

RADIO AND

AUGUST 1949 25c



DISTRIBUTION MAINTENANCE

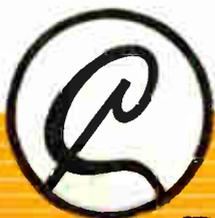
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**A QUALITY PRODUCT OF THE
RADIO CORPORATION OF AMERICA**

What you should know about...WOMEN!

1.
God Bless Them



2.
... They are our Pride



3.
... and DESPAIR!

4.
... When She Goes Shopping—She'll Handle

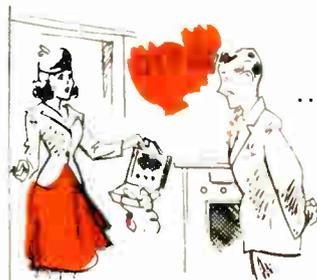


5.
Sniff, Taste and Compare ... and usually leave



6.
With a Vague "No—thank You... I'm just looking."

7.
... But when she Walks into your Store with the Little "Portable" that doesn't seem to work any more



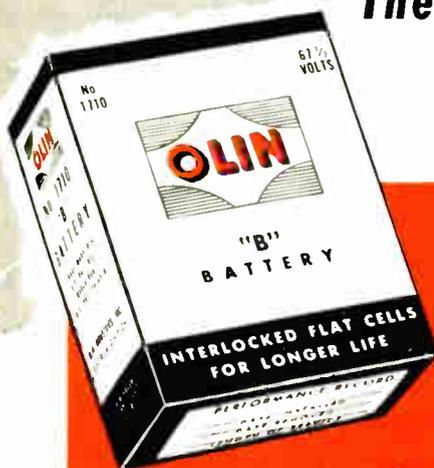
8.
... THAT'S WHEN SHE LOOKS UP TO YOU ...



9.
... and if it's a new "B" Battery she needs, you can add a "halo" to your stature by recommending ...

The only Radio "B" Battery which is

INTERLOCKED!



Stronger---
lasts longer
... yet costs
no more.



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exclusive
with
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Available only in the **WINCHESTER** and **BOND** lines
of OLIN INDUSTRIES, INC., Electrical Division, New Haven 4, Conn.

GET SET FOR VACATION SELLING—order complete line Olin Radio Batteries and combination display from your Wholesaler's Salesmen TODAY!

8 NEW IRC RESISTOR AND CONTROL ASSORTMENTS

... all in sturdy metal

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NEW RESIST-O-KIT

Latest addition to IRC's big family of metal kits. Pocket-size case ideal for service calls. 10 compartments, resistors can't mix. Ranges stamped on resistors. 2 assortments, 45 half watt or 30 one watt resistors—popular ranges, widely found in television.



METAL RESIST-O-CABINET

Perfect way to buy and stock resistors. 4 drawers with 28 range identified compartments. 3 fast-moving assortments: 100 half watt, 83 one watt, or Combination Assortment of 91 resistors (includes close tolerance IRC Precistors).



VOLUME CONTROL CABINET

Stocked with 18 new IRC type Q Controls plus switches and special shafts. Handles over 90% of all AM, FM and TV control replacements. Compartments individually marked. 3 drawers are provided for stocking switches, shafts and spare parts.



BASIC KIT

Wide variety resistor stock for all daily requirements. Covers 35 watts to heavy duty power resistors in selected ranges. Available with Serviceman's Special Assortment—heavy duty resistors omitted leaving space for small tools and parts. 8 new type Q Controls included.



Here's a full family of 8 IRC kits and cabinets tailored to your individual requirements. Each of these new resistor and control assortments comes to you in a beautiful all-metal cabinet at absolutely no extra cost—you pay only the regular price of the merchandise.

You'll want several of these attractive kits. They provide an efficient way to stock parts, add to the appearance of your shop—and save your time in unnecessary buying trips. All ranges have been carefully selected after a detailed analysis of AM, FM and TV requirements.

See these new kits at your IRC Distributor's, or write today for free catalog bulletin. International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa. In Canada: International Resistance Co., Ltd., Toronto, Licensee.



INTERNATIONAL RESISTANCE CO.

Wherever the Circuit Says 



Test Pointers

ON TV RECEIVER ALIGNMENT

Experienced television technicians have learned that the tuned circuits of television receivers must be aligned within a few hundred cycles, or at the most a few thousand cycles, of the manufacturer's specifications, if the alignment procedure is to be handled expeditiously. The operation requires, therefore, a signal generator of correspondingly high accuracy.

To attempt the alignment procedure with a conventional signal generator having an accuracy in the order of $\pm 2\%$ invites all sorts of difficulties in making the rf frequencies, oscillator frequencies, intermediate frequencies, and trap frequencies coordinate properly.

Two per cent error in adjusting an intermediate-frequency system can result in distorted sound, no sound at all, poor picture quality, and unstable sync in weak-signal channels. In addition, the technician may find himself readjusting properly aligned circuits and increasing his troubles. Attempts to cure the intermediate-frequency errors by adjusting the oscillator frequency may succeed, but often the adjustment is inadequate, with the result that he must repeat all of his work. Since time is money in the service shop, it is apparent that an inaccurate generator is expensive at any price.

The operator of an inaccurate signal generator can attempt to estimate the scale error. However, he runs into further difficulty when the band-switch of an inaccurate generator has to be changed; the scale error may be positive in one band, but negative in another band.

Such difficulties can be easily avoided by the use of crystal-controlled frequency standards, but the minimum number of crystals required to handle only the RMA standard TV intermediate and trap frequencies, local TV channels, and rf oscillator frequencies, will run to several dozen, with perhaps another dozen or more crystals required to take care of other intermediate frequencies; in all, a rather sizeable investment.

Fortunately, there is a simpler method of providing accurate frequencies. This method employs a variable-frequency oscillator in combination with dual crystal standards and a heterodyne detector which serves to calibrate the oscillator at frequent intervals. For example, the use of a 2.5-Mc crystal and a 0.25-Mc crystal makes it possible to establish crystal calibration points every quarter megacycle over the entire oscillator band. With an oscillator covering a 100-Mc band, the method provides 400 accurate check points.



For TV Servicing...

Indispensable— and in a class by itself! The RCA WR-39A Television Calibrator

THE RCA WR-39A Television Calibrator is the most useful TV servicing instrument money can buy. It's actually three instruments in one:

1. A Fundamental Frequency Signal Generator covering all TV and FM frequencies within the ranges of 19-110 and 170-240 Mc.

2. A Dual-Crystal Frequency Standard providing over 600 crystal-calibrated VFO check points at 0.25 Mc intervals.

3. A Heterodyne Frequency Meter with Audio Amplifier and Speaker.

And here is what the WR-39A Television Calibrator will help you do:

- Accurately adjust all trap circuits.
- Speedily mark any television alignment response curve.
- Easily adjust the rf oscillator to correct frequency for any one of the twelve television channels.
- Peak-align stagger-tuned if transformers.
- Calibrate any signal generator in your shop to $\pm 0.01\%$ accuracy or better.

- Accurately measure the frequency of any source of rf over the entire range of 250 kc to 240 Mc.

The RCA WR-39A Television Calibrator is temperature-compensated and uses a voltage-regulated power supply to assure frequency stability. It features an easy-to-read band-spread dial, 10 feet long. It is sold complete with all crystals and a terminated cable.

Don't overlook the benefits of using the WR-39A in conjunction with your present TV and FM sweep generators. For a complete and modern television alignment set-up, your best buy is the WR-39A Television Calibrator combined with the WR-59A Television Sweep Generator and the WO-55A Oscilloscope. This "TV Trio" is available in the new WS-17A 3-unit rack.

See your RCA Test Equipment Distributor today for further details... or write RCA, Commercial Engineering, Section 511IX, Harrison, New Jersey.

For Test Equipment you can trust see your RCA Distributor



RADIO CORPORATION of AMERICA

TEST AND MEASURING EQUIPMENT

HARRISON, N. J.

RADIO AND

DISTRIBUTION MAINTENANCE



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August 1949

Number 8

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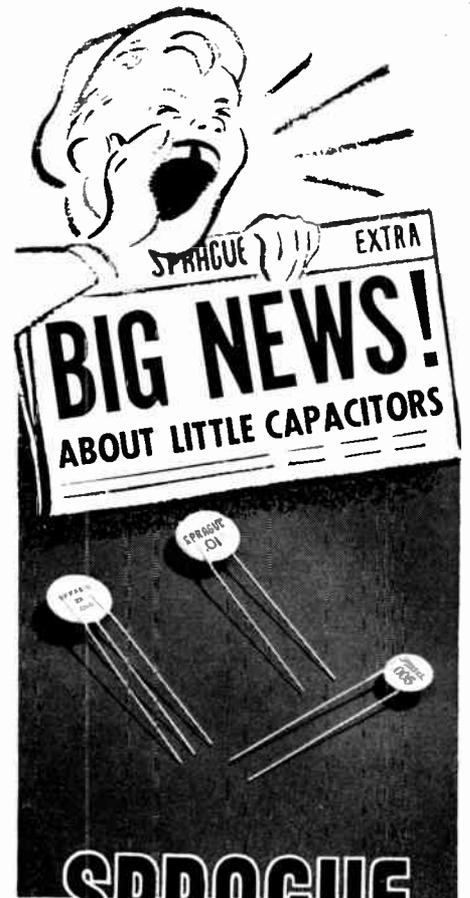
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Entered as second class matter June 15, 1949, at Post Office, East Stroudsburg, Pa., under the Act of March 3, 1879.

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.



SPRAGUE DISC

CERAMIC BYPASS AND COUPLING CAPACITORS

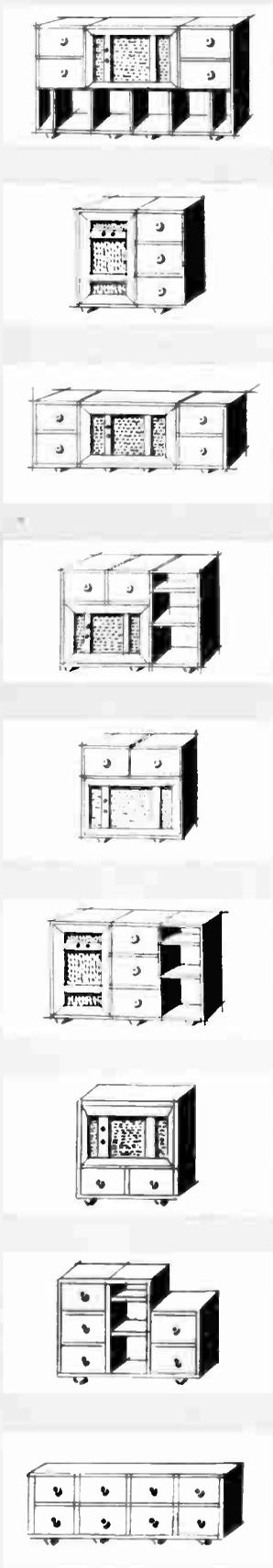
These new ceramic units—no bigger than a dime—find dozens of bypass and coupling uses in both standard and FM as well as television equipment. They have higher self-resonant frequencies than conventional capacitors and fit neatly across miniature tube sockets. They're covered with a tough, protective coating which guards against moisture and heat. Sprague Disc ceramics are available in both single and money-saving dual capacitors.

Use Sprague Disc ceramics whenever circuits call for ultra-compact, bypass or coupling capacitors. Each unit is clearly stamped with capacitance. All capacitors are rated at 1000 v. test, 500 w.v.d.c.

See these remarkable new capacitors at your Sprague distributor today! Write for bulletin M 431.

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PRODUCTS COMPANY

Distributors' Division
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NORTH ADAMS, MASS.

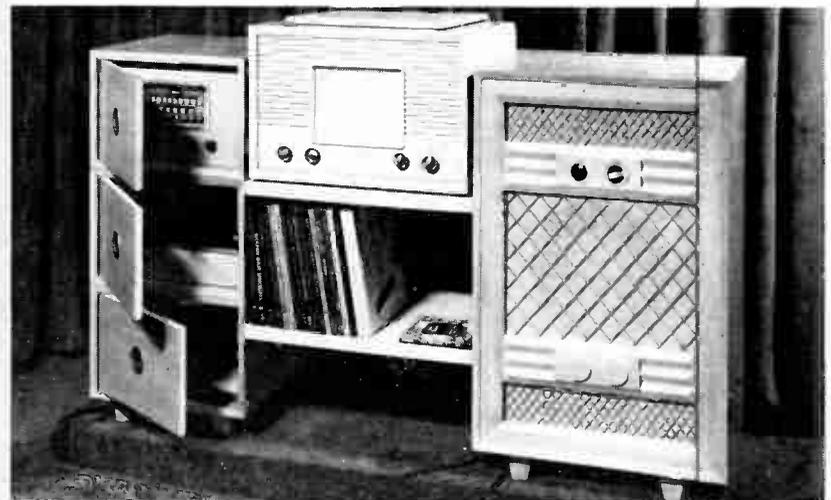


Jensen Customode

CUSTOMODE is the answer to the ever expanding requirements of audio-video equipment. Today you may install a tuner, an amplifier and a record changer with your loudspeaker. Tomorrow you can add a TV receiver, a pick-up for micro-groove records and a record cabinet. The illustrations show a few of the hundreds of possible arrangements for Home Entertainment Centers.

Designed by leading furniture stylists and acoustic engineers around a JENSEN 15-inch loudspeaker in a Bass Reflex Cabinet — the very ultimate in high-fidelity sound reproduction — CUSTOMODE is as functional as it is beautiful. Its "building block" versatility enables you to create your own layouts as you wish, when you wish.

Write today for literature and scale cut-outs. Jensen Manufacturing Company, Division of the Muter Company, 6637 South Laramie Avenue, Chicago 38, Illinois. In Canada: Copper Wire Products, Ltd., 351 Carlaw Ave., Toronto



Shown above is Shelf which provides for inclusion of TV receiver or record albums in a CUSTOMODE ensemble.

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The BIGGEST Book Value in the Industry!

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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. Here 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!

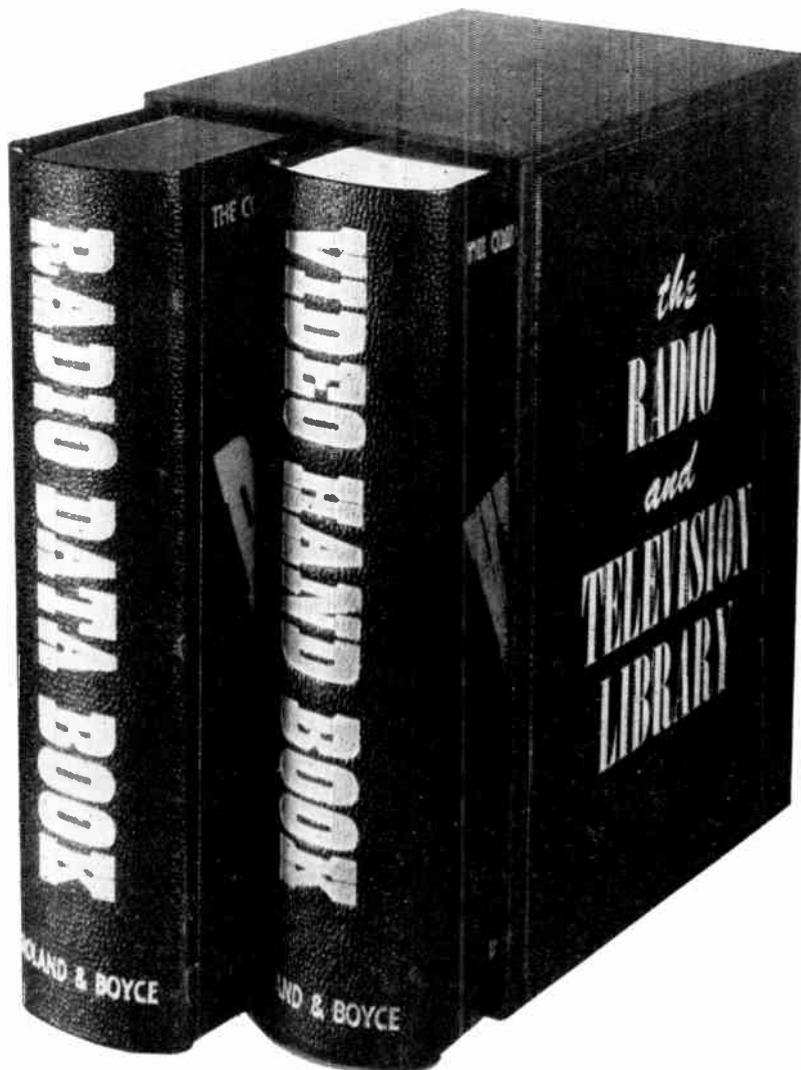
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ANYONE and everyone in radio and electronics can use this book!

