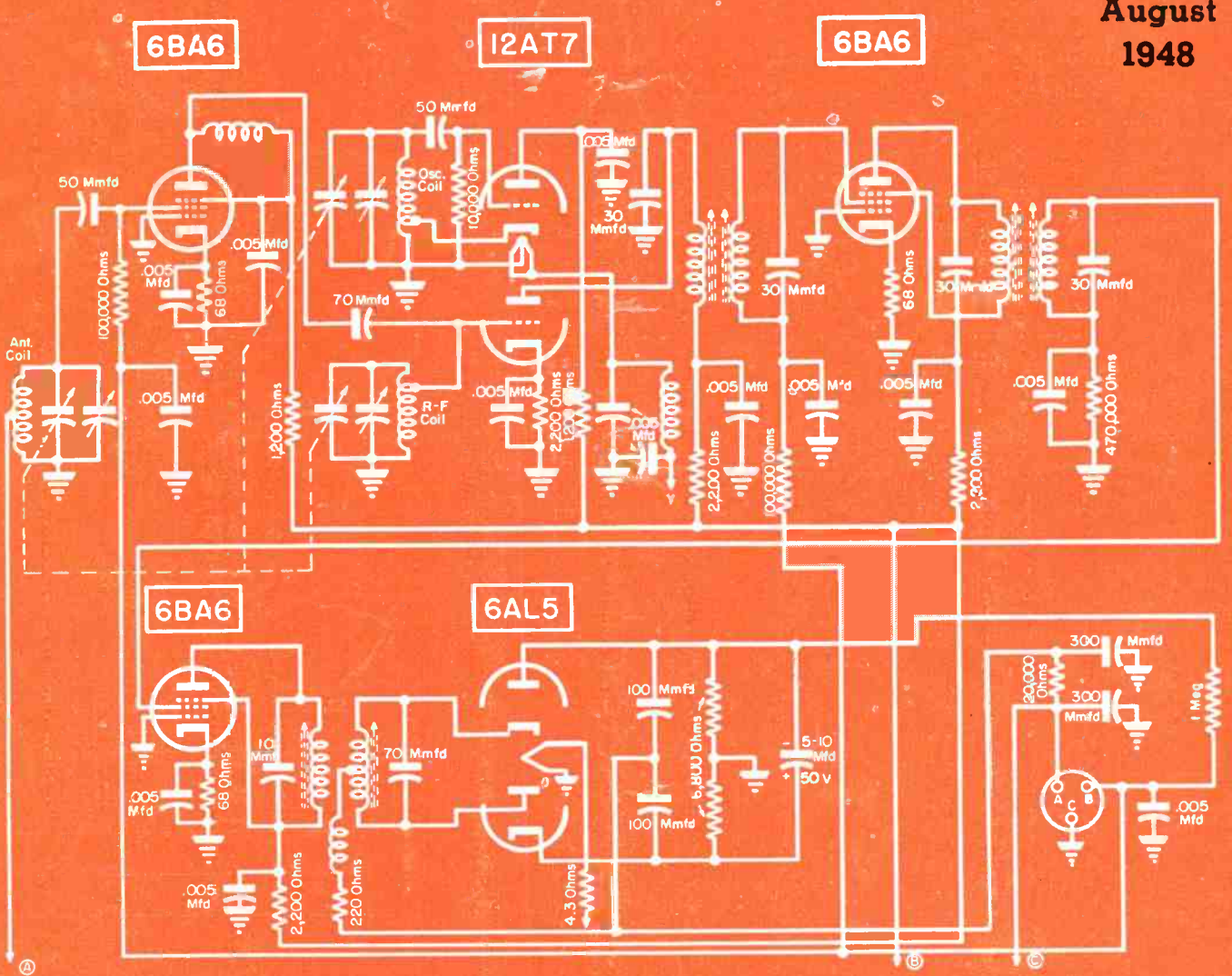
RADIO • TELEVISION • ELECTRONIC

SERVICE

August
1948

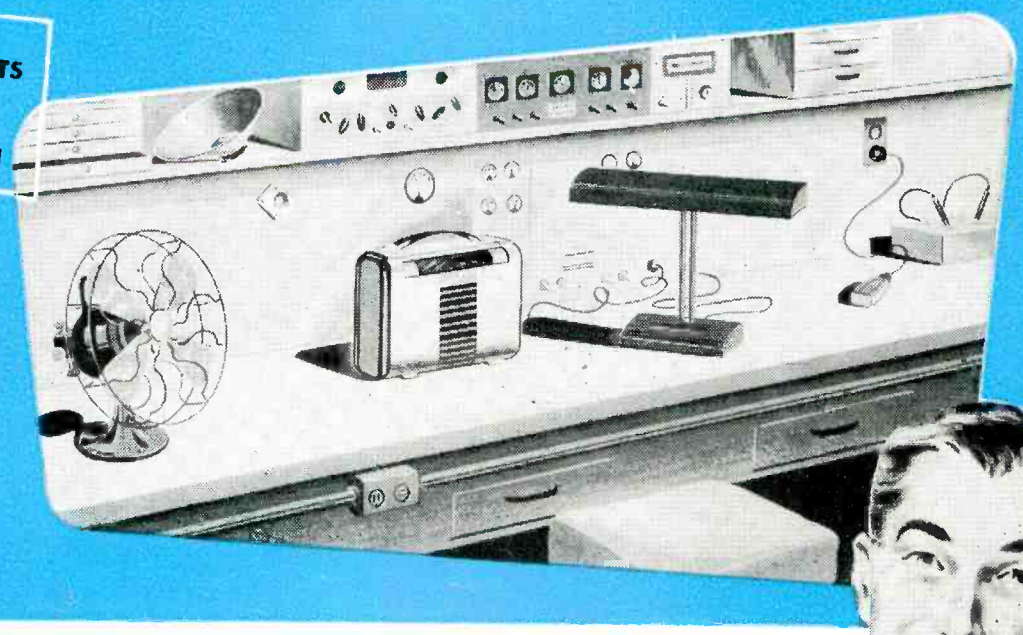


Self-powered seven-tube f-m tuner featuring a dual-diode converter and oscillator (12AT7), ratio detector (6AL5); and an audio booster (6J5).

[See page 2]

THE TECHNICAL JOURNAL OF THE RADIO TRADE

NEW PROFITS FOR SERVICEMEN



here's how one serviceman makes more money with C-D quietones...

Along with the finest test equipment, Frank Viscardi of Glen Rock, New Jersey, includes on his bench an electric shaver, an old-fashioned brush-type fan, and a fluorescent lamp. These articles – together with four popular types of C-D Quietone Radio Noise Filters – make up a potent demonstration. Every service customer is shown – *with his own set being used as guinea pig* – how the radio noises he thought had to be tolerated – can easily be eliminated. *Three out of four customers buy the filter recommended.*

Most of *your* customers need one or more C-D Quietones – *but they don't know it. Tell* them – better yet *show* them, like Frank Viscardi does – and you'll discover the quickest-selling, fastest-moving accessories in the entire service field.

Start cashing in on this big profit opportunity NOW! Mail coupon below for free copy of Catalog No. 195A. Cornell-Dubilier Electric Corporation, Dept. S8, South Plainfield, New Jersey. Other large plants in New Bedford, Brookline, and Worcester, Mass., and Providence, R. I.

IF54

IF21

IF18

IF6

SEE YOUR LOCAL CLASSIFIED TELEPHONE DIRECTORY FOR NEAREST AUTHORIZED C-D DISTRIBUTOR

FREE! profit-building ideas in capsule form within the two covers of "THE CAPACITOR".

CORNELL-DUBILIER
WORLD'S LARGEST MANUFACTURER OF
CAPACITORS

MICA • DYKANOL • PAPER • ELECTROLYTIC

This remarkable magazine – published for servicemen – makes it easier for you to service any set ever made. Also, every month it brings you a fresh supply of hints for bringing more customers to your shop – boosting your profits. *Mail coupon NOW – your free subscription will start at once!*

CORNELL-DUBILIER ELECTRIC CORPORATION,
Dept. S8, South Plainfield, New Jersey

I can use those ideas for servicemen.

