AUGUST 1952

RADIO-ELECTRONICS

LATEST IN TELEVISION • SERVICING • AUDIO

30¢

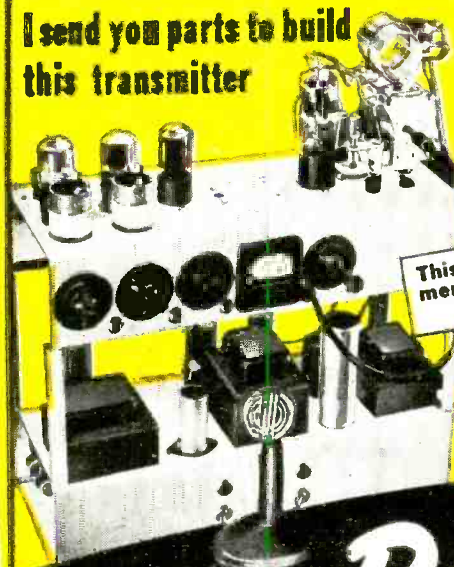
U. S. and CANADA

In this issue: **A New Audio Distortion Meter • Home Trials—and Tribulations • "Long-Lines" TV Booster**

You Practice COMMUNICATIONS

I send you parts to build this transmitter

As part of my Communications Course you build this low power broadcasting transmitter, learn how to put a station "on the air," perform procedures demanded of Broadcast Station operators, make many tests.

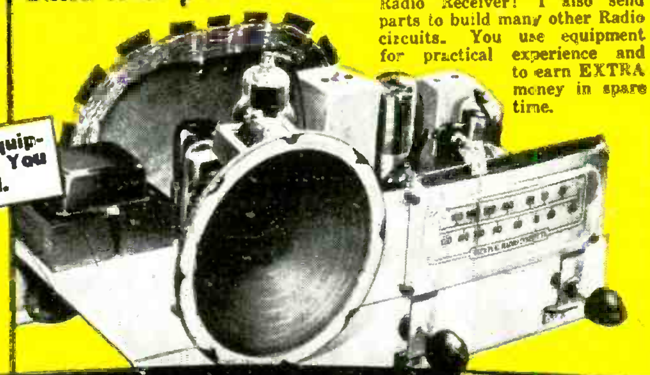


This is just part of the equipment my students build. You keep all parts I send.

You Practice Radio SERVICING

on this modern radio you build with parts I send

As part of my Servicing Course, I send you the speaker, tubes, chassis, transformer, loop antenna, EVERYTHING you need to build this modern, powerful Radio Receiver! I also send parts to build many other Radio circuits. You use equipment for practical experience and to earn EXTRA money in spare time.



BE A RADIO-TELEVISION TECHNICIAN

NOW! Advanced Television Practice

New, special TV kits furnished to build high-definition SCOPE . . . RF OSCILLATOR with flyback power supply . . . complete TV set . . . many other units. You see pulse, trapezoidal, saw-tooth wave forms. Get valuable PRACTICAL EXPERIENCE locating and correcting TV troubles. Mail coupon for facts, pictures and prices!

Learn Servicing or Communications Practice at Home in Spare Time

J. E. SMITH, President
National Radio Institute

Do you want good pay, a job with a bright future and security? Would you like to have a profitable shop or store of your own? If so, find out how you can realize your ambition in the fast growing, prosperous RADIO-TELEVISION industry. Even without Television, the industry is bigger than ever before. 90 million home and auto Radios, 3100 Broadcasting Stations, expanding use of Aviation and Police Radio, Micro-wave Relay, Two-way Radio for buses, taxis, etc., are making opportunities for Servicing and Communications Technicians and FCC-Licensed Operators.

Television is TODAY'S Good Job Maker

In 1950, over 5,000,000 TV sets sold. By 1954, 25,000,000 TV sets estimated. Over 100 TV Stations now operating. Authorities predict 1,000 TV Stations. This means more jobs, good pay for qualified men all over the United States and Canada.

Many Make $10 Extra a Week in Spare Time

Keep your job while training. Hundreds of successful RADIO-TELEVISION TECHNICIANS I trained had no previous experience, some only a grammar school education. Learn Radio-Television principles from illustrated lessons. Get PRACTICAL EXPERIENCE—build valuable multitester—experiment with circuits common to Radio and Television. Keep all equipment. Many students make $5, $10 extra a week fixing neighbors' Radios in spare time. SPECIAL BOOKLETS start teaching you the day you enroll.

Send Now For 2 Books FREE—Mail Coupon

Send now for my FREE DOUBLE OFFER. You get actual Servicing lesson to show you how you learn at home. Also my 64-page book, "How to Be a Success in Radio-Television." Read what my graduates are doing, earning; see equipment you practice with at home. Send coupon in envelope or paste on postal. J. E. SMITH, President, Dept. 2HF, National Radio Institute, Washington 9, D. C. Our 39th Year.

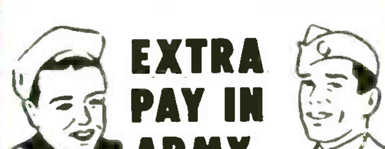
I TRAINED THESE MEN

"I have been operating my own Servicing business. In two years I did $14,000 worth of business; net profit $6,850. Have one full time employee, an NRI student."—PHILLIP G. BROGAN, Louisville, Ky.

"Four years ago, I was a bookkeeper, with a hand-to-mouth salary. Now I am a Radio Engineer with a key station of the American Broadcasting Company network."—NORMAN H. WARD, Ridgefield Park, New Jersey.

"When halfway through the NRI course, I made $5 to $8 a week fixing sets in my spare time. Am now selling and installing Television sets and antennas."—E. J. STREITENBERGER, New Boston, O.

"My first job was operator with KDLR, obtained for me by your Graduate Service Dept. I am now Chief Engineer of Police Radio Station WQOX. I never hesitate to endorse NRI."—T. S. NORTON, Hamilton, Ohio.



EXTRA PAY IN ARMY, NAVY, AIR FORCE

Knowing Radio, TV, Electronics can help you get extra rank, extra prestige, more interesting duty at pay up to several times a private's base pay. You are also prepared for good Radio-TV jobs upon leaving service. Mail Coupon TODAY.

Have Your Own Business

Many N.R.I. trained men start their own Radio-Television sales and service business without capital. Let me show you how you, too, can be your own boss, have a good income from your own shop. Send coupon for FREE book now!

Tested Way to Better Pay

Good for Both - FREE

MR. J. E. SMITH, President, Dept. 2HF
National Radio Institute, Washington 9, D. C.

Mail me Sample Lesson and 64-page Book about How to Win Success in Radio-Television. Both FREE. (No Salesman will call. Please write plainly.)

Name...Age.......

Address...

City.......................................Zone.......State..........

Approved for training under G. I. Bill

RADIO-ELECTRONICS

Formerly RADIO-CRAFT • Incorporating SHORT WAVE CRAFT • TELEVISION NEWS • RADIO & TELEVISION*

ON THE COVER
Model Claudia Laymon compares the quality of two Auditioneer-controlled musical selections. Battery of speakers is part of the demonstration room described in the article on page 36.
Color original courtesy Allied Radio Corporation

CONTENTS

AUGUST 1952

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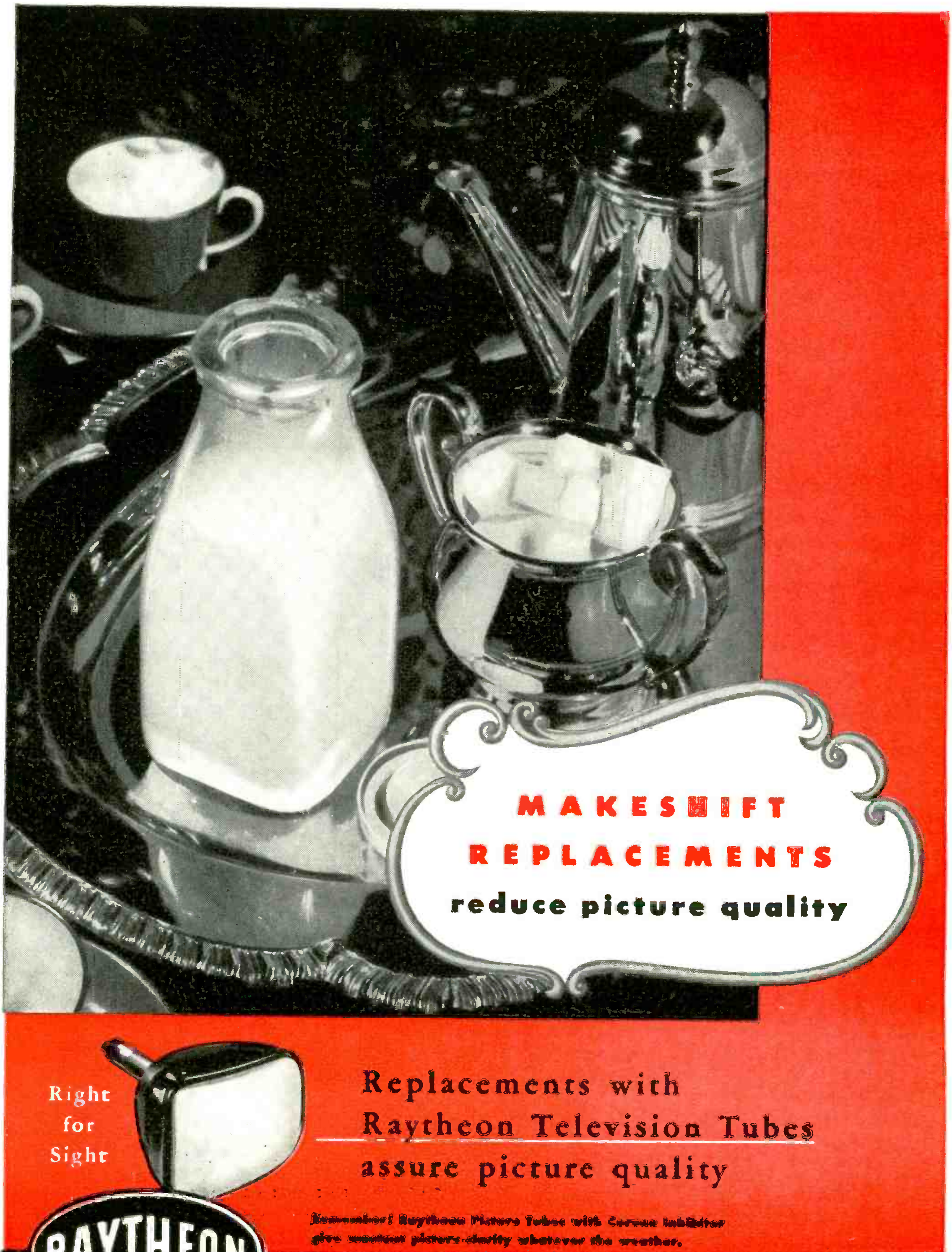
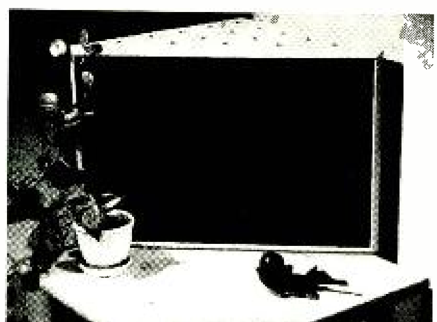

MAKESHIFT
REPLACEMENTS
reduce picture quality
Right
for
Sight
Replacements with
Raytheon Television Tubes
assure picture quality

POOR MAN'S HI-FI system is promised in a speaker developed by Dr. Jordan J. Baruch and Henry C. Lang of the Massachusetts Institute of Technology Acoustics Laboratory. Four modified 5-inch speakers in a one-half cubic foot enclosure give sound output flat within 3 db from 40 to 11,000 cycles. Only two watts audio power is used, with an *acoustical* output of one-half watt.

The speaker cabinet is like a cubical box with one-foot inside dimensions cut diagonally across top and bottom. Four speakers are mounted on the diagonal face. Fifteen 15/32-inch holes are drilled in the top. These take the place of the ports in bass-reflex types of speakers. Mounted in a corner with the holes up (or down, if the speaker is mounted near the ceiling), these holes are said to produce an acoustic mirror effect in conjunction with the walls, doubling the virtual size of the enclosure.

The speaker, for all its apparent simplicity, is no job for the home constructor, its developers warn. Its secret is careful measurement and engineering, with each part carefully selected and modified for its function. Speakers of a different type might call for matching changes in the size and pattern of the holes or the volume of the cabinet. Several manufacturers were said to be planning to manufacture the unit in quantity at a price which would provide moderate high-fidelity within the reach of an "instructorial salary."



Courtesy Ultrasonic Corporation

The speaker fits neatly in a corner.

The device was first described and demonstrated at the May 22 meeting of the Radio Club of America in New York City.

WWV'S STANDARD FREQUENCY services now include simultaneous round-the-clock transmissions on 2.5, 5, 10, 15, 20, and 25 mc. Carrier frequencies have an accuracy of 1 part in 50 million (.02 cycle per megacycle). Amplitude modulation of 440 cycles and 600 cycles is used for alternate 4-minute periods. These are separated by 1-minute time announcements in which each second is marked by a 1-kc pulse. Warnings of propagation disturbances and predictions of transmitting conditions in the North Atlantic area are sent in code twice every hour. WWVH (Hawaii) provides a similar service on 5, 10, and 15 mc only.

TV SET OWNERS believe in their service technicians. This was discovered in a poll conducted recently by leading pollster Elmo Roper, under the sponsorship of RCA Victor and the RCA Service Company. An overwhelming majority (86%) of all television set owners who have had their sets serviced have a high opinion of the quality of the work done. A large majority also consider the TV service technician to be courteous, prompt in responding to calls, and fair in his charges.

"Recently published articles have reflected on the honesty and competence of television servicemen by charging that the TV public was being gouged," said E. C. Cahill, president of the RCA Service Company. "While we knew from experience that these reports were based on isolated instances and did not reflect the true character of the service industry, we were disturbed by the unfair and misleading impressions they were creating among the public. So we commissioned Mr. Roper to get the full facts from the people who were best able to judge—the TV set owners."

The Roper survey polled 5,000 families, representing an accurate cross-section of adults in television areas throughout the country. The findings are based on the replies received from over 90% of the television homes in the sample. The survey is believed to be the first scientific, impartial, nationwide sampling ever made to determine the true public attitude toward the technicians who install and maintain the nation's 17 million TV receivers. While other surveys have been conducted on this subject, they have been confined to local areas.

"The findings have fully substantiated our confidence in the ability and integrity of television technicians," Mr. Cahill stated.

"For example, when the set owners who had had service calls were asked to evaluate the work done, only 7% expressed dissatisfaction. A sizeable majority, 68%, replied the work was 'really good,' while 18% described it as 'fairly good.'" (7% did not reply.)

When asked if the technician who called to service or repair a set was pleasant and courteous, only a fraction of 1% gave a negative reply. Almost 9 out of 10 of these respondents, 88%, said he was "pleasant and courteous." Another 6% considered the technician's manner "satisfactory." (6% did not reply.)

The public maintains a similar high opinion of the promptness of service technicians, the survey reveals. Three out of four said they thought the work had been done in a reasonable length of time. Only one out of five felt he had had to wait too long. Even on the delicate matter of price, the TV set owners had a high opinion of their service technicians. In spite of the articles which have appeared purporting to "expose" television technicians for overcharging their customers, two out of three customers described the service charges as "entirely reasonable." Only one out of ten considered their service bills "too high."

TRANSIT RADIO'S LEGALITY was upheld by the U. S. Supreme Court in a 7 to 1 decision. While supporting the majority opinion permitting broadcasts to public transit vehicles, Justice Black expressed the belief that broadcasts of news, speeches, or propaganda would violate the First Amendment. Opponents of transit radio plan to continue their fight by seeking Congressional legislation.

BINAURAL BROADCASTING, utilizing AM and FM outlets for simultaneous transmission of separate sound pickups, was demonstrated late in May by KOMO-AM-FM, Seattle, and WGN-WGNB, Chicago. Dual receivers, audio channels, and speaker systems are reported to have reproduced the programs with phenomenal realism.

TV IN VENEZUELA will be operating by November. A government-run 10-kw RCA transmitter in Caracas, the capital, will furnish non-commercial cultural and educational programs.

EMPORIUM SECTION OF THE IRE will hold its 13th annual Summer Seminar at Emporium, Pennsylvania, Friday and Saturday, August 15th and 16th. Four papers on late television developments will be presented. Two will be given Friday evening after the opening cocktail party and banquet, and the others the following morning. The Seminar will close with a picnic Saturday afternoon. Information regarding reservations, transportation and tickets can be obtained from Francis T. Quigley, General Engineering Department, Sylvania Electric Products, Inc., Emporium, Penna.

NEW LIGHT on northern lights was cast by Harvard astronomer Dr. Donald Menzel at a recent meeting of the American Physical Society. Clouds of ionized particles erupted from the sun are normally deflected by the earth's magnetic field. Strong concentrations, reinforced by cosmic debris, break through the field at its weakest point—just below the North Pole—and produce dazzling auroral displays when they collide with dust particles in our upper atmosphere.

CANADA'S FIRST TV STATIONS were expected to start transmissions in July. According to Fergus Mutrie of the Canadian Broadcasting Corporation, Montreal (channel 2) is to send test patterns and International League baseball games intermittently from July 25 until the station's formal opening early in September. Toronto (channel 9) will start about the same time.

A microwave relay link to Buffalo, New York, will enable Toronto to carry U. S. network programs. An extension of the link to Ottawa and Montreal, now under construction, is scheduled for completion early next year.

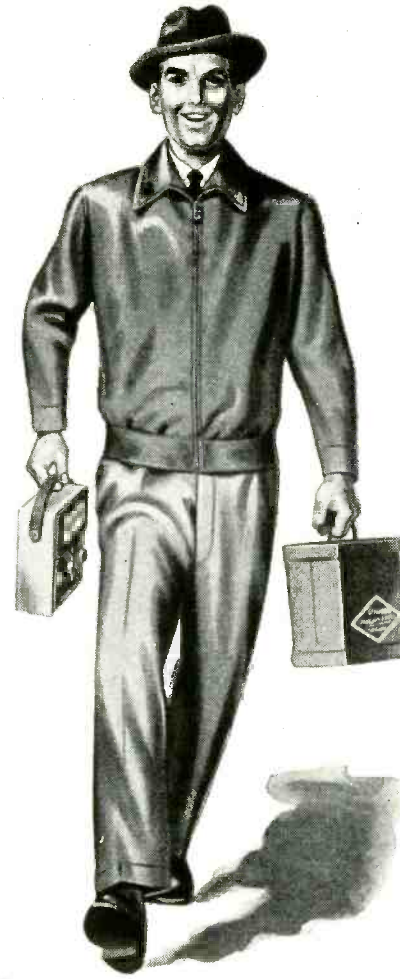
Both stations will have 5-kw transmitters with multibay antennas, giving an effective radiated power of 26 kw. American standards will be used.

Program policy is still undecided, but will probably divide time equally among Canadian commercial, U. S. commercial, and local sustaining programs.

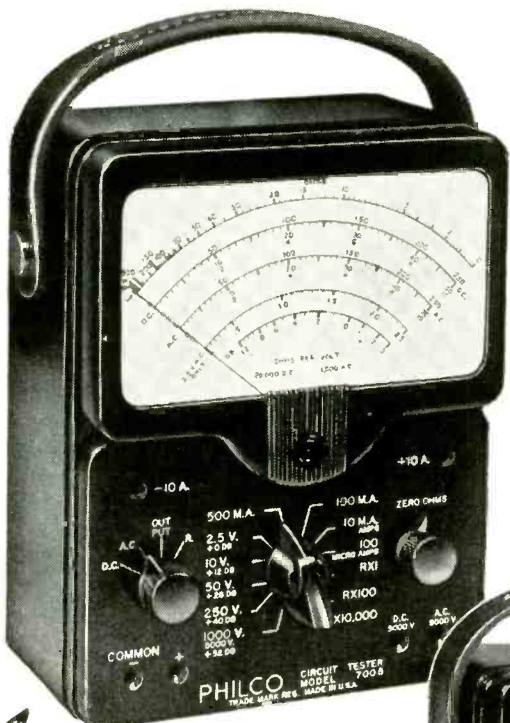
—end—

PHILCO

Test Equipment
for Measurements you can rely on



GET it right the *first* time with precision-built Philco Test Equipment. Save time, avoid guessing, build your reputation for dependable, thorough service work. Choose Philco instruments, tested and approved in the famous Philco Engineering Laboratories, for reliable performance and long-life accuracy.



Philco Circuit Tester

Model 7005 Dimensions—5⅜" wide x 7⅛" deep x 3½" high.

Battery—Dry cell—"A" size.

Voltage Ranges DC—(20,000 ohms per volt) 2.5, 10, 50, 250, 1000, 5000 Volts.

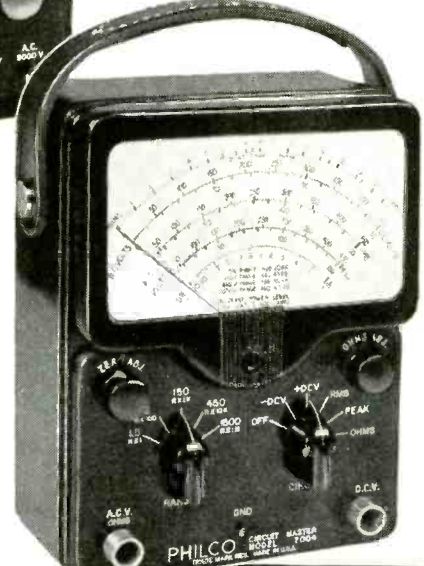
Voltage Ranges AC—(1000 ohms per volt) 2.5, 10, 50, 250, 1000, 5000 Volts.

A.F. Output—2.5, 10, 50, 250, 1000.

Volume Level— —12 to +55 db (5 steps).

Resistance—RX1—12 ohms center —2000 Full Scale. RX100—1200 ohms center—200,000 Full Scale. RX10,000—120,000 ohms center—20 Megs. Full Scale.

Current—100 Microamperes; 10, 100, 500 Milliamperes; 10 Amperes.



Philco Circuit Master

Model 7004 Dimensions—5⅜" wide x 7⅛" deep x 3½" high.

Operating Voltage—105-125 Volts; 60 cycles.

Basic Circuit—Balanced difference amplifier. Miniature double triode.

Voltage Ranges (DC)—1.5, 15, 150, 450, 1500 Volts.

Voltage Ranges (AC)—1.5, 15, 150, 450, 1500 Volts. 1.5, 15, 150 Volts. AC—RMS and peak—compensated to same frequency response.

Circuit Switch Positions—Off + DC Volts, —DC Volts, RMS Volts, Peak Volts, Ohms.

Ohms Ranges—Full scale, 100 times center. RX1—10 ohm center, RX100—100 ohm center. RX1000—10,000 ohm center. RX10,000—100,000 ohm center. RX1 Meg.—10 Megohm center.

Decibels— —20 to +65 on AC Peak. Reference level 1 Milliwatt, 600 ohms—zero level.

Internal Resistance—AC Volts (RMS and Peak), 5 Megohms. DC Volts, 10 Megohms.

External Adjustments—Zero adjust and ohms adjust.

For Information and Prices-Call Your

PHILCO DISTRIBUTOR

Fast . . . easy replacement for any set

MALLORY MIDGETROL®

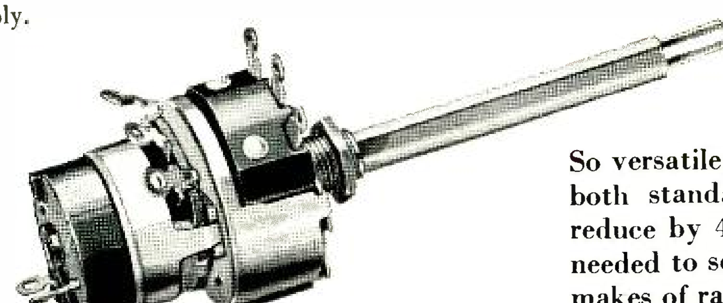
Dual Concentric Volume Controls

DO THE JOB WITH SMALL STOCKS

- You can match 10,000 combinations of resistance values, taps and tapers with a minimum inventory of Mallory Dual Concentrics.
- Assembly involves just five simple steps. Takes less than five minutes. You need no special tools . . . do no soldering.
- Front and rear sections are factory-assembled and inspected.
- Instant AC switch attachment without control disassembly.

PERFORMANCE THAT PAYS OFF

- Longer-lasting resistance elements even in extremes of temperature and humidity.
- Better and more accurate taper curves resulting from precision processing methods.
- No pigtail connections to break—thanks to Mallory's exclusive sliding contact that gives EXTRA quiet operation.
- Minimum wobble with Mallory exclusive two-point shaft suspension.



So versatile are Mallory Midgetrols—both standard and dual—that they reduce by 40% the cost of inventory needed to service the 10 most popular makes of radio and TV sets.

Make Sure! Make it Mallory!

Shown here is the Mallory Dual Concentric Midgetrol with a wire wound front section, available for such uses as TV focus controls. The Mallory Midgetrol line, in addition to dual concentrics, includes round shaft, standard controls with the advantages of stable, two-point shaft suspension, instant AC switch attachment, ready adaptability to split-knurl and flatted type knobs.

MALLORY

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS • RECTIFIERS • VIBRAPACK* POWER SUPPLIES • FILTERS
*Reg. U.S. Pat. Off.

APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

BAROMETER of the PARTS INDUSTRY

During June, 50 of the leading 400 manufacturers of Radio-Television-Electronic parts and equipment made changes in their lines. Actually there was a decrease in "change activity" as compared to May.

In price revisions by the number of manufacturers and products affected, the following summary illustrates the comparative trend for the months of May and June:

	No. of Manufacturers	
	May	June
Increased prices	13	10
Decreased prices	25	16

	No. of Products	
	May	June
Increased prices	885	67
Decreased prices	392	315

For a summary of the most active product categories, see the following table:

Products Group	Increased Prices		Decreased Prices		New Products		Discontinued Products	
	No. of Mfrs.	No. of Products	No. of Mfrs.	No. of Products	No. of Mfrs.	No. of Products	No. of Mfrs.	No. of Products
Antennas & Access.	2	6	4	56**	10	190*	5	75*
Capacitors	0	0**	0	0	1	5**	0	0**
Controls & Resistors	0	0	0	0**	2	19**	0	0**
Sound & Audio	1	1	3	118*	10	60*	4	8**
Test Equipment	3	22*	0	0**	3	12**	2	5*
Transformers	0	0	1	1*	1	6**	1	1*
Tubes	4	38**	8	140**	5	30**	3	20**
Wire, Cable, Connectors	0	0**	0	0**	0	0**	0	0

* Increase over May
** Decrease from May

* Increase over May
** Decrease from May

Comment: For the first time in 5 months tube prices seem to be leveling off. The antenna and accessory manufacturers, on the other hand, have become increasingly active which might possibly be due to the expected opening of new TV areas.

This data is prepared by the staff of United Catalog Publishers, Inc., 110 Lafayette Street, New York, publishers of RADIO'S MASTER, the Official Buying Guide of the Parts Industry.

General Electric Tube Department, Schenectady, N. Y., is conducting a nation-wide service-promotion contest for radio and TV service technicians from June 15 to August 15. The contest is aimed at bringing in more summer servicing business based on preventive maintenance. Three 1952 Dodge panel trucks are the top prizes. Entrants will be judged on the planning, originality, and results brought in by their campaigns. Judges will be Mort Farr, president of NARDA; George Wedemeyer, president of NEDA; John Rider; Howard Sams; and John T. Thompson, G-E replacement-tube sales manager.

Entry blanks and promotional material are available from G-E tube distributors.

Merchandising and Promotion

National Union Radio Corp., Orange, N. J., is offering a 17-piece, all-purpose tool kit especially designed for TV and radio service work. The kit comes in a heavy plastic roll which may be worn as an apron or hung on the wall. National

Union is giving the kit free, through its distributors, with the purchase of 250 tubes.

Grayburne Corp., New York City, is supplying its distributors with a newly-designed counter-display stand. The

stand holds three of the company's fastest selling products—Ferri-Loopsticks, Vari-Loopsticks and the TV-IF Signal Boster. The stand is available with the purchase of a combination of three cartons of any of the products mentioned.

Allen B. Du Mont Laboratories is emphasizing improvement in television reception rather than mere replacement in the new promotional campaign on its TV picture tubes. Around the slogan,

You can double your fall service business with this NEW SYLVANIA CAMPAIGN

Two gorgeous movie stars, Ann Blyth and June Havoc, feature their personal endorsements of your service in this brand new Sylvania advertising campaign for service dealers. On life-like window displays and streamers, they recommend *you* just the way they will in the big Sylvania ads in *Collier's*, *Life*, *Look*, and *The Saturday Evening Post*, which will appear this Fall.

In addition, the Sylvania Campaign offers you four sets of personalized mailings imprinted with your name, address and phone number. All of the mailing pieces have stamps already attached. You pay *NO POSTAGE!* Radio spot announcements, and reminder stickers for your customers' sets round out this sure business-attracting kit!

And all you pay is *just 2 cents per prospect per month* for the mailers. All the rest is absolutely FREE . . . even the postage on the mailers! Call your Sylvania Distributor today, or mail the coupon below.

SYLVANIA

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

Sylvania Electric Products Inc.
Dept. R-2708, Emporium, Penna.

Please send me full details on Sylvania's big Fall Campaign for Radio-TV Service Dealers.

Name__________

Street__________

City______ Zone___ State______

"A new Du Mont television picture tube is more than a replacement . . . it is a definite improvement." The program will be backed by vigorous advertising and sales-promotion efforts.

New Plants and Expansions

The New Haven Clock & Watch Co., New Haven, Conn., completed negotiations for the acquisition of Condenser Products Co., Chicago, manufacturer of capacitors, power supplies, and pulse-forming networks. Condenser Products will operate as a division of New Haven Clock. S. M. Levenberg, former president of Condenser Products, will be in charge of administration in Chicago. Other key personnel, including James Claxton, production manager, Stephen Meskan, chief engineer, and Jack Powers, sales manager, will continue their association with the company.

General Electric is constructing a multimillion-dollar transformer manufacturing plant in Rome, Ga. It is expected to be completed some time in 1953.

Speer Carbon Co., St. Marys, Pa., and its subsidiaries, Jeffers Electronics, Inc., Du Bois, Pa., International Graphite & Electrode Corp., Niagara Falls, N. Y., and Speer Resistor Corp., St. Marys, Pa., have consolidated into one company with headquarters in St. Marys, Pa. The subsidiaries will henceforth operate as divisions of Speer Carbon.

Jersey Specialty Co., Little Falls, N. J., is rapidly completing construction of its new plant in Mountainview, N. J. The company's operations include the manufacture of television lead-in wire and wire spooling operations.

Allied Electric Products and its Sheldon Electric Division, Irvington, N. J., moved its West Coast branch office and warehouse to larger quarters in Los Angeles to improve its facilities for serving manufacturers and distributors in that area.

Krylon, Inc. is now occupying a new two-story plant in Philadelphia which provides an additional 18,000 square feet of space. A new research laboratory will be set up to provide for product expansion.

Workshop Associates, Needham Heights, Mass., completed a new antenna-pattern measuring range on the site of its new laboratory in Natick, Mass.

Ajax Condenser Co., Chicago, opened a new factory on the West Coast which will be operated by the company's newly formed California affiliate, Ajax Condenser Corp., North Hollywood.

Hytron Radio & Electronics Co. moved its executive and sales offices to its new plant in Danvers, Mass.

Raytheon Manufacturing Co. opened a new Receiving Tube Division branch plant in Brockton, Mass., for the assembly of subminiature electronic tubes. A staff of 200 will be employed. The new Brockton operation reports to O. P. Susmeyan, manager of the Newton and Quincy receiving-tube plants. Raytheon also established an International Division to meet its expanding foreign business. Ray C. Ellis, formerly vice-president in charge of the Equipment Sales Divisions, now heads the new division.

Approved Electronics, New York City manufacturer of test equipment, moved to new, larger quarters at 928 Broadway.

Business Briefs

. . . **P. R. Mallory & Co., Inc.,** Indianapolis, is augmenting its program for providing replacement information to service technicians by listings in Howard W. Sams' *Photofacts.*

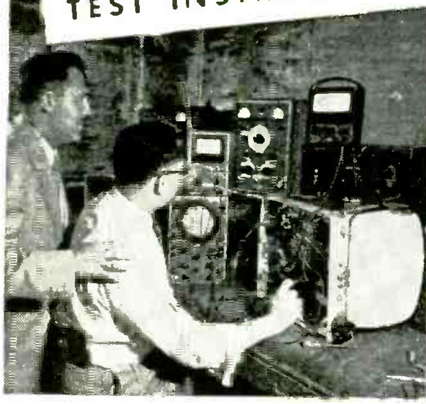
. . . **The 1952 Western Electronic Show and Convention** will be held in the Municipal Auditorium, Long Beach, Calif., August 27 to 29, sponsored by the West Coast Electronic Manufacturers Association, with the Institute of Radio Engineers acting as convention hosts. About 175 exhibitors are expected to display at the show.

. . . **Capitol Radio Engineering Institute,** Washington, D. C., is celebrating its 25th anniversary this year. The celebration was opened in June with a banquet in the Mayflower Hotel in Washington, D. C.

. . . **Littelfuse, Inc.,** Des Plaines, Ill., celebrated its 25 years in the industry with a buffet-bar party in Chicago. E. V. Sundt, Littelfuse president, T. N. Blake, executive vice-president, and Jack D. Hughes, vice-president in charge of sales, were presented with silver cufflinks in honor of the occasion.

—end—

EICO TEST INSTRUMENTS *Guard* CBS-Columbia Inc. HIGH STANDARDS OF TELEVISION PRODUCTION QUALITY



In the CBS-Columbia design laboratories, Al Goldberg takes some important readings with the EICO Model 221 Vacuum Tube Voltmeter and Model 555 Multimeter, as Harry R. Ashley looks on.

Mr. Al Goldberg, Assistant Chief Engineer of CBS-Columbia, and Harry R. Ashley, President of EICO, inspecting the use of the EICO Model 221 Vacuum Tube Voltmeter and Model HVP-1 High Voltage Probe at the Sweep Frequency Troubleshooting Position on the CBS-Columbia Television production lines.

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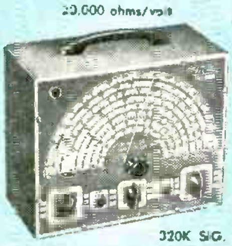

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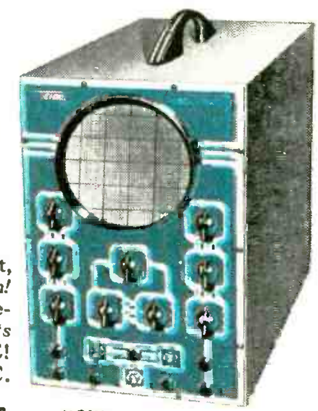

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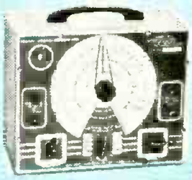

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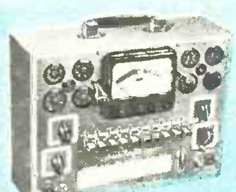

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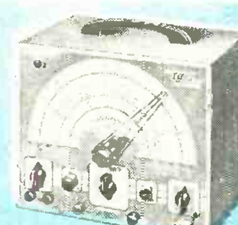

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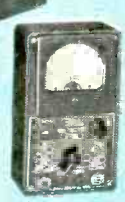

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ELECTRONIC BRAINS

. . . . An electronic computer boom is now in the making. . . .

By HUGO GERNSBACK

SCIENTISTS are pretty well agreed now that most animal brain functions are partly electric, many wholly electric. It is known that the human brain has the equivalent of over ten billion neurons (nerve-cells), many of which act very much like vacuum tubes, or, to be more up-to-date, transistors. The human brain has the facility of storing many millions of impressions fed to it from the outside world. When required, these stored impressions act upon or solve various problems.

Some exceptional human beings have what are called computing brains. They can solve, in a few seconds, complicated mathematical problems merely by exercising certain not-too-well-understood functions in the brain.

Electronic computers as we know them today can duplicate many functions of the human or animal brain. Frequently electronic brains can do all this much faster and better and without chance of error.

No wonder then that the best electronic engineering minds have been busy for many years devising better and more efficient electronic computers. These machines started out originally as highly complex and cumbersome devices, and now are becoming even more complex, but are also constantly shrinking in size.

With the advent of the transistor, compact electronic desk computers of the highest order will be a reality in the not very distant future. Not all electronic computers and calculating machines are alike. They differ in various respects, depending upon the work they are called upon to do.

The vast quantity of intricate calculating done nowadays by humans takes a terrific amount of mind power and man-work hours. This valuable power will in the future be released and used for other more productive work. The reason is that one good computer can easily do the work of dozens of accountants in a fraction of the time it takes humans to do the same chore. Indeed in many instances the ratio is 1000 to 1, increasing in favor of the computers as they become more efficient.

How closely the human brain is now imitated is best illustrated by a recent invention of Dr. Howard Aiken, head of Harvard Computing Laboratory. He developed the new *Static Magnetic Memory*—a rapid storage device. The brain of the nation's most ambitious computer, the fabulous new Mark IV, now nearing completion, has 40,000 such Static Magnetic Memory Units.

No wonder then that one of the biggest branches of the electronic industry is now electronic computers. More and more firms are engaged in building these calculators for various purposes. It is quite certain that electronic computers will be one of the biggest, if not *the* biggest, division of electronic manufacturing in the foreseeable future. This estimate was recently made by Dr. Simon Ramo, chief of research of Hughes Aircraft Corporation, at the fifth annual convention of the Federated Financial Analysts Society in San Francisco.

At the present time, as is only natural, military establishments have first call on electronic computers, because of the importance of the military uses of these devices. In modern war, electronic computers are priceless. They literally spell the difference between victory and defeat. All guided missiles, whether modern cannon or long-distance guided rockets or planes, must be directed by electronic computers. Even in World War II, the German robot long-distance V1 and V2 rockets were shot down with almost perfect regularity by electronic computing devices attached to anti-aircraft guns in England.

This, however, is only the beginning. The future general, before he goes into a battle, will have the possible results forecast by an electronic computer in such a manner that he will know for a certainty—given certain vital factors—if he can win or not.

There are today hundreds of special military electronic computer uses, and it may be safely stated that if and when World War III comes, it will be fought—*and won*—chiefly with military electronic computers.

