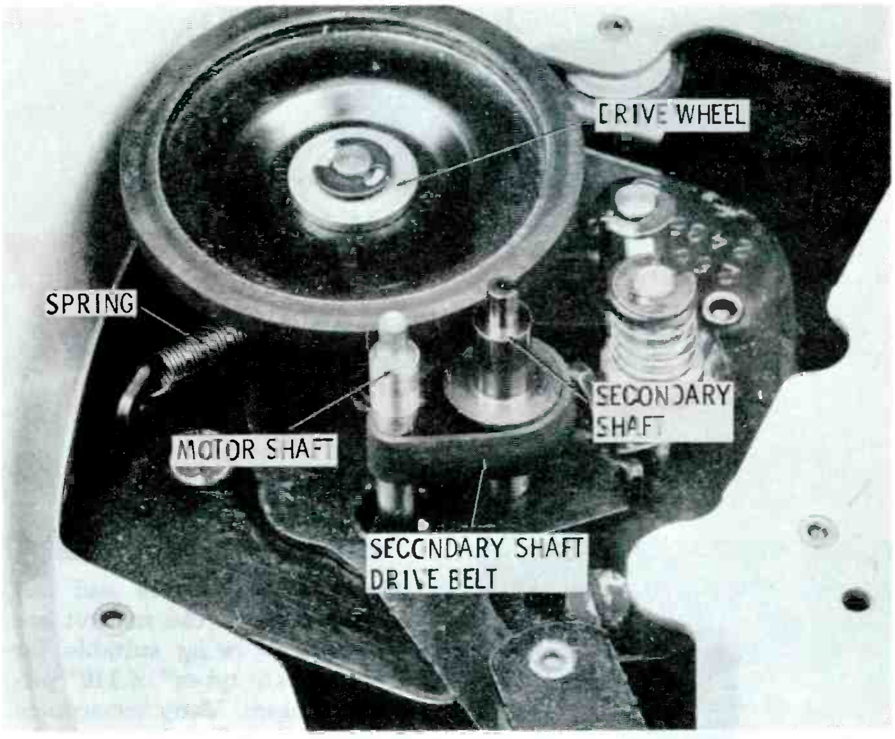


Fig. 6. Drive assembly on RC 607. Both motor and secondary shafts are stepped.

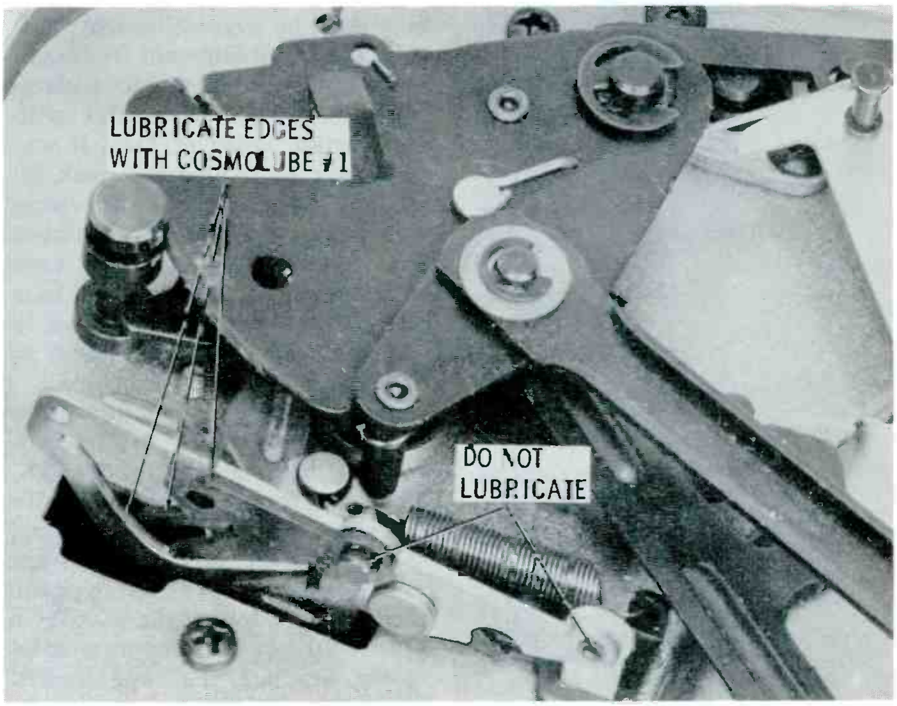


Fig. 7. Set-down index assembly on RC 607 requires no oil on two pivot points.

denatured alcohol are suggested solutions. Light oil (SAE 20), "Lubriplate," and "Cosmolube" No. 1 (Admiral part no. 418A50) will satisfy lubrication requirements.

Other items normally needed for changer servicing are crocus cloth (fine carborundum dust on cloth backing), assorted "C" clips, rubber grommets, and a small brush and pan set for cleaning parts.

Cleaning and Lubrication

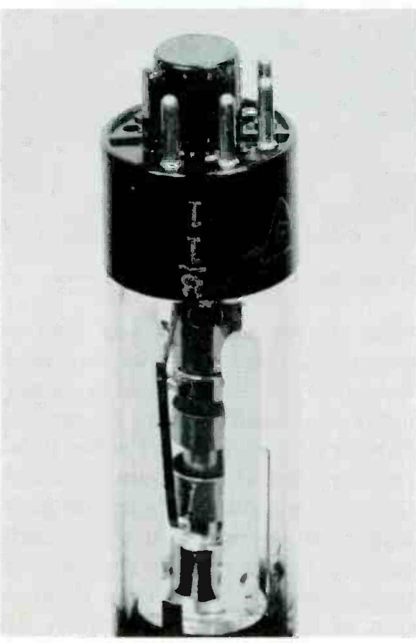
There are two reasons why a changer needs cleaning and relubricating: (1) Dust has contaminated the lubricant, or (2) extended operation causes a varnish to form on the bearing surfaces, or the non-liquid lubricant has hardened on sliding parts. In either event, the first step is to remove the necessary parts and clean the bearing surfaces with carbon-tet or another grease solvent. If the surfaces are free of corrosion, relubricate as required. Be sure all excess oil is wiped away to avoid getting it on the rubber drive wheels or other driving surfaces. If corrosion is found, use crocus cloth to clean the part, soak it in solvent and then lubricate as necessary. In the case of porous bronze bearings, a drop or two of SAE 20 oil is usually all that is required. If any oil should

· *Please turn to page 71*

servicing NEW DESIGNS

by Thomas A. Lesh

(A) Small-button type.



(B) Shell type.

Fig. 1. 110° picture tube bases.

110° Picture Tube Bases

Several CRT testers and test adapters now on the market are advertised as being suitable for use with "both types" of 110° picture tube bases. Many servicemen are probably unfamiliar with the differences between the two, and may even be wondering why 110° tube bases are different from conventional types in the first place.

To make possible a CRT with a deflection angle of 110°, it was necessary to reduce the neck diameter. (April, 1957, "Servicing New Designs.") The new thin neck does not have enough base area to accommodate the duodecal base and socket we are accustomed to seeing on 70° and 90° tubes, so new bases had to be designed.

Most types of 110° picture tubes are equipped with the "small-button" base shown in Fig. 1A. The pins, like those in miniature receiving tubes, are slender and sealed directly into the glass envelope of the tube. Fitted over the pins and bonded to the glass is a plastic button that supports a locating key for the tube socket. The latter is a lightweight plastic cylinder about the same length as the key and the same diameter as the base. The chief advantage of the small-button base is compactness, and this ties in with the main purpose of the 110° tube design—to minimize its over-all length in order to reduce cabinet depth as much as possible.

The "shell" base shown in Fig. 1B closely resembles the familiar conventional design except for its small diameter. The 17BVP4, 17BWP4, and 21CQP4 tubes employed in Sylvania and Philco receivers are the principal 110° types having shell bases.

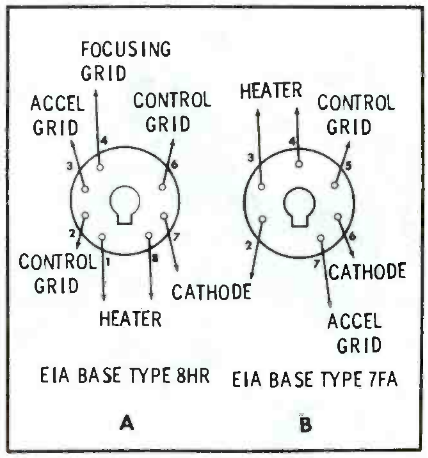


Fig. 2. Basing diagrams for 110° tubes.

Pin connections are arranged differently in the two varieties of 110° tubes. The small-button base shown in Fig. 2A has room for 8 equally-spaced pins, but the pin 5 position is blank. The control grid is internally connected to both pins 2 and 6, but pin 2 is usually the only one having an active socket connection. Fig. 2B is a diagram of the 110° shell base. Note that there is space for 7 pins but that the pin 1 position is blank. The single connection to the control grid is made through pin 5.

Regardless of base type, the necks of 110° tubes are more fragile than those on other types of CRT's; so be sure to use a little extra caution when removing sockets or otherwise handling the tubes.

Color TV Chassis

RCA's latest color TV models have several interesting new features, including more precise horizontal convergence adjustments, a redesigned color killer circuit, and a 3-stage sound section utilizing a 6DT6 quadrature-grid detector. In general, the new receivers can be described as conservatively-designed, deluxe models.

The CTC7 chassis used in the new 800 Series is vertically mounted on one side of the cabinet and is noticeably more compact than previous designs. Most of the various set-up adjustments are in new locations. All the dynamic convergence controls are on a printed-circuit subchassis which is connected to the main receiver chassis by a long cable. While working on the set, the technician can remove this subchassis from its normal position inside the receiver and attach it to the top of the cabinet (as shown in Fig. 3) so that he can reach the controls while looking directly at the screen.

DC (center) convergence is obtained by mechanical adjustment of permanent magnets mounted on the neck of the picture tube with the convergence yoke assembly. The edge-purity or "field-equalizing" magnets, which have been familiar fixtures around the edge of the faceplate in earlier color sets, have been moved back to a new location on the pull-up ring which supports the bell of the picture tube (see Fig. 4). They are now adjusted from the back of the receiver.

Grey-scale adjustments (screen and background controls) are under a cover plate on the rear apron of the chassis. The currently-recommended adjustment technique is to leave one or more of the screen controls at maximum throughout the set-up procedure. This method has been found to produce the brightest possible picture while still maintaining proper grey-scale "tracking" over the entire brightness range.

The all-glass 21CYP22 picture tube is equipped with a new type of shadow mask that permits increased levels of screen brightness. Nominal anode voltage is 22.5 kv. The picture tube has two anode receptacles—one for the internal connection and one for the external lead—linked together by a 56K-ohm resistor which protects the high-voltage power supply by limiting anode current in case of arcing within the picture tube.

The CTC7 chassis has a two-stage chroma bandpass amplifier which is tuned to pass frequencies of up to 0.5 mc on either side of the color subcarrier. The output is demodulated on the same "X" and "Z" axes employed in last year's deluxe CTC5N chassis. You may recall that these axes are 57.5° apart and correspond very closely to —(R-Y) and —Q. Both triode sections of a 12AZ7 are used as demodulators in place of the pair of 6BY6 pentagrid tubes employed last year. In each

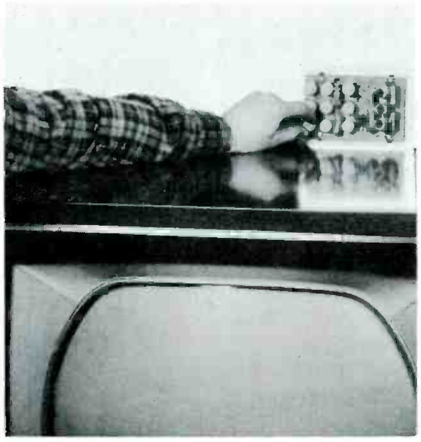


Fig. 3. Making convergence adjustments on RCA Victor "800 Series" receiver.

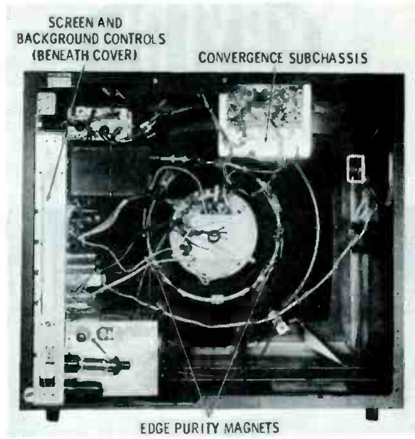


Fig. 4. Location of field equalizing magnets for RCA's "800 Series" receivers.

triode, the incoming chroma signal is fed to the grid and the 3.58-mc reference signal is fed to the cathode. Outputs of the demodulators are mixed and amplified in separate R-Y, B-Y and G-Y amplifiers and then applied to the picture tube.

In the color sync section, a phase detector and reactance tube are utilized for control of the 3.58-mc oscillator. This system has been used by RCA since the earliest days of color TV, but was omitted from the CTC5 and -5N chassis. Now it's back in use again.

A schematic of the new two-stage color killer circuit in the CTC7 chassis is presented in Fig. 5. The killer tube, a triode section of a 6U8A, operates on the same principle as an AGC keying tube. A pulse from the horizontal output transformer is applied to the plate of the killer, driving it into conduction during horizontal retrace time. The resulting surges of plate current are applied to a filter in the plate circuit, producing a negative DC voltage which is applied to the grid of the second chroma bandpass amplifier as bias.

When no color signal is being received, the grid of the 6U8A is biased well above cutoff to allow the tube to conduct heavily when keyed. Enough output voltage is then produced to cut off the bandpass amplifier, thereby preventing color snow and similar interference during black-and-white reception. Grid voltage of the 6U8A can be regulated by means of the "Killer Threshold" control.

During color reception, the 6U8A must be cut off in order to remove the control bias from the bandpass

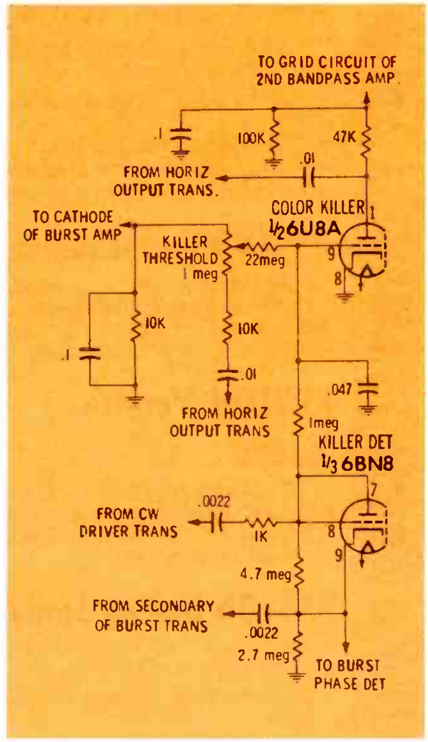


Fig. 5. Color killer circuit of CTC7.

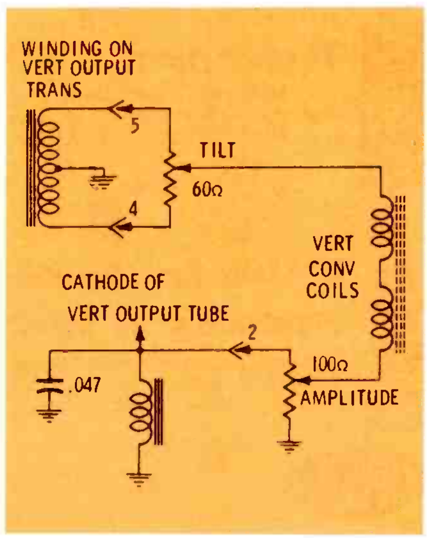


Fig. 6. CTC7 vertical convergence circuit.

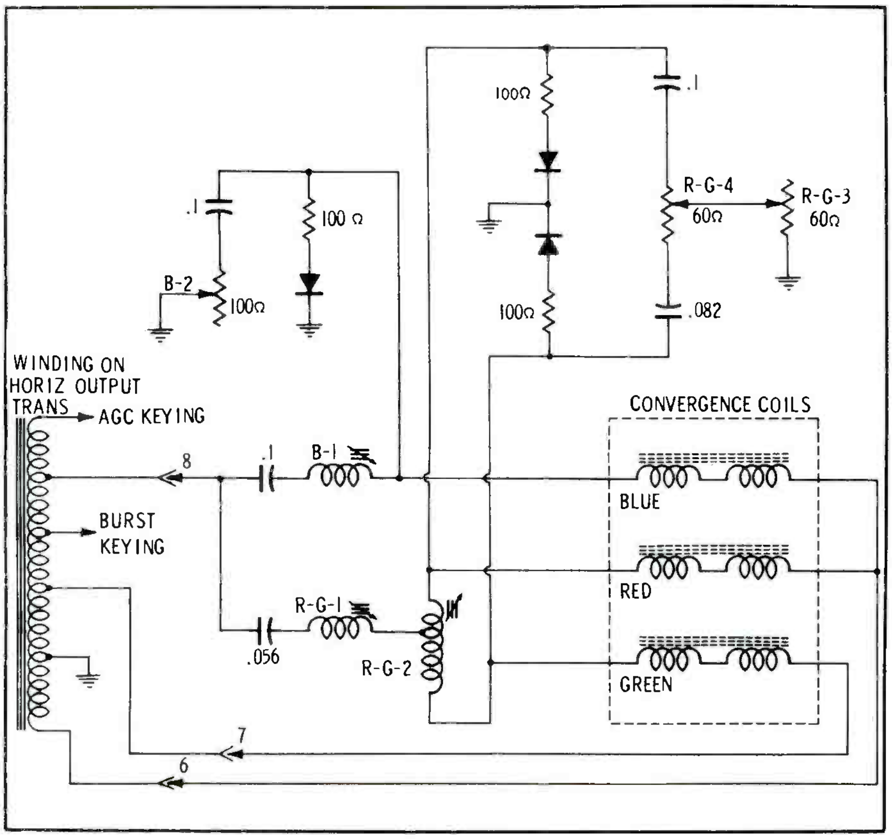


Fig. 7. Horizontal convergence circuits used in RCA Victor Chassis CTC7.

amplifier. This is accomplished by a "killer killer," a triode section of a 6BN8 connected as a diode detector. In the absence of a color signal, the only input to this latter stage is a sample of the CW output signal of the 3.58-mc oscillator, fed to the grid and plate of the 6BN8. This signal alone is insufficient to cause conduction of the detector, and so there is no effect on the 6U8A. But if a color signal arrives, a 3.58-mc burst signal appears at the burst transformer and is fed from there to the cathode of the killer detector. This signal is 180° out of phase with the grid-plate signal during normal color operation. The killer detector is biased so that it will conduct only for the short time that the cathode signal is near its negative peak and the grid-plate signal is near its positive peak. The result of this conduction is a negative output voltage which is fed to the grid of the 6U8A, cutting it off. Since the detector requires two different input signals with a definite phase relationship to drive it into conduction, it tends to be insensitive to noise pulses or other random signals that might produce color interference in monochrome programs.

An examination of the circuits on the small convergence subassembly shows, first of all, that there are three identical circuits (wired in parallel) for vertical convergence of the three electron beams. A typical circuit for one beam appears in Fig. 6. As in earlier models, a parabola-shaped waveform is obtained from the cathode of the vertical output tube via the "Amplitude" controls and then modified by a sawtooth wave which is fed from the vertical output transformer through the "Tilt" controls.

The horizontal convergence circuits have been redesigned to provide relatively independent adjustments for beam convergence at the left and right sides of the screen. The basic convergence waveform is produced by applying a pulse from the horizontal output transformer to a resonant circuit on the convergence subchassis. (See Fig. 7.) For the blue beam, this resonant circuit is made up of the blue convergence coils in series with adjustable coil B-1 and a .1-mfd capacitor. Slug B-1 affects the phase of the waveform; for the most part, it alters the pattern traced by the blue beam toward the right side of the picture. A

somewhat similar circuit is used for simultaneous control of the red and green beams. Slug R-G-1 adjusts the phase of the waveform in both the red and green horizontal convergence coils and therefore adjusts both the red and green beams in relation to the blue beam. Slug R-G-2 is a balancing adjustment which produces final convergence between the red and green beams at the right side of the screen.

The remaining controls are potentiometers which regulate the discharge time of RC circuits through crystal diodes. Generally speaking, they regulate the shape of that portion of the convergence waveform which affects the left side of the picture. B-2 adjusts the blue beam to produce a straight blue line, R-G-3 adjusts the other two beams simultaneously with respect to blue, and R-G-4 provides final convergence of red and green.

The "right" and "left" controls are not completely free of interaction with each other, but they do provide more exact convergence than has been previously obtainable.

Line Voltage Adjustment

The AC power systems in some localities are too "generous with the volts," and a steady overdose of power-line voltage causes excess wear and tear on television sets if they are not protected in some manner.

The Magnavox 26 Series chassis features built-in provisions for counteracting high line voltage. As shown in Fig. 8, a link can be connected to either of two terminals—"117V" for normal operation, or "127V" when voltage reduction is desired. In the latter position, extra turns are added to the primary of the power transformer, decreasing the effective step-up ratio from primary to secondary. This prevents B+ and heater voltage from increasing excessively when the line voltage rises to high levels.

The link is not a voltage regulator and cannot compensate for severe power-supply fluctuations. Nevertheless, it is useful in situations where the power-line voltage characteristically runs higher than normal.

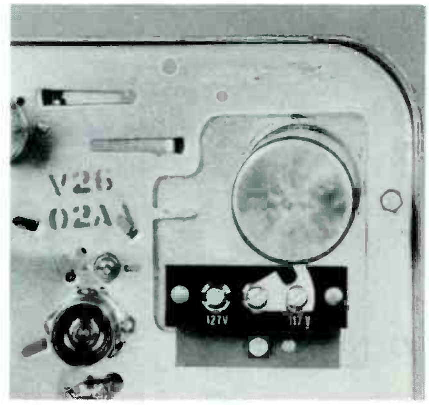


Fig. 8. Line-voltage adjustment link used in Magnavox 26 Series chassis.

It Had to Happen— TV With One IF Stage

The "IF strip" of the Olympic Chassis DY (Fig. 9) consists of a pentode section of one 6AZ8. Adequate gain is maintained by reducing the over-all bandwidth, as indicated in the accompanying response curve. The narrowing of bandwidth not only permits peaking the IF stage for greater gain, but also enables the video detector to operate more efficiently. Since shunt capacitance across the detector output becomes less of a problem when the highest video frequencies do not have to be preserved, the video detector load resistor can be made larger in value than usual—18K ohms in this circuit. With a higher value of load resistance, a relatively large output signal can be developed.

AGC is not applied to the IF stage but is fed to the 2CY5 tetrode RF amplifier. There are three IF adjustments, all tuned to 44.5 mc. One of these, which is not shown in the schematic, is in the mixer plate circuit; it's accessible at the top of the tuner.

Other features of this chassis include a transformer-type power supply with 5U4G rectifier, a 21ALP4 picture tube, and a 6DT6 sound detector. ▲

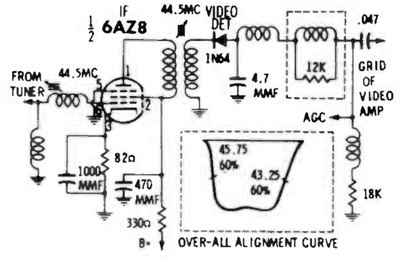


Fig. 9. IF and video detector circuits of Olympic Chassis DY. Inset—Over-all IF response curve.

