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The CK 703 Crystal Triode
UHF Television Converters
Front Ends, Part 7
Selling 3-Speed Record Players
Radio Symbols Chart
Improving TV Booster Performance in Fringe Areas
A New Cathode Ray Tube Tester

Total Distribution Of This Issue: Over: 30,000
Mallory Vibrators
Give Peak Performance!

Fast, clean break of contacts minimizes arcing and pitting. It teams up with gentle contact impact for less wear, and high contact pressure for low resistance—to produce a combination of features attainable only with the patented, tuned mechanism in Mallory Vibrators. That’s the secret of their peak performance.

Mallory Vibrators are a result of Mallory’s unique facilities in electronics, electrochemistry and metallurgy. The perfect tuning is accomplished by an exclusive design and individual adjustment by skilled technicians. The contacts are made by Mallory’s Contact Division, among the largest in the world. They possess an unusual “self-cleaning” action which prevents oxidation in service.

That’s why more Mallory Vibrators are used in original equipment than all other makes combined. When you use Mallory Vibrators for replacement you can be sure of long life, dependable starting and high output efficiency. See your Mallory distributor now!

More Mallory Vibrators Are Used in Original Equipment Than All Other Makes Combined.
You get all five  

...with RCA Batteries

1. Top Brand Acceptance

2. Radio Trade Distribution

3. Completely Rounded Line

4. Radio-Engineered Quality

5. Super Selling Aids

No other battery line offers you all five of these important selling advantages. That's why RCA is the one brand holding first place in the profit picture.

Backed by "the greatest name in radio," RCA Batteries enjoy unparalleled consumer acceptance...and RCA Batteries give you a clear selling field because they're distributed primarily to the radio trade.

Starting now—push RCA Batteries and watch your business grow!

See your RCA Battery Distributor for fast, reliable service.

The battery for the Radio Trade!

RADIO CORPORATION of AMERICA
RADIO BATTERIES
HARRISON, N.J.

Radio Corporation of America
Made in U.S.A.
EDITORIAL
by S. R. COWAN

Battery Sets & Batteries MUST Be Made

Torrential rains, hurricane winds, and an extremely heavy snowfall plagued most of the key cities in the Eastern part of the nation late last November. Consequently, millions of homes were, for varying periods, completely isolated and without means of communication as telephone and power lines failed.

Several major broadcast stations became silent, some because of toppled radiators, others due to loss of power. Many newspapers were not published; and some that were could not be delivered. For modern times it was a period of unparalleled void in news dissemination.

To many millions of people only three means of communications were open: 1) radio on amateur frequencies; 2) radio via sets in autos; and 3) radio via battery operation (from the BC stations still operating).

We, meaning all of us, — politicians, the military services, radio manufacturers, dealers and just ordinary taxpayers — must without fail take heed and learn a lesson from the emergency conditions that prevailed. And we must accordingly act to eliminate our short-comings should another emergency arise. For example, we should have learned that from now on every home in our country must have in it at all times at least one battery operated radio receiver that is always in operable condition.

Had an A-Bomb struck our key cities instead of the November storms the death toll would have been greater. But there would not have been a greater stoppage of communications. Radio stations learned their lesson. They, who had none, have purchased gas-powered emergency auxiliary power supplies, so power line failure won’t completely incapacitate them again. Now it’s the public’s duty to provide for itself radios that need not depend solely upon utilities to be operable.

So, regardless of any curtailments that may become necessary, even because of a Presidential declaration of national emergency, the fact remains that battery operated receivers must be made in sufficient quantities so that every home not having one now can obtain one — and furthermore, there must be made available a steady supply of batteries to keep these sets in usable condition. If you agree with this contention do something about it — tell your customers and urge them to write to General Harrison suggesting that he too recognize the seriousness of the situation, and act accordingly.

TV and the FCC

Some educational institutions are asking, at Washington, that the Federal Communications Committee reserve at least one V.H.F. channel in every metropolitan center for non-commercial educational use of television. This is hardly a request. We also urge FCC to hurry up with the “green light” on stations having TV CP applications pending.
Regency
Division, I.D.E.A. INC.  55 New Jersey St., Indianapolis 4, Indiana

Regency TV IS THE LARGEST SELLING SIGNAL BOOSTER!

BECAUSE... Regency wins all performance tests in nationally-known laboratories... Regency is the lowest priced QUALITY Television Signal Booster... Regency offers such features as simplified tuning control; easy installation; full coverage on all 12 channels... and Regency is UNDERWRITERS' (UL) APPROVED.

REGENCY Division, I.D.E.A. INC.  55 New Jersey Street, Indianapolis 4, Indiana
Trade Flashes

A "press-time" digest of production, distribution, and merchandizing activities

Receiver Production For First 11 Months

Television receiver production in eleven months of 1950 aggregated 6,529,615 sets, according to preliminary industry estimates released recently by the Radio-Television Manufacturers Association. RTMA's estimates represent production by member and non-member companies.

November radio and television production each dropped eight percent below the previous month's output. TV sets produced in November numbered 792,006 units and radio receiver production amounted to 1,304,094, RTMA estimated. Radio receivers, including home sets, auto and portables, manufactured in the 11-month period totalled 12,785,917.

2nd Annual Southwestern Electronics Conference

Historic Fort Clark on the Texas border, once the refuge of warriors, today a western luxury-ranch spouse with the color and romance of Old Mexico, will be the setting when approximately 300 manufacturers and distributors attend the 2nd Annual Southwestern Electronics Conference, January 24-January 27, at Bracketville, Texas. The conference is sponsored again this year by the Southwestern Chapter of "The Representatives" of Radio Parts Manufacturers, Inc.

RCA Antenaplex System

Individual high-gain radio-frequency amplifiers, each designed and tuned for a specified local television channel, are featured in RCA's new Type SX-8B Television Antenaplex System. It is disclosed in a description of the equipment just released by the manufacturer.

The new and improved multiple-outlet TV antenna system, initial units of which have already been installed in New York, Philadelphia, Chicago, Detroit and other large cities is capable of furnishing high-quality picture reception at as many as 350 outlets simultaneously with a

FREE! This New TV Replacement Capacitor Manual by SPRAGUE

From A to Z, from Admiral to Zenith, this 16-page book is jam-packed with complete replacement recommendations for critical TV capacitors in 497 television sets from The Technical Service Division of Sprague, world's largest capacitor maker.

Get your copy FREE from your SPRAGUE DISTRIBUTOR or send 10c directly to Sprague to cover handling and mailing costs.

Remember! Avoid costly call-backs in your service work by sticking to Sprague—the capacitors you can depend upon.

Sprague Products Company

Distributor's Division of The Sprague Electric Company

Be Sure of Your Installations—
Get the **Aptitude-Tested**
TRANSMISSION LINE

You know what you are doing when you use Belden Transmission Line Cables—they're aptitude rated. They are designed from the start to provide desirable electrical characteristics, and rigid manufacturing control assures constant, unswerving quality.

You can safely put Belden Wire to work for you, and know for sure how it will perform. You can know, too, that it will have the stamina to stay loyal on the job for years. For trouble-free installations, specify Belden Radio Wires.

Belden Manufacturing Company
4639 W. Van Buren Street
Chicago 44, Illinois

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### APTITUDE RATING No. 8225

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<th>Frequency (mc)</th>
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<td>400.</td>
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For use with television and FM receiving antenna. Exceptionally low losses at high frequencies.

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### APTITUDE RATING No. 8235

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For use with television and FM receiving antenna; also for low-power transmitting antenna.

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### APTITUDE RATING No. 8227

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<td>400.</td>
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For use with television and FM antenna in extremely noisy locations.

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### APTITUDE RATING No. 8240

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For use with radio frequency transmission video, test equipment, and pulse transmission.
A satisfied customer is your most valuable business asset. You take a chance on losing him with "just-as-good" replacement parts. Standardize on Ohmite resistance components—known the world over for top dependability among servicemen, amateurs, and design engineers. It’s smart business!

OHMITE MANUFACTURING COMPANY
4845 Flournoy St., Chicago 44, Illinois

Don't TAKE CHANCES WITH "JUST-AS-GOOD" REPLACEMENT PARTS
Be Right with

OHMITE
—IT'S GOOD BUSINESS!

single amplifier assembly in use, according to the Sound Products Section of the RCA Engineering Products Department. When additional amplifier assemblies are used, the system will provide service for much larger numbers of wall outlets.

Ray Simpson Becomes "Great Eagle"
Warriors, "Bright Water" and "Fleet Arrow" watch Ray Simpson of the Simpson Electric Company, do part of his tribal initiation duties on the lawn of the Simpson home at Lac de Flambeau, Wisconsin. This ceremony officially entered Ray Simpson into the tribe as an honorary Chieftan. His Indian name is "Me-gese" or "Great Eagle". It took place during the recent Simpson Sales Conference which lasted for three days Sept. 25-26-27. The Simpson Factory at Lac du Flambeau employs approximately 400 of the tribe, which previous to erection of the factory four years ago, were nearly destitute. This was their way of saying "thank you" to Ray.

Skiatron Subscriber-Vision Given Inaugural Tests
New Yorkers and all those within a 60-mile radius of WOR-TV are being given their first view of box-office television with the inauguration of test broadcasts of Subscriber-Vision, a revolutionary system of home box-office TV. This patented pay-as-you-see system, developed by the Skiatron Electronics & Television Corporation, marked the debut of the only subscription TV method whose programs are transmitted entirely over the air, without the use of telephone lines. In accordance with Federal Communications Commission authorization, the tests of approximately one hour duration will appear on Channel 9, WOR-TV every night immediately.

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ON LONG ISLAND

817 EXPERTS SPECIFY

PETE CHANKO SAYS:
Chanrose Distributors
Jamaica, N. Y.

Servicemen and Service Dealers are our customers and we carry the products they want. From the very beginning, we have featured N. U. tubes because N. U. pioneered in designing and building tubes to meet the serviceman's strictest requirements. Uniform, reliable, properly designed for interchangeability, N. U. tubes solve every service problem. And, backed by N. U.'s cooperative management, helpful service aids and advertising, N. U. tubes are profit-makers for both us and our 817 customers.

NATIONAL UNION RADIO CORP.
Main Office: 350 Scotland Rd., Orange, N. J.
Experts choose
JACKSON TV instruments
for important jobs

IN PRODUCTION WORK AT STEWART-WARNER

Shown in this typical production scene at Stewart-Warner are some of the Jackson Oscilloscopes used in checking television receivers. Used in various stages of production, these Jackson ‘scopes are depended upon to maintain Stewart-Warner’s high production standards. This is only one example of how Jackson’s outstanding oscilloscope is used for important jobs in industry, too. Also, many other applications.

IN TEACHING AT DEFOREST’S TRAINING, INCORPORATED

At this famous electronics school, where thousands of the nation’s leading TV technicians are trained, the Jackson Television Generators are used to instruct future technicians in the proper method of aligning television and other high frequency equipment. Shown here are some of the generators used by Deforest’s in this important work. Jackson equipment was chosen for its ability to provide accurate results, even under the hard usage encountered in teaching.

Includes both Sweep and Marker Generators in one instrument. Electro-mechanical sweep variable from 100KC to over 12 MC. Crystal calibrator circuit provided for external crystal. Generator covers full FM and TV bands. Instrument is same height as oscilloscope for compact service bench installation. Marker Generator has 400 cycle Audio Generator. Scope timing voltage provided.

Trust the Experts’ Judgment . . . Choose JACKSON

See your distributor — or write

JACKSON ELECTRICAL INSTRUMENT COMPANY
Dayton 1, Ohio

after WOR-TV concludes program transmission, under call letters KE-2XXC especially assigned by FCC, during the 30-day period specified by the Commission.

Lewis & Kaufman Acquires Taylor Tubes Inc.

Jack Kaufman, President of Lewis & Kaufman, Inc., west coast electronic tube manufacturing company, has announced that a group headed by him has purchased the entire capital stock of Taylor Tubes, Inc., pioneer Chicago manufacturer of transmitting, industrial and television tubes.

Philco Acquires New Site

A subsidiary of Philco Corporation, Lansdale Tube Company, with its main plant and laboratories in Lansdale, Pa., has purchased a site at Frederick Maryland for a new plant for the manufacture of critically short electronic tubes for the Armed Forces and essential civilian requirements, it was announced by William Balderston, president of Philco.

North American Philips Announces New Receivers

Two complete, compact, self-contained, low-cost television receivers, one producing a picture 30" high and 40" wide, and the other a 21" x 28" picture, have been developed by North American Philips Company, Inc., New York, for use in hotels, clubs, bars, restaurants, schools, institutions, department stores, super-markets and similar locations. Both can be controlled from distances up to 150 feet by a remote tuner measuring 8" x 16" x 10½".

DuMont Requires Contract Service Dealers to Maintain Escrow Accounts

To protect owners of Du Mont television sets from financial failure of service organizations with which the set owners have service contracts, Allen B. Du Mont Laboratories, Inc., announced recently that its authorized service organizations and authorized servicing dealers will in the future be required to maintain escrow accounts in banks to cover every contract customer.

1951 Parts Distributor Show SellOut Indicated

On the basis of reservations received to date for the 1951 Parts Distributors Show here in May, another sell-out of booth and display space is in prospect very shortly.

RCA Exec Predicts Black & White TV For Long Time

Black and white television will remain the backbone of the industry for some years to come, with continued
You get THE ORIGINAL. The studio-matched rectangular tube is Hytron’s baby. Its logically designed screen matches the 4 by 3 aspect ratio of the studio picture. Quite naturally, Hytron’s new rectangular is fast becoming the most popular picture tube.

You get UNIFORMITY. Hytron’s new picture-tube plant is the most modern in the world. It was designed especially to mass-produce Hytron studio-matched rectangulars of uniform dependability.

You get A COMPLETE LINE. Hytron offers you 14-, 16-, 17-, and 20-inch studio-matched rectangulars. All the popular rectangulars (and the popular types of round tubes too).

You get THE QUALITY LEADERS DEMAND. Nine out of ten leading TV set makers choose Hytron. More and more leading service-dealers pick Hytron. Because their own experience proves Hytron studio-matched rectangulars give “amazingly clearer, sharper, more brilliant pictures.” Demand this same performance for yourself. Demand original Hytron studio-matched rectangulars.
See these big-space ads! They're appearing in the Saturday Evening Post, Life, Look, and Collier's Magazine. Each is loaded with stop-appeal and sales-appeal. Each one features an endorsement of your service by a famous star such as Paulette Goddard, Marie Wilson, Diana Lynn, or Patrice Munsel.
HERE'S the hardest hitting . . . and the most complete advertising campaign ever planned, to bring service business to every dealer who displays the Sylvania emblem. 

All during 1951, your prospects are certain to SEE, HEAR, and READ about your expert service in magazines, on television, and through window displays.

The great Nation-wide TV show, "Beat the Clock," featuring Bud Collyer over CBS-TV, will go to bat for your service and the Sylvania products which you sell. Clever animated cartoon commercials on the CBS-TV station in your area will inform prospects of your expert workmanship and prompt service.

Tying everything together is the greatest and most colorful dealer tie-in program you have ever seen! You get FREE giant, full-color displays of the featured stars. You get counter cards . . . bright window streamers . . . spot radio announcements . . . mailing pieces . . . all designed to identify you as the Sylvania Service Dealer advertised on television and in the national magazines.

