ELECTRONIC TECHNICIAN

1963 index P 58-60

- ESTABLISHING A 2-WAY SHOP
- COMMUNICATIONS MICROPHONES
- SELECTIVE CALLING SYSTEMS

AN OJIBWAY PUBLICATION

JANUARY 1964

STOP! LOOK! SAVE!

All crystal controlled

A STANDARD COLOR BAR GENERATOR at 1/2 THE COST OF OTHERS

only $124.50

the all new SENCORE CG126 STANDARD COLOR BAR GENERATOR

A standard color bar, white dot, crosshatch generator especially made for field service on color TV . . . and at a great savings to you.

Check these outstanding features and you will see why this generator belongs on the top of your list for color TV servicing.

All patterns crystal controlled offering "rock like" stability. You'll think the patterns are painted on the TV screen.

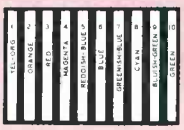
Simplified operation speeds up every servicing job. Just dial the standard keyed bars, white dots, crosshatch, vertical bars or horizontal bars and watch them "pop" on the screen. That's all there is to it.

Exclusive adjustable dot size. The white dots can be adjusted to the size that satisfies your needs by a screwdriver adjustment on the rear. No need to argue about dot size anymore. Just select the size that you like to work with best.

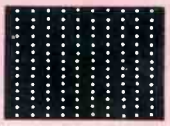
Pretuned RF output to Channel 4. Other low channels can be selected if Channel 4 is being used in your area by simple slug adjustment. Patterns are injected directly into antenna terminals, simplifying operation and saving servicing time.

Reserved output on color bars for forcing signal through defective color circuits. The color output control is calibrated at 100 percent at the center of rotation, representing normal output. A reserve up to 200 percent is available on the remainder of rotation.

Smaller and more portable. With color receivers weighing much more than black and white TV, portable equipment becomes essential for home servicing. The CG126 weighs less than 10 pounds and measures only 11" x 8" x 6".

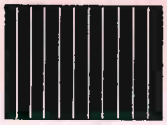


Ten standard keyed color bars (RCA type) that automatically provide all colors at specified NTSC phases . . . but without need of interpretation when servicing.

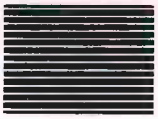


Stable white dots with new exclusive dot size adjustment in rear.

Stabilized crosshatch pattern for simplifying convergence adjustments.



10 thin white vertical lines for horizontal dynamic convergence adjustments . . . often missing on other generators.



14 thin horizontal lines for vertical dynamic convergence. Also missing on many high priced generators.

March into your local parts distributor and demand the CG126 Sencore color generator that sells at ½ the price of others. Don't let him switch you.

SENCORE

426 SO. WESTGATE DRIVE • ADDISON, ILL.

- - - for more details circle 38 on post card

"The responsibility of leadership is to innovate, produce and deliver a reliable product."

William Dubilier, Mica Capacitor Inventor

D. C. Tubular Aluminum Electrolytic Capacitors

Preferred Replacements: *Three selected types, immediately available, cover all replacement needs.*

Reliability: *Typically high Cornell-Dubilier quality to protect your reputation and profits.*

The right replacement . . . when and where you want it. Immediately available from the CDE network of Authorized General Line Distributors, and especially selected to solve any under-chassis and sub-panel tubular electrolytic replacement problem. Each of the three D.C. aluminum electrolytics use highest quality materials, utilizing the latest, exclusive CDE processes—the result of CDE's 53 years of knowledge and experience in capacitors.

Type ECSP—for printed circuit and low voltage, transistorized equipment. The industry's only rectangular cased, miniature electrolytic. Pre-molded case, exclusive moisture resistant encapsulation, and guaranteed lead center dimensions. Available 3 to 75 volts DC working, 3 to 250 microfarads, operating temperature range—20 to 65C.

Type NLW—for transistorized and portable equipment, or other miniaturized applications. Ultra-miniature axial lead electrolytics, hermetically sealed in aluminum cases, and provided with plastic insulating sleeves. Available 3 to 150 volts D.C. working, 1 to 450 microfarads, operating temperature range—40 to 85C.

Type BR/BBR—the famous CDE "Blue Beaver"®, most popular and widely used of any tubular electrolytic. Hermetically sealed in compact aluminum cases and provided with cardboard insulating sleeves. Available 3 to 700 volts D.C. working, 1 to 5000 microfarads, operating temperature range—20 up to 85C. Also available BBRD (dual), BBRT (triple), and BBRQ (four section).

Order a supply of these preferred replacements from your CDE Distributor. For more information, ask him for Section 201 of the CDE REPLACEMENT COMPONENT SELECTOR, or write: Cornell-Dubilier Electronics, Division of Federal Pacific Electric Co., 50 Paris Street, Newark 1, New Jersey.

CDE CORNELL-DUBILIER

INNOVATION WITH RELIABILITY

- - - for more details circle 21 on post card

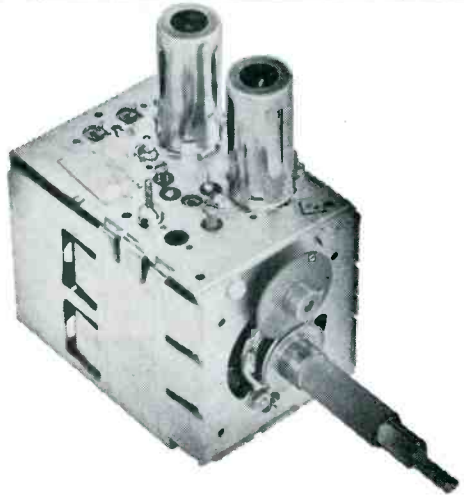
Prices effective January 1, 1963

Tarzian offers FAST, DEPENDABLE TUNER REPAIR SERVICE (ALL MAKES)

ONLY $9.50 INCLUDING

ALL PARTS (except tubes) and LABOR

24-HOUR SERVICE
1-YEAR WARRANTY



It just makes sense that a manufacturer of tuners should be better-qualified, better-equipped to offer the most dependable tuner repair and overhaul service.

Sarkes Tarzian, Inc. pioneer in the tuner business, maintains two complete, well-equipped Factory Service Centers—assisted by Engineering personnel—and staffed by specialized technicians who handle ONLY tuner repairs on ALL makes and models.

Tarzian-made tuners received one day will be repaired and shipped out the next. Allow a little more time for service on other than Tarzian-made tuners.

Tarzian offers a 12-month guarantee against defective workmanship and parts failure due to normal usage. And, compare our cost of $9.50 and $15 for UV combinations. There is absolutely no additional, hidden charge, for ANY parts except tubes. You pay shipping costs. Replacements on tuners beyond practical repair are available at low cost.

Ⓣ Tarzian-made tuners are identified by this stamping.

When inquiring about service on other tuners, always give TV make, chassis and Model number. All tuners repaired on approved, open accounts. Check with your local distributor for Sarkes Tarzian replacement tuners, replacement parts, or repair service.

SARKES TARZIAN, INC.
Bloomington, Indiana

MANUFACTURERS OF TUNERS . . . SEMICONDUCTORS . . . AIR TRIMMERS . . . FM RADIOS . . . AM/FM RADIOS . . . AUDIO TAPE . . . BROADCAST EQUIPMENT

TWO SERVICE CENTERS TO SERVE YOU BETTER

See your distributor, or use the address nearest you for fast factory repair service

537 South Walnut St. Bloomington, Indiana Tel: 332-6055	10654 Magnolia Blvd. North Hollywood, Calif. Tel: 769-2720

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

ELECTRONIC TECHNICIAN

JANUARY • 1964 VOL. 79 • No. 1

AN OJIBWAY PUBLICATION

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AUDITED PAID CIRCULATION ABC

COVER

There's a lot more here than meets the eye at first glance. See page 73 for the complete story on this month's cover photo.

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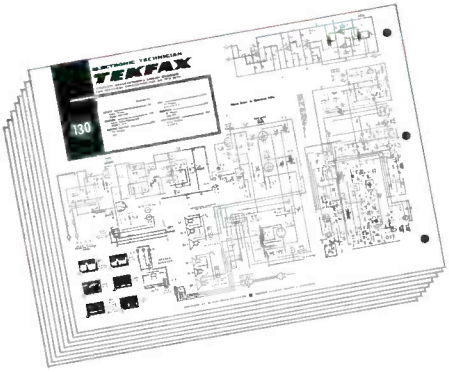
DEPARTMENTS

TEKFAX ..... 16 PAGES OF LATEST SCHEMATICS



AIRLINE: TV Chassis 1174-184, 1174U-184 1188-184 Models GTC-1684A, -94A, -2684A.

DELCO: Chevrolet Auto Radio, Model 985694.

EMERSON: TV Chassis 120708, 712, 725.

GENERAL ELECTRIC: TV Chassis AY.

HEATHKIT: Stereo Amplifier, Model AA-21.

With SPRAGUE you get EVERYTHING...

...no other Capacitor Line even comes close!

6S-119-63

Sprague's latest capacitor catalog, which lists thousands of replacement capacitors for practically every application, is just off the press. Get your copy of Catalog C-615 from your Sprague Distributor, or write to Sprague Products Company, 65 Marshall Street, North Adams, Mass.

SPRAGUE®
THE MARK OF RELIABILITY

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LETTERS TO THE EDITOR

DIY

At the possible chance of getting my head in a noose, I am bound by conscience to write this letter in the hope that it may clear the air on the receiving tube situation. The opinion stated here, is my own and does not in any way reflect the opinion of TSA-Ohio or TSA-Ohio News, the latter of which I am the managing editor.

There is undoubtedly an answer to the DIY tube tester situation and I feel mine is as good an answer as I know about. In your editorial in the November 63 issue of ET you cite a case of an association member using rebranded and used tubes. To this situation I must wholeheartedly agree with your opinion and then some. There is absolutely no justification for this type of practice. As a matter of fact, if the case were proven there would be grounds for legal action, because he is probably using name brand manufacturers' tube cartons so that the customer assumes he is buying a new tube and is paying the new tube price.

It has long been known in the trade, that the tube discounting situation and tube pricing structure is entirely out of proportion with other parts. I see no reason why tubes should have such an inflated discount over other parts. If the tube discount were set at 40 percent of list, like most other service parts, the druggists, the supermarkets, etc., would not be able to or would not want to, have the DIYs in their stores. The reason is simple. With their suppliers' profits chopped down, they in turn will lower the percentage to the outlets and the outlets in turn will not make enough profit to put up with the headaches involved.

At this stage I can hear thousands of voices screaming. If they will stop screaming long enough to allow me to finish, they may learn a few things.

First let me say, should this ever come about, they will probably see a lot of familiar as well as new faces in their stores. Second, once you have them in your store, you have every chance in the world

LETTERS TO THE EDITOR

to sell, not only tubes, but batteries for their transistor radios, new needles for their record player, etc. In other words, you could give them a sales pitch on everyday items. Third, there is always the possibility of a sale on a new TV or a stereo set, or a new transistor radio. Fourth, if the corner store doesn't sell tubes anymore he may just call you for a service call, which means more money than just selling a tube. Fifth, if it is absolutely necessary to have the long discount in tubes to stay in business, take my advice, you're in the wrong game. You had better move on to something else. Finally, since it is a well-known fact that the independent service technicians are interested in a buck today, rather than two bucks tomorrow, this solution will probably have more rocks thrown at it than dogs have fleas. I only ask one thing. Before you start throwing sit back and think real hard about the benefits it will bring you and your families.

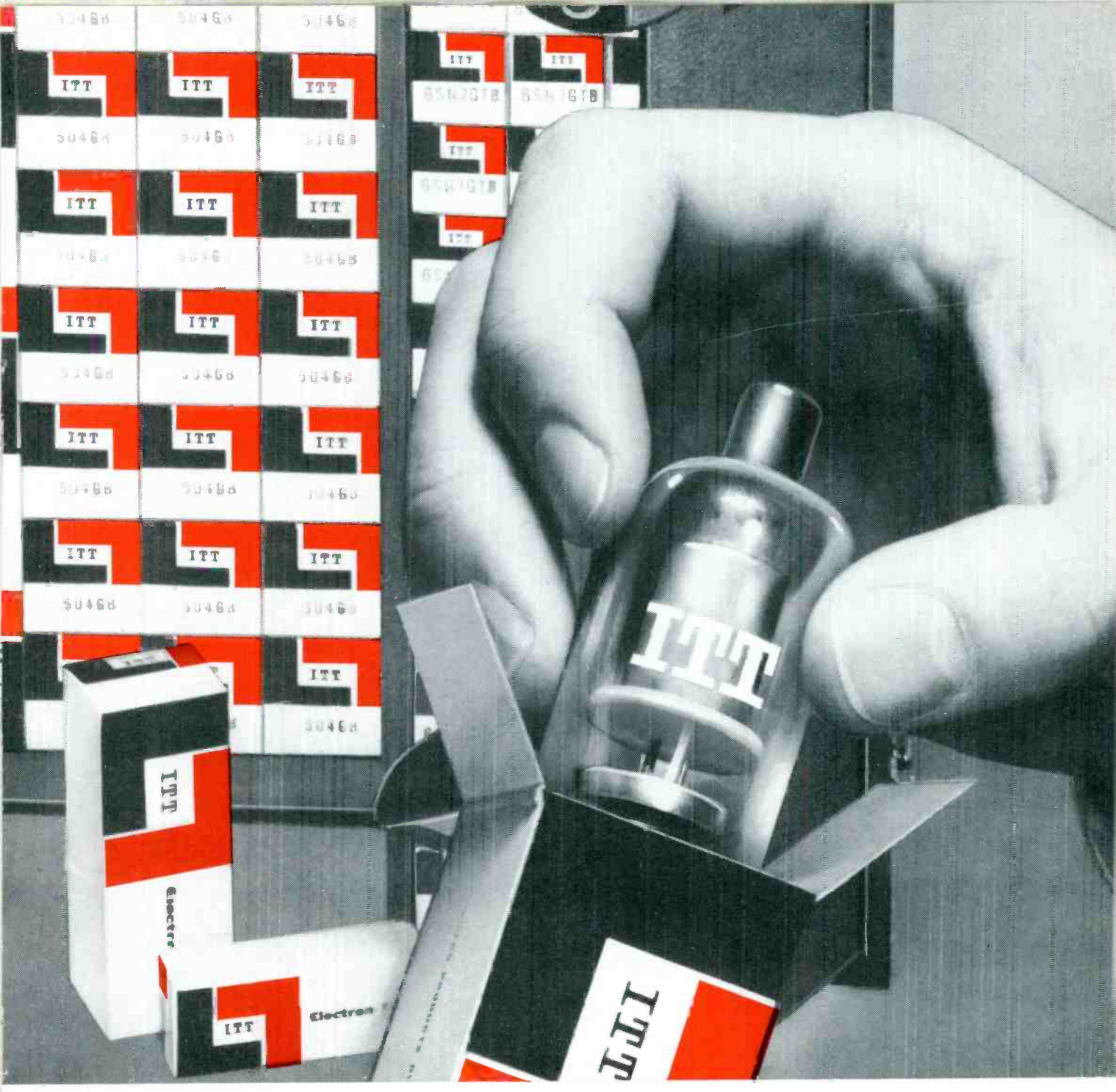
A. R. MIDDLECOOP
Managing Editor
TSA-Ohio News

Akron, O.

Licensing

. . . Had Mr. Bell actually read the provisions of the (Louisiana Licensing) Act . . . and not categorized in his statement "all the city and state statutes I have seen have a glaring lack of protection for the customer and all have an unnecessarily high fee," his strong opinions may have been tempered somewhat. . . . This act is specifically designed for the protection of the public, and the $15.00 annual fees can hardly be termed unnecessarily high. . . . As only one indication of our efforts in behalf of the public, I have also enclosed our folder "Ethical Practices for the Licensed Technician." This is widely distributed to both technicians and their customers.

Mr Bell has many good thoughts in his editorial; thoughts which are in line with policy effected by licensing in Louisiana — that the



There's more profit in your hands with ITT tubes

Yes, you can pocket extra profit when you stock ITT receiving tubes . . . with full confidence that you are giving your customers the finest replacement tubes money can buy.

Your customers will appreciate it, too, because they know ITT's international reputation for quality and leadership in electronics.

ITT can provide this "extra value" of finest quality at higher profit margins because ITT products are available from 154 factories and laboratories in 24 countries. Brands without these world-wide resources cannot offer you these advantages.

Ask your local distributor about ITT tubes. He'll give you *extra profit* details.

ITT Distributor Products Division, International Telephone and Telegraph Corporation, Box 99, Lodi, New Jersey.

ITT

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LETTERS TO THE EDITOR

technician is recognized by his competence and ability, rather than by the number of hours he works. The examination he must pass to be licensed insures these qualifications to the public. The ethics he must maintain under his license status perpetuates these qualities, and extension training, made available by this agency, enchances them. . . .

HAROLD J. YURATICH
Administrator
State of Louisiana
Radio and Television
Technicians Board

New Orleans, La.

● *It was our intent to show that what some technicians expect of a licensing law is wrong. As was pointed out, some good laws must exist.—Ed.*

Congratulations to you for your very sound explanation on licensing TV repairmen as expressed in the October issue of ELECTRONIC TECHNICIAN. You very plainly showed there are two lines of thinking among practicing technicians today, those who consider electronic service a profession and those who consider it a trade. The man who wants to make it a profession gets satisfaction from rendering good service in addition to making it a means of livelihood. The tradesman is interested mainly in the financial gain he may obtain.

. . . It seems ET has struck a new note in helping servicemen to think of their life work as a profession. I hope you have much success along this line in the months and years to come.

JOHN F. STOLL
Peoria, Ill.

I read with interest your editorial in the October issue, as you have the same convictions that I have. . .

ALBERT N. WILLIAMS
Cheltenham, Md.

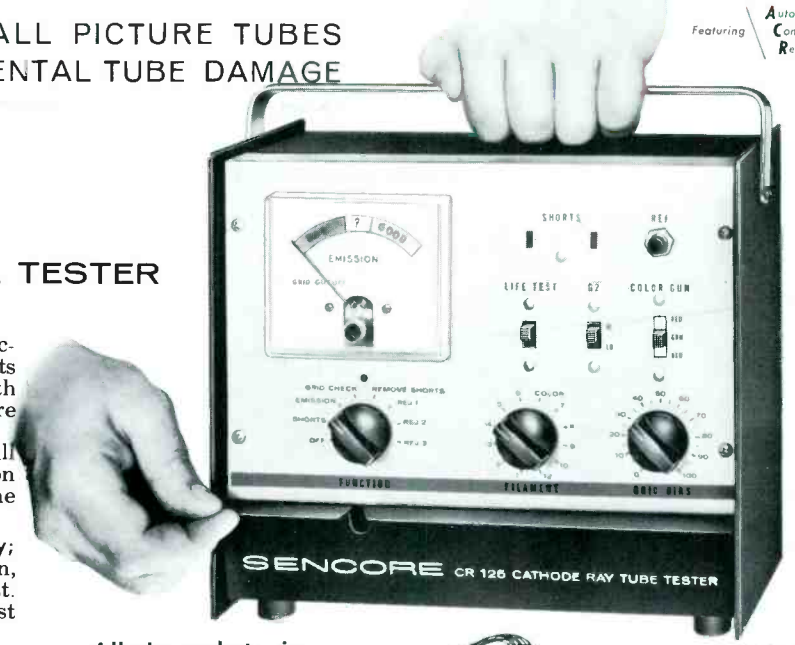
Mobile Changers

. . . We are looking for some

CHECKS AND REJUVENATES ALL PICTURE TUBES
WITHOUT ADAPTORS OR ACCIDENTAL TUBE DAMAGE

Featuring Automatic Controlled Rejuvenation

The All New
SENCORE
CR125 CATHODE RAY TUBE TESTER



An all new method of testing and rejuvenating picture tubes. Although the method is new, the tests performed are standard, correlating directly with set-up information from the RCA and GE picture tube manuals.

Check these outstanding features and you will see why this money making instrument belongs on top of your purchasing list for both monochrome and color TV testing.

Checks all picture tubes thoroughly and carefully; checks for inter-element shorts, cathode emission, control grid cut-off capabilities, gas, and life test. Checks all picture tubes with well filtered DC just like they are operated in the TV set.

Automatic controlled rejuvenation. A Sencore first, preventing the operator from over-rejuvenating or damaging a tube. An RC timing circuit controls the rejuvenation time thus applying just the right amount of voltage for a regulated interval. With the flick of a switch, the RC timer converts to a capacity type welder for welding open cathodes. New rejuvenation or welding voltage can be reapplied only when the rejuvenate button is released and depressed again.

Uses DC on all tests. Unlike other CRT testers that use straight AC, the CR125 uses well filtered DC on all tests. This enables Sencore to use standard recommended checks and to provide a more accurate check on control grid capabilities. This is very important in color.

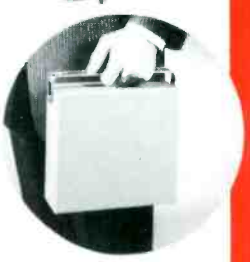
No adaptor sockets. One neat test cable with all six sockets for testing any CRT. No messy adaptors, reference charts or up-dating is required. The Sencore CR125 is the only tester with both color sockets. (Some have no color sockets, others have only the older type color socket.)

All six sockets, including latest color socket, on one neat cable.

Checks Each Gun Individually In Color Tubes.

No draggy leads. A neat, oversized compartment, in the lower portion of the CR125 allows you to neatly "tuck away" the cable and line cord after each check in the home.

Model CR125 ..... **$69.95**



MODEL CR128
For the man on the go. Same as above but in all steel carrying case $69.95

PS127 DELUXE WIDE BAND OSCILLOSCOPE
AT A
SURPRISINGLY LOW PRICE

This all new 5 inch oscilloscope offers the finest in performance, portability and appearance. Vertical amplifier frequency response, flat within 1 DB from 10 CPS to 4.5 mc and only 3 DB down at 5.2 mc insures true waveform reproduction. Vertical amplifier sensitivity of .017 volts RMS for one inch deflection on wide band (without band switching) is found only on scopes costing hundreds of dollars more. High input impedance of 2.7 megohms shunted by 99 mmfd (or 27 megohms with 9 mmfd with built-in low capacity probe), insures minimum circuit loading. For the first time, waveforms can be viewed in TV horizontal and vertical output circuits with the low capacity probe that will withstand up to 5000 volts peak to peak. To top that, the vertical amplifier attenuator controls are calibrated directly in peak to peak volts for fast direct reading of all peak to peak voltages.

Horizontal amplifier extended sweep range from 5 to 500 kc in five overlapping steps and frequency response from 10 CPS to 1 mc within 3 DB insures linear sweep and positive sync. External inputs for horizontal sweep and sync, intensity modulation, and smart two-toned case and "designer" styled controls brands the PS127 a truly professional oscilloscope.

PS127 ..... **$169.50**

- - - for more details circle 39 on post card

LETTERS TO THE EDITOR

record players to install in "cars." Kindly give us names and addresses of manufacturers that would make such "record players."

R. L'ECUYER
St-Eustache-sur-le-Lac, Quebec

● *Can anyone help?—Ed.*

One Day

Your article in October '63 issue "One Day—In A Technician's Life" is the type of article I have been looking for for a long time.—

JAMES L. BERAIST
Miami Beach, Fla.

Trade Name

We are pleased to note that our product "Nichrome" is mentioned in an article entitled "PC Hole Cleaner" which appeared in the May 1963 issue of ELECTRONIC TECHNICIAN. However, we fail to note any reference to the fact that Nichrome is the registered trademark of the Driver-Harris Co.

Nichrome is a very old trademark, having been registered by us in 1908 and used continuously by us ever since to denote our famous alloy. It is among our most valuable assets. You can, therefore, understand our great concern in the proper protection of our registered trademark.

R. B. ALLARDICE, JR.
Driver-Harris Co.
Harrison, N. J.

On Estimates

Regarding your item "Comments Please," here are my comments:

We specialize in auto radio repairs. We try to avoid estimates as much as possible, but to get the jobs, we have to make a few. When a customer asks for an estimate, we will quote an educated guess, but at the same time explain the possibility of noisy tubes, bad speaker or antenna. We set an estimate charge in case the customer decides not to have the set repaired. We get the customer's phone number and explain we will call if the charges are to be more and let him decide for himself.

Quality is no gamble!

when you specify ELMENCO dipped Mylar* paper

Every time you make a call . . . service a circuit . . . change a component – you bet on the parts used. Make sure the odds are in your favor with miniaturized Elmenco Dipped Mylar-Paper (DP) capacitors. Over 100 million are in use now, because Elmenco DP capacitors give missile quality at commercial cost. Whether for radio-TV repairs, or critical industrial circuitry, reliable, dependable, rugged Elmenco capacitors eliminate profit-killing callbacks and customer complaints. Elmenco DP capacitors operate at 125°C without derating, are completely moisture proof, and are up to 50% smaller than comparable types. You can substitute values in a capacitor, but never virtues. Ask for Elmenco, and be sure you get it. Elmenco DP capacitors are available from stock only at authorized ARCO distributors throughout the U.S.A.

*Reg. Du Pont Trademark

ARCO
electronics inc.

