

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION



- Roaring CB Business
- Repair That Microphone!
- Volume Limiting
- Narrow-Band FM Maintenance



JANUARY 1965

Any type of TV lead-in...

BELDEN makes it!

Your **BELDEN** distributor has it!



PERMOHM* 8285 . . . excellent for color TV. Gives stronger, clearer UHF and VHF signals under conditions of extreme salt spray, industrial contamination, rain, and snow. 300 Ohm.



WELDOHM 8230 . . . resists pulling, whipping, twisting. Weldohm has two and a half times the flexing life, and one and a half times the breaking strength of ordinary 300 ohm lead-in.



COAXIAL TRANSMISSION LINES—RG/U AND FOAM RG/U TYPES . . . low-loss signal transmission for multiple TV installations such as motels.



STANDARD 300 OHM LINE 8225 . . . low losses at high frequencies. Well suited for use with FM receiving antennas.

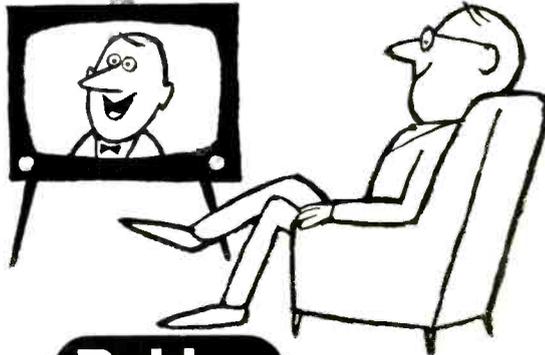


CELLULINE* 8275 . . . installs easily . . . no end sealing necessary. Has excellent resistance to sun, abrasion, and wind. Delivers strong UHF and VHF signals. 300 Ohm.



DECORATOR CABLE 8226 . . . for interiors . . . neutral color blends into decor of any room. No dark brown color to contrast with light carpets or walls. 300 Ohm.

Your Belden distributor has a complete line of Belden TV lead-in cable . . . in standard lengths for easy handling. He also carries microphone and shielded power supply cables; hi-fi, stereo, and phonograph cables; power supply cords; multi-conductor portable cordage; antenna rotor cables; hook-up wire; TV and cheater cords; aluminum ground wire . . . plus many other related items.



Better Built . . . Better Buy . . .

Belden
WIREMAKER FOR INDUSTRY
SINCE 1902 - CHICAGO

WELDOHM, PERMOHM, CELLULINE are Belden Trademarks
Reg. U.S. Pat. Off. *Belden Patents U.S. 2,782,251 and 2,814,666

8-9-3

cord sets and portable cables • electrical household cords • magnet wire • lead wire • automotive wire and cable • welding cable
- - - for more details circle 14 on post card

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SEVEN NEW SETS

Schematic No.

MOTOROLA TV Chassis TS-589	899	TRUETONE TV Chassis Models 2DC1501A and 2DC1501B	894
PHILCO Color TV Chassis 15M91	898	UNITED SCIENTIFIC LABS Citizens Band Transceiver	896
RAYTHEON Two-way Encoder/Decoder	895	Contact 23	
SETCHELL-CARLSON TV Chassis 401	897	WESTINGHOUSE Color TV Chassis V-2476-1	900



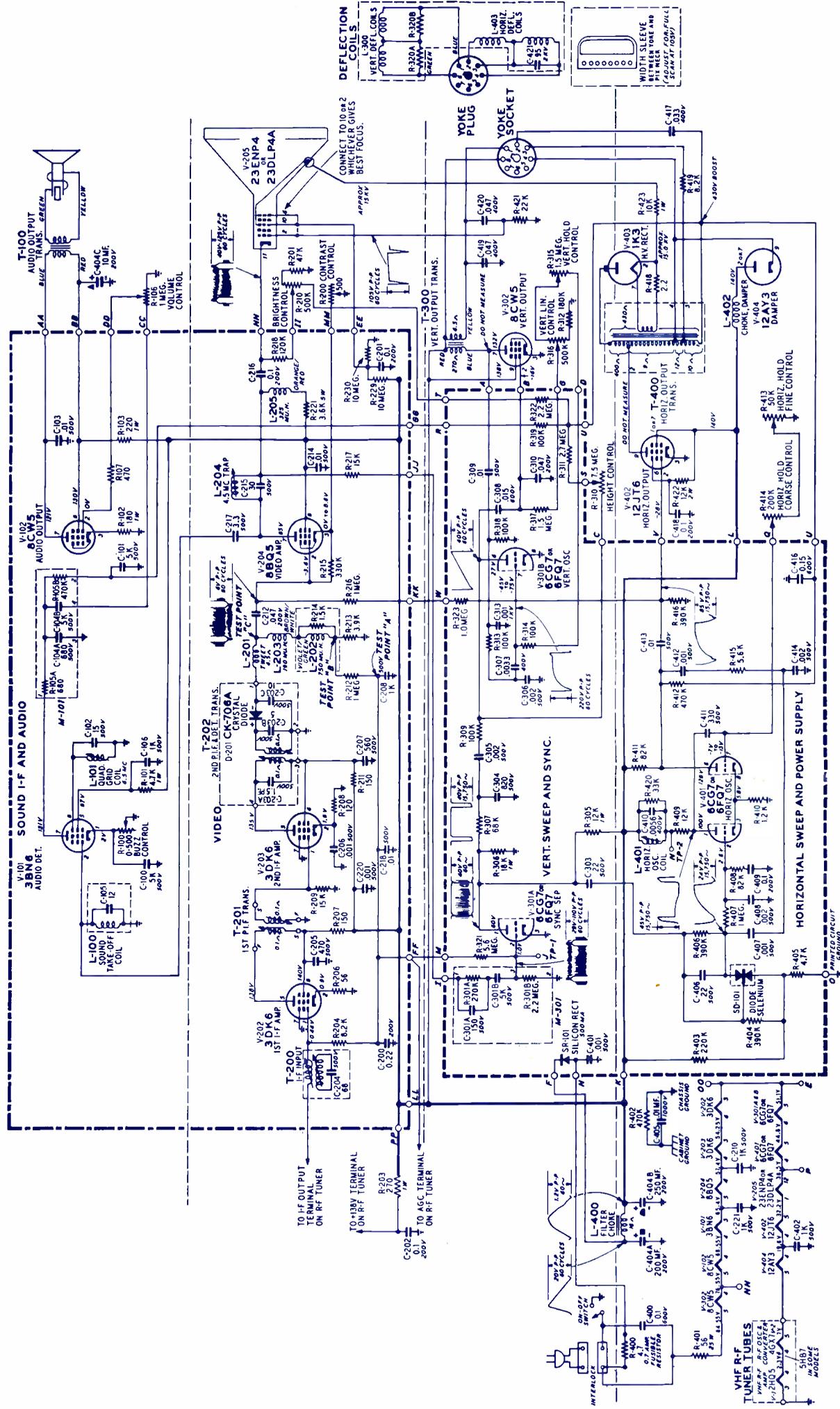
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SEVEN NEW SETS

OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms shown on the schematic diagram are as observed on a Tektronix type 524D wide band television oscilloscope with the receiver tuned to a reasonably strong signal and a normal picture. The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequency accompanying each waveform indicates the repetition rate of the waveform not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown on the schematic diagram and the amplitude of any high frequency pulse will tend to be less.

DC SOCKET VOLTAGES

All DC socket voltages shown on the schematic are measured with a high impedance VTVM and under zero signal conditions.



SCHEMATIC IS DIVIDED INTO FOUR SECTIONS
WITH EACH SECTION HAVING ITS OWN
SERIES OF REFERENCE NUMBERS.
ALL RESISTANCE VALUES IN OHMS
AND HALF WATT UNLESS OTHERWISE
SPECIFIED.
ALL CAPACITANCE VALUES LESS THAN
1.0 IN MF. AND ABOVE 1.0 IN PF.
UNLESS OTHERWISE NOTED.
COIL RESISTANCE VALUES LESS THAN
10 OHM ARE NOT SHOWN.
K=1000

ELECTRONIC TECHNICIAN and
TEKFAK are published monthly by
Electronic Technician, Inc., a sub-
sidiary of Ojibway Press, Inc.,
Ojibway Building, Duluth, Min-
nesota 55802. Single copies, 60c.
Subscription rates: U. S. and Can-
ada, \$5 for 1 yr.; \$8 for 2 yrs.;
foreign countries, \$9 for 1 yr.;
\$14 for 2 yrs.; \$18 for 3 yrs.
Second class postage paid at Wa-
seca, Minn. and at additional
mailing offices. POSTMASTER:
Send notification form 3579 to
ELECTRONIC TECHNICIAN, Ojib-
way Building, Duluth, Minnesota
55802.

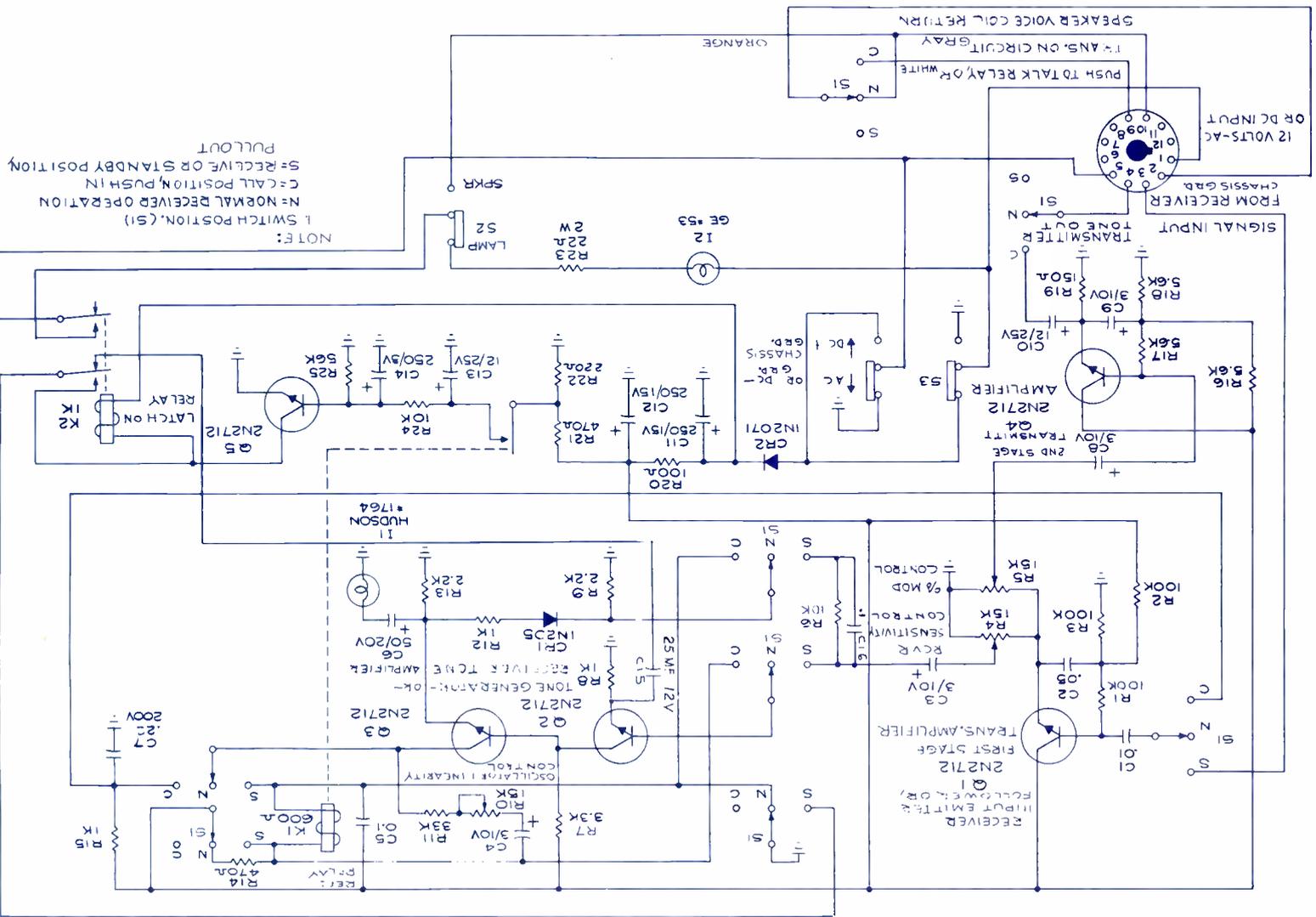
895

RAYTHEON
Two-way Encoder/
Decoder

ELECTRONIC TECHNICIAN TEKFAAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SEVEN NEW SETS

January 1965



COPYRIGHT 1965 BY ELECTRONIC TECHNICIAN

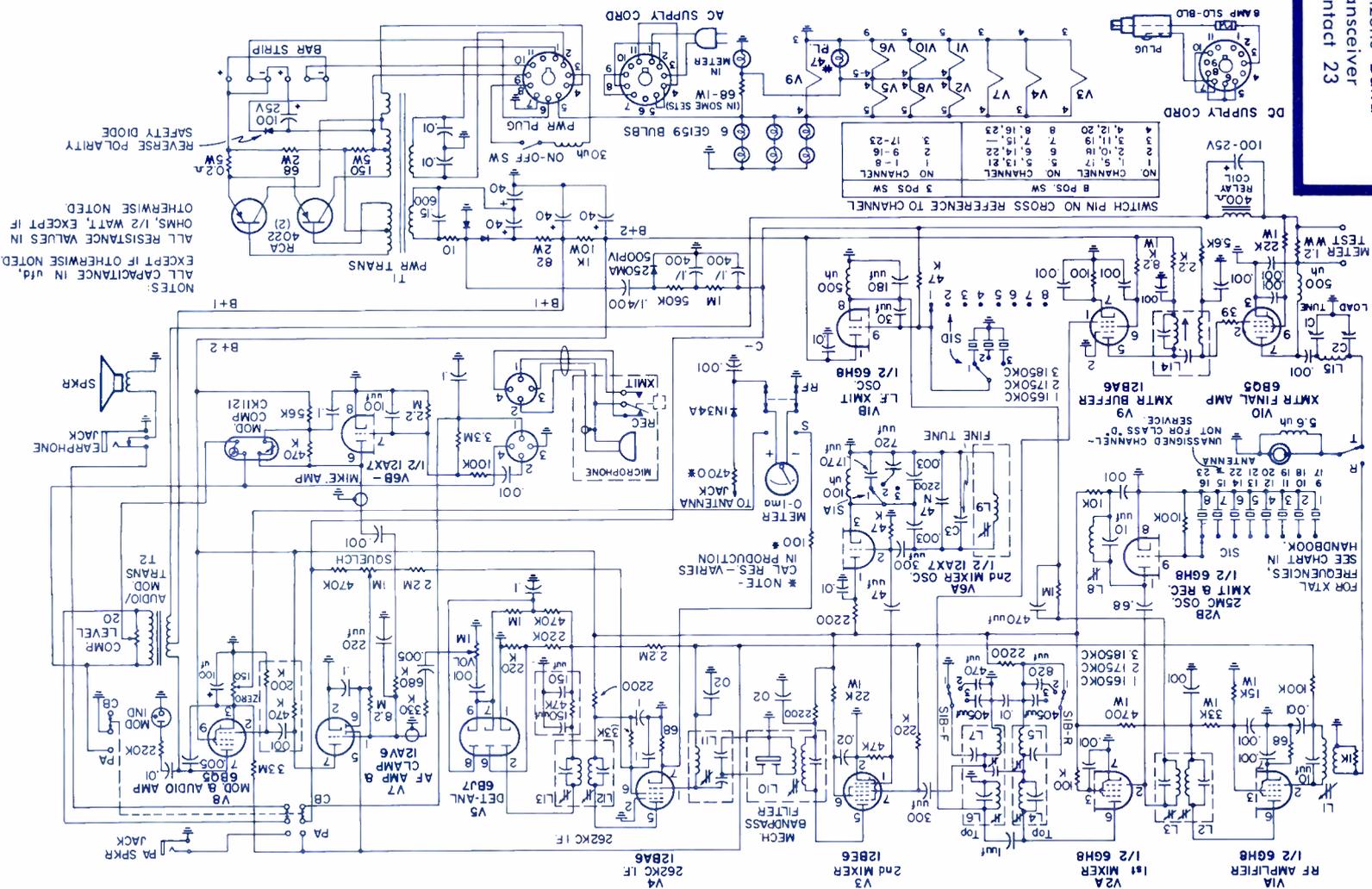
896

**UNITED
SCIENTIFIC
LABS**
Citizens Band
Transceiver
Contact 23

ELECTRONIC TECHNICIAN TEKFAAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SEVEN NEW SETS

January 1965



OLIVEWAY BUILDING, DULUTH, MINNESOTA 55802

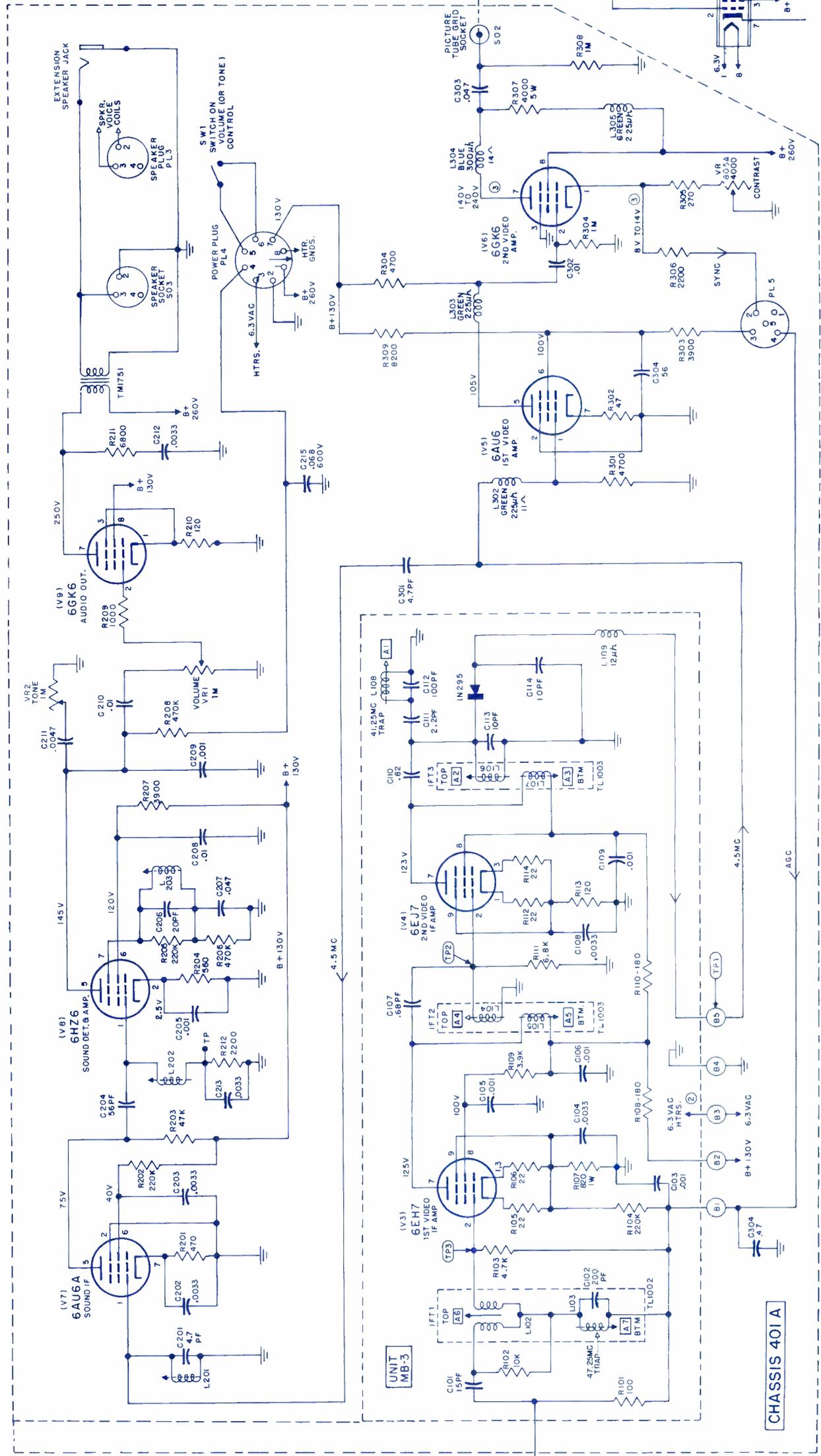
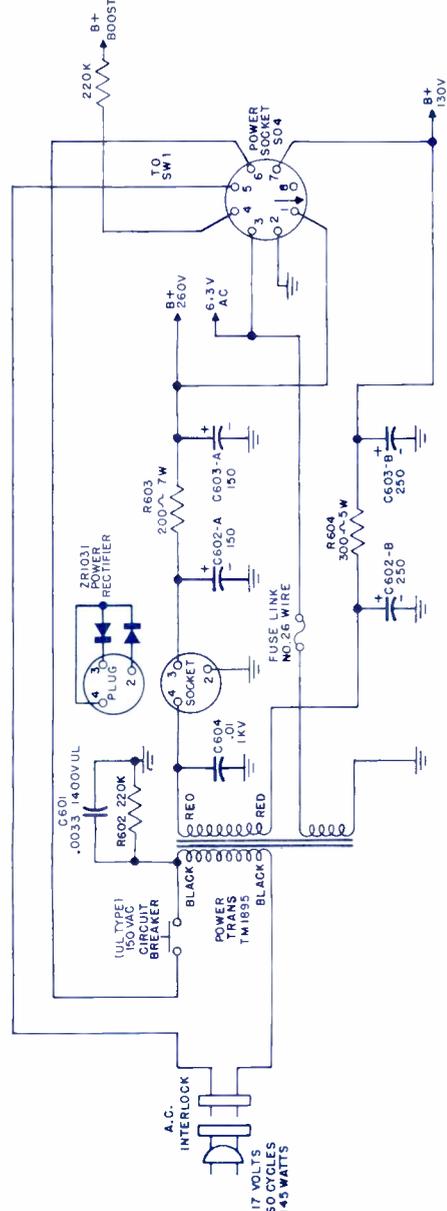
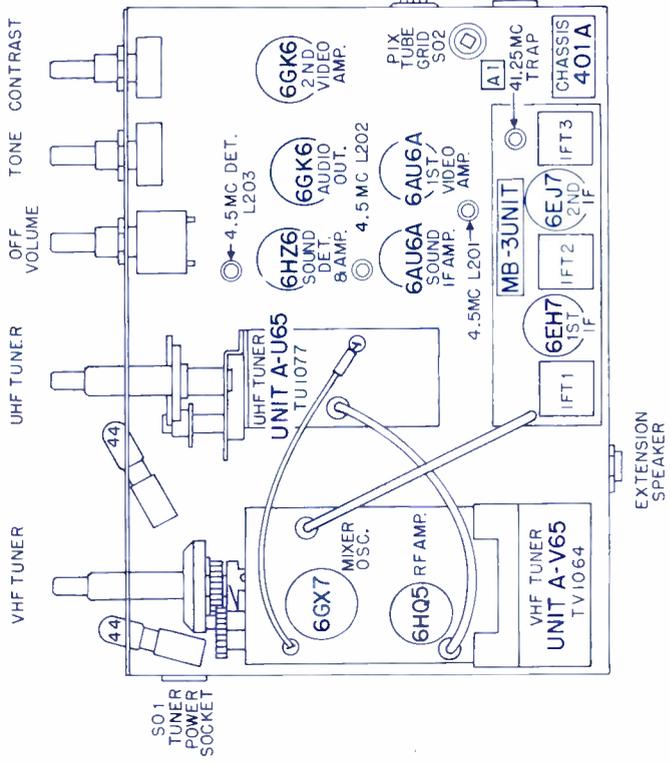
ELECTRONIC TECHNICIAN TRENKFA

897

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SEVEN NEW SETS

**SETCHELL-
CARLSON**
TV Chassis 401

January 1965



More Data on Reverse Side

COPYRIGHT 1965 BY ELECTRONIC TECHNICIAN • OJIBWAY BUILDING, DULUTH, MINNESOTA 55802

ELECTRONIC TECHNICIAN

TEKFA

898

PHILCO
Color TV Chassis
15M91

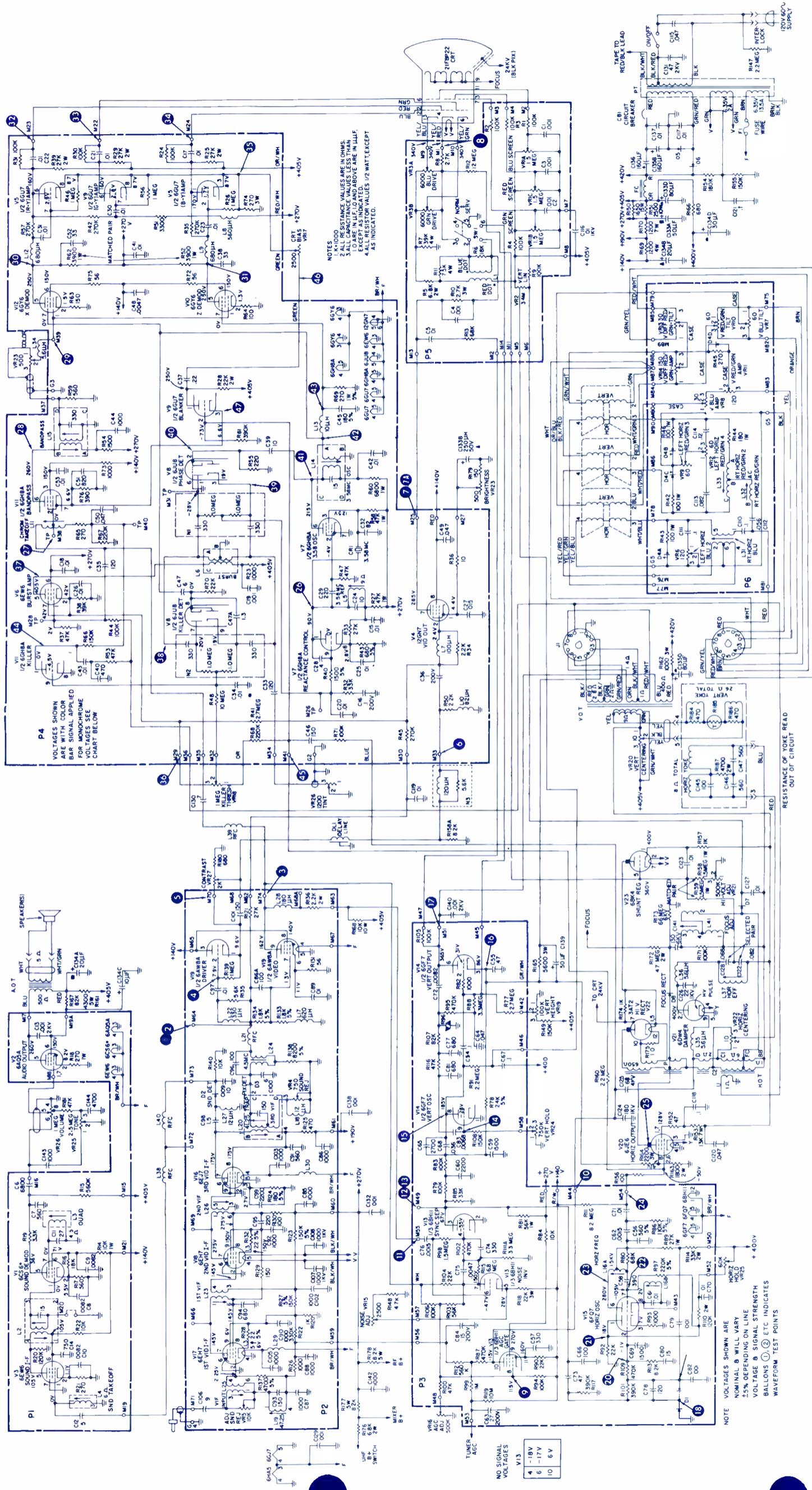
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SEVEN NEW SETS

January 1965

MONOCHROME VOLTAGES (PN) CHROMA PANEL

TUBE & USE	PIN NUMBERS									NO SIGNAL			
	1	2	3	4	5	6	7	8	9				
V1 12D97 Video Out.	4 BV	2 BV	OV	FIL	FIL	285V	140V	OV	1	5V	7	320V	
V5 6G07 (E-Y) Amp. & (S-Y) Amp.	160V	2 BV	8.7V	FIL	FIL	160V	2.5V	8.7V	OV				
V6 6E6 Burst Amp.	1V	44V	FIL	FIL	420V	275V	44V						
V7 6BH8 3.5MC Osc. & React. Cont.	92V	-4.1V	127V	FIL	FIL	220V	OV	2.8V	OV	9	1.7V		
V8 6J8 Killer Det. Phase Det.	-11V	OV	11.5V	FIL	FIL	OV	-5.5V	OV	5.1V	1	1.5V	3	48V

TUBE & USE	PIN NUMBERS									NO SIGNAL			
	1	2	3	4	5	6	7	8	9				
V9 6G07 (R-Y) Amp. & Blaster	250V	-80V	3 BV	FIL	FIL	160V	2.8V	9.5V	OV	7	155V	3	8V
V10 6BY6 Z Demod.	OV	1.3V	FIL	FIL	255V	158V	OV			6	235V	6	3V
V11 6BH8 Killer & Bandpass	-1.4	5V	8 BV	FIL	FIL	275V	3.6V	OV			1	1V	
V12 6BY6 X Demod.	OV	1.5V	FIL	FIL	260V	160V	OV						



899

MOTOROLA

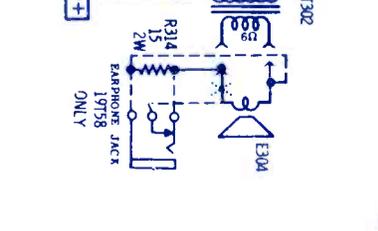
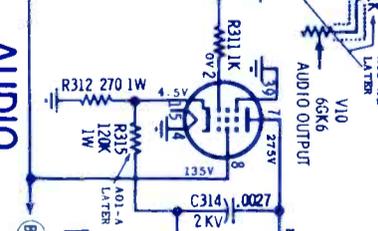
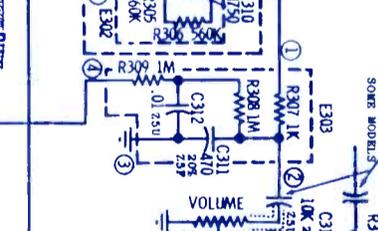
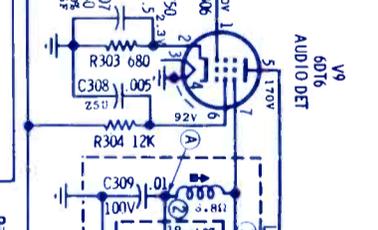
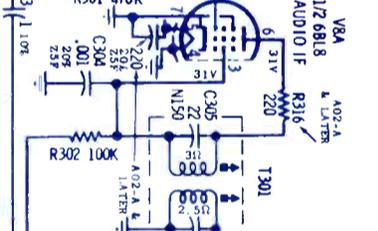
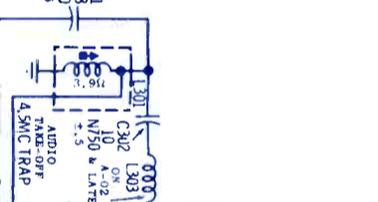
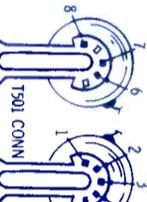
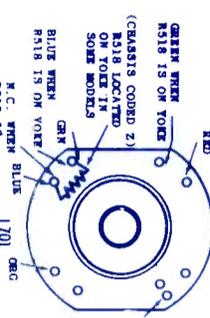
TV Chassis TS-589

TEKTRAX

COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SEVEN NEW SETS

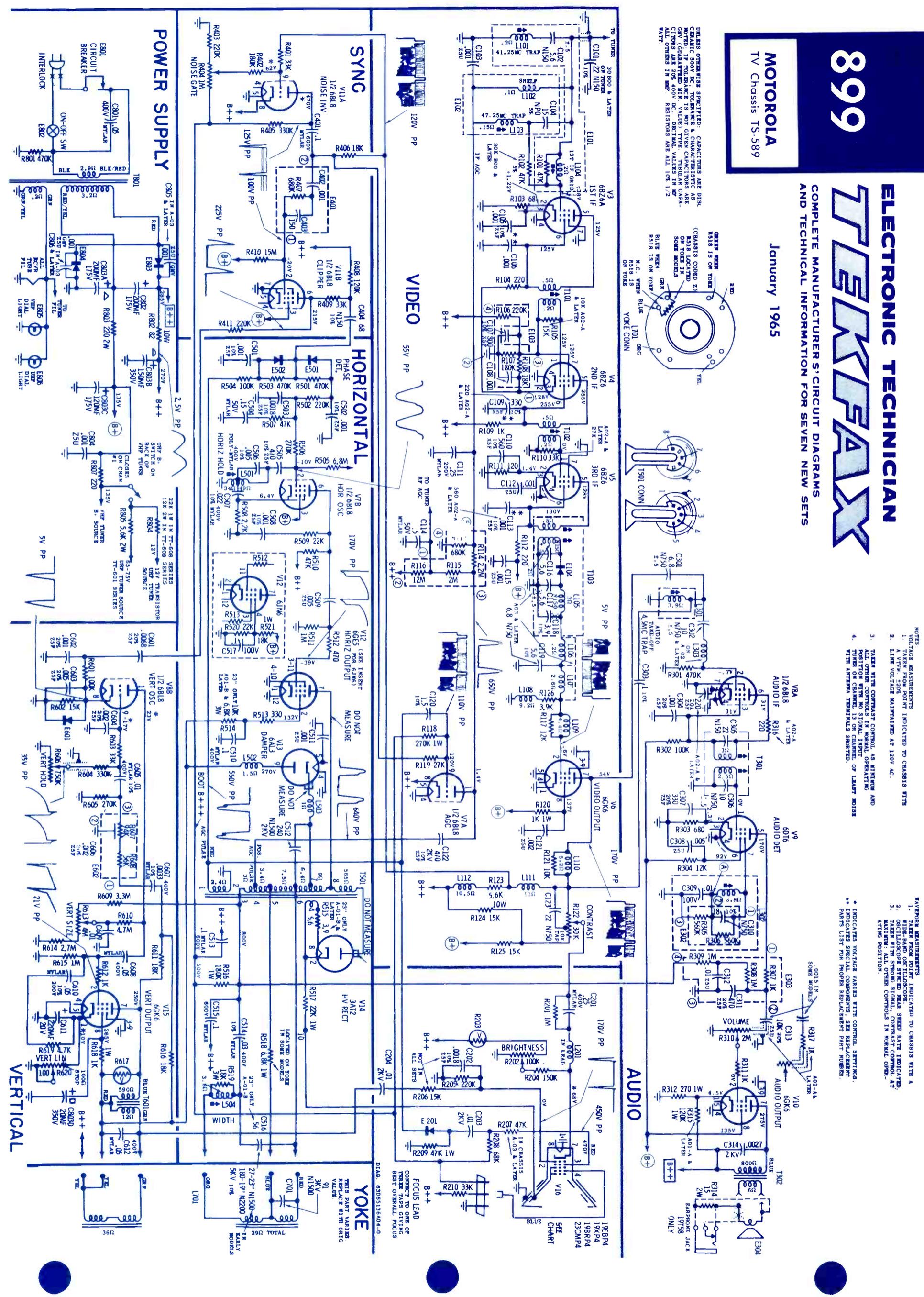
January 1965

UNLESS OTHERWISE SPECIFIED: CAPACITORS ARE DISK CERAMIC 500V DC TOLERANCE & CHARACTERISTIC AS NOTED; IF TOLERANCE IS NOT GIVEN CAPACITORS ARE 50V (GUARANTEED MIN. VALUE) TYPE; TUBULAR CAPS. C/TURNS ARE 25% 400V DC; DIAL VALUES IN μ F ALL OTHERS IN MMF. RESISTORS ARE ALL 1/2 W.



