Get the "Tune-Up" flier from your Cunningham Distributor for the full story on the new "Tune-Up" campaign.

10 Million Radios Need Repair!

Cunningham's new "Tune-Up" campaign helps you tap this business

NOW... CUNNINGHAM OFFERS YOU an effective way to overcome the public's reluctance to have faulty radios checked... a year-round personalized campaign that tells your customers just what they will get for their money... and you name the price. Here's your chance to cash in on one of the greatest service promotion campaigns ever launched! Get the special flier that gives the whole story from your Cunningham Distributor.

ALWAYS KEEP IN TOUCH WITH YOUR CUNNINGHAM DISTRIBUTOR

A QUALITY PRODUCT OF THE RADIO CORPORATION OF AMERICA
NOW

A SMALL SIZE
VOLUME CONTROL

TO MEET THE REQUIREMENTS OF
MODERN AM, FM AND TV SERVICING

COMPACT 1\(\frac{3}{4}\)" DESIGN and 1\(\frac{1}{4}\)" long bushing permit easy installation in the most crowded chassis. Type Q Controls fit many smaller sets which will not take usual 3\(\frac{1}{4}\)" long bushing, yet are fully capable of handling larger set requirements.

KNOB MASTER FIXED SHAFT
fits 90% of AM, FM and TV \(\frac{3}{4}\)" shaft knobs. No alteration except cutting to length. Knurled, flatted and slotted to accommodate knurled push-on knobs, spring-type push-on knobs or set screw knobs. Ends spread for fitting oversize or worn knobs. 3" length meets television requirements. No shaft insert is needed.

RESILIENT RETAINER RING
permits removal of Knob Master Shaft and replacement with any of 11 special fixed shafts, in less than a minute, using only a pocket knife or screwdriver.

INTERCHANGEABLE FIXED SHAFT FEATURE
Gives widest coverage of replacement with nominal stock of controls. Eleven types of shafts let the technician meet many special requirements without expanding control stock. These shafts are sealed in cellophane and individually packaged.

CUSHIONED TURN.
New Resilient Retainer Ring contributes unusually smooth rotation. Your customers will notice the quality "feel" at once. Cushioned Turn does for IRC Q Controls what low-pressure balloon tires do for automobiles.

NEW TYPE
76 SWITCHES
designed and manufactured by IRC. Easily and quickly attached to any IRC Q Control.

STURDIER AND MORE BEAUTIFUL.
Rugged, molded control base and switch enclosure are colored distinctive IRC blue. All metal parts are non-ferrous material nickel-plated for lustrous finish and resistance to corrosion. Customers will like the Type Q's rich precision appearance.

IRC now offers Radio Technicians a new volume control carefully engineered to meet the needs of modern television and radio replacement. The new Type Q Control leads the field in practical convenience. It embodies outstanding constructional, electrical and mechanical features. Absolute uniformity is assured through the elimination of hand operations in manufacture, and by complete production testing.

SEEING IS BELIEVING
In an actual field test, IRC Q Controls and Interchangeable Shafts were demonstrated to a large cross-section of radio and television technicians. All were enthusiastic over the unique features of these revolutionary new controls. Because of their versatility, ease of use, and dependability, we believe they will become the most widely used controls in the industry.
A COMPLETE LINE
OF 59 TYPE Q CONTROLS
and 11 Special Shafts
GIVES YOU WIDEST SERVICE COVERAGE

Now, with IRC's versatile Q Control Line and Special
Fixed Shafts, you can service virtually every type of
small control requirement—in a minimum of time.
Ease of installation—even in crowded chassis; one-
minute replacement of shafts for specials; shaft and
bushing lengths to meet current radio and TV
conditions—all mean faster, easier servicing.

PLUS THESE EXTRA CONSTRUCTION ADVANTAGES

Every IRC Q Control, Knob Master Shaft, Interchange-
able Fixed Shaft or Switch is simply designed,
ruggedly constructed, safeguarded by complete pro-
duction testing. Control base is precision molded of
high strength, low moisture absorption bakelite.
Contractor is IRC patented one-piece dual unit of
thin high-stress alloy. One-piece collector ring and
center terminal are silver-plated brass. And the
resistance element is the best IRC ever manufactured!

FREE CATALOG
GIVES FULL
INFORMATION

For complete details of IRC's revolutionary new Type Q
Controls and Interchangeable Fixed Shafts, write us today.
IRC Q Controls mean easier AM, FM and TV servicing for you—
more convenience for you. Get the full story. Mail coupon
for our new Catalog DC-1.

INTERNATIONAL RESISTANCE COMPANY
401 N. Broad St., Phila. 8, Pa.

Please send me Catalog DC-1 giving full information
on new IRC Type Q Control.

Name
Address
City Zone State
DU MONT Type 16FP4

16"

ALL GLASS!!

- Fully in keeping with the trend towards larger, direct-viewing tubes originally pioneered by Dr. Allen B. Du Mont—and also the lower price range for higher grade TV offerings.

Type 16FP4 is a 16-inch magnetic focus and deflection television picture tube designed to give high brilliance and sharp definition. Electron gun design utilizes a bent electrode structure to be used with a single external magnet for the elimination of ion spot blemishes. The exclusive Du Mont screen depositing technique assures the longest pleasurable usage.

CHECK LIST OF 16 FP4 ADVANTAGES...

- All glass! No mounting problems.
- A mass-produced standard TV tube for maximum value at minimum cost.
- Overall length of only 20 1/4 inches.
- Deflection angle: 62°.
- Maximum diameter: 16 1/4 inch ± 1/8 inch.
- Bent-gun ion trap requiring but a single magnet.
- Accelerating potential: Maximum 16 KV; (Design Center Value).
- New type small shell duodecal 5-pin instead of 7-pin base, for use with economical half-socket.
- Ideal compromise between large picture size and moderate tube cost.

Detailed Specifications on request. Let us quote on quantity requirements.
CONTENTS

Newsletter ........................................................................... 7

Vertical Deflection Amplifiers in Oscillographs .......... Morton G. Scheraga 10
Here are the five specifications which will tell you how good an instrument you are buying

How to Check Audio Amplifiers ................................ Rufus Turner 12
Step-by-step procedures tell how audio amplifiers are serviced, and what instruments are used

What's New in Picture Tubes ........................................ Isidor I. Gross 14
A report on recent developments in picture tube design

Choosing the Right Antenna is Important ............... Martin Clifford 16
A summary of the antennas which are available to you to bring in that elusive signal

Using the Professional Touch ............................... Henry H. Huff 20
The techniques used by one sales and service organization to increase business and profits

Electronically Speaking ................................................. 24

Trade Literature ................................................................. 35

Industry Presents ............................................................. 37

ADVERTISING REPRESENTATIVES

Eastern
Herbert J. Olsow
480 Lexington Ave.
New York 17, N. Y.
Plaza 1-0661

Midwestern
Stuart J. Osten
333 No. Michigan Ave.
Chicago 1, III.
Dearborn 2-3507

Copyright 1949, Boland & Boyce, Inc.
Radio Distribution and Maintenance is published monthly by Boland & Boyce, Inc., at 34 No.
Crystal St., East Stroudsburg, Pa., U.S.A.; Executive and Editorial Office, 460 Bloomingdale Ave.,
Mountair, N. J. Subscription Rates: In U. S., Mexico, South and Central America, and U. S.
possessions, $3.00 for 1 year, $5.00 for two years, single copies 25 cents; in Canada, $3.50 for 1
year, $6.00 for two years, single copies 30 cents; in British Empire, $4.00 for 1 year, $7.00
for 2 years, single copies 45 cents; all other foreign countries, $5.00 for 1 year.
Entered as second class matter June 15, 1949, at Post Office, East Stroudsburg, Pa., under
the Act of March 3, 1879.
Change of address: Four weeks' notice required for change of address. When ordering a
change, please furnish an address stencil impression from a recent issue if you can. Address
changes cannot be made without the old stencil as well as the new one.

For YOU! from SPRAGUE

New Booklet to BUILD BETTER SERVICE BUSINESS

• Gives customers a new appreciation of your service facilities
• Helps you avoid "cut-throat" price competition

"Your Money's Worth in Good Radio and Television Service" is the title of this new 16-page booklet now made available by the makers of Sprague Capacitors and Koolohni Resistors for distribution to your service customers and prospects under your own name!

Profusely illustrated, finely lithographed in two colors, the booklet will help you win customers, justify fair service prices and meet "cut throat" competition that is springing up on all sides. It tells owners about the complexities of today's radio and television equipment and about the extensive service facilities needed to keep receivers in first class working order.

In short, it is a book designed to win confidence for you by showing customers how complicated the work really is and by proving to them exactly how and why good service work commands a fair price.

Write for FREE SAMPLE

Dept. RM-109 Sprague Products Co.,

Please rush free sample of the new booklet "Your Money's Worth in Good Radio and Television Service" and tell me how I can obtain additional copies for distribution to my service customers.

Name ___________________________
Address _______________________________________
City, Zone, State ____________________________
Now music can come to life for everyone— for in the new Jensen Genuine Wide Range Loudspeaker series, there is a choice of cost, size and degree of performance to meet every requirement for thrilling, realistic reproduction. Whether it be a 5" loudspeaker at $8 list, a 12" Coaxial at $33.40 list, or a 15" Coaxial with the new Jensen Wide-Angle Acoustic Lens listing at $135, you will find totally new concepts of performance, way ahead of conventional speaker reproduction, brilliantly engineered and painstakingly constructed into these new products.

Write now for Data Sheet No. 152 describing all the new loudspeakers in the Jensen Genuine Wide-Range series, and booklet "Let Music Come to Life!"

Typical of Jensen leadership in loudspeaker engineering is the new acoustic diverging lens used on the H-510 Coaxial illustrated above. Adapting optical principles to acoustics, this lens acts in conjunction with the h-f horn to distribute h-f radiation uniformly over a wide angle, insuring constant balance and high quality reproduction throughout the whole room.

This trademark identifies an advanced-design loudspeaker with performance to meet today's exacting requirements for faithful music reproduction—achieved through the most modern applications of acoustics.
Television Channel allocations continue to be the biggest news in the industry, as the FCC proposals meet opposition from many quarters.

ABDuMont declared that the FCC assignment proposals, if adopted, might result in a one-network monopoly of television. DuMont's T. T. Goldsmith had a solution ready. Main features of his plan...

* It would minimize the intermixture of VHF and UHF assignments, and consequently the requirements for converters and other additional equipment.
* Most metropolitan districts would have four or more channels.
* It would reserve 12 channels for future assignments to small communities, and 9 for non-commercial educational use.

Communications Measurements Laboratory, Inc. also found fault with the FCC proposal. CML proposes that the FCC move all television broadcasting into the UHF band, vacating the VHF band entirely.

The company claimed that use of both bands would complicate future receivers because they would be required to operate over an enormous band of frequencies.

CML pointed to the shift of FM as an example and said that the time to make the change is now.

Such a plan, if adopted, would have the opposite effect of the DuMont plan in that everyone now owning a receiver would need a converter.