On a more peaceful side, according to General David Sarnoff, chairman of the board of the Radio Corporation of America, "the nation's business operations will be revolutionized within a reasonably near future." In a recent talk, Sarnoff said: "These modern electronic robots promise to revolutionize and simplify the clerical operations of insurance companies, banks, tax bureaus, stock exchanges, and business in general. A single electronic computer can do the combined accounting of receivables, payables, purchases and stock controls."

He continued, "With some nine million persons—or 16% of the working population—engaged in clerical activities, present business systems are too slow and costly. The men responsible for making major decisions all too often find out that they must shape tomorrow's policy on the basis of statistics which are weeks or months out of date. It is now feasible to combine the automatic devices which have been developed for radio-television to form a complete electronic accounting system for even the largest business organization."

It was recently predicted by government scientists that new and simplified electronic computers will soon make their appearance for practical business uses, such as inventorying, accounting, market research, sales, mailing lists, and such business calculations as payroll amortization, prorating, various statistics, quality control, and other records.

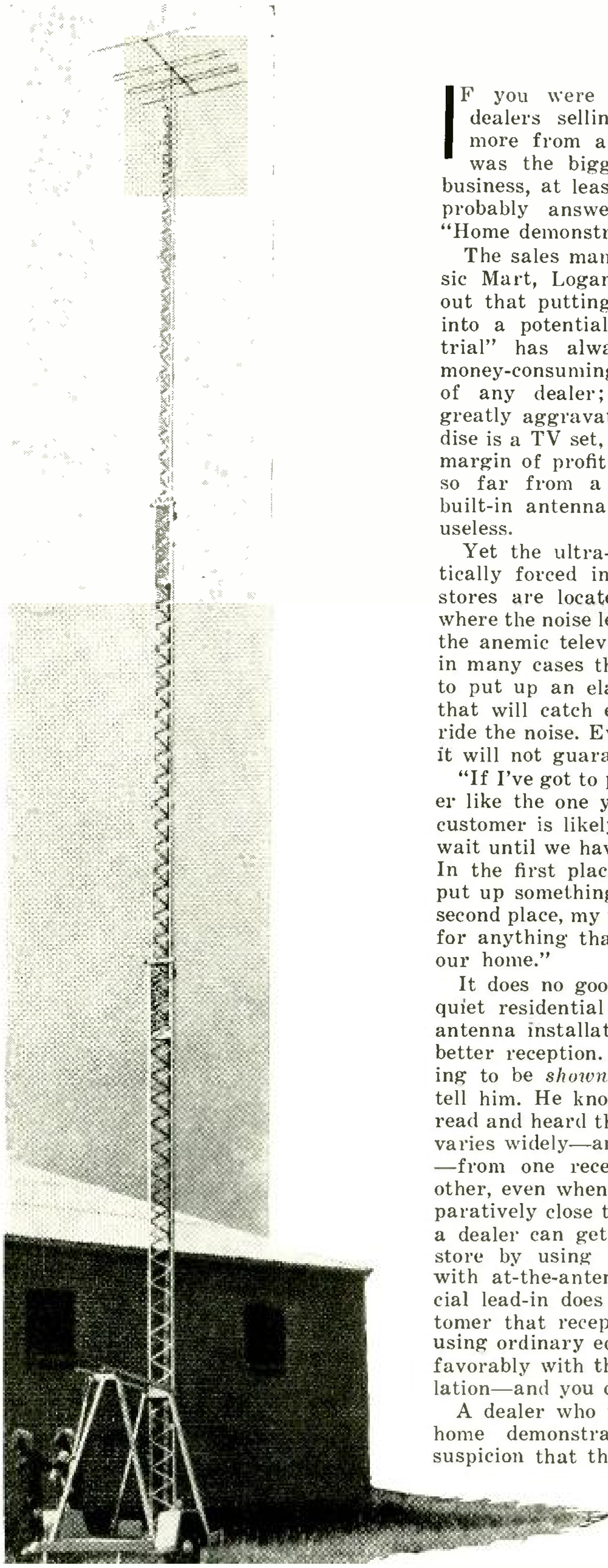
Electronic computers will not only be used for future business systems, but for many other endeavors, chiefly for scientific and research purposes, which were the first to use the electronic computers in the past. They can also be used for such unusual purposes as sports. College football has already begun to use electronic computers. An eastern university has used electronic brains in analyzing opponents' plays. The best scientist of the university uses the usual punch-card system and electronic computers to plot in advance a coming game. It is also a fact that in the past several seasons the electronically-guided team remained undefeated!

From this it seems reasonable to deduce that organized baseball will use computers to give the team the right answers well in advance. Other sports, such as tennis, and horse racing, are in the same class.

Right here the thoughtful non-electronic mind may well calculate what is going to happen if the opposing team *also* uses electronic computers. For the answer we need no electronic computer—almost certainly *the better team will win.*

Mobility makes money when customers can try—then buy

HOME TRIALS AND



If you were to ask ten television dealers selling sets fifty miles or more from a TV transmitter what was the biggest headache in their business, at least seven of them would probably answer without hesitation: "Home demonstrations!"

The sales manager of Marocco's Music Mart, Logansport, Indiana, points out that putting a piece of equipment into a potential customer's home "on trial" has always been a time-and-money-consuming gamble on the part of any dealer; but the problem is greatly aggravated when the merchandise is a TV set, carrying a microscopic margin of profit in the first place, and so far from a transmitter that the built-in antenna of the set is entirely useless.

Yet the ultra-fringe dealer is practically forced into this practice. Most stores are located in downtown areas where the noise level completely swamps the anemic television signal. Moreover, in many cases there isn't room enough to put up an elaborate antenna array that will catch enough signal to override the noise. Even if this can be done, it will not guarantee on-the-spot sales.

"If I've got to put up an antenna tower like the one you're using here," the customer is likely to tell you, "I'll just wait until we have a closer transmitter. In the first place, I couldn't afford to put up something like that; and in the second place, my wife would never stand for anything that big being put up at our home."

It does no good to explain that in a quiet residential area a much simpler antenna installation can bring in even better reception. The customer is willing to be *shown* this, but you cannot tell him. He knows from what he has read and heard that TV signal strength varies widely—and often unpredictably—from one receiving location to another, even when these points are comparatively close together. The fact that a dealer can get a fair picture in his store by using a skyscraper antenna with at-the-antenna boosters and special lead-in does not convince the customer that reception at his own home using ordinary equipment will compare favorably with this "souped-up" installation—and you can hardly blame him!

A dealer who flatly refuses to make home demonstrations simply invites suspicion that the sets he sells are inferior and that he is afraid to have them compared with competitors' sets in the customer's home. "If the sets are as good as he says they are, why is he afraid to demonstrate them?" the customer wonders; and you may rest assured that the dealer's competitors will make capital of his refusing to put his sets in on trial. So, whether he wants to or not, the fringe-area television dealer is practically forced into making home demonstrations.

Demonstration antennas

The worst feature of making the demonstration is the antenna problem. If the reception is to be of selling quality, the antenna must be good, and it must be up in the air high enough to pull in a strong signal. At the same time, since the sale is problematical, the whole antenna installation must be temporary: no permanent anchors can be screwed into the customer's house, and not too much time or money can be expended in erecting the trial antenna.

The portable antenna-tower mounted on some sort of trailer has proved to be one of the best answers to this problem. Views of a modern, commercially-built example are shown. Fig. 1 shows the telescoping aluminum tower extended to its full height of 80 feet. In Fig. 2 it is in its folded position for transport. The antenna can be raised and lowered at will with this equipment for determining the best height for reception—information that will be very useful when and if a permanent antenna is put up later. Another feature is that this crank-up tower can be used as a telescoping ginpole, requiring only two men to raise permanent towers up to 100 feet in height.

Mobile show rooms

The owner of Booth's Radio & Appliance Company, Bakersfield, Calif., has worked out a much more elaborate setup. He uses a specially-constructed tubular antenna mast that can be hydraulically extended to a height of 80 feet, mounted permanently on a truck that also contains boosters, signal-strength measuring equipment, a television receiver, and comfortable accommodations for viewers. When a customer wants to know what kind of television reception he can expect if he buys a set, the truck is simply parked in front of his door, the antenna is pumped up to any desired height, and he can sit there

TRIBULATIONS By JOHN T. FRYE

in the truck and see exactly how the set performs. This method of home demonstration has several advantages: One man can make the entire demonstration. Nothing in the customer's home needs to be disturbed. The set is in the dealer's possession at all times, and is out of the shop for only a few hours. No compromise between a good antenna and an inadequate temporary antenna installation need be made. The only catch —and of course there is one—is that the owner of this mobile demonstrator has some six thousand dollars tied up in it!

The Home Furniture Company of Zanesville, Ohio, has gone this even one better. A huge trailer has been expensively equipped with rugs, fluorescent lamps, and fine furniture to simulate a living room and provide a flattering setting for the TV sets displayed. These are demonstrated in action with the aid of a telescoping antenna mounted on the trailer roof. The on-the-hoof value of this perambulating living room is figured at seventeen thousand dollars; but it should be pointed out that in addition to being used for home demonstrations, this equipment is also valuable for mass demonstrations at fairs, carnivals, and conventions.

Not many fringe-area dealers want to invest that much money in home-demonstration equipment, especially now that the freeze has been lifted and new stations will soon start the fringe areas shrinking; but the illustrations show to what lengths some dealers have gone to let potential customers see what kind of reception they can expect before they buy. Certainly those dealers considered home demonstrations very important.

Home-trial headaches

There is one kind of customer in the fringe area who solves the antenna problem for himself. He installs his own antenna—or has an independent outfit put it up for him—he buys a booster, and then he feels free to try out various makes of television receivers to his heart's content and for as long as he wishes without apparently feeling the slightest obligation to the dealers who sell these sets! After all, he put up his own antenna, didn't he?

Some dealers encourage him in this matter of installing his own antenna, for they feel that if he goes that far he is almost certain to end up buying a television set from someone. At the same time, this does away with the expense and trouble of erecting a temporary antenna. Other dealers, though, are not pleased with the arrangement. They dislike seeing the profit of the antenna installation going to someone else. On top of that, they usually have a pet antenna and booster that seem to give the best results with the sets they handle, and they prefer to sell a complete installation rather than just the set alone.

If the customer is determined to put up his own antenna, there is not much anyone can do about it. When he does, he usually wants to try out two or more sets at the same time so that he can compare them on the same program. Since the strength of the TV signal in an ultra-fringe area can vary greatly from minute to minute, this makes good sense (though exasperating to the dealer).

However, it does bring up several new problems. For one thing, it is not practical to operate two sets from the same antenna with the puny signal found in a fringe area. Couplers that permit such operation without mismatch necessarily introduce some loss, and ordinarily you have no signal to spare. Moreover, it is quite possible to connect two TV sets to the same booster with certain critical lengths of lead-in so that on the same station one set will receive much more signal than the other. This state of affairs is an open invitation to electronic skullduggery when one dealer is asked to connect up his set with a competitor's set.

If the sets must be connected simultaneously to the same booster, the leads from the booster to the sets should be of identical length. A better arrangement is to use a single lead from the booster with one of those glorified clothes-pin connectors on the end so that it can be quickly connected first to one set and then to the other. Be sure to explain to the customer that the set actuating the booster through its automatic switch must be left turned on all the time these quick comparisons are being made, even though the picture is being watched on the other set. I know a case in which failure to do this simple thing lost a sale.

One thing that makes the average dealer take a dim view of home demonstrations is the fact that after a TV set has weathered about a half dozen of these home trials it can no longer be offered as new merchandise. Be as careful as you will, hauling a heavy TV set around is almost certain to result in some marks and scratches. To my surprise, most dealers report that customers take reasonably good care of the sets while they are in on trial; but sets in the home are bound to receive some damage, especially if there are small children. Then there was the case told me by a dealer who, when he went to pick up his demonstrator set, found the speaker grille cloth badly frayed.

Fig. 1 (opposite)—Collapsible 80-foot mast finds best antenna height at customer's site, doubles as derrick for raising permanent tower. Fig. 2 (right)—The aluminum test tower in transport position—ready to roll to another customer-home demonstration.

"Oh yes," the lady of the house said when this was called to her attention; "I meant to tell you about that. It was the cutest thing! When the weatherman draws on his glass-covered map, his chalk squeaks; and Agnes—that's our cat—thinks there's a mouse in the speaker and tries to get it. You would just die to see her!"

1 Demonstration = 1 Sale

Ralph Todd of Todd's Home Appliance Store in Logansport, Indiana, who has been outstandingly successful in selling fringe-area installations told me that he considered home demonstrations as a challenge and an opportunity rather than a nuisance. I quizzed him closely about his methods, and his answers went like this:

"First, we never take a set out until it has operated satisfactorily in the store for at least three consecutive hours. Before we put a set in on trial, the antenna must be adequate for the location; and this goes if the customer has put up his own antenna or if we use one of our antenna-trailers. When it is delivered either I or my technician goes along with it and sees that it gives top performance in the home.

That means the picture size is adjusted so that it will stay beyond the mask during the drop in line voltage we have during the early evening hours. A too-small picture will be noticed much more quickly than one that is a trifle too large. Ion trap, focus, hold, and a.g.c. controls are carefully reset at the customer's home, even though they were in perfect adjustment when the set left the store.

Considerable time is devoted to showing someone in the home how to operate the set. When possible, these instructions are given to the most interested party, the one who will make the decision about buying the set; but there are times, say when an elderly person is the potential purchaser, when a younger member of the household can be more easily taught to run it. In any event, the person is first shown how to tune the set, adjust the contrast and brilliance, operate the hold controls, etc. Then the set is deliberately thrown out of tune and sync, and the person is asked to bring it back into adjustment. This is repeated about three times to make sure he or she has the hang of it. Mimeographed instructions, using the same steps and phraseology, are left with the set.

While I am giving these instructions, I try to show the customer how to recognize a good picture when he sees one. I show him how 'the size of the snow'—often talked about by laymen—is just a function of the contrast setting. He is taught to look for fine detail, especially in the small vertical elements of the picture. I show him that a really good picture still looks good at reasonably close range, while to a bad picture 'distance lends enchantment.' The ability of a picture to remain steady under ignition interference is stressed. In short, I want him to be able to do an intelligent job of comparing when he stacks my set up against a competitor's."

Lend or Lease?

The final problem of home demonstrations is how long to leave the set in on trial. All dealers with whom I talked agreed there should be a clear understanding that it would not be left indefinitely, but they did not agree on what limit should be set. One left the set in for a flat three days. Another did not pick up the set until there had been at least one night of good reception. Still another said he had no definite limit, but he kept the customer aware of the passing of time by frequent callbacks while the set was on trial.

He pointed out that these calls, if they were made—as they should be—by a TV technician, served several other useful purposes: First, they allowed the technician to spot and correct any minor trouble that might develop with the set; second, they provided insurance that competitors did not foul up the installation in any way detrimental to the dealer's set; and third, they gave the customer the comforting assurance that the dealer had trained personnel on hand to take care of any future trouble. A commission on sales was given the technician to interest him in making these evening calls.

Still another approach to the home demonstration headache is the practice of charging for this trial. For example, Ken's Radio of Jackson, Michigan, charges a flat five dollars for each set put in on trial, with the understanding that if the set is purchased, the money is applied to the purchase price. He claims this discourages the grafters, and cuts down the number of home demonstrations, but increases the number of sales. Certainly it neatly shifts the expense of making the demonstration from the dealer to the customer. At the same time there is serious doubt that this method will enjoy any great popularity under the dog-eat-dog competition of large urban areas. American people have been accustomed too long to free trials of everything from toothpaste to automobiles to take kindly to the idea of paying for their sampling—no matter how unfair to the dealer this well-rooted practice may be.

But the purpose of this article was not to advocate any one way of meeting the problem. Instead, it was hoped that by presenting a cross-section of what many dealers think and do about home demonstrations, the reader would be stimulated to do some thinking of his own on the subject. If it has done that, we can write: "Mission Accomplished."

The writer would like to express his deep appreciation to all the dealers and service technicians who contributed their ideas in preparing this article; and he especially wants to thank the management and service departments of Todd's Home Appliance Store and Marocco's Music Mart—both of Logansport, Indiana—for their invaluable assistance.

—end—

TV DX REPORTS

August will be bad news for the TV dx enthusiast. This month will mark the end of the major TV dx period of 1952. The dx season averages just about three months, taking the country as a whole, but the starting and ending dates shift from one year to the next by as much as two weeks. This year's dx was very late in getting under way, so it is reasonable to assume that it will carry over farther into August than usual.

The last major opening of the year will probably occur around July 25 to 28, but there will be scattered dx during the first two weeks of August, with the possibility of fairly good conditions as late as August 10 to 12. It is doubtful if there will be any sporadic-E skip dx after the 15th, though there is a good possibility of major auroral disturbances later in the month. Past experience has shown that July and August auroral activity is often accompanied by dx that closely resembles sporadic-E skip in character. In fact, many propagation authorities now consider them to be variations of one phenomenon.

August marks the turning point for the better in tropospheric propagation. Over much of the country there is a shift in the weather toward fall late in the month, and with this change come the year's best opportunities for observing tropospheric phenomena on the frequencies above 30 mc.

The daily weather maps printed in many newspapers will give the best clues as to when weather effects will show in TV reception. Look for pronounced high-pressure areas, especially the slow-moving variety. Tropospheric propagation will be at a peak when these pass across your part of the country, usually being associated with calm, stable, local weather. A slowly increasing overcast is a good sign. If you have a barometer, watch for steady periods of above 30 reading, or a very slow fall in pressure after a spell of fair weather.

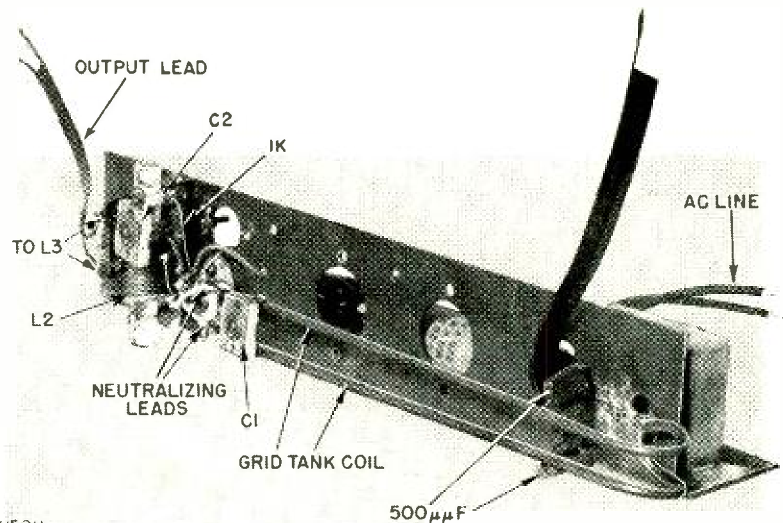
The effect of stable inversions of late summer is most marked on the high channels. Particularly along coastal areas, in the Mississippi and other large river valleys, and around the Great Lakes, the bending of v.h.f. waves may be very marked at this season, producing strong steady signals for many hours at a time. Amateurs have communicated on the 144-mc band over distances as great as 1,200 miles on at least one occasion under such conditions, and 500 miles or more is quite common. Although the amateur works with much weaker signals than are capable of producing a satisfactory TV picture, the TV dx enthusiast should not overlook the possibility of reception up to several hundred miles by this medium, especially on the high-frequency channels.

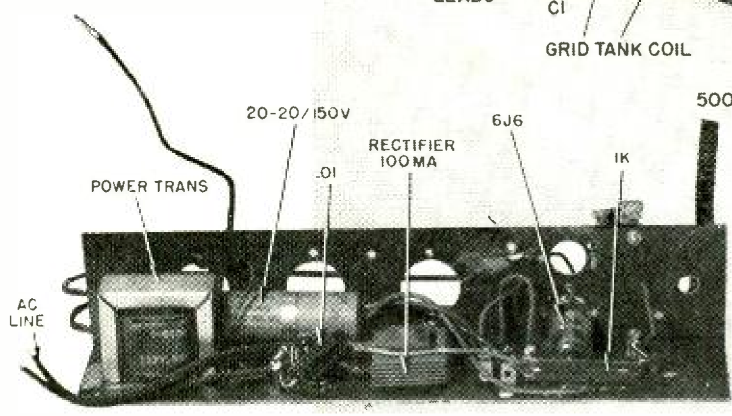
—end—

LONG LINES TV BOOSTER

An Efficient Single-channel Job

By JAMES BOYETT





HERE'S a novel, easily-built booster for a single low-band TV channel. It uses a 6J6 as a neutralized push-pull amplifier, and gives excellent reception from a station 120 miles away.

The circuit, shown in Fig. 1, borrows a trick from v.h.f.-transmitter practice by using a folded-line grid tank made of ⅛-inch brass or copper tubing. A 22-inch length of tubing is bent into a hairpin 10½ inches long and ¾ inch wide on the outside. The closed end is folded over and grounded at the center as shown in the upper photo L2, the plate coil, consists of 13 turns of No. 20 plastic-insulated wire close-wound on a ¼-inch polystyrene rod. Make a tap at the exact center for the plate-voltage connection. L3, the output link, is two turns of the same wire *wound in the same direction* over the center of L2. The 1,000-ohm loading resistor should be soldered directly across the ends of L2.

C1 and C2 are 2–8-μμf mica trimmers. C1 is soldered across the grid line about 1 inch from the open end. This can also be seen in the upper photograph.

The neutralizing leads are 2-inch lengths of insulated wire from the 6J6 plate pins inserted in the opposite open ends of the grid tank.

Plate voltage for the 6J6 is supplied by a 100-ma selenium rectifier and an R-C filter. Heater voltage may be taken from the TV receiver, or from a small 6-volt transformer (see photo). If the TV receiver is the transformerless type, or if any part of the antenna system is grounded, take the following precautions to prevent shocks or short circuits: Isolate the B minus lead from the booster chassis and connect it directly to the B minus line of the TV receiver; use a *single line-cord lead* from the rectifier input to one side of the booster line plug.

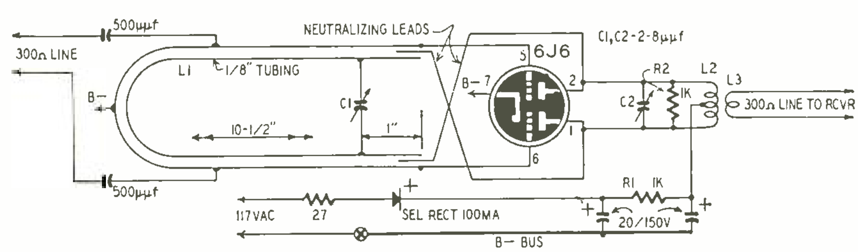


Fig. 1—The schematic. Amateur "long-lines" technique is used to get high-Q circuits.

To neutralize the 6J6, connect the booster output link to the TV-receiver antenna terminals and set the receiver to the desired channel. Short out the booster antenna terminals. With both units turned on, slide both neutralizing leads in or out of the grid tank in equal steps until the rushing sound (oscillation) from the speaker just disappears. With the station tuned in and the grid and plate tanks tuned for maximum gain, readjust the neutralizing leads for possible improvement.

The best points for connecting the 500-μμf antenna-blocking capacitors to the grid tank should be found in the same way.

Although this booster was designed for a single low-band channel, you can prune L1 and L2 and use it for FM, 150–170-mc emergency, or high-band TV signals. The grid tank can be tuned to a higher frequency by snipping short lengths from the open ends and turning C1 through its range to peak the signal. If you don't notice an increase in signal strength, clip about one-quarter inch more from the ends and repeat the process until you can peak the signal with C1 in the center of its range.

L2 is comparatively broad because of the loading effect produced by R2. However, it may be necessary to remove a few turns from this winding so the output circuit resonates in the center of the desired frequency range. Of course, if you have a v.h.f. grid-dip meter, you simply prune the coils until the meter indicates resonance at the desired frequency.

Materials for booster

Resistors: 1—1,000 ohms, 1 watt; 1—1,000 ohms, ½ watt, 1—27 ohms, ½ watt.
Capacitors: (Ceramic or mica) 2—500 μμf. (Electrolytic) 2—20 μf, 150 volts. (Variable) 2—2-8 μμf trimmers.
Miscellaneous: 1—6J6; 1—100-ma selenium rectifier; 22 inches ⅛-inch brass tubing; 1—7-pin miniature socket; polystyrene rod; chassis; s.p.s.t. toggle switch; wire, solder, terminals, hardware.

—end—

the last word on conVERSION

Including problem discussions and pointers which do not often appear in a conversion article

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Editorial Director

PART I

THE LAST word on the important subject of television conversions has not been said. Far from it. Suppose, for instance, you make a big-tube conversion and find there isn't enough high voltage. What then? Or maybe there's not enough width—or height. Or the linearity or focus is poor. Or the horizontal output tube droops after a few days. If you don't know the answers to all these everyday conversion problems, stick around. You'll find some of them here.

To show how conversion problems can be licked, let's take the case of an RCA 8T244 (KCS28 chassis) which we converted recently.

The conversion was to a low-voltage electrostatic-focus tube, the 17TP4. The original set delivered 8.5 kv to the 53-degree 10BP4, so a new yoke and horizontal output transformer were needed. We selected a new ferrite-core output transformer, the RCA 231T1. This transformer has a number of interesting features. It is a *universal* job designed for both replacement and conversion work and will properly match a variety of output tubes to yokes with horizontal coil inductances ranging from 8 to 30 mh. This covers just about all types of yokes for tubes with 50- to 66-degree deflection angles. A 7-tap secondary provides this matching flexibility.

An extra primary tap provides the proper match for all horizontal output tubes. Thus in sets with d.c. supply voltages of from 250 to 300, using a 6BQ6-GT or 6AU5-GT, the plate connection goes to tap 2. If the receiver has a d.c. supply voltage of 300 to 350 and uses tubes such as the 6BG6-G, plate connection goes to tap 3. Maximum high-voltage output is 15 kv.

Because of its flexibility, the transformer can be used in straight *replacement* work in 10-inch (53-degree) tube sets, in 21-inch (66-degree) tube sets, or anything in between.

Before starting on any conversion job, *make sure the receiver is in top operating condition.* If the set is operating properly beforehand, you will know that any troubles after conversion are due to the conversion itself. Make sure that the low d.c. supply voltages are at normal values, and that the vertical and horizontal sweep systems function normally (good interlace, sufficient height and width, normal linearity, hold controls locking in at the center of their range). Replace all weak tubes in these circuits and give the set a final operating check. Don't start the conversion until all these things have been done.

Why is all this necessary? Conversion means higher sawtooth voltages, higher boost voltages. The higher sawtooth voltages can stray around the chassis, causing interlace difficulties. The higher boost voltages (if they are applied to the horizontal oscillator or discharge tubes) change operating conditions and may cause the oscillator to shift frequency. The same trouble can occur in the vertical oscillator circuit. If the v. and h. hold controls are checked *before* conversion and serviced so that they lock at the center of their range, a considerable frequency change would have to occur before the picture could not be locked in by adjustment of the hold controls. Suppose, however, that the hold controls were *not* checked before conversion. If one of them locked near one end of its range, a small frequency change resulting from the conversion could throw the lock setting outside the range of the control. The technician's reaction to this trouble would be, "What did I do wrong?" He would waste time checking for wiring errors that weren't there. So check before conversion!

In making this conversion a number of small parts were removed in addition to the old yoke and flyback transformer. The focus control R191 and the 330-ohm resistor R190 in series with it were eliminated. The focus coil L115 was shorted out in the chassis and removed,

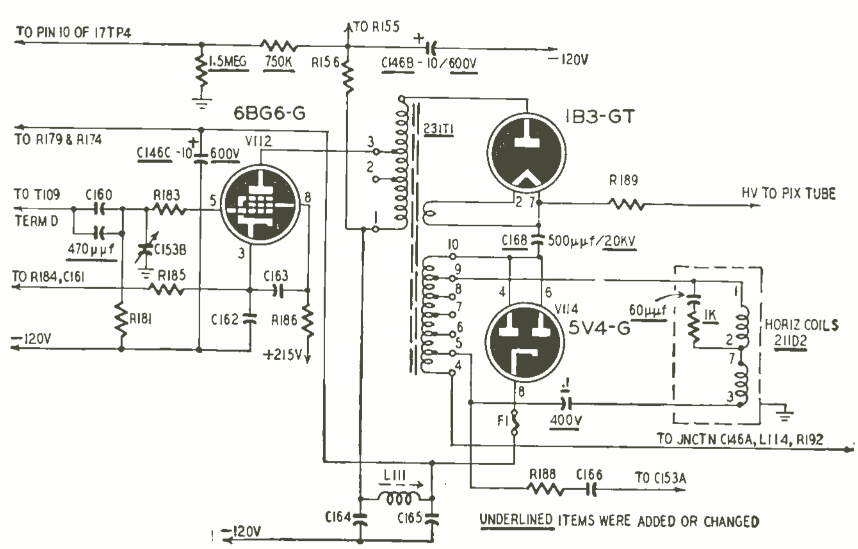
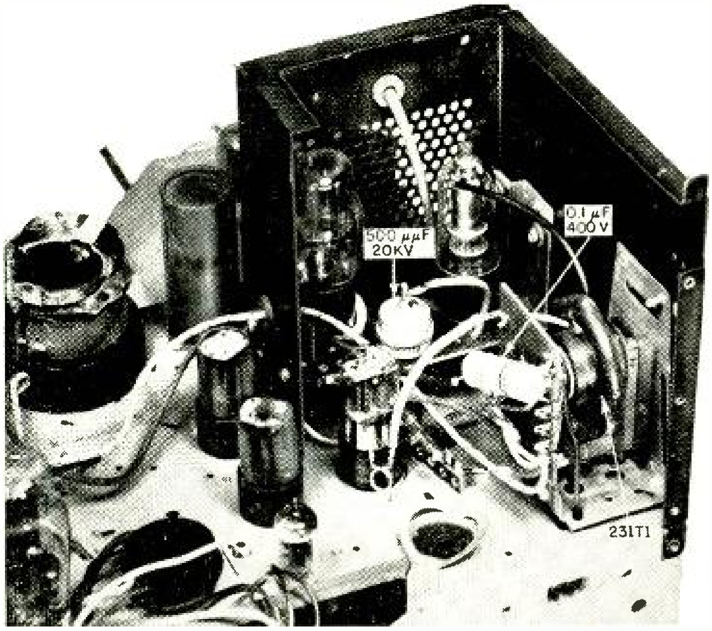


Fig. 1—Conversion of an RCA 8T244, using the 231T1 universal transformer.



Mounting details of the replacement transformer.

since it is not required for the 17TP4. The width control L110 was also removed, as was R187, the 3.3-ohm filament resistor for the 1B3-GT.

The method of mounting the new flyback transformer is shown in the photograph. Follow the usual precautions against corona and arcing in wiring the high-voltage circuits. Keep all high-voltage leads at least an inch from other wires and the chassis. Length and placement of the lead from the top of the primary winding to the plate cap of the 1B3-GT are particularly critical. Keep it as short as possible and make sure that it is far away from the walls of the high-voltage cage or from other wiring, to keep stray capacitance to ground at a low value. Too much capacitance between this lead and ground will reduce high voltage and affect horizontal linearity. Incidentally, the 231-T1 transformer comes with 4 plate lead clips (2 small and 2 large) to fit the plate caps of all popular h.v. rectifiers and horizontal output tubes. The 2 large ones are used in this case.

The circuit changes for converting the 9T244 are shown in Fig. 1. The underlined items in this figure indicate either an added part or one whose value or voltage rating has been changed.

Few changes were needed in the horizontal circuit other than those having to do with the new flyback transformer. A 470-μμf capacitor was shunted across the coupling capacitor C160 to increase the drive voltage to the 6BG6-G grid, for more high voltage and width.

A word about drive. In any horizontal output amplifier circuit a certain amount of sawtooth voltage is needed to drive the horizontal output tube at maximum efficiency. If the horizontal oscillator or discharge tube can't supply sufficient voltage, the output tube will run at lowered efficiency, drawing an excessive amount of cathode current and shortening its life. The high-voltage output will be low and picture width insufficient.

An easy way to tell if the output tube is getting enough driving voltage is by the raster's appearance. Adjust the drive control for maximum. Then adjust the linearity coil through its range to see if you can produce a vertical white overdrive line near the center of the raster (Fig. 2). Back off the drive control until the overdrive line just disappears. This is the optimum drive point. If it is not possible to produce the overdrive line, the sawtooth driving voltage is not high enough. To increase it, increase the size of the coupling capacitor feeding the output-tube grid. (Be careful. Too large a capacitor may shift the oscillator frequency.) Another way to increase drive is to *decrease* the size of the plate-load resistor of the oscillator or discharge tube. A third method is to increase the plate voltage on these tubes by feeding their plate-load resistors from the boosted B plus supply through an R-C decoupling network.

If the drive voltage is sufficient to overdrive, but width and high voltage are insufficent, increase the output-tube screen voltage by reducing the resistance of its screen-dropping resistor. When doing this be careful not to exceed the tube's maximum allowable screen dissipation in watts (the product of screen-to-cathode voltage and screen current in ma). You may find that with increased screen voltage you can no longer overdrive the output tube. The remedy is to increase the output of the horizontal oscillator or discharge tube, using the methods indicated above. Then readjust the drive control to overdrive, then back off just enough to eliminate the overdrive condition. If width and high voltage are still insufficient, decrease the output-tube screen resistor until the desired results are obtained.

Fortunately in the 8T244, the only change necessary was the addition of the 470-μμf capacitor mentioned above. In a low line-voltage area it might be necessary also to reduce the 6BG6-G screen resistor R186 to get enough width, or the screen resistor could be reduced to 5,000 ohms and a 2,500-ohm rheostat installed in series with it to act as a width control.

C168, the 500-μμf high-voltage filter capacitor, was replaced with one having a 20-kv rating. In a circuit of this kind, where C168 is returned to the damper tube plate, it is important not to eliminate the 1-meg filter resistor R189. It isolates the damper-tube plate circuit from the 100 to 500-μμf capacitance which exists between the anode of the C-R tube and ground. If this capacitance was directly across the damper-tube winding it would greatly increase retrace time and cause foldover difficulties and loss of high voltage.

The only other horizontal circuit changes were to replace the 10-μf capacitors C146B and C with 600-volt rating units, and to eliminate the d.c. flow through the new yoke by placing a 0.1-μf, 400-volt capacitor in series with it. Eliminating the d.c. tends to give a cleaner raster with fewer ripples. The new yoke is an RCA 211D2, an anastigmatic edge-to-edge focus unit. It differs from the older 211D1 only in that the connecting leads and damping resistors are already installed. (But the neutralizing 60-μμf capacitor and 1,000-ohm resistor which connect across part of the yoke's horizontal windings are supplied in an envelope since they must be connected to different yoke terminals in some applications. With an isolated-secondary flyback transformer such as the 231T1, they connect as shown in Fig. 1.)

The horizontal a.f.c. phasing feedback network R188-C166—which formerly connected to the damper tube plate—was moved down to a point of much lower output on the secondary of the flyback transformer. With the increased

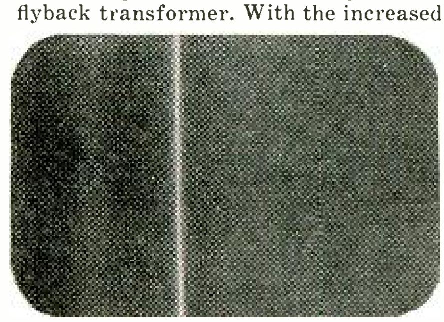


Fig. 2—How the overdrive line looks.

sweep voltages resulting from the conversion, the original connection gives far too much voltage for proper a.f.c. operation. This causes the horizontal oscillator either to operate off frequency (a torn picture results), or merely slightly out of phase (result—foldover appears on the left side of the raster. This looks like foldover due to wrong retrace time, but the cause is different).

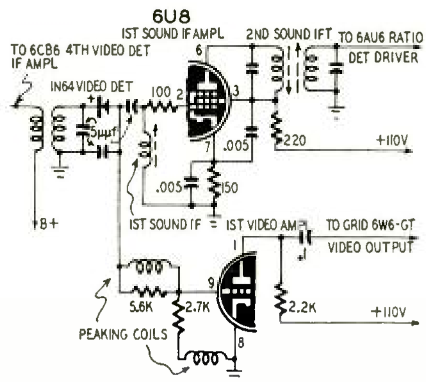
In the second part of this story next month we'll discuss the vertical circuit changes and the things that can cause poor linearity, foldover, not enough (or too much) width, blooming and some other points.

(to be continued)

short circuits

Some of the more unusual applications of familiar tubes and selenium rectifiers in modern TV set design

By ROBERT F. SCOTT



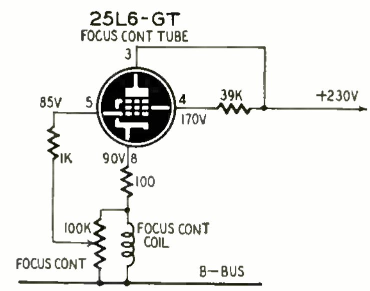


Fig. 1 (above)—Sound and video takeoffs with a 6U8. Fig. 2 (right)—A 25L6 as a focus control in recent G-E television receivers.

LAST month we talked about the use of conventional receiving tubes in unconventional applications in TV receivers. Along these lines, two more circuits warrant discussion.

The 6U8 is a comparatively new high-frequency miniature triode-pentode, best known as an oscillator and mixer in TV, short-wave, and FM receivers. When used in the front-end of a receiver, the 6U8 does not arouse unusual interest because circuitwise it resembles the 6K8 in broadcast sets and the 6AG5-6C4 or 6AG5-½ 6J6 combination in TV sets. But when it is used elsewhere in TV circuits, it stands out like a blot of ink on the wife's new lace tablecloth. Stromberg-Carlson engineers have put this tube to work in the video amplifier and sound i.f. of their 421 series. The circuit is shown in Fig. 1.

The germanium-diode video detector is direct-coupled to the triode section of the 6U8. Typical operating conditions for this triode are: Plate voltage 150, plate current 18 ma, amplification factor 40, transconductance 8500 μmhos, and plate resistance 5,000 ohms.

The pentode first sound i.f. amplifier is coupled to the video detector through a 5-μμf capacitor. This section of the 6U8 is similar to the 6AU6.

25L6-GT focus control tube

Generally, whenever we see a 25L6-GT nestled in its socket on a TV chassis, we can safely assume that it is in the audio output circuit and can disregard it if the symptoms indicate trouble in the sync or video circuits, or replace it if the trouble is definitely in the audio output stage. If you don't have a diagram or table of tube functions for the G-E 16K1 or 16K2, don't let the 25L6 mislead you. It is *not* in the audio output stage. It is the focus-control tube and its circuit is shown in Fig. 2.