- NOTES
- VOLTAGE MEASUREMENTS: INDICATED TO CHASSIS WITH A 100K OHM OSCILLOSCOPE
 - IF SIGNAL INPUT POSITION WITH NO SIGNAL INPUT
 - IF SIGNAL INPUT POSITION WITH NO SIGNAL INPUT
 - IF SIGNAL INPUT POSITION WITH NO SIGNAL INPUT
 - IF SIGNAL INPUT POSITION WITH NO SIGNAL INPUT

- NOTES
- VOLTAGE MEASUREMENTS: INDICATED TO CHASSIS WITH A 100K OHM OSCILLOSCOPE
 - IF SIGNAL INPUT POSITION WITH NO SIGNAL INPUT
 - IF SIGNAL INPUT POSITION WITH NO SIGNAL INPUT
 - IF SIGNAL INPUT POSITION WITH NO SIGNAL INPUT
 - IF SIGNAL INPUT POSITION WITH NO SIGNAL INPUT



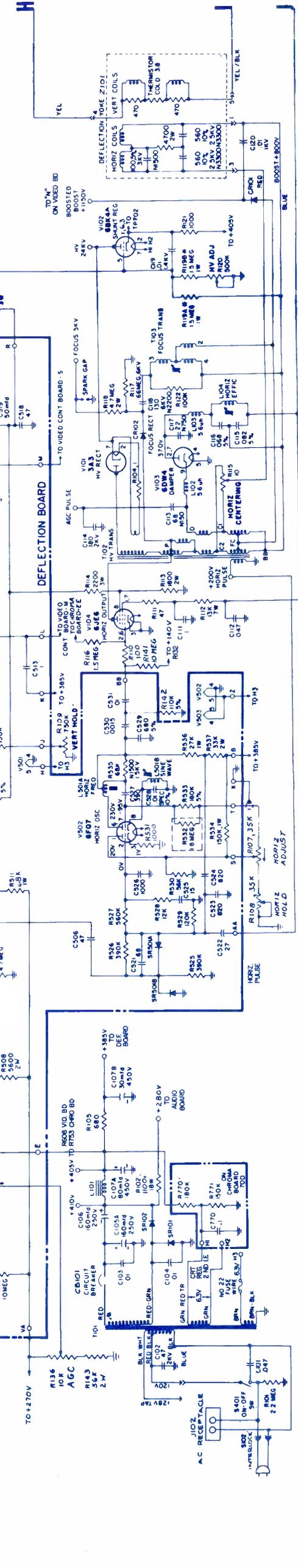
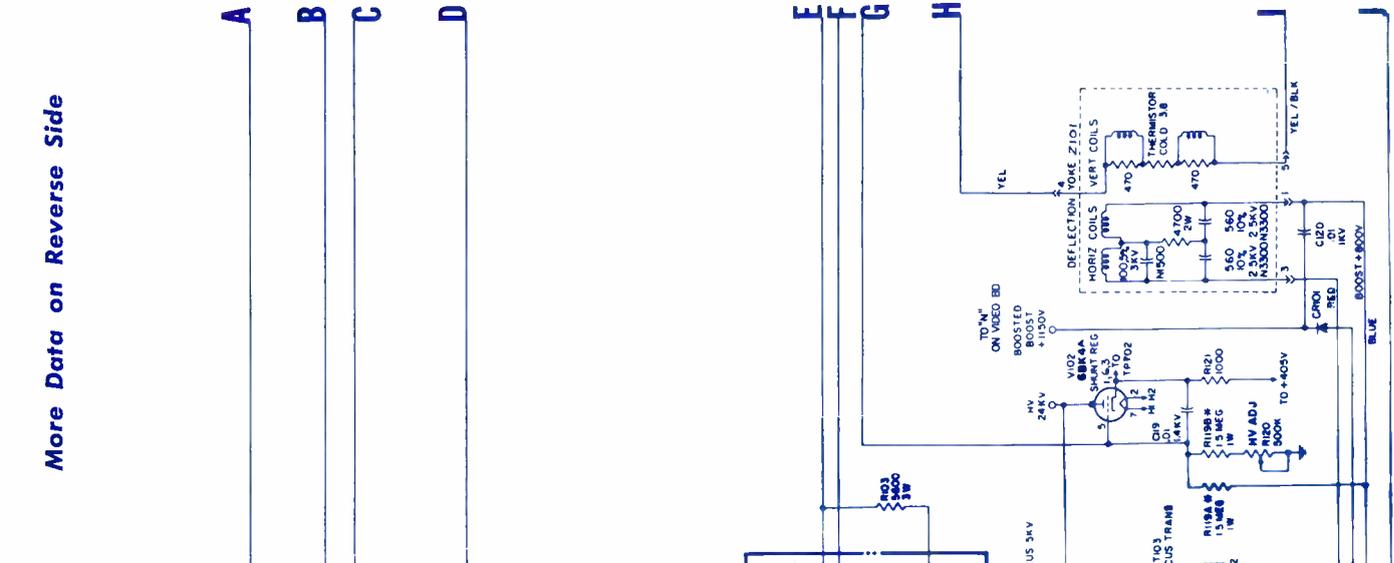
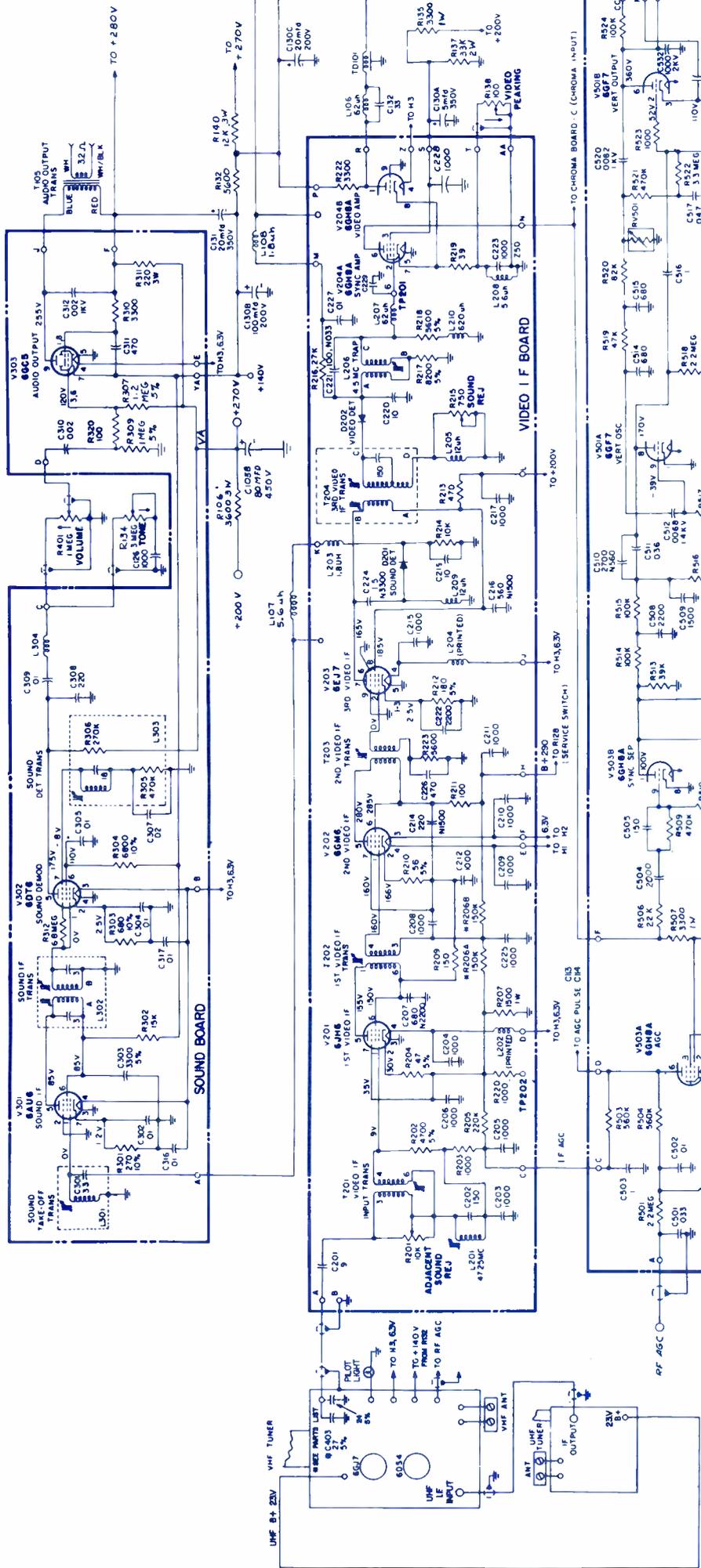
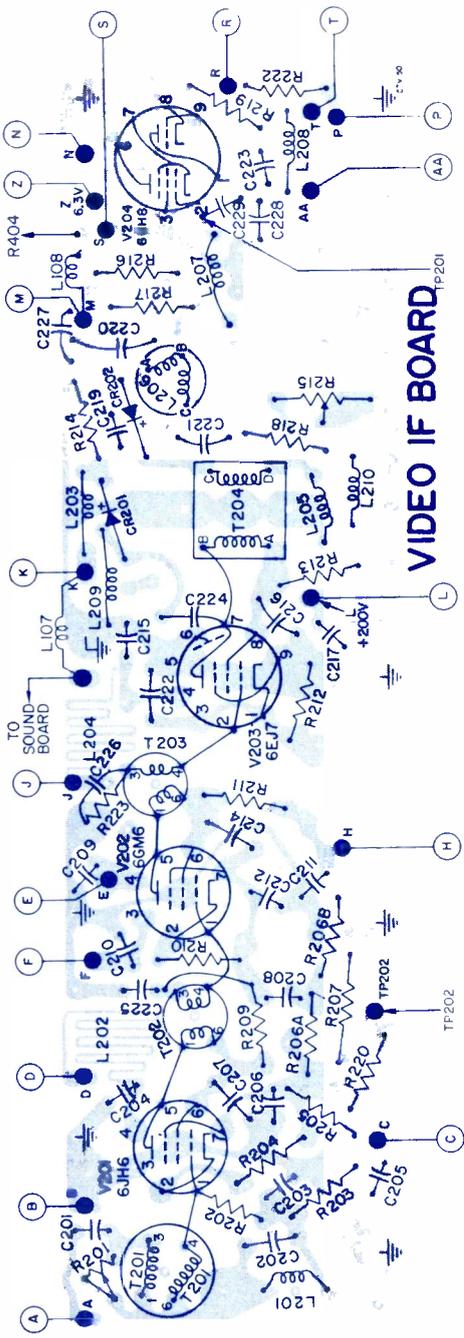
ELECTRONIC TECHNICIAN TEKFAK

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR SEVEN NEW SETS

January 1965

900

WESTINGHOUSE
Color TV Chassis
V-2476-1



More Data on Reverse Side



4 good reasons that spell **QUALITY** and **SERVICE...**

1.

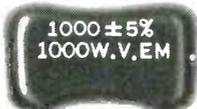
ARCOLYTIC superior quality electrolytic capacitors are made of 99.99% pure aluminum foil... designed to operate at 85°C, and withstand high ripple and surge voltages. All are made and tested to EIA RS-154. Premium grade materials and construction make Arcolytics last longer... on the shelf... and in the set! Over 1400 values to meet all requirements for tubular and twist-mount electrolytics — single, dual, triple or quadruple capacitance in voltage combinations for radio, tv and industrial electronics. All unconditionally guaranteed! No extra charge for this high quality.

2.



ELMENCO Dipped Mylar-Paper (DP) capacitors give missile quality at commercial cost. Over 100 million are now in use. Whether for radio-TV repairs or critical industrial circuitry, reliable, dependable, rugged Elmenco capacitors eliminate profit-killing call-backs 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.

3.



ELMENCO High Voltage Dipped Silvered Micacs are solidly impregnated with corona resistant material. They operate to 125°C compared with 85°C for older molded silvered types. Greatly reduced size and radial leads make them ideal for printed circuit use. Extra reliability is assured through maximum moisture resistance. Capacitance, tolerance and working voltage are stamped on every unit.

4.



ARCO general purpose Type CCD ceramic disc capacitors have improved ceramic bodies which assure longer life and greater stability. The standard CCD line has a $\pm 10\%$ tolerance and 1000 VDCW rating. It makes possible a single ceramic disc stock for universal use. The "space-saving" size of Arco discs is another feature designed to offer greater service convenience with complete safety of operation. Higher voltage ratings are available upon request.

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

ARCO

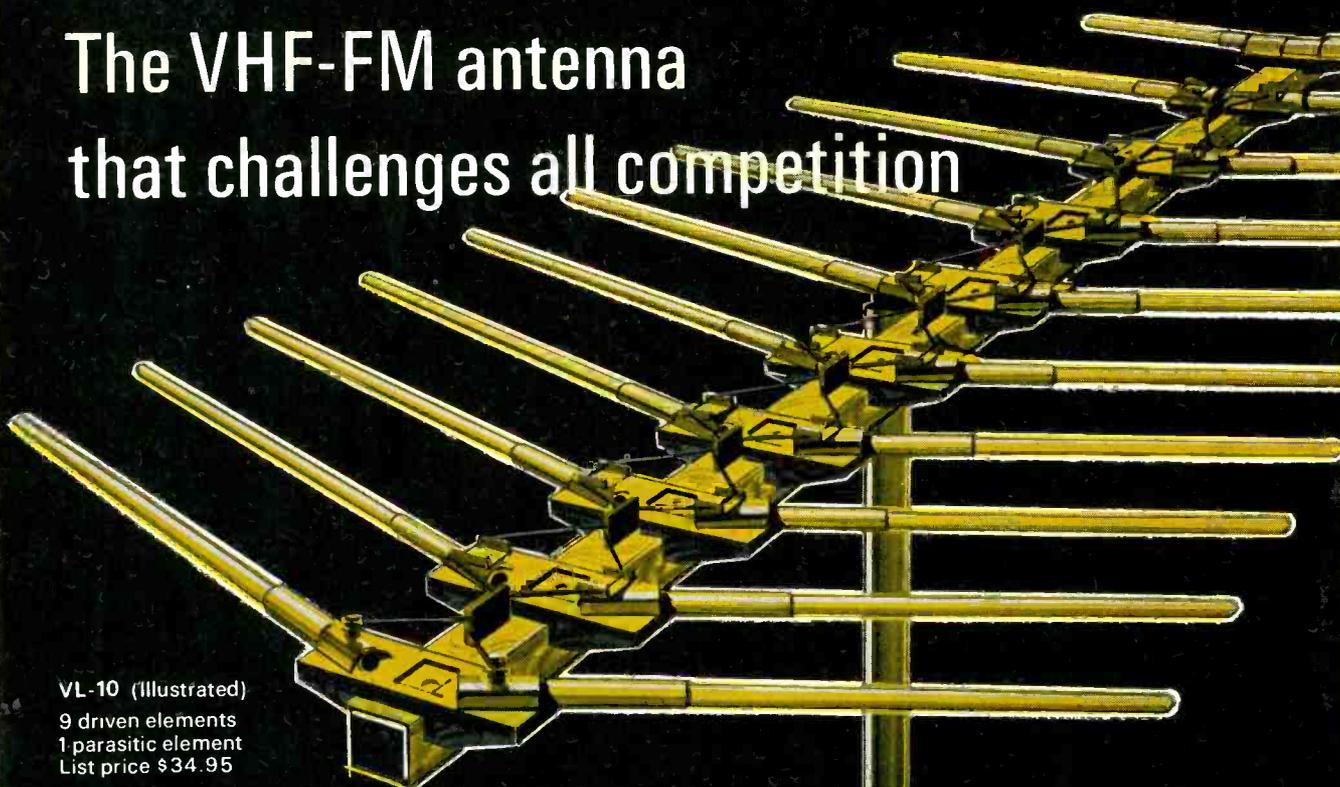
electronics inc.

A LORAL SUBSIDIARY

COMMUNITY DRIVE, GREAT NECK, N.Y. 11022

516-487-0500

The VHF-FM antenna that challenges all competition



VL-10 (Illustrated)
9 driven elements
1 parasitic element
List price \$34.95

NEW **FINCO**® *Swept Element* "COLOR-VE-LOG" VHF-FM ANTENNA

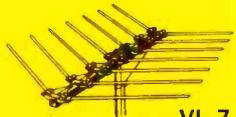
Finco's Color Ve-Log challenges all competition on color or black and white reception and stands behind this challenge with a "Guarantee of Supremacy". The swept element design assures the finest in brilliant color and sharply defined black and white television reception – as well as superb FM monaural and stereo quality. FINCO precision-engineered features make these advanced-design antennas indispensable to good home sight-and-sound systems. And, of course, they carry the famous unconditional guarantee from the leading manufacturer in the field – FINCO. Promote the Color Ve-Log Antennas with pride, sell them with confidence, and profit handsomely.

Featuring Finco's Exclusive Gold Corodizing



VL-5

5 element VHF-FM
5 driven elements
List price \$16.95



VL-7

7 element VHF-FM
7 driven elements
List price \$23.95



VL-15

15 element VHF-FM
9 driven elements
6 parasitic elements
List price \$46.95



VL-18

18 element VHF-FM
9 driven elements
9 parasitic elements
List price \$54.50

The FINNEY Company • 34 W. Interstate Street • Bedford, Ohio

Write for color brochure #20-307, Dept.

... for more details circle 27 on post card
ELECTRONIC TECHNICIAN

JANUARY 1965
VOL. 81 NO. 1

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

Cover

You'll learn all about our cover this month by turning to page 82.

FEATURES

This Roaring CB Business 39

Jack Catterall reviews a two-way medium that offers a rare opportunity to diversify profitably

Trends in CB Servicing 42

Ken Dawes explains what the switch to silicon transistors and module structures is doing for 2-way repair techniques

Volume Limiting in Communications 44

Tom Haskett tells all about communications clipper circuits

Servicing 2-way Narrow-Band FM Equipment 46

How to select test and measurement equipment to meet FCC regulations

Give Your 2-way Customers a Break! 48

Joe Jatis begins an important series on maintaining communications equipment

Communications Microphones 49

Larry LeKashman says 'what you don't know about microphones can hurt your 2-way business'

Repair that Microphone 52

Bob Hite gives detailed maintenance procedures for mike cards, interiors and switches

The Selective Radio-Paging Boom 55

What 'men-on-the-move' are wearing today

What You'll Find in 1965 TV Sets 56

Final installment covering new TV circuit innovations

DEPARTMENTS

Letters to the Editor 22	'Tough Dogs' 58
Editors' Memo 26	New Products 60
Sync on Business 30	News of the Industry 80
Technical Digest 32	Advertisers Index 84

TEKFAX 16 PAGES OF THE LATEST SCHEMATICS

MOTOROLA: TV Chassis TS-589

PHILCO: Color TV Chassis 15M91

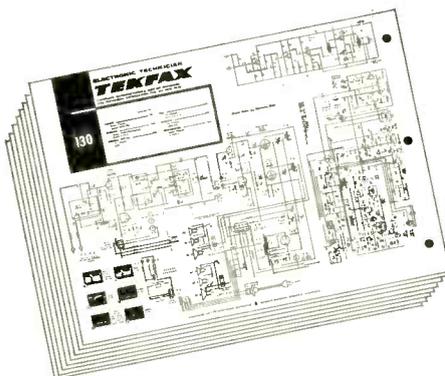
RAYTHEON: Two-way Encoder/Decoder

SETCHELL-CARLSON: TV Chassis 401

TRUETONE: TV Chassis, Models 2DC1501A and 2DC1501B

UNITED SCIENTIFIC LABS: Citizens Band Transceiver, Contact 23

WESTINGHOUSE: Color TV Chassis V-2476-1



RON KIPP Publisher
JACK HOBBS Managing Editor
QUINTO BOCCHI Technical Editor
DOUGLAS HEDIN Industrial Editor
JOHN BAILEY Assistant Editor
ERNEST BLUM Assistant Editor
MARY CONNORS Production Manager
MAGGIE KANE Advertising Production
JIM GHERNA Art Director
RUTH GELINEAU Circulation Fulfillment



AN OJIBWAY
PUBLICATION

OJIBWAY PRESS, Inc.

Ojibway Building, Duluth, Minn. 55802

AREA CODE 218 727-8511

ADMINISTRATION:

MARSHALL REINIG President
ROBERT EDGELL Executive Vice President
DEAN MYHRAN Vice President
GREGORY BLODGETT Treasurer
BEN MARSH Editorial Director
HARRY RAMALEY Production Director
JOE WOLKING Circulation

Sales Offices:

NEW YORK: Ron Kipp, 25 W. 45 St.,
New York, N.Y. 10036
AREA CODE 212 581-4200

CHICAGO: William Klusack, 221 N.
LaSalle St., Chicago, Ill. 60601
AREA CODE 312 CE 6 1600

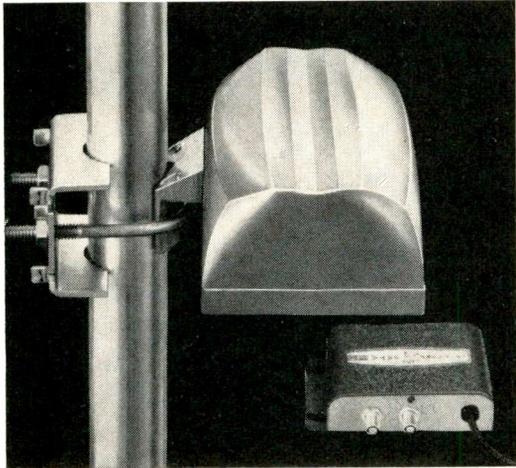
LOS ANGELES: Boyd B. Garrigan, 1655
Beverly Blvd., Los Angeles, Calif.
90026
AREA CODE 213 MA 8-8556



Copyright 1964 by Ojibway Press, Inc., Duluth, Minn. 55802. Reproduction and reprinting prohibited except by written authorization of the publication. Subscription prices: \$5 for 1 year, \$8 for 2 years, \$10 for 3 years. Foreign, \$9 for 1 year, \$14 for 2 years, and \$18 for 3 years.

If you have a change of address or a question about your subscription, write: ELECTRONIC TECHNICIAN, Circulation Department, Ojibway Building, Duluth, Minnesota 55802. BE SURE TO SEND ALONG THE ADDRESS LABEL FROM YOUR MOST RECENT ISSUE.

"A professional quality TV system priced for the home?"



"Try this!"

"I understand that professional TV systems use 75 ohm coax."

"That's right. Because coax minimizes interference and ghosting."

"How's that?"

"It's shielded—doesn't pick up noise. Also, it's unaffected by changing weather conditions.

With 300 ohm twinlead, moisture can play havoc with the signal."

"So, that's it."

"What's more, you can feed coax thru all types of surfaces, even near metal, without interfering with performance."

"I'd like to have a system with TV outlets all over the house—bedrooms, kitchen and patio."

"The new two-transistor Blonder-Tongue Vamp 2-75 is easy to install and it can deliver sharp, clear pictures to as many as 8 TV outlets."

"Sounds real professional. What about the cost?"

"The rugged, weatherproof amplifier with remote power supply lists for only \$44.95."

"I'm on my way to my dealer."

(This message was paid for out of the gross profits of BLONDER-TONGUE, 9 Ailing St., Newark 2, N.J.)



- - - for more details circle 17 on post card

LETTERS TO THE EDITOR

Needs Tester Schematic

I have a Shell S10 tube checker made by the Shell Electronic Mfg. Co., addressed as 1688 Utica Avenue, Brooklyn, N.Y. They have evidently gone out of business. Does anyone have a schematic I could buy or borrow? I would even consider sending the tester to a competent and reputable repair center.

JAMES C. MAYS

Dade City, Fla.

Needs Scope Info

I need information on a scope. It was made by the Triumph Manufacturing Co. (which I understand is no longer in business) of Chicago, Ill. Model number is OBL-3 and the serial number is 2928. I need a schematic.

EDWARD G. SHANDER

Mt. View, California

Needs Help Too

Can any of your readers tell me where I can find a schematic for a Link two-way mobile receiver, 11UF ED-70 and for a link transmitter, type 35UFM-ED7A.

HUBERT HALL

Tucson, Arizona

Something's Missing

Is a connecting wire missing in Fig. 1, page 62 of your October issue? I can't see how this circuit would work without a connection from the negative side of VBB to the emitter. Would appreciate an explanation.

G. B. CONNER

Kenmore, N. Y.

You are only one of many who asked the same question. The connection did appear in the author's original drawing. Our artist inadvertently left it out. —Ed.

Improved Hint

The shop hint by Bob Hutson in November ET can be simplified even further. Any tube with the proper basing, heater voltage and current, can be substituted by clip-

Have you tried new **QUIG**[®] connectors?

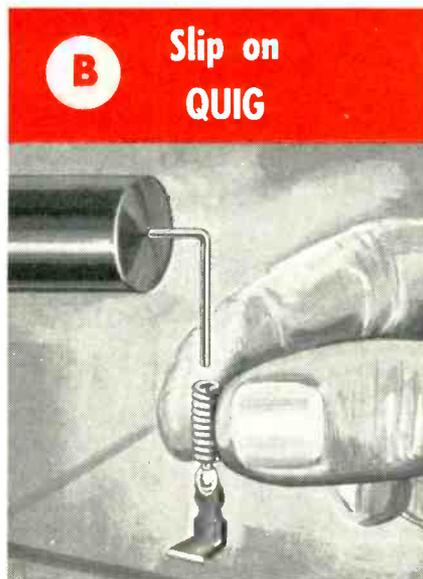
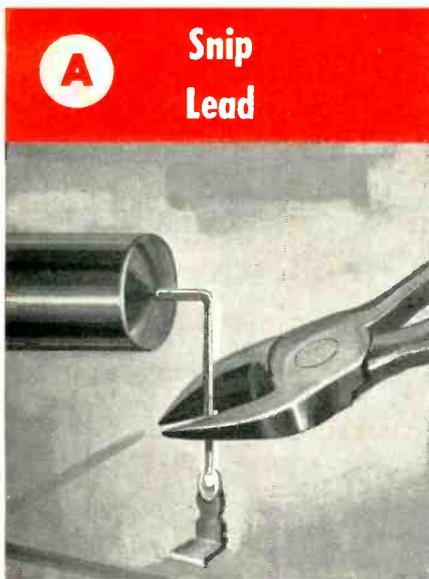
Not just another wire spring connector!
The 3-in-1 QUIG is brand new and different . . . Cop-
perweld wire inner core, a layer of flux, and an
outer jacket of solder . . . all you need is heat!
Makes one-handed soldering possible!

Once again, Sprague helps the TV-radio service industry by solving two increasingly serious problems . . . parts replacement in those "inaccessible" chassis nooks, such as crowded tube sockets, as well as soldering onto the delicate circuitry of printed wiring boards.

Mechanically sturdy and electrically reliable, the revolutionary QUIG provides fast, expertly-soldered connections as easy as A-B-C!



Ten times
actual size



***NOBODY ELSE HAS QUIG CONNECTORS...
YOU GET 'EM ONLY FROM SPRAGUE PRODUCTS!***

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



WORLD'S LARGEST MANUFACTURER OF CAPACITORS

65-4124

JANUARY 1965

--- for more details circle 49 on post card

23

Devant "1"

The All NEW
DEVANT-1
From MOSLEY

The result of
continuous research
and development to bring you
Superior Quality at a

NEWEST ADVANCE IN CB COMMUNICATIONS

A field tested base station antenna that will equal or outperform anything available on the CB market today. Many of the features of the DEVANT "1" are built into the base section. The vertical element terminates in a phenolic sleeve which has greater strength than the aluminum element. Radials terminate into a high strength "Cyclocac" base, which again, has more strength than the aluminum element. The Coax female connector is part of the (weather-proof) radial support assembly. Antenna mounting is simplified, just mount the antenna on your mast, tighten two screws and lock nuts. Tapering the ends of the aluminum tubing (called swaging) is designed to reduce wind load, and any possibility of vibrations which would cause metal fatigue. Loading and impedance matching of the DEVANT "1" is accomplished with loops of one eight inch aluminum rods.

Available Nov. 1st.

New Low Price

\$22.76

\$14.50



27 Mcs.
CB Mobile Ant.

The Traveling Companion of
the Base Station DEVANT "1"
is the New Mosley DEVANT "2"

This stainless steel mobile antenna has
the world famous Mosley performance.
A slim line beauty with built-in durability.
Cash in on these outstanding engineering efforts
wherever Mosley antennas are sold.

For detailed specifications and performance data on
the DEVANT "1" and / or DEVANT "2"
clip coupon below and mail.

Please send me (FREE of charge & obligation) literature on the following
antennas. DEVANT "1" DEVANT "2"

Name

Address

City/State

Mosley Electronics Inc.

4610 N. Lindbergh Blvd.,
Bridgeton, Mo. 63044

--- for more details circle 42 on post card

LETTERS

TO THE EDITOR

ping all pins with the exception of the two or three heater pins. In most cases, the screen, plate and cathode voltage of this clipped-pin tube will not affect the remaining tube to an appreciable degree. I have been using this method ever since the first series tubes came out years and years ago, and the number of tubes required for my method is not extensive in contrast to Mr. Hutson's method of using different tube types.

HORACE D. WESTBROOKS
Griffin, Georgia

Help!

I am trying to locate Shell Electronic Mfg. Corp., Westbury, N.Y. I have a model 18 tube tester made by them and I need a tube chart. Can any reader help me?

W. H. ROTHENBAUM
Vineland, N. J.

Take Note

In reference to the first part of my article in the October 1964 issue, I would like to point out one minor error on page 58. The caption which goes with the picture of the pushbutton oscillator model 241A is not quite accurate. The model 241A oscillator is power line operated, it's not battery powered.

ARTHUR M. WALTERS
Palo Alto, Calif.

What Does He Offer?

In answer to J. F. White's request, I have extra copies (in mint condition) of 101 and 103 Circuit Digests (TEKFAX). What does he offer?

R. A. BUSS
Burbank, Calif.

Needs Schematic

Where can I get a schematic for a Daco model 303 tube tester? It's made by Dayton Acme Co., Cincinnati, Ohio, apparently out of business.

J. CHANIN
Beulah, Mich.

For window-size blow-ups of this message, send 10¢ to Sprague Products Co., 65 Marshall St., North Adams, Mass., to cover handling and mailing costs.



You'll never see your doctor advertise a special sale on appendectomies . . .
You'll never see your lawyer announce cut-rates for divorce cases . . .
You'll never see your dentist hold a "2-for-1" sale on extractions . . .

AND You'll never see the day when you can take your TV set in for a service "bargain" and be sure you're getting a square deal!

"Bargains" in home electronic service are as scarce as the proverbial hen's teeth! Here's why—

The expert service technician, just like other professional people, must undergo years of study and apprenticeship to learn the fundamentals of his skill. And a minimum investment of from \$3000 to \$6000 per shop technician is required for the necessary equipment to test today's highly complex sets. Finally, through manufacturer's training courses and his own technical journals, he must keep up with

changes that are developing as fast as they ever did in medicine, law, or dentistry. Those best equipped to apply modern scientific methods are almost certain to be most economical for you and definitely more satisfactory in the long run.

Unfortunately, as in any business, there will always be a few fly-by-night operators. But patients, clients, and TV set owners who recognize that you get only what you pay for, will never get gypped. "There just ARE no service bargains" . . . but there is GOOD SERVICE awaiting you at FAIR PRICES!

THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS, FOR . . .

YOUR INDEPENDENT TV-RADIO SERVICE DEALER

65-124-63

. . . for more details circle 50 on post card

**exciting new product!
exciting new profits!**



e.c.i. Courier 23

**EASY TO SELL... EASY TO USE... EASY TO MAINTAIN
2-WAY RADIO FOR THE BOOMING CB MARKET!**

Never before this performance breakthrough! Never before this big chance for you to cash in on the fast-growing 2-way radio market . . . for car, boat, home, business, office. The Courier 23 has unequalled performance with dollar for dollar value others can't match. It features dual conversion, transistor power supply, 23 crystal controlled channels and more features CB users want. It is priced at \$189.50 . . . and that includes all crystals, mounting brackets, power cords and noise-cancelling microphone. Best of all, the Courier 23 is "hot" . . . with wide acceptance everywhere!

CAN YOUR FIRM QUALIFY AS AN AUTHORIZED e.c.i. DEALER?

A sound knowledge of radio and/or communications equipment . . . the desire to install and service this equipment . . . an established business reputation and a good credit rating . . . a real interest in a dynamic new product with dramatic profits. These are the requirements. Write today for details!

**e.c.i. electronics communications inc., Dep't ET-1
56 hamilton ave., white plains, n.y.**

Please send full details on the Courier 23 and an e.c.i. dealership.

name

firm name

address

city zone state

- - - for more details circle 24 on post card

Now's the Time

Most of us wait until January to make plans for the new year. And some of us never have the time to plan at all. Or rather, we never *make* time. But here's something you can't afford *not* to plan for: spring TV-radio and Hi Fi tune ups!

According to reliable information, the gas and oil stations in this country pick up a half-billion dollars every year by promoting spring auto tune ups. And TV-radio service-dealers can do even better.

After March winds have added finishing touches to deteriorated antennas and feed lines, after long winter nights have pushed TV sets a little closer to the failure-brink, after radios and Hi Fis have taken their annual winter beating, you can begin a highly profitable fiscal year by planning your tune-up campaign right now.

First, clean up your shop window soon and put in some new sales aids that you can get from your distributor. Then sit down and work out a "Tune-Up" advertising plan that fits the size of your business and purse. It may mean direct mail — with a brief but definite mouth-watering offer to check and adjust the entire TV installation, Hi Fi and radios; or a series of local radio or TV station spots with an unusual offer to prospects and old customers alike; or just an inexpensive telephone campaign. Some salesmen in the \$25,000-a-year class, you know, do it by phone.

And before we forget, if you go in for direct mail, make the package distinctively *you*. It shouldn't look like anything else that comes in the mail. You can do this with color or distinctive-textured paper or envelopes.

And make sure you have plenty of antennas, masts, feedline, tape, tubes, replacement parts and some other things in stock before you start the campaign.

Now's the time to draft your plan. And if you do it well, you'll end up 1965 far ahead of where you left off 1964—just a few days ago.

16 YEARS AND STILL UP TO DATE

all sockets
conveniently
grouped

checks all
radio & TV
types

sensitivity &
shorts tests
between
elements



angle view
zig-zag
roll chart

fast
pushbutton
sequence
switching

line
voltage
indicator
control

*** FREE**

**NEW TUBE TEST DATA ISSUED REGULARLY -
KEEPS YOU CURRENT BETWEEN ROLL CHARTS**

JACKSON MODEL 648S DYNAMIC TUBE TESTER

Developed over 16 years ago to give the servicemen a tube tester that could be kept up to date without fear of it becoming obsolete in a few short months. A tube tester that was fast and easy to use, while being able to check all radio and TV type tubes. The results are a tube tester that is more profitable. There are over 30,000 servicemen to prove this.

DEALER NET **\$17995**

DON'T BE FOOLED BY INADEQUATE PICTURE TUBE TESTERS



Now a picture tube tester - booster with features wanted most by the TV servicemen. Color keyed - push button operated for ease and speed. Designed to make more accurate tests than any other tester now in existence. Completely versatile for all black and white or color picture tubes. Oh yes! we keep you up to date.

DEALER NET **\$11995**

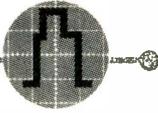
**See These Testers At Your Franchised Distributor
and Ask Him About a Trade-In Deal**

"Service Engineered Electronic Test Equipment"



The Jackson Electrical Instrument Company Dayton, Ohio

--- for more details circle 36 on post card



Sales taxes on TV service in New York is a possibility. Mayor Robert Wagner's finance committee made the suggestion. It would have to be approved by the city council.



Portable microwave equipment is now being used to expand TV program coverage. Solid-state transmitters and receivers made by Microwave Associates were used by ABC/TV, with excellent results, during the Buick Open Golf Tournament. The solid-state transmitter was mounted in a mobile golf cart and covered the event over rough, hilly terrain with full television broadcast quality at all times, a report said.

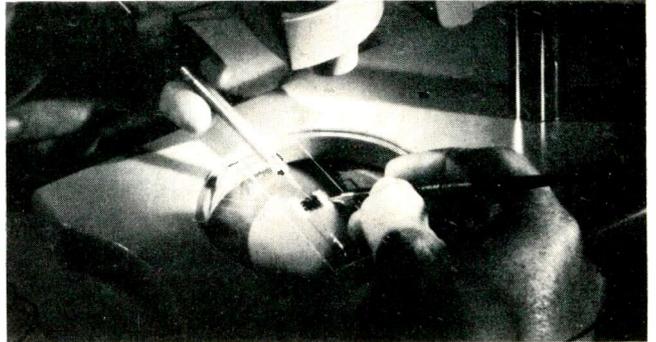


The sho 'n tell phono-viewer, unveiled by General Electric, shows full color pictures in time to words and music. The unit combines a transistorized, four-speed phonograph and a slidefilm viewer with 11 in.

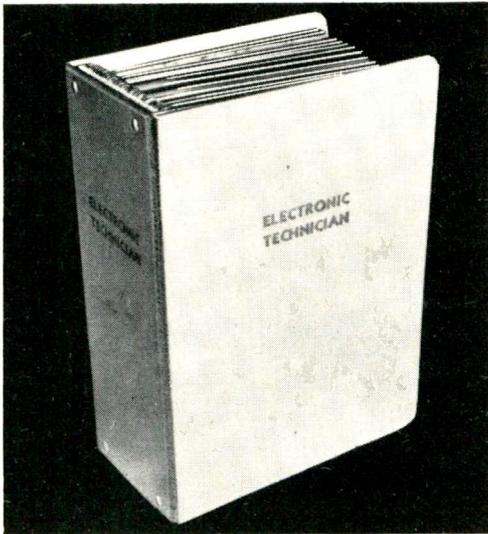
screen. G-E will also produce and market programs, each consisting of an unbreakable vinyl, 7-in., 33 1/3 rpm record and a mounted show film strip. Played together on the phono viewer, they show and tell a complete story with full color pictures changing automatically in time to the sound.



Microprobes for production testing microcircuitry foreshadows the day when technicians will be troubleshooting TVs, radios and Hi Fi equipment composed of a series of miniature or microminiature integrated



circuit modules. A defective module will probably be thrown away and a new one plugged in to complete the repair. These microprobes are manufactured by Circon.



KEEP PAST ISSUES OF ELECTRONIC TECHNICIAN FOR FAST CONVENIENT REFERENCE . . .

in this sturdy hard-cover binder.

You can make your issues of ELECTRONIC TECHNICIAN work for you month after month, year after year when you have past issues bound in this handy rich-looking binder. You'll have past issues of ELECTRONIC TECHNICIAN in perfect, like-new condition at your fingertips — whenever you want to refer to a special article or a particular issue.

To get your copy, just fill out the coupon below.