The RMA and several others filed statements with the commission.

While all this activity left the average observer slightly bewildered one thing remained clear... it will be some time before the Commission can reach decisions which will enable it to lift the TV freeze.

Color Television has been stirring up a great deal of feverish activity in many parts of the industry.

CBS filed the details of its system with the FCC and as it prepared to demonstrate it at the hearings...

RCA filed the details of its all electronic system.

Said RCA of its system:—no changes in present black-and-white transmission standards are necessary, performance is equivalent to present black and white, present sets could receive color programs in monochrome without modification, color programs could be received either on special receivers or existing receivers with an adaptor.

Since it would not require changes in standards or cause present receivers to become obsolete, RCA's system seemed to meet all Commission requirements and, from the description released by the company, was superior to the CBS system.

As CBS, RCA, and a third contender, Color Television, Inc., prepared to
demonstrate in Washington, Dr. DuMont requested permission from FCC's Wayne Coy to install commercial black and white receivers alongside the color receivers in order to compare the quality of the various color systems.

In response, Mr. Coy called a meeting to prepare a schedule for comparison tests.

With the possible exception of CBS, the industry agreed that no matter what took place at the hearings, color was years away as far as the public is concerned.

Nevertheless, fear persisted that the public might not see it that way and continue to hold on to its purse strings.

The industry's efforts to acquaint the public with the facts were looked upon with suspicion in some government quarters.

RMA answered the industry's critics in its statement to the FCC. Wrote RMA: The industry does not oppose the development of a sound and thoroughly tested system of color television. The industry has not retarded nor opposed the development of color. on the contrary, has spent many millions of dollars and years of time in experiments and research.

Members of the Pennsylvania and New York State Federations are staging a "Preventative Radio Maintenance Month" during October. Local distributors, broadcast stations, and manufacturers' reps are cooperating with the State Federations.

Sales of Philco's new teleset line are exceeding expectations, according to the company.

ABDUMont Labs report 87% increase in sales over 1948 for 24-week period ending June 19. This is a good indication of the kind of progress television is making, since this firm is producing almost exclusively for TV.

Motorola August & September teleset deliveries were 103% above same months of last year.

The company hired an additional 1,000 workers in August, bringing the number of its employees to 4,500.

Raytheon, which has been producing and marketing telesets on a small scale for some time, announced that it will enter the market on a national scale.

Samples of its new Belmont Line: a 7" table model at $129.95; a 16" table model at $289.95.

G-E announced a price reduction on its TV sets—lowest in their line is $189.95 ten-inch table model.

Altec-Lansing, which to date has been producing a TV chassis for custom installation, announced that it will enter the "high end of the high-quality market" with a new line of TV sets.

Capeheart-Farnsworth demonstrated a wired television system for use in industry. The equipment will permit one person to observe activity at several distant points and in places he could not ordinarily see.

Sylvania announced a price protection policy to cover period of August 31 to October 31. It provides for reimbursement to distributors of losses due to price declines within 60 days after receiving tubes shipped during the protection period. According to company, the chief beneficiary will be the radio and TV service industry.

Standard Transformer also announced price protection policy. Will protect distributors against loss for period of 90 days from date of shipment.
Here are some of the many reasons why there are more Simpson 260 high sensitivity volt-ohm-milliammeters in use today than all others combined. The Simpson 260 has earned world-wide acceptance because it was the first tester of its kind with all these “Firsts”:

**Simpson 260 SET TESTER**

**WORLD FAMOUS FOR ALL THESE "FIRSTS"**

- First high sensitivity instrument to use a metal armature frame.
- First to use fully enclosed dust proof rotary switch with all contacts molded in place accurately and firmly.
- First to do away with harness wiring.
- First to provide separate molded recesses for resistors, batteries, etc.
- First to cover all resistors to prevent shorts and accidental damage and to protect against dust and dirt.
- First with a sturdy movement adapted to the rugged requirements of a wide range of service work or laboratory testing.
- First to provide easy means of replacing batteries.
- First to use all bakelite case and panels in volt-ohm-milliammeters.
- First voltmeter to cover all resistors to prevent shorts and accidental damage and to protect against dust and dirt.
- First to provide convenient compartment for test leads (Roll Top case).
- First to offer choice of colors.

*RANGES*

- **20,000 Ohms per Volt DC, 1,000 Ohms per Volt AC**
- **VOLTS**: AC & DC—2.5, 10, 50, 250, 1,000, 5,000
- **OUTPUT**: 2.5, 10, 50, 250, 1,000
- **MILLIAMPERES, DC**: 10, 100, 500
- **MICROAMPERES, DC**: 100
- **AMPRES, DC**: 10
- **DECIBELS**: (3 ranges)—12 to + 55 DB
- **OHMS**: 0-2,000 (12 ohms center), 0-200,000 (1200 ohms center), 0-20 megohms (120,000 ohms center).

*Prices*: $38.95 dealers net; Roll Top $45.95 dealers net.

---

The Model 260 also is available in the famous patented Roll Top safety case with built-in lead compartment. This sturdy, molded, bakelite case with Roll Top provides maximum protection for your 260 when used for servicing in the field or shop.

25,000 volt DC Probe for television servicing, complete, for use with 260, $12.85

**SIMPSON ELECTRIC COMPANY • 5200-18 W. Kinzie St., Chicago 44, Ill. • In Canada: Bach-Simpson, Ltd., London, Ont.**

RADIO DISTRIBUTION AND MAINTENANCE • OCTOBER 1949
The primary function of a cathode-ray oscillograph is to provide a means for plotting a visual curve of an electrical signal on the fluorescent screen of a cathode-ray tube. In the conventional oscillograph, the electrical signal is applied to the vertical deflection plates of the cathode-ray tube. Another signal, generated inside the instrument, is applied to the horizontal deflection plates in order to produce a time base.

Unfortunately, the cathode-ray tube itself is a relatively insensitive device and potentials of the order of several hundred volts must be applied to its deflection plates for full scale deflection. Most oscillograph uses for f-m and television servicing involve signals of much lower potential, and an amplifier is therefore necessary.

As pointed out above, the electrical signal is applied to the vertical deflection plates. The amplifier which is interposed between the signal and this set of plates is called the vertical, or Y-axis deflection amplifier. This article deals with the characteristics of the Y-axis amplifier and how they affect the techniques employed in servicing various sections of the receiver.

Simple Y-axis Amplifier

The Y-axis amplifier in low cost oscillographs has generally a frequency response from 30 cycles to 50 kc. Usually, a single amplifier stage, of the type shown in Fig. 1, is sufficient to cover this range. Certain points in the design of this simple amplifier are of interest.

Since an ordinary resistance-capacitance coupled amplifier stage does not provide sufficient bandwidth, some form of low and high frequency compensation must be employed. High frequency compensation is secured by placing a suitable inductance, L1, in the plate circuit. Its function is identical to similar inductances utilized in the video amplifiers of television receivers. L1 adds a reactance which increases with frequency. Stray capacitances and interelectrode capacitances of the vacuum tube have the effect of decreasing the plate load impedance as the signal frequency is increased, therefore attenuating the higher frequencies. For this reason, L1 is employed to increase the load impedance at high frequencies and thus maintain the amplifier gain.

Another method of obtaining high frequency compensation in amplifiers of this type is to use a small cathode bypass condenser, between 0.001 mmf and 0.01 mf. At low frequencies, this capacity is insufficient to give adequate bypassing, and cathode degeneration results. This produces less gain than would be obtained with a fully bypassed cathode resistor. At higher frequencies, where the gain of the stage would start to drop off, the bypassing action becomes more effective. The cathode degeneration is eliminated and the gain of the amplifier is raised to compensate for the loss caused by the stray capacities shunting the plate load resistor, R1.

Low frequency compensation takes the form of resistor Rf and capacitor Cc. These components, and Cg and Rg, are chosen for optimum low frequency response.
In addition to frequency response, the gain of the Y-axis amplifier is also important. It is convenient to express the gain of an amplifier in an oscillograph by deflection sensitivity. This is the number of volts required at the input of the amplifier to produce one inch of deflection on the screen of the cathode-ray tube. For example, if the Y-axis amplifier of an oscillograph is said to have a deflection sensitivity of 1 volt peak/inch, it means that a signal, having a peak-to-peak amplitude of one volt, will produce one inch of deflection on the screen. Sometimes the deflection sensitivity is expressed in terms of rms volts per inch, which means that the root-mean-square value is used. To obtain the peak voltage from the rms value, multiply the latter by 2.8.

Simple, single stage amplifiers, such as shown in Fig. 1, have deflection sensitivities of about 0.5 volts peak/inch when coupled to a cathode-ray tube operating at about 1000 volts accelerating potential. For television servicing, it is desirable to have an oscillograph with a sensitivity at least ten times higher, or 5 millivolts peak/inch, otherwise special techniques, which will be described later, must be employed when using lower gain instruments.

It will be noted in Fig. 1 that the Y-axis amplifier is connected to one deflection plate, while the other plate is grounded. This type of circuit is called a single-ended, or unbalanced deflection amplifier, and is generally confined to the smaller, more inexpensive oscillographs. When a signal is applied to only one plate of a deflection plate pair, it is ordinarily not possible to properly focus the resultant trace across the entire screen. The focus control on the oscillograph may be adjusted in order to focus some particular portion of the trace, but then some other portions will be defocused. This effect is compensated for in more expensive oscillographs which employ push-pull amplifiers to feed both deflection plates.

**High-Gain, Wideband Amplifiers**

The properties of an amplifier are such that the higher its gain the narrower is the bandwidth, and visa versa. The gain of an amplifier is determined mainly by the value of the plate load resistor, and is higher for greater values of resistance. On the other hand, the high frequency response is reduced as the load resistance is increased. In designing an amplifier, it is necessary to compromise on gain if one wants a wideband amplifier, or to reduce the bandwidth if a high gain amplifier is desired. Of course, a high gain, wideband amplifier can be built, if one wishes to employ a sufficient number of wideband, low-gain stages.

To increase the gain of the amplifier system shown in Fig. 1, it is necessary only to add another stage or two of similar design. If a wider...
EFFICIENT audio amplifier testing calls for checking of (1) frequency response, (2) gain, (3) distortion, and (4) power output. No overhaul of p-a equipment may be considered complete unless these four performance characteristics have been examined by the technician. Instruments required for complete amplifier testing are (1) sine-and square-wave audio oscillator tuneable from 20 cycles to 20,000 cycles, (2) a-c vacuum tube voltmeter, (3) electronic switch, and (4) oscilloscope. They are shown in Fig. 1, set up for amplifier checking.

The several test instruments are employed in various ways to check the amplifier characteristics. The connections shown in Fig. 2, 3, and 4, and the simple methods of making the tests will be described in this article. Each of the measurements are explained separately in the following paragraphs.