☐ Start The Capacitor coming my way at once – FREE.

☐ Please send copy of Catalog No. 195A.

Name.....

Address.....

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

I am a serviceman ☐ amateur ☐ experimenter ☐

Other classification.....

"YOU CAN'T BEAT KEN-RAD TUBES!"

"You can't beat Ken-Rad tubes—I found that out long ago!

"Ever since 1935, when I started in business, I've been using Ken-Rad tubes.

"And believe me, they hold up—never let me down!

"I found Ken-Rad tubes dependable. So I sold them to my customers. They like them, too. I never receive a complaint.

"In fact, I think a good part of the big repeat business I do is the result of Ken-Rad tubes.

"Quality pays off!"

JOHN F. BERANICH, 4439 West Madison St., Chicago, Ill., does a big business servicing radios, and like thousands of other servicemen he uses Ken-Rad tubes. He likes their dependable quality!

"HERE'S WHY YOU CAN'T BEAT KEN-RAD TUBES!"

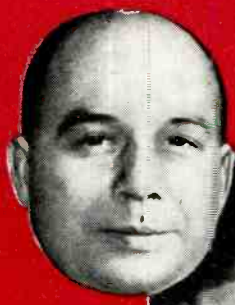
"From start to finish, Ken-Rad tubes undergo strictest inspections and tests.

"I know, because I help test them!

"They're made to stand up, satisfy customers, increase your business.

"You can depend on Ken-Rad tubes because they're tested for noise, microphonics, static, life, shorts, appearance, gas, air and hum.

"Your customers can depend on Ken-Rad tubes because they're built, throughout, to the highest standards of quality, stamina, and endurance."



WALTER DOWNING, Foreman, Raw Materials Inspection Department, is in charge of comprehensive testing of all materials used in making Ken-Rad tubes. Here cathode sleeves are being tested for breaking strength.

178-GA9-8850

KEN-RAD *Radio Tubes*

PRODUCT OF GENERAL ELECTRIC COMPANY

Schenectady 5, New York

The Serviceman's Tube

Vol. 17, No. 8

RADIO · TELEVISION · ELECTRONIC
SERVICE

August, 1948

LEWIS WINNER
Editorial Director

F. WALEN
Assistant Editor

ALFRED A. GHIRARDI
Advisory Editor

Published monthly by Bryan Davis Publishing Co., Inc.
52 Vanderbilt Avenue, New York 17, N. Y. Telephone MUrray Hill 4-0170

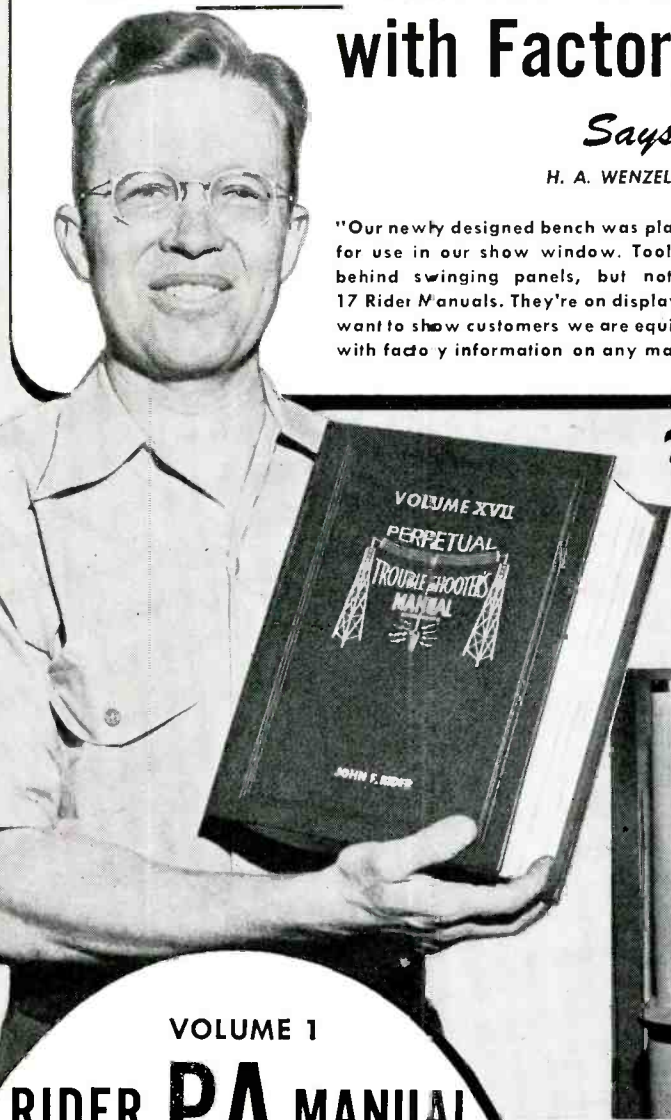
Bryan S. Davis, President — Paul S. Weil, Vice Pres.-Gen. Mgr. — F. Walen, Secretary — A. Goebel, Circulation Manager

Cleveland Representative: James C. Munn. 2253 Delaware Dr., Cleveland 6, Ohio. Telephone: Erieview 1726

Pacific Coast Representative: Brand & Brand, 1052 W. Sixth St., Los Angeles 14, Calif. Telephone: Michigan 1732
Suite 1204, Russ Building, San Francisco 4, Calif. Telephone: SUtter 1-2251

Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price: $2.00 per year in the United States of America and Canada; 25 cents per copy. $3.00 per year in foreign countries; 35 cents per copy.

"We show customers we're equipped with Factory Information"



Says: H. A. WENZEL

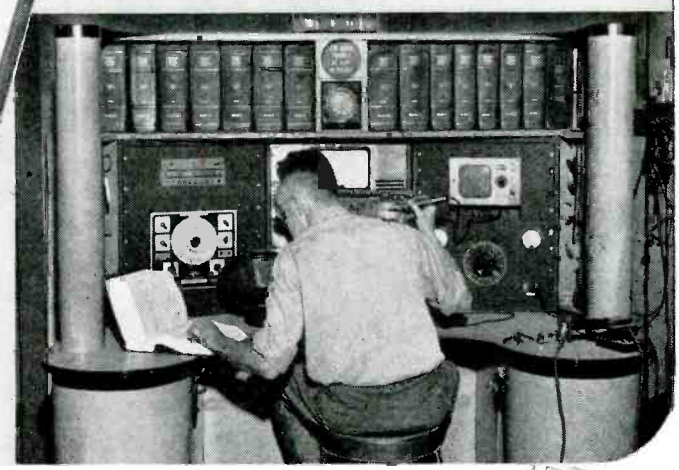
H. A. WENZEL RADIO SERVICE, Quincy, Ill.

"Our newly designed bench was planned for use in our show window. Tools are behind swinging panels, but not our 17 Rider Manuals. They're on display. We want to show customers we are equipped with factory information on any make or model receiver they bring us for repair. "We keep our Rider Manuals at our fingertips as they are an important part of our servicing procedure. Speeding up diagnosis, they're important to our servicing profits too."

You NEED ALL 17 RIDER MANUALS

Volume XVII	$16.50	Abridged Manuals I to V (one vol.)	$19.80
Volume XVI	8.40	Record Changers and Recorders	9.00
Volume XV	19.80	Master Index, covering Manuals, Vols. I to XV,	1.50
Volume XIV to VII (ea. vol.)	16.50		
Volume VI	12.50		

ORDER** – FROM YOUR JOBBER – **TODAY!