Ask your jobber for full information about the bigger-than-ever 1951 Service Dealer Advertising Program. If he can't give you all the facts, mail the coupon now!

Be sure to display this emblem. Put up these Sylvania decals right now! This seal is the target of the whole Sylvania Service Dealer campaign. Put them on your windows and on your trucks. Made in 8-inch and 12-inch sizes. Order a supply from your jobber TODAY! They're free!

Sylvania Electric Products Inc. 
Dept. R-2301, Emporium, Pa.

Please send me full details about the greatest in the history of the industry.

Name:
Street:
City: Zone State:
NO OTHER CARTRIDGE so clearly demonstrates the high calibre of your service. Gives unsurpassed fidelity.
And it's so simple to install. $\frac{1}{8}$ and $\frac{3}{16}$ hole spacing saves you time and work. Ideal for replacement in RCA type “45” rpm changers. Just as good, too, for 33\(\frac{1}{3}\) rpm changers.

Has high compliance, wide range, low-tracking pressure and other TORQUE DRIVE advantages. Replaceable needle.

Model 34. With Osmium tip needle, List Price, $6.50
Model 34-S. With Sapphire tip needle, List Price, $7.50

Replace now. Your customers will approve. Order from your E-V Distributor.

### E-V MODEL 34 REPLACES

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<td>CAC-J</td>
<td>W21AR P73A</td>
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Electro-Voice

412 CARROLL STREET • BUCHANAN, MICHIGAN

Export: 13 E. 40th St., New York 16, U.S.A. Cables: Arlob

PHONE PICKUPS • MICROPHONES • HI-FI SPEAKERS • TV BOOSTERS

IN RETROSPECT 1950 was a banner year for most Service Dealers and technicians and despite the fact that all-out war effort is demanded of us and our suppliers for 1951 (at least) the prospects are exceedingly bright.

Top radio-TV manufacturers, discounting the knowledge that upwards of $5 billions of Government commitments for electronic components and equipment are about to be issued, concur that during 1951 it probably will be possible to manufacture almost 5 million TV sets, 10 million home and 5 million auto radios. There will be shortages in all categories, and of 3-speed record-players in particular. Regretably, trends of black-marketing are already apparent in most of the radio and TV "name brand" lines, and things will get worse before they get better.

It is axiomatic that when new equipment is not easily obtainable, or when merchandise is overpriced, the public endeavors to keep in useable condition those appliances which it already owns. In this regard the servicing profession must take a leaf from its book of 1942-45 experiences and be prepared to do an abnormal amount of repair and maintenance work especially by means of "substitution methods". Complexity of present-day circuits will make our jobs more difficult than would ordinarily be the case . . . but, it is possible for the Nation's servicing fraternity to keep in operable condition all the receivers now in use if "reasonable quantities" of certain components and tubes and test instruments are made available. Approachment to RTMA in this regard has already been made by the Publisher of "Service Dealer" on behalf of the Nation's technicians.

CHARLES E. WILSON, DDM. When Mr. Truman appointed General Electric Company's former president, Mr. Charles E. Wilson, to assume the duties of Director of Office of Defense Mobilization — the biggest, most important and most difficult assignment ever relegated to one man in history — it was a stroke of genius, and if Mr. Truman's name is recorded by posterity, it will be for that one, sound selection. Americans, and people in all freedom-loving lands, are again
A top bobsled team—athletes trained to work as one in handling their balanced, ruggedly built sled—can consistently defeat the clock in negotiating the treacherous, one-mile Mt. Van Hoevenberg run.

Likewise, T. E. I. engineers and production personnel work as a unit with a similar goal—the conquering of TIME's deteriorating effects through the building of an ever-stronger picture tube. For Thomas' highly trained personnel, specially designed equipment, and efficient production techniques are consistently increasing the life of Thomas tubes in the contest with TIME.

For the greatest value in today's television picture tubes—for top operating efficiency and truly LONGER life—specify T.E.I. In all popular rectangular sizes, black-face.
How De-Coupling Networks Operate

by J. Jacobson
(Instructor, Delehanty Institute)

One of the defects, responsible for regeneration in multi-stage amplifiers, is a faulty de-coupling network. The symptom is usually oscillation and howling in audio amplifiers, and erratic operation, inability to align, and oscillation in r-f or i-f amplifiers. A knowledge of the operation of decoupling filters will aid the technician in recognizing the symptoms, and also enable him to calculate the correct value of condenser and resistor when replacing missing components.

**Basic De-Coupler**

Figure 1 shows a simple de-coupling unit consisting of R and C. Four terminals are shown, a and b being input, and c and d being output. An a-c potential of 10 volts is impressed across the input terminals. The frequency is 1000 cycles. The value of R is 30,000 ohms and the capacity of the condenser is .05 mf. The capacitive reactance of the condenser is found to be about 3000 ohms, using the formula:

\[ X_c = \frac{1}{2 \pi F C} \]

Therefore, it may be seen that our network is essentially a voltage divider, and the larger portion of the applied voltage appears across the resistor, with very little voltage appearing across the output terminals. The basic function of a de-coupling network is to do just that; to prevent an unwanted a-c component, which is impressed across the input terminals, from appearing across the output terminals. Of course, if the wrong value of C were chosen in Fig. 1, say 0005 mf, then practically all of the applied voltage would be across C, as:

\[ X_c = 3 \text{ megohms at 1000 cycles.} \]

Or similarly if R were not proportioned correctly to C, with R being too large, the applied voltage would appear across the output terminals.

**De-coupling networks are used in almost every circuit where the possibility of feedback from a common impedance is present. This article gives a step by step analysis of what happens to a signal in a typical circuit and how de-coupling networks prevent feedback effects.**

Why De-Coupling is Needed

In order to understand the need for de-coupling in amplifiers, two important points concerning the operation of amplifiers should be known:

(a) the impedance of the power supply feeding the amplifier.

(b) the phase relationship of voltage and current in an amplifier.

**Power Supply Impedance**

Figure 2 shows a typical power supply consisting of a full wave rectifier with a single section condenser input filter. This type of power supply will be found in the majority of receivers and audio amplifiers in use today. A d-c voltmeter and milliammeter may be used to be measuring the output voltage and current with no load on the power supply, with the exception of the bleeder resistor. The values are 375 volts and 25 milliamperes. Switch "S" connects a load resistor \( R_1 \) across the output of the power supply and the voltage and current values are now 280 volts at 150 milliamperes. Thus, it may be seen that the voltage, in dropping under loaded conditions, caused the power supply to act as though an impedance was inserted every time "S" was closed. The value of the power supply impedance may readily be found by dividing the change in voltage by the change in current. Thus,

\[ Z = \frac{375-280}{0.150-0.025} = \frac{95}{0.125} = 760 \text{ ohms.} \]

The impedance is actually the effective resistance of the choke, rectifier tube, and transformer winding connected in series. The presence of the first filter condenser also contributes to the value of the impedance.

**The Impedance is "Common"**

When a power supply of this type is called upon to supply plate voltages to a multi-stage amplifier, this series...
impedance will be common to all of the stages. In other words, current flow to all of the individual tubes will have to pass through this common impedance. Therefore assuming a three stage audio amplifier, the separate stages will have a common coupling impedance between them, which, it will be shown, will have a detrimental effect upon the operation of the amplifier; as if a feedback voltage were purposely allowed to exist between the output and input stages.

Phase Relationship in an Amplifier

Figure 3 shows a three stage amplifier using a conventional resistance coupled amplifier circuit. It may be seen that the power supply, previously discussed, is supplying plate voltage to all three tubes. Assume that a peak sine wave voltage of .0187 volts a.c. is impressed across R. The polarity of the grid in relation to the cathode at a given instant is considered negative. The instantaneous phase relationship of plate voltages, plate currents, and signal voltages may be seen at a glance, by the 10 meters indicated in the circuit diagram. It can be seen that the 6F5 plate voltage, and the plate voltage of the 6V6 output tubes are in phase. Precautions should be taken therefore to prevent any of the output signal voltage, present in the 6V6 plate circuit, from feeding back to any in-phase voltage point of the input signal circuit. It will be recalled from basic circuit theory, that an amplifier operates on the basis of an amplifier voltage that is developed in the plate circuit of a tube and fed back in the same phase to its grid. This of course must be guarded against in the amplifier circuit of Fig. 3 to prevent it from oscillating.

Amplification and Phase

When the relatively small signal voltage of .0187 peak volts is applied to the 6F5 grid, the plate current falls. The voltage across R1, the plate load resistor, rises to a value of .75 volts higher than when no signal appeared on the grid. This is due to a voltage gain of 80 which appears across both the two equal resistors, R1 and R2. Thus a signal voltage of .75 peak volts appears across R2. The voltage of the voltage therefore on the grid of the 6C5 is now positive, due to the 180° phase shift of the 6F5 tube. The 6C5 stage, having a voltage gain of 16, amplifies the .75 volt signal on its grid, and therefore a peak voltage of 10.8 volts appears across R3. However, the voltage has again been reversed in phase, and now appears as a 10.8 volt decrease across R3. The voltage across R4, being in parallel across R3, is now a 10.8 peak at a negative phase. The voltage gain of the 6V6 stage is 20 and therefore the peak voltage across Z, the impedance of the primary of the output transformer is 210 volts in a positive phase. The current in the 6V6 plate circuit equals 43.2 milliamperes, at this instant and may be seen to be 180° out of phase with the primary voltage.

Feedback Due to Power Supply

Impedance

Note that at this instant, the 6V6 plate current is in a negative phase and is decreasing. Also note the fact that due to the internal impedance of the power supply a decrease in plate current that is now occurring in the plate circuit of the 6V6 tube, is accompanied by an increase in supply voltage. The value of increase of plate supply volts equals 33 volts, as E = I x Z = .0432 x 760 = 33 volts. It is this increase in plate supply voltage to the 6F5 tube at this instant that will result in oscillation. The increase of plate voltage occurs at the same time as the increase due to normal amplification of the 6F5 stage. However the increase of plate voltage due to normal amplification only called .75 volt as may be seen in Fig. 4. The 6F5's stage however at this instant, with the help of the other two stages, actually amplified the .0187 input voltage 44 times greater than the gain of 80 called for. In other words, instead of a .75 volt increase appearing across R1 due to normal amplification, actually an increase of 33 volts occurs. This same action repeats and builds up until the circuit goes into oscillation.

How The De-Coupling Network Operates

It may be seen that some means must be taken to prevent this instantaneous change in power supply voltage from increasing the plate supply voltage of the 6F5 tube. This may be accomplished with the use of a de-coupling network. Referring back to Fig. 1 shows that in order for a de-
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Snyder Mfg. Co. Antenn-Engineers Philadelphia

Radio-Television Service Dealer • January, 1951
In this article, the first in the series on the CBS Color System, the author explains the basic operating principles of this method of color reception. These principles refer to the physiological aspects of color viewing, the scanning sequence, and the frequency requirements. Explained also, in block diagram form, is the system used in the color disc and motor assembly.

The CBS Field Sequential Color System

Part I

By Edward M. Noll

The CBS color system is a field sequential one as compared to the line or dot sequential methods used by CTI and RCA respectively. In the CBS system a different color is transmitted during each field in the order red, blue, and green. See Fig. 1. In the CTI system, a new color is conveyed each line in the RCA system, a new color during each dot element along the line. It is apparent immediately that the rate of color interruption is much faster for line and dot sequential color systems. In fact, the rate of color interruption is so fast that no mechanical means of color interruption is practical. Instead, color interruption must be electronic— at 15,750 times per second for CTI, 10,740 million times per second for RCA. With the CBS system using a much slower rate of color change, color interruption can be electronic or a less expensive mechanical interruption method.

Basic Operation - - CBS

In the CBS system, Fig. 2, an image is evaluated in terms of three basic colors red, blue, and green. This does not limit our color picture to three colors, because it is a fact that our secondary colors can be duplicated with proper relative levels of two or three basic colors. In fact apparent white light is produced when essentially equal levels of red, blue and green are transmitted.

Light reflected from a color scene is evaluated in terms of three basic colors by a color filter that rotates in front of an image orthicon camera tube (same type used in black-white transmission) allowing passage of three basic colors in regular sequence. Thus, field after field, the sensitive surface of the image orthicon is excited by light coming through filters. Each filter allowing light of only one color to pass for each field. Signal variations are formed for each field according to intensity variations along the lines of the image for the color of the specific filter in position. In three fields a set of variations is formed for each color.

At the receiver, the signal is applied to the grid of picture tube, being reproduced as a black-white or monochrome picture on the fluorescent screen (signal variations change beam intensity). However, if this black-white picture is observed through a rotating color filter (moving in synchronism with camera filters) a color picture is reproduced.

For example if signal variations for a complete field representing red intensity changes at the camera are applied to the grid of the receiver picture tube the fluorescent screen will light up (in black-white) according to these variations. Now if the same screen is observed through a red filter the same intensity variations are observed as changes in red. In successive sequence, blue and green images are reproduced at a rapid rate, superimposing on each other to form our color picture (aided by human persistence of vision). If a yellow object is televised at the camera, light is passed to the camera tube at almost equal levels during red and green fields; and none, during the blue field. At the receiver, therefore, a succession of red and green images are formed that blend together to form a visual yellow.

CBS Color Standards

It requires six fields to transmit a complete color picture. We might first assume only three fields are needed - one per color. However it is standard practice to use 2 to 1 interface and, to form a complete color picture, each line must of necessity be scanned in each basic color.

Fig. 1. Color interruption methods.
as shown in Fig. 3. Field scanning sequence is as follows — red, odd lines; blue, even lines; green, odd lines; red, even lines; blue, odd lines; green, even lines. These six fields comprise a complete color picture. The field rate of the CBS color system is 144 per second, requiring two fields to scan a complete raster but six fields to scan a complete color picture — each line in each color. The color picture rate is 144/6 or 24 color pictures per second.

It was found necessary to increase the field scanning rate to minimize flicker. For example if it is required to transmit a solid basic color such as red, only one of the three fields excites the camera tube and illuminates the fluorescent screen at the receiver. Thus, the screen is in darkness for a greater length of time than if it is illuminated and, is only illuminated every third field. To minimize flicker under these conditions (too few interruptions and too long an interruption period), it was necessary to step up the field rate to 144 interruptions per second.

Of course with more fields there must be an increase in the number of lines transmitted per second to retain a suitable number of lines per frame. Horizontal line rate of the CBS system is 29,160 per second, which amounts to 405 lines per frame. Fewer horizontal lines means some vertical resolution must be sacrificed. However, the presence of color in a picture enhances its clarity and appearance so that the lack of resolution goes unnoticed. A black and white presentation of the CBS color signal shows an obvious loss in vertical resolution.

An increase in the line and field rates of a television system steps up the scanning velocity and thereby limits the horizontal resolution to a lower value when the signal must be confined in a six megacycle channel. With dot sampling, referred to as horizontal interlace, this loss is substantially recovered. In fact using dot sampling, horizontal resolution can possibly be made superior to that of a dot sequential color system because the sampling process does not have to contend with color interruption (perfect registration), and mixed hights.