In this application, the plate-cathode resistance of the 25L6 is used as a variable resistance in series with the coil of the EM-PM type focusing unit. Varying the 100,000-ohm focus control varies the bias on the grid of the tube and controls the flow of current through the tube and focus coil in series. We can see that a weak or gassy 25L6 can seriously affect the current through the focus coil and make it impossible to focus the picture properly. Although poor focusing can be caused by a bad picture tube, open or shorted focus coil, or weak magnet in the PM section of the focusing assembly, it is only reasonable to check the tube first, as it is easier to get at and simpler to check than the other components.

Selenium rectifiers

We are familiar with selenium rectifiers in the low-voltage power supplies of a.c.-d.c. receivers and transformerless TV sets, but in other applications their use and operation are not always evident from the circuit or manufacturer's data. One example is the Setchell-Carlson model 151. A selenium rectifier supplies d.c. to the screen of the horizontal output tube by rectifying a part of the 15,750-cycle voltage developed across the secondary of the flyback transformer. This novel application is shown in Fig. 3.

There is an excellent reason for using the rectifier in this manner. When the horizontal output stage is operating with normal drive and plate and screen voltages, the heat dissipated in the plate and screen is close to the maximum ratings set by the tube manufacturer. In the absence of drive to the output stage, plate current and dissipation increase and the tube may be damaged within a few seconds. During the period the tube is without drive, excessive plate current may cause the primary of the flyback transformer to open up or catch fire.

Many sets have fuses to protect the transformer primary, but if the fuse is the wrong size or has too long a delay before blowing, the tube and transformer can still be damaged. Some TV sets have an extra-large cathode-biasing resistor to provide safety bias if excitation fails. The use of a high cathode bias reduces the actual plate voltage, limits the horizontal deflection power and reduces the high voltage.

In the circuit of Fig. 3, the positive spike of the 15,750-cycle horizontal sawtooth is rectified to produce approximately 140 volts at 25 ma for the 6BQ6 screen grid. In the absence of grid drive, there is no a.c. voltage to be rectified so the d.c. screen voltage is supplied through the 1-megohm resistor from the 280-volt d.c. line. The voltage on the screen is now so low that plate current is reduced to the point where the plate dissipation rating cannot be exceeded and the primary winding of the transformer cannot burn out.

Bendix centering circuit

Some late-model Bendix TV sets use a selenium rectifier as a centering aid rather than as an auxiliary source of B voltage. The Bendix circuit used in

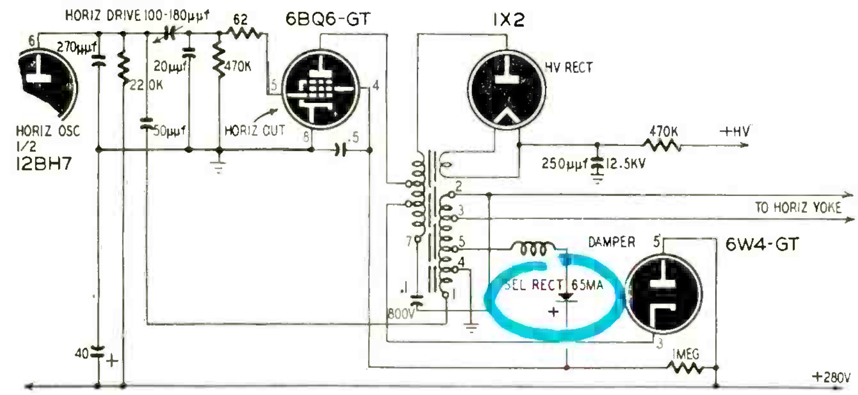


Fig. 3—Screen voltage for the 6BQ6-GT is supplied by the selenium rectifier from the sweep output. Drive failure cuts off the screen voltage, protects the 6BQ6.

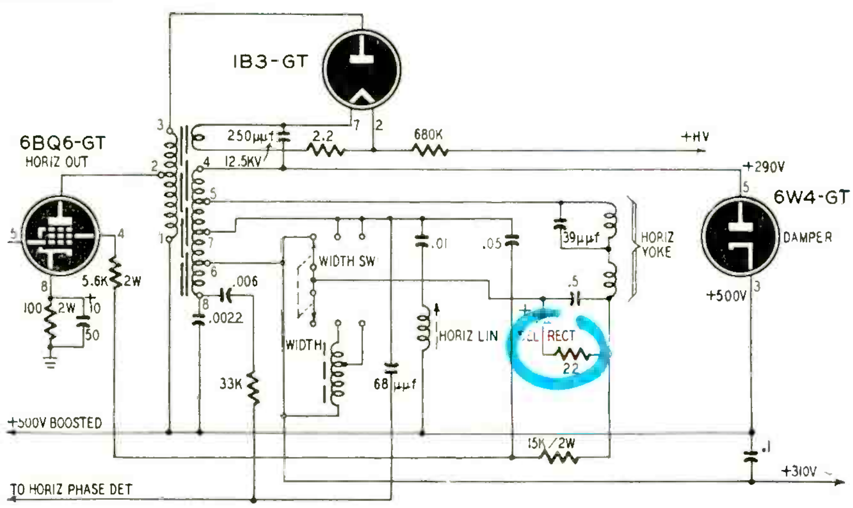


Fig. 4—Automatic bucking bias from the selenium rectifier keeps raster centered.

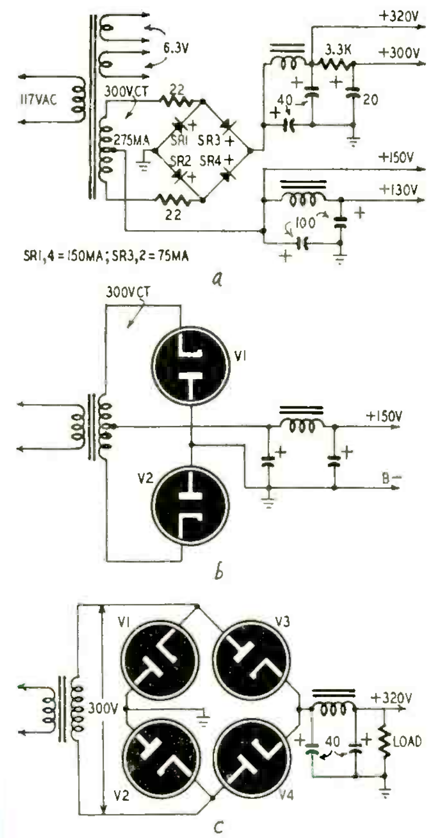


Fig. 5—Radio Craftsmen full-wave bridge power supply with equivalent vacuum-tube rectifier circuits.

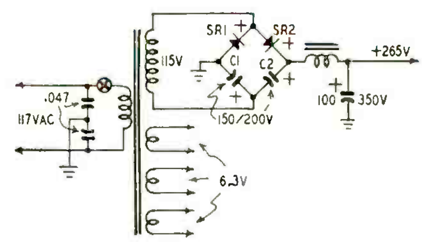


Fig. 6—Full-wave voltage doubler rectifier in RCA KCS66-series chassis.

TV receiver models C172 and C2000 is shown directly above in Fig. 4.

Since boosted B plus voltage from the damper tube is used in the horizontal deflection circuit, the horizontal deflection coils are above ground. The direct current flowing from top to bottom through the horizontal yoke windings causes the picture to be displaced to the right. To compensate for this, the selenium rectifier is connected to B plus to supply a bucking current which flows through the coils in the opposite direction. This allows the picture to be centered with the normal centering device.

Radio Craftsmen power supply

Fig. 5-a shows the low-voltage power supply circuit in the Radio Craftsmen RC-201 receivers. This circuit uses four selenium rectifiers and a 300-volt center-tapped 275-ma transformer to deliver 130, 150, 300, and 320 volts to the various sections of the set. This arrangement replaces the twin 5U4-G's and voltage dividers used in many other makes and models of TV sets. With this circuit, any minor change in current drain on one B plus line will not affect the voltages on the others as it will with many voltage dividers.

Fig. 5-b shows the basic circuit of the 150-volt supply with V1 and V2 substituted for selenium rectifiers SR1 and SR2. This is a conventional full-wave rectifier with the plate and cathode connections reversed and the positive potential taken from the center-tap on the transformer.

In Fig. 5-c, tubes have again been substituted for the selenium rectifiers. This is a full-wave bridge circuit. The center-tap on the transformer is not needed in a full-wave bridge.

When the top of the secondary winding is positive with respect to the bottom, V2 conducts and current flows through it to ground, up through the load, and then back to the transformer through V3. Current cannot flow through V1 or V4 because their cathodes are more positive than their plates. When the a.c. voltage reverses, the bottom of the secondary is positive. V1 conducts and passes current to the load. The current returns to the transformer through V4.

Fig. 6 is the full-wave voltage-doubler circuit used in the low-voltage power supply of the RCA KCS66 and similar chassis. When the voltage across the secondary of the transformer makes the anode of SR2 positive, this element conducts and a positive charge accumulates on the positive plate of C2. SR1 does not conduct, because its cathode is more positive than its plate. When the polarity of the a.c. voltage changes on the following half-cycle the cathode of SR1 is negative with respect to its anode. This element conducts and places a negative charge on the negative plate of C1. Each capacitor charges to the peak voltage developed across the transformer. Since C1 and C2 are in series, the charges on them are in series, and the total voltage across them is twice the peak across the transformer. When these capacitors are delivering power to the load, the voltage drops slightly to a value determined by the magnitude of the load current and the values of C1 and C2. With this circuit, the voltage drops to approximately 265 under load.

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TV SERVICE CLINIC

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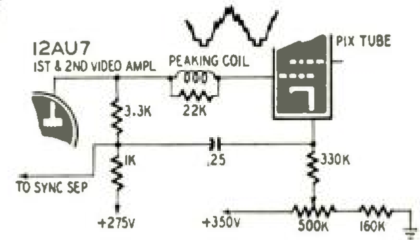


Fig. 1—Direct video coupling.

READERS often ask about brilliancy-control troubles in receivers using direct coupling between the last video amplifier and the picture tube. When direct coupling is used, no d.c. restoration is necessary and the grid circuit of the picture tube is simplified. Troubles occur, however, because B plus voltages exist at both the grid and cathode. Defects can include insufficient or excessive brilliancy, inoperative brilliancy control, poor contrast, and unstable sync.

With direct coupling the video signal may be fed to either the grid or cathode of the picture tube. Fig. 1 shows a typical grid feed used in Olympic and many other receivers. With plate voltage directly on the grid, the cathode must be at a higher d.c. voltage so the grid will be negative with respect to the cathode. The brilliancy control permits varying the voltage on the cathode to change the relative grid bias and control the beam current.

It is important that the d.c. supply voltages at both grid and cathode remain stable. If changes occur in voltage or in the values of series resistors, the balance of potentials between grid and cathode may be upset. A decrease in cathode voltage or an increase in the voltage at the grid will lower the bias and make the picture excessively bright. The control is then unable to decrease brilliancy sufficiently for good viewing.

If changes in resistance values increase cathode voltage or decrease the grid voltage, insufficient brilliancv will result.

The same is true in circuits where the signal is fed to the cathode. Fig. 2 shows a circuit used by Stewart-Warner. Here the functions have been transposed and the brilliancy control is now in the grid circuit. With the signal applied to the cathode, positive variations are equivalent to negative changes in the grid circuit in their effect on the electron beam.

When brilliancy-control troubles occur, a v.t.v.m. can be used to measure the relative potentials between grid and cathode. Regardless of the feed method used, the grid should be negative with respect to the cathode. When the brilliancy control is varied throughout its range, the v.t.v.m. should show a change in negative bias sufficient to cut off the beam or release a sufficient amount of electrons for good brightness. The potentials from grid to chassis and cathode to chassis should also be checked and compared with the values given in the service notes.

The values of the various dropping resistors also should be checked. The same holds true for the brilliancy control. This should be tested for continuity through each of the three potentiometer terminals.

If all components and voltages conform to the service notes, the second-anode potential and the accelerating-grid voltage should be checked. It is also essential that the ion-trap magnet be placed properly on the neck of the tube for maximum brilliancy. A weak ion-trap magnet can also contribute to poor brilliancy. Only after all other possibilities have been exhausted should the picture tube be suspected of being gassy or otherwise defective.

Intermittent width in Admiral

I am having considerable trouble servicing an Admiral 24E1 receiver. This set has insufficient width, noisy sound, and intermittent picture. I removed the chassis from the cabinet and checked all tubes and voltages. Upon trying the receiver it played all right and I returned it to the customer. Upon installation in the cabinet there was again an intermittent picture, and all the other troubles encountered previously. What could cause this trouble? L. B., Trenton, New Jersey.

You are undoubtedly running into a trouble which existed in the early production of this receiver, and the following is the manufacturer's recommendation for correction:

In early production models the chassis is mounted on a board with 1¼-inch bolts. The mounting bolt near the horizontal width control may short-circuit the control, resulting in insufficient width, horizontal nonlinearity, and loss of picture brightness, or no raster at all.

To correct this, pull the mounting board four or five inches out of the cabinet, remove the bolt, and put four or five washers under the bolt head. Late production sets use a shorter bolt.

When installing the chassis do not use a sharp-pointed tool for locating this mounting hole, as the width-control winding might be damaged.

Horizontal sync in Westinghouse

On a Westinghouse model 627K16 receiver, the picture loses horizontal sync after the set is on from one-half hour to two hours. I have replaced the tubes in the horizontal sweep circuits and also checked the values of parts. This chassis does not have the 6AL5 type of horizontal phase detector. What could cause this condition? F. R., Ridgewood, N. Y.

Several different horizontal control circuits were used in these models, and from your description the receiver you are working on uses the single-6C4 phase-detector circuit.

The fact that horizontal sync is lost only after an hour or two of operation indicates that some component is intermittent and changing its characteristics after warm-up. As you have already changed tubes, check the resistors and capacitors in the phase-detector circuit as well as in the horizontal oscillator.

Also make sure the changes you have made according to the manufacturer's supplements include the following:

If R446 is 15,000 ohms, change to 18,000 ohms.

Change R436 to 270,000 ohms.

Insert a 220,000-ohm resistor in parallel with R434 (pin 7, grid circuit of horizontal multivibrator).

insert a 120-μμf capacitor in parallel with C422. (In some chassis using a 12BN7 as the horizontal multivibrator not containing above changes, a 1.5-μμf capacitor is connected between pins 6 and 7 to improve performance.)

Keystoned picture

In a Techmaster 630 type receiver, the picture has a keystoned appearance, with the right side of the picture having less height than the left side. What could cause this trouble? L. R., Groveland, Florida.

This is usually caused by shorted turns in the vertical deflection coil (or a shorted resistor across one section of the vertical coil).

The particular coil section involved can be identified from the nature of the keystoned picture. As shown in Fig. 3, the vertical coil sections are on either side of the picture tube neck. For downward vertical sweep the coils must be positioned as shown. When one coil section shorts, the remaining coil section must perform the entire vertical sweep by itself. The beam is influenced less as

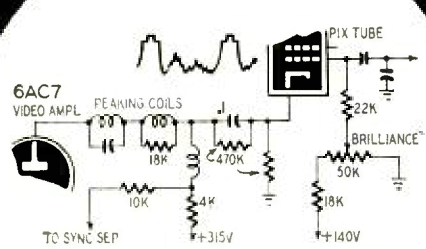


Fig. 2—Cathode video input.

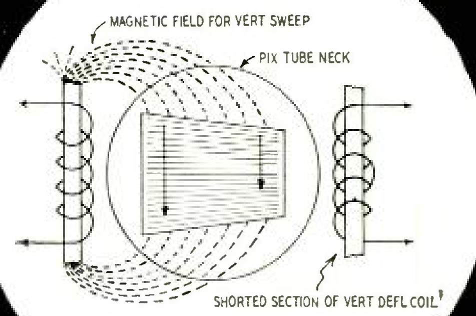


Fig. 3—Vertical keystoning.

the horizontal sweep pulls it away from the field of the single coil, and the latter is unable to sweep the beam fully at extreme horizontal deflection. The narrowed section shows on which side of the deflection yoke the shorted coil section is located.

Open-wire line match

In the installation of an open-wire transmission line, I find that the line crimps in making a loop to allow for rotor operation. Could I use 300-ohm ribbon line from the stacking bars of the antenna down to and just below the motor, and from here attach the open-wire line? Will this cause a mismatch? M. M., Grove City, Pa.

If you are using 300-ohm open-wire line, you can attach any length of 300-ohm ribbon line to it without worrying about a mismatch. The open-wire line has much lower losses than the 300-ohm ribbon type. As you are going to use only a short length of ribbon line from the stacking bars to a place right below the motor, you should have virtually no loss.

This procedure is sometimes followed at the receiver end, whenever it is difficult to bring the open-wire line into the house without a large opening. Open-wire line is run to the entry point and 300-ohm ribbon line is then used. If too much 300-ohm ribbon line is used, you will defeat the purpose of using the low-loss open-wire line.

Even with 400-ohm open-wire line, good results will be obtained, although the losses will increase because of the mis-match. If the signal strength is fairly high, the loss will be hardly noticeable.

Flyback transformer match

In a conversion, I have on hand an RCA 204T2 vertical output transformer, a 211T5 horizontal output for voltage doubling, a 206D1 deflection yoke, and a 470-ohm focus coil. In view of the fact that the 211T5 is listed as a 53-degree component, and the 206D1 has a 70-degree angle, with the combination given will I obtain proper sweep and deflection for a 17BP4A tube? Also, could I substitute the Merit MDF-70 cosine yoke for the 206D1 in the same circuit? W. V., New Orleans, La.

The 211T5 horizontal output transformer has a rating of 50 to 57 degrees deflection at 13.5 kv. This may work with the 206D1, depending on the efficiency of the drive circuit of the receiver. For the 206D1, however, the RCA 218T1 would be a better match. The latter is rated at 14 kv for deflection angles from 66 to 70 degrees.

The Merit MDF-70 cosine yoke has the same characteristics as the 206D1 except for a slight difference in vertical-winding inductance. You can use the Merit instead of the 206D1 and get better edge-to-edge focus. The very slight vertical mismatch should produce no noticeable difference in height, but there may be a slight pincushion effect characteristic of practically all cosine-wound yokes.

Vertical defects (Philco)

In a Philco receiver model 52T2252 I am having difficulty in getting good vertical linearity. The height is also insufficient. Besides this, there are trailing smears on the screen for large circles or letters. None of the controls seems to clear up this trouble. The receiver was only installed a few weeks ago. What could cause these troubles? J. W. L., Wayne, W. Va.

Normally, the vertical linearity control should correct compression at the bottom and elongation at the top. If it does not, check the coupling capacitor to the grid of the vertical output tube. A leaky one will cause the symptoms you describe. Adjustment of linearity and height should then be made with a test pattern. Horizontal width and linearity may also require correction.

On some of these sets this condition can be cured by adjustments to the yoke, and the following information is supplied by the manufacturer:

Remove the deflection yoke from the housing; then remove the metal band around the yoke. Apply pressure to both sides of the ferrite metal pieces around the yoke so that the ends of the pieces are as close together as possible. Apply two layers of plastic tape to hold the pieces in this position. Replace metal band and reinsert the yoke. Another cause of poor linearity and insufficient height may be a defective width-coil core. These sometimes change permeability with temperature. This affects boost voltage which, in turn affects vertical output-tube plate voltage. If this is the case, a new width coil and core must be installed.

Trailing smears indicate poor low-frequency response in the picture-amplifier system. This might be caused by improper video-i.f. alignment or defects in the video amplifier, particularly open decoupling capacitors in the resistive networks feeding plate voltages to the tubes. Check these first before testing, tracking, or alignment. Overloading on strong local signals may also produce a smearing effect in the picture. This may call for using attenuator pads in the antenna input circuit.

High-voltage resistor troubles

In a Magnavox CT244 there is repeated failure of a 1.5-megohm high-voltage resistor (R225) connected to the cap of one of the 1B3GT tubes. The failure results in loss of focus with accompanying jitter. I have tried different types of resistors, but each gave me trouble. Would two 750,000-ohm resistors in series help, or what do you advise? R. C., Brooklyn, N. Y.

You could use two 750,000-ohm resistors in series, each having the same wattage rating as the original 1.5-megohm resistor. This will divide up the load as you surmised, but it would be well to check several items in the receiver first to see whether or not the high-voltage system is being overloaded.

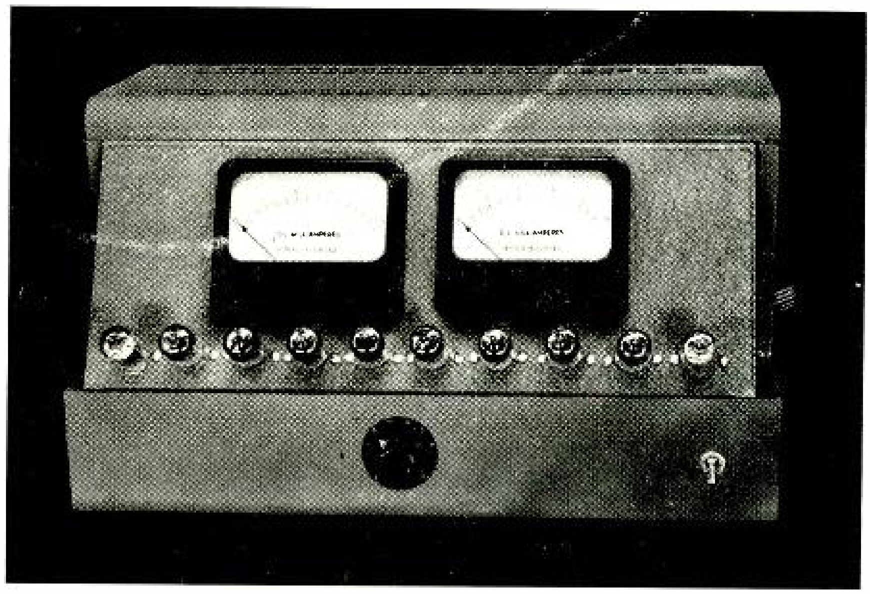
Check your drive control setting to make sure the drive is not excessive. Reduce the drive to the point where left-hand stretch and center compression disappear. If width is inadequate, readjust the width control. In this receiver there is a "width compensating switch" which changes the screen voltage of the horizontal output tube to compensate for various line voltages and tube aging. Improper setting of this switch can cause excessive width and high voltage, shortening the life of the high-voltage tubes and overheating parts (including the 1.5-megohm resistor). In No. 1 position it compensates for low line voltage (105 volts). No. 2 position is for 117 volts with a weak horizontal amplifier tube. No. 3 is for 117 volts with good tubes. No. 4 is for high line voltage (125 volts).

—end—

This Practical

TUBE TESTER FOR INDUSTRIAL REPLACEMENTS

Can Check Up to 10 Tubes At One Time



The multiple checker, with a bank of ten tubes inserted ready for checking.

By **DAVID ALLEN**

EXPERIENCE in testing large numbers of new tubes shows that approximately one out of every hundred is defective. Testing batches of new tubes, or periodic checking of tubes in service is a tiring, disagreeable chore.

In testing dual triodes several controls must be reset on the tube checker for each triode section. This is a serious inconvenience when anywhere from 20 to 500 tubes must be checked. So much time is wasted just waiting for the tubes to warm up, and in switching between sections, that the simple emission tester shown in Fig. 1 was a logical contrivance. It checks both sections of a dual triode simultaneously. Up to 10 tubes can be plugged in at one time and tested in quick succession with the rotary switch. (This control is a Centralab type 1423. Equivalents may be used.) It is used mainly for 12AU7's, but other twin-triode types can be checked by adjusting the bias with the panel control.

A good 12AU7 with matched sections is first selected with a conventional tube checker. It is then placed in the multiple checker and the bias is adjusted for 10 ma on each meter. This is the rated plate current for each triode. The plate currents of other 12AU7's can then be read as percentages of the standard—for example, 8 ma = 80%, 5 ma = 50%. I generally discard tubes that read below 7 ma (70%), or whose sections differ by more than 1.5 ma (15%). In testing other types, adjust the bias to give rated plate current for the reference tube.

The filament transformer shown in Fig. 1 has a secondary rating of 6 amperes, which is more than enough to supply 10 12AU7's. A 6AX5-GT rectifier with plates connected in parallel may be used in place of the 117Z3, by operating its heater from the 6.3-volt winding of the power transformer (a Thordarson T-22R12 or equivalent).

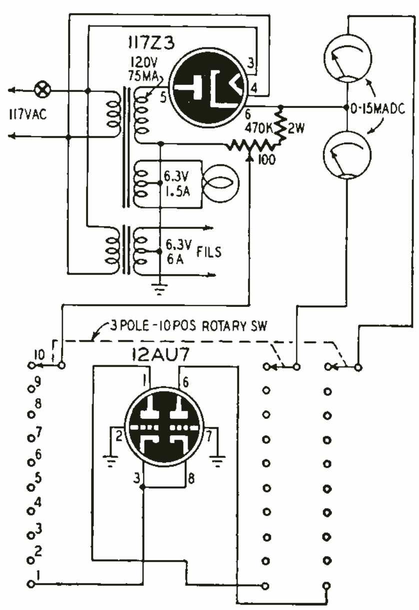


Fig. 1—Circuit of the checker, showing only one of the sockets wired in. Connections to the other numbered switch positions (2, 3, 4, etc.) are identical.

Parts for tube tester

Resistors: 1—470,000 ohms, 2 watts; 1—100-ohm wire-wound potentiometer.
Transformers: 1 Thordarson T22R12 (or equivalent); 1 Stancor P4089 (or equivalent).
Miscellaneous: 2—0-15-d.c. milliammeters; 1—3-pole, 10-circuit selector switch; 1—s.p.s.t. toggle switch; 1—7-pin miniature socket; 10—9-pin miniature sockets; 1—117Z3 tube; 1—No. 44 or No. 47 pilot lamp; 1 pilot-light socket; 1 cabinet (Bud CA1753 or equivalent); chassis; wire; solder; hardware.

—end—

HANDY SUBSTITUTION BOX

identifies unlabelled or damaged parts—supplies equivalent values

By HAROLD PALLATZ

THE construction of a substitution box will provide the service man with a most useful tool. The values of burned-out resistors or unmarked capacitors may be determined quickly by simply inserting the box in the circuit and selecting the values that result in best operation.

To cover a wide range and yet keep the unit compact in size, a switching system was decided upon. Two 6-position, 2-gang selector switches select any desired resistor, capacitor, or inductor. These units also may be connected up in combinations to form wavetraps and R-C networks.

The possibility of requiring odd resistance values in certain circuits is met by the dual potentiometer included in the unit. One section covers a range between 0 and 20,000 ohms, while the other section goes to 350,000 ohms. The selector switch determines which section is used.

A small variable capacitor also has been included, which permits an easy determination of trimmer values. The capacitor should be of the straight-line capacitance type for ease of calibration. When combined with the various inductance values in this unit, this capacitor makes a handy adjustable wavetrap or tuned circuit. The resonant frequency may be quickly determined by reference to charts or by use of the formula:

$$f = \frac{159{,}200}{\sqrt{LC}} \qquad \text{L in } \mu\text{h}, \ \text{C in } \mu\mu\text{f}, \ \text{F in Kc}$$

All component values should be checked on a bridge if possible. In any case it would be wise to obtain resistors of 5% accuracy or better. One-watt carbon resistors can be used, although wire-wound 2-watt units are recommended. Paper and mica units are used for the capacitor decade. The inductance decade uses r.f. chokes for the smaller values. The 1-henry and 10-henry coils are standard filter chokes.

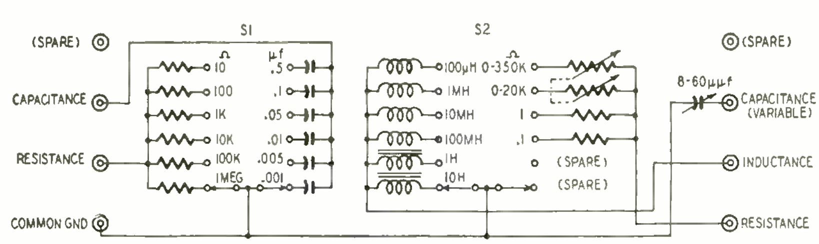
Construction

The instrument is housed in a standard metal cabinet. All parts should be mounted on the removable front panel. Two rows of jacks are arranged for short leads and low resistance. When wiring in the inductors leave as much room as possible between coils. This will reduce coupling and prevent resonant dips.

If carbon resistors are used, solder fast, as heat may cause a change in value.

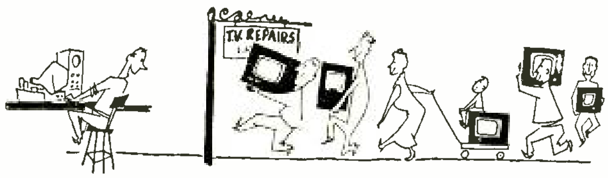
Measure the values of the dual potentiometer at different shaft positions and mark them on the panel. Do the same with the variable capacitor (after the unit has been completely wired), but if the necessary instruments are not available, refer to the manufacturer's literature for capacitance curves. In this case be sure to add about 7 μμf to the figures given to allow for wiring capacitance.

—end—



Circuit of the substitution box. Use switches with low-resistance contacts.

WHY THE SMALL SHOP WILL STICK



By JOHN D. BURKE

I CAN well understand why anyone should pose the question: "Can the one-man shop survive in television?" It is a problem.

One could also ask: "Can the big television shop survive?" Many have gone smash, others are groggy. The small shop can survive in television.

I shall try to set down the positive features in today's somewhat chaotic repair field—features which help the small man. Also, I shall try to point out the pitfalls to avoid (most can be anticipated, though sometimes one is taken by surprise).

At a time when among doctors there is a great tendency to specialize, there is still a great field for the general practitioner.

That is what we are in television—general practitioners.

We fix them all. Yet, if the repairman is able to stabilize his clientele to some extent, so that he has a basic number of sets to take care of, he will know those sets—those particular chassis. Then the new sets can be taken in stride, the new tubes stocked as needed, the new diagrams obtained and looked over.

The question of big shop *vs.* small shop can be put in another way.

It can be compared with the situation in transportation, as between bus, street-car, and subway service on one hand, compared to taxicab service on the other. The big job is done by the mass transportation facilities. But there is still plenty of room for the taxicabs. They do all sorts of special jobs and people are willing to pay extra for that service.

Now—we little fellows in TV cannot charge anything like the difference between subway fare and cab fare—proportionately—for our services. But, since we can give extra services, we can reap an extra reward here and there.

We work the late shift

Where fast service, available on the instant, is needed, the small man can survive. An example is public places, such as bars, where fast service is essential. I have a number of bars that call me regularly. I never sought such business; it came through recommendations.

To survive, the one-man television shop must operate in the evenings and even do some work on Sundays.

Part of the annoyance people feel about the way the big shops operate is because service is offered only during the day, on week-days.

One might argue that the policy protects the workers in the industry from longer hours and further exploitation.

True, in a sense. But I feel that the main idea of the service contractors is to save money—and allow the one-year contract to run its course without having to make too many calls. If the service contractors would meet union requirements for men to work evenings and week-ends, more people would renew their contracts.

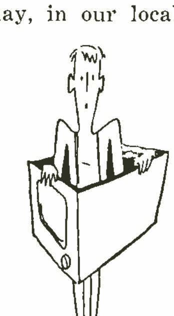
That is their problem. We "independents," self-employed, work all sorts of hours. However, our working day usually doesn't start till around noon, so we really don't have it so bad.

But we can go broke

The records show that a big percentage of small businesses of all kinds *fail* within their first year of existence.

It has been thought by some that the same rule would apply to the small radio-TV repair shop. In my opinion this is not the case. Failure is quite possible, but not so likely as in other lines of business.

Every day, in our local newspaper,



there are about a dozen ads offering TV service. In today's paper *five* of these ads offer service on the basis of $1 per call, plus parts. Some of the five add statements which would indicate that: (1) All the work is done in the customers' homes. (2) All work is guaranteed. (3) Only such parts as are *needed* are put in.

I can only wonder at these ads! Why—if they actually are doing such *remarkable* services for people, at such *low prices*—is it necessary for them to advertise day after day?

If these $1 concerns really did what they imply, they would be *flooded* with work, and, rather than advertising *for* business, they would have ads apologizing for their inability to answer all the calls.

The point—at this moment in TV repair history—is that the small shop operates under a considerable strain, created precisely by those fools (or crooks) among us who advertise service at the *impossible* figure of $1 per call.

These ads are a new development. Where it will end, I do not know. Even a year ago I was able to tell people individually that they could call on me at odd hours, and even on Sundays, for service at the rate of $4 plus parts. This news they welcomed.

Now—they have only to open their paper and read that so-and-so is ready to rush them a repairman, available 24 hours a day, for $1 plus parts.

I feel that *all* established, self-respecting repair shops, large and small, are suffering from this definitely unfair, and definitely unethical, manner of doing business.

We can stick—and make money!

How then is the small shop to survive?

As before, by basing itself on:

A small clientele.

A limited territory.

Mutual confidence between customer and repairman.

No wild promises. Instead, a thorough effort to explain the causes of TV breakdowns, and make understood our inability to predict what failure will be next, or when.

Charges based on time spent, but

limited to a reasonable figure (without actually losing money, of course).

An effort to save the customer expense (Such as on picture tubes).

Fast service. Limited distance of call; fast methods of trouble-shooting; a good stock of tubes and parts; substitution or revision of circuits where necessary. Work done in homes where practical and sensible.

No sales. The repairman loses more than he gains by engaging in TV sales. (????—*Editor*)

Repair of radios (all kinds) and phonographs. (This is one of the weakest spots in the position of the big TV shops.) Customers appreciate the service; you will double your income.

Accessibility of the shop for the customer. Many will bring their sets directly to the shop.

No service contracts. All work by the job.

Open workbenches. Let customers see us suffering over their chassis. The more sweat they see, the more they will appreciate us.

Refuse some jobs. *Do not take jobs where the customers show inability to realize what TV repair entails.* Let them take their arguments elsewhere.

Limited overhead. Low rent; little advertising.

Careful explanation of: (1) What the set needs to play *at all.* (2) What the set needs to play *properly.*

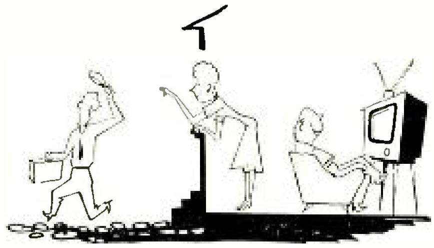
And a real effort to have the customer *decide* which he wants—the minimum or the maximum. *But*—do not let him imagine that the maximum repair job is, in any sense, an *overhaul.* Don't get out on a limb—don't get "married" to a set simply by selling a customer a $20 repair job!

Watch out for the "dogs" among TV sets. If a set *should not* be repaired—say so! They may *love* the set, but in the long run they will appreciate your truthfulness.

Be patient—be philosophical. No matter what you do, you are bound to be misunderstood by some people; blamed when sets break down again; bound to be thought a "robber" by some; bound to suffer from the public's inability to comprehend television, and also from their misconceptions fostered by all sorts of interests, such as the publishers of some of the "dollar books" offered to set users, or the ads screaming "fantastic trade-in allowances" with no down payments on "new, super-powered sets."

Concentrate on doing the best job of repair you can, on treating people as well as you can—and work for recognition and success.

—end—



INEXPENSIVE ELECTROSTATIC PRECIPITATORS

By EDWIN N. KAUFMAN

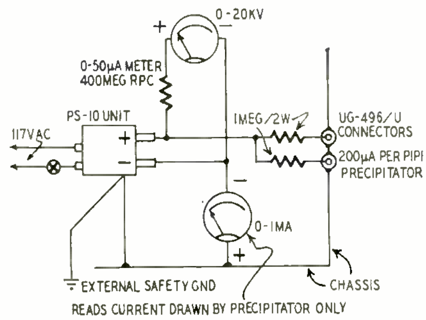


Fig. 1—Power supply for two precipitators, using commercial high-voltage unit.

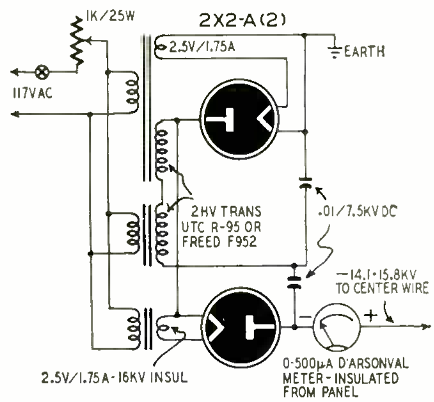


Fig. 2—A full-wave doubler high-voltage supply built from commercial parts.

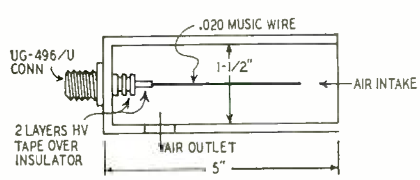


Fig. 3—Details of the precipitator unit.

SMALL electrostatic precipitators are used in many laboratories today for experiments in air filtering, materials finishing, and collecting radioactive particles. Commercial power supplies for small units cost between $350 and $750. Two types are in common use: a spark-coil-rectifier unit and a transformer-rectifier unit. Voltages range from 10,000 to 30,000 at currents up to 1 milliampere.

It is possible to build a precipitator power supply for much less than these figures. A unit that will deliver 10,000 volts at 2 ma, or 12,000 volts at 500 μa can be assembled for about $100. This is shown in Fig. 1. The power unit is a Condenser Products Company PS-10 "Hi-Volt" supply. The voltmeter is merely a convenience, since the milliammeter shows the actual precipitation current. If used, the voltmeter must be mounted on high-voltage standoff insulators, or on an insulating panel with several inches clearance from any grounded metal objects.

The 1-megohm resistors limit the current in case of accidental body contact or short circuit. Use dummy plug as cover for unused terminal.

Type UG-496/U receptacles and UG-59A/U plugs have been used successfully at this voltage. The UG-496/U *must have several layers of plastic high-voltage tape* wrapped around the insulating portion of the receptacle.

All connections must be made before the voltage is turned on. **These voltages will kill you if contacted.**

The PS-10 Hi-Volt unit has the advantages of compactness and reduced shock hazard, as all components including tubes are contained in a hermetically sealed case. The entire supply must be replaced in the event of a breakdown anywhere in the circuit. The unit delivers 200 μa at each terminal.