ARCO'S RESERVE WAREHOUSES

You can get your Elmenco (DP) capacitors in any quantity within 24 hours from coast to coast. They're stocked in depth at Arco's reserve warehouses serving authorized Arco distributors throughout the nation. Call your Arco distributor today!

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Branches: Dallas 7 ☐ Los Angeles 35

- - - for more details circle 12 on post card

LETTERS
TO THE EDITOR

We explain carefully to the customer that there is no sure way to give him an estimate without checking the set out, which generally means a complete repair job before on accurate estimate can be made. After an estimate is made, we add a couple of dollars to take care of unforeseen troubles. On an estimated job, the charges run more because of extra time spent on the job. After all, we are in business to make a profit. Estimates are a business hazard and we have to learn to live with them.

San Antonio, Tex. HAROLD WOLFF

I would like to comment on Mr. William M. Peacock's letter in the October issue. I service all makes of TV and used to have this problem. When I take a television in the shop for repair that doesn't show any picture or sound and the customer asks for an estimate, before I take it in I ask him if it had a good picture and sound just before it went out. Usually they will tell me if they were experiencing any particular difficulty, but if they say it was working good before it went out I will tell them what I think it would cost to put the set in operating condition and agree to call if it costs more.

When I give an estimate in the home, I make it clear that it is just an educated guess. We have to bear in mind that a fifty cent boost filter shows the same symptoms as a $15.00 flyback.

Emporia, Kan. ROBERT W. WILLEY

William Peacock, in his October letter, asks how others handle estimates. He gives an estimate, finds he quoted too low, then blames the customer for misinforming him.

Experience, I feel, should teach that you cannot depend upon what the customer considers as "not working right"—particularly *before* the set went out. The next time, Mr. Peacock will make allowances for the unforeseen, should an estimate be demanded of him before taking a set from a home.

Giving an estimate before taking a set from the home (in spite of the Editor's note), I find best—better than charging fees required for taking a set in for an estimate. This does not mean an exact price be given; the final price of the repair, I never give, but I do give a maximum-possible price in practically every instance. After all, there is not a repairman that can give the final price until the repair is fully completed. This, is what is needed to explain to the customer; regardless of how much he may suspect as being the cause of the immediate trouble, he cannot be sure of the unforeseen. I feel much better starting on a shop repair when a customer has conceded to spend "up to so much" and this "so much" figure has been suggested by me. By the same token, regardless of the customer's insistence, I'll never quote a "minimum" when giving an estimate. Similarly, a "minimum-maximum" estimate, I believe, only leads to confusion. I make it clear that much depends on the customer trusting me.

Pittsburgh, Pa. OSCAR SCHECTAR

P. R. MALLORY & CO. Inc.
MALLORY

Tips for Technicians

Mallory Distributor Products Company
P.O. Box 1558, Indianapolis 6, Indiana
a division of P. R. Mallory & Co. Inc.

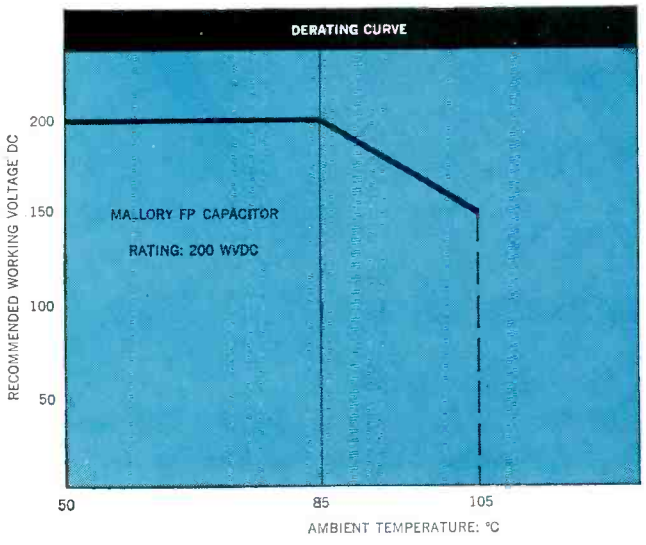
About voltage ratings on electrolytics

Maybe this has happened to you. You've got to replace a 10 mfd electrolytic capacitor. On its label, loud and clear, you read 200 volts. You look on your shelf. No 200 volt units in sight—but there's one that says 10 mfd 300 volts. Question—can you use it, and if so, will it reform itself and become a 200 volt capacitor when used at the lower voltage?

Answer—you can, and it won't.

The reforming of electrolytics to lower voltage is an idea held over from the ancient days of wet electrolytics, which had a tendency to adjust themselves to the voltage at which they were being used. This doesn't happen with modern electrolytics, especially the way Mallory makes them.

You can rely completely on the voltage rating you read on a Mallory capacitor's label. We've built in the safety factors *before* we print the voltage rating on each capacitor. This means you can use a Mallory capacitor right up to its rated DC working voltage, at rated ambient (this is 85° C. for FP's, WP's and TC's) without worrying about premature failure or call backs. And you have inherent extra muscle to withstand the usual surge voltage above rated value. Conversely, you can *always* use a Mallory capacitor *below* its rated voltage when convenience demands it; you're just buying some extra reliability at a bargain price.



When necessary, you can use Mallory electrolytics at temperatures beyond 85° C. You won't get as long life, and you'll need to run them below rated voltage. No hotter than 105° C., please, and no higher then 400 volts. The chart at left gives you typical temperature derating data. If you run into higher temperatures, you really need one of our fine tantalum capacitors.

The best way to make sure you get the electrolytics you need is to see your Mallory distributor. He carries a complete line of all ratings of Mallory FP, WP, TC, TT and wax tubulars. Right now, he is featuring a new dealer cabinet that gives you a compact, convenient working stock of most popular FP types. See him soon—make him your headquarters for all your parts requirements.

- - - for more details circle 32 on post card

EDITOR'S MEMO

Progress

It is probably safe to say that one never fully appreciates vertical transportation until it is unavailable. Some of you may have suffered this agony if you ever shopped in a store when new elevators were being installed—a process which usually involves shutting down the old ones while the change is being made.

Publishing houses can have the same situation when they undergo mushrooming growth in a short time. Such has occurred at Ojibway Press, parent company of ET, where the manually-operated vertical transportation in our Ojibway Building became outmoded. While push-button automation is being installed, everything is out of commission and the only vertical transportation left is the stairway.

True, we have no Empire State Building to negotiate, but even our fifth floor perch seems remarkably lofty. Fortunately, the fifth floor staff is all youthful and vigorous, and climbing a mere five flights of stairs several times a day is taken in stride (pun intended).

The fourth floor is being extensively remodeled at the same time, to the resounding accompaniment of drills, hammers and other sounds of progress. Soon that glistening area will house the art layout departments and most of circulation.

Meanwhile, small social changes continue apace. A few more individuals have joined the ranks of brown-baggers (those who bring their lunch) rather than face an additional five-story climb after lunch.

It will all come right in the end, of that we are sure. But to spare you any pangs of sympathy I'll tell you that by the time you read this we should be zooming up and down in push-button comfort.

Speaking of push-buttons, I'd like to invite your attention to five communications articles among this month's features. *Establishing a Two-Way Service Shop* should be of particular interest to those who are not now servicing two-way equipment.

Vic Beel

COMING EVENTS

Jan. 28-31: Fifth Annual Conference, Electronic Representatives Association, Fontainebleau Hotel, New Orleans.

Feb. 19-21: International Solid-State Circuits Conference, Sheraton Hotel & University of Penn, Phila.

Mar. 23-26: IEEE International Convention, Coliseum and New York Hilton, New York.

MOVING?

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

TECHNICAL DIGEST

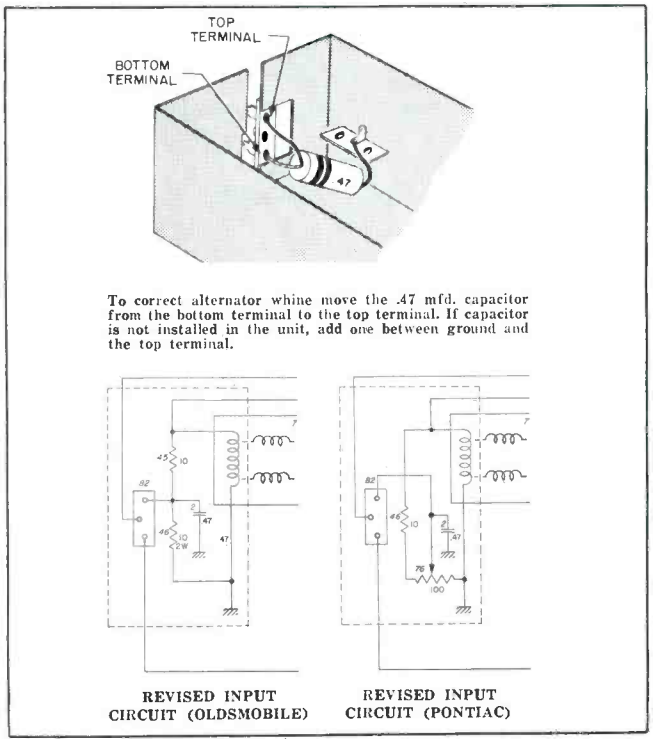
ADMIRAL

TV Chassis Stamped Run 11, Models C21A1-1A, -1E, C21A10-1C—Changes

The following schematic corrections should be indicated on TV installation, alignment and service data, form number 41D9-351-002 or St988-2. In run change column of schematic, disregard run 11 information, relating to change in value of several resistors and capacitors. Run 10 and 11 sets are identical. Proposed changes were cancelled, since it was not feasible to make changes at that time. Indicate correct value for following components in the schematic: Resistor R413 should be 470-kΩ, instead of 680-kΩ. Vertical hold control should be 750-kΩ, instead of 1.2 MΩ. Resistor R436 should be 150-kΩ, instead of 47-kΩ. Capacitor C405 should be 470 pf, instead of 220 pf. Capacitor C408 should be 560 pf, instead of 1200 pf. Also on schematic, indicate correct pin numbering for V405 (1X2B tube). Filament pins should be 2 and 9, instead of 4 and 8.

DELCO

Oldsmobile and Pontiac Reverberation Amplifiers—Alternator Whine



To correct alternator whine move the .47 mfd. capacitor from the bottom terminal to the top terminal. If capacitor is not installed in the unit, add one between ground and the top terminal.

On early production 1963 reverberation amplifiers the .47μf capacitor was connected between the 12 v input line and ground. To correct alternator whine this capacitor should be connected between the audio input line and ground. This modification can be performed by removing the capacitor from the bottom lug of the connector and connecting it to the top lug. See drawing and revised schematics.

DUMONT-EMERSON

TV Chassis 120677-A, -678B, -679A, -684A, -689A—Field Modification Note

These chassis are equipped with IF input coil which has been designed to allow for the addition of a second adjacent channel sound trap without removing the chassis from the cabinet. This input coil, which is housed in a two-piece shield can with removable top, has been wound around a coil from which extends beyond the windings sufficiently to allow the added adjacent channel sound trap (part No. 720396) to be cemented in place around it. An additional tuning slug (part No. 404052) is then inserted into the open end of the coil form and tuned for minimum adjacent channel sound interference, and the removable metal top section of the coil shield replaced. Parts necessary for this modification may be ordered from the manufacturer's distributors in areas where the need for these items may exist.

GAMBLE-SKOGMO

TV Chassis TV2-9542A—Poor Vertical Linearity

If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause: 1) Check variable resistors R310, 315 and 316. 2) Vertical output transformer defective 3) V7B or V8 defective, check voltages. 4) Excessive leakage or incorrect value of capacitors C306C, 307, 308, 309, 310 or open or incorrect value of resistors R312, 313, 314 or 318. 5) Low plate voltages. Check power supply. 6) Vertical deflection coils defective.

MONTGOMERY WARD (Airline)

TV/FM/AM/Phono Combinations, WG5914A, 5944A, 5974A, 6914A 6944A, 6974A—Poor Resolution

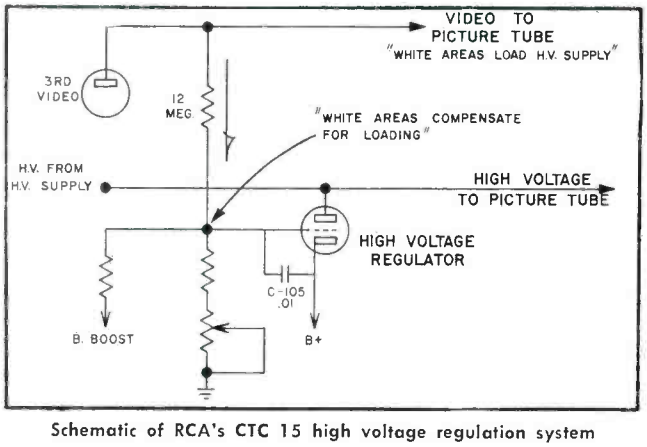
TECHNICAL DIGEST

If the picture resolution is not up to standard, it may be caused by any of the following: 1) Defective pix IF tubes V3 or V5. 2) Defective pix detector crystal (part of T-202). 3) V6 defective. 4) Defective CRT. 5) Open video peaking coil. Check all peaking coils L202, L203, L205 and L206 for continuity. Note that L203 and L206 have shunting resistors. 6) Leakage in V6 grid capacitor C212. If the capacitor is not found to be defective, check the following: (A). This trouble can also originate at the transmitter. Check reception from another station. (B). Check all potentials in video circuits. (C). Check CRT grid circuit for poor or dirty contact. (D). Check and realign, if necessary, the picture IF and RF circuits. 7) Incorrect setting of fine tuning control.

RCA

Color TV CTC 15—High Voltage Regulation

The CTC 15 high voltage supply includes a regulating system which maintains a steady high voltage despite variations in picture tube loading. A feature consists of a connection between the third video amplifier plate circuit and the shunt regulator grid. Normally, white areas of the picture tend to load the high voltage supply because of additional beam current drawn by the CRT. To compensate for this, video of the same polarity as that at the CRT cathodes is coupled to the shunt regulator grid through a 12 MΩ resistor. This causes the high voltage to remain at the same level when large white areas are being displayed on the CRT. The long time-constant formed by the 12MΩ resistor and the 0.01 μf capacitor in the regulator grid circuit insure that only long term video variations are coupled to the shunt regulator.

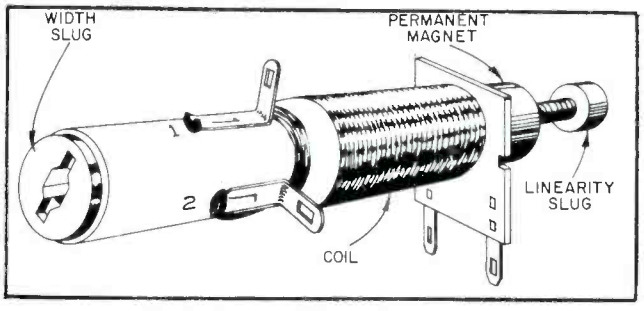


Schematic of RCA's CTC 15 high voltage regulation system

WESTINGHOUSE

TV Chassis—Width and Linearity Coil Operation

Horizontal width and linearity coils are installed in many Westinghouse chassis. The coil shown here is mounted on a form with a permanent magnet on one end. It is connected in series with the horizontal yoke winding. It can modify the sweep current flowing through this winding. While the width end of the coil is a regular inductor, the magnet on the other end changes the waveform to compensate for circuit nonlinearity.

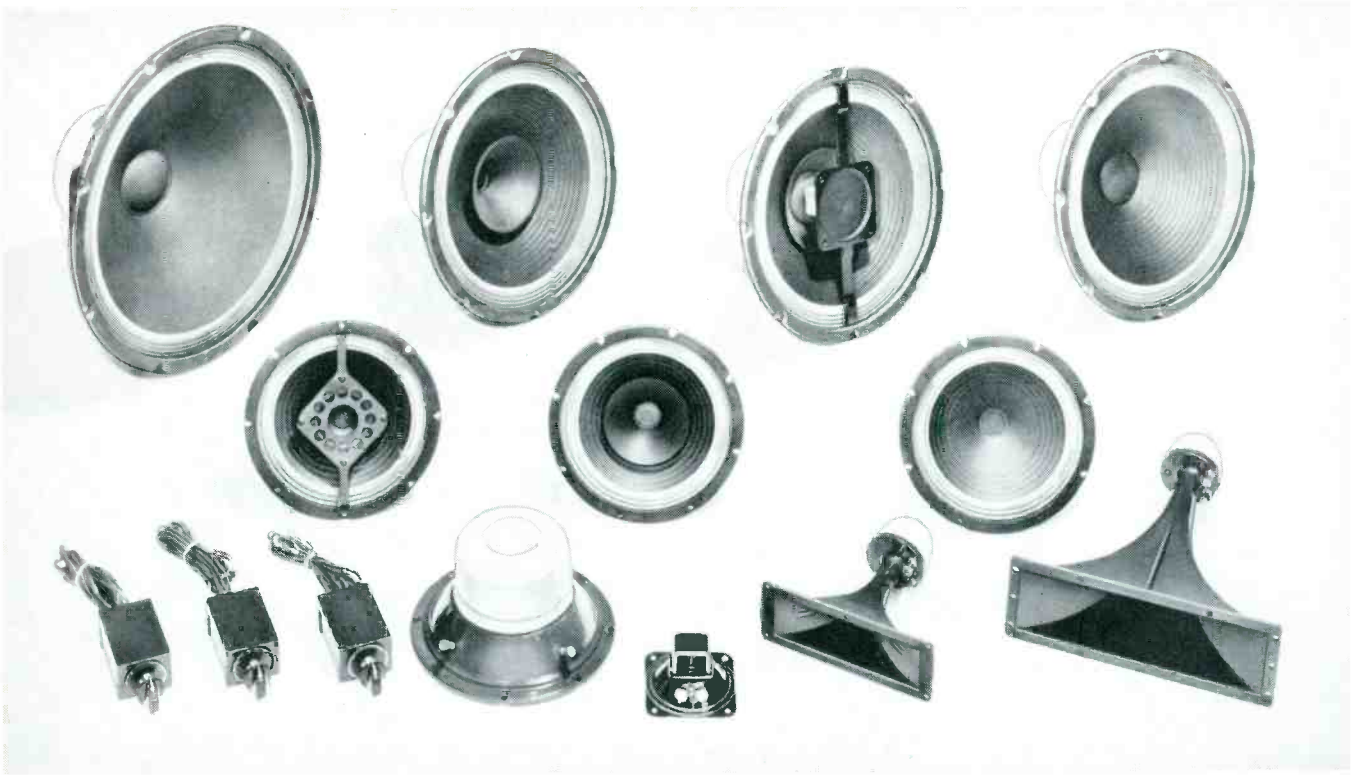


Westinghouse width and linearity coil.

TV Chassis V-2443 — Horizontal Instability

This problem takes many forms — weaving in the picture, unstable sync when channels are changed, or a critical hold control. Realign the ringing coil first. The ringing coil or the capacitor across it may have become open. Observe the applied B+ on a scope for evidence of hum caused by an open electrolytic. Just to be sure, bypass all electrolytics connected with the multivibrator.

The most likely source of trouble is the AFC diodes or its filter network. The front-to-back ratio of the diodes may have changed, or leakage may have developed in the packaged filter circuit.



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MODEL NO.	TYPE	SIZE	FREQUENCY RANGE	IMPED. OHMS	POWER RATING†	LIST PRICE
DC-80	High-Compliance Full Range, Dual Cone	8″	40–14,000	8	11 w.	$19.95
DC-120	High Compliance Full Range, Dual Cone	12″	25–13,000	8	13 w.	22.95
KD-80	High-Compliance Two-Way Coaxial	8″	30–15,000	8	12 w.	28.25
KD-120	High-Compliance Two-Way Coaxial	12″	20–15,000	8	14 w.	33.25
W-80	High-Compliance Woofer	8″	30–2,000	8	15 w.	19.25
W-120	High-Compliance Woofer	12″	20–2,000	8	18 w.	22.25
W-150	High-Compliance Woofer	15″	20–2,000	8	20 w.	33.25
M-81	Midrange, Closed-Back	8″	600–4,000	8	25 w.	14.80
TW-350	Direct Radiator Tweeter	3½″	2,000–15,000	8	15 w.	5.95
TH-100	Compression Tweeter	—	1,000–16,000	8	25 w.	19.95
TH-200	Compression Tweeter	—	2,000–16,000	8	25 w.	17.80
XN-100*	2-Way Crossover	—	1,000 cycle Crossover	—	—	15.50
XN-200*	2-Way Crossover	—	2,000 cycle Crossover	—	—	15.50
XN-640*	3-Way Crossover	—	600/4,000 cycle Crossover	—	—	19.95

*Complete with H-F Control

†Program rating. Peak power is twice the indicated figures.

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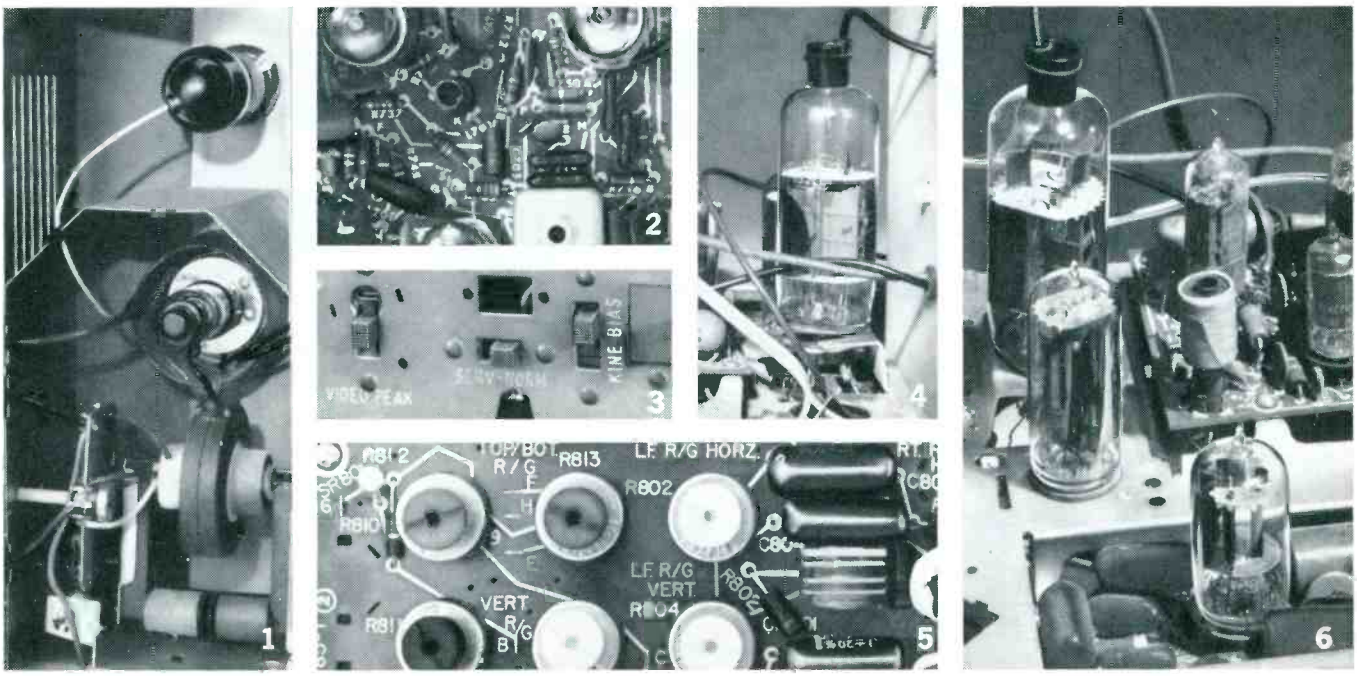
- - - for more details circle 31 on post card

CTC 15 Color TV Chassis gives brighter, sharper picture; has greater reliability; is easier to service... than any previous RCA Victor Color TV Chassis!



RCA Victor's new CTC 15 chassis keeps all the performance-proved virtues of the CTC 12 . . . but adds these engineering improvements that should please both you and your customers:

The picture is brighter, better. It's brighter because a new design in the high voltage section (1) gives 30% more current output at the same voltage. The picture tube circuits are designed for effective use of this higher power.

It's sharper because the picture tube screen voltages have been boosted . . . giving a smaller, sharper dot pattern with less blooming. The video amplifier has better phase response.

It's steadier because of substantially improved vertical hold circuits.

A new picture "tone control" . . . it's a video peaking switch (3) . . . offers three choices of picture quality: soft, normal and sharp. When snow and ghosts are your problem, use the soft setting for a smoother, more pleasing picture. When the signal is better, make the most of it with the normal or sharp setting.

Less color fringing results from a new clamp diode in the convergence circuit and rearranged controls are easier to use.

And UHF reception is improved by new circuitry that reduces snivets . . . those black vertical lines near the center of the picture.

Greater reliability . . . longer component life. Heat build-up has been reduced by housing the flyback transformer and the regulator tube in separate compartments.

The horizontal output tube (4) is placed on a raised "cooling shelf" outside the H.V. compartment. Its position allows free flow of air around its base. Three conventional tubes have been replaced by novars (6). They run cooler and last longer. One of them is the hardest working tube in the set—the horizontal output tube.