In summary the CBS standards are as follows:

- MONO:
  - Color Picture Rate 24
  - Field Rate 144
  - Frame Rate 72
  - Color Picture Rate 24
  - Lines/Frame 405
  - Line Rate 29,160
  - Color Sequence R-R-G-

- CBS CROME:
  - Color Picture Rate 24
  - Field Rate 144
  - Frame Rate 72
  - Color Picture Rate 24
  - Lines/Frame 525
  - Line Rate 29,160
  - Color Sequence R-R-G-

Color Disc and Motor Assembly

A field sequential system using a color disc is practical (direct-view) up to and including a 12 1/2" tube. The size of the color disc is approximately twice the diameter of picture tube and consists of six individual color filters (Fig. 4), that rotate in front of the picture tube. The color disc drive shaft is belt-driven from a small motor (1/20 to 1/50 HP) that rotates at a speed of 1440 RPM.

If the color disc contains 6 filters and revolves at the above mentioned speed, 6 x 1440 or 8,640 color filters pass in front of screen per minute. This corresponds to a filter rate of 8,640/60 or 144 filters per second to match the field rate of the color system — one color and filter per field.

Note that the filter segments are neither triangular nor rectangular but have their own peculiar shape. This shape is necessary to prevent color contamination. It assumes that the edge of the color filter as it moves down the screen will always move parallel with the scanning lines as the beam scans down the screen. Thus, at no time will any line or section be viewed through a filter of one color, while a line is excited by a signal representing another color (despite the fact that screen is rectangular and filters are rotating).

To keep the motor at the receiver in synchronism with the camera motor, a motor control unit is used (Fig. 5). It consists of a small generator driven by the motor and a two tube control section. The control section is locked in by the vertical sync pulses (144 cycles) from the station.

-Lock-In- is not made directly from the received vertical sync but by using the positive sawtooth present at the plate of the vertical output tube. The con-
The control section compares a signal generated by the local generator (rush off of color disc drive shaft) with the above pulse taken from the vertical output tube. If there is any phase differential between the two signals the motor control tube receives a different level of the bias. The plate circuit of the control tube contains a saturable reactor that is connected in series with the motor windings. When the control tube bias changes the inductance of the saturable reactor and speed of the motor does likewise. With a change in motor speed, the locally generated signal changes in phase as frequency in a direction to correspond with the vertical synchronization. Thus the motor speed and phase is made to correspond with the incoming vertical sync and no new type of pulse has to be inserted into the transmitted sync signal.

Although the camera and receiver motors are locked in frequency and phase, it is possible to have an incorrect color filter in position at the receiver. To permit correct color phasing a push-button is incorporated with the motor. When this button is depressed the motor speeds up and allows a succeeding color filter to catch up. In one out of three presses color phasing will fall in as indicated by the true rendition of skin tones.

CBS has developed an automatic color phasing system that can eliminate the push-button. A special color phasing pulse needs to be inserted between first and second equalizing pulses preceding the red field for automatic operation.

Large Picture Practice

A field sequential system is not limited to a small picture. Neither does the motor limit size of picture. The field sequential system can use a three-image system method of presentation or a tri-color tube and need not confine itself to a rotating motor.

The truth of the matter is that for a small color picture (12½" and under) a color disc permits low cost color television of high fidelity. For a large picture the same three-image technique that CTI and RCA are forced to use can be employed. The three-image technique can be used at the receiver on a CBS sequential signal to produce a large picture.

If the three-image system cannot be developed (applies to any type of color scanning) at a point where it is simple, inexpensive, easy to operate, and produce a high quality picture, a color disc and motor might be the direct answer to low cost high quality color television. We do not object to a phonograph motor. Perhaps a small disc and motor, a high brightness projection tube, and an efficient projection system is the direct answer to a large color picture.

One more obvious means of obtaining a larger color picture is to use a magnifier. To convert a large picture receiver to color and still limit the size of the motor, the raster size can be reduced and a small motor and magnifier used to restore picture size.

Compatibility - Adaptability - Convertibility

One of the very definite advantages of the CBS system is that a present receiver can be converted for color reception at low cost. Operation of the converter is quite simple and the picture has excellent color fidelity. The line and dot sequential color systems are not really convertible. At most, such a converter would be expensive, complex, bulky, and difficult to operate.

Compatibility is a term applied to a color system the signal from which can be received on a present black-and-white receiver without any changes whatever in that receiver. With CTI and RCA systems, the signal can be picked up on a standard receiver and will reproduce as a black-and-white picture of good resolution. If the CBS system is used some circuit changes will have to be made on present models to permit reproduction of color signal as a black-and-white image.

Adaptability refers to the ability to change over a present receiver to make full use of a color signal for black-and-white presentation. With the RCA and CTI systems no adapter is necessary. To change-over a present receiver for use with CBS color system an adapter is necessary to increase the field and line rates (horizontal and vertical deflection) whenever the color signal is to be received. With this adapter a black-and-white version of CBS color signal can be obtained. The resolution of this picture, although usable, is poorer than our present monochrome pictures.

The latter two factors show a definite RCA-CTI advantage. This advantage is balanced by a CBS advantage in terms of convertibility.

Sweep Adaptation

A number of deflection circuit changes must be made to adapt or convert a standard receiver for reception of CBS color signal. It might be assumed that the only changes necessary would involve the frequency controlling elements raising the frequency of the vertical generator from 60 to 144 and the horizontal from 15,750 to 29,100 cps. A number of additional factors are involved as a result of the frequency changes. When frequency changes are made it is also required to preserve size and linearity of deflection waveshapes. Proper drive must be obtained for deflection output tubes, particularly horizontal output tube.

In some cases it is necessary to re-arrange the horizontal output circuit to prevent losses and arcing. Replacement of horizontal output transformer is at times required. Switching is another problem to be solved so that the customer can switch from standard to color rates at will without having to make any back panel adjustments. On occasion this will involve duplication of some of the pre-set controls so they can be preset at both rates.

Extent of changes is a function of class design, there being no universal change-over technique. Despite elaborate changes, converters have been designed that do not even require removal of the chassis from cabinet. If the CBS system is adopted commercially the various manufacturers can design converters for their own models to present the least number of headaches for the service technician.

In next month's installment some actual change-over circuits will be discussed. More details and schematics of CBS system will also be presented.
THE Raytheon CK 703 germanium crystal triode, shown in Fig. 1, is the first commercial transistor we have obtained. In accordance with our promise to keep the radio service dealer informed regarding crystal triode development1, a technical description of the CK 703 is presented here.

Physical Characteristics
The CK 703 follows the basic design and construction described in the transistor articles of a year or so ago. It consists of a germanium crystal with two catwhiskers (the emitter and collector) in pressure contact at closely separated points on the crystal surface. The emitter (grid) and collector (plates) whiskers are attached to two small protruding external contact pins.

The CK 703 is contained in a cylindrical brass shell which is in contact with the germanium crystal and serves as the base (cathode) terminal. Overall length of the unit is 0.75 inch, and its diameter is 0.250 inch. Each of the two contact pins, which extend through a phenolic disc in the bottom end of the brass shell, is 0.03" in diameter, and the pins are spaced 0.07 inch. No sockets are available at this writing and experimenters are making their own. A bottom view of the CK 703, with identification of terminals, is shown in Fig. 2.


Electrical Characteristics
The emitter whisker of the crystal triode is the control electrode and corresponds to the grid of a triode tube. The collector whisker corresponds to the plate of a tube. And the crystal (referred to in transistor practice as the base) corresponds to the cathode of a tube. A low positive d-c bias voltage is applied between the emitter and base, while a high negative d-c voltage is applied between the collector and base. These polarities are just the opposite of tube practice where the plate is positive and grid negative.

Following are maximum ratings of the CK 703. Collector voltage 70 v.
Collector current 4.0 ma.
Collector dissipation 200 milliwatts. Emitter current 10 ma.

Typical operation is shown in the following table:
Collector Voltage -30 v.
Collector Current 2.0 ma.
Emitter Voltage 0.2 v.
Emitter Current 0.75 ma.
Transconductance 5000 micromhos
Emitter Impedance 500 ohms
Collector Impedance 10,000 ohms
Average Power Output 2.0 milliwatts
Average Power Gain 16 db.

From the preceding set of data, notice that the CK 703 has a low-impedance input and high-impedance output. In a conventional cascaded amplifier of several stages, this necessitates use of some means of match.
**UHF TELEVISION CONVERTERS**

by Allan Lytel

The u-h-f television converter may be compared to the FM converter which has been widely used with broadcast band receivers. With an FM tuner, an a-f output from the tuner is taken to the a-f amplifier of the receiver. The tuner itself is a complete receiver lacking only the audio amplifier and speaker.

The television tuner, on the other hand, is not in any sense a complete receiver since its fundamental purpose is to take the incoming u-h-f television signal and feed this signal into the i-f amplifier stages of the receiver. Fig. 1 is a block diagram of such a tuner, showing the necessary stages. An u-h-f antenna separate and distinct from the present v-h-f antenna is necessary, both because of the extremely high frequency of the new station and the very probable need for new antenna orientation. The pre-selector stage is necessary to reduce image response. It would be highly desirable to have this pre-selector as a tuned r-f amplifier stage to assist in image response reduction. For example, if the station is to be tuned in on 500 mc the local oscillator would operate at 470 mc for a 30 mc i-f. However, this local oscillator operating on 470 mc would also beat against a 410 mc signal to produce the same 30 mc i-f. Thus any local oscillator could beat against two signals to produce the same i-f. The undesired signal is of course the image response of the oscillator.

The mixer and oscillator are used as in the ordinary superheterodyne to convert the signal to an i-f. It is possible to use a double superheterodyne involving two mixer stages so that the signal may be brought down to the television receiver i-f. in two stages. Crystal diodes are conveniently used for mixer stages in u-h-f converters, and the local oscillator presents the first difficult design problem. This oscillator must cover the entire frequency band and track reasonably well over this entire band so that a tuning dial can reasonably accurately indicate the desired station. Special types of tuned circuits are necessary to obtain oscillator output at these frequencies. The i-f amplifier which is the following stage is necessary since the output from the mixer oscillator is not sufficiently strong to feed directly to the television receiver. The output may be a cathode follower or link coupling. A separate power supply for the tuner allows adequate regulation of the plate supply voltage which is necessary to prevent frequency drift of the oscillator.

There are two possible ways an u-h-f converter can be used with the ordinary television receiver. The output of the converter may be fed into the antenna terminals of the receiver so that it must pass through the u-h-f tuner and the entire r-f section of the existing television receiver. When used in this manner, the output of the tuner of the new band must be one of the present 12 channels. The tuner is adjusted to the desired new station and the television receiver is tuned to the channel whose frequency is the same as the output of the tuner.

The other possibility is to feed the output of the u-h-f tuner directly to the i-f amplifier of the existing tele-

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Fig. 1. Block diagram of u-h-f converter.

Fig. 2. Alternate method of u-h-f conversion.
vision receiver. This is illustrated in Fig. 2 showing the v-h-f tuner and the i-f amplifier which are already a part of the receiver. An u-h-f tuner is added to the receiver together with a switch S1. This switch has two functions, an upper or v-h-f position, which uses the output of the tuner feeding directly to the i-f amplifier; and if the switch has several sections, an additional section of the switch may be used to disable the local oscillator of the other tuner to prevent interference. When the switch is thrown to the lower or u-h-f position, this tuner now has its output fed directly to the i-f amplifier. Again the local oscillator of the tuner which is not being used may conveniently be disabled to prevent spurious signals.

The DuMont Television Converter

Several large manufacturers of television receivers have research divisions which are busy engaged in designing and testing UHF television converters. Mr. Robert P. Wakeman of the Research Division Allen B. DuMont Laboratories, Inc. has been responsible for designing and testing a very interesting u-h-f television converter.*

Figure 3 is a block diagram of this tuner which utilizes continuous band tuning. DuMont has pioneered in continuous tuning and such a system is used on all of their present v-h-f television receivers. This method has the advantage for u-h-f of covering the entire band instead of a channel selector band switching arrangement.

Thus, any change in frequency allocations which is to be expected with the new type of broadcasting service, can cause no difficulties for continuous band tuner.

The DuMont u-h-f television converter tunes over the entire range from 475 megacycles to 900 megacycles. A tuned r-f circuit feeds a crystal mixer which also gets a signal from the 6F4 acorn type local oscillator. A miniature pentode-type 6AK5 is used for the i-f amplifier.

A 12AT7 cathode follower supplies the signal to TV receiver's i-f amplifier.

Several of these converters are presently being used in the National Broadcasting System Radio Corporation of America Experimental 555 megacycle television transmitter in the Bridgeport, Conn. area. The reception of this u-h-f television signal is apparently equal to ordinary television broadcasting within the normal range of this station. The r-f section of this converter system is probably of greater interest and its equivalent schematic is shown in Fig. 4. This is called an equivalent schematic since it is electrically the same as the circuit actually is, but it is physically quite different. This is because unusual tuned circuits are necessarily used to cover the band. The antenna input is coupled into the r-f tuned circuit shown with a trimmer capacitor across the tuning element. The 6F4 local oscillator has its plate tuned circuit inductively coupled into the mixer circuit. This mixer circuit is of course, coupled to the r-f tuned circuit as well.

The oscillator is an equivalent of the ultradion since it has a single tuned circuit in which the plate and grid are tied to opposite ends. Bias is obtained through a series r-f choke and a 15,000 ohm resistor. Both legs of the filament as well as the cathode lead have series radio frequency chokes and a 0.001 uf capacitor is used for the filament r-f by-pass. Plate voltage is supplied through a series r-f choke with its by-pass capacitor. A crystal (type 1N23) is used for the first detector or mixer, because of its simplicity and relatively high conversion factor.

Figure 5 shows a cross section of the cylindrical tuning elements which are used in this converter. These cylinders resemble both the butterfly tuned circuit and the parallel wire transmission line tuned circuit. The acorn local oscillator is mounted directly on the tuning cylinder. Inside the outer cylinder, there are two cylinders of smaller diameter. One is the stator and it remains fixed in position while the other is the rotor which is free to turn. Tracking adjustments are two screws which vary the positioning of the stator inside the larger cylinder. As the rotor is turned, the capacity of this tuned circuit and to a smaller extent, the inductance as well, changes value and tuning is accomplished. The capacity for the circuit is the capacity across the slot of a cylinder and the inductance is the effect of the one turn cylinder as viewed from the end as in Fig. 5.

Tuning elements of this slotted cylinder variety are used for the mixer, the r-f, and the local oscillator sections of the DuMont Television Converter.
Converter. The problems remaining in the design of this converter seem at the present time to be the frequency stability and local oscillator radiation. It is obvious that without any tuned r-f amplifier stage, other local oscillators and image signals still present a serious problem.

The RCA UHF Television Tuner

As a part of the National Broadcasting System experimental u-h-f television program, the Radio Corporation of America has designed and built several u-h-f television tuners. This tuner shown in Fig. 6 is not designed for operation over the entire range, although very probably a modified tuner of this type using different vacuum tubes could adequately perform over the entire band.

There are four individual stages with an associated power supply in this tuner.