Assembled power supply

Fig. 2 shows a high-voltage supply that can be constructed from standard commercial parts. The circuit is a full-wave voltage doubler using two 2.5–2.8-kv transformers. The Freed transformer delivers 2.5 kv a.c. and develops 14.1 kv. The U.T.C. unit supplies 2.8 kv. a.c. and develops 15.8 kv. A separate filament transformer with at least 16,000-volt insulation must be used for the negative rectifier. This transformer must also be mounted on stand-off insulators to prevent arc-over to any grounded part of the circuit. The 1,000-ohm resistor controls output voltage and current.

(Two 1B3's can be used instead of the 2X2A's for greater safety in case of accidental contact. Two separate 1.25-volt filament transformers will be required. The transformer for the negative rectifier will need the same insulation as for the 2X2A.—*Editor*)

Precipitator construction

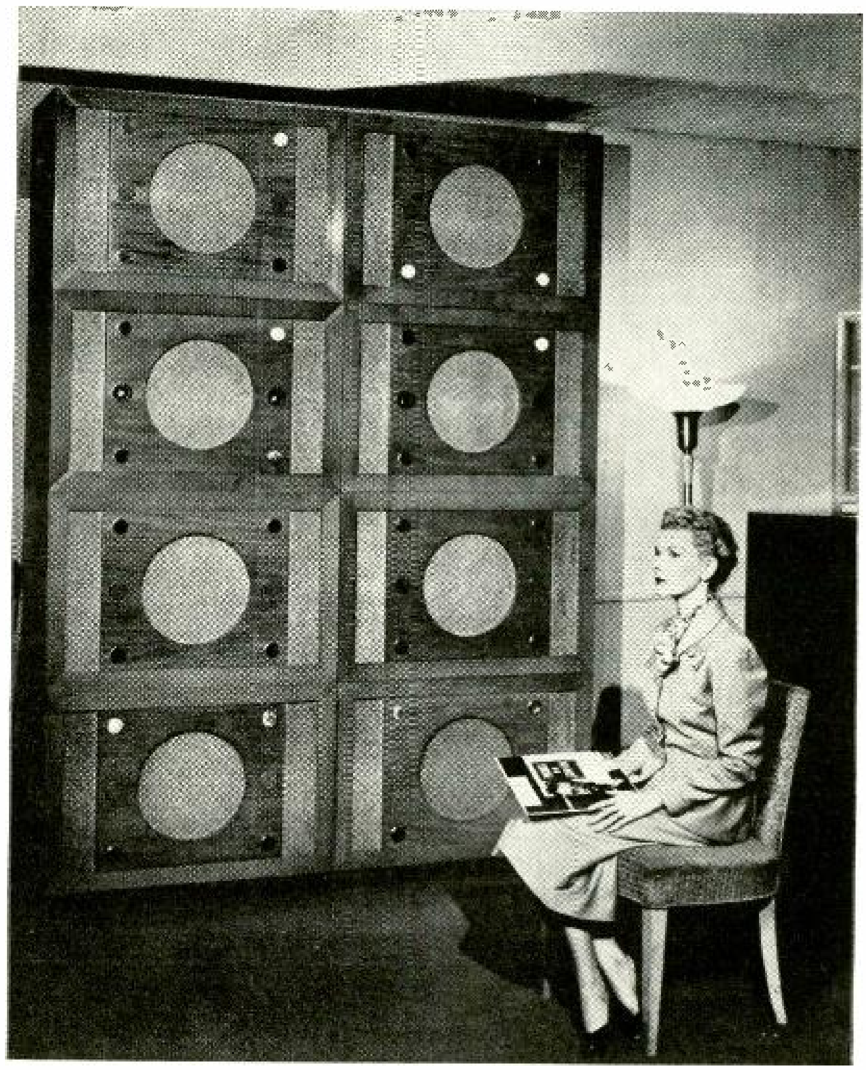
The precipitator unit shown in Fig. 3 is a 5-inch length of 1½-inch inside diameter dural tubing. The inside of the tube is polished to make it easy to remove the collected particles. The center electrode is .020-inch diameter stainless steel wire, with the open end folded over to prevent arcing or heavy corona discharge from the tip.

The center wire is usually negative, but the polarity may be reversed to suit the application. I have not found much difference with either polarity for cigarette smoke collection.

—end—

AUDITIONEER

A switching system that simplifies and speeds up the selection of electronic musical equipment



This battery of speakers is part of the equipment controlled by the Auditioneer.

THE MAN who wants to buy an audio system is likely to come into the demonstration room with no definite idea of what components he wants. He may ask to hear a "good speaker" or an amplifier with "high-fidelity response." He may have no idea of whether he can get the most faithful rendition of Bach or Beethoven through a Jensen or Electro-Voice speaker; whether "Carmen" or the "Bolero" will sound better when reproduced by Pickering or G-E pickup arms and cartridges. He may not know whether his musical taste will be satisfied with a moderately priced system or whether his ears demand the output of a high-priced one.

Many of the large suppliers who stock a wide variety of audio units also have facilities for demonstration. Sales personnel simply find out approximately what the customer wishes to spend for his equipment, and then discover his tastes with the famous *AB Test*.

The customer simply listens to part of a selection with one pickup, amplifier, microphone, or other component, and in the middle of the selection is rapidly switched over to another pickup, amplifier, or whatever component may have been on test. The identity of the components is witheld—the customer only knows that he is listening (for example) to "speaker A" or "speaker B". Thus any preconceived ideas about any brand name have no effect. Comparison is made strictly on the basis of what the listener hears and the actual performance of the components as they are switched rapidly in and out of the playing system. The rapid change-over also makes the most minute differences in quality stand out clearly—differences which in all probability would not be uncovered by other testing methods.

The AB test, by eliminating the time

lag in switching from one combination of units to another, as well as neutralizing the effects of any previous ideas about the performance of given units, has become the accepted method of comparing high-fidelity equipment in the modern audio salesroom.

But if there is a time lag in switching from one combination of units to another the advantages of side-by-side performance testing are lost and the demonstration does not provide a true listening test. Every time amplifiers, tuners, or speakers are to be switched for comparison, connections have to be made and unmade.

The Auditioneer

The perfect solution would be a switching system which would connect *any* combination of audio apparatus instantaneously. One such successful solution of the demonstration problem appears on our cover. The engineers of Allied Radio Corporation (Chicago) who designed it, call it the "Auditioneer". Pushing a button on its control panel switches a component in or out of the system instantaneously. And a fantastic number of different music-system combinations can be made with it.

Speakers or other components can be switched in and out for comparison in a fraction of a second, as many times as the listener wishes. Often just a few minutes of side-by-side comparison enables him to make a decision which may have been delayed for days or weeks just because of the apparent similarity of two units in which he was interested. The *speed* of the changeover is a tremendous help in making such decisions. There is no time lag to dim the listener's impressions or confuse his judgment.

The Auditioneer is fundamentally a console carrying a sufficient array of switches to connect into an audio system any one of the more than 60 separate components installed in the demonstration room. Numbers of these are arrayed on the shelves of the cabinet seen in the picture—others are installed in cabinets in various parts of the room. The number of components varies, but at the time the photo was taken it was possible to take your choice of any combination of 9 pickups, 3 changers, 8 preamps, 12 tuners, 15 amplifiers, 26 speakers, and 4 tape recorders. Some of these cannot be combined at the same time, of course—one would not use a pickup and a tuner in the same combination—but the total number of possible combinations is over 400,000! Allied engineers calculate that it would take a listener over three years to hear every separate combination available by pushing Auditioneer buttons (one combination a minute, 8 hours a day, 5 days a week).

The sloping panel of the Auditioneer has seven vertical rows of push-buttons. Each of the first three rows handles a different type of component—pickups, preamps, or tuners. Two of the remaining rows handle amplifiers and the other two rows control speakers.

To set up a program, a button is pressed to select a pickup or tuner as a source of program material. By pressing another button, its output is channeled to the desired amplifier. Another push-button feeds the amplifier output to any one of a large selection of speakers. A master volume control at the Auditioneer adjusts the audio-output level. This control is in the speaker section and is in addition to the individual volume controls on the amplifiers.

In addition to the switching system, the Auditioneer has its own phonograph system, with five pickup arms on two turntables. An interesting application of the AB testing technique is the placing of two pickup arms in the same groove on the same record. The output of each pickup is fed to the amplifier and speaker in turn, while the turntable rotates. This provides an unbeatable aural comparision. When the listener hears the two pickups virtually side by side, with practically no time lag between, he can easily tell which unit is—to him—the better one.

The demonstration room

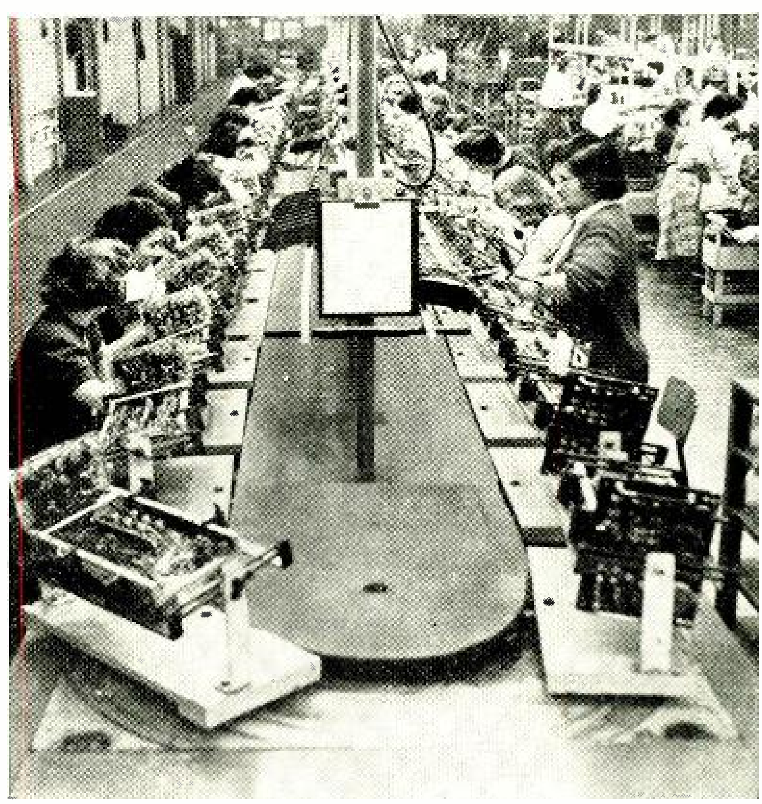
A high-fidelity demonstration room must be designed to have typical home acoustics rather than those of a professional sound studio, so the customer will have no letdown when he puts the equipment to work in his home. Every effort has been made to cloak the Auditioneer, with its complex switching mechanism and circuits, in the pleasing garb of tasteful modern home furnishings.

The console itself is a specially-designed steel cabinet with sloping control panel and "sunken garden" turntable area. The finish closely resembles natural bleached mahogany. Comfortable divans and attractively-styled drapes highlight the decor of Allied's high-fidelity studio, and though many conventional pieces of furniture are replaced with loudspeaker cabinets, the listener can feel he is sitting in an ordinary living room. Isolated from street noises and other disturbances, a demonstration of high-fidelity audio equipment becomes a leisurely period of musical relaxation.

The many mail-order customers, who cannot select audio components in person, are also served by the Auditioneer. As a typical example, a Maine or New Mexico audiophile may ask Allied to help him select a music system for about $500. He may specify that he definitely wants the Browning HJ-20A FM-AM tuner and matching amplifier, but has several alternates in mind for the speaker, record player, and other accessories. The consultant handling this request will usually base his recommendations for a well-matched music system on a listening test—or on prior tests—with the Auditioneer.

—end—

MASS PRODUCTION OF RADAR UNITS



U.S. jet-fighter guns find targets automatically with these small radar units. Highly successful in Korea, and mass-produced on these high-speed General Electric assembly lines, they are now standard equipment for all U.S. air arms.

TAPE RECORDING

Concertone recorder-playback

By I. QUEEN

First in a series on this swiftly-growing field for electronic technicians — principles and circuitry highlighted by analysis of new commercial units

PART I

THE *New York Times*,* marking the 75th anniversary of Edison's phonograph, noted the current "revolution . . . in the science of capturing and reproducing sound." Thus does *The Times* refer to tape recording, the new art which has already found many important applications. Tape has become the most popular medium for storing sound or other information. It is now widely used in entertainment, business, educational, and professional fields.

Tape has many advantages over other recording media. Among them are:

1. High fidelity.
2. Erasability.
3. Long play.
4. Indefinite life.
5. Editing flexibility.
6. Ease of operation.

A good tape recording is free from background noise, hiss, scratch or hum. Normally the l.f. response remains flat down to about 70 cycles. Professional equipment provides flat response down to 50 cycles. The h.f. limit varies with tape speed (given in inches per second):

I.P.S.	Kc
1.88	3.0
3.75	5.0
7.5	7.5
15.0	15.0

*April 10, 1952

Speeds slower than 3.75 i.p.s. are suitable for speech only. At 7.5 i.p.s., speech and music can be reproduced with good quality. Broadcast quality is obtained at a speed of 15 i.p.s. Fig. 1 shows the frequency response of three *professional* recorders.

Because of its excellent fidelity, tape is often used by professional recorders to make an original or master track. This original may be edited, cut, or erased as desired (provided it is a single-track recording). Then the final track is re-recorded onto disc, film, or another tape. This saves considerable cost in film and processing during motion picture retakes and rehearsals. The double recording causes no appreciable distortion.

A versatile medium

Tape has little competition in the field of temporary recordings (office dictation, sales talks, audio tests, rehearsals). When a recording is no longer needed, it is simply erased and the tape is ready to be used again. Erasure is automatic. All previous sound is removed during the process of recording a new one.

Tape accommodates a maximum amount of sound in minimum space. A 7-inch reel of tape holds 1,200 feet. With dual tracks (one on each edge of the tape) and a speed of 7.5 i.p.s., a solid hour of recording is available. Professional type machines can hold extra-large reels with up to 9 hours of track. (A schedule of playing times is given in Table I, which appears below.)

Tape recorders are readily adapted to special requirements. Battery-operated machines are made by the Amplifier Corporation of America, Stancil-Hoffman, Miles, and others. The Amplifier Corp. also sells a "synchronized sound" model for use with any automatic slide projector. Fairchild model 126 is designed to keep a tape track in exact synchronism with a motion picture film. Recently, a thin magnetic strip has been adapted to be put on movie film instead of the optical track. Thus it is possible to change the track easily if and when desired.

TABLE I
Running time in hours (dual-track tapes)

Reel Size (Ins.)	Tape Length (Ft.)	Tape Speed (i. p. s.) 1.88	3.75	7.5	15
5	600	2	1	0.5	0.25
7	1,200	4	2	1	0.5
10.5	2,500	9	4.5	2.25	1
14	5,000	18	9	4.5	2.25

Running times are approximate

Continuous-tape machines are available for advertising campaigns, repeated public announcements, and similar purposes. Some have automatic switching. At the end of one track, the machine reverses itself and plays the other. Other machines (such as Ekotape model 114 and Ampro model 731) provide for a magazine which holds a

Ekotape and Stancil-Hoffman portables—General Industries tape-phono unit

closed loop of tape. The loop runs continuously until the machine is shut off.

Tape itself is very rugged and can run many hundreds of times without deterioration or loss of fidelity. If accidentally broken, the ends are easily spliced together.

Recorder applications

Educational institutions and workshop groups have been quick to see the value of tape recorders. Some use the machines to record educational or entertainment programs for subsequent broadcast or reproduction.

Cornell University operates a Tape Recording Center with a library of hundreds of subjects. Educational and scientific topics, speeches, and special events are included. This Center is prepared to record on tape any desired topic supplied to it. At present the service is free but limited to schools and other interested groups in New York State. The Berkeley Opera Workshop (Berkeley, California, Adult Evening School) uses tape to record rehearsals and actual performances. This helps the members improve their efforts.

Many broadcast stations use tape to record lengthy transcriptions, delayed programs, and commercial "spots" for advertisers and clients. Lawyers and doctors are using tape to record testimony and consultations. More and more business offices are using tape recorders for dictation.

Good recorders are now moderately priced and within the reach of most homes. They are a source of much fun and entertainment as well as education at social gatherings. Here are some of the uses to which they are put:

1. Recording children's voices.
2. Accompaniment for home movies.
3. Recording radio programs.
4. Code practice for amateurs.
5. Greetings for mailing to friends.

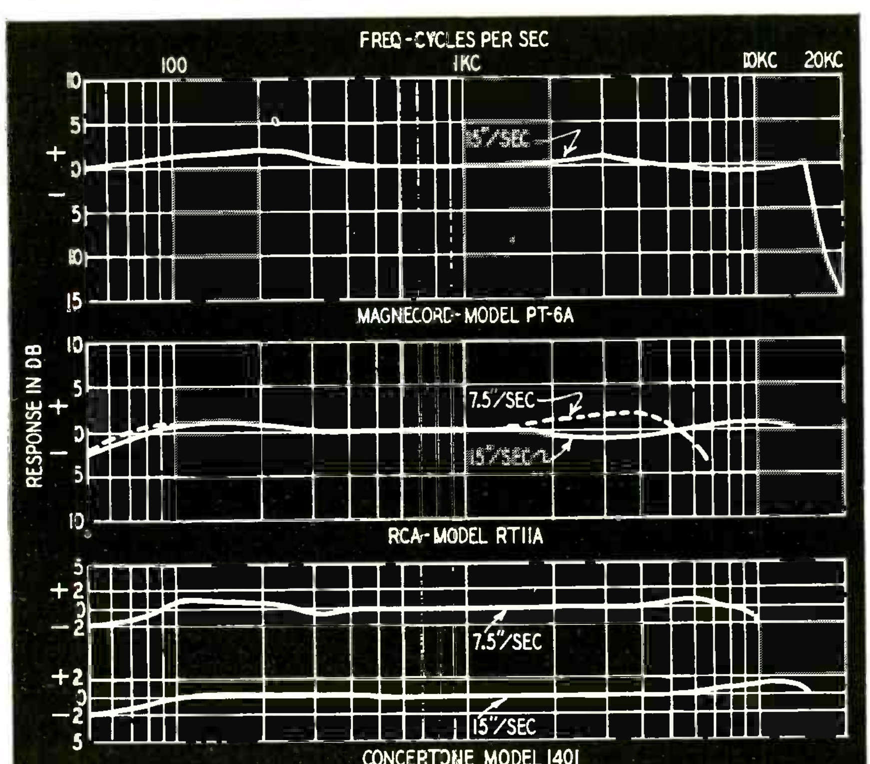


Fig. 1—Frequency-response curves of three broadcast-type tape recorders.

6. Weddings, birthdays, party events.
7. School, church, and club plays.

Recorder circuits

A tape recorder consists of two major portions, (1) the electronic circuits which include the recording, play, and erase heads, amplifier and equalizer, and power supply; (2) the tape transport or mechanism.

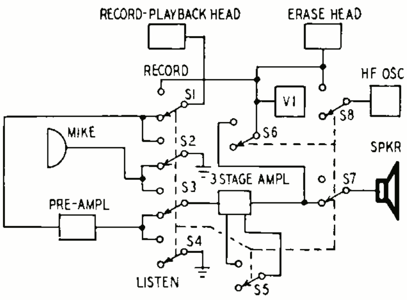


Fig. 2—Recording playback switching.

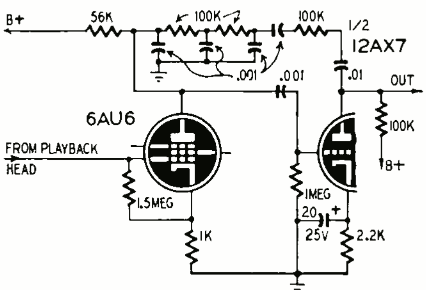


Fig. 3—Feedback-type high-low booster.

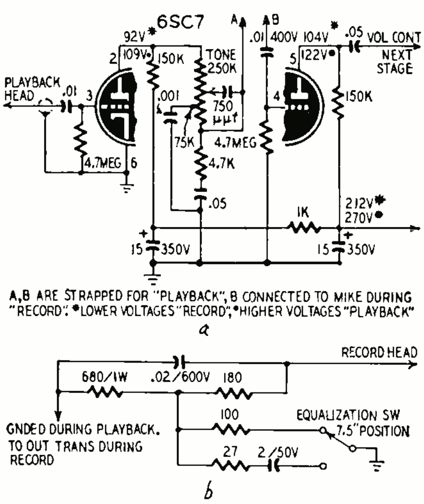


Fig. 4—Input switching and h.f. boost.

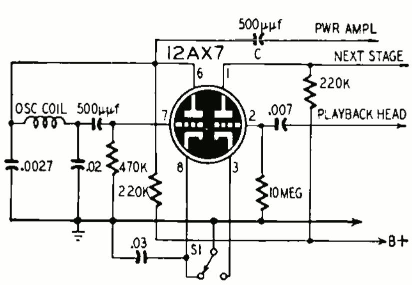


Fig. 5—Typical erase-oscillator circuit.

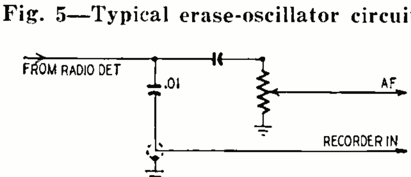


Fig. 6—Suggested radio-record hook-up.

A tape amplifier differs from a conventional amplifier in two important ways. A tape circuit requires a special—often elaborate—switching arrangement. Also, considerable equalization is required in a tape amplifier. Both bass and treble boost must be used, because of the inherent characteristics of the tape itself. Professional-type recorders (such as Concertone) use separate record and playback amplifiers. The treble boost is incorporated in the record amplifier, the bass boost in the playback amplifier. This arrangement attenuates hiss and other noise. Inexpensive recorders use a single amplifier and a less efficient equalizer.

A typical switching arrangement is shown in Fig. 2. The switches are usually ganged. They are shown in the "listen" position. S1 connects the playback head to the preamplifier input. Note that the same head is used for both playback and recording. S2 grounds out the microphone. The tape signal passes through S3 and S7 to the main amplifier and speaker. The volume indicator (VI) and h.f. oscillator are in the circuit only during "record." When recording, the ultrasonic voltage feeds the erase head and also mixes with the a.f. signal at the record head.

S4 grounds the preamplifier during recording while the sound source is connected to the main amplifier through S3. Usually the speaker is disconnected during recording to avoid feedback howl. This is done by S7. The tape travels through the two heads (or the combination head) "erase" and "record-playback." S8 disconnects the ultrasonic signal in the "listen" position.

S5 cuts out the tone control during recording. It also controls equalization, which must be changed when tape speed is changed (if the recorder includes more than one speed). Therefore S5 may be part of the motor speed control.

The more expensive recorders include some method for monitoring, usually through headphones.

Fig. 3 is one type of equalization circuit. This network is recommended for use with model 250 General Industries recorder, which does not include its own amplifier. The R-C network couples the plates of the two tubes as shown, when the instrument is switched to "playback." The network attenuates both highs and lows, so only the middle register is fed back to the first tube. This degeneration provides *boost* for both bass and treble as required.

Boost at h.f. alone is sometimes obtained by using only low capacitance across an amplifier cathode resistor. Fig. 4-a shows the excellent equalization system of Webcor model 210 (Webster-Chicago). The first triode is a bass-boost preamplifier for playback. The mike feeds directly to the second triode. Fig. 4-b shows the treble boost circuit for recording.

A tape erasing oscillator generates a frequency near 30 or 40 kc. The more expensive-type recorders are designed for push-pull output which gives less noise and better efficiency. Ultrasonic erasure is considered superior, but some less expensive recorders rely on PM erasure. In the latter method, a permanent magnet is mounted near the tape just ahead of the recording head. As the tape moves past, it encounters magnetic polarity changes and is demagnetized. Of course, the magnet must be drawn well away from the tape path during playback or rewind.

Manufacturers have shown considerable ingenuity in simplifying their circuits to reduce costs, yet maintain efficiency. Some circuits use the same tube as power amplifier during playback and as oscillator during recording. One model (the Ampro 731, Fig. 5) uses a duo-triode tube for two different functions. One triode is a Colpitts oscillator during recording. The other triode preamplifies during playback. S1 opens the cathode of the triode not being used.

Less-expensive machines use a neon lamp instead of an "eye" indicator or meter to indicate the level of modulation input. The lamp is small and requires no power supply, yet is well adapted for this application. The recording level is correct when the lamp flashes only occasionally during peaks. When an eye is used, it should close only during occasional peaks.

Many recorders are provided with output jacks to connect an external high-fidelity speaker instead of the recorder speaker when desired. In a small portable instrument, there is no space for a speaker larger than about 8, or perhaps 5 x 7 inches.

The number of inputs is sometimes an important consideration. The simpler machines have only one input jack or terminal, for a high-impedance source such as a crystal microphone. Other recorders have separate inputs for mike, radio, and phono.

Recordings may be made from a radio receiver as shown in Fig. 6. This eliminates the receiver amplifier and uses the recorder amplifier and volume control. A short shielded lead should be used between the radio and the recorder. If this method is not convenient, the recorder may be connected across the radio-speaker voice coil. No shielded lead is needed, but the speaker level may have to be kept very low.

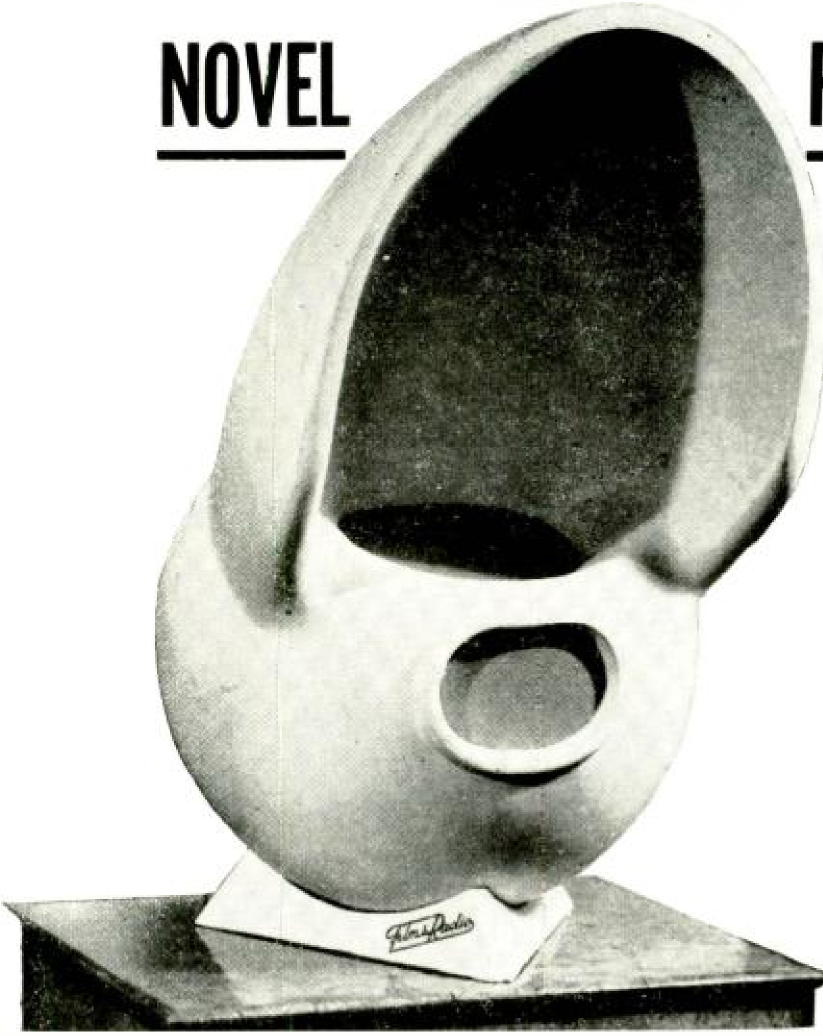
Frequency-checking a tape recorder is much like making a frequency run on an amplifier. An a.f. generator with calibrated output is required. A known signal of a few millivolts is applied to the input terminals and recordings are made at 100, 1,000, and 5,000 cycles, or higher frequencies if desired. The same input signal is used in each case. Then the tape is played back with an a.c. voltmeter measuring the output across the speaker voice coil.

Wow is best tested by listening to a tape recorded at a single high frequency.

(to be continued)

NOVEL FRENCH SPEAKER

By P. HEMARDINQUER



Apartment model of the unique sound mixer with low-frequency chamber and aperture.

Large sound mixer baffle (Pathe type) used in French film-theatre sound systems.

A SPEAKER mounted on a flat baffle transmits the middle range and part of the bass satisfactorily, but the higher notes are radiated in a narrow beam, so that the sound quality depends on the position of the listener.

For bass notes, reflection and refraction become very complex as the baffle dimensions approach the length of the sound waves.

Numerous acoustic systems have been devised in the attempt to distribute the high notes over an angle of 60 to 80 degrees, and to improve reproduction of the low notes with folded horns and resonant chambers. Another solution, recently developed in France, uses a conch-shell-shaped element, which in form is part of an ellipsoid of revolution. (See photos.) An ordinary cone-type speaker is placed in one of the foci of the ellipsoid. Middle and higher-range sound waves from this point are collected at the other focus of the system, which becomes a virtual point of origin for the sound waves, diffusing them at a wide angle (Fig. 1). The special shape of the reflector concentrates the sound energy at one point in space, giving the subjective impression that the point is itself emitting the sound.

Bass notes are reinforced by a resonant chamber in the lower part of the equipment, with a carefully-calculated opening for the back-wave, following the principle of the reflex baffle.

The complex baffle form is made of plaster. The surface is glazed to provide a reflecting surface for the higher frequencies. The interior of the resonant chamber is given a rough sound-absorbing finish.

The new baffle reduces intermodulation distortion and improves the efficiency of the speaker. See Fig. 2. In spite of the fact that only one speaker is used, there is a lifelike effect of depth, of a diffused source.

The concentration of sound toward the listener, with reduced transmission into neighboring spaces, will be especially appreciated in apartments.

An acoustic device of this nature must be used with a high-quality loud speaker and a well-designed amplifier with precise control of the high and low ends of the spectrum.

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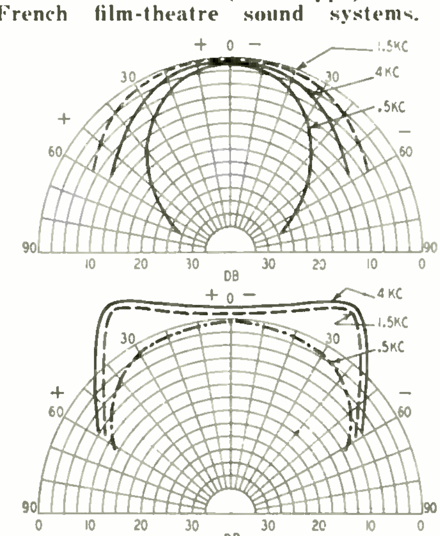

Fig. 1—Relative directivity of 10-inch speaker mounted in a 3-foot flat baffle and in the new ellipsoidal sound mixer.

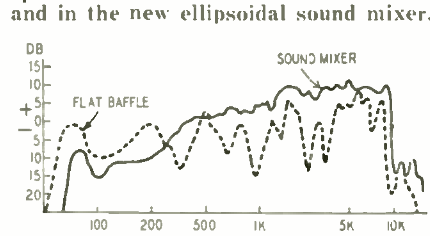

Fig. 2—Improvement in musical quality when sound mixer replaces flat baffle.

By ROBERT L. LIBBEY

PHASE SHIFT DISTORTION METER

makes accurate "must" measurements on audio amplifiers easy and inexpensive

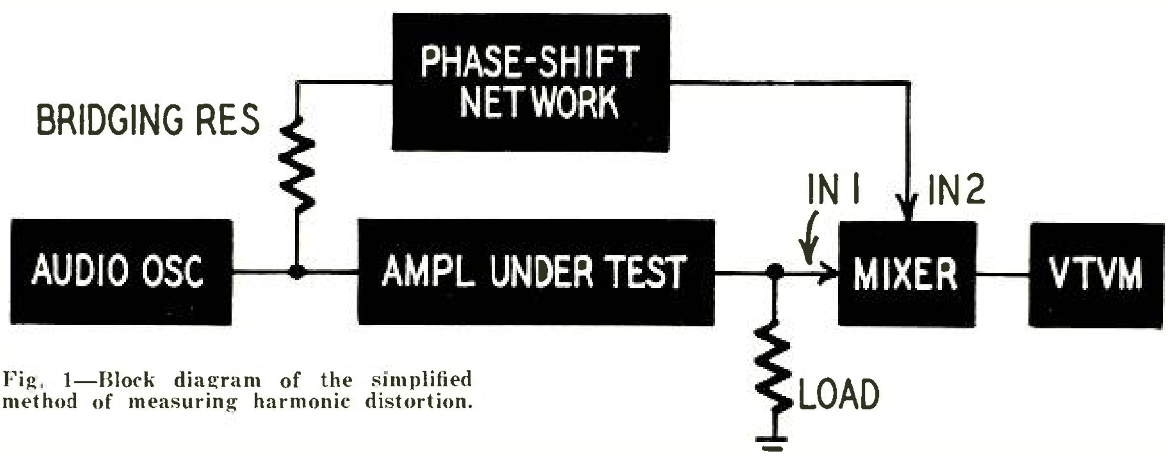

Fig. 1—Block diagram of the simplified method of measuring harmonic distortion.

THE measurement of harmonic and intermodulation distortion is an important step in determining the quality of an audio amplifier. In the broadcast industry, distortion meters are a *must* by FCC rule. Serious audio enthusiasts and technicians who build and service audio equipment are turning to the distortion meter for specific and accurate checks on amplifier performance.

The first distortion meter was a milliammeter in the plate circuit of an amplifier tube. Theoretically, there should be no fluctuation in the *average* plate current of a class A amplifier. At times, however, the meter needle will kick up or down from its steady-state value. Kicks of more than 10 percent of the steady-state reading indicate unsymmetrical amplification, with resulting distortion.[1] The plate-current distortion meter indicates only that distortion is present; the remedy is still a problem.

The principle of modern distortion-measuring technique is simple. A signal from an audio oscillator is applied to the amplifier under test. The output of the amplifier is fed to the distortion meter.[2] This output contains the fundamental frequency of the oscillator, plus any harmonic distortion (multiple or submultiple frequencies) introduced by the amplifier. The output voltage is adjusted to a reference mark on the v.t.v.m. associated with the distortion-measuring equipment. This is called the "calibrate" step. Next, the fundamental frequency is eliminated, leaving only the harmonics. The combined amplitude of these harmonics is then read directly on the v.t.v.m. as a percentage of the total output.

The heart of the distortion meter is the means used to eliminate the fundamental frequency and leave all the harmonics for measurement. One method uses a bridge circuit. The bridge is highly effective, but requires costly precision components and very careful balancing adjustments. Another method is by means of a T or bridged-T filter network. This also requires balancing, and a switching arrangement for each frequency band, since a given set of high-Q filter components are effective only over very narrow frequency limits.[3]

A new approach

With the basic principles of these two commonly-used distortion meters in mind, we will outline the theory and construction of a different type of instrument. This new distortion meter was developed in the electronics laboratory of the University of Wyoming. The new meter is inexpensive, easy to operate, and accurate within 2 percent. It can be used with inexpensive audio oscillators with no sacrifice in accuracy.

The new circuit eliminates the fundamental by *phase cancellation*. If we impress two sine waves of equal frequency on the same circuit, a number of results may be obtained. If the two waves are *in phase* (in the same position in their respective cycles at any given time), they will add, and the measured voltage will be the sum of the two individual amplitudes. If the waves are exactly opposite in polarity (*180° out of phase*), the larger will cancel the smaller, and if they are of equal amplitude, they will cancel each other completely.

No doubt you have jumped ahead of us in your thinking, and see the basic principle involved: *If the output of an amplifier containing a fundamental and harmonics is mixed with the correct amount of fundamental shifted exactly 180°, the resultant will contain only the harmonics.*

Fig. 1 shows the principle in block-diagram form. The oscillator output is applied to the amplifier. A phase-shift network is "bridged" across the oscillator output. (A *bridging connection* should not be confused with a *bridge circuit*. "Bridging" is a term used in telephone and broadcast work to de-

[1] Ghirardi's *Radio Physics Course*, 3rd edition, pages 509 to 514, gives a fine review of distortion due to nonlinear amplification.

[2] In measurements of this type, perfect impedance matching between all components is imperative to prevent reflections that affect the accuracy. See any text on sound, sound recording, or communications.

[3] Both methods of eliminating the fundamental are discussed in Terman's *Radio Engineer's Handbook*, 1st edition, page 944.

scribe a high-impedance connection across a low-impedance circuit. Program monitors, volume indicators, and other testing devices are bridged across standard 600-ohm lines through high series resistances to reduce loading effects and provide a high degree of isolation. The v.t.v.m. is the most common example of a bridging device.—*Editor*)

The impedance match between oscillator and amplifier is not affected by the bridging connection, but the amplitude of the signal going to the phase-shift network is small. The amplifier output is fed to a suitable resistance load, and the load voltage is applied to one input of the mixer. The output of the phase-shift network is fed to the other mixer input.

Amplifier phase relations

In an *ideal* vacuum-tube voltage amplifier stage *with a resistive load*, the grid and plate voltages are exactly 180° out of phase. This relationship is not true in practical circuits. Tube and stray capacitances, coupling transformers, capacitors, and reactors upset the perfect resistive condition. In a multistage amplifier, we may have different phase shifts in each stage. The shift-per-stage will also change as the frequency changes. In any case the shift-per-stage cannot vary more than 90° from the 180° ideal. Thus an amplifier with an even number of stages would have an ideal phase shift of 360°, a minimum shift of 180°, and a maximum shift of 540°. An odd number of stages would have an ideal shift of 180°, a minimum shift of 90°, and a maximum shift of 270°.

The phase-shift network in this instrument has two functions: (1) It provides a fixed shift of 180° to compensate for an odd or even number of amplifier stages; (2) it can be also varied over a range of approximately ±90° to make up for practical amplifier conditions.

(For a detailed explanation of the effects of phase relationships in amplifiers, see the series of articles "Audio Feedback Design," by George Fletcher Cooper, in the October, 1950, to November, 1951, issues of RADIO-ELECTRONICS. —*Editor*)

The distortion-meter circuit

The basic phase-shift circuit of the instrument is shown in Fig. 2. This circuit has been borrowed from industrial electronic equipment.[4] Reversing-switch S gives a fixed shift of 180°. Smaller shifts are obtained by varying R.