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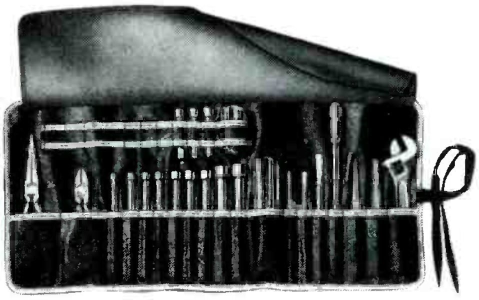

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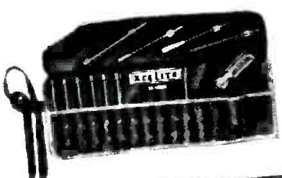

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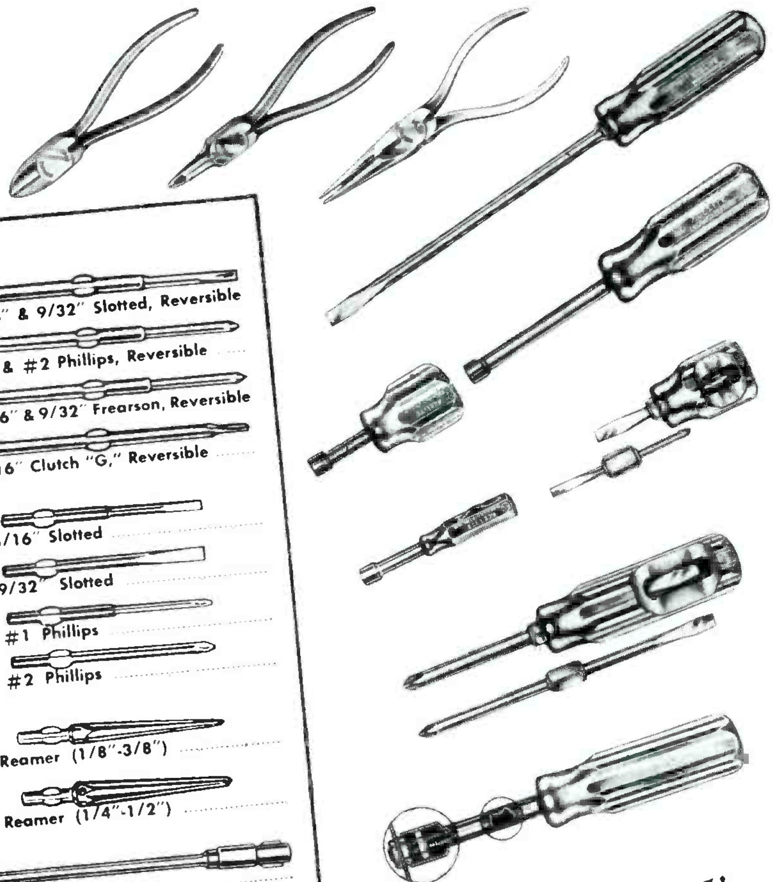

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fine points

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Robert G. Middleton

Sometimes a simple adjustment of the AFC balance control in the diode phase-detector circuit restores the subcarrier oscillator to correct frequency. Fig. 1 shows a typical phase-detector circuit. When the subcarrier oscillator is pulling against the color-burst frequency, there is a DC output from the AFC balance control to the reactance-tube grid.

For example, running the color-phasing control through its range will cause the output from the phase detector to change about 0.25 volt. This is because the reactance of the color-phasing-control capacitor reflects back into the color-sync system and upsets the balance slightly. The phase detector responds by delivering a small corrective bias to overcome the "pull" of the subcarrier oscillator against the burst frequency.

The subcarrier oscillator is never brought back *exactly* to 3.579545 mc, unless it happens to occasionally drift through the exact color-burst frequency. This is because "pull" can never be corrected 100% by the color-sync system. However the correction is so close that the eye cannot detect the slight shift in hues.

Suppose Color Sync Breaks?

But suppose the color sync breaks for any reason? Then we would no longer have a simple phase error, but a frequency error which must be corrected before the phase can be controlled. What does this mean?

Well, suppose we connect a scope and a VTVM at the arm of the AFC balance control. Then, let's make the set break color sync. We can do this by overloading the chroma circuit, mistuning the subcarrier oscillator, misadjusting the balance control, or running the color-bar generator slightly off frequency. Now—what do we see?

The waveform shown in Fig. 2 will appear on the scope screen. The peak-to-peak voltage will vary from zero to about 1.5 volts, depending on the number of horizontal rainbows displayed on the screen. The frequency of the waveform is the difference between the subcarrier oscillator frequency and the burst frequency. When there is one horizontal rainbow on the screen, it will have a 60-cycle frequency and the maximum voltage amplitude.

If there are 10 horizontal rainbows on the screen, the waveform will have a frequency of 600 cycles, and its amplitude will be much less than for the one-rainbow display. The fuzz in the pattern is noise from the signal circuit and cross-talk from the sweep circuits. We get used to this in practical work.

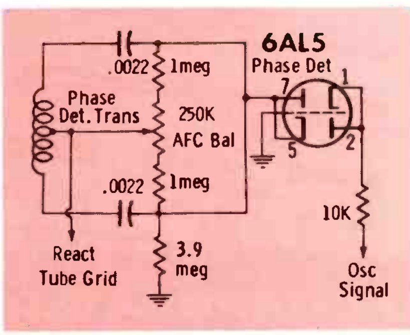


Fig. 1. We sometimes think of the AFC output as a DC test point, but there is AC present when color sync breaks.

Why AC From the Phase Detector?

We have the AC signal from the phase detector because the color-sync system is hunting. The subcarrier oscillator is no longer pulling, but has run away and "has a mind of its own." The reactance tube is swinging the subcarrier oscillator frequency back and forth with the AC wave, trying to make it pass through burst frequency.

If the reactance tube can make the oscillator pass through burst frequency, a "lock-in" state will be attained. The AC waveform will disappear because the frequency of the subcarrier oscillator will equal burst frequency; however, this is not enough. The phase of the oscillator signal must also be matched with burst phase, but since there will be a DC output from the phase detector when the two frequencies are equal, the reactance tube will be biased so that the phase of the subcarrier oscillator will be forced into step with the burst phase. The harder the oscillator tries to pull out of phase, the higher the DC correction voltage will become. When the crystal can no longer be tuned to burst phase by the reactance tube, the frequency will break and the sine waveform will pop up on the scope screen.

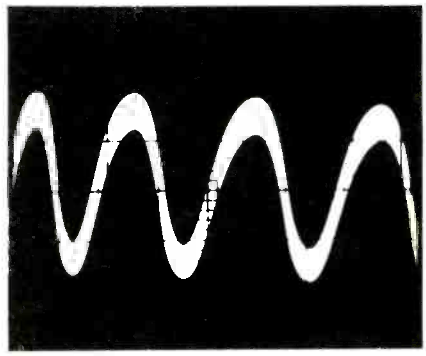


Fig. 2. This is the AC signal present at the arm of the AFC balance control when the receiver breaks color sync.

How is the AC Waveform Controlled?

The AC color-sync waveform seen in Fig. 2 is controlled by a filter network such as that shown in Fig. 3. First of all, the output from the AFC balance control is partially bypassed to ground. This eliminates the higher frequencies outside the control range of the oscillator since they would only interfere with its desired action. The 0.01-mfd capacitor, 33K-ohm resistor and 0.22-mfd capacitor form an antihunt network which prevents the color-sync system from feeding back positively and breaking into a squegging action.

For example, if the 0.01-mfd capacitor opens up, you cannot obtain color sync. The DC meter will indicate that operation is okay, but the scope will show that there is a large squegging voltage in the sync channel. This is due to a positive feedback, causing the system to hunt continuously and uncontrollable rainbows to appear on the screen.

If the 0.22-mfd capacitor opens up, color sync can still be maintained, although the stability will not be as great as with the capacitor functioning normally. A beginner might overlook the pos-

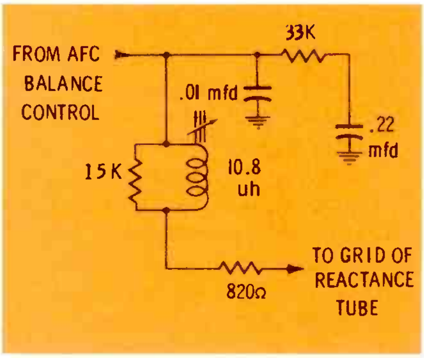


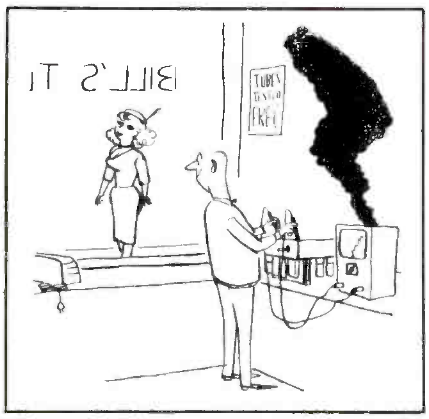
Fig. 3. How well the chroma oscillator pulls in depends upon the various components in this filter network.

sibility of an open 0.22-mfd capacitor and waste endless time looking for other causes of impaired pull-in.

Another thing to keep in mind, and that is we must have 3.58-mc voltage on the grid of the reactance tube to maintain oscillator control. If the 10.8-μh inductance becomes shorted, the 3.58-mc feedback voltage will be shorted to ground by the 0.01-mfd capacitor and color sync will be lost completely. The 15K-ohm resistor lowers the Q of the choke so that it will have ample impedance when the oscillator is slightly off frequency and when slight changes in the input grid impedance of the reactance tube tend to detune the inductor slightly.

Check the Filter

Hence, when color sync is bad, and usual measures do not restore proper pull-in, look to the filter circuit. One of the best ways to do this is with a scope. Published waveforms are not available, but after a bit of experience, you will have little trouble in buzzing through a color-sync filter with a scope and isolating the trouble. Oh yes—and don't forget to use a low-capacitance probe! ▲



QUICKER SERVICING

by Calvin C. Young, Jr.

Checking Phono Cartridge Styli

A phono cartridge stylus is not a permanent fixture—even a diamond will eventually show signs of wear. Generally speaking, a sapphire needle is satisfactory for about 50 hours of playing time on records in average to good condition, and an osmium tip is good for about half as long. A good quality diamond should show evidence of little or no wear at 400 hours if used on records in good condition. Badly-worn or dirty records will materially shorten the life of any needle.

When new, a stylus tip is shaped as shown in Fig. 1. A worn stylus will have flat spots on the tip, resulting in sharp edges which cause rapid and extensive record damage. You'll be doing your customer a favor by offering to check any stylus that has been in service for more than three months.

This brings up the question, "How do you check a stylus for wear?" It's too small to be checked with the naked eye. The answer is almost obvious—a microscope, 60-power or greater, must be used. Various needle manufacturers have suitable units available at nominal costs.

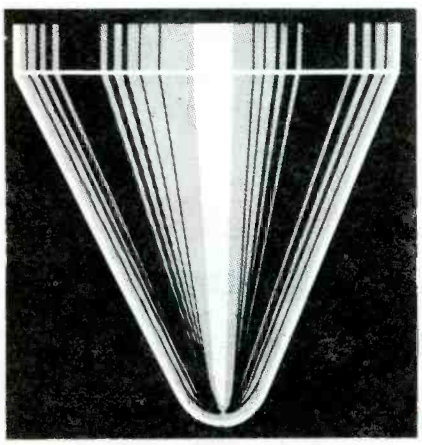


Fig. 1. Oversized drawing of stylus shows the shape it should have when new.

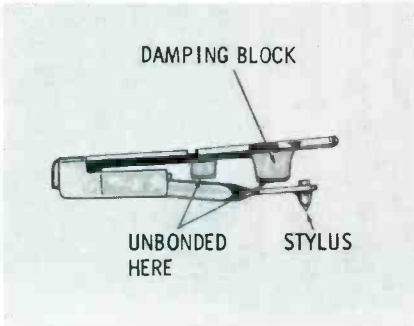


Fig. 2. Enlargement of 1-mil stylus assembly shows unbonding at damping block.

Wear is not the only thing that will make it necessary or desirable to replace a stylus. For example, the owner of a new hi-fi outfit called recently to complain of a loss of volume and groove-skipping. The stylus was a 1-mil diamond used in a variable-reluctance cartridge. Since the cartridge was one of the turn-over type, the technician tried the 1-mil side on a 33-rpm record and the 3-mil side on a 78-rpm record. Volume and tracking were satisfactory at 78 rpm, but the customer's complaint was verified at 33 rpm. The diamond was replaced with a new stylus, resulting in normal volume and tracking. An enlarged photograph (Fig. 2) shows that the stylus tip had become unbonded from the damping block. This, not a worn or broken tip, was the cause of the trouble.

Another point to look for when checking a stylus is proper alignment of the tip with the remainder of the assembly, since the angle at which the tip meets the record grooves must be accurate.

Rapid Tube Failure in Portable Radios

Each spring, when people are outdoors for longer periods of time and portable radios are pressed into service, there is a general rush for repairs. In many instances, insertion of a new tube or two and a new battery seems to be all that is needed. However, this doesn't necessarily mean that the actual trouble has been cured; in fact, chances are that it hasn't.

Referring to the diagram in Fig. 3, filament power is applied via a voltage-dropping resistor from the B+ supply when the portable is operated from the AC line. The 1810-ohm resistor in series with the tube filaments serves as a voltage-dropping element so that the required 6 volts is applied across the filaments. The voltages indicated are obtained only at a normal line voltage of 117VAC and may actually be greater at higher input levels. This is permissible, as you will notice if you add up the individual filament ratings (1.4, 1.4, 1.4 and 3 = 7.2). If, for any reason, the voltage across the filament string should exceed 7.2 volts for an appreciable length of time, tube life will be shortened materially.

It is possible that a very innocent act, such as replacing the metallic rectifier with one having a more efficient rating, could raise the filament voltage above the danger level; or the dropping resistor could decrease in resistance.

If a portable radio employs a battery-saver switch, it should be placed in the *strong battery* or *save battery* position when a new battery is installed. This introduces a resistor in series with the battery and filaments and reduces the voltage to a safe level. Voltage will drop as the battery ages, and the switch can then be placed in the normal position. Failure to follow this procedure will place excessive voltage across the filaments when the battery is new.

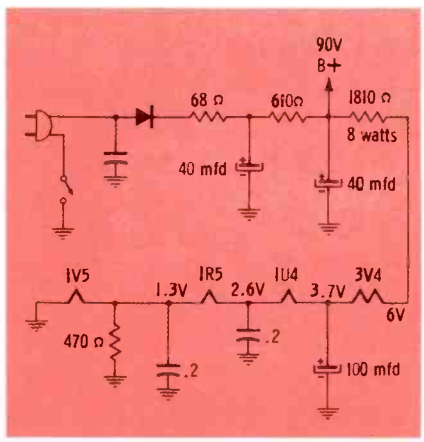
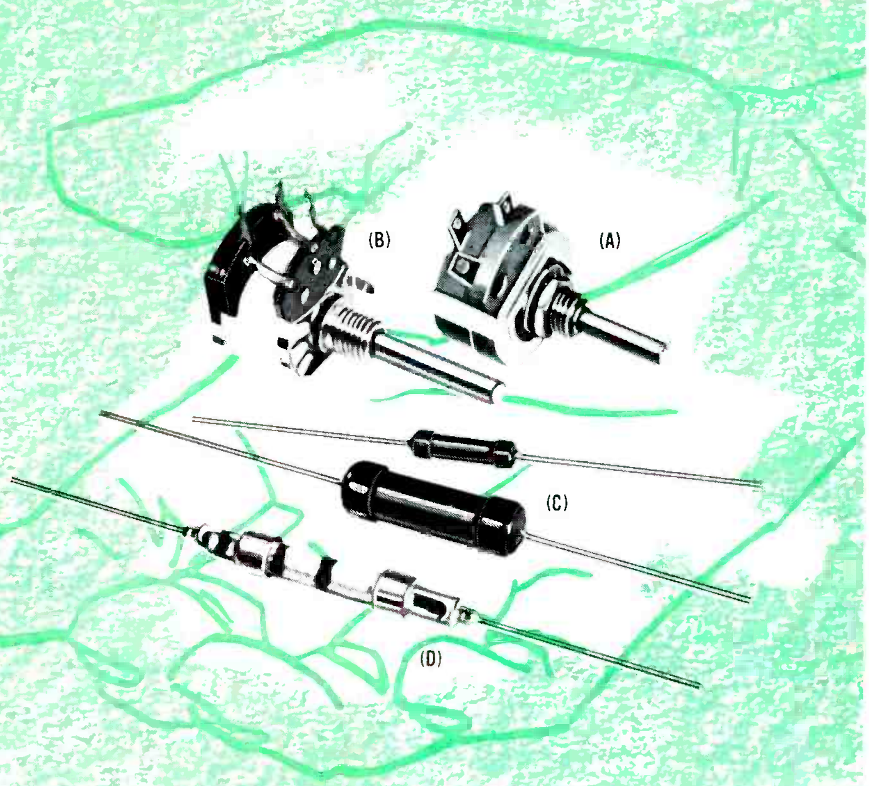


Fig. 3. Typical schematic of filament circuit used in modern portable radios.



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(B) Boiled-down version of popular 15/16" control, Series 44 is no bigger than a dime! 0.2 watt rating. 0.015 lb. 500 ohms to 5 megohms. With or without switch. Popular in hearing aids, pocket radios and other compact assemblies.

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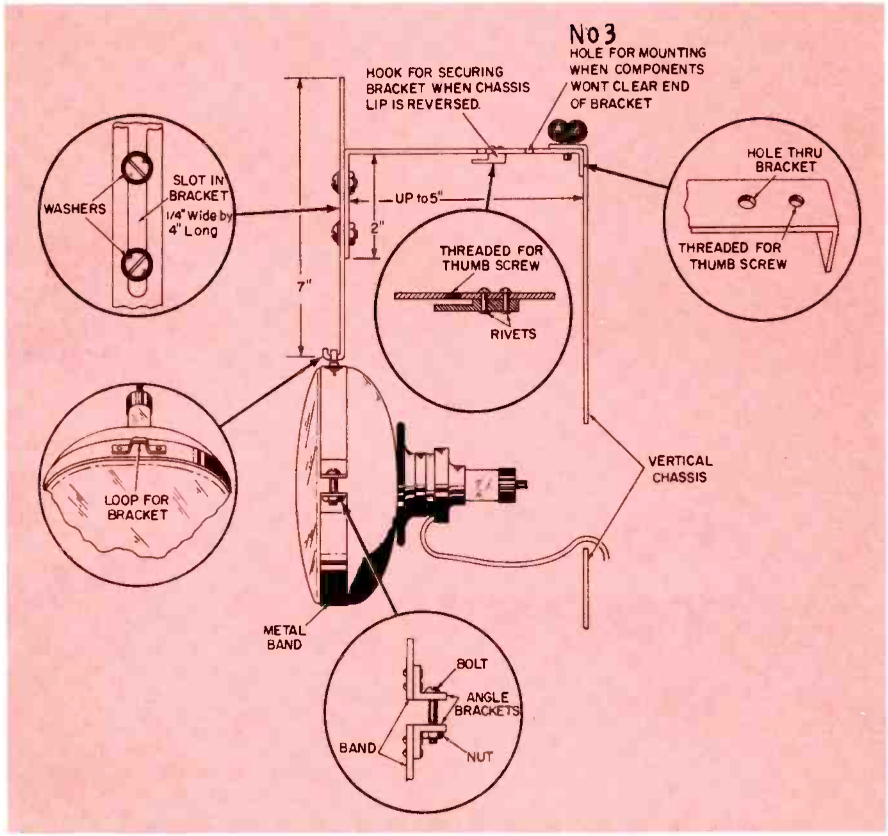

Fig. 4. Details for 110° 8YP4 check-tube bracket show how it may be constructed and used with practically any vertical-type chassis design.

Using the 8YP4 110° Check Tube

The recently-introduced Sylvania 8YP4, a 110° check tube, is almost a necessity for servicing receivers with 110° deflection circuits. In many of these sets, the CRT is cabinet-mounted, and either the component or wiring side of printed boards will be inaccessible for service. The original CRT could be removed and extension leads employed, but this creates several problems that aren't easily solved; namely, the danger of breaking the tube and supporting it while servicing the chassis on the bench. On the other hand, the 8YP4 is small and easily mounted or suspended.

The bracket pictured in the drawing of Fig. 4 will provide the necessary support for the 8YP4 and is adjustable so that it can be readily used with practically any chassis design. There is only one small hitch—you will have to make your own. It can be fabricated from two pieces of 1/8" × 1" × 7" malleable iron or ST grade aluminum and assorted screws, rivets, and washers. The distance between the sliding vertical member and the chassis can be any length up to 5"; however, the shorter it is (down to about 2½"), the less trouble you will have keeping the vertical chassis upright.

Three different means of attaching the bracket to the chassis are considered in the drawing: (1) Chassis lip turned forward with sufficient clearance between it and components to clear ½" "turn down" on the bracket. (2) Lip on chassis turned toward the rear. (3) Lip turned forward but components won't clear bracket "turn down." In the latter case, simply lay the bracket over the chassis, drill a hole through chassis to match hole no. 3 and secure with bolt and nut. In the other two cases, a thumb screw can be threaded into the bracket hole. In case no. 1, a hole must be drilled into the lip of the chassis if none already exists.

A strip of the metal band material used for antenna mounting (chimney strap, etc.) will serve very well for the band around the 8YP4 bulb. Small right-angle brackets can be used to provide a means of tightening the band. Details are shown in Fig. 4. A

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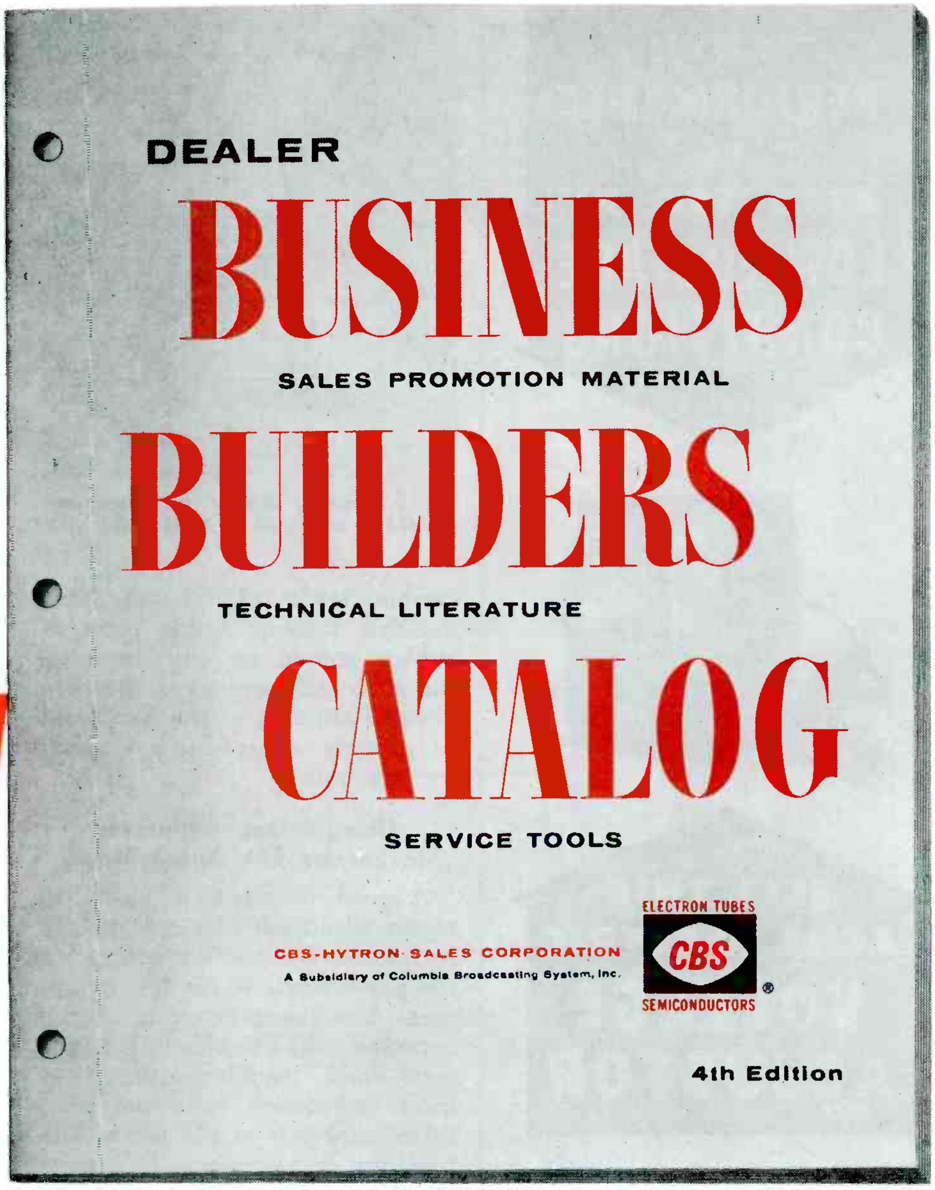

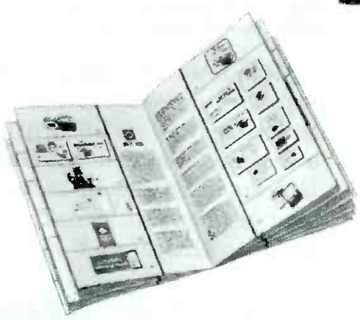

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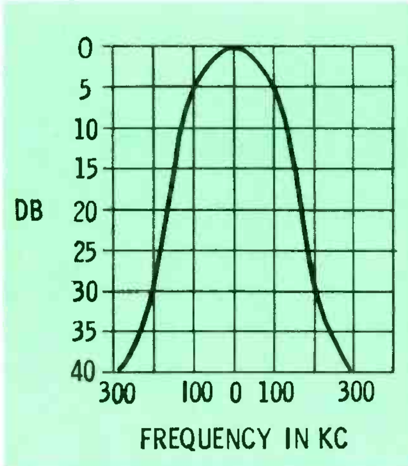


Fig. 5. Drawing of ideal response curve desired at the input of the FM detector.