Note these outstanding features:

- Especially designed for ELECTRONIC TECHNICIAN
- Long-wearing, leather-like cover and back
- Attractive gold leaf embossed
- Handles like a book, just open and turn to any page, any issue
- Holds a full two year's copies
- A full, money-back guarantee

Please send me _____ book binders at \$4.95 each

I am enclosing \$ _____

Name: _____

Address: _____

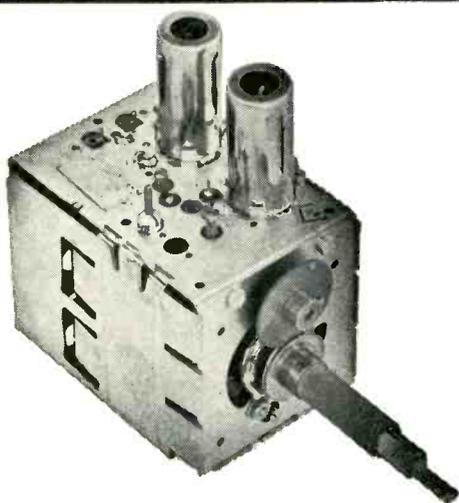
City: _____ State: _____ Zip: _____

I understand that these are fully guaranteed and if I am not satisfied I can return the binder and have my money refunded.

ELECTRONIC TECHNICIAN

Reader Service Department
Ojibway Building
Duluth, Minnesota 55802

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



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

ONLY
\$9.50
INCLUDING

ALL PARTS
 (except tubes)
and LABOR

24-HOUR SERVICE
1-YEAR WARRANTY

**TWO SERVICE CENTERS
 TO SERVE YOU BETTER**

**See your distributor, or use the
 address nearest you for fast fac-
 tory repair service**

**537 South Walnut St.
 Bloomington, Indiana
 Tel: 332-6055**

**10654 Magnolia Blvd.
 North Hollywood, Calif.
 Tel: 769-2720**



A seven foot microphone was one of the many microphones used at the Republican national convention by Electro-Voice. This directional, wide-range microphone was utilized to pick up speech at long distances. Conversations that might otherwise have been lost because a microphone was not available or practical at the particular place needed, were picked up by the Model 643.



An all-wheel drive, Red carpet Series Scout, has been introduced by the International Harvester Company, marking the production of the 100,000th such vehicle. The red carpet series Scout features an all red custom interior with red carpeting, padded door panels and dash. International dealers and branches will make the commemorative vehicle available in their local areas for special community events, parades and festivals.



The value engineering training program of Sylvania Electronic Systems has graduated its 1500th trainee.

Value engineering is an organized government-industry effort directed at analyzing the function of material to achieve its required function at the lowest cost.



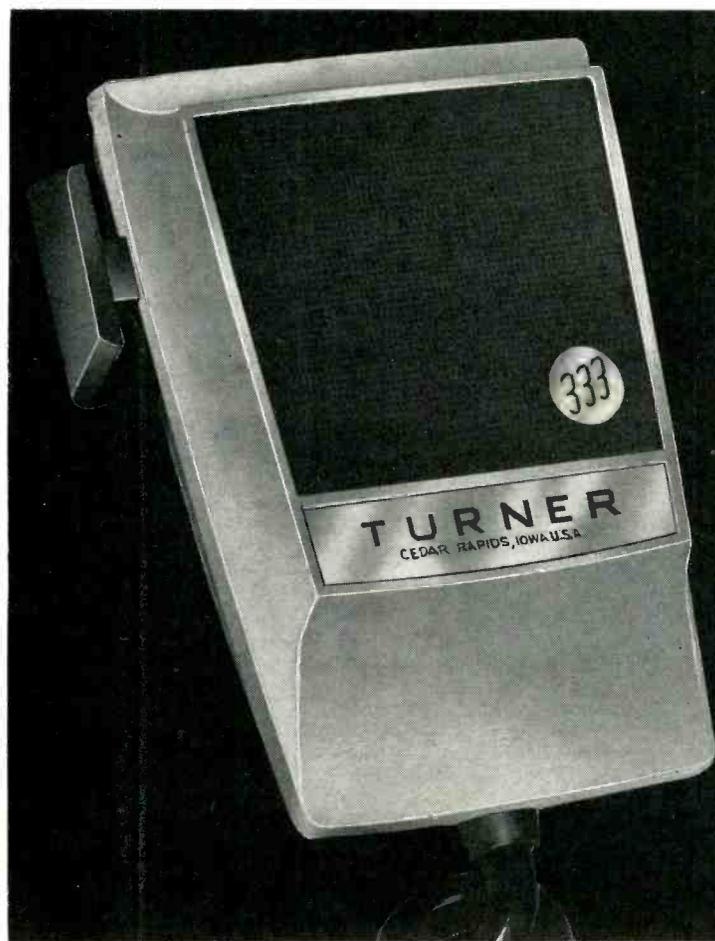
CB and other mobile and base station antennas and accessories are listed in specification sheets available from Master Mobile Mounts, 4125 West Jefferson Blvd., Los Angeles, Calif. 90016.



Service literature covering all Sylvania radio, TV and Hi Fi sets is published by Sylvania. The information is bound in five volumes for 1949 to 1960 sets. Service literature for sets from 1961 to date are punched for binding in three-ring notebooks. The cost for the complete set including a current subscription is only \$23.50. A current subscription covering all releases including preliminary schematics and code changes for radio, TV and Hi Fi is available separately for \$3 a year.



A new school of technology, the Capitol Institute of Technology, has opened in Washington, D. C. It is a nonprofit, three-year school of technology. Students who graduate from CIT will receive the degree of the Associate in Applied Science.



TURNER'S NEW MODEL 333 CB MICROPHONE

**LATEST ADDITION TO THE ONLY
COMPLETE CB LINE IN THE WORLD!**

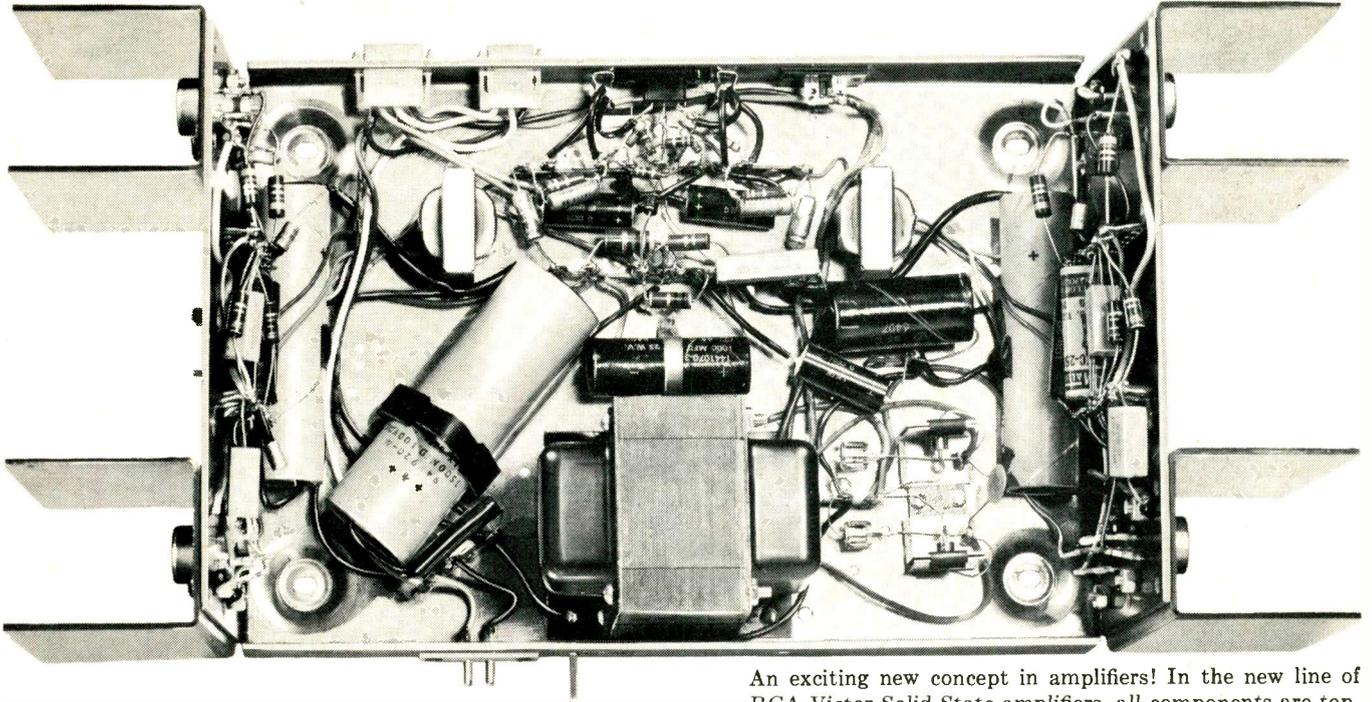
This new Turner Model 333 represents a new concept in microphone merchandising — a professional communications mobile microphone that's now available for CB use. It's a "noise canceling" microphone that features the fast-selling Koiled Kord that's used professionally on police cars, taxicabs, etc.

List Price \$21.50 . . . For complete information and specifications write:

THE TURNER MICROPHONE COMPANY
918 17th Street N. E.
Cedar Rapids, Iowa

In Canada: Tri-Tel Associates, Ltd., 81 Sheppard Ave. West,
Willowdale, Ontario

Export: Ad Auriema, Inc., 85 Broad Street, New York 4, N. Y.



An exciting new concept in amplifiers! In the new line of RCA Victor Solid State amplifiers, all components are top-mounted. This helps dissipate heat, makes servicing easier.

...another advance from RCA Victor for better performance, easier service!

It takes an advanced system of highest quality components to make a top-performance home entertainment instrument. Short cuts or shortcomings anywhere along the line make it difficult for you to get top performance out of a set—and top performance, not excuses, is just what a service customer expects for his money.

For your peace of mind . . . and

profits . . . it's good to know that every RCA Victor instrument is a fully engineered, fully integrated, fully tested system of advanced components. Add your know-how to this kind of engineering excellence and you're sure of one thing: satisfied customers every time!

An RCA Data Service subscription, including the service industry product information digest, "Plain

Talk and Technical Tips," is available from your local RCA Victor distributor.

See Walt Disney's "Wonderful World of Color," Sundays. NBC-TV Network.



The Most Trusted Name
in Electronics

Tmk(s)®

PEARCE-SIMPSON PUTS YOU WHERE THE PROFITS ARE!

NEW



IBC 301

TWO-WAY BUSINESS BAND RADIO with remote head*

Close competitive volume sales to truck and auto fleets with the low-priced IBC 301. Exclusive remote head and low power drain permits installation in any type of vehicle. Pearce-Simpson backs you with a lead-producing advertising and promotion program!

12 Volt Model **\$329.90**

*Can be dash mounted as a complete radio or the removable remote head can be installed independently with its own mounting cradle. Remote head weighs less than 2½ pounds — small enough to fit in your hand • Solid state power supply and receiver for low power drain and greater efficiency • Illuminated operating indicators • Adjustable squelch, noise limiter • Universal mounting bracket — slide-rail • Optional AC power supply

NEW



GUARDIAN 23

CB TWO-WAY RADIO

23 CHANNELS — featuring Pearce-Simpson's exclusive HETROSYNC® circuitry. Two signals are combined instead of the usual three providing outstanding stability and maximum protection against spurious signals.

\$299.50

- Superior squelch circuit • RF gain control, tone control and noise limiter switch • Illuminated "S" meter, channel selector and modulation indicator
- Automatic speech clipping • Transistorized universal power supply • Dual conversion superhet receiver with low-noise Nuvistor front end • Easily provides full 5 watt legal input while operating at 50% of its full load capacity, insuring long component life and tremendous power reserve for overload protection

Other profit-making Pearce-Simpson models



The "ESCORT" 8 channels (23 chan. trans/receive W/ext. xtl socket) **\$229.95**



The "COMPANION II" 5 channels (23 chan. trans/receive W/ext. xtl socket) **\$189.50**



PEARCE SIMPSON INC.
MIAMI, FLORIDA



PEARCE-SIMPSON, INC. ET-165
2295 N. W. 14th Street • Miami, Florida 33125
Please send me FREE dealer kit and profit making details on the complete Pearce-Simpson CB line.

Name.....
Address.....
City..... State.....
Company Name.....

- - - for more details circle 46 on post card

SYNC ON BUSINESS

Color TV set sales will exceed 2 million units in 1965, says Jack Williams, RCA Sales Corp. He also believes that 15 million color receivers will be in use in the U.S. by the end of 1969.

A mobile communications catalog—completely revised—is now available from Antenna Specialists Co. Its 33 pages is filled with information about more than 40 new mobile antennas. The address is 12435 Euclid Ave., Cleveland, Ohio 44106.

A programed course on transistor circuit troubleshooting, including application and testing, is being distributed by G-E. This is another step in the direction of keeping professional TV-radio and Hi-Fi technicians abreast of the rapidly changing technology in our industry. See your jobber.

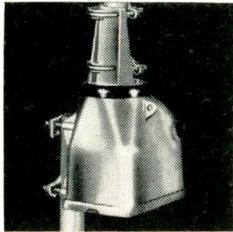
A box of "Band-Aid" sheer strips is being given free by Permacel with each purchase of four rolls of their #29 plastic electrical tape or #295 all weather tape. The box of sheer strips is attached to a free reusable plastic parts box holding the four rolls of tape. At your distributor.

A CB contest for consumers, offering three different models, has been conducted by United Scientific Labs, a division of Vernitron Corp. Some of the 4,500



entries received in the contest are shown between the two U.S.L. executives. The three units offered as prizes are also shown.

A fifth wheel? Who needs it?



Does a manual rotator require a *fifth* wire?

Sure. Like your car needs a fifth wheel. Who needs it!

Somebody else maybe. Not us, thank you. Channel Master Tenn-a-Liner rotators are designed to give you more torque on four wires than another rotator does on five.

The other guy may need that fifth wire to try to bring his turning power up to ours. (Due to an inherent weakness in his potentiometer circuit). But it may also do more harm than good. Because you're asking for a lot of unnecessary trouble with that fifth wire. And expense.

Like extra callbacks due to a 25% increased chance of connection failure. Not to mention the added cost of the wire itself. At least 25%. Do you need it?

Not when Channel Master Tenn-A-Liners (automatic *and* manual) can turn even the heaviest antenna arrays—under the toughest weather conditions. A 300 lb. ice-loaded installation won't faze a Tenn-a-Liner. Nor will a 70-mile an hour gale. (Tenn-a-Liner "guts" are made of hard steel only—never soft zinc or aluminum. And their thrust bearing, unlike the other guy's, is built-in). What's more, no manual rotator is more accurate. *And none costs less.*

A fifth wire? Like we said: who needs it? You?



Compass, Model 9520

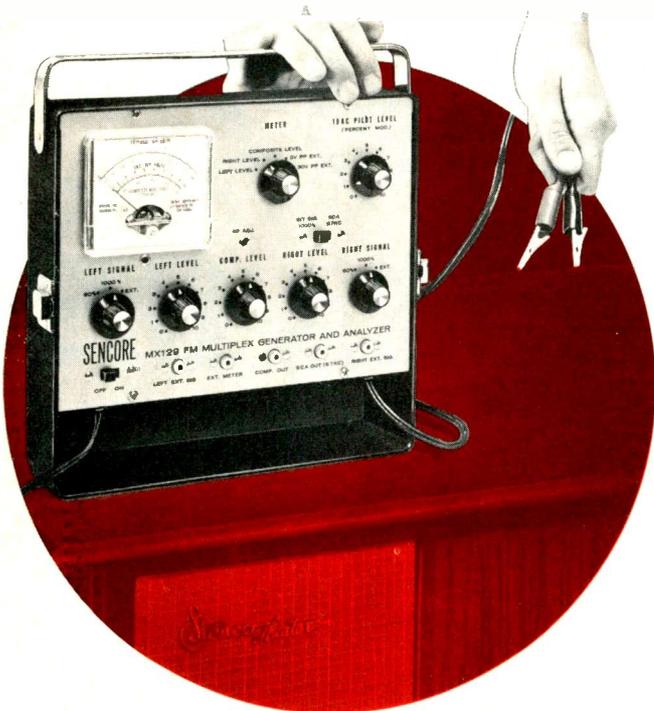


Automatic, Model 9524. The only rotator that can aim an antenna within 1 degree of transmitter location. Only 3 wires. Foolproof Control console. No irritating gear click.

CHANNEL MASTER rotators

ELLENVILLE, NEW YORK

add an fm-stereo service center
with this one new
sencore unit!



THE SENCORE MX129 FM STEREO MULTIPLEX GENERATOR & ANALYZER

FM-Stereo growth continues to mount and is fast becoming as big a field as Color TV. This means more FM-Stereo service business for you, now and in the future. Is your shop equipped? It can be — completely and economically — with the MX129, the FM-Stereo "Service Center in a Case." The instantly stable, 19-Transistor, crystal controlled MX129 is the most versatile, most portable (only 7½ pounds), most trouble free and efficient multiplex unit on the market — just like having your own FM-Stereo transmitter on your bench or in your truck. Powered by 115 volts AC, it produces all signals for trouble shooting and aligning the stereo section of the FM receiver . . . can be used to demonstrate stereo FM when no programs are being broadcast. Self-contained meter, calibrated in peak to peak volts and DB, is used to accurately set all MX129 controls and as an external meter to measure channel separator at the FM-Stereo speakers. **NO OTHER EQUIPMENT IS REQUIRED.** only **\$169⁵⁰**

SIGNALS AVAILABLE FOR ALIGNMENT, TROUBLE SHOOTING AND ANALYZING:

- FM-RF carrier with composite multiplex audio signal with 38kc suppressed carrier, 19kc pilot and 67kc SCA signals • Multiplex signal formed by 60 or 1000 cycle internal tones or any external signal
- Full control over left and right channel amplitude (modulation)
- External 67kc SCA signal available for trap adjustment • Composite signals available for signal injection FM detector •

professional quality — that's the difference!

SENCORE

426 SOUTH WESTGATE DRIVE • ADDISON, ILLINOIS

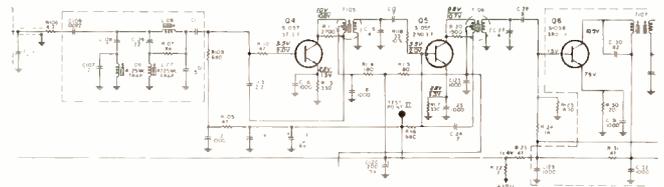
- - - for more details circle 47 on post card

TECHNICAL DIGEST

GENERAL ELECTRIC

TV Chassis TA, Video IF Strip—Circuit Description

The tuner IF output signal is coupled to the base of Q4, the 1st video IF amplifier, through L108, C111 and R110. L106, C107 and C108 form a series parallel 41.25 Mc tunable trap. L107, along with C109, forms a series tunable 47.25 Mc adjacent channel sound carrier trap. Any 47.25 Mc signal that might appear across L108 will have a lagging 90 deg shift and it will be cancelled at this point by a similar 47.25 Mc signal which is leading by 90 deg and coupled from the top end of L107 by R107. L108 and C111 along with the input capacity of Q4 form a series resonant circuit which is tuned to 45 Mc.



The signal that was fed into the base of Q4 is amplified by the transistor and appears across the primary winding of T105. Q4 is a silicon NPN transistor. The dc ground path for the emitter of Q4 is through R113 while the ac ground path is furnished by C116. The primary of T105 is tuned to 44.15 Mc and is loaded by R111, a 2700 Ω resistor. The collector voltage is supplied from the +12 v supply through R122, R114 and through the tapped primary winding of T105. The neutralizing capacitor C113 couples a small amount of the output voltage that appears across the primary of T105, back to the base of Q4. The feedback voltage is of the opposite polarity in respect to the voltage at the collector of Q4.

The AGC voltage which is developed in the AGC circuitry controls the gain of the video amplifier by increasing the amount of forward bias voltage applied to the emitter-base junction of Q4 through R108.

The IF signal which is present across the primary winding of T105 is inductively coupled to the secondary of T105 and then through C121 and R118 to the base of Q5, the 2nd video IF amplifier. The signal is amplified by Q5 and appears across the primary winding of T106. The AGC voltage which controls the gain of Q5 is supplied to the base through R116.

The signal that appears across the primary of T106 is inductively coupled to the secondary of T106, then through C128 to the base of Q6, the 3rd video IF amplifier. The signal is amplified by the transistor and appears in the collector circuit across the primary of T107.

Q6, an NPN silicon transistor, has its emitter-base junction forward biased. The proper value of base voltage is developed through the voltage dividing action of R124 and R125. It should be noted that there is no

TWO NEW HIGH-PERFORMANCE CB TRANSCEIVERS FROM LAFAYETTE... *Leader In CB Equipment*

NEW! LAFAYETTE 23-CHANNEL CRYSTAL-CONTROLLED DUAL CONVERSION 5-WATT CB TRANSCEIVER



Model HB-400
169⁵⁰

With Advanced "Range-Boost"

- ✓ Ruggedly Built For Reliable 2-Way Radio Communication
- ✓ Easy To Use... Easy To Maintain. With Every Feature CB Users Want!
- Frequency Synthesis Offers 23 Crystal Controlled Transmit/Receive Channels—No Extra Crystals Needed!
- "Range-Boost" Circuit for Increased Sideband Power... Greater Range!
- 17-Tube Performance With 13 Tubes
- Low Noise Nuvistor "Front End"
- 5 Double-Tuned IF Transformers
- Sensitive 3/10 μ v Dual Conversion Receiver
- Built-in 117V AC & 12V DC Power Supply
- Plug-in Facilities For Lafayette Selective Call Unit ■ Imported

NEW! LAFAYETTE ALL-TRANSISTOR DUAL CONVERSION 5 WATT CB TRANSCEIVER With Mechanical Filter For Ultra-Sharp Selectivity

- ✓ 100% Solid-State... Full 5-Watt Performance!
- ✓ 11 Rugged Silicon Mesa Transistors Used In Critical Areas
- ✓ Small, Compact—Only 3" High!
- ✓ Low Battery Drain—Less Than 350 ma on Receive, 850 ma on Transmit!

- 12 Crystal Transmit & Receive Positions
- 23 Channel Tunable Receiver with Spotting Switch
- 15 Transistors, 5 Diodes
- Sensitive 5/10 μ v Dual Conversion Receiver
- Variable Squelch, plus ANL
- For 12V DC, or 117V AC with Optional Solid State AC Power Supply ■ Imported



Model HB-500
139⁵⁰

**Dealerships
Now Available for**

LAFAYETTE'S NEW "HOT-LINE"

Lafayette Radio Electronics, "World's C.B. & Electronics Center" has available dealerships for its new "Hot Line" of Citizens Band equipment. A leader in the C.B. field, Lafayette equipment has been performance proven and customer accepted.

Lafayette is now introducing its new C.B. "Hot Line" for '65—Transceivers, Walkie-Talkies, Accessories,

etc. Engineer-designed, precision-crafted and field-tested to make Lafayette THE NAME in Citizens Band.

Be the first one to hook-up with Lafayette's

NEW "HOT-LINE."

Get complete information without obligation—mail the coupon today.

LAFAYETTE RADIO ELECTRONICS CORP.
Dept. ASETA-5
111 Jericho Turnpike
Syosset, L. I., N. Y. 11791

Mr. Robert Laub:
Please send me full information on how I can become an exclusive Lafayette dealer. I understand there is no obligation.

Name

Address

City State Zip

— for more details circle 39 on post card

top money maker in
the service business



NEW IMPROVED SENCORE CR133 CRT CHECKER & REJUVENATOR

The new, improved CR133 CRT Checker is designed to test all present picture tubes — and it's ready for future tubes too! Two plug-in replaceable cables contain all sockets required. The compact, 10 lb., CR133 checks CRT emission, inter-element shorts, control grid cut-off capabilities, gas and expected life. Checks all tubes: conventional B&W, new low drive B&W, round color tubes and new rectangular color picture tubes. Exclusive variable G2 Volts from 25 to 325 Volts insures non-obsolescence when testing newly announced "semi-low" G2 CRT tubes. New Line Voltage Adjustment insures the most accurate tests possible. Uses well-filtered DC for all checks to avoid tube damage and reading errors. Color guns are individually tested as recommended by manufacturers. Exclusive automatically controlled rejuvenator applies rejuvenation (ACR) voltage as required by individual tube condition; precisely timed to prevent over-rejuvenation or tube damage. The ACR feature is most useful for color tube current equalization to insure proper tracking. Hand-wired and steel-encased for protection of meter and panel in truck or shop, the new improved CR133 is only . . .

\$89⁹⁵

The famous CR128 CRT Checker and Rejuvenator is similar to above, but with a three position G2 slide switch and without Line Voltage Adjustment at \$69.95

professional quality — that's the difference!

SENCORE

426 SOUTH WESTGATE DRIVE • ADDISON, ILLINOIS

— — — for more details circle 48 on post card

TECHNICAL DIGEST

AGC control voltage applied to the base circuit of Q6. The collector voltage is supplied through the series connection of R123, R131 and the primary winding of T107. The necessary ac ground path for any signal that might appear at the junction of R131, R133 and the primary winding of T107 is furnished by C132. The resistor R130 furnishes the dc ground return path for the emitter while C131 supplies the necessary ac ground path. The primary and secondary of T107 are tuned to 45 Mc.

PHILCO

Color Chassis 15M91, Run 6—Production Change

Sound panel capacitor C14 changed from 750 to 820pf—part number 30-1293-35. Panel is identified by a red dot and is known as a run 2 panel. Reason: To improve sound IF performance and prevent IF oscillation.

MAGNAVOX

45 Series Color TV Chassis—Audio Problems

Some models using the 45 series chassis have an objectionable 60 cps hum in the sound. It has been found that this hum can be caused by a ground loop resulting from grounding the shields of the audio leads at the loudness control to the tuner and control mounting plate. This hum can be removed by cutting the jumper wire which connects from the low end of the loudness control to the ground lug on the mounting plate.

Production changes have been incorporated to improve the audio high frequency response in 45 series color chassis which utilize the AP92-01-00 external audio amplifier. Earlier production chassis may be modified in the field as follows: parallel R315-100K resistor with a 1500 pf capacitor, replace C26, 1000 pf, with a 3300 pf capacitor. On 45 series chassis with internal audio systems, replace C126, 1000 pf, with a 3300 pf capacitor.

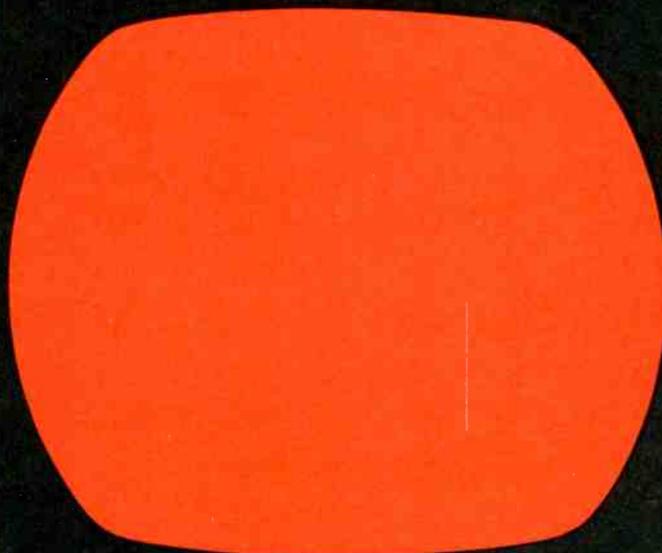
In self-contained audio versions of the 45 series chassis, an occasional unit may have higher than normal minimum volume hum because of component stacking tolerances to the low side. To correct this condition, add a 100 μ f 200v electrolytic across C130B. This change has been made in production.

A small quantity of the initial production of the 3RT540K may have a noticeable audio buzz when the remote control audio step relay is in No. 3 or No. 4 position. To eliminate the buzz, install a .01 μ f 1000v capacitor to ground from the ac connection on the terminal strip, located on the remote receiver. A blue ac lead from the TV chassis is connected to this terminal.

you get **PRODUCT PLUS** from your Sylvania Distributor

suddenly

**COLOR TV
HAS A NEW
RED STANDARD**



Sylvania's new EUROPIUM RED.

New COLOR BRIGHT 85 picture tube brings more natural color to television and increases monochrome brightness 43%.

The startling news in the television industry is Sylvania's new picture tube, and its new, truer red phosphor.

EUROPIUM RED, developed at GT&E Laboratories, is the brightest red known to the industry. And, to match it, now the full brightness of blue and green is used. The result is a color picture tube that gives the entire television industry a boost.

Because the COLOR BRIGHT 85 tube is *really* bright, dealers can demonstrate color TV effectively in normally lighted showrooms. As the set's brightness is adjusted, the colors remain true—not shifting to unnatural tones in the highlights of the picture.

Another thing, black and white performance is far better than you've ever seen before in a color tube. Be-

sides the increased brightness, there's improved contrast in a sharp, vivid picture.

The new, exciting COLOR BRIGHT 85 picture tube is a product plus from Sylvania for the entire color television industry, and particularly for dealers. In color, as in black and white, you know it's good business to handle the Sylvania line.

SYLVANIA
SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS GTE

NEW CAPABILITIES IN: ELECTRONIC TUBES • SEMICONDUCTORS • MICROWAVE DEVICES • SPECIAL COMPONENTS • DISPLAY DEVICES

*Tests show the COLOR BRIGHT 85 tube is 43% brighter, on the average, than standard color picture tubes.

Color-TV servicing is profitable

GET THE MOST OUT OF IT WITH COLOR-TV TEST INSTRUMENTS FROM RCA—
PIONEER OF COLOR TV



Making last-minute convergence adjustments on a color-TV receiver with an RCA WR-64A Color-Bar/Dot/Crosshatch Generator.

**(A) RCA WR-64A COLOR-BAR/
DOT/CROSSHATCH
GENERATOR**

Low-cost, lightweight, portable instrument that provides all essential Color-TV test patterns:

- *Color-bar pattern*: ten bars of color for checking phase and matrixing, and for automatic frequency and phase alignment.
- *Crosshatch pattern*: thin sharp lines for adjusting vertical and horizontal linearity, static and dynamic convergence, raster size, and overscan.
- *Dot pattern*: small dots to facilitate accurate color convergence.

\$189.50* with output cables

**(B) RCA WR-70A RF/VF/IF
MARKER ADDER**

For use with a marker generator and a sweep generator. Used for RF, IF, and VF sweep alignment in color and B&W TV receivers.

- Choice of four different marker shapes
- Provides very high-Q markers of high amplitude and narrow bandwidth

\$74.50* complete with cables

**(C) RCA WO-91A 5-INCH
OSCILLOSCOPE**

A wideband scope for checking colorburst signals and general troubleshooting.

- Dual bandwidth: 4.5 Mc at 0.053 volt rms/in. sensitivity; 1.5 Mc at 0.018 volt rms/in. sensitivity.
- Continuously adjustable sweep frequency range: 10 cps to 100 Kc

\$249.50* including direct/low capacitance probe and cable, ground cable, and insulated clip.

**(D) RCA WR-69A TELEVISION
FM SWEEP GENERATOR**

For visual alignment and troubleshooting of color and B&W TV receivers, and FM receivers.

- IF/Video output frequency continuously tunable from 50 Kc to 50 Mc.
- Sweep-frequency bandwidth continuously adjustable from 50 Kc to 20 Mc on IF/Video and FM; 12 Mc on TV channels

\$295.00* including all necessary cables

**(E) RCA WR-99A CRYSTAL-
CALIBRATED MARKER
GENERATOR**

Supplies a fundamental frequency RF carrier of crystal accuracy for aligning and troubleshooting color and B&W TV receivers, FM receivers.

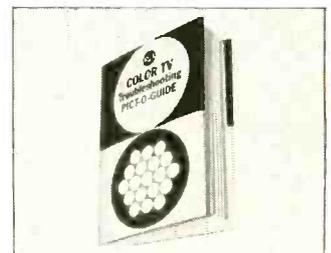
- Most-used IF and RF frequencies indicated on the dial scale
- Sound and picture carrier markers available simultaneously

\$256.50* complete with output cable and phone tip

**(F) RCA WT-115A COLOR
PICTURE TUBE TESTER**

Designed specifically to test color-TV picture tubes, either in or out of the set. Tests each gun for emission quality, inter-electrode leakage and shorts.

- Large sensitive meter with separate 3-color scales
- Provision for accurate adjustment of cut-off point for each gun



New RCA Color Pict-O-Guide is now available through Authorized RCA Electron Tube Distributors.

\$89.50* with cable, carrying case and socket assembly

See them all at your Authorized RCA Test Equipment Distributor.

*Optional Distributor Resale Price
All prices are subject to change without notice. Prices may be higher in Alaska, Hawaii and the West.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.



The Most Trusted Name in Electronics

This ROARING CB Business

by Jack Catterall

**A
two-way medium
that offers you
another rare opportunity
to diversify
profitably**

■ The Citizens Radio Service has mushroomed to the point where it has become a major activity of the Federal Communications Commission. Conservative estimates indicate that 2,000,000 or more CB units are now in use. And this does not include the hundreds of thousands of low power, 100 milliwatt walkie-talkies that do not require licenses.

Taking a rough figure of \$100 per unit, with base station installation materials at \$25 and mobile antennas and accessories at \$15, it can be readily seen that more than \$250,000,000 has been invested in CB equipment. And this figure does not include cost of installation and repair.

The aforementioned figures are impressive. But they are extremely conservative. Industry leaders feel that the surface has only been scratched. CB license applications currently being filed with the FCC point to the inescapable conclusion that some 25,000 to 30,000 units are being sold monthly.

THE AUTHOR

Jack Catterall has been in electronics for over forty years. During this period he has been an active radio amateur with the call WICQ. He currently holds an Amateur Extra Class license and is Manager, Technical Services for Raytheon Company's Commercial Apparatus & Systems Division.

Who's Buying CB?

Who is buying CB equipment? Why are they investing money in equipment which has a limited range of some 10 to 15 miles under average, normal conditions? How are they using CB? To obtain answers to these questions I have traveled thousands of miles, talked to people in many walks of life, in countless types of businesses, and I have looked over hundreds of CB installations.

Before citizens radio, the average person had to study electronic theory, learn to send and receive Morse code, and pass an FCC examination before having the right to own and operate a two-way radio station.

Today, any U.S. citizen, eighteen years of age or older, may obtain a citizens radio license. No examinations or code tests are required. An individual can use CB equipment to keep in touch with his home while driving his car; a business man can maintain contact with his office or employees. A hunter or fisherman can maintain contact with others in his party and the age-old problem of being lost in the wilderness is becoming a thing of the past.

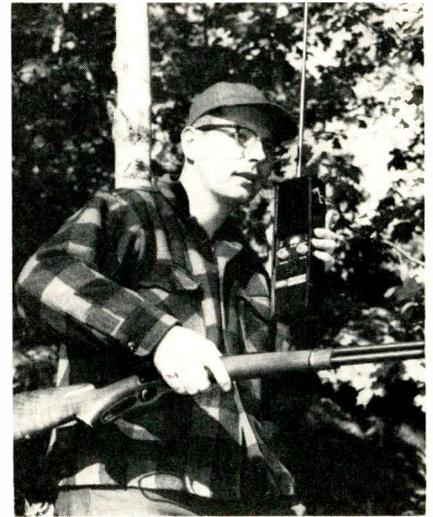
A random sampling of warranty cards returned by purchasers of CB equipment shows *who* is buying it. A list of one hundred classifications



Hand-held CB units are widely used in construction, municipal and public safety areas.



Transistorized CB set is only about half the size of comparable tube types.



Hand-held units are also popular with hunters in deep woods.

of users is shown in Table I. Although the list is not complete, it illustrates diversified usage for this popular communications medium.

Citizens band equipment has been installed in fire look-outs in the Pacific Northwest forests for instant communications between fire wardens. Others are being used by law enforcement officers, veterinarians, etc. It is being used by hundreds of fishermen whose scope of activities do not economically justify installation of commercial-type marine radiotelephones.

CB was recently responsible for saving the lives of three persons off the New England coast. Their small craft struck a submerged object and immediately began to sink. The fact that they were able to contact a CB'er on shore who instantly notified the Coast Guard will never be erased from their memories.

The prompt reporting of a grass fire in tinder-dry woodlands by a CB'er this past summer saved precious time, which in the opinion of the local fire chief, saved hundreds of acres of vital woodlands.

Growth Potential

Will the CB radio industry continue to grow? Nothing on the horizon today indicates that this truly remarkable new industry will not continue to grow at an unprecedented rate. But the growth to date cannot be attributed to a demand created by a concerted national ad-

vertising campaign directed at the American public.

As an experiment, complete strangers have been asked if they knew that they could now own and operate two-way radio stations. Less than one in twenty had ever heard of CB!

In another experiment, a day was spent in a Midwest farm supply store. The same questions were put to 14 customers who came into the store. Not one had heard of CB. Two customers purchased CB units on the spot. A third expressed great interest, felt he could use the equipment profitably on his farm, but wanted to "look around" before deciding on a particular brand.

Travelers are just beginning to learn that they can call ahead for hotel or motel reservations while still miles away from overnight stops, and be guided directly to their destination through unfamiliar territory.

Farmers and ranchers, miles from the nearest telephone are learning that they are no longer isolated. In any emergency, and for routine communications purposes, CB is proving to be invaluable. CB is even being used by undertakers for contact between vehicles in heavy urban traffic.

The benefits and peace of mind which CB affords the motorist cannot be over-emphasized. Its contribution to highway safety is inestimable. A stranded driver with an

immobilized car on a turnpike or lonely country lane in any kind of weather can invariably contact a CB'er who will get help dispatched in a hurry. Growth prospects in this area alone are fantastic.

Some Industry Problems

Like other areas that suffer from growing pains, the CB industry has some problems. Customer satisfaction is one problem. And this must be corrected if the CB industry is to continue its fantastic momentum. An analysis of complaints produced some interesting facts.

First, citizens band equipment is being sold in many instances by people completely unfamiliar with the equipment or its capabilities to customers who know even less about CB. And, of course, some "fast buck" operators have sold equipment to hobbyists who believed they could use the equipment like "ham" radio equipment. This is not a blanket indictment of normal distribution channels for CB equipment. Many of these channels are conducting exceptionally fine merchandising programs.