**Gain Measurement**

A sine-wave audio oscillator and a-c vacuum tube voltmeter are required for this test. The apparatus setup is shown in Fig. 2. Connect the output of the oscillator to the input terminals of the amplifier under test. Connect the regular loudspeaker to the amplifier output terminals. If it is desired to keep the test noiseless, replace the speaker voice coil with a resistor (preferably non-inductive) having the same resistance as the voice coil impedance and a wattage rating equal to twice the expected power output of the amplifier. Arrange a double-throw switch, S, so that the voltmeter may be switched back and forth between the input and output terminals of the amplifier.

Either overall gain (that is, for the entire amplifier) or gain per stage may be checked. To measure overall gain:

1. Set the amplifier gain control for maximum gain.
2. Set the amplifier tone control to its middle (flat-response) position.
3. Switch the meter to the input position 1.
4. Adjust the oscillator output control to give a small, readable deflection of the meter. Record this voltage as $E_1$.
5. Switch the meter to output position 2 and record its new reading as $E_2$.
6. Divide $E_2$ by $E_1$ to obtain the overall voltage gain.

If distortion, such as plugging or blocking occurs, it will be necessary to reduce the oscillator output. If the reduced output voltage then is too low, it will be necessary to reduce the oscillator output. If the reduced output voltage then is too low, it will be necessary to reduce the oscillator output.
small to give a readable deflection on the lowest range of the v.l.v.m., install a 10-to-1 or 100-to-1 resistance-type voltage divider between the oscillator output and amplifier input. Connect contact 1 of the switch \( S \) to the input terminal of the voltage divider. Note the meter reading and divide this value by 10 or 100 (according to the voltage divider ratio) to obtain \( E_1 \). Output voltage \( E_2 \) is obtained in the manner described in the preceding paragraph.

Repeat the gain measurement at several oscillator frequencies such as 100, 1000, and 10,000 cycles, and at several selected settings of the amplifier gain control and tone control.

To check separately the voltage gain of any stage in the amplifier apply the oscillator signal voltage to the grid input of the stage under test and check the input voltage \( E_1 \) and output voltage \( E_2 \) (the latter at the plate output terminal of the stage). Divide \( E_2 \) by \( E_1 \) to obtain the stage gain. When coupling transformers are present, make them a part of the measurement circuit. For example, where both input and output transformers are employed in a single stage, apply the signal to the primary of the input transformer and connect the meter to the secondary of the output transformer. When checking stage gain, an isolating capacitor (0.1 mf, 600-volt tubular) should be connected in the “high” output lead of the oscillator to prevent any d. c. in the circuit under test from entering the oscillator.

If an a. c. vacuum tube voltmeter is not available, an oscillograph may be used in its place, as shown in Fig. 3. The screen of the oscillograph must be calibrated in voltage. In this way, input voltage \( E_1 \) and output voltage \( E_2 \) may be read by measuring the height of the wave pattern on the 'scope screen.

Still another apparatus setup for gain testing is shown in Fig. 4A. With this arrangement, both the input and output voltage waves appear simultaneously on the oscilloscope screen and the height of each may be measured separately to determine the \( E_1 \) and \( E_2 \) values. The electronic switch used in this setup is a tube-type instrument which rapidly switches the 'scope input back and forth electronically between the input and output terminals of the amplifier, actually building up both input and output signals in little bits on the screen. However, the action is so rapid that the eye sees only the completed picture rather than the patterns separately. In C the input and output patterns are superimposed. The technician can choose whichever he prefers.
what's NEW in PICTURE TUBES?

by Isidor I. Gross

Many manufacturers have announced new developments in picture tube design and material. The more important ones are reviewed in this article.

LAST year, when the shortage of picture tubes was acute, manufacturers had as their slogan: More Picture Tubes. Today when supply has caught up with demand, their motto is: Better Picture Tubes. Quite a number of improvements in picture tube design have been effected during the past few months, most of them intended to enhance the quality of the picture as it appears on the screen and thereby reduce the incidence of eyestrain. Some of these developments will be discussed here.

New Glass

Two of the problems which face the televiewer are the effect of ambient light (i.e., the external light in a room, for example) on the contrast of the picture, and a phenomenon known as halation (discussed below).

In order to achieve good contrast in the picture, it is necessary that its black areas be really black. The reason for this is the fact that the television picture is composed of black areas, white areas, and different degrees of grey areas in between. It is clear that the greater the difference between the black and the white areas, the greater will be the possible number of shades of grey, and the higher the contrast. Increasing the blackness of the black areas would therefore be one of the ways to increase contrast. Black areas in television pictures, however, can only be obtained by the absence of light. For this reason, any light falling on the screen would normally change the black to a lighter shade, thereby reducing the overall range of contrast. It can thus easily be seen that one of the ways to increase contrast would be to keep the amount of external light which might fall on the picture tube to a minimum. But how?

Viewing the screen at night with radically reduced room illumination has been one of the ways the public has found to cope with the problem. But medical and optometrical authorities have agreed that this practice is detrimental to the health of the eyes.

Pittsburgh Plate Glass Co. has now developed a glass for use with metal tubes (called Teleglas) designed to solve this problem. The accompanying photograph shows how this is accomplished.

Two identical television receivers with some signal, photographed on same negative at Zenith Labs, illustrate the difference in contrast between the conventional type tube face and Teleglas. Tube to the left has conventional glass, tube at right Teleglas.

Teleglas also cuts down halation. Normally, light from a bright picture area of the tube striking the exterior tube surface at angles greater than 48° is 100% reflected over into the dark area, thereby diminishing contrast. The design of the glass is such that this reflection is held to a very low level. Fig. 2 shows how this is accomplished.

A company spokesman stated that Teleglas maintains a contrast of the order of 35 to 1 under widely varying conditions of room light. This means that the highlights of the picture would be 35 times brighter than the darkest shade obtainable.

Zenith has already adopted the glass (under the tradename "Gare-Ban") and other manufacturers with whom we have checked were experimenting with it prior to arriving at a final decision.

Coating

The problem of contrast was attacked from a different angle by American Television, Inc. They started with the observation that the
phosphorescent powder in the screen of the picture tube is of a crystalline nature. Now, when the electron beam hits these crystals, light is scattered uniformly in all directions. For best viewing results, however, light should be traveling only toward the observer. In the conventional tube, that part of the light not traveling toward the viewer goes either back into the tube or toward the surrounding crystals. The net result of this action is that the black areas in the picture seem to be grey and give a washed-out appearance. Fig. 3 shows what happens.

The task which the researchers set themselves was to devise a method whereby side dispersion of the light produced on the screen by the electron beam would be eliminated. They found that manganese dioxide (an opaque powder) combined with sodium metasilicate and mixed with the crystals, would give satisfactory results. The opaque powder acts in such a way as to confine the light emission of each crystal to that crystal alone, as shown in Fig. 4. This action prevents the scattering of light which has heretofore taken place, and as a result increases the contrast of the picture.

Incidentally, American Television Inc. engineers also found that opaque powders of various other chemical composition were equally suitable for this purpose.

This new coating has already been incorporated by Garod in its latest receiver models, and others may follow.

New Tube

Also concerned with the problem of contrast, but going beyond it, Dumont engineers developed the 19-inch 19AP4. They attacked the problem of better pictures via a process which they call “flow-coating.” This process involves the more uniform settling of the phosphorescent screen during the coating process, which brings about a reduction in the scattering of light by the phosphorescent crystals.

The tube, however, has some additional and more important features designed to improve picture quality. A very short neck gives it an overall length of 21½ inches, which makes it 2 inches shorter than the 15-inch tube. The result of the shorter beam throw in this tube is a more clearly defined spot and a sharper focus. The problem to be overcome in this design was one of increased power. Because of the short neck and the large screen diameter, wider deflection angles are required, and these can only be obtained with increased power.

The tube is also equipped with the “bent electron gun,” as contrasted with the “slashed field” in conventional tubes. The effect of the bent gun is that the electron beam is bent only once, instead of twice, as in earlier tubes. A single ion trap magnet (rather than the conventional two) is used. Since the electron beam is bent only once, distortion of the spot is considerably reduced. The bent electron gun combined with the shorter beam throw in the tube thus...
choosing the right antenna IS important

by Martin Clifford

TELEVISION technicians have come to realize that the success of an installation depends almost entirely upon the selection of the proper antenna, that it’s the antenna which finally determines the performance of the receiver. As a result there has been an increasingly strong interest on the part of the technician in the suitability of the various types of antennas for different installations; and we wish to devote this article to a discussion of some representative examples of practical television antennas which are available to the technician today.

Selection of the antenna is complicated by such factors as location, gain, selectivity, directivity, elimination of unwanted signals, reflections, interference, and finally the ability to receive either a particular station or stations. No wonder that some antenna installations look like—and almost are—engineering construction jobs.

The simplest of all our television antennas is the open dipole. In areas where there is only one station, and where the field strength intensity is good, this antenna has proven to be quite satisfactory. Its performance can be improved for greater signal strength and the reduction of ghosts through the use of a director or a reflector. Additional dipoles can be added if more than one station exists in the area, but the practice today is to have a low and a high frequency dipole in such cases. Both dipoles can be made to have a sufficiently low Q—and therefore broader bandwidth—for the frequency range to cover several stations.

Variations

All television stations radiate waves which are best received by antennas which are horizontal to the earth, because television transmitters radiate horizontally polarized waves. If buildings, trees, or other obstructions exist between the station and the receiver, particularly near the receiving antenna, the radio wave may be so altered that it may be necessary to change the antenna angle.

It also happens occasionally that a “direct” and a “reflected” signal combine at the receiving antenna. Where an ordinary horizontal type dipole antenna is used, this combination of signals produces a minimum of desired signal since one signal tends to cancel the other. In such instances we can use an adjustable V dipole antenna.

This antenna is simply a dipole whose arms may be moved up and down. In this manner it is possible to make the two signals combine in phase, thereby increasing the signal. The arms of the antenna are moved up or down until best overall reception is secured. Some adjustable V-antennas, particularly of the indoor type, have, in addition, a telescoping arrangement with which its arms can be made longer or shorter, thus physically tuning the antenna to a station.

The folded dipole is a variation of the open dipole. It has a broader bandwidth and a higher input impedance than the open dipole. This antenna is designed for use in areas of medium to high signal strength, or in cases where bidirectional sensitivity is desired. Where elimination of ghosts is necessary, a reflector may be added. The reflector, not electrically connected in any way to the dipole or the receiver, is placed behind the dipole, that is, on the side farthest away from the station. Low and high frequency dipoles, and their reflectors, may be combined into one antenna to serve those areas having television stations in both the upper and lower channels.

It’s customary to see the high frequency dipole placed above or below the low frequency dipole, each oriented separately for best reception. However, in areas where both the high and the low frequency stations are located in approximately the same direction from the receiver, both the low and high frequency dipoles may be placed in the same plane, that is, in line with each other. Having both dipoles in the same plane makes it
possible to have one reflector serve both.

The Array

In addition to reflectors, television antennas also use directors to increase directivity and gain. The director, like the reflector, is not electrically connected to the antenna. It is about 4% shorter than the antenna, and is placed between it and the television station. When an antenna is used with a reflector or a director, or a combination of both, it is called an array. Such arrays are used within the normal range of the television station, where it is necessary to discriminate against reflected or interfering signals within this normal service range. Combinations of two or more of these three-element arrays can be mounted on a single mast so that signals on separate channels can be received from different directions.