VOLUME 1

RIDER PA MANUAL

OUT IN SEPTEMBER

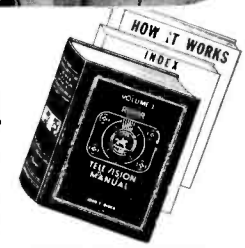
The first industry-wide service manual covering amplifying systems produced from 1938 to date, by more than 135 manufacturers. Schematics voltage data, resistance values, capacity values, parts lists, etc. Separate "HOW IT WORKS" book explains the theory of various designs employed in different types of amplifier systems, the servicing of PA systems, using sine wave and square wave means of checking, methods of rapidly locating faults. Everything you need.

Approx. 2000 Pages . . . $18.00

ORDER YOURS TODAY!

VOL. 1 JUST OUT

RIDER *Television* MANUAL



Establishing Sales Records!

Contains circuit descriptions, adjustment of various trimmers, traps, transformers, etc., voltage and resistance readings, alignment instructions, parts lists, schematics, patterns, chassis views, wave forms. Everything needed.

208-page "How It Works" book covers underlying theory of television. Transmission and reception, frequency standards, antennas, various portions of television receivers.

OVER 1400 PAGES
(but the equivalent of 2000 pages)
PLUS, 2 Separate Books, "HOW IT WORKS" & INDEX
Complete $18.00

Television* "HOW IT WORKS" *Available Separately

If television is not yet in your area, it will be soon. Here is theory you want. 208 pages . . . **$2.70**

RIDER MANUALS *Mean* SUCCESSFUL SERVICING

JOHN F. RIDER PUBLISHER, Inc., 404 Fourth Avenue, New York 16 Export Agent: Rocke International Corp., 13 E. 40th St., N.Y.C. Cable ARLAB.

NOTE: The Mallory Radio Service Encyclopedia, 6th Edition, makes reference to only one source of Radio Receiver Schematics—Rider Manuals.

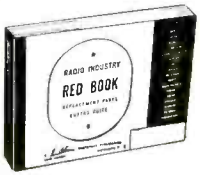
IT'S HERE!
WEBSTER-CHICAGO AUTOMATIC MICROGROOVE RECORD CHANGER

"MICROGROOVE" IS HEADLINE NEWS—
MODEL 133 IS "CASH REGISTER" NEWS!

Model 133 • the famous Webster-Chicago *foolproof* record-changer mechanism • New balanced tone arm and nylon knee action needle • magnificent reproduction from microgroove records • 33 RPM turntable speed—plays 10 twelve inch or 12 ten inch microgroove records *automatically* at one loading • 4 hours of continuous record play with fast change cycle.

Safety.....

The cop on the beat that protects your home . . . guides children across the street — he offers an important factor of safety in community life! And so it is with the patented construction feature of the RADIART VIBRATOR — the mica stacks! Because of this mica detail, sudden shifts in load peaks to high voltages are taken in stride, because they are designed to carry an overload! The resulting longer life and more dependable, longer performance means more satisfied customers for you . . . and yet this expensive feature costs no more! Just another factor that has helped build RADIART VIBRATOR superiority, and made them the fastest selling in the field.



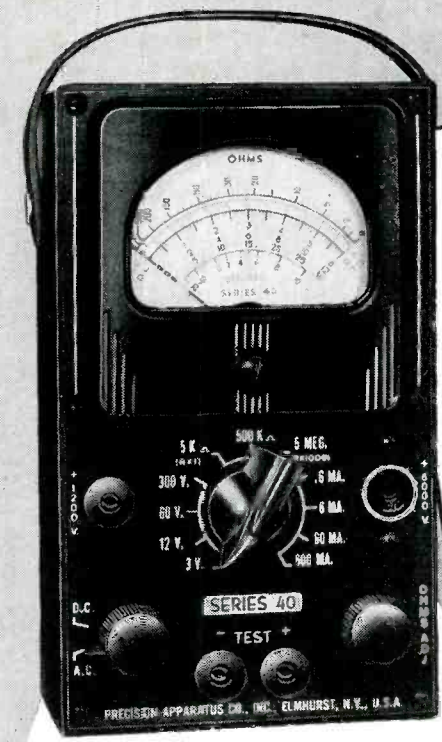
THE ONLY VIBRATOR LINE TO BE LISTED IN SAMS RED BOOK

STANDARD OF COMPARISON
RADIART

The Radiart Corp.

CLEVELAND 2, OHIO

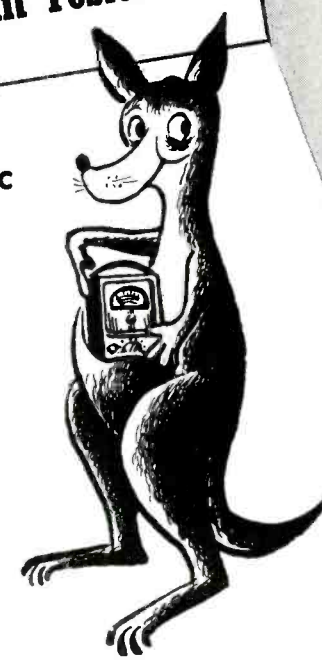
Export-Scheel International Inc., 4237 N. Lincoln Ave., Chicago 18, Ill.



. . . a Pocketful of PRECISION Series 40

Compact Wide-Range Circuit Tester

Self-Contained to 6000 Volts AC & DC
5 Megohms, 600 MA, + 70 DB,
with full size 3" Rectangular Meter



In a custom molded bakelite carrying case, the series 40 is an unparalleled instrument of its type and size. Ideally dimensioned and engineered to meet the need for a portable, compact, yet rugged, accurate test set to withstand hard, long term usage as is imposed by the service technician, maintenance engineer, production inspector, trouble-shooter, radio amateur, etc.

The Series 40 offers every advanced design feature and full-bodied components as are regularly incorporated in "Precision's" larger multi-range test sets, including: Rotary Range Selection—1% shunts and multipliers—heavy duty insulated pin jacks—Large numeralled, easy reading meter.

ALL RANGES, including 6000 volts and 5 Megohms, are SELF-CONTAINED and ready to operate. NO EXTERNAL BATTERIES OR MULTIPLIERS ARE REQUIRED.

RANGE SPECIFICATIONS

- ★ **6 A.C.-D.C. & Output Voltage Ranges:** all at 1000 ohms per volt. 0-3-12-60-300-1200-6000 volts.
- ★ **4 D.C. Current Ranges:** 0-.6-6-60-600 MA.
- ★ **3 Resistance Ranges:** with self-contained batteries. 0-5000-500,000 and 0-5 megohms.
- ★ **6 Decibel Ranges** from −22 to +70 DB.
- ★ **Full Size 3" Rectangular Meter:** 400 microamperes ± 2% accuracy.
- ★ **1% Wirewound & Metallized Resistors.**
- ★ **Only 2 Pin Jacks** serve all standard functions.
- ★ Recessed 6000 volt safety jack.
- ★ Anodized, etched aluminum panel: resistant to moisture and wear.

See this new "Precision" Test Set now on display at all leading radio parts and equipment distributors, or write directly for the Precision 1948 catalog describing the complete Precision line of quality Electronic Test Instruments for all phases of modern radio-electronics—A.M., F.M. and TV.

Series 40 (illustrated) In custom molded bakelite case with plastic handle. 3¾" x 6¼" x 2½". Complete with ohmmeter batteries and test leads.