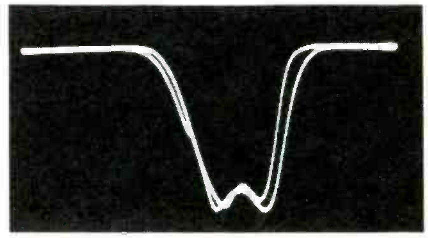
double layer of friction tape, masking tape or a thin piece of rubber should be used between the glass bulb and metal strap to prevent slipping of the band and to provide a protective cushion for the bulb.

Using Sweep Generator to Service FM Sound Strips

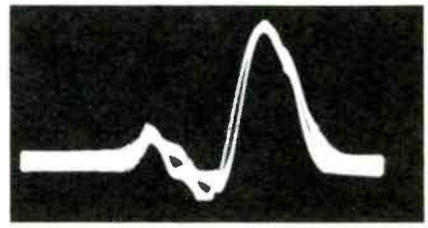
A good technician's ability to repair electronic devices rapidly is limited by his knowledge of the applications of his test equipment. The sweep generator is the accepted unit for video IF alignment and troubleshooting, but most technicians have not seen fit to employ it in FM work. The bandpass requirements of a good FM tuner, while not as complex as those for video, are nonetheless critical.

In a typical hi-fi FM tuner, the desired bandwidth at the detector input is shown in Fig. 5. Note that the response is down only 5 db at points 100 kc either side of center frequency and is 40 db down at 300-kc deviation points. Correct alignment would therefore be extremely difficult to obtain with an AM signal generator and VTVM. To prove this point, the response curve obtained with an AM generator and VTVM is compared with a swept curve in Fig. 6. Discriminator curves obtained in the same manner are shown in Fig. 7.

Should the alignment instructions specify the AM generator-VTVM method and you wish to further improve operation of the receiver, the swept alignment method used here can be utilized. First of all, the signal must be

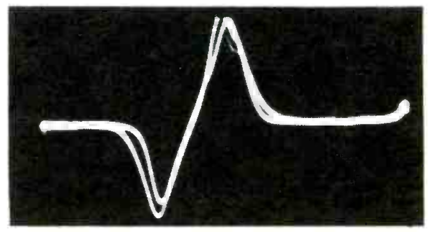


(A) Swept.

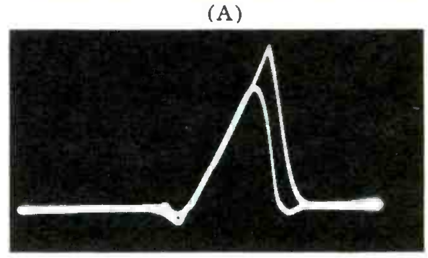


(B) Non-swept.

Fig. 6. Response curves obtained with swept, non-swept alignment techniques.



(A)



(B)

Fig. 7. Discriminator patterns obtained with swept and non-swept techniques.

injected at the proper point. A separate mixer is employed in this case, and as shown in Fig. 8, a 3.3 megohm resistor acts as the DC load for the mixer grid. The simplest way of introducing a signal into this circuit is to clip the

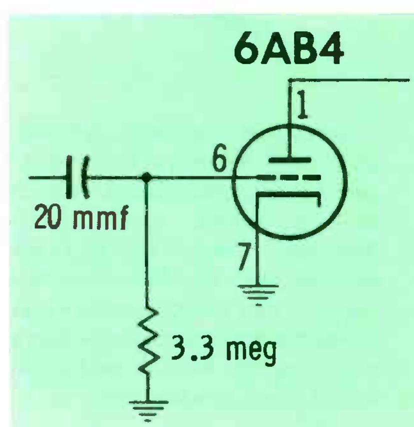
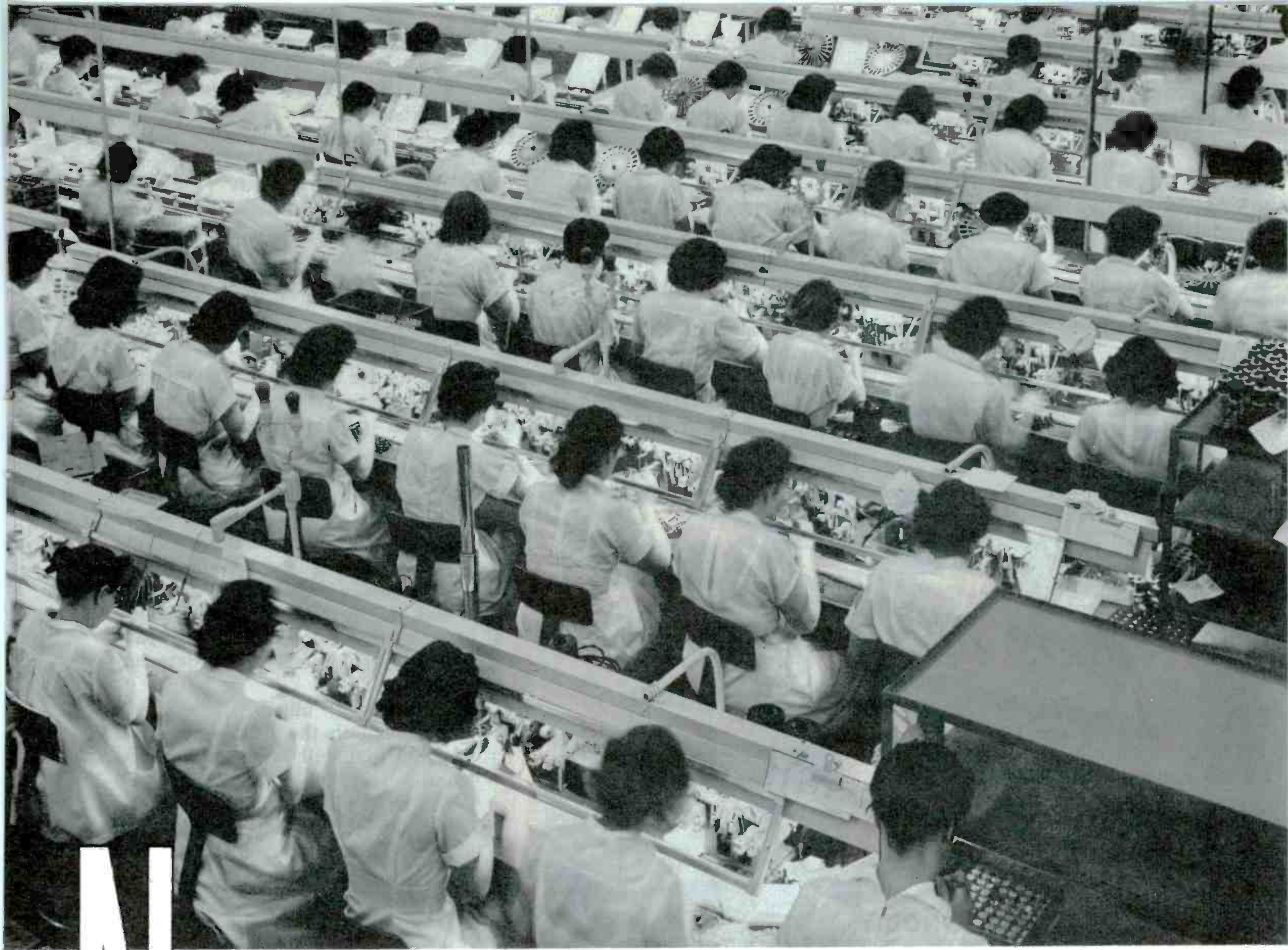


Fig. 8. Grid circuit of separate FM mixer stage used in some receiver designs.



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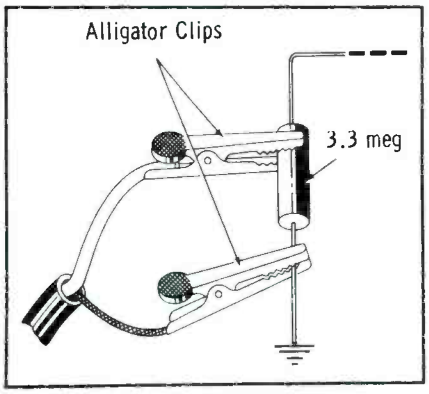


Fig. 9. Signal injection involves clipping hot lead to the top of resistor body.

hot lead of the signal generator to the upper end of the resistor body (Fig. 9), connecting the ground lead of the generator to the ground lead of the same resistor. The scope is then connected across the grid-leak network (Fig. 10) of the last limiter stage if one is employed. If no limiter stage is used, the scope should be connected across the 100K-ohm resistor between the center tap of the detector transformer and ground. The IF transformers can now be adjusted to produce the desired 200-kc response between 5-db points.

For adjustment of the detector transformer, the scope is connected to the output (Fig. 10) and the transformer slugs are adjusted for proper "S" pattern reproduction (see Fig. 11). If a ratio detector is employed instead of a discriminator, it will be necessary to disconnect the electrolytic capacitor used across the output during the IF bandpass alignment, reconnecting it when adjusting for the "S" pattern. Signal for the IF response curve is obtained across the 47K-ohm detector load when this circuit is used (see Fig. 12). When the sweep method is used, it isn't necessary to use the two 100K-ohm resistors specified for zero balance with a VTVM. As it was in the case of the discriminator, the ratio detector "S" pattern is obtained at the detector output .

Normally, alignment is performed with the least amount of signal that will produce a usable indication. When the alignment has been completed in this manner, the scope should be connected across the limiter grid-leak circuits and the generator gain advanced while the response curve is observed. The point where the curve no longer increases in amplitude is where full limiting occurs. While the shape of the curve will change during this procedure, it shouldn't become appreciably distorted. If it does, the signal input should be reduced until response is midway between the highest and lowest tolerable levels and the IF and detector circuits readjusted for the proper curves. A point should be reached where

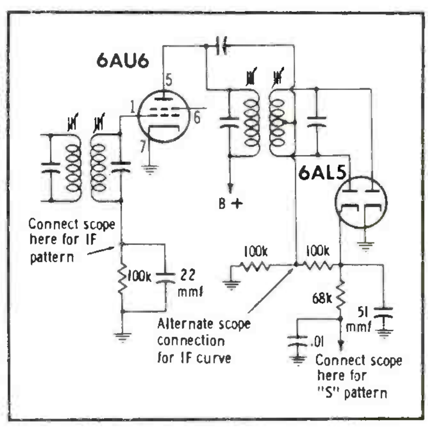


Fig. 10. Schematic showing scope connection points for IF and detector alignment.

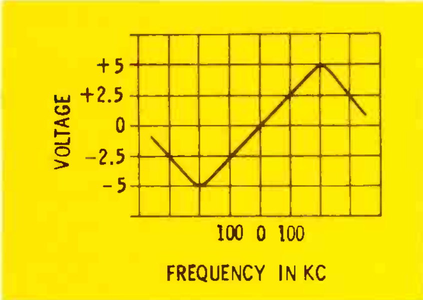


Fig. 11. Drawing of ideal "S" pattern desired at the output of the detector.

both high- and low-level responses are acceptable.

Some signal generators do not have 10.7-mc internal markers, but do have markers in the 88- to 108-mc range. In this event, a sweep signal with a center frequency of about 98 mc and a width of 600 kc to 1 mc should be applied to the antenna terminals; 120-ohm carbon resistors are connected in series with the generator leads for impedance matching. With the marker generator and station selector both tuned to 98 mc and the scope connected as previously outlined, the sweep frequency is varied slightly until the proper pattern is present on the scope. The IF and detector circuits can then be aligned for proper response.

One thing further—if the FM unit in question doesn't have an audio output stage (i.e., it is just a tuner), the discriminator curve can be viewed at the audio output jack. This provides more gain and permits the use of less input signal. If you should happen to be using RF instead of IF sweep, the added gain will be most welcome. With the output stage included in the unit, however, the extra audio stage cannot be used to this advantage because it includes the volume control, and its setting will affect response. ▲

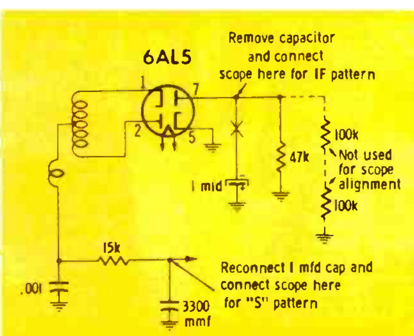
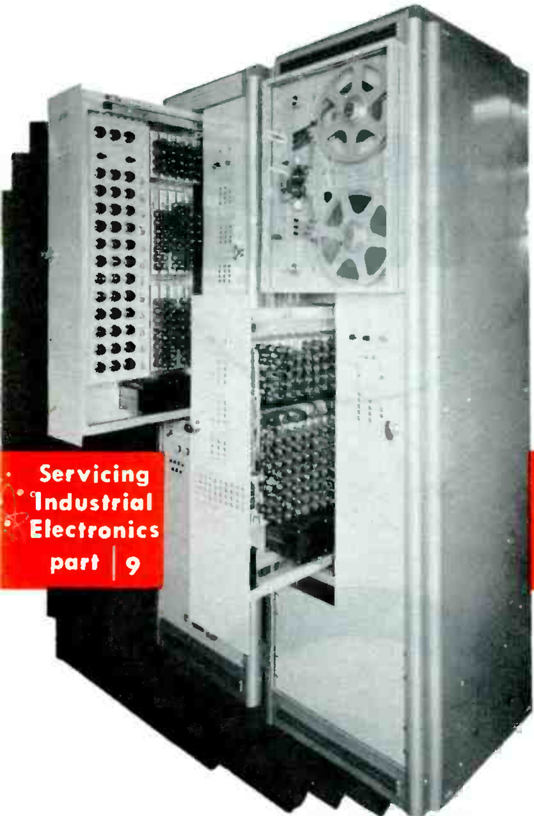


Fig. 12. Schematic of ratio detector stage showing scope connection points.

Servicing Industrial Electronics part 9



machines that COUNT

by Melvin Whitmer

Do you realize that you can count up to 31 on the fingers of one hand! The common method of counting is based on the system of tens, where each finger represents one; however, a greater number can be counted if the fingers are assigned numbers as shown in Fig. 1. Thus, number 3 is formed by holding up the little and ring fingers, and number 7 requires these plus the middle finger. Table 1 is complete for numbers 0 through 32, where the number 1 is used in place of an upright finger and a zero indicates a down finger. Note that each finger in Fig. 1 is valued at *twice* the number of the finger to the right, which is why this system is called binary notation.

Consider what you know about electronics. Is a two-condition circuit easier to think of than a ten-condition circuit? Switches are closed or open; tubes may conduct or be cut off; relays are energized or de-energized. All these are two-condition devices. Are there any ten-condition devices? No—at least not in common usage. Thus, with electronics, the binary notation system is more easily duplicated than is the decimal. system. In fact, from the smallest to the largest digital computer, the basic operating circuit is a two-condition device.

A service call was made recently for a packaging plant because an electronic counter always skipped the first digit, although the rest of the counter operated normally. The trouble was evidently in the first stage, a schematic of which is shown in Fig. 2. Note the similarity between it and an R-C coupled multivibrator, the only difference being that R3 and R4 are used in place of coupling capacitors. While the capacitors in a standard multivibrator would couple AC voltage changes between the two sections, resistors R3 and R4 are used for DC voltage coupling. Thus, instead of depending on capacitor charge and discharge for flip-flop action, the grids of Fig. 2 receive a DC voltage which remains constant until plate voltage changes. This circuit is called a two stable-state trigger or an Eccles-Jordan circuit. The DC voltage applied to the grid of V1 (assuming it is conducting) must cause its associated plate voltage to drop below the cutoff level of V2. This will account for the stable condition of V1 conducting, since nothing will cause V2 to conduct until one of the grids is pulsed with a signal of the proper polarity. Then V2 will conduct and V1 will be cut off.

Since the trouble was isolated to the first stage, it had to be something that would prevent the change in stable states but still allow pulses to pass on to the next stage. Voltage measurements at the two grids proved that the grid of V1 was more positive, but when pulses were applied, the circuit always returned to the state

Table 1—Binary Count for Digital Numbers From 1 to 32.

	ASSIGNED NO.						ASSIGNED NO.				
	16	8	4	2	1		16	8	4	2	1
1	0	0	0	0	1	**17**	1	0	0	0	1
2	0	0	0	1	0	**18**	1	0	0	1	0
3	0	0	0	1	1	**19**	1	0	0	1	1
4	0	0	1	0	0	**20**	1	0	1	0	0
5	0	0	1	0	1	**21**	1	0	1	0	1
6	0	0	1	1	0	**22**	1	0	1	1	0
7	0	0	1	1	1	**23**	1	0	1	1	1
8	0	1	0	0	0	**24**	1	1	0	0	0
9	0	1	0	0	1	**25**	1	1	0	0	1
10	0	1	0	1	0	**26**	1	1	0	1	0
11	0	1	0	1	1	**27**	1	1	0	1	1
12	0	1	1	0	0	**28**	1	1	1	0	0
13	0	1	1	0	1	**29**	1	1	1	0	1
14	0	1	1	1	0	**30**	1	1	1	1	0
15	0	1	1	1	1	**31**	1	1	1	1	1
16	1	0	0	0	0	**32**	0	0	0	0	0

Fig. 1. Numbering system used for binary counting requires fewer indicators.

of V1 conducting. Careful resistance measurements disclosed that R3 had almost twice the value of R4. The negative pulse would arrive at the grid of V1, cutting it off, and the plate of V1 would generate a positive pulse which was coupled to the grid of V2; however, the resultant negative pulse at the plate of V2 was not sufficient to hold V1 in cutoff because too much of the B+ voltage was being developed across R5 (since R4 was too low in value). Conduction of V2 would generate a negative pulse for the next stage, which accounted for the balance of the circuits working. Replacing resistor R4 with a 1% tolerance part restored the counter to normal operation and started the packaging line again.

Stages are cascaded to increase the number of applied pulses required to produce an output. For each one of the fingers in Fig. 1, a separate Eccles-Jordan circuit must be used. A block diagram of a 5-stage counter is shown in Fig. 3. Each stage requires two negative input pulses (one to each grid) to generate one negative output pulse. Thus, in order to generate a negative pulse at the output of the second stage, four pulses must be applied at the input of the first stage.

A rush call came in from a manufacturer of pulse generators. The trouble was in a production line frequency counter used to test the generators. The frequency would register up to 15 but no higher. From this bit of news, the trouble had to be in the fourth stage or in the input coupling to the fourth stage (see Fig. 4.) A 50V negative pulse is applied at the input and coupled through the diode with the more positive plate (the one connected to the nonconducting triode plate V1. The negative pulse is generated across the nonconducting triode plate load resistor and coupled to the conducting triode grid, driving it into cutoff. C2 and C3 are included in most Eccles-Jordan circuits to couple the leading edge of an applied pulse to the grid because they aid in providing fast response to an incoming pulse, but the controlling action is still through the DC or resistive coupling. Tracking down the trouble in this particular case, it was found that no B+ was present at the diode cathodes because R8 was open.

Neon lamps are placed across one of the plate loads to indicate when the stage is in the "one" or zero state (when the triode containing the lamp is conducting). Before a count is begun, the stages must be tripped into the zero state. A common method of doing this is to open the ground return in the grid circuit of the triode without the lamp. Fig. 5 shows the connections for the lamp, the current limiting resistor, and the reset switch. When the reset switch is momentarily opened, the grid of V2 will be placed at B+ potential, causing V2 to go into conduction and V1 into cutoff. The lamp cannot light and the stage will be in its zero state.

On one occasion, the complaint was that a lamp could not be turned off although counting seemed normal. The tube in that circuit was checked and found to have grid-to-cathode leakage in the first section. When reset was attempted, V2 would conduct, but the leakage caused V1 to come back into conduction when the reset switch was closed. Counting was normal at high speeds, but a slow input rate caught V1 going from cutoff to conduction without the application of a pulse. The leakage added enough voltage to the grid to overcome cutoff.

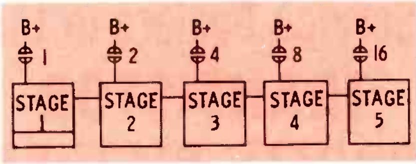


Fig. 3. Five Eccles-Jordan stages used in cascade can count up to 32.

Input pulses to an Eccles-Jordan circuit must contain a definite set of characteristics. The amplitude must always be the same, the width or duration of a pulse must be the same within a very small tolerance, and finally, rise time (t_r) from 10% to 90% of pulse height must be very short. With all these restrictions, the shape of the applied pulse cannot be left to chance.

A pulse-forming circuit as shown in Fig. 6 is usually used ahead of a scaler or computing circuit. Even with a wide variety of negative input pulse shapes, the shape of the output pulses will be uniform. C1 and R1 form a timing circuit having a time constant which is greater than the duration of the input pulses. When a pulse is applied to the grid of V1, this tube is driven into cutoff. The voltage across R4 drops with the pulse until V2 comes out of cutoff. The voltage change at the plate of V2 is many times that of the input pulse, and the discharge

• *Please turn to page 69*

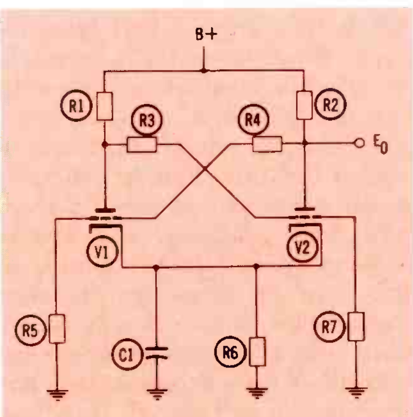


Fig. 2. Eccles-Jordan stable-state multivibrator used in binary counters.

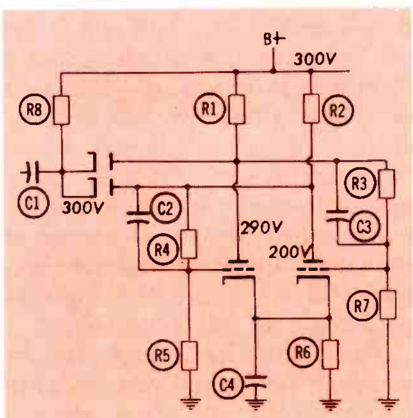


Fig. 4. Diode coupler circuit feeds input pulse to the conducting tube grid.

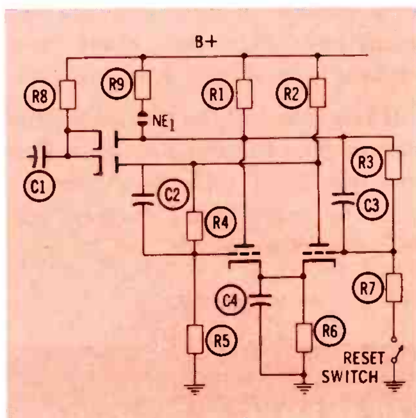


Fig. 5. R9, NE1 and a reset switch are commonly used in most binary computers.

TV SERVICE ...A LIVING?

by W. C. Pecht

TV has been with us about ten years now, and what you fellows don't know about theory is pretty well compensated for by experience—and vice-versa. The newcomers have many sources of information, and if they tie up with an old-timer, they should be able to earn a living.