And dark heater tubes are used in all high-performance circuits.

To further increase life, the focus rectifier is now a special long-life selenium type.

Easier servicing. Circuit tracing is easier and faster . . . the new schematic solid-line roadmaps (2) go point-to-point, and component labels are larger.

It's easier to service the high voltage compartment . . . it has a hinged cover and better arrangement.

Color setup has been simplified by the addition of a conveniently placed 3-position bias switch (3) which accommodates wide variations of picture-tube characteristics.

RG controls (5) on the convergence board have also been rearranged for your convenience. Now you use the entire top row to make adjustments according to the horizontal lines in a crosshatch pattern; the entire second row is for the vertical lines.

Color TV is the technician's big bread and butter business . . . for years to come. We stand ready to help in every possible way to make this fast-growing business a profitable one for technicians —and for dealers as well.

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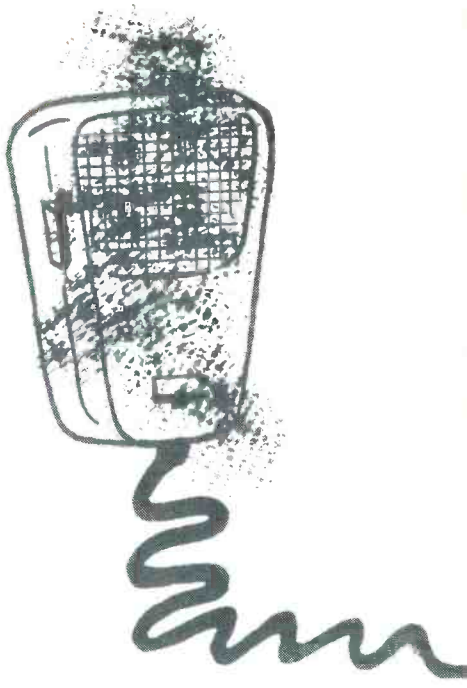
ELECTRONIC TECHNICIAN Magazine

JANUARY 1964

COMMUNICATIONS MICROPHONES



by George Riley
American Microphone Co.

■ To set up guidelines for the use of microphones in the home, hobby and commercial fields would require a well-organized book and might well be authored by a group of microphone specialists. It is relatively easy, however, to assemble the requirements for any one specialized application, such as communications microphones, and organize them into useful form. The technician owes it to his customers to be aware of these guidelines.

Features common to communications microphones have proved themselves in actual use, while worthless innovations have generally been eliminated. Only those characteristics which have been proved both in theory and, even more importantly, by actual use, are discussed here. They can be used as a guide in selecting microphones for communications applications.

Curves, Peaks and Punch

To begin with, the most important single characteristic of a communications microphone is its ability to provide high accentuation of fricative consonants. (Use of such terms help one to sound like an expert but, more simply stated, this merely means that the microphone must sound crisp and clean at the receiving end.) The primary purpose of communications equipment is to communicate, and if any one component in the system, microphone, transmitter, receiver or antenna, isn't doing a good job, it should be improved or replaced with something that will. The microphone must accept voice frequencies from bass to tenor, pick out the useful ones, accentuate them, and turn them into electrical impulses used to modulate the carrier. This is in contrast to the public address, recording or broadcast microphone where the aim is to accept *all* audio frequencies and convert them into electrical waveforms without any accentuation—a fact which precludes the use of the "flat" or "high quality" microphone on commercial two-way or CB radio equipment. Such microphones could only be used if their frequency response characteristics were drastically altered, after which they would offer high intelligibility ("readability") but would no longer be flat or high quality microphones.

Because intelligibility is the key to all successful communications, it would be well to examine this topic more closely. Fact and fancy are easily intermixed, but it was proved, early in the development of telephone communications, that only those frequencies in the range of 300 to 3000 cps are vital to voice intelligibility. Frequencies above and below this range are needed to reproduce music, but, in communications equipment, they only absorb power better used in the vital intelligibility rather than high fidelity is the aim, and call letters suffice nicely for identification.

Since the frequencies from 300

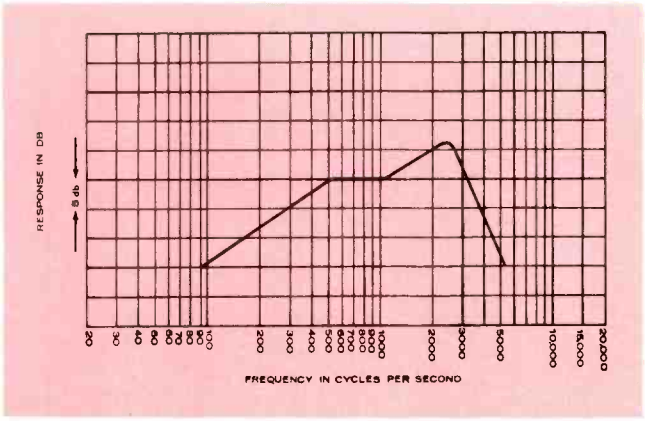


Fig. 1—Ideal frequency response for communications microphone.

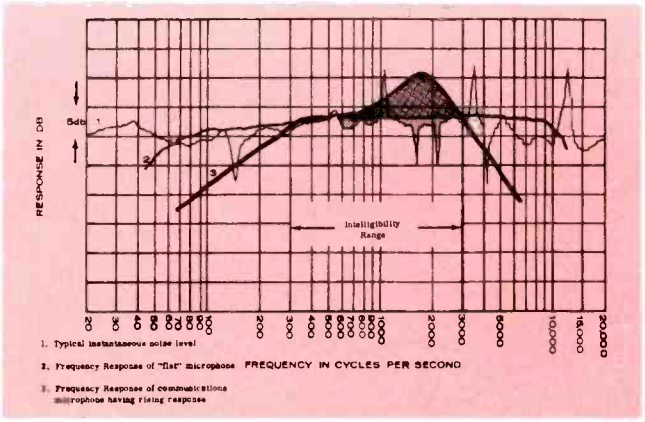


Fig. 2—The shaded area under Curve 2 represents the acoustical or "talk power" provided at the receiver by a "flat" microphone. That for the communications type is the same amount plus the shaded area under Curve 3.

to 3000 cps are a prime requirement, the next step would logically be accentuation of those frequencies within this band which would further increase intelligibility. Flat reproduction of these frequencies is actually all that is required for telephone communications, where there is virtually no interference, and this is true under many conditions of two-way communications. But the added element of interference, man-made or natural, provides another problem best solved by good microphone design.

It has been theorized in the laboratory and proved in the field that the vowels in our speech add little to readability. This may not be true of Mandarin Chinese, but in the English language it is an established fact. Consonants, instead, are the backbone of speech. And frequencies which form them fall in the middle and upper end of the intelligibility range. The logical next step, then, is to design a rising response into the microphone which will reproduce the vowels but accentuate the consonants. This is shown graphically in Fig. 1.

Further refinements are necessary if clean, crisp communications are to be obtained, however. And, as with most manufactured products, it is the accumulation of small refinements that distinguishes the outstanding communications microphones.

The male voice often tends to be deep or "bassy." Reproduction of these lower voice frequencies actually reduces readability since they produce a "muddy" response at the receiving end. This is especially true in CB transceivers which are usually reactance-modulated. Introducing a roll-off into the microphone response below 500 cps greatly diminishes this effect and retains the readability provided by the higher frequencies. This refinement in response alleviates the necessity for special equalization for the user of two-way radio, amateur radio or CB equipment who has a deep voice.

The response curve shown in Fig. 1 illustrates ideal characteristics for communications. The microphone producing this curve will provide usable output level throughout the intelligibility range, yet it is properly equalized to eliminate unnecessary frequencies and harmonics. Thus, it restricts modulation power to just those frequencies vital to readability. Finally, those frequencies remaining are properly balanced to accentuate the hard (fricative) consonants which make speech understandable, the p's, k's, x's and ch sounds. This accentuation is the "punch" needed to "punch through" heavy interference or noise. This is shown clearly in Fig. 2.

Before leaving the graphs and charts, one more characteristic must be mentioned. No matter what frequency response the microphone provides, it will not be able to make the transmitter perform its full capabilities unless sufficient electrical output level is obtained. Output level is usually less a problem in the more expensive commercial two-way radio equipment than in amateur radio and CB equipment, where cost prohibits the more complex circuitry which provides reserve audio gain and modulation control. In CB use it is illegal to increase input on the final beyond 5 w, but it is not illegal to increase modulation power, which puts more power on the carrier and increases working distance.

Output level is stated in db and referred to a standard acoustical power input to the microphone. This system is useful because it provides a standard but is a bit confusing to your customers because it deals in negative numbers. These negative numbers are best illustrated by the common thermometer analogy where the larger the number below 0° the less heat in the surrounding air. In microphones, the larger the number below the reference level, the lower the output. We distinguish that number by putting a negative sign (—) in front of it. Thus, the microphone that provides —55 db output is well above one furnishing —61 db. In a crystal or ceramic type the microphone furnishing —61 db is putting out just half the voltage of that providing —55 db level.

Beyond this point a dissertation on output level and how it is determined becomes unnecessarily complex. A few basic rules are all that are really needed in appraising a communications microphone. If the level is —55 db or above ("above" being a *smaller* negative

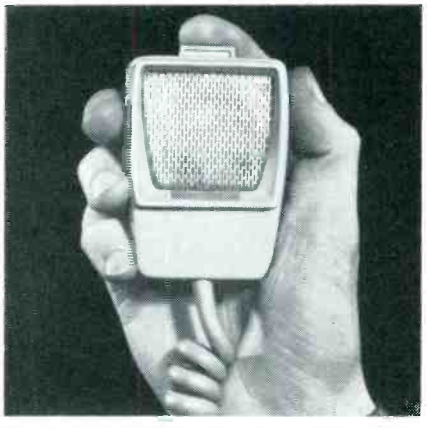
TABLE I

Microphone Type	Generator Element Material	Relative Cost	Relative Output	Life Expectancy	Comments
Carbon	Carbon granules	Medium	High	Dependant on button current	Normally button (element) must be repacked or replaced every two years. High internal noise.
Crystal	Rochelle Salt	Low	High	With care can last many years	Temperature above 115° or high ambient humidity can permanently damage element.
Ceramic	Barium Titanate	Low	Medium to high	Long	Not damaged by temperature extremes or high humidity.
Dynamic	Voice coil and diaphragm assembly	Medium	Medium to high	Long	Must not be exposed to stray metal particles.

Comparison of Generator Elements

Shure's "Ten-Four" is magnetic unit with built-in transistor preamp.

American Microphone's ceramic unit commonly used in low-cost installations.



Sonotone's ceramic communications microphone.

number), the microphone has good output level. This is true regardless of whether the microphone is a dynamic, ceramic, crystal or carbon type. On CB equipment in particular the level should not fall below —58 db at any point in the intelligibility range. And in speaking of level, most specification sheets state the level at a particular frequency, even though that frequency may not be mentioned. Because of this, the response curve is the best reference and in communications microphones, 1000 cps is the best checkpoint.

What's Inside

The frequency range response and output level described here can be designed into a microphone regardless of whether it is a dynamic, ceramic, crystal or carbon type. This brings up the question of why so many types are available. The answer is that each has its advantages and disadvantages as outlined in Table I. All the points in the five column headings should receive careful consideration in choosing a microphone.

A review of this table would lead one to the assumption that the principle choice in current microphones is rapidly narrowed down to one between the ceramic and dynamic types. This assumption is correct and can be confirmed by a fast examination of any equipment catalog. For a long-term investment, the dynamic microphone, because of its extreme ruggedness, is the best buy.

But one strong caution must be exercised in regard to dynamic types. Most mobile microphones are furnished with the cable built into the microphone case. And, in most cases, no connector is supplied on the free end since the manufacturer cannot predict what type will be required or how it must be wired. Since the cable cannot be disconnected, the normal procedure is to lay the microphone on the workbench while the connector is being installed. This is permissable as long as the working area is covered with a clean newspaper, a sheet of wrapping paper or something similar.

On an open workbench, however, the strong internal magnet is free to pull any sort of filings, bits of steel wool or other magnetic particles into the grille. They will eventually find their way into the air gap where they will "freeze" the voice coil or grind it apart. Once free of the shop, little danger of this sort exists, and—given reasonable care—life expectancy is unlimited.

While not as rugged as the dynamic type, the ceramic microphone represents excellent value. Unlike crystal microphones, they are unaffected by extremes of temperature and humidity, making life expectancy quite long. This, coupled with low cost (usually $10 or less), has promoted this type to "most popular" position in the CB field.

Switches, Button and Eye Appeal

Only a few additional considerations are in order. Two types of switches are in popular use: slide switches and leaf switches. Except for specialized designs, slide switches of the past involved very low cost, and they were not built for continuous use. More recently, they have been greatly improved and will provide long life in the types manufactured for microphone use. They have the advantage of wiping contacts which clean themselves, but the disadvantage of being difficult to clean, when cleaning is required. Leaf switches, in comparison, are more expensive but will usually provide longer life In addition, cleaning of contacts

Continued on page 79

UNDERSTANDING SELECTIVE CALLING SYSTEMS

Solving installation and

2-way tone squelch and selective

by Leo G. Sands

■ Selective signaling has become vital for many 2-way mobile radio users who are forced to share channels. Several selective signaling and tones squelch systems are now being used and technicians cannot service this equipment successfully without a general knowledge of typical systems and how they operate.

Systems

Two systems are generally employed: Tone squelch and selective tone signaling. Tone squelch makes mobile units responsive only to radio signals modulated by a tone of specific frequency. Either *tone burst,* which unlocks the receiver's squelch at the start of each transmission, or *continuous tone squelch,* which keeps the squelch of all mobile receivers unlocked may be used.

Selective tone signaling is used to provide selective contact with individual mobile units. Each receiver unit is equipped with a tone decoder which is responsive to a tone or combination of tones. Each decoder responds to a different tone code. The operator pushes a button or combination of buttons at the base station to transmit the tone code of the desired mobile unit. The decoder may employ an LC or RC filter to reject all tones except the desired one. And it may be connected at the receiver's output as shown in Fig. 1. A block diagram of a decoder requiring only a single tone is shown in Fig. 2. To avoid false tripping by speech a time delay circuit is usually employed, requiring a specific minimum tone duration. One system employs a tone squelch device operating at the high end of the audio speech range. This system is impervious to false tripping.

Vibrating Reed Relays

Many tone-selective systems employ vibrating reed relays designed to be responsive to only one tone frequency. A simple circuit using a 4PST resonant reed relay is shown in Fig. 3. Only one of the reeds is used. A tone at 280.8 cps causes reed contact 1 to vibrate. The other contacts do not vibrate sufficiently to mate with the common stationary contact. Since reed 1 does not maintain steady contact with the stationary contact, a second relay (K2) is used. Capacitor C keeps K2 energized during the periods that the vibrating contact is open. When the reed stops vibrating, K2 drops out when C becomes sufficiently discharged. A recently introduced resonant reed relay snaps into the closed position and stays closed until the tone signal ceases.

When only a single tone is used, a multi-pole resonant reed's frequency response can be changed by selecting a different reed contact. Contact 2, 3 or 4 (Fig. 3) could be wired into the circuit instead of contact 1.

Resonant reed relays are extremely selective. One, for example, has a bandwidth of only 6 cps. Tones need be separated by only 20 cps within the 50-175 cps range, and by 40 cps in the 175-500 cps range. Up to 15 mobile units can be selected by using a single tone system.

Typical Decoders

One 4-tone decoder employs resonant reed relays identified as RR1, RR2, RR3 and RR4 as shown in Fig. 4. Windings are connected in series-parallel across the radio receiver output through contacts 8-11 of relay K1. The decoder actuates an alarm or energizes the receiver speaker circuit upon receipt of four tones of appropriate frequency in the correct sequence.

The first tone causes RR1 to vibrate, its contacts intermittently applying B+ to capacitor C2 which becomes charged. If the second tone is received while C2 is still charged, RR2 vibrates and the circuit through its contacts applies the voltage stored in C2 and C3 which also becomes charged. The third tone causes RR3 to vibrate and allows C4 to become charged.

The fourth tone causes RR4 to vibrate, allowing C5 to become charged. The positive voltage in C5 is applied to the tube grid, normally at cut-off, causing the tube to conduct and energize relay K1.

The 1-4 contacts of K1 break and the 1-3 contacts make—connecting charged capacitor C6 to the tube grid. This holds the grid positive until C6 discharges through R9 and R10—hold time depending on the setting of R10. Contacts 5-6-7 are used to control an in-

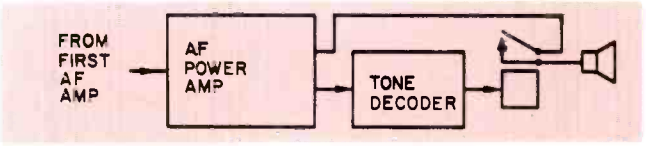


Fig. 1—Tone decoder at receiver output.

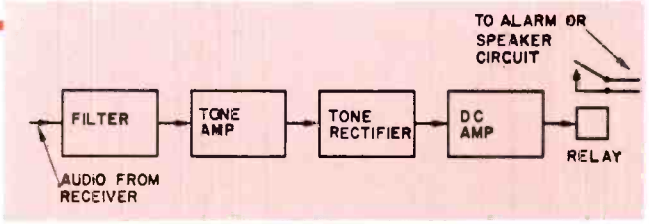


Fig. 2—Single tone decoder using filter for selectivity.

dicating device. Contacts 8-11 open and remove receiver audio from the decoder input to make the decoder insensitive to any further signals until K1 drops out. Contacts 9-11 close the receiver speaker circuit through volume control R14.

The decoder can be cut out of the circuit to allow channel or communication monitoring without tone signaling by pressing latching switch S2. The tube is cut out of the circuit when S2-A contacts open and the receiver speaker circuit is completed through the closed S2-B contacts. A second push on S2 resets the decoder for tone signal operation.

The four resonant relays operate in the above manner only when the tones match the frequencies of the resonant reed relays and are received in the correct order.

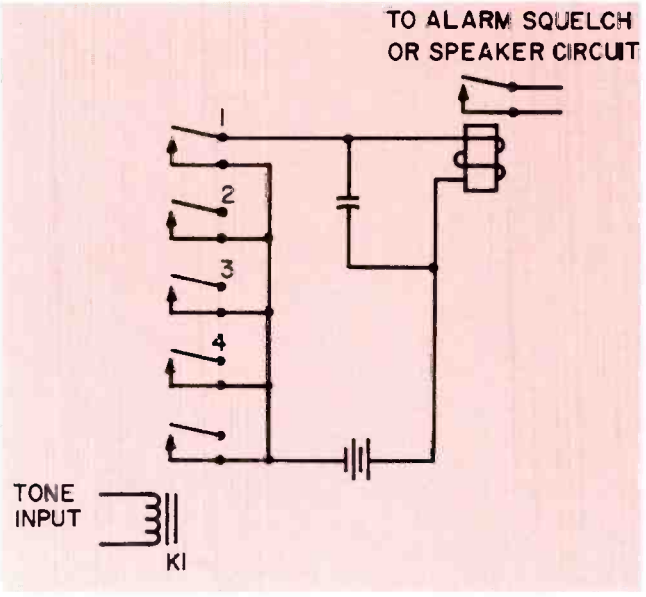


Fig. 3—Single tone multi-pole resonant-reed relay circuit.

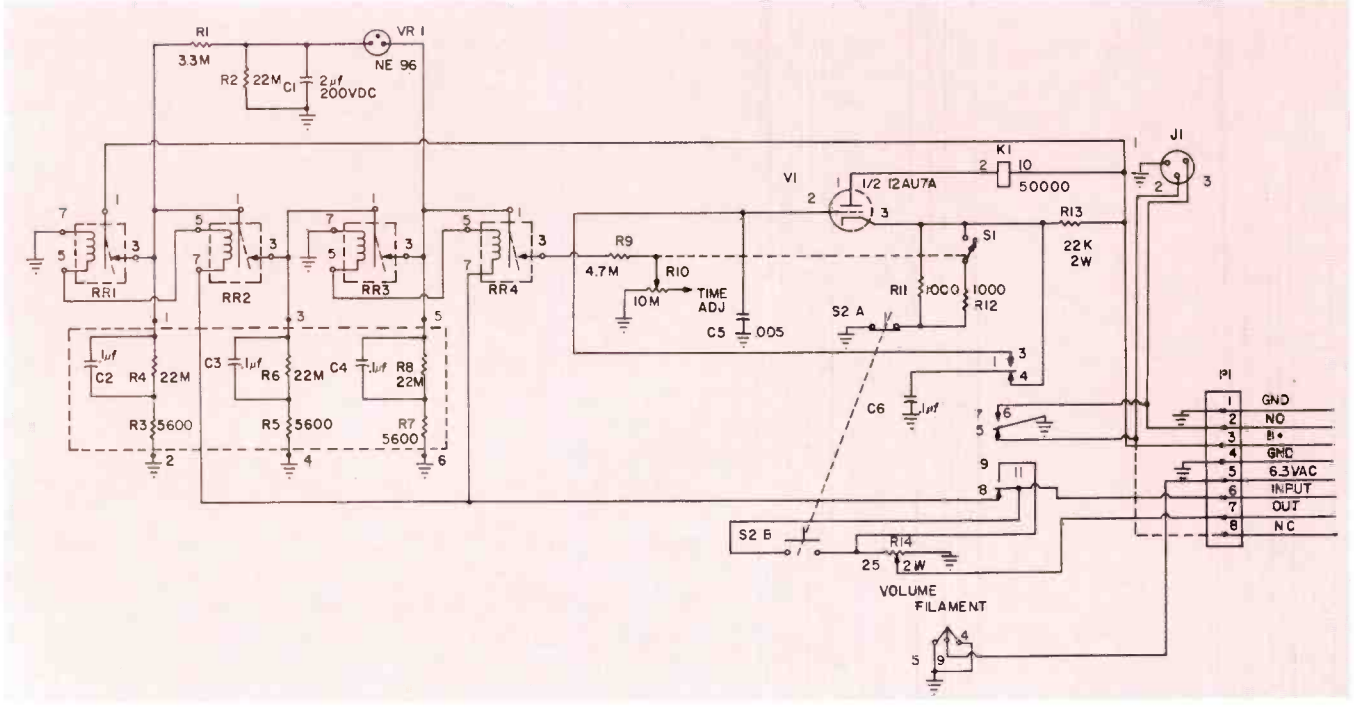


Fig. 4—Schematic of 4-tone decoder employing resonant reed relays.

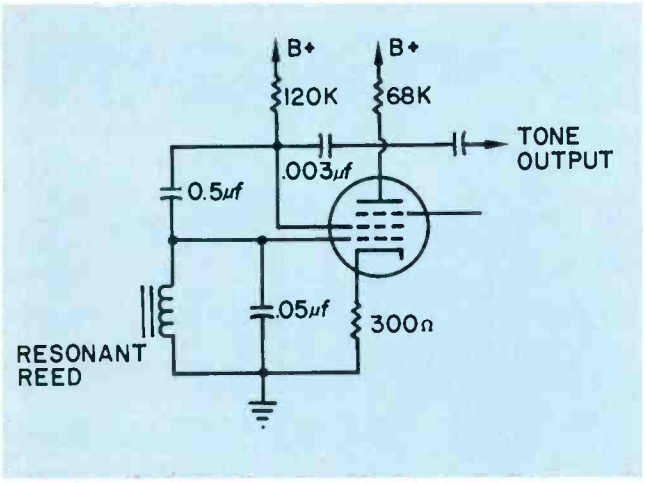


Fig. 5—Schematic of resonant reed generator.

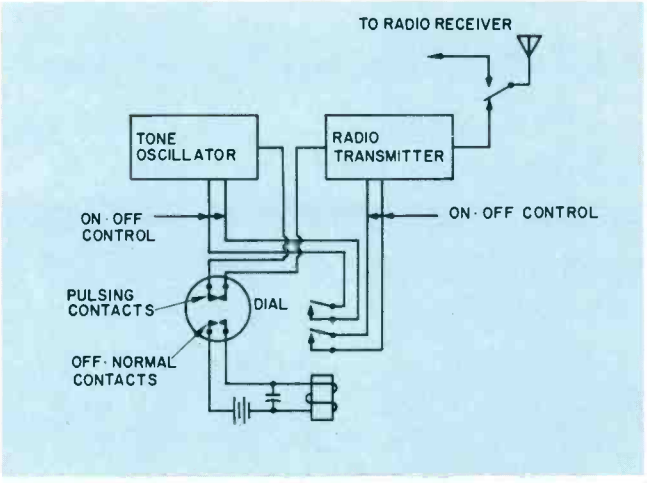


Fig. 6—Selective calling dial system used at base station.

Group-call operation is also possible by making the first tone three times longer than normal, causing C1 to also become charged and neon lamp Vr to fire. This causes RR2 and RR3 to be bypassed and RR4 is made responsive to a second tone of appropriate frequency. Hence, only two tones are required to signal mobile units which employ common tone frequencies for RR1 and RR4.