Input to the tuner is by means of a 75 ohm coaxial line from the antenna, and the output is the 21 megacycle to 27 megacycle range. This first stage of the tuner is a hi-pass filter which is a printed circuit. Its cut-off is at approximately 500 megacycles as may be seen from Fig. 5. This is a plot of the insertion loss of the high pass filter as a function of frequency and megacycles. The use of a high pass filter prevents interfering signal below the 500 megacycle band. This filter feeds an r-f amplifier stage with a tuned input and output using a 6H4 grounded grid r-f amplifier. The tuner operates on a double superheterodyne principal and the r-f amplifier feeds the first oscillator-mixer which uses a 6J6. The first detector heterodynes the incoming signal into a 135 megacycle i.f. which is then amplified by two stages using 6AG5 tubes. As this i.f. remains constant the second local oscillator need not be tuned. This second local oscillator operates at a fixed frequency to produce a 24 mc output.

The tuning elements in this television converter do operate over the entire signal range from 500 megacycles to 700 megacycles so that apparently only slight changes in design would allow this converter to work over the entire band. A switch is used which allows the i.f. amplifier of the existing television receiver to be attached to the u-h-f tuner or the v-h-f tuner. Filaments on the new tuners are always kept hot to reduce inevitable drift when the oscillator is first turned on with cold filaments. When the plate voltage of the oscillator is turned on it reaches a stable operating condition in less than 3 minutes.

The design and placement of components is critical in any u-h-f circuit and they are particularly sensitive to change. In the television converter in which tracking over the entire band is necessary, the high pass filter feeds a signal by means of cathode coupling into the grounded grid r-f amplifier. This grounded grid circuit permits satisfactory operation at higher frequencies, since the cath-
In this installment we begin the discussion of tuner repairs. First, typical symptoms indicating the need for these repairs are given. Following this, proper cleaning and lubrication procedures are outlined, as well as actual mechanical repairs.

Front End repairs and service may be divided into two main categories, mechanical and electrical. Mechanical repairs are concerned with cleaning and lubrication, adjusting electrical contacts, and replacing defective components such as wafers, contact springs, detents and dial drive mechanisms. Electrical repairs include locating and replacing defective tubes and other circuit components, alignment in the shop and "touching up" adjustments in the home.

Needless to say, one should be reasonably sure that the trouble is definitely in the tuner before repairs are begun. Furthermore, one should be absolutely sure of the sequence of adjustments, the purpose and locations of the various trimmers, and the accuracy and reliability of the equipment being used. The pitfalls are many in Front End alignment, and the end results, where improper equipment and techniques are employed, is usually a degraded picture. On the other hand, proper adjustment of tuners on all channels will often produce amazing results, bringing in pictures with a measure of depth, clarity, and freedom of distortion previously not obtained.

The experienced technician will readily recognize certain symptoms that point to a defective tuner, enabling him to employ his knowledge of their causes to affect a repair in the quickest possible time.

Symptoms

Symptoms attributable to faulty Front End operation, assuming that the antenna and the station transmission are O.K., are as follows:

1. No Sound, No Pix, Raster O.K.: Reference to the block diagrams of TV receivers as shown in Fig. 3-55 will reveal that the only sections responsible for this symptom are the power supply and the Front End. Of course the proper procedure in this case is to check the power supply before working on the tuner. Another remote cause of this condition is a faulty a-g-c circuit causing the grid bias to become excessively high in the tuner and cutting off the signal in its stages.

2. Weak Sound, Weak or No Pix, Raster O.K.: In addition to Front End and power supply trouble this condition can be caused by a faulty component in any other part of the receiver which can pull down the voltage normally present in the power supply. Another possibility for this condition, strictly in split-sound receivers, where the sound i-f is taken off the output of the first or second video i-f stage, is a defective component in these stages.

3. Intermittent or Noisy Sound, Intermittent Pix, Raster O.K.: Assuming that the power supply voltage is constant, the above symptom is definitely characteristic of tuner trouble—primarily faulty tubes or band switches.

4. No Sound or Sound Is Weak, Pix O.K.: In split-sound receivers this condition may be caused by a defective sound section following the mixer, or misalignment of the Front End. Reference to Fig. 3-56 will reveal that the sound r-f channel takes up a narrow part of the band, so that it does not take much misalignment of the oscillator to throw the sound r-f out of the range of the response limits in the sound i-f amplifiers. In intercarrier receivers, on the other hand, misalignment of the oscillator within certain frequency limits will not affect the sound signal as drastically as it does in split-sound receivers.

5. Sound O.K., Pix Poor Due to Loss of Highs or Lows, Raster O.K.: Misalignment of the r-f trimmers in both split-sound and intercarrier receivers can result in a relative attenuation of the high or low video frequencies. Loss of lows results from peaking.
the i-f response towards the sound carrier and attenuating the signal near the pix carrier. Recalling that the low video modulating frequencies as well as the sync pulses are near the pix carrier, the low frequency content of the picture will be poor, causing smear, and a loss of sync will be apparent. Loss of highs can result from peaking the i-f response towards the pix carrier and attenuating the signal near the sound carrier. The high video frequencies being absent will result in the vertical wedges near the center of the picture becoming blurred. Most often no apparent loss of sound will be noticed in spite of the fact that the signal energy has been reduced, because the sound signal is usually relatively stronger than the video signal.

In this discussion it must be borne in mind that the last symptom can be caused by defects in the video i-f and amplifier circuits. For this reason a check on the proper operation of these circuits should be made before starting work on the Front End.

6. Microphonics: The typical ringing sound indicative of a microphonic condition in any receiver, plus the appearance of sound bars on the screen has been traced in many cases to vibrating mechanical and electrical components located in the tuner.

7. Frequency Drift: This might result in loss of sound, sync, or picture fidelity during the course of program. When this condition occurs it is safe to blame the Front End. It might be added that split-sound receivers are more vulnerable to this type of annoyance than intercarrier.

8. Modulation Hum and Sync Buzz: Some cases of modulation hum and sync buzz have been reported which were caused by poor contacts and connections in the tuner. A poor connection can result in detection, and stray fields such as 60 cycle hum, vertical sync, and horizontal sync will modulate the incoming signal, thus producing modulation hum and sync buzz.

Cleaning and Lubricating

A typical Front End contains approximately 300 parts, 150 switch contacts, coil connections, trolley, etc. Following this a very thin film of switch contact oil such as Viscosity Oil Co. #709B may be added to prevent oxidation. Other contact oils recommended by various manufacturers are Lubriplate, Spul-Get 512, Penola #305 grease, Walsealube B-92, and Lub Rex 100. However, it must be pointed out that at least one manufacturer advises against the use of contact lubricants containing zinc or cadmium; and some of the above products do contain these ingredients.

Another expedient often employed is to mix equal solutions of oil and cleaning fluid in a container. This mixture is then injected as a fine spray by means of a syringe, hypodermic or atomizer (see Fig. 3-57) into the various contacts to be cleaned and lubricated. It is then heated a number of times, and as the cleaner evaporates, a fine surface of the lubricant is left on the switch contacts. It must be emphasized at this point that the use of too much of this mixture will produce detrimental effects on the tuner’s operation.

It is comparatively easy to detect a tuner which requires cleaning and lubricating. As the switch or dial is rotated the sound is raspy, the picture teases, and the entire operation of the receiver is erratic and intermittent. It might also be found that a slight pressure on the tuner dial often produces the same intermittent operation, depending on whether or not the switch makes and breaks contact with this action. We might interject at this point that drum-type switches with improper indexing (mechanical alignment of the coil contacts on the drum with the spring contacts on the frame) and warped wafer-switch shafts behave in the same way, that is, cause the receiver...
to fade in and out with slight pressure applied to the dial.

In addition to keeping the contacts and other electrical wiping surfaces clean and lubricated with a thin electrical conducting film of contact oil, the bearings, shafts, and other similar surfaces must also be lubricated with a fine grade of surface lubricant such as light vaseline or Viscosity Oil Co. #8072.

The principles of cleaning and lubrication outlined in this section can perhaps be better understood by applying them to the exploded view of a typical turret tuner as shown in Fig. 3-58. As shown in the figure, mechanical lubrication (vaseline or Viscosity Oil Co. #8072 lubricant) is applied between the outside bracket of the fine tuning condenser (1) and the rotor of same, to the turret indexing roller (5) and its supporting spring (8); and the shaft on one side of the turret and the shaft end on the other side.

Cleaning with carbon tetrachloride and lubricating with contact oil applies to the coil contacts on the turret (4); the turret grounding spring (7); and the spring contacts shown on both sides of the turret grounding spring. Again, it must be emphasized that this oil must be used sparingly.

Other types of tuners are cleaned and oiled along the same principles. Thus, wafer-switch type mechanisms require that all switch and other sliding electrical contacts be given the same treatment, as do the coil wires and trolleys in continuously-tuned inductance mechanisms, or the end plate grounding surfaces in variable condenser tuners. It might be added that other switches, such as those which throw the tuner from high band to low band operation and vice versa, are subject to the same dirt-accumulating and oxidation effects as the mechanisms just discussed, and should be cleaned and oiled in the same manner.

We might well conclude this section by stating the following rules:

1. All electrical switch and wiping contacts (including grounds) subject to dust or dirt accumulation should be cleaned with a suitable cleaning fluid and lubricated with a thin layer of contact oil.

2. All mechanical bearing, wiping, and shaft surfaces should be cleaned of dirt and grit with cleaning fluid and lined with a suitable lubricant.

Mechanical Repairs

1. Contact Springs:

It often becomes necessary to repair a tuner because of sprung contacts or inadequate spring tension. Stationary contact springs in wafer-type switches may be repaired as follows. First the stationary contact is disengaged from the moving contact. Following this the spring is bent carefully in the proper direction with the aid of a pair of tweezers or fine pliers until adequate pressure is obtained between the stationary and moving contact when the switch is re-engaged into position. This operation should be done most carefully, otherwise the contact spring may be broken off or bent at an angle. If bent over too far the spring can cause jamming of the switch as it is rotated.

Figure 3-58 illustrates the location of the contact springs in the Philco 12-position tuner (Standard Tuner). Notice that all contacts are mounted on the panel assembly. Should these springs make poor contact to the coils because of insufficient tension, several sets of coils should be removed to get at the springs. The springs should then be bent inward with a narrow-bladed screw driver RSD 4 Marshall until the highest point of the spring extends about 9/64" above the plastic surface of the contact plate. The spring will then clear the flat surface of the turret coil by 1/64" which will assure adequate contact with the coil terminals.

Sometimes it will be found that the springs are damaged beyond repair. In such cases it becomes necessary to replace the entire contact panel assembly. See (2) in Fig. 3-58.

2. Frozen mechanisms:

The serviceman will often encounter tuners which are difficult and sometimes impossible to turn. This indicates a jammed or frozen mechanical link in the assembly.

Mechanisms will freeze or bind because of:

a) jammed switch springs and contacts, (all types)
b) locked control shafts due to dirt grit, etc. on their surfaces, (all types)
c) defective detents, (all types)
d) defective mechanical drives (all types)
e) broken or stripped gears (all types)
f) broken wafers (wafer-switch mechanisms)
g) warped shafts (wafer-switch mechanisms)
h) loose coils in turret (turret mechanisms)
i) poor indexing (turret mechanisms)
j) shorted plates (variable condenser mechanisms)
k) jammed cores (permeability tuned mechanisms)
l) defective locking on latching bars (push-button tuners)
m) sticking on bent selector rods (push-button tuners)
n) weak coil or flat springs (push-button tuners)

3. Miscellaneous mechanical troubles:

Other troubles encountered which result in faulty mechanical operation of the tuner are:

a) stretched springs which have lost their tension
b) loose set screws
c) slipping or broken dial cords

To be continued
Selling 3-Speed RECORD PLAYERS

by W. S. HARTFORD

(Vice-President, Webster-Chicago Corporation)

This article should be read by every servicing technician interested in adding to his income by selling, with little effort, a fast-moving item.

W. S. HARTFORD

The service dealer has been traditionally chained to the clock, his profits limited mostly to the number of man hours put into his operations. More man hours spent in repairs and installations meant more money. Fewer man hours meant less money. Fortunately, that system no longer completely dominates the service dealer's operations.

Added to his profits today is the money he can make on sales of products in his line of work. And right outside his door waits the biggest market for radio components in the history of the industry, by every known estimate. This is the market for phonograph replacement and plug-in units, a market that, happily, can be regarded as even more the field of the service dealer than that of the music or radio dealer.

The introduction of microgroove records left a national total of 15,000,000 families with obsolete phonographs that could play only 78 r.p.m. records. How many of these are in each service dealer's territory is a matter of guesswork but, certainly, the figure is large enough to be important.

Microgroove records have had widespread publicity. One-speed phonograph owners are well aware that they are not taking full advantage of the entertainment records can provide. They are aware, too, that their records are costing more, are taking up more storage space and are not providing the high-quality reproduction they could get from the microgroove records.

Then why don't they have three-speed phonographs? They already have phonographs for which they paid a fair amount of money and which are still in good condition. They don't want to buy a brand new radio-phonograph or a brand new three-way combination to replace one that is still a nice-looking piece of furniture and still operates well.

If fully aware of the possibilities of replacing their one-speed changer with a three-speed changer at a reasonable price, one that would be completely repaid in record savings, a large percentage of them would be inclined to buy. That is where the service dealer comes in.

When a call comes in for service on a phonograph unit contained in an expensive console, the service man goes out on the call prepared to put the unit back into working condition. He exerts time and energy on extensive repairs on a worn changer, collects his money and returns to the store not very much richer.

How To Sell 3-Speed Units

Contrast that with the serviceman who goes out on that same call, equipped with literature on the replacement units. Using the prices of Webster-Chicago Corporation, manufacturer of phonograph units, as an example, for $46.50, plus the installation charge if the dealer wants to make one, he can give that phonograph owner a three-speed automatic Webster-Chicago replacement unit instead of merely repairing the one-speed unit. Selling that Webster-Chicago won't be too hard if the serviceman understands just what he has to offer and all the advantages of having it. Besides the more obvious advantages already mentioned, he can point out that the same unit is contained in brand new prestige label phonographs selling at high prices. He can point out that it is the one unit accepted for installation in most expensive custom-built phonographs.

He can explain that from the cost of this new replacement unit can be deducted immediately what the owner would have to spend on the current repair job. He can remind the prospect that any unit as old as the one now in the phonograph will have to be repaired again because other parts will eventually wear out and that will mean another repair bill.

He can be specific about the savings in the purchase of records, which will eventually pay for the replacement unit. Some classical record albums are as much as $2.50 cheaper on microgroove records than on 78 r.p.m. disks. Almost all popular disks are a dime each cheaper on microgroove than they are on 78 r.p.m. records. Children's albums are considerably cheaper on microgroove pressings.

Another selling angle the service dealer may use is pride. It is practically a national characteristic to want to be completely up-to-date, to have the newest model car, the latest fashion dress. This same idea can be applied to a record changer. When being up-to-date is possible at no added cost in the long run and with considerably more enjoyment promised, few will resist.

There is the basic theory on the replacement changer campaign for the service dealer. It takes no more, and probably less, of his time, than would repairing the one-speed unit. It will cost him nothing more than the price of literature on the replacement units he may want to leave with set owners who might think about his suggestion for a while before making up their minds.