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 board, 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!

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THE VIDEO HANDBOOK

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Comments

Don't Stop the Music

A RECENT FCC ruling prohibits television stations from broadcasting music simultaneously with test patterns. Most stations have been broadcasting music in the past because they have found that it is easier to adjust a teletest using a test pattern accompanied by music than one transmitted in conjunction with a single one. To our knowledge, experienced technicians are just about unanimously agreed in favor of music.

We believe that the transmission of music is in the public interest and therefore, the FCC should modify its ruling to permit television stations to transmit music simultaneously with test patterns.

Public Confidence

WITH recent intensification of competition in the sale of teletests a number of rather unfortunate practices have made their appearance. One of the worst is the so-called "free installation." This type of installation is usually performed by untrained personnel and consists of delivering the receiver, connecting it to the power line and to an indoor antenna. In isolated instances, this practice results in satisfactory performance. In the vast majority of cases, performance is partially or completely unsatisfactory. As a result, the public's confidence in television and the radio industry is lessened.

There is sufficient evidence available today to prove that the television buying public will trade where reliable service is available.

In New York City, where destructive sales and service functions are rife, the Better Business Bureau has warned the radio industry to re-examine its sales policies. Lack of confidence, according to the BBB, is the surest way of killing sales.

Safety First

THE RMA recently released a list of safety precautions which technicians should follow in caring for picture tubes. As the RMA points out, picture tubes are a source of great potential hazard which can be overcome by carefully following a few simple rules.

1. Don't expose picture tube until you are ready to use it.
2. Always wear goggles when handling a naked tube.
3. Keep people away at a safe distance when a picture tube is exposed.
4. Place the used tube in the carton which contained the new tube and take it away.
5. Always keep the picture tube in the protective container whenever possible. Always place an exposed tube on some sort of clean soft padding when necessary to set it down.
6. Don't leave any picture tubes lying around. There are two safe ways of disposing used tubes:
 - (a) Place the old tube in a shipping carton properly sealed and then drive a crowbar or similar instrument through the closed top of the container.
 - (b) An alternative method, in the disposing of more than one tube, is to use a metal ash can with a plunger operated through the closed top.
7. Don't use regular picture tubes for displaying purposes. Contact your supplier for special display tubes.

JJR

Another radio service dealer thanks Sylvania Campaigns for big rise in business



"THE FIRST DAY'S PROFIT FROM THE MAILING PAID FOR THE ENTIRE THREE MONTHS SERVICE!"

HERE'S YOUR OPPORTUNITY!

Increase your Business with Sylvania's Fall Campaign—**READY NOW!**

Sylvania's September, October, November, and December campaigns are available now. Here's what you receive:

- 4 Postal Card Mailings — one for each month.
- 4 Window Displays — one for each month.
- 4 Window Streamers — one for each month.
- 8 Newspaper Ad Mats — two for each month.
- Radio Spot Announcements—several for each month.
- 8- and 12-inch decals for window, door and truck.

Tied up directly with Sylvania's national advertising, these campaigns will boost your business. You pay only the postage on the cards you mail. Sylvania gives you everything else *free*. Write for full details immediately, or see your Sylvania distributor.

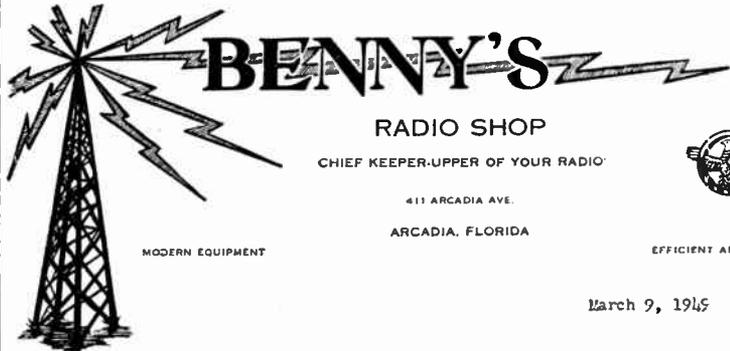
SYLVANIA ELECTRIC

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

Sylvania Electric Products Inc.
Advertising Department R2008
Emporium, Pa.

Gentlemen: Please send me full details on your September, October, November, and December Service Dealer Campaigns.

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



BENNY'S
RADIO SHOP
CHIEF KEEPER-UPPER OF YOUR RADIO

411 ARCADIA AVE.
ARCADIA, FLORIDA

MODERN EQUIPMENT EFFICIENT AND RELIABLE

March 9, 1949

Hammond-Morgan, Inc.
7 South Terry Street
Orlando, Florida

Gentlemen:

Last month your representative showed me his display matter on the Sylvania Direct Mail Advertising campaign for February, March and April.

I placed an order for the series of direct mail cards and received them about two weeks later.

I mailed the first group of cards out on the morning of February 26th about 8 o'clock. Before 2 PM I had a call for service as the result of the mailing!!! Later the same afternoon I had a couple come in to look over new radios. They had received my card regarding repairs and decided that instead of having their set repaired, they would come in and see what I had in new radios. They are at this time about decided on buying a set retailing for \$99.95 plus an FM antenna installation.

I have read the statements of other servicemen over the country about their business increasing 30% and upward as the result of this Sylvania advertising, but I believe the results I have obtained are above anything I have yet heard about. The first day I had made enough profit from the mailing to pay for the entire three months service, and the prospects are that the other two months mailings will bring other business.

I thought perhaps you would be interested in the results I had with this series, and I can tell you now that I hope to increase my mailing list on the next series, and I think I will stick to this form of advertising as long as it is available at such a very low cost.

Yours very truly,
BENNY'S RADIO SHOP
B. McGehee
B. McGehee

PUBLIC ADDRESS SYSTEMS BEST REPAIR SERVICE ON ANY MAKE OR MODEL RADIO HOME RECORDING APPARATUS

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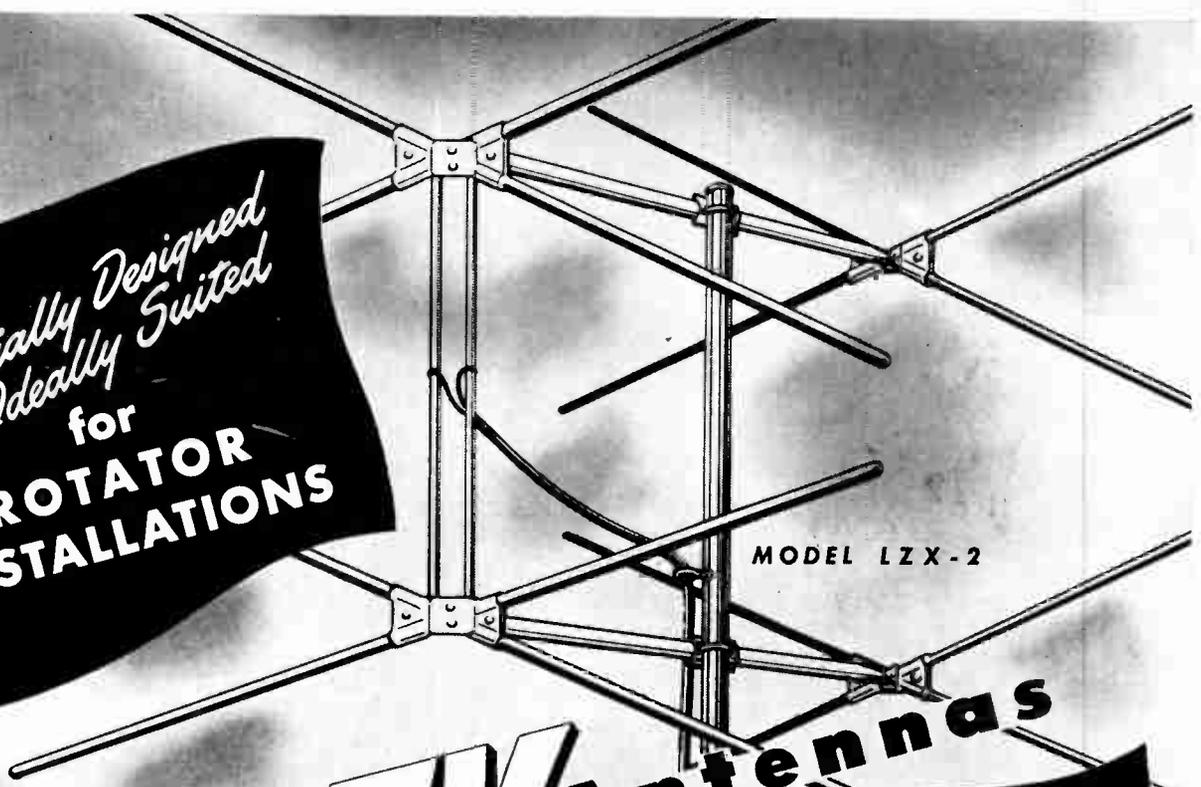
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*Especially Designed
... Ideally Suited*
for
**ROTATOR
INSTALLATIONS**

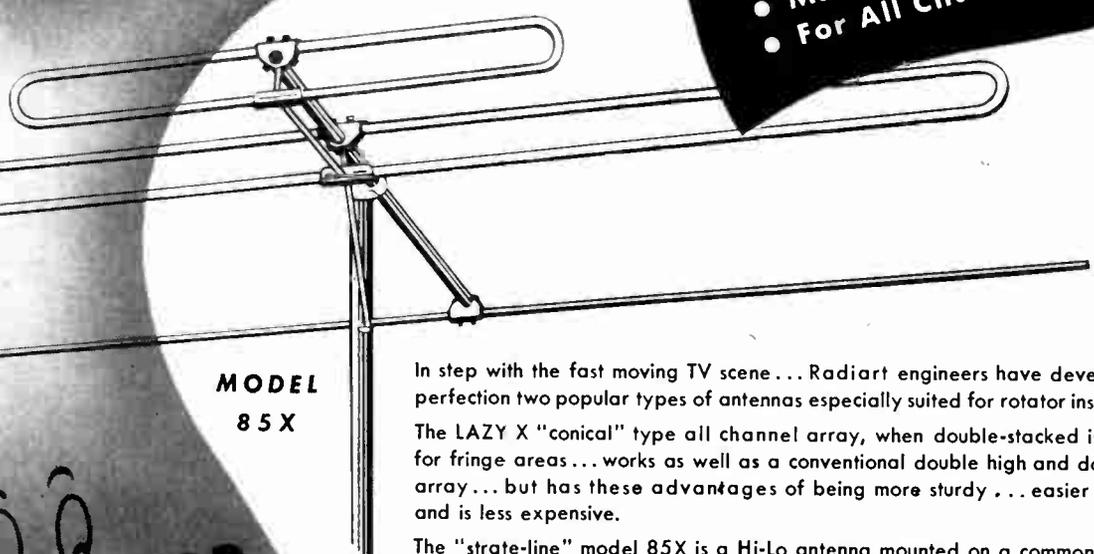


MODEL LZ X-2

Radiart TV Antennas

Better All Ways

- Easy To Install
- Sturdy and Dependable
- Matchless Performance
- For All Channels



MODEL
85X

In step with the fast moving TV scene... Radiart engineers have developed to perfection two popular types of antennas especially suited for rotator installations.

The LAZY X "conical" type all channel array, when double-stacked is superior for fringe areas... works as well as a conventional double high and double low array... but has these advantages of being more sturdy... easier to install and is less expensive.

The "strate-line" model 85X is a Hi-Lo antenna mounted on a common "boom". Ideal for strong signal areas where stations on both high and low channels are received from different directions because of its high front acceptance. And, it is easily installed.

WATCH FOR
the Radiart
TELE-ROTOR
WITH "COMPASS CONTROL"
... the last word in rotators



IT'S RIGHT WHEN IT'S RADIART!

THE RADIART CORPORATION
CLEVELAND 2, OHIO



Manufacturers of the Famous Red Seal Vibrators

RADIO INDUSTRY

Newsletter

edited by Joseph J. Roche

August 1, 1949

FM-AM and FM receiver production, declining since January, dropped to a mere 28,388 in May. Actually, this is not quite as bad as it looks, since the number of FM-equipped telesets has been rising sharply, reaching 38,154 in May. Recent figures indicate that TV is not only overshadowing FM, but is actually hurting it at a time when the industry can least afford it.

* * * * *

Teleset price cutting continues...In New York, Vim, leader of the cut price parade, advertised a ten-inch set for \$139...a twelve-inch set for \$199 and a fifteen-inch set for \$299.

Inaccurate and misleading sales practices are hurting radio and television sales, according to the Better Business Bureau of New York City. Cited among other things were exaggerated guaranties, phony free trial offers, and trade-in deals. Such practices are causing loss of public confidence, says the BBB.

* * * * *

Sylvania's latest television survey turned up the following: out of 50 teleset brands, five account for 70% of sales, the next ten do 28% of total volume, leaving only 2% for the remaining 35 brands. The number one manufacturer accounted for 28% of total receivers, number two for 15.7%, and number three for 11%.

Survey also found that 16 percent of all sets use indoor antennas, that seven-inch tubes are more popular in the newer television areas than in areas having television for two or more years, and that two out of three telesets use ten-inch tubes. 61 percent of the owners questioned could not find anything about their sets to criticize.

* * * * *

A partial lifting of the TV freeze was requested by the Television Broadcasters Association. Pointing to 11 areas with a total of 22 channels, TBA president Poppel stated that interference and station spacing, reasons for the freeze, are not factors in these areas and requested immediate action to lift the freeze.

The FCC looked over TBA's proposal and turned thumbs down.

* * * * *

To help the public realize the need for good radio and TV service, Sprague Products has published a booklet entitled "Your Money's Worth in Good Radio and Television Service." A post card to Sprague Products, North Adams, Mass., will bring free copy and tell how to obtain supply.

RMA appointed two new committees...a Legislative Committee, established "because of increasing new legislation, particularly state and municipal affecting television"...and a Television Committee to be "concerned with growing television problems such as FCC allocations, public information and other matters".

To educate teletset owners, RMA and the Television Broadcasters Association will prepare ten one-minute films. To be ready in early fall, films will be broadcast by television stations. Purpose of the program is to relieve technicians of "nuisance calls" by teaching set owners care and use of their teletsets.

A Washington, D. C. Town Meeting is being considered by RMA.

* * * * *

Non-broadcasting TV may eventually surpass TV broadcasting in terms of equipment. That's the opinion of RCA Engineering Products' W. W. Watts. Typical non-broadcasting applications will be in industry, traffic safety, guarding asylums and prisons, retailing, teaching, and communications.

* * * * *

Long Distance...A Phoenix, Arizona dealer reports that he is consistently picking up TV stations 500 to 1420 miles away. Photos taken of screen showed good pictures from WMCT, Memphis, Tenn., 1200 miles away.

Equipment: Admiral receiver, Taco stacked dipoles with reflectors.

* * * * *

Emerson sold the inventory and fixed assets of its wholly owned subsidiary, Radio Speakers, Inc., to the Jensen Manufacturing Co.; Reason...the subsidiary, which was acquired during the period of post-war shortage is no longer necessary, since Emerson can now buy speakers elsewhere.

General Electric will manufacture a new line of microwave television relay equipment for network use.

Sylvania formed a new Television Picture Tube Division to specialize in design, engineering and production.

General Electric exploring the possibilities of juke box TV...has equipped a Hoboken, N. J. luncheonette with booth sets to determine public reaction.

The first issue of General Electric's new dealer publication The Accelerator was released last month. Publication will feature radio and TV sales ideas.

DuMont's East Paterson teletset plant is in production. Plant is world's biggest.

* * * * *

The National Association of Broadcasters has suggested that a government supported corporation handle all American international broadcasting. At present, this is a State Department function.