Another resonant relay system uses sequential pairs of incoming tone frequencies to operate the decoder. Two sequential tone transmissions, each consisting of two tones, are required to select a desired mobile unit. To call a group of mobile units, or all at once, only one transmission consisting of two tones is required.

Tone Transmitters

Tones may be generated by an audio oscillator employing an LC or RC circuit or a resonant reed as the frequency determining element. The schematic of a resonant reed oscillator is shown in Fig. 5. Frequency is determined by the reed, which is usually replaceable by itself.

Low-cost RC oscillators are destined to become popular for this application. Two low-cost systems with small RC oscillators have recently been introduced.

When resonant reed relays are used in the decoders, it is important that tone oscillator frequency stability be extremely good because of the narrow bandwidth of the reeds.

Dial Systems

Dial-type selective signaling systems have tremendous capacity. One system, for example, is capable of decoding more than 300,000 different dialed numbers. At the base station, the operator dials the number assigned to the desired mobile unit. When he *pulls* the dial, its *off-normal* contacts energize a relay which turns on the radio transmitter and the tone oscillator, as shown in Fig. 6. During the return excursion of the dial, its *pulsing* contacts open and reclose the tone circuit. Hence, the dialed digit consists of a train of "break" pulses. At the conclusion of dialing, the radio transmitter and tone oscillator remain active until the time-delayed relay drops out.

The decoder, as shown in Fig. 7, consists of an audio amplifier, filter rectifier and a dc amplifier which pulses a relay which in turn pulses an electro-mechanical selector. During each "break" pulse, the decoder advances one step. By means of removable code pins, the selector can be made to respond to the desired number. If the number of pulses in each digit, or the sequence of digits, is wrong, the selector will not close its contacts.

Installation Problems

A selective signaling system designed for use with a specific make and model mobile unit and base station seldom presents any unusual installation problems. But, when adding selective signaling of another brand, problems may arise.

For instance, the transmitter may not be capable of adequate modulation by the tones, particularly if they are low in frequency. This can be determined by measuring modulation deviation (FM) or modulation percentage (AM) with the tones applied and comparing the modulation level obtained when a 1000-cycle tone from a signal generator is applied. The cure is to modify the transmitter modulator to lower its frequency response instead of boosting the tone level, unless inadequate tone level is the cause of the trouble.

In a continuous tone squelch system, the tone may be knocked out by a high level speech modulation. Here, it is a matter of making the tone level high enough without causing the transmitter modulation to exceed the legal limit when both speech and tone are present.

At the receiver, frequency response at the low end may be inadequate for satisfactory operation of decoders employing resonant reed relays. The solution is modification of the receiver audio circuits to improve low frequency response, but not to the point where transmitter hum becomes objectionable. Filters to route the tone signals over one path and voice over another, as suggested in Fig. 8, may be required.

Modifications should only be attempted by those technically qualified to do so. Others should seek the technical assistance of the maker of the radio equipment or the tone signaling equipment, or both.

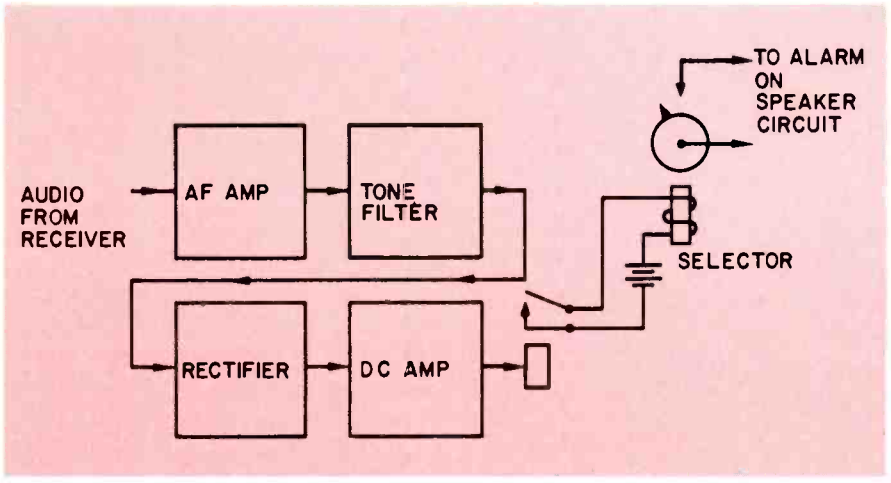


Fig. 7—Simplified block diagram of dial pulse encoder.

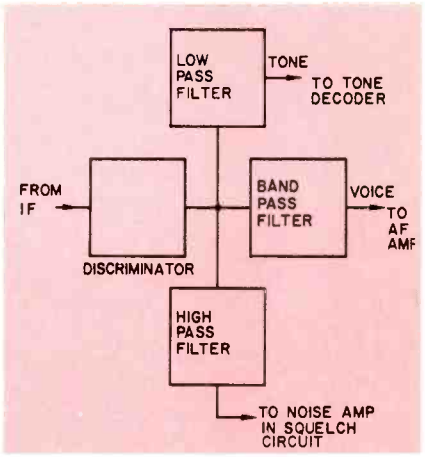


Fig. 8—Filter system for routing tone, audio and noise.

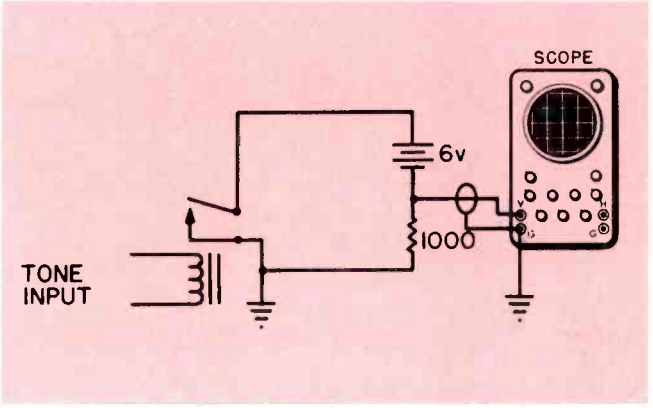


Fig. 9—Scope is employed to observe vibrating reed relay action.

Maintenance

Resonant reed relays, conventional relays and electro-mechanical selectors are subjected to environmental conditions which cause dirt or other foreign matter to impair operation. They should be cleaned carefully with a vacuum cleaner or gentle stream of air. When cleaning these components with a cloth or brush, carbon tetrachloride should not be used since it may create new problems.

Contacts should never be cleaned with a file or sandpaper. Only a relay contact burnishing tool should be used, and then only with caution to avoid bending contact arms.

Proper operation of these components can also result from metal fatigue and wear and tear. Repairs should be attempted only by one competent to work on delicate mechanisms, and when the proper tools and instruments are available. Since they are relatively inexpensive to replace, compared to the cost of down-time, such components should be replaced if they function improperly or have become unreliable.

Excessive power source voltage variations may cause erratic operation of decoders. While variations in voltage across a vehicle battery are unavoidable because of the nature of the charging system, variations should be maintained within required limits. The generator regulator should be adjusted to prevent excessively high voltage excursions. A defective battery can allow input voltage to drop the minimum required for proper operation of the decoder when the engine is idling or turned off.

Encoder tone frequencies should be as close as possible to the applicable decoder frequencies. In equipment employing resonant reeds, replacement of an off-frequency or erratic reed is indicated when frequencies don't match. Input voltage variations and changes in component values can affect the frequen- of encoders employing LC or RC oscillators. An oscilloscope and accurate audio signal generator are invaluable for checking encoder output frequencies.

Tone Frequencies

Compatability of selective signaling systems has become important. Systems employing Brand A selective signaling equipment cannot use Brand B equipment when expanding a system unless Brand B is compatible with Brand A. For this reason, some equipment is designed to be compatible with other makes. In resonant reed type equipment this is done by employing the same tone frequencies in Brand B equipment as in Brand A equipment.

Shop Instruments

The input power voltage conditions encountered in the field should be duplicated on the bench. Hence, a variable output rectifier should be available for checking out the equipment at minimum, normal and maximum voltages encountered in the field.

An accurately calibrated audio signal generator is required for checking out tone selective decoders. With the decoder connected to a bench receiver, an FM signal generator can be modulated by the audio signal generator. When the audio signal generator is tuned to the various decoder tone frequencies, the various relays should

Continued on page 82

Technicians service two-way communications equipment in well-equipped shop. Instruments on table from left to right include combined frequency and deviation meter, calibrated signal generator and portable test set.

ESTABLISHING A TWO-WAY SERVICE SHOP

Here's a growing ready-made market for alert, licensed and properly equipped TV-radio service-dealers and technicians

by Robert F. Clendenin

Service Training Coordinator
Motorola Communications Div.

■ It is difficult to realize that 2-way radio was practically nonexistent 15 years ago.

The Federal Communications Commission licensed a total of only 63,000 transmitters in the Public Safety, Industrial and Land Transportation services in 1948. Advances born of World War II, however, created a new demand for this time and labor saving device.

What has happened since then? Various channels have been split because of the insatiable demand. The FCC created the Business Radio Service to accommodate the many legitimate businesses who sought radio. The state of the art continued to be improved, and the units became more efficient and complex.

More manufacturers entered the field, with several offering a wide variety in their lines, ranging from mobiles and base stations to hand-carried and "pack-set" portables. Offshoots were radio paging receivers of various types. Radio traffic signalling devices and other equipment stemming from radio technology sprang into being.

This cursory review, of course, is intended merely to give a brief chronology of 2-way radio history. To emphasize even further the importance of the industry, the FCC in its 1962 fiscal report (latest available) listed more than 3 million licensed fixed, portable and mobile transmitters in the safety and special radio services. In the 1961-62 fiscal year alone there was an increase of 562,307 transmitters.

Manufacturers and users have found that 2-way radio's usefulness depends on the availability of maintenance. There are three courses a user can take to keep his system in operation: 1. Hire a qualified, licensed technician, buy equipment and parts, and set up a company-owned shop. 2. Utilize the local TV-radio repair shop. 3. Arrange with a broadcast station engineer

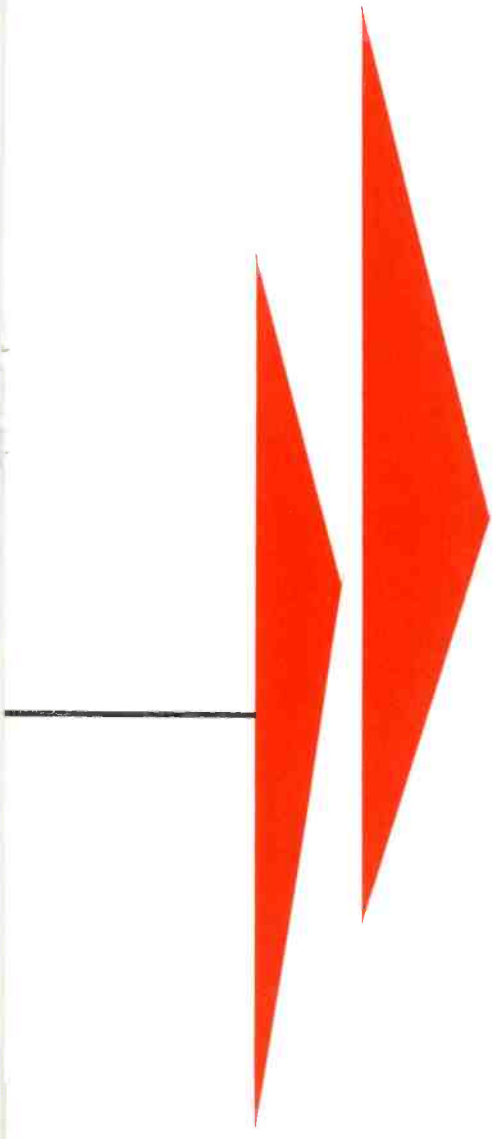


TABLE I
Typical One-Man Organization

Investment:	
Test Equipment	
Test Set	
In-line wattmeter	
Frequency and modulation meters	
Calibrated signal generator	
Tools, etc.	$ 3,900.00
Inventory (parts and supplies)	1,000.00
Service Vehicle (Less test equipment)	3,000.00
Accounts Receivable	1,300.00
	$ 9,200.00
Expenses—Monthly:	
Test equipment depreciation	$ 65.00
Vehicle depreciation	60.00
Vehicle operation expense	100.00
Telephone	35.00
Rent (prorate of residence)	20.00
Utilities (pro rata)	20.00
Parts cost (for maint. contracts)	175.00
Postage, office supplies	10.00
Insurance	35.00
Expenses away from home	35.00
Reserve for taxes, etc.	45.00
	$ 600.00

$1,300.00 monthly gross less $600.00 expenses yields gross profit of $700.00. Assuming owner salary of $600.00, return on investment of $9,200.00 is $100/mo. or $1,200.00 yearly, or approximately 13%.

TABLE II
Typical Class A Service Station (4 Men)

Investment:	
Two (2) Calibrated Signal Generators @ $700	$ 1,400.00
Three (3) Test Sets @ $150	450.00
Three (3) Sets of Freq. and Modulation Meters @ $1200	3,600.00
Three (3) In-Line Wattmeters @ $200	600.00
Three (3) Sets Voltmeter & Oscilloscope @ $800/set	2,400.00
Accessory Kits @ $300/set	600.00
Three (3) Sets of Hand Tools @ $300	900.00
Shop Equipment — battery, charger, benches, grinder, drill, air compressor, desk, typewriter, etc.	1,500.00
Total Test and Shop Equipment	$11,450.00
Operating Capital	4,000.00
Two (2) Vehicles @ $3,000	6,000.00
Accounts Receivable	3,500.00
Inventory	4,000.00
Total	$28,950.00
Gross volume per month, $5,000.00 for owner-operator plus three men.	
Yearly Gross Business	$60,000.00
Operating Expenses; Yearly:	
Rent	$ 1,800.00
Utilities	1,650.00
Salaries:	
Owner	9,500.00
Technician	6,500.00
Technician	6,000.00
Helper	5,200.00
	$30,650.00
Depreciation	$ 3,000.00
Vehicles operating cost	3,000.00
Travel Expense	750.00
Insurance	1,200.00
Advert. and Entertainment	450.00
Reserve for Taxes	3,000.00
Postage, office supplies	600.00
Accounting and Legal	1,200.00
Parts Cost (Maint. Contracts)	9,200.00
Total	$53,050.00

$60,000 Gross less $53,050 expenses yields $6,950 net profit on investment of $28,950.00 or a return of approximately 24%.

or other licensed technician to maintain the system in his spare time.

For various reasons, none of these solutions is entirely satisfactory. But this picture reveals one clear fact: A professional type organization staffed with well-trained, licensed technicians, prepared to install and maintain commercial FM communications equipment, is required. Here, then, is the market for the qualified, licensed and properly equipped service station operator or technician who is interested in the 2-way radio service business.

Historically, many present successful 2-way radio service station operators have come from the TV-

TWO-WAY SERVICE SHOP

Continued

Tuning an IF stage in a mobile 2-way radio. Technician uses portable test set and wattmeter.

radio technician ranks, from industry and from the military. A basic requirement, of course, is a thorough background in the technical skills. To work on transmitters, the 2-way technician must also be licensed by the Federal Communications Commission.

Getting Started

If you contemplate entering the 2-way service business, there are certain things you will need to know if you are to have a chance to succeed.

Charts, I and II, illustrate the investment involved and income that may be derived from two types of operations. These should not be considered 'typical," since both businesses have been in existence for some time and are actual case histories.

There are, of course, many different types of businesses either below the level of the one shown in Chart I or those which fall between the one-man and the four-man operation.

For those who contemplate entering servicing business, a practical rule-of-thumb for predicting gross business is: Each licensed technician, devoting full time to 2-way work, should gross $1000 or more monthly to get a fair return on his investment. Thus, a two-man organization should gross approximately $2000; a four-man station, approximately $3800, etc. The gross per person will begin to drop in the larger organizations because of non-productive" employees—secretaries, accountants, etc.

Service companies specializing in 2-way radio fall into two general groups: Group A consists of the completely equipped and staffed commercial organization. Group B includes the small one-man type operation with modest facilities.

A typical full-time Group B operator may have accumulated specialized test equipment and tools worth $3900, and may have one part-time helper under a working arrangement. (See Table I.) He usually maintains 75 to 150 mobile units and 15 to 20 base stations, many of them under contract. He probably has one vehicle for service work and transportation for himself and his equipment to the job site. Station wagons, vans, trucks and even autos have been utilized as service vehicles. Generally, however, a vehicle is preferred which serves as a "shop-on-wheels" and has provisions for carrying a spare parts inventory.

The shop location may be a simple drive-in garage on the edge of town, even a residential garage. Generally, the area of operation would have a radius of about 60 miles from the base. A gross business of $1000 to $1500 a month is usually realized, sufficient to yield acceptable earnings.

Some communities or areas have insufficient 2-way radio equipment to support a full-time service operation, so that many part-time operators are necessary. With the growth of 2way radio in their communities, many of these individuals reach the point of transition to a full-time business operation.

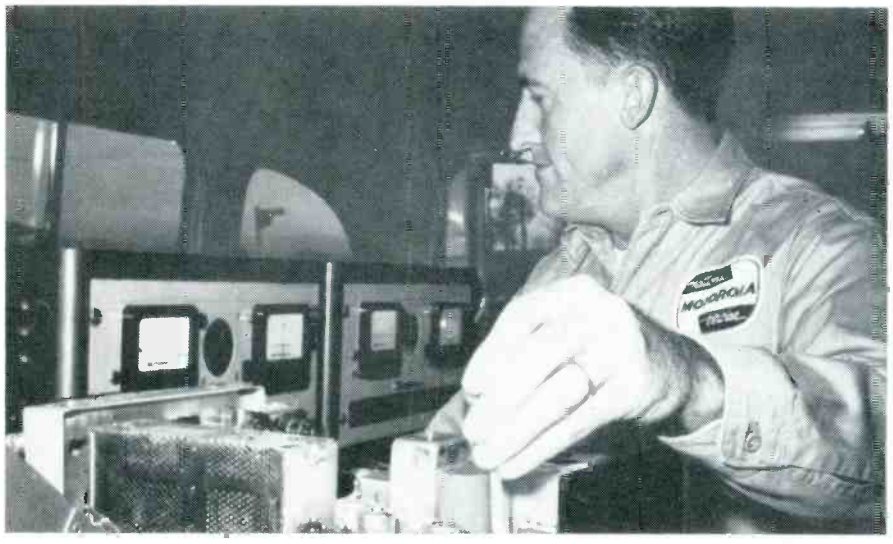
Many Group A service companies include metropolitan area operations. Capital investments may run into several thousands. (See Table II.) Many of these companies are graduates from Group B who have grown up with the 2-way industry.

A Group A station may include an owner-operator and 3 to 5 full-time employees, most or all of whom are FCC licensed. The shop is more centrally located, and usually is a drive-in garage type structure. Operational area may encompass a 100 mile radius for "drive-in" business. "Satellite" operations may be established to cover service at more distant points.

Shop facilities, however, may be geared largely towards "drive-in" speedy repairs in volume with duplicate test positions, spare unit chassis of various types and a large stock of supplies. Waiting room and reception facilities may be provided. Personnel complement may include one non-technician, perhaps a combination bookkeeper, receptionist and coordinator. This type of organization soon develops a lower unit rate and greater volume to remain competitive and continue to grow with increasing service demands. Obviously, considerable business and administrative ability is required for success in this operation.

Test Instruments

The FCC requires that transmitters operate within certain speci-



Technician makes an oscillator frequency check with station monitors.

fied limits and that the frequency, deviation and power be measurd at last once a year. This necessitates accurate frequency and deviation meters. A variety of these units, covering a wide range of types and prices are available. These instruments, depending on design, are also useful in "netting" each set to minimize future service calls and "call-backs."

A wattmeter is necessary for measuring power output. It enables measuring forward power from the transmitter to the antenna and reflected power from the antenna to the source. The wattmeter is extremely helpful in determining antenna efficiency and in troubleshooting.

Another instrument, generally known by the mundane nomenclature of "portable test set" allows technicians to measure all the important circuits inside the receiver or transmitter at the flip of a switch. This measurement method can quickly isolate and locate troubles too.

The portable test set is generally battery operated, thus facilitating field servicing where ac power is unavailable. Another test set advantage is its ability to make system checks without removing 2-way equipment from its normal environment. Sophistications which can be added to this set include an RF peaking generator and a frequency deviation meter.

It should be remembered that test requirements are considerably higher in the 2-way radio servicing industry because of stringent FCC requirements. Although many instruments used in TV-radio servicing can be extended to the 2-way field, several are "musts" for the 2-way technician if he is to: 1. perform his work efficiently and profitably; 2. provide professional service to a customer for whom radio communications is one of his most valuable assets.

Test instruments listed in the accompanying tables, along with new-instrument prices, should be on the shelf or in the truck of every technician who embarks on 2-way servicing.

A signal generator is an invaluable tool for analyzing receiver performance, determining overall sensitivity and for making stage gain measurements when the receiver is not up to par. But the signal generator used in 2-way servicing should be a specially designed instrument with accurately calibrated output indicator.

Business Outlook

Today, the typical 2-way service company is a responsible business which is a complete service function. The 2-way specialist has acquired a well-earned professional status, particularly since the introduction of selective calling, split-channel equipment and numerous other improvements. What is the profit picture? The return on dollar investment is much higher than the average in small business. The successful service company often realizes 10 to 25 percent return, compared to the usual 6 to 8 percent.

Present trends point to an increasing volume of contracted preventive maintenance. Contracts between equipment supplier and user originating at the time of sale are becoming the rule. And the resulting subcontracts, held by the supplier and authorized service company, increasingly call for all-inclusive service on flat-rate, with provisions for periodic preventive inspection of all units. A pattern of regular system inspections is emerging. Preventive checks are scheduled by the service station to minimize in-service failures. Improved techniques are holding emergency calls to a minimum, bringing greater customer satisfaction, and leading to more new users.

Improved liaison between customers, service stations and supplier, stepped-up distribution of information, as well as better coordination of system installation details are already in evidence. In the short term future, further improvement along with the growing volume of contract maintenance will bring a better profit ratio to the service station, stimulating rapid growth of many part-time operators into full-time professional organizations capable of providing service on a round-the-clock schedule. All types of operations will be enabled to make substantial progress. The growing market is both a challenge and an opportunity for TV-radio service-dealers and technicians. ■

Servicing Citizens Band Communications Equipment

Efficient test and troubleshooting procedures reduce repair time and yield a handsome service profit

by John Haskell

■ An increasing number of alert licensed TV-radio service technicians are boosting income by servicing citizens band equipment. Many began originally by contacting CB neighborhood clubs and by advertising their services in local newspapers.

It has been reported that more than a thousand sales-service organizations across the country have already found the business sufficiently worthwhile to concentrate heavily on sales and service. And the outlook for increased use of CB equipment in autos, boats, summer camps and in many business organizations is good.

All you need to get into CB servicing is an FCC first-or second-class license, a licensed CB station in your shop and one or more relatively inexpensive specialized test instruments. In addition, you will need a general knowledge of CB-type equipment and a file of schematics and service data for all popular CB units.

The basic technical knowledge you will normally have after passing a license examination should be sufficient to qualify you to troubleshoot, repair and adjust CB equipment—considering your past TV-radio experience—and after you have studied the design and operating principles of a few typical CB units. Actually, much of this equipment, especially the transceivers, is the ultimate in simplicity —compared to TV sets and most other 2-way communications units.

Service Approach

The secret ingredient in a successful CB service operation appears to be similar to that used to profitably repair table-model and transistorized portable radios: *A highly organized, efficient test, troubleshooting and repair procedure that reduces total repair time to a minimum.* This requires establishment of fixed diagnosing and test procedures. It requires careful record-keeping—tabulation of observed symptoms, test procedures used and faults located. These records will prove highly useful almost immediately in establishing overall repair procedures.

CB Equipment

The receiver and transmitter sections of CB equipment may be completely separated circuitry housed in one cabinet or it may be designed to function in a transceiver mode with some circuits and one or more tubes or transistor stages serving dual roles in receiving and transmitting. This arrangement may appear, at first thought, to complicate troubleshooting. Actually it simplifies trouble diagnosis and reduces the number of trouble areas. Hence, troubleshooting is simplified.

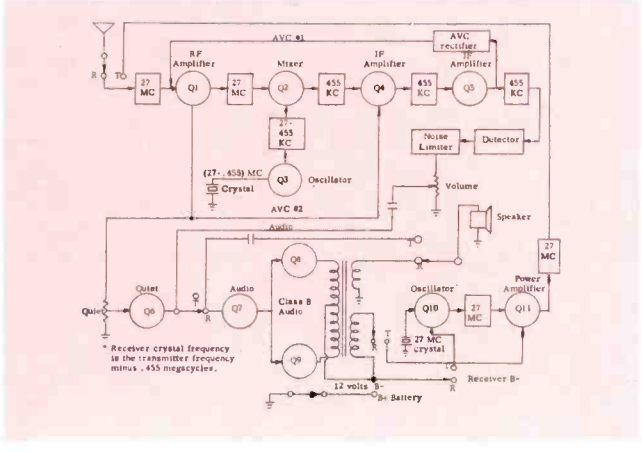


Fig. 2—Block diagram of Johnson 'Personal Messenger' transistorized CB transceiver.