NET PRICE **$24.75**

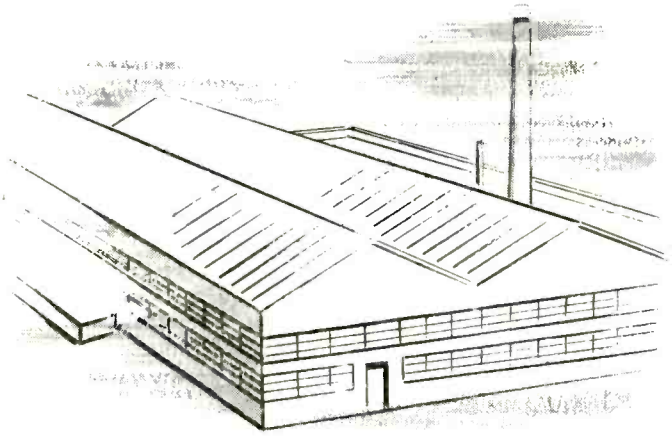
PRECISION TEST EQUIPMENT
Standard of Accuracy

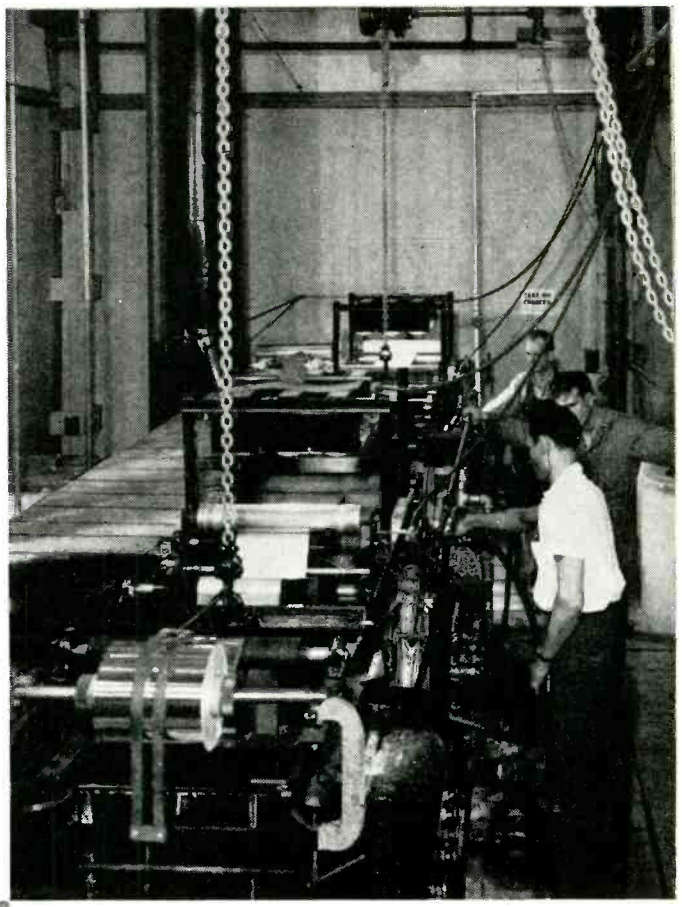
PRECISION
APPARATUS COMPANY INC.

92-27 HORACE HARDING BOULEVARD
ELMHURST 6, NEW YORK

Export Division: 458 BROADWAY, NEW YORK CITY, U.S.A. • Cables: MORHANEY

Electrolytics by Sangamo





a *New* plant for Electrolytic Capacitors

Sangamo is manufacturing electrolytic capacitors in a completely new plant, with the latest equipment, and with the most modern techniques. The plant is completely conditioned with filtered air to conform with Sangamo standards of cleanliness. Humidity is carefully regulated to accurately control moisture absorption. Stainless steel or aluminum is used on all surfaces which may be touched by the capacitors, and all operators wear rubber gloves in order to avoid contamination of foil.

The fine aluminum foil used in Sangamo Electrolytics is given particular attention. The equipment pictured above washes the foil in hot chemicals to remove any trace of surface impurity and etches the foil in one continuous operation.

Every capacitor is aged and tested at voltages in excess of the working voltage, and is heat-treated in temperature-controlled ovens. Only after these tests and repeated individual inspections, are Sangamo Electrolytics ready for you.

CAPACITORS:
PAPER • MICA • SILVER • ELECTROLYTIC

SANGAMO

A complete line of capacitors for every electronic application—write for information today.

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD • ILLINOIS

SC487

RADIO · TELEVISION · ELECTRONIC

SERVICE

The New Long-Playing Records

THE RECENTLY ANNOUNCED MICRO-GROOVE long-playing records requiring the use of slow-speed 33⅓ rpm motors offers an unusual installation-service opportunity to every Service Man. The long-playing idea is unique and is rapidly winning over not only those who now have phono systems, but those with standard receivers.

It won't be long before there will be a substantial demand for either complete slow-speed phono setups, or the slow-speed motor alone, or complete high-fidelity phono setups with a slow-speed motor. In each instance, the Service Man can play a significant installation and servicing role. In many cases, it will be necessary to remove the 78 rpm motor setup and install the new system or provide for dual high and low-speed service. Where no phono system exists at present, connection to the audio-frequency circuit will be required, new switching may be necessary, and in many instances it will be necessary to provide a housing for the receiver, phono and speaker. Where the a-f system has a normal audio range, there'll be the opportunity of providing a wide range amplifier with, perhaps, a high-fidelity speaker in a custom-built setup.

Some alert Service Men have begun to sell the long-playing record idea by demonstrating a l-p phono unit during their service calls. The look, listen and try-it-yourself tests are quite convincing and usually quite productive.

Some Service Men have also been called on by furniture and music shops to conduct these demonstrations during their calls and then, perhaps, make an installation, with a sales commission-service charge arrangement in force. In New York City the tieup proved quite profitable to many.

The p-a field has also begun to show interest in the l-p system. Several Service Men having already installed the necessary slow-speed motors and lightweight pickups and revamped the amplifiers to provide the required high-fidelity reproduction.

As indicated last month, SERVICE will soon publish a special report on l-p systems covering the features of the equipment and accessories, and detailing installation and servicing procedures, from the lab and the field.

Watch for this important report!

The Ideal F-M/A-M/Phono System

THE ADVANCED TECHNICAL KNOWLEDGE possessed by the Service Man enables him to serve as an accurate guide in the choice of receivers and accessories. Many consumers have been aware of this important factor and have come to rely completely on the judgment of the Service Man before buying.

Discussing this point with Harry Burnett of Hytron, recently, it was learned that Service Men are not only links in the complete receiver sale, but particularly combination affairs involving tuners, amplifiers, speakers, phonos, etc. He pointed out that Service Men are invariably questioned when the purchase of tuners are in mind, the consumer requesting information on the *best* or *ideal* system with often no ceiling on price. Here's a situation where general design and circuit familiarity become particularly helpful, and many interesting and effective combinations of equipment can be assembled, Burnett declared.

The Service Man can really go to town in *service* in this instance, we were told. And interviews with a number of Service Men revealed this fact to be quite true, with numerous successful tuner-amplifier projects recorded. Many interesting combinations of equipment seem to have been used because of many variables such as size, receiver location, cabinetry, outputs required, etc.

In each instance, the Service Man had assembled what he believed to be the ideal setup.

We believe that these *ideal* setups would be of interest to all Service Men and are thus preparing a series of articles describing these arrangements. Undoubtedly, many SERVICE readers have their ideal setups, too. If you have one you feel would be of interest to the professional Service Man, send in a brief description, and every effort will be made to weave it into our articles. If you have photos, send them along, too. Feature article rate payments will be made for all material published.

Hope we'll be hearing from you soon.

New York Servicing Clinic

DATES FOR THE long awaited New York servicing clinic sessions have been set; there will be a three day series of meetings at the Hotel Astor in New York City on September 27, 28 and 29, with meetings being held in the afternoon and evening.

The New York meeting will be followed by one in Boston at the Hotel Bradford, November 15, 16 and 17, and others are scheduled for Atlanta in January, Los Angeles in March, and Chicago in April.

The sessions, which will be known as Town Meetings, will be conducted under the sponsorship of the Radio Parts Industry Coordinating Committee, composed of RMA, EPEM, WCEMA and Sales Managers Club (Eastern Division).

Walter W. Jablon, vice president in charge of sales for Espey, will be in charge of the New York meeting preparations and William P. Ready, radio parts sales manager of the National Company, will service similarly for the Boston meeting.