* * * * *

WOR-TV's 760-foot tower, located in North Bergen, N. J. has been completed. One of world's tallest, it is destined to become a familiar landmark on the Hudson.

* * * * *

NBC, CBS, and DuMont are considering plans for a 57 acre TV broadcasting center. If adopted, the center will probably be located in Passaic, N. J.

Joseph J. Roche
Editor

Sound Advice From One Serviceman To Another!



MAC'S Radio REPAIR

Choteau, Montana PHONE 74
BOX 638

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. radiomen who have gone into business for themselves are practically starving to death. I can well believe such rumors since I am an ex G.I., and after a year and a half I am just beginning to pull away from the deep part of that red ink pool. I think Dun & Bradstreet, Inc. still list me as a good cash-on-the-line customer. Since the above-mentioned rumors are probably true, I would like to take advantage of your advertising department to pass on some tips to ex G.I.'s who are now in or who contemplate entering the radio repair business.

A man entering radio repair must have some working capital, a good working knowledge of radio, adequate test equipment, and a GOOD REFERENCE LIBRARY. That good reference library cannot be stressed too much, because the big jobs, the mean 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 setting those radios right 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 all 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 doesn't mind paying a good price for it. Rider's manuals give you the information on nearly every radio made and if used will mean pleased customers. REPEAT BUSINESS and word-of-mouth advertising means extra money in your pocket. By doing conscientious work that proves satisfactory you will get both repeat business and good advertising.

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

A. E. McCORKLE

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This is not a code. It is simply an abbreviation of a very important condition in the operating life of a service shop. HIWYNI means HAVE IT WHEN YOU NEED IT. It applies to many things, but especially to RIDER MANUALS. Make sure that you have a complete library of RIDER MANUALS on hand at all times.

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NOTE: The Mallory Radio Service Encyclopedia, 6th edition, makes reference to only one source of radio receiver schematics—Rider Manuals. ANOTHER NOTE: The C-D Capacitor Manual for Radio Servicing, 1948 edition No. 4, makes reference to only one source of receiver schematics—Rider Manuals.

RIDER MANUALS mean Successful Servicing!

deflection amplifiers in

Oscilloscopes

by Joseph J. Roche

THE circuits used in oscilloscopes can be divided into four groups, the deflection amplifiers, the positioning circuits, the sweep generating circuits, and the power supply circuits. The design and construction of these circuits determine the characteristics of the oscilloscope described last month.

Before discussing oscilloscope circuits, it may be well to point out several things about commercial oscilloscopes. There are four general categories of oscilloscopes. The most common is the general purpose service scope. Instruments in this category, which cost from \$60 to \$150, have moderate sensitivity and bandwidth. Such scopes are suitable for a wide variety of uses and when you buy one you undoubtedly get more for your money, dollar for dollar, than you do when you purchase one of the more expensive oscilloscopes.

The second category consists of oscilloscopes which are characterized by high sensitivity and moderate bandwidth. Instruments in this group cost between \$250 and \$350. In the third category are instruments which are designed to give extremely wide bandwidth with moderate sensitivity. These instruments cost approximately the same as those in category two.

In the fourth group are the very expensive instruments, designed for special purpose laboratory and industrial work. In this group are instruments which combine high sensitivity and extremely broad response. Also to be found in this group are oscilloscopes with circular

sweep, built-in electronic switching to permit simultaneous observation of two signals, provisions for modulating the intensity of the beam, blanking of the retrace, and many other special features.

Deflection Amplifiers

The purpose of the deflection amplifiers is to amplify the signal to be studied sufficiently to permit convenient observation on the cathode

ray tube screen.

The amplifiers permit us to study signals of much smaller potentials than would be possible without them. Without amplifiers it would be necessary to apply the signal to be observed directly to the deflection plates. The deflection sensitivity of cathode ray tubes is such that signals having amplitudes of less than several volts could not be observed.

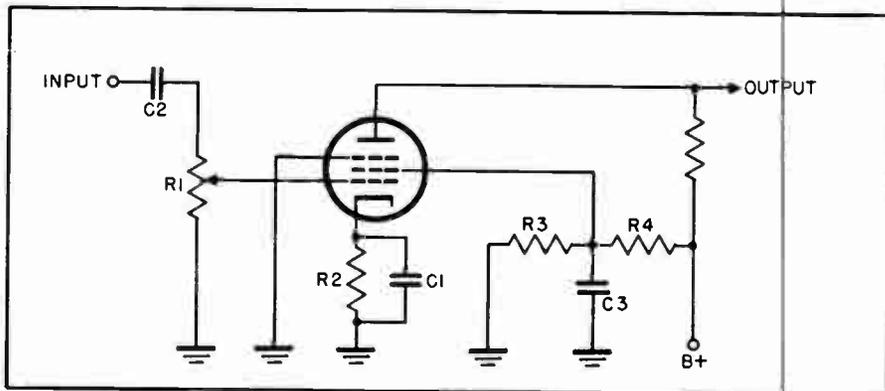


Fig. 1 Deflection amplifier and input attenuator as used in general purpose service oscilloscopes. This type of design suffers from several shortcomings discussed in the text

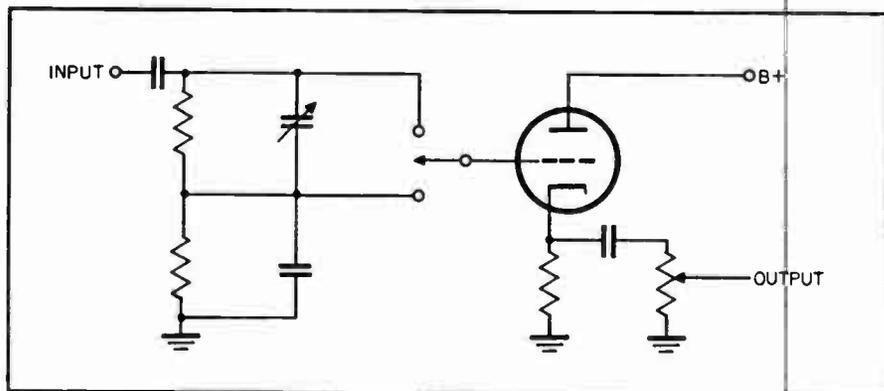
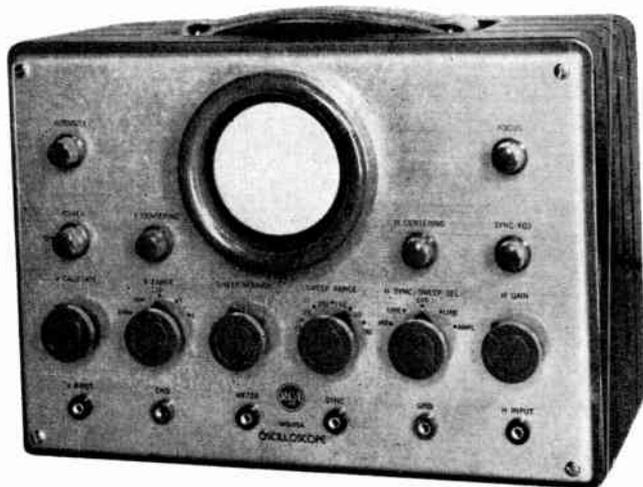


Fig. 2 Input circuit using cathode follower. This circuit minimizes frequency discrimination with changes in input signal attenuation, uses two-position attenuator



We must be familiar with oscillograph circuits to make an intelligent choice when purchasing the instrument

With the addition of properly designed amplifiers, signals with amplitudes of but a few millivolts can be studied.

Unfortunately, amplifiers also place restrictions on the usefulness of the oscillograph. These limitations result because present amplifiers have comparatively limited bandwidth. With the signal applied directly to the plates of the cathode ray tube,

signals with frequencies as high as 50 megacycles can be observed, whereas, when amplifiers are used, the upper frequency limit is restricted to less than one megacycle. This can be extended to perhaps 10 megacycles by careful design and rather expensive construction. Amplifiers, then, do three things: (1) they increase the sensitivity of the instrument, enabling signals of small am-

plitude to be examined, (2) they limit the band of frequencies which can be observed, and (3) they introduce distortion which under certain conditions limits the usefulness of the instrument.

Since ordinary resistance coupled amplifiers do not provide sufficient bandwidth, they are not suitable for use as deflection amplifiers. Fig. 1 is a simplified schematic of a resistance coupled amplifier, modified so as to be suitable for use as a deflection amplifier. A potentiometer is provided in the input to permit attenuation of signals of high amplitude. In other respects, the amplifier appears conventional. However, one other modification has been made. The cathode bypass capacitor C1, has purposely been made quite small. As a result, it has very little effect at low frequencies. At high frequencies it is effective and consequently the gain of the amplifier is increased at these frequencies. This increase in gain at the high-frequency of the amplifier's pass band compensates for the reduction in gain which would otherwise take place and extends the useful high frequency response limit of the amplifier.

The circuit in Fig. 1 is typical of deflection amplifiers found in general purpose service oscillographs. It provides a deflection sensitivity of about 0.3 rms volts per inch and useful high frequency response to 100 kc.

The amplifier and attenuator of Fig. 1 have several shortcomings which can only be overcome by more complex construction. The input po-

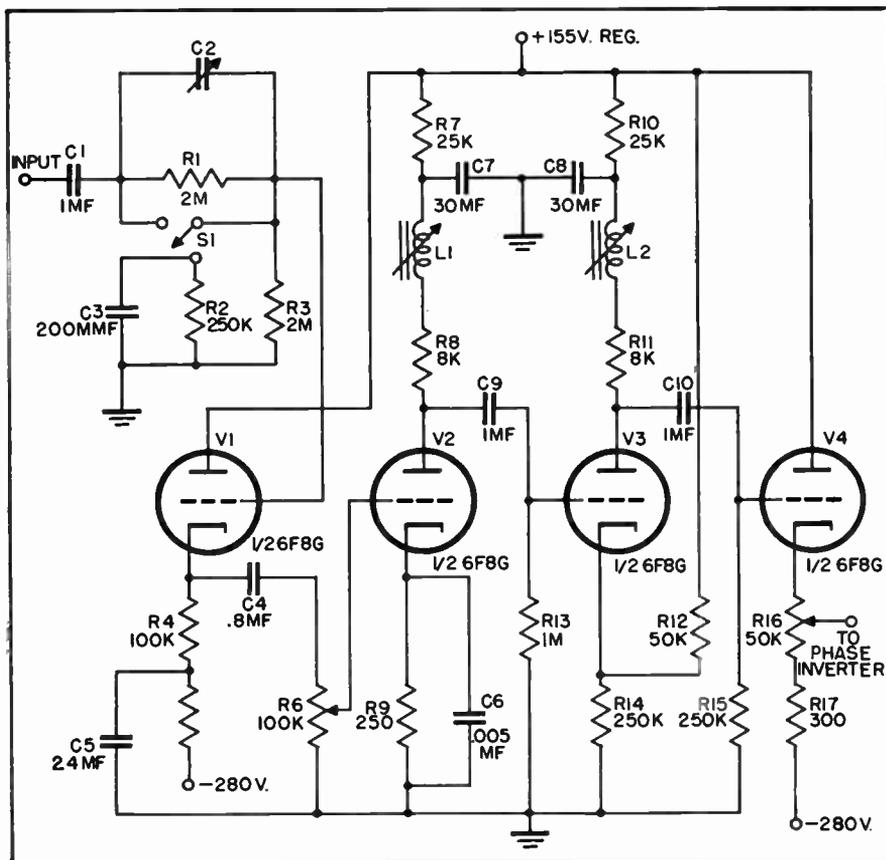
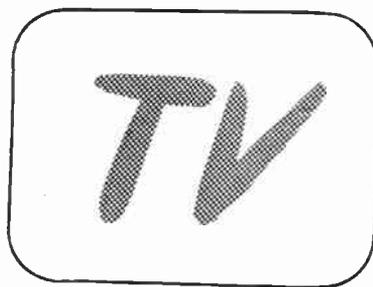


Fig. 3 Vertical deflection amplifier as used in the DuMont Type 208 oscillograph. Peaking coils are employed in plate circuits to extend the upper frequency response limits

→ to page 36

FOR FINER



RECEPTION



THE inconsistent performance of many television installations—good reception at one location or time, poor reception at another—plus the existence of “ghosts,” “snow,” and noise is due, in many cases, to the transmission line. In these cases the line either acts as an antenna for many unwanted signals, or causes severe signal loss because of changing climatic or geometric conditions. Experience indicates, for example, that reflections picked up by the lead in were responsible for the appearance of secondary images on the screen, and that in some localities fog completely saturated the line and shorted out the signal.

These effects can be minimized through the use of a shielded cable jacketed with a weatherproof material. A cable with these characteristics, designated as K-111, has been developed by Federal Telephone and Radio Corporation. This 300 ohm shielded line, a twin-conductor cable, has proved to be the answer to many of the troubles mentioned.

The characteristics of the K-111 are responsible for this improved performance. One is that it maintains a constant characteristic impedance independent of the presence of other objects and the weather. In contrast, the unshielded line has a 300 ohm impedance only when dry and “insulated” from ground. In practice it is of course impossible to meet these requirements at all times and hence the impedance changes, causing mismatch and therefore “ghosts” and signal loss.

The second important characteristic of the cable is the reduction of noise picked up by the lead-in. It should be noted that the antenna—a highly selective circuit—chooses only

signals in the television band while an unshielded cable acts as an antenna for the innumerable signals ever-present in the atmosphere ranging from very low frequencies to ultra high frequencies. The harmonics of any of these signals, or the sidebands of two, could easily fall within the television band. Furthermore, it is far more likely for a 100 foot (average) antenna lead-in to pick up undesired reflections than the 4 foot antenna. The shielded line, of course, only delivers to the receiver the signal picked up by the antenna.

Clear, steady reception will be obtained with this cable providing it is installed correctly. However, a careless installation can do more harm than good. By complying with the following 6 simple steps, optimum results will be obtained. The six steps are:

Step I—Remove a 3” length of outer jacket from both ends of Federal K-111 cable.

Step II—Remove a 2” length of copper braid.

Step III—Pull the remaining 1” of braid over the outer jacket.

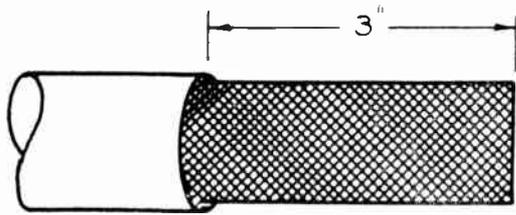
Step IV—Solder a 4” pigtail of #18 A.W.G. wire to braid. The purpose of this pigtail is to ground shield to antenna mast. Strip 1” of Polyethylene.

Step V—Tape each end of the cable with scotch insulating tape (Minnesota Mining and Mfg. Co. #33 or #22 Scotch Electrical Tape or equivalent) to prevent water or moisture

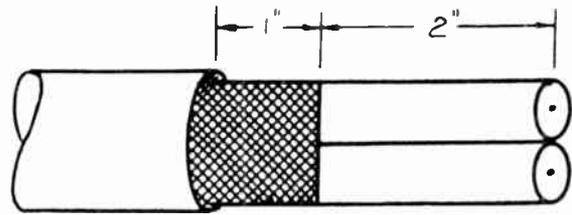
from entering or condensing under jacket. This is a very important factor. An alternative method would be to apply coat of waterproof plastic seal over exposed ends. Crimp Aircraft-Marine Products #31771, or equivalent, lugs over tubing and solder leads to lugs (use minimum amount of heat). Note that by crimping lug over tubing, the cable is not dependent upon the inner conductors for support.

Step VI—Clamp or tape cable to connecting rod between antenna and reflector so that the end of cable is sloped downward toward the antenna connections. Connect the two inner conductors to antenna, ground pigtail to mast. Clamp or tape cable to mast periodically. Fasten cable to house by means of Diamond Drive Ring—Graybar #802 or equivalent. At the receiver, connect inner conductors to input, ground pigtail through a 0.05 MFD condenser to chassis.