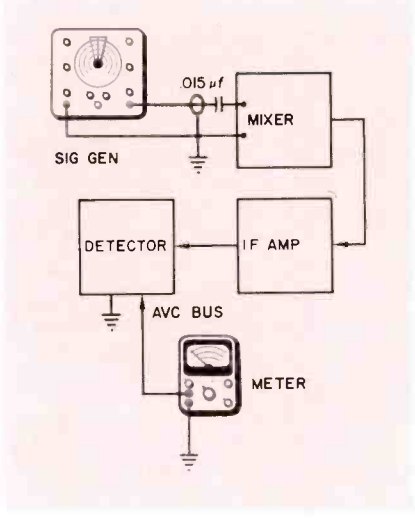


Fig. 1—Block diagram showing equipment setup for aligning CB receivers.

CB receiver circuitry may be regenerative, superregenerative or conventional single or double conversion superheterodyne. And most receiver circuitry is provided with AVC, squelch and noise limiting circuits.

You will find both receiver and transmitting units of some CB equipment set up to operate on one or more "fixed" crystal controlled channels.

Power supplies will range from conventional 117-vac types used in fixed station equipment, regular mobile battery-powered vibrator packs to semiconductor chopper-type supplies and, in hand-held transistorized equipment, dry-cells or compact dry-battery packs.

Troubleshooting And Repair

General procedures for troubleshooting, repair and adjustment of CB equipment is similar to that for all AM equipment. But you will be called upon to perform services that you never heard of before.

For example, you may be asked to insert different-frequency crystals and retune the receiver or transmitter circuitry to these new frequencies. Manufacturer's service literature usually provides complete information on this. Single conversion superheterodyne receivers would require retouching of the RF and mixer stages for maximum receiver sensitivity on the new frequencies. Transmitters would require possible retouching of the "rubber-crystal" adjustment in the oscillator stage and possible output stage retuning for maximum transmitter power output.

All of these adjustments are generally performed over narrow ranges.

Some double conversion CB receivers equipped with a single-crystal controlled 1st local oscillator may be retuned to any band in the CB spectrum by readjusting a tunable 2nd local oscillator stage. Others require different crystals and a little more complicated procedure for retuning to a different frequency.

You may be called upon to perform a complete alignment job on the receiver section. This is about as complicated as comparable work on a table-model radio. All you will

Eico model 772 citizens band transceiver.

Pearce - Simpson 'Companion II' CB transceiver.

General Radiotelephone Co. transceiver.

Mark Products SSB Citizens Band transceiver.

Dare CB transceiver.

Hallmark 3000 CB transceiver.

Heath's GW-30 portable CB transceiver.

Cadre CB equipment mounted in auto.

Western Auto's CB unit.

Lafayette HE-15B transceiver.

need is your present signal generator and VTVM. General procedure requires the signal generator frequency to be set at the receiver's IF frequency. This signal is fed to the receiver's first mixer grid, or second mixer grid in a double-conversion receiver. And the VTVM is connected between the AVC bus and chassis ground. You start at the detector IF transformer secondary and work back to the mixer, adjusting each transformer trimmer for maximum deflection on the VTVM. Keep the signal generator output as low as possible. Reduce it each time that an adjustment shows a gain on the VTVM. Of course, the oscillator crystal or crystals, should be removed from the receiver before this procedure begins.

In a double conversion receiver the 2nd oscillator crystal is replaced after IF alignment and the generator signal is now switched to the 1st mixer grid. The generator dial should be reset to the 2nd mixer input frequency. The 2nd mixer input circuits are now tuned to obtain maximum indication on the VTVM. This procedure, of course, is skipped on single conversion receivers.

The 1st oscillator crystal should now be inserted in its socket. The generator signal is fed into the receiver's antenna input through a 50Ω carbon resistor and the generator output is set to the channel-frequency of the receiver. Adjust the mixer input circuit carefully and then the RF amplifier circuits to give maximum meter indication. Once again, keep the generator signal just high enough to give you a practical indication on the VTVM. A block diagram of the alignment set-up is shown in Fig. 1.

Transmitter tuning is even simpler. Remember that you should not perform this job without connecting the transmitter to a dummy antenna. This will insure you against a lot of trouble. The adjustments required to be made will vary from transmitter to transmitter—depending on the manufacturer. There may be two, three or more adjustments. In any event, the best method requires a separate

Continued on page 82

Think like a customer
and analyze the media you use

WRITING BETTER ADS

■ Before you spend another dime on advertising, ask yourself these questions:

- How can I be sure I'll reach my best prospects?
- How can I get them to read my ad?
- How can I convince them to buy from me, rather than a competitor?

The answers lie in five "tricks of the trade" used by America's top advertising experts. Here is how the men on Madison Avenue make each of their creations a new opportunity to turn black ink into cash:

1. Aim for the bull's eye. Every advertising medium — newspaper, magazine, radio, classified telephone directory, shopper's guide or whatever—has a special purpose and a unique "selling context." This "selling context" is usually a blend of news, entertainment, education or basic information.

Each medium has its own blend, designed to appeal to its audience in a distinctive way. In newspapers, for instance, the emphasis is on news. With radio, it is entertainment. With the yellow pages, it is directional information.

Your ad should be written to fit into the special selling context of the medium you plan to use. If that context is news, your ad should be timely and newsworthy, with emphasis on new products, special services or sales. If the context is basic information, such as the telephone directory, it should give facts that convey why prospects should call you rather than another.

F. Malcolm Minor helps to create advertising for several major accounts of Cunningham & Walsh Inc. The advice he gives is distilled from 15 years of experience in selling.

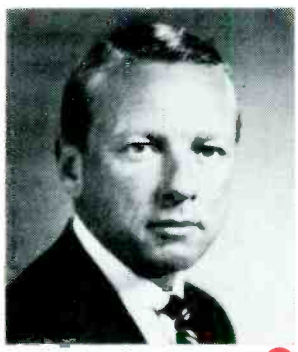
Every ad medium worth its salt has facts and figures on audiences it attracts: Not only numbers of people, but age, sex, income level, education, hobbies and occupations.

Before you write your ad, study as much of this data as you can get. Match the audiences offered with what you have to sell. Then choose those media that appear to reach your best prospects at lowest cost.

2. Mix well before selling. In deciding where to spend your ad dollars, you probably will find that no one medium will reach all of your customers at all times. So you'll want to achieve what is known in advertising circles as a "media mix"—a combination that will reach as many prospects as possible with minimum overlap of audiences. If possible, try to tailor each ad precisely to the medium in which it will run.

3. Think like a customer. Ready to write that ad? Not yet. Before one word goes on paper, create a mental image of your most likely customers. What do you sell that they most likely need or want? Do you have a particular line of TVs, radios, batteries or other items—incuding a better type of service—at competitive prices? Every business has—or should have—advantages that no competitor can match. It's your job to decide what those advantages are, and to clearly state them in your ad. If you do, you can expect better-than-average results.

This holds true for all forms of advertising. Many advertisers make the mistake of amplifying their names and telephone numbers into the most important elements in their ads. Important as they are, they cannot sell a new prospect. Selling messages should always



by F. Malcolm Minor

come first, followed by an appeal to action.

Now, answer all of your customer's other questions: what is it? (describe your product or service) . . . who sells it? (you do) . . . why should I buy from you? (again, advantages of your product or service) . . . how and where? (your location and telephone number) . . . when? (your hours).

4. Use a single selling approach. Fight the temptation to tell all in one ad. If you stress too many elements, you'll end up with an ad that emphasizes nothing and repels, rather than attracts.

Your ad should have a single theme that is expressed in all of its elements—layout, headline, copy and illustrations.

Again, keep benefits to your customers in mind. If your major advantage is a wide range of products or services, build your ad on the theme that the buyer can find almost anything he wants under your roof.

If you have an exclusive franchise, or offer superior service in one area, make this the highlight of your ad. Subordinate all other elements to it. This approach can give you an edge in at least one

Continued on page 83

It's easier than you think

to service ham-type receivers

by Doug Hedin

KØOFB

A Look Into Communications Receivers

■ "No, I don't have time to align it. Now take that knobby monstrosity back where it came from," barked a somewhat frightened voice from behind the counter.

I had brought in a second-hand amateur receiver that I'd just bought, and as I stamped the snow off my boots that Saturday afternoon I wondered what kind of joke "Hungry Bob," as I'd called him since our high-school basketball days, was trying to play on me.

But to my amazement, it was no joke—he honestly didn't want anything to do with the receiver.

"Then how come you've got a sign out front that says 'Bob's Radio & Repair'," I chided him, a little put out by his usual obstinancy.

"There's not enough of that kind of business to make it worthwhile learnin' what all those knobs are for, much less going back to school to learn a completely different type of equipment," he replied.

"Well then, how about letting me use your signal generator and VTVM and I'll do it myself," I asked, sure that any reference to "do-it-yourself" would bring him around.

"Ok," he sighed, with a shrug of his shoulders that I'm sure meant "There are all kinds of people and then there are 'hams'."

The receiver I'd bought was in the $300 class when new a few years ago, which placed it on the borderline between receivers that should be sent to the factory or authorized service shop and those that can be serviced by a reasonably competent radio-TV technician with common test equipment and a few inexpensive service aids. I'd just about finished checking out the second-IF strip when I noticed Bob (actually I smelled the day-old cigar butt he was chewing) leering over my shoulder.

"Don't worry," I remarked, "my receiver isn't going to contaminate your precious test equipment."

"Oh, I'm not worried about that," he replied. "I was just curious to see if you know what you're doing."

"Well," I joshed, "if you don't know enough about these receivers to do a simple alignment, how the heck are you going to tell if I know what I'm doing?"

"Well any fool can see that's an IF strip, but what's that thing between the converter and the first IF amplifier?" he asked, stabbing a hole through my schematic with a test lead right by the crystal filter.

After I explained what a crystal

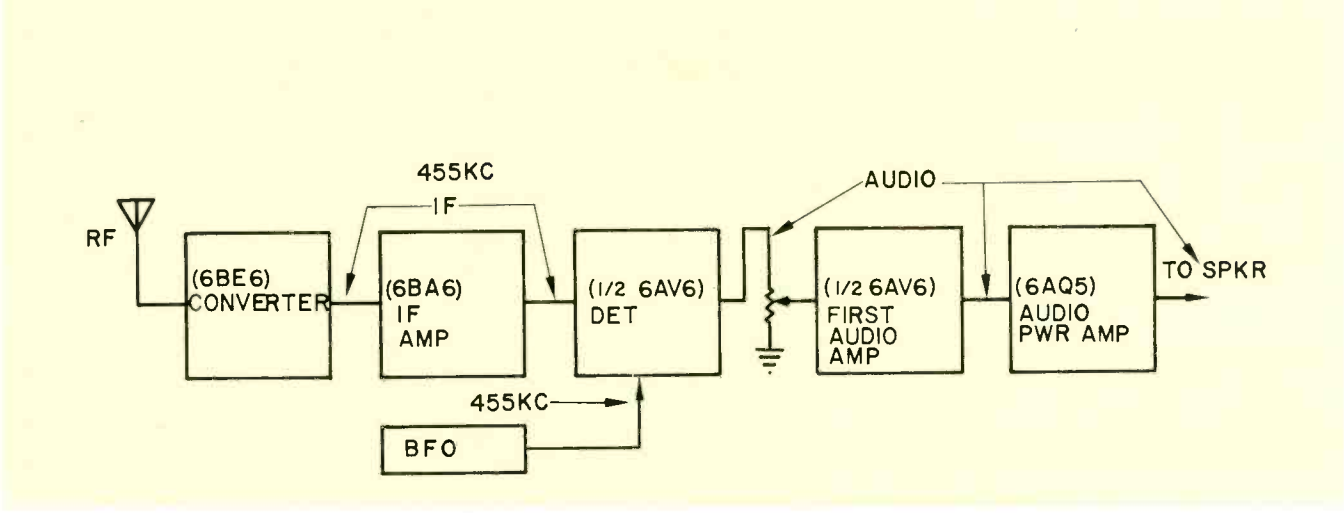


Fig. 1—Block diagram of basic receiver.

filter was and how it works, Bob got so interested in the schematic that I had to fight him for it in order to complete the second-IF alignment. Then I had to stop again to explain why the receiver had two IFs and a separately tuned front end. After my wife had called and asked me for the third time when I was coming home for supper, I finally got done, but not before I had spent more time explaining how this and other rigs worked than I had aligning it.

I knew that Bob had learned a lot about communications receivers, but the episode had not prepared me for the sign I saw in his window Monday morning on my way to work—"We specialize in servicing amateur and communications receivers."

I should not have been susprised, though, because anybody who can understand how a complex apparatus like a TV set operates can surely understand the operation of an amateur or general coverage HF receiver—mainly because he knows most of it already!

The circuits in communications receivers are essentially the same as those in home radios and TV sets. Most of the few circuits that are not found in the consumer items are included only in the kind of receivers you probably would not want to service for other reasons. The basic circuits you will find in communications receivers are RF, IF and audio amplifiers, mixers, detectors, AGC circuits, oscillators and power supplies. In many cases each circuit is easier to work with and much less "touchy" than its TV counterpart because it works at a much lower frequency.

General-coverage HF receivers generally tune from 0.540 Mc to 30 Mc, give or take a little, while ham-band-only receivers tune to selected amateur frequency ranges within these limits. The HF amateur bands are 1.8 to 2.0 Mc, 3.5 to 4.0 Mc, 7.0 to 7.3 Mc, 14.0 to 14.35 Mc, 21.0 to 21.450 Mc and 28 to 29.7 Mc. Most ham-band-only receivers tune only these frequency ranges, with varying degrees of coverage on either side of the band limits. Some of the more expensive receivers also have a special band for tuning WWV, usually either 10 or 15 Mc.

The technician should categorize these receivers, however, not according to frequency coverage but according to whether he should work on them or not. Certain types of receivers, both ham-band-only and general coverage, can be serviced properly only with the aid of special, expensive test equipment (spectrum analyzers, digital counters and precisely calibrated signal generators, for example) that only the factory or a factory-authorized repair station with a high volume of repair business can afford. But there is no reason why you shouldn't work on the others.

You can get a rough idea of whether you should work on the receiver or not, and what type of work you should attempt, from the cost of the receiver when it was new. Generally speaking, if a receiver cost less than about $175 you can do all alignment and repair. If it cost between $175 and $300 you probably can align it and make simple repairs, but work on circuits carrying ac signals higher in frequency than audio should be avoided. It's not likely that sets costing more than $300 will be brought in to you because most owners (amateurs at least, and most receivers costing this much are owned by amateurs) will automatically take or send the set to the factory or an authorized repair station. Of course, you can, and should, check all the tubes of any receiver brought in, and you should check them by substitution, because the set owner may have checked them previously on a do-it-yourself (ptui!) checker, while it sometimes takes substitution to disclose a bad tube, especially one handling RF.

Basic Receiver

The simplest type of communication receiver you're likely to encounter is very similar to the 5-tube household radio (see Fig. 1). In fact, they both use about the same tubes. The primary difference between them is that on the communications receiver several (usually four) bands are used and there may be an AGC on/off switch,

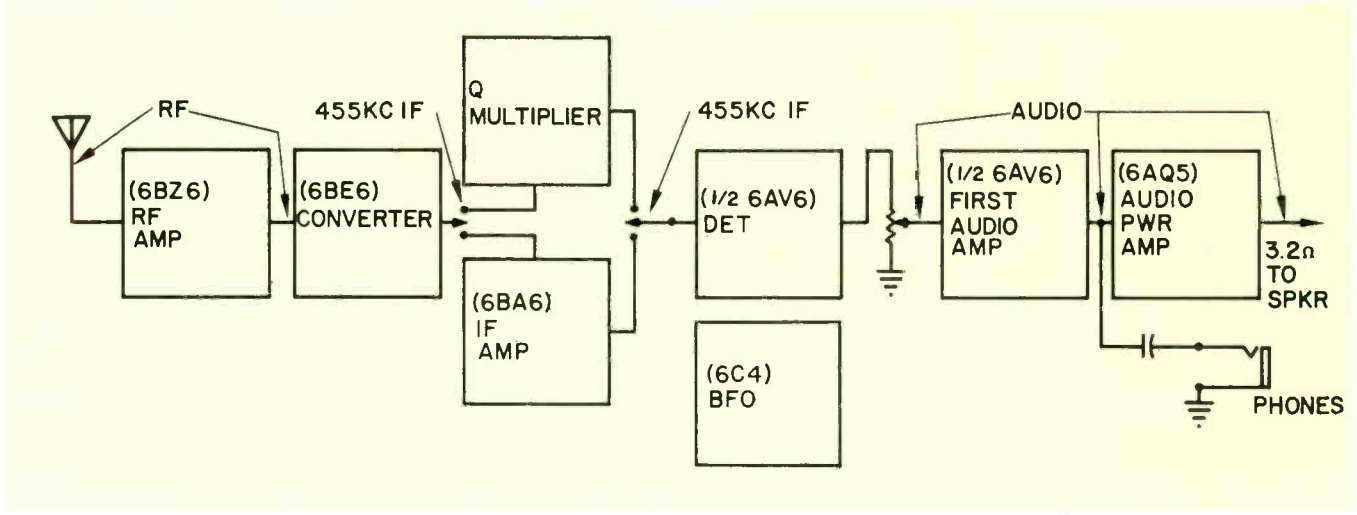


Fig. 2—Block diagram of basic receiver with RF amplifier and Q-multiplier.

a noise limiter, a speaker/phones switch, an AM/CW switch, a BFO (beat-frequency oscillator) on/off switch and pitch control, a receive/standby switch and a separate bandspread knob. American made receivers of this type usually sell for $75.00 or so, while foreign-made receivers cost 10 to 20 percent less.

Medium Class

The first step up in quality from the basic receiver usually is the addition of an RF amplifier, which improves sensitivity, noise figure, image rejection and cross modulation characteristics. As a rule, the RF amplifier is accompanied by a manual gain control and a Q-multiplier, "T-notch" filter or, in the higher-priced receivers of this type, a crystal filter.

A Q-multiplier is a regenerative circuit usually connected between the mixer and the first IF amplifier (it can be switched out of the circuit if desired) in order to increase the selectivity of the receiver. Its operation is based on the principle that as the regeneration in an amplifier stage increases and the more closely the stage approaches oscillation, the narrower will be its bandwidth. In some receivers the Q-multiplier also is used as the BFO for CW and SSB reception, so it cannot be used as a Q-multiplier in these operating modes. Two controls usually are associated with it, a frequency control which tunes the Q-multiplier to the proper frequency and the regeneration control.

The RF amplifier tube usually is a remote-cutoff or semiremote-cutoff pentode such as a 6K7, 6SK7, 6SG7 (octal) or 6BA6, 6BZ6 or 6DC6 (miniatures). AGC usually is supplied to the control grids of these tubes, while manual gain control consists of a pot in the cathode circuit.

A crystal filter usually consists of a crystal tuned to the IF center frequency and a "phasing" control. Its principle of operation is that the crystal is used as a series-tuned circuit through which the received signals must pass. Its Q is extremely high compared to that of good IF tank circuits—so high, in fact, that the crystal must be loaded, i.e., its response broadened, in order to receive voice signals. Like the Q-mulitplier, the crystal filter also can be switched out of the circuit if desired.

The conventional form of detector for lower priced receivers is the thermionic diode, usually one of the diodes in a 6AV6 or similar tube. A few single conversion receivers, however, also have product detectors for use in CW and SSB reception. The product detector may be a new type of circuit to you, but it is nothing more than a mixer or converter. Either triodes or pentodes are used, but in either case, the IF signal is fed into one tube element (usually the control grid for all types of tubes) and the local oscillator signal is fed into another element (usually the cathode for triodes, but either the cathode or screen grid—for pentodes). Like the conventional mixer the output is the difference between the two input signals—in this case audio—and the IF signal components are filtered out just as in a conventional receiver. In most cases, a switch permits the operator to choose between the diode and the product detector, although the detector usually is automatically selected according to the mode switch on the front panel of the receiver.

The AGC of a conventional receiver is derived from a diode in the detector stage, and in AM operation it is proportional to the mean carrier value of the received signal. In CW operation AGC is seldom used. SSB operation, however, combines the piece-by-piece characteristic of CW with the general evenness of AM. A manual setting of the gain control might permit most syllables of voice to

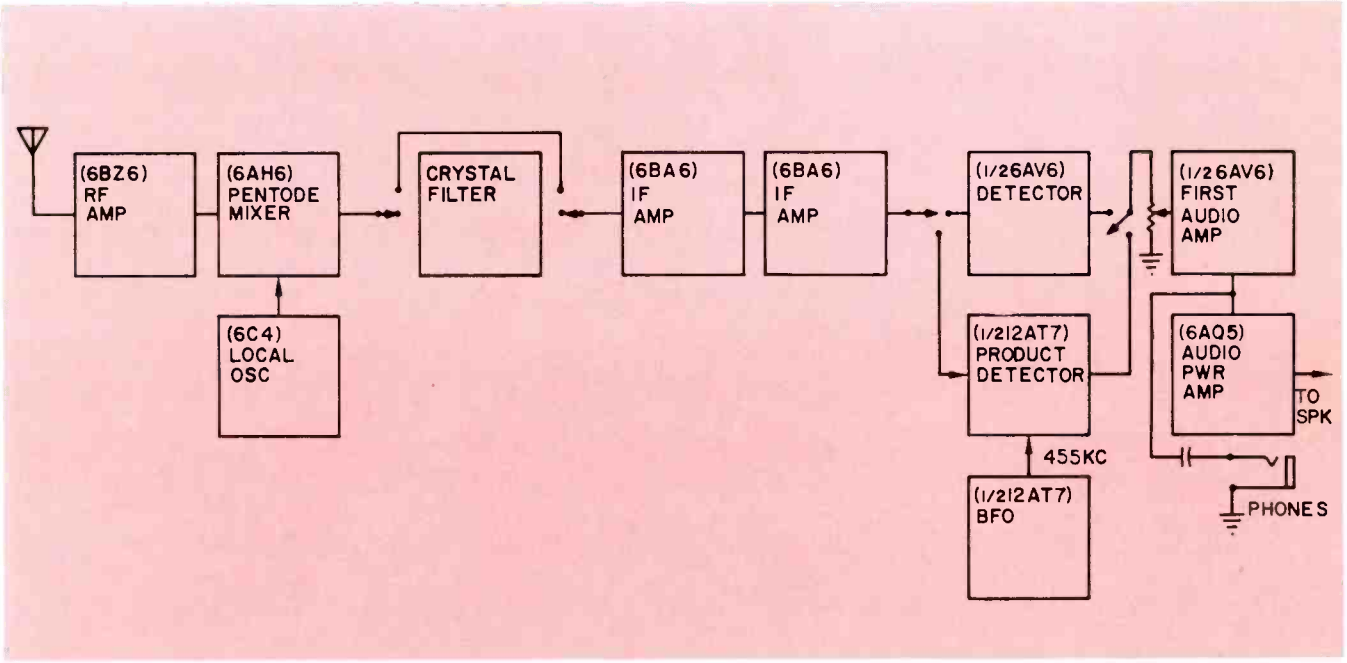


Fig. 3—Block diagram of Medium Class single conversion receiver.

be heard but at some times they would be just audible while at others they would be loud enough to drive the operator out of the room. The AGC for SSB receivers, therefore, usually is derived from the rectified audio output of the product detector. In the better receivers the SSB AGC is of the "hang" type, in that when a signal is received, the AGC is developed to the proper level very rapidly (in milliseconds), yet it does not immediately drop back to a lower level after a received signal disappears. Instead, the AGC will remain at its previous level for a period of up to several seconds. If more audio of the proper level is received, the AGC stays "up." If a signal is not received before the end of the "hang" time, the AGC level then drops rapidly to a lower value.

The resonant IF circuits in these receivers may be double-tuned IF cans, ferrite filters, ceramic filters or combinations thereof. Both the ferrite and ceramic filters operate in much the same way as conventional IF cans, but they may have greater selectivity or steeper-sided bandpasses than IF cans.

Double Conversion

The receivers described thus far are single-conversion types; that is, they have only one mixer (or converter), for which the local oscillator tracks the received signal so that the difference between the received signal frequency and the local oscillator frequency is the intermediate frequency. Unfortunately, the image rejection of single-conversion receivers with no RF amplifier stage becomes poor around 6 or 7 Mc, and images become noticeable in the neighborhood of 14 Mc in a receiver with one RF stage (two tuned RF circuits) if the IF is 455 kc. The images can be reduced, however, if a higher IF is used. The most common such IF is 1600 kc, although others are used. The higher IF reduces images, but it also reduces selectivity, which may merely substitute one problem for another. Although Q-multipliers, crystal filters and other techniques are used in an attempt to achieve low-IF selectivity with high-IF image rejection, the most common and successful technique is to use a second conversion, or two IF's. Then the image rejection is achieved in the first IF, while the selectivity is obtained in the second IF.