Second, a great many CB units are over-sold. Promises of performance and impossible-to-achieve range are being made, sometimes intentionally, often not.

Third, and possibly most important of all, altogether too many well-designed and manufactured CB units now in use are being



Low-cost CB communications unit used in office for local fleet dispatching.



This state-financed CB station at Laconia, New Hampshire, won a national boat safety award.

operated at levels far below capabilities. This is not characteristic of any one name brand or model, but is fairly general in scope. During one recent field trip, the transmitter power output was checked on 64 operating CB units. Twenty-seven were operating at less than normal efficiency. Measured power outputs on all units varied from a high of 3.8 w to a low of less than 1 w. With the exception of three units

that had internal electrical problems, all were adjusted easily to provide normal 3 to 3.5 w output. Inefficient mobile and base station antenna installations contribute largely to customer dissatisfaction. This problem exists primarily because a large number of antenna installations are made by the CB'er, without benefit of prior experience with electronic equipment — particularly two-way radio.

Some base station installations had the antenna instead of the mast grounded for lightning protection. Others had guy wires connected to the antenna elements. Some installations used ordinary insulated wire instead of coax cable between the radio and the antenna. Mobile installations varied from broadcast whips to "plumber's delights." In a great many instances, lack of engine noise suppression limited the range of the equipment.

Too many "good" mobile installations failed to operate well even though correct antennas and cables were used. Reasons for poor performance varied from 1.) shorted or open coax cables and 2.) poor or improper grounding of the antenna base because of insulation, sound deadening material, paint or rust between the antenna mounting base and the vehicle's fender or roof. Frayed, chafed and pinched coax cables were responsible for some poor performance complaints.

One very vocal complainant insisted his CB radio was "too strong." A competitor ten miles away (also in the automobile towing business), was beating him in some instances to the scene of an accident after hearing him dispatch the wrecker. Installation of a beam antenna and a reduction of transmitter power made the customer very happy.

These examples are not intended to present a gloomy, pessimistic view of CB as it now exists. It should be pointed out that the majority of CB users were perfectly happy with their equipment and its performance. In cases where the equipment was made to perform better, they were even more happy.

The market for CB is expanding. Satisfied users will still be largely instrumental in the adoption of CB by their friends. But the largest single contribution that can be made to the solution of present day CB problems can come from thoroughly experienced and interested groups of CB service-dealers who are ready, willing and able to assist their customers when they call for help. And CB offers you another golden sales and service opportunity ■

TABLE I
WHO BUYS CB EQUIPMENT?

Aerial Photographers	Fuel and Gas Deliverymen	Refrigeration Repairmen
Aerial Spraying Service	Game Protectors	Refuse Disposal Operators
Ambulance Services	Garages	Reporters
Appliance Servicemen	Garbage Collectors	Road Repairmen
Asphalt Paving Companies	Grain Elevator Operators	Rural Mail Carriers
Asphalt Refiners	Hauling Contractors	Salesmen
Automobile Dealers	Hospitals	Sand and Gravel Companies
Auto Parts Dealers	Humane Societies	Seed Dealers
Auxiliary Policemen	Insurance Salesmen	Service Stations
Boat Pilots	Investigators	School Bus Operators
Boat Yards	Land Clearing Companies	Sheriff's Patrols
Body Shops	Land Developers	Shippers
Boy Scout Camps	Laundries	Snow Plow Operators
Building Contractors	Lawyers	Soil Conservationists
Bulldozer Operators	Livestock Ranchers	Steamfitters
Cafe Owners	Loan Companies	Surveyors
Cemetery Sextons	Lobster Buyers	Tank Wagon Operators
Civil Defense Workers	Lumbermen	Taxicab Operators
Civil Engineers	Lumberyards	Townships
Coal and Oil Dealers	Milk Deliverymen	Telephone Repairmen
Concrete Delivery Trucks	Motel Operators	Truck Dealers
Construction Companies	Newspaper Deliverymen	Truck Stops
Crop Dusters	Oil Dealers	Tugboat Operators
Dairies	Oil Field Workers	TV-Radio Technicians
Dairy Farmers	Packing Houses	Undertakers
Dentists	Pharmacists	Used-Car Dealers
Dry Cleaners	Photographers	Vending Machine Operators
Electricians	Physicians	Veterinarians
Farm Equipment Dealers	Plumbers	Volunteer Fire Departments
Farmers	Police	Water Treatment Companies
Feed Mill Operators	Publishers	Well Drillers
Fishermen	Ranchers	Yacht Clubs
Forest Firefighters	Realtors	Yachtsmen

Silicon transistor circuitry and module structures open way for new and more profitable repair techniques

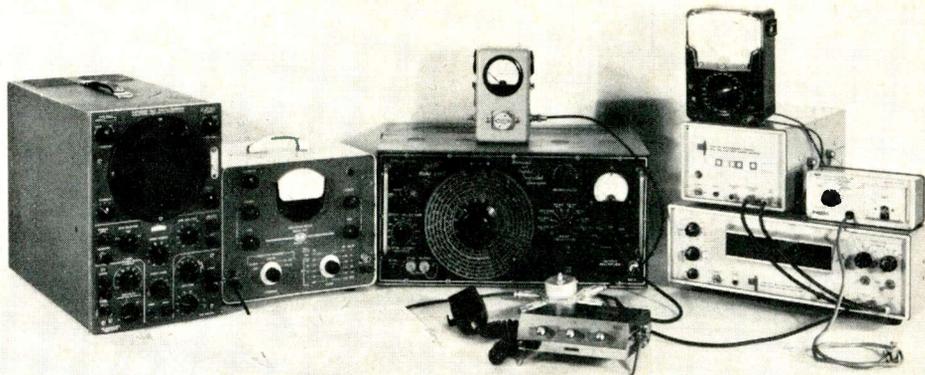


Fig. 4—Instrument lay-out for making complete checks on high-performance CB equipment.

Trends in CB Servicing

by Kenneth Dawes

Pace Communications Corp.

■ The normally difficult problems of servicing transistor circuitry become even more complicated in transistorized citizens band equipment. This is true primarily because of higher frequencies involved. And millivolt RF voltmeters and high frequency low level scopes, for example, are expensive and difficult to justify except by the largest service organizations.

But the trend toward silicon transistor circuitry in citizens band equipment — plus the transistor module approach — has opened the way for better equipment performance, greater reliability and simplified servicing techniques.

To provide reliable infield local servicing, the only reasonable approach is to give CB service dealers a method of quickly and reliably servicing equipment at a reasonable cost to the user. "Instant service" procedures, with a module exchange program, is proving to be very well accepted by the user and very profitable for CB service dealers across the country.

Switch to Silicon Transistors

To understand the trend toward more rapid and profitable servicing techniques in CB equipment, it is necessary to understand why a swing is now taking place away from germanium and toward silicon transistors.

Silicon devices are rapidly replacing germanium for a number

of reasons. For instance, silicon transistors overcome the most serious problem of germanium: *temperature instability*. Although some germanium devices can operate with a junction temperature up to 100°C, silicon can easily operate up to double that.

An even more important advantage is that circuit stabilization techniques are highly simplified because silicon devices have such low collector leakage current (IC₀), or more correctly, IC_{BO}, the collector cutoff current. This measurement is made between collector and base — with the emitter open. How this measurement is made for an NPN transistor is shown in Fig. 1. The collector supply voltage V_c is about one-half the breakdown voltage of the unit under test. And the value of IC_{BO} may increase from 0.5μa at room temperatures to 15μa at 100°C (212F) for a typical small-signal silicon transistor. Under similar conditions, the best germanium device will increase from 6μa to 200 or 300μa. This would obviously upset the operation of an amplifier running at 500μa or even 1 ma of collector current.

This situation is even more aggravated in audio power applications. The maximum IC_{BO} for a typical silicon power unit would be 5 ma at 150°C, while at only 100°C the same size device in germanium, would have an IC_{BO} value of about 30 ma. At high ambient

temperatures and "no-signal" conditions, the IC_{BO} is converted to heat which in turn increases the IC_{BO} until the transistor goes into a "run-away" condition. This problem is taken care of in germanium by using thermistors and massive heat sinks. The problem does not develop with silicon devices.

It becomes obvious that the increase in IC_{BO} with temperature is so small with silicon, that the normal operating current, being much greater, is completely unaffected by temperature. Most epitaxial silicon transistors have room temperature leakage measured in micromicroamps (pa).

Servicing techniques with silicon are similar to those used with germanium semiconductors. But silicon devices are much more rugged and forgiving of hot soldering irons. Although usual precautionary servicing measures are recommended, an occasional careless move will not generally result in the destruction of a silicon transistor.

General Considerations

When making circuit measurements with a high impedance voltmeter, the first difference between silicon and germanium is that base-emitter "difference voltage" will be between 0.5 and 0.6 v. It is usual for this voltage to be 0.1 to 0.2 v with germanium devices. The polarity of the usual silicon NPN device will be the reverse of the nor-

mal PNP germanium — the collector will be positive. Of course, PNP silicon (collector negative) are made, but they are not so widely used.

After some experience, technicians will soon realize that few problems arise because of defective silicon transistors. Loss of receiver RF caused by static and transients will be nonexistent with silicon. When a transistor is suspected, and no suitable transistor tester is available, a fairly reliable check can be made by using an ohmmeter. These steps are shown in Fig. 2. The negative lead of most VOMs will bear a positive potential in the Ω position but if doubt arises, connect the leads to another voltmeter or ohmmeter. The ohmic values will be high for small signal devices and lower for power devices.

A high impedance voltmeter may be necessary to obtain live-circuit measurement accuracy since bias circuits may be less "stiff" than those commonly used in germanium circuitry. The simple constant current or "series" bias shown in Fig. 3 may be encountered quite often with silicon devices. This bias scheme is rarely used with germanium because of disastrous temperature effects. Usually, R_b will be large as shown in a typical stage (Fig. 3). To accurately measure the 2.6 v at the base, a meter with an input impedance of 1 M Ω/v or greater should be used.

To perform a complete check on a high performance CB two-way radio would require equipment comparable to that shown in Fig. 4. The dc coupled scope shown is fitted with a linear detector to measure recovered audio and modulation percentage. A microvolt signal generator is used in conjunction with a voltmeter/distortion

analyzer to measure receiver sensitivity. To accurately check frequency, a counter or frequency meter is necessary. A 10 Mc counter with a 100 Mc converter is shown here. With only a signal generator and some form of output indication, a thorough service job becomes difficult.

Signal tracing is rather impractical in the RF circuits. A simple and practical technique is to inject a signal beginning at the output



Fig. 5—Modular-constructed silicon transistor CB radio in troubleshooting position with service meter connected to set and microphone plugged into meter.

stage and working toward the front end. Many service charts list the signal levels that should be injected to produce a given output. But many times a unit will perform at levels far below those shown or an amplifier stage may have marginal gain resulting in the technician devoting much effort to increasing it only to find performance is still unsatisfactory. And though output may be proper for a given signal condition on the bench, a customer complaint may still result. This can be caused by distortion, cross modu-

lation, or sometimes, a momentary oscillation can occur when noise pulses pass through an IF strip. A faulty component in the dc input circuit may result in excessive noise in a mobile installation but will never show up on the bench. Hidden defects of this nature can result in annoying call backs, and the only recourse is an exchange of the entire equipment.

The Logical Approach

To minimize troubleshooting difficulties, most industrial/business two-way radios are manufactured with test points utilizing a 50 μ a meter movement. This provides technicians with a method of quickly localizing troubles by using standard troubleshooting charts prepared by the manufacturer. By bringing the test points to a socket in the radio, it is only a matter of minutes to perform service checks since the set does not have to be opened up.

Because of competitive cost, however, most CB radio manufacturers have eliminated this service convenience. But the trend toward more rapid and profitable servicing persists.

A typical inoperative silicon transistor CB transceiver, for example, can be placed back in operation easily by using a service meter that plugs into the front of the radio for testing, as shown in Fig. 5. The radio remains completely functional when the service meter is connected. It can be checked in its own installation by unplugging the microphone and inserting the service meter plug. The microphone is then plugged into the service meter.

Individual circuit modules in the radio can be given a functional test while in actual operation. And only

Continued on page 78

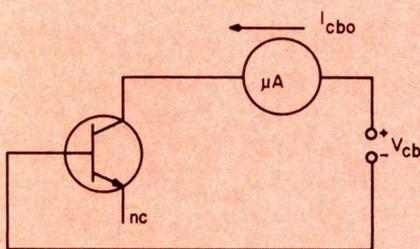


Fig. 1—Method for measuring ICBO.

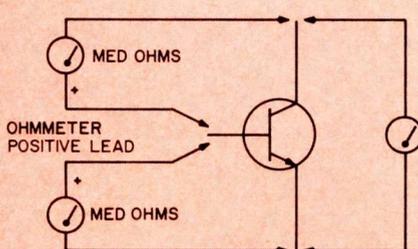


Fig. 2—Using ohmmeter for making transistor checks.

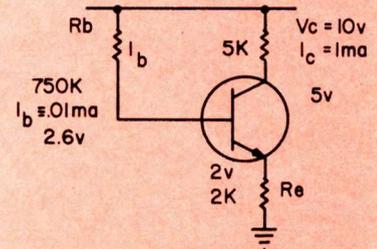


Fig. 3—Constant-current 'series bias' system.

Volume Limiting in Communications

by Thomas R. Haskett

You can troubleshoot and repair clipper circuits easily if you know how they work

Part I

■ Two-way radio communications systems use volume limiting and speech processing for maximum intelligibility, efficiency of equipment and spectrum space, and minimum interference. Since *speech* only communications are desired, the main criterion is that the *listener understand the talker*. Anything else is superfluous. Even distortion is permitted, if it doesn't affect intelligibility (and doesn't cause RF interference).

Intelligible Speech

In speech, most of the consonants — especially lip sounds (p, b, v, f, etc.) — are from 20 to 30 db weaker in intensity than vowel sounds. A graph of speech power content, shows this (Fig. 1). Consonants, however, are the major contributors toward connected-speech intelligibility. When a signal is barely above the noise level and individually - articulated, strong vowel sounds can just be recognized, connected - speech or discrete - sentence intelligibility is poor, because the weaker lip sounds — the really important sounds — are lost in background noise. The simple remedy is to turn up the transmitter audio gain until consonant sounds cause heavy modulation. Then, however, loud vowel sounds will overmodulate and cause severe distortion.

Although vowel sounds contain much power, they contribute little to articulation. Therefore, it's possible to change or distort the wave-shape of vowel sounds (voice peaks) without decreasing intelligibility. But there is no need to do this by overmodulation and incidental clipping, which generates distortion and sideband splatter (in standard AM). The system to use clips the peaks in the *audio* system so that high-order harmonics so generated can be filtered out before they reach the modulator. Actually, such a system obtains more talk-power than would be possible by simple overmodulation and consequent clipping.

Clipping

The speech clipper is an instantaneous device. It is inoperative until the audio reaches a predetermined level; it then chops off everything above that level. As soon as the signal drops below this limit the clipper ceases to operate. Although it introduces a considerable amount of distortion, this distortion is introduced at a point ahead of modulation, where the objectionable harmonics can be controlled and not allowed to appear in the RF output.

This action is shown in Fig. 2 — an instantaneous voltage-amplitude limiter. As V1's cathode

swings positive, the tube conducts until cathode and plate potentials are equal. Current flow through the combined load resistor, R4, couples the signal into V2, where it appears across R2 and the output. During the input signal's positive peak,

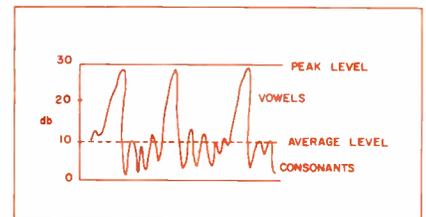


Fig. 1—Graph of speech power content.

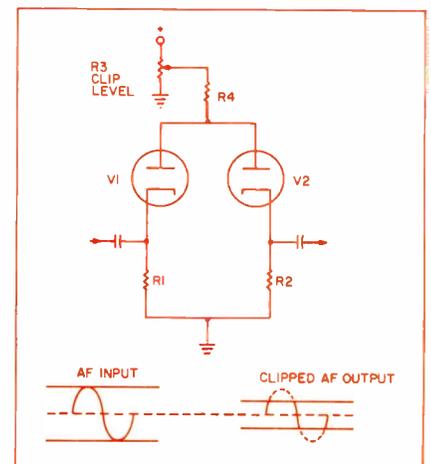


Fig. 2—Basic speech clipper.

when V1's cathode is positive with respect to its plate, no current flows through V1, and no signal is coupled to V2 or to the output. During the negative half-cycle, increased current flow through R4 causes a voltage drop equaling the applied plate voltage; since V2's plate is no longer positive with respect to its cathode, conduction through V2 ceases and the negative peak does not appear in the output. Hence positive and negative peaks are clipped at a level established by R3.

In standard AM, with average modulation of 30 percent, the sideband power is down about 10 db from the 100 percent level. If voice peaks are clipped 10 db and audio gain increased the same, lower-level voice components are better utilized and average modulation nears 100 percent.

Tests have been made to determine how much clipping destroys intelligibility. Peak clipping of 6 db is barely noticeable, 12 db is not objectionable, and clipping of 24 db can be tolerated. Around 20 db the speech sounds unnatural, but it can be understood. Phrase and

sentence context aids understanding, too. Hence, speech clipping has the following advantages: Power in consonant sounds (low-level components) is increased; intelligibility is increased in the presence of noise; and the carrier is utilized to the maximum.

Filtering

When speech energy is compared to frequency two things are found: The lower-frequency vowels contain more energy than higher-frequency consonant sounds, yet contribute very little to intelligibility; sounds whose frequencies are above the intelligibility range improve fidelity but at the expense of broad sidebands. Thus, neither lows nor highs are required for the transmission of speech intelligence.

And there's another point to be considered; since peak clipping introduces harmonic distortion, these harmonics must be removed or they will cause interference when radiated. Since audio above about 3000 cps isn't required for articulate speech, a simple low-pass filter will do the trick. Although distortion in speech-band frequencies

isn't removed, the harmonics are, thus preventing sideband splatter. What incidental distortion remains doesn't affect intelligibility.

Much modulated power is still wasted on the low frequencies, however, which can be eliminated by a low-pass filter. With frequencies below 300 cps removed, the remaining middle range can be caused to modulate the transmitter more heavily, giving an increase in the talk-to-noise ratio at the receiver. In practice, the lows are removed by using small values of coupling capacitors in the speech amplifier, while the highs are usually taken out by a pi-section audio filter.

Typical Clipper-Filter

The clipper-filter circuit shown in Fig. 3 is typical and has become a standard circuit. The microphone preamp feeds R28, the audio control, which sets the gain of the speech amplifier and hence the degree of modulation. Following V12B, audio passes through V13, the clipper tube, where peaks are set by R34, the clipping control. Note that R34, when properly adjusted, limits modulation peaks regardless of the signal level in the preceding stage. Clipped audio is fed through a filter consisting of L45, C94, and C95, which, in combination with the interstage coupling capacitors, limits bandpass to 250-3000 cps. Clipped and filtered audio is then fed to V14 and subsequently to the modulators. The system produces up to 20 db of clipping.

Although this precise circuit is used in a popular amateur AM transmitter, a similar clipper-filter is used in a well-known VHF/AM transceiver in aeronautical service, which permits average modulation of at least 70 percent but not exceeding 100 percent. Audio bandpass is 300-3000 cps. In this class of service such clipping is required by FCC for all transmitters with output of 10 w or higher.

The system is also used on a few well-designed Class D Citizens Band transceivers. Up to 23 db of clipping is available and audio bandpass is 300-3000 cps — a welcome improvement over some CB circuits. ■



Kahn Research Lab's Model LIM-63-1A limiter amplifier.

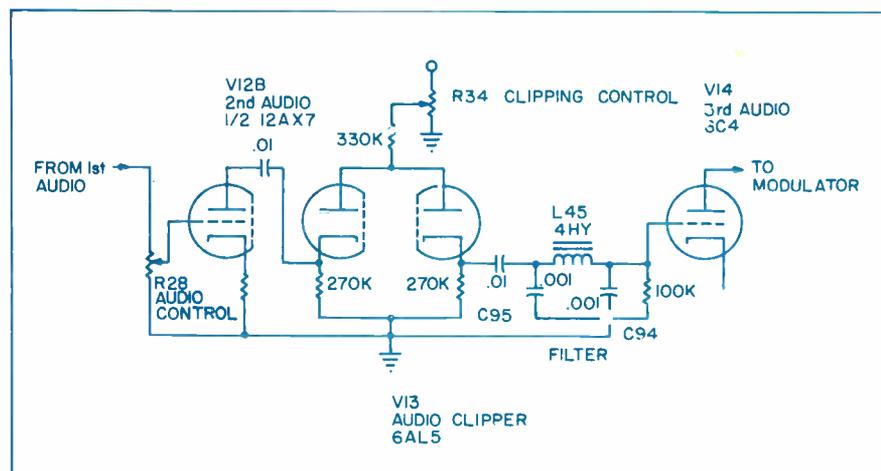
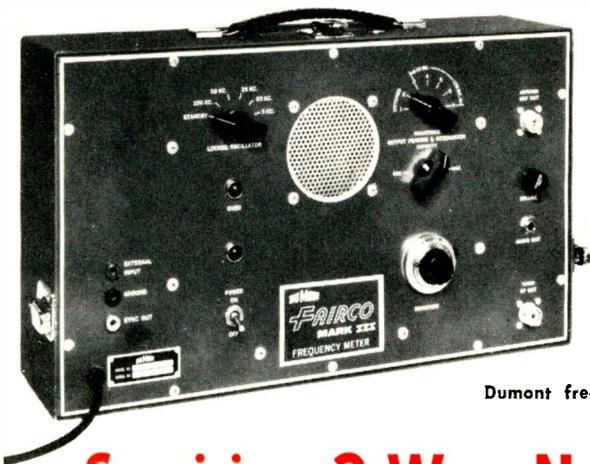


Fig. 3—Typical clipper-filter circuit. Courtesy: E. F. Johnson



Dumont frequency meter.

Select your test and measurement equipment carefully to meet FCC regulations and provide maximum customer satisfaction

Servicing 2-Way Narrow-Band FM Equipment

■ Most two-way radios in certain services use narrow-band FM (NB-FM) almost exclusively. And shops that maintain NBFM equipment frequently do no other type maintenance. Richard L. Plessinger, for example, operates Mobile Communications Service, with shops in Hamilton, Ohio and Lexington, Kentucky, and his experiences are typical. All of his work is on narrow-band, two-way gear, mostly from police and taxicab users. Approximately 50 percent of this work is on a contract basis, where the customer uses his equipment constantly, needs it badly, and wants regular preventive maintenance performed to minimize down time. The other 50 percent is spot work — where the customer simply operates the gear until it breaks down and then calls the shop for repairs. Plessinger says he schedules routine maintenance on the contract fleets and is able to keep his technical staff busy every day — thus available for spot work as it comes in.

What's NBFM?

As we know, an FM broadcast station deviates ± 75 kc under 100 percent modulation; for TV sound the deviation is ± 25 kc. In two-way radio communications, the old deviation standards were ± 15 kc. Although signal-to-noise ratio and dynamic range were less than in broadcasting, it was quite possible to transmit intelligible speech, which was the only desired quality.

Recently, however, standards were made even more strict, with the advent of NBFM, in which the deviation is only ± 5 kc. NBFM makes it possible for more stations to operate in a given frequency band and with a minimum of mutual interference. It also means that transmitter and receiver alignment is more critical. There's no room for sloppy maintenance.

FCC Regulations

Volume V of the FCC Rules & Regulations (available from the Government Printing Office, Washington 25, D. C.) contains rules applicable to most NBFM service and maintenance. As you must observe these rules in transmitter service, it's recommended that the shop have a current copy of Volume V on hand, and that each technician become familiar with it.

The volume is subdivided into four parts, three of which are of interest here: Part 89 covers Public Safety Radio Services (Police and Fire Departments, etc.); Part 91, Industrial Radio Services (Business, Manufacturer, and similar users); Part 93, Land Transportation Radio Services (Taxi, Motor Carrier, and other transportation services). Although NBFM is used by others, most shops deal exclusively with those listed here. Standards of interest are:

The FCC defines a NBFM transmitter as one that deviates no more than ± 5000 cps for 100 per-

cent modulation by a 1000 cps tone. This is also referred to as type 16F3 emission, and the channel bandwidth is known as 20F3 — in other words a carrier that is frequency-modulated with speech, occupying a channel 20 kc wide. In two-way work, all present FM operation in the 25-50 Mc and 150-450 Mc regions is restricted to narrow-band or 20F3 emission.

Frequency tolerance for transmitters of more than 3 w power is as follows: From 25 to 50 Mc — 0.002 percent; above 50 Mc — 0.0005 percent. If the dc plate input to the final RF stage doesn't exceed 3 w, the tolerance is only 0.005 percent. Most units serviced by the typical NBFM shop, however, exceed 3 w power and the frequency tolerance around 150 Mc is approximately ± 750 cps.

One hundred percent modulation is defined as ± 5 kc deviation, and this must not be exceeded by the transmitter, or clipping and distortion occurs at the receiver, and the message doesn't get through. To prevent this, the rules require an ADL (automatic deviation limiting) circuit, which clips audio that would cause overmodulation. In addition, a speech filter is required to limit frequency response to 3000 cps. As higher frequencies don't contribute to intelligible speech, their transmission is both wasteful and interference-producing.

Since no home-built equipment can be licensed in these services,



Inside view of a truck equipped to test and repair two-way radios.



LEFT: Waters Model 343 frequency meter is transistorized and portable.

RIGHT: Motorola digital frequency meter measures two-way radio frequencies, selective calling tones, audio frequencies, crystal oscillator frequencies and other measuring functions involving frequency checks and adjustments.

and usable gear must be type-accepted by the FCC, the manufacturer's ratings as to power output are specified in the station license. This rated power input to the final RF stage cannot be exceeded by more than 10 percent.

All service and maintenance work on this gear must be performed by the holder of an FCC first- or second-class commercial license, either telephone or telegraph. Furthermore, each time such service is performed, a descriptive entry must be made in the station records, along with the technician's name and address, class of license, its serial number, and date of expiration. These records are retained by the client.

The rules require that a properly-licensed technician measure the transmitter center frequency, deviation under 100 percent modulation, and the plate power input — whenever a transmitter is initially installed, or any change is made which may affect any of the preceding constants, and at intervals not to exceed one year. Almost all equipment used today is crystal-controlled. Should non-crystal-controlled gear be used, it must be frequency-checked each month. Incidentally, none of the preceding applies to transmitters with less than 3-w plate input.

There are no general rules governing receivers. It's obvious, however, a receiver must match associated transmitters in alignment, and

for this reason most shops service them at the same time, and with the same instruments.

Instruments Required

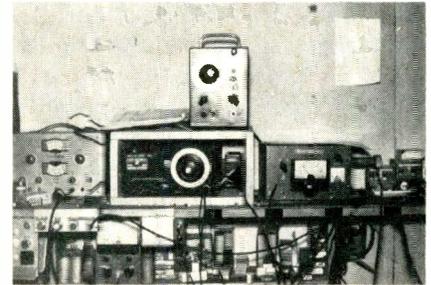
A frequency meter is needed to measure transmitter center frequency. Since the transmitter's frequency tolerance is ± 0.0005 percent, the frequency meter must have an accuracy equal to at least half that figure — 0.00025 percent.

To insure proper calibration of your frequency-measuring devices, the usual practice is to zero beat them against WWV with the aid of a crystal calibrator and a communications receiver. The crystal calibrator can also be useful in receiver alignment when using signal generators.

Transmitter deviation under modulation must be checked with an FM deviation meter which measures the actual carrier excursions. As with the frequency meter, only a quality instrument will do the job properly. Typical accuracy of deviation meters is 3 percent.

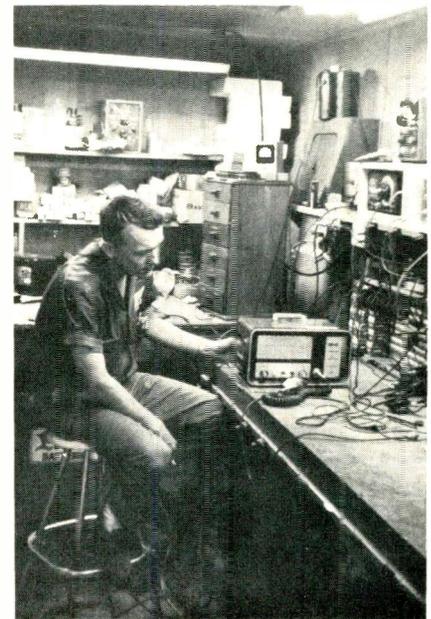
A stable, variable-frequency VHF signal generator is very useful. This instrument should have provisions for several crystal-controlled frequencies needed in the 10.7 Mc range. Remember, you cannot do receiver IF alignment with the transmitter signal, although final touch-up of the local oscillator is always done using the transmitter as a signal source.

Continued on page 78



Instrument bench in NBFM two-way shop.

Technician prepares to check out NBFM equipment.



Maintain equipment at a high performance level through preventive maintenance checks

Give Your 2-Way Customers A Break!

by Joe Jatts, Manager

Motorola Two-Way Training

Part 1

■ If your customer gets the most from his two-way radio network, the equipment must be maintained at a high performance level. Even the highest quality radio will gradually lose operating efficiency when neglected over a long period of time. Losses in receiver sensitivity and changes in transmitter frequency caused by normal tube aging, can add up to a noticeable drop in range and intelligibility. Periodic, preventive maintenance will keep the equipment operating at a high performance level and will insure optimum communications efficiency from the user's investment in two-way radio.

The important factors in maintaining peak operation are "netting" and deviation checks. Other important factors will be covered in later articles.

Netting

Netting involves tuning the stations of a network to the exact frequency (or frequencies) assigned to the network. For efficient communications between two stations, the receiver of each station must be tuned exactly to the transmitter frequency of the other — off-frequency operation degrades communications efficiency. Off-frequency operation at a net-control base station, for example, is particularly undesirable, since it affects communication with all mobiles in a system. Detuning at a given mobile is less critical since it affects only that mobile. In any case, the recent changeover from ± 15 kc deviation to ± 5 kc deviation in many systems heightens the effect of off-frequency operation and adds emphasis to the importance of careful netting.

In systems where the base sta-

tion and all mobiles are readily accessible to the technician, the ideal method for netting the system is to put the base station exactly on transmit and receive frequencies and then use it as the standard for tuning all the mobiles. In systems where many of the mobiles are not readily accessible, it will usually be necessary to tune each mobile as it becomes available.

To put the base station transmitter on frequency, use an approved frequency standard according to the instructions supplied with it.

To put the base station receiver on frequency, use one of the following methods:

1. Keep the base station receiver on the air while the transmitter goes on and tune the receiver oscillator to discriminator zero. (To be used only in single frequency systems.)

2. Tune another fixed or mobile transmitter exactly the same as the base station transmitter, then tune the base station receiver for zero discriminator reading with the other transmitter on the air.

3. Tune a high quality, stable signal generator to the transmitter's frequency with the frequency meter as a standard, then tune the base station receiver to discriminator zero reading with the signal from the signal generator.

Once the base station transmitter and receiver are properly tuned, the transmitter is put on the air for tuning each of the mobile receivers. With a portable test set connected to the receiver metering socket, each mobile receiver oscillator is tuned to discriminator zero. This assures that each mobile receiver is "zeroed" to its transmitter frequency.

Similarly, with the base station receiver tuned as described, each



Field technician using portable test set to net receiver of a vehicle mounted radio.

mobile transmitter is turned on in order and tuned to produce exactly zero discriminator reading at the base station receiver. Again, the portable test set is the ideal instrument for reading the discriminator voltage. Thus, all mobile transmitters are tuned to the assigned frequency. Mobile transmitters, of course, should be checked periodically against a frequency standard to assure compliance with FCC regulations.

In systems where it is impractical to verify that the mobile transmitters are all exactly on the base station receiver frequency, a highly stable frequency meter should be used. Once a system is carefully netted, the close tolerance of transmitter and receiver circuits hold the netting adjustments exceptionally well.

Deviation Check

The exact setting of transmitter deviation is a very important factor in getting the most out of a two-

Continued on page 77

■ Responding to a call from the base station, your customer has bucked heavy cross-town traffic to drive out to . . . a wrong address! He'd swear his office said "Forty-second at Windsor," but could it have been "Forty-seventh at Windsor?" Or did he say "Forty-second at Winthrop?"

The cost of one fuzzy phrase may range from a few blocks of unnecessary driving to a human life or thousands of dollars worth of property. In other situations, one garbled sentence could result in an unsafe airplane landing, a lost order, an irate customer. The price can easily be several times the difference between the poorest and the best communications equipment made.

Recognizing this, many two-way equipment owners and public safety organizations willingly spend thousands of dollars each year for servicing, testing, and updating vital equipment components. Oddly, one component which often gets little attention — the microphone — is one of the most important.

Communications Types

Behind this seeming indifference to microphones lurks an assumption that all are pretty much alike — differing chiefly in style and color, the kind of switch (if any) and, of course, the cost!

Well after all, *aren't* microphones pretty much alike?

The answer is a resounding "no!" Important differences in type and quality exist. A presentation of the various types, along with a list of the inherent advantages and disadvantages of each reveals basic differences of vital concern to those who must rely on two-way communications equipment.

One way to classify microphones is by their *generating elements*. (One of the few things they do have in common is that all types transform sound into electrical energy, though the ways they do this are many and varied.)

Easily the most common communications microphone is the type having a *carbon element*, often called a "button." This unit contains finely-ground carbon granules and a thin diaphragm which vibrates



Directional cardioid crystal.

What you don't know about this important component can hurt your 2-way business

Communications Microphones

by Lawrence LeKashman

Electro-Voice, Inc.

when sound strikes it, causing the granules to compress and decompress at the same frequency as the sound. When electric current flows through this element, the current varies proportionately with changes in sound pressure.

The general simplicity of a carbon microphone results in a fair degree of reliability, since little can go wrong with it. But some things *do* occasionally go wrong with carbon microphones. Physical or electrical shock, for example, may pack the granules, causing a loss of effectiveness.

Other carbon microphone disadvantages include a tendency toward internal noise — a result of shifting granules — and a relatively narrow and ragged frequency response. But the advantages of carbon microphones should not be overlooked. These include relatively high output (a strong sound signal), consistent performance under unfavorable conditions — high humidity and temperature extremes — and relatively low cost. One important recent carbon microphone refinement — incorporation of noise-cancellation — provides additional advantages of good articulation and low interference from extraneous noise.

A second generating element type is a crystal which produces a sound-modulated electrical output

when it is subjected to pressure. Rapidly varying pressure applied by the vibrating diaphragm changes the electrical output accordingly.

One overriding disadvantage of crystal microphones has all but eliminated its use, except in very inexpensive microphones. Heat and humidity rapidly break down the element, rendering the microphone useless. Attempts to overcome this objection (encapsulating the element in humidity-proof cartridges), have partly solved the problem but it has not been eliminated.

A third element is the *ceramic* type. Its operating principle is much the same as the crystal but without heat and humidity disadvantages. This type uses a thin slab of ceramic material which, like a crystal, emits electrical current when subjected to physical stress. Unlike the crystal, however, it is unaffected by humidity and temperature extremes.

The relatively low cost of the ceramic microphone makes it a wise choice where reliability and economy are prime requisites and where output and flat frequency response are not highly critical. Citizens band and economy ham installations can often make good use of this instrument; commercial two-way users, however, should choose a comparable dynamic type.

A fourth microphone element used in communications is the *con-*



Hand-held ceramic mike with integral switch is highly popular in mobile applications.

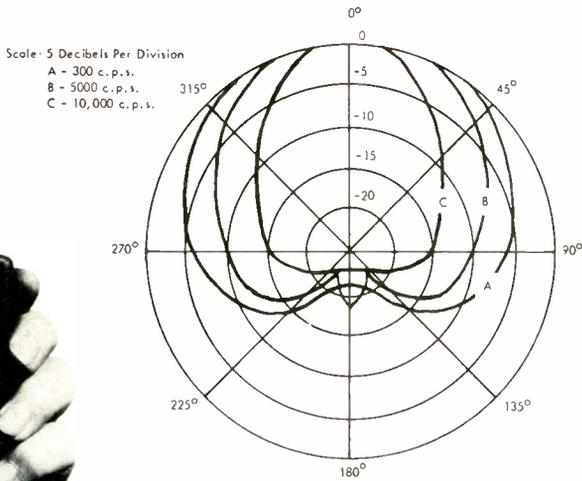


Fig. 1—Typical cardioid polar pattern.

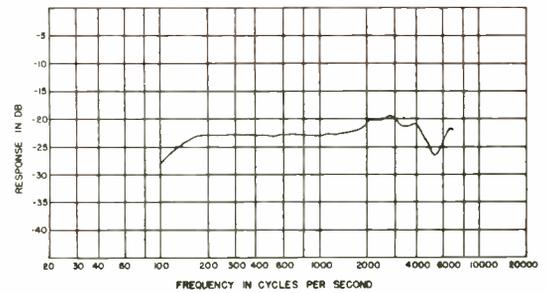
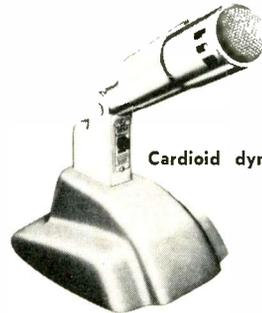


Fig. 2—Typical voice-range frequency response chart.



Cardioid dynamic.