The Associated Radio Service Men of New York Inc., is cooperating in program development for the New York meeting. The sessions will feature 40 minute talks, with 20 minute *q* and *a* periods. To illustrate servicing techniques, typical lab equipment will be employed.

Every Service Man is urged to attend these all-important sessions at the Astor.

A complete report on the meetings will appear in SERVICE. Watch for it.—L. W.

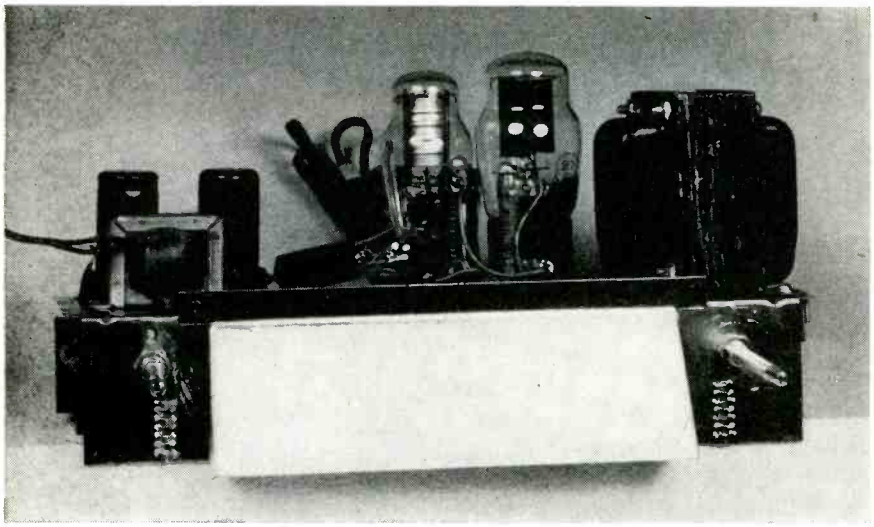


Fig. 2. Interior view of Baby Light.

Fig. 3. Baby Andrea Jane Baxter of Syracuse *activating* the *Electronic Baby Light*, causing a lamp in the living room to flash and warn her parents that she wants attention.

The Electronic Baby Light

Unique Light-Sound Converter-Amplifier Designed For The Deaf Uses Sounds, Such As From A Crying Baby, To Actuate A Warning Light.

by JACK NAJORK

Specialty Division
General Electric

A FEW MONTHS ago, we received a request for a unit which would turn a remotely-located light on and off in response to sounds. This unusual device was wanted by deaf parents who were living in constant apprehension over the welfare of their baby girl because they could not hear the infant cry.

What was needed was a simple, reliable system of amplifying and converting sound into light. Simplicity and reliability go hand-in-hand, since the simpler the unit, the less likelihood of component failure. Therefore, these two features influenced the final design more than any other factors.

Simplicity was achieved by using only two active tubes, plus two other tubes for voltage regulation and rectification. The test of reliability will be answered after the unit has been in operation for a year or more. However, by using quality parts and allowing large safety factors, the possibility of component failure can be reduced to a minimum.

The Circuit

Basically, the system comprises a high gain audio amplifier which drives a relay instead of a loudspeaker. The relay turns a remotely located light on and off through an extension cord which can be almost any length. A conventional four-inch p-m loudspeaker is used as a microphone and this is coupled to the amplifier stages through the output transformer originally designed for the speaker. A two stage resistance-coupled voltage amplifier using a dual triode 6SC7 develops sufficient audio gain to drive a 6J5 triode. The 6J5 is operated in class *B;* that is, it is biased almost to plate current cut-off in the absence of signal. When the amplified signal is applied to the grid of the 6J5, plate current flows, and this current flows through the relay and closes the contacts. The relay contacts remain closed only for the duration of the sound.

For the remotely-located light 117 v a-c is used since most relays have contacts rugged enough to handle approximately one-half an ampere or so. A 60-watt lamp was specified as the largest which should be used with the unit because tests showed that this resistive load caused almost no sparking at the relay contacts. Since the relay was considered the most vulnerable component from the standpoint of failure due to sticking contacts, it was given an accelerated test by connecting a 120-watt resistive load to the test model. This test model was then run continuously for several days in a noisy laboratory. Inspection of the relay contacts at the end of this period showed no apparent pitting or wear and the relay was therefore considered capable of breaking the current taken by a 60-watt lamp.

The possibility of using a universal (a-c/d-c) power supply was considered and rejected, primarily for safety reasons. Since the unit would, of necessity, be within reach of infants and small children, it had to be as

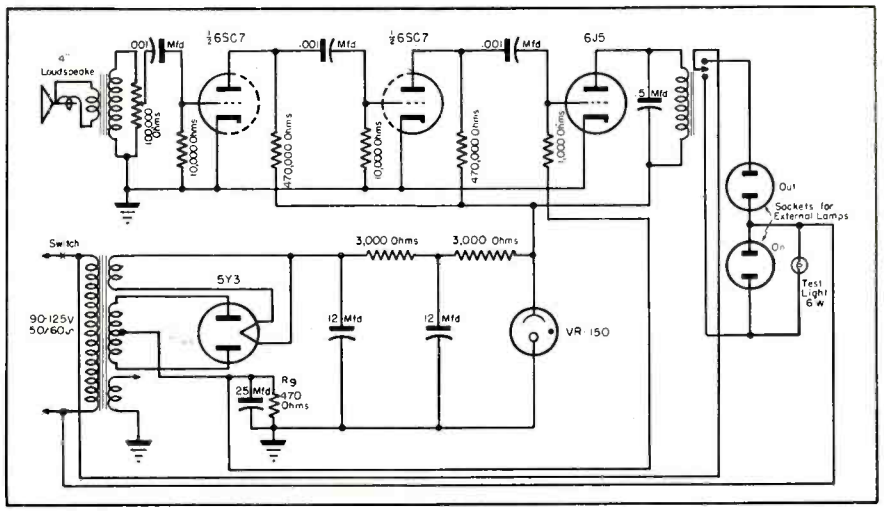
fool-proof and danger-free as possible. The higher d-c voltage available from an a-c supply also simplified the design since this enabled greater voltage amplification from the cascaded triode stages. With the usual 100 volts available from an a-c/d-c supply, the gain of the 6SC7 was insufficient to drive the 6J5. Although the incorporation of the voltage regulator tube may be considered an unnecessary refinement, its addition prevented the unit from being triggered by line voltage variations and surges, and enabled us to tack a gold star alongside the reliability claim. The filtering action of the voltage regulator also lowers the impedance of the supply voltage source and therefore reduces the possibility of feedback in the three audio frequency stages.

The relay used in the original unit was a high sensitivity type which closed on approximately four milliamperes. The plate current of the 6J5 was therefore adjusted to two milliamperes in the absence of signal. This adjustment is made by selecting the proper value for R_9 which controls the bias on the 6J5. Loud sounds near the microphone will swing the plate current of the 6J5 up to ten milliamperes with the gain control wide open, so there is plenty of reserve sensitivity. A less sensitive relay can also be used by decreasing the bias on the 6J5, or, more plate current swing for a given signal can be obtained by using a tube with higher mutual conductance in place of the 6J5. A 6SN7 connected in parallel will give a much greater current swing than the 6J5 and its use will permit satisfactory operation with a ten or fifteen milliampere relay. R_9 should then be adjusted so that the 6SN7 draws approximately 50% of the closing current of the relay.

The relay, in addition to being wired to the sockets for the external lamp or lamps, is also connected to a 110-volt, 6-watt test lamp which is located behind the glass front of the cabinet. This test lamp is used to initially set the gain control to the desired level, because after the unit is set up the remote lamps will probably be out of sight.

Because of the high gain, it was necessary to shield the grid lead to the input stage. It was also necessary to break up the usual volume control and switch arangement into two separate controls to keep the 60 cycle a-c line away from the very sensitive first grid of the 6SC7. By using small coupling capacitors (.001 mfd) between all stages, low frequency response (which is neither necessary or desirable in this application) is reduced and this

Fig. 1. Circuit of the *Electronic Baby Light*. The grid lead of the first triode is shielded.