In the "Basic" and "Medium" class receivers, and perhaps in some of the less expensive double conversion units, the first conversion stage is a true pentagrid converter, such as a 6SA7 or 6SQ7 (octal), 6BE6 (7-pin miniature) or 6BA7 (9-pin miniature). Pentagrid converters, which combine the local oscillator and the mixer in the same envelope and electron stream, are inherently very noisy and may contribute heavily to the overall receiver noise even when an RF amplifier precedes them. On the other hand, they provide excellent isolation between the local oscillator and the RF circuitry.

The separately excited triode mixer, for which the local oscillator is in a separate tube (although possibly in the same envelope), is the "quietest" type of mixer, however it combines most of the advantages of both types with a noise figure somewhat higher than that of a triode mixer but much lower than that of a pentagrid converter, and it therefore is often used in double-conversion receivers.

There are two basic types of double conversion receivers: In the first the local oscillator is tunable and tracks the received signal at a frequency equal to the sum of the received signal and the first IF. The first IF signal passes through one or more fixed-tuned circuits and

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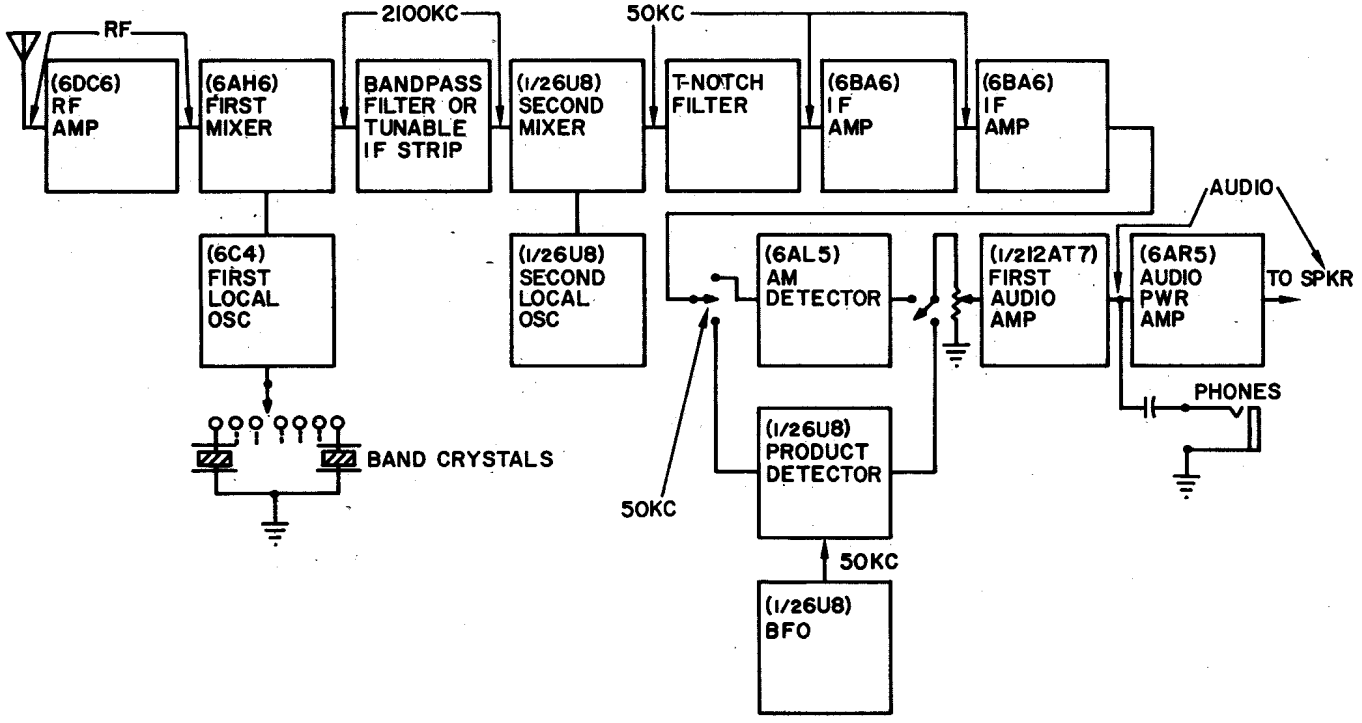

Fig. 4—Block diagram of typical double conversion HF communications receiver.

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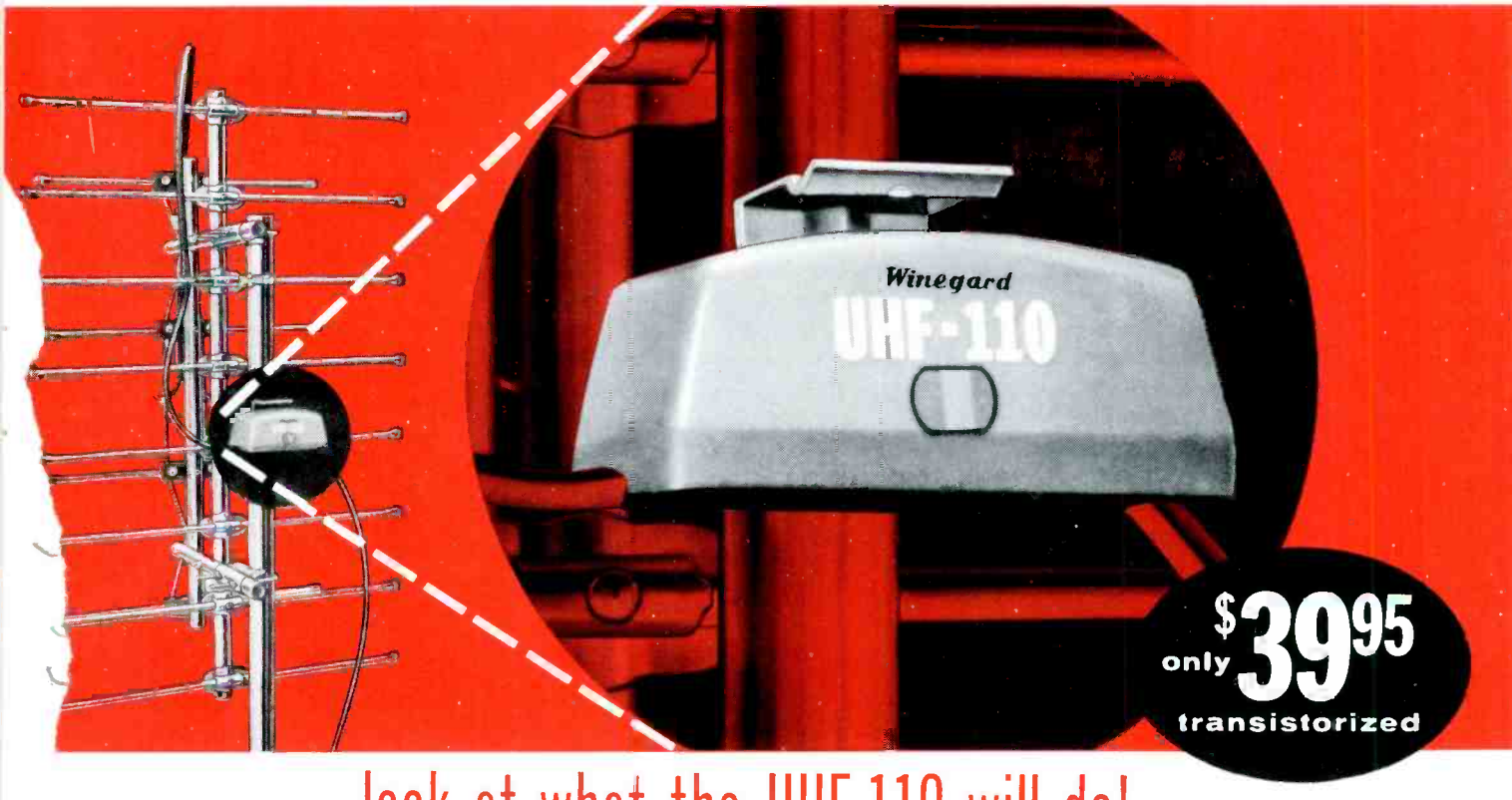
Manufacturers' Technical Digest

Winegard brings you the first low cost all-channel UHF antenna amplifier (channels 14 to 83)



look at what the UHF-110 will do!

DDS MANY MILES TO RECEPTION DISTANCE.

Improves over-all signal-to-noise ratio as much as 12 DB

Practically Eliminates Snow for better pictures

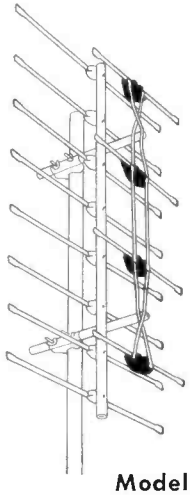
Works perfectly on color and black and white

Never before has an all-channel antenna amplifier been available for UHF. Now, at a price that everyone can afford, the new Winegard Model UHF-110 brings to UHF the same sensitivity and low noise reception as VHF! This means you can clear up snowy UHF pictures, get distant stations, and new clarity to color and black and white TV!

Model UHF-110 employs a new, ultra low noise RF transistor that amplifies UHF signals on all channels 14—83. It works on any UHF antenna and can be mounted on the antenna boom, mast or remote. Has balanced 300 ohm input and output, lightning protected circuit—no transistor burn-out, comes with an all AC power supply. No polarity problems.

For your next UHF installation, try the new Winegard MODEL UHF-110. Ask your distributor or write for spec. sheets.

other UHF products by Winegard . . .

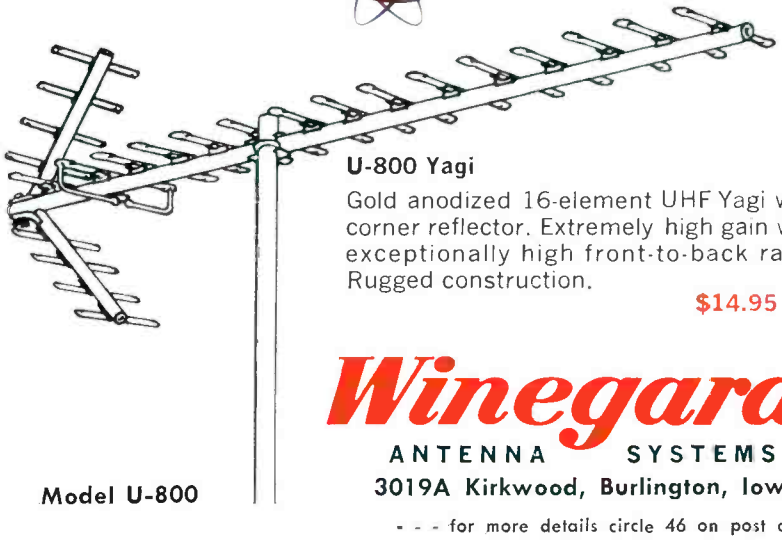


"Ultra-Beam" Antenna

Gold Anodized colinear UHF antenna for all areas including deep fringe. As much gain as an expensive parabolic.

$12.50 list.

Model U-730



U-800 Yagi

Gold anodized 16-element UHF Yagi with corner reflector. Extremely high gain with exceptionally high front-to-back ratio. Rugged construction.

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Model U-800

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3019A Kirkwood, Burlington, Iowa

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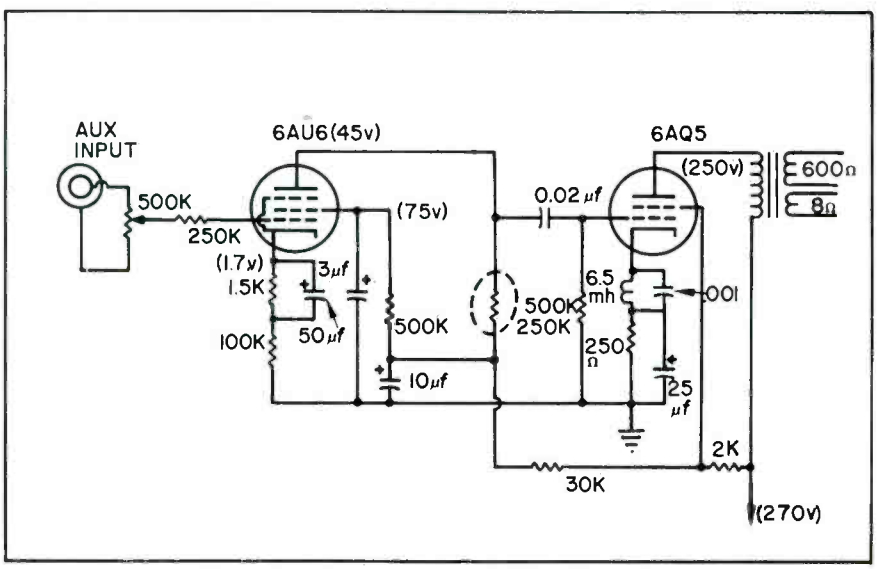
TOUGH DOG CORNER

Difficult Service Jobs Described by Readers

Film Breakdown

For several months a Sony Stere-corder 300 tape recorder had been developing a bad case of intermittent noise in one amplifier channel. The noise was described as sounding like "static" when it occurred. The set might play for several hours without acting up only to have a short burst of noise which might persist for several minutes or clear up almost immediately. The second channel amplifier was never affected, and both amplifiers worked well when the noise was not present. The most difficult problem was getting the set to make the noise. The noise was independent of the volume control setting, of any mechanical vibrations or heat applied by infrared lamp. The power supply was quickly eliminated as it was common to both channels, and only one was noisy. The pre-amp was eliminated owing to the independence of the volume control setting. Substituting the driver and output tubes was to no avail. A detailed check of the wiring harness and connections, along with patient probing in hope of finding a broken shielded cable or faulty connection was fruitless. The noise was present on the plate and grid of the 6AQ5 audio output tube and on the plate of the 6AU6 driver, but not on the grid of the 6AU6. A check of operating voltages showed the plate voltage of the 6AU6 was dropping about 15 v when the noise occurred. The trouble was finally corrected with the replacement of the 250 K plate load resistor, a deposited-film type which was breaking down at random causing a noise signal to appear on the grid of the power amplifier tube.—*Calvin Smith, Arlington, Tex.*

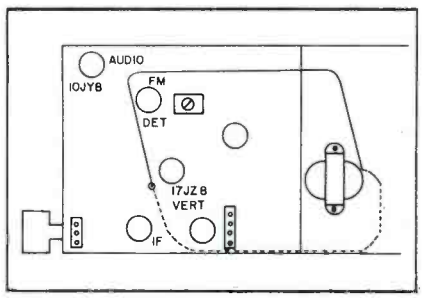


Film resistor breakdown caused intermittent noise.

Buzz

In a Philco TV, Chassis number 14N30, a 60 cycle buzz was audible. The buzz varied in intensity with volume control setting; no buzz in sound at zero volume control set.

Upon investigation I determined that the buzz originated in the vertical circuit. Removing the vertical output tube momentarily, removed it, even at maximum volume control setting. Further investigation showed that the blue plate lead of the vertical output transformer was dressed along the front of the chassis in a lead bundle and draped directly across the PC board between the 4CS6 FM detector and the 10JY8 audio output tube. The high amplitude vertical pulse on this lead radiated into the high impedance audio grid causing the buzz in the sound to vary with volume control setting.



Redressing vertical output lead cured buzz which varied in intensity when the volume control was changed.

The repair, which resulted in complete removal of the buzz, was effected by removing the blue plate lead from the lead bundle at the front of the chassis, shortening by approximately 6 in. and redressing the lead along the rear of the chassis to its terminal next to the 17JZ8 vertical oscillator-output tube.—*Richard F. Doyle, Keyport, N. J.*

TOUGH DOGS WANTED

$10.00 paid for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photographs are desirable. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to "Tough Dog" Editor, ELECTRONIC TECHNICIAN, 1 East First St., Duluth 2, Minnesota.

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Simplifies static and dynamic convergence. No digging into set

4 COLOR SELECTOR
Produces each color one at a time for accurate color set-up

5 COLOR GUN KILLER
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Produces Patterns, Burst, and Colors Individually—Provides dot pattern, crosshatch, vertical lines, horizontal lines, burst signal, and individual colors—one at a time—on the TV color set—for fastest, easiest check. Unique window-viewer on front of the instrument panel shows you each pattern as it should be—gives you exclusive display standard to use as a sure guide for quick, visual comparison.

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Makes Convergence and Linearity Adjustments Easy—Highly stable crystal-controlled system with vertical and horizontal sync pulses, assures the ultimate in line and dot stability.

Simplifies Demodulator Alignment—The type of color display produced by this instrument provides the ultimate in simplicity for precise demodulator alignment.

Provides Automatic Deconvergence—Eliminates the necessity for continual static convergence adjustments. The instrument automatically deconverges a white into a color dot trio without digging into the color set to misadjust the convergence magnets. It also deconverges a white horizontal or vertical line into red, green and blue parallel lines. This greatly simplifies dynamic convergence adjustments.

Provides Exclusive Color Gun Killer—Front-panel switch control makes it easy to disable any combination of the three color guns. Eliminates continuous adjustment of the background or screen controls, or connection of a shorting clip inside the receiver. The switch also selects the individual grids of the color tube and connects to a front-panel jack to simplify demodulator alignment.

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SHOP HINTS

TIPS FOR HOME AND BENCH SERVICE

"Head" Light

A headstrap flashlight we bought from a mail order house often speeds service work in the home and on two-way mobile equipment mounted in vehicles where you don't want to be annoyed lugging an extension cord around and you need both hands free to work

This flashlight unit has an adjustable strap that fits around your forehead and has a cord to a small battery case you can clip to a spot on your trousers belt, or slip in your pocket.—*S. Clark, East Bradenton, Fla.*

Tightens Pocket Clips

I find pocket screwdrivers and hex nut drivers, etc. become lost frequently when the pocket clips loosen. An easy solution is to heat the clip slightly with a small soldering iron or gun until it molds into the handle.—*A. J. Fusco, Key West, Fla.*

Jig Pad

Some types of the "jigs" used to hold a record changer for service have a pointed or blunt end on the clamp screw which bears against the chassis. This may mar the paint finish in a place that shows.

To correct this, grind the ends of the bolts flat, round off the edge of the face, then with the bolts back in place cover the ends with the plastic caps which some makers use to protect the stylus tips of new cartridges. Plastic or rubber tips are also available in some hardware stores.—*Fred Stone, Youngstown, Ohio.*

Parts Identification

Special parts, especially older ones, may be difficult to track down without "rooting" through a lot of parts catalogs and wasting time. We use a Polariod camera and present a picture of the defective part to the distributor or the factory. Time is saved and woe avoided trying to figure out an exact replacement.—*Henry Mullen, Cleveland, Ohio.*

Preventive Maintenance

I'm sure every television technician has gone on service calls with the complaint of "no picture" or "no sound, no picture" and found the set performing perfectly when he turned it on and could find nothing wrong.

You can quite often save a callback on one of these intermittents by checking the filament pins on the low voltage rectifier, horizontal output and horizontal damper tubes for cold solder connections. The pin will generally be discolored from heat generated by a poor contact between socket pin and tube pin. This poor connection is what causes a cold solder connection in the tube pin.

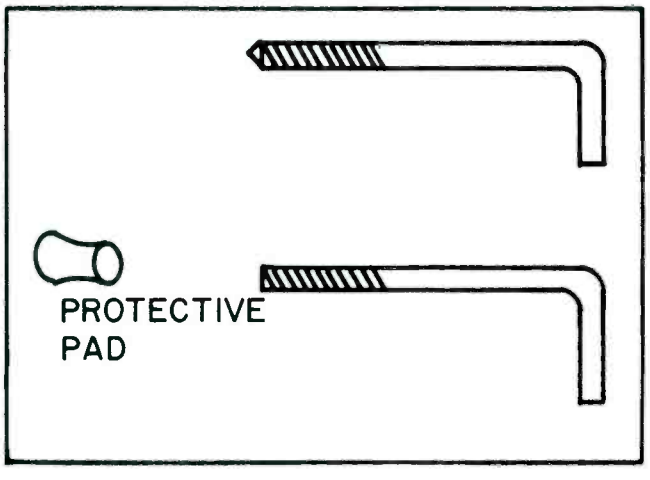
Replace any tube which shows a bad connection and make sure the pins are making good connection in the tube socket. I carry an awl in my tool kit for this purpose. It is thin enough to go down inside of the sockets so you can squeeze them tighter. The tube then fits tighter in the socket and eliminates the cause.—*Richard D. Mohrmann, Dalton, Mass.*

Stringing Aid

When winding a new dial cord through those difficult turns around shafts and pullup, I find my wife's crochet hook the most useful tool in the shop. The hook is much faster than a long nose pliers and the shaft can be passed through a much smaller space.—*Geo. Boettcher, Pelican Lake, Wis.*

Liquid Tube Puller

For several years I have fought unsuccessfully to remove tubes from sockets mounted in printed circuits sometimes damaging the socket or sometimes the printed circuit. I recently tried syraying under the tube with tuner cleaner and found it helps in most stubborn cases.—*Clem O'Brien, Monmouth, Ill.*



Jig screw with pointed ends may cause damage to finishes. Grinding off sharp end and installing pad prevents damage.

SHOP HINTS WANTED

$3 to $10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to Shop Hints Editor, ELECTRONIC TECHNICIAN, Ojibway Building, Duluth 2, Minn. The hints published in this column have not necessarily been tried by ELECTRONIC TECHNICIAN editors and are the ideas of the individual writers.

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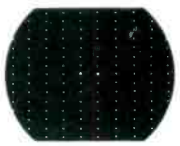
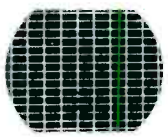
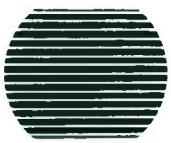


Dot Pattern



Crosshatch

Vertical Lines



Horizontal Lines

Color Pattern

Here is an exciting new addition to the famous B&K series of Television Analysts—*designed to give every service technician a faster, easier way to service more TV sets!*

The compact "1074" gives you a complete TV signal generating source of your own. Using the B&K *point-to-point signal injection technique*, you can isolate and pinpoint any performance problem for quick correction.

By injecting your own signals, with a visual check on the TV screen, *you can easily signal-trace and troubleshoot any stage* throughout the video, audio, r.f., i.f., sync and sweep sections of black & white and color television sets.

It becomes much easier to find and fix "tough dogs," and troublesome intermittents, as well as to solve other general TV set troubles—to the satisfaction of your customer, and to your own profit. Net, **$249.95**

Supplies complete r.f. and i.f. signals, with pattern video and tone audio. Video signals are switch selected for fast, visual troubleshooting. Provides FM modulated 4.5 mc sound channel, with built-in 900 cycle tone generator. Provides composite synchronizing signals. Provides separate vertical and horizontal plate and grid driving signals to check complete output circuit and interrelated components. Many other features.

Makes it Easy to Set-up and Service Color TV

Provides dot pattern, crosshatch, vertical lines, horizontal lines, burst signal and individual colors (Green, Blue, B-Y, R-Y, Red, I, and Q) one at a time on the TV set—all crystal controlled for maximum accuracy. Color phase angles are maintained in accordance with NTSC specifications. Thin lines and high stability assure fastest, easiest convergence and linearity adjustments. Color display makes demodulator alignment extremely simple.

Time-Saving, Money-Making Instruments Used and Preferred by Professional Servicemen Everywhere.

Model 375 Dynamatic Automatic VTVM

Model 360 V O Matic Automatic VOM

Model 700 Dyna-Quik Tube Tester

Model 850 Color Generator

Model 445 CRT Tester Rejuvenator

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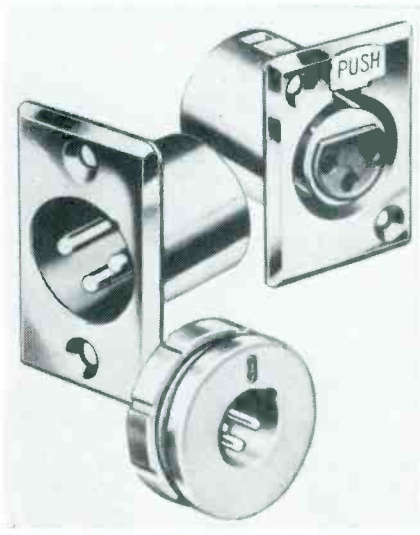
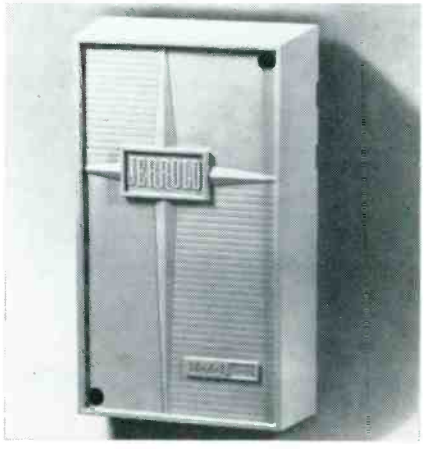
NEW PRODUCTS

AUDIO CONNECTOR 200



Model XL-3-13, a common audio receptacle for wall mounting with 3 socket contacts, is announced. It has latch lock and mounting holes. The shell is zinc alloy and it has a phenolic insulator. Model XL-4-13 is the same unit with 4 contacts. Other models reported are model XL-3-14, an audio receptacle for wall mounting with 3 pin contacts, and its mate model XL-3-13N is a panel mounted audio receptacle with 3 socket contacts. The mountings accommodate from 1/32 to 5/16 in. panel. Other features are latch lock, zinc alloy shell and satin nickel finish. Model XL-3-14N is a panel mounted audio receptacle with 3 pin contacts. Model XL-4-14N has 4 pin contacts. Robins Industries.