Close-talking, noise-cancelling carbon microphone.

trolled reluctance type. This generator works on the principle that an electrical current is induced in a coil of wire located in a changing magnetic field. A magnetic armature attached to the microphone's diaphragm is suspended inside the coil. The vibrating diaphragm moves the armature and induces an equally varying coil voltage.

High output and fair response are advantages claimed for the reluctance type, but it has typically ragged response, the result of inertia involved in setting the rather cumbersome mechanism in motion. The complexity of the apparatus also tends to make it somewhat more trouble-prone than exacting communications uses permit.

The *dynamic microphone* is the most important classification to communications equipment users. The element generates an impulse by the movement of a light-weight coil within a strong permanent magnet field. This voice coil is vibrated by the thin diaphragm to which it is attached.

The dynamic microphone is preferred for all classes of communications service — and for numerous reasons. One of its greatest advantages is its high reliability. Extremely rugged and stable, it is virtually immune to the effects of temperature, humidity, and physical shock. Its uniform frequency response assures high articulation. (This is of particular value in modern transmitters which employ automatic level controls and other lim-

iting devices which depend on peak-free signal information.) Its ability to perform dependably under arduous operating conditions is underscored by the fact that all military services have standardized on dynamic microphones.

Today, regardless of the type of microphone supplied with original equipment, a dynamic may be substituted for dramatic improvements. Where a carbon microphone was used originally, a *transistorized dynamic* is a direct replacement and provides the many advantages inherent in the dynamic. The built-in transistor amplifier uses the same power as the original carbon button and boosts output to the same level. The user thus derives all the benefits — improved articulation, greater dependability, and broader, more natural response — without the disadvantages of other microphone types.

Dynamic microphones may also be used as direct replacements for most other types, including ceramic and controlled reluctance types, without circuit modifications. Regardless of what type of microphone the dynamic may replace — assuming comparable quality — a measurable improvement in "talk power" and reliability will be obtained.

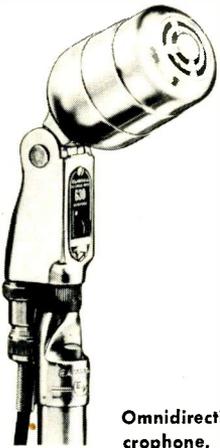
In classifying microphones by their generating elements we have covered only half the usual method of identification. Microphones are usually classified as "ceramic omnidirectional," "crystal omnidirectional," "dynamic cardioid," and so

on. Let's delve now into the second — and equally important half — of this identification, which refers to the microphone's *directional characteristic*. It is not enough to choose a microphone based on the element it utilizes; the instrument's sensitivity to sound from various directions must also be considered.

The most common classification in this category is the omnidirectional (sometimes erroneously referred to as nondirectional), which receives sound equally well from all angles. This may seem to be a definite advantage, since it implies greater versatility than would a restricted directional sensitivity. In most communications uses, however, an omnidirectional type is heir to noise pickup problems, as we will see in our discussion of the cardioid type. Omnidirectional microphones may often be used quite satisfactorily, however, in situations where little competing noise is present — as in a base station well isolated from unwanted noise.

The other common type of pickup, the one preferred for many communications uses, is the *cardioid* — a name derived from the Greek word, *kardia*, or heart. A graph of the microphone's directional characteristics (See Fig. 1) makes clear how this association came about, since it is shaped like a heart. This microphone is sensitive to sounds directly in front, considerably less so at either side, and almost "deaf" to sounds that originate directly from behind.

Noise-cancelling differential dynamic mike.



Omnidirectional microphone.



A moment's reflection reveals why the cardioid is an ideal choice for communications use in all situations ranging from those with moderate noise competition to fairly noisy situations. By its sharp reduction of unwanted sounds from the rear and sides, it assures a more favorable ratio of wanted to unwanted sound. A cardioid microphone will pick up at almost twice the distance and reduce the pickup of unwanted sounds almost twice as well as an omnidirectional type. The cardioid is especially useful with equipment having voice-operated switching (sometimes called VOX), since it excludes extraneous sounds which may otherwise trip the circuit.

In addition to the two directional types previously mentioned, several other types are available. These include the bi-directionals (sensitive to sound from front and back, but not from the sides) and superdirectional (highly sensitive to sounds originating from directly in front of them and insensitive to all others), but neither type is commonly used in communications.

Noise-Cancelling

No discussion of communications microphones would be complete without prominent mention of the *differential noise-cancelling* type, though this is not a directional classification, but a design feature which restricts the microphone's pickup only to sounds originating a short distance away, say within

a quarter inch. This type was introduced during World War II for use in tanks. By accepting only sounds of close origin, and rejecting unwanted background noise, this mike permits clear transmission even under extremely noisy conditions. The full output of the transmitting equipment can then be used for intelligible signal information, increasing the *effective* range dramatically. This noise-cancelling microphone almost doubled the distance from which understandable transmission was received in tanks — an improvement that will be significant to anyone operating from a noisy vehicle or in a noisy industrial environment.

Still another distinguishing characteristic in microphones is their impedance, abbreviated "Z". Impedance, generally speaking, is the apparent opposition in a circuit to the flow of an alternating current.

Each piece of electronic equipment has an impedance characteristic, and sometimes inputs are provided for more than one impedance rating. Impedance is usually described as "high" or "low," and may be expressed in Ω . Microphones also are available with various impedance ratings and should always be matched to the equipment. A serious mismatch usually results in an uneven frequency response, loss of output, or both.

A final distinguishing factor worth knowing, in choosing a communications microphone, is its output level — the signal strength it provides to the transmitter. When other factors are equal, the microphone providing the highest output level will be the most desirable. One word of caution, however. Output levels are specified in negative numbers of db. The output level is higher as the number becomes smaller. A microphone with an output level of -55 db would thus have a higher output level than one specified as -60 db.

Armed with a knowledge of generating elements, their inherent advantages and disadvantages — directional characteristics, impedances, and output levels — you can easily evaluate communications microphones, for most conventional uses. A few miscellaneous consider-

ations are worth bearing in mind, however. For your convenience, they are grouped here under appropriate headings:

Mechanical Requirements. Most communications microphones are subjected to extremely hard usage and, unlike their studio cousins, must be depended on without standby auxiliary equipment. In field and mobile use they must bear up well under severe temperature extremes and withstand the onslaught of mud, dust, accidental dropping, and a host of punishments.

A sturdy case — one resistant to cracking, chipping, and discoloration — is therefore important. The microphone should also have a reliable switch to assure continued trouble-free operation. Do not recommend a microphone switch without assurance of careful testing by the manufacturer.

For mobile use — and for many base stations — a coiled cord is desirable. Here one must rely on the integrity and reputation of the manufacturer, since cables which appear to be identical often differ widely in quality. Many stiffen in cold temperatures; some soften when subjected to heat. Chafing and breaking are common types of failures, also.

Frequency Response. It is not important for a communications microphone to possess an especially *broad* response range (not as important, that is, as it would be in a broadcast or recording microphone); it is quite important, however, that the frequency response in the voice spectrum be smooth and peak-free (Fig. 2).

Many communications transmitters (like single side band) automatically adjust their own output so that radiated power is within FCC regulation limits. (Even if not, audio gain must be adjusted manually.) If peaks exist in the microphone's frequency response, they will determine maximum output, with other frequencies held at lower levels. This means that average output will be far below what is possible or permissible. If response is peak-free, your customers will have full talk power across the entire voice spectrum, resulting in more intelligible transmissions. ■

Detailed maintenance techniques for cords, interiors and switches

Repair That Microphone

by Bob Hite

The Turner Co.

■ Technicians are usually confronted with three primary repair areas in communications microphones: cords, "interior" or generating system components, and switches.

Cord Maintenance

The microphone cord, or coiled cord, is the object of strenuous use. It probably accounts for the largest number of failures in communications microphones.

Some communications microphones contain switching facilities to turn the transmitter on. When the microphone fails to turn the transmitter on, or to "talk," a careful examination should be made of the cord for obvious damage. Note its condition at the microphone base and at the connector, or at the point where it enters the transmitter — in the event a connector is not used. These stress points are the usual trouble areas.

If no visible damage is observed, the microphone should be laid carefully on the service bench, preferably on a large sheet of clean paper. In the case of a dynamic microphone, care must be used to prevent iron filings from being pulled into the interior. This can result in eventual failure of the dynamic interior. After removing the case screws, care should be used in opening the case, otherwise the interior may be damaged. Note the position of the inner parts so the microphone can be correctly reassembled after the cord repair or component replacement is made. A VOM or VTVM should be used to check cord continuity. It is a good idea to use clips on the meter probes so your hands are free to flex the cord at stress points to

show up the intermittent conductor (See Fig. 1).

In addition to checking for continuity, it is a good idea to check for possible shorts between cord conductors. Cord flexing will usually make it easy to pinpoint the trouble area. Check the cable for additional wear as it is economically unsound to waste labor on a poor cord.

If the cord is bad at a flex point, cut it back at least an inch behind the identified break point. Strip the leads back to match the length used in the microphone. Again, check carefully with the meter to be sure the broken conductor area has been removed. Now place the cutback cable through the strain relief grommet or spring. Secure it in the same manner as it was originally. Carefully unsolder the old leads and solder in the redressed cord. Make a wiring diagram, if necessary, to prevent wiring errors. The strain relief is extremely important — no stress should be placed on the leads to the switch or the interior. You are now ready to reassemble the microphone.

In the case of self tapping screws, turn them counter clockwise until the threads mesh, then tighten.

There are several types of coiled cords available for communications microphones. The common outer jacket types are neoprene and PVC (polyvinyl-chloride). The PVC type has become more popular in the last two years. Life expectancy is generally greater on cords with tinsel conductors than on regular stranded conductors. They may have a higher electrical resistance than regular stranded wire, however, and they usually carry a higher

price tag. The tinsel cord may be cut back and reworked but care must be used. Employ the following procedure, as shown in Fig. 2. Carefully remove the tinsel conductor insulation. Now use a fine tinned, bare wire, and wrap it carefully around the tinsel conductor, beginning at the insulation, out to the end. Solder with a clean, low temperature solder. Clip off the ends of the wrapping wire. You will have to provide a strain relief for the tinsel wire so no strain is placed on the conductors.

Carbon microphones do not generally use or require shielded cords. A communications shop should carry both the shielded and non-shield cord types.

Interior Replacements

The generating system of a microphone (in the case of crystal or ceramic types), includes the steel cup, crystal or ceramic element, mounting for the element, drive pin, and diaphragm. In the case of the dynamic microphone, the interior includes the complete generating system of magnet, pole pieces, voice coil, diaphragm, and damping provisions.

When it becomes necessary to replace interior microphone parts, care must be observed to assure your customer of performance equal to his original microphone.

A high percentage of CB mikes are ceramic type interiors, whereas a high percentage of commercial two-way types are dynamics or transistorized dynamics. Since considerable variation exists in ceramic interior sizes and specifications, you would do well to obtain a direct manufacturers' replacement through your local distributor.

With the advent of transistor transceivers, the typical ceramic element of a few hundred pf capacity has now grown into many different capacities with fifty to sixty thousand pf being common. If in doubt about the element capacity, it may be measured with a bridge, as shown in Fig. 3. Here the interior terminals are connected to the bridge terminals making sure the interior ground lug goes to the low bridge terminal. Failure to replace a high capacity interior with a high capacity unit may result in severe low frequency loss as well as output level differences and customer dissatisfaction.

When replacing the ceramic interior, examine it and note if it has a hole or holes in the diaphragm, or cutouts in the back or side of the cup. The cutout in the cup back or side is usually covered by nylon cloth. Examples of special response interiors for microphones may be seen in Fig. 4.

Most transceivers have sufficient AF gain to produce full modulation over a reasonable latitude of microphone sensitivities. In some cases, however, an unusually "hot" mike will overload the transceiver, producing distortion and poor intelligibility.

Your main concern will usually be with low sensitivity from a failing element. AB type comparisons are useful at this point. Use a sensitive ac VTVM or high gain oscilloscope. If neither is available, use an audio amplifier to drive a VTVM or a less sensitive scope.

A sensitivity check may be made by talking into the known good microphone and then speaking at the same distance and level into the defective microphone noting the differences in output.

A more refined method is to feed your bench speaker with an audio oscillator at a fixed level, placing the two mikes at equal distance from it. Best results will be had by keeping speaker level low and the test microphones against the speaker grille. This helps prevent differences in distance between the source and the microphone under test which could give erroneous readings.

As an example, by changing the

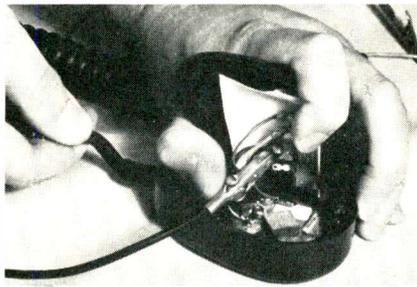


Fig. 1—Use clips on meter probes so your hands are free to flex the cord at stress points.

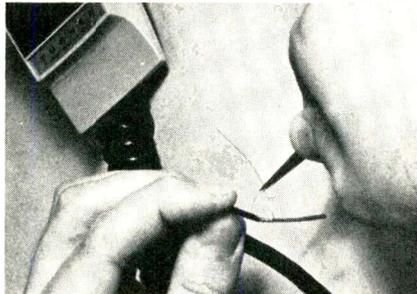


Fig. 2—Remove tinsel conductor insulation and wrap conductor carefully with fine tinned, bare wire.



Fig. 3—If in doubt about the ceramic element capacity, measure it on a bridge.



Fig. 4—Special response microphone interiors.



Fig. 5—Voice-coil drag can be detected by holding the interior as shown here and pushing the diaphragm in gently and then releasing it slowly.



Fig. 6—Iron particles on the front of the diaphragm should be carefully removed with a piece of masking tape.



Fig. 7—The center rubber foot shown in base plate is a 'lift' switch.

spacing between the source and the test microphone from one-half in. to 1 in., a 6 db drop in voltage output would occur. When using the oscillator method, make the tests at several frequencies. If your sensitivity tests indicate the need for a new ceramic interior, proceed as previously outlined to assure correct element capacity, correct response shaping, and correct sensitivity. It is good practice to check the modulation percentage on the transceiver following microphone replacement, or microphone interior replacement. This will allow you to correct for any minor differences in microphone output and to correct for any previous adjustments which were made on the basis of the failing microphone.

Care and maintenance of the dynamic type microphone is quite similar to the ceramic. It, too, has been affected by transistorized equipment. Dynamic microphones are now supplied with voice coils wound in a variety of impedances to match directly into the input circuitry of a transceiver. Common voice coil values are 150, 200, 500, and 600 Ω .

The primary reason for higher impedance voice coils is to eliminate the bulky expensive impedance matching transformer. This allows a lighter weight, less bulky and more competitive priced microphone. In repairing dynamic communications microphones, you will be confronted by types with and without matching transformers. Those with a matching transformer will probably have a voice coil impedance between 5 and 50 Ω . When the dynamic microphone is opened and no transformer is used, it is imperative that you determine the voice coil impedance before replacing this interior.

Failures most common to dynamic interiors are (1) voice coil drag, (2) iron particles in the magnetic gap, (3) open voice coil, and (4) punctured diaphragm. Some precaution should be exercised when repairing dynamic microphones. Never open the case in the presence of iron filings as these particles will usually find their way into the magnetic gap. Clear an area on the bench and then place the

microphone on a large sheet of clean paper. It is a good idea to use tools that have been demagnetized, otherwise the tools may carry iron particles to the microphone.

Voice coil drag causes severe dips or holes in the microphone response and reduces sensitivity as well as creating audible distortion. Voice coil drag is the voice coil rubbing against the magnet or part of the magnetic structure and may be caused by severe shock, a slipping diaphragm or distortion of the diaphragm/voice-coil assembly. It can often be detected with a light touch. Holding the interior as shown in Fig. 5, gently push the diaphragm in and release it slowly. Normally the diaphragm will move in and out uniformly. When one side resists moving it usually indicates a drag on that side and quite often can be felt as it rubs. The drag may also be identified by connecting the interior to the output of an audio oscillator and driving it as a speaker from 200 to 2000 cps. A severe buzzing or raspy sound at one or two frequencies in this range indicates a drag. Be careful to keep the output of the oscillator low to prevent damage to the interior. If the tests indicate a drag, the interior must be replaced with a new one.

Replacement interiors should be obtained from the original microphone manufacturer through your local distributor. Make sure it has the correct voice coil impedance for the microphone being repaired. The voice coil impedance may be measured with a bridge or a good ohmmeter, since it is primarily resistive. Be sure to disconnect the interior from other parts of the circuit before making the measurement.

Iron particles in the magnetic gap can create drag as previously outlined, though the drag may be intermittent. It will eventually result in complete failure, thus a contaminated interior should be replaced immediately. When iron particles are noted on the front of the diaphragm, they should be carefully removed with a piece of masking tape. Grasp the masking tape, as shown in Fig. 6, about one-half inch from the tip and carefully

touch the tip to the particle. Do not press the tape against a large area of the diaphragm at any time, because its removal might then cause permanent damage to the diaphragm. A dynamic interior with an open voice coil is usually beyond repair. It may be worthwhile, however, for you to reheat the voice coil connections with a 40 w soldering iron in the event of a cold solder joint or a broken voice coil lead at the terminal. If this fails to restore continuity, a new interior is required.

The dynamic microphone is built with a controlled air mass behind the diaphragm. The stiffness of this air mass is one of the major controlling factors of the diaphragm. It dampens the natural resonance of the diaphragm/voice-coil system which would otherwise appear as a sharp resonant peak in the audible band. This controlled air volume behind the diaphragm further vents into the case of the microphone through a controlled or dampened path, usually made up of a felt ring under adjustable pressure. If a hole appears in the diaphragm it will reduce the dampening effect and the mid-range sensitivity will probably increase and a hump or resonant point will appear in the 250 to 500 cps range with a roll-off below this resonant hump. The interior with a hole in it should be replaced.

Switch Maintenance

Switches in communications microphones have been greatly improved in the last few years. The switch may fail or give intermittent operation, however, after long usage or when used in a corrosive environment. Contacts on the leaf type switch may be burnished with a relay or contact burnishing tool. If a tool is not available, use kraft paper to clean the contacts. Care must be taken to avoid bending the leaves. One of the good liquid contact cleaners may be sparingly used on the slider type switch. If this type switch does not respond readily to treatment, it should be replaced. In replacing a switch always note the wiring on the old switch and make a sketch, since

Continued on page 83



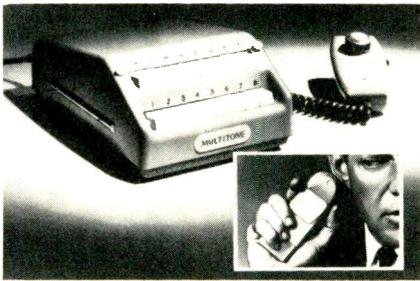
The Selective Radio-Paging Boom

Units become 'pocket-companions' for men on the move

■ From small-plant industrial or business operations to sprawling steel, chemical and other plants, department stores and institutions, a new market has opened for shirt-and jacket-pocket radio receivers. And one system is designed to tie any plant or business phone directly into PBX switchboards, making it possible to *selectively call* and transmit phone messages direct to anyone

carrying a pocket receiver. Some systems in operation have literally hundreds of people carrying receivers. Engineers, maintenance and production supervisors in some plants are saving hundreds of valuable man hours every month.

Service-dealers in many areas are now selling, installing and servicing this equipment and the field hasn't been scratched yet. ■



Multitone Electronics' paging equipment showing 5 oz receiver in use.



Motorola 20-call encoder for pocket pagers.



Dial-paging terminal equipment made by G-E for PBX-equipped buildings. Equipment allows direct voice message from any plant telephone to radio-equipped men on the move.



E. F. Johnson's pocket paging receiver carried on inside jacket pocket.



Complete Bogen 'Pagemaster' system.



Executone's pocket paging system desk set for locating roving personnel.

Transistor noise gate, improved color CRT

Phosphor and VDRs highlight some 1965 TV sets

What You'll Find in 1965 TV

■ This is the third and final installment covering 1965 TV circuit innovations.

Setchell-Carlson

The 1965 color chassis has seven plug-in units on an aluminum chassis. The chroma circuitry is arranged so the chroma unit can be removed without disturbing monochrome reception.

An 8.3 v power transformer secondary winding furnishes heater power for the 6BK4 and the CRT. This circuit is held at about 260 v above ground to minimize cathode leakage in associated tubes. The 8.3 v supply is dropped to the normal 6.3 v for the 6BK4 by an 11 Ω resistor in series with the filaments. A 1 Ω dropping resistor for the CRT heaters is mounted under the main chassis at the rear. This resistor not only protects the CRT heaters from warm-up surge, but can be shunted to act as a built-in booster for a weak CRT. A wire can easily be soldered across the resistor.

The heater supply of all tubes — excepting the CRT and 6BK4 — is divided so a portion of the load is carried by each side of a grounded center-tapped 12.6 v winding. Loads for each side are almost completely balanced to eliminate ac current loops through the chassis, thus eliminating ripple. The color chassis is shown in Fig. 1.

Sylvania

Horizontal blanking and retrace clamping is a continuing feature in Sylvania "power bonus" chassis.

The overshoot spike shown in Fig. 2 is a result of high frequency emphasis in the video amplifier. The high resolution picture is desirable but the resultant overshoot spike produces an intense ragged vertical line in the center of raster during retrace time. The negative polarity blanking pulse is derived from the horizontal output transformer during the flyback period. The diode in the circuit suppresses the positive half of any damped oscillations.

A transistor noise gate is incorporated in all current sets for better noise suppression. Noise picked up from the detector output opens the sync separator circuit. This prevents sweep circuit triggering (Fig. 3).

A toroid yoke is used on all models. This allows a new design in the vertical output stage which greatly reduces the tube's power dissipation.

The color TV line contains a major CRT improvement. The 21 in. round color CRT employs a new red phosphor which increases brightness by over 40 percent, according to the manufacturer.

Westinghouse

Two basic chassis are used in all 19 and 23 in. CRT models for 1965. The basic layout for the two chassis — V-2474 and V-2475 — is the same with only minor variations for control panels. Chassis V-2474 has a two stage IF with a single rectifier low voltage power supply while chassis V-2475 (Fig. 4) has a 3 stage IF with a double rectifier. A different flyback transformer and yoke is required when

a given chassis uses a 19 in. tube.

A circuit design in the V-2475 chassis minimizes variations in raster width (Fig. 5). The key to this improvement is a voltage dependent resistor (VDR). As we know, the resistance of a VDR drops as the voltage across it increases. The VDR in this circuit shows a greater change in resistance above 600 v than it does below this point.

Pulses from the flyback transformer are reduced in amplitude by capacitive voltage divider Z401 and applied to R417, the VDR. A steady positive voltage is also applied to the VDR through width control R418 and resistor R419.

Pulses applied to the VDR assume a negative value but reach large positive values during each pulse (approximately 1000 v). Each high voltage pulse is short compared to the time between pulses. The positive pulses occupy only 15 percent of each pulse cycle. When a pulse is applied to the VDR its resistance drops very sharply, reducing the pulse amplitude.

Two different time constants are obtained: a short time constant during each high voltage pulse, and a long time constant during the time between pulses. During each positive pulse, the VDR side of the top capacitor in Z401 is charged. Because its charge time is shorter than its discharge time, this side of the capacitor is maintained at a negative average voltage. This negative voltage, together with the positive voltage supplied through the width control, establishes grid bias on the horizontal output tube.

Sets

No current is drawn by the output tube grid, minimizing Barkhausen oscillations. The width control setting determines output tube conduction time during each input waveform from the horizontal multivibrator. If the flyback pulse amplitude drops because of low line voltage or low B+, the VDR response to the pulse will be less, and the more positive bias on the grid will maintain the sweep width.

Zenith

A continuing feature in the 1965 color chassis is the Zenith-developed high level color demodulator. A beam deflection type 6JH8 tube is used in this circuit (See TEKFAK 886 in November 1964 ELECTRONIC TECHNICIAN.)

A signal from the local 3.58 Mc oscillator drives the deflection plates of each individual demodulator, push pull through the quadrature transformer. The color information is fed to V12 and V13 grids. Each demodulator tube has two outputs which are 180 deg out of phase. Pin 9 output of V12 is the detected B-Y color difference signal and the R-Y signal appears at pin 9 of V13. These color difference signals are applied, through filters, to the proper CRT grids. The G-Y signal is obtained by combining the -(R-Y) and -(B-Y) signal outputs of pin 8 plates of the respective demodulator tubes. Resistors R16, R37, R38 and R39 form the mixing network to produce the proper G-Y signal.

Output of the high level demodu-

Continued on page 79

Fig. 1—Sethell-Carlson model U800 unitized color TV chassis.

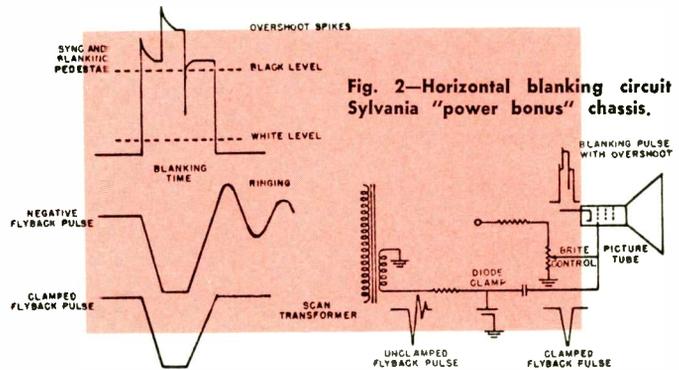
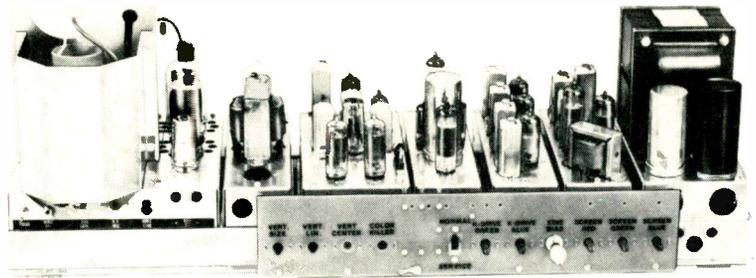


Fig. 2—Horizontal blanking circuit in 1965 Sylvania "power bonus" chassis.

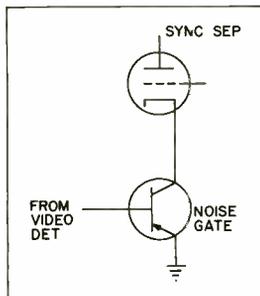


Fig. 3—Transistor noise gate circuit used in Sylvania 1965 TV line.

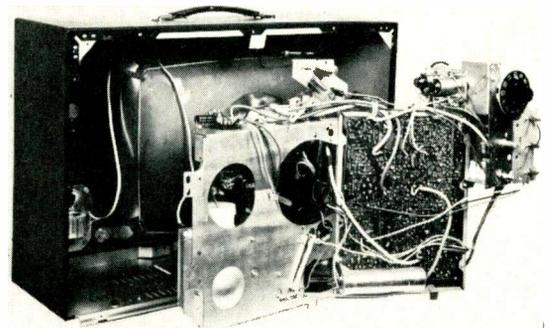


Fig. 4—Westinghouse V-2475 TV chassis.

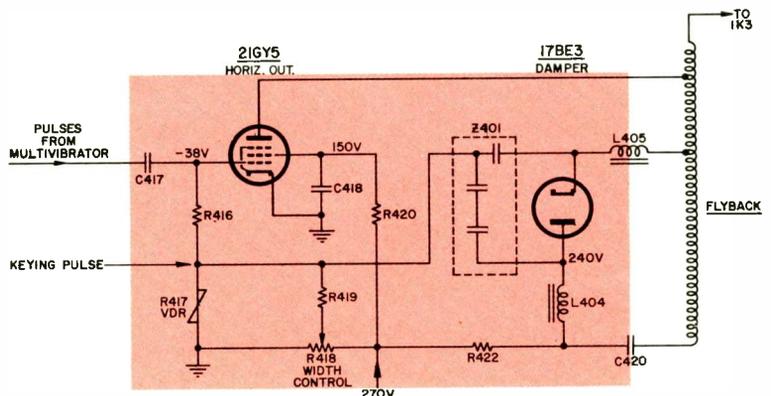


Fig. 5—Horizontal output circuit employed in V-2475 Westinghouse TV chassis.

TOUGH DOG CORNER



Difficult Service Jobs Described by Readers

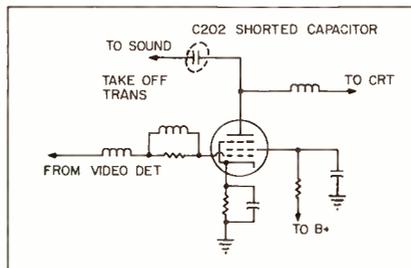
Faulty Tuning Capacitor

A customer brought a Model 3TMF Motorola auto radio into the shop. The owner said that it went dead after about 15 minutes of normal operation. With the radio in a non-operating condition, I was able to hear the output of a noise generator at the speaker with the signal inserted at the antenna. This indicated that the local oscillator was not working. The oscillator-mixer transistor checked out OK with an in-circuit transistor tester. To be doubly sure I substituted a new transistor in the oscillator-mixer stage. The radio remained dead. The RF and oscillator-mixer voltages were all normal. I noticed while probing, if I applied pressure to the printed board in the vicinity of the mixer stage, the radio would start playing. This led me to believe that the printed board was probably broken. The board was checked and rechecked for breaks but there were none to be found. Most of the components in the mixer stage were replaced — but still no positive results. The tuning capacitor, C3, appeared to be normal and it checked out fine on a capacitor tester. Appreciating the fact that the capacity tester could have given the wrong indication, the tuning capacitor was replaced and the radio started operating normally. The radio continued to

perform satisfactorily for two days so it was returned to the customer.
Frank D. McCreery, Providence Forge, Va.

AGC Malfunction

A KCS-136Y RCA chassis was brought into our shop. The set exhibited what appeared to be AGC overload. The 6GY6 AGC tube was replaced with no improvement noticed in the picture. A negative voltage from a bias box was applied to the AGC buss and the picture appeared somewhat washed out but



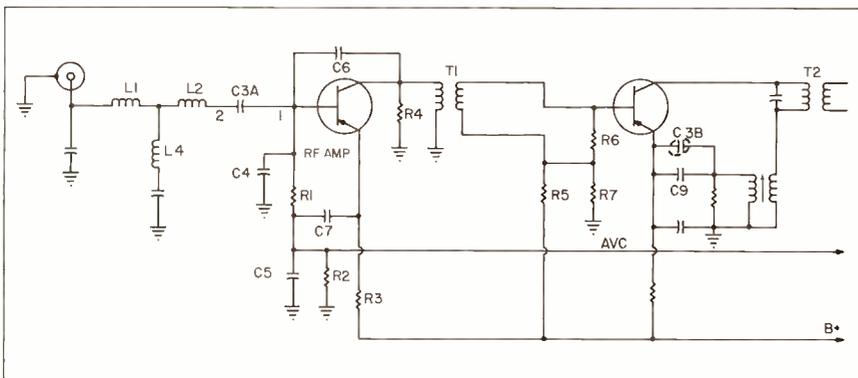
Shorted sound take-off capacitor, C202, caused loss of AGC voltage in KCS-136Y RCA chassis.

was viewable. This indicated probable AGC trouble so I checked the voltages in the AGC circuit. The voltage on pin 5, the plate of the 6GY6 AGC tube, was positive 5 v. It should have been -1.3 v. All the other voltages on this tube were normal. A normal horizontal pulse was present at the plate of the AGC

tube. All components in the AGC plate circuit were checked and found to be OK. The 6HF8 video amplifier tube was replaced but the trouble still persisted. The voltage on the video output tube screen was 160 v and the plate read 45 v. Normal voltages are 95 v on the screen and 110 v on the plate. The composite video signal is fed to the grid of the AGC tube so any defect in the video stage can affect the AGC action. A resistance check in the plate circuit of the video amplifier revealed that the sound take-off capacitor had a 4500 v reading across its terminals. A new capacitor was installed and set started operating normally.
Jack Ray, Springfield, Illinois.

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, Minnesota 55802.



Capacitor C3B caused intermittent operation of local oscillator in Model 3TMF Motorola auto radio.



"Smith can't stand anyone looking over his shoulder."

MIRACLE WORKER

in professional TV service shops

PINPOINTS ANY TV TROUBLE FAST! UPS YOUR PROFIT!



FLYING SPOT SCANNER

transmits B&K patterns or your own pictures onto TV screen

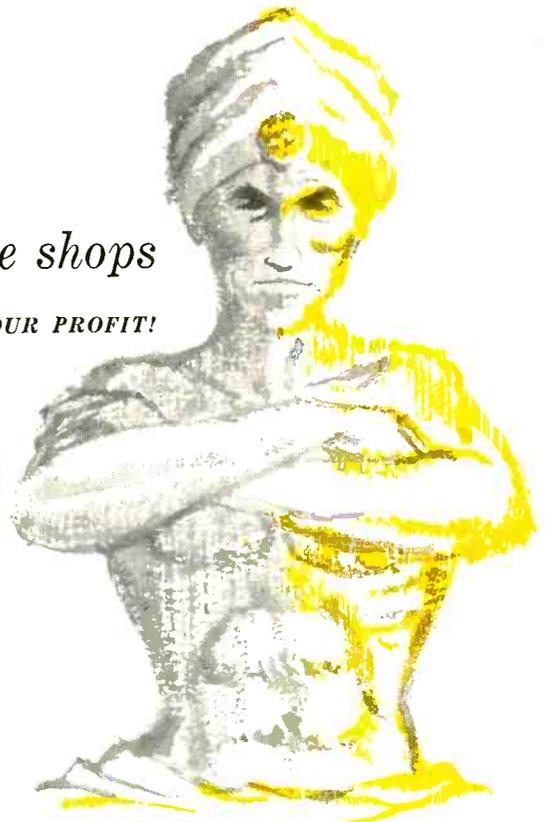
It's like having your own TV station! You can inject your own TV signals at any time, at any point—and quickly solve tough dogs, intermittents, any TV trouble, as you watch the generated test pattern on the raster. Checks any and all circuits in any stage throughout the video, audio, r.f., i.f., sync and sweep sections of the TV set. No external scope or waveform interpretation is needed. And if you wish, you can transmit your own slide-pictures.

Makes Color TV Servicing Easy, Too.

Generates white dot, crosshatch and color bar patterns for convergence. Generates crystal-controlled keyed rainbow color display to check color sync circuits, check range of hue control, align color demodulators. Demonstrates correct color values.

Saves time and work for the "pro." Makes servicing easier and faster for the beginner technician. Most valuable instrument in TV servicing.

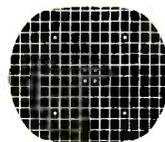
Net, \$329.95



DELUXE B&K

MODEL 1076 B&W and COLOR TELEVISION ANALYST

*with Crystal-Controlled Keyed Rainbow Color Display
and Highly-Stable Horizontal Oscillator Sync*



*Profit with a B&K Service Shop
See your B&K Distributor
or Write for Catalog AP21-T*

B & K MANUFACTURING CO.

**DIVISION OF DYNASCAN CORPORATION
1801 W. BELLE PLAINE AVE. • CHICAGO, ILL. 60613**

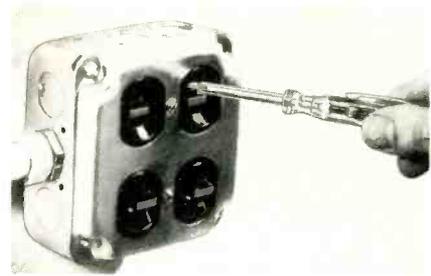
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 123 Grand St., New York 13, U.S.A.

- - - for more details circle 15 on post card

NEW PRODUCTS

VOLTAGE TESTER 200

A combination screwdriver/voltage tester for checking opens or hot lines in circuits from 110 to 380 v is announced. Incorporated in the transparent plastic handle are a resistor and a neon lamp that glows when the screwdriver tip is applied to a live line. Ideal for TV-radio technicians, the molded



plastic extends all the way down the screwdriver shank to make it shock-proof. Only the screwdriver blade is exposed. A clip keeps the pocket-size screwdrivers handy when needed. Littelfuse.

TUBE CHECKER 201

The "counter/bench" version of a portable tube tester is introduced. The unit will test over 2500 tubes



— including Nuvistors, Compactrons, 10-pins, Novars, Magnovals and Japanese, French and German tubes, the manufacturer reports. The tester can be used as a counter checker or self-service tube seller in your shop. Sencore.

SPEAKER Baffle 202

Bi-directional sound distribution in corridors and sheltered outdoor locations is possible with speaker



and baffle combinations containing an extended range 8-in. cone speaker. The speaker housing has an adjustable mounting bracket, designed for universal installation on walls, ceilings, poles and under roof overhangs. Specifications are: Power, 8 w. Impedance, 8Ω. Magnet, 3.16 oz. Alnico V. Dimensions 9 in. dia and 5 in. deep. Atlas.

TRANSISTOR MEGAPHONE 203

A transistorized device that may be used as a megaphone, as a remote microphone and megaphone or as a complete PA system, is called "Amplivoice."



- Tests TV and Radio Tubes —both old and new
- Tests all Novars
- Tests Nuvistors, 10-pin Tubes, and 12-pin Compactrons
- Tests Voltage Regulators, Thyratrons, Auto Radio Hybrid Tubes, European Hi-Fi Tubes, and Many Industrial Types

B&K PROFESSIONAL QUALITY AT LOW COST

Model 600 Compact Portable Dyna-Quik
Makes Tube Testing Quick, Accurate, Profitable!