Which is the subject for today. Do you make a good living out of TV? If not, why not? Your ability to fix 'em needs no investigation; you have been and still are the most important cog in the whole TV machine. That sounds like big talk, but if we consider that the average TV breaks down at least four times a year and people still buy them . . . you guys must not only be fine servicemen, but also the world's greatest salesmen. Anything else requiring so much attention couldn't be given away even with two pairs of mukluks as a premium.

In spite of this, many of us may not be doing as well as we have a right to expect. Perhaps we've been too conscientious, too eager, too ready to accept fact, and too quick to reject fantasy. What's wrong with fantasy? A child's world you say—but aren't all men just bigger kids? In John Q. Public's mind the whole idea of television is about as fantastic as any fairy tale.

Gentlemen, we have overlooked the pearl in the oyster. When a customer gasps at the sight of a TV chassis and says, "How did you ever learn what all those things do?", you puff up a little and say with much modesty, "Nothing to it, ma'am—just a bit of study, a bit of curiosity and an old voltmeter willed to me by my drinkin' uncle." Man . . . you missed the boat. By stretching the truth a little and capitalizing on human nature, you could strike a powerful blow for the financial well-being of all servicemen.

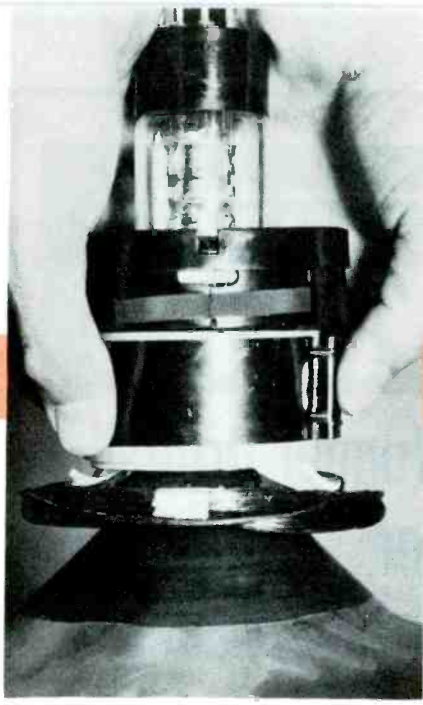
You could have said, for instance, "Well, to tell you the truth, ma'am, there are some parts in there that nobody has yet been able to figure out. This set was designed by a Yogi and before he could explain the thing to the engineers, he disappeared."

When faced with a technical problem of such magnitude as this, the customer can't help feeling that if you can fix this one, you can fix anything; and with compassion in her heart for your coming ordeal, she says, "Take as long as you like, do whatever has to be done and we'll have the cash waiting for you when you bring it back." If they think that a job is difficult, why spoil their fun?

Most people regard the scientist as a genius, an educated super-human, necessary, expensive, screwball. Get that, EXPENSIVE SCREWBALL! Of course, this is ridiculous; it doesn't even approach fact. You and I know that a scientist has to be level-headed and extraordinarily intelligent but, what's our opinion against millions of others?

So, let's go along with it. The next time a customer says, "No offense, Irving, but doesn't learning all that stuff make you a little punchy?" try to let your jaw hang a little slack and mumble, "If the aspect ratio equals pi times the reluctance of the first detector, then it proves that Barnum was right." Look him right in the eye and say, "Confound it, go back and tell them we take off when I'm ready and not one light year before!"

When this guy leaves your shop, he'll tell the first person he meets, "That guy really knows his stuff, but is he a nut—a first class filbert." As soon as you have established your position in the public eye as a "scientist," you can enjoy the financial reward that accompanies the title. People generally assume that genius is but a short putt from madness, and are as eager to patronize the genius as they are to shun the madman. People like to give money to science; don't disappoint them—get with it! A little showmanship and imagination will pay off. Hmmm—I wonder how I'd look in black tights with a space helmet? ▲



REPLACING DEFLECTION YOKES

It's no problem when you have the facts *by Les Deane*

On the surface, replacement of a deflection yoke should not present much of a problem to the average TV technician. Looking deeper, however, it is found that wiring hookups, damping and neutralizing elements, and mounting considerations have been causing servicemen a certain amount of trouble. The purpose of this article, therefore, is to acquaint the reader with underlying facts which must be considered even for some "run-of-the-mill" yoke replacements—also, to present a logical approach to the servicing angle. To do this, let's first examine a typical deflection yoke both physically and schematically.

Physical Description

Pictured in Fig. 1 is an actual yoke assembly which has been cut in two, leaving one complete horizontal winding and half of each vertical winding intact. The horizontal windings are located on the inner surface and usually come in direct contact with the neck of the picture tube. In actual operation, the horizontal coils are placed in a vertical plane, so that the resultant field will deflect the electron beam in a horizontal direction. An insulating material, most often a plastic-like substance having high-voltage insulating and moisture-resistant qualities, is used to separate the vertical and horizontal windings. The vertical windings are located on top of the plastic insulator and at right angles with respect to the horizontal windings. In normal operation, the two vertical coils are positioned in a horizontal plane on each side of the picture tube neck and thus their fields control the beam in a vertical direction.

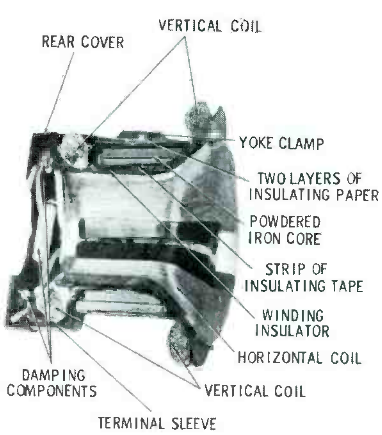


Fig. 1. Cross-sectional view of a typical 90° yoke showing its complex makeup.

In this particular example, the core material is divided into four sections laid end to end, completely surrounding the circular form. Over the core pieces are two additional layers of insulation. In this case, a fairly heavy grade of fish paper is employed. The plastic terminal board is wedged beneath the core and insulation materials, and the entire assembly is held together by a single metal clamp. In many designs, especially the older 50° and 70° units, the core clamp may also have a built-in nut arrangement for mounting. Vertical and horizontal damping components, as well as a section of the rear cover, are also identified in the photo of Fig. 1.

Electrical Description

Investigating the yoke from another point of view, the technician may also become a little confused when called on to trace its wiring schematically. A diagram of a typical yoke assembly is shown in Fig. 2. In service schematics illustrating all of the yoke windings in close proximity (such as Photofact Folders), the horizontal coils are generally drawn vertically and the vertical coils horizontally, as shown. On other schematics, the individual windings may be positioned with their appropriate output circuits.

Replacement instructions, operational theory and production changes will often use terms which may not be completely understood by the service technician. Such references as *high side* or *top* of a winding, yoke return, fifth yoke lead, or damping and neutralizing elements, are vernacular terms dealing with yoke circuits.

Contacts within the yoke assembly are usually identified by numbers stamped or printed on the terminal board; these in turn will often appear on the schematic diagram. It can be seen in Fig. 2 that one coil of the horizontal system is connected between terminals 2 and 1, while the other is connected between terminals 3 and 7. The

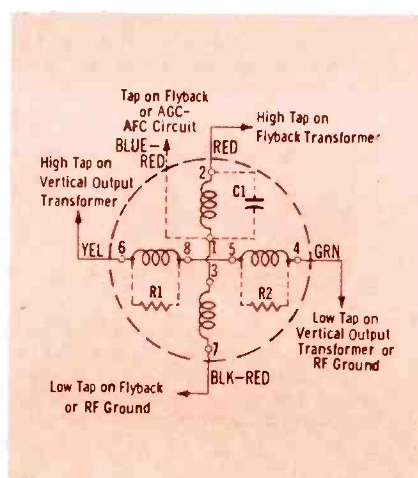
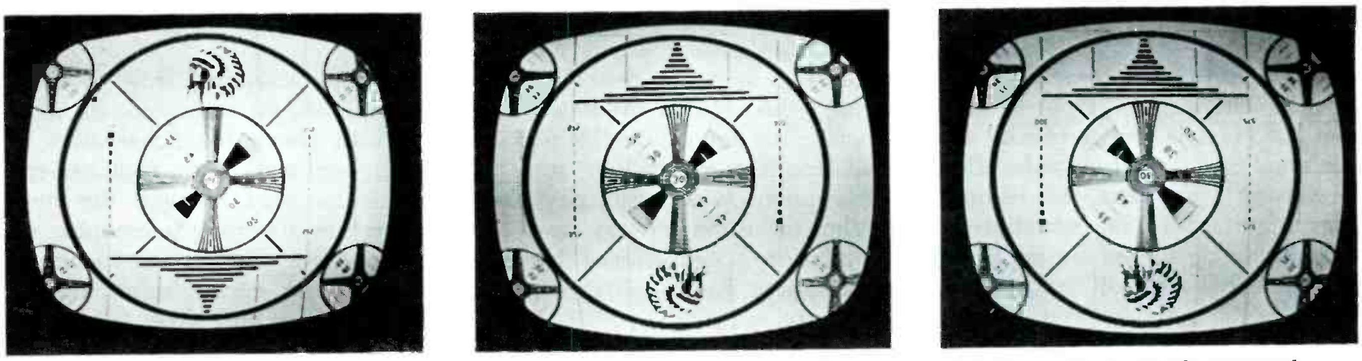


Fig. 2. Wiring diagram of a deflection yoke and most likely circuit connections.



(A) Horizontal connections reversed. (B) Vertical connections reversed. (C) Connections of both reversed.

Fig. 3. Improper picture orientations caused by incorrect yoke connections.

vertical coils are connected from terminals 6 to 8 and 5 to 4. When reference to the *high side* of the horizontal windings is made, it means the uppermost yoke connection on the flyback, where sweep energy is greatest. The high side may also be called the *top* or *hot* side, and in Fig. 2, this is represented by the connection at terminal 2. Although seldom described as such, the high side of the vertical windings is likewise the connection at the top of the vertical output transformer, or terminal 6 in the example.

Colors of the original yoke leads frequently are identified on the schematic. Referring again to Fig. 2, we see that the lead connected to the high side of the horizontal windings is coded red, while that to the high side of the vertical windings is yellow. Such identifications aid the technician when yoke replacement becomes necessary.

The expression *yoke return* or *low side* may refer to either the horizontal or vertical deflection circuits, indicating the lead returning to RF ground or nearest to it. This may be to one of the lower taps on the flyback, the boost line, the B+ supply, or chassis ground. A capacitor is often connected in series with the horizontal yoke return lead. This component is employed to prevent DC current flow in the windings and to meet certain centering requirements.

Many circuit designs will call for a fifth yoke lead, such as that represented by the broken line coded BLUE-RED in Fig. 2, and it may connect to the junction between either the horizontal or vertical windings. When tied in with the horizontal circuit as shown in the schematic, the lead may return to a tap on the flyback between the high-side connection and RF ground, to an AGC keyer circuit, or to a horizontal AFC network. In some instances, the lead provides the connection to a damping component not physically located within the yoke housing. If the fifth lead is connected to the vertical deflection coils, it will generally return to RF or chassis ground. When replacing a five-lead yoke, make sure that you will be able to duplicate the original wiring or that proper instructions for circuit revision accompany the replacement.

Yoke-damping and neutralizing elements are merely electrical components added to the deflection circuit to reduce oscillation within, and interaction between, windings. As far as horizontal sweep is concerned, the damper tube prevents sustained oscillations; nevertheless, the ringing which results from the sudden reversal of yoke current during flyback time can result in damped oscillations during the trace period.

In Fig. 2, damping components R1, R2, and C1 are shown connected in a typical arrangement across the vertical and horizontal yoke windings. Units R1 and R2 are of equal resistance—normally a standard value between 150 to 2200 ohms. The shunt capacitor across the high side of the horizontal winding will range in value from 10 to 300 mmf and naturally, with the high peak voltages involved, will have a working voltage rating of 2 to 4 kv. Yoke circuits, especially some of the early designs for 90° deflection, may incorporate a resistor of approximately 1000 ohms in series with the horizontal damping capacitor. Rarely, one may also encounter a network where the shunt capacitor is connected across the bottom horizontal coil (terminals 3 and 7 in Fig. 2) or even between vertical and horizontal windings. More will be said about these later on.

The Replacement

In choosing the proper yoke replacement, consideration must be given to the deflection angles, inductance values, internal coil connections, and even physical size in some cases. Other minor considerations include yoke plugs, additional leads, mounting assemblies, or special rear covers with centering devices.

While in some cases it may be desirable or even necessary, securing an exact duplicate from the set manufacturer usually is not expedient. Fortunately, yoke manufacturers have made standard replacements available for practically any unit; fortunately too, cross-reference data is available in abundance. Service data often recommends exact replacements and/or substitutes which require only slight electrical or physical alterations; however, it's a good idea to consult your distributor's latest catalogs and cross-reference guides before making a final choice, since a unit better suited to your needs may have been introduced after the initial reference data was published.

Wiring

Dealing more directly with the problem of making a replacement yoke work, let's turn our attention to the installation procedure.

Removal of the defective yoke is naturally the first step. This will not give rise to any problems unless, by chance, the yoke insulation has melted and hardened on the neck of the picture tube. Before using a crowbar, the technician might give the situation a little thought, unless he replaces picture tubes free of charge.

One recommended procedure is to heat the yoke until the insulation softens. Perhaps the easiest and safest way of producing the needed heat is through the use of controlled current through the windings; one ampere through the horizontal windings is usually sufficient.

In disconnecting the original yoke leads, it's a good idea to make a simple wiring diagram for later identification of the various lead colors and their circuit connections. If an exact duplicate is used as a replacement, the color-coded leads will probably agree with the originals. Standard or universal replacements, on the other hand, may have different lead colors and terminal numbers. If so, it will be necessary to trace the circuitry of both the old and the new yoke in order to determine the proper lead connections. When such a replacement is selected, pay particular attention to any and all installation notes offered by the replacement guide and/or service literature.

If the replacement is nearly identical to the old yoke, chances are the installation note will read, "Connect same as original." This indicates that both yokes are wound in the same fashion and that the numbering of their terminals correspond. Installation notes accompanying universal replacements give detailed instructions for wiring the unit into the circuit. In many instances, the instructions will state exactly which leads of the replacement go to what pins of an original yoke plug. When making the substitution, the possibility of certain damping elements being part of the chassis wiring rather than the yoke assembly should be kept in mind.

If the technician fails to heed special wiring notations or neglects to check the schematics of both original and replacement units, he may damage the new yoke, its damping elements, or even other chassis components. On occasion, certain minor installation errors will show up in the displayed picture, but will not result in any damage. (See the symptoms pictured in Fig. 3.)

Yokes employed in many modern, vertical-chassis receivers have lead openings and mounting devices located close together. Generally, a universal-type yoke has leads emerging from one side and mounting device from the other; thus the technician may find it necessary to loosen the core clamp and rotate it 180°.

Another case when this procedure might be called for is where the terminal numbers on the replacement are reversed from those of the original. In order for the installation note to read simply,

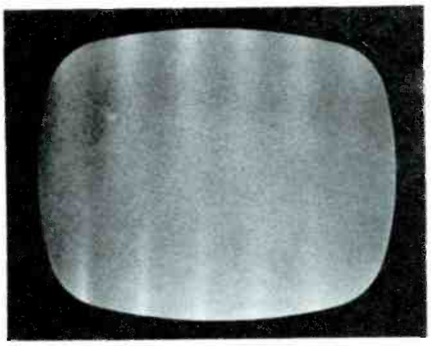


Fig. 4. Yoke ringing—the tell-tale evidence of incorrect damping.

"Connect same as original," further instructions indicate the sweep should be reversed by merely rotating the yoke assembly 180°, leaving the clamp in the same mounting position. In this type of installation, the horizontal damping capacitor must be relocated and the yoke leads will naturally end up in a different position.

During a yoke replacement, one may encounter a number of different trouble symptoms on the screen caused by improper damping of the deflection system. The symptoms may range from only a slight ripple at the beginning of each horizontal scanning line to very noticeable light and dark vertical bars near the left side of the screen. This type of distortion often results from an unbalanced condition between the two horizontal coils or excessive coupling between vertical and horizontal windings.

Yoke ringing produces a fluctuation in the horizontal magnetic field, causing beam deflection to speed up and slow down accordingly. This results in nonlinear deflection and shows up on the screen as light and dark vertical bars as pictured in Fig. 4. If the ringing is not too severe, but suffi-

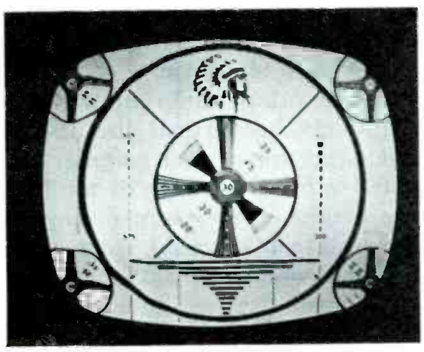


Fig. 5. Ripple at beginning of trace is due to interaction between deflection circuits.

Fig. 6. Yoke cover with centering device not standard on most replacement units.

Fig. 7. Cover with clamping device holds deflection yoke in position.

cient coupling exists between vertical and horizontal windings, a ripple effect may appear as shown in Fig. 5. The vertical deflection appearing along each scanning line represents horizontal ringing current in the vertical yoke coils.

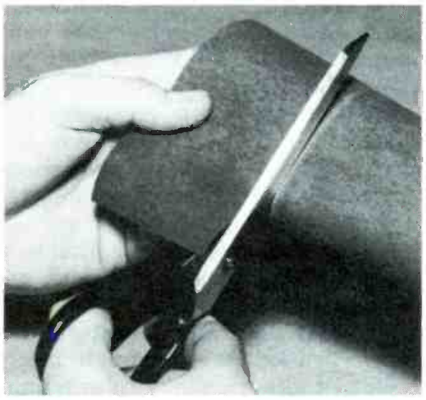
Although the limited amount of yoke ripple shown in Fig. 5 would not be too noticeable on stationary images, it becomes very apparent when the TV camera pans to either side. In more extreme cases, the ripples become very objectionable, and even the most congenial customer wouldn't let you get by without correcting it.

As mentioned previously, capacitors and resistors of various values are employed as damping and neutralizing elements in different circuit designs. These values are somewhat critical in some cases, while in others they are of relatively small consequence. This brings to mind another installation note often found in service literature—"May require use of original damping network." Simply stated, this means that if ringing is encountered when using the damping network supplied with the replacement, use of the original network (or equivalent replacements) is recommended.

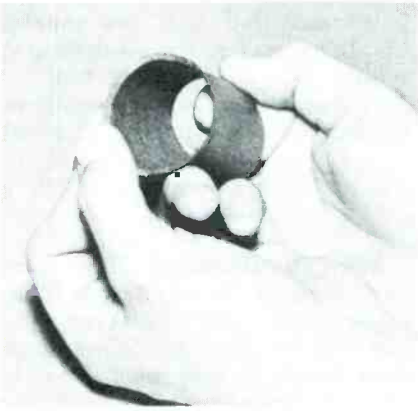
An interesting feature concerning yoke damping components is the unique arrangement found in late-model Philco receivers. The yoke, a 90° unit, makes use of a fifth lead which connects between the two horizontal yoke windings and returns to a tap on the flyback transformer through a resistor. This lead, as well as all other yoke wires, terminates at a chassis plug. The fifth yoke lead, together with the one connected to the high side of the horizontal windings, are confined in close proximity by a length of insulating spaghetti for the distance between the yoke terminals and the yoke plug. These two leads, running side by side, provide the required damping capacitance of 110 mmf. When replacing the yoke in this particular set, remember that it may be necessary to use the original plug and leads and also to remove the damping capacitor supplied with the new yoke.

When confronted with a ringing problem after yoke substitution has been made, check to see that the horizontal damping components are connected across the proper terminals. If no discrepancies are found, vary the capacitor value until ringing is minimized. In obstinate cases, ringing can sometimes be reduced further by connecting a capacitor between horizontal and vertical windings. A unit of approximately 270 mmf may be placed from the center of the vertical windings to the bottom or RF ground of the horizontal winding. When changing yoke components, use capacitors having adequate voltage ratings and noninductive resistors, preferably of 5% tolerance.

Substituting different resistor values in the vertical circuit will not affect horizontal ringing, but if the value is too high or too low, the height of the picture may be reduced considerably. Since the original damping network may have been exposed to high temperatures and voltages, it pays to use new components when the yoke is replaced.



(A) Cutting fish paper to size.



(B) Cut and roll to form flange.

(C) Cement, position, and allow to dry.

Fig. 8. Details for the construction of a width sleeve insulator.

Covers, Clamps, and Sleeves

The most important factor in the choice of a yoke replacement naturally concerns the electrical qualifications. There are, however, certain physical aspects that must also be taken into consideration. In many receivers, for example, the original yoke may include a centering device such as that shown in Fig. 6. The device is actually part of the yoke cover and is made up of two magnetic rings that can be rotated independently to achieve picture centering.

The installation note for a conventional replacement yoke may read, "Use original rear cover and centering device." Since these covers are standard in size, the technician need only remove the old one and place it in position on the new yoke.

Another design feature found only in modern receivers is a self-contained yoke-clamping device. This item may also be a part of the rear-cover assembly as pictured in Fig. 7, constructed so that the yoke clamps to the neck of the picture tube and no mounting bracket from yoke to chassis is needed. Here again, we find that the original rear cover assembly must be used.

Certain General Electric, Hotpoint, and Philco receivers employ special yoke-clamping devices which cannot be used with general yoke replacements; therefore, the technician may find it necessary to fabricate or purchase a new mounting. The yoke must seat against the flared bell of the picture tube and mount securely either to the chassis or picture tube before the replacement job can be considered complete. Otherwise, the customer eventually may find himself viewing a tilted picture with his neck bent to one side—and as a callback, the pain in the neck will be yours.

As a final physical consideration, mention should be made of receivers employing a metal sleeve which slips between the yoke and the neck of the picture tube. Movement of this sleeve along the neck varies the strength of the deflection field and thus affects raster width. When a yoke replacement is made, this width sleeve must be used in its original application. Since it is metal and comes in close contact with the horizontal yoke windings, however, some form of insulation must be used. In a few receivers, the sleeve itself may be insulated, but in most cases the original yoke will have the necessary insulation.

It's almost impossible to remove the insulating material from the original yoke without damaging it; so if it is not already incorporated in the replacement, the technician should follow the procedure outlined in Fig. 8 and form a new width-sleeve insulator. ▲

Relocate. Shops that specialize strictly in TV servicing are forced to keep rent costs low in order to hold overhead expenses to a minimum. In the past, this fact has relegated many service businesses to hole-in-the-wall locations on side streets.

However, the time is now ripe for such shops to seek better locations with more elbow room. In many cities, the stores which depend on heavy customer traffic have moved in droves to new shopping centers and other outlying locations with good parking facilities; consequently, many large store buildings in older areas near the middle of town have been left vacant. These "empty shells" are an excellent value for the rental dollar. In many cases, rents have dropped considerably because of a lack of demand for locations of this type, even though many of the buildings are in choice business districts.

Parking is usually a prime problem, but you have no worries about customer parking facilities when you are taking your services to the customer in his home! All you need is enough space to park a few service trucks. Some of this space is usually available behind the store; in addition, many cities will designate the curbside area in front of the store as a "loading zone" for a small fee, further easing your own parking problem.

Realtors emphasize that locations on heavily traveled streets are the best bargain for two good reasons:

1. People who read your advertisements will recognize the name of an important street and will know where you are located. This factor encourages people on your side of town to call you when they need service.

2. On a busy street, your shop will be noticed by larger numbers of passersby. Incidentally, you can call their attention to your place of business by erecting a clearly visible sign that prominently features your telephone number.

$ & ¢

Test Your Tact — III. Except in fringe areas, an outdoor antenna seems to be one of the most difficult to sell TV accessories. Unreasoning fear of the lightning menace, reluctance to have "that unsightly thing" on the roof of the house, or holes drilled in the siding, plus a tendency to balk at the added expense — all these customer attitudes can add up to stubborn resistance to an outdoor antenna installation. Your most skillful and tactful efforts are often required to jar the customer loose from his preconceived notions.