Where "line-of-sight", or clear optical paths do not exist between station and receiver, the technician must use more elaborate means to furnish the receiver with signals strong enough to give acceptable pictures. Particularly in fringe areas, multiple stacked arrays, such as that shown in Fig. 1 may have to be used. Four, and sometimes even six element arrays are used. For more severe requirements, a twelve-element array could be assembled, consisting of stacked six-element arrays. The six-element array shown in Fig. 1 consists of two basic three-element antennas aligned in the same direction, connected together by a special cable harness, and spaced one-half wave-length apart. The array is commonly referred to as a broadside array, and is capable of furnishing high gain and sharp directional pattern to bring weak television signals up out of the "snow" and discourage ghosting. While it is essentially single channel in terms of optimum reception, the stacked array shown in the illustration will accept adjacent channel signals with a slight loss of gain (about 2 db). Any interfering signal approaching from the rear will be reduced as much as 98%. Multiple array systems should, in some instances, employ guy wires, depending on the method of support.

The forward gain of such a multiple array is much greater than the conventional half-wave dipole and will produce a signal approximately six times as strong in power. The sharp directional pattern, combined with the advantages of shielded coaxial transmission line, means that the signal-to-noise ratio is greater.

Stacked arrays can be designed for reception of a limited number of television stations, whether in the low or in the high frequency range. In Fig. 2 we have a four-element high-frequency band stacked array consisting of two folded dipoles and reflectors. This antenna is designed to be used in areas of low signal intensity where only high band reception is desired. For all-channel work, a dual stacked array consisting of one low-band four-element array and one high-band four-element stacked array can be used. This antenna is designed for use in areas of low signal intensity (fringe areas) where reception of both low and high band stations is desired, as illustrated in...
Fig. 3 Individual transmission lines are suggested for use with this dual antenna to minimize inter-connector losses.

Matching Section

In Fig. 4 we have another of the antennas characterized by high forward gain, giving maximum pick-up in one direction, while affording minimum pick-up from the sides and rear, thus helping in the elimination of interference.

A unique feature of this antenna is a "Q" or matching section which affords a convenient and accurate method for matching impedances of the transmission line (which may be from 60 to 600 ohms) to that of the antenna, resulting in the elimination of ghosts and other undesirable char-

Fig. 7 The Radiant Tele-Rotor shown here provides a practical means of securing peak performance from a given antenna.
Sound Advice From One Serviceman To Another!

John F. Rider Publisher, Inc.
480 Canal Street
New York 13, N. Y.

Rumors are running around financial circles to the effect that a good many ex-G.I. radio men who have gone into business for themselves are practically starving to death. I can well believe such rumors since I was one of them for a year or two and I now believe in giving away my experience to help others who are in similar financial straits.

A man entering radio repair must have some working capital, a good knowledge of radio equipment, and a good reference library. That good reference library cannot be stressed too much, because the big jobs, the main jobs, and the tough jobs are dependent on that library.

Unfortunately there are quite a few radio wreckers operating, and the only complete key that I have found for telling those radio junkers is the use of Rider's manuals. If the manufacturer has made changes in the set, those changes are included in Rider's. In most cases other changes should be discarded and the radio re-assembled according to schematic.

The SPEED with which repair work is completed has much to do with income. In the interest of speedy repair I recommend Rider's. A customer who is pleased with the work done on his radio is paying a good price for it. Rider's manuals give the information on nearly every radio made and if used will mean pleased customers.

There are many shops operating without Rider manuals, and that is especially true of newcomers to the business. I am sure that many of the newcomers will find that an investment in a complete set of Rider's manuals will mean the difference between success and failure in their business.

I have written this with the hope that it will help some of the boys who are busy pulling out what little hair is left in their heads, and also with the hope that it will serve to help a lot of men improve their work and thus give a better name to our business.

Yours truly,
A. E. McCorkle

These RIDER books are the result of twenty years of specialized publishing for the Radio Servicing Industry.

Television Manual, Volume 3 (Plus "How It Works" and Index). $18.00
Television Manual, Volume 14X. $18.00
PA Equipment Manual, Volume CT. $18.00
"How It Works" and Index. $18.00
Volume XXI. $18.00
Volume XXII. $18.00
Volume XXV. $18.00
Volumes XIV to VI. $18.00
Volume VI. $12.20
Record Changers and Recorders. $18.00
Master Index, Covering Manuals, Vols. II. $18.00
TV Picture Projection and Extension. $18.00
Installation and Servicing of Low-Power PA Systems, 208 pages. $1.90
The QUILTER AT WORK. 238 pages, illustrated. $2.20
Automatic Frequency Control Systems. 144 pages, illustrated. $1.75
Servicing Superheterodynes, 368 pages, illustrated. $2.00
Servicing Receivers By Means of Resistance Measurements, 203 pages, illustrated. $2.00
Servicing Receivers By Means of Inductive Measurements, 203 pages, illustrated. $2.00
Servicing Receivers By Means of Capacitive Measurements, 203 pages, illustrated. $2.00
Servicing Superheterodynes. 288 pages. $2.00
Servicing High-Frequency Receivers. 288 pages. $2.00
"D.C. and A.C. Voltage Distribution". $2.00
"Resonance and Alignment". $2.00
"Automatic Volume Control". $2.00
"Noise and Alignment". $2.00
"A.M. and F.M. Reception". $2.00
"D.C. Voltage Distribution". $2.00
Receiver - What It Is. 72 pages, illustrated. $1.00
FM Transmission and Reception, by John E. Rider and Seymour D. Eisken. 194 pages, illustrated. $2.50
Broadcast Operator's Handbook, by Harold E. Ennes. 200 pages, illustrated. $2.50
THE RADIOMAN'S BROOM POINTED GUIDE. 32 pages, illustrated. $1.00
Inside the Vacuum Tube. 242 pages, illustrated. $4.50
Cathode-Ray Tube At Work. 338 pages, illustrated. $4.00
Servicing by Signal Tracing. 298 pages, illustrated. $4.00
Servicing by Signal Tracing. (Spanish Edition). 404 pages, illustrated. $4.00
Servicing Audio-Visual Systems. 180 pages, illustrated. $4.00
Understand Phonographs. 361 pages, illustrated. $6.00
Understanding Microwaves. 361 pages, illustrated. $6.00
A.C. Calculation Charts. 160 pages, illustrated. $6.00
High Frequency Measuring Techniques. Using Transmission Lines. 64 pages, illustrated. $7.50
The Meter at Work. 152 pages, illustrated. $7.50
The Radio Amateur's Beam Pointer Guide. 32 pages, illustrated. $1.00
JOHN F. RIDER PUBLISHER, INC. • 480 Canal Street, New York 13, N. Y.
Export Agent: Rocke International Corp., 13 East 46th Street, New York City • Cables: ARLAB
MURDER!

The front page is full of it! Turn the page quickly to these ads of ours. At least they won't depress you—and, who knows, you may become one of our happy customers!

“RADIO REBUILT” DIVISION

Wm. A. Holmin & Co.

Radio and Electronic Laboratories

Dial 4-5313 1010 Elm Street

The Atomic Bomb

has nothing on us when it comes to making things “radio active!”

“RADIO REBUILT” DIVISION

Wm. A. Holmin & Co.

Radio and Electronic Laboratories

Dial 4-5313 1010 Elm Street

BOOSTER BAIT!

We sort of like to cater to people who are fed up with ordinary radio service and come to us with a “chip on their shoulder,” as they put it. They always become our best boosters!

“RADIO REBUILT” DIVISION

Wm. A. Holmin & Co.

Radio and Electronic Laboratories

Dial 4-5313 1010 Elm Street

by Henry H. Huff

THE terms “repair” and “fixing” are never used by William A. Holmin & Co., Radio & Electronics Laboratories, Rockford, Ill. In its promotion work, as well as in its dealings with customers, the organization speaks only of “radio reconditioning.”

“When people call us they expect to pay more money than the so-called ‘radio repair shop’ would charge,” says Mr. Holmin. “Through our advertising and contacts with customers we have educated people to expect a professional job from us, not just the replacement of a tube or minor repairs. We sell them on the idea that a radio that has been in use a long time requires a thorough going-over, as well as replacement of worn or defective parts. It should be made to duplicate its original performance.

“To the customer, a radio is just a box with knobs which he turns to make it talk, sing, or play music. When the radio goes dead or loses volume, about ninety-five percent of the people think the trouble is simply a bad tube. If the radio service technician replaces a tube or repairs the part that is causing trouble, and does not give the entire receiver a thorough checkup, the customer is likely to get mad and blame the service man if the radio goes bad again. After the customer has paid once for having it fixed, he feels that it is the serviceman’s responsibility to keep it in repair if more trouble should occur a short time later. The later trouble, of course, may have nothing to do with the original breakdown. That is the reason our company re-
PROFESSIONAL TOUCH

gives the customer confidence in your sales and service, and
increases his respect for the radio service industry. Here's
the story of a firm that tried it and found it worked

fuses to take 'repair' jobs. We in-
sist on a thorough reconditioning."

The Holmin radio service includes
everything required to put a receiver
into an electrical condition equal to
or better than it was originally. Not
only defective parts are replaced, but
the fatigued ones as well. If a by-
pass condenser is a bit leaky, all by-
pass condensers are replaced. In ad-
dition, new filter condensers and con-
trols, etc. are provided. When the
set comes in for reconditioning, it is
inspected as thoroughly and as con-
scientiously as though it were Mr.
Holmin's own personal radio.

The Professional Touch

A radio technician cannot build a
reputation around a "fix-it" shop.
"We Fix Radios" is a sign which
implies that minor adjustments are all
that is required to put a radio in
working order. The customer feels
that a tube replacement or simple ad-
justment will usually do the trick
and expects to pay only a small fee
for the work. As a result, the repair
man just fixes what is immediately
causimg trouble, although something
else may develop after the radio has
been back in the home a few days.
By making a profession of radio re-
conditioning, one can assure the cus-
tomer of continuous and satisfactory
service from the set. When this is
explained to him, he usually agrees
that it is better to pay a sufficient
amount for lasting service than
smaller amounts repeatedly as various
defects show up.

Mr. Holmin believes that it is a
function of the trade to elevate the
ideas of the public about radio serv-
icing. From experience with radio
shops, it is the impression of many
people that minor adjustments will
usually start a radio working again.
Once they have become educated to
the fact that a radio is a complicated
machine which requires professional
knowledge, they are not inclined to
think of reconditioning as a minor
matter. They are willing to pay
higher prices for such work when
they understand what it involves to
do a first-class job.

About Giving Estimates

William A. Holmin & Co. never
give customers estimates on the cost
of reconditioning a radio. People
like to know in advance what the
job will cost, so an exact price is
quoted. This avoids quibbling over
the price when the work is finished.
The firm is prepared to state the cost
of a job over the telephone, even
without seeing the set. This is ac-
complished by inquiry as to the make
of radio and the model. They have
an established price for recondition-
ing any set, the only exception being
that the set must have had normal
care and use. The price would not
apply if the radio has parts missing
or has been in a fire or accident.