It's amazing how quickly you can accurately check out tubes on every call—sell more replacements, and make more money—with this up-to-date, low-cost professional quality tube tester.

Checks for all shorts, grid emission, leakage, and gas. *Checks* each section of multi-section tubes separately. *Checks* tube capability under simulated load conditions. Rejects bad tubes, not good tubes. Quickly reveals tube condition, saves customers, stops call backs, increases servicing profit.

Exclusive adjustable grid emission test. Sensitivity to over 100 megohms. Phosphor-bronze socket contacts. Complete tube listing in handy reference index. Handsome, sturdy leatherette-covered carry-case. Size 8½" x 11" x 4½". Net, \$74.95



QUICK, DIRECT, ERROR-FREE READINGS WITHOUT MULTIPLYING

Model 375
VTVM
Net, \$89.95

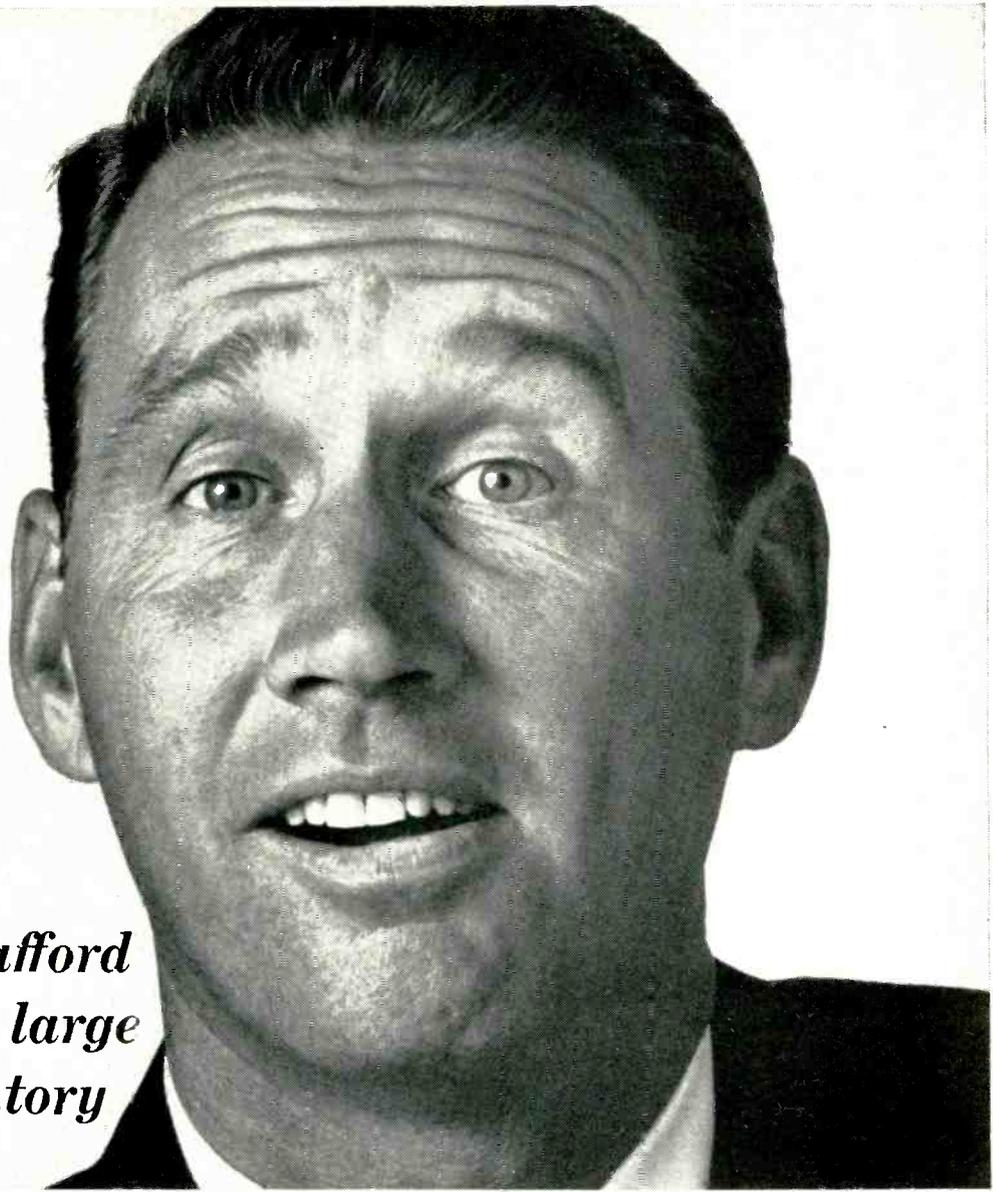


Model 360
V O Matic
Net, \$59.95

See Your B&K Distributor or Write for Catalog AP21-T

B & K MANUFACTURING CO.
Division of DYNASCAN CORPORATION
1801 W. BELLE PLAINE • CHICAGO 13, ILL.
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 253 Broadway, New York 7, U.S.A.

--- for more details circle 16 on post card



*“I can’t afford
to carry a large
inventory*

...that’s why I specify Greyhound Package Express!”

You may not have the space of a warehouse, but your customers will think so when you specify Greyhound Package Express. Order only *what* you need, *when* you need it. Greyhound Package Express will get it where you want it, quickly, easily, economically.

Your orders travel aboard regular Greyhound buses, on fast, frequent schedules...365 days a year,

24 hours a day, week-ends and holidays. Save time, money, space, with Greyhound Package Express. Convenient C.O.D., Collect, Prepaid or special charge account service, too.

For information on service, rates and routes, call Greyhound or write today: Greyhound Package Express, Dept. 53-A, 140 S. Dearborn St., Chicago 3, Ill.

It’s there in hours...and costs you less

For Example:	Buses Daily:	Running Time:	20 lbs.	30 lbs.	40 lbs.*
BOSTON— NEW YORK	20	5 hrs. 0 min.	\$2.00	\$2.35	\$2.60
LOS ANGELES— SAN FRANCISCO	28	9 hrs. 20 min.	2.10	2.45	2.80
DALLAS— SAN ANTONIO	10	7 hrs. 15 min.	1.90	2.15	2.45
CINCINNATI— LOUISVILLE	14	2 hrs. 20 min.	1.65	1.90	2.15

*Other low rates up to 100 lbs.

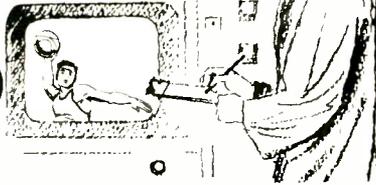


One of a series of messages depicting another growing service of The Greyhound Corporation.

--- for more details circle 28 on post card



A TOTALLY NEW STANDARD OF PERFORMANCE AND RELIABILITY!



Superior's talent for matching theory with practical experience has produced electron guns that give you plus value where it really counts . . . in your customers set.

A high degree of technical skill . . . the ability to put this skill into practice . . . and the determination to produce electron guns of unequalled reliability and performance are some of the factors that have made SUPERIOR ELECTRONICS the world's leading exclusive producer of electron guns for the foreign and the domestic cathode ray tube market . . .

Whatever your needs we invite you to profit from our background and experience. For the right gun . . . for the right service . . . always specify 'SUPERIOR' and be sure!

©Superior Electronics 1965

SUPERIOR ELECTRONICS Corporation

208-212 PIAGET AVENUE CLIFTON, NEW JERSEY TEL: 772-2500

- - - for more details circle 52 on post card



New stick-on wiring system eliminates mechanical fasteners

New "Scotchflex" Brand Flat Cable System lets you install low-voltage hookups anywhere in seconds. Applies like tape to tile, concrete, brick, paneling, any surface. No stripping necessary . . . sharp "U" shaped prongs in the connectors pierce the insulation and establish firm contact with each of the round wire conductors. "Scotchflex" Cable saves installation time and provides better looking wiring on intercoms, call systems, hi-fi, and other low voltage systems. For details, write: 3M Co., St. Paul, Minn. 55119.

Electrical Products Division **3M** COMPANY

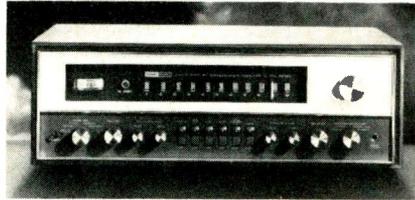
"SCOTCHFLEX" IS A TRADEMARK OF 3M CO.

- - - for more details circle 41 on post card

NEW PRODUCTS

FM STEREO RECEIVER

204



An all-transistor FM stereo receiver, model SR 900, extends frequency response both above and below

the audio spectrum. A wide range of frequencies, including sub-sonics and ultrasonics are handled by the receiver at its natural relative amplitudes according to the company. The manufacturer reports that one unit includes a solid state stereo logic circuit. This circuit automatically switches from stereo to monophonic. In addition, when stereo signals fade, the stereo logic circuit chooses mono reception over noisy stereo reception. Harman Kardon.

HANDS FREE COMMUNICATOR

205

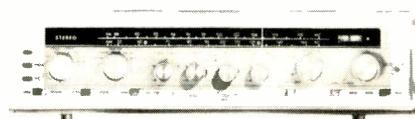
"Shoulder-Talk" permits hands-free two-way radio communications for walking personnel. Unit combines



microphone, speaker and antenna in one housing. It was said that 25 of the units were used at the Cow Palace in San Francisco during the Republican Party convention. Features include noise elimination circuitry, push to talk button, and all aluminum construction, weight approximately 1 lb, complete with battery and leather case. Units were said to be exceptionally useful in inventory, production and traffic control. Mar-co.

FM TUNER AMPLIFIER

206



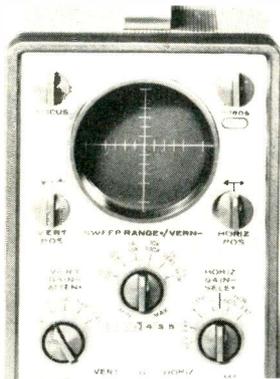
Announcement is made of a tuner / amplifier containing an engineering refinement which,

according to the manufacturer, facilitates installation in areas where reception is an exceptional problem due to multipath interference. The S-7700III FM Stereo Tuner/Amplifier incorporates circuitry and built-in test points for directly connecting a scope for on-the-spot visual display of incoming signal characteristics. A

high fidelity iastaller can quickly identify the presence, degree, and direction of multipath interference so corrective action can be taken, the report states. Sherwood.

WIDEBAND SCOPE

207



A compact scope is designed for production testing, electronic equipment maintenance, and servicing color and black and white TV sets. The model 435 instrument employs a flat-face 3 in. CRT.

The manufacturer reports that vertical response is flat within + 1 db, -3 db, from dc to 4.5 Mc and sensitivity is 18 mv per cm rms and 50 mv per cm P-P. Input impedance is one M Ω shunted by 35 pf. Horizontal response is flat within + 1 db, -3 db, from 1 cps to 500 kc and sensitivity is 0.7 per cm rms. Input impedance is four M Ω shunted by 40 pf. Intensity modulation input sensitivity is 3 v rms for blanking and input impedance is 2.2 M Ω . Sawtooth output signal level is 10 v P-P from 10 cps to 100 kc. Output impedance is 300 Ω . The scope weighs 15 lb and measures 8½ x 5¾ x 12⅝ in. EICO.

"TORQUE WRENCH" MANUAL

SENT UPON REQUEST

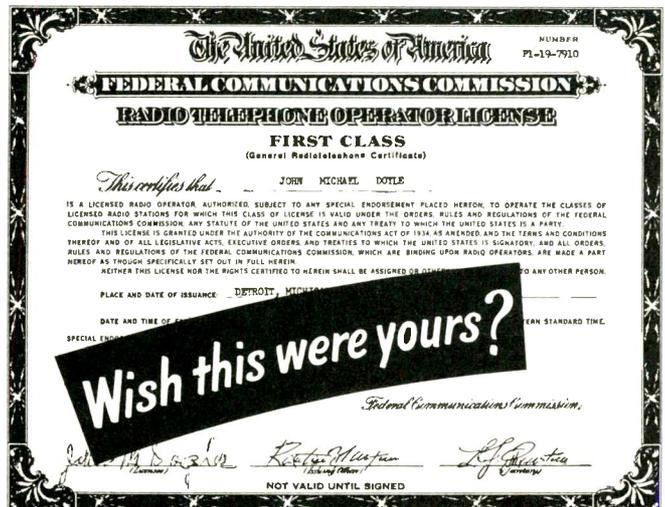
Formulas
Applications
Engineering Data
Screw Torque Data
Adapter Problems
General Principles

P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

Manufacturers of over 85% of the torque wrenches used in industry

--- for more details circle 51 on post card

You get your "ticket" to greater income



or your money back

THERE'S A WORLD OF OPPORTUNITY FOR THE MAN WITH AN FCC LICENSE

All it takes is a few spare hours a week and NRI's FCC License Course to open the way to increased opportunities in Communications. With an FCC License, you're ready to operate, service and install transmitting equipment used in aviation, broadcasting, marine, mobile and Citizens-Band communications.

What does it take? Men with absolutely no training or experience in Electronics complete the course in 10 months. A Technician or man with some background can easily cut that time in half. And because NRI has a greater enrollment than any other school of its type, training costs you less than comparable courses offered by other schools. Further, **YOU MUST PASS your FCC exams or NRI refunds your tuition in full.**

Get full details today about NRI FCC License Course plus 9 other home-study instruction plans offered by NRI, oldest and largest school of its kind. Mail coupon for free catalog. There's no obligation. No salesman will call. NATIONAL RADIO INSTITUTE, Washington, D.C.

MAIL NOW for FREE CATALOG

 NATIONAL RADIO INSTITUTE
Electronics Division
Washington, D. C. 20016 14-114

Please send me complete information on FCC License Training and other NRI courses, as checked below. (No salesman will call.)

<input type="checkbox"/> FCC License	<input type="checkbox"/> Radio-TV Servicing
<input type="checkbox"/> Complete Communications	<input type="checkbox"/> Industrial Electronics
<input type="checkbox"/> Aviation Communications	<input type="checkbox"/> Electronics for Automation
<input type="checkbox"/> Marine Communications	<input type="checkbox"/> Basic Electronics
<input type="checkbox"/> Mobile Communications	<input type="checkbox"/> Math for Electronics

Name _____ Age _____
PLEASE PRINT

Address _____

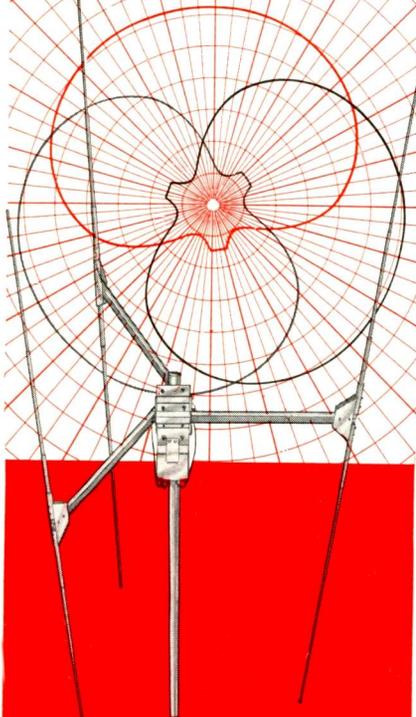
City _____ State _____ Zip _____

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL

--- for more details circle 44 on post card

Revolutionary!

**Change the Pattern
of Your Whole
Base Station Business**



The unique new all-electronic sector-phased Omni-Beam CB base antenna...



THE Scanner

Model **M-119**
PAT. PENDING

Available December 1st

- Instantaneous scan
- All electronic three-sector beam—no mechanical rotator needed
- Extremely compact—easy to assemble
- 7.75 db directional gain—23 db front to back ratio
- Costs 30% less than old-fashioned rotator driven beam arrays

Contact your Antenna Specialists representative for full details.



the antenna specialists co.

12435 Euclid Ave., Cleveland, Ohio 44106

Stripes of Quality

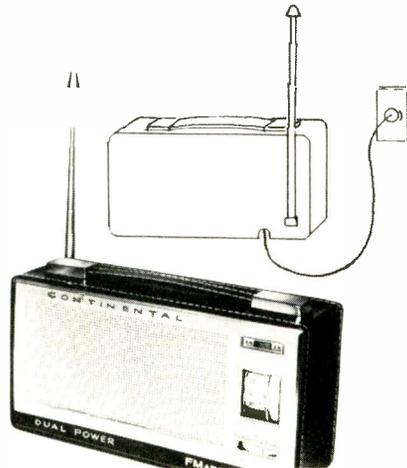


--- for more details circle 12 on post card

NEW PRODUCTS

AM/FM PORTABLE 208

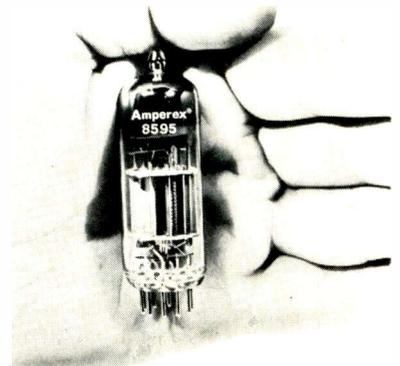
A portable radio containing a built-in adapter for changing from battery to ac operation is introduced. This model, using 10 transistors and 5 diodes, has output-transformer-less circuitry. The cabinet is made of top grain cowhide, saddle stitched, with retractable handle. The grille is silver, satin



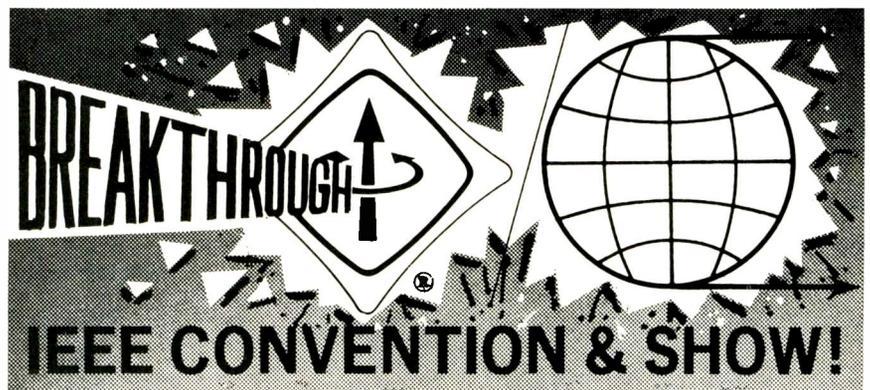
finish. Antennas include a heavy duty ferrite bar plus a 27 in., 8-section 360 deg swivel type fully retractable telescopic antenna. An earphone jack is provided. Size: 8-3/4 x 4-3/4 x 2-3/4 in. Continental.

COMMUNICATIONS TUBE 209

The 8595, a miniature UHF twin tetrode output tube that is electrically similar to the 6939 is an-



nounced. Designed for both replacement and new equipment, the 8595 may be used as a UHF power amplifier, oscillator, and fre-



March 22-26, 1965

ELECTRICAL-ELECTRONICS

- ◆ Exhibit hours (4 days): Monday & Thursday, 9:45 a.m.-9 p.m.; Tuesday & Wednesday, 9:45 a.m.-6 p.m.
- ◆ Technical sessions (5 days) 10 a.m.-5 p.m. (Hilton, Tuesday to 10 p.m.)
- ◆ 80 subject-organized technical sessions presenting 400 vital "break-through" papers.

◆ Over 1000 Exhibits using 140,000 running feet of display units in N.Y. Coliseum & N.Y. Hilton.

◆ Gala IEEE Banquet on Wednesday, March 24, 1965 at 6:45 p.m. in Grand Ballroom, N.Y. Hilton.

◆ Registration: \$2.00 IEEE Members, \$5.00 Non-members. High School students admitted Thursday afternoon only, \$2.00 if accompanied by an adult (not over 3 per adult).



NEW YORK COLISEUM and the NEW YORK HILTON

Buses every few minutes

--- for more details circle 35 on post card

quency multiplier operating at frequencies up to 500 Mc. Amperex.

TWO-WAY RADIO 210

The first in a line of two-way mobile radio systems for performance in commercial and municipal



vehicles is announced. Transmitter output is rated at 90 w with an optional 110 w when required and receiver power is 5 w with 35 ma of battery drain once squelched, the manufacturer says. Dumont Laboratories.

SOLID STATE TRANSCEIVER 211

A solid-state, citizens band two-way radio offering 11 crystal-con-

trolled channels for two-way communications has been introduced.



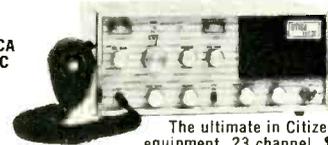
The set's five-inch oval speaker is built-into the front panel for loud and clear reception, particularly in under-the-dashboard installations in cars, trucks and boats. Its complement of 14 transistors and 5 diodes contribute to the unit's compact size and low current requirements. Webster.

CB TRANSCEIVER 212

A 23-channel transceiver for the citizens band, is announced. The Model CAM-88, with integral crystal synthesizer, comes complete and ready to operate. Superheterodyne receiver provides two separate IF frequencies and two stages of IF amplification. Meter on front

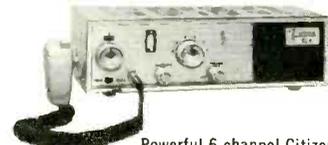
**LOOK NO FURTHER
UTICA
HAS THE COMPLETE LINE**

UTICA
T & C
III



The ultimate in Citizens Band equipment, 23 channel. \$259.95

UTICA
T & C
II



Powerful 6 channel Citizens Band Transceiver, many outstanding features. \$162.50

UTICA
MC-27



6 channel xtal control, built-in dual power supply, a powerful unit. \$142.50

UTICA
"650"



New improved and powerful. 117VAC and 12VDC transistorized supply. CW and phone operation plus even greater features. \$199.95

UTICA
RECEPTOR



4 Band Short Wave Receiver. 3 short wave bands plus standard AM broadcast. \$64.95

UTI-COM



FM Transceiver for assigned frequencies in the 150-175 Mc FM commercial band. \$359.95

UTI-COM

Remote head accessory for FM transceiver includes speaker and controls. \$41.50



UTICA FMR-12

UTI-COM FM Receiver — the 12VDC mobile monitor for any assigned frequencies on the 150-175 Mc FM commercial band. \$149.95



UTI-CALL
TONE SIGNAL DEVICE
UTI-CALL tone signal monitor for selective calling alert for your operators, fully automatic. \$89.95



UTI-COM "30"

AM Business radio transceiver for use on the 30-50 Mc AM band, 30W input, dual power supply. A powerful unit. \$234.95

UTICA SIGNAL OPTIMIZER

Single unit to test CB equipment for: antenna power in watts, mod., field strength, additional features. \$47.50



Columbia Wire's Permaline television transmission cable costs a few cents more, but it's well worth it. Permaline is the only television wire available of such quality that it can be guaranteed, in writing, for 15 and 25 years.

Columbia Wire is proud to say that in ten years we have never had to replace as much as one foot of Permaline for reasons of deterioration.

Columbia Permaline has electrical characteristics similar to those of ordinary brown polyethylene lines but the difference is, a small amount of carbon black that is added to a virgin compound to protect the transmission line from ultraviolet rays of sunlight.

Install Permaline and you will be assured of a happy customer and repeat business... but not for a new television cable.

Permaline is Available From Your Local Distributor. Write for samples and literature.

Columbia WIRE & SUPPLY CO.

2850 Irving Park Road • Chicago 18, Illinois



GET THE FACTS FAST!

2917 W. Irving Park Road Chicago, Illinois 60618

NAME _____

ADDRESS _____

CITY _____ STATE _____

T-ET

--- for more details circle 21 on post card

--- for more details circle 55 on post card

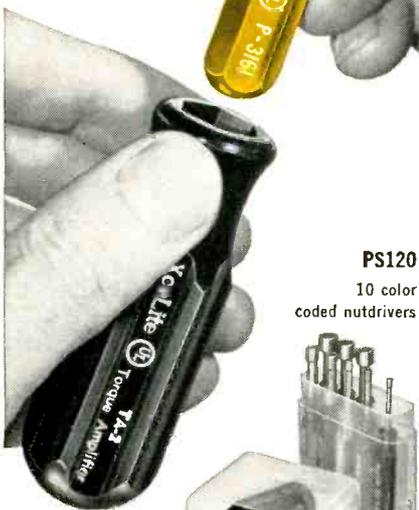
now there are 3 time & tool-saving double duty sets

New PS88 all-screwdriver set rounds out Xcelite's popular, compact convertible tool set line. Handy midgets do double duty when slipped into remarkable hollow "piggyback" torque amplifier handle which provides the grip, reach and power of standard drivers. Each set in a slim, trim, see-thru plastic pocket case, also usable as bench stand.



PS88

5 slot tip,
3 Phillips screwdrivers



PS120

10 color
coded nutdrivers



PS7

2 slot tip,
2 Phillips screwdrivers,
2 nutdrivers



WRITE FOR CATALOG SHEET N563



XCELITE, INC., 14 Bank St., Orchard Park, N.Y., U.S.A.
Canada: Charles W. Pointon, Ltd., Toronto, Ont.

- - - for more details circle 58 on post card

NEW PRODUCTS

panel measures incoming signal strength on receiver and relative "power output" on transmit. Modu-



lation indicator shows that signal is being transmitted and voice is modulating properly. Squelch control eliminates background noise — also silences receiver until signal comes in, according to specifications. Slide switch converts unit to 3-w public address system, using auxiliary speaker. Earphone jack on front panel permits private listening with low-impedance earphones. Transistorized universal ac/dc power supply operates on both 117 vac and 12 vdc. B&K/Mark.

FM 2-WAY RADIO 213

Narrow band FM two-way radio communications equipment for operation in the 30-50 Mc band has



been announced. The 50-w output equipment is available in two base station and three mobile unit configurations. Designated as CSB-50-1 (base station, 50-w-HF band) CSM50-1 (50 w mobile unit) this two-way radio equipment is designed to Electronics Industry Association standards and specifications CD-I-100 of the Office of Civil Defense Mobilization, the announcement said. Hallicrafters.

**406-470 Mc
8.0 db**

COLLINEAR BASE STATION GAIN ANTENNA

**Cat. No.
458-509**

- 8.0 db
Omnidirectional
Gain
- 1.5:1 VSWR
- 250 Watt Rating
- 14 ft. Overall
length at 460 Mc
- 20.0 Mc Bandwidth
at 460 Mc
- 2 3/8" dia. Support
Pipe
- 7/8" dia. Foam
Dielectric Internal
Feed Line
- Weight 29 lbs.
at 460 Mc

This collinear array consists of six 1/2 wavelength elements mounted .81 wavelengths apart and fed inphase. Lightning protection is provided by a stainless steel spike at the top of the fiberglass housing connected to the support pipe at the base by a 1/8" conductor.

*Communication Products
Company*  Div. of PHELPS DODGE
ELECTRONIC PRODUCTS
Corporation

MARLBORO, NEW JERSEY—Tel. 201-462-1880
LOS ANGELES, CALIF.—Tel. 213-245-1143

- - - for more details circle 59 on post card
ELECTRONIC TECHNICIAN

Time and labor saving Rider Books

Now available from

**ELECTRONIC
TECHNICIAN**

Magazine



ADVANCED SERVICING TECHNIQUES, 2nd Edition

Vol. 1 by Paul B. Zbar and Peter W. Orne
Vol. 2 by Orville Neeley, Lawrence Massaro, Robert S. Harris,
Murray Rosenthal and William P. Kist

Prepared under the sponsorship of the Electronic Industries Association. Volume 1 covers color and black-and-white TV and gives you all the latest industry approved trouble-shooting methods that lead you right to the source of the trouble.

The second volume includes up-to-the-minute information on maintenance, repair and troubleshooting procedures for the latest home audio and intercom equipment.

Every chapter is completely illustrated with charts, graphs, schematics, photographs and several full color forms to speed up and simplify all your repair work. Now in its second big edition, ADVANCED SERVICING TECHNIQUES, Vol. 1 and 2 brings you right abreast of the latest developments in the electronic servicing field. 476 pages, 700 illustrations, \$14.20. By individual volumes: Vol. 1, \$8.25—Vol. 2, \$5.95.

HOW TO LOCATE AND ELIMINATE RADIO AND TV INTERFERENCE

by Fred D. Rowe

This completely revised and up-to-date book contains the latest techniques for locating and eliminating radio and TV interference. The latest electronic components are discussed at length, and their applications analyzed. Extremely practical in its approach, this book tells you what to look for, what to do and how to do it. 168 pages, illustrated, paper—\$2.90.

REPAIRING TRANSISTOR RADIOS

by Sol Libes

Presents methods for the repair of transistor radios. Includes basic transistor theory transistorized circuitry, design and superheterodyne radio receiver principles. Cover step-by-step procedures, trouble check points, charts, test equipment and tools. 159 pages, illustrated, paper—\$3.50.

HOW TO SERVICE TAPE RECORDERS

by C. A. Tuthill

Gives you complete information on tape recorder repairs. Contains lucid discussion on the basic principles of magnetic recording, tape recording, mechanisms, circuitry and trouble-shooting procedures. Explains the tape recorder and its operations with many fine illustrations. 160 pages, illustrated, paper—\$2.90.

ITS EASY TO USE ELECTRONIC TEST EQUIPMENT

by Larry Klein and Ken Gilmore

Various techniques for using electrical and electronic test instruments are completely explained in this up-to-date book. An extremely wide range of test instruments are covered, from very simple VOM to the distortion analyzer and oscilloscope.

More than 100 illustrations provide a full grasp of the test instruments and their various applications. 192 pages, illustrated, paper—\$4.00.

MODERN ELECTRONIC VOLTMETERS

by Sol D. Prensly

This text will provide a thorough understanding of modern electronic voltmeters. It first reviews fundamental principles of the basic instrument, then covers the well-established, service VTVM and transistor voltmeter test procedures. The author also investigates, in detail, the more advanced voltmeters used in shop, industrial and scientific work. Many examples of testing are covered for radio and television applications and industrial electronic systems. 224 pages, 5½ x 8½, illustrated—\$4.95.

10-DAY Free Book Approval

NO POSTAGE NEEDED

Gentlemen:

Please send me the following books for free examination. At the end of 10 days, I will either remit payment plus postage, or return the books without further obligation.

1. _____ \$ _____
2. _____ \$ _____
3. _____ \$ _____

Name _____
(Please Print)

Address _____

City _____ State _____ Zip Code _____

Check here and save. Enclose payment with order and the publisher pays postage. Same return privilege guaranteed.

Mail today

BASIC TELEVISION

by Alexander Schure

Presents the basic theory, operation and circuitry and black and white television in a clear, thorough and accurate 5-volume "picture book" course. Individual volumes completely cover the transmitter, organization of the TV receiver and receiver circuit explanations. The text is supported by more than 500 informative illustrations that help you to visualize each individual concept. 5 volumes, 664 pages, illustrated, paper—\$11.25, cloth—\$12.75.

SERVICING TV AFC SYSTEMS

by John Russell

Discusses the trouble, location and repair of the major and minor type of TV AFC circuits in use today. You'll find crystal-clear information on theory, wave-forms, circuits, components, common faults and their diagnosis together with over 75 illustrations—to make the material completely understandable. 128 pages, illustrated, paper—\$2.70.

BASIC RADIO REPAIR

by Marvin Tepper

A sensible, up-to-date approach to servicing both receivers and transmitters. Beginning with clear discussion of more than 20 test instruments, the book then proceeds to clarify the significant aspects of various components. A general presentation of servicing procedures is followed by the practical techniques for repairing superheterodyne, portable, automobile and FM receivers.

Transistor receivers are treated in four full chapters. Later sections deal with the long neglected area of transmitter servicing. 212 pages, illustrated, paper (2 vol. set)—\$5.30, cloth—\$5.95.

TV TROUBLESHOOTING AND REPAIR

by Robert G. Middleton

Newly revised and updated, this book reflects the rapid changes in TV technology. It covers new circuits, new tubes and the transistor, giving the latest troubleshooting methods and techniques. Covers visual-alignment, sweep troubles, video amplifier circuits, external interference, high voltage power supplies and much more. 216 pages, illustrated, paper—\$3.95.

INTRODUCTION TO PRINTED CIRCUITS

by Robert L. Swiggett

Here is the clearest, most comprehensive treatment yet written on the development that has revolutionized the electronics industry. The author, an acknowledged expert on the subject, fully acquaints you with (1) various manufacturing processes used, (2) maintenance techniques peculiar to printed circuitry, and (3) a wide variety of practical applications. Thus, everyone associated with electronics production can find in these pages the specific information needed on the job, whether it's to check up on the various types of printed circuits and their components or to solve problems on servicing printed circuits. 112 pages, 5½ x 8½, illustrated, paper—\$2.70.

MATHEMATICS FOR ELECTRONICS AND ELECTRICITY

by National Radio Institute Staff

Beginning with a complete review of arithmetic, the book progresses through algebra, trigonometry, Boolean Algebra, and the binary number system. It relates every topic to its electronics applications such as finding resistor tolerance with percentages, and solving complex vector problems with trigonometry.

There are several other valuable sections which help you to save time in setting up equations, simplifying a-c and d-c circuit calculations, constructing and applying many types of widely used graphs, etc. Example problems throughout are worked out in detail. 256 pages, illustrated, paper—\$3.95, cloth—\$5.60.

HOW TO TROUBLESHOOT TV SYNC CIRCUITS

by Ira Remer

A practical, valuable book which covers the many variations in monochrome and color television sync circuits and possible troubles that might occur in them. Discusses fundamentals of sync circuits, takeoff, clipping, limiting, noise cancellation and time consultants. The section on output circuits includes integration and horizontal circuit signals. 128 pages, illustrated, paper—\$2.90.

HOW TO READ SCHEMATIC DIAGRAMS

by David Mark

Of particular use to beginners in the field of electronics, this compact volume covers all the essential symbols and abbreviations used in schematic diagrams for electronics work. Thoroughly practical in approach, it progresses in easy-to-understand stages from individual components right up to complete receivers and similar equipment. All major components and circuits are identified and explained, including C-C and A-C circuits, electronic equipment power supply circuits, and audio amplifier circuits. Of special interest is the section on interpreting complete schematics for radio and tv circuits. 160 pages, 5½ x 8½, illustrated, paper—\$3.50.

HOW TO USE GRID-DIP OSCILLATORS

by Rufus P. Turner

Deals with the construction and use of this versatile instrument as well as its application to all kinds of radio and television receivers. Chapters include: Principles and Circuits; Grid-Dip Adaptors; Resonant Circuit Measurement; Capacitance Measurements; Inductance Transmitter Applications; Antenna and Transmission-Line Tests; Applications; Commercial Grid-Dip Oscillators. 112 pages, illustrated, paper—\$2.50.

BASICS OF FRACTIONAL HORSEPOWER MOTORS AND REPAIR

by Gerald Schweitzer

This book provides a working explanation of fractional horsepower motors and presents procedures for repairing and maintaining them.

It fully explains the operation, troubleshooting techniques, and testing of electrical induction, split phase, capacitor, repulsion, shaded-pole, universal and three-phase motors. Each motor is accompanied by a troubleshooting chart. 176 pages, illustrated, paper—\$3.90, cloth—\$4.90.

METALLIC RECTIFIERS AND CRYSTAL DIODES

by Theodore Conti

In comprehensive style, this book presents basic information for understanding and applying these components with sure results. Discussion includes construction of metallic rectifiers and crystal diodes, their characteristics and notation, basic design data, applications, troubleshooting, repair and replacement. 164 pages, illustrated, paper—\$3.50.

CLOSED CIRCUIT TV SYSTEM PLANNING

by M. A. Mayers

Here is a complete report on the vitally important and rapidly expanding concept of closed circuit TV, its utility and functioning. Includes authoritative discussion system organization, planning space requirements, cost of installation, manpower, applications and every facet of operation. 264 pages, illustrated, cloth—\$10.00.

BUSINESS REPLY MAIL

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

FIRST CLASS
Permit No. 665
DULUTH MINNESOTA

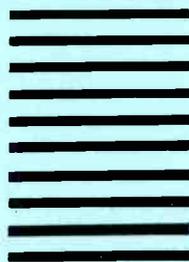
postage will be paid by

John F. Rider Publisher, Inc.

c/o



OJIBWAY BUILDING,
DULUTH, MINNESOTA 55802



NEW PRODUCTS

UHF PORTABLE RADIO

214

Introduced is a portable two-way radio for Ultra High Frequency operation in the 450 to 470 Mc UHF band. Designed to provide communications to supervisory, construction and maintenance personnel on foot, the fully transistorized "Handie-Talkie" portable radio can also be adapted for low-power mobile use. Power for the unit is supplied by a single rechargeable cadmium battery. It weighs thirty five oz and measures 3 1/8 x 8 x 1 5/8 in. Power 0.7 w. The receiver sensitivity is said to be 0.8 μ v. The radio is also available in the universal and selective call models. A special vehicular charger is available. Motorola.



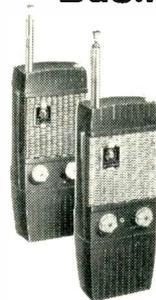
In any CB application . . .

you'll outperform 'em all with a

MESSENGER[®]



Your own 2-way radio for Business or Personal use!



"PERSONAL MESSENGERS"—Compact, hand-held 100 milliwatt or 1 1/2 watt units! Rugged and reliable—11 transistors, 4 diodes. Twice the sensitivity and 40% more range than similar units with conventional circuitry—more output than similar units with same rated inputs!