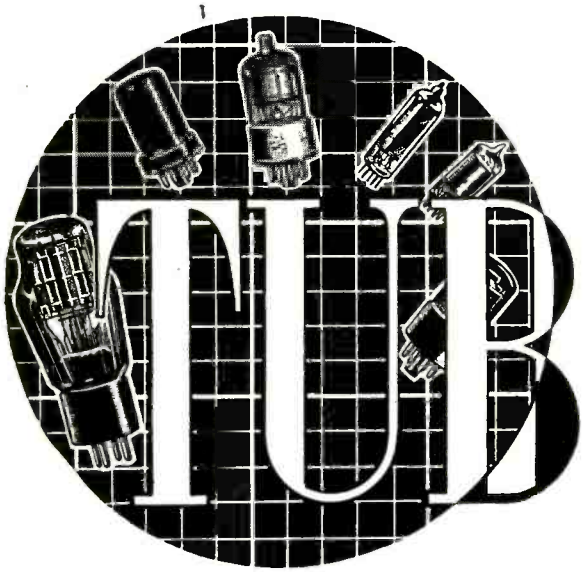
lessens the possibility of low-frequency feedback (motorboating).

One serious problem was encountered in the final unit. This was mechanical feedback from the relay to the loudspeaker. When the relay contacts closed, a slight click was made and this was transmitted to the loudspeaker via the chassis and cabinet. Shock mounting the loudspeaker on rubber grommets cured most of this trouble, and increasing the time constant of the relay circuit by the addition of a 0.5 mfd capacitor across the relay coil cleaned up the rest of the feedback. The unit could then be run with the gain control wide open without difficulty.

Aside from electrical consideration, aesthetic factors also entered into the design and construction of the unit. Since baby would be seeing a lot of this electronic watch-dog, it was felt that the usual grim-looking black cabinet with its multiplicity of dials and meters was out. We didn't want to be responsible for the development of a Buck Rogers complex in the infant and we were quite sure the parents wanted the device to be as inconspicuous as possible. The unit was therefore fitted into a standard five-tube chassis and cabinet which provided plenty of room for all the components. The back of the cabinet was securely fastened, with just enough clearance left between the back and the chassis to permit insertion of the extension cord plug. Since the relay was a single pole, normally-closed affair, two standard household outlets were provided for remote lights. One socket closes the lamp circuit and the other socket opens the circuit. Thus, the remote lamp can be either turned on or out when the unit is triggered. The outlets are located on the back apron of the chassis, well away from the top of the unit. This arrangement makes it impossible to touch the tubes when the back is in place—a necessary precaution to prevent inquisitive fingers from being burned.

In operation, the unit is placed near the baby's crib, just out of reach of the infant. The sensitivity control is adjusted to trigger the relay under normal wailing conditions and this adjustment, of course, depends upon the lung power of the individual infant. Since the lamp will light only when sounds occur near the unit, a little experience soon tells watching parents when the infant has coughed, kicked the crib, or is howling continuously. Too high a setting of the sensitivity control will cause the unit to be triggered on very light sounds such as movement of bedclothes, heavy breathing, etc. More calloused parents can, of course, reduce the sensitivity to a level where only the most ambitious wails will flash the light.

A check with the parents after several days of actual operation disclosed a surprising and entirely unanticipated effect. Whenever the infant started to cry, the test lamp in the front of the unit flashed on, along with the remote lamps. This sudden appearance of light appeared to intrigue the baby, who was so surprised she stopped crying, and the light would then, of course, go out. How often this cycle of start and stop occurred is not known, but it is apparent that we had accidentally stumbled upon an entirely new form of negative feedback. As yet, we have been unable to find details of this type of feedback in any engineering textbook.



TUBE News

Improved Circuit Arrangements Available With The New Base-Pin Connections of 35C5, 50C5, 6BH6, 12AW6 And 6BJ6 Miniatures. Diode Filters.

by L. E. STEWART

RECENTLY SEVERAL miniatures with new basing arrangements, to facilitate circuit design, were announced; beam power amplifiers 35C5 and 50C5, sharp-cutoff pentodes 6BH6 and 12AW6, and remote-cutoff pentode 6BJ6.

Types 35C5 and 50C5 were designed for use in the output stages of a-c/d-c receivers. They are performance equivalents of miniature types 35B5 and 50B5, respectively, differing in basing connections only.

The use of two connections to grid *1* in beam-power amplifiers has been found very desirable because of the additional cooling effect of the second lead. If the temperature of grid *1* becomes too high, current flows in the grid circuit because of electron emission from the grid. This current causes loss of bias and, consequently, signal distortion.

However, because of this double grid connection, the basing arrangement used with types 35B5 and 50B5 (Fig. 1) has a tube-interchange disadvantage; for instance, if the 35B5 or 50B5 is accidentally inserted into a socket wired for a 12BA6. When the 12BA6 is used as an r-f amplifier without a coupling capacitor in the grid-*1* circuit, which is often the case, a low resistance connection is made between the cathode terminal (socket pin *7*) and the terminal connected to the loop antenna and the stator of the tuning capacitor (socket pin *1*). In an a-c/d-c receiver, the cathode terminal of the r-f amplifier socket is generally connected to one side of the power line, either directly or through a small biasing resistor (Fig. *2*). Consequently, the accidental insertion of a 35B5 or 50B5 into the 12BA6 socket connects one side of the power line to the tuning capacitor and loop antenna.

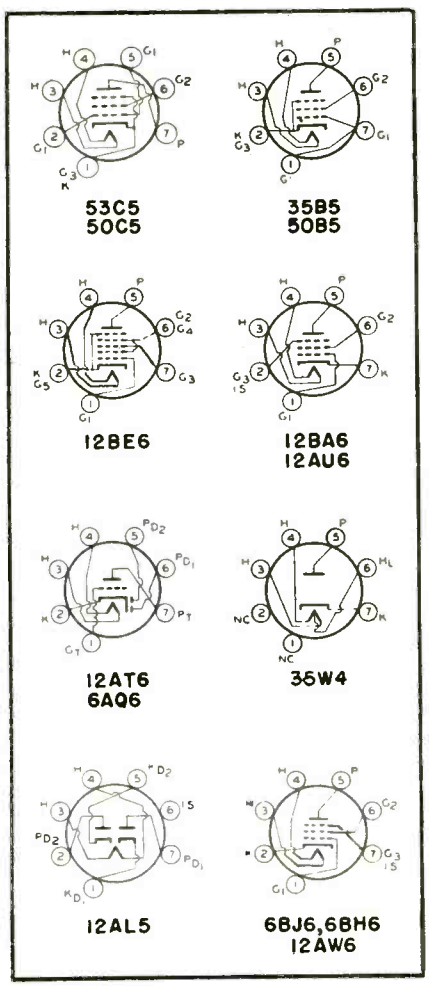


Fig. 1. Basing connections of new miniatures (35C5, 50C5, 6BH6, 12AW6 and 6BJ6) and comparable types.

A similar situation can occur if a 35B5 or 50B5 is accidentally substituted for a 12BA6, when the latter is used as an i-f amplifier, in a circuit having the signal grid of the converter connected as in Fig. 3. In this case, one side of the power line is connected from the cathode of the i-f amplifier through the i-f grid, the avc line, and the loop antenna to the signal grid of the converter.

Mistakes of this kind result in inoperative receivers and a possible fire and shock hazard, when a plugged-in receiver is handled or serviced with

(*Continued on page* 34)

Lightest Most Efficient Crystal Pickup Cartridge Ever Conceived!

NEW SERIES 12 TORQUE EV DRIVE

ACTUAL SIZE ➡ ⬅ WEIGHS ONLY $\frac{1}{5}$ OZ.

NANCY NEW KIT MAKES SALES AND SERVICE EASY!