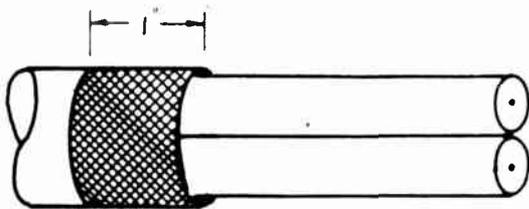
The effectiveness of this transmission line, when properly installed with a properly tuned receiver, has been graphically demonstrated in areas where interference conditions previously made TV reception unsatisfactory, such as heavily congested urban apartment house areas, heavily industrialized areas, and the vicinity of electrified railway lines.



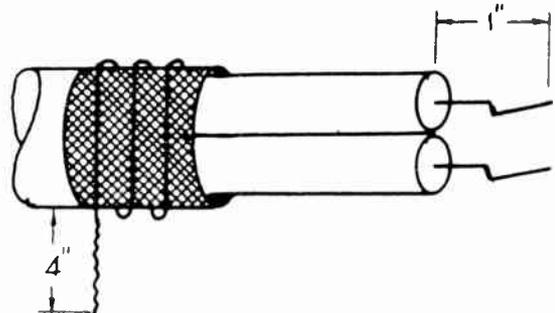
STEP 1—Remove a 3" length of outer jacket from both ends of Federal K-111 cable



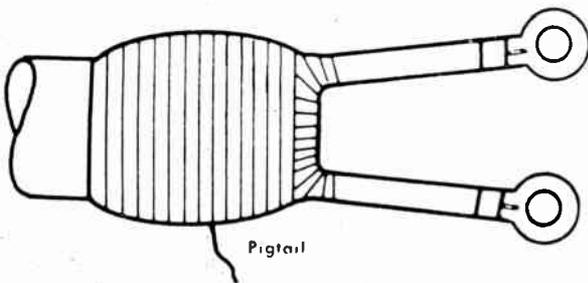
STEP 2—Remove a 2" length of copper braid.



STEP 3—Pull the remaining 1" of braid over the outer jacket.

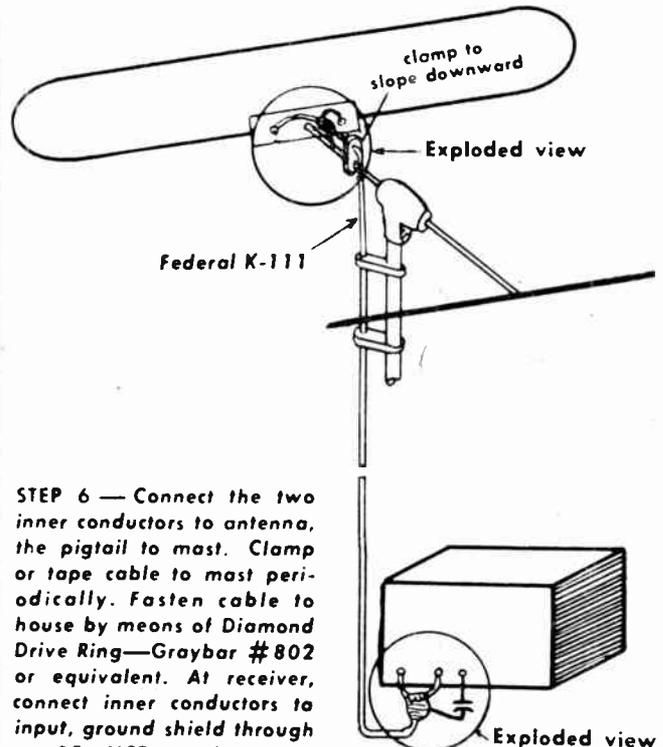


STEP 4—Solder a 4" pigtail of #18 A.W.G. to braid Strip 1" of polyethylene.



STEP 5—Tape each end of cable with scotch insulating tape (Minnesota Mining and Mfg. Co. #33 or #22 Scotch Electrical Tape or equivalent) to prevent water or moisture from entering or condensing under jacket. An alternative method would be to apply a coat of water-proof plastic seal over exposed ends. Crimp lugs over tubing and solder leads to lugs (use minimum amount of heat).

CAUTION: Maximum K-111 efficiency will be obtained when care is taken to assure a water-tight seal at each end of lead-in.



STEP 6—Connect the two inner conductors to antenna, the pigtail to mast. Clamp or tape cable to mast periodically. Fasten cable to house by means of Diamond Drive Ring—Graybar #802 or equivalent. At receiver, connect inner conductors to input, ground shield through a .05 MFD condenser to chassis.

optical systems in

PROJECTION TELEVISION

how they work • how to service them

IN last month's article on projection television systems we discussed the RCA type and began a discussion of the Philco system. This article will conclude that discussion and proceed to cover the Protelgram projection television system.

The Philco Micro-Lens screen as used in their Model 48-2500 receiver is a specially curved metallic screen which must be set at a very definite and fixed angle. The cabinet lid, to which the screen is fastened, must be raised to the proper angle. A mechanical stop arrangement is used so that the screen angle may be correctly set at all times. Improper setting of the angle of the lid may be caused by a binding hinge or a damaged stop. A wrong screen setting angle will result in a lack of sharp picture focus.

The surface of the screen has a special plastic coating consisting of millions of tiny globules of material, each of which acts as a tiny, separate lens. These globules help diffuse and distribute the light uniformly throughout the screen. The surface of the screen also has a large number of vertical grooves. These vertical grooves help spread the light horizontally. The construction of the screen is such that the effect of random light (light from lamps or light reflected from walls) is greatly reduced. As a result the screen picture is evenly illuminated, almost un-

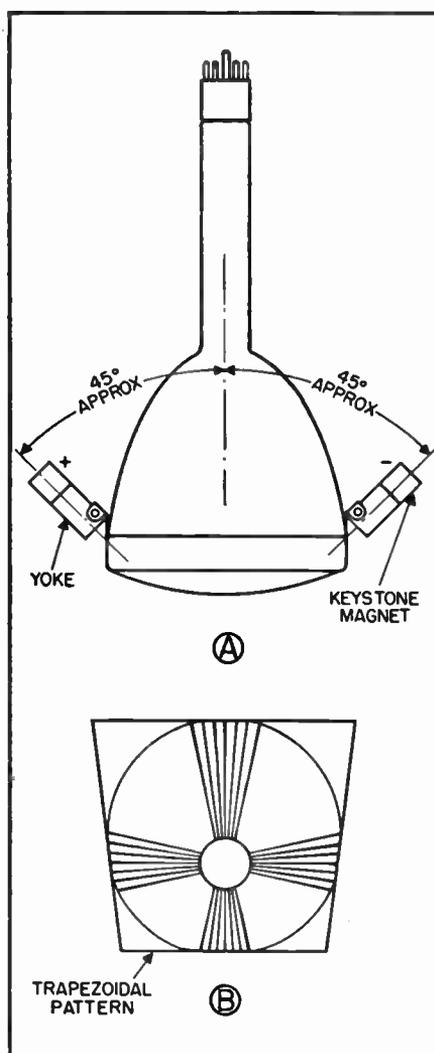


Fig. 1 (A) Projection tube of the Philco system, with magnets, (B) Keystone pattern

affected by random light, the picture brilliance and independence of external light enabling daylight viewing. If the plastic coating on the screen is scratched or chipped it will be necessary to replace the screen. The screen may be dusted with a soft cloth but this should not be done too often since scratching the screen will do more mischief than dust.

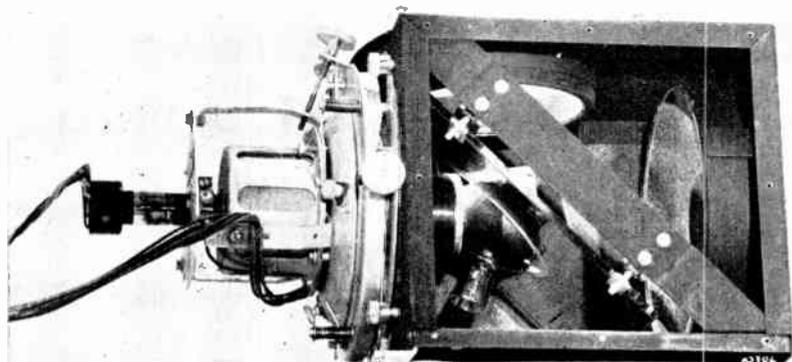
Since the micro-lens screen is set at an angle, the light coming from the flat mirror will strike the screen at an angle. The light striking the bottom of the screen has a shorter distance to travel than the light hitting the top of the screen, resulting in a type of picture distortion called compression. The picture that is thus formed has a trapezoidal or keystone shape. A trapezoid is a geometrical figure having sloping sides, while the top line is narrower than the bottom line.

Keystoning Magnets

In order to overcome this distortion, permanent magnets are attached to each side of the picture tube at the front face edge. These permanent magnets are oppositely polarized bar magnets, attached to curved pole pieces. They exert a magnetic influence on the cathode ray beam, causing the picture on the face of the tube to assume a keystoneed effect. The keystoning magnets are mounted on diametrically opposite edges of

the television technician of today must face an astronomer's tool

by Martin Clifford



The optical barrel developed by North American Philip for its projection system

the projection tube. The pole pieces to which the bar magnets are attached are curved so that they fit the sides of the tube snugly. The keystone magnets are adjusted for the proper keystone pattern by moving them toward (parallel with the tube neck) or away from the tube (at right angles to the tube neck). Keystoneing the image in the projection tube will cause it to appear in normal rectangular view on the screen. Fig. 1 shows how keystoneing is accomplished in the picture tube.

There is no electrical connection between the high voltage and the magnets. However, the magnets are quite capable of collecting an electrostatic charge, hence each of the magnets must be grounded before making any adjustments. The tube, which in itself acts as a capacitor, and the magnets, are capable of holding a charge for quite a long time. A good procedure is to ground the anode and the magnets for a moment or two before using the tube, even if the tube is a brand new one and hasn't previously been used. It is essential that the keystone magnets be placed in the same plane. Failure to do so will result in a picture which has curvature on the bottom. If the keystone magnets are not correctly adjusted it will result in a picture whose sides are not parallel with each other.

The same precautions in the hand-

ling of the mirrors should be applied to the projection tube. The curved portion of the TP-400A has a coating which has high insulating properties. Since the voltage placed on the anode of this tube is quite high, it's very easy for a leakage path to develop if the tube is handled unnecessarily. Fingermarks can cause leakage currents and arcing may even occur. The neck of the tube is coated with a conducting material. This conducting material acts as a shield for the cathode ray gun and serves to protect the cathode ray beam from any stray fields.

Corona Discharge

The high voltage used in this system, as in any other projection system, presents the service man with new problems. Ionization of the air, plus a corona discharge, can occur near any high voltage spot. This is most likely to happen when the high voltage exists between two sharp points. The corona discharge is actually an arc—and its action will be exactly like that of old time arc and spark transmitters. The corona arc sends out a broadly damped wave train whose wave form closely resembles that of noise impulses. This radiation will show up as noise bursts on the screen. You can test for the presence of corona in two ways. In a dark room you may see a line of light, a sort of ghostly, flickering blue, appearing between high

voltage points and ground. There will also be the acrid, pungent odor characteristic of ozone. Don't have sharp right angle bends in any high voltage conductor. If any bending is necessary, do it in the form of a long, gradual curve.

Although the optical system proper comes in the form of a barrel-like housing, a number of adjustments are necessary in order to get the system working properly. Improper adjustment of the optical housing with respect to the cabinet will produce a shadow at the lower corners of the screen.

Customer tampering with the receiver can easily ruin the system. Since correct adjustment procedure involves proper setting of background, contrast and focus controls, adjustment of the picture tube and deflection yoke, setting of the keystone magnets, positioning the micro-lens screen to the proper angle, it's highly advisable to have the manufacturer's literature giving detailed instructions.

Protelgram Projection System

Norelco Protelgram, the North American Philips development, also makes use of a modified Schmidt optical system. The components of the Protelgram system are shown in Fig. 2. Norelco Protelgram utilizes a much smaller projection tube than the sets described thus far. The

→ to page 34



by **Victor M. Turner**

A store front is an architectural problem in design, both from the functional and esthetic point of view. By this is meant not only that a good architect is a good investment in building a new store or re-modeling an old one, but that the store owner should himself take an active interest in current architectural trends and styles before deciding on a design for his place of business.

Very often a store front is classed solely as a display arrangement and, as a result, suffers by becoming out-moded in a short time. It's true that the store front, in providing a setting for the display of your products, is a very important factor in attracting the customer. But as it cannot be changed as often as the display of your products, it is imperative that a good design be adopted before starting construction.

There are a number of principles of modern architectural design that should be made clear in order to better understand current ideas on the subject. One is that a design for any sort of structure must be functional in order to be good. The other is that the term "modern" architecture is not meant to denote a *style* of deco-

ration or plan, but an application of new materials and scientific knowledge to the creation of a structure that is efficient, comfortable, and pleasing. For example, in other times buildings were limited by structural qualities of materials then available. In a large auditorium, pillars were needed to support the roof, since there was no such thing as a beam strong enough to do the job without vertical reinforcement. The pillars, of course, obstructed visibility, and the efficiency of the room was reduced.

In a modern auditorium there is no need for supporting pillars, and introducing them for their decorative value would be absurd.

Yet in many other instances this very thing is being done in order to conform to a style of architecture originated in another era. Windows that should be large to admit light and provide visibility are kept small to retain Gothic, Renaissance, or Colonial proportions of design and structure. This practice of admiring building customs and styles of by-gone days and recreating them for contemporary use is unflatteringly called "eclecticism." In building a residence, this practice affects only the comfort of the people residing

therein, but in applying it to a commercial building it wastes money through inefficiency of operation and lost trade.

Modern Design

It is for this reason that people have accepted the radical changes in appearance of modern architecture more quickly for commercial structures than for private dwellings; and it is now a proven fact that modern design in store fronts means increased sales.

In a retail store the most obvious application of modern materials and design is in the store front, where the use of glass will give absolute visibility. The entire store interior can now be seen from the sidewalk through an all-glass store front, not only giving opportunity to display a greater variety of products, but also presenting a striking effect when combined with modern lighting and color schemes.

In using large areas of glass, the problem of reflections arises and the individual situation requires its own solution. In general, however, reflections can be offset by keeping the interior of the store in light colors and well illuminated. Dark sidewalks outside the store will not reflect on the panes as much as bright sidewalks.

how good is your STORE FRONT design?

There are many ways to increase the pulling power of store fronts. Some of them are examined here

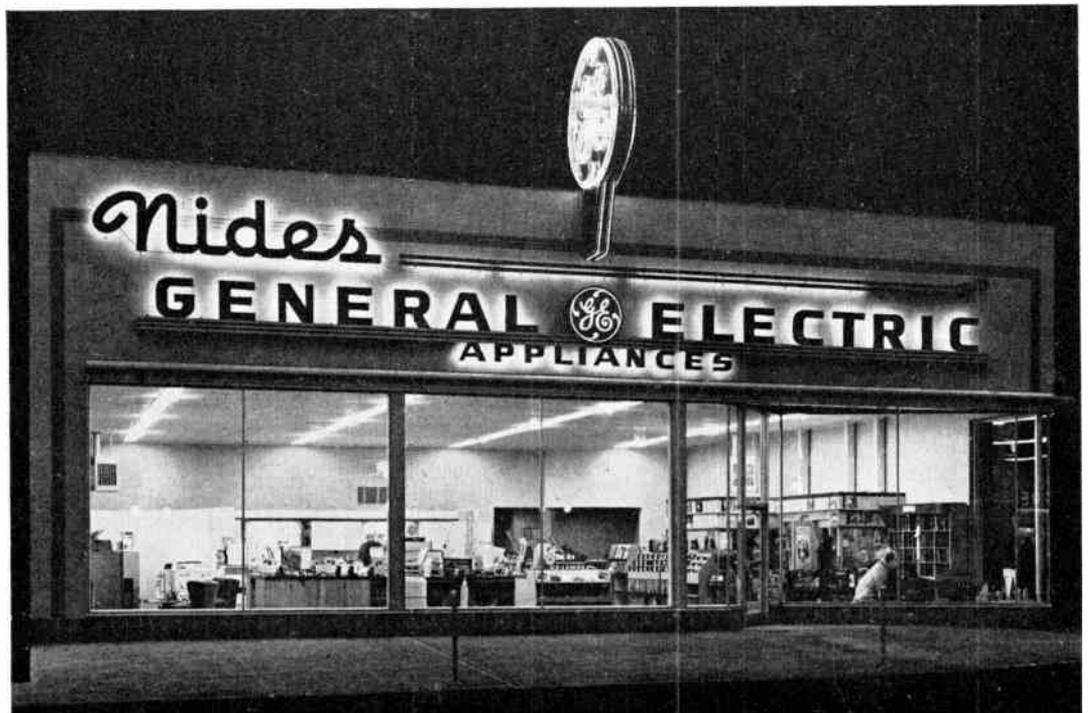
Tilting the glass in at the bottom cuts reflections from the sky or signs across the street, and beveling the glass at an angle in plan, as shown in Fig. 1, further reduces reflections in many cases. In all instances, however, the sources of reflection must be determined before deciding which way the glass should bevel. Another

method of cutting reflections consists of the use of curved window panes, as shown in Fig. 2. This method cuts reflections almost completely, but it suffers from the disadvantage of collecting considerable dust and requiring extensive cleaning daily. As a result it has fallen into disuse laterly.