Fig. 3 is the complete circuit. T1 is a *line-to-push-pull-grids* or *plate-to-push-pull-grids* type, with the highest possible step-up ratio. It need not be a high-fidelity type, but the secondary center-tap must be accurately balanced. Resistor R should match the input impedance of T1. R2 and R3 are equal bridging resistors. Their value is not critical and may be from 10,000 to 100,000 ohms. Higher values improve isolation but reduce the voltage to the transformer.

R1 should be about 50,000 ohms. C1 may be from 0.01 μf to 0.1 μf. Its value depends on the characteristics of T1, and can be found with the help of an audio oscillator and a scope. Set the oscillator to 1,000 cycles and connect it to the network input terminals, and to one of the scope inputs (either vertical or horizontal). Connect the other scope input to X1, and shut off the internal sweep. Select C1 so that by varying R1 the scope pattern changes from a diagonal line to an ellipse, and then to a circle.

A 6N7 mixer is shown in the diagram, but any twin-triode type (6SL7, 6SN7, 12AT7, or 12AU7) may be used. R4 and R5 may be 500,000-ohm volume controls, or a T pad may be substituted for R5 if a calibrated attenuator is preferred.

The mixer is operated as a cathode follower. There is no voltage gain, but the stage has no measurable distortion. X1 and X2 are test jacks for oscilloscope checks. The 6SJ7 is a conventional resistance-coupled amplifier, except that the cathode resistor is double the usual value because of the direct-coupled input. X3 is the terminal for the v.t.v.m.

Testing and operation

After a complete continuity and voltage check, connect a v.t.v.m. to X3, and short out both mixer inputs. Any reading on the meter indicates hum or noise in the instrument, which must be tracked down and eliminated.

When the unit is in perfect working order, connect an audio oscillator to the OSCILLATOR INPUT terminals and check the controlling effect of R4 on the output. At least 1 volt output should be obtained through the phase-shift circuit. Next, check the amplifier input section of the mixer in the same way.

Actual harmonic distortion measurements are carried out in the following way:

1. Connect the audio oscillator to the input of the amplifier under test, and bridge the phase-shift circuit across the input as shown in Fig. 1. Adjust R4 for full-scale reading on the highest possible range of the v.t.v.m plugged into X3.

2. Disconnect the bridging circuit from the input to the amplifier and short out the bridging input terminals. Connect the amplifier load resistor to the AMPLIFIER INPUT of the mixer, and adjust R5 for the same full-scale reading as in step 1.

3. Restore the bridging connection

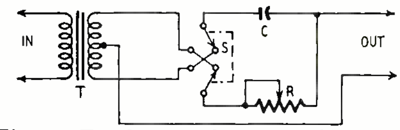

Fig. 2—Fundamental phase-shift circuit used for harmonic distortion measurements on audio-frequency equipment.

across the input to the amplifier and adjust R1 for *minimum* output. If the v.t.v.m. pointer goes off scale, reverse S and adjust R1 again for minimum output voltage.

4. Repeat steps 1, 2, and 3 for absolute minimum reading. The final reading is the harmonic distortion in *volts*. For maximum accuracy, the v.t.v.m. may be switched to a lower range *only after steps 1, 2, and 3 have been completed*.

The final voltage measurement may be converted to a percentage by the formula:

$$\% \text{ Distortion} = \frac{100\, E_{min}}{E_{max}}$$

Distortion in the audio oscillator itself will not affect the accuracy of the measurements, since the original signal is completely canceled in the mixer if the final balancing adjustments are made with care.

If T1 is an inexpensive type, the frequency range of the instrument may be limited. Several different capacitance values for C1, connected to a selector switch, will improve the response.

The new distortion meter will give professional results with simple and inexpensive equipment. With the kit-type audio oscillators and v.t.v.m.'s now available, you can build a measuring set that any service technician or audio enthusiast will be proud to own.

Materials for measuring set.
Resistors: 1—510,000 ohms, 2—100,000 ohms, 2—10,000 ohms, 1—2,200 ohms, 1—1,000 ohms, R, R2, R3 (see text) ½ watt; 2—500,000-ohm potentiometers.
Capacitors: (Paper) 1—0.25 μf, 1—0.1 μf, 1—0.05 μf, 400 volts; C1 (see text). (Electrolytic) 1—20 μf, 25 volts, 1—8 μf, 150 volts.
Miscellaneous: 1—6N7 tube; 1—6SJ7 tube; 1 push-pull input transformer (see text); 2 octal sockets; chassis, connectors, terminals, solder, hardware; power supply—100 volts d.c. at approximately 20 ma; 6.3 volts a.c. or d.c. at 1.1 amp; 1 d.p.d.t. switch.

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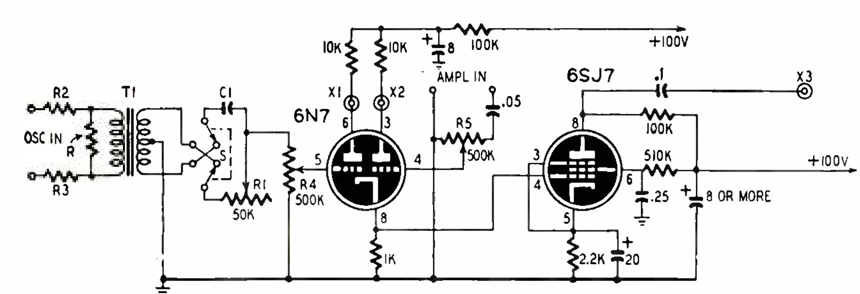


Fig. 3—Schematic of the complete distortion measuring instrument. Characteristics of lettered parts are given in the text. Any similar tube types may be used.

[4]The Westinghouse *Industrial Electronics Reference Book* explains the operation of this circuit in complete detail. It is available at most large public libraries.

ELECTRONICS and MUSIC

Part XXVI – More on the Minshall organ

By RICHARD H. DORF

Fig. 1—The Minshall Model E two-manual electronic organ. The speaker is installed in a separate enclosure.

THE tone-color filters or "stops" of the Minshall electronic organ are among its most interesting features. Vacuum tubes are used as tuned-circuit electronic filters without inductors. The tone resources of various Minshall models differ. Model E shown in Fig. 1 has 16 stops, 5 couplers, and vibrato.

Fig. 2 shows how the GREAT manual stops operate. This circuit, the SWELL manual circuit (Fig. 3), and the controls—couplers and vibrato—are mounted on a tablet board, each switch controlled by a standard organ-stop tablet. Twenty-four of these tablets may be seen above the swell manual in Fig. 1.

In Fig. 2 the three GREAT manual signal busses, *4*, *8*, and *16-foot*, represent keyed tones with octave separation. Unlike the Baldwin organ, the Minshall does not provide separate sets of filters for each of these registers, but uses a single set of filters on each manual, with provision for coupling any or all of the registers to them. The Minshall system is less expensive.

The first requirement is a method of selecting the registers which are to speak. This is done by grounding the bus or busses which are *not* to be heard. Each switch in Fig. 2 operates schematically when the straight arm is pressed downward at the end opposite the terminal. All switches are shown in normal (unoperated) position.

The *4-foot* bus is normally grounded by the GREAT SUPER switch through a normally-closed contact of the FULL ORGAN switch. The same is true of the GREAT SUB switch, which grounds the *16-foot* bus. The *8-foot* bus is normally *ungrounded*, and the GREAT UNISON OFF switch must be operated out of its normal position to silence the *8-foot* tone. The terms *super*, *unison*, and *sub* have been adopted by Minshall rather than *4-*, *8*, and *16-foot*.

The three busses are connected through 470,000-ohm resistors R1, R2, and R3, to a common point, thence through 100,000-ohm resistor R7 to the amplifier input lead. The 470,000-ohm resistors are for isolation purposes so that grounding a bus through the *super*, *unison*, or *sub* switch will not affect the other busses.

The tone filters are of the shunt type. They are connected between the junction of each set of 470,000-ohm resistors and the corresponding 100,000-ohm resistor.

The *string* filter is connected to the junction of R7, and R1, R2, and R3. This filter is electronic rather than electric and is unique in electronic musical instruments. There are two such filters in the GREAT-manual portion of the tone-coloring system; they employ the two triode sections of a single 12AX7. The tube is connected as an amplifier with a reactive feedback network from plate to grid. The feedback reactance is a multiple R-C combination in the form of a low-pass filter. The first portion of the filter is the tube plate resistance in series and the .0047-μf capacitor in shunt. The second section is the right-hand 47,000-ohm resistor and the .0027-μf capacitor.

Since the feedback phase changes with frequency, the effective voltage at the grid for a constant input voltage signal also varies with frequency. Over a certain band of frequencies the phase of the feedback signal at the grid is in the same quadrant as the input voltage and reinforces it. At one frequency in this band the reinforcement is maximum and the voltage at the grid reaches a peak. When this happens the filter circuit has minimum shunting effect on the signal line to the amplifier and a response peak is produced.

In another band of frequencies the phase of the amplified signal fed back to the grid is in the opposing quadrant and tends to reduce the grid voltage. At one frequency the opposition is maximum and a trough is produced in the response of the bus-to-amplifier signal.

The electronic filter acts like a resonant circuit which has a peak at one frequency (and may therefore be considered a parallel-tuned circuit), and a dip at another (at which it may be considered a series-resonant circuit). These analogies are relative, of course, and are correct here because the entire circuit shunts the signal line. The parallel-resonant frequency of the GREAT STRING filter is approximately 4,000 cycles; its series resonance takes place at about 500 cycles. The Q of the electronic filters used in the Minshall runs between about 3 and 6. Greater Q's are attainable, but it is not desirable to peak the response too sharply in analoguing musical formants. The "resonant" filters give formant characteristics to the tone colors.

The STRING filter is controlled by the switch shown in the lower grid circuit. The switch is normally closed, shorting the grid and the first signal path to ground. Resistors R1, R2, R3, and R7 in the signal network prevent this short from grounding the amplifier input or any of the signal busses.

The shunt for the other filters of the GREAT manual is connected in the other signal path, at the junction of R8 and R4, R5, and R6. In addition to a second electronic filter, this group also has R-C components which modify the shape of the signal transmission curve.

allowing the generated tone to go to the amplifier. The size of R9 controls the level of the signal, since it is effectively the output leg of a voltage divider.

When the *flute* stop is required and the FLUTE switch opened, the bus network is shunted to ground through R10 and C1. This low-pass filter attenuates the high frequencies rapidly, making the output lose much of its harmonic content. When the DULCIANA switch is opened two things happen. The impedance to ground of the shunt is raised by the addition of the 12,000 ohms of R11, and the upper electronic filter is brought into play. The peak of

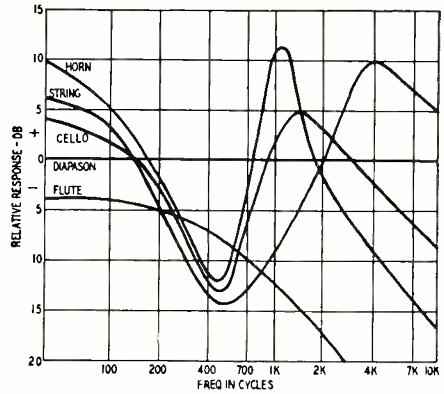


Fig. 3—Frequency response curves produced by the electronic filters in simulating characteristic instrument tones.

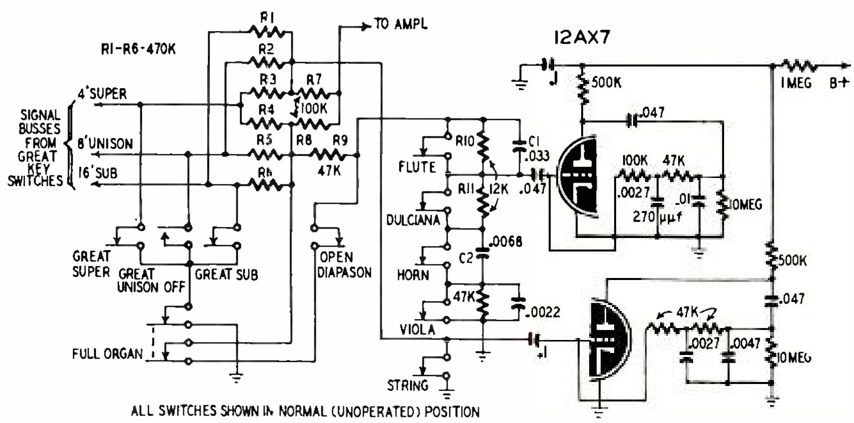


Fig. 2—Tone-color control circuits of the Minshall GREAT manual. The 12AX7 feedback amplifiers are electronic resonant filters across the signal line.

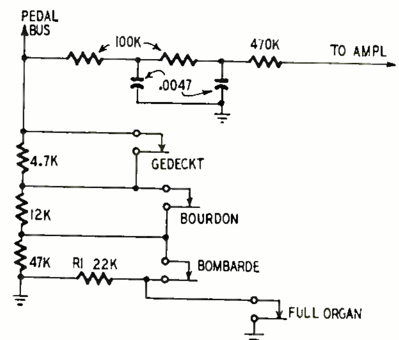


Fig. 5—Pedal stop switches change volume in fixed steps, have no effect on tone. Filter removes harsh quality.

These components are all in series and a normally-closed switch shunts each element.

The OPEN DIAPASON stop does not use a filter; it is simply the generated waveform, a sawtooth with a fairly large flyback time. The OPEN DIAPASON switch is normally closed; with all the other switches closed (except the STRING switch, which does not matter for this purpose), the junction of R8 and R4, R5, and R6 is shorted to ground, so that no signal passes through the bus network to the amplifier. When the OPEN DIAPASON stop is required, the switch is opened. This places the 47,000-ohm resistor R9 between the network and ground, removing the short and

this filter is about 1,100 cycles and the trough 450 cycles. To this response is added the treble attenuation of the *flute* filter, though in reduced quantity. Opening the HORN switch connects C2 in series with the shunt, increasing the bass response. Opening the VIOLA switch further alters the curve in the same manner.

These descriptions of the filter action are only qualitative, since it is the overall shape of the curve which matters. A more exact story is told by the curves of Fig. 3, which show actual frequency characteristics of the signal path with various R-C and electronic filters connected across the amplifier-input circuit by the keyboard stops.

The swell filters

The SWELL filter system, diagrammed in Fig. 4, operates basically in the same way as the GREAT filters, even using many of the same circuit components, but the switching is more complex. In the SWELL the three busses include *4-* and *8-foot* but not *16-foot* tones. Instead there is the *quint* bus, containing tone one octave and a musical fifth above the *8-foot* tone (approximately the third harmonic). As in the GREAT, there are a SUPER switch and a UNISON OFF switch. The SUPER switch leads through sections of the VOX HUMANA switch and both go through the FULL ORGAN switch. (The latter is the same switch in both diagrams, different sections of it being shown in Figs. 2 and 3.) Thus, when the VOX and FULL ORGAN are not in use, the *8-* and *4-foot* tones may be shorted out, but operating the VOX automatically turns on the SUPER and pulling FULL ORGAN makes both main busses speak.

The *string* filter is similar to that in the GREAT. The return end of the STRING switch is not returned directly to ground, but is grounded through sections of the OBOE and VOX HUMANA switches so that when these stops are drawn the *string* tone sounds. The main shunt filter is fed from the lower of the two signal paths, this time through a 22,000-ohm resistor. When the GEIGEN switch is opened, the signal is shunted by the main filter in series with the 22,000-ohm resistor; if STOPPED DIAPASON, SALICIONAL, and CLARINET switches are closed, the tone heard is attenuated

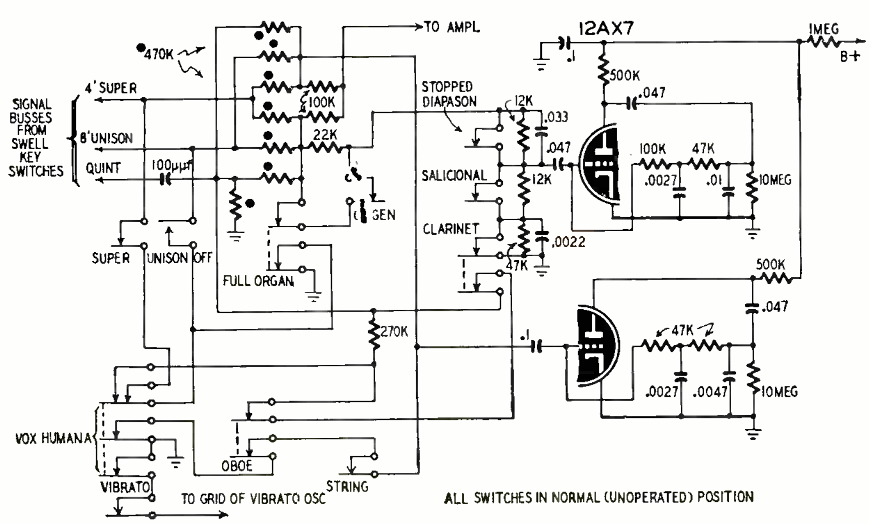


Fig. 4—The SWELL manual stop circuits add more tone qualities and a vibrato.

sawtooth *4-* and *8-foot* tone plus QUINT. The same is true if the FULL ORGAN switch is opened.

The STOPPED DIAPASON, SALICIONAL, and CLARINET stops operate in the same way as the similarly-placed circuits in the GREAT. In addition, when CLARINET tone is desired, a second section on its switch removes the ground which is placed on the *quint* bus through sections of the OBOE, VOX, and FULL ORGAN switches. Then the *quint* tone is attenuated only by the 270,000-ohm resistor shunting it to ground through the VOX and FULL ORGAN switches.

tion at the top removes the ground short from the *quint* bus, allowing the *quint* to come forth at full strength (a lower level than the other two busses due to the permanent filter just mentioned). This section also sounds the *4-foot* bus by removing its ground. The center section removes the short from the *string* filter, adding it to the combination. The lower section adds vibrato by ungrounding the line through the VIBRATO switch to the vibrato oscillator.

When the FULL ORGAN switch is used, it causes *geigen* tone (raw sawtooth) to sound, and also removes the ground

low-pass filter to remove most of the harshness of the sawtooth tone and give a more or less flutelike quality.

When all *pedal* tabs are in normal position (up) the bus is shorted to ground. When the FULL ORGAN tab is pressed (the contacts shown in Fig. 5 are part of the entire FULL ORGAN switch already shown in Figs. 2 and 3), the bus is grounded through R1. With *full organ* not in use and the GEDECKT tab down, the shunt is 4,700 ohms. The BOURDON tab adds 12,000 ohms in series, raising the level, and the BOMBARDE tab adds 47,000 ohms for maximum level.

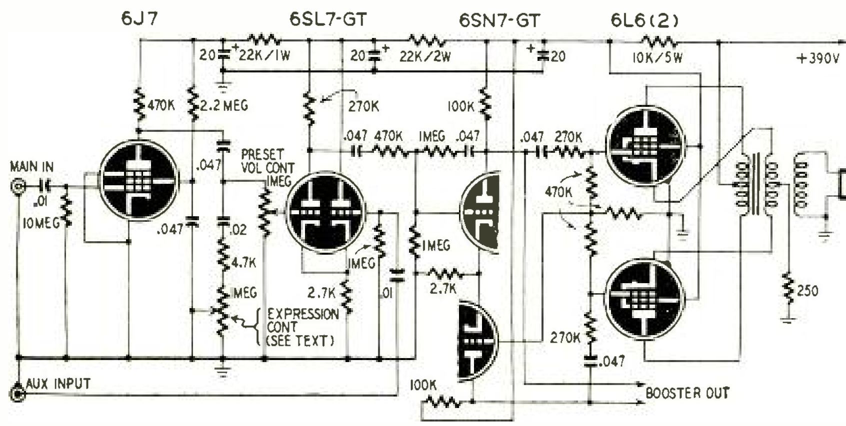


Fig. 6—Main amplifier. The output transformer has a tertiary cathode-feedback winding.

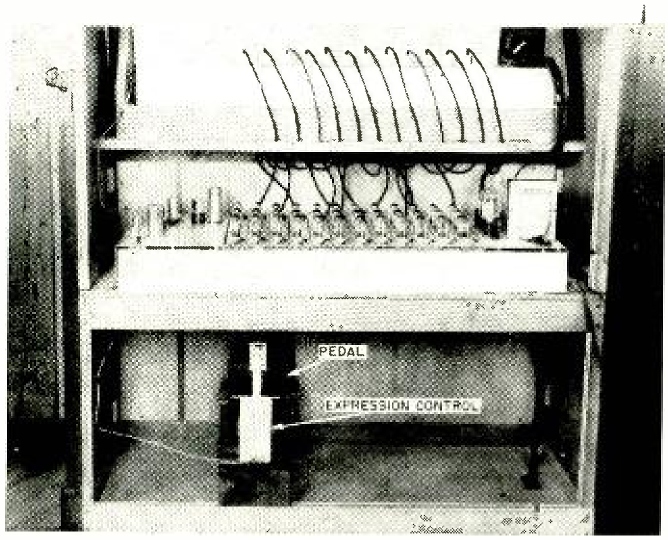


Fig. 7—Rear view of the Minshall organ showing the expression - control foot-pedal linkage.

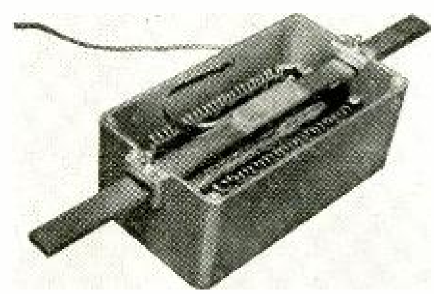


Fig. 8—Inside the expression control. Sliding bar contacts fixed resistors, attenuates volume in 60 small steps.

When the OBOE switch opens, the short across the *string* filter opens and the *string* characteristic is heard. Added to that, the *quint* bus is unshorted, just as with the CLARINET switch, and is shunted to ground only by the resistor.

The *quint* bus does not provide the ordinary sawtooth wave present on the other busses. At the *quint* input to the filter assembly this line has a series 100-μμf capacitor and a shunt 470,000-ohm resistor. As a result, the *quint* signal is attenuated about 3 db per octave below 6,500 cycles and has practically no fundamental. The waveshape more nearly resembles sharp pulses than sawtooth waves. This has a "buzzy" quality which sharpens any tone to which it is added.

The VOX HUMANA switch, when opened, does several things. The double sec-

connection from the UNISON OFF switch and the grounds going through the VOX switch from the *4-foot* and *quint* busses, so that all three busses sound at full level. Slight amounts of the desired characteristics can be added to the FULL ORGAN by using the desired stops in addition to the FULL ORGAN.

The pedal filters

The principal purpose of the pedal clavier in ordinary organ playing (as distinguished from concert work) is to provide foundation bass. Pedal stops are rarely elaborate and this idea has been followed in the Minshall.

Fig. 5 is a diagram of the pedal control system. Three stops are provided. They do not alter the tone quality but simply change the volume level. The output of the *pedal* bus from the pedal key switches passes through an R-C

The amplifier

The amplifier used in the model H (single-manual spinet) and Model J (dual-manual with built-in speaker) is diagrammed in Fig. 6. This is a conventional circuit with some novel features. The EXPRESSION pedal operates a step-type variable resistor which shunts the input to the second stage through a fixed 4,700-ohm resistor and a .02-μf capacitor. The fixed resistor prevents the pedal from reducing the level to zero. The .02-μf capacitor is a rudimentary "loudness control", raising the bass relatively as the volume decreases.

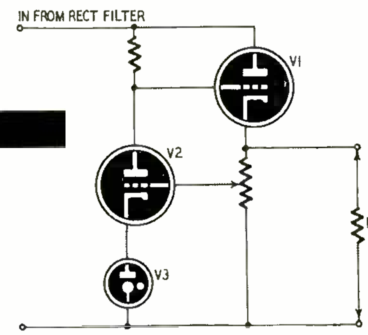
The *expression control* assembly can be seen linked to the pedal in Fig. 7. Fig. 8 is a close-up of the control with cover removed. It contains 60 contact bars embedded in plastic, each connected to a pair of resistors which make up the attenuation steps. The actuating bar is grounded and a spring contact on it rides the contact bars as it is moved by its link to the SWELL pedal.

Returning to Fig. 6, the first-triode grid of the 6SL7-GT has a standard potentiometer which is preset at installation for a maximum volume suited to the room and the organist's taste. The second triode is an auxiliary input amplifier provided for future addition of an electronic chime system.

Output from the plates of the 6SN7-GT phase inverter is fed to a BOOSTER OUTPUT connector as well as to the grids of the 6L6 final stage. This permits signals to be fed to a separate tone cabinet for sound reinforcement, or it may be used in a radio station for connection through a suitable transformer to the station's audio system.

(to be continued)

VOLTAGE REGULATION



These circuits will deliver constant d.c. voltage under large line and load changes

By R. D. HORWITZ

SERVICE technicians, radio amateurs, and electronics experimenters meet many circuit situations calling for highly stable d.c. power supplies. Variations in B plus voltages will affect the accuracy of a signal generator, the stability of even a crystal-controlled oscillator, and the gain of an amplifier. In receivers with high-Q tuned circuits, changes in supply voltages may affect the selectivity. This is especially true in TV receivers, where the settings of the contrast, brightness, and volume controls, the horizontal drive and the other sweep adjustments, and normal aging of the tubes cause large variations in the total current drawn from the power supply.

Gas-filled regulator tubes will maintain constant voltage where only a few milliamperes are required, and their use is generally limited to a single critical tube or circuit. Fortunately, an electric regulator that will deliver constant voltage to the full load from almost any type of power supply can be built at low cost.

The basic regulator circuit is shown in Fig. 1. The input to the regulator (from the rectifier-filter) must be greater than the required output voltage. V1 acts as a series resistor. The voltage drop across V1 is controlled by the voltage on its grid. The purpose of the complete regulator circuit is to vary this voltage drop automatically, to maintain the output voltage constant at any predetermined level.

V2 is a d.c. amplifier, with its cathode held at a fixed positive voltage by the gas-filled regulator tube V3. The grid of V2 is set at a slightly less positive voltage than its cathode by the potentiometer across the output. The net bias on V2 is the voltage difference between its grid and cathode. The plate of V2 is connected directly to the grid of V1.

If the *load voltage* decreases for any reason, a proportional decrease occurs at the grid of V2. The voltage at the plate of V2 (and the grid of V1) becomes more positive, reducing the voltage drop in V1, and raising the output voltage to its original value. If the load voltage increases, the grid of V1 becomes more negative, and a greater drop takes place across the tube. The action is practically instantaneous, as there are no coupling capacitors or inductors to introduce any time delay. Any change in load voltage is automatically counteracted by a change in the drop across V1.

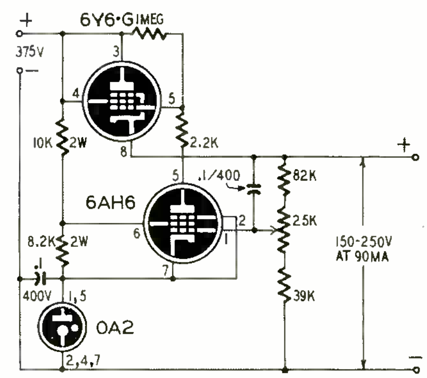
V1 must carry the full load current. A high-plate-current triode, such as the 2A3 or 6AS7-G, or a triode-connected 6L6 or 6Y6-G, is required. V2 should have the highest possible voltage gain. A single 6AH6 or 6AC7 pentode is suitable, or a high-mu twin-triode, a 12AT7 or 6SL7, may be used as a two-stage amplifier.

An important element in the circuit is the gas tube which provides a constant reference bias for V2. The VR series, or 0A2, 0B2, and 5651 types are standard for this application. A neon lamp without an internal limiting resistor also may be used.

Complete regulator circuits are shown in Fig. 2 and Fig. 3. The first will supply 90 ma (the maximum capacity of the 6Y6-G) at any voltage between 150 and 250. Additional 6Y6's may be connected in parallel for heavier load currents. The 0.1-μf capacitor improves filtering by feeding any a.c. ripple back through the regulator for cancellation.

Fig. 3 is a heavy-duty regulator capable of supplying 225 ma at 250 volts. The 6SL7 is a two-stage d.c. amplifier. Its high gain improves regulation by responding to even the smallest changes in load voltage.

In addition to its value as a source of unvarying d.c., the voltage regulator has another great advantage. Because it has practically zero internal impedance, it is an almost perfect bypass to ground for any a.c. in the supply circuits of the equipment with which it is used. Motorboating and oscillation, especially in high-gain multistage circuits, are eliminated without the need for elaborate decoupling networks.



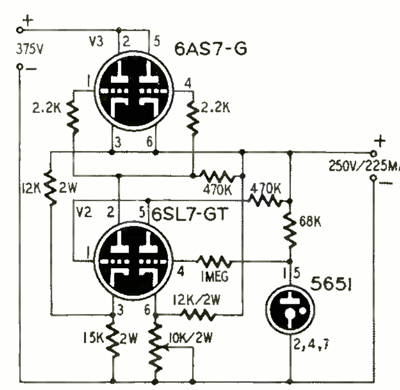


Fig. 1 (top)—The basic electronic regulator circuit uses amplified negative feedback to hold load voltage constant.

Fig. 2 (center)—Complete regulator for loads up to 90 ma, with adjustable output. Note input voltage required from filter. Use separate heater winding or transformer for 6Y6 to prevent heater-cathode insulation breakdown.

Fig. 3 (bottom)—A heavy-duty regulator unit, with 2-stage triode feedback amplifier and high-stability reference tube. Give all components—especially the 6AS7-G—plenty of ventilation.

Materials for 90-ma regulator

Resistors: 1—10,000 ohms, 1—8,200 ohms, 2 watts; 1—1 megohm, 1—82,000 ohms, 1—39,000 ohms, 1—2,200 ohms, ½ watt; 1—25,000-ohm potentiometer.
Capacitors: (Paper) 2—0.1 μf, 600 volts.
Miscellaneous: 1—6Y6-G, 1—6AH6, 1—0A2; 1 octal socket, 2—7-pin miniature sockets; chassis, connectors, wire, solder, hardware.

Materials for 225-ma regulator

Resistors: 1—15,000 ohms, 2—12,000 ohms, 2 watts; 1—1 megohm, 2—470,000 ohms, 1—68 000 ohms, 2—2,200 ohms, ½ watt; 1—10,000-ohm, 2-watt potentiometer.
Miscellaneous: 1—6AS7-G, 1—6SL7-GT, 1—5651; 2-octal sockets, 1—7-pin miniature socket; chassis, connectors, wire, solder, hardware.

—end—

LONG-PERIOD RADIO TIMER

By H. A. VASQUES

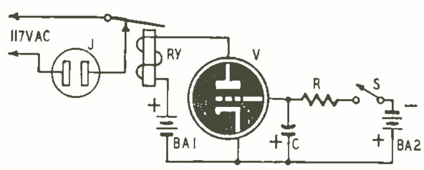
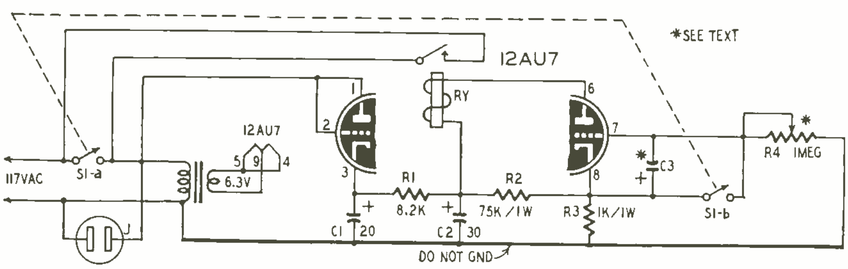
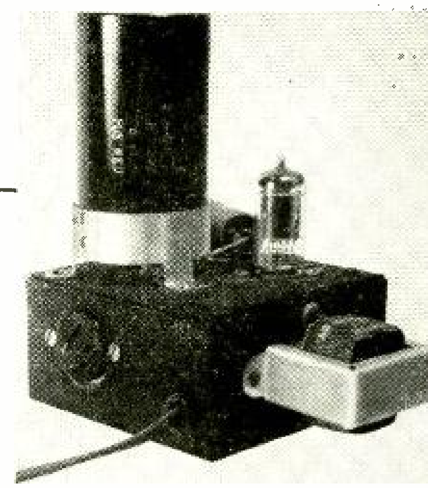


Fig. 1, a basic timing circuit, is at left; Fig. 2, the complete circuit, below. The equipment is shown in the photo at the right.





THIS timer was prompted by my habit of falling asleep while listening to the radio and letting it run all night. Although many mechanical timers are on the market, I decided to build an all-electronic model from the spare-parts box.

With the radio plugged into the timer outlet, it plays continually until the timing cycle is started. The flick of a switch starts the timing cycle and after a predetermined interval the relay opens and radio and timer both are turned off automatically.

Timing principle

The basic circuit of the timer is shown in Fig. 1. V is a 6J5 or any equivalent medium-mu triode. RY is a plate-circuit relay with normally-open s.p.s.t. contacts. J is an ordinary power-outlet receptacle.

As long as switch S is open, V has no grid bias and draws enough plate current to energize RY. The relay contacts close and apply power to receptacle J. When S is closed, capacitor C charges gradually through R, developing an increasing negative voltage at the grid. Plate current falls as the grid becomes more negative, and eventually becomes too small to energize the relay. The contacts open and remove power from the receptacle J.

The time required to release the relay depends on the values of C and R. Intervals of one-half hour or more are possible with large values.

The timer circuit

The circuit of a complete timer is shown in Fig. 2. The 12AU7 is used as a combination line-voltage rectifier and control tube. C1, R1, and C2 form the power-supply filter, with R2 and R3 as a voltage divider across the output. RY is a 2,500-ohm relay with normally-open contacts (Potter and Brumfield type LM-1, Staco type T40F, or equivalent). S1-a and S1-b are the two sections of a d.p.s.t. toggle switch. J is the power receptacle for the controlled radio or other device.

Closing the switch applies power through S1-a to J; to the heater and rectifier section of the 12AU7; and shorts the grid and cathode of the control triode through S1-b. About 12 volts is developed across R3 by the control-tube plate current and the bleeder current through R2. RY is energized by the plate current and the contacts close.

The timing interval is started by opening S1. Power is still applied to the circuit through the closed relay contacts. With S1-b open, C3 is connected in series with the 1-megohm potentiometer across R3. The capacitor charges slowly, developing a negative potential at the grid end.

The plate current falls as the negative grid voltage increases, until it drops low enough to release the magnetic pull of the relay and open the contacts. This automatically disconnects J and the timer itself from the power line.

The correct setting of R4 must be found by experiment, since the exact value of charging resistance depends not only on the desired time interval, but on the characteristics of C3, the control triode, the relay, and the supply voltage. In the original model a timing interval of 25 minutes was obtained when resistor R4 was set at approximately 350,000 ohms.

Construction

The unit was built on a 4 x 5 x 2-inch chassis. The layout is not critical. C3 may be made up of several lower-capacitance units in parallel, if a 4,000-μf capacitor is not available. R2 and R3 must be adjusted so the voltage across R3 is never greater than the rated working voltage of C3. Less than 4,000 μf may be used by increasing the resistance of R4.

Materials for timer

Resistors: 1—75,000 ohms, 1—8,200 ohms, 1—1,000 ohms, 1 watt; 1—1-megohm potentiometer.
Capacitors: (Electrolytic) 1—20 μf, 1—30 μf, 150 volts; 1—4,000 μf, 15 volts (see text).
Miscellaneous: 1—12AU7 tube; 1—2,500-ohm s.p.s.t. relay, normally-open contacts (see text); 1—6.3-volt filament transformer; 1 d.p.s.t. toggle switch; 1—9-pin miniature socket; 1 power receptacle; chassis; terminals, wire, solder, hardware.

—end—

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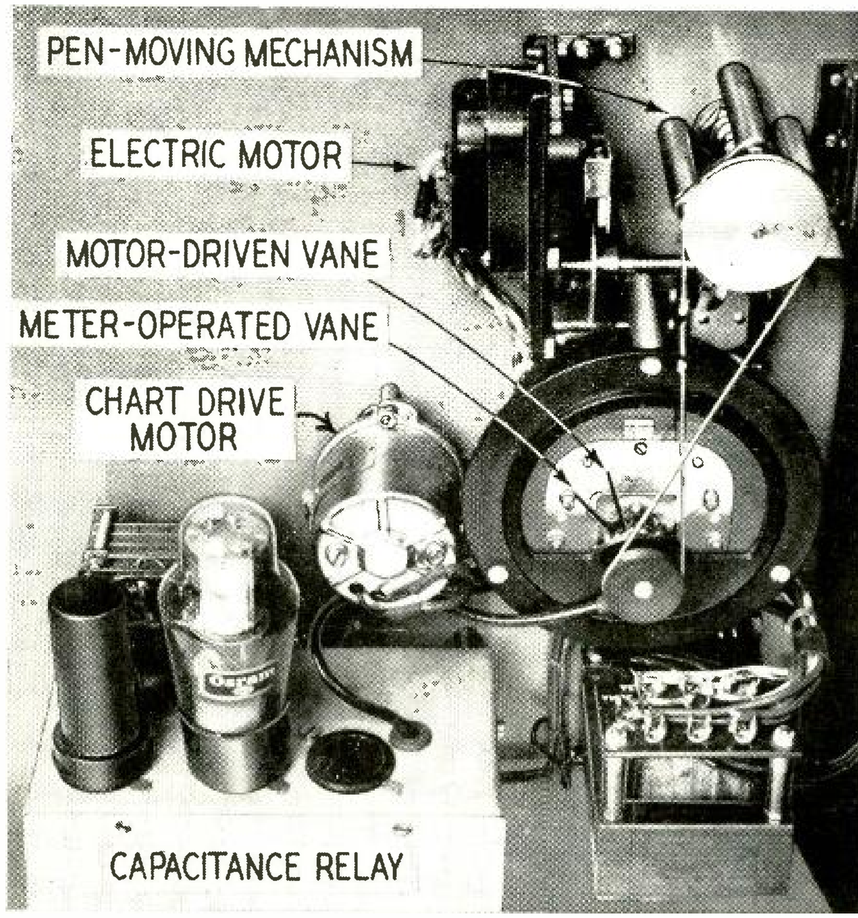


Photographs courtesy *Wireless World*

A Servograph assembly. Action is reversed by merely uncrossing the vane drive belt.

ELECTRONIC RECORDER

By RALPH W. HALLOWS

A new electronic data recorder called the Servograph has been developed by the Fielden Company of Manchester, England. It provides continuous ink records of any measurements that can be made with pointer-type instruments.