INDOOR PREAMP 201

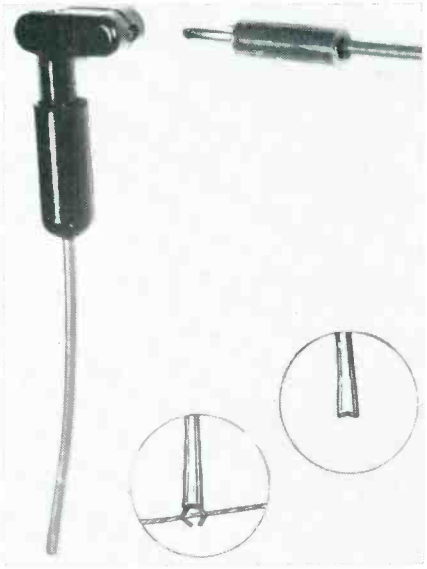


The Indoor Super-Powermate features a combination of high gain-overload and low noise characteristics according to the manufacturer. The Model TA-66, using 2 transistors, amplifies and feeds TV signals to as many as 4 TV sets, from a single antenna. The low band gain is said to be 7.5 db (4 sets connected) for an output of 180,000 μv at each of the 4 output terminals and the high VHF band gain is 5.6 db (4 sets connected) for an output of 100,000 μv available at each of the outlets. Housed in a low-silhouette, high-impact plastic case, the Indoor Super-Powermate includes a fully isolated power supply for shock protection. $34.95. Jerrold Electronics Corp.

TEST CLAMP 202

A universal test clamp is announced for the

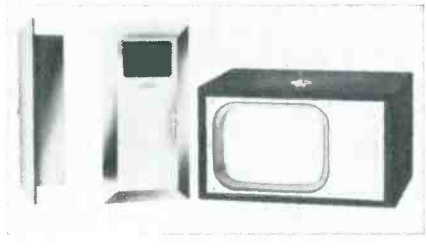
NEW PRODUCTS



technician. It is said to have a wide application in the field of electronic testing and production. This device consists of a retractable spring clamp which is activated by a pressure on the head of the handle. The manufacturer claims the clamp grips the finest wire and retracts into the insulating sleeve, thus permitting its use in high density circuitry without danger of shorting. The head contains a standard banana jack. Hunter Associates.

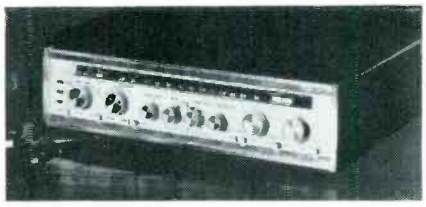
CCTV 203

The development of a "high decor" general surveillance closed circuit television system for areas where exposed cameras are undesirable, has been announced. Designed for use in lobbies of apartment and office buildings, finished offices, plant aisles, elevator cabs, showrooms and wherever space is extremely limited, the HD system is both unobstrusive and tamperproof according to the manufacturer. Two types of 14 in. industrial-type monitors are available in the HD system, both claimed to provide 600 line resolution for high-definition picture quality. TM 23P is equipped with removable safety glass, "hidden" controls, stainless steel front panel and is mounted in a standard desk-type 19 in. rack cabinet. Pierpont Industries, Inc.



STEREO RECEIVER 204

Increased IF coil selectivity and a D'Arsonval tuning meter have been incorporated in the S-8000III FM multiplex stereo receiver, according to the manufacturer. It is claimed that these two features provide tuning ease and accuracy on FM stereo broadcasts and that they are particularly beneficial to the tuning of Class A stations. These new suburban stations are limited power FM broadcasters interspaced between more powerful FM broadcasters. The zero-center meter is also helpful in tuning any FM stereo broadcast. Because stereo broadcasts contain more information, they completely utilize their authorized 200 kc bandwidth. This in turn makes more critical the necessity for tuning to the carrier at the exact center of this band to achieve the maximum stereo separation with minimum distortion. Among the other features of the tuner/amplifier are its 2.4 db capture-effect which eliminates stereo broadcast background noise, and FM Interchannel Hush which suppresses between-station noise when tuning. FM distortion is only 1/3% at 100% modulation. The 8-in. long, professionally calibrated tuning dial is extremely easy to read and a stereo indicator light illuminates when an FM broadcast is in stereo. The amplifier section, in addition to delivering a full 80 w of stereo music power, provides complete control of phono and tape-head functions. $319.50. Sherwood Electronic Laboratories, Inc.



RECORDING TAPE 205

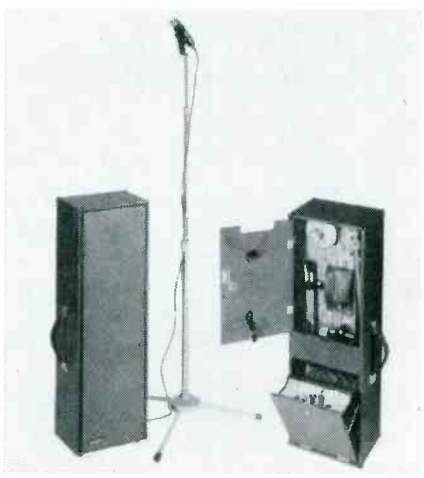
A stronger magnetic recording tape for use in schools, churches, industry and other audio-visual ap-

NEW PRODUCTS

plications has been developed. The new tape, "Scotch" brand No. 175. is said to have properties that give it 15 times its former working life. A new heavy duty oxide coating helps the tape stand up to continuous use, the company said, like the rough use of classrooms and the extra-rough and constant handling of language laboratories, where tapes are kept running hour after hour. The company said the new coating has proved exceedingly durable in heavy duty tapes for high speed computers. The coating is said to resist heat and to minimize oxide rub-off despite continuous play. In addition, the manufacturer said the new oxide prevents dust attraction and eliminates static that can build up, particularly in the winter months, when school heating systems drive humidity down and static up. Price of the new tape continues in the same range as standard acetate-backed tapes. 3M Co.

PA SYSTEM 206

The Voice Director introduced recently is said to be desirable for almost any public address system where portability and complete independence from a power source are required. Audiences of up to 700 people have been adequately covered by a single unit according to the manufacturer. The 24½ lb system includes a 6-speaker sound column, a 25-w battery-powered transistor amplifier, microphone with 18-ft cord, full-size microphone floor stand and lavalier. All of the system components are contained in a carrying case measuring 6-7/8 by9-3/4 by 29-3/4 in. The unit is said to operate up to 400 hours on alkaline flashlight batteries. This is a year of normal usage. $283. Argos Products Co.

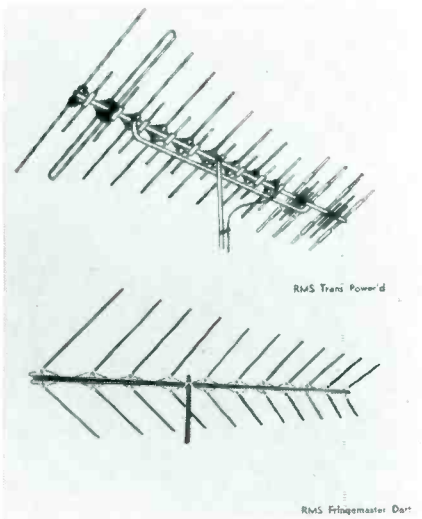


TAPE RECORDER 207

Two self-contained stereo tape recorders, the Miranda Sorrento and the Miranda Nocturne, both completely enclosed in teak cabinetry, are announced. The unit has no handles or other external hardware to indicate that the cabinet houses a tape recorder. This unique concept makes it possible for the Miranda to become part of the living room decor, rather than

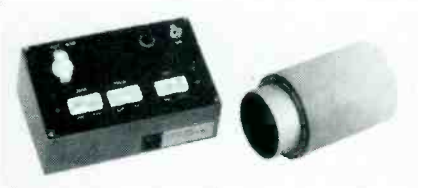
be concealed behind doors. Top recorder in the line is the Sorrento, which features solid state circuitry with 21 transistors and 19 diodes in an OTL circuit and an all-electronic matrix type push-button switching system. Tape movement of the Sorrento is controlled by three separate motors, for capstan drive (7½ and 3¾ ips), rewind and fast forward. A servo motor is also incorporated in the circuitry for use with the remote control unit. Allied Implex.

ANTENNAS **208**



Two antenna designs, the Transpower'd and the Fringemaster Dart, have been introduced. The element configuration is said to offer new levels of performance in all areas — local, semi-fringe and fringe. Some of the features claimed are: highest gain, highest front-to-back ratio, flat response for high and low band response, broad bandwidths, all elements reinforced with 7/16 in. crimped slip-proof aluminum sleeves, high impact Styrene plastic insulators, snap-lock element positioning and gold aluminum protective finish. RMS Electronics Corp.

ZOOM LENS **209**

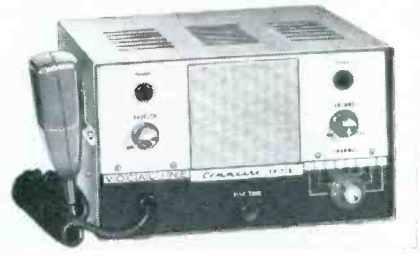


A motorized zoom lens for use with vidicon cameras has been introduced. Model CM-16 has a zoom range of 25 to 100 mm and a speed of f1.8. The control box contains simplified push-button controls of iris, focus, zoom and the speed is adjustable to either fast or slow according to the manufacturer. The lens is a standard "C" mount. The industrial net for the lens complete with control box, 25 ft of cable and metal carrying case is $995. Canon Camera Co., Inc.

NEW PRODUCTS

CB TRANSCEIVER 210

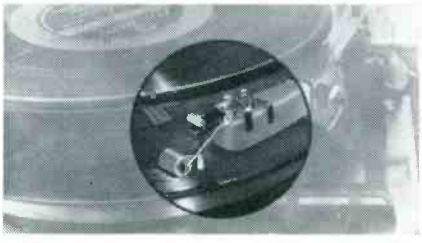
The availability of the Commaire ED-278, a citizens band two-way radio is announced. The unit was



designed for professional or commercial use on the Class D citizen's band where reliability and simplicity of operation at modest cost are paramount according to the manufacturer. The unit transmits and receives on eight channels, is claimed to have an exceptionally sensitive and selective receiver with fine tuning control. The transmitter features a red panel lamp which indicates transmit operation when microphone button is depressed. A microphone is standard equipment with the unit, $189.50. Vocaline Co. of America.

DUST BUG 211

A Dust Bug for changers is said to be adaptable to any changer arm. It cleans without interferring



with changer or tone arm operation and removes static and dust while it protects the record surface, according to the manufacturer. The unit is carefully pre-balanced for minimal additional tracking force and uses a plush pile cleaning head with added antistatic agent according to the manufacturer. Retail $5.00. Elpa Marketing Industries, Inc.

STEREO RECEIVER 212

On one chassis, the Award TA-

7000X combines an AM/FM and FM stereo tuner, dual preamplifiers and a 70-w stereophonic amplifier. An unusual feature claimed is its "Stereo Logic" circuit—a solid state device which automatically switches the FM tuner to stereo the instant a station begins to broadcast stereo. The FM tuner's frequency response is said to extend from 10 to 35,000 cps ±1 db. The FM tuner also offers a stereo indicator light, stereo headphone reception, automatic frequency control and a professional D'Arsonval tuning meter. The FM multiplex section is flat from 15 to 15,000 cps ±1 db with less than 1% distortion according to the maker. The power amplifier section features a solid state power supply plus heavy duty output transformers which are said to reproduce frequencies from 12 to 70,000 cps ±1 db at 1 w. $369.95. Harman-Kardon.

ALARM SYSTEM 213

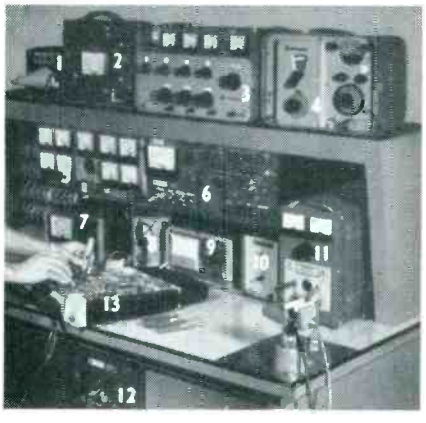
An improved oscillator and antenna system for the wide-range industrial and central station models of the Radar-Eye anti-intrusion space alarm has been announced. The refinements make the radar-operated warning device "substantially insensitive" to radio interference from outside sources, according to the patent application filed by the manufacturer. The wide-range models are designed chiefly for larger industrial and government installations. They are said to have a range of 50 ft in diameter. The system consists of a detector and alarm unit. Turning a key in the control unit floods the area to be protected with three-dimensional radar waves. Any invasion of the standing waves by a

solid object returns a signal to the antenna on a different frequency from that on which it was sent, causing an alarm to sound. Pinkerton Security Corp.

PORTABLE TRANSLATOR 214

A multi-use test instrument is said to provide UHF television signals for TV technicians as a time saving device for servicing, and to dealers demonstrating new all-channel television receivers. The translator provides UHF television signals when none are available through local telecasting stations. The test instrument is designed for use by the television technician and dealers for servicing all-channel television sets as well as making it possible for the dealer to demonstrate all-channel television receivers in his showroom. It should help the latter sell all-channel TV sets in areas where UHF channels are not yet on the air. He can also air-check the UHF portion of the all-channel sets before delivery to the customer. $100. Standard Kollsman.

ABOUT OUR COVER . . .



Our cover this month shows a technician servicing a mobile two-way radio. The cover photo was furnished by Motorola Communications Division. Instruments included in the picture are

TOP ROW

1. Dummy Load
2. Portable Test Set with Deviation Meter and RF Peaking Generator
3. Frequency Meter
4. Calibrated Signal Generator

SUSPENDED FROM TOP SHELF

5. Test Set Meter Panel
6. Universal Control Panel

ON WORK TABLE

7. AC Voltmeter
8. Thru-Line Wattmeter
9. DC Multimeter
10. Ripple Filter
11. DC Power Supply

UNDER TABLE SHELF

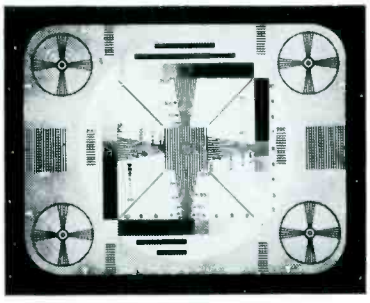
12. Junction Bo. for Universal Control Panel

UNIT BEING SERVICED ON TABLE

13. Mobile Two-Way Radio

TV TIPS FROM TRIAD

NO. 24 IN A SERIES



Junior PTM Joe had successfully bird-dogged a no-high-voltage problem to a shorted shielded lead from flyback to AGC coupling capacitor. The normally high peak-to-peak voltage (700 to 800 volts) had triggered a breakdown. Confidently, he replaced the shielded lead. The raster bounced back to life, but both width and brightness were sadly lacking. Like a good, level-headed serviceman should, he methodically checked out the components in the horizontal output circuit. They checked fine. Joe groaned out loud, "Dubble trubble."

"Come again?" said Senior PTM Bill.

Joe explained his quandary in detail and ended with a query, "Think the flyback might be damaged?"

"Sounds more like the electrolytic cathode capacitor."

"But it checks out okay on the capacity indicator."

"Let's try a new one anyway."

Joe did. The raster filled out. Full brightness returned. He looked at Bill.

"A capacitor will often measure normal, yet will not be effective at the high horizontal sweep frequency," explained Bill readily. "Therefore, it's good practice to install a paper capacitor in parallel. Another thing. Carefully check the electrolytic boost filter capacitor when the symptoms are reduced high voltage and insufficient width, especially if loss of height is also evident."

Joe nodded, mentally filing the information.

Bill wasn't through. "A final point. Since this chassis has a linearity coil, be sure to connect a voltmeter across the cathode resistor and adjust the coil for *minimum* voltage. Doing this insures minimum plate and screen current for most efficient operation of the horizontal output circuit."

"Good thinking," said Joe and squirreled away that information also.

MORAL: The best way to take advantage of the latest techniques and the most advanced materials in flybacks is to buy Triad. So jot down T-R-I-A-D F-L-Y-B-A-C-K-S in big black letters in your cerebral notebook along with the reminder that every flyback comes packaged with complete instructions. **Triad Distributor Division**, 305 North Briant Street, Huntington, Indiana.

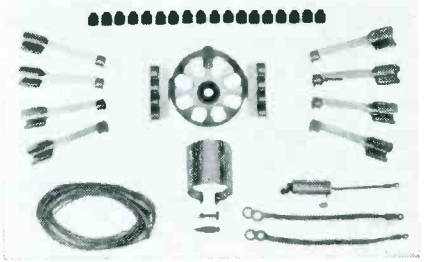
A DIVISION OF LITTON INDUSTRIES

- - - for more details circle 43 on post card

NEW PRODUCTS

SHIELDING KIT 215

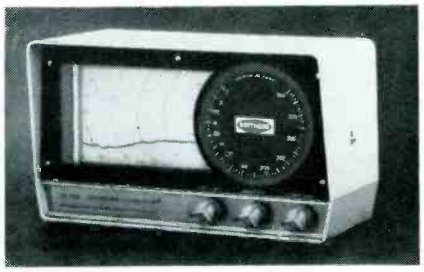
A "universal-type" automotive ignition shielding kit designed to control both conducted and radiated interference is announced. The kit may be installed on either 6's or 8's—V or in-line engines. Installation requires only the use of ordinary, readily available hand tools,



and even though an "Eliminoise" kit has been installed on one vehicle, it may easily be removed and transferred to another vehicle with the same number of cylinders according to the manufacturer. The kit utilizes existing standard automotive components and reportedly does not require special shielded-type spark plugs. A specially designed coil shield with an integrally mounted capacitor is said to control conducted interference from the switch lead as well as radiated interference from the coil terminals, towers and associated wiring. Kits are said to increase the receiver range and improve the performance of citizens radio equipment; industrial and public safety AM and FM two-way radio equipment; amateur mobile radio equipment; and automotive AM and FM broadcast receivers. $29.95 and $38.50. E. F. Johnson Co.

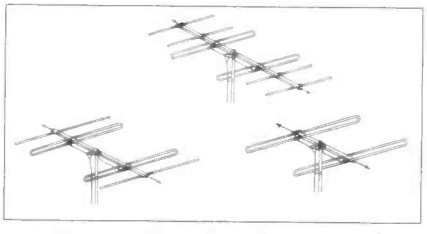
LORAN-DEPTH SOUNDER 216

A loran receiver and a combination recording and indicating depth sounder are introduced. Designed especially for sport fishermen and



navigators, it utilizes a flashing light depth sounder with a recorder in a single cabinet. The combination is said to provide the graphic features of a recorder and the night-vision advantages of an indicator. For record-keeping and detection of depth trends, the recorder section is scaled to 240 ft. The flashing light indicator has a normal scale of 120 ft but is calibrated to 360 ft to take advantage of the extended readings that are frequently possible when a boat is operating over a hard bottom that acts as a good reflector of the ultrasonic pulses. A single knob serves as an off-on switch and an intensity control. A switch is also available to withhold the operation of the recorder when it is not necessary to graph the ocean or river floor. This feature saves chart paper when only an instantaneous depth sounding is needed. $176. Raytheon.

BI-DIRECTIONAL FM YAGI **217**



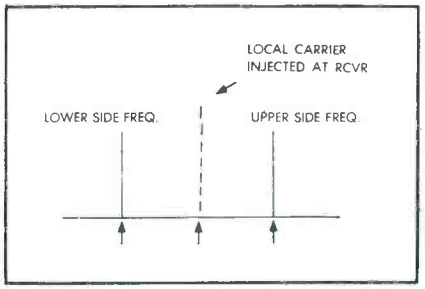
Three Bi-Directional FM antenna models are now available. These three models are the FM2-2BD, FM3-3BD and the FM4-4BD. The first is said to provide reception in opposite directions for 30 mi, the second to 50 mi and the third to 75 mi. $11.50, $16.50, and $28.95. Finco.

SSB for CBers

Single Side Band makes twice as many channels available for CB users--first CB SSB unit includes option for upper or lower sideband

■ Up until now, single sideband communications equipment has been expensive and its use confined to business and amateur communications. But the technique is now being used in CB transceivers.

The standard AM signal, as we know, is composed of the carrier plus an upper and a lower sideband as shown in Fig. 1. But since the carrier conveys no information and both sidebands are mirror images of each other, only one sideband is needed for communications. In a nutshell, that's single sideband (SSB). There are several advantages in using SSB, the most noted being increased range, narrowed bandwidth, reduction in noise and interference.

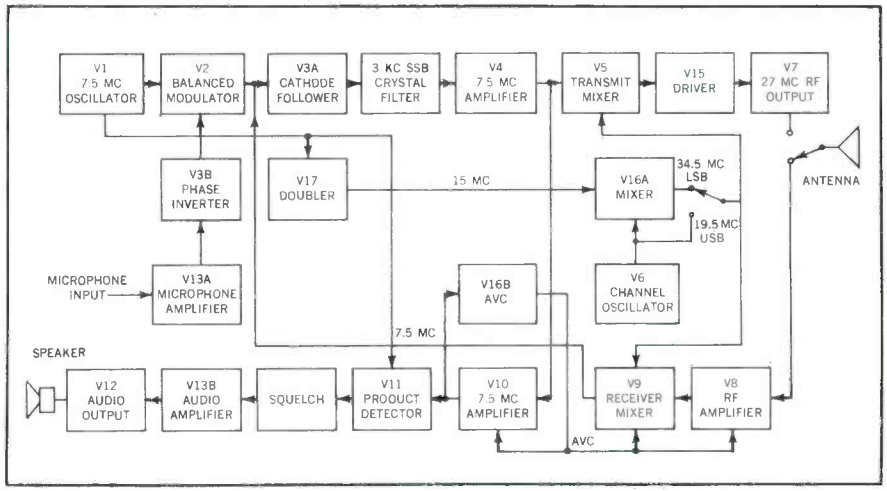


Carrier and one sideband is removed for SSB operation.

With the carrier and one sideband removed, the power previously wasted by them can be concentrated on one sideband. Noise is less of a problem because bandwidth is much narrower and a narrow-band receiver picks up less noise for the same or greater signal strength.

Another interesting fact is that SSB can increase the number of usable CB channels from 23 to 46. Each of the 23 channels normally includes an upper and a lower sideband, so with the ability to transmit either an upper sideband (USB) or a lower sideband (LSB) the number of channels is effectively doubled.

The big stumbling block for SSB in this frequency range has been frequency stability. This was solved by using techniques found in more expensive communications gear: A crystal oven is employed to maintain a constant crystal temperature and a four section crystal lattice filter to aid in adjacent channel rejection.



Block diagram of Mark Products SSB CB transceiver.

The 3 kc bandpass crystal lattice filter—in addition to post-detection-filtering in the shaped-response audio circuits—rejects adjacent channel interference and permits only the intelligence of the selected SSB signal to come through. A true product detector is employed for efficient SSB service and minimum distortion of received signals. Transistorized dc-to-dc power supplies with silicon rectifiers are designed to give maximum voltage regulation. ■

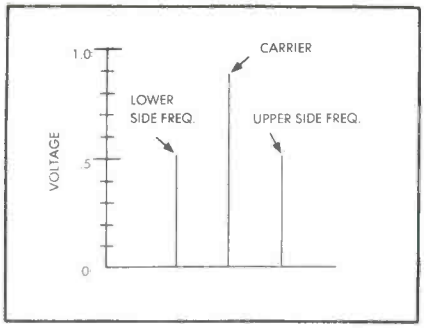


Fig. 1—Distribution of the standard AM signal.

Excerpts From A Technician's Nightmares

by Dick Rawlinson

"... I know all that, but it didn't act that way before you worked on it."

"... I checked those tubes at the super market and all checked good. It can't be *that* tube."

"... I turned it on and that black smoke came out. You just worked on it nine months ago. Shouldn't it hold up longer than that?"

"... Three dollars and ninety-five cents for that tube? Why, I thought tubes sold for a dollar apiece!"

"... I'll leave the back door unlocked. Just deliver the set and I'll be by the store to pay you soon."

"... THAT MUCH for a complete overhaul? But we never look at TV—much. ... When can you get the set back?"

"... Now, look Bud, I was a radar technician in the Army. I don't see how a picture tube and yoke can cost that much!"

"... The station is only sixty miles away and I don't see why I can't get a good picture on rabbit-ears. My brother, in the city, don't even use rabbit-ears and he gets a wonderful picture."

"... What do you mean the set needs shop work? The last man who worked on it fixed it in the house."

"... I can't afford a new picture tube. Can you loan me an old set until I have the money for a new tube?"

"... Twenty dollars trade-in on this set? Look, I paid $450.00 for it ten years ago. You must be one of those crooks I've been reading about!"