When a type of radio is encoun-
tered on which the firm has had no
previous reconditioning experience,
reference is made to the standard
manuals describing the make and
model number of the radio and its
construction. Records of previous
jobs reveal what any set is likely to
require to put it in "like new" order.
When the reconditioning job is com-
pleted, the customer gets a list of
parts used, but parts and labor are
not individually itemized. This has a
psychological effect on the custo-
mer, inspiring confidence. Because
people become accustomed to the in-
ferior reception of a set that has lost
its efficiency, they frequently assert
that an instrument which has been
reconditioned in the Holmin shop
sounds "better than new."

Advertising Campaigns

By imparting to its newspaper ad-
vertising a "professional" appear-
ance, the company leads its cus-
tomers to expect really first-class work.
It attracts the better type of cus-
tomers. As the firm also manufactures
custom-built radios, it identifies its
reconditioning service as the "Radio
Rebuilt" division. Their newspaper
ads have ample white space and a
catchy heading to intrigue readers.
Some of the headings in recent ads
are: "The Man Said . . .," "Booster
Bait!" "The Atomic Bomb," all of
which arouse curiosity and induce
people to read further. A light face,
dignified type is used in the ads.

Bill Holmin has virtually grown
up in the radio business. At the age
of 12 years, he constructed crystal
sets. Upon his return from military
service, he started his present busi-
ness. "After all, people think of you
what you think of yourself," he says,
"by treating radio reconditioning
business as a profession, they are
willing to pay the prices that pro-
fessional work justifies." The growth
of Wm. A. Holmin & Co. is proof
that people like good work and are
willing to pay what it costs. This
firm's success may offer inspiration
for others in the trade.
Vertical Deflection Amplifiers

→ from page 11

A wide-band amplifier is desired, then the plate load resistor must be reduced in order to obtain a better high frequency response. A typical wide-band amplifier is shown in Fig. 2. Because of the low value plate resistors employed, it is difficult to obtain sufficient voltage to deflect the cathode-ray tube with single-ended deflection. Therefore, push-pull output stages are employed. Many of the phase inverting circuits used at audio frequencies are not suitable at video frequencies, and almost all oscillographs having push-pull amplifiers use the cathode-coupled, self inverting output stage shown in Fig. 2. In this circuit, the signal applied to the grid of V1, produces across the common cathode resistor, R1, a voltage wave of the same shape and polarity, but of approximately half the amplitude, as the input. This voltage is used to drive V2. Since it is a degenerative voltage for V1, the effective voltage between grid and cathode of this tube is approximately half of the input voltage. Thus the input voltages of the two tubes are of nearly equal, but opposite polarity with respect to the grids. Thus, the outputs of the circuit are two voltages of approximately the same amplitude and opposite polarity. The plates of the two amplifiers are directly coupled to the deflection plates of the cathode-ray tube to prevent attenuation of the low-frequency signals. This type of push-pull arrangement is employed in higher priced oscillographs.

Gain Controls

It is necessary to provide the Y-axis amplifier with some type of gain control in order to adjust the size of the pattern on the screen. The simplest method of obtaining a gain control is to put a high resistance potentiometer in front of the amplifier, as shown in Fig. 3. This is the method employed in low cost oscillographs. The use of such an attenuator has certain disadvantages, particularly extreme high frequency discrimination at intermediate settings of its movable arm. As shown in Fig. 3, the distributed capacitances, C1 and C2, produce a voltage division at the higher frequencies. This voltage division is essentially constant and independent of the setting of the potentiometer arm. Thus, as the position of the potentiometer arm is changed, the relative voltage division across the sections of the potentiometer and the fixed, stray capacitances will differ, producing serious frequency discrimination. Although this frequency discrimination could be reduced by using a low-resistance gain control, the loading upon the circuit under test would be excessive.

The oscillograms of Fig. 4 illustrate what may happen if a square wave signal is applied to an oscillograph which has an amplifier with a high resistance gain control. The response in 4A is obtained when the gain control is at maximum position, while that in 4B is obtained with the control at an intermediate position. It shows distortion produced by the narrower bandwidth characteristic of the gain control. If this oscillograph were used for square wave testing of a television receiver, it would be impossible to tell whether the high frequency distortion of the square wave is caused by the received amplifier or the oscillograph amplifier.

A solution to this difficulty is to provide an input attenuator with fixed steps and adjustable capacitance elements, as illustrated in Fig. 5. This scheme will permit individual adjustment for each attenuation ratio, maintaining uniform voltage division over a wide frequency range. Obviously, this cannot be used as
The Offer Still Stands!

Only '18.73 Down Puts the Complete Photofact Library in Your Shop Today...

NOW—the new “Pay-as-you-Profit” Plan brings the famous photofact Library within the reach of every Serviceman! Now you can easily own the world’s finest radio service data—seven complete volumes, plus continuous photofact Folder Set service—full coverage of all post-war AM, FM and TV models! Everything you’ll ever need for quicker, more profitable servicing! You pay only $18.73 down—the remainder in small monthly payments. Absolutely no carrying charges and no interest! Make the down payment—and you get the complete Library immediately. Your Jobber has all the details of this amazing new purchase plan. See him today, or write us direct for full information.

Get the Easy-Pay Details Now!

CURRENT PHOTOFACT BEST-SELLERS

The Recording and Reproduction of SOUND, by Oliver Read. The complete, authoritative treatment of the entire subject of Sound, written by the editor of Radio & Television News. .............. $5.00

Photofact Television Course. The book used by thousands; gives you a clear understanding of TV principles, operation and practice. $3.00

Television Antennas. Shows you how to select and install the proper antenna, and how to overcome antenna problems. .............. $1.25

1948 Record Changer Manual. Covers 45 models made in 1948, including new LP and dual-speed changers, plus leading wire recorders. Based on actual analysis of the equipment. .............. $6.75

Auto Radio Manual. Complete Photofact service data on more than 100 post-war auto radio models—a time-and-money-saver. $4.95

SERVICEMEN: We’ll Prove You’ll Save Time, and Earn More with PHOTOFACT!

We’ll Send You Absolutely FREE

Any PHOTOFACT Folder Listed in the PHOTOFACT Cumulative Index!

NOW—learn for yourself—at our expense—how photofact will make your service work quicker, easier, more profitable! Examine an actual PHOTOFACT Folder. Use it. You’ll learn first-hand why this indispensable service data is used daily by over 25,000 successful service technicians. You’ll discover quickly that no other service gives you PHOTOFACT’S outstanding advantages: completeness, accuracy, uniformity and ease-of-use. PHOTOFACT alone, is the only radio service data prepared from laboratory analysis of the actual equipment. Nothing in the field equals PHOTOFACT. Know the facts—get your FREE Folder now. Examine it—use it—compare it—and you will understand why no modern service shop can afford to be without PHOTOFACT.

NOTE: This FREE offer is limited to Service Technicians. Attach coupon below to your letterhead and mention the name of your jobber. If you have no letterhead, send coupon to your jobber. Experimenters and others may obtain the Photofact Folder by remitting 50c.

HOWARD W. SAMS & CO., INC.
955 N. Rural St., Indianapolis 1, Ind.

Send FREE Photofact Cumulative Index
Send Full Easy-Pay Details
I am a Service Technician:
Send FREE Photofact Folder for set model
I am an Experimenter:
Send Photofact Folder for set model
(50c enclosed)

Name: ........................................
Address: .....................................
City: ........................... Zone: ............................ State: ...........................

RADIO DISTRIBUTION AND MAINTENANCE • OCTOBER 1949
ELECTRIC SOLDERING IRONS

are sturdily built for the hard usage of industrial service. Have plug type tips and are constructed on the unit system with each vital part, such as heating element, easily removable and replaceable. In 5 sizes, from 50 watts to 550 watts.

TEMPERATURE REGULATING STAND

This is a thermostatically controlled device for the regulation of the temperature of an electric soldering iron. When placed on and connected to this stand, iron may be maintained at working temperature or through adjustment on bottom of stand at low or warm temperatures.

Getting Clipped. We're indebted to reader B. McGee for sending in an item from the Tampa Morning Tribune concerning the experiences of a Florida barber. How do barbers get into a radio magazine you ask? Read on.

Seems they have a law in Fla. requiring the licensing of barbers. One day, a tonsorial artist from Elmira, N. Y., came to settle in that state, and discovered that he was required to take a license examination before being permitted to practice his trade. He didn't object to that, but was a little surprised when he found it would cost him $27 just to be allowed to take the exam. His surprise grew considerably when he heard broad hints that it would cost him another $500 to pass the test; in fact he got pretty mad.

He reported the matter to the police who, with the aid of some marked bills, arrested two members of the licensing board on charges of bribery.

Now if you will substitute the words "radio technician" for the word "barber," the point of the story becomes obvious. Says reader McGee: "This sort of thing happens all the time where there is a 'licensing board' to pass on the applicant's qualifications, and it is only once in a lifetime that it comes out."

Here are the notes he brought back:

"Arrived at library 10 a.m., doors just opened. Went to librarian and stated errand (very cooperative lady). Found seat, got old magazines and started reading (very dusty here).

"First experimental auto receiver in 1922, but nothing commercial till 1930 when Transistor (later merged with Philco) came out with first. No production figures available before 1935. That year output 700,000, grew to 3,500,000 in 1948. Nobody very interested in it at first, 25% of dealers in '30 saw no future in it. Very expensive proposition, cost car owner up to $200, took one to three days to install.

"First car radio came in six parts: radio chassis in steel box, tuning control, volume control, B batteries, loudspeaker, suppressor. Tubes powered by car storage battery. Was a t-r-f (first superheterodyne was RCA's..."
These outstanding, new, deluxe high-fidelity speakers make PERMOFLUX, the most complete speaker line in the world!

**SERVICEMEN — DEALERS**
- Insist on the best!
- Buy PERMOFLUX Speakers!
- See your jobber today!

PERMOFLUX speakers will outperform, model for model, any speaker on the market.

NEW catalog available upon request. Write for your FREE copy!
Electronically Speaking

Radiola Super in 1923, but superhet patents not released by RCA till late 1930). Early sets headache all around. Problem was where to put all the components of receiver. One guy cut hole in floorboard, suspended B battery from it. Another, with a small sedan, also found the underside of his car a likely place, put a speaker there. Saw picture of one car with equipment (plus wires) hanging all over. Interference from ignition system fierce, had special suppressors to cut it out. Some of suppressors used, suppressed motor instead of static. No whip antennas; instead, capacitor plates under the car or in roof. Reception very poor. Don't see why anybody bothered with these radios. Took til about '35 for all units of the radio to be combined into one. Started placing the entire assembly under dashboard.

"Safety officials worried about effect of radio on drivers, feared they'll be detracted. Also worried about pedestrians being disturbed by blaring receivers. M. Metcalf, then Pres. of RCA eased their mind, said that no one expects car radios to be played in crowded traffic, suburban travel, at noontime. One of main purposes, he said, was to make waiting in parked car pleasure. Guess motorists didn't pay too much attention to him.