For the parts of the facade, bulk-

heads, and supporting columns not using transparent glass, a material can be used which has a color contrasting with the interior of the store. This material may be any one of a great variety of metals, compositions, woods, brick, stone, etc., specially adapted for store front use and available in beautiful new colors,

Example of modern design store front which pulls in the customers (photographs courtesy Libbey-Owens-Ford Glass Co.)



patterns, and textures. There are so many different materials now available for this purpose that an effort should be made to see as many samples as possible before deciding on the one to use. The architect, construction company, and manufacturers of these materials should be contacted for these samples. An excellent idea is to look through late issues of architectural magazines for suggestions. Many firms and organizations have informative booklets available on request, and a list of some of these sources appears at the end of this article.

Observe Your Neighbors

In designing a store front it is well to keep in mind the neighboring dealers and the appearance of their establishments. For example, if a store next door uses a polished black front, it would be unwise to do the same; because then the two stores may be mistaken for one. Care should however be exercised in adopting a contrasting color to that of a neighbor, for if one store is predominantly red, the other should not be in those shades of blue or green which will vibrate when used in conjunction with red. This would be a drawback to both storefronts.

The policy of group planning has become gradually more popular with many communities, and is of very definite benefit to all those who are participating. In a bulletin issued by the Pittsburgh Plate Glass Co. the group modernization projects in Franklin Square, Long Island; Rome, New York; Faribault, Minnesota; and Miami, Florida were cited as illustrations of the successful application of this policy.

These examples have proven what progressive architects and builders have long maintained—that an area with all stores modernized through a master plan will eventually attract more trade than a block of both old and new stores. This result is not only achieved through the attractive appearance of a planned shopping center, but also through such features as cooperative parking facilities and the like.

Group modernization programs are not always easy to initiate, however. The best way is for one or two merchants to propose the plan through an interested second or third party, such as the local Chamber of Commerce. This organization (or

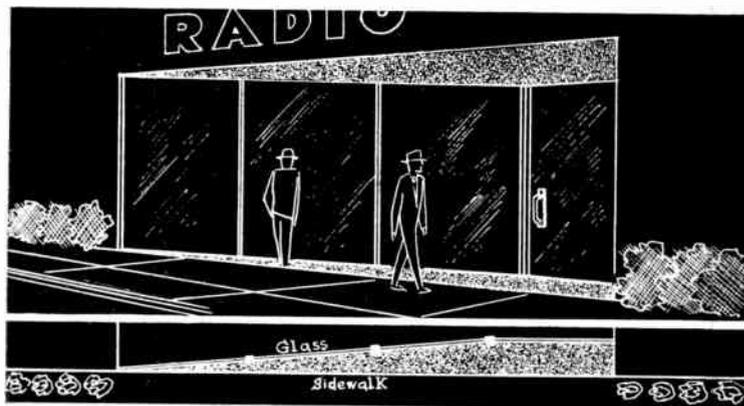


Fig. 1 Beveling the glass at an angle in plan reduces reflections and makes for a much more attractive window. It's becoming increasingly popular

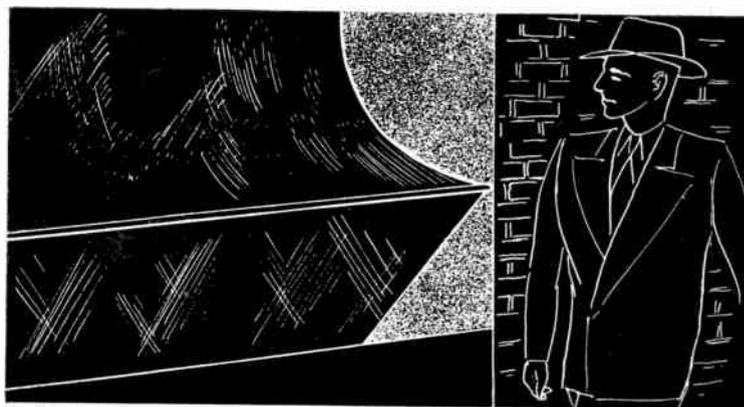


Fig. 2 Curved window panes were once very popular. The amount of dust they collected daily has caused them to fall into disuse in recent years

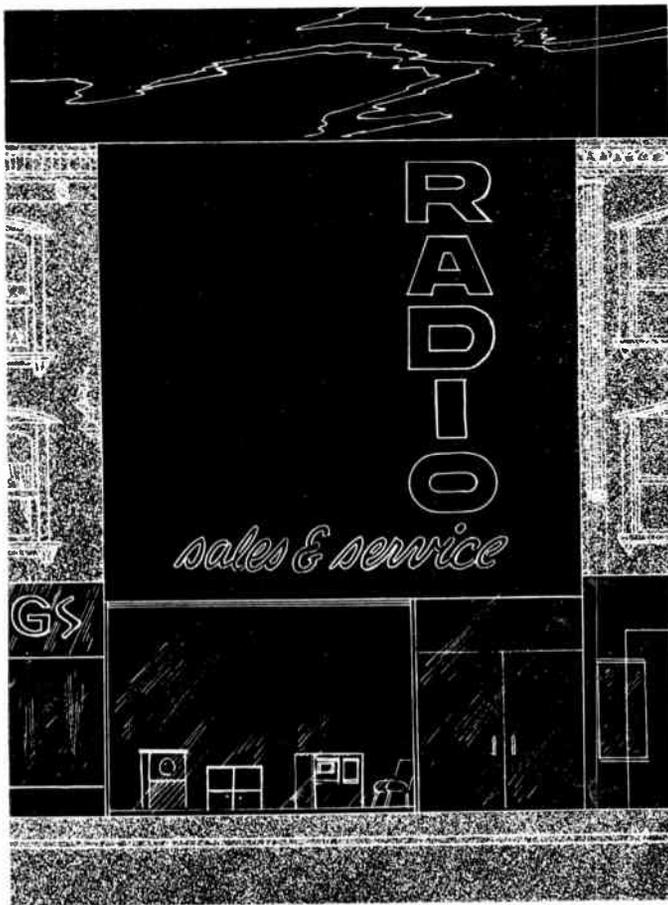
a bank, or a newspaper) can educate the neighborhood to the benefits of such a plan, stressing the fact that in a master modernization program, the individual store can best be made to stand out and its re-designing costs often reduced. It is not necessary to have 100% cooperation by all merchants in order to set a program in operation, as those not participating at the start will probably come along later when the obvious improvements and new advantages begin to take shape about them.

A radio and television receiver dealer has an incentive in his own stock to make his store front ultra-modern. He is dealing with some of the outstanding examples of modern design and development in the products he sells, so it is altogether fitting and actually imperative to make the store equally modern. If the establishment is in an old building, the

store front should be rebuilt to modern standards.

Redesigning a Store Front

In redesigning the front of a store which has an old-fashioned building above it, the effect is sometimes make-shift in appearance if an archaic or run-down building front rises above a newly renovated store. Wherever possible, the dealer should modernize the entire building front, and this will be especially advantageous to a store that is in a narrow building where the display window and store entrance present only a small area of attraction. If the entire building front is utilized to carry the color scheme of the store, and in some cases a vertical sign bringing the eye down to the display window, the drawing power of the establishment will be increased tremendously. Since so much of the store front ma-



It pays in many cases to redesign the entire house front, rather than merely the area surrounding the store window. Here is an example

terial now available can actually be applied as a veneer over existing structures, this can be done at a cost infinitely lower than building renovation in past times.

When creating a new store front the sign should very definitely be incorporated as part of the overall job. The architect can use the name of the store as an active part of the new design, and some very striking effects can be achieved by a large, plain background over a show-window bearing the name in illuminated letters of good size.

As a parting thought we want to caution a dealer considering a new store front that there are some legal points to check before starting a re-decorating job. One, of course, is the restriction in some zones against projecting or hanging signs, and another is that in some localities there are various insurance laws requiring greater coverage when some materials are used.

In this respect, and in the assurance of a successful result in a re-decorating program, careful planning means money saved and money earned. ✓✓✓

Partial list of manufacturers and associations who provide excellent literature and information on store front materials and design:

American Institute of Architects, New York Chapter

Amplex Products, 1106 Arch St., Philadelphia, Pa.
Plastic illuminated canopies, spot lights, and floods.

Architectural Porcelain Fabricators, Inc.
492 East 163rd St., New York 56, N. Y.
Store front materials.

Bliss Display Corporation, 460 West 34 St., New York City
Display materials.

General Electric Co., Lamp Dept., Nela Park, Cleveland, Ohio.
Display lighting.

Kawneer Co., 737 N. Front Street, Niles, Mich.
Store front materials.

Libbey-Owens-Ford Glass Co., Toledo 3, Ohio
Store front materials.

Pittsburgh Plate Glass Co., 632 Duquesne Way, Pittsburgh 22, Pa.
Store front materials.

Pittsburgh Reflector Co., Oliver Bldg., Pittsburgh 22, Pa.
Lighting Equipment.

Seaporcel Metals, Inc., 28-20 Borden Ave., Long Island City, N. Y.
Store Front Materials

Store Modernization Institute, 40 East 49 St., New York City
General Information

And an informative and interesting book on the subject:

Shops and Stores by MORRIS KETCHUM, Jr., Reinhold Publishing Co. 310 pp. \$10.00.

ELECTRONICALLY SPEAKING



by Isidor I. Gross

The Silver Lining. Reports from the manufacturing front failed to give a clear picture of future production rates, but generally agreed that production schedules were being revised downward. Sylvania was cutting back on its picture tube production, Motorola and Magnavox doing the same with receivers. RCA and Philco, however, were going ahead with planned expansions, looked for brisk sales of their lines. As has been observed in the past, it seemed to be the smaller concerns which were suffering most.

Supply and Demand. What was clear by midyear was that original 1949 production estimates had been far too optimistic, that television production was beginning to outstrip demand. A two-month inventory had already accumulated by the end of February.

The Buyers Market. With television programming at its low summer level, the public needed price inducements to buy. Sylvania reported in a recent survey that since the beginning of this year only 12% of the sets were sold at over \$515, found that more than half of the sets in use were owned by families with a yearly income of less than \$5,000. The Federal Reserve Board added its opinion that people are as willing as ever to buy, are making sure the price is right.

Pound of Cure. Going along on the theory that it's lower prices the customer wants, Vim of New York slashed the tag on its stock of television receivers from 24 to 60 percent, reduced some sets by \$500. Conspicuously absent among the 895 receivers put on the block was DuMont.

Second Front. The retailer was not only troubled by reluctant customers, was also beset by manufacturers' price cuts. Caught with large inventories and no rebates, stores were feeling the squeeze acutely, started a hand-to-mouth buying policy, sometimes with no more than a weeks supply of merchandise on hand. Department stores were complaining loudest, were looking toward some sort of agreement with the manufacturer.

The Culprit? One industry representative let off some steam on sagging prices. Said Percy L. Schoene, executive Vice President of Olympic Radio & Television: "Certain manufacturers now competing in the lowest-price market have cut corners to the extent of reducing the number of tubes in the circuits below the minimum necessary for good performance and trouble-free operation," failed to name any names.

Writers in the Sky. For years the sky over New York had been reserved for messages written by planes for Pepsy Cola and I. J. Fox. This month the monopoly was broken by television. Writing away madly, over and over again, were two planes spelling out Muntz TV, Muntz TV, Muntz TV. Merchandising seemed to have more aspects than simply price reductions.

Service. Those who were able to, tried to get the customer's dollar by way of sales through service. One store, advertising receiver sales, said: BEAR IN MIND: the television you buy is only as good as the service and installation you receive. Another proclaimed proudly:

Our Staff of highly trained television technicians are available to give you courteous service at all times.

The Prospect. After all was said and done, the fact remained that sales were off, were not expected to rise till fall.

Concentration. Sylvania's Frank Manfield made a survey of the field, found that only five of the fifty brands of television receivers had become strongly established, accounting for 70 percent of all television sets bought.

Tower Power. New York's WOR was completing its 760 foot tower atop the Palisades, was preparing to start telecasting late summer or early fall. Incidentally, the top of the antenna mast will be 1,050 feet above sea level, second highest local antenna.

Service to Servicemen. Eleven service depots, strategically located throughout the country for the convenience of DuMont oscillograph owners are currently being operated by Allen B. DuMont Laboratories, Instrument Division. The depots are intended to eliminate the need for shipping the instrument when in need of repair, provide virtually local service. They are located at Clifton, St. Louis, Houston, Los Angeles, Detroit, Chicago, Dallas, Atlanta, Minneapolis, and Waltham, Mass.

Antenaplex. Initial installations of RCA's first multiple outlet television system for multi-unit structures (apartment houses, hotels) have been completed in New York and Philadelphia. It uses one antenna with cross-arms for each station or a separate antenna for each channel, depending on the location of the local transmitters in relation to receiver site. The system obviates installation of separate antennas for each receiver in the building. Television Antenaplex signals are fed to specially designed electron tube amplifiers, the outputs of which are combined and fed to room outlets. Each outlet requires only one cable to supply all television and radio channels. At present available only in a few Eastern television areas.

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Morton Scheraga and Joseph J. Roche

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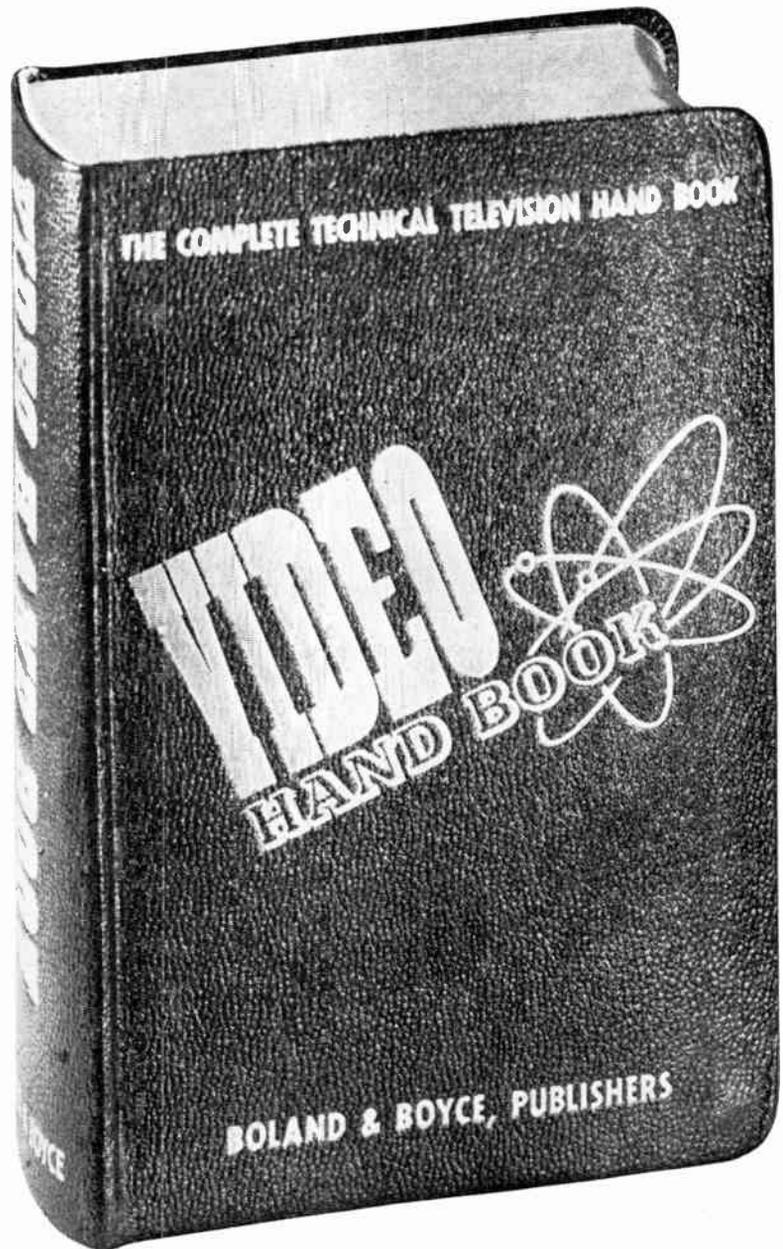
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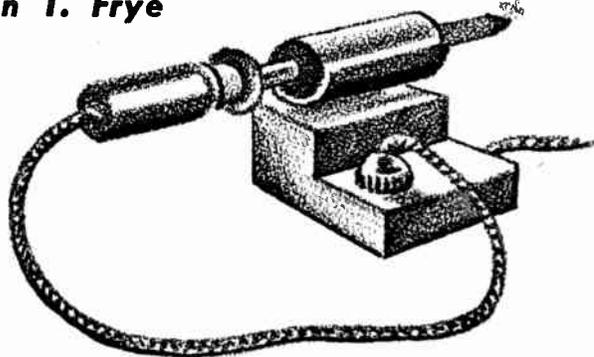
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MONTCLAIR, N. J.