How would you present your case to him? It may be helpful to stop and think over the following points:

A careless technician named Cy,
While checking a power supply,
Put his hand on a spot
Where the B plus was hot,
And discovered that E causes I.

There was an oldtimer named Billy
Who thought that textbooks were silly,
Now new circuits amaze him
And transistors daze him,
And he doesn't know micro from milli.

What are your reasons for recommending an outside antenna? Besides the obvious profit motive, you also have an interest in improving picture quality so that the customer will be better satisfied with your service work. "A much clearer picture" is your strongest selling point, especially if you can show the customer slight faults in the picture that would be cleared up by a proper antenna installation.

If you run into customer resistance, why try to get across your point all at once? Mildly state the points in favor of an outdoor installation; after the customer has had time to think these over, he may come around to agreement without any further effort on your part.

Stress that you can make a neat-looking installation and reassure him that a well-grounded mast and lightning arrester have been proved safe through many years of experience with antennas much taller than the one you hope to install for him. You can even point out that you are making his home safer by equipping it with a type of lightning rod!

Above all—when the customer finally OK's the job, do it right!

$ & ¢

Window Dressing. How many variations of the old "How Many Beans in the Jar?" guessing game can you recall seeing? One appliance dealer in Maryland dreamed up one more new twist on this theme. Taking a jumble of miscellaneous parts from junked TV sets, he dumped them all into a jar which he placed in his front window as the basis for a contest.

Here is a good idea for a simple but effective display to use in a TV shop window. If you conduct a "How Many Parts?" contest, a prize such as a free service call or a supply of radio batteries could be awarded to the winner.

$ & ¢

Repairs Inside and Out. When you have to take a TV set into the shop for a couple of days, inspect the cabinet to see if it could stand a few repairs, too. By offering to have both the chassis and cabinet repaired at the same time, you encourage customers to have minor nicks and scratches removed instead of putting off this work indefinitely. In case you don't want to do your own cabinet touch-up jobs, or damage is beyond your ability to repair, hunt up a furniture-refinishing shop in your neighborhood and make an agreement. Both you and the furniture shop can profit, and the customer still gets the work done at less cost than if the furniture refinisher had to work on the TV set in the home or haul it away, chassis and all, to his shop.

notes on TEST EQUIPMENT

Informative reports from the lab

by Les Deane

Signal-Pickup Device

The Model 850 Induced Waveform Analyzer shown in action in Fig. 1 is a product of Winston Electronics, Inc., Philadelphia, Pa. The Model 850 provides for pickup and amplification of signals without direct connection to the circuit under test. Output of the analyzer is fed to an oscilloscope for observation and analysis. Tuned circuits are provided so that undesired signals can be rejected.

Specifications and Features are:

1. *Power Requirements — 105 to 125 volts, 50/60 cps; 30 watts at 117 volts, 60 cps.*
2. *Frequency Coverage — turret tuner provides for selection of VHF channels 2 through 13 plus inputs at 21, 41, 3.58 and 4.5 mc; fine tuning provided for all RF bands except 21 mc.*
3. *Functions — high gain audio-video, RF-IF, 3.58-4.5 mc and direct scope input.*
4. *Input Sensitivities—using oscilloscope with input sensitivity of 25 mv/inch, the following typical sensitivities will apply for the various functions of the instrument.*
   a. *High Gain Audio-Video — 1 mv/inch or better.*
   b. *RF-IF and 3.58-4.5 input functions:*
      ch. 2 to 6 - - 300 μv/in. approx.
      ch. 7 to 13 - 400 μv/in. approx.
      3.58 mc - - - 0.6 mv/in. approx. (assuming broad band scope)
      4.5 mc - - - - 40 mv/in. approx. (assuming broad band scope)
      21 mc Band - - - 350 μv/in. ap.
      41 mc Band - - - 300 μv/in. ap.
   c. *Direct scope input — same as scope used.*
5. *Probes — two ring-shaped and one crescent-shaped pickup, small ring for 7- and 9-pin miniature tubes, larger ring for larger tubes, and crescent shape for dual-purpose tubes and other components.*
6. *Gain Control—front panel control gives continuously variable attenuation and also varies tuner bias.*
7. *Audio Monitor Jack — phone jack on rear of instrument provides for audio monitoring.*
8. *Demodulation — modulated RF signals are automatically demodulated by the instrument and can be applied directly to scope.*

While working with the Model 850, I was impressed by its sensitivity and the ease with which the pickup probes could be used to detect signals at various points on the receiver chassis. A usable indication was obtained when the smaller ring was slipped over the RF amplifier tube (shield removed, of course). I noticed a difference in indication as the ring was moved from the top to the bottom of the tube. Using the crescent-shaped probe, I was able to pick up the audio signal with the pickup next to the speaker leads.

A diagram of the test setup employed with this instrument is illustrated in Fig. 2. The output cable from the Model 850 comes from the rear of the instrument and connects to the vertical input of the scope. The ground lead is clipped to a common ground point in the receiver. No sweep signal is provided by the Analyzer, so the scope is set to sweep at the line frequency or some multiple thereof.

A closeup of one of the ring pickups appears in Fig. 3. The cable shield extends down to the probe and continues in the form of a metal ring around the outside of the pickup. The inside of the probe is another metal ring

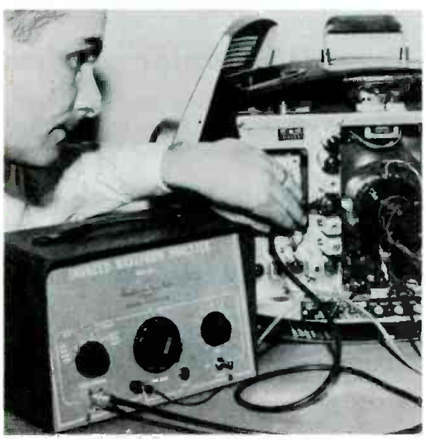


Fig. 1. Winston Model 850 picks up signals without direct contact to the circuit.

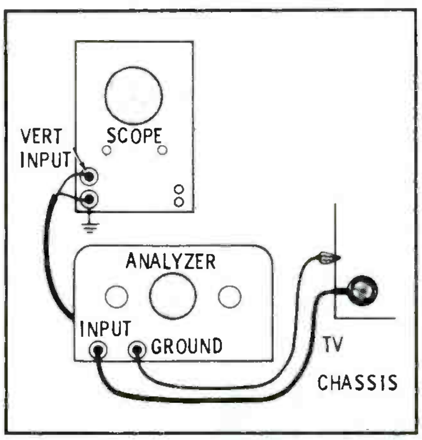


Fig. 2. Test setup for "Analyzer" requires the use of a general-purpose oscilloscope.

Fig. 3. Model 850 uses pickup rings to sample the signal from the receiver.

which is the sensitive part of the pickup, and the two metal rings are insulated from each other.

Portable Field-Strength Meter

The Model FSM-1 Field Strength Meter pictured in Fig. 4, manufactured by Blonder-Tongue Laboratories, Inc., Newark, N. J., covers a band of frequencies for VHF television, FM, aircraft, mobile, amateur, and other special services.

Specification Features are:

1. *Power Requirements—battery-operated, using three 45-volt units in series for B+, two 1.5-volt batteries in parallel for tube filaments, single 1.345-volt cell for bias.*
2. *Frequency Range — continuously variable from 54 to 216 mc.*
3. *Sensitivity — minimum signal strength of 10 μv up to a maximum of 3 v.*
4. *Input Impedance — 75 ohms, 300- to 75-ohm matching network supplied.*
5. *Meter Ranges—ten ranges from 300 μv to 3v full scale are provided using various combinations of built-in RF attenuators; meter provided with db and %AM scales.*
6. *Accuracy—±1 db at full scale using 1000-μv input.*
7. *Signal Monitoring Provisions—output jack for both video or sound indications.*
8. *Size and Weight—8¼" × 12" × 9¼", 14 lbs. less batteries.*

By using a Model FSM-1 in the lab and examining its instruction manual, I found that the average service technician could certainly use an instrument of this nature in the installation and trouble-shooting of TV or FM antenna systems. In the shop, it would also be of value when checking the output of a VHF generator, measuring the percentage of AM in an FM signal, or locating a source of interference. The signal accepted by the meter can also be viewed on an oscilloscope or heard through the use of earphones. Observing the sync pulses contained in a composite TV signal, for example, one can easily detect undesired clipping caused by an overloaded amplifier.

A photograph of the instrument's meter face is presented

Fig. 4. Blonder-Tongue Model FSM-1 direct-reading VHF Field Strength Meter.

in Fig. 5. The top scale has ten divisions and is used when the 10 db RF attenuator is out of the input circuit. Under these conditions, the scale may be used with any combination of the other four 20-db attenuators. A small table in the lower right corner of the meter face indicates the proper full-scale reading for attenuation from 0 to 80 in steps of 20 db.

The second scale has six divisions from 0 to 3 and is to be used when the 10-db pad is in the circuit. Reading from this scale, the technician refers to the table in the lower left corner which gives full scale value in volts, millivolts, or microvolts, depending on the number of attenuators being used.

The %AM scale located in the center of the meter is calibrated from 0 to 20 and is used to determine the percentage of amplitude modulation present in an FM carrier. With the meter properly set up, the scale will give a direct reading up to 20%.

The bottom scale on the meter face serves as a db reference indicator and is calibrated from minus 20 to minus 40 db. The scale

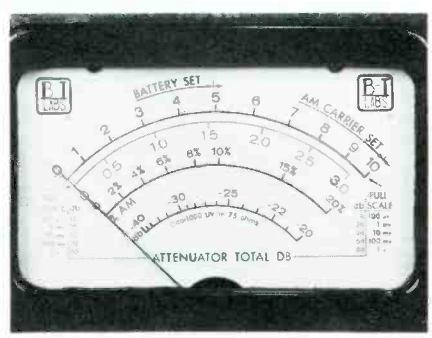


Fig. 5. Meter scales are calibrated against db attenuation used during measurement.

is based on a standard of zero db equals 1000 microvolts across 75 ohms. The measured signal will either be above or below this standard by the db value indicated on the scale.

When using the FSM-1 to test the signal strength of local TV stations on our antenna distribution system in the lab, I set up the instrument as follows: By placing the ATTR slide switches in their up positions, I started out with all db attenuators in the circuit. Next, I turned the AM CARR SET switch completely counterclockwise and placed the function selector to VIDEO/FIL position. I then adjusted the filament battery voltage until the meter pointer was directly over the BATTERY SET mark located at the very top of the meter face. Changing the function selector to SOUND/B+ position, I proceeded to adjust the B+ control until the pointer again fell over the BATTERY SET indication. With filament and B+ voltages properly set, I placed the function selector to the FS (field strength) position.

Since the antenna system being checked terminated into a balanced 300 ohms, I made use of the Model MB matching network supplied with the 75-ohm instrument. Following instructions for wiring the special solderless connectors and using a short piece of 75-ohm coax, I attached the antenna lead to the matching device and the coax connector to the instrument's RF input jack. Zeroing the meter and tuning to the desired channel frequency, I switched the attenuator pads out one by one until I obtained a usable meter reading.

I checked filament and B+ voltages periodically as I measured the available signal level from four local TV stations and our

"No, I wouldn't care to take a crack at it ......"

own closed-circuit system. Using the scale called for in the tables on the meter face, I was able to read the various signal voltages directly.

Something Unique in Probes

Doss Electronic Research of Kansas City, Mo., has developed three interesting pieces of equipment especially designed with the TV technician in mind. Each can be held in the hand, the largest being about 7½" long and less than 2" in diameter. The unit shown in operation in Fig. 6 is known as the Video Master Model D-200, a tuned, high-gain RF demodulator probe.

Specifications and Test Features are:

1. *Power Requirements — 110 to 120 volts AC for tube filament supply, resistive-type line cord and series-dropping resistor provided; amplifier B+ voltage supplied from receiver under test through the special clip lead provided.*
2. *Accessory Equipment Needs — any normally operating general-purpose oscilloscope.*
3. *Frequency Ranges—built-in IF amplifier tunable over the 20- and 40-mc IF bands, separate calibration dial and adjustment for each range.*
4. *Test Applications — IF signal-tracing from TV tuner output to video detector; stage-by-stage IF and trap alignment; eliminating AGC circuit as source of trouble; general tuner and IF troubleshooting.*

In my examination of the Model D-200, I found that it surpasses the usefulness of ordinary scope demodulator probes by having, in addition to a detector circuit, a complete tunable IF stage. This circuit furnishes amplification of the composite video signal prior to detection, and thus provides a sizable scope indication for the technician to analyze. Deciding to use the Video Master for signal tracing (its primary function), I followed the instructions outlined in the manual and connected its output cable to the vertical input terminals of an oscilloscope. I next attached the red lead to the IF B+ line of a TV chassis. After permitting the instrument and chassis to warm up for a short time, I placed the probe tip on the IF output point of the tuner.

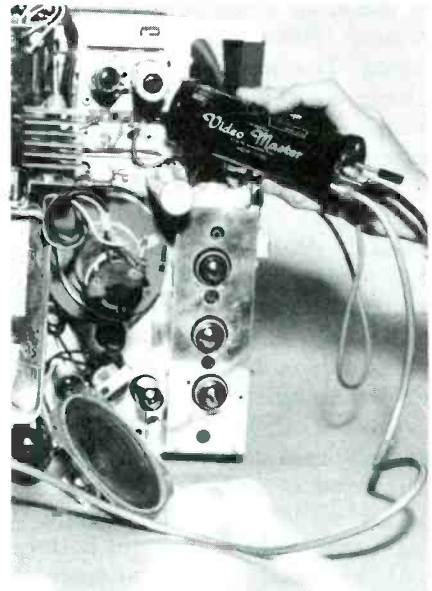


Fig. 6. Doss probe Model D-200 is used with a scope for RF and IF servicing.

Since the IF range of the receiver was in the 40-mc band, I placed the 20/40-mc switch in the appropriate position. The switch, a slide-type device, is located on the body of the probe where it can easily be operated with the thumb. Tuning the 40-mc slug at the rear of the probe. I was able to obtain the signal indication shown in Fig. 7. The strength of the signal obtained at this point was such that I didn't need all of the sensitivity offered by the scope. In weaker signal areas, the scope gain would have to be increased, especially when viewing a signal near the front-end of the receiver.

While performing other tests with the Model D-200. I checked its operation over a fairly wide range of B+ voltages and noticed little change in signal gain with B+ variations from 125 to 250 volts. This range is typical of that found in the IF section of most receivers. Methods for IF alignment and other troubleshooting

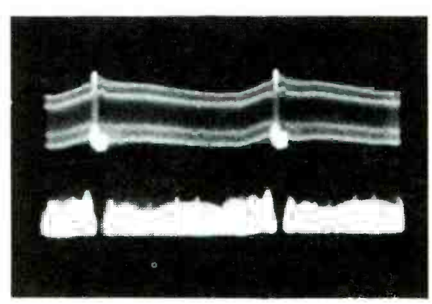


Fig. 7. Waveform of the tuner output signal produced by Doss "Video Master."

Fig. 8. Other TV troubleshooting probes manufactured by Doss.

procedures are clearly discussed in the instruction manual supplied with the Video Master.

Two additional Doss probes are pictured in Fig. 8. The Sweep Analyzer Model D-100 is used in conjunction with an oscilloscope to determine the condition of inductive components such as flyback transformers, yokes, and vertical oscillator or output transformers. A sharp pulse is applied to the component, producing a ringing which can be observed momentarily on a scope screen. The scope pattern formed by this action will appear as a spiral, mushroom, or circular-shaped figure depending on the inductance value of the component under test. Certain components may be tested in-circuit; others must be at least partially disconnected.

By comparing the short-duration patterns flashed on the screen with those given in the instruction booklet, the technician can detect shorts, opens, or leakage in TV sweep components. In addition, the probe can be used to check power, audio, and interstage transformers as well as other inductive components.

The Slave Oscillator pictured in Fig. 8B is another probe designed especially for sweep troubleshooting. Identified as the Model D-500, the instrument is actually a gen-

"When you reach ten dollars stop and we'll palaver a bit --"

erator with output signals which may be substituted for either the vertical or horizontal oscillator signals in a TV receiver. The unit operates on 117 volts AC with B+ supplied from the receiver under test. A 12BH7A tube is required to complete the two individual oscillator circuits contained within the probe.

The unit can be used to isolate trouble from the grid of the vertical or horizontal output tube back to the video detector stage if necessary. When the sweep output circuits are operating normally, I found that I could substitute for either oscillator driving signal and reproduce a raster having sufficient sweep. Aside from vertical and horizontal hold controls, the probe also features a vertical size adjustment and a special jack for sync control.

Wire Your Own Scope

PACO Electronics Co., Inc., Glendale, L. I., has recently introduced a new line of test instruments to the industry. PACO, a subsidiary of Precision Apparatus Co., Inc., markets this line of equipment in kit form only. One of their instruments is the Model S-50 Oscilloscope shown completely assembled in Fig. 9. Designed for general-purpose applications, the unit features adequate sensitivity and frequency response for both radio and monochrome television servicing.

Electrical Specifications are:

1. *Power Requirements — 105 to 125 volts AC, 50/60 cps; power consumption approximately 70 watts.*
2. *Cathode Ray Tube—5BP1 with green fluorescence and medium persistence, screen calibration mask provided.*
3. *Vertical Amplifier — sensitivity 90 mv rms/inch; sinusoidal response from 5 cps to 1.2 mc ±3 db or ±6 db to 2 mc; input impedance 1.5 megohms shunted by 25 mmf; push-pull operation with 3-step input attenuator and calibrated vernier; maximum input voltage 400 volts; direct connection to vertical deflection plates provided.*
4. *Horizontal Amplifier—sensitivity 250 mv rms/inch; sinusoidal response to 450 kc ±3 db or ±6 db to 700 kc; input impedance 10 megohms shunted by 25 mmf; push-pull operation with calibrated vernier gain control.*
5. *Sweep — linear sawtooth from 20 cps to 150 kc, selector provides 4 overlapping ranges plus line and external positions; sync switch provides internal, external or line synchronization; sync amplitude and horizontal phase controls on front panel.*
6. *Internal Calibration — sinusoidal signal at line frequency, amplitude 1.0 volt p-p, on-off calibration switch on front panel.*

Fig. 9. Model S-50, 5" Cathode Ray Oscilloscope—a new "PACO" kit instrument.

Since many of our readers have expressed the desire to hear more about kit-type equipment, we recently obtained a Model S-50 kit for examination. The instrument was wired and assembled in the lab, giving me first-hand information concerning the construction procedures, tools required, and time spent.

I found that, in addition to a carefully written step-by-step assembly procedure, the manual contained drawings and a complete schematic of the instrument's wiring. These drawings accompany the manual and may be attached to the wall above your work bench as a quick reference guide. I might also mention that soldering instructions, as well as color code and symbol charts, are incorporated in the manual to assist the builder in wiring and in component identification.

The use of printed-board construction for a large portion of the instrument's circuitry lightens the wiring task considerably. A small-tipped pencil iron of 25 to 60 watts is recommended for the

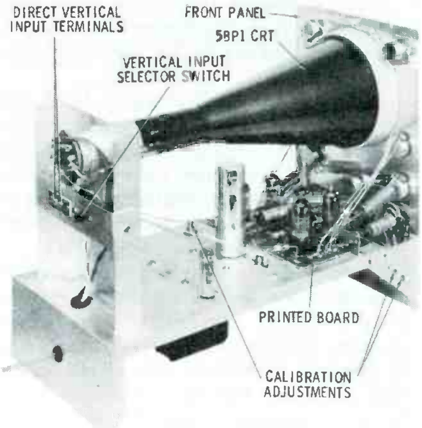


Fig. 10. PACO kit has printed-board assembly, neat lead dress, simplified layout.

soldering operation. Other tools required to complete the kit are of an ordinary variety and include such items as long-nose pliers, side cutters, screwdrivers, and a set of nut drivers or end wrenches.

A rear view of the finished chassis is pictured in Fig. 10. Some of the major items are pointed out, but the power transformer, line fuse and several others are on the underside of the chassis and cannot be seen.

Having seen how this kit was put together, I estimate that the average technician could assemble this scope in 6 to 10 actual working hours, including testing and calibrating. Naturally, allowances must be made for variations in the working speed of the individual and the facilities available to him.

Any piece of equipment, whether assembled by the user or by factory-trained personnel, must be constructed *exactly* as called for in the specifications or the instrument's over-all operation may suffer. A chain is only as strong as its weakest link — keep this in mind at all times during the assembly of a kit instrument. ▲

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the troubleshooter

answers your service problems

Poor Vertical Sync

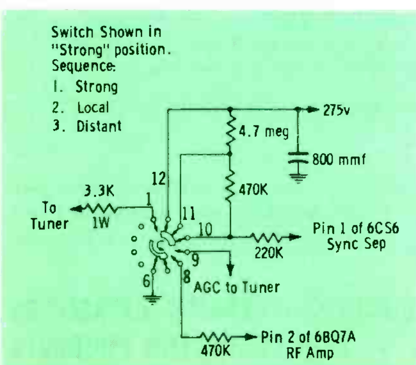
I have had considerable trouble with vertical roll in several General Electric "K" line television sets (Model 21T28). All components and voltages check OK in the sync and vertical circuits. I can find no production changes recommended by the manufacturer, so I have tried substituting parts of a slightly different value for almost all capacitors and some of the resistors in the sync and vertical sections of the receivers. So far, none of the changes have been of any help. Four identical sets have had this same trouble since they were new, and this leads me to believe that there is a defect in the design. Can you recommend anything to improve the vertical stability?

WILLIAM B. WOOD

Varnville, S. C.

The circuits surrounding the AGC switch were changed during the production run of these sets in order to improve vertical stability. See if the wiring in your receivers corresponds to the schematic shown, which gives the late-production circuitry. In addition to the changes shown, the value of the vertical hold control was reduced from 250K to 200K in later production.

In case the sets still do not work properly with the revised circuits installed, you probably will have to concentrate on trying to increase the p-p amplitude of the sync pulses applied to the vertical oscillator. Before modifying any part of the integrator or sync amplifier circuits for this purpose, make sure that you do not have excessive signal or DC bias at pin 1 of the 6CS6 sync separator. Either condition would cause this tube to cut off on sync tips, reducing the amplitude of the output pulses.



Overheated Flyback

The horizontal output transformer on a Capehart Chassis CT-157 overheated until the wax melted. I installed a replacement, but it also heated up after three or four hours of operation. I have replaced the yoke and all tubes and capacitors in the circuit, but have not cured the trouble. Voltages are correct when the set is first turned on, but they drop when the transformer starts to heat up.

MIKE MAKIDON

Television Service Eng'n'g, Inc.
Flint, Mich.

Try to find out what portion of the circuit is overloading the transformer. First, insert a DC milliammeter in the cathode circuit of the horizontal output tube. If the current is greater than the normal value of 90 to 100 ma, this may indicate that insufficient drive signal is reaching its grid. You should be able to bring this signal up to 75 volts p-p by adjusting the drive control; if you cannot, then look for trouble in the grid circuit or back in the horizontal oscillator circuit. Another possible cause of excessive current in the output tube is an open screen-bypass capacitor.

If output-tube current is normal, your trouble may be in the high-voltage rectifier circuit. One suspect would be the filter capacitor—a 500-mmf, 20-KV unit.

Pie-Crust Effect

In an Admiral Chassis 19K1, I recently installed an exact replacement flyback transformer. Since then, I have had pie-crust distortion around the edges of people and objects in the TV picture. This distortion, accompanied by lines or streaks, increases when the brightness control is turned up. Also, I sometimes hear arcing that I can't locate.

E. H. UNDERWOOD

Ernie's Radio & TV Service
Bluefield, W. Va.

If you installed the transformer correctly, and it is not defective, rule it out as a suspect. You mention that the distortion seems to increase at high brightness levels; this suggests two possibilities for trouble, neither of which are directly concerned with the flyback.

1. You might have AC ripple in the horizontal AFC voltage. To check for this condition, temporarily bridge a large capacitor (about .05 mfd) from the grid of the horizontal oscillator to ground, and see if the pie-crust effect disappears.

2. The picture tube might be defective. Temporarily substitute a similar type or a universal check tube, and see if the picture clears up. Incidentally, does the aquadag coating on the outside of the picture tube have a secure connection to ground?