"Craze for DX (long distance reception) hit just about the same time. Some adventurous spirits tried to get DX via car radio. Had to park car, rig up antenna. Should have stayed home.

"The whole business a far cry from today.

"Left library 1 p.m. for lunch. Found 1 had left radio on in car. Battery dead. Making trip to garage."

Rollo

The Eyes Have It. Last month we reported here the findings of our physicians with regard to health and TV. Now the optometrists have made a study of their own, published their findings in the Journal of the New York State Optometric Association. After viewing images of varying sizes from several different receivers, they found that projection television offers pronounced advantages to the viewer from the standpoint of visual health.

We're waiting for word from our dentists.

Latest on Licensing. Seems we were a little premature last month in reporting that sales and service contracts by independent service organizations would be considered illegal under New York State Insurance law. Word has just reached us that the N.Y. State Insurance Department has made a ruling on the question (last month's report was based on an opinion by the N.Y. State Attorney General), and has interpreted the opinion of the Attorney General as follows: Television manufacturers, including wholly owned subsidiary corporations, as well as dealers who sell television sets may enter into yearly sales and service contract agreements. These contracts must be limited to keeping the televisions in proper operating conditions because of failure arising from normal use. No manufacturer or his subsidiary or a dealer is allowed to renew such an agreement. A service organization which is not the dealer or the manufacturer of a television receiver may not enter into such agreements.

This, we believe is the final word on the matter.

OCTOBER 1949 • RADIO DISTRIBUTION AND MAINTENANCE
Radiart features

THE Lowest Priced Quality Line
OF TV CONICAL ANTENNAS

With the development of the conical type antenna as an important factor in television reception... Radiart leads the way with the lowest priced QUALITY line. Precision engineering... quality controlled manufacture combine to give you and your customers the greatest value for the dollar! Easily installed... and rigidly sturdy when installed, these Radiart products truly are "The Standard of Comparison."

THE SINGLE BAY "LAZY X"
... for primary service areas

THE DOUBLE STACKED "LAZY X" ARRAY.... for improved gain in low signal strength areas—also where a higher signal-to-noise ratio is desired... Model LZX-2

THE QUAD-STACK "LAZY X" Array... easily assembled and installed for the ultimate in all channel fringe area reception... Model LZX-4

THE RADIART CORPORATION
CLEVELAND, OHIO
Manufacturers of the Famous Red Seal Vibrators
Vitreous Enameled Resistors

A favorite with service men. Easily mounted by its tinned wire leads. In sizes 5, 10, and 20 watts, Tol ± 10%.

BROWN DEVIL

Vitreous Enamelled Resistors

A favorite with service men. Easily mounted by its tinned wire leads. In sizes 5, 10, and 20 watts, Tol ± 10%.

DIVIDOHM

Adjustable Resistors

Vitreous enameled. 10 to 200 Watts. Ideal for securing odd resistance values.

Antennas

Characteristics caused by mis-matching. The matching section provides maximum signal transfer with minimum losses. The antenna is a four-bay, sixteen-element stacked array, cut and stacked for maximum performance on any specific high channel, although it performs well on other channels.

A simpler job is the four-element array shown in Fig. 5. Since this antenna (like that of Fig. 4) has an impedance of 72 ohms, a matching section is provided so that connection may be made, without loss of signal strength to different types of transmission line.

An interesting array designed for single channel performance is the well-known Vee-D-X Yagi array. The four-element beam is cut especially for each particular channel. The antenna has high forward gain and is sharply directional. High front-to-back ratio helps reject unwanted signals. The stepped-up driven element (the element to which the lead-in is connected) is a modified folded dipole and matches a 300-ohm line. For multi-channel reception, several arrays may be mounted on the same mast and directed to different transmitters.

Of course, the stacked array is not a cure-all, particularly in metropolitan areas in which multiple reflections exist. Sometimes a single reflection can be picked out and utilized to greater advantage than the direct picture. To overcome the problem of multiple reflections, a radar type antenna has been developed, known as the "Channel Chief" and shown in Fig. 6. This antenna, offered in kit form for assembly by service technicians, provides a method of obtaining long distance pictures on any high band television channel. The antenna is designed to take advantage of radar techniques. The unit employs a square corner reflector type antenna (like that of Fig. 4) has an impedance of 72 ohms, a matching section provides maximum signal transfer with minimum losses.

The antenna has high forward gain and is sharply directional. High front-to-back ratio helps reject unwanted signals. The stepped-up driven element (the element to which the lead-in is connected) is a modified folded dipole and matches a 300-ohm line. For multi-channel reception, several arrays may be mounted on the same mast and directed to different transmitters.

Of course, the stacked array is not a cure-all, particularly in metropolitan areas in which multiple reflections exist. Sometimes a single reflection can be picked out and utilized to greater advantage than the direct picture. To overcome the problem of multiple reflections, a radar type antenna has been developed, known as the "Channel Chief" and shown in Fig. 6. This antenna, offered in kit form for assembly by service technicians, provides a method of obtaining long distance pictures on any high band television channel. The antenna is designed to take advantage of radar techniques. The unit employs a square corner reflector type curtain, mounted in back of a broad-band folded dipole. The curtain functions as a mirror, catching and reflecting back to the antenna, many times the amount of signal that would normally be present if the antenna alone were used.

Being precision tuned to any one television band, this antenna has a gain of 8 to 10 db over a conventional dipole. The folded dipole and associated curtain reflector provide...
stagger tuned response in order to cover the video and sound channel width requirements. Large diameter tubing, combined with folding of the dipole, provides low Q response, thus aiding full frequency coverage. In addition to the high gain feature of the curtain design, the directional response pattern is sharp. This means freedom from interfering signals, reflected responses and ground noise. Ghost patterns, ignition noises, f-m signals, are virtually eliminated. Because the signal is in effect amplified by the antenna without boosting noise, longer distance reception is practical, since the amount of snow in the picture is greatly reduced. Signal-boosters used at the set become even more effective, since the signal-to-noise ratio is greatly improved by antenna gain before amplification. Accurate matching to 300-ohm twin lead is provided by proper spacing between the antenna and the curtain.

Rotators
For satisfactory reception of television, a highly directional beam antenna can be used to advantage. To obtain maximum signal strength, the beam must be properly directed. The antenna rotating device shown in Fig. 7 provides a practical means of securing peak performance from a given antenna system by allowing the user to turn his antenna in any direction. The system consists of an electrically powered rotator unit which is mounted on the antenna mast and is connected to a control box located at the receiving set. This control box, plugged into the 110-volt 60-cycle house line, provides power for the rotator, which slowly turns at 1 r.p.m. The point of optimum reception is found by watching the screen of the television receiver for the clearest picture.

Some antennas, such as the “Duo-band” feature flexibility in installation or permit adjustment after installation. In Fig. 8 this antenna is collapsed, prior to installation. In Fig. 9 we see the same antenna set up for proper reception.

No matter where the installation—whether close to the station or out in the fringe area—problems will arise. Making a station come in where none came in before, getting rid of multiple images, eliminating interference, these are logical sources of service and profit.

Your Answer to accurate television alignment

✓ The RCA WR-59A Television Sweep Generator
✓ The RCA WO-55A Oscilloscope
✓ The RCA WR-39A Television Calibrator

- Designed by RCA engineers at “television headquarters”—these companion units furnish all basic signals necessary for the rapid, accurate alignment of television receivers. Flexibility, dependability, and accuracy are outstanding characteristics of these instruments.

For alignment, the WR-59A Television Sweep Generator and WR-39A Television Calibrator can be used with the RCA WO-55A General Purpose Oscilloscope matching unit—as illustrated—or with any good oscilloscope.

The WR-59A Television Sweep Generator covers all television frequencies. All ranges develop 0.1 volt rms or more on fundamentals and can be quickly selected by means of a band switch. Excellent shielding plus a piston attenuator allow the output to be reduced to the noise level. Unusually flat output is provided with amplitude variation on all ranges of less than 1 db. Phasing and retrace-blanking controls are incorporated.

The RCA WR-39A Television Calibrator is a variable-frequency oscillator, dual-crystal frequency standard, and heterodyne detector with audio amplifier and speaker. The VFO puts markers of fundamental frequency and crystal accuracy on TV-FM traces from 19 to 110 Mc and 170 to 240 Mc. Dual-crystal standard is used to calibrate VFO or other signal generators with 250-kc and 0.25-Mc check points from 250-kc to 240 Mc.

See your RCA Test Equipment Distributor today for further technical details or write RCA, Commercial Engineering, Section 51JX, Harrison, N. J.

For test equipment you can trust always keep in touch with your RCA Distributor

RADIO CORPORATION of AMERICA
TEST AND MEASURING EQUIPMENT
HARRISON, N. J.
How to Check Audio Amplifiers

Fig. 5 Another method of checking amplifier distortion. Here square-wave audio oscillator supplies test signal to amplifier, output waveform is observed on oscilloscope screen.

Fig. 6 Some distorted square waves. A—poor low-frequency response. B—poor high frequency response. C—resonant attenuation (dip) in amplifier. D—oscillation in amplifier. E—presence of output-to-input capacitance (found in some low-grade transformers).

small pieces by means of which the pattern is constructed.

By adjusting the “position” control of the electronic switch, either the two separated input and output patterns (Fig. 4B) or the superimposed patterns (Fig. 4C) may be obtained. The technician may use whichever of the two he prefers, ease of height measurement being the determining factor.

Frequency Response

To check frequency response, the sine-wave audio oscillator frequency is varied gradually throughout the audio spectrum, starting at 20 cycles and progressing to 20,000 cycles. The oscillator output voltage is held constant, while variations in the amplifier output voltage are read and recorded. If the amplifier has a perfectly flat frequency response (an ideal situation seldom, if ever, realized in practice), the output voltage will not change one way or the other as the input frequency is shifted. If the output voltage variations are plotted on graph paper against frequency steps, the result will be an informative frequency response curve.

The apparatus setups for checking frequency response are shown in Fig. 2 and 3. If an a-c v.t.v.m. is available for this measurement, the technician undoubtedly will prefer the arrangement shown in Fig. 2.

The test should proceed as follows:

(1) Set the amplifier gain control to maximum.
(2) Set the amplifier tone control to its center (flat-response) position.

(3) Apply a low-voltage 20-cycle signal from the oscillator to the amplifier input terminals. Switch the voltmeter to input position 1. If the input signal is too low to be read accurately on the lowest-voltage scale of the meter, employ an input voltage divider as explained above.

(4) Switch the meter to output position 2.

(5) Record the output voltage for 20 cycles.

(6) Increase the oscillator frequency to 50 cycles, switch the voltmeter back to input position 1, and reset the oscillator output (if necessary) to give the same reference voltage as that used in the preceding 20-cycle measurement.

(7) Switch the voltmeter to output position 2 and record the 50-cycle output voltage.

(8) Repeat at as many frequencies as practicable.

(9) Repeat at various selected settings of the amplifier gain control and tone control.