The meter pointer is replaced by an aluminum vane. Another vane is added, insulated from the first and free to move independently over the scale. If the free vane is set at a given position, any movement of the meter vane will vary the capacitance between them.

The vanes are connected to an electronic capacitance relay which controls the direction of a reversible motor. The free vane is driven by the motor; at a predetermined vane spacing the motor is idle; if the meter vane moves, the motor starts instantly and moves the free vane in the correct direction to restore the original spacing. This is the servo principle.

A stylus linked to the motor shaft records all movements on a calibrated chart driven by clockwork or a synchronous motor. Meter variations are thus recorded continuously over any desired period of time.

The motor circuit

Fig. 1 is the basic circuit of the Servograph motor unit. A two-winding motor moves the free vane and the recording stylus. Winding X receives voltage continuously from the 6-volt winding of the power transformer, but the motor cannot start until a voltage approximately 90 degrees out of phase with X is applied to winding Y. The direction in which the motor turns depends on whether the voltage across Y leads or lags the voltage across X.

The required leading and lagging phase shifts are provided by L1 and C1 respectively. These receive a.c. *alternately*—in the same phase as winding

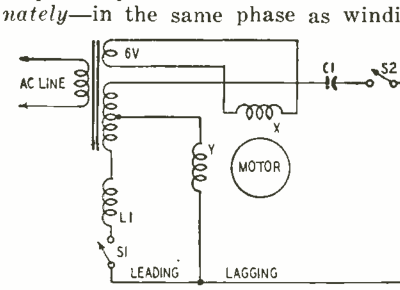
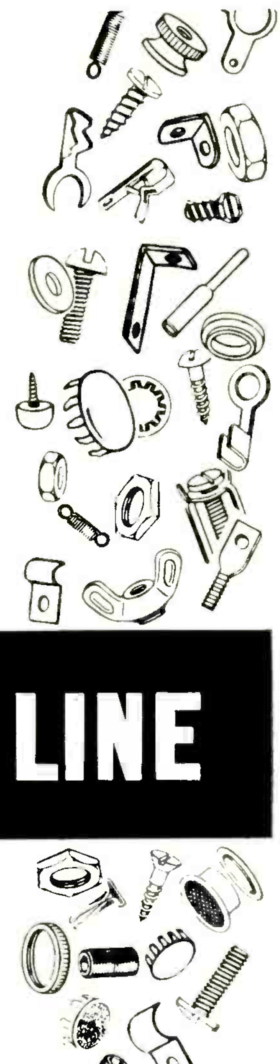


Fig. 1—The basic motor-control circuit.



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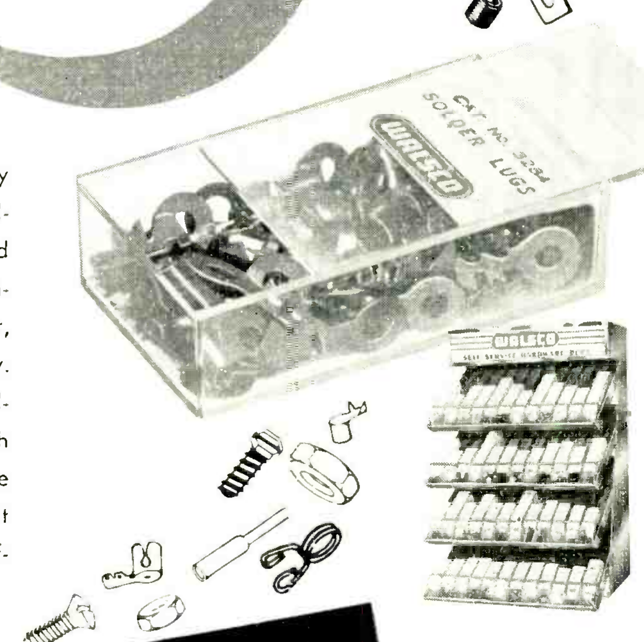

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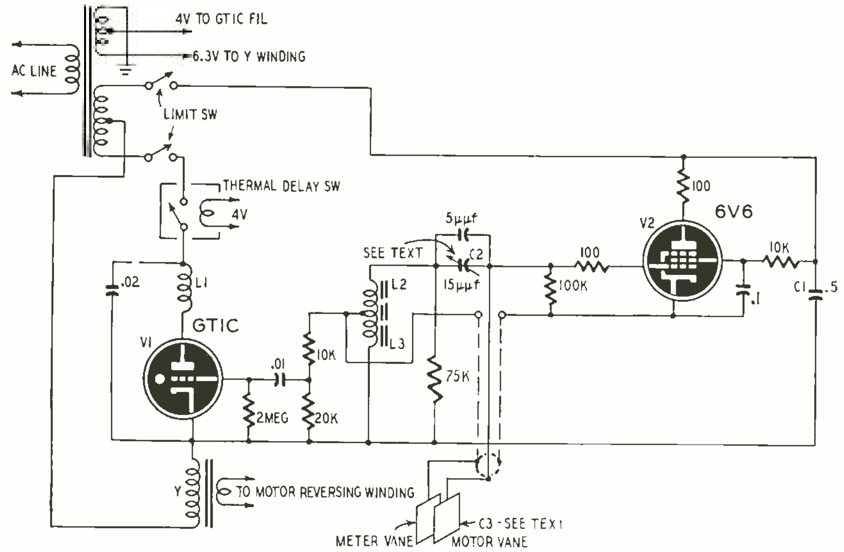

Fig. 2—The complete Servograph circuit, as used in the electronic data recorder.

X—from opposite ends of the center-tapped winding on the power transformer. If S1 and S2 are closed winding Y will receive alternate leading and lagging pulses from L1 and C1 at the line frequency. These tend to rotate the motor in opposite directions and no movement results. If S1 is opened, Y receives only lagging pulses, and turns clockwise; if only S2 is opened, the motor turns in the opposite direction.

The complete relay circuit

In the complete circuit (Fig. 2) V1 and V2 act as the switches. Each tube conducts on alternate half-cycles from the line. V1 is a thyratron adjusted to draw twice as much plate current as V2. With both tubes conducting alternately Y, the primary of a transformer for the reversing winding of the motor, receives more voltage during the half-cycles from L1-V1, and the motor turns counterclockwise. If V1 is cut off, Y receives pulses only from the V2-C1 circuit and the motor turns clockwise.

In addition to acting as a switch, V2 is also part of the oscillator circuit L2-C2-C3. C3 is the capacitance between the meter vane and the motor-driven vane. C2 is adjusted to equal C3 at the desired reference position on the meter scale. Under these conditions equal and opposite voltages from the ends of L2 are applied to the V2 grid and the circuit cannot oscillate. If the meter pointer moves, C3 decreases, more voltage reaches the grid through C2, and oscillation starts. Enough voltage is induced in L3 to develop cutoff bias for V1 through the .01-μf capacitor and 2-megohm grid leak.

In the nonoscillating condition, with both branches conducting, the motor turns counterclockwise until stopped by the left-hand limit switch, or until C1 decreases enough to start oscillation and reverse the motor. The right-hand limit switch prevents overswing in the clockwise direction.

Polar diagrams of antenna directivity that take about one-half hour to make by older methods, have been drawn automatically in 15 seconds with the Servograph. The antenna feeds a crystal diode detector whose output is indicated on a sensitive microammeter. Synchronized motors rotate the antenna and a recorder chart with polar co-ordinates. Variations in signal strength from a test transmitter as the antenna rotates are drawn directly on the chart by the Servograph stylus.

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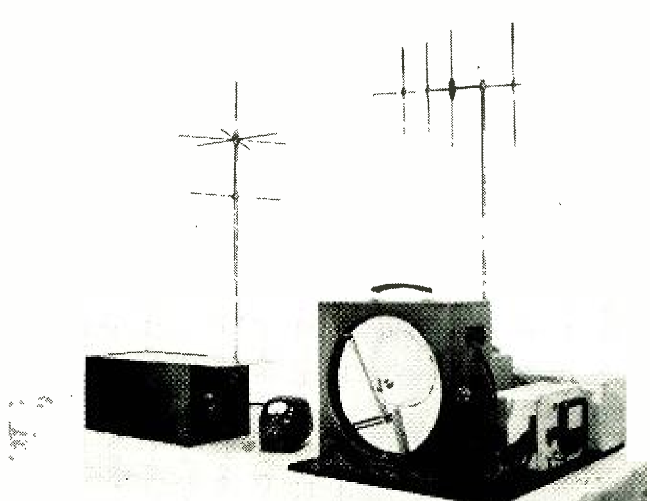
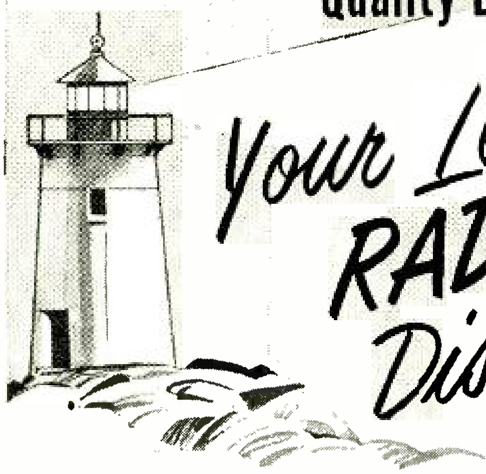


Typical Servograph setup for plotting antenna directivity patterns automatically in 15 seconds.

A Guiding Beacon For Quality Electronic Parts



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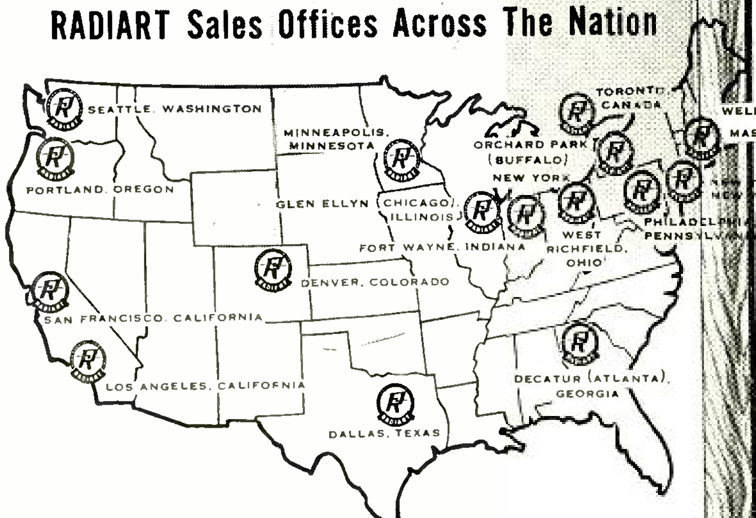
RADIART Sales Offices Across The Nation



BUY OF THE MONTH

The RADIART TV TWINS are the two best friends any TV set ever had! They are the RADIART BOOSTER and the RADIART CDR ROTOR! A perfect team in working together to get the most out of any TV set...they are also designed when combined to appear as a single unit—a welcome piece of furniture in any home.

These Are The Cities With RADIART Distributors In Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina and Tennessee

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- MIAMI
- ORLANDO
- PANAMA CITY
- PENSACOLA
- SARASOTA
- ST. PETERSBURG
- TALLAHASSEE
- TAMPA
- WEST PALM BEACH

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- ATLANTA
- AUGUSTA
- COLUMBUS
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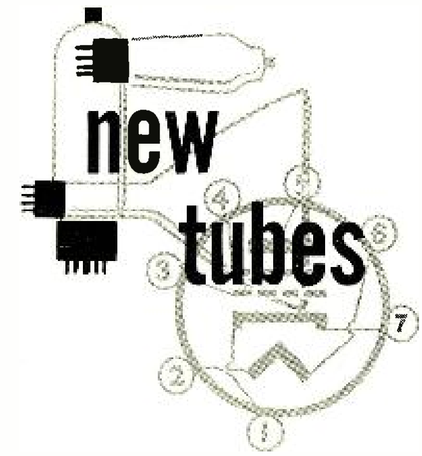


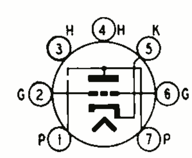
Most of the tubes announced this month are high-stability, shock-resistant versions of familiar types, intended for military and industrial equipment. Practically the entire production of these types is going to the defense program.

In this category G-E has developed a series of ruggedized tubes which are direct replacements for existing standard types. These include: the GL-6072, equivalent to the 12AY7 except for an increase in heater current to 350 ma; the GL-6135, identical to the 6C4W except for heater current of 175 ma; the GL-6136, equivalent to the 6AU6; the GL-6137, interchangeable with the 6SK7; and the GL-6201, a direct replacement for the 12AT7.

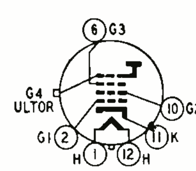
Sylvania is producing the 6111 and 6112 subminiature twin triodes, whose characteristics were given in last month's RADIO-ELECTRONICS.

Receiving and TV types

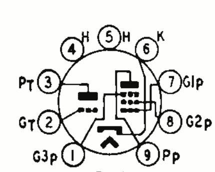
The Sylvania 6AN4 is a miniature triode for use as a grounded-grid r.f. amplifier or mixer in u.h.f.-v.h.f. TV receivers. It features high transconductance, shielding between plate and cathode leads, and double pin connections to grid and plate. The 6AN4 will give a gain of 10 db, a bandwidth of 10 mc, and a noise figure of 15 db at 900 mc. Cascaded 6AN4's may be used for improved oscillator-antenna isolation and increased r.f. gain.



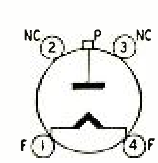
6AN4



10SP4



19X8



8013-A

RCA has announced the 19X8, a triode-pentode converter with 150-ma heater for transformerless AM-FM-TV receivers. The triode section is used as the oscillator, and the pentode sec-

RADIO-ELECTRONICS is paying good rates *on acceptance* for original and unusual articles on phonograph, television, FM and AM servicing, as well as articles on industrial electronic equipment and applications. *Good* constructional stories on receivers or other pieces of electronic equipment can also be used. Send for a copy of our Authors' Guide. Address:
THE EDITOR
RADIO-ELECTRONICS
25 West Broadway New York 7, N. Y.

COMMON SENSE about easy tv servicing

Make your servicing job easier than you ever thought possible

Complete Servicing Facts Method Proved Outstanding Success

Tens of thousands of service technicians throughout the country have learned this key to fast, easy, profitable servicing: They *insist* on having the complete servicing facts for every receiver they repair! They know that by having the complete story . . . and only by having the complete story . . . can they spot trouble quickly and do an easy, permanent servicing job.

Here's an example: On Philco models 52-P-1810, 52-P-1812, 52-P-1840, 52-P-1842, 52-P-1844, 52-P-1882, 52-P-2110, 52-P-2142, codes 122 and 123, the manufacturer released 32 pages (8-½ x 11") of official service data. (That is what we published in Rider TV Manual Vol. 9 and in Rider TV Tek-File Pack 22.)

These models were made in a variety of production runs; using three different chassis . . . each with its own schematic. These chassis are identical in many respects . . . but the vital differences can make servicing a real headache. For instance, three types of power transformers are used. Each has different electrical constants—and a different part number. In the C2 deflection chassis, the power transformer has one high voltage winding of 635 volts, center-tapped, and four low voltage windings: one 5 volts, two 6.8 volts and one 6.4 volts. In the CP1 deflection chassis, the power transformer has one high voltage winding of 635 volts, center tapped, but only three low voltage windings: one 5 volts, one 6.8 volts and one 6.4 volts. In the F2 chassis, the power transformer has one high voltage winding of 675 volts, center-tapped, and four low voltage windings: one 5 volts, two 6.8 volts and one 6.4 volts.

Suppose you were the service technician faced with one of these receivers. A single schematic showing just *one* of these chassis and *one* of these power transformers certainly would not be coverage for all production runs. If you were lucky, the single schematic might happen to match the receiver you had before you. But—and it's a very big but—you might also be unlucky and be faced with a receiver not described by the schematic! This is only one example in thousands of why you need *complete*, factory-prepared and factory-issued data for every set you service.

Here is how you can get this vital information. Insist on Rider Servicing Data. For 22 years Rider Servicing Data has been the *only* publishing source for the complete servicing facts: Exactly as issued by the manufacturer who made the set. Unabridged facts . . . everything is here to make your diagnosis and repair EASY. You get page after page of troubleshooting test patterns . . . large, easy-to-follow *complete* schematics . . . circuit explanations . . . stage by stage alignment curves . . . clear, enlarged chassis views . . . all circuit changes . . . and much, much more. For example: Rider tv servicing data has shown 'scope waveforms in tv receivers ever since the first tv receiver was made!

To meet your individual needs, Rider Servicing Data comes in two forms . . . both with these important, new features:

Manufacturers' Trouble Cures

These 3" x 5" standard index cards called Rider Handies contain vital manufacturer-issued permanent trouble cures plus production changes. Each Handy is identified with a manufacturer and a receiver model. With Rider Handies you save countless hours of diagnosis and repair time . . . because Handies contain the data you *must have* to make *permanent repairs* on many manufacturers' models. (Rider Handies information appears in Rider TV Tek-File packs, and Rider TV Manuals beginning with Vol. 9.)

Guaranteed Replacement Parts Listings

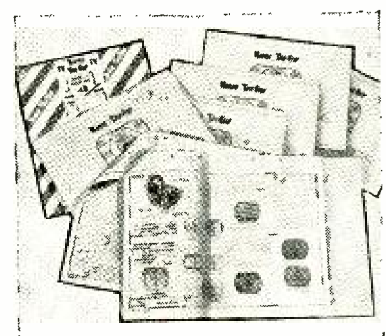
Beginning with Rider T.V. Manual 10 and Rider T.V. Tek-File Pack 57, replacement parts listings are included. All the replacement parts listed in Rider tv servicing data meet the physical and electrical performance ratings of the original equipment!

Rider T.V. Manuals Vols. 1 to 9 (covering more than 4,200 models)

Each contains full data for manufacturers' receivers produced during a certain period. (The latest, T. V. 9, recently published, covers October 1951 through February 1952.) Each manual has over 2,000 (8-½" x 11") pages in permanent binder, with an index covering the contents of all manuals. Rider manuals are perfect for shop use and permanent reference. Price—$24 each.

Rider T.V. Tek-Files (Packs now cover 2,200 models)

A typical T.V. Tek-File pack is shown below. In Rider Tek-File packs you buy complete Rider servicing data for whatever receivers you want . . . when you want it. You buy according to your needs with the assurance of getting the *complete servicing facts* for every repair. Notice that each pack consists of handy, standard file folders for easy use. Only $2 each pack.



FREE Rider T.V. Tek-File indexes covering the contents of all published packs are at your jobber's. If he doesn't have them, write us.

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Prove to yourself that Rider Tek-File makes tv servicing easy. Buy one pack for the next receiver you service. If you don't agree it's better than anything you ever used, return the pack to us within seven days . . . we'll send you a full refund.

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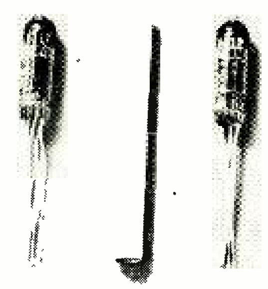
John F. Rider Publisher, Inc., 480 Canal St., New York 13, New York. West Coast Office: 4216-20 W. Jefferson Blvd., Los Angeles, California.

tion as the mixer. The mixer section may be triode-connected for lower noise level where the receiver does not have an r.f. stage. The 19X8 has the following ratings for typical operation: triode section (250-mc oscillator): plate



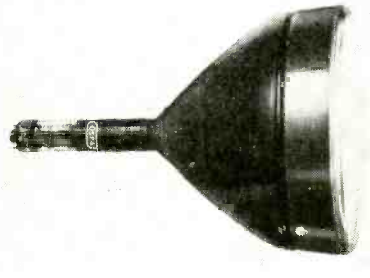
The 6111 and 6112 described last month.

voltage, 150; grid resistor, 2,700 ohms; plate current, 13 ma; grid current, 3.6 ma; power output (approximately), 0.5 watt. Pentode section (as pentode mixer): plate voltage, 150; grid 3, connected to cathode at socket; grid 2 voltage, 150; grid 1 supply voltage, minus 3.5; grid 1 circuit resistance, 120,000 ohms; conversion transconductance, 2,100 μmhos; plate current, 6.2 ma; grid 2 current 1.8 ma; grid 1 current, 2 μa. Except for heater voltage and current ratings, the 19X8 is identical to the 6X8.

RCA has also released the 10SP4, a high-resolution picture tube for monitor service in studio equipment, theater-television systems, and industrial TV installations. The 10SP4 utilizes 50-degree magnetic deflection and electrostatic focus. A special electron-lens structure maintains constant focus under variations in line voltage and brightness adjustment. The Filterglas face-plate is relatively flat, and the metallized screen improves brightness and requires no ion-trap magnet. Typical design-range ratings of the 10SP4 at the maximum ultor voltage of 14,000 are: ultor current, 100 μa, grid 3 (focus) voltage, 1,640 to 2,225; grid 2 voltage, 200; grid 1 voltage for visual

The five new ruggedized G-E tubes.

Sylvania 6AN4.

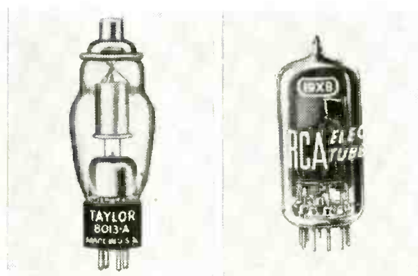


The 10SP4 is a 10-inch monitor tube.

extinction of the standard 6 x 8-inch rectangular raster, minus 18 to minus 48.

Industrial and special tubes

Taylor Tubes, Inc., has announced production of the 8013-A high-voltage rectifier. For operation in air, the



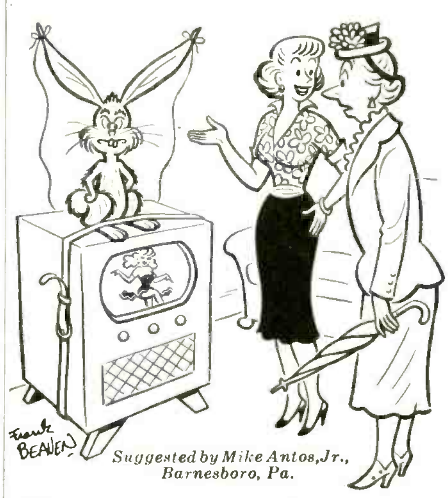
The Taylor 8013-A and RCA 19X8 tubes.

8013-A has a peak rating of 40,000 volts inverse or forward, and an average current of 20 ma. In oil-immersed operation the rated peak voltage is 55,000, and the average current, 30 ma. Instantaneous peak current is 450 ma. The thoriated-tungsten filament requires 5 amperes at 2.5 volts.

The 8013-A has a Nonex glass bulb and an oil-resistant silicone base. Its life expectancy is more than 5,000 hours at the ratings given above.

A number of new tubes have been announced and will be described in next month's issue. Possibly the most interesting of them is RCA's new 27-inch metal-shell kinescope, planned for high-quality 1953 receivers.

—end—



Suggested by Mike Antos, Jr., Barnesboro, Pa.

"Why buy a 'Rabbit-Ear' antenna when we have a rabbit of our own!"

APPEALS TO COLLEAGUES

The Television Installation Service Association (TISA) of Chicago, has recently appealed to service associations in other cities to police local service complaints and weed out undesirables in their own areas. The recent success of TISA in closing up several firms which advertised three-dollar service calls (which were stated to have cost the average customer between $15 and $25 per call) was cited as an instance of what a vigorous and determined TV service association can do.

LUZERNE IN DRIVE

The Luzerne County (Pennsylvania) Radio Servicemen's Association was reported to be carrying on an extensive membership drive. The *FRSAP News Letter*, source of the information, stated that they expect to increase their membership of 115 considerably. New members are coming in and old members' interest is increasing as a result of the unfreeze, and information is being gathered on the problems that will arise in a virgin television area.

Plans for the annual outing to be held at Lily Lake this month were rapidly being worked into shape. The entertainment committee was also busy on the annual theater production with which the association raises money.

LACKAWANNA HOLDS PARTY

The annual charter night party of the Lackawanna County (Pennsylvania) Radio Technicians Association was held May 22 at the Dietrick Hotel in Scranton. John McGoldrick was toastmaster and Attorney Daniel Jenkins was principal speaker. Mr. McGoldrick gave a brief history of the association, and discussed the coming impact of u.h.f. television. Mr. Jenkins discussed the workings of the Pennsylvania Public Utilities Commission.

More than 80 members, wives, and friends attended the affair, as well as a number of guests from the neighboring Luzerne County association.

AKRON IS ACTIVE

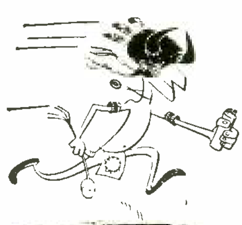
The Akron Radio Technicians Association is now reorganizing with the idea of doubling the membership of the eight-year-old organization.

The membership includes *Qualified* members, who have had three years of technical experience and are now actively employed, and *Associate* members, which includes those with less than three years experience, radio amateurs, or others whose connection with electronics qualifies them for admission.

Activities include group hospitalization and medical insurance; a training program which will open the possibility of introducing an *Apprentice* grade of membership; work towards stabilizing the wage situation among service shop employees, thus reducing too-frequent job changing; and plans to meet the problem posed by the wildcat $1.00-per-call operator.

Officers for 1952 are Walter Dickerson, president; John Mintz, vice-president; and Joseph Vegh, secretary-treasurer.

Sangamo Type PL Dry Electrolytics are used as original equipment by *all major* TV set manufacturers



Here's "good medicine" for ailing TV sets (and servicemen's headaches, too)! Sangamo "Twist-Tab" (Type PL) Electrolytics are *exact* replacements —they assure long life and dependable performance at 85° C. and under conditions of high surge voltages and extreme ripple currents often found in TV applications.

"Twist-Tabs" are compact, light in weight and easy to mount. They are used by leading TV manufacturers . . . and they are available from the largest listing of capacities and voltages available in the industry.

Ask your distributor for a copy of the Sangamo TV Replacement Catalog. It's easy to use and helps you choose the *right* replacement every time.

Those who know The SANGAMO Tribe PAPER·MICA·SILVER·ELECTROLYTIC CAPACITORS *...choose Sangamo*

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SC52-8

DO THEIR OWN RESEARCH

Dell Davis, vice-president and director of public relations of the Glendale (Calif.) Society of Radio and Television Technicians, reports progress from that association. They now have a group doing research on horizontal output transformers, he states, and have already come up with useful information on their characteristics, interchange adapability, use in conversions, action under different loading conditions, and horizontal retrace time.

The information gained by the research group is demonstrated at meetings, and the association is developing a technique of using color slides with accompanying tape-recorded explanation, which it hopes will make the information available to neighboring associations.

NEWS FROM B. C.

The Okanagan (British Columbia) Chapter with its president, Bert Thorburn, was host to the B. C. Provincial Council for the May 24 meeting at Kelowna, B. C., with representatives from Victoria, Vancouver, Fraser Valley, and Okanagan Chapters.

The meeting was attended by Dominion Radio-Electronic Technicians Association (R.E.T.A.) executives Wilf Munton, president, and Jim Baird, secretary-treasurer. A large number of members turned out.

The highlights of the meeting included the B. C. Bulletin's editor, Tom Grant, in an exhortation requesting better co-operation in getting material for the paper.

Bookkeeping procedure took a lot of batting around with secretary-treasurer Sam Beyer getting a decision handed down to the effect that chapters' dues assessments are to be paid annually in advance at the beginning of the year.

Wilf Munton read a letter from the R.T.M.A. (Canada), who are planning a series of tape-recorded lectures for R.E.T.A. across Canada, and also a home-study TV course.

Election of officers made Sam Beyer the chairman for the next year and Bill Filtness secretary-treasurer.

SAN DIEGO ORGANIZES

The San Diego County (California) Electronic Association announces that it has received its charter. With a membership of over one hundred, it aims to establish, promote, and maintain the highest standard of ethics in the business practices and service of its members, and to function as a public service.

Frederick Palmer was elected president of the new Association, with Upton Hildebrand vice-president; C. J. Mahoney, treasurer; and William E. Stout, secretary. Directors are: John R. Dorsen, John Miner, George N. Corcoronis, Sonny Kahn and Tom C. Crawford.

As its first step in developing qualified technicians, the Association is formulating a standard training plan for all members. They will be tested and classified by the San Diego Vocational School, which functions as a public agency training for industry.

—end—

102 BILLION

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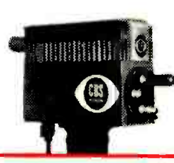
NEW CBS-HYTRON BRAND gives you:

Acceptance



1,973,326,000 times a week! 102,612,952,000 times a year! The magic letters "CBS" are seen and heard on radio and TV station breaks. Impact is terrific. An average of 13 sales impressions weekly for every man, woman and child in the country. Every one of your customers knows CBS. Knows he can depend upon CBS. Consumer acceptance of your CBS-Hytron brand grows hourly.

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As a division of the Columbia Broadcasting System, Inc., CBS-Hytron commands tremendous engineering resources for you. Because CBS embraces the field of electronic entertainment: Radio broadcasting. TV broadcasting. Radio, television, and phonograph sets. Records. Electronic research laboratories. And CBS-Hytron tubes.

Leadership

For example, CBS-Hytron originated: the GT tube . . . the subminiature tube . . . the rectangular picture tube . . . specialized, low-cost TV receiving tubes. CBS-Hytron's new picture-tube and miniature-tube plants are the most modern in the world. Such aggressive leadership guarantees you the newest and best in tubes.

YOU CAN'T BUY BETTER

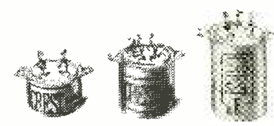
Demand the CBS-Hytron brand. You get the finest electron tubes that progressive engineering skill and craftsmanship can make. You get the brand known and respected by every one of your customers. **You get the brand they see and hear the most . . . CBS-Hytron.**

MANUFACTURERS OF RECEIVING TUBES SINCE 1921
HYTRON RADIO AND ELECTRONICS CO.
A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.

MAIN OFFICE: SALEM, MASSACHUSETTS

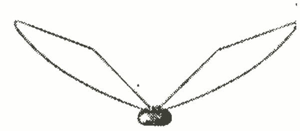
SUBMINIATURE TRANSFORMERS

Crest Laboratories, Inc., Whitehall Bldg., Far Rockaway, N. Y., is producing a new line of sub-subminiature transformers for transistor applications. The units are available in the micro-miniature size (7/8 inch diameter and 5/8 inch high). They are hermetically sealed and are available with glass bead headers or military-type ceramic feed-through terminals. The transformers are also available in 3/4 x 3/4 x 1 1/8-inch military-type cases.



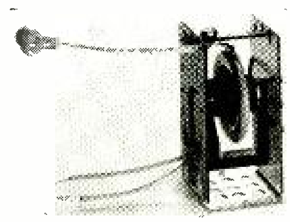
INDOOR TV ANTENNA

Telrex, Inc., Asbury Park, N. J., is manufacturing the new *Bat Wing* indoor antenna for TV and FM reception. The unit does not require tuning, pruning, or other adjustments. The polished aluminum elements are mounted on a tip-proof base.



FLYBACK TRANSFORMER

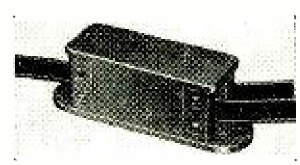
Ram Electronics Sales Co., South Buckhout St., Irvington-on-Hudson, N. Y., has added the new model X069 high-efficiency ferrite-core horizontal-output and flyback transformer to its line of TV receiver components. The unit, designed as a direct replacement for the ferrite-core units used in the newest G-E and Stromberg-Carlson sets, has



wide replacement application in sets employing the latest circuits. The X069 features low retrace time, good regulation, and improved anticorona construction. It delivers 16-17.5 kv for 19-21-inch TV picture tubes. The X70F14 14-mh cosine deflection yoke is the matching unit for the transformer.

TWO-SET TV COUPLER

Mosley Electronics, 2125 Lackland Road, Overland, Mo., has introduced the Dual-Match, a new coupling unit designed to permit two TV sets to be operated simultaneously from a single



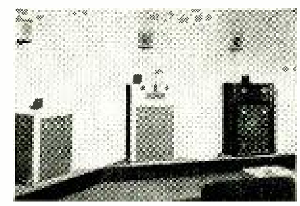
antenna without interacting or interfering with each other. The unit is compact and mounts on the back of the set or baseboard. Connections to standard 300-ohm ribbon lines are made without solder.

SPEAKER ENCLOSURES

Jensen Mfg. Co., 6601 S. Laramie Ave., Chicago, Ill., recently demonstrated two new back-loading folded-horn speaker cabinets and a new three-way reproducer system. The three cabinets feature a long, folded *Hypex*-formula horn which loads the back of the speaker for low distortion and good bass response. The horn is within the cabinet with mouth sections at sides to permit effective operation with the cabinet against the wall and full corner effect with the cabinet placed in a corner.

The new *Tri-plex* three-way reproducer system consists of the cabinet described above, and three speakers. A Jensen RP-302 tweeter and A-402 network handle signals from 4,000 cycles to the limits of audibility. A RP-201 speaker unit handles frequencies from 600-4,000 cycles. A model A-61 network feeds signals in the 600-4,000-cycle range to the RP-201 and signals below 600 cycles to the P15-LL 15-inch woofer. The cabinet is 38 3/4 inches high, 25 1/2 inches wide, and 18 3/4 inches deep.

The model BL-151 cabinet is designed for 15-inch speakers and the BL-121 for 12-inch speakers. The three cabinets are available in mahogany and in blonde Korina finishes.



SINE-SQUARE-WAVE GENERATOR

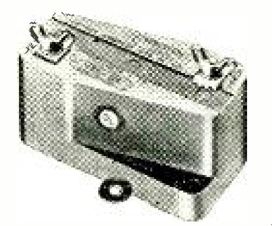
Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y. has added the model 377 sine and square-wave audio generator to its line of kit and factory-wired test instruments. The model 377 generates sine waves from 20 to 200,000 cycles in four individually

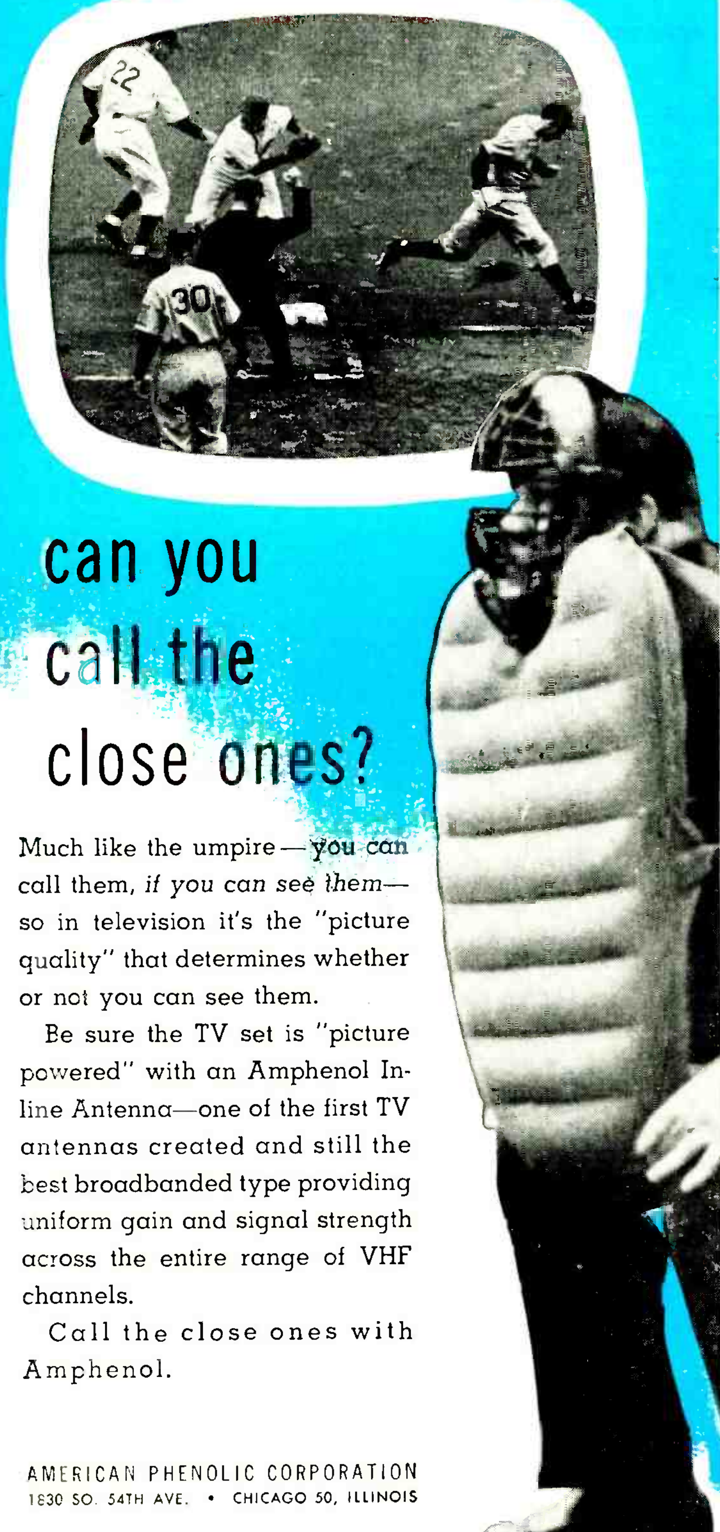
calibrated ranges. Square-wave coverage is from 60 to 10,000 cycles with 5% overshoot at 10 kc. The unit uses an improved Wien-bridge circuit with variable-capacitor tuning. Response is flat within 1.5 db from 60 cycles to 150 kc. Output is continuously variable with a maximum of 10 volts across the 1,000-ohm rated load. Distortion is only 1% of rated output and hum level is less than 0.4% of rated output.

The unit is housed in an 11 1/8 x 7 1/8 x 7 5/8-inch steel case with a three-color etched panel. The 377-K (kit) is supplied with complete construction and operating instructions.

TV LIGHTNING ARRESTERS

The LaPointe Plascomold Corp., Windsor Locks, Conn., has added several new models to the VEE-D X line of lightning arresters. The RW-200 S and RW-204-S feature straps and gripping prongs for nonslip mounting on all size masts and pipes. Their electrical characteristics are similar to those of the standard RW-200 and RW-204 arresters. Model RW-310 open-wire arrester has brass connecting blocks and prong-tooth washers that provide positive connections and assure accurate wire spacing. This model is similar to the heavy-duty RW-300. Models RW-210 and RW-214 are modifications of the RW-200 and RW-204 with a single wood screw for mounting on wood surfaces. All the arresters are UL-approved.