OVER THE BENCH

By John T. Frye



SEVERAL of you have written me asking for information and advice about the various service-equipment kits that are appearing on the market in increasing quantities. Are the kits worth the money? you ask. Are they hard to assemble? Is it better to buy a kit and put it together or to buy a factory-built instrument?

Any opinion in a matter of this kind is worth just as much as the actual experience of the writer—and no more; so let me say that my own experience is limited to having assembled and used a half-dozen of these kits, ranging from comparatively simple VTVM probes to cathode ray oscilloscopes. In addition, advantage has been taken of every opportunity to check these instruments against similar manufactured units in various price brackets, and notes have been compared with dozens of other servicemen and amateurs who have built and used these kits. Particular interest has been taken in the reports of those men who have taken their home-assembled instruments into college and radio-factory laboratories and have tested performance against accurate standards.

From these sources have come a few definite opinions on the subject of service instrument kits. Probably all of them can be lumped under two general convictions: First, the kit supplies a very real need and is here to stay; I never expect the instrument kit to supplant the sale of manufactured instruments.

The main thing the kit has to offer is lower cost. In general, a kit is priced at from one-half to one-third of what a complete instrument of comparable design sells for. The kit manufacturers say that this saving results from the fact that high-cost radio assembly labor has not been added to the actual cost of material. In addition, I am convinced that a further saving has been made—at least in many cases—by the purchase and ingenious use of whopping quantities of war-surplus radio parts.

In no way is this fact a reflection on the quality of these parts. In fact, the stringent military specifications to which they have been manufactured are usually much higher than are imposed on the ordinary run of radio equipment. All of the surplus items I have seen in the kits have been clean, unused, and of a nature that suffers no deterioration with age.

As for the difficulty encountered in assembling the kits, there is no real difficulty that any practicing serviceman needs to dread. It is true that they really come in a completely unassembled form—although occasionally a ticklish unit, such as a tuned-circuit sub-assembly will come already wired—but everything fits together smoothly, and no drilling, punching, or bending is necessary. The combination of diagrams, pictures, and schematics that are furnished provide all of the information that anyone should require. No special tools, outside of those that a radio technician must have, are need-

ed. The kits do not, however, put themselves together; and the same servicing necessity for making good solder joints and for seeing that everything is mechanically solid still exists.

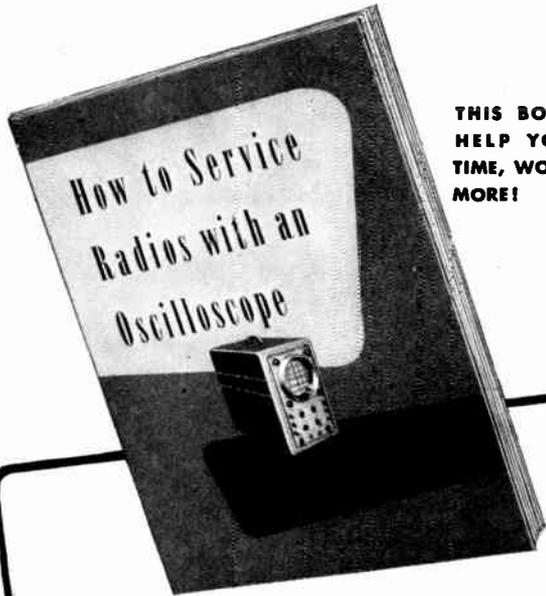
If you do get one of the kits, the main thing to keep in mind is not to rush the job. Pay no attention to any advertising blurbs that say you can put it together in a pleasant hour or so. You will probably be using the instrument for years; so do not fail to do a leisurely, thorough job of it. Do not keep at it until weariness and impatience drive you to slovenly workmanship. I like to stretch one of the more complicated assembly jobs over three or four evenings and take the kind of pains that makes the description "hand-made" a mark of excellence rather than an apology.

And if, after the last wire has been soldered into place, you will go over the schematic with a color pencil, tracing out in red every connection after that particular wire has been carefully checked in the completed instrument, you will not need to be afraid to throw the switch for the first time.

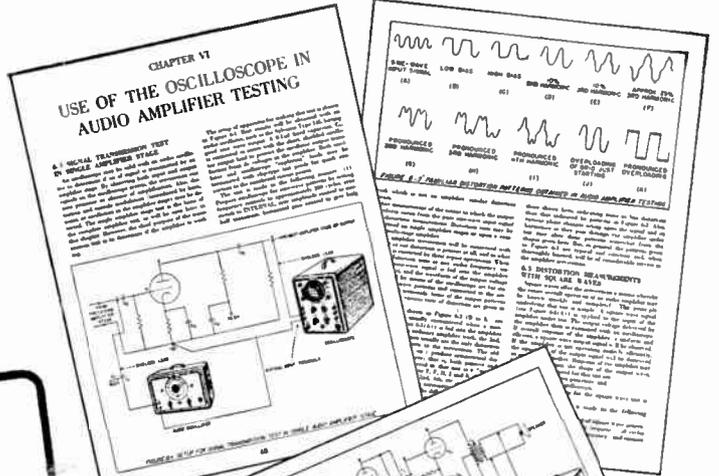
When it comes to whether or not you should buy a kit or a complete instrument, that is a point about which blanket advice cannot be given. There are too many variables. How busy are you? To what use are you going to put the instrument? How valuable is your time? Do you enjoy building things? These are but a few of the questions that bear directly on the subject.

I think that it is likely the established and very busy radio serviceman will usually buy factory-built instruments. Any amount saved by buying a kit must be balanced against the value of the time taken away from lucrative service work to put it together and calibrate it. In the case of a serviceman with lots of work, this consideration would cut down considerably on the saving accomplished by buying a kit. In addition, there are many servicemen who prefer to have on their bench only instruments bearing well-known names. Many of them have come to rely on the products of one particular manufacturer and are quite willing to pay extra to have their instrument assembled and any possible "bugs" taken out of it at the factory.

→ to page 33



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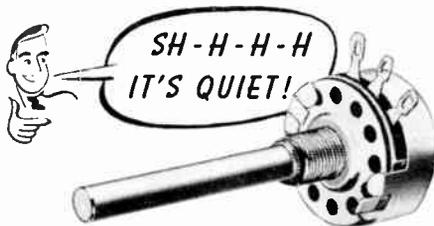


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INSULATED COMPOSITION RESISTORS

In critical television applications, Little Devil Resistors can be depended on for longer, trouble-free service. These tiny, rugged units give quiet performance and are ideal for sensitive RF circuits. Moreover, they are available in $\pm 5\%$ as well as $\pm 10\%$ tolerances — in $\frac{1}{8}$, 1, and 2-watt sizes; standard RMA values.



NOISE-FREE TYPE AB POTENTIOMETER

Continued use has little effect on the resistance of this unit because the resistance material is solid-molded—not sprayed or painted on. In fact, the noise level often becomes less with use. The unit has a 2-watt rating with a good safety factor.

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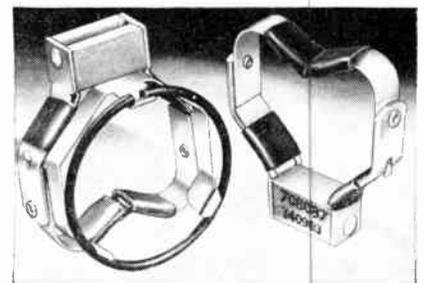
A new v.t.v.m., the Sylvania Polymer Type 221, has been announced. It is said to provide an essentially flat response in voltage measurements at frequencies ranging from 20 cycles to 300 megacycles, and useful measurements at frequencies between 300 megacycles and 500 megacycles. A-C and d-c measurements of 0-3 to 0-1000 volts are provided through six scales for each type, 5 r-f ranges permit measurement of 0-3 to 0-300 volts. Resistance and current measurements are, of course, also provided for.

Manufacturer: Sylvania Electric Products, Inc., 500 Fifth Ave., New York 18, N. Y.

SIGNAL GENERATOR

According to the manufacturer, this instrument, streamlined in appearance, has a frequency coverage which will take care of all the a-m and f-m bands and provides useful signals from 95 kc to 150 megacycles. Two individual percentages of modulation, 30% and 80% are included for checking detector performance. Modulation can be applied externally or from the self-contained 400-cycle oscillator circuit. This audio source is also available for use externally at the audio output terminals. Dimensions: 8" x 11 $\frac{3}{4}$ " x 5". Weight: 11 pounds.

Manufacturer: Radio City Products Co., Inc., 152 W. 25th St., New York 1, N. Y.



BEAM BENDERS

Two new types of television tube beam benders are offered by Clarostat. These devices slip over the neck of standard television picture tubes and serve to minimize burnt spots on tube screens. One type, TV-2, features single permanent bar magnet and is intended mainly for the 10-inch tube; TV-3 has a bar and a ring magnet and is intended for 12-inch or larger tubes.

Manufacturer: Clarostat Mfg. Co., Inc., Dover, N. H.



POCKET SIZE METER

With overall dimensions of 3-1/16" x 5-7/8" x 2-9/16", this volt-ohm-milliammeter has resistance ranges from 0-3000 ohms to 3 Megohms, self-contained; ten a-c/d-c voltage ranges to 5000; and three d-c current ranges. This meter comes complete with batteries, test leads and instruction book. Known as Model 666-R.

Manufacturer: The Triplett Electrical Instrument Co., Bluffton, Ohio.

FILTERS

Four new television and radio noise filters have been announced. They are for use on motors, generators, and r-f heating equipment. Three of these are

**It's New! It's Hi-Fidelity!
It's PERMOFLUX SPEAKERS!**
Watch for full page announcement

intended for low voltage motors and generators, the fourth for equipment operating from power lines up to 250 vac-dc.

Manufacturer: Cornell-Dubilier Electric Corp., South Plainfield, N. J.

MOBILE ANTENNA

This antenna is designed to cover the 75-meter band. It incorporates a special base-loading coil and a graduated whip of about six feet in length, making its overall length 88 inches. The company states that this type antenna shows about 6 db gain over the conventional "whip" types. Such gain would equal the quadrupling of transmitter power, and increase the range of mobile operations, both on transmission and on reception. According to the manufacturer reports state that the use of this antenna has helped solve many of the difficulties in the 75-meter band.



Manufacturer: Premax Products, Niagara Falls, N. Y.



INDOOR ANTENNA

The first indoor antenna placed on the market by this firm is said to have the following features: individual orientation and tuning for the various channels, modification and often elimination of ghosts and interference, base sufficiently heavy to prevent tipping with dipoles at different angles, telescoping dipoles with electrically correct joints to insure good contact. Known as Catalog Number 975.

Manufacturer: Technical Appliance Corp., Sherburne, N. Y.

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THE NEW SHURE TURNOVER PICKUP

PLAYS ALL THREE!



RCA 45 RPM

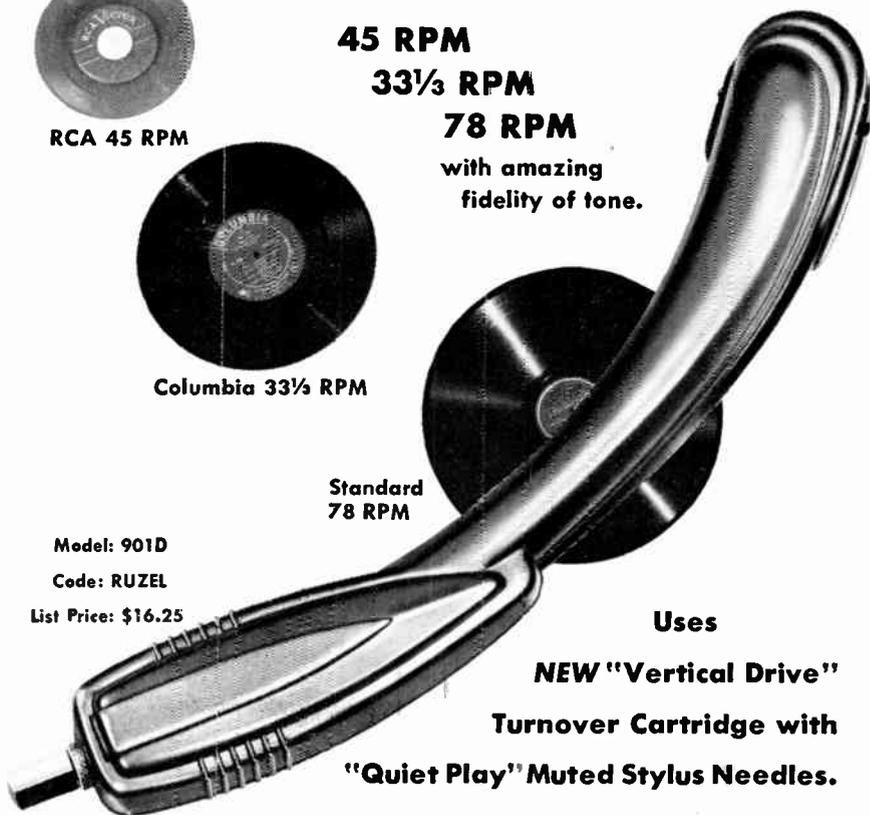


Columbia 33 1/3 RPM



Standard 78 RPM

45 RPM
33 1/3 RPM
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with amazing
fidelity of tone.



Model: 901D
Code: RUZEL
List Price: \$16.25

Uses
NEW "Vertical Drive"
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The Model 901D Crystal Turnover Pickup . . .

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3. Tracks with but 1/4 oz. (7 grams) on all records.
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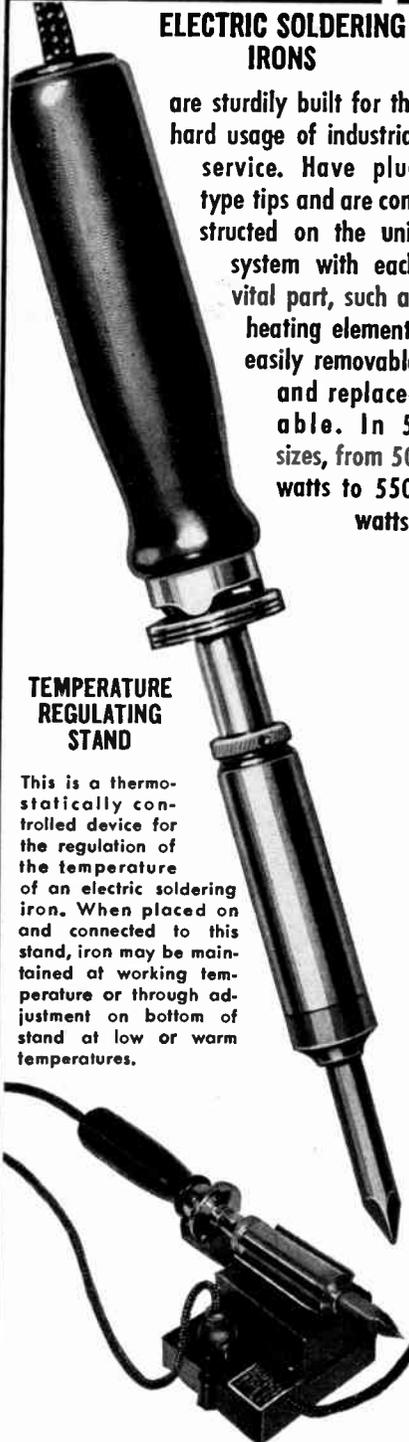
American Beauty

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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.