(10) The numerous output voltages obtained in this test may be plotted against frequency settings on graph paper, to give a family of highly-informative frequency-response curves.

Distortion Checking

A distorting amplifier changes the wave shape of the signal it amplifies. The oscilloscope is a convenient instrument for examining waveforms for distortion.

If we use the apparatus setup shown in Fig. 3 (with the oscilloscope switched permanently to output position 2) or that of Fig. 4A, we will be in a position to observe whether the amplifier output is sine-wave (as was the input signal from the oscillator) or if it has been distorted. Separate tests should be made at several frequencies and at several settings of the amplifier gain and tone controls. Pronounced harmonics in the amplifier output cause severe mis-shaping of the output waveform and are readily observed. However, small percentages of distortion are rather difficult to detect and evaluate by means of this method.

Another convenient method is illustrated in Fig. 5. Here, a square-

---

NOW DU MONT OFFERS THE TYPE 274-A

CATHODE-RAY OSCILLOGRAPH FOR

RADIO and TELEVISION Servicing

AT REDUCED COST

Remember...

DOUBLED BAND WIDTH
TRIPLE SENSITIVITY

Some time ago Du Mont announced a new oscillograph—Type 274-A—featuring several notable improvements over Type 274. Since then the 274-A's popularity has been unparalleled by any other low-priced oscillograph in the fields of radio and television servicing. Here's why:

The 274-A has an improved vertical amplifier with a sensitivity better than 0.2 rms volts/in., and a range (within 30%) of 20 cps to 100 kc in frequency response.

In your servicing of both radio and television receivers, you can look at more parts of more circuits with still greater accuracy and therefore better results. For example, you can see lower level signals and you can handle more sections of the detector and i-f circuits. You can minimize "hum" troubles more easily, and you can do a better job on sync circuits as well as on other circuits in TV sets.

All in all, with the 274-A you can't miss doing an all-around, bang-up, more satisfactory and therefore more profitable job. You enjoy all the benefits of the big 5-inch cathode-ray tube (either medium-persistence Type 5BP1-A or short-persistence Type 5BP11-A).

CAT. NO. 1420-A with 5BP1-A tube $124.50
CAT. NO. 1422-A with 5BP11-A tube $124.50

DuMont for Oscillography

ALLEN B. DU MONT LABORATORIES, INC., PASSAIC, N. J.
CABLE ADDRESS: ALBEEDU, NEW YORK, N. Y., U. S. A.
Picture Tube News
→ from page 15

act to improve the resolution of the picture.

Some of these developments have been incorporated in other DuMont tubes; and we have been informed that further improvements are in the mill there now (specific information on what these were, however, could not be obtained).

Tilting

Still another attempt to cope with external and internal light reflections has been made by Philco. In its "No-Glare" system, the picture tube is tilted back so that the viewer looks slightly downward at the screen, approximating his normal line of vision; and a glass plate has been tilted forward in front of the tube, so that distracting reflections from external light sources are reflected to the floor, rather than the eye. To reduce reflections further, the picture mask area has been covered with a green lacquer which has been used during the war for camouflage purposes.

This basically mechanical system has been incorporated in the 1950 Philco Receiver line.

How to Check Audio Amplifiers
→ from preceding page

wave audio oscillator supplies a test signal to the amplifier, and the output waveform is observed on the oscilloscope screen. If no distortion is present in the amplifier, the output wave will be square. Variations of the output waveform from squareness indicates various faults within the amplifier. A few representative distorted square waves are identified in Fig. 6. It is a rule-of-the-thumb among amplifier technicians that a rise or fall of the horizontal portion of an output "square" wave indicates low-frequency deficiency in the amplifier under test, while a sloping of the vertical sides of the pattern with a rounding off of the corners indicates poor high-frequency response.

Distortion checks should be made in the low, medium, and high-frequency portions of the audio spectrum (for example, at 20, 1000, and 10,000 cycles) and at several settings of the amplifier gain and tone controls. These tests may be applied to a single amplifier stage, as well as to the complete amplifier.

Power Output

For power output measurement, use the apparatus setup shown in Fig. 2, with the v.t.v.m. permanently connected across the speaker voice coil or, better still, across a load resistor (preferably non-inductive) having the same resistance value as the voice coil impedance and having a wattage rating equal to twice the expected power output of the amplifier.

Set the amplifier tone control to its center (flat-response) position and the gain control to maximum. Set the oscillator output control to give maximum undistorted output of the amplifier. At this point, record the voltmeter reading as E. Calculate the amplifier power output by dividing E^2 by R, where R is the ohmic value of the load resistance (or the voice coil impedance).

Repeat the power output measurement at several frequencies and at several settings of the amplifier gain control. If desired for comparison, the measurements may also be made at each extreme setting of the amplifier tone control.
Deflection Amplifier

the only attenuator, since a large number of steps would be required to cover a wide voltage range and still maintain useful attenuation ratios. Consequently, an additional method of attenuation is employed for fine adjustment of gain. Such a method is the use of a cathode follower stage, providing a low impedance cathode output suitable for use with a continuous attenuator. Although this stage has a gain of less than unity, the low output impedance permits it to work into a low-impedance potentiometer (500 to 5000 ohms). Even with the capacity of the next stage which exists between the arm of the potentiometer and ground, the response of this type of gain control is flat to 10 Mc or more.

Amplifier Specifications

The foregoing discussion of the design of the vertical amplifier system of an oscillograph will enable the reader to appreciate the important specifications to look for when choosing an oscillograph. The following specifications apply only to the vertical amplifier system. Additional factors on other sections of the oscillograph will be discussed in later articles.

1. High Gain — The deflection sensitivity of the Y-axis of the oscillograph should be 0.05 volts per inch. This high gain is required when aligning a single r-f or i-f amplifier stage, using a sweep frequency generator. If the oscillograph does not have this high gain, it is necessary to increase the output signal from the sweep generator in order to produce a sufficiently large pattern on the oscillograph screen. Increasing the sweep generator output to more than a few millivolts is not recommended, because it may overload the stage that is being aligned.

Although it is often desirable to do a stage-by-stage alignment with a high gain oscillograph, the next best thing to do, if only a low gain oscillograph is available, is to connect the instrument to the output of the second video detector. An overall alignment of each stage may then be accomplished, because the gain of each amplifier in the receiver makes up for the low sensitivity of the oscillograph.

2. Good 60-cycle square wave response—For aligning the r-f and

Kester Cored Solder—1st in the Television Field

Use Kester Solder for fast, efficient soldering on all TV receivers

In the television and radio fields, where good work is important and economy in present high labor costs is essential, Kester Solder of the Rosin-Core type fit right into the picture. Made to the highest standards possible, Kester Flux-Core Solders have always been and still are the standard in the industry.

The Finest Solder Made For Fast, Efficient Maintenance

Insist upon Kester Plastic Rosin-Core Solder from your jobber. Use Kester Flux-Core Solder exclusively and be assured of satisfied customers and repeat business.

KESTER SOLDER COMPANY
4201 Wrightwood Avenue, Chicago 39, Illinois
Factories Also At
Newark, New Jersey • Brantford, Canada
CDFR: F R E Q U E N C Y  R E S O N S E — A  v ertical  a mplifier  r e sponse  e xtending  t o  100 kc  i s  a dequate  f or  a lignment  w ork  w ith  a  sweep  g enerator  a nd  f or  o bserving  t h e 60-c ycle  s ync  a nd  s a wtooth  s ignals  i n  t he  v ertical  s weep  c ir cu it  o f  a  TV  r ecei ver.  I f  t he  oscillograph  i s  u sed  f or  e xamining  h orizontal  s weep  s ignals,  a nd  f or  c hecking  v ideo  a mplifiers  b y  m eans  o f  a  h igh-f requency  s quare  w ave,  t he  r e sponse  s h ould  e xtend  t o  b etter  t ha n  30%  d own  a t  2  M c,  a nd  p referably  t o  30%  d own  a t  4  M c.

Now  that  w e  k now  w hat  i s  r equired  o f  an  oscillograph  w ith  r egard  t o  t he  Y-a xis  d eflection  s yste m,  w e  shall  c onsider  n ex t  t he  X-a xis  c ircuits  a nd  sawtooth  g enerators  w hich  p rovide  t he  t ime  b ase.  T hese  w ill  be  d iscussed  i n  t he  n ext  i ssue.

(The  a rticle  s cheduled  f or  t hat  t ime  w ill  c over  e s s e nt ially  t he  s ame  g round  a s  Mr.  R oche’s  p rop os ed  d iscu ss ion  o n  sawtooth  g enerators,  w hich  i s  t her e f ore  c ancelled)


INTRODUCING

NEW IRC PRECISTORS

Here is the precision resistor you've been hunting. IRC's new Deposited Carbon PRECISTOR combines accuracy, stability and economy!

PRECISTORS are principally designed for uses where carbon compositions are unsuited and wire wound precisions too expensive. They are excellent in television, voltmeter multiplier, and high frequency circuits. PRECISTORS are supplied in two sizes: Type DCF—200 ohms to 5 megohms and Type DCH—500 ohms to 20 megohms.

Your IRC Distributor has new PRECISTORS packaged in sturdy plastic cases—fully protected against scratches and jars. Characteristics are printed on the case, and range, type, and tolerance are given on the resistor. Ask to see new IRC PRECISTORS when you visit your Distributor!

IRC also manufactures a complete range of Wire Wound Precision Resistors. 1% accuracy is standard, but closer tolerances to 1/10 of 1% are available at slightly higher prices. Highest quality materials combined with skillful winding technique make IRC Precision Wire Wounds the choice of leading instrument makers. International Resistance Co., 401 N. Broad St., Phila. 8, Pa.

INTERNATIONAL RESISTANCE CO.

WHEREVER THE CIRCUIT SAYS

In Canada: International Resistance Co., Ltd., Toronto, Licensee.

Capacitor Catalog. A 6-page supplementary folder lists Duranite molded paper tubulars, several types of electrolytics, oil-filled tubulars, mica capacitors, interference filters, and auto radio suppressors. Copy of the condensed catalog (Form SC-549) is available from Aerovox jobbers or Aerovox Corporation, New Bedford, Mass.

Switchcraft Catalog S49 has a complete listing of jacks, plugs, and switches carried by the firm. Gives specification data. 1328-30 N. Halsted St., Chicago 22, Ill.
THE LEADER IN VIDEO PUBLICATIONS!

THE COMPLETE TELEVISION MANUAL

THE VIDEO HANDBOOK

Morton Scheraga and Joseph J. Roche

How Television Works,
Basic . . . through advanced.
How to Design and Engineer Television,
How to Troubleshoot and Repair Tele-
vision, Safety procedures.
How to Select and Install a Television
Antenna.
How to Create a Television Show.
How to Build an Operating Television
Receiver, Complete instructions.
How to Select a Television Receiver.

Now in this great one volume book—
all the essential knowledge of television!

Inside the covers of the VIDEO HANDBOOK is presented complete up-to-the-
minute information on television arranged
for quick reference—in easy to read, non-
mathematical style.