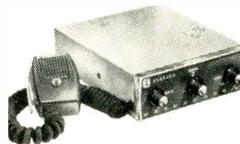
Cat. No. 242-101 . . . 100 Milliwatts . . . \$109.50 Net
Cat. No. 242-102 . . . 1 1/2 Watts . . . \$129.50 Net



"MESSENGER"; "MESSENGER TWO"
For mobile, base station. High efficiency makes full use of maximum allowable legal power. Excellent receiver sensitivity and selectivity. Automatic "squelch" control. 5 crystal controlled channels on the "Messenger" and 10 crystal controlled channels plus tunable receiver on the "Messenger Two".



"MESSENGER" — \$114.95 Net
Cat. No. 242-127 115 VAC/6 VDC
Cat. No. 242-128 115 VAC/12 VDC



"MESSENGER TWO" — \$169.95 Net
Cat. No. 242-162 115 VAC/6 VDC
Cat. No. 242-163 115 VAC/12 VDC

"MESSENGER III"—Everything you want in a CB transceiver—a husky signal, extreme sensitivity, razor-sharp selectivity—and complete flexibility for base station, mobile, public address, or battery powered portable use! Double conversion receiver—set-and-forget "Volume" and "Squelch" controls —11 channel coverage—"Tone Alert" Selective Calling System available as accessory.

The nation's most popular Citizens Radio equipment line!

Rated BEST by Distributor Salesmen in National Survey!

Cat. No. 242-150
12 Volts DC Messenger III . . . \$189.95 Net
Cat. No. 250-823
117 Volt AC Power Supply . . . \$ 29.95 Net

WRITE TODAY for full color brochure, or see your Dealer/Distributor and ask for a demonstration!



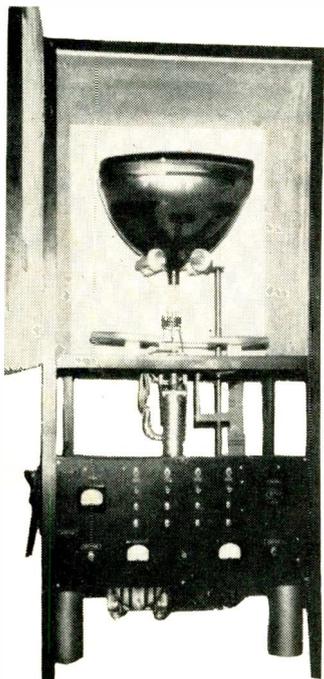
E. F. JOHNSON COMPANY

® 2706 TENTH AVE. S.W. • WASECA, MINNESOTA

--- for more details circle 38 on post card

Me...? Rebuild Color Tubes???

Why Not!



Windsor Equipment Handles Color & Bonded-Face As Well As Black-and-White Tubes.

So What?

Rebuilding with Windsor is a **QUALITY PROCESS . . . and PROFITABLE !!!**

Rebuild Color Tubes for a Cost of \$11.75 each . . . You Sell them for???

Windsor Equipment pays for itself in a few months.

Financing Available
Free Training at our Plant

Write for our Booklet "The Open Door to TV Profits"

WINDSOR ELECTRONICS, INC.

Equipment Division
999 N. Main St., Glen Ellyn, Illinois

--- for more details circle 56 on post card

NEW PRODUCTS

CITIZENS BAND TRANSCEIVER 215

The HB-200 is designed for fixed or mobile communications. The dual conversion superheterodyne receiver operates on any 8 of the 23 channels assigned by the FCC. In addition, all 23 channels are tune-

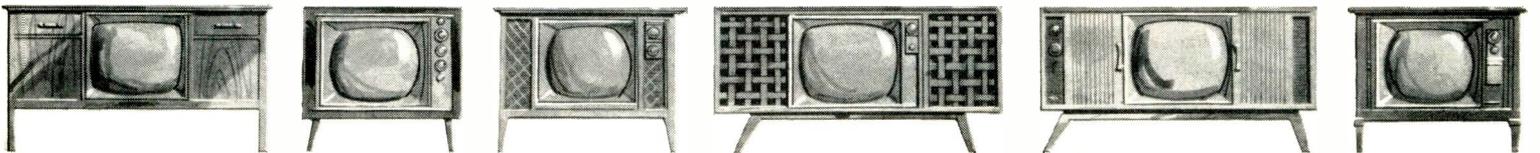
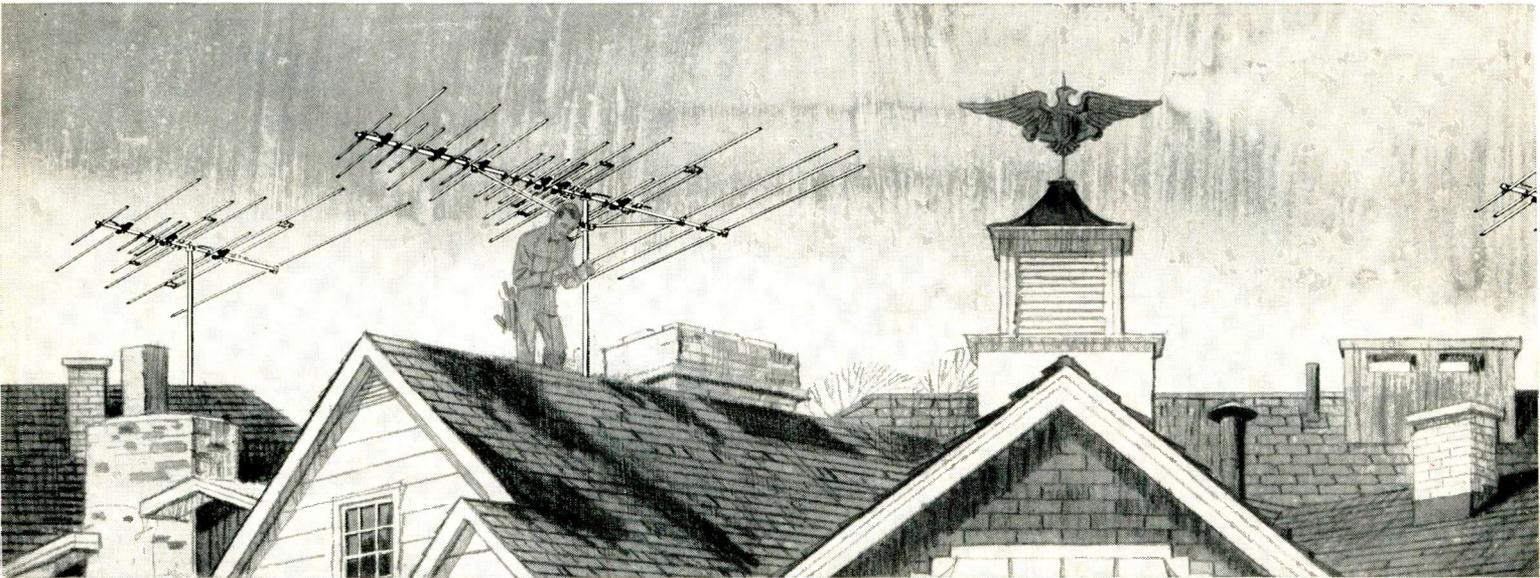


able with a receiver sensitivity of $1 \mu\text{v}$. 5-w input to transmitter with pi-network output to match 30-100

Ω antennas, the specifications indicated. Power Supply is for 117 vac and transistorized 12 vdc mobile supply. 9 tubes, 3 silicon diodes and 2 crystal diodes. Size: 12 x 5 x 8½ in. Shpg. wt., 15 lb. Lafayette.

CB TRANSCEIVER 216

A 23 channel tunable receive CB transceiver is introduced. Seven sets of crystals can be inserted, but



Why are most Color Television Sets

BECAUSE EXPERIENCED COLOR TV DEALERS KNOW THAT WINEGARD COLORTRONS ALWAYS DELIVER THE BEST COLOR PICTURES POSSIBLE!

And it's just plain, common sense . . . when a man invests \$400-\$1000 or more in a color TV set, he expects—and deserves—the finest possible color reception!

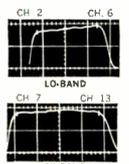
Most people who demand the finest in color TV reception choose Winegard Colortron. Here's proof:

Look on top of the largest retail stores in the country . . . they demonstrate their sets connected to Winegard antennas; or look on the homes of the famous TV and movie stars in Hollywood; or on the studio buildings of all three major TV networks; even atop the Whitehouse in Washington. Wherever the best color is seen, you'll see a Winegard Colortron . . . it's the TV antenna made for color.

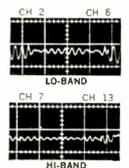
What's behind Colortron's Superior Performance? Balanced Design! Just what is Balanced Design? It's the perfect combination of high gain, accurate impedance match, complete band width, and pinpoint directivity . . . and only Colortron has it!

For example:

Gain and Bandwidth—A superior color antenna must have high gain and complete bandwidth. But the response must be flat if it is to be effective. Peaks and valleys in the curve of a high gain antenna can result in acceptable color on one channel and poor color on another. No all-channel VHF-TV antenna has more gain with complete bandwidth across each and every channel than Colortron. Look at the Colortron frequency response in this oscilloscope photo. Note the consistently high gain on all channels. Note the absence of suck-outs and roll-off on end channels. Note the flat portion of the curve . . . there is less than ½ DB variance over any channel.



Impedance Match—the two 300 ohm "T" matched Colortron driven elements have far better impedance match than any antenna using multiple 75 ohm driven elements. The Colortron transfers maximum signal to the line without loss or phase distortion through mismatch. The oscilloscope photo here shows the Colortron



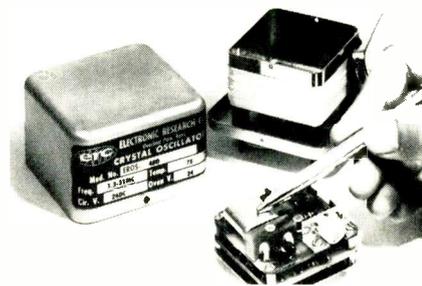


a set of external sockets makes it possible to go on the air quickly over any one of the remaining 16

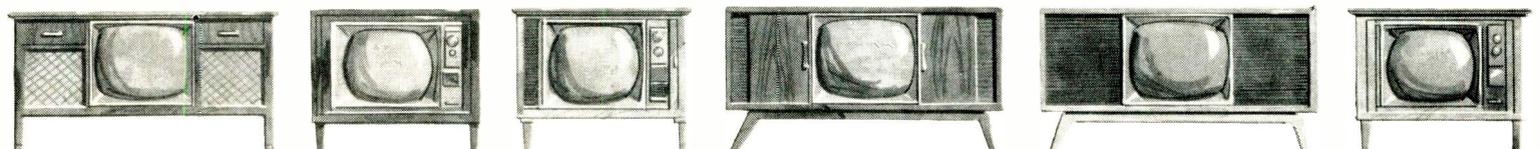
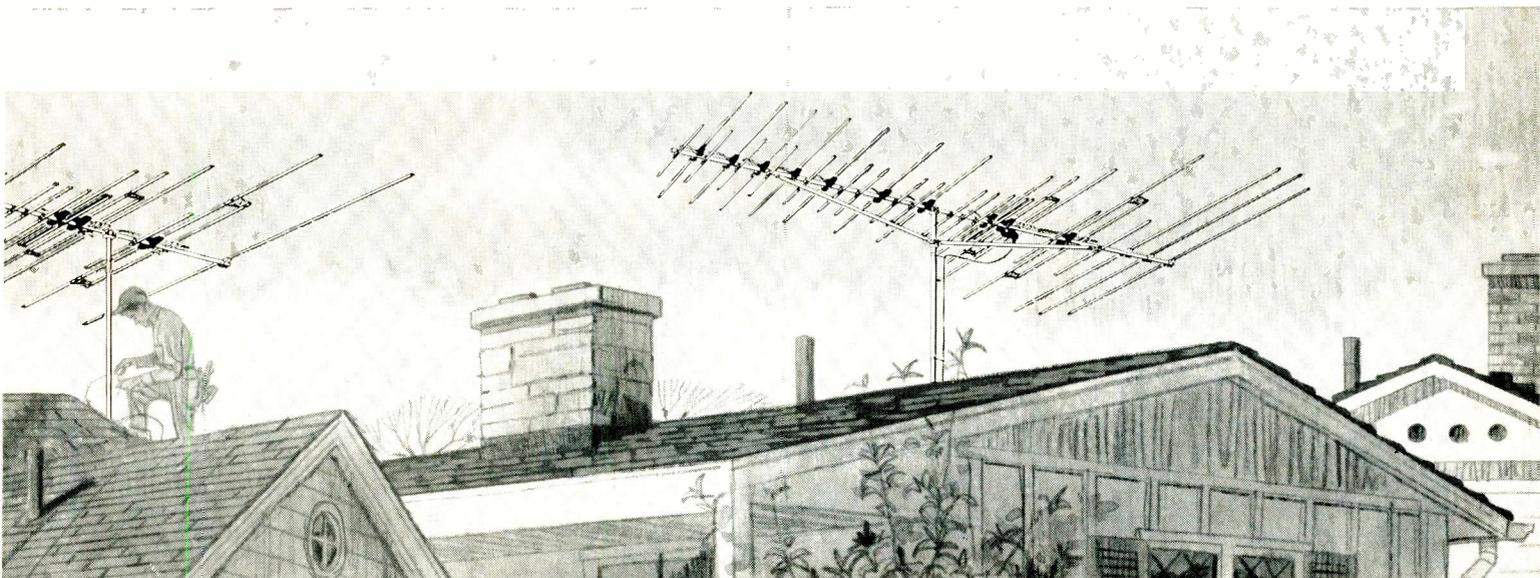
channels. The "Contact!" has a public address system, earphone jack, illuminated meter, press-to-talk hand mike, channel spotting switch and a built-in 110 and 12 v power supply. United Scientific Laboratories.

OSCILLATOR PACKAGE 217

A solid state, temperature-controlled, precision crystal oscillator package covering the entire 1.5- to



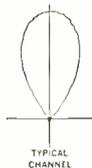
31-Mc range is announced. The EROS-450 provides a linear .1-v rms output into a 200-Ω load



connected to **Winegard** Antennas?

VSWR curve (impedance match). No current VHF-TV antenna compares with it across all 12 channels.

Directivity—An antenna with sharp directivity and good signal-to-noise characteristics is necessary for perfect color. Extraneous signals, picked up at the back and sides, produce objectionable noise and ghosts in black and white reception. But in color TV, they frequently ruin reception. *Winegard Colortron has the most ideal directivity pattern of any all-channel VHF antenna made.*



The Unsurpassed Performance of Balanced Design is Matched Only by the Colortron's Unsurpassed Construction!

Colortron has been engineered for maximum strength, minimum weight and minimum wind loading. The result is a streamlined,

lightweight antenna that stays stronger longer. Colortrons have even been wind tested to 100 m.p.h.

Advanced-design snap lock hardware makes Colortron the easiest antenna to install. Winegard Colortron also has the finest *Gold Anodized finish* of any TV antenna made.

Winegard Helps You Sell . . . With *More* National Consumer Advertising *Than All Other Brands Combined!* Look for Winegard . . . on AFL Football over ABC (over 1,500,000 viewers per game) . . . in Life Magazine (over 13,000,000 readers per issue) . . . in Parade (the big Sunday supplement with 21,000,000 readers per issue).

This is the Season for TV buying . . . The season for you to stock up on Winegard Colortrons. Remember . . . over 2,000,000 Color TV Sets will be sold this year and *the antenna made for color TV is Winegard Colortron.* Order today!



COLORTRON ANTENNA
Model C-44 • Gold Anodized • \$64.95



COLORTRON ANTENNA
Model C-43 • Gold Anodized • \$51.90



COLORTRON ANTENNA
Model C-42 • Gold Anodized • \$34.95



COLORTRON ANTENNA
Model C-41 • Gold Anodized • \$24.95



3019-A KIRKWOOD • BURLINGTON, IOWA

--- for more details circle 57 on post card

NEW PRODUCTS

across the entire band, by changing crystals operating on the fundamental mode, the announcement said. The unit consists of a Zener-regulated crystal oscillator, an amplifier which stabilizes the output voltage level, and a decoupling buffer stage to minimize the effect of loading. A variable capacitor is provided for trimming the crystal

to the exact frequency desired. Outside case dimensions are 2¾ x 1¼ in. Electronic Research Co.

CITIZENS BAND TRANSCEIVER 218

A citizens band transceiver having six crystal controlled transmit channels and tunable to receive all 23 channels, has been introduced. In the transmit mode, the unit operates on any six of the 23 available CB channels. Plug-in crystals, mounted on the chassis, can be changed to give any desired fre-



quency. The receiver is super-heterodyne with a tuned RF stage for maximum sensitivity 0.3 μV usable, the announcement said. Metrotek.

ROTARY CONVERTER 219

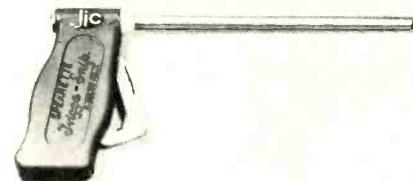
A rotary converter that changes 24 vdc to 110 v, 60 cps ac is introduced. This machine has a ca-



capacity of 350 w, 115 v, single phase. The unit has solid silver collector rings and silver commutator bars. Converters are available from 100 w to 10,000 w. The approximate weight is 24 lb. Size: 13¾ x 7¼ x 7 in. Kato Engineering.

CUTTER-STRIPPER-PULLER 220

A wire cutter-stripper-puller is introduced. Wires can be cut, removed, and rewired in most inac-



cessible places. The tool has a long tubular nozzle with a stainless steel rod that will move forward to cut when finger is pressed on the trigger, and released, by spring action, when finger is removed. Barrel diameter ¼ in. Over-all length 7 in. Price \$4.75. Jonard Industries.

SCREEN REFLECTOR YAGIS 221

A series of high gain broad-banded screen yagi type antennas are designed for communications

AT LAST!
a true
professional
performing
TUBE TESTER
for only
\$29.95 NET

Slightly higher in the West

Model 1100A TUBE TESTER

a new LOW in cost... a new HIGH in value!



TESTS RECEIVING TUBES FOR:

- ✓ Dynamic cathode emission
- ✓ Shorts and leakage
- ✓ Grid leakage and gas

If you're looking for a professional performing tube tester and want to keep the cost way down, the new Model 1100A was designed just for you. MERCURY's vast tube tester experience is behind this unique instrument. It is engineered to operate simply, quickly and accurately... to detect hard-to-find tube defects... to test both old and new tube types—more than any other tester in its price class. Even if you're presently using a tube tester, the Model 1100A is priced so low, is so versatile, and portable, so light you'll want it as an extra tester to keep at your side always, while making service calls.

ADDITIONAL FEATURES

- Checks each section of multi-section tubes separately
- Will detect any short in a tube, even where internal pins are tied or heater is tapped
- Exclusive meter bridge circuit provides accuracy found only in the more expensive tube testers
- Handsome two-tone aluminum panel
- Built-in 7-pin and 9-pin straighteners conveniently located on panel
- Complete easy-to-read tube chart
- Small compact size: 9" x 8¼" x 3¼"
- Housed in handsome, sturdy leatherette case

TESTS MORE TUBES THAN ANY OTHER TESTER IN ITS PRICE RANGE

- ✓ Novars and Nuvistors
- ✓ Compactrons and 10-pin types
- ✓ Battery type, Foreign and hi-fi tubes
- ✓ Auto radio hybrid tubes and most industrial types

See your parts distributor or write for complete Mercury catalog

Mercury ELECTRONICS CORPORATION
manufacturers of quality electronic products

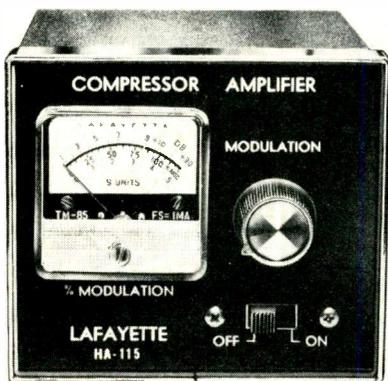
111 Roosevelt Avenue, Mineola, New York

... for more details circle 40 on post card

and special purpose applications. Each model consists of a quad yagi-type array of horizontally polarized elements mounted above a single mesh surface ground plane. Models are available for the frequency bands of 390 - 425 Mc; 450 - 470 Mc; and 470 - 512 Mc. The ground screen measures 48 x 36 in. and is fabricated of 1¼ in. sq 0.062 wall tubing, welded into a framework and covered with a reflective surface. Taco.

COMPRESSOR AMPLIFIER 222

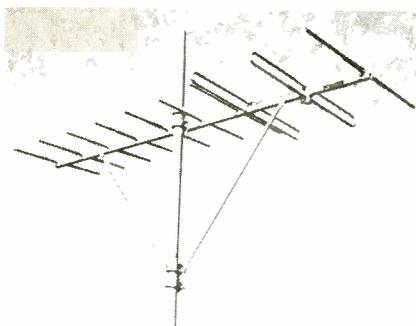
A new CB accessory, the Model HA-115 audio compressor is announced. This device automatically



increases the average modulation of a CB transmitter without overmodulating the carrier, the maker said. An illuminated meter reads modulation percentage directly. The HA-115 works with all 6 or 12 vdc or 117 vac CB transceivers. Lafayette.

MULTI-DRIVEN YAGI 223

A ten-element triple-driven yagi antenna designed for communications or special purpose applica-



tions is announced. Elements are welded to the 1¼ in. diameter crossarm. Electrical characteristics are: 11.2 db nominal gain with a maximum VSWR of 1.5:1 over the 120 - 140 Mc band. Nominal

HPBW in the E plane is 50 deg and 65 deg in the H plane, the announcement said. Taco.

CB 2-WAY RADIO 224

A 23 channel Citizens Band two way radio is announced. Close-tolerance crystals are used resulting



in a transmitted frequency tolerance of ±.003, the announcement said. Front panel contains an illuminated S meter, illuminated channel selector and modulation indicator. The GUARDIAN 23 utilizes a transistorized universal power supply (12v dc or 117v ac) and a dual conversion superhet receiver. The plate tuning and antenna loading controls are easily accessible on the rear panel. The unit has an external speaker jack, plate meter jack and P1 network with a two stage TVI filter. The built-in solid state power supply provides 5-w

COMCO

Dealerships

FOR

2-WAY RADIO SALES AND SERVICE

NOW AVAILABLE IN MANY AREAS



PRODUCTS

HF-SSB (1.6-16 Mc/s.)

- Point-to-point
- Marine, ship and shore stations
- Military

VHF-AM (108-156 Mc/s.)

- Aeronautical ground stations
- Airport vehicles
- Point-to-point
- Military

UHF-AM (220-400 Mc/s.)

- Ground-to-Air
- Airport vehicles
- Military

VHF-FM (25-54, 144-174 Mc/s.)

- Mobile
- Base
- Repeater
- Marine
- Portable
- Military
- Point-to-point
- Voice
- RTTY
- Data

UHF-FM (400-420, 450-482 Mc/s.)

- Mobile
- Base
- Repeater
- Portable
- Military
- Point-to-point
- Voice
- RTTY
- Data

- Antennas
- Transmission line
- Remote controls
- Line termination panels
- Tone control and signaling

COMCO offers dealers reliable, high performance two-way radio equipment, backed by 25 years of engineering and production experience.

A complete line of two-way equipment is sold— Directly to U. S. Military Agencies, to other two-way radio manufacturers, and by dealers throughout the world.

You can qualify for a dealership if you have —

✓ An FCC second-class radiotelephone license.

✓ A shop with necessary test equipment for installation and maintenance of VHF-FM equipment.

✓ An established business with good credit rating.

✓ Enthusiasm to promote sales of COMCO radios.

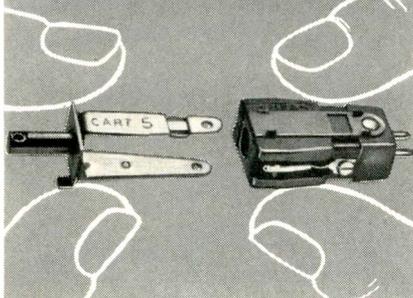
For complete information on available dealerships in your area, write or telephone today to Frederick R. Macklin, Sales Manager.

COMMUNICATIONS COMPANY

Post Office Box 520
Coral Gables, Florida 33134
Telephone (Area 305) 445-2671

Why doesn't
everybody
stock

Jensen[®] SNAP-IN CARTRIDGES?



If you've been shying away from profitable cartridge replacement business because of the cost and connotations of cumbersome inventories, let Jensen get you back on the right "track." Here's how:

- Less inventory
- Complete coverage
- Superior performance
- Respected, accepted brand name

Why doesn't everybody stock Jensen Snap-In Cartridges? Give 'em time. Soon they will.

SPECIAL K-1964 DEAL

Write for details on special Dealer Starter Kit K-1964—12 brackets and 6 interchangeable cartridge bodies which will replace 80% of all basic cartridge requirements.

World's finest phonograph needles, cartridges, drives, accessories

Jensen[®]
INDUSTRIES, INC.
301 Interstate Rd., Addison, Ill.

In Canada: A. T. R. Armstrong,
P.O. Box 244, Islington, Ontario

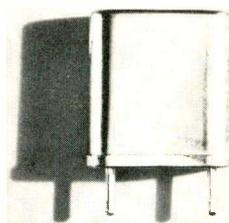
... for more details circle 37 on post card

NEW PRODUCTS

legal input while operating at 50 percent of its full load capacity. The transceiver is 11½ x 4¾ x 10½ in., and weighs 15 lb complete. Pearce-Simpson, Inc.

CITIZENS BAND CRYSTALS 225

A line of citizens band crystals has been introduced. Available in



most CB equipment, the line includes both receiver and transmitter type crystals hermetically sealed in standard MIL HC-6/U and sub-miniature HC-18/U. Tolerance on nominal frequency is $\pm .002\%$ at room temperature with tolerance $\pm .005\%$ over temperature range of -40°C to $+80^{\circ}\text{C}$ the manufacturer says. Crystals are available with various diameter pins or wire leads. Guardian Crystals.

TWO-WAY RADIO 226

Two crystal-controlled channels are offered in a tubeless two-way radio that employs 13 transistors,

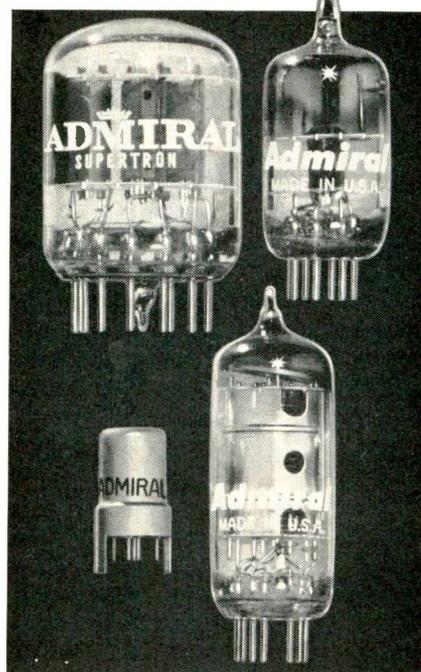


two diodes and a thermistor. A meter on the side of the set shows



Be a wise owl!

How to cut call backs, increase profit on receiving tubes!



Engineered for peak performance... priced for extra profit! Every Admiral Supertron Electronic Tube must pass rigorous super-quality control tests and life tests to meet the high premium standards required for circuit approved tubes.

The remarkable Admiral price and volume discount helps you make more dollar profit on every service job! Reduce expensive call backs.

Order a complete supply of new Admiral Supertron Receiving Tubes today... start pocketing big profits tomorrow! Call your Admiral Distributor now!

Be wise... standardize on

Admiral[®]
SUPERTRON
RECEIVING TUBES

Always Precision Crafted Quality

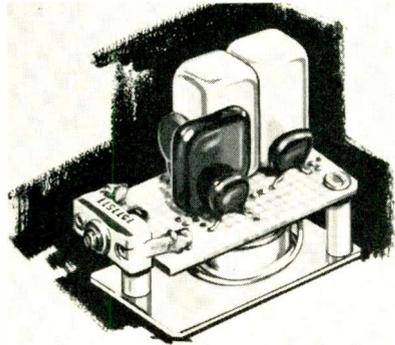
... for more details circle 10 on post card

ELECTRONIC TECHNICIAN

the amount of charge in the self-contained nickel-cadmium batteries. These can be recharged from any household outlet without the necessity for replacing the batteries. Raytheon.

MOBILE ENCODER 227

An Encoder intended for mounting inside mobile two-way radios, or other equipment cabinets is an-



nounced. The circuitry is entirely solid state with no reeds or other moving parts. This unit is designed for .2 vdc operation. However, it can be operated from equipment B+ by using a resistor divider. Satisfactory operating range is 10.5v to 18 vdc since the unit is internally zener controlled. There are 60 separate one-tone codes. Tone frequencies are from 500 to 3800 cps. Spacing between channels is 3 1/3 %. Actuation is manual. Reach.

RADIO PAGING SYSTEM 228

A tone-plus-voice radio paging system has been introduced. The equipment is a complete system con-

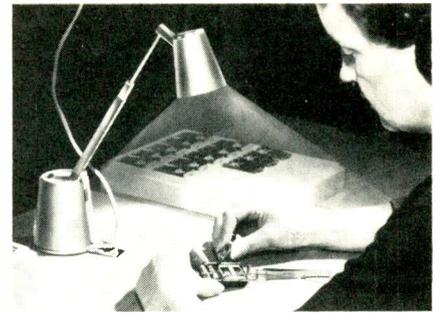


sisting of a compact transmitter, microphone, antenna, control unit, and any number of receivers which are transistorized. Round Hill.

PORTABLE LAMP 229

A lamp with a telescoping arm which extends from 5 to 16 in.

and a shade-reflector which swivels a full 360 deg is introduced. It has a 3-position switch: ON-DIM-OFF. When not in use the lamp can be folded for carrying or storage into a package that measures 3 1/2 x 6 in. Normal bulb life is 350 hr in ON, 1000 hr in DIM positions. Power requirements are 110-120 vac, 50/60 cps (primary); drawing 31 w (6.2 v secondary) in ON and 26 w (5.7 secondary) in DIM. The base of the lamp has a built-in bracket for balance of extreme horizontal reaches of the



shade. A separate polyethylene disc and "O" snap-ring adapter are available for semi-permanent wall- or easel-mounting. Koch.

New CB-10 solid state transceiver



Ideal for business and personal communications

ACTUAL PERFORMANCE:

The CB-10 is a completely transistorized, extremely compact transmitter/receiver offering five-channel operation and the highest performance levels yet achieved in solid state CB transceiver design.

Its three stage transmitter is rated for full authorized power with maximum modulation capability. The dual-conversion receiver provides excellent adjacent-channel and image rejection • A series-type noise limiter drastically cuts auto and local interference • A special jack permits use of an external paging or P.A. speaker • Receiver sensitivity is less than 1 μv S/N ratio • Power requirement is just 1.0 amps on transmit (max. modulation) and 0.2 amps on receive.

ACTUAL SIZE:

2 5/8 inches high, 6 inches wide, 9 1/2 inches deep.

ACTUAL PRICE: \$149⁹⁵



"Quality through Craftsmanship"

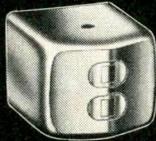
hallicrafters

Export: International Div., Hallicrafters. Canada: Gould Sales Company, Montreal, P. Q. 5th & Kostner Aves. • Chicago, Ill. 60624

Dealer franchises available in selected territories. Write for information.

- - - for more details circle 29 on post card

**sooner
or
later...**



you will demand the extra quality and precision of Nortronics tape heads! All Nortronics heads feature:



laminated core structures and deposited quartz gaps for superior high frequency response, and . . .



hyperbolic, all-metal faces for intimate tape-to-head contact—longer wear with minimum oxide loading.

Now, you can demand the best! Offer your customers Nortronics tape heads . . . *designed and produced to the highest standard of excellence.*

Get full details! Write today for your FREE copy of Nortronics Tape Head Replacement Guide.



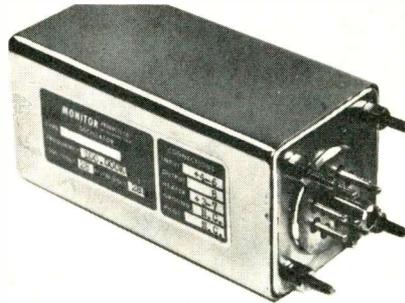
8133 Tenth Ave. N., Minneapolis, Minn. 55427

- - - for more details circle 45 on post card

NEW PRODUCTS

CONTROL OSCILLATOR 230

A crystal-controlled oscillator, model 621, is a 28 v proportional controlled unit available from 75 kc



to 20 Mc. Output is available at 2 and 4 R-P, in sine or square wave, depending on frequency. The unit reportedly is designed for vibration of 10-2000 cps, 15 Gs and Mil-I-26600, Mil-E-5272, airborne equipment applications. Monitor.

NARROW BAND RECEIVER 231

Announcement is made of an FM, narrow band monitor receiver for Fire, Police Dept., Rescue



Squads, etc., receiving both mobiles and base. This receiver is available in any frequency from 25-50 Mc, or 150-170 Mc. The monitor receiver is housed in a walnut wood cabinet 15 x 6 x 8 in. Signalab.

TAPE RECORDER 232

A cordless, transistor tape recorder using tape cartridges that can be inserted into the machine in a single motion is announced. A single master control starts, stops, winds and rewinds the tape. The units weighs 3 lb with batteries and can be worn over the shoulder like a small camera. The recorder comes as a complete outfit which includes the tape recorder, microphone, carrying case with microphone pouch, four cartridges (in-

FREE OFFER

WITH
150 POPULAR DBE
±10% DIPPED MYLAR*
PAPER BYPASS CAPACITORS
*Registered Dupont T.M.

AEROVOX AKU-102 KIT

KIT CONTAINS:

10 ea.	.001	600V	50 ea.	.01	600V
5 ea.	.0022	600V	5 ea.	.022	600V
5 ea.	.0033	600V	20 ea.	.047	600V
5 ea.	.0047	600V	20 ea.	.05	600V
10 ea.	.005	600V	20 ea.	.1	600V

... packaged 5 each in See-Thru plastic bags.



PLUS famous UNGAR #270 DE-SOLDERING KIT

Complete with Instruction Manual and two extra tips.

This labor-saving unit is offered FREE. The cost of this kit is less than the price of the capacitors alone! Makes work on printed circuits as easy as hand wired units.



only
\$27.95

Special Dealer Net With Ungar Kit

Send for more information Today—and the name of your nearest Authorized Aerovox Distributor



**AEROVOX
CORPORATION**

Distributor Division, New Bedford, Mass.

- - - for more details circle 11 on post card

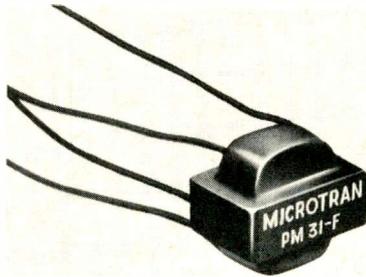
ELECTRONIC TECHNICIAN



cluding one demo tape) and patch cord. The unit operates at 1 7/8 ips and can record from a radio, TV, phonograph, telephone, as well as its own microphone according to the maker. Transistor Complement includes: 1: AC126, 4: AC125, and 2: AC128. Size: 7-2/3 x 4 1/2 x 2-1/6 in. Norelco.

MINIATURE TRANSFORMER 233

A transformer developed for application in equipment using micro-circuitry modules is announced. The dimensions of the pico-miniature transformer are 0.37 x 0.250 x



0.406 in. and the unit weighs 0.05 oz. This transformer is vacuum resin impregnated and is built to meet MIL-T-27B, Grade 6, Class R, Life X. The unit is available in 7 impedance ranges from 3.2 to 25,000 Ω . Microtran.

... 2-WAY CUSTOMERS

Continued from page 48

way radio network, especially with the reduction in deviation from ± 15 to ± 5 kc.

Audio recovery at the receiver is directly proportional to transmitter deviation, up to the limits established for the system. For best operation, deviation should be accurately adjusted to the prescribed value.

Transmitting deviation can best be adjusted by using a frequency monitor and a good scope. The

scope is an ideal instantaneous deviation indicator and needs only accurate calibration before being used to adjust the transmitter IDC control. The frequency monitor is used to calibrate the scope, preferably using a 1000 cps sinewave input. The height can be adjusted for any convenient scale of readings, for example, one square for each kc. This makes it very easy to read any other deviation value directly from the scope screen.

With the scope screen calibrated against the monitor, the transmitter IDC control can be set using any convenient input to the transmitter. This can be done rather quickly and conveniently in a well-equipped shop once the equipment is set up and calibrated.

Periodic adjustments of this type keep radio equipment up to peak operating performance — assuring users of the most for their investment in two-way radio. ■

LOADED.

Except for the price.

That's a stripped-down \$129.95



The Brand New CB-9 six channel CB transceiver

- Ideal for business and personal communication.
- Six crystal-controlled transmit and receive channels, plus full tuneable receiver with spotting switch.
- Accurate, easy-to-read "S" Meter built in.
- Complete, ready to operate either base or mobile, including all power cables and hardware.
- Hallicrafters "drop down" chassis for simple installation, instant crystal-changing or service.
- Accommodates all CB-3 Series accessories including HA-11 "Rocket Buster" noise eliminator, HA-12 Selective Caller.
- Full 100% modulation capability, five watts input.
- Sensitivity 1 microvolt for 10 db. signal-to-noise ratio.

Write for complete specifications

"Quality through Craftsmanship"

hallicrafters

Export: International Div., Hallicrafters.
Canada: Gould Sales Company, Montreal, P. Q.

5th and Kostner Aves. Chicago, Ill. 60624

Dealer franchises available in selected territories. Write for information.