But he will make a lot more money. For example, if he is handling Webster-Chicago replacement changers, he will make $18.16 profit on the highest-priced unit, which retails for $51.75. He will make $16.58 on the Webster-Chicago three-speed automatic replacement changer that sells for $46.50. Comparable profits are made on that firm's other units, which sell for $37.50 and $37.75. In addition, he makes whatever he wishes to charge.

[Continued on page 51]
RADIO SYMBOLS AND THEIR MEANINGS

ANTENNA, General
Dipole
Loop
ARRESTER, or Protector
BATTERY
CABLE, Coaxial
Coaxial, twin conductor
Pair
Pair with grounded shield
CAPACITOR, General
Electrolytic
Variable
CONTACT, Normally closed
Normally open
Adjustable or sliding contact for resistors, inductors, etc., also fixed contact for jacks, keys, plugs, relays, switches, etc.
CRYSTAL, Detector
(Arrow points in direction of forward current flow)
Piezoelectric
FUSE
AC SOURCE
GROUND
INDUCTOR, General
With variable powdered iron core
Laminated iron core
JACK, Two conductor

COMPONENTS
RMA STANDARDS
PREFERRED VALUES

An orderly progression of sizes is maintained by the use of preferred numbers which are used for nominal values of many components. Table I shows the basic preferred values for tolerances of 5%, 10%, and 20%. To obtain the desired value, these basic numbers are multiplied by a decimal multiplier as shown in the color code table (Table II).

<table>
<thead>
<tr>
<th>TABLE I—PREFERRED VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
</tr>
<tr>
<td>5%</td>
</tr>
<tr>
<td>10%</td>
</tr>
<tr>
<td>20%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE II—RMA STANDARD COLOR CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
</tr>
<tr>
<td>Meaning</td>
</tr>
</tbody>
</table>

COLOR CODE

COMPOSITION RESISTORS

AXIAL LEAD RESISTORS (Fig. 1a) have three or more bands of color around the body of the resistor. Band A as shown in the figure indicates the first significant figure of the resistance. Band B indicates the second significant figure. Band C indicates the decimal multiplier. Band D, if any, indicates the tolerance limits about the nominal resistance value. The body color of insulated resistors is usually tan, but may be any color except black. The body color of non-insulated resistors is black.

RADIAL LEAD RESISTORS, shown in Fig. 1b, use a body color for the first significant figure, and end color for the second significant figure and a body dot for the decimal multiplier. The tolerance is indicated by a color (gold, silver, or no color) at the other end.

EXAMPLES

<table>
<thead>
<tr>
<th>RESISTANCE</th>
<th>TOLERANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 ohms</td>
<td>20%</td>
</tr>
<tr>
<td>470,000 ohms</td>
<td>10%</td>
</tr>
</tbody>
</table>

MOLDED MICA CAPACITORS are color coded to give the value of capacitance in microfarads. To translate this into microfarads move the decimal place six places to the left. The color markings are in form of six dots arranged in two rows of three each parallel to a line through the midpoint of the body. Figure 2 shows this arrangement. The first significant figure and the second significant figure are read from the body, and the third significant figure is read from the body dot.
EQUATIONS BASED ON OHM'S LAW

Chart, combining Ohm's Law (I = V/R) and Joule's Law (W = PR), shows 12 equations for quick solution of radio math problems.

I = Current in amperes
R = Resistance in ohms
V = Voltage in volts
W = Power in watts

For full-wave transformer the second diode lead is Green. Note: The previous standard was the same as above except that the grid return was Black and the second diode was Green-Black.
**Improving TV Booster Performance in Fringe Areas**

**By Ransom Beers**

The booster is probably the most important aid to securing good long distance TV reception. Of course as high gain a stacked array as practical and mounted as high as possible must be employed.

**Connecting Receiver For Maximum Sensitivity**

Assuming a good stacked array is employed and mounted at least 25 feet high; and a station on channel 9 at 100 miles and one on channel 3 at 100 miles are to be received. Channel 3 would be the weaker in strength due to the higher frequency waves being attenuated more over a long distance and the receiver gain dropping at the higher frequency. Several boosters may be employed ahead of the receiver. The tuned plate tuned grid type are the most sensitive to weak signals. Because of their sensitivity and narrow band pass usually over two cannot be cascaded without running into serious difficulty with oscillations between boosters or between set and boosters.

More boosters can be employed but the third booster should not have both grid and plate circuits tuned; and in some cases it may be necessary to disconnect the single tuning condenser from the circuit. Further boosters added will of course require no tuning condenser and may need a lower resistance shunted across the tank circuit to broaden the band width. The value of added boosters can be appreciated by referring to Fig. 1. Observe that it takes two boosters stagger tuned to cover the sound and video both. Added broadbanded boosters will then raise the total amplification over both the video and audio.

To successfully cascade several boosters the lengths of the transmission lines between boosters, between the last booster and receiver input coil, and between first booster and antenna are very important. The transmission line to the antenna should preferably be of exact multiples of $\lambda/2$ of the frequency being received. If more than one channel is to be received, some compromise must be made. In the example here channel 9 is the weakest channel to be received. Since the electrical length of the transmission line to the antenna from booster #1 is difficult to cut to the exact multiple of $\lambda/2$ due to metal being in the antenna mast and the obstructions over which the line will pass, the following method will aid in securing a good match to the input of booster #1 for the weakest signal.

See Fig. 2A.
Make a loop in the line folding the line back on itself between the thumb and forefinger as shown in Figs. 2A, 2B, 2C, and 2D. Increase the length of loop while watching the receiver screen for maximum signal strength. The length of loop which gives the best picture is the best match of antenna to the booster input. When this point is found the loop juncture can be taped together with electrical tape.

This method can also be used between boosters and receiver, however the following method for line length is preferable. For the line length between boosters, the transmission line should be cut in lengths of exact multiples of \( \lambda/2 \) for the weakest station. A line of much less than \( \lambda/2 \) length will have standing waves on it causing oscillations between boosters or between boosters and receiver. Under weak signal conditions a line shorter than \( \lambda/2 \) will often mean no picture while one exactly \( \lambda/2 \) will produce an entertaining picture. Between the final booster and receiver the length of line is found by subtracting the length of line from receiver input terminals, to the input coil from the original multiple of \( \lambda/2 \). Table I gives the lengths of \( \lambda/2 \) for each channel.

**Table I**

<table>
<thead>
<tr>
<th>CHANNEL</th>
<th>LINE LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>106.7&quot;</td>
</tr>
<tr>
<td>3</td>
<td>96.4&quot;</td>
</tr>
<tr>
<td>4</td>
<td>87.8&quot;</td>
</tr>
<tr>
<td>5</td>
<td>77.0&quot;</td>
</tr>
<tr>
<td>6</td>
<td>67.0&quot;</td>
</tr>
<tr>
<td>7</td>
<td>57.6&quot;</td>
</tr>
<tr>
<td>8</td>
<td>48.8&quot;</td>
</tr>
<tr>
<td>9</td>
<td>40.0&quot;</td>
</tr>
<tr>
<td>10</td>
<td>31.6&quot;</td>
</tr>
<tr>
<td>11</td>
<td>23.7&quot;</td>
</tr>
<tr>
<td>12</td>
<td>26.0&quot;</td>
</tr>
<tr>
<td>13</td>
<td>18.0&quot;</td>
</tr>
</tbody>
</table>

Line lengths of transmission line for different channels.

In the example here channel 3 is also to be received. Since \( \lambda/2 \) for Channel 9 is 31.0" and \( \lambda/2 \) for channel 3 is 96.4" the line between boosters and between set and final booster would be \( 3 \times 31.6" = 94.8" \). If the lines were cut to only 31.6" for channel 9, they would be too short for channel 3 and the boosters would tend to oscillate seriously on channel 3. If the lines were cut to 96.4", \( \lambda/2 \) for channel 3, channel 9 would be mismatched reducing its weaker signal, a 94.8" length line for channel 3 would not as seriously mismatch channel 3 signal or reduce its signal strength seriously.

**Fig. 4.** (A-left) Connecting booster power source in series with TV receiver on-off switch. (B-right) Details of mounting a 2-plug receptacle on an RCA 630 TS chassis.

It is very important to keep boosters separated as much as possible from each other and from the receiver to prevent oscillations. Boosters #1 must never be near the T.V. receiver, often if oscillations are troublesome reversing the lines between boosters 1 and 2 and, or set and booster 2 will cure the trouble (ie, instead of 3 going to 1, and 4 to 2, make 3 go to 2 and 4 to 1). See Fig. 3.

**Simplifying Receiver Operation**

When several boosters are added to a set the set owner is apt to complain of the complexity of turning off one when he or she is through viewing the program. To overcome this the following expedient is used: Mount an ordinary two plug receptacle on the T.V. chassis and wire the receptacle in series with the on-off switch of the T.V. receiver. See Fig. 4A. With the boosters plugged into

**Fig. 5.** Simultaneous operation of multiple TV sets from one antenna in weak signal strength areas.

(Continued on page 48)
TELEVISION PROSPECTS FOR 1951

by Dr. ALLEN B. DUMONT

(President, Allen B. DuMont Laboratories Inc.)

TELEVISION, like all American industry, will contribute to the National Emergency effort in 1951. The defense effort will be greatly expanded, but until we get out of the planning stage and into full swing in terms of men and materials, it will be difficult to gauge its effects on television accurately.

The big problem for television in 1951 is, of course, production. The full impact of the defense effort will not be felt until Spring or early Summer. But restrictions on basic materials and shortages of small parts used in receivers already have made it obvious that production figures will have to be cut drastically. There will also be a growing shortage of television technicians who will be concentrating on government work in electronics undertaken by television manufacturers.

Just how much this will effect production is anybody's guess. But it may be that 25% fewer sets will be made than in the 1950 September-October period when receivers came off the assembly lines at the rate of 9 million a year.

Increasing costs of essential materials and shortages of component parts will add up to moderately higher consumer prices. But that picture is changing so fast that it is impossible to say when price raises are coming or what they will be.

It is to be hoped that the shortages will not give rise to black market operations, thereby driving prices up further. In any event, the Du Mont company will adhere to its present policy of merchandise control to keep such possibilities to an absolute minimum.

The shortage situation should not affect sets already made because there are sufficient replacement parts for all sets now in existence. Authorized Du Mont service organizations and servicing dealers will receive priorities in obtaining replacements.

It may be necessary in some cases to use substitutes in order to continue production. The Du Mont company will use them only if it can do so without any lowering of quality.

Where color TV is concerned, the recent demonstration of a vastly improved all-electric and compatible system of color, coming on the heels of statements that such a system wasn't feasible and an FCC decision in favor of mechanical color, has thrown the whole color situation into a state of complete confusion. It will take considerable time to settle this question. In any case, the abundant problems now facing the industry make it evident that the color question for 1951 will be mostly an academic one.

Despite the fewer number of sets to be produced in 1951, there will be sales-retarding factors such as credit restrictions, drops in family income due to increased income taxes, induction of wage earners into the armed services and buyer resistance due to higher prices. Manufacturers and dealers will find it important to continue and even to step up advertising, promotional and sales efforts.

Lifting of the freeze which, it is hoped, will take place in 1951, will do much to increase the demand for sets.

Naturally every manufacturer would like to make more sets in 1951. But the important thing right now is make sure our defenses are strong first. Events of the past few weeks have made it clear that, if we don't increase our nation's strength, we very soon won't have a nation.

The electronics industry, of which television is a part, did a good job in the last war. You can be sure it will do a good job in this present emergency year of 1951.

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Book Reviews

TV and Other Receiving Antennas (Theory and Practice) by Arnold B. Bailey, John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y., 606 pages, 310 illustrations, $6.00.

This book is primarily concerned with the theory, design and applications of VHF and UHF antennas, on the following: Review of Definitions with emphasis on Television applications. Its contents includes chapters on Theory and Terminology, The Television Signal and its Bandwidth, problems of Television Reception, The Electromagnetic Wave, The Radio Path, The Theory of Signal Interception, The Center-Fed Zero-db Half-wave Antenna, Comparison of Zero-db Half-wave Antennas, Parasitic Element Antennas, Horizontally Polarized Antennas, Vertically Polarized Antennas and Special Types, and Practical Aspects of TV Receiving Antennas. Included in its covers are data sheets on approximately 50 different basic type antennas. Each antenna type is illustrated and its performance characteristics, impedance, directivity patterns, requirements and proper matching frequency bandwidth characteristics and other important details tabulated.

This book is written for the engineer and the technician alike. The more technical aspects of antenna [Continued on page 48]
A cathode ray tube tester that tests all cathode ray tubes, electromagnetic and electrostatic, with the ease and facility of a conventional tube checker, has been a long felt need in the industry. The serviceman will welcome it because it will answer that ever-recurring question, "Is it the TV set or is it the picture tube?" In addition, it provides for him a convincing item of authority for the type of customer who is impressed primarily by test equipment findings, thereby making his selling job that much easier. Dealers and distributors will find it an answer to how de-

teriorated or defective a CR tube is, and whether or not it is bad enough to warrant replacement by the manufacturer. This tester, in providing a definite answer to this question should pay for itself in eliminating unnecessary transportation costs alone. Finally, the manufacturer will welcome it because it affords a convenient, rigid, economical and technically sound basis for sorting the mass of "field rejected" CR tubes which tend, at times, to load the floor. Such an instrument is the Model CR-30 Cathode Ray Tube Tester recently developed by Precision Apparatus Co., Inc.

**Design Considerations**

The design of this tester centers around the electron beam characteristic of a CR tube whereby the most copious and useful emission (because of the electronic focusing structure of the tube) comes from only the center area of the cathode surface. (See Fig. 1). Thus, the total overall surface emission might be high, yet the tube will be poor if the stream of electrons derived from the center area of the cathode is low. On the other hand, a tube with low overall cathode surface area emission, but with high center area emission, will perform satisfactorily.

**Beam Current Test**

Making use of this characteristic, the electron beam is obtained by connecting the control grid to ground through a suitable series resistance and making the first anode the collecting element. It is interesting to note that under these conditions the normal beam currents obtained will vary from a few microamperes (poor to dead tubes) all the way up to approximately 1700 microamperes (new good tubes).
This beam current is measured by means of a VTVM connected in the circuit shown in Fig. 2.

The actual beam current test procedure is as follows:
1. All necessary test potentials are determined by setting the circuit selectors to designated positions given on the roller chart. (See photo of front panel).
2. Balance the VTVM
3. Press READ METER button
4. Read specially designated CR tube quality scale

Element Continuity Test

Additional tests include checks for element continuity, shorts, leakage and filament continuity. In order to obtain truly complete test on the CR tube, all elements, which do not contribute to the Beam Current test must be continuity tested via an extremely sensitive indicating circuit. The built-in VTVM is employed for this purpose and is capable of indicating minute currents. In fact just 1/10th of one microampere will create a meter deflection of approximately 5 divisions on the 120 division meter scale. The basic test circuit is shown in Fig. 2.

Suitable potential fields are obtained for the various elements by means of a selector switch which applies predetermined, in-phase, accelerating potentials to the various elements following the first grid. Other elements, previous to the element being checked for continuity, are shorted to anode No. 1 and become accelerating electrodes. Thus, to check one of the deflecting plates for continuity (see Fig. 3) anode No. 1 and anode No. 2 are connected together, following which a voltage is applied to the two sets of elements by means of the in-phase transformer windings. The resultant beam current, flowing through the element being tested, is then read on the VTVM. If the element is open the meter will not read.