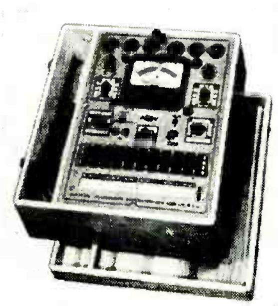




New Devices

NEW TUBE TESTER

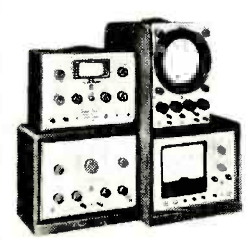
Electronic Measurements Corp., 280 Lafayette St., New York, N. Y., has announced the addition of a new mutual-conductance tube tester to the EMC line of electrical testing equipment. Model 206 is designed to give microhmo readings for all amplifier tubes. It also tests cold-cathode, electron-ray, voltage-regulator, and bal-



last tubes. Flexible lever switching allows all present and future tubes to be tested regardless of location of elements on tube base. Individual sockets for each tube-base type eliminate possible errors. This instrument is available in stationary or portable oak cases.

TV TEST EQUIPMENT RACK

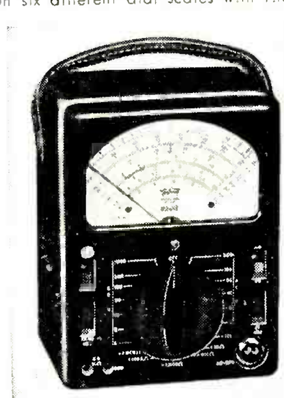
The Tube Department of RCA Victor, Harrison, N. J., has announced a four-section test-equipment rack designed for the WR-39C television calibrator, the WR-59B sweep generator, WO-56A oscilloscope, and WV-87A Master Volt-



Ohmyst. The double-tiered wood rack is finished to harmonize with the line of test instruments. It saves space on the workbench and consolidates major TV test instruments in one location, saving time and steps for the service technician.

MODEL 650 VTVM

Triplett Electrical Instrument Co., Bluffton, Ohio, is distributing the new model 650 v.t.v.m. Peak-to-peak or r.m.s. a.c. and r.f. voltages from 20 cycles to over 110 mc. are measured with one probe. A.c. voltages are read on six different dial scales with r.m.s.

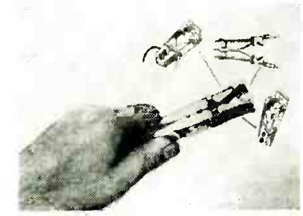


ranges of 1, 5, 10, 50, 100, and 500. A special control permits zeroing the meter for a.c. voltages under varying line conditions.

D.c. voltages are metered in ranges of 1, 5, 10, 50, 100, 500, and 1,000 with 11 megohms input impedance. A zero center is provided for discriminator alignment.

ANTENNA LINE CLIP

General Cement Mfg. Co., 919 Taylor Ave., Rockford, Ill., has just introduced a new three-way TV antenna line clip



which is easily attached to the antenna lead-in without solder. In addition to clipping onto the terminals at the back of any receiver straight on, this clip can be hooked up sideways where space is tight, and it can also be quickly connected to the RCA plug-in type terminals.

RECORDER AMPLIFIER

TapeMaster, Inc., 13 West Hubbard St., Chicago 10, Ill., is now distributing the new TapeMaster model SA-13 power amplifier and speaker as a companion unit to the PT-125 tape recorder. Together, they form a complete tape recorder and playback

assembly. The amplifier delivers 8 watts peak. Total distortion is less than 1% at 5 watts output. Frequency response is within 1 db from 30 to 15,000 cycles. Damping factor is 10. The unit has a 7½-inch speaker and is housed in a 12 x 9½ x 18½-inch portable carrying case designed for good baffling.

PAPER CAPACITORS

Astron Corp., 255 Grant Ave., East Newark, N. J., announces the availability of the new type AQ capacitors. These are subminiature paper units designed for good capacitance sta-

bility over a temperature range of —65° to + 125° C. Extended-foil, non-inductive type construction is employed in the AQ capacitors to insure low resonance losses. The units are available in a variety of hermetically-sealed tubular cases and construction types.

NEW RIBBON LINE

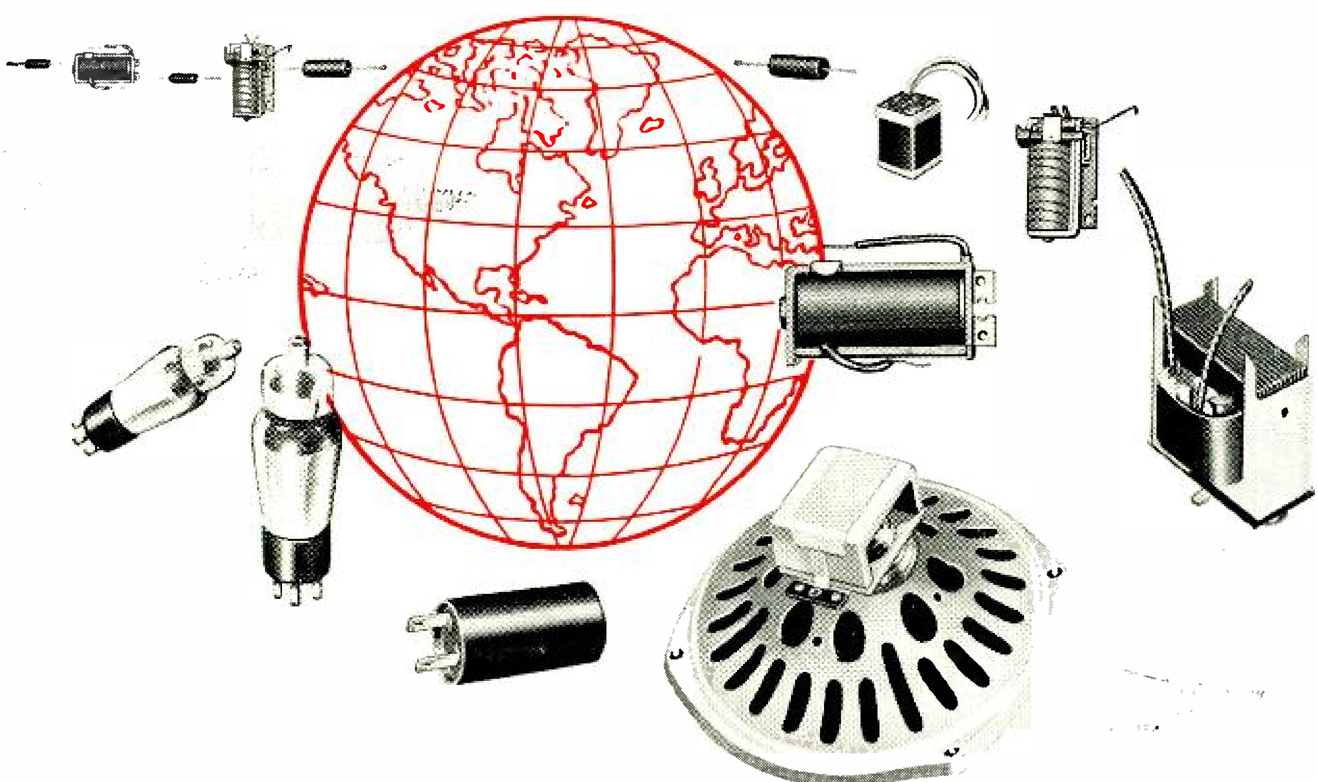
Belden Mfg. Co., 4647 W. Van Buren St., Chicago 44, Ill., is the manufacturer of the new *Weldohm* 300-ohm ribbon-type TV lead-in wire. The cable is designed to resist conductor breakage caused by wind whipping and severe flexing. The conductors are made of 20-gauge, 7 x 28 copper-clad steel with brown polyethylene insulation.

TV ANTENNA TOWER

Rohn Electronic Supply Co., 2108 Main St., Peoria, Ill., manufactures a line of antenna towers designed to withstand winds up to 80 miles per hour when set in a 3-foot concrete base. The tower is a three-cornered arrangement with 1-inch tubular steel legs. Since the tower is grounded, damage from lightning is negligible.

—end—

All specifications given on these pages are from manufacturers' data.



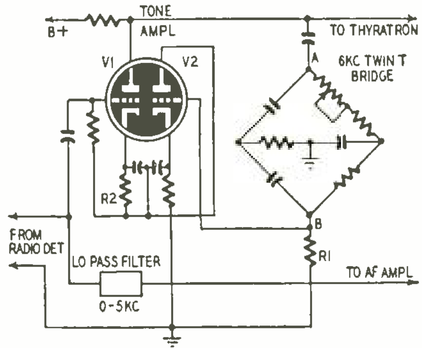
SELECTIVE SQUELCH

Patent No. 2,590,310

George D. Hanchett, Jr., Millburn, N. J.

(Assigned to Radio Corp. of America)

In a police radio network, headquarters must contact various cars from time to time. Sometimes a general call must be picked up by all cars. At other times, the call concerns only one car or a certain group of cars. This patent discloses a selective control system which alerts the desired cars. A distinctive h.f. signal is assigned to each car. The tones, superimposed on the carrier, are chosen to be above the audio pass-band so they cannot be heard. Normally all receivers are blocked. When the assigned tone is picked up, the corresponding receiver begins to operate.



The radio detector delivers all control tones as well as the audio message. The control tones are filtered out so only the audio feeds the audio amplifier. However, as mentioned above, this amplifier is normally squelched and the set is quiet. It is up to the control tone to operate it. The control circuit is shown in the diagram.

Detector output is fed to the tone amplifier which consists of V1 and V2 in series. This amplifier cannot function if either triode is blocked. Assume a *positive* signal is applied to V1. Then its plate goes negative. Part of this negative voltage appears across R1 and is delivered to V2. It blocks the triode. Now let a *negative* signal appear at V1. A positive drop occurs across R1. V2 conducts fully, but this produces such a large bias across R2 that V1 is blocked. There is only one way to get any output from the tone amplifier. This is by eliminating the degenerative voltage across R1.

Many of us know how a twin-T works. All frequencies will be transmitted through the twin-T except that to which the bridge is tuned. Input signals may be fed in between A and ground. The output will appear between B and ground. Therefore, at the tuned frequency there will be no degeneration across R1. Since the twin-T is tuned to the assigned signal tone, V1 has output only while this particular tone is being transmitted.

When V1 output is available, it triggers a thyratron. This gas tube completes the cathode circuit of the a.f. tube and permits it to operate.

COLD CATHODE FLIP-FLOP

Patent No. 2,593,375

Charles R. Williams, Hawthorne, and Glenn E. Hagen, Lawndale, Calif.

(Assigned to Northrop Aircraft, Inc., Hawthorne, Calif.)

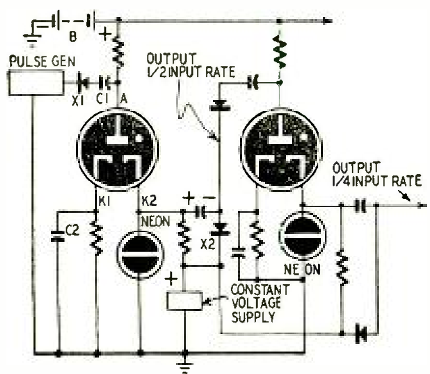
This flip-flop circuit requires a special gas-filled tube with two cathodes and a single anode. Pulses applied to the anode trigger the cathodes alternately. A single output pulse is available (at either cathode) for every pair of pulses across the input. Since the tube has no filament, power requirements are low.

A discharge is normally present between the anode A and one of the cathodes, K1 or K2. At a given time, assume that K1 is the conducting cathode. Current then flows from ground to K1 and from the anode into battery A. It charges C2 to a potential greater than that of the constant voltage supply.

The generator sends out negative pulses. These can flow through X1 and C1 to the tube anode, to interrupt the tube discharge. When this occurs, the anode voltage begins to rise to the terminal voltage BA. When the potential between A and K2 is large enough, a discharge occurs between these elements. The tube does not fire between A and K1 (instead) due to the positive charge on C2.

The next negative pulse again interrupts the tube discharge. By this time C2 has been discharged. K1 now has a lower potential than K2. Thus K1 becomes the conducting cathode. Thus the cathodes conduct alternately.

When either cathode fires, there is an instantaneous drop in the potential between it and the anode. Also, a high current surge flows between this cathode and the anode. While K2 conducts, a



large current flows through the constant voltage supply and its limiting resistor. The neon lamp is triggered, thus indicating the binary count. This lamp is extinguished when K1 conducts.

At the moment K2 begins to conduct, a sharp positive pulse appears across the neon lamp. It biases rectifier X2 to full conduction and charges the capacitor with the polarity shown. As a result, a negative pulse is available for transfer to the next tube. The output of the second stage has a pulse rate one-fourth that of the input generator.

X1 prevents negative pulses from passing from the tube anode back into the pulse generator.

DIRECT-COUPLED AMPLIFIER

Patent No. 2,590,104

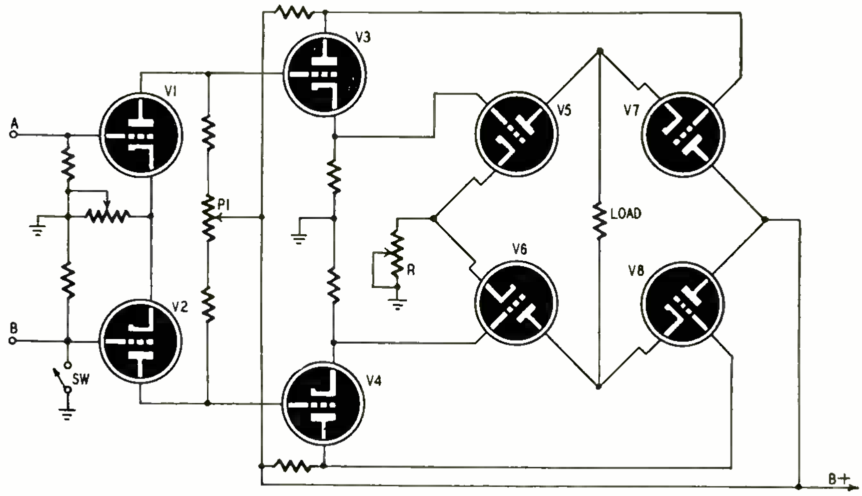
Howard L. King, Vancouver, Wash.

(Assigned to United States of America as represented by the Secretary of the Interior)

This amplifier handles signal voltages from d.c. up to about 10,000 cycles with negligible phase shift. It has high input impedance and can feed loads as small as 1 ohm. Distortion is very low. The input may be balanced or single-ended.

For single-ended input, SW is closed. Plate and cathode resistors of V3 and V4 are all equal. These tubes feed a bridge network composed of V5, V6, V7, and V8. With no signal and P1 correctly set, the voltage across the load will be zero.

Assume that the input signal is positive at A and negative at B. Current through V3 will decrease while the V4 current will rise. Grids of V5 and V8 will go more negative, while the grids of V7 and V6 will be driven more positive. These simultaneous changes unbalance the bridge, and a voltage appears across the load.



R should be adjusted to avoid overdriving the tubes in the last stage. Because of the balanced operation no a.c. appears across this resistor and there is no degenerative feedback.

In the balanced condition there is no d.c. through the load. This makes it possible to apply the circuit to electromagnetic or iron-core inductance loads without loss of inductance due to partial or complete core saturation. A loudspeaker voice coil might be connected directly as a load, eliminating the output transformer. The B supply voltage would have to be twice the normal value, as the output tubes are in series for d.c. V7 and V8 might require a separate heater supply insulated for the high voltage to ground.

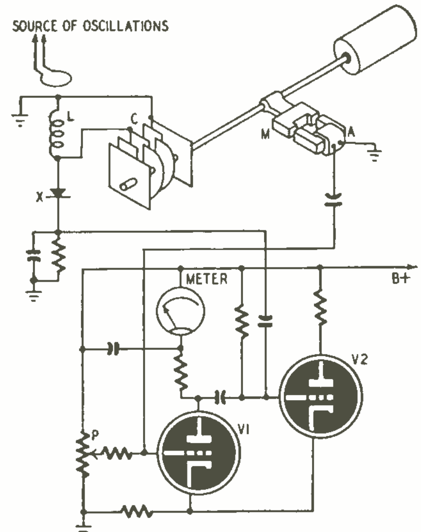
FREQUENCY MEASUREMENT

Patent No. 2,592,235

Alfred F. Bischoff, Ballstan Spa, N. Y.

(Assigned to General Electric Co.)

This r.f. meter can measure a changing frequency as well as one that remains constant. A motor-driven variable capacitor tunes a resonant circuit over the desired frequency band. The interval between the start of each sweep and the instant of resonance determines the frequency of an incoming signal. A directly-calibrated meter is used.



L-C is a variable tank whose capacitor C is swept by a motor. The same motor also moves magnet M past the poles of armature A. C has a straight-line frequency characteristic during its forward sweep from minimum to maximum capacitance. Preferably, the remainder of the sweep (return from maximum back to minimum) should be accomplished within a relatively small angle of rotation. Triodes V1, V2 form a multivibrator. Normally V2 conducts and V1 is blocked. This condition is set up by adjusting P. As in any multivibrator, only one of the triodes conducts at any given time.

At the start of each forward sweep of C, the magnet M moves past A as shown. This induces one complete a.c. cycle in the armature coil. The coil of armature A is polarized to induce a *negative* half-cycle first. This voltage, applied to the grid of V1 has no effect since this triode is already blocked. The positive half-cycle which follows unblocks the triode and cuts off V2. The plate current meter now starts to indicate. At some later instant, L-C tunes to the signal and a positive pulse is transmitted through rectifier X. This unblocks V2 and cuts off V1, ending the flow through the meter. The average reading on this meter depends upon the interval during which V1 conducts. In turn, this depends upon the signal frequency.

For a higher frequency, resonance occurs at lower capacitance of C, that is, shortly after the start of its forward sweep. Therefore V1 conducts for a relatively short time and the meter reads low. The reading will be higher on a lower frequency. For convenience the meter is calibrated from known signals.

—end—

LOW LINE VOLTAGE

Many common complaints on three-way portable sets are due to low line voltage. Generally the converter tube refuses to oscillate at reduced plate and filament voltages. This trouble is easily cured by either of two methods:

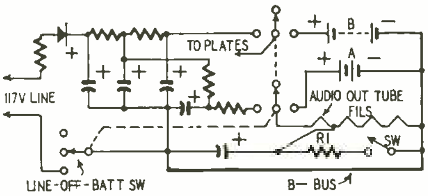


Fig. 1—Filament-voltage booster circuit.

In Fig. 1, a s.p.s.t. switch is connected between the resistor from the power-amplifier filament and ground (R1). This switch is opened when the line voltage drops, increasing the filament current of the tubes by the amount of the power-amplifier plate current.

Where the line voltage fluctuates over wide ranges the circut of Fig. 2 is recommended. This circuit will sup-

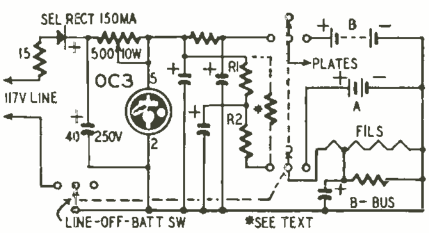


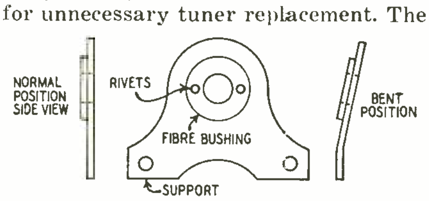
Fig. 2—Regulating tube supply voltages.

ply 105 to 107 volts d.c. to the receiver at all times. The 500-ohm series resistor is adjusted for a current of 30 ma through the regulator tube at the highest line voltage. It may be necessary to shunt the filament-dropping resistors R1 and R2 to supply the required current under the new conditions.

Fig. 1 will also compensate for lowered voltage from filament batteries.—*L. H. Trent.*

NOISE IN TV TUNERS

The front ends of the RCA KRK-2 tuners used in early 630-type TV sets are supported by brackets which have a fiber bushing fitted snugly around the tuning control shaft. When the fiber wears, it often permits enough play in the shaft to cause erratic operation and noisy tuning. This is often the cause for unnecessary tuner replacement. The

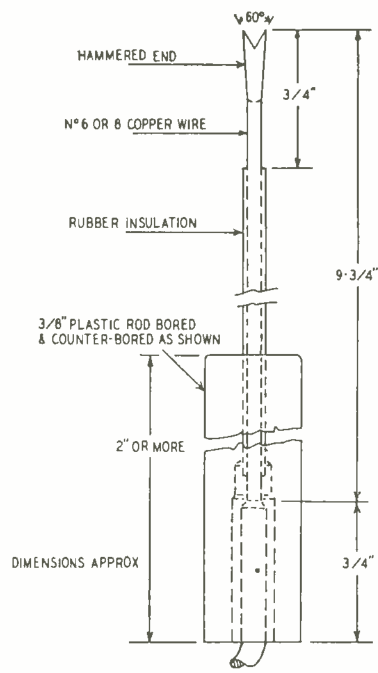


trouble can be cleared up by bending the support either in or out so it fits more snugly on the shaft. You may have to raise the shaft a few thousandths of an inch. If so, enlarge the screw holes used to bolt the bracket to the chassis, then tighten the screws while holding the support in the best position.—*Hyman Herman.*

HANDY TEST PROBE

Much of my daily work in an electronic laboratory is with test leads and probes for making circuit measurements. For this work, I have made several probes like the one shown in the drawing.

We remove approximately ¾ inch of insulation from one end of a 10-inch piece of No. 8 rubber-covered wire and then hammer and file the end to the shape shown. The other end of the lead is soldered to a brass jack designed to fit standard phone tips and the assembly is fitted snugly into a countersunk hole drilled through a ⅜-inch hard fiber or plastic rod.



The fish-tail end of the probe straddles circuit leads like a rider on a horse so it does not require a special effort to prevent it from slipping off. The wire end of the probe can be bent as desired to reach into crowded spots on the chassis.—*Wm. Oburger.*

(A standard tip jack can be used as a substitute for the brass jack described by the author. This eliminates a lot of time-consuming metal work.—*Editor*

SODA STRAW SERVICING AID

I find that a soda straw is a good substitute for a syringe or injector for squirting carbon tet into tuners and volume controls. Place one end of the straw into the bottle of carbon tet and put your finger over the other end. The liquid will be held in the straw until you release it by removing your finger. —*Jack J. Rothstein*

IMPROVISED SLIDERS

When you have heavy equipment that requires a lot of moving around on the service bench, get four metal bottle caps from gallon jugs and slip them under the rubber feet of the equipment. The metal caps make good temporary casters.—*B. W. Welz.*

$3.00 FOR CARTOON IDEAS

RADIO-ELECTRONICS prints several radio cartoons every month. Readers are invited to contribute humorous radio ideas which can be used in cartoon form. It is not necessary that you draw a sketch, unless you wish.

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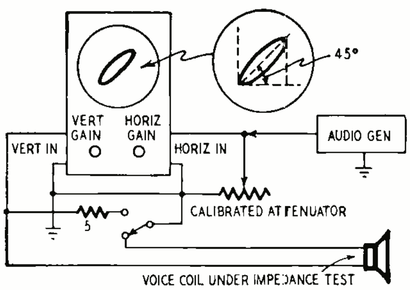
MEASURING VOICE COILS

In high-fidelity sound systems and high-power PA installations, speakers must be correctly matched to the output of the amplifier for maximum output and minimum distortion. Sometimes we are reluctant to use a speaker because we do not know its voice-coil impedance.

By using the method recommended in the *Philco Serviceman*, anyone having a scope and audio oscillator can quickly and easily measure the impedance of a speaker voice coil. The setup of equipment is shown in the diagram below.

Connect a 5-ohm resistor across the vertical input terminals of the scope and connect the a.f. oscillator and a calibrated attenuator or variable resistor in parallel across the horizontal input terminals. Set the calibrated variable resistor to 5 ohms and the oscillator to 400 cycles. Adjust the



scope gain controls so the trace is a 45-degree line forming the hypotenuse of an equilateral triangle having its legs parallel to the X and Y axes of the screen. *Do not touch the scope controls after you have obtained this trace.*

Disconnect the 5-ohm resistor and replace it with the speaker voice coil. Adjust the variable resistor for a 45-degree line identical to the one obtained in the initial adjustment. The voice-coil impedance will be equal to the reading on the dial of the calibrated resistor.

If you don't have an attenuator calibrated in resistance, substitute a 20-ohm potentiometer and use an accurate ohmmeter to make the initial setting at 5 ohms and to measure its resistance at the final setting.

EMERGENCY POWER SUPPLY

I use a surplus DM-33-A dynamotor and a 6-volt storage battery to operate small a.c.-d.c. receivers in my car and in rural areas where power lines are not available. The low-voltage leads of the DM-33-A, a 28-volt dynamotor used on the modulator of the SCR-274-N command sets, are connected to the storage battery; the high-voltage leads are fitted with a receptacle for the receiver line cord. The output voltage is about 90 volts, enough to give good results with most small receivers. This method will not work with three-way portables having tube filaments connected in series for line operation since they usually require more than 90 volts input to operate.—*Ross L. Merryhew.*

—end—

SQUARE WAVE OUTPUT FROM ANY AUDIO OSCILLATOR

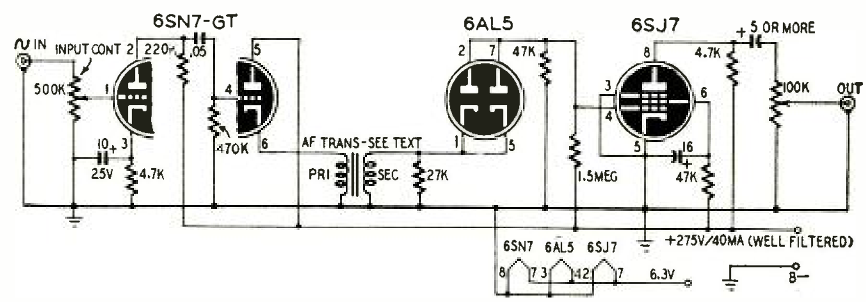
Square-wave generators are continually being adapted for new applications. They are used in electronic switches, timing devices, and for audio and video testing. A generator which develops square waves from a sine-wave source for testing audio amplifiers and allied equipment is described in *Photofact Index and Technical Digest.*

In the circuit shown, an audio sine wave between 100 and 10,000 cycles is applied to the input terminal. After amplification in the first section of the 6SN7-GT, the signal is passed to the second half of the tube, which operates as a cathode follower transformer-coupling the amplified signal to the 6AL5 bias rectifier. This tube develops a d.c. signal voltage which drives the 6SJ7 grid beyond cutoff to produce a square wave in the plate circuit.

The maximum square-wave output, 75 volts at 100 cycles and 71 volts at 1 kc, is sufficient to check a single stage in a conventional amplifier. A 4-volt sine wave on pin 1 of the 6SN7-GT develops maximum output at 100 cycles. At 1 kc, 3.4 volts is required to develop the rated output.

The transformer is an interstage audio unit having a step-up turns ratio of 2.6 to 1. The unit which was used has a primary resistance of 1,120 ohms, which provides just enough bias to limit the cathode-follower plate current to 10 ma. If the d.c. resistance of the primary is less than 1,100 ohms, make up the resistance by connecting a suitable resistor in series with the grounded side of the primary and bypass the resistor with a 10-μf, 25-volt capacitor. The 27,000-ohm resistor across the secondary reduces spurious pips and traces on the waveform by damping out shock oscillations in the transformer. The correct value may have to be determined experimentally for each transformer.

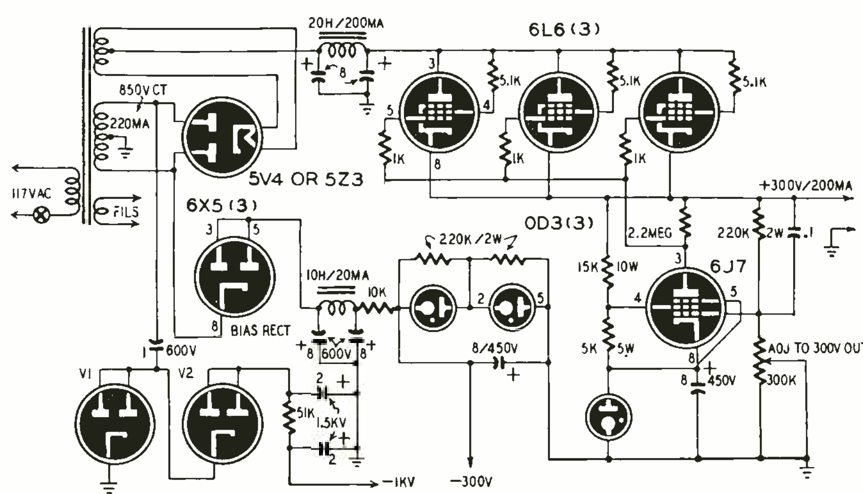
The generator draws approximately 40 ma from a 275-volt source. The supply should be well filtered to prevent hum from affecting the waveform at low frequencies.



POWER SUPPLY HAS AUTOMATIC REGULATION

A regulated power supply which delivers B voltages and currents at levels usually encountered in average receivers and amplifiers is a useful instrument in a radio-TV service shop or electronic laboratory. A supply of this type which also includes a 300-volt regulated bias supply and a 1-kv negative source for C-R tubes is a much more valuable instrument because of its versatility. Such a supply is incorporated in a TV test instrument described in *TSF Pour Tous* (Paris, France).

The circuit, with minor variations, is shown in the diagram. It delivers 300 volts regulated at current drains up to 200 ma, 300 volts negative bias at up to approximately 18 ma, and 1,000 volts with negligible load. The 5V4 or 5Z3 is a full-wave rectifier. The 6L6's and 6J7 regulate the voltage delivered by this rectifier. The bias supply uses a single 6X5 half-wave rectifier supplied from one side of the high-voltage winding on the power transformer. Voltage is regulated at 300 volts by the series-connected 0D3's. The 10,000-ohm series resistor may have to be varied



slightly so the two 0D3's draw 10-12 ma.

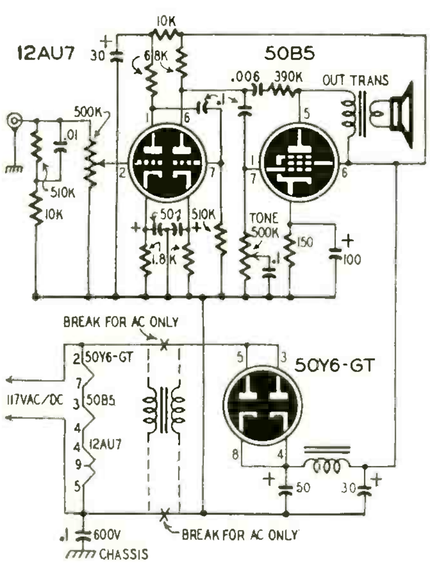
One thousand volts negative is developed by a half-wave voltage doubler circuit connected to the opposite end of the high-voltage secondary. With light loading, the voltage developed on the input filter capacitor is approximately twice the peak voltage across one-half the high-voltage secondary.

The power transformer should have several 6.3-volt filament windings. One is rated at 5 amps or more for external circuits and the heater of V1. Two 600-ma windings are for the bias rectifier and V2. The winding for the latter tube should be insulated for 2 kv or more. Two additional windings rated at 3 amps and 300 ma are for the 6L6's and 6J7, respectively.

MINIATURE AUDIO AMPLIFIER

The schematic shows the circuit of a compact audio amplifier which is designed for listeners who would like to play their FM tuners through something better than the audio system of the average radio receiver. The unit has good volume and fidelity. It drives a 15-inch speaker with clean tones and no discernible hum, even at low volume levels.

Good low-frequency response is assured by the large coupling and decoupling capacitors, inverse feedback from plate to grid of the output stage, and the equalizer in the input circuit.



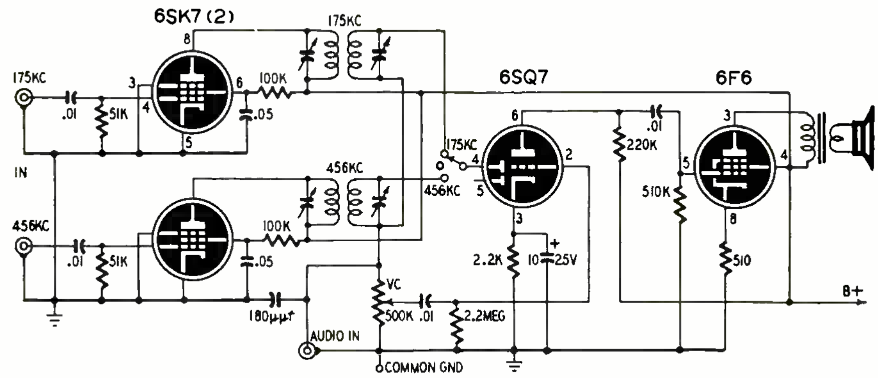
The amplifier can be constructed on a chassis approximately 5½ inches square. For the filter choke, we used the primary of a small surplus headphone transformer. A small a.c.-d.c. type filter choke can be used if you make the chassis larger.—*Paul J. Ascherl*

(This amplifier is designed to operate from a.c. or d.c. lines. If you plan to use it on a.c. only, it is advisable to install a half-wave power transformer to isolate it from the power line. Break the connections at the points indicated and connect the transformer as shown by the dashed lines.—*Editor*)

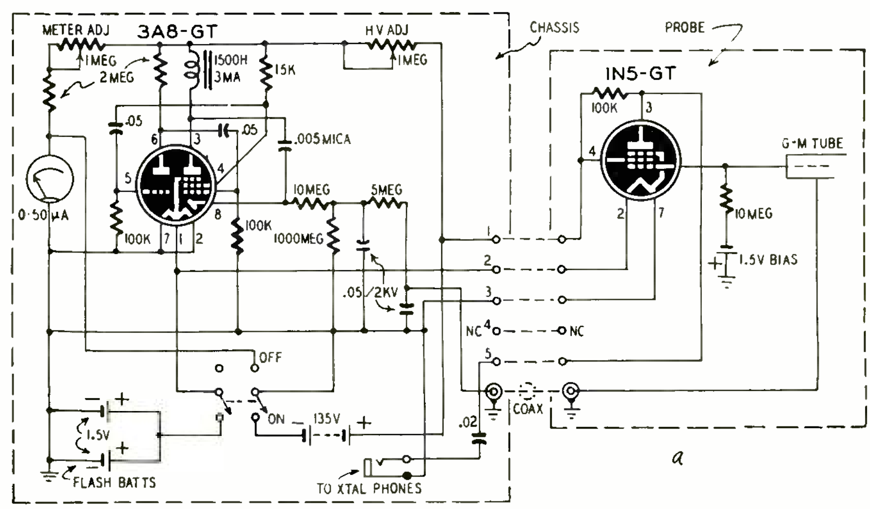
FOR AUDIO AND I.F. CIRCUITS

This simple signal tracer has two tuned channels for tracing signals and aligning broadcast receiver i.f.'s, and an input circuit for tracing and probing in audio circuits. The tuned stages consist of two 6SK7 amplifiers with 175- and 456-kc i.f. transformers in their plate circuits. The secondary of either transformer can be switched to the detector diodes of the 6SQ7 detector and first a.f. amplifier.

After aligning the tracer's transformers with an accurate signal generator, it can be used to trace a signal from the mixer plate to the second detector in receivers using 175- or 456-kc i.f.'s. Smaller receivers can be aligned without using a signal generator. Switch the tracer to the proper i.f. and connect its input to the i.f. output of the set. Adjust the set's i.f. trimmers for maximum output from the tracer's speaker. Plug a shielded lead into the audio jack for audio-signal tracing.—*B. W. Welz*



PORTABLE G-M COUNTER

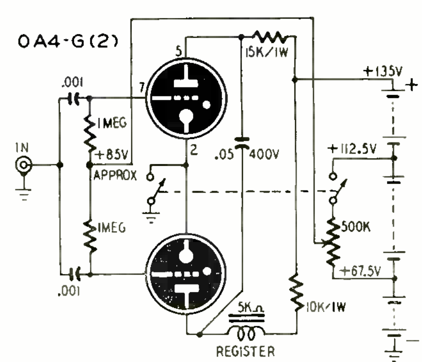


a

A supersensitive G-M counter, designed especially for detecting contamination where beta and gamma activity is near background level is described in bulletin MDDC 1502, published by the United States Atomic Energy Commission and sold for ten cents per copy by the U. S. Government Printing Office, Washington, D. C.

The instrument, called the "Clinton Walkie-Talkie," consists of a 9¾₁₆ x 7 x 3⅞ inch case to house the batteries and a multivibrator-type high-voltage supply, and a probe housing a Eck and Krebs G-M tube and 1N5-GT amplifier tube. The circuit is shown at *a*.

The triode and the screen-grid section of the pentode in the 3A8-GT form a symmetrical flip-flop multivibrator with a frequency of about 100 cycles. Each time the pentode section is cut off a positive pulse of several thousand volts appears across the 1,500-henry choke. This is rectified by the diode section and filtered to give about 1,500 v.d.c.



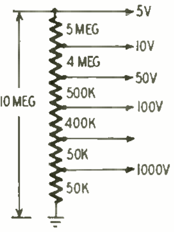
b

The scale-of-two counter shown at *b* may be used as an indicator in place of crystal headphones. The register is a 5,000-ohm unit made by Cyclotron Specialties Co. of Moraga, California.

VOLTAGE DIVIDER DESIGN

The design of a divider for a v.t.v.m. is not difficult but it may become confusing unless a system is followed.

A	B	C
VOLT RANGE		DIVIDER
5	10 MEG	
10	5 MEG	5 MEG
50	1 MEG	4 MEG
100	500K	500K
500	100K	400K
1000	50K	50K
		50K



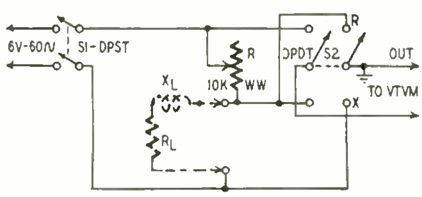
First list the desired voltage ranges in column A, starting with the lowest range. Next fill out column B, writing down the total divider resistance at the top. Under this are numbers which are inversely proportional to the corresponding voltage ranges. For example, if the next range is 5 times as large, the corresponding column B number is 1/5 the preceding one.