For descriptive literature write

110-2

AMERICAN ELECTRICAL HEATER COMPANY
DETROIT 2, MICH., U. S. A.

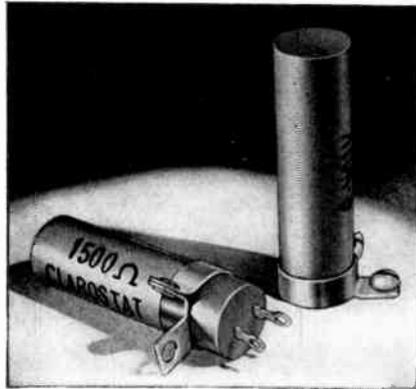
Industry Presents

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RESONANT CAPACITORS

"Resonant" paper tubular capacitors are now available to the radio service technician. This new type of capacitor is widely used in many late models by leading manufacturers. This Sprague Type 72P resonant capacitor has a controlled inductive construction, so that the combination of self-inductance and capacitance will series resonate at about 455 kc, the i-f frequency of most modern a-m broadcast receivers. Complete listings and application data are given in Bulletin M-430, available on post card request. Manufacturer: Sprague Products Co., North Adams, Mass.



VERTICAL POWER RESISTOR

Named the "Standee", a vertical resistor for above-chassis mounting has been announced by Clarostat. It can be mounted above the chassis with a large hole to clear the terminals and a small hole to take a self-tapping screw or rivet for the mounting bracket. It is said that this above-chassis mounting solves the problem of heat dissipation. Manufacturer: Clarostat Mfg. Co., Inc., Dover, N. H.

BENCH POWER SUPPLY

A 6-volt bench power supply, Mallory 6RS10, of particular interest to the service trade, has been designed as a convenient source of direct current wherever 110-115 volt a-c lines are

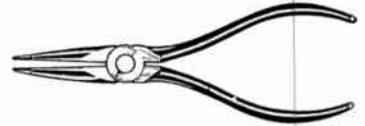
available. Especially useful for testing automobile radios. D-C voltage is continuously variable from 0 to 8 volts; unit may be operated safely at 10 amperes continuously, at 20 intermittently.

Manufacturer: P. R. Mallory & Co., Inc., Indianapolis 6, Ind.

WIRING NAILS

Walsco has brought out a line of wiring nails whose heads are made of insulating material and whose metal portion is held to a minimum, for use with 300-ohm parallel twin leads in television and f-m installation. They are said to have no appreciable effect on the impedance of the line. Heads are same color as standard brown lead and have ornamental design, giving lead-ins attractive appearance.

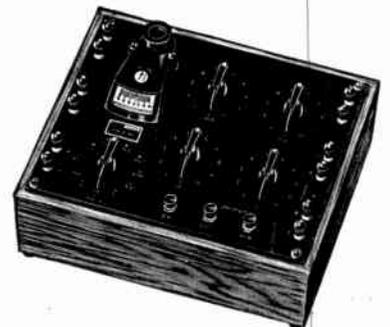
Manufacturer: Walter L. Schott Co., 9306 Santa Monica Blvd., Beverly Hills, Calif.



TWO-IN-ONE PLIERS

This instrument, called "Hook-Cut" Pliers, has both sharp tempered cutting edge and a long nose for probing into small places. Made of hardened tool steel, overall length is 6 1/2". Width tapers from 2" maximum on the handle to 1/6" on the extreme tip.

Manufacturer: Transvision, Inc., New Rochelle, N. Y.



KELVIN-WHEATSTONE BRIDGE

This bridge combines both bridges in a single instrument. The Kelvin range

The Greatest Development
in Speaker Design ...

Watch for PERMOFLUX in September!

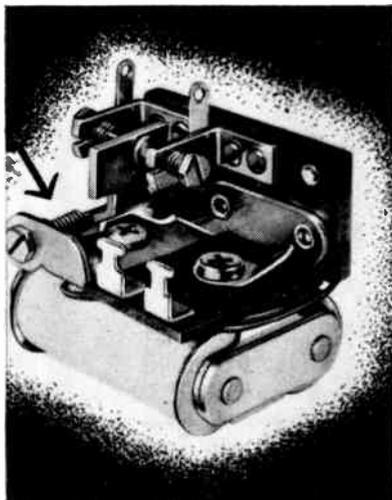
is from 0.0001 to 11.11 ohms and a Wheatstone range of from 0.1 to 11,110,000 ohms. A bulletin giving complete details will be sent on request to manufacturer.

Manufacturer: Shallcross Mfg. Co., Collingdale, Pa.

FM-AM SIGNAL GENERATOR

Providing a radio frequency signal source from 80 kc to 120 Mc, a new signal generator has been introduced for aligning f-m and a-m receiver. The instrument may be employed for standard a-m alignment method or for the f-m method, using an oscillograph. R-F output meter plus step-by-step and smooth attenuator controls are provided to assure constant reference level over the r-f bands. A-M output: 80 kc to 60 Mc, a-m modulation of 400 cycles. F-M output: 120 Mc on fundamentals with sweeps of ± 350 kc with 60 cycles modulation and ± 75 kc with 400 cycles modulation, or 80 kc to 61 Mc with ± 15 kc sweep at 60 cycles. A-M modulation percentage is variable from 0 to 100%. The accuracy of calibration is said to be $\frac{1}{2}$ of 1%.

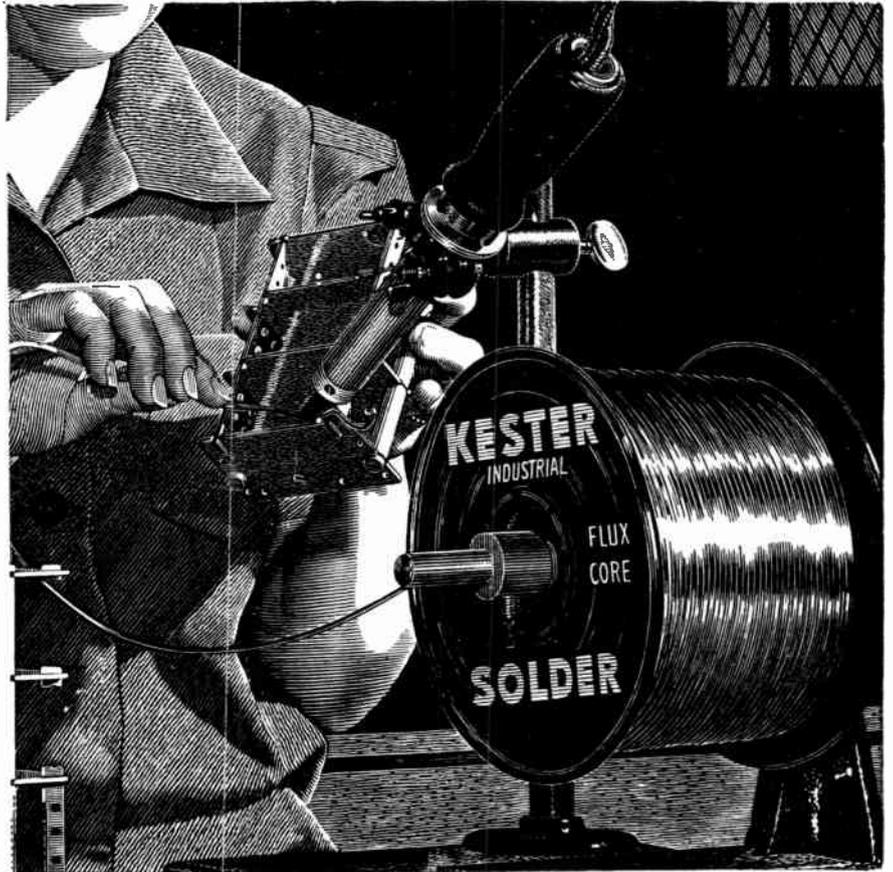
Manufacturer: Sylvania Electric Products, 500 5th Ave., New York 18, N. Y.



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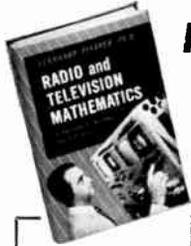


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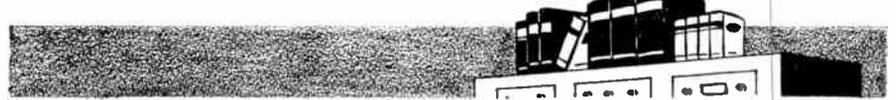
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trade **LITERATURE**



Magnetic Recording. by S. J. BEGUN, (Murray Hill Books, Inc., 242 pages, \$5.00)

The Vice President and Chief Engineer of Brush Development Co., manufacturers of wire and tape recording equipment, has written the first comprehensive treatment on the subject of magnetic recording published in book form to date. Magnetic recording is still at an early stage of its development and will undoubtedly expand appreciably in the future. But as a statement of the present state of the art, the book makes a valuable contribution.

The author covers the history and the fundamentals of magnetic recording, and makes the book particularly useful in his discussion of close to thirty pieces of wire recording equipment.

The text is well written. The illustrations are clear and follow the style made famous in Sam's Photo-fact Folders. Bibliographical notes appear at the end of each chapter. A very worthwhile book.

Radio and Television Mathematics, by BERNHARD FISCHER (The Macmillan Co., 484 pages, \$6.00)

There has been a general feeling in the service industry that mathematics have little to do with servicing and should be avoided wherever possible. Yet, many service technicians have admitted that a knowledge of arithmetic has come in very handy at times in the actual service work being in the shop. This book brings to the technician the necessary tools with which he can apply mathematics to his daily work.

Of particular interest to the technician will be the sections on receivers, power supplies, and measurements, although he will find the remainder of the book also informative. The volume is particularly recommended for persons planning to take the FCC Radio License Examination.

A noteworthy feature is the use of practical problems to illustrate mathematical procedures. If you have

looked for a book containing the mathematics you might need in your work, this one may be the answer to your search.

The Cathode-Ray Oscilloscope, by GEORGE ZWICK, (Radcraft Publications, Inc., 112 pages, \$7.75)

This little book will be of interest to the technician who is starting out in the television field, and who will soon be using the oscillograph in his daily work. It describes, without reference to mathematics or previous engineering knowledge, the operation and applications of the cathode ray oscillograph, including an analysis of the various circuits found in the instrument. The application sections are written in great detail and provide step-by-step procedures for use in actual service work.

The book does not contain too much material for the experienced television technician, but will be of definite use for those just going into the field.

Most-Often-Needed 1949 Television Servicing Information, compiled by M. N. BEITMAN, (Supreme Publications, 192 pages, \$3.00)

This latest in the series of Most-Often-Needed Servicing Information volumes follows closely in the steps of its predecessors, but is quite improved in readability and illustrations. The book covers over 50 receiver models and chassis, and the information, factory compiled, is authentic.

Why each page has "Most-needed 1949 television receivers" printed across its top (instead of listing the receiver which is being discussed on that page) is hard to understand. No index.

**Public Address Speaker Users
will be interested in PERMOFLUX'S
September Announcement**

Over the Bench

→ from page 26

On the other hand, the serviceman who is just starting, or the one who is not busy all of the time, or the one who must keep a close watch on his pennies is a natural customer for the kits. So is the serviceman who has the usual instruments but who wishes to experiment and use such things as VTVM's, scopes, square-wave generators, laboratory bridges, etc. If he had to buy these items already assembled, their cost would be prohibitive; but the kit manufacturers make it possible for him to possess and use these "luxury" servicing aids without imposing any strain on his budget.

There are a couple of other bonuses that the kit-buyer gets. For one, you cannot put one together without acquiring a great deal of information about the theory of operation of the instrument. Knowing how something works is a great aid to using it intelligently.

Another point to be considered is that the familiarity you acquire with the instrument's construction will aid you in diagnosing and correcting any troubles that may develop. After all, a baby's mother is the only one who can properly interpret and satisfy its gurgling demands! Having put the instrument together in the first place, you will have no hesitancy about servicing it.

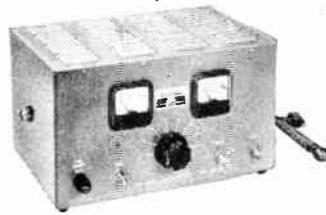
Side by side on my bench are factory-built instruments and ones that I have assembled from kits. I am proud of and rely on both. When, in the future, I decide to buy another service tool that is presented in both forms, I shall obtain all the possible information on the design, circuit, and features of both instruments; and then I shall choose the one or the other without prejudice. If I decide the completely-assembled job is worth the extra cost, it will get the nod; if not, I shall buy the kit and heat up the old soldering iron.

The above outline contains the advice I intend to follow; so, naturally, it is the best I have to give. ▾ ▾ ▾



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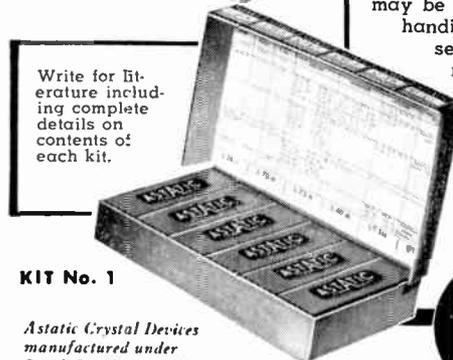
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Projection TV

→ from page 19

magnetic projection tube is a 3NP4, overall length only 10½ inches and a face diameter of 2½ inches. The Protelgram package consists of a protection tube, an optical box with focus and deflection coils, and a high voltage power supply. Projection tube second anode voltage is 25 kv. Like the tube used in RCA projection, an aluminum coating on the phosphor screen increases light output and contrast. No ion trap is used since the aluminized screen prevents ion spots. Both focusing and deflection are done magnetically.

The Norelco Protelgram projection box is a metal box consisting of an optical unit and alignment assembly mounted together by 4 screws to permit rapid tube replacement and service inspection. The optical unit contains three optical elements—a 6 inch spherical mirror, a corrector lens, and a special plane mirror to "fold" the light beam. These three elements form an optical triangle

within the optical unit and are set in the factory. They remain in adjustment under normal use. Do not try to tamper with the optical unit. Optical parts must be replaced at the factory. The optical unit is dust-proof. Only the upper face of the corrector lens is exposed. It can be dusted with ordinary cloth without scratching. Should it become necessary to clean the concave mirror, or the 45 degree mirror, remove one of the side plates of the projection unit and use a high quality lens tissue or a camels hair brush. Care should also be exercised while cleaning the projection tube face to prevent scratches.

In the optical box, no obstructions such as wires or coils intercept useful light. The light thrown out by the projection tube is gathered by the spherical mirror, reflected to the plane mirror, then projected upwards through the corrector lens. A throw distance of 31 inches from the corrector lens to the viewing screen is required.

The neck of the projection tube

extends from the optical box. The alignment assembly consists of the focus coil, horizontal and vertical deflection coils. The tube can be aligned optically by means of three screws which can be locked after adjustment so as to ensure good mechanical stability and reasonable freedom from vibration. Horizontal and vertical deflection coils are inside the optical unit, the focusing coils outside. Only three adjustments are needed for effective alignment.

Many of the manufacturers making use of the Protelgram optical system place a focus control knob on the front of the cabinet to ensure best picture fidelity under widely varying operating conditions. Therefore, the only difference a user of a television receiver equipped with a Protelgram will encounter, as compared with a direct viewing set, is greater flexibility provided by "front" focus control.

Protelgram is simple to service. Inserting the tube and focusing the system can be done in five minutes, after a little practice.