... for more details circle 30 on post card

send for New FREE
CRYSTAL CATALOG
 ... with New
TRANSISTOR OSCILLATOR CIRCUITS

3 PLANTS TO SERVE YOU BETTER
**HERMETICALLY SEALED
 PRECISION GROUND
 CUSTOM-MADE
 NON-OVEN CRYSTALS**

Gold or silver plated, spring mounted, vacuum sealed or inert gas, high freq. stability, 10 milliwatt max. current cap. Meet mil. specs.

	Prices on Request
1000KC to 1600KC (Fund. Freq.)	.....
1601KC to 2000KC (Fund. Freq.)	.....\$5.00 ea.
2001KC to 2500KC (Fund. Freq.)	..... 4.00 ea.
2501KC to 3000KC (Fund. Freq.)	..... 3.50 ea.
3001KC to 4000KC (Fund. Freq.)	..... 3.25 ea.
4001KC to 5000KC (Fund. Freq.)	..... 3.75 ea.
5001KC to 7000KC (Fund. Freq.)	..... 5.00 ea.
7001KC to 10,000KC (Fund. Freq.)	.....
10,001KC to 15,000KC (Fund. Freq.)	.....
15MC to 20MC (Fund. Freq.)	.....
OVERTONE CRYSTALS	
15MC to 30MC Third Overtone	.....\$3.85 ea.
30MC to 40MC Third Overtone	..... 4.10 ea.
40MC to 65MC Third or Fifth Overtone	..... 4.50 ea.
65MC to 100MC Fifth Overtone	..... 6.00 ea.
DRAKE 2-B Receiver Crystals	.....\$4.00
(All Channels—Order by Freq.)	
OVEN-TYPE CRYSTALS	
For Motorola, GE, Gonset, Bendix, etc.	
Add \$2.00 per crystal to above prices	
SUB-MINIATURE PRICES slightly higher	

ORDER FROM CLOSER PLANT
TEXAS CRYSTALS
 DEPT. T
 1000 Crystal Drive
 FORT MYERS, FLORIDA
 Phone 813 WE 6-2109

AND
 4117 W. Jefferson Blvd.
 LOS ANGELES, CALIF.
 Phone 213-731-2258



- - - for more details circle 53 on post card

... TRENDS
 Continued from page 43

a scope, wattmeter and signal generator are needed in addition to the service meter to check out the entire radio. But the scope can be eliminated because a light bulb load contained in this service meter will give a satisfactory modulation percentage indication.

By using spare individual circuit modules, technicians can perform rapid equipment maintenance. When trouble is pinpointed by the service meter, an entire module is simply unplugged by using needle-nosed pliers. A new module is then substituted. Since no soldering iron is required, this operation is easily performed in the field. Defective modules are returned to the factory for repair and tuning — on an exchange basis.

Before making a circuit module exchange, however, a preliminary examination is made to determine that no minor problems — disconnected wire or loose connections are causing the faulty reading. The

meter chart provides detailed steps in arriving at a decision to replace a module. This particular CB radio has separate modules for the receiver, audio and modulator, transmitter, power supply and control panel.

Circuit modules are priced on an exchange basis so a reasonable profit can be made by service-dealers. And the user generally pays less than he would in labor alone for a complete service checkout.

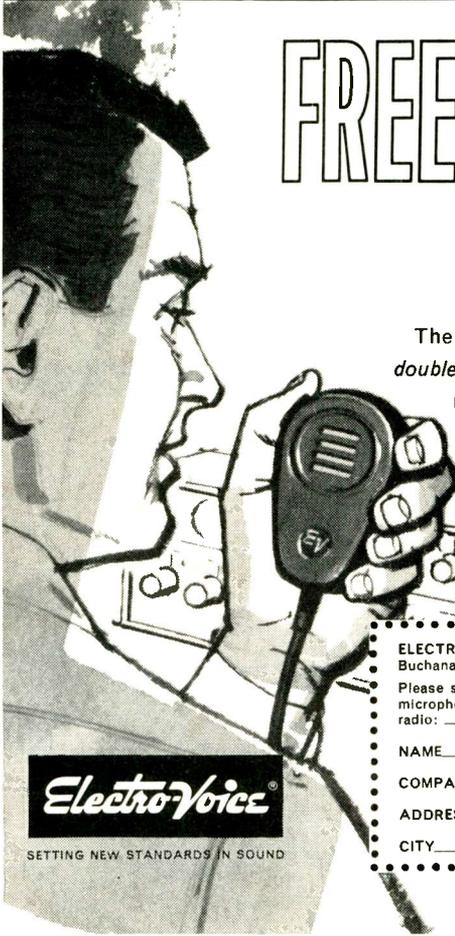
By carrying a service module stock, service-dealers can provide immediate customer satisfaction without the necessity of diluting stock by giving customers another unit while the defective one is being repaired. ■

... SERVICING 2-WAY
 Continued from page 47

A through-line type RF wattmeter, for use with 50Ω coax, capable of indicating both forward and reflected power, is very valuable in tune-up operations. It should indicate power output, line losses, SWR and antenna impedance mismatch. A 50Ω dummy load is also needed for making accurate measurements and performing bench troubleshooting without interfering with communications by radiating into the regular antenna. The dummy load usually consists of a non-inductive power resistor mounted in a metal can (for shielding) which may or may not be filled with liquid, for greater power dissipation over longer periods of time.

A VOM with 20,000Ω/v sensitivity is useful, especially if it has a 50 ma current range, which is used to align receivers by indicating limiter grid current. In addition to the VOM, a standard 11 M Ω input VTVM is invaluable for routine troubleshooting and measurements. And to power mobile units brought to the bench for servicing, a variable dc power supply with output from 5 to 18 v is necessary. It should have a current range up to 20 amp with good regulation and low output ripple.

Some two-way radio sets are built in one piece, while others come in two — a control head, which mounts under the vehicle dash, and another unit which goes in the trunk. The latter contains the "guts"



FREE!

HOW TO IMPROVE YOUR TWO-WAY RADIO!

The right communications microphone may double the talk power of even the finest transmitters! Learn how unwanted noise can be eliminated—reliability improved—intelligibility increased by proper microphone selection.

Write for our helpful free booklet today!

ELECTRO-VOICE, INC., Dept. 152T
 Buchanan, Michigan 49107

Please send the free E-V booklet on choosing communications microphones. I am interested in the following areas of two-way radio: Amateur Aviation CB Business.

NAME _____

COMPANY _____

ADDRESS _____

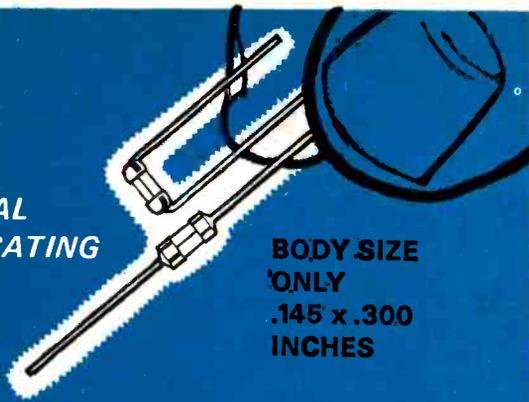
CITY _____ STATE _____



SETTING NEW STANDARDS IN SOUND

- - - for more details circle 25 on post card

**VISUAL
INDICATING**



**BODY SIZE
ONLY
.145 x .300
INCHES**

BUSS Sub-Miniature PIGTAIL TRON FUSES

For use on miniaturized devices,— or on gigantic multi-circuit electronic devices.

Glass tube construction permits visual inspection of element.

Smallest fuses available with wide ampere range. Twenty-three ampere sizes from 1/00 thru 15 amps.

Hermetically sealed for potting without danger of sealing material affecting operation. Extreme high resistance to shock or vibration. Operate without exterior venting.

BUSS

Write for BUSS
Bulletin SFB

BUSSMANN MFG. DIVISION, McGraw-Edison Co., St. Louis, Mo. 63107

a major airlift of its dealers. The company reports that nearly 5000 Philco dealers and distributors visited the New York World's Fair in May.

African Transistors

The first known production run of transistors on the African continent was announced by International Telephone and Telegraph Corp.

ITT said that its South African subsidiary, Standard Telephones and Cables (SA) (Pty) Ltd., has finished a production sample run of 15,000 of the latest type of silicon epitaxial transistors in a newly established manufacturing unit.

ITT estimated that its 1966 transistor output in South Africa may reach 175,000 units, and said that plans are also being considered for the production of silicon diodes.

Engineer Salaries

Average starting salaries for Illinois Institute of Technology engineering graduates, which reached a record high this year, has increased more than 60 percent in the last 10 years and more than 600 percent in the last 25, according to Earl C. Kubicek, IIT director of placement and alumni relations. Kubicek indicated that IIT mechanical engineers top the 1964 salary scale with an average starting salary of \$660 per month. In other engineering areas, 1964 starting salaries average \$624 for civil engineers, \$609 for electrical engineers, \$605 for both industrial and metal-

BUSS: 1914-1964, Fifty years of Pioneering...

NEWS OF THE INDUSTRY

Trade Mission to Yugoslavia

Harold Harris, vice president in charge of sales and engineering of Channel Master Corp., Ellenville, N.Y., was in Yugoslavia as a member of a special U.S. Trade Mission to Yugoslavia, it was announced by Harry Resnick, Channel Master president.

The Trade Mission was sent by the Department of Commerce for the purpose of exploring the Yugoslav market for American goods. The seven-man team of business leaders and Department of Commerce officials took with them more than 360 specific proposals from U.S. firms interested in doing business in Yugoslavia, to discuss them with foreign trade representatives in the five major Yugoslav cities.

Before leaving the United States, Mr. Harris attended a four-day briefing session in Washington conducted by Secretary of Commerce, Luther Hodges.

Philco Airlift

More than 4000 Philco dealers and distributors, as well as members of their families, will fly to Puerto Rico next June to witness the official introduction of Philco's 1966 electronics lines. This will be the second time in a year that Philco has engaged in



Actual Size
Only 1-5/8 inches long...
Extends just 29/32 inch
behind front of panel

BUSS Space Saver Panel Mounted Fuseholder

• Fuseholder takes 1/4 x 1 1/4 inch fuses. Converts to 9/32 x 1 1/4 inch fuses simply by changing screw type knob. Holder is rated at 30 ampere for any voltage up to 250.

• Also available in military type which meets all requirements of MIL-F-19207A.

BUSS

Write for BUSS
Bulletin SFH-10

BUSSMANN MFG. DIV., McGraw-Edison Co., ST. LOUIS, MO. 63107

--- for more details circle 18 on post card

ELECTRONIC TECHNICIAN

GMW FUSE
and HWA
FUSEHOLDER



FUSE SIZE
ONLY .270 x .250
INCHES

BUSS
VISUAL
INDICATING

Sub-Miniature FUSE-HOLDER COMBINATION

For space-tight applications. Fuse has window for inspection of element. Fuse may be used with or without holder.

Fuse held tight in holder by beryllium copper contacts assuring low resistance.

Holder can be used with or without knob. Knob makes holder water-proof from front of panel.

Military type fuse FM01 meets all requirements of MIL-F-23419. Military type holder FHN42W meets all military requirements of MIL-F-19207A.

BUSS

Write for BUSS
Bulletin SFB

BUSSMANN MFG. DIVISION, McGraw-Edison Co., St. Louis, Mo. 63107

of existing broadcasting television stations in this country. The 16-page statement asserted that the history of the past 12 years has established "a complete lack of impact" by community antenna systems on the existence and growth of broadcast television in the U.S. Of the 107 UHF stations that have gone off the air, only 10 were in CATV communities. And two of these ten wrote letters commending CATV for helping them to stay on the air as long as they did, the statement said.

Webster Appoints Distributors

Howard C. Stacey, vice president and general manager of Webster Electric Company Communications Division, announced the appointment of 13 new distributorships.

Blonder-Tongue Files Suit

Blonder-Tongue Labs, Inc., has filed suit against Viking Cable Co., Hoboken, N.J., for patent infringement on an electrical outlet attachment used in television master antenna systems.

Viking Cable Co. is a wholly owned subsidiary of Rego Industries, Inc., also of Hoboken.

The complaint charges Viking Cable with employing a Blonder-Tongue invention, without license, in the manufacture and sales of electrical outlet attachments. Blonder-Tongue claims exclusive rights for the invention under U.S. Patent No. 3,131,985.

...New Developments in Electrical Protection

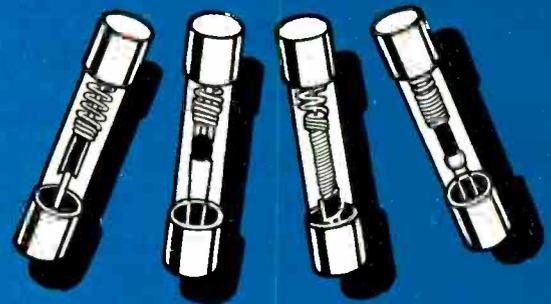
lurgical engineers, and \$597 for chemical engineers. It was noted that in 1938 the typical IIT engineer started at \$100 per month. He earned \$368 per month in 1954.

Raytheon Sales Manager

David C. Thompson has joined Raytheon Company as sales manager for the firm's Ray-Tel communications products. He will direct sales of Ray-Tel citizens band two-way radios, selective calling devices, antennas, microphones, noise suppression kits, and related accessories. For the past two years, he served as marketing manager for Machtronics, Inc. of Mountain View, Calif. From 1957 until 1962 he held various manufacturing management and marketing posts with Ampex Corp., Redwood City, Calif. Thompson graduated from Lehigh University in 1951. After a four-year tour of duty as a Naval officer in Korea and the Far East, he attended the Harvard Graduate School of Business Administration from which he received a master's degree in 1957.

CATV and Existing Television Stations

Comments submitted by Jerrold Electronics to the FCC urged that body to adopt a "case-by-case approach" in deciding whether existing stations need protection from a CATV system. Jerrold said the nation's community antenna television systems have had no adverse economic impact on the operations



FUSETRON dual-element Fuses

time-delay type

"Slow blowing" fuses that prevent needless outages by not opening on motor starting currents or other harmless overloads—yet provide safe protection against short-circuits or dangerous overloads.

BUSS

Write for BUSS
Bulletin SFB

BUSSMANN MFG. DIVISION, McGraw-Edison Co., St. Louis, Mo. 63107

--- for more details circle 18 on post card

NEW!

Hy-gain

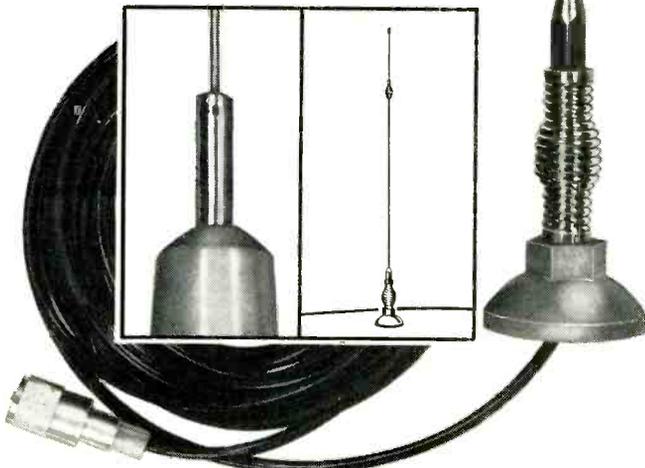
SOLID STATE Mobile Toppers for Citizens Band

- Hy-Q Solid State Loading Coil
- 23 Channel Broadband Performance
- Precision Adjustable Tuning

Now...a major advance in the state of the art...new Hy-Gain Mobile Toppers...featuring a space-age Hy-Q solid state loading coil expressly designed to deliver a new dimension in performance on all 23 channels of the 27 megacycle Citizens Band. New concept adjustable tuning rod allows "no cutting" lifetime precision tuning for optimum performance on any vehicle.

New Hy-Gain Mobile Toppers are virtually indestructible...Hy-Q solid state loading coils are totally encapsulated in ever-enduring molded polystyrene...whip sections and tuning sections are of low wind resistant top quality stainless steel (except telescoping model where whip section is chrome plated brass) . . . all mounts are field tested to take maximum abuse. New Hy-Gain Mobile Toppers are available for mounting any place on any vehicle...roof mount, deck mount, cowl mount, fender mount...you name it, there's a Hy-Gain Topper that will fill the bill! They're available now from your favorite Hy-Gain distributor or dealer.

Write for fully illustrated performance-comparison Technical Data Report on the new Hy-Gain Topper line...it's FREE!



HY-GAIN ANTENNA PRODUCTS CORP.
8566 N.E. Highway 6 • Lincoln, Nebraska

- - - for more details circle 34 on post card

NEWS OF THE INDUSTRY

Sylvania Color Tube

It is reported that Sylvania color TV sets, equipped with picture tubes containing a rare earth phosphor, were picked overwhelmingly by shoppers in six major markets for outstanding picture qualities.

The survey, conducted by John J. Henderson Associates of New York City, covered nearly 10,000 consumers at popular shopping centers in New York, Chicago, Philadelphia, Detroit, Los Angeles and Boston. Four 1965 color TV sets were placed in operation side by side, with the cabinets masked to conceal the identity of the manufacturer, the report concluded.

'Quality' Slogan Contest

"Quality through Craftsmanship," a new Hallcrafters slogan, was announced by Bob Halligan at a presentation to the winners of the slogan contest. It was said there were over 1100 entries in the contest, which ran from June 24 to July 31, among the Chicago hourly employees. The winners in the contest were Mrs. Cecilia Tomaxin, who received a Lowry organ; John Kopczak was second and received a WR-2000 receiver. Paul Rivera, who placed third, was awarded an S-120 receiver.

This month's cover

Our cover this month shows one of many test benches in General Electric's National Service Headquarters, Lynchburg, Va. Here, data on new technology is communicated to technicians who service FM mobile radio equipment all over the nation. Regular sessions are held for the company's own communications engineers, for independent service station operators, and for communications personnel of utilities, telephone companies, municipalities and other radio users.



1. VTVM
2. Tone Sender
3. Signal Generator
4. Frequency Counter

5. Multimeter
6. Modulation Monitor
7. Test Set
8. Wattmeter

**Sensational
Performance!**

**New
small size!**

**Hand wired
modular
construction!**

HALLMARK 1250



suggested list
\$169.50

Get on the profit line with the "hottest" CB going — the new Hallmark 1250!

Hand wired top performance and reliability in a size so compact (only 4"x6 1/4"x10") it fits any vehicle. Built like a 15 watt unit, the new full wave silicon bridge easily provides the power for maximum output and modulation. A dual powered, 12 channel, crystal-controlled unit, the 1250 has 0.3 μ V sensitivity and 45 db selectivity. Other features include electronic switching, ferrite speaker and sturdy snaps for easy access to crystal sockets and chassis.

SPECIAL OPTION! Model 1250 X — with plug-in transistorized power supply! \$189.50, suggested list.

Write for information on the complete Hallmark line!

Hallmark 512. 12 channel CB.

Hallmark 3000. FCC type accepted 30 watt transceiver for business service.

Transceiver Tester. Battery powered, crystal-controlled signal generator.

Power Supply. Transistorized plug-in to replace vibrator power supply.



HALLMARK INSTRUMENTS

2620 Freewood Dr. P. O. 10941 Dallas 20, Texas FL 7-0184

— for more details circle 33 on post card

JANUARY 1965

... MICROPHONES

Continued from page 54

many different configurations are used.

Although the majority of communications microphones fall in the mobile category, the base station mike is an important factor in communications today. A typical base station microphone and the same microphone with the switch base removed is shown in Fig. 7. You will note the complexity of the switching in this microphone as compared to a typical mobile microphone. An almost unlimited variety of base station microphones exist. Most transceiver manufacturers insist on a custom arrangement and a number use a built-in transistor amplifier.

The microphone will often have two methods of switch activation. One may be a finger tip bar for use when the microphone is at rest on the desk top and the second will be a "grip to talk" for use when the microphone is picked up or the microphone may have a "lift" switch which is activated when the microphone is picked up. The center rubber foot shown in the base plate in Fig. 7 is a "lift" switch.

The microphone with the "lift" switch may also contain a third switch which acts to override the "lift" switch. Also, many base station microphones have a locking device to lock it on for longer transmissions or to free the operator's hands. The "finger tab" switch with a locking device, often contains a center position for "monitor only" operation. A number of base station microphones show the switch diagram on the bottom of the microphone base.

Maintenance of the cord and interior of base station microphones is essentially the same as mobile microphones. Their disassembly may take slightly longer but no additional precautions are required other than to replace all parts in proper sequence.

With proper care, the repair and maintenance of communications microphones need not be a formidable task. With a basic understanding of their malfunction symptoms, you will be in a better position to make the decision of whether to repair, or replace, the communications microphone. ■



Can you service mobile radio and CB?

It's a big business . . . and getting bigger every day. There are thousands of mobile radio systems now in use plus thousands more marine and CB sets. **BUT . . . ONLY MEN WITH COMMERCIAL FCC LICENSES ARE LEGALLY AUTHORIZED TO SERVICE THEM.** Don't let this profitable new business get away from you. At home, in your spare time, a Cleveland Institute training program will prepare you for the tough new FCC License Exam . . . is backed by this remarkable offer: "If you complete the CIE program yet fail the FCC License Exam specified, all tuition will be refunded".

Get details. Send coupon for our book "How to Get a Commercial FCC License". No obligation. Cleveland Institute of Electronics, Dept. 1776 E. 17th St., Cleveland, Ohio 44114.

Cleveland Institute also offers the following Electronics courses: Electronics Technology, Industrial Electronics, Broadcast Engineering, and Electronic Communications.

ACT NOW . . . SEND COUPON FOR FREE BOOK

**Cleveland Institute
of Electronics**

1776 E. 17th St., Dept. ET-14
Cleveland, Ohio 44114

Please send me your free brochure "How to Get a Commercial FCC License".



Occupation _____ Age _____

Name _____
(Please Print)

Address _____ County _____

City _____ State _____ Zip _____

Now training over 15,500 students through Electronics Home Study.

COLMAN

AUTOMATIC DEGAUSSING KIT DK-001

FOR ALL 63-64 COLOR SETS

Using RCA chassis

**ADMIRAL • CORONADO
DUMONT • SYLVANIA
EMERSON • OLYMPIC
MAGNAVOX • PHILCO
GE • WESTINGHOUSE
SILVERTONE • RCA
& CURTIS MATHES**

Easily adaptable to other sets

PREWIRED • EASY TO INSTALL

Kit DK-001 List 14.20

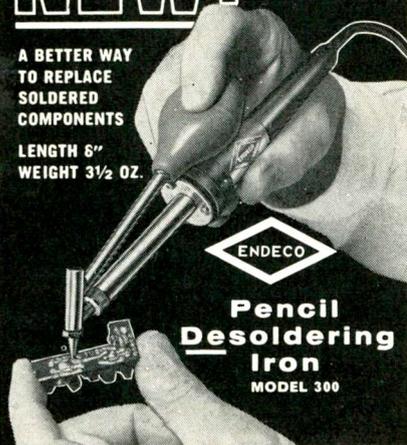
**COLMAN ELECTRONICS
Amarillo, Texas**

--- for more details circle 20 on post card

NEW!

A BETTER WAY
TO REPLACE
SOLDERED
COMPONENTS

LENGTH 6"
WEIGHT 3 1/2 OZ.



Now—remove miniature soldered components in seconds—without damage

Hollow tip fits over connection; vacuums all solder for easy removal of component. Leaves terminals and mounting holes clean. Then, with 360° contact, it resolders even faster and better than regular irons. Handles miniature and standard components in printed circuit boards and conventional wiring. Self-cleaning. All parts replaceable. 40 watts, 115-v. 5 tip sizes. Pays for itself in time saved. \$9.95 net East of the Rockies.

Larger model available. See your distributor or write:

**ENTERPRISE DEVELOPMENT CORPORATION
1102 E. 52nd • INDIANAPOLIS, IND. 46205**

--- for more details circle 26 on post card

ADVERTISERS INDEX

Admiral Corporation	74
Aerovox Corporation	76
Antenna Specialists Co.	64
Arco Electronics, Inc.	19
B & K Manufacturing Co.	59
B & K Manufacturing Co.	60
Belden Manufacturing Co.	2nd Cover
Blonder-Tongue	22
Bussmann Mfg. Div.	80-81
Channel Master Corp.	33
Cleveland Institute of Electronics	83
Colman Electronics	84
Columbia Wire & Supply Co.	65
Communications Company	73
Communication Products Company	66
Delco Radio Division	3rd Cover
E.C.I. Electronics Communications Inc.	26
Electro-Voice, Inc.	78
Enterprise Development Corp.	84
Finney Company	20
Greyhound Corporation	61
Hallicrafters Company	75
Hallicrafters Company	77
Hallicrafters Company	79
Hallicrafters Company	84
Hallmark Instruments	83
Hy-Gain Electronics Corp.	82
I. E. E. E.	64
Jackson Electrical Instrument Co.	27
Jensen Industries, Inc.	74
E. F. Johnson Company	69
Lafayette Radio Electronics Corp.	35
Mercury Electronics Corp.	72
Minnesota Mining & Mfg. Co.	62
Mosley Electronics, Inc.	24
Multicore Sales Corp.	84
National Radio Institute	63
Nortronics, Inc.	76
Pearce-Simpson, Inc.	32
Radio Corporation of America RCA Electronics & Components	4th Cover, 38
RCA Sales Corp.	31
Sarkes Tarzian Tuner Service Div.	29
Sencore, Inc.	34
Sencore, Inc.	36
Sprague Products Company	23
Sprague Products Company	25
P. A. Sturtevant Company	63
Superior Electronics Corp.	62
Sylvania Electric Products, Inc.	37
Texas Crystals	78
The Turner Company	30
Utica Communications Corp.	65
Windsor Electronics	69
Winegard Company	70-71
Xcelite, Inc.	66

NOW...

you can sell Hallicrafters COMMAND LINE



NEW FM 3-WAY RADIO for industry and commerce

This is an excellent opportunity for experienced electronic sales and service companies to represent Hallicrafters COMMAND LINE FM 3-way radio. New sales concept. No inventory. No financing problems. Complete factory back-up. Equipment for all frequencies, competitively-priced, up to \$100 less per unit. Lead-producing national advertising; comprehensive technical literature; plus Hallicrafters 31-year reputation for quality through craftsmanship help you sell.

For details, contact Norman A. Sholseth



hallicrafters

5th & Kostner Aves., Chicago, Ill. 60624
Phone: 312-826-6300

--- for more details circle 32 on post card



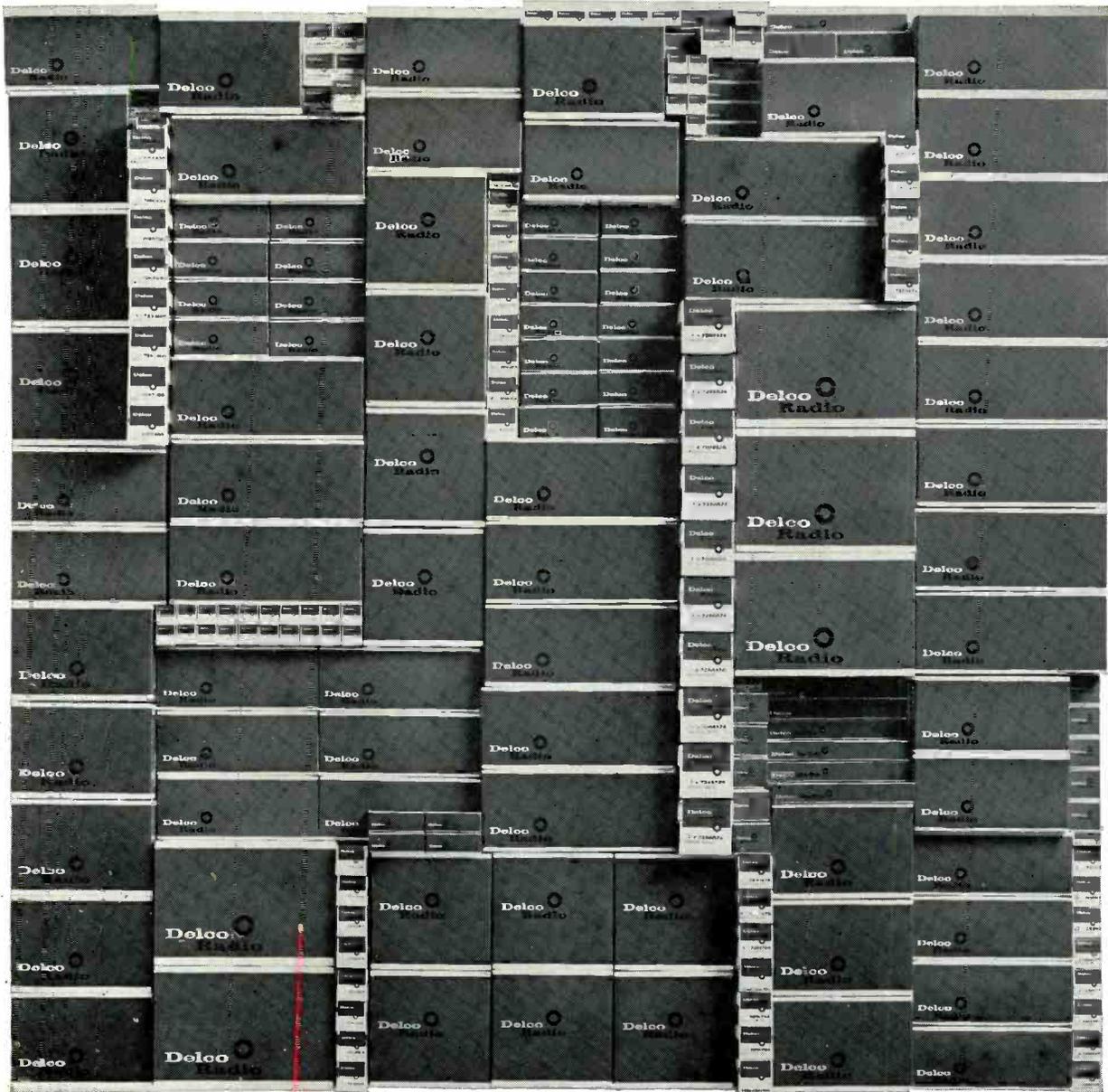
ERSIN MULTICORE

NEW EASY DISPENSER PAK ONLY 50¢

BUY IT AT RADIO-TV PARTS STORES
MULTICORE SALES CORP. PORT WASHINGTON, N. Y.

--- for more details circle 43 on post card

ELECTRONIC TECHNICIAN



If the part you need isn't here, we've probably got it on the next shelf.

How can we be so sure we've got the auto radio parts you need? There are two reasons. One, nearly *half* the cars on the road have Delco radios. And we make Delco radio parts. Two, you can service *most* other kinds of radios with Delco parts.

We think this makes things easier on you. Because you can get just about all your parts from one reliable source, your United Delco supplier.

And what you get are good parts. You don't have to say a prayer every time you use them. They're well-built, well-tested parts

that won't let you or your reputation down. Your United Delco supplier will gladly send you our big detailed catalog. (To find the supplier nearest you, phone your area number below and ask for the Zone Service Manager.)



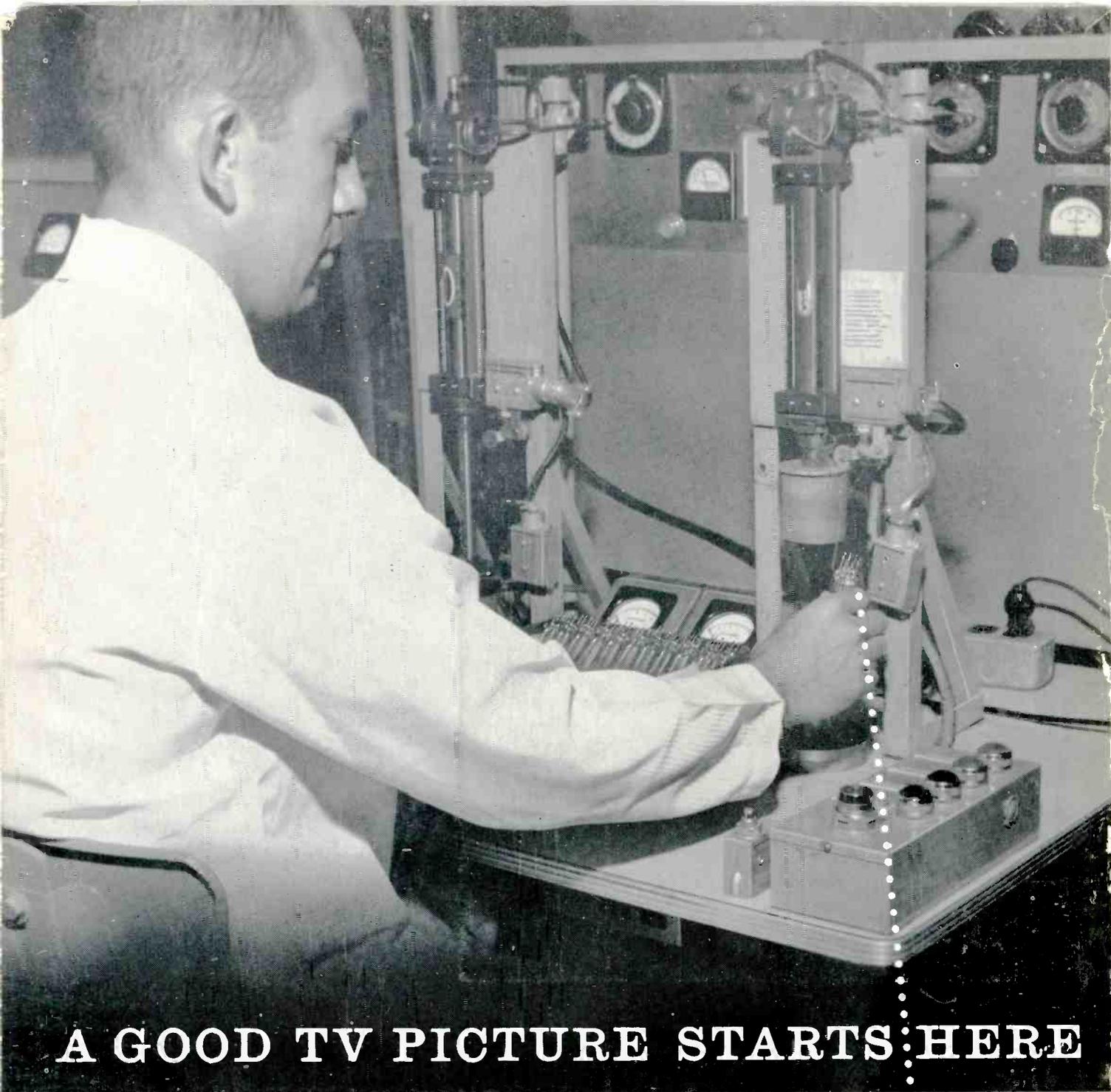
DELCO RADIO • Division of General Motors

Atlanta.....Cedar 7-1501
Boston.....Wells 3-3100
Buffalo.....TF 2-5362
Charlotte.....Edison 4-8671
Chicago.....437-5300
Cincinnati.....Cherry 1-2310
Cleveland.....671-6460
Dallas.....Fleetwood 2-8471
Denver.....Keystone 4-0273

Detroit.....584-1025
El Paso.....Keystone 3-1651
Houston.....Jackson 6-4338
Indianapolis.....Melrose 6-4351
Jacksonville.....Exbrook 8-5755
Kansas City.....Fairfax 1-3900
Los Angeles.....Dunkirk 5-6487
Memphis.....Jackson 5-6471
Minneapolis.....331-4811
Newark.....297-3300

New Orleans.....523-4281
New York.....Judson 2-3824
Omaha.....558-0225
Philadelphia.....Garfield 3-8200
Pittsburgh.....Court 1-6551
San Francisco.....Landscape 6-8221
Seattle.....Parkway 2-4477
St. Louis.....Jefferson 3-4230
Washington, D.C.....Juniper 8-7494

--- for more details circle 23 on post card



A GOOD TV PICTURE STARTS HERE

It Depends on a Leakproof Stem Seal

The slightest leakage of air weakens the high vacuum of a TV picture tube...resulting in a costly callback and a dissatisfied customer for you. This is why RCA takes extra precautions to maintain the vacuum in Silverama picture tubes.

Potential trouble spots are the glass-to-metal lead-wire seals in the electron-gun stem assembly (below). At RCA, stem assemblies are batch tested for leakage in a supersensitive leak detector *before* they go into electron guns.

So sensitive is this detector that it can pinpoint a leak that would not affect tube performance for years...a leak so tiny that no other inspection method could hope to find it.

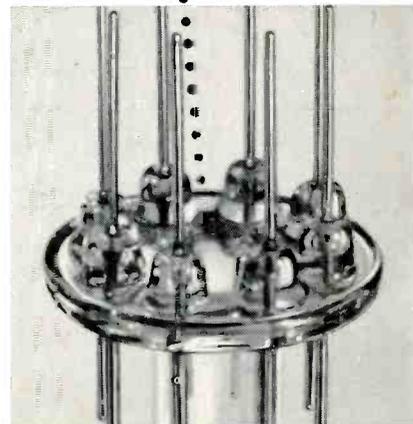
Yet the slightest sign of a leak is cause for rejection of a stem. This extra precaution is one more example of the care that goes into every phase of Silverama manufacture...and one more reason why RCA Silverama should be your first choice in replacement picture tubes.

Silverama is made with an all-new electron gun, finest parts and materials, and a glass envelope that has been thoroughly cleaned and inspected prior to re-use.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.



The Most Trusted Name in Electronics



Stem assemblies are tested on a special high-vacuum leak detector. Detector is a helium mass spectrometer, detecting passage of helium "tracer" gas through any of the glass-to-metal seals. A stem assembly passing this rigorous test is ready to become a vital part of an RCA Silverama® Picture Tube.