When the first two columns are finished, start column C. The numbers in this column are the differences between consecutive numbers in column B. When column C is finished it gives the individual divider resistances in megohms from the hot terminal to ground.—*I. Q.*

MEASURING INDUCTANCE

If you use this circuit arrangement for measuring the inductance of audio-frequency chokes and transformers, you need no longer pass up a good-looking surplus choke or transformer just because its value isn't given.

Connect the circuit up like this: The input is connected to a source of approximately 6 volts at 60 cycles



through S1. This voltage appears across resistor R and the unknown inductance in series. The 10-volt range of an a.c. v.t.v.m. is connected across the output terminals. S2 is then flipped rapidly back and forth while R is adjusted until the meter reading does not change as the switch is thrown between the two positions. The voltage drops across R and the coil are equal so the impedance of the coil equals R.

Open S1, switch the meter to the ohms range, and record the resistance readings with S2 in the R and X positions. The inductance of the coil is now calculated from the formula

$$X_L \text{ (in henries)} = \frac{R^2 - R_L^2}{377}$$

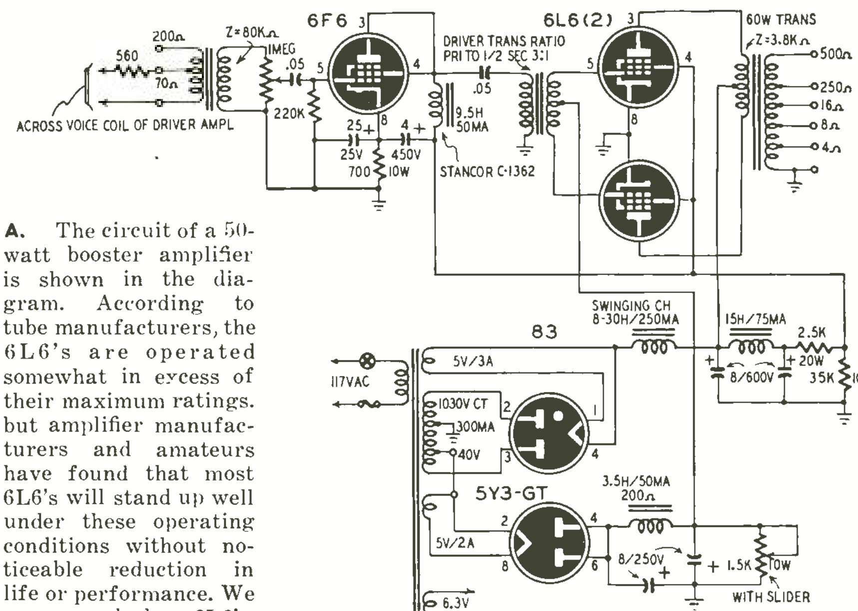
where R is the resistance of the resistor and R_L is the resistance of the coil.

You can measure the capacitance of large paper and mica capacitors by using the same setup. In this case, the resistance of the capacitor will be very high and can be ignored. The capacitance in *microfarads* equals 1,000,000 divided by 377R.—*Paul S. Lederer*

—end—

50-WATT AUDIO BOOSTER WITH 6L6 OUTPUT STAGE

? *I have a sound-movie amplifier which delivers a maximum of 15 watts output into a 16-ohm load. I would like to have a diagram of a booster amplifier which will deliver about 50 watts output. Please design such an amplifier and explain how I can connect it to the present amplifier which I plan to use as a driver.—Sgt. L. C. W., San Francisco, Calif.*

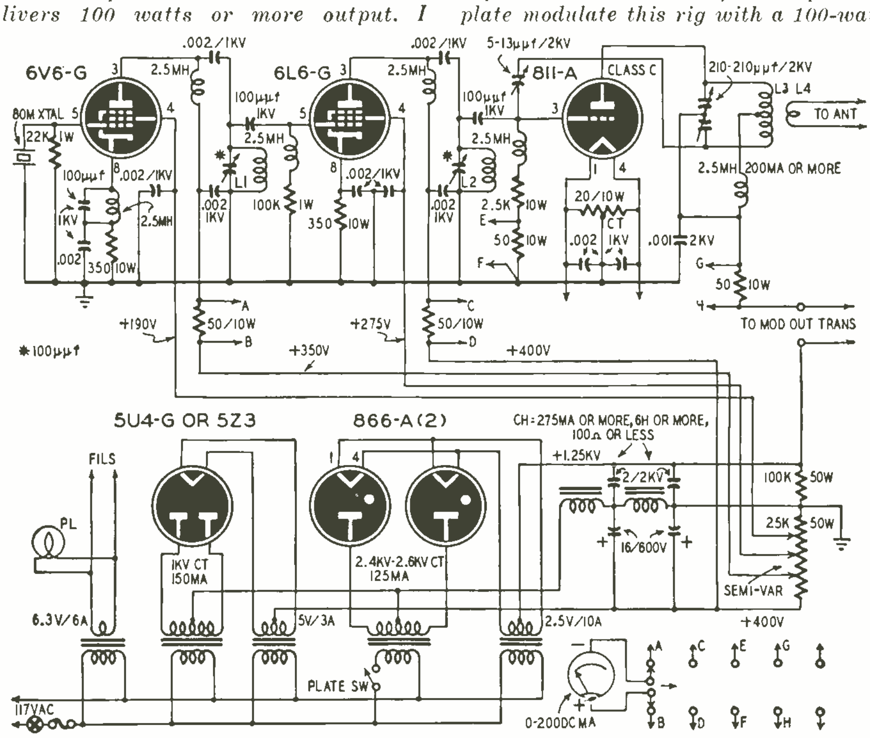


A. The circuit of a 50-watt booster amplifier is shown in the diagram. According to tube manufacturers, the 6L6's are operated somewhat in excess of their maximum ratings, but amplifier manufacturers and amateurs have found that most 6L6's will stand up well under these operating conditions without noticeable reduction in life or performance. We recommend glass 6L6's.

This unit is designed so the present amplifier can be used to drive speakers as well as to supply signal voltage to the booster unit. Input connections to the booster are paralleled across the 16-ohm speaker operated by the driver amplifier. In this way, the present amplifier can supply full power to its speaker with only a small portion of the voltage being tapped off to excite the booster. The 1-megohm volume control in the booster may be a semiadjustable unit set so the booster delivers about 45 watts output when 10 volts appears across the voice coil of the speaker in the driver circuit. The tap on the 1,500-ohm resistor should be adjusted for 31 volts of bias on the 6L6's. About 8-10 watts more can be obtained by using a separate supply for the screens.

MEDIUM-POWER TRANSMITTER FOR 75-METER PHONE

? *I would like to have a diagram of a 75-meter phone transmitter which delivers 100 watts or more output. I would like to use an 811 or similar inexpensive triode in the final. I plan to plate modulate this rig with a 100-watt*



class-B audio stage that I have.—*E. W. S., New York, N. Y.*

A. The circuit shows the r.f. stages and power supply. You can wind your own coils or use commercial plug-in units. L1 and L2 consist of approximately 30 turns of No. 22 enameled wire spaced to 1½ inch on a 1½-inch form. L3 is 30 turns of No. 14 wire, 2½ inches in diameter and 3½ inches long with a tap at the center. L4 is 1–5 turns of No. 14 wire wound around the center of L3. The exact number of turns depends on the impedance of the antenna transmission line.

With 1,250 volts on the plate of the 811, the plate current should not exceed 140 ma. Assuming that the stage is about 75% efficient, the r.f. power output will be approximately 132 watts.

V.H.F. INDUCTOR DATA

? *I need winding data for a series of coils for tuned circuits in the range of 30 to 300 mc. Can you supply winding data? How can I be sure that the coils and capacitors are tuned to the desired frequency?—A. C. F., Greensboro, N. C.*

A. You have not specified the value or range of the capacitors you plan to use with the inductors. For 30 mc and above, slug-tuned coils are often ideal for receivers, signal generators, and low-power transmitter stages since you can vary the inductance over a fairly wide range to compensate for stray inductance and capacitance. In some cases, you will be able to tune to the desired frequency by using the variable inductance and tube and wiring capacitance.

There are several commercial coils which can be used to cover frequencies in the 30–300-mc range. Cambridge Thermionic Corporation's LS-3 type 30-mc coils cover a range of approximately 15 to 50 mc and 27 to 90 mc depending on the position of the slug when tuned with a 10–100-μμf capacitor. The 50-mc coil tunes from 48 to 144 and 60–190 mc with a 10–100-μμf tuning capacitor. AR-2 and AR-5 coils made by The National Company cover from 75 to 220 mc and 37 to 110 mc respectively when used with 10–100-μμf capacitors. The J. W. Miller Company has a set of antenna, r.f., and oscillator coils for use in receivers in the 110–235-mc range.

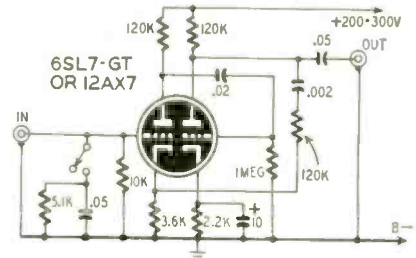
The simplest method of tuning a coil to the desired frequency with a given capacitance is to use a grid-dip meter which covers the desired range. If you don't have one and the frequency you want to reach is within the tuning range of your TV, FM, or v.h.f. receiver, you can connect the tuned circuit as an antenna trap. Insert the coil and capacitor combination in series with the antenna lead if the circuit is parallel-tuned, or across the antenna terminals of the set if the circuit is series-tuned. Adjust the inductance and capacitance for minimum signal pickup.

Coils for frequencies above about 225 mc are very critical. You can start with a simple hairpin loop or a 1 or 2-turn coil and vary its size until you get the inductance you need.

PICKERING EQUALIZER PREAMP

? *I have a Pickering model 120M cartridge in a Webster record changer. I find that I must use a preamplifier and equalizer when using this cartridge with the audio system of my radio. Please prepare a diagram of a simple circuit for this purpose, using a miniature tube if possible.—F. R., Columbia. S. C.*

A. The circuit of the Pickering model 125H preamplifier-equalizer is shown in the diagram. You can substitute a 12AX7 for the 6SL7-GT used in the original model.



The response of this circuit is approximately flat from 500 to 20,000 cycles with a rise of 6 db per octave below 500 cycles with the switch open. Closing the switch causes the highs to roll off at the rate of 20 db per octave above about 4,000 cycles.

High-grade resistors and capacitors minimize circuit noise. Use wire-wound resistors for the plate loads (120,000 ohms) and for the 3,600-ohm cathode resistor. Use shielding and a compact layout to reduce hum pickup. Noise and hum level of various tubes vary over comparatively wide levels. Hand-pick the tube for low noise and hum.

Pickering also makes a similar preamplifier with built-in power supply (model 230H); and the 132E record compensator, with six h.f.-rolloff curves. (The plate resistors may be made up of two 56,000-ohm (or 51,000-ohm) resistors in series, as higher ohmages are available only in expensive high-wattage ratings.—*Editor*)

—end—

RE: INTERMITTENT GHOSTS

In the "Television Service Clinic" of the March, 1952, issue, a reader inquired as to the cause of intermittent ghosts in the Techmaster 630 type receiver. I had this trouble in my Techmaster 630 and traced it to an intermittent plate-coupling capacitor between the first and second video i.f. amplifiers. This trouble can be caused by leaky or intermittent coupling capacitor anywhere in the video i.f. strip. I suggest that he get some high-quality 270-μμf capacitors and replace those now in the set.—*E. F. Scheer*

(We received several phone calls from readers who advised us that the condition was probably caused by intermittent coupling capacitors. It seems that this trouble is common to many 630-type sets.—*Editor*)

UNUSUAL SERVICING TROUBLE

An RCA model 87K1 that came in for repairs exhibited every sign of a defective volume control. Moving the control knob even a short distance caused a terrific scratching sound and the volume would shift erratically from high to low. I doubt that any service technician would have hesitated to order a new volume control. That's what I did. But, I first decided to check the tubes. Two, the 6F5 and the 6H6 a.v.c. tube, were a bit weak. We replaced them and then turned on the set to note the performance. When the set came on it played like new; volume was high, tone quality was excellent. Not a sign of scratchiness was evident in the volume control. It was as silent as a tomb over the entire length of travel; not a trace of noise could be heard from it.

More than a little puzzled by the error in my original diagnosis, I replaced the old tubes and tried the volume control again. Sure enough, there it was—the scratching was just as bad as ever! We never found out why two weak tubes could cause a condition with all the symptoms of a defective volume control, but we do know that replacement of the volume control was completely unnecessary.—*Joseph Amorose*

1950 SPARTON SETS

Late in 1950, the shortage of resistors made it necessary to use resistors which were improperly color-coded. These units meet all specifications except color identification markings and were inspected at the factory to insure proper resistance. Therefore, if it is necessary to replace a resistor in one of these sets, please refer to the schematic diagram for the correct resistance value.—*Sparton Service Bulletin*

SERVICING TV SETS

When servicing a TV set, be sure to check the 5U4-G rectifier socket before turning the set on end or on its side to get at the under side of the chassis. Pins 1 and 4 must be in the vertical plane or the filament is likely to sag and short to the plate, thus causing the tube to blow out. I had the sad experience of blowing a couple of new tubes before I realized the source of the trouble.—*Paul Trinkle*

ARCING IN OLYMPIC TV SETS

Unusually high humidity and heat may cause arcing and corona discharge on the underside of the 1B3-GT socket assembly. This condition may be corrected by the following procedure:

1. Procure ceramic insulator kit. (Part number SB51-13)
2. Remove screws holding high-voltage cage to chassis; remove tube clip leads and high-voltage clip lead. It is unnecessary to unsolder any leads.
3. Turn cage over. Remove two screws holding bakelite plate to side of cage and mount two ceramic insulators to plate. Fasten two spade bolts to opposite ends of ceramic stand-offs and mount assembly to end of cage in approximately the same former position.
4. Solder the tube-socket retainer ring to the nearest corona button. Reassemble cage to chassis.
5. Check rubber cover on high-voltage capacitor and on second-anode lead for dust and moisture. Dress leads carefully.

Olympic Television Service Bulletin

ADMIRAL 30A1 TV CHASSIS

Hum or black bars across the picture can be caused by a faulty input filter capacitor in the B supply feeding the video and sweep circuits. This capacitor, connected to the 5U4 side of the 2-henry filter choke, should be replaced with a 40-μf, 450-volt unit.—*Wilbur J. Hantz*

DU MONT RA-103 TELESETS

Separation of sound and picture, accompanied by a strong hum on either side of the sound center frequency, has been the complaint on several of these sets. In each case the trouble was traced to a shorted .0068-μf screen bypass in the first 6AG5 picture i.f. amplifier. Replacing this capacitor clears up the trouble.—*A. D. Marikle*

CHECKING AUTO-RADIO FUSES

Visual inspection of auto radio fuses will not always tell you if they are bad, because some of them blow out at one end instead of in the center. Test the fuse with a low-range ohmmeter because just a few ohms of resistance in the fuse will allow a good vibrator to operate but will not supply proper heater voltages.—*Peter J. Foradas*

SERVICING 3-WAY SETS

Many of us tend to underestimate the value of a variable-voltage line transformer when servicing three-way portables. One of these sets was brought in because it had stopped playing while being operated on the power line. It didn't play in the shop until we replaced the 1R5 oscillator tube. We returned the set to its owner after allowing it to play normally for a few hours. The next day, the set was returned with the same complaint. It had stopped playing during the day and had been left turned on and plugged into the line. It started to play again in the middle of the night and woke up the whole family.

Plugging the set into the output of a variable-voltage line transformer, we found that it would not start to operate until the line voltage reached 120 and would cut out again when the voltage dropped to about 115.

The trouble was cleared up by substituting a 75-ma selenium rectifier for the 50-ma unit in the set. Apparently the original did not pass enough current at normal line voltages, although its forward and backward resistances checked o.k. on an ohmmeter.—*Walter Stern*

MOTOROLA AUTO RADIOS

Replacing the cloth cover of the speaker grill with a well-grounded copper screen often eliminates ignition noise and similar interference which may enter the set through the speaker opening. This practice is equally useful in other models having the speaker mounted in the receiver cabinet.—*O. C. Vidden*

SERVICING TV INTERMITTENTS

Many compactly-built TV receivers develop intermittents only after the set has heated up during several hours of operation. The intermittents seldom appear when the set is removed for servicing because the added ventilation prevents the temperature from rising to the point where intermittents begin.

Mr. Richard Wiseman, of Tomaso's Inc., 7115 West Grand Avenue, Chicago, Ill., has found a practical solution to the problem. He simply uses a home hair dryer to blow a stream of warm air on the suspected parts, thus simulating an in-the-cabinet condition.—*S. L. Chentok*

60-CYCLE DISTORTION IN TV SETS

A strong 60-cycle signal in video or horizontal-sweep circuits may cause a heavy horizontal bar across the screen, wavelike-distortion at the sides of the raster, or both. This trouble is easily identified and simple to localize. A trouble which is often deceptive and difficult to diagnose occurs when just a small amount of 60-cycle voltage finds its way into the video or sweep circuits. The result is a slight distortion or interference pattern in the picture. During some programs, the distortion is motionless and is likely to pass unnoticed. On others, it may move vertically and be very annoying to viewers.

The interference pattern is stationary when its frequency and that of the set's vertical oscillator are exactly the same, as is the case when the TV sync generator is locked in with the 60-cycle power source supplying the TV set. Thus the interference is usually motionless on local programs. However, when the local station broadcasts programs originating at a distant point, as is the case with many network programs, the frequencies of the vertical oscillator and the interference will be slightly different and the distortion will drift vertically.

Whenever you receive a complaint of distortion or interference of this type, be sure to check the set on a network program and examine the picture carefully for a faint horizontal bar and slight bending at the sides of the raster The sources of this trouble are the same as when the interference is much more severe but it may be more difficult to localize. The hum may be caused by heater-to-cathode leakage in the picture tube, d.c. restorer, video amplifier, video detector, picture i.f., or tuner stages. It can usually be tracked down with a scope, with an r.f. detector probe added for the stages ahead of the video detector. It may also be due to insufficient filtering in the B supply circuits to these stages, or to capacitive or inductive coupling between signal and heater leads. A speaker field coil can cause similar troubles, and occasionally the antenna lead-in wires may pick up strong 60-cycle fields from power lines or machinery.—*Robert C. Ramsey*

SENTINEL 421 AND 423

Symptoms: No high voltage, horizontal oscillator not working, and 50–150 volts positive on the grid of the control section of the 6SN7 horizontal oscillator tube. This is caused by a shorted or leaky coupling capacitor between the horizontal output transformer secondary and the 6AL5 phase-detector tube. The condition can be cleared up by replacing the capacitor. It is advisable to check the diode load resistor and the plate resistor of the reactance tube.—*Arthur D. Marikle*

—end—

THE FUND REACHES $9,654.76

HELP-FREDDIE-WALK FUND

It is with great pleasure that we acknowledge the continued response to the Help-Freddie-Walk Fund, contributions to which are still coming in from far and wide. Inaugurated over two years ago, the fund was started in an attempt to supply some of the thousands of dollars that will be needed in the fight to aid Freddie Thomason, little son of Herschel Thomason, radio technician of Magnolia, Arkansas. For four-year-old Freddie was born without arms and legs, and all his life he will be dependent upon mechanical appliances.

But already he is mastering the rudiments of walking by artificial means. As his father wrote recently: "Freddie received his new legs and he can practically walk on them. He can pick them up one at a time, but still has to master the forward motion. The legs are about three inches longer, and make him look like a very grown-up boy. Our hopes for him are very high now, and we know that he will be walking more than ever before long."

The faith and encouragement of his parents are mirrored in the many letters we here at RADIO-ELECTRONICS receive each month. Typical of the personal interest our readers take in Freddie are the following excerpts:

From Jacob Shapiro, Brooklyn, N.Y.: "I like the way Freddie smiles in your latest issue. Here is my check." And from Juli, New York City, we get the following comments: "I derive a great deal of pleasure helping Freddie walk. Having made contributions in the past, I feel it my duty to write this letter.

With prices high and salaries at a standstill, it's difficult to make large donations. Many times I wanted to send a little something, but every time I felt I could spare a little more next week. Many readers must feel the same way. So kindly accept my modest donation. I hope the many who have helped Freddie in the past will do so again and again."

We should like to point out to Juli, and any others who have been afraid that their donations might be too small to be of any importance, that NO donation is too small for our sincere appreciation and acknowledgment. Every little bit helps!

We should also like to make special note of a donation of $34.10 sent in by Dixon J. Helmick, E.T.1, in the name of the E-T Gang on the U.S.S. Boxer. Many thanks to our servicemen who take time from their varied duties to contribute to this worthy cause.

Please send your contributions, large or small, from time to time. *Make all checks, money orders, etc., payable to Herschel Thomason.* Address letters to:

HELP-FREDDIE-WALK FUND
c/o RADIO-ELECTRONICS Magazine
25 West Broadway
New York 7, N.Y.

FAMILY CIRCLE CONTRIBUTIONS

Balance as of May 19, 1952	$ 551.50
Mary Westerlind, Brooklyn, N. Y.	2.00
	$ 553.50

RADIO-ELECTRONICS CONTRIBUTIONS

Balance as of May 19, 1952	$9,026.16
Anonymous, Boston, Mass.	1.00
Anonymous, Albuquerque, New Mex.	1.00
Anonymous, Kew Garden Hills, N. Y.	2.00
A Reader, Chicago, Ill.	1.00
C.R.Buchanan, W4JBV, Disputanta, Va.	3.00
E. J. Cazeman, Shreveport, La.	5.00
John L. Cooper, Petal, Miss.	1.00
C. J. Dempsey, Euclid, Ohio	3.00
From the ET Gang on the U.S.S. Boxer	34.10
Juli, New York, N. Y.	1.00
William P. Oieffenbach, c/o Postmaster, San Francisco, Cal.	10.00
Lt. Wille J. Rivers, Shaw AFB, S. C.	5.00
Jacob Shapiro, Brooklyn, N. Y.	4.00
Mr. & Mrs. F. Walsh, Castleton-on-Hudson, N. Y.	1.00
T. J. Welch, Brooklyn, N. Y.	3.00
RADIO-ELECTRONICS CONTRIBUTIONS Received to June 19, 1952	$9,101.26
FAMILY CIRCLE CONTRIBUTIONS	553.50
TOTAL CONTRIBUTIONS to June 19, 1952	$9,654.76

Radio Thirty-Five Years Ago
In Gernsback Publications

HUGO GERNSBACK
Founder

Modern Electrics	1908
Wireless Association of America	1908
Electrical Experimenter	1913
Radio News	1919
Science & Invention	1920
Television	1927
Radio-Craft	1929
Short-Wave Craft	1930
Television News	1931

Some of the larger libraries still have copies of ELECTRICAL EXPERIMENTER on file for interested readers.

AUGUST, 1918
ELECTRICAL EXPERIMENTER

The Magnetic Storm, by H. Gernsback
The Phenomena of Electrical Conduction in Gases, by Rogers D. Rusk, M.A.
Memorizing The Code, by Harold A. Bauman
New "Glass Slate" For Teaching Hook-Ups.
An Improved Condenser Scale.
A Different Rotary Switch.
The Design and Use of the Wave-Meter, by Morton W. Sterns

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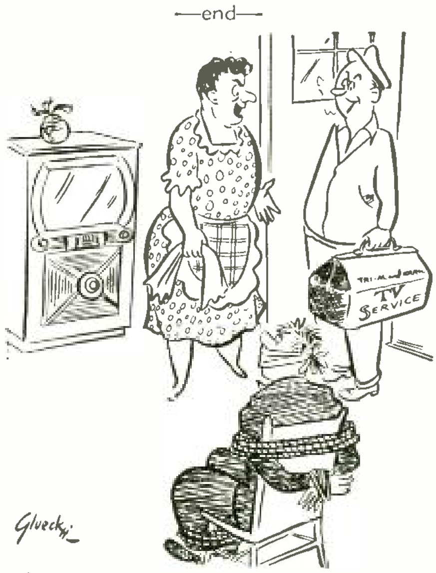


"Glad to see you—couldn't keep my husband from tinkerin' with it any more."

Eugene J. Flesch, who had been chief specification engineer of STANDARD TRANSFORMER CORP., Chicago, was promoted to the position of assistant to the general sales manager, according to an announcement by Jerome J. Kahn, Stancor president. He will assist Gilbert C. Knoblock, general sales manager, in sales and distribution.

Frank B. Powers was elected vice-president in charge of manufacturing at a meeting of the Board of Directors of P. R. MALLORY & Co., Indianapolis. He came to the company from Federal Telephone and Radio where he had been vice-president in charge of operations and a member of the Board of Directors.

Charles Castle was named sales manager of the Distributor Division of WEBSTER-CHICAGO CORP. Charles Dwyer, former service manager, succeeds Castle as assistant sales manager of the Distributor Division. Both men have been with the company since 1948.

Samuel B. Williams was promoted to assistant to the president of SYLVANIA ELECTRIC PRODUCTS. He had been director of public relations since 1949.

T. M. Douglas was elected a vice-president and director of FEDERAL TELEPHONE AND RADIO CORP., Clifton- Passaic, N. J., affiliate of International Telephone & Telegraph Corp. At the same time, S. J. Powers, manager of Federal's Selenium-Intelin Division, was elected a vice-president. Douglas, who had been works manager, will now serve as general works manager.

Victor Mucher, president of CLAROSTAT MFG. CO., Dover, N. H., and AUSTIN C. LESCARBOURA, head of the Croton-on-Hudson, N. Y., advertising agency which services the Clarostat account, were awarded gold wrist watches and testimonial scrolls honoring their quarter century of service to the company.

. . . **George W. Henyan** resigned as chief of the components branch of the Electronics Division of the NATIONAL PRODUCTION AUTHORITY. He returned to General Electric as assistant to the general manager of the Tube Department. Robert O. Bullard, who had been manager of manufacturing for industrial and transmitting tubes, advanced to Henyan's former position as manager of industrial and transmitting tubes.

. . . **Joseph J. Kearney, A. K. Mallard,** and **Ted Martin, Jr.**, former field sales representatives for the RCA TUBE DEPARTMENT, were promoted to be district managers of the East Central, Southwestern, and Northeastern districts, respectively.

. . . **Albert Saunders** and **C. Pat Walder** were appointed district managers for ALLIANCE MANUFACTURING CO., Alliance, Ohio, in the first of a series of decentralization moves by the company. Saunders will be responsible for all field men east of Altoona, Pa., and Walder will handle the new western district. Both have been with the company for three years.

—end—

Polio Pointers FOR 1952

DON'T get chilled nor bathe too long in cold water.

DON'T become fatigued from overwork or play.

DON'T mix with new groups.

DON'T take children out of camp or playground where there is good health supervision.

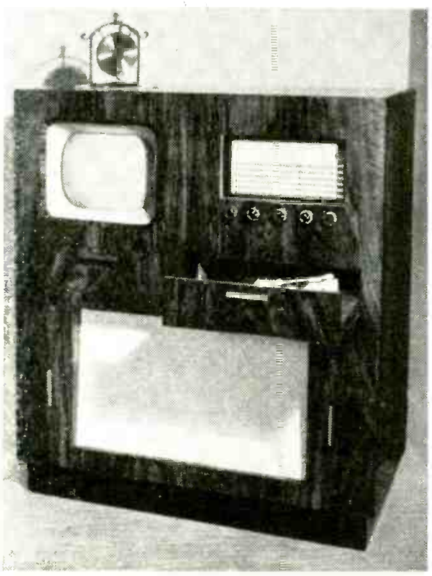
Recommended by

THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS

DUTCH CRAFTSMANSHIP

Dear Editor:

In the four years I have been reading RADIO-ELECTRONICS I have seen only a few articles from Dutch sources. Perhaps you will be interested in this photograph of my home-made TV-Radio-Phonograph combination. The TV set has a 12-inch picture tube, with a 250-kc r.f. high-voltage supply. There is only one channel in Holland at the present time, transmitting a 625-line



Mr. de Graaf's **homebuilt combination.**

picture, with 50-cycle interlace (25 frames per second). The channel is 7 mc wide, with picture carrier on 62.25 mc, and FM sound on 67.75 mc.

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I am happy to tell you that I hope to come to the United States this year, and expect to make my permanent residence in the State of Utah.

P. DE GRAAF

Utrecht, Holland

KARLOFF'S KEEPERS?

Dear Editor:

In regard to Mr. Richardson's letter —"Conversions Dangerous?"—in the March issue of RADIO-ELECTRONICS, I get the impression that we TV-Radio technicians are being referred to as "parts replacers". I concede that parts must be replaced, but the technician must have the knowledge and ingenuity to find out *which part* to replace. The design engineer, like Frankenstein, has created a monster, and we technicians have to turn it loose and keep it on the right path.

As to the reference to garagemen—the auto mechanic is a skilled technician in his own right, but in a full day's work he does not use as much knowledge as it takes to do *one* TV repair job.

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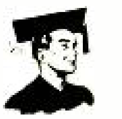

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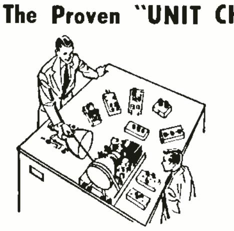

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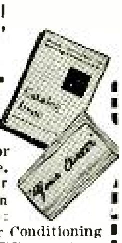

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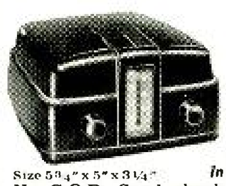

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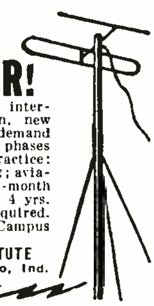

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JAM ON AM

Dear Editor:

Your June issue contained a letter from L. S. Bitton asking "Why not more AM broadcast stations?" He says "Theoretically the band is crowded—but not practically." I think any competent radio engineer will assure him that the band is crowded to the gunwales, no matter how you look at it. The stations that he says "go off the air at 6 pm" do so from sheer necessity because of this extreme crowding.

My point is: FM is the obvious and perfect answer, hence my sincere bewilderment at why anyone should even consider adding more units to the AM band. FM can—and does—do everything that AM ever has, at less cost, less technical trouble, and with greater clarity. Its only disadvantage is a temporary lack of receivers, which will be corrected automatically by the very lack of AM service which Mr. Bitton decries. Except for long-distance clear channels AM is dead—it just hasn't fallen off its feet yet.

MARK T. MCKEE, JR.
WMLN, Mt. Clemens, Michigan

(The admitted lack of FM receivers is, of course, just the point that those who agree with Mr. Bitton consider decisive. Even though FM stations are erected in small communities, they ask, who will receive them? But this lack of FM receivers can be remedied, whereas no amount of rationalization can increase the available spectrum space on the already badly overcrowded high-frequency end of the present broadcast band.—*Editor*)

FOR TV DX HOUNDS

Dear Editor:

I have been reading the article "TV Pattern For The Future" in the May issue of RADIO-ELECTRONICS. The changes made or suggested for stations in New York, Connecticut, and Rhode Island make very good sense to me.

I worked on Mt. Washington, New Hampshire, at an elevation of 6,288 feet. We were 145 miles from the nearest TV stations in Boston, yet there was never a day when we could not receive them clearly. However, there was generally co-channel interference on channel 4 from WRGB in Schenectady, N. Y. We were also able to get the low-channel New York City stations, but with co-channel interference on 5 between WABD and WSYR-TV (Syracuse, N. Y.).

In the fall of 1949 a smoke layer from forest fires in Canada gave us a chance to log about 20 high- and low-channel stations, including every station in New York City and Philadelphia.

Our best dx was Jacksonville, Florida, on channel 2, although we were never able to get anything from Delaware, Maryland, or Washington, D. C.

If anyone is interested in conducting tests on Mt. Washington, I suggest they get in touch with Mr. Wallace E. Howell, Director, Mt. Washington Observatory, 2 Divinity Avenue, Cambridge, Mass.

NORMAN TURNER
Cerro de Pasco, Peru

—end—

ELECTRONICS FOR COMMUNICATION ENGINEERS, by John McGraw and Vin Zeluff. Published by McGraw-Hill Book Co., Inc., New York, N.Y. 8¼x10¾ inches, 610 pages. Price $10.00.

This is a compilation of selected articles which have appeared in *Electronics* Magazine during the past 5 years. They have been edited and condensed. Seldom have such a wide variety of subjects and such solid information been published in one book. A total of 252 articles are presented.

There are 16 chapters, with such representative headings as: amplifiers, microwaves, filters, measurements, electronic music, oscillators, components. A list of contents names the various articles, gives page number and original publication date. The index lists by author as well as by subject matter. This makes it easy to locate any desired article.

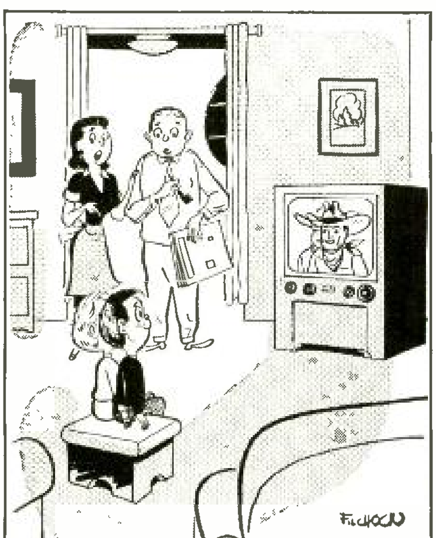
This book is a good cross-section of recent electronic research, design and instrumentation. Many articles are practical in nature. Schematics, operating data and charts appear often. We find information on such practical topics as cathode followers, gated-beam circuits, sweep oscillators, voltmeters, transistors, thermistors, TV tuners and generators, a. f. filters, and others.

—*IQ*

RADIO AND TELEVISION RECEIVER TROUBLESHOOTING AND REPAIR, by Alfred A. Ghirardi and J. Richard Johnson. Published by Rinehart Books, Inc., New York, N.Y. 6 x 9 inches, 822 pages. Price $6.75.

This volume is written for the practical man. Theory is given where needed, but attention is focused on proved methods for locating and correcting defects. It is well suited for radio beginners who know the basic principles of electricity.

The first half of the book (11 chapters) describes receiver components and their most common faults. Clues are given for locating noise, hum, and distortion, as well as that most-dreaded trouble, intermittent operation. Sepa-



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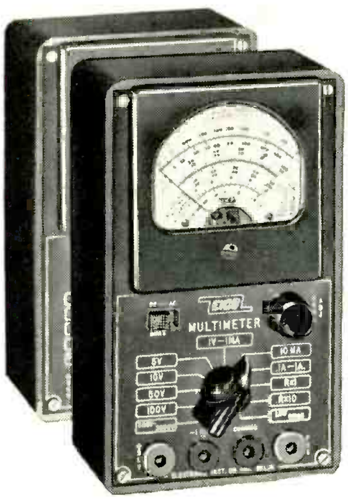

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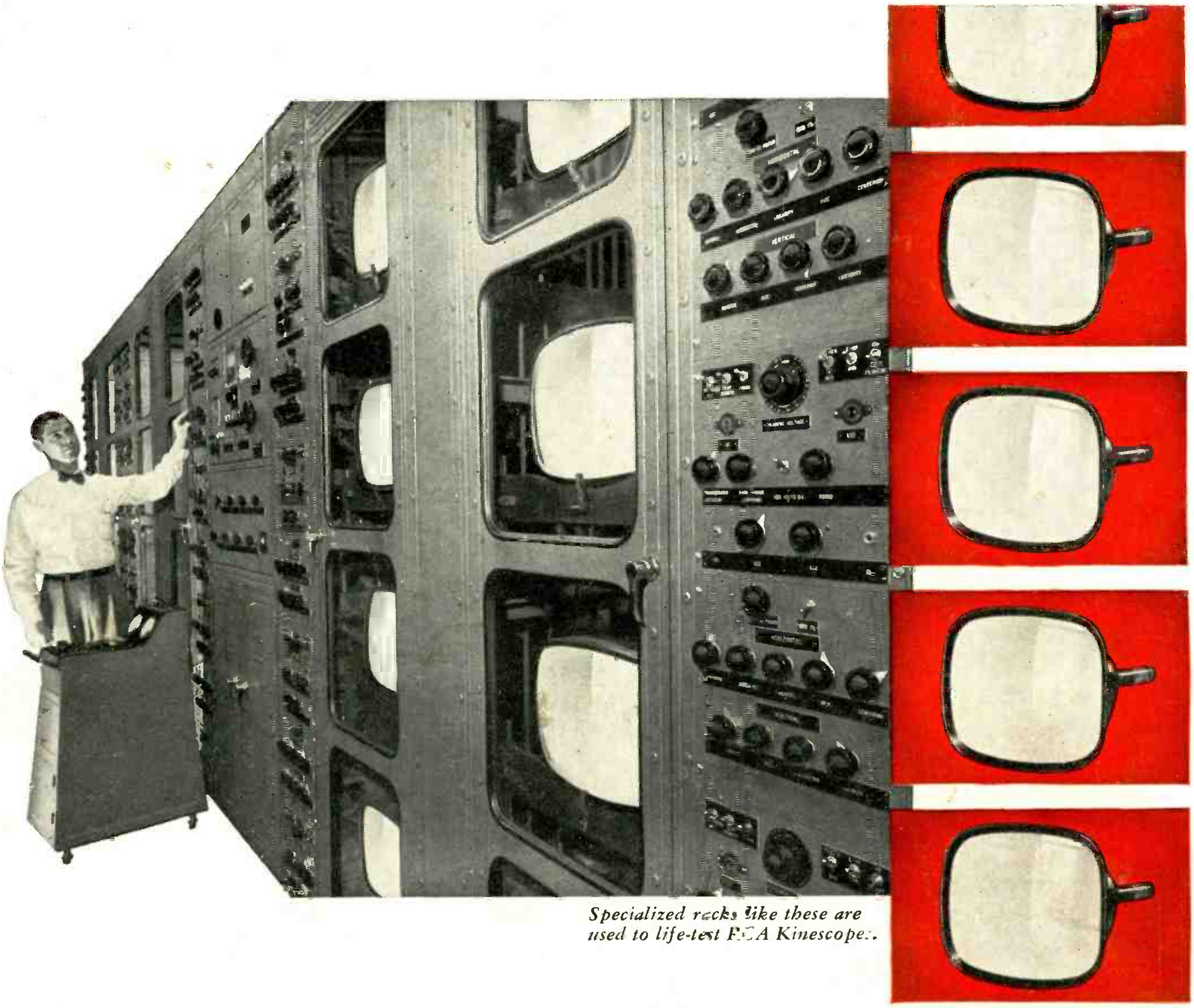

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