The use of a VTVM has another advantage — if the tube were gassy the beam current would be inordinately high and an ordinary meter would slam. In the circuit used in this instrument, the VTVM is biased so that any current over 1700 microamperes will not cause the pointer to go beyond full scale. Thus, if a full scale reading is obtained the tube may be considered gassy. If the tube is saturated with gas, an opposite effect is obtained, that is the electron beam is blocked and the scale reading will be very low (dark to dim). There is a remote possibility that an unused tube might read full scale because of an extraordinarily high beam current characteristic, but this possibility is rather remote. Thus a gassy tube will either read absolute full scale or very low.

Shorts, Leakage, and Filament Continuity Tests

Shorts, leakage, and filament continuity tests are made in conjunction with an appropriately sensitive neon lamp circuit. To test for shorts and leakage, each element lever is raised individually to the H position and the operator watches for the neon tube to glow. Then, to determine the actual leakage path, the lever already raised in the H position is kept in that position and each of the remaining levers is successively thrown to the H position, the operator watching for the glow to be extinguished. The lever which causes the glow to be extinguished corresponds to the other shorted element. Levers are numbered in accordance with RTMA basting, which enables the operator to identify the exact elements that are shorted or defective.

The filament continuity test utilizes the above principles to check for continuity between the pre-determined filament connections given in the chart under the column, FIL. CONT. The filament voltage selector switch is adjustable to include the voltages used in present day tubes (2.5 and 6.3 v.) and in addition includes provisions for future CR tube filaments up to 25 volts. See Fig. 4. Discussions with CR tube manufacturers makes it appear most improbable that CR tube filament voltages will ever go higher and in fact highly doubtful that they will ever go up to 25 volts, for technical reasons.

Flexibility

This instrument has facilities for independent variation of base pin terminations which, according to best predictions, will accommodate all picture tubes to be manufactured in the foreseeable future. Thus, the possibility of obsolescence is reduced to a minimum. At present the maximum number of element circuits used is eleven.

Two cables are provided for connecting various CR tubes to the tester. The first is a duo-decal terminated

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Fig. 2. Measuring beam current with VTVM.

Fig. 3. Continuity testing of CR tube elements.
Reject Limits

voltage cap (which connects to the plate and the high spring the connection intermittentinging the RTMA basing grip-tip connectors are connected to the tube base pins and which are numbered in accordance with RTMA basing figures. These cables are shown in the photograph illustrating the instrument.

Intermittent Connections

An interesting application of this instrument is its use in checking for intermittent connections, particularly the connection between the internal spring clips which connect the anode plate and the high voltage inside coating (see Fig. 5). A continuity test, as described under the section heading: "Shorts, Leaks, etc." is made between the anode plate and the high voltage cap (which connects to the inside lining), and the tube is tipped for intermittency.

Reject Limits of CR Tubes

All else being normal, screen brightness is proportional to the beam current. The question that had to be answered by the designers of this instrument was, "What are the limits of beam current with respect to a tube's rejection or acceptance?" This was determined through consultation with several prominent CR tube manufacturers and also determined through actual tests conducted on a large number of good and bad tubes. Exhaustive experiments helped determine the apportioning of the scale limits as shown in the photo. Thus, all tubes reading from zero up to the line separating the DARK TO DIM (red) and DIM TO BRIGHT region (yellow and green) should be rejected. All tubes in the DIM TO BRIGHT region may be rejected or still be kept in use depending on how demanding the owner is for maximum brightness and highlight contrast. Tubes reading in the lower portion of the BRIGHT region, up to the 45 mark on numbered divisions of the scale, will be satisfactory to most viewers. However, the more critical observer may notice a loss of peak whites. Tubes reading above the 45 mark on the scale are good and should yield in a normally operating receiver, requisite brightness and highlight contrast.

Fig. 4. Circuit diagram of Precision Apparatus Co. Model CR-30 CR tube tester.

Fig. 5. High voltage cap is connected to the 2nd anode by means of an inside conductive coating making contact against 6 or more concentric spring clips mounted on 2nd anode and pressing up against inside coating.
Philco-Care Of Optical System

Extreme care must be taken at all times in handling the precision-ground optical parts of Model 48-3500. Avoid contact with the optical surfaces of the screen, mirrors, and corrector plate, since the body acid contained in fingerprints is harmful to these surfaces. The units must be handled only by their unused areas.

Since the projection screen has a lacquered surface, it can be damaged by vigorous rubbing. Therefore, under normal conditions, it should never be touched. If it does accumulate dust, the dust should be removed by flicking vertically with a clean, soft, cotton flannel cloth. In a normal location and with proper handling, the screen should never acquire fingerprints or smudges. But in case prints or smudges do appear on the screen, remove them in a manner that the quality of the picture is affected, they may be removed by breathing on them and gently rubbing vertically with a soft, clean, cotton flannel cloth.

Dust may be cleaned from the dust cover and the flat and spherical mirrors by dusting them with a piece of soft, clean, cotton flannel cloth. The spherical mirror must be removed to be dusted, and the dust cover must be removed to dust the flat mirror. The flat mirror may be cleaned in its normal position.

In cleaning the dust cover and the flat and spherical mirrors, use a slight application of water on a piece of soft, clean, cotton flannel cloth and rub gently over the entire surface. Then, using another strip of the same type of cloth, gently wipe the surface dry and free of smears.

When the corrector plate accumulates dust, it causes a very noticeable deterioration in contrast and resolution, and a less noticeable decrease in brilliance, because the diffusion of light by the dust particles tends to lighten those portions of the picture which would normally be black. As a result, the black tones become gray. It is recommended that the corrector plate be cleaned every two to six months, to preserve the quality of the picture. The period between cleanings depends on the amount of dust present at the receiver location.

The corrector plate may be cleaned in the same way as the dust cover and the flat and spherical mirrors, without removing it from its normal location. Use a light application of water on a clean, soft, cotton flannel cloth and rub gently over the entire surface. Using another strip of the same cloth, gently rub the surface dry and free of smears.

Remember that careful and intelligent handling of all optical components is imperative.

Philco Service Dep't.

The Console Coupler

In order to use the television jack on radio receivers, Stromberg-Carlson has announced the Console Coupler in conjunction with its table model television receivers.

![Diagram of Console Coupler](image)

On all models except the 1210, this will be a plug with one prong. The shield of the plug should be connected to the shield of the Coupler cable and the prong should be connected to the inside end of the Coupler jack. On the 1210, use the following diagram to make connections:

**NOTE:** On a very few early table model television receivers, the small speaker was made to cut out when the Console Coupler was plugged in. If it is desired to have both speakers playing at once, the inside end of the Console Coupler jack can be soldered together to keep the connection from breaking when the plug is inserted.

Excessive Hum 1220-T AM Chassis Used in TV-12 Combinations

To reduce excessive hum in 1220-T AM Chassis used in TV-12 Combinations, the Engineering Department by virtue of Engineering Change R-1531, dated June 7, have made the following addition to this chassis: Connect our P-11926, 35 mfd, 15 volt capacitor between cathode terminal of 6SC7 tube and ground. In most cases this will reduce hum to a point where it will no longer be objectionable. Because of variations in 6SC7 tubes, hum may sometimes be noted after this capacitor has been added. However, in these cases, changing tubes will invariably eliminate this complaint.

Stromberg-Carlson Model TC19 Receivers—Focus Coil Position.

A greater “in-focus” picture area can be obtained if the focus coil assembly is separated by approximately three-quarters of an inch (3/4") from the deflection yoke on the picture-tube neck. The separation distance is best determined by observing the picture while adjusting the focus coil position.

Stromberg-Carlson Sec. Dep't.

Westinghouse MODELS H-217 AND H-226—Picture Width

With early production versions of the Modela listed, some difficulty may be experienced in obtaining sufficient picture width. If this condition occurs, check the voltage divider (R501, R502, R503 and R504) in the voltage doubler circuit of the high voltage supply. In original production, the plate of the 12BG7 doubler tube was connected to the junction of R501 and R502. To increase the picture width, move the plate connection down to the junction of R502 and R503. This is being done in later production.

Westinghouse Elec. Sec. Dep't.
QUALITY
You Can Always Depend On

Because...
They're Produced by the World's Largest Manufacturer of Both Antennas & Rotators

C · D · R
TELE-ROTOR
HEAVY DUTY MODEL
This heavy-duty TELE-ROTOR has no match! It's more powerful... turns any TV antenna array under any weather conditions! Recommended by servicemen everywhere because of its dependable, TROUBLE FREE performance. Handsome control cabinet gives quick, easy control... indicates antenna position instantly.

Model TR-2... rotator with "Compass Control" cabinet having illuminated "perfect pattern" dial... (Uses 8 wire cable)...

... $44.95

Model TR-1... rotator and control cabinet with end of rotation light...
(Uses 4 wire cable)

... $39.95

New TELE-ROTOR CUB for average installations. Same husky motor... as heavy-duty TELE-ROTOR. FASTEST, EASIEST ROTATOR TO INSTALL. All-In-Line design... with true in-line thrust between antenna and mast. ½" STEEL shaft rotates in line reamed oilless bearings. Plastic control cabinet offers easy, accurate control.

Model 502-A... rotator with control cabinet having indicating meter for "hairline" tuning. (Uses 5 wire cable)...

... $44.95

Model 501-A... rotator with control cabinet having end of rotation signal. Light flashes every 7.2° showing antenna is turning. (Uses 5 wire cable)

... $34.95

"Lazy-X" Conicals
"Strate-Line" Antennas
Double-Stacked Arrays
"Hi-Lo" Antennas
Indoor Antennas
FM Antennas
"Super-Vee" Antennas

You Can't Beat a RADIART Antenna on a TELE-ROTOR
IT'S TOPS

IT'S RIGHT WHEN IT'S RADIART

THE RADIART CORPORATION
CLEVELAND 2, OHIO

RADIO-TELEVISION SERVICE DEALER • JANUARY, 1951
NEW PRODUCTS

7-INCH ELECTROSTATIC CR TUBE

The RCA 7JP1 is a 7-inch cathode-ray tube of the electrostatic focus and deflection type designed to provide exceptional brightness when operated with an anode-No. 2 voltage near the maximum of 6000 volts, and good brightness at anode-No.2 voltages as low as 1500-2000 volts. Intended for general oscillographic applications, the 7JP1 has a small, brilliant, focused spot and high deflection sensitivity for its relatively short length. The screen is of the medium-persistence, greenfluorescence type and provides high contrast.

The 7JP1 utilizes an electron gun which has a grid No.2 operated at anode-No.2 potential so that the beam current and grid No.1 cutoff voltage will not be affected by focusing adjustment. The gun also has an anode No. 1 which takes negligible current. As a result of these features, the spot can be sharply focused on the screen, and remains sharp when beam current is varied over a wide range.

HEAVY DUTY DUAL SPEAKER

The new Racoan Model RR-10 Dual Speaker is designed primarily to meet the rigorous 365-day requirements of railroad sound systems. Exhibiting high intelligibility, and unusual clarity and sensitivity for "talk back" purposes, it is also admirably suited for other industrial installations, such as open pit mines, steel mills, factories, etc. Extreme ruggedness, immunity to acid fumes and easy serviceability are other outstanding design features.

Manufactured by Racoan Electric Co., Inc., 52 East 16th Street, New York 3, N.Y., the Model RR-10 consists of a heavy non-corrosive center aluminum casing with a weatherproof steel bell resonant speaker at each end of the opening. There is ample room internally for a line transformer, terminal strip and minor accessories, which may be installed on the inside of the bell cover plate to permit ready access. Heavy vulcanoid markers between each cover plate and the casing prevents any water seepage.

For full details on this model and the rest of the complete Racoan line, write directly to Racoan Electric Co., Inc., 52 East 16th St., New York 3, N.Y.

FIELD STRENGTH METER

The Simpson Electric Company of Chicago has introduced a Television Field Strength Meter which will measure television signals in any locality and in all types of installations. New engineering design which has given special consideration to fringe area applications, includes such functions as location of maximum signal areas, antenna orientation, comparison of antenna systems, adjustment of boosters and checking antenna and lead-in installations.

Model 488 incorporates a 12 channel television tuner, with each channel separately adjustable for maximum flexibility and uniform results.

A phone jack is included for making audible tests so that the operator can quickly identify the type of signal being measured.

The large 4-1/2 inch modernistic meter is easily read from a considerable distance. All controls and connections arranged for greatest accessibility.

Model 88's case is of gray hammer-laid, with leather handle. Weight 11-1/2 lbs., (shipping weight 13 lbs.). Case measures 8" x 11" x 8-1/2". Dealer’s price $99.50.

R-C-1 COMPARATOR BRIDGE KIT

The new Model 506-K R-C-1 Comparator Bridge Kit was recently announced by the Electronic Instrument Co., Inc., 276 Newport Street, Brooklyn 12, New York, manufacturers of the famous complete RICO line of kits and instruments.

The Model 506-K tests every type of resistor over the full range of .5 ohms to 500 Megohms, in 4 convenient steps: 0.5-50 ohms; 50-500 ohms; 5K-5M; and 5M-50M.

The Capacitance Range tests every type of condenser - paper, mica and electrolytic - over the full range of 10 mmfd to 5000 mmfd, in 4 convenient steps: 10 mmfd - 500 mmfd; .001 - .5 mmfd; 1 - 50 mmfd; and 50 - 5000 mmfd.

For leakage test and polarisation, a source of variable voltage is incorporated with the complete range of 0-500 volts. This also provides for the precise measurement of the power factor of electrolytics from 0 up to 89%.

17-INCH RECTANGULAR TUBE

Type 17HP4A, a 17-inch rectangular tube has been announced by National Union Radio Corporation of Orange, New Jersey.

The N.U. 17HP4A is a direct-viewing television picture tube providing a 11-3/8" x 14-1/4" rectangular picture having the standard 3 x 4 aspect ratio. It features a face plate having an integral neutral gray filter which increases the contrast ratio when viewing under ambient light conditions.

The N.U. 17HP4A utilizes the new tilted-beam type gun to obtain improved picture detail. It requires only a single-field ion trap. The N.U. 17HP4A is electrically similar to the now-popular N.U. 16KP1/16KP4 and therefore a suitable replacement in new set designs where the larger dimensions can be taken care of.

MULTIPLE RECEIVER TV SIGNAL SOURCE

An entirely new concept of closed-circuit television is provided by the new addition to the Du Mont television equipment line, the Dumitter. This unit, just announced by the Television Transmitter Division, Allen B. Du Mont Laboratories, Inc., Cliffon, N. J., permits TV camera signals to be distributed to a large number of standard TV receivers, over connecting cables, thereby eliminating costly and bulky equipment heretofore required for the same function.

The Dumitter is a single, compact, completely portable unit. It takes the composite
The RCA "TV Duo"

...the last word in precision and versatility

RCA WR-59B Television Sweep Generator

What it does—Provides fast and accurate sweep alignment and trouble shooting of TV front ends... sound and picture if amplifiers... discriminators and ratio detectors... trap circuits... video amplifiers... and if amplifiers in FM sets.