"... I know it's Saturday night and the set has been out for six months. But we wanted it this evening."

"... Who's the 'Jack-leg' that fixed this set last?" "You did!"

NEW BOOKS

TELEVISION SERVICE TRAINING MANUAL. *By Edward F. Rice. Published by Howard W. Sams & Co., Inc. 224 pages, soft cover. $3.95.*

It should be stated at the outset that this book was written by a TV rapair technician. He incidentally holds a B.S. degree and teaches in a vocational school. The text is designed to help both apprentice and advanced technicians. It does not go into theory, but assumes that all professional TV-radio technicians have already obtained the necessary theory. The book is not "intended to be used on the bench as a bride uses a cookbook," the author says, but it does illustrate an organized method to carry out service procedures successfully in a minimum of time. Ten of the 12 chapters deal with specific problems covering high voltage, vertical deflection, raster distortions, defective width and height, vertical sync, horizontal instability, defective video, low voltage power supply and sound failures, and video alignment. The first chapter is an introduction which also makes suggestions for working on TV chassis. The last chapter includes 14 case histories with solutions. Review questions at the end of each chapter indicate that the book could easily be used as a vocational or TV-service school text. It is well illustrated with drawings and schematics.

TRANSISTOR TELEVISION RECEIVERS. *By T. D. Towers. Published by John F. Rider Publisher, Inc. 194 pages, hard cover. $6.95.*

This book begins with the original mass-produced Philco "Safari" transistorized TV and covers developments up to date. Twelve chapters describe transistor tuners, transistor IF amplifiers, video amplifiers, sound sections, sync separator circuits, horizontal and vertical circuits, CRT and associated circuits, power supplies, servicing and others. Transistor AGC and bias circuits are detailed. Typical American, British, Japanese and Russian equipment is described with schematics included. Some areas of the volume appear ambiguous, however. For example, the author refers to non-intercarrier (split sound and video) circuits as conventional. The conventional video circuit in the United States is intercarrier, of course, which the author notes later. The text is adequately illustrated wtih drawings and diagrams.

"Check It."

FREE LITERATURE

TWO-WAY EQUIPMENT 300
A Micrometer Frequency Meter and an FM Modulation Meter are described in specifications now available. Lampkin Laboratories.

PARTS CATALOG 301
A 1964 catalog now available has a total of 228 pages and includes parts for all types of electronics work. Burstein-Applebee.

ALL CHANNEL ANTENNAS 302
An antenna catalog is available announcing a line of "Space Age" antennas. Five antennas are described. Kay-Townes Antenna Co.

FM ANTENNA 303
Three FM antennas are described in a specification sheet. Construction and performance are detailed. Trio Manufacturing Co.

Missing the Sales Boat

■ "Sorry, we don't carry that brand," the sales clerk said to the customer who asked for a certain kind transistor radio. He didn't offer to show the customer the brand which the store did carry.

The store's brand had features (for the same price) which the competing brand did not have. But the customer never knew it—unless he heard about it elsewhere.

"Do you have that TV in the window with a smaller screen?" the woman asked. The salesman shook his head. She turned and left the store.

Later she told her friends, "I'll never go in there again. The least he could have done was to offer to show me what they did have."

"Make up your mind," was the expression on the salesman's face as he waited for a customer to decide which radio she liked best. His message got through because she walked out without buying.

"I know she must have thought that I had all day to wait on her," he said. He was right, but what he didn't know was that she was planning to buy a color TV soon.

Some marketers watch opportunities walk out the door because they have the wrong people on the job. Sometimes these clerks are the best available. As one retailer says, "Industry attracts all the good people and leaves me the scrubs."

Perhaps this is true in some cases. Yet in other instances, it may be coverup thinking to justify the retailer's laziness or lack of interest in training and developing his salespeople.

Some men and women prefer store work to factory work. They like people and enjoy selling. Yet they do factory work because the hours and pay may be better than those in retail selling.

"I can't afford to hire such people," some retailers say. However, they may be missing the boat. Which is cheaper, four $45-a-week clerks who can't, or won't, learn to sell or two $75-a-week live wires who enjoy selling and more than earn their pay? ■

. . . MICROPHONES

Continued from page 41

is accomplished quite easily.

Two general designs are prevalent in communications microphones; the hand-held mobile and stand-mounted base station styles. Hand-held microphones are much the same in size but case construction varies. Early designs in CB microphones used polystyrene cases which are attractive but have relatively low impact resistance. Later cases utilized high-impact plastic cases. These plastics combined with ingenious case designs and color styling result in low-cost microphones which are both attractive and rugged.

Medium-priced hand-held microphone cases utilize more expensive materials to achieve durability. Die-cast zinc provides great ruggedness but becomes quite heavy. Thermosetting materials such as Bakelite achieve durability and are much lighter. The durability of metal and the lightweight features of plastics are gained in one design by using

Continued on page 82

Each technician who passes the examination at the end of the course is given a certificate and registered with the factory as an approved technician.

The series of training meetings would be continued into 1964 and it is expected that approximately 15,000 service technicians will complete this specialized color television training program.

1000th Graduate

Many aggressive and alert TV-radio technicians are preparing to move into the fertile green field of two-way radio. Many are taking home-study courses.

TV-radio technician, Ronald W. Osterland of

The 1000th graduate of the Motorola Training Institute, Ronald Osterland (center) receives his completion certificate from MTI administrator El Mueller (left) as Robert Borchardt, Motorola National Service Manager, looks on

NEWS OF THE INDUSTRY

Sony Ads to CB Line

Sony now has two transceivers operating in the 100 mw class. The newest model is the CB-106. Featured in this unit is a headset which allows the unit to be operated "hands free."

Color Meetings Top 3000

Attendance at 142 of Philco's color TV training meetings has totaled 3,005, according to the company.

Distributors are sponsoring the meetings, which can be offered as an eight-hour, one-day course; two four-hour courses on succeeding days or three-hour courses on three succeeding days.

The courses deal with these five topics:

1. The black and white portions of a color receiver that differ from black and white receivers.
2. Circuit descriptions of the color-only portion of the receiver.
3. The basic construction of the tri-gun Cathode Ray Tube, the causes of misconvergence and a description of covergence circuitry.
4. Step-by-step instruction covering the basic receiver set-up and detailed convergence procedure.
5. Troubleshooting analysis of six color TV problems, illustrated, demonstrated and discussed.

New Pentodes

Two new series of pentodes for amplifier use in low B+ and color TV receivers have been introduced by Raytheon Company's Industrial Components Div. The 6HJ5, 21HJ5 and 30HJ5 are heater-cathode beam pentodes for use as horizontal deflection amplifiers. Design maximum ratings are: peak plate voltage 7000 v positive and 1500 v negative, plate dissipation 24 w.

The 6HA6, 8HA6,10HA6, 15HA6 and 29HA6 are power pentodes for video amplifier use. The 8HA6 is for 600-ma series heater strings, the 10HA6 for 450-ma, the 15HA6 for 300-ma and the 29HA6 for 150-ma operation.

Teaching with TV

Teaching by television is likely to become as familar as the use of textbooks by 1970, as a result of a "breakthrough" ruling by the Federal Communications Commission. This prediction was made by Stanley P. Lapin, Director of Adler Electronics' Industrial Products Div. The company believes that the FCC action, which opens a band of 30 channels in the 2500-Mc range for instructional use virtually eliminates the two major barriers to the growth of instructional TV: high costs and insufficient channels. Adler claims that a two-channel instructional system can be installed in a large city for as low as $2.25 per pupil, although it was obvious that various circumstances would make initial costs somewhat higher in smaller school districts for similar installations.

...New Developments in Electrical Protection

Aurora, Ill., is only one of the thousands. He has been honored as the 1000th graduate of a specialized home study course on two-way radio servicing conducted by the Motorola Training Institute. The two-way course, first offered in 1960 by MTI, is an advanced study of the theory and service of FM communications equipment, including recently developed transistorized gear. His service company, A & H Radio, Aurora, performs maintenance for approximately 200 mobile radios operated by governmental and business organizations in the Aurora area.

Trio Launches Premium Program

Antennas in the new Trio line are packed with a coupon worth a certain point value, depending on the antenna's price. S&H green stamps will be issued for the coupons or the dealer may redeem coupons for premiums ranging from wrist watches to VW trucks.

Phono Production Up in Fall

Latest EIA report shows that phonograph production last fall was up compared to the previous year. For the same period, sales had fallen off slightly, although both were higher for the first three quarters as a whole.

New Antenna Line

RCA has just announced an antenna line of 3 B/W and color antennas and one FM antenna. The three TV antennas are designed for "city," "suburban" and "fringe area." The entire line is gold anodized.

Continued from page 79

diecast aluminum. Ruggedness, weight and ease of switch operation should be a foremost consideration in any selection.

While hand-held microphones can be used on base stations, specialized designs provide greater ease of operation. This becomes increasingly important during busy operating periods when fatigue might lead to frustration. All such microphones must, of course, provide a reliable push-to-talk switch. A locking feature is also desirable. Designs are available with built-on desk stands, and one type has a removable desk stand which allows it to be used for fixed-station or mobile operation.

The features provided in today's communications microphones would have placed them in a high-cost category only a few years ago. Great expansion in the mobile radio field has allowed mass producing microphones to such an extent that there is virtually no such thing as a high-cost communications microphone. This is one area, typical of many, where all concerned, the manufacturer, dealer and user, have enjoyed very real benefits. ■

. . . CALLING SYSTEMS

Continued from page 45

respond. Or, the audio signal generator output may be fed directly into the decoder input, noting particularly if there is a difference in required tone level to actuate the various relays.

An oscilloscope is handy for observing the action of the contacts of a resonant reed relay when energized by a tone at the required frequency. The scope may be connected across the resistor shown in Fig. 9, after the relay contacts have been carefully disconnected from the decoder circuit. ■

. . . CITIZENS BAND

Continued from page 52

receiver, equipped with an inexpensive 100-kc rubber-crystal standard with good harmonic output, and a wattmeter. The crystal standard can be set against WWV signals and the transmitter crystal-controlled output can be checked on the receiver against this signal to make certain the transmitter is actually on specified frequency. The wattmeter can be used to quickly and accurately tune the transmitter to resonance and maximum output. In all cases, manufacturers' tuning instructions should be followed carefully.

CB communications equipment is now being transistorized at a rather fast clip, especially in the low-powered hand-held units. Although transistorized "personal" type units require more refined servicing techniques, most TV-radio technicians have become well versed in these procedures through servicing transistorized radio and TV receivers. And problems encountered here will be similar to those found in other transistorized equipment.

Transistorized CB Equipment

The block diagram of a typical "personal" type CB transceiver is shown in Fig. 2. It has a crystal controlled superheterodyne receiver and a two-stage crystal controlled transmitter. Antenna and audio circuits are common to both receiver and transmitter. If any of these sets come in for repair it will probably be for battery replacements. And make sure that you place new batteries in them correctly. Check the crystals to determine if they are well seated in the sockets. Volume and squelch controls should be set properly. Check the "push-to-talk" switch. And make sure that receiver and transmitter crystals have not been switched.

Special Test Instruments

Most experienced CB servicers are agreed that quick servicing is the key to successful work in this area. And most agree that rapid troubleshooting, repair and tuning can be accomplished only with modern instruments. These instruments *are* available at modest cost and technicians should use them. For example, because of the power involved, one inexpensive unit has been made that checks antenna power in watts, measures modulation percentage, serves as a field strength meter, checks harmonic output of the transmitter, and measures SWR. Comparable type equipment is available at reasonable cost which will make it possible for any licensed technician to speed up service procedures and make the business pay. ■

. . . BETTER ADS

Continued from page 53

category over competitors who make completeness and variety their major selling approach.

Emphasize your brand name products. Emphasis of this fact can make an effective advertising approach. It enables you to cash in on national advertising of brand names. Trade marks in your ad will be effective in selling brand-conscious buyers.

5. Make your ad uniquely yours. Compare your ad with those of competitors. Give yours its own special character and appearance. But be sure that every word and illustration are appropriate to your business and to the people you want to sell. Then follow these tips:

Keep your layout simple. Use lots of open space. Employ only a few units, and arrange them so that the eye is led through the message in logical order—from attention-getting headline or illustration, through the reasons why people should buy, to a call for action by the prospect, then to your name, telephone number and address.

Your copy should be short. Write it for quick, easy understanding—without flowing phases or flowery adjectives. Each word should expand the basic promise of your headline or it doesn't belong in your ad.

Follow these tricks of the advertising trade and you can be sure you'll get more for every ad dollar you spend. ■

. . . COMMUNICATIONS RECEIVERS

Continued from page 57

then is heterodyned down to the second IF in another mixer. The oscillator for the second mixer usually (though not always) is crystal controlled.

In the second type of double conversion receiver, the RF stages are tuned separately, while the first-mixer oscillator is crystal controlled. The circuits which follow the first mixer may be broad-banded, i.e., stagger-tuned or tuned in some other manner so that they provide essentially constant response to all signals within a narrow frequency range, usually no more than 500 kc wide. The signals then are fed to the second mixer, the local oscillator for which is tunable and which does most of the "tuning" for the receiver. Of course, the RF stages must be "peaked" or tuned separately, which means that the receiver is a "two-handed tuner." On the other hand, the circuits which follow the first mixer sometimes are tunable along with the second-mixer local oscillator.

The double conversion receiver with a crystal controlled front end offers a significant advantage over a receiver with a tunable first local oscillator. LC resonant circuits all tend to drift roughly the same *percentage* for a given change of line voltage or temperature. Thus, a 30-Mc ocsillator that drifts 0.001 percent will drift 300 cps, while a 3-Mc oscillator that drifts 0.001 percent will drift only 30 cps. In many types of communication (chiefly RTTY and SSB) a drift of 30 cps is tolerable but a 300-cps drift is not!

Crystal oscillators, on the other hand, drift only slightly—perhaps only 0.00001 percent under the same circumstances that make LC oscillators drift 0.001 percent. By using a crystal oscillator with the first mixer and an LC oscillator with the second mixer, the total drift can be kept to, say, 0.00001 x 30,000,000 + 0.001 x 3,000,000, or 6 cps in the first mixer plus 30 cps in the second mixer, for an overall drift of only 36 cps. (A stability of ±50 cps is satisfactory in most cases.)

Even more sophisticated receivers are in everyday use, but it's unlikely that you would ever be asked to work on them, because they are quite expensive and because the owners know that you do not have the specialized equipment that would be necessary. You can recognize them not only by their price when new but by the fact that some of them include mechanical filters or crystal bandpass filters.

While you should have no trouble working on "below $300" receivers, it's easy to get overconfident after you have been at it for a while. It should be remembered, however, that even receivers with the same basic chassis are still "individuals." And never attempt to do anything on an HF communications receiver except change tubes without first consulting the handbook. ■

ADVERTISERS INDEX

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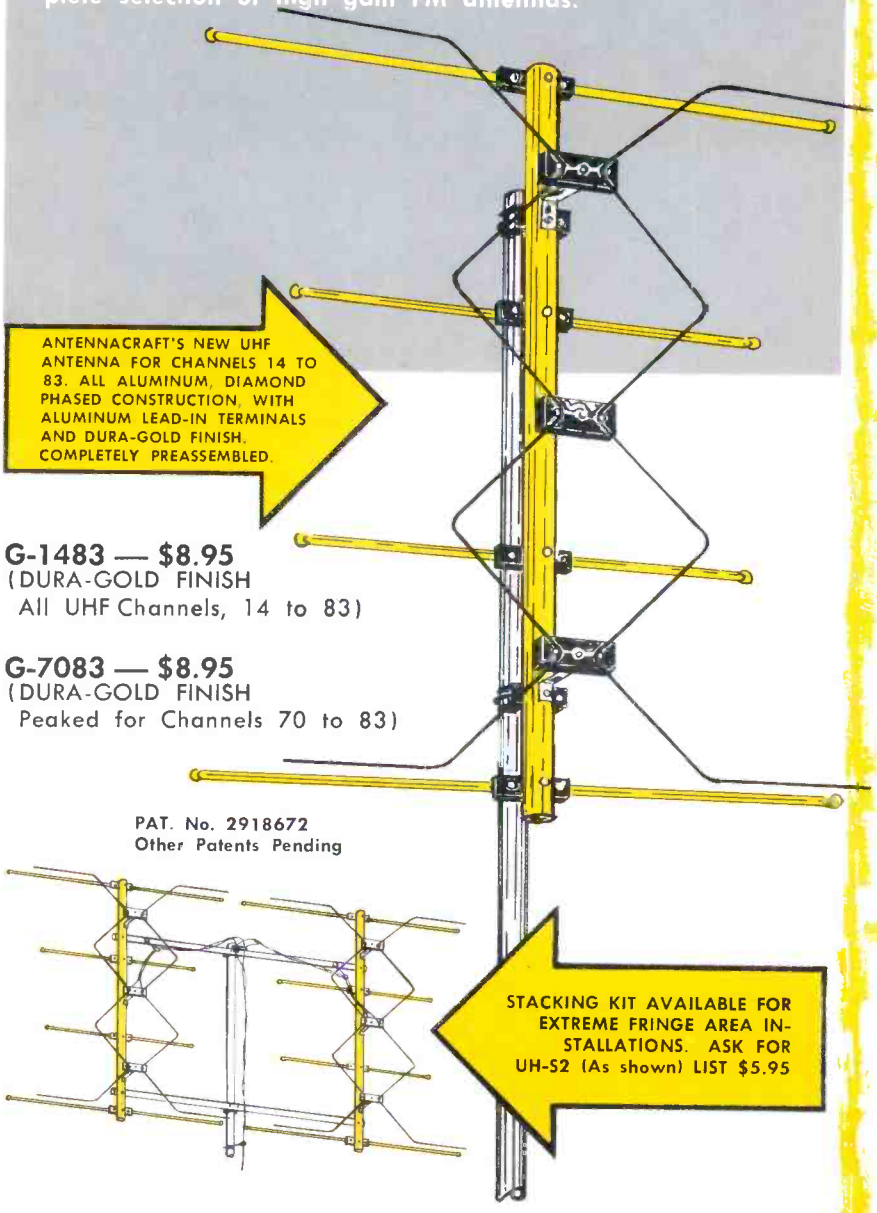
By the world's fastest growing antenna company. Why the fastest growing? Because of the excellent product integrity of Antennacraft antennas. Our qualified electronic engineers, backed by high quality controlled production and the finest raw materials available, give Antennacraft customers the best TV and FM antennas their money can buy. Antennacraft antennas have more built-in sales features, offer more customer satisfaction and dealer profit than any other brand. Antennacraft antennas are positively the easiest to install. Insist on Antennacraft construction, quality and performance. Antennacraft manufactures a complete line of standard rotor type all channel antennas, area special antennas, UHF antennas and a complete selection of high gain FM antennas.



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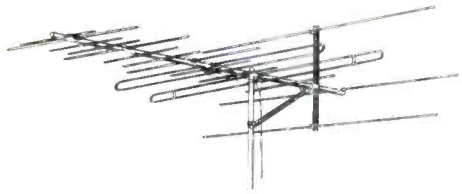

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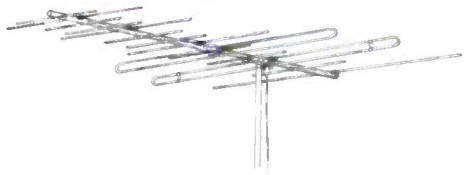
The Bonanza Super Chief is an all channel antenna SUPER POWERED for deep fringe areas. The new tri-flector reflector system provides maximum front-to-back ratio. Structural ruggedness is increased with the new boom brace and longer lasting peak performance and beauty is assured with Antennacraft's dura-gold finish.

MODEL B59G ONLY $39.95



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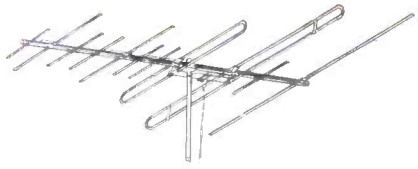

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MODEL B57G ONLY $24.95

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MODEL B52G ONLY $17.95

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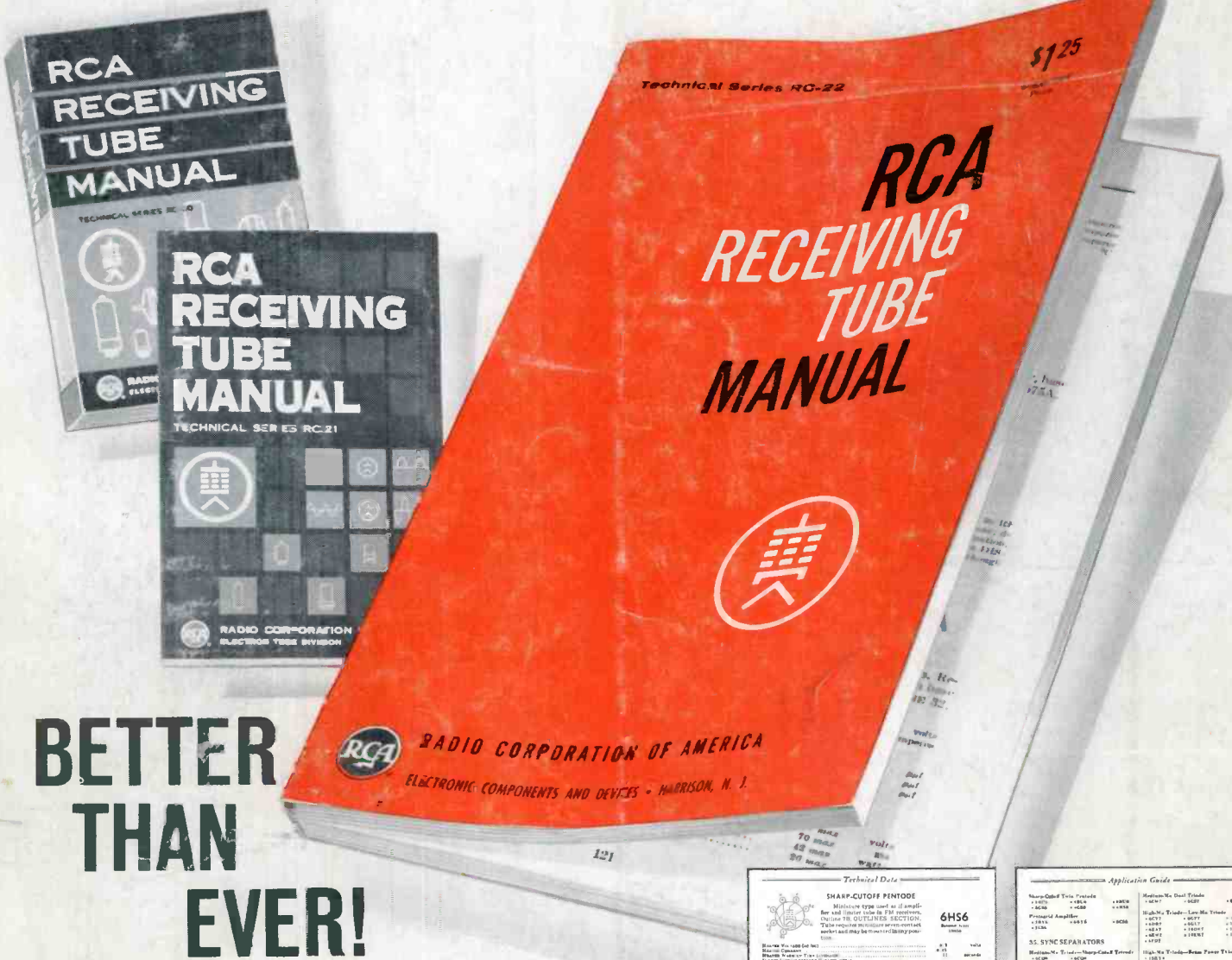

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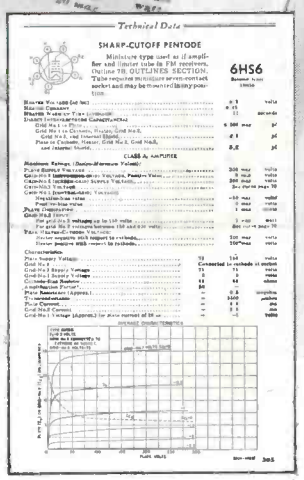

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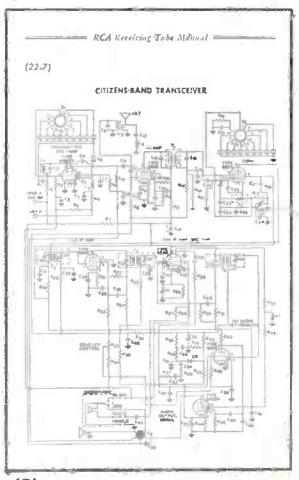

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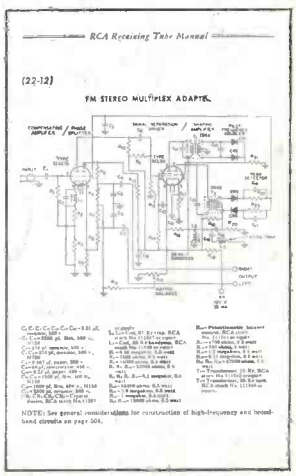

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