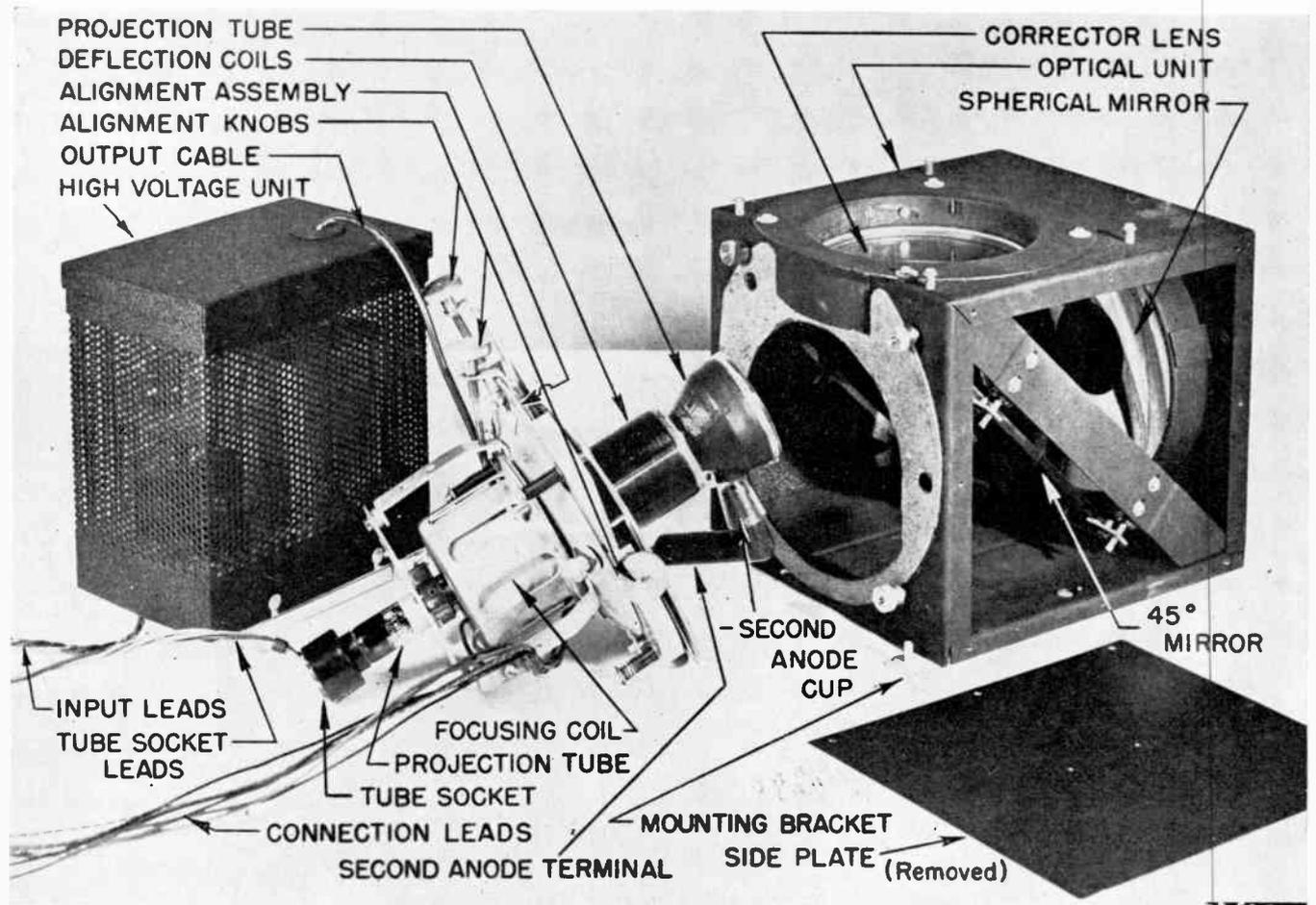


Fig. 2 Components of Protelgram television system. At the left is the 25 kv power unit, in the center the projection tube assembly

with its focusing coils, and at the right the optical box with concave mirror at extreme right and corrector lens on top of box



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The 2nd anode voltage for the 3NP4 is developed by the high voltage supply independently of the horizontal sweep circuits. The value of this voltage, therefore, does not depend on the horizontal sweep amplitude, neither does it increase its fly-back time by additional loading. The pulse type 25 kv supply is sufficiently shielded so that it causes no radiation interference to any television or radio receiver. The high voltage supply comes in a sealed can and contains a tripler transformer, three special rectifier tubes and high voltage filter capacity. The high voltage supply is impregnated under high vacuum and sealed at the factory. In the event of faulty operation or failure of the high voltage supply it should be returned to the factory for any repairs. Faulty operation of the high voltage supply can be detected by lowered voltage (voltage down to 10kv to 17kv), reduced picture brightness, excessive sweep width and height, poor focus control or complete inability to focus picture electrically.

Bombardment of the face of the projection tube by a 25kv beam produces soft x-rays which are well absorbed by the projection unit when the tube is in the normal position. Without the shielding, free radiation will result, prolonged exposure to which could prove harmful. As a consequence it is recommended that the tube be operated outside the projection unit for as short a time as possible.

The high voltage connection is recessed in a conical cup made of glass. Use of this conical cup makes for a long, high voltage leakage path. This cup, placed over the second anode, prevents corona or arcing. The outer walls of the projection tube are coated with Aquadag (colloidal carbon) and are at ground potential.

North American Philips does not manufacture television sets. It does produce the Norelco package, consisting of the optical system and high voltage supply, which is then sold to various manufacturers. You will find the unit incorporated in projection receivers made by such companies as Emerson, Fada, Pilot, Scott, Stewart Warner, Brunswick, Ansley, and others. Although the sets made by these companies may have different electrical characteristics, yet the optical system in each will be the same.

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Deflection Amplifiers

→ from page 15

tentiometer of Fig. 1 must have a very high resistance in order to secure a suitably high input impedance. When a high resistance potentiometer is used, frequency discrimination, which varies as the attenuation varies, results. If a low resistance potentiometer were used, frequency discrimination would be minimized. However, the input impedance of the instrument would be so low that prohibitive loading of the circuit under test would occur.

This difficulty is overcome in the circuit of Fig. 2. Here a cathode follower is used at the input. The signal to be examined is fed to the grid which has a high impedance. The attenuator is located in the cathode circuit. It is thus possible to use a low resistance potentiometer, minimizing frequency discrimination, and at the same time maintain a high input impedance. A two-position attenuator is used in the grid circuit of the cathode follower in order to permit high amplitude signals to be examined. In position *A*, the signal is connected directly to the grid. In this position signals with amplitudes up to approximately 40 volts may be applied before the cathode follower stage overloads. With the switch in position *B*, signals of several hundred volts may be examined.

In designing an oscillograph, a compromise must be made between bandwidth and deflection sensitivity. This compromise is necessary because, as the bandwidth of an amplifier is widened, its gain is reduced. Therefore, a wide-band amplifier will have low gain. It is possible to increase the gain by using a series of stages. However, the number of stages which can be used is limited by the fact that each additional stage increases noise problems and reduces the stability of the amplifying system. It is for this reason that wide-band scopes usually have low deflection sensitivity, while high gain scopes have only medium bandwidth characteristics.

→ to page 38

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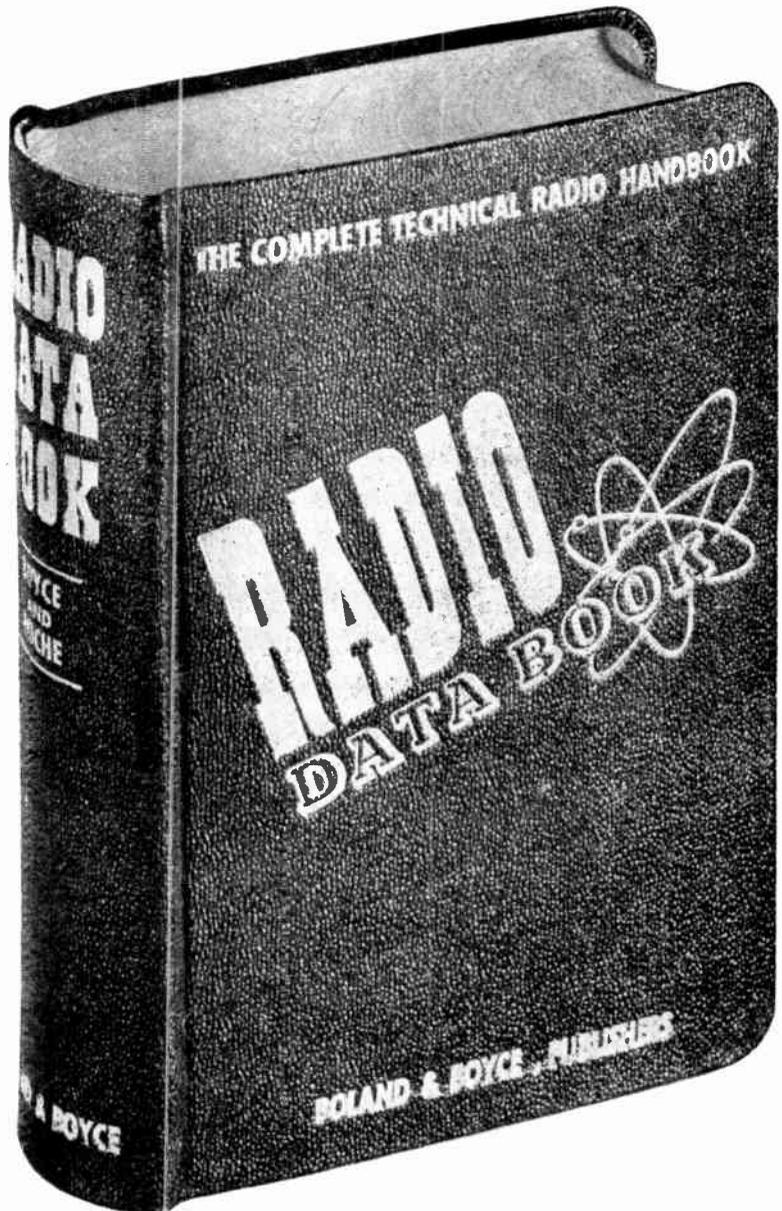
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Deflection Amplifiers

→ from page 36

The amplifier of Fig. 3 is a high gain affair and as a result its bandwidth extends to approximately 300 kc. In this amplifier the output of the cathode follower is coupled to the input of a two-stage wide-band amplifier, consisting of V2 and V3. Peaking coils are used in the plate circuits of these stages to extend the upper frequency response limit. These peaking coils function in the following manner: The gain of a resistance-coupled amplifier is reduced with increasing frequency by the inter-electrode capacitance and stray capacitance between components and wiring. The total of this capacitance appears across the load resistor to produce a shunting effect represented by C_s in Fig. 4.

By inserting a suitable inductance,

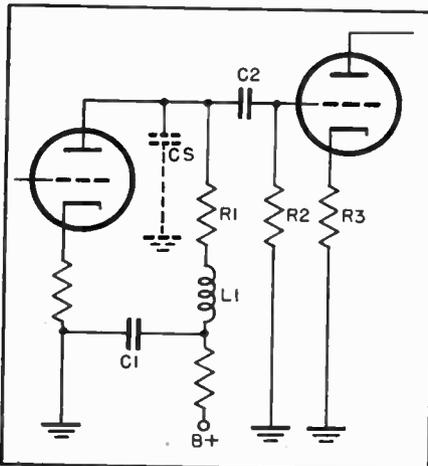


Fig. 4 Resistance-coupled amplifier; C_s represents interelectrode capacitance, and capacitance between leads and components

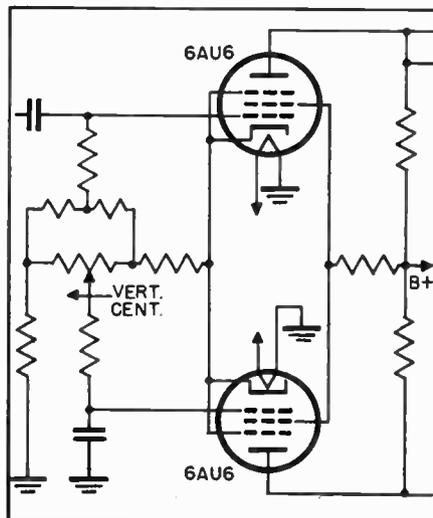
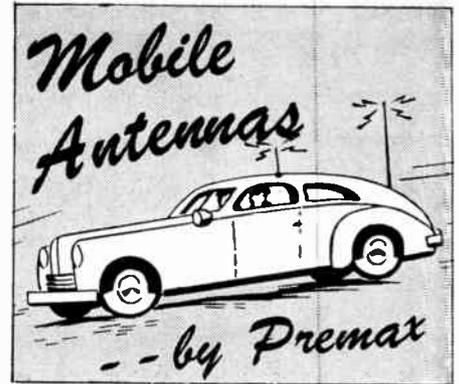


Fig. 5 Schematic of push-pull deflection amplifier. This circuit is a combination of phase inverter and amplifier



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September announcement

L_1 , in Fig. 4, it is possible to offset the effect of the shunting capacity. Since the inductance increases with frequency, it produces an increase in gain which compensates for losses due to stray capacity.

Many oscillographs are equipped with push-pull deflection amplifiers. While they are not necessary in all cases, they do have several advantages which make them worthwhile.

Fig. 5 shows the circuit diagram of a push-pull deflection amplifier. Two 6AU6 pentode amplifiers are used in a cathode coupled push-pull amplifier. This circuit is actually a phase inverter and amplifier combined. It eliminates the defocusing at the extremities of the base line which occurs when single ended deflection is used.

In the next issue we will discuss the circuits which generate the sawtooth voltage necessary to examine signals with respect to time.

1



BALANCED TONE ARM
... a perfectly balanced tone arm for either standard or Microgroove records.

2



TANDEM-TIP NEEDLE
... two needles in one. A Micro-ground tip for Microgroove records and a standard-ground tip for standard records. Needle is matched to cartridge for perfect reproduction.

3



VELOCITY-TRIP
... Record change operates on lateral motion. Tone arm travels freely in either direction... tracks "comfortably" in Microgroove or standard grooves.

These **3**

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WEBSTER-CHICAGO THREE-SPEED AUTOMATIC RECORD CHANGERS

MODEL 356

THREE-SPEED FULLY AUTOMATIC CHANGER



The Model 356 is the deluxe record changer for custom installation or replacement.

- Plays a full one-inch stack of 7-, 10- or 12-inch records — 33 $\frac{1}{3}$, 45, or 78 rpm—automatically.
- Controls provide Speed Selector and Reject-Manual-Stop-Control for automatic or manual play.
- Record drop is gentle and quiet—cushioned spindle and heavy flock turntable preserves records.
- Operates on 105-120 Volt, 60 cycle AC. 50 cycle adapter available.
- Dimensions: Base plate 14" x 14", Height above main plate 5 $\frac{5}{8}$ ", Below main plate 3 $\frac{1}{8}$ ".

Also Available—Model 256 (Dual-Speed), Model 156 (Single-Speed)

MODEL 346

THREE-SPEED FULLY AUTOMATIC CHANGER



The Model 346, compact in size will fit any radio. It is an ideal replacement unit.

- Plays a full one-inch stack of 7-, 10- or 12-inch records — 33 $\frac{1}{3}$, 45, or 78 rpm—automatically.
- Controls provide Speed Selector and Reject-Manual-Stop-Control for automatic or manual play.
- A heavy flock turntable cushions the gentle record drop.
- Operates on 105-120 Volt, 60 cycle AC. 50 cycle adapter available.
- Dimensions: Base plate 12" x 12 $\frac{1}{8}$ ", Height above main plate 4 $\frac{5}{8}$ ", Below main plate 3 $\frac{1}{8}$ ".

Also Available—Model 246 (Dual-Speed), Model 146 (Single-Speed)

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CHICAGO 39, ILLINOIS

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"It's tested at practically every step in its production.

"For instance, stems are checked every hour in the polariscope (above, left), an instrument used for detecting strain in glass by means of color or line change.

"When the strain pattern is constant, the stems are uniform and one acts like the next in the finished tube.

"Result is a final tube that is more uniform, of better quality.

"Reliable is the word for Ken-Rad Tubes, all right!"



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