What it features—Preset switch positions for TV channels 2 to 13... continuous tuning from 300 kc to 50 Mc... flat output, within ±1.5 db even at maximum sweep width... fundamental oscillator output on all TV channels... filtered beat-frequency-fundamental output on if/vf range... zero-voltage reference line provided by return-trace blanking... dual piston attenuator with maximum attenuation ratio of 20,000 to 1... continuously variable sweep width up to 10 Mc... output frequency-modulated at the fundamental frequency by a precision-type vibrating capacitor, for long life and good linearity... balanced rf output cable terminated in 300 ohms... fully shielded circuits and filtered power line... resistance-terminated if/vf output cable.

For complete details ask your RCA Test Equipment Distributor for Bulletin 2F753.

RCA WR-39B Television Calibrator

What it does—Provides dual markers for rf picture and sound carriers... provides signals for peak alignment of stagger-tuned if amplifiers... develops vertical bar pattern for horizontal linearity adjustments... generates a crystal-controlled AM signal for alignment of inter-carrier sound if's... provides triple markers for sound discriminator adjustment... allows adjustment of local oscillators in TV front ends with crystal accuracy... checks reception on all 12 channels by means of video signal obtained from single channel of a TV set.

What it features—Variable-frequency oscillator operating on fundamentals over entire range... sound and picture carrier frequencies marked on expanded, easily-read scale... two crystal oscillator stages with 3 crystals supplied... wide-band modulator stage with range of 0 cps to 30 Mc... crystal standard supplying over 600 calibration check points at 0.25-Mc intervals... bar-pattern generator for linearity adjustments.

For complete details ask your RCA Test Equipment Distributor for Bulletin 2F751.

Available from your RCA Test Equipment Distributor

RADIO CORPORATION OF AMERICA
TEST EQUIPMENT

HARRISON, N.J.
video signal from any standard TV camera chain and feeds it via cable to the regular antenna terminals of any standard TV receiver. Transmission is excellent over several thousand feet.

Each receiver is tuned to either Channel 2 or 3, depending on the setting of the Dammiter, and the closed-circuit program is received. The antenna lead-in is disconnected from the receiver while the Dammiter signal is being received. For merchandising promotions, it can distribute the antenna picture to standard TV receivers located at strategic spots throughout the largest store.

CR TUBE CHECKER

Thomas Electronics, Inc. announces a new CR tube checker, the "Catho-Chek". One quick check of the tube, made simply by completing the connection of the Catho-Chek to the terminals at the tube base, shows immediately the exact condition of the tube in checking emission (reading directly on a 0-1 Ma. meter scale), gas ratio, shorts and leakages (reading directly on a 0-100 Micro-ammeter). All readings require only unplugging of the power cable from the tube in the tube cap and taking up of the Catho-Chek lead wires which come equipped with standard snap-on test clips. Removal, loosening, or shifting of the picture tube from the chassis is unnecessary with any tube now in use.

The Catho-Chek is finished in gray, wrinkle-finish, baked enamel and comes equipped with all necessary lead wires of adequate length, and sturdy handles for easy carrying. The entire unit weighs 13 pounds.

Further information and prices may be obtained by writing direct to Thomas Electronics, Inc., 118 Ninth St., Passaic, New Jersey.

LIGHTNING ARRESTER

A new, all-weather radio-tv lightning arrester featuring two-way protection has just been developed by Rolls Merchandise Sales Inc., New York 59, N. Y.

The arrester, streamlined and sturdy constructed, incorporates neon gas discharge and air gap to assure positive protection against lightning and static. Infinite resistance is maintained before and immediately after discharge, import impedance is constant.

The RMS arrester is completely waterproof, requires no wire stripping and mounts easily on walls, masts and sills. The unit takes both regular and jumbo size twin lead and in Underwriters Laboratories approved for both indoor and outdoor use.

OXFORD INTRODUCES NEW SPEAKERS

Oxford Electric Corporation, manufacturers of speakers, announces the development and availability of eight new models.

These are: Model 3CMWS - weatherproof speaker; Model 6CMWS - weatherproof speaker; Model 82EV5 - pin cushion type for automobile replacement; Models 46146S, 60A16S, 90A102, 105A18S and 12548S - electro dynamic speakers.

Inquiries and further information are available upon request. Address your correspondence to Oxford Electric Corporation, 1911 South Michigan Avenue, Chicago 15, Illinois.

WALSCO TV ANTENNA

The Walter J. Schott Company, Beverly Hills, has unveiled the new Walco Signal King antenna capable of receiving all channels. A new signal "director" has been added to improve gain on high band channels and eliminate "cheeks". Preliminary tests indicate no weak spots over entire TV spectrum. Some of the features make the Signal King an excellent fringe area antenna as well.

This new arrester, be stated, is similar in design to the popular 2-wire RW-204, but is constructed with only 2 sun-tooth contact points instead of 3. The RW-204 provides positive protection for all standard installations and lists for $1.25.

PHONO PICKUP

Sonomite Corporation, leading manufacturer and distributor of hearing aids, has announced two additions to its line of Titone phonograph pickups—the "Playal" with replaceable needle and the Super Titone "Turnover."

Pickups made with Titone, the original piezo-electric ceramic element, have these advantages, according to Sonomite: They provide a wide frequency response, eliminate "needle talk," and are easy on records, rugged and unaffected by humidity and temperature changes.
Yes, UNIFORM! There's no such thing as a "better tube" or a "poorer tube" when you insist on Du Mont Teletrons. Advanced engineering, precise mechanization second to none, and the most rigid quality control account for uniformly dependable performance that has made the Du Mont label symbolic of the finest in TV tubes. Best of all, with a productive capacity in excess of one million BIG picture tubes a year, the giant Du Mont Allwood plant meets quantity as well as quality requirements. Literature on request.
expansion and improvement of black and white program service, Walter A. Buck, Vice President and General Manager of the RCA Victor Division, Radio Corporation of America, said in a letter mailed recently to all RCA Victor distributors.

ESFETA TV Lectures For February & March

The schedule of lectures for the Empire State Federation of Electronic Technicians Associations for the months of February and March are as follows:

New York Area: Feb. 1, DuMont, March 1, Ward Products Co., March 15, RCA.

Long Island Area: Feb. 27, Philco.


Endicott-Binghamton Area: Feb. 20, Philco.

Rochester Area: Feb. 6, Philco. March 6, Sylvania.

Simpson Announces Servicing Lecture Program

Mel Beuhring, Sales Manager of Simpson Electric Co. of Chicago, Ill., has announced that Simpson, in cooperation with its Representatives, will sponsor a series of lectures on “Television Servicing” to be delivered by Jack Whiteside, senior engineer with the company. A Vu-Graf projector and 30 illustrative slides will be used to clarify important points.

The New York lecture will be held at the Engineering Society Building at 29 W. 39th St. on the evening of Jan. 23, 1951, at 8:00 P.M. The Newark meeting will be held at the Robert Treat Hotel, Newark, N. J. on the evening of Jan. 24, 1951, at 8:00 P.M. Free refreshments will be served. Door Prizes consisting of Simpson test equipment will be given away.

Precision Apparatus Company Lecture Schedule

The lecture schedule of the Precision Apparatus Co., in which R. G. (Bob) Middleton, senior engineer with this company, will speak on “Television Circuitry, Alignment Practice and Trouble-Shooting, has been released for February, and is as follows:


Sylvania Award

Believing that the most effective way to improve the quality of Television Programa is by positive action rather than by destructive criticism, Sylvania Electric Products Inc. has established the Sylvania Television awards to honor those who have contributed most to the Television Art.

At a gathering in which the awards were announced, Don G. Mitchell, President of Sylvania said, “Because Television is a new art, the top Award will be given to the program deemed best as Creative Television Technique.”

Don G. Mitchell

Other Awards will be given to individuals on any TV program — to a writer, a producer, a director, an actor or actress, a camera man, a scene designer, a lighting expert and a make-up man — considered to have made the greatest contribution in the period from January 1st, to June 30th, 1951, in each of these departments. The winners will be honored at a dinner to be held next August.

Duplicate Awards will be given to the network or station on which the winning program is seen and, if sponsored, to the sponsor and his advertising agency Television stations not yet on networks will be invited to send kinescopes for the consideration of the judges.

Mr. Mitchell further pointed out that, “Leaders in the field of entertainment — Music, Drama, Comedy — educators, Officials of Parent-Teachers and Women’s Club groups, Critics, Business Men, as well as Specialists in various phases of Televis-

RADIO-TELEVISION SERVICE DEALER announces a new Department

“TUBE TOPICS”

by James Corey

Beginning with the forthcoming issue of Radio-Television Service Dealer, and to appear monthly thereafter, we are happy to announce a new regular department edited solely in the interests of the Radio-Television Service Dealer who finds himself beset with tube shortages.

This department will deal with technical data in connection with tube replacements and substitutions of all types including picture tubes, presenting up-to-the-minute information based on availability.

The editor of this department will gladly answer tube replacement and substitution problems arising in the field.
The new Heathkit Model V-4A VTVM Kit measures 30,000 Volts DC and 250 megacycles with accessory probes — think of it, all in one electronic instrument more useful than ever before. The AC voltmeter is so flat and extended in its response it eliminates the need for separate expensive AC VTVM's. + or - db from 20 cycles to 2 megacycles. Meter has decibel ranges for direct reading. New zero center on meter scale for quick FM alignment.

There are six complete ranges for each function. Four functions give total of 24 ranges. The 3 Volt range allows 375 of the scale for reading one volt as against only 20% of the scale on 5 Volt types. The ranges decade for quick reading.

New 3% ceramic precision are the most accurate commercial resistors available — you find the same make and quality in the finest laboratory equipment selling for thousands of dollars. The entire voltage divider decade uses these 3% resistors.

New 200 microampere 4½" streamline meter with Simpson quality movement. Five times as sensitive as commonly used 1 MA meters.

Shatterproof plastic meter face for maximum protection. Both AC and DC voltmeter use push-pull electronic voltmeter circuit with burn-out proof meter circuit. Electronic ohmmeter circuit measures resistance over the amazing range of 1/10 ohm to one billion ohms all with internal 3 Volt battery. Ohmmeter batteries mount on the chassis in snap-in mounting for easy replacement.

Voltage ranges are full scale 3 Volts, 10 Volts, 30 Volts, 100 Volts, 300 Volts, 1000 Volts. Complete decade coverage without gaps. The DC probe is isolated for dynamic measurements. Negligible circuit loading. Gets the accurate reading without distorting the operation of the instrument under test. Kit comes complete, cabinet, transformer, Simpson meter, test leads, complete assembly and instruction manual. Compare it with all others and you will buy a Heathkit, Model V-4A.

New 30,000 Volt DC Probe Kit
Beautiful new red and black plastic high voltage probe. Increases input resistance to 100 megohms, reads 30,000 Volts on 309 RF Probe Kit. Shipping Wt., 2 pounds.

New RF Probe Kit
Crystal diode probe kit extends range to 250 megacycles — 10% comes complete with PL55 type plug.

New low price $23.50

The new Heathkit Model V-4A VTVM Kit

$23.50

NEW 1951 • • MODEL V-4A

Heathkit VTVM KIT
HAS EVERY EXPENSIVE Feature

* Higher AC input impedance, (greater than 1 megohm at 1000 cycles).
* New AC voltmeter flat within 1% 20 cycles to 2 megacycles (600 ohm source).
* New accessory probe (extra) extends DC range to 30,000 Volts.
* New high quality Simpson 200 microampere meter.
* New 15% voltage divider resistors (finest available).
* 24 Complete ranges.
* Low voltage range 3 Volts full scale (½ of scale per volt).
* Crystal probe (extra) extends RF range to 250 megacycles.
* Modern push-pull electronic voltmeter on both AC and DC.
* Completely transformer operated isolated from line for safety.
* Largest scale available on streamline 4½ inch meter.
* Burn-out proof meter circuit.
* Isolated probe for dynamic testing no circuit loading.
* New simplified switches for easy assembly.

NEW LOW PRICE

$23.50

The Heathkit Company
BENTON HARBOR 12, MICHIGAN
son Production will be invited to serve as judges who will make their selections from Television programs broadcast between January 1st to June 30th, 1951.

"Deems Taylor — author, composer, critic and commentator — has consented to serve as Chairman of our Committee of Judges.

"The motion picture industry has its 'Oscars'. Television will now have its 'Sylvias'.

"We have decided to offer these Awards with a sincere desire to make a concrete contribution, not merely to our own industry but for the good of Television's impact on American family life. Further announcements will be made as the details of this project are perfected."

Raytheon Sponsors Bonded Dealer Meetings

The Electrical Supply Corporation, 1739 Massachusetts Avenue, Cambridge, Massachusetts, distributor of tubes in the Boston area, last month launched the first of a planned series of Bonded Dealer meetings.

In answer to the growing wave of customer dissatisfaction to what they consider unfair practices of T.V. service organizations, Raytheon Bonded Dealer meetings are being launched throughout the country by a number of independent parts distributors who handle Raytheon tubes and are authorized to service the famous Bonded Dealer program sponsored by Raytheon.

This dealer promotion program is primarily designed to help dealers build up more customer confidence and generally create better customer relations through registered dealer bonds issued by the American Mutual Liability Insurance Company through the Raytheon Tube Division.

Personnel Changes & Promotions

The promotion of Harry E. McCullough to manage, radio and television sales section, for the Crosley Division of Avco Manufacturing Corporation, has been announced by W. A. Blee, Avco vice president and Crosley general sales manager.

V. L. Walker, former sales engineer, radio parts, of United Motors Service, has joined The Triplett Electrical Instrument Co., Bluffton, Ohio, as a sales engineer.

William J. Halligan, president of The Hallcrafters Company today announced the appointment by the Board of Directors of Rollie J. Sherwood as Vice President in charge of sales. Mr. Sherwood, joined the company in 1944 as communications sales manager, and has been general sales manager since 1946.

O. O. Schreiber, who has been with Philco for the past 17 years and during the past year has been assistant secretary has also been appointed assistant to the president, it was announced today by William Balderson, president of Philco Corporation.

Frank H. Russell of Philco, author of the "Shop Overhead Analysis" article which appeared in Nov. RTSD, has been promoted from "Promotion Manager, Service Division" to Assistant to the Director of Sales Training. The title listed under his name in the article was an error.

John P. Boksenbom, has been elected a Vice-President of the RCA Service Company in charge of its Consumer Products Service Division, it was announced recently by E. C. Cahill, President.

Simultaneously, Mr. Cahill announced the election of Donald H. Kunsman as Treasurer and Controller.

Jack M. Williams has been appointed Advertising and Sales Promotion Manager of the RCA Victor Home Instrument Department.

Clifford M. Rigabbee, veteran department store executive, has been
Choice of Manufacturers for ORIGINAL Equipment

Cash in on the growing TV ballast replacement market. You can't go wrong when you use the EXACT TV Ballast ORIGINALLY Used by the Manufacturers themselves. Models for EMERSON, MOTOROLA, TELE-TONE, BELMONT, STEWART-WARNER, PILOT, and others.

$2.25 Each

JFD has the most complete line of Detent Switches on the market — exact replacements for RCA, Emerson, Admiral, Teketone and other TV sets. Designed for RCA Tuners used in 630 700 and 721 type chassis. Available with or without locating plates. Write for FREE Replacement Reference Chart No. 60R.