I suspect that the arcing is not directly related to the picture distortion; instead, it is probably caused by a lead-dress problem inside the high-voltage cage. If you had to reroute some leads when you installed the new flyback, check them for adequate spacing away from other leads and from the transformer windings.

Radio Design

Lately I have serviced several small radios that use a 12BA6 tube in the converter stage. Since this requires an extra winding on the oscillator coil, I am curious as to the advantages of this type of circuit over a conventional one using a 12BE6.

JOHN W. KELLER, JR.

Oaklyn Radio & TV Service
Sunbury, Pa.

The 12BA6 pentode, unlike the 12BE6 pentagrid tube, lends itself to use in a circuit design that provides some gain in the converter stage. Thus, the entire IF stage can be omitted, and the resulting cost reduction more than makes up for the small extra expense of a more complex oscillator coil.

Speaker Distortion

I have two radios on the bench with similar symptoms. When the volume on either set is turned up more than halfway, the output becomes extremely noisy. Below the halfway point, both sets sound very good, I have decided that some stage is overdriven, but haven't been able to cure the trouble.

F. WAYNE NEAL

Temple City, Calif.

You didn't specify the kind of noise you are hearing, but your comment about an overdriven stage leads us to believe that your complaint must be distortion or garbled sound rather than impulse-type noise.

The original speakers might have defects such as a rubbing voice coil or torn cone which could give rise to distortion, especially at high volume levels. It's even possible that the radios are capable of putting out more audio power than the speakers can handle. Try a substitute speaker or known good quality in each set, and see if the sound is improved.

If the trouble is not in the speaker, try injecting a signal at the second detector with an audio signal generator and viewing the output across the speaker voice coil with a scope. This will give you a clear visual indication of whether or not the signal is being distorted as it passes through the audio section of the receiver.

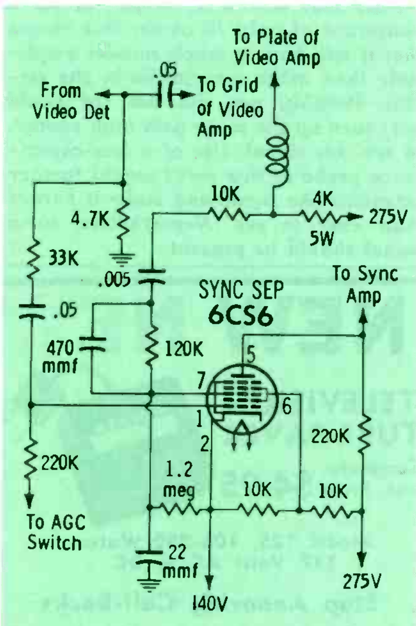
Poor Vertical Sync

A General Electric Model 21C238 loses vertical sync at times, and the vertical hold control has very little usable range. I changed all tubes several times in the vertical and sync circuits and also tried a new integrator unit and new height and vertical hold controls. Scope presentations appear normal. All voltages are normal except at pin 7 (the #3 grid) of the 6CS6 sync separator, where I read —25 volts instead of the —4.5 volts given on the PHOTOFACT schematic.

ROBERT G. JONES

Elliott, Ill.

There's a chance that —25 volts is normal at pin 7 under the conditions you are using for measurement. The reading of —4.5 volts is correct only when no signal whatsoever is being applied to the 6CS6. Any input signal will develop grid-leak bias, driving the voltage in a negative direction. Even with no video signal present, enough random noise might possibly be coming through to increase the bias to —25 volts.



To help isolate the trouble, feed a signal to the set, adjust the scope sweep to 30 cps, and recheck the plate waveform of the sync separator. If it is normal in shape and amplitude, I would say your trouble is in the vertical circuits rather than the sync stage. But a faulty waveform would tend to confirm your suspicions about the #3 grid voltage of the 6CS6. If this is actually too negative, the basic trouble is probably too long a time constant in the grid-leak circuit. Check especially for high-resistance soldered connections and increased component values.

B+ Too High

A Westinghouse Chassis V-2192 came to me with the horizontal output screen resistor open. After replacing it, three new troubles showed up. It had visible retrace lines, a slight horizontal foldover at the left of the screen, and slight pulling at the top of the picture. I installed a retrace suppression circuit, but then the picture would come in rolling for 30 seconds or more after turning the set on. I put a cathode bias network on the horizontal output tube (33-ohm resistor in parallel with a .1-mfd capacitor between cathode and ground) and this eliminated the foldover. But I can't seem to put my finger on the cause of the pulling. B+ voltage is 370 volts. Is this too high?

NORRIS ASCHE

Leigh, Nebr.

If you have 370 volts of B+, this is too high. Some step should be taken to lower it to the prescribed value of 310 volts output from the rectifier filter network. Suggest correcting this trouble first—it may be the cause of all the troubles!

The bending or pulling you describe is most likely due to trouble within the horizontal AFC and multivibrator circuits. The DC output of the AFC circuit is filtered and applied to the horizontal multivibrator as a control voltage. A lack of filtering of this voltage would cause waving or bending to occur in the picture. You can check for this condition by viewing the waveform at the input grid of the multivibrator; the presence of ripple means poor filtering.

The vertical roll during the first 30 seconds of operation sounds as though a tube in the sync circuits is slow to heat up, unless your retrace suppression circuit has affected sync stability. See if sync is improved with the new retrace blanking circuit disconnected. If not, check by substitution the tubes in the sync circuits, also those in the AGC and video circuits.

Noisy Vibrator

I have just finished installing a new vibrator transformer, buffer, and vibrator in a 1953 Mercury push-button radio. It plays perfectly and all voltages are normal, but the vibrator makes an unusually loud and annoying buzz whenever the accelerator is depressed. The noise does not come through the speaker, but it is loud enough to be heard above the signal from the radio. I have tried several different vibrators, and they all do the same thing.

HOMER L. MCANINCH

Texas City, Texas

A certain amount of increase in DC supply voltage is normal when you step on the accelerator; however, if the voltage rises much above 7 volts, you are likely to exceed the rating of the vibrator and produce a loud buzz.

Check the DC voltage at the "A" input of the radio; if this rises abnormally when you speed up the motor, have the car's voltage regulator checked over by an auto mechanic. Trouble there will shorten the life of the car battery as well as that of the radio.

Poor Color Reception

I am unable to get a good color picture on my RCA Model 21CT661U color TV set. In this area, most of our color shows are on Channel 14, with some also on 50. Black-and-white reception is pretty good, but I get a strong RF interference pattern and color snow when I turn the color on. The receiver circuits seemed to be working all right when I went through a color alignment of the set.

MARVIN PEYTON

Henderson, Ky.

It sounds as if the high frequencies in the incoming signal, including the color information, are being attenuated. Have you checked the frequency-response curves in the RF, IF, video and chroma sections of the receiver?

Since Channel 14 is right on the edge of the UHF band, there is also a strong possibility that the response of your present antenna is not flat over the entire bandwidth of this channel. Try one having high-band response which extends well into the UHF range.

Intermittent Rolling

I have a Zenith Model R2671E that is giving me a headache. In the customer's home, the picture will roll vertically for a few seconds every once in a while, or else the vertical blanking bar will move up to the center of the screen and come to rest for a few seconds before moving back down. Adjustment of the vertical hold control will restore sync. With the chassis out on the bench in my shop, the set operates perfectly except that the picture will roll one frame whenever I change channels.

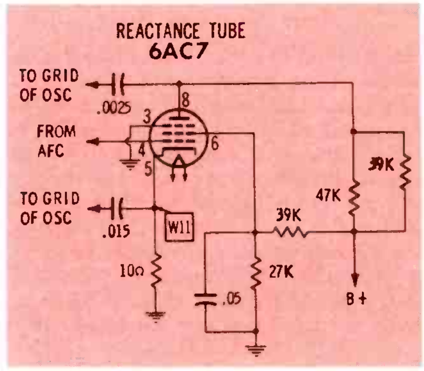
AC voltage in the customer's home varies from 105 to 117 volts.

CARLYLE WHEELER

Wheeler's Radio Service
Madison Heights, Va.

To help isolate the trouble, view the waveform at the output of the vertical integrator while you vary the applied AC line voltage with a variac. If the sync pulses (spikes on top of the waveform) momentarily decrease in amplitude when the voltage is shifted, make further scope checks in the sync, AGC, and video stages; there may be a defect in one of these circuits which causes a tendency toward clipping or compression of the sync pulses under certain conditions. You may be able to find a setting of the AGC and fringe lock controls which will minimize the loss of sync.

If the amplitude of the vertical sync pulses is not much affected by changes in line voltage, you can assume that the vertical oscillator itself is unstable or abnormally sensitive to changes in B+ voltage. The vertical output transformer would be worth checking if other tests don't solve your problem.



AFC Analysis

I am working on a Gruen type of horizontal sweep system (sine-wave oscillator controlled by a reactance tube and discriminator). All waveforms in the circuit look normal as described in the article about this in the August, 1954 PF REPORTER, with the one exception of W11 at the cathode of the reactance tube. I am unable to get a waveform at this point.

J. G. RODRIGUEZ

Vista, Calif.

Note that W11 is developed across a resistance of only 10 ohms; this means that it will have a much smaller amplitude than other waveforms in the circuit. Possibly you did not (or could not) turn up the scope gain high enough to see this signal. Use of a low-capacitance probe at this point would further attenuate the signal and make it harder than ever to see. Nevertheless, some signal should be present.

Shop Talk

(Continued from page 12)

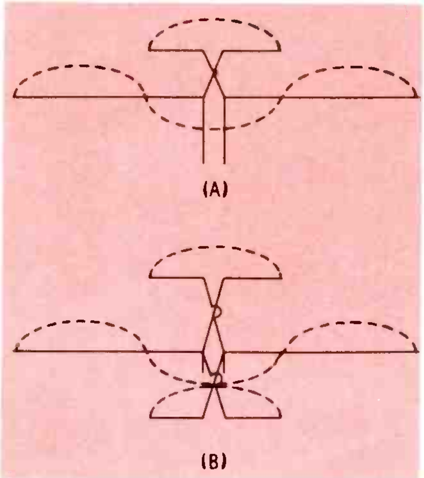


Fig. 4. Connections for small dipoles used in Clear Beam "Tri-King" array.

The same triple dipole arrangement is used in a yagi by Channel Master and given the name of "Rainbow" antenna. (See Fig. 5.) An interesting feature of this yagi is the use of separate reflectors and directors for the low and high bands. For the low band, the elements shown in heavy lines in Fig. 6A are the active ones, while the other elements, depicted by thin lines, are without much effect. For the high band, the dark elements in Fig. 6B are active, while the low-band elements are not.

Note, too, that the high-band directors and reflectors each possess three sections (Figs. 5 and 6C), with insulators between each section. The insulators hold the elements firmly in place, making the combination structurally strong. By this arrangement, the effect of three high-band yagis mounted side by side is achieved. The use of separate reflectors and directors for the low and high bands results in higher gain and sharper directivity. In effect, this is an all-channel yagi supported by a single crossarm.

Another Approach

Still another approach to the use of a low-band dipole at the higher frequencies was developed by Technical Appliance Corp. (TACO). Their method is derived from collinear arrays in which those sections producing out-of-phase currents are folded back on themselves so that the undesirable currents are eliminated.

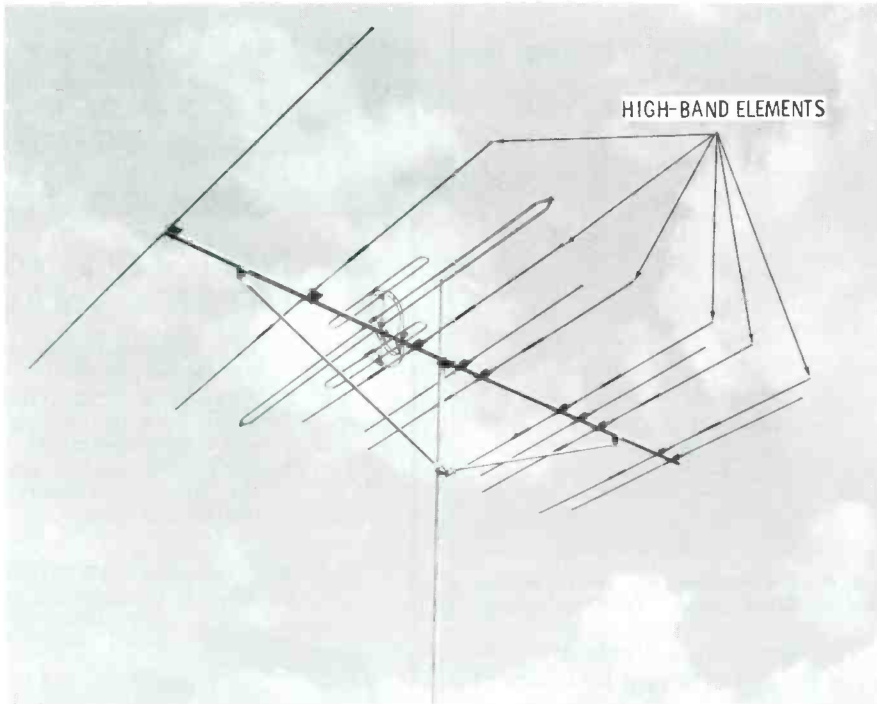
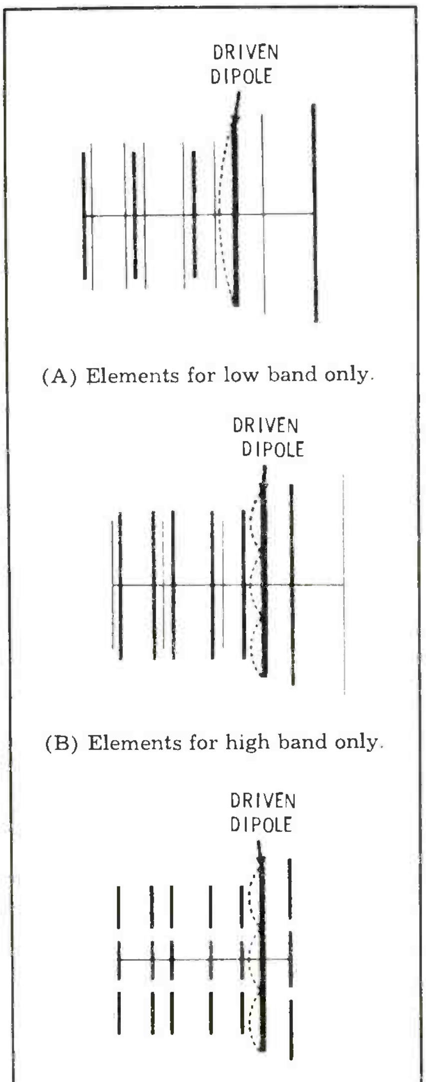


Fig. 5. High-band elements of Channel Master "Super Rainbow" have 3 sections.



(A) Elements for low band only.

(B) Elements for high band only.

(C) 3-section high-band elements.

Fig. 6. Elements of the "Super Rainbow."

The dipole, which is one-half wavelength at the mid-point of the low VHF band, becomes one and one-half wavelengths in the upper VHF band. To avoid the out-of-phase condition just discussed, two additional half-wave sections are added to the antenna, one on each side of the center feed point. (Fig. 7A.) This antenna length will produce the current distribution shown in Fig. 7B. Sections I, III, and V produce currents similarly phased, while sections II and IV produce oppositely-phased currents. To eliminate the effect of the latter two sections, They are folded back on themselves as shown in Fig. 7C.

Because the folded wires, such as lengths AB and CD, are closely spaced and because the directions of their currents are opposite, their magnetic fields cancel, virtually removing the effect of the entire section from the response pattern of the antenna. The end result is a high-band pattern that is essentially a figure-8 with only minor secondary lobes. The effect of the folded sections on low-band operation is negligible.

Since the folded sections are in essence quarter-wave stubs possessing a fair amount of impedance, they tend to reduce the amount of RF current flowing from the center section to each end section and reduce the effectiveness of the array. This limi-

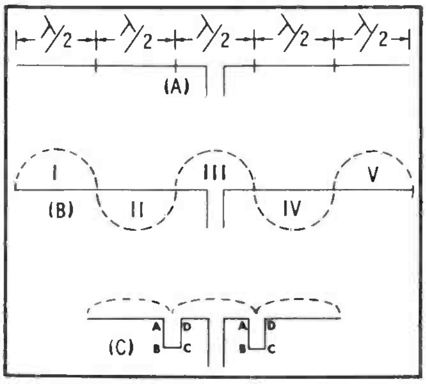


Fig. 7. Drawings which illustrate the evolution of the TACO "Trapper" array.

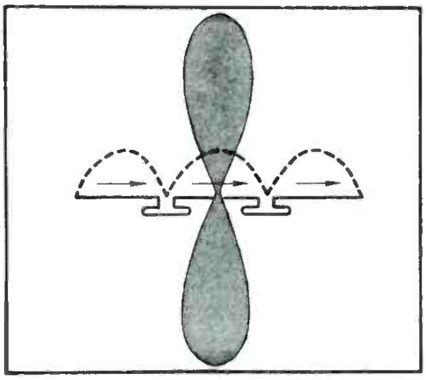
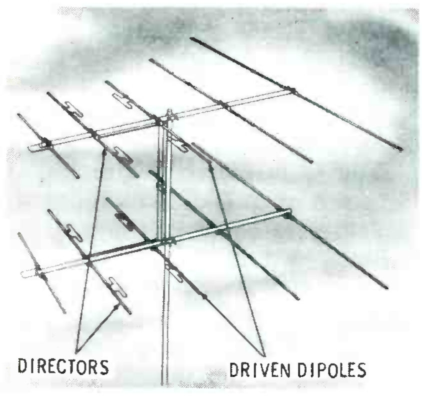


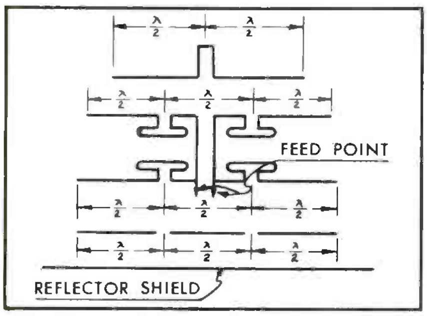
Fig. 8. Use of folded dipoles achieves better current distribution.

tation can be overcome by inserting folded dipoles in place of the stubs. (Fig. 8.) The folded dipole is designed to have a lower impedance than the stub, not only permitting more current to reach the outer sections, but also providing a broader effective bandwidth for the array. At the same time, the phase-reversing ability of the stubs is retained.

In the TACO "Trapper" array (Fig. 9), a director constructed similarly to the driven dipole is employed. The spacing between these two elements is .34 λ for channel 10 and .12 λ for channel 4. Furthermore, instead of permitting the director to serve as a parasitic element, it is connected to the driven dipole by means of metal strips; consequently, the total energy in the driven dipole resulting from direct pickup of the oncoming signal and the parasitic radiations from the director are combined more closely in phase for all channels. Also, a second director, designed to act as a half-wave dipole on channel 6 (82 to 88 mc), is placed at the very front of the array. On channel 13, this rod is approximately one and one-half wavelengths long, possessing the current distribution shown in Fig. 2. To re-



(A) Identification of elements.



(B) Electrical dimensions on high band.

Fig. 9. The TACO "Trapper."

ABOUT THE COVER

What better reason for robbing the piggy bank than to buy Mom a present—and that's exactly what this month's young trio is doing.

And, even though the original idea of getting Mom a personal radio of her own was Sister's, the "baby" seems to have taken the play away from her—with the friendly cooperation of the neighborhood Radio-TV service shop.

While we're on the subject, don't forget to send *your* Mother something extra-special for the one day in a year she can really call her own —May 11th.

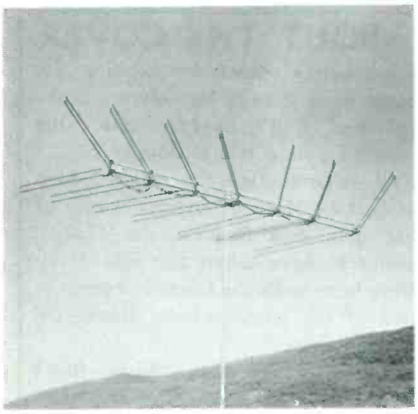


Fig. 10. The "Traveling-Wave" antenna by Channel Master has 6 driven elements.

move the central out-of-phase section, a stub is employed. Thus, on channel 6, the over-all length of this rod is one-half wavelength, while on channel 13 it is one full wavelength.

Behind the driven element there are two reflectors. The one closest to the driven dipole is designed specifically for the high band and toward that end it is divided into three half-wave sections, each separated from the other by insulator spacer rods. The other reflector, at the rear of the array, is designed to serve the low band.

When A Yagi Is Not A Yagi

The "Traveling-Wave" antenna (Fig. 10) is a development of the Channel Master Corp. and while it may, at first glance, appear to be a type of yagi array, it differs considerably from yagis in a number of important respects.

Physically, this antenna contains seven elements, six of which are driven. The seventh element is the reflector, and as such is positioned at the rear of the array. This element, incidentally, is a folded reflector. Of the six elements which are driven, i.e., connected together

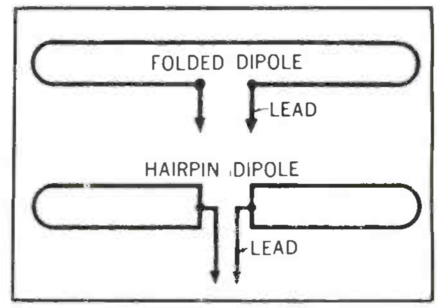


Fig. 11. Comparison of conventional folded dipole with "hairpin" or "fat" dipole.

and to the transmission line, the closest to the reflector possesses three rods in order to develop a high impedance. The others are known as "FAT" or "HAIRPIN" dipoles of the type shown in Fig. 11, a shape chosen for its ability to maintain its impedance over a wide range of frequencies. Finally, it can be seen that all of the dipoles are veered forward and that the over-all length of each dipole decreases in the progression from rear to front.

The folded dipoles are veered forward in order to minimize the breakup of the forward response pattern at the higher VHF frequencies (as discussed last month). Each of the six driven dipoles are interconnected and feed the transmission line, but if the array is examined closely, it will be noted that the length of each interconnecting line is greater than the physical spacing between the two dipoles connected to it. It was found that by properly selecting the line length, narrower response lobes and higher gain would be obtained than if the line length was equal to the dipole spacing. The principal reason for this, while quite complex mathematically, is governed by the phase relationships between the signals which are picked up directly by the various dipoles and the signals which reach each dipole via the line. Also, there is an additional factor which has to do with the individual impedances of the driven dipoles.

It will be found that optimum performance of a multielement array of the type shown in Fig. 10 is achieved when each dipole receives an equal amount of current. It would seem that this can be achieved simply by connecting all of the dipoles in parallel, just as we connect equal resistors in parallel. That this does not work with dipoles connected at various distances along a line stems from the fact that each dipole is separated by a significant portion of a wavelength from its nearest neighbor and, along a transmission line, the current will vary, not only in amplitude but also in phase.

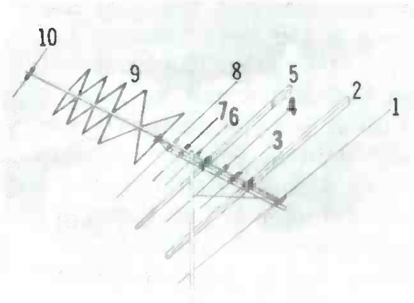


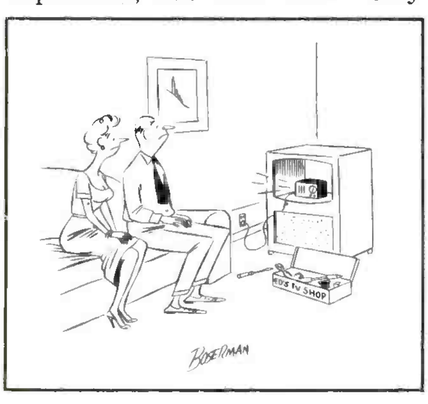
Fig. 12. Elements of JFD's "Wonder Helix" numbered for explanatory purposes.