Enables you *to service* most replacements *immediately*—helps you *sell more* replacement jobs to old and new customers—cuts overhead and inventory—increases turnover and profit! Contains 6 cartridges, 4 needles, mounting plates, literature, replacement chart and full instructions. Available in KIT "A" (Osmium) or KIT "B" (Sapphire).

ONLY TORQUE DRIVE GIVES YOU ALL THESE FEATURES!

Low mass drive system—Light weight—No bearings or bushings—Multiplied needle-force-to-crystal—High lateral and vertical compliance—Low distortion—Record matched frequency response—Ample voltage output—Zero output for vertical movement—Moisture-proofed crystal—Easy mounting—Replaceable osmium or sapphire tip whisker needle.

BETTER COUPLING OF RECORD GROOVE TO CRYSTAL

Exclusive Electro-Voice development now brings amazing improvement in record playing . . . *outmodes existing crystal pickup cartridges* . . . opens up vast new replacement opportunities. Fully tested and proved . . . the new Series 12 TORQUE DRIVE provides a more rugged cartridge for everyday use in home phonographs, booth demonstrators, and coin-operated machines. Assures finer reproduction, less surface noise, less needle talk, less record wear, longer record life, more needle plays!

3 BASIC MODELS REPLACE OVER 100 STANDARD TYPES

Comes in low, medium and high voltage outputs to provide universal replacement. Speeds servicing, steps up your profit. Installation is simple. Each cartridge is furnished with replaceable Osmium-tip or Sapphire-tip long-life whisker needle. It is available individually or in kits.

Series 12 with Osmium-tip needle. . . . . List price, $7.50
Series 12 with Sapphire-tip needle. . . . . List price, $8.50

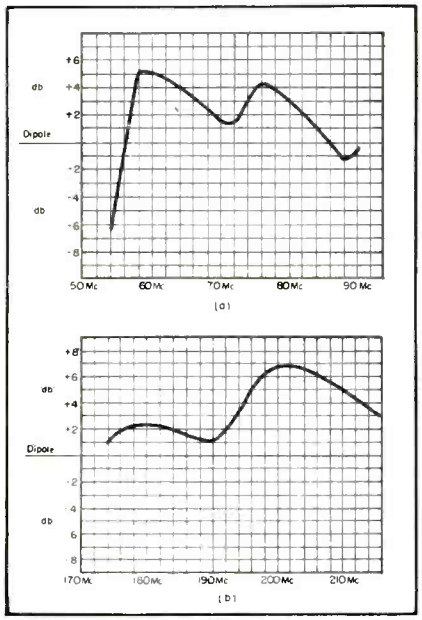
It's the talk of the industry! Ask your E-V Distributor, or send now for Bulletins 141 and 142.

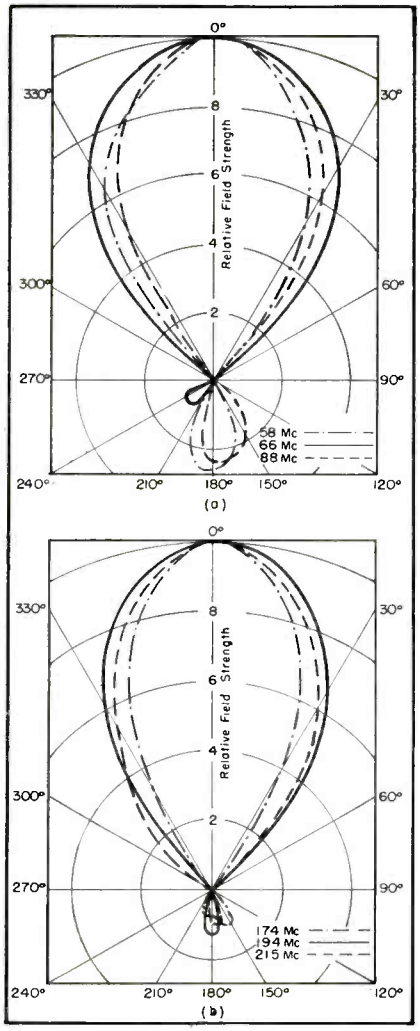
ELECTRO-VOICE, INC., BUCHANAN, MICH.

Export: 13 East 40th St., New York 16, U.S.A.
Cables: Arlab

ANOTHER FIRST BY **Electro-Voice**

Use of Math In 12-Channel TV Antenna Installations





ONE OF THE most important factors in tv installation work is the antenna's decibel gain, or db.

The db term is applied as an r-f function, expressing the ratio between any two electrical powers. In itself db is not an absolute measurement unless it is referred to some specific reference levels.

In the audio field, there have been several reference levels.

Broadcast engineers have selected a one milliwatt reference level; and replaced the db with a term called *volume unit* or *vu*. This means that a ten-watt broadcast amplifier has a power ratio of 10 w/.001 w or 10,000. Referring to a db table we find that this amplifier has an absolute value of 40 db or 40 vu, with respect to the one-milliwatt reference level.

Public-address amplifier manufacturers use a six milliwatt reference level in rating their amplifier equipment. A 10-watt p-a amplifier has a power ratio of 10 w/.006 w or 1666 with respect to the 6-milliwatt reference level. The db table will show that the 10-watt amplifier has an output rating of 32.2 db at this reference level.

Television antennas are rated in db antenna power gain, which is a measurement of the power ratio between the tv antenna under test and a standard dipole antenna having a gain of *one;* therefore, *one* is the reference level.

A tv antenna, rated as having an average gain of 3 db, will have a power gain ratio of 2:1 and a voltage gain ratio of 1.4:1 (1.4 is the square root of 2), with respect to a dipole antenna with a gain of one.

Fig. 1 (top, left). Effect of frequency on gain of broadband antenna with respect to a dipole antenna having a gain of one. (*Courtesy Amphenol*)

Fig. 2. Effect of frequency on front-to-side and front-to-back ratio of broadband antenna. (*Courtesy Amphenol*)

Gain of Broadband Antennas

In Fig. 1 appears a 12-channel curve which shows the effect of frequency on gain. It will be noted that the gain of the broadband antenna plotted varies from one to almost 7 db. Fig. 2 shows the high front-to-back and front-to-side ratios of the antenna, which is illustrated in Fig. 3. The minor rear lobes (from 90° to 270°) are of low level and have a very small influence on the overall operating pattern.

The radiation pattern information must be coupled with the db antenna gain specification, as a highly directional pickup pattern (Fig. 2) raises the signal-to-noise level, a vital characteristic in weak signal areas.

Single channel 3-element antennas have a 5-db gain and a high front-to-side ratio at the specific channel (Fig. 4) and can be adjusted to match 73-ohm transmission line as shown in Fig. 5. The gain and directivity of a single-channel array can be further increased by piling the arrays which raises the forward gain to 7.6 db.

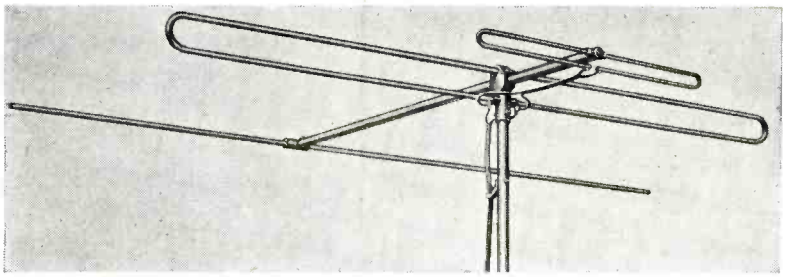
In interpreting the design features and specifications of any antenna, the following *rule of thumb* information will be found helpful:

(*a*) Three db is a power gain of 2:1 and a voltage gain of 1.4:1.

(*b*) Six db is a power gain of 4:1 and a voltage gain of 2:1.