The VIDEO HANDBOOK is designed to
give you the practical . . . answers to all
your questions on television—the complete,
detailed procedures on all phases of tele-
vision work—step-by-step explanations for
everyday problems. This book provides the
ready information to make your television
education complete.

The VIDEO HANDBOOK will save you
time — improve your efficiency and make
your work easier. It provides the knowledge
that means more profit for you. Every page
adds to your background for greater pres-
tige and income. Here is the means for
everyone in television—employed and exec-
tutive—to increase his value to his firm.

This book is more than a source of in-
formation and interesting reading—it is an
investment in your future in television.

READ BY:

Engineers, Designers, Servicemen, Experi-
menters, Production men, Laboratory
technicians, Maintenance men, Program
directors, Studio personnel, Broadcast
technicians, Manufacturers, Laymen.

The vast amount of information contained
in this book can only be briefly outlined
here. The VIDEO HANDBOOK contains
900 pages—over 800 illustrations—thousands
of vital facts—covering everything you need
for working in Television. All this infor-
mation is designed for easy reading, quick
reference—all in non-mathematical lan-
guage, every point of discussion pictured
in diagrams or photographs. The VIDEO
HANDBOOK is divided into 14 sections—
each a complete, authoritative coverage on
its subject—arranged in a practical, easy-to-
follow handbook of solutions to every tele-
vision problem.

$5.00 • AT YOUR LOCAL RADIO JOBBER

Handsomely bound in DuPont Fabrikoid . . . over 900 pages . . . 14
sections . . . over 800 illustrations — photographs, charts, diagrams,
schematics.

Section 1. Television: Past, Present &
Future.
Section 2. Fundamentals of electronic
Television.
Section 3. The Television Station.
Section 4. The Television Receiver.
Section 5. Television Antenna Systems.
Section 6. Creating a Television Show.
Section 7. Descriptions of Modern Tele-
vision Receivers.
Section 8. Installing Television Receivers.
Section 9. Servicing Television Receivers.
Section 10. Television Test Equipment.
Section 11. Building a Television Receiver.
Section 12. Data Section.
Section 13. Television Terms.

A PRODUCT OF BOLAND & BOYCE INC., PUBLISHERS

MONTCLAIR, N. J.

• RADIO DATA BOOK • VIDEO HANDBOOK • RADIO AND TELEVISION LIBRARY • RADIO DISTRIBUTION AND MAINTENANCE • TECHNICAL MANUALS •

36 OCTOBER 1949 • RADIO DISTRIBUTION AND MAINTENANCE
INDUSTRY PRESENTS

REPLACEMENT TUNER

The “Standard Tuner”, until recently available only to teleset manufacturers for factory installation in TV receivers, can now be had by the technician for his replacement needs. The tuner, similar to a type described in the January '49 issue of this magazine, features interchangeability of channel inductors, individual oscillator adjustment screw for each channel, one control shaft for fine tuning and channel selection, and covers all 12 channels.

The tuner is available through local jobbers or by writing directly to the company, Standard Coil Products Co., Inc., 2329 N. Pulaski Rd., Chicago 39, Ill.; or 2901 E. Slauson Ave., Huntington Park, Calif.

AUTO RADIO TOOL

Here we have the third tool to come out from the Hytron Contest of last year. This one is an auto tool for tuning, adjusting volume and tone, realigning dial, etc., after cables of universal auto radio have been detached. It has a square tip which fits spindles. Another feature is the slotted V-shaped tip for different thicknesses of spade and similar key fittings. 24c at Hytron jobbers.

SCREWDRIVER

You may be interested in this screwdriver for work in dark places. It has a built-in battery and bulb that focuses light on your work. It’s called the Flashdriver, has shockproof handle and comes with interchangeable blades. Town-Talk Products, 308 Hoffman Building, Detroit 1, Mich.

TWO-DIRECTION

SHOOTS TROUBLE FASTER! MAKES MORE MONEY FOR YOU ON JOB OR AT SERVICE BENCH!

PRICE
99c at Distributors or direct
Ohioan’s add 3% State Sales Tax

SIGNALETTE

MULTI-FREQUENCY GENERATOR
In radio service work, time means money. Locate trouble faster, handle a much greater volume of work with the SIGNALETTE. As a trouble shooting tool, SIGNALETTE has no equal. Merely plug in any 110 V AC-DC line, start at speaker end of circuit and trace back, stage by stage. Listening in set’s speaker, generators RF, IF and AUDIO frequencies, 2500 cycles to 20 Megacycles. Also used for checks on sensitivity, Gain, Peaking, Shielding, Tube testing, etc. Wt. 13 oz. Fits pocket or tool kit. See at your desk or order direct.

CLIPPARD INSTRUMENT LABORATORY, INC.
Dept. M 1125 Bank Street
Cincinnati 14, Ohio
Qualified Jobbers write, wire for details

FREE! Send for it NOW!

ALLIED’S NEW 1950 CATALOG!

196 PAGES— Everything in Radio and Electronics

GET RADIO’S LEADING BUYING GUIDE: ALLIED’S 1950 Buying Guide brings you all the new releases and money-saving values—from the world’s largest stocks of test instruments, amplifiers, P.A. systems and equipment, tubes, parts, tools, books and accessories—ready for expert shipment. Send today for your FREE new 196-page ALLIED Catalog.

ALLIED RADIO CORP., DEPT. 27-K-9
833 W. Jackson Blvd., Chicago 7, Ill.
□ Send FREE New ALLIED Catalog.
A COMPACT AND COMPLETE LIBRARY!

The BIGGEST Book Value in the Industry!

THE

RADIO & TELEVISION

LIBRARY

CONSISTING OF

THE VIDEO HAND BOOK

The complete television manual... over 900 pages... over 860 illustrations... in 14 big sections.

Now in this great one volume book—all the essential knowledge of television! Inside the covers of the VIDEO HANDBOOK is presented complete, up-to-the-minute information on television arranged for quick reference—in easy to read, non-mathematical style.

The VIDEO HANDBOOK is designed to give you the practical answers to all your questions on television—the complete, detailed procedures on all phases of television work—step-by-step explanations for everyday problems. This book provides the ready information to make your television education complete.

The VIDEO HANDBOOK will save you time—improve your efficiency and make your work easier. It provides the knowledge that means more profit for you. Every page adds to your background for greater prestige and income. It is the means for everyone in television—employed and executive—to increase his value to his firm.

This book is more than a source of information and interesting reading—it is an investment in your future in television.

THE RADIO DATA BOOK

the only radio handbook of its kind... over 900 pages... 12 sections, each covering a radio subject more completely than any other book!


ANYONE and everyone in radio and electronics can use this book.

Plan every operation in radio and electronics with the Radio Data Book. This new radio bible will be your lifelong tool... you will use it every day, on the bench, at the bench, in the field! Use it for engineering, construction troubleshooting and testing. The RADIO DATA BOOK will be your invaluable aid in design, experiment and in layout. It will help make your production better, faster and easier. In any and every operation in radio and electronics, you will use the RADIO DATA BOOK!

CONTENTS:

Section 1. THE 150 BASIC CIRCUITS IN RADIO
Section 2. COMPLETE TEST EQUIPMENT DATA
Section 3. TESTING, MEASURING AND ALIGNMENT
Section 4. ALL ABOUT ANTENNAS
Section 5. SOUND SYSTEMS
Section 6. RECORDING
Section 7. COMPLETE TUBE MANUAL
Section 8. CHARTS, GRAPHS AND CURVES
Section 9. CODES, SYMBOLS AND STANDARDS
Section 10. 50 TESTED CIRCUITS DESIGNED FOR OPTIMUM PERFORMANCE
Section 11. DICTIONARY OF RADIO AND ELECTRONIC TERMS

THE VIDEO HANDBOOK

CONTENTS:

Section 1. Television: Past, Present & Future
Section 2. Fundamentals of electronic Television
Section 3. The Television Station
Section 4. The Television Receiver
Section 5. Television Antenna Systems
Section 6. Creating a Television Show
Section 7. Descriptions of Modern Television Receivers
Section 8. Installing Television Receivers
Section 9. Servicing Television Receivers
Section 10. Television Test Equipment
Section 11. Building a Television Receiver
Section 12. Data Section
Section 13. Television Terms
Section 14. Bibliography

THE RADIO & TELEVISION LIBRARY IN ATTRACTIVE SLIP CASE $9.00 AT YOUR LOCAL RADIO JOBBER

A PRODUCT OF BOLAND & BOYCE INC., PUBLISHERS

MONTCLAIR, N. J.
How to Service Radios with an Oscilloscope

SYLVANIA ELECTRIC

SYLVANIA SHOWS YOU

"HOW TO SERVICE RADIOS WITH AN OSCILloscope"

Here's a big, complete book that gives you step-by-step instructions for using the oscilloscope in testing and servicing radio receivers, audio amplifiers and transmitters.

The more than 90 illustrations of circuits, 'scope patterns, and set-up arrangements for circuit testing explain over 50 separate oscilloscope applications.

★ Get this big 72-page book!
★ More than 90 pictures and diagrams!
★ Written in easy-to-follow servicemen's language!

Only $1.00

EXPLAINS THESE AND MANY MORE
1. AM and FM receiver alignment
2. Locating hum
3. Signal tracing and trouble shooting
4. Finding receiver faults from oscilloscope patterns
5. Checking AVC action
6. Voltage gain measurement
7. Auto radio vibrator tests
8. Checking peak current in rectifiers
9. Impedance measurement
10. Checking filter capacitors — and many others!

SYLVANIA ELECTRIC

FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES, SIGN TUBING, LIGHT BULBS, PHOTOLAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES

Sylvania Electric Products Inc.
Advertising Dept. 8-2100
Emporium, Pa.

Gentlemen:
Send me "How To Service Radios with an Oscilloscope." Enclosed is $1.00.

Name: ____________________________
Address: __________________________
City: ____________________________ Zone: __________________________
State: ____________________________
"I tell you, businesses aren't built on promises. They're built on performance—performance that brings customers back for more.

"And it takes good quality to guarantee good performance!

"Take Ken-Rad tubes. Why, they've been the quality leader for years—backed by one of the country's biggest, finest companies with plenty of engineering know-how.

"Result is, Ken-Rad tubes have paid me a steady dividend of increased business. For turnover and profit, they have what it takes!"

RALPH L. CLARK, Foreman, Miniature Mounting Section, is one of the many experts who carefully supervise the manufacture of Ken-Rad tubes. These men build quality into the tubes at the very beginning; test out trouble at every stage of production.

"My tests prove Ken-Rad tubes have what it takes!"

"Here at the plant we put Ken-Rad tubes through one test after another to prove their quality is unsurpassed.

"The short test, shown on the left, is given tubes before the characteristics test. It enables us to spot tubes that are not up to Ken-Rad standards.

"Ken-Rad tubes also are tested for noise, microphorics, life, appearance, gas, air and hum.

"We don't guess. The Ken-Rad tubes we make and ship have proved themselves over and over again!"

KEN-RAD Radio Tubes
PRODUCT OF GENERAL ELECTRIC COMPANY
Schenectady 5, New York