To solve this problem, the "Traveling Wave" antenna is designed so that the dipole impedances decrease from the feed point to the front end. The feed point is at the input terminals of the 3-rod folded dipole closest to the reflector. This dipole possesses the highest impedance and is designed to provide one-sixth of the total signal current. As we move further toward the front end, each dipole has a progressively lower impedance, but each draws only one-sixth of the current. As a safeguard against any back flow of current that may not be completely absorbed, a terminating resistor is inserted in the nose of the array to dissipate any current that remains.

Since much of the desirable action of this array depends on the even distribution of current in the six folded dipoles, it is imperative that their impedances decrease from feed point to front end on all received frequencies (which here means channels 2 to 13). This result is achieved by use of progressively shorter dipole lengths. Dipoles of the "hairpin" type were selected because they possess better impedance characteristics than either folded or straight dipoles.

A Variety of Elements

Just as a multielement filter uses a variety of components to a desired bandpass effect, a number of different half-wave elements can be combined to produce a sought-after frequency response. One such complex array is the "Wonder-Helix" antenna



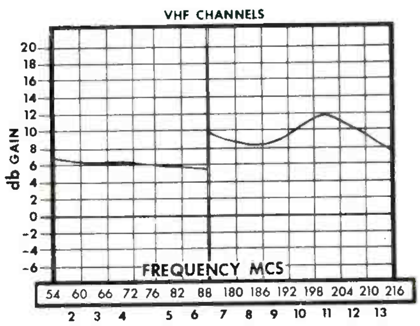


Fig. 13. Graph showing gain versus frequency for the "Wonder Helix" antenna.

developed by JFD Electronics Corp. As seen in Fig. 12, it contains 10 driven or parasitic elements combined to provide the gain pattern shown in Fig. 13. Note that the gain is flat within ±1 db on the low VHF band, and within ±2 db over the high band.

The purpose of each element in this array is as follows: Elements 2 and 5 are cut for channels 2 and 5 respectively, and are driven in tandem. Element 1 is a channel-2 reflector. Element 8 is a channel-6 director. Element 4 has a dual function—it operates as a loading element on the shorter dipole (no. 5) and as a director for element 2. Elements 3 and 6 are phasing elements, their purpose being to prevent third harmonic lobe response on the low-band driven elements.

Element 9, known as a helix, is a high-band driven element. Its operation may best be understood by considering the circular helical antenna from which it is derived. The true or circular helix has a diameter of $1/\pi$ wavelength, at least 3 turns, and a spacing of approximately ¼ wavelength between turns. This antenna possesses an almost constant resistive impedance of 150 ohms between ¾ and ⅓ wavelengths. The bandwidth is such that the gain is down only 1 db at 150% of center frequency, and gain at center frequency is about 8 db. By flattening the original cylinder so that the high current points are adjacent to each other, and by tapering the dimensions, an element was obtained having high inherent gain, a narrow directional pattern and a flat bandpass characteristic.

Returning to Fig. 12, element 7 is a channel-7 reflector for the helix and element 10 is a channel-13 director for the same. The signal take-off is located at the terminals of the forward folded dipole (element 5). This is made possible by transposition of the harness connecting the two low-band dipoles. The stub labelled 11 is for impedance matching. There is one further action which takes place. The first section of the helix, in conjunction with the harness, acts as a channel-2 peaking stub for elements 2 and 5. ▲

Editor's Note: Part 5, the last in this series, will round out the coverage on commercial antenna designs and how they work.

D'YA MIND IF I USE THIS?
THE BATHROOM'S OCCUPIED.

Industrial Electronics

(Continued from page 41)

of C1 through R1 will hold V1 in cutoff for a specified amount of time. V1 will then conduct and cause V2 to return to a cutoff condition (via the cathode voltage), and the output pulse will be ideally formed.

R1 is of sufficient value to drop the major portion of the B+ voltage when the grid of V1 draws a small current. All tubes used in computers and counters are especially designed to permit grid currents in the .7-ma range. One of the most rugged of these tubes is the 6SN7. We know of one which has been in service for 2 years under conditions that require a grid-current surge in excess of 1 ma and still shows no abnormal fatigue. The grid in Fig. 6 draws .265 ma when there are no input pulses.

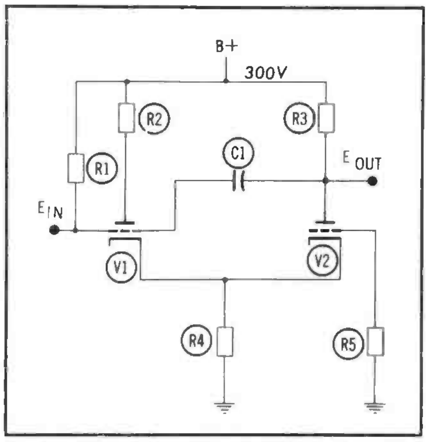


Fig. 6. Pulse shaper ahead of stages keeps pulse width and amplitude constant.

The output pulse of Fig. 6 is developed across R3, its value governing proportionately the amplitude of the output pulse. Since 50- to 100-volt pulses are usually required to drive an Eccles-Jordan, R3 must be of a value which will permit this amplitude to be developed. When pulses of greater size are applied to a counter stage, there is the possibility of coupling them right through one stage into the next. If R3 develops too small a pulse, the counter stage is likely to miss some of the counts; therefore, any change in R3 will have a serious effect on the counter stage operation.

It is a common practice to use plug-in units for many counter and computer circuits. A 4-stage counter of the plug-in design is shown in Fig. 7. Connectors for power supply and pulse input are at the lower left. 6AL5's are used as coupling diodes and the first four 12AU7's provide a scale of 16. The last two 12AU7's are for pulse forming and amplifying. The lights are plugged into the lower right socket to provide a means for determining the number of input pulses which have been applied.

With the plug-in type of construction, service is performed by isolating the trouble to one particular unit. Then, instead of trying to locate the trouble right at the computer, a good unit is plugged in as a replacement for the defective one. In this manner, the equipment is kept in operating condition for the maximum possible time, and the technician can repair the defective unit on the service bench where he has a greater variety of useful service aids.

In Fig. 8, both a recording instrument and a counter are shown. The counting stages are built-in rather than plug-in units, but this complete assembly plugs into a larger computer unit. Connectors

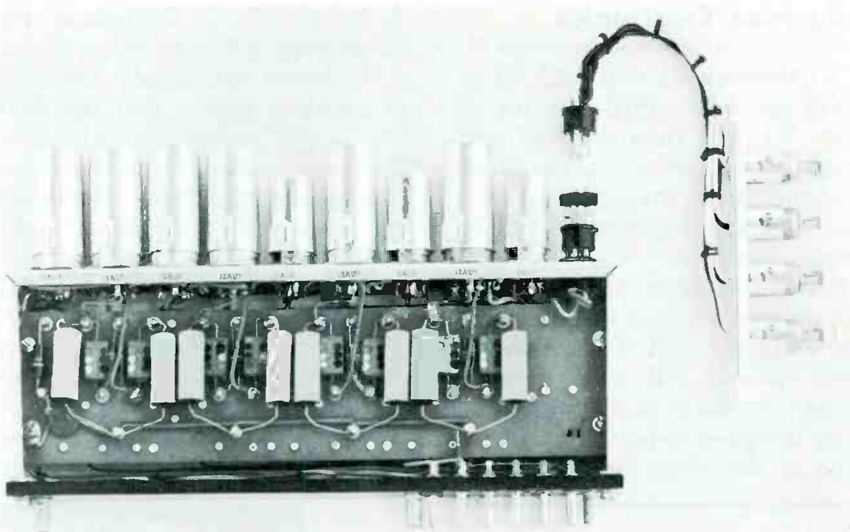


Fig. 7. Subassembly plug-in units can be substituted to make servicing easier.

for all the various functions are provided at the rear of the instrument. Six counter blocks, capable of accepting 16 input counts each, provide a total of 16,777,216 counts! The binary information from these counters is recorded on a paper tape (not shown), and tape movement is controlled by the motor and gear train which operate at a specific rate of speed. In addition to their mathematic value, permanent records obtainable with this machine aid in service and maintenance.

A computer was suspected of giving wrong answers, but the size of the computations being performed made a mathematic verification difficult. A common method of testing computers is to add the number 1 to the largest number capable of being indicated by the computer. For instance, if a computer will indicate 9,999,999, then adding one to this number will make every stage in the computer work. This method was used on the problem, and at several points along the sequence train, the conditions of various stages were recorded on tape. The defective stage would cause all remaining counts to be low; thus, by a series of recordings, the defective counter block was easily located.

In this article, the basic circuits used in computers have been described along with several examples of actual service problems encountered in practice. Part 10 of this series will deal with other very useful modifications of the basic counter. ▲

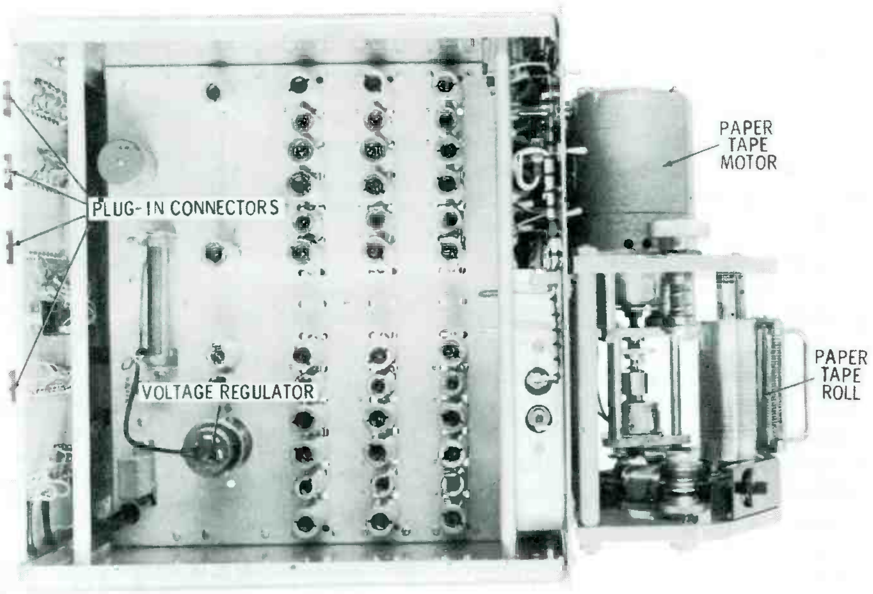


Fig. 8. A recording device which will provide both partial and complete answers can be a valuable aid in the servicing of complex computor circuits.

Record Changer Servicing

(Continued from page 21)

get on the rubber drive wheels, it can be removed with alcohol and a clean cloth. Incidentally, never lubricate a bearing that hasn't been properly cleaned, since chances are you'll overlubricate and cause future trouble.

For those parts requiring a non-liquid lubricant, it is best applied after the changer has been reassembled. However, if it is necessary to apply the lubricant before reassembly, take care not to smear the grease where it doesn't belong or isn't needed.

So much for the general requirements of changer servicing; now, let's get right into the actual adjustments and repairs most often encountered.

Admiral Model RC 607

The Admiral RC 607 is a four-speed, intermixing type (10" and 12" records only) changer which employs a velocity-tripping mechanism. Set-down and pickup-arm height adjustments (Fig. 4) are made in the usual manner. When these are properly adjusted, the needle should drop into the lead-in groove and should be exactly $1\frac{3}{8}$" above the set-down area before it starts its downward movement. If all sizes of records are not available for set-down tests, a ruler may be used. Measuring from the near side of the centerpost, the distance to point of set down should fall within the following limits: $3\frac{1}{4}$" to $3\frac{5}{32}$" for 7"; $4\frac{5}{8}$" to $4\frac{11}{16}$" for 10"; and $5\frac{19}{32}$" to $5\frac{11}{16}$" for 12".

Record dropping is accomplished by camming action at the spindle. If records fail to drop, too many drop, or if the action is erratic, check the adjustment (Fig. 5A) by hand-cycling the changer, stopping at the point where the push-off shaft is at maximum upper position. Raise the push-off adjustment nut (Fig. 5B) and check for .015" clearance as indicated. Also check the action of the ejector and slider to make sure they operate freely. A weak spring within the spindle assembly (see Fig. 5B) can also cause more than one record to drop.

Four speeds are obtained through the use of a stepped motor shaft, a belt-driven sec-

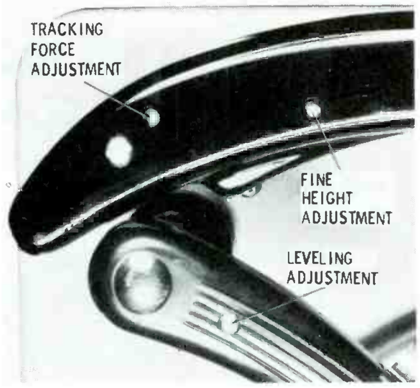


Fig. 8. Tone arm and stabilizer bar adjustments of Collaro "Conquest" changer.

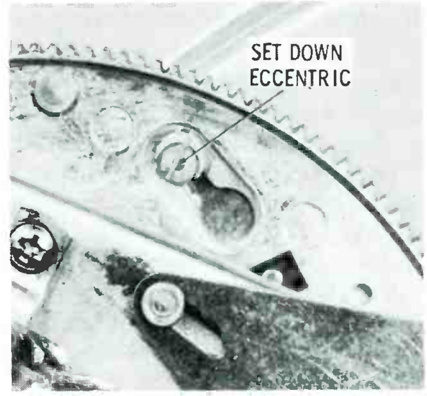


Fig. 10. Set-down eccentric can also be adjusted from beneath the changer pan.

ondary shaft (also stepped), and a single drive wheel as shown in Fig. 6. Failure of the changer to operate at 16 and 33 rpm, while working normally at 45 and 78 rpm, is due to a broken belt. Slow operation on 33- and 16-rpm positions is due to a stretched belt or oil on the belt, while slow operation at all speed settings is caused by low motor speed, a worn drive wheel or oil on the drive wheel surface. The spring indicated in Fig. 6 holds the drive wheel engaged with the turntable rim. A broken spring could also cause the changer to be inoperative on all speeds, while a weak spring could result in slow speeds.

Just as there are points in a changer that need lubrication, there are also points that do not. On the set-down index assembly (Fig. 7) the two pivot points indicated must be clean and dry if they are to pivot freely; otherwise, erratic indexing may occur.

Shut-off occurs after the last record because the record stabilizer (Fig. 4) drops and actuates a series of arms which push the switch to the off position. If the stabilizer arm fails to drop, the last record will be repeated continuously until the switch is operated manually.

No separate tracking force adjustment is provided on this changer; therefore, any replacement cartridge must be exactly the same weight as the original if correct tracking force is to be maintained and excessive record and needle wear avoided.

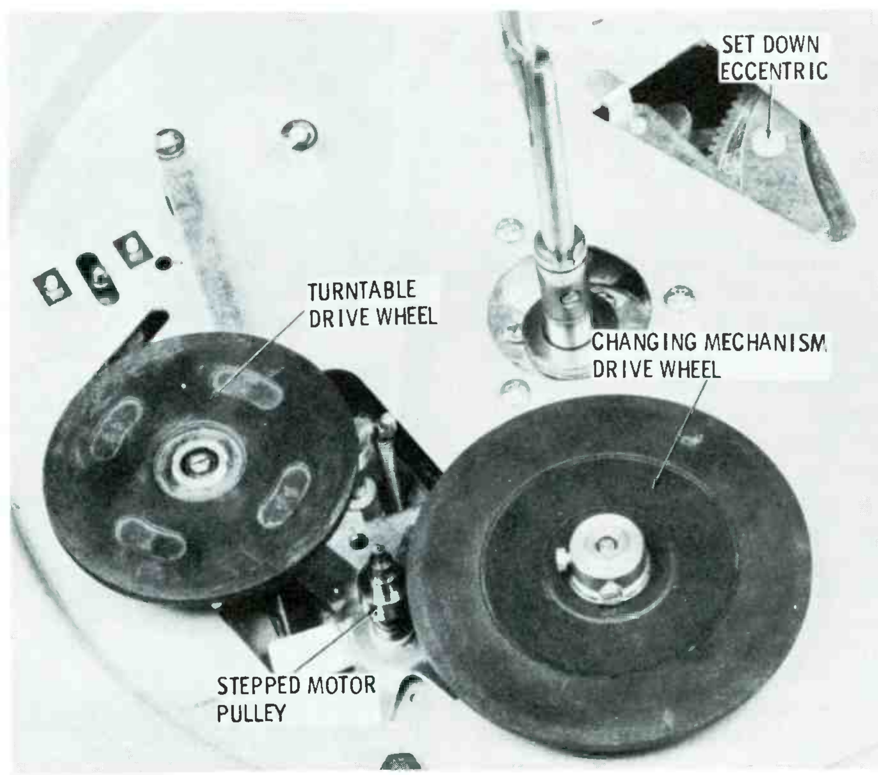


Fig. 9. Set-down eccentric is accessible when the turntable is removed (Collaro).

Collaro "Conquest"

The Collaro "Conquest" is a four-speed intermixing (7", 10" 12") changer with provisions for manual operation at any speed. Velocity tripping is employed. Tracking force and fine tone-arm height adjustments are located on top of the arm as shown in Fig. 8. (A coarse height adjustment is also provided, but is located below the changer pan, as you will see in Fig. 12.) The height adjustment must be set so that the tone arm clears records on the spindle by 1/8" at the completion of a cycle. Fig. 8 also shows a leveling adjustment for the stabilizer arm which must hold the records in a plane perpendicular to the spindle. This is a trial and error adjustment that should rarely, if ever, require adjusting.

The set-down adjustment is accessible when the turntable is removed (Fig. 9), or it may be reached from below (Fig. 10). To make this adjustment from the underside of the changer, remove power, operate the starting switch, and turn the cam gear counterclockwise until the eccentric screw appears. Use a pencil to mark both the eccentric screw and the cam gear and adjust the eccentric to first one side of the mark and then the other until proper set down is obtained. A small dot of glue or paint can then be used to hold the eccentric firmly in place, but be sure it doesn't interfere with the normal trip cycle.

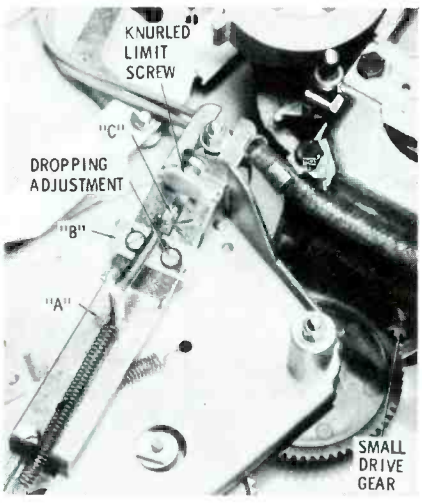


Fig. 11. Record-dropping adjustment and changer-mechanism drive gears (Collaro).

Referring back to Fig. 9, you will notice two rubber drive wheels, the smaller of which couples motor power to the turntable rim. The other wheel rides on the turntable and transmits the power to operate the changing mechanism. The stepped motor pulley provides the different speeds. Note—since this changer is designed for either 50- or 60-cycle operation, there are a variety of motor pulleys available. A different set of pulleys is used when the unit is powered with 50-cycle current, so make sure the correct pulleys are installed if there are any gross speed errors.

On the underside of the changer (Fig. 11), we find the record-dropping adjustment and a knurled limit screw. In the act of dropping a record, arm "A" moves over, causing adjustable plate "B" to actuate ejector lever "C," and this in turn moves the ejector mechanism in the spindle and causes a record to drop. Misadjustment of plate "B" or of the knurled limit screw can result in improper record dropping. The proper location for plate "B" is near the point where the two locking screws are centered in

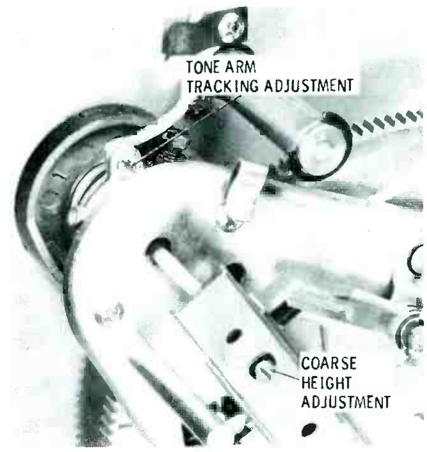


Fig. 12. Coarse height and tone-arm tracking adjustments on the Collaro unit.

their respective slots.

Two more adjustments (coarse tone-arm height and tone-arm tracking) are provided at the tone-arm end of the changer mechanism (Fig. 12). The tracking adjustment controls the position of the tone-arm cam-following pin which passes through a groove in the top of the cam. When correctly adjusted, the pin, over the center portion of its movement, clears the bottom of the cam groove. Over the 20% movement at each end of its normal arc, the pin rides along the bottom of the groove.

The signal lead from the cartridge is shown clamped to the changer base. This lead must not be pulled excessively tight as it will restrict tone-arm movement and cause improper tracking.

V-M Model 1200A

The V-M Model 1200A is a four-speed, intermixing changer and features a velocity-tripping mechanism. The record-supporting arm holds the record stack until each record is dropped onto the turntable, and then drops down to actuate the mechanism which shuts the changer off after the last record is played. Set-down, tone-arm height and tracking-force adjustments, (Fig. 13) are made in the usual manner. The pickup should raise 1⅜" at the start of the change cycle, and needle pressure should be 8 to 10 grams.

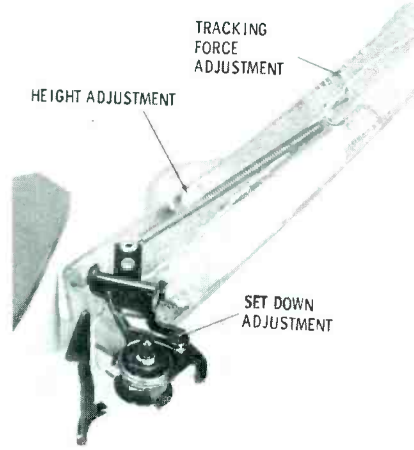


Fig. 13. Record-support arm and tone-arm adjustments on V-M 1200A changer.

The motor assembly (Fig. 14) is a separate unit mounted to the changer pan with two small screws and a hex nut under the speed selector knob. The entire motor is moved up or down to change speeds, since the four-step motor shaft is the speed selector. The rubber driving wheel mounting is stationary.

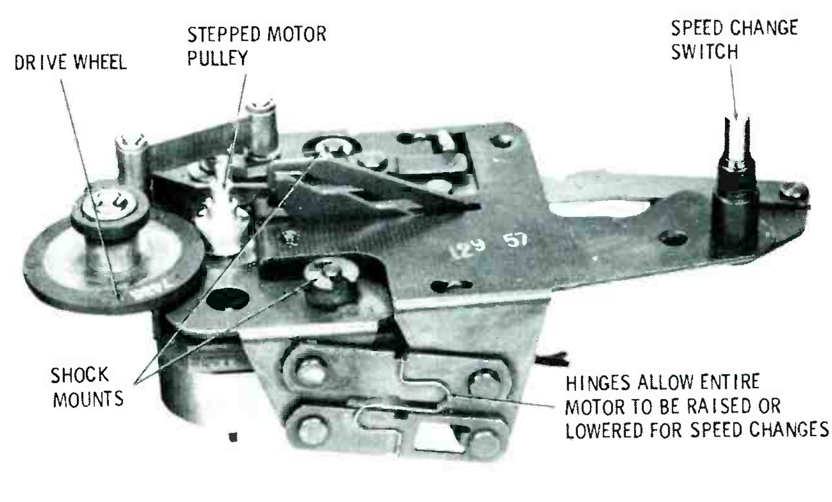


Fig. 14. Motor assembly of V-M has stepped motor pulley and rubber drive wheels.

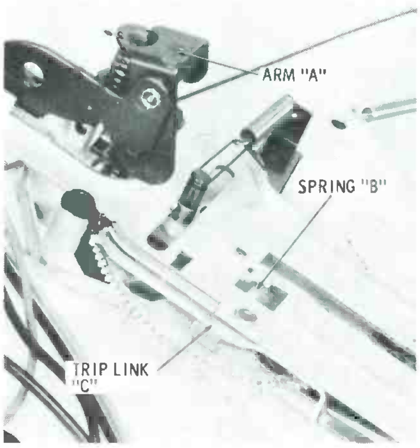


Fig. 15. Record-dropping mechanism on V-M 1200A. Bend arm "A" to adjust.