No. DT10 — Short shaft, complete with locating plate. (Replaces RCA part No. 71463.)
No. DT11 — Long shaft, complete with locating plate. (Replaces RCA part No. 72743.)
No. DT12 — Extra long shaft, complete with locating plate. (Replaces Admiral part No. 76814 used in entire Model 120A.)
No. DT13 — Without locating plate.
No. DT14 — All phenolic shaft, complete with locating plate. (Replaces RCA part No. 75162.)

 Write for FREE Replacement Reference Chart 2260R

Write for Complete Catalogue of JFD Television Antennas and Accessories, No. 58G

JFD MANUFACTURING CO., Inc.
6125A 16th Ave., Brooklyn 4, New York
FIRST in Television Antennas & Accessories

RADIO-TELEVISION SERVICE DEALER • JANUARY, 1951
SYNC PULSES

(from page 12)

in debt to Mr. Wilson. In accepting this assignment he does so at great personal sacrifice, and there remains practically no token of esteem or appreciation great enough to repay him in part for his contribution, save possible one. In this regard let us refer to the Editorial that appeared in the January 1944 issue of "Service Dealer" — it reviewed Mr. Wilson's accomplishments in his work of that period, (Executive Vice President of War Production Board), — and the editorial explained why both of the major political parties of the U.S. should draft Mr. Wilson as their candidate for the position of Chief Executive of the United States in the then impending 1944 elections.

Time is running out. Rumor has it that Mr. Truman does not plan to seek re-election in 1952. Whether he does or not makes no difference. The one American whose record of accomplishment proves beyond a question of doubt that he is qualified to be our Nation's president is none other than our present DDM, Charles E. Wilson.

THE STORMS' TOLL —November 1950 will long be remembered because of the unprecedented damage suffered by millions of radio and TV equipped homes in the storm-stricken areas, East, West and mid-west. Millions of TV aerials blew down. The storm's intensity was so great that in many instances heavy guage steel masts were blown into pretzel shapes. Repair bills not covered by service contracts cost owners enormous sums, and records now show that only a relatively few TV service policies were drafted in such a way as to make liable for repairs the contract issuer. So, the radio-TV service profession enjoyed (sic) a storm-caused boom period amounting to many millions of dollars that it did not relish and would have preferred not to have had. But such is fate! Actually because of the storm, and his immediate response, the public began to appreciate how important is the Service Dealer who serves it, and once the Better Business Bureau and like protective associations made clear the degree of responsibility of the servicer under policies and contracts bearing "Act of God" and "Storm Clauses", a better understanding was enjoyed by all parties. Although not obligated to do so, many Service Dealers and service organizations undertook the job of repairing blown down antennas without charge, and that is to their everlasting credit, a fact that we hope the public will appreciate.

The storms taught us all a lesson: for example, that most masts that did not blow down were those that were properly guyed; that most dipoles that did not bend or break were those manufactured by national advertisers, reputable firms, who use high quality materials.

WITH REFERENCE TO COLOR TV, on Dec. 5, our correspondent saw a demonstration of the improved RCA compatible all-electronic color TV system in Washington, D.C. A full
The new Precision CR-30 fills an obvious gap in the test equipment facilities employed by TV service and installation technicians. Because of the absence of a reliable cathode ray tube tester, up to 50% of so-called "rejected tubes" are found to be fully serviceable and should rightfully never have been "pulled out."

Proven product of extended development, the CR-30 has been specifically engineered to answer the question, "Is it the TV Set or is it the Picture Tube?"

The Precision CR-30, a complete and self-contained Electronic Instrument, incorporates a TRUE BEAM CURRENT Test Circuit. The CR-30 checks overall electron-gun performance for proportionate picture brightness as well as additional direct testing facilities for accelerating anodes and deflection plate elements.

The Precision CR-30 should not be confused with mere adapters connecting to ordinary receiving tube testers which were never designed to meet the very specialized needs of CR tube checking. Similarly, it is not to be confused with neon-lamp units or similar devices of limited technical merit and which do not check all CR tubes or all tube elements.

**GENERAL AND TECHNICAL SPECIFICATIONS**

* Tests All Modern Cathode Ray Tubes—Magnetic and Electrostatic, Scope Tubes and Industrial Types.
* Tests All CR Tube Elements—Not just a limited few.
* Absolute Free-Point 14 Lever Element Selection System, independent of multiple base-pin and flooting element terminations, for Short-Check, Leakage, "Setting and Quality Tests. Affords maximum anti-obsolescence insurance.
* True Beam Current Test Circuit checks all CR Tubes with Electron-gun in operation. It is the Electric Beam (and NOT total cathode emission) which traces the pictures or pattern on the face of the CR tube. Total cathode emission can be very high and yet Beam Current (and picture brightness) unacceptably low. The CR-30 will reject such tubes because it is a true Beam Current tester. Conversely, total cathode emission can be low and yet Beam Current and picture brightness perfectly acceptable. The CR-30 will properly pass such tubes because it is a true Beam Current tester. The significance of the above tests is the fact that Beam Current (and picture brightness) is primarily associated with the condition of the center of the cathode surface and not the overall cathode area. (See illustration below)

* Voltage Regulated, Bridge Type VTVM provides the heart of the super-sensitive tube quality test circuit. Such high sensitivity is also required for positive check of very low current anodes and deflection plates.
* Micro-Line Voltage Adjustment Meter-monitored at filament supply.
* Accuracy of test circuits closely maintained by use of factory adjusted internal calibrating controls, plastic insulated, telephone type cabled wiring; highest quality, conservatively rated components.
* Built In, High Speed, Roller Tube Chart.
* Test Circuits Transformer: Isolated from Power Line.
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* Heavy Gauge Aluminum Panel etched and anodized.
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RADIO-TELEVISION SERVICE DEALER • JANUARY, 1951
BOOK REVIEWS

[from page 31]

theory are duly treated mathematically, yet the basic theory is explained in language so simple and analogies so clear that a high school student can understand it. The author writes well, his style being one of ease and facility of expression which helps him convey his thoughts to his readers so that the reading itself becomes almost as fatiguing as when reading a novel.

S. L. M.


Service data on the following products is presented in this Manual: Admiral, Crestwood, Eicor, Markel, Musco, Milwaukee, Oak, Philco, RCA, Silvertone, Travler, VM, Webster, Webster-Chicago, and Zenith.

Each unit is analyzed with respect to general information, operating instructions, change cycle, adjustments, troubles, and lubrication. Illustrations include top and bottom views to more clearly explain the subject matter discussed under the above topics. In addition, a parts list is supplied with each unit with reference numbers corresponding to the part numbers appearing in the various illustrations. Circuit diagrams are given where required.

Servicing technicians will find this Manual valuable aid in the repair, adjustment and maintenance of record changers and recorders described in this book for many reasons: First, because of the technical information contained within its covers; and second because of the clear and well-defined methods of presentations. The evident planning entering into its preparation, examples of which are the excellent "exploded views" of the complete mechanisms, should be reflected in speedier and more lasting repairs made by the serviceman.

S. L. M.

BOOSTERS

[from page 31]

this receptacle they will automatically turn on and off greatly simplifying operation. For mounting on the popular fringe area R.C.A. 630 T.S. see Fig. 4B for dimensions.

Simultaneous Demonstrations

The problem of simultaneous demonstration of more than one TV set from one antenna in fringe areas is not practical with the conventional methods which employ pads or isolation amplifiers as the weak signal cannot be sacrificed in any way.

The following method is quite successful and no noticeable decrease in signal strength is apparent. Refer to Fig. 5. Line #2 to receiver #2 is inductively coupled to line #1 to receiver #1. This coupling must be made between the final booster and receiver #1, otherwise an effective transfer of energy will not take place.

About three inches of line #2 is laid
Krylon is liquid magic that puts dollars in your pocket. Thousands of service dealers from coast to coast are using it on every installation. It cuts down service calls and builds good will—because it's an important aid to keeping picture quality at its peak. You measure its cost per installation in pennies.

Krylon is an acrylic plastic coating, packaged in 12 oz. aerosol dispensers. All the service man needs to do is press a button and spray it on. It dries in a few minutes to form a permanent protective coating of high dielectric strength.

Spray Krylon on the antenna and antenna leads... it seals them against the rust and corrosion that can ruin picture quality. Spray it on high voltage wiring and transformers... it helps prevent corona and breakdown. Two types—clear and non-conducting aluminum. Stock both, because you'll need both. List prices: clear $1.95, aluminum $2.25 per 12 oz. spray can. Also available in gallons for application by brushing or dipping.

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for the installation. Some dealers, however, install the units without extra charge, finding that this makes it easy to make the sale.

Contrast that with the profit a service dealer makes for the time and energy he puts into repairing a failing one-speed unit.

Nor do his sales end with the replacement unit. Plug-in phonograph units, too, can be sold on television repair calls where the customer has no phonograph. There are more table-model television sets in homes today than console models with phonographs. Many of the owners of these table models have no phonograph but most of them would like to have one, if they could get one at a reasonable price. The serviceman on a TV call can casually mention that such units are available and give the prices. Here, his sales literature will be particularly valuable because the decision on such a purchase won't be as hurried as the decision on whether to buy a replacement unit or to get the old unit fixed, which requires a quick answer. It will probably be made after he leaves; a graphic piece of sales literature left with the prospect can do the final selling job. Profits and prices on these units generally run about the same as those on the replacement units but here the service-man usually doesn't need to bother with the installation, since the units are simply plugged into a television set or radio phono jack.

If the service dealer can conduct a direct-mail program in connection with his sales campaign on replacement and plug-in changers, it will increase the returns. Webster-Chicago and some of the other replacement changer manufacturers have literature available that can be simply imprinted with the service dealer's name and mailed to everyone who has had a single-speed phonograph repaired in the last few years or has acquired a table model TV set recently.

---

The divider network that does away with the use of separate transmission lines when high and low channel antennas are mounted on the same mast.

**SAVES**
- 300 ohm transmission line
- installation time and money
- extra accessory costs

The Mighty Match is a remarkable development. With Mighty Match two antennas can be operated with a single transmission line. Everyone benefits from it — dealer, serviceman and user. Mighty Match eliminates the need for two separate transmission lines from high and low channel antennas mounted on the same mast — thus saving 1) transmission line, 2) installation time and expense, 3) extra accessories. The user gets a highly efficient installation that is also far better in appearance.

**How The Mighty Match Operates**

The Mighty Match isolates the high and low channel antennas by preventing the undesirable high frequency signal received by the low band antenna from entering the transmission line. The Mighty Match also eliminates the partial shunting effect of the high band antenna on the low.

**NOTE** Only 300 ohm transmission line throughout may be used with the VEE-D-X divider network.
UHF CONVERTERS

(from page 23)

The tuned circuits for the r-f amplifier stage and the first oscillator are of a copper foil slug tuned variety. Since the second oscillator is fixed in frequency, the only variable is a slug tuning its tank circuit which permits sufficient variation with proper adjustment. The output from the u-f tuner may be linked into the first stage of the picture i-f amplifier strip of the television receiver. If the television receiver uses a different i-f than the output of this converter, only the second local oscillator of the tuner needs readjustment. By means of the slug tuning, this frequency is adjustable through a ring sufficiently wide to allow the output to match the i-f of the picture amplifier.

The three u-f tuning elements are rather unique although there are many types of tuning elements which could cover this range. For example, butterfly tuners, rolled up transmission lines, and tuned transmission lines could be used to cover this frequency band. However, the ever-present problem of economics and space requirements as well as shielding has led to this rather physically simple tuning...
"Lend me a hand"

JOIN the MARCH OF DIMES
THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS
FRANKLIN D. ROOSEVELT"
arrangement. These tuning elements consist of very thin strips of copper foil mounted on bakelite tubes. This foil represents less than a full turn and its longitudinal shape is tapered to produce the desired tracking. As the slug moves in or out by means of its attached threaded screw, the frequency is varied. Tapered copper foil is used to obtain both a desirable tuning curve and the proper tracking of the radio frequency section and the oscillator. Fig. 7 illustrates the tuning curve and Fig. 9 is a drawing of one of these u-h-f tuning elements.

Since even a section of straight wire is an inductance in a u-h-f band, a coil can and does consist of only a portion of a turn in this frequency range. The electrical equivalent of these tuning elements is a slug tuned coil having a number of turns. Direct connection is made from these “coils” to the other circuit elements and vacuum tubes.

**CRYSTAL TRIODE**

(from page 20)

Fig. 9. Detail of u-h-f tuning element

The crystal triode is a simple, yet versatile relay. The GUARDIAN blades, a contact switch and a contact switch field piece. The recommended circuit symbol for the crystal triode is given in Fig. 3.

Applications

The crystal triode will be useful as a detector, amplifier, and oscillator. The CK 703 is recommended for use at frequencies up to the video range. Several circuits have been worked out for crystal triode amplifiers and oscillators. The simplest amplifier, perhaps, is the circuit shown in Fig. 4. While fixed emitter bias (batteries B₁ and B₂) is shown here, and may be obtained in each instance from a 1½-volt cell and low-resistance potentiometer, “cathode” bias (obtained by means of a suitable resistor in series with each CK 703 base lead) might also be used.

The crystal triode has the advantages of small size, light weight, simplicity, instantaneous operation, and...
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You “tune in" the
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DE-COUPLING
[from page 15]

Coupling network must be effective, the proper value of R and C must be chosen. A glance at Fig. 4 shows that the undesired 53 volts variation of the power supply, must be reduced below a point that will not exceed the amplified signal voltage of .75 volts appearing in the same phase across Rf. Under these conditions, no regeneration will occur. Assume that the frequency of the applied signal voltage to the 6F5 grid to be 200 cycles, which is the lowest frequency that the amplifier is expected to pass. Also assume that at this frequency, the coupling condensers do not affect the gain of each stage. Therefore, the voltage variation of the power supply occurs at a 200 cycle rate, and the de-coupling network must be designed for this frequency.

Values for R and C
The 53 volt variation must be reduced to a value below .75 volt, which is a ratio of 44 to 1. Therefore the capacitive reactance of the condenser in the network must be 1 the value of 44 of the resistor in ohms. If the resistor is chosen as 20% of Rf, the plate load resistor, then R of the de-coupling network equals 100,000 ohms, or 2270 ohms. This calls for a 35 µf coupling network to be effective.

32-6V.

100,000Ω

4V

33V

F = 200Ω

0.5 µF

3

4

5

Fig. 4—Voltage across .5 μf cap.

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105 West 72nd Street
New York, N. Y.

Therefore \( X \) must be 1 of this value
\[
\frac{2\pi F X}{\text{f}}
\]

Figure 6 shows an equivalent circuit of an a-c generator impressing 33 volts across \( R \) and \( C \) in series. \( R \) is equal to 100,000 ohms and \( C \) is equal to .5 \( \mu \)f. The reactance of the .5 \( \mu \)f con-
denser at this same frequency of 200 cycles is about 1600 ohms. Therefore the output voltage across \( C \) = .40
volts. Referring back to Fig. 4 shows
that the de-coupling network, placed in the plate supply lead of the 6F5 tube, will effectively reduce this in-
phase feed-back voltage to a negligi-
able value.

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