As mentioned earlier, over-lubrication is more of a problem than under-lubrication, especially around phono motors and rubber drive wheels. Remember that the brass bearing surfaces on the drive wheels and motor are oil-treated porous bronze which don't require oiling unless the bearing is cleaned. Should it become necessary to disassemble the motor unit and clean any of the bearings with solvent or crocus cloth, be sure the cleansed unit is free of all grit, and then lubricate with a single drop of oil on each bearing surface.

Fig. 15 shows that a rather simple, straight-forward mechanism is used. Unless some part becomes worn or bent, no adjustments should be required. At the beginning of each cycle, a record is dropped when arm "A" moves, causing the ejector in the spindle to move. If the ejector doesn't move far enough, the record won't drop. Bend arm "A" as required to produce proper movement, or replace the entire assembly. Continuous tripping can occur if small spring "B" is missing. Another possibility is that trip link "C" is frozen in the reject position.

Jerky vertical motion of the tone arm can be caused by binding of the tone-arm lift pin or by burrs on the main slide and cam (Fig. 16). If the latter, remove the burrs with a fine file and relubricate the edges. If horizontal motion is jerky or rough, make sure the fibre washer is installed above the pickup-arm return locator. Also see that the return spring is hooked up properly and has the correct strength.

This article would not be complete without a word or two of caution. The changers discussed herein, or comparable units of any make, make use of rather complex and somewhat delicate mechanisms; thus, mechanical knowhow and physical dexterity are necessary attributes for the expert serviceman.

Stick to the simpler phases, such as adjustment, lubrication and minor replacements (drive and idler wheels), until you develop additional skill and knowledge. Most changers usually won't require more extensive work anyway. ▲

Editor's Note: The next article in this 2-part series will cover various aspects in the servicing of several other popular changers.

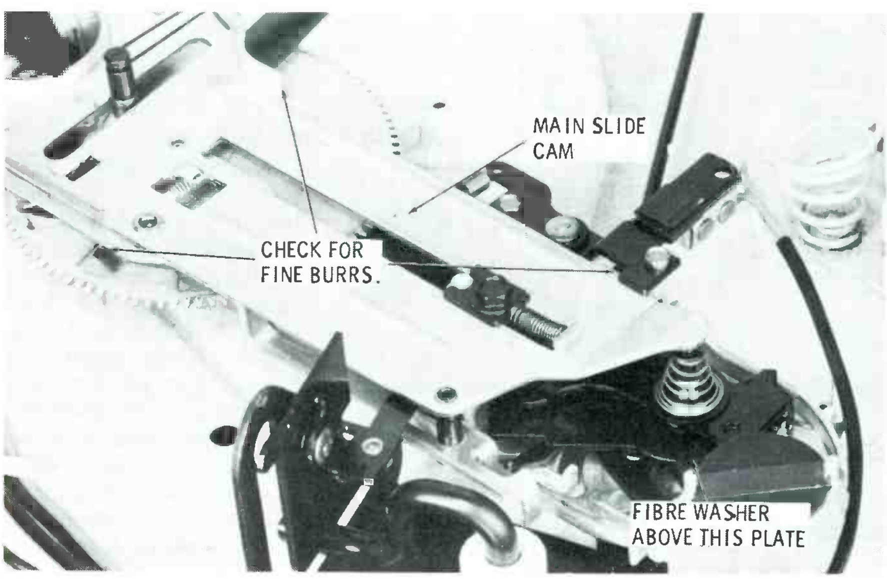
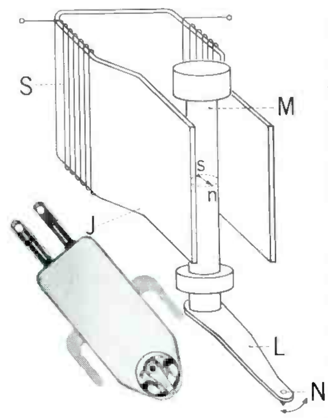


Fig. 16. Tone-arm mechanism on V-M showing pickup-arm return locater.

PRODUCT report

Unusual Phono Cartridge



In most phono cartridges that operate on magnetic principles, the needle moves an unmagnetized object through the field of a fixed permanent magnet. The familiar electrodynamic cartridge has a moving coil from which the output signal is obtained. Another type, the variable-reluctance cartridge, contains a moving iron core that affects the field of the permanent magnet in such a way as to induce a current in a coil wound on the magnet.

It is also possible to design a cartridge in which the permanent magnet is movable instead of stationary. Such an arrangement is employed in the Norelco "Magneto-Dynamic" cartridge just introduced by High Fidelity Products Div., North American Philips Co., Hicksville, L. I., N. Y. The magnet (M) is a rod of "Ferroxdure" ferrite material which is magnetized at right angles to the axis of the rod instead of having a north pole at one end and a south pole at the other. When the stylus (N) travels along the grooves of a record, the rod is rotated around its axis. This action introduces a varying magnetic field between the pole pieces of the nonmagnetized mu-metal core (J) of the output coil. The signal obtained from the coil is fairly high-level—on the order of 35 millivolts. The unusual construction of the unit is said to permit exceptionally linear frequency response.

Vertical tracking force of the stylus is 5 grams, and ideal load resistance is 68K ohms. Net price complete with 1-mil diamond stylus and installation hardware is $29.

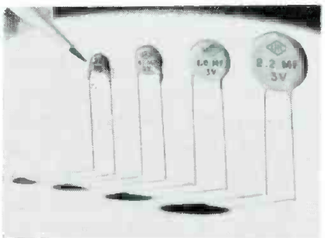
For further information, check 51R on Literature Card.

Alkaline Dry Cell

National Carbon Co., New York, N. Y., has begun production of the "Eveready Energizer," a new alkaline-type dry cell. Although the new units cost three times as much as standard-type cells, they have many operating advantages, including an ability to withstand higher current drain, a much longer service life, and reliability of operation at extremely high or low temperatures where standard cells will not function properly. Two sizes, "D" and "½D," are now available—both with the same output voltage of 1.5 volts, but each with a different current capacity.

For further information, check 46R on Literature Card.

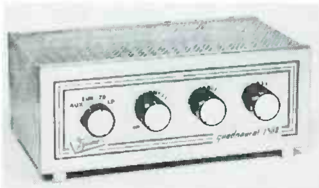
Ceramic Capacitors



Type UK Ultra-Kaps are high-capacitance, low-voltage ceramic capacitors which are now being sold through parts distributors by Centralab, Milwaukee, Wis. These components, intended chiefly for use in transistorized equipment, have previously been supplied only to original equipment manufacturers. Four standard values of .22, .47, 1.0, and 2.2 mfd, all at a rating of 3 WVDC, are now available. Diameters range from ¼" to ¾".

For further information, check 43R on Literature Card.

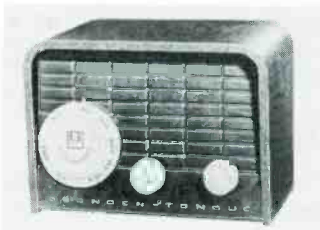
Hi-Fi Amplifier



A new Model Q1500-PA hi-fi amplifier with built-in preamplifier has been introduced by Dynamic Electronics-New York, Inc., Forest Hills, L. I., N. Y., as a successor to the previous Model Q1500. Among the features of the new amplifier are the following: 12-watt output, separate bass and treble controls, tone-compensated loudness control, record compensator with auxiliary tap, two phono input jacks plus a jack for tuner or tape recorder inputs, and separate output taps for 4, 8, or 16 ohm speakers. List price is $59.50.

For further information, check 52R on Literature Card.

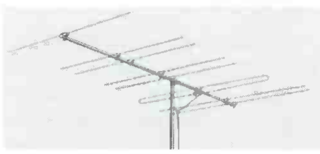
UHF Converter



Blonder-Tongue Labs., Inc., Newark, N. J., has introduced a new Model BTU-2R "Ultraverter" all-channel UHF converter, engineered to meet the latest FCC standards with respect to oscillator radiation. Features include both coarse and vernier channel tuning, a double-tuned input circuit, and a low-noise triode amplifier following the converter stage. Dimensions of the cabinet are 6¾" × 5" × 4¾", weight is 4 lb., and retail price is $39.95.

For further information, check 53R on Literature Card.

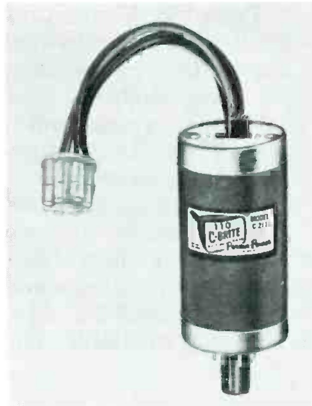
FM Radio Antennas



Two types of antennas for FM radio reception have been added to the line manufactured by Winegard Co., Burlington, Iowa. Both have a gold anodized finish. Model FM-3A, designed for strong signal areas, is a non-directional, preassembled unit complete with mast, roof mount, lead-in wire and other mounting hardware. Retail price is $17.95. Model FM-Y8 is an 8-element yagi for long-distance reception, priced at $22.95. Gain across the entire FM band is claimed to be 10.2 db over a tuned dipole.

For further information, check 44R on Literature Card.

110° Tube Brighteners

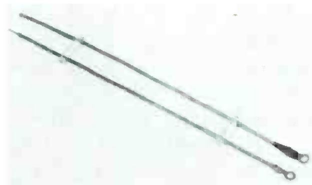


Perma-Power Co., Chicago, Ill., is all set to supply the trade with tube brighteners designed to fit the new 110° bases. Shown at left is "C-Brite" Model C-211 for use with the popular button-type (miniature-pin) bases. Also available is Model C-221, which fits the shell-type bases (with large pins) used mainly on Sylvania and DuMont 110° tubes. List price of either type is $3.75.

"C-Brites" boost heater voltage to 7.8 volts. A selector switch is provided so that the units can be used in either series or parallel heater circuits.

For further information, check 49R on Literature Card.

Low-Loss Lead-In



A 300-ohm television lead-in line for extremely difficult reception areas has been developed by New Products Engineering & Mfg. Co., Minneapolis, Minn. Features contributing to low signal loss are open-wire construction, factory-sealing of terminals against moisture, and use of 14-gauge solid copper conductors with plastic insulation. "Weatherproof Signal Master" line is marketed in pre-cut lengths. "Antenna-Gard" weatherproofing compound for the antenna array is also sold as a companion product.

For further information, check 48R on Literature Card.

Tube Manual

Detailed information on over 1000 radio-TV tube types is included in the new edition of the "Receiving Tube Data Book" just published by Raytheon Mfg. Co., Newton, Mass. Data is current to within 30 days of issue and includes the latest series-string tubes. Basing diagrams appear on the same page as the tube data, making it unnecessary to refer back and forth for reference to pin connections. Copies are available from Raytheon distributors at 50¢ each.

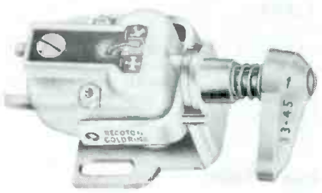
For further information, check 47R on Literature Card.

Leakage Checker

Service Instruments Corp. (Sencore), Addison, Ill., has introduced a new Model LC3 Leakage Checker for specialized testing of tubes used in high-impedance circuits. Tests are made for heater-cathode leakage, grid emission, and related troubles, exactly as in the previous Model LC2 checker; in addition, the LC3 has several new features including a heater continuity test, roll chart, two extra sockets for preheating tubes, and a test cable for checking CRT's in the cabinet. Dealer net price of the LC3 is $28.95, and the LC2 is also still available at $24.95.

For further information, check 45R on Literature Card.

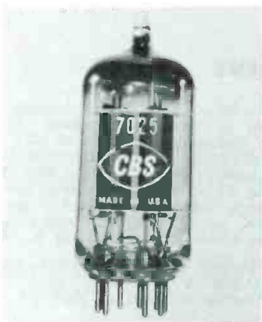
Variable Reluctance Cartridges



Recoton Corp., Long Island City, N. Y., announces two new variable-reluctance phono cartridges, the RG-500 and RG-550. Both types have the following specifications: Frequency response, flat from 20 cps to 20 kc; stylus tracking pressure, 5 to 7 grams when used on a record changer or 3 to 4 grams on a transcription arm; output voltage, 10 millivolts; DC resistance, 1500 ohms; and recommended value of load resistance, 47K ohms. The units are available with either diamond or sapphire needles. The only difference between the RG-500 and RG-550 is that the latter has a mu-metal shield to eliminate hum.

For further information, check 50R on Literature Card.

Rugged Audio Tube



CBS-Hytron, Danvers, Mass., has developed a "ruggedized" replacement for the 12AX7 double triode tube that is widely used as a preamplifier in high-fidelity audio equipment. The new tube (type number 7025) has "folded-coil" heaters and more precise physical tolerances for grids and mica supports, and these features keep hum and microphonism to a minimum. Electrical ratings are the same as for the 12AX7.

For further information, check 42R on Literature Card.

Auto Radio Tube Tester

A self-service checker for auto radio tubes and vibrators, intended for use as a counter merchandiser in service stations and garages, is being supplied to service technicians through parts distributors by Vis-U-All Products Co., Grand Rapids, Mich. The "Vis-U-All" Model V101 includes tests for 0Z4's and low-B+ tubes and has storage space for 66 tubes and vibrators. A substitution guide for interchangeable types is included in the set-up chart on the tester.

For further information, check 54R on Literature Card.

PF REPORTER

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CATALOG and LITERATURE SERVICE

ACCESSORIES

1R. *COLMAN*—Complete reference listing of all available metal-to-glass picture tube conversion kits. *See ad page 48.*

2R. *E-Z-HOOK*—A convenient reference sheet titled, "How to Build the Five Most Useful Scope Probes," with schematic, mechanical component layout, etc. *See ad page 72.*

ANTENNA DISTRIBUTION

3R. *BLONDER-TONGUE*—New catalog sheet, Form No. TS-28, describes B-23 two-set booster which boosts the signal on 1 or 2 sets and couples 2 or 3 TV sets to one antenna. *See ad page 26.*

4R. *CHARLES ENGR.*—Complete description of new conductive capacitance TV set coupler and how it's used for coupling 2, 5, 10, 20 or more sets to one antenna without amplification. *See ad page 66.*

5R. *JERROLD*—New 8-page illustrated catalog on equipment for improving home TV reception, simplifying TV distribution systems and improving TV servicing.

BOOKS

6R. *GERNSBACK*—Descriptive literature on Gernsback Library books. *See ad page 63.*

BUYING GUIDES

7R. *UCP*—Complete descriptive literature on Radio-Electronic Master, 1584-page buying guide for the industry. *See ad page 70.*

CAPACITORS

8R. *CORNELL-DUBILIER*—Motor start-run capacitors, Bulletin XTR-MOT.

9R. *SPRAGUE*—"ABC's of Ceramic Capacitors," comprehensive brochure on the theory and applications of ceramic capacitors. *See ad page 2.*

CARTRIDGES & NEEDLES

10R. *DUOTONE*—Specification sheets on new "Acos Hi-g" stereo and manual phono cartridges, microphones, and tone arms. *See ads pages 46, 71.*

11R. *RECOTON*—Simplified replacement needle guide; inventory and re-order form; gift premium catalog. *See ad page 63.*

12R. *SONOTONE*—Phonograph modernization manual gives data on ceramic cartridges and their installation. *See ad page 55.*

CHEMICALS

13R. *KRYLON*—Catalog pages describing crystal-clear rust release, dulling spray, spray enamels, varnish sprays, and metal primers. *See ad page 24.*

CONTROLS

14R. *IRC*—Form SO67A, new merchandising guide. *See ad 2nd cover.*

FUSES

15R. *BUSSMANN*—Complete TV Fuse Guide shows types and ampere ratings of fuses used in various TV sets. *See ad page 25.*

HI-FI ENCLOSURES

16R. *BRITISH INDUSTRIES*—High Fidelity Plan Book and River Edge Cabinet Catalog. *See ad page 72.*

PICTURE TUBES

17R. *DUMONT*—Picture tube data chart. *See ad page 9.*

18R. *RAYTHEON*—Revised 14-page Television Picture Tube Characteristics Booklet includes data on aluminized black and white and color tubes, face plate deflection angle, bulb dimension, ion trap information, and basing diagrams. *See ads pages 14, 42.*

POWER SUPPLIES

19R. *ACME*—Variable Voltage Adjustor Catalog VA-312. *See ad page 36.*

20R. *PERMA-POWER*—Complete new catalog describing and illustrating several new products in company's lines. *See ad page 71.*

RECTIFIERS

21R. *SARKES TARZIAN*—Completely revised Silicon Rectifier Handbook No. 67—40 pages of technical data on complete line of silicon units.

RESISTORS & CONTROLS

22R. *CLAROSTAT*—"C Line" composition element and wire-wound potentiometers for lab and prototype work; 2, 3, and 4 watts. Form No. 753394. *See ad page 33.*

23R. *MILWAUKEE RESISTOR*—Catalog of servicemen's replacement items—fuse resistors, auto resistors, "W" series resistors. *See ad page 75.*

SERVICE CASE

24R. *MASTRA*—Complete data on "Totemaster," a new convertible master tube and tool tote box with room for over 360 tubes plus tools and equipment. *See ad page 69.*

SALES PROMOTION

25R. *CBS-HYTRON*—New 4th edition, CBS Tube Business Builders Catalog PA-37, describes over 90 items especially designed for the independent service dealer. *See ad page 35.*

26R. *VIS-U-ALL*—Auto radio service merchandising manual. *See ad page 61.*

27R. *WESTINGHOUSE*—"Dress Up Your Store" folder, Form No. 7ET-0505, describes Westinghouse identification materials, signs, decals, etc.

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28R. *HOWARD W. SAMS*—Complete details on new free file cabinet program. *See ads pages 29, 47, 56.*

29R. *SYLVANIA*—Information on black and white servicing course, "New Shortcuts to TV Servicing."

TEST EQUIPMENT

30R. *B&K*—Bulletin AP12 gives helpful information on new point-to-point signal-injection techniques with Model 1075 TV "Analyst"; other bulletins describe B&K "Dyna-Quick" models 500B, 650, and automatic 675 portable dynamic mutual conductance tube and transistor testers plus B&K model 400 CRT cathode rejuvenator tester. *See ads pages 5, 38.*

31R. *DOSS*—Details on D-100 "Sweep Analyzer," D-200 "Video Master" and D-500 "Slave Oscillator." *See ad page 73.*

32R. *EICO*—New 16-page, 2-color catalog describes 55 models of test instruments and hi-fi equipment in both kit and factory-wired form; shows how you can save 50%. *See ad page 64.*

33R. *SERVICE INSTRUMENTS*—Catalog-size folder of entire Sencore line of time savers. *See ads pages 48, 54, 58, 62, 70, 75.*

34R. *TRIPLETT*—Transistor tester circular. *See ad pages 10-11.*

35R. *WINSTON*—One-page flyer on full line of equipment. *See ad page 43.*

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36R. *ANCHOR PRODUCTS*—Information sheet on SL-10 light soldering instrument, the handy "Pee Wee" iron that does a giant-size job.

37R. *VACO*—Catalog on special free tool hanger board. *See ad page 78.*

38R. *WALSCO*—Form FR 3383, an illustrated brochure on the usage of Walsco "C" ring tool for removing C-ring washers.

39R. *YEATS*—4-page catalog describing appliance dolly and padded covers for delivering TV sets. *See ad page 78.*

40R. *XCELITE*—Illustrated catalog on full line plus literature on new products. *See ad page 27.*

TRANSFORMERS

41R. *CHICAGO STANDARD*—100-page TV Transformer Replacement Guide, cross-referenced for over 7,000 chassis of 98 manufacturers. *See ad page 68.*

SUPPLEMENT TO SAMS FEBRUARY 1958 MASTER INDEX

Covers PHOTOFACT Set Numbers 390 through 400 Released

MARCH through MAY

This Supplement is your index to new models covered by PHOTOFACT since March 1958. For model coverage prior to this date see the Sams Master Index dated February 1958. Use this Supplement with the Sams Master Index—together they are your complete Index to PHOTOFACT coverage of over 30,000 receiver models.

THIS IS YOUR LATEST INDEX SUPPLEMENT!

FOR COMPLETE PHOTOFACT LISTINGS USE IT WITH THE FEBRUARY 1958 MASTER INDEX!

THROW AWAY ALL OTHER SUPPLEMENTS

NOTE: PCB Denotes Production Change Bulletin. ● Denotes Television Receiver. **S** Denotes Schematic Coverage Only.

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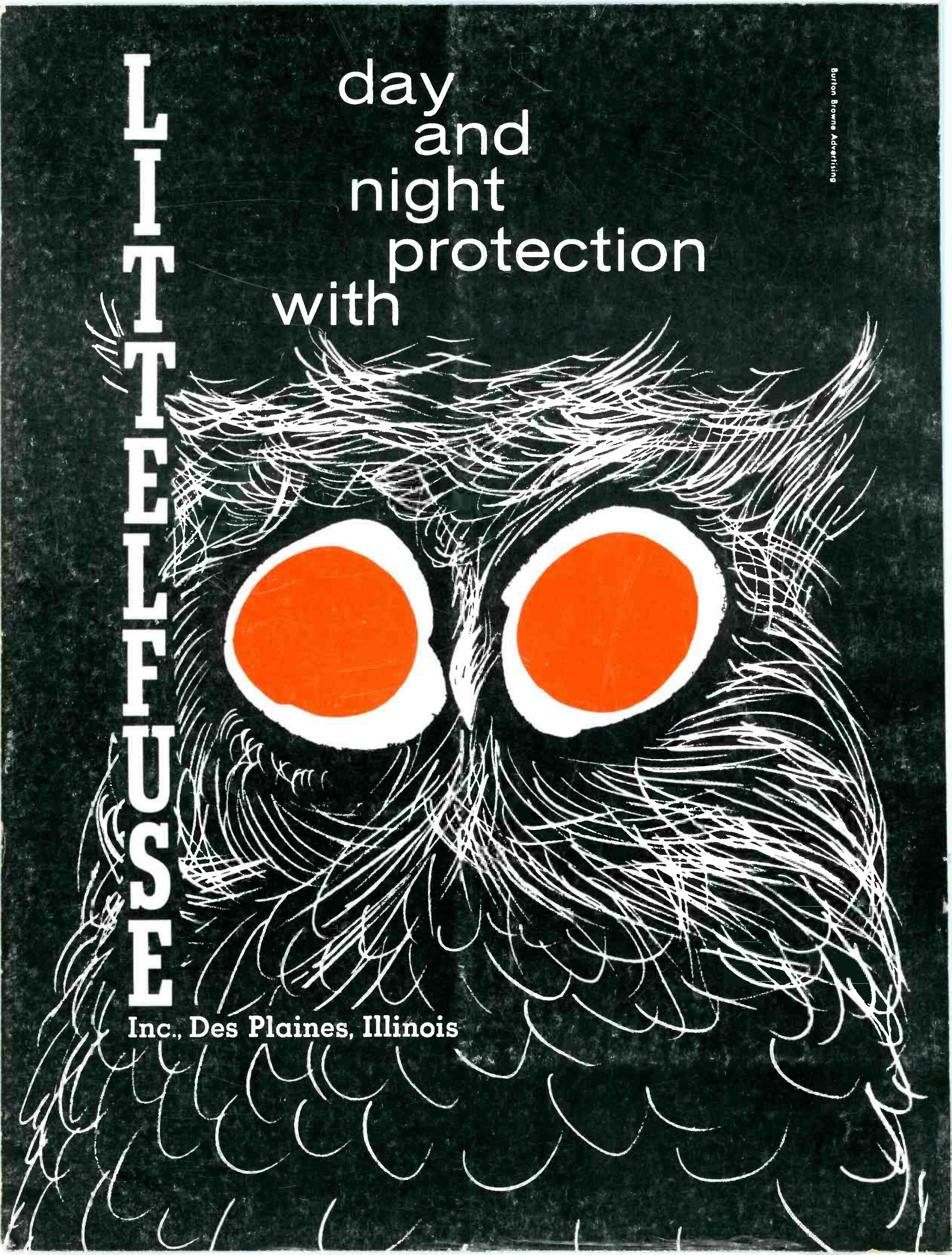
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