(*c*) A 1-db increase in gain is negligible and does not provide a noticeable improvement on a tv picture unless the antenna also has a

Fig. 3. Broadband antenna with gain and pattern characteristics indicated in Figs. 1 and 2. (*Courtesy Amphenol*)



Simplified Explanation Of The Major Mathematical Factors With Which Service Men Must Be Familiar To Accurately And Successfully Install TV Antennas For Full Band Coverage. Typical Problems Analyzed.

by IRA KAMEN

Manager, Television Antenna Dept.
Commercial Radio Sound Corp.
New York City

radiation pattern which raises the signal-to-noise ratio.

(*d*) Broadband antennas should be analyzed and chosen on the basis of their gain characteristic with respect to the signal level problem in the area. For example, some broadband antennas favor the high channels more than the lower channels and should be used in those areas where there is less signal available from the higher channels, and conversely broadband antennas favoring the low frequency channels, should be employed where the signals are weaker from those stations in that section of the tv band.

(*e*) Broadband antennas with directional patterns should be used when all the stations are in the same direction with respect to the antenna.

(*f*) The tv channel favored by any dipole or folded dipole antenna can be readily checked by reference to Fig. 7.

(*g*) When a single tuned dipole has to be matched to a 300-ohm line, it is possible to increase the gain on a single tv channel by inserting a matching section between the two impedances.

$$\text{Impedance } (Z) \text{ of matching section} = \sqrt{Z \text{ of dipole } XZ \times \text{ line}}$$
$$= \sqrt{72 \times 300}$$
$$= \sqrt{21600}$$
$$Z = 140 \text{ (approx.) ohms}$$

As 140 ohms is not commercially available a 150-ohm piece of balanced line may be selected as the matching section. The length of the matching section should be approximately .9 times the length of the dipole rod. For example, for a channel *5* rod whose length is approximately 36″, the matching section would be .9″ x 36″ or 32.4″. The reason the matching section is shorter than $\lambda/4$ rod length, is that the velocity of wave propagation is different in transmission line than in air.

Typical Problems

The best way to understand 12-channel tv antenna engineering is to apply the fundamentals to some specific problems.

Problem 1: Fig. 8 shows an antenna located from 1 to 15 miles from low and high-frequency tv stations, which are all in one direction with respect to the receiving antenna.

Assuming that a 15-mile maximum radius is still in a primary signal area of at least five millivolts and that no reflection problem exists, a simple straight or folded dipole, or dipole and reflector, will have sufficient gain to energize the tv receiver on the low and high frequency channels. Even if a dipole adjusted for the lower channels had a 12-db loss at the higher channels, the signal would still be adequate. As indicated in our *rule of thumb* notes, a 6-db gain or loss is a voltage gain or loss of 2:1. Therefore 12 db is a voltage loss of 4:1 and in a five millivolt area, there would still be 5/4 or 1¼ millivolts of signal available for the tv receiver. This is more than twice the FCC minimum requirement for a satisfactory picture. If the signal-to-noise ratio in the area is low, a wideband antenna array with reflector assembly is preferred.

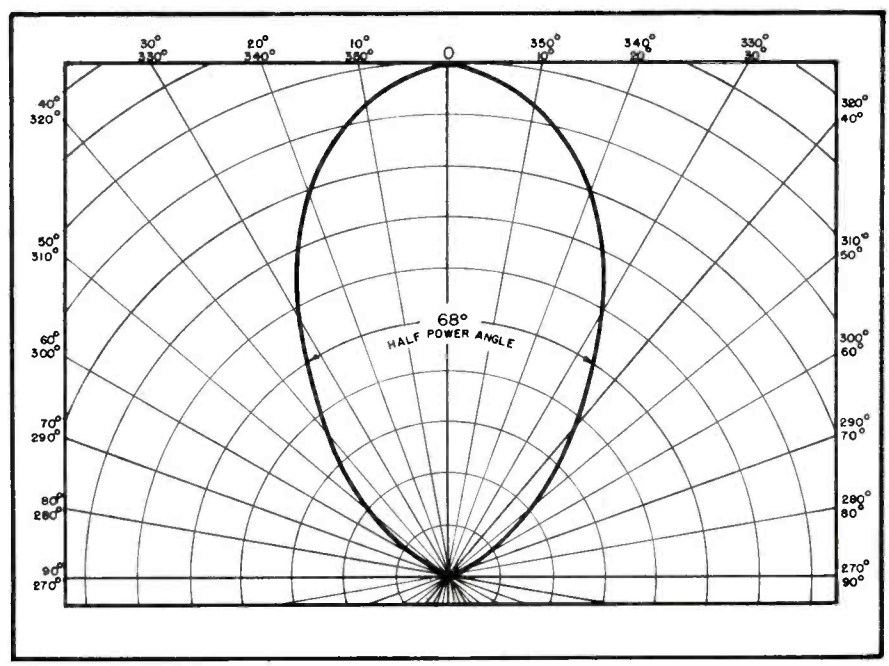
Problem 2: Fig. 9 shows a tv receiving antenna located with high and low-frequency tv stations on both sides of its position.

When the tv signals are 180° apart, an antenna without reflectors should be selected. While a wideband array is preferred a simple straight or folded dipole will be satisfactory in areas where the signal-to-noise ratio is high.

Problem 3: Fig. 10 illustrates a single high-frequency station at approximately right angles to a group of high and low-frequency tv stations.

A straight or folded dipole adjusted for the mean frequency of the lower tv channels will operate on the third harmonic for the high-frequency channels and will pick up adequate signal strength for channels *2, 4, 5* and *11*, when matched into a 300-ohm line. A high frequency antenna attachment (Fig. 11) which consists of a straight

Fig. 4. Plot of horizontal pattern in power indicating the high front-to-side ratio of dipole, director, and reflector. (*Courtesy Workshop Associates*)



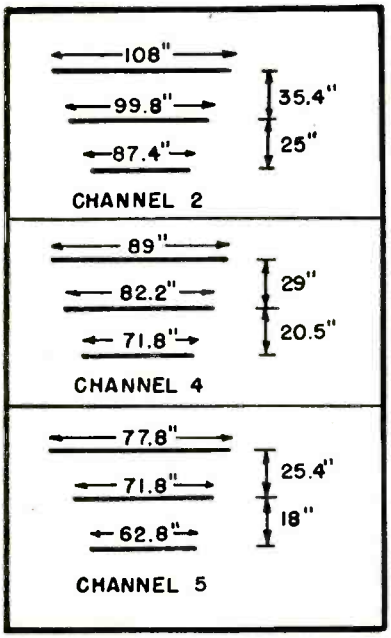


Fig. 5. Dimensions and spacing of antenna elements of three-element array to realize approximately 73 ohms at the dipole terminals for one specific tv channel.

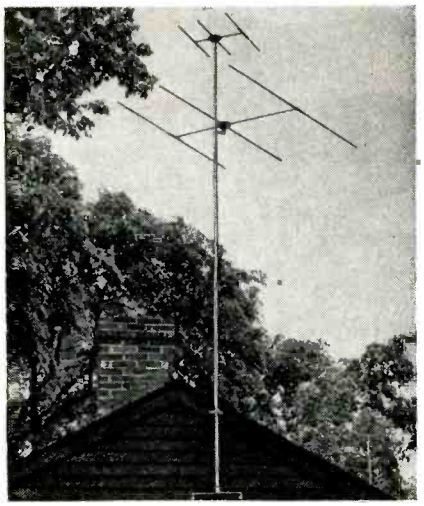
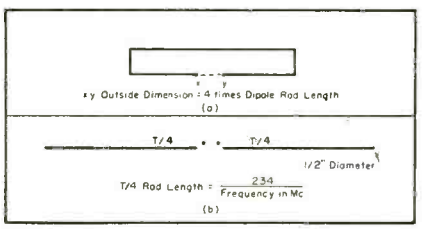


Fig. 6. A double stack of three element arrays, which serves to increase the forward gain of a specific tv channel.
(Courtesy Workshop Associates)

Fig. 7. Tables for determining resonant frequency of dipoles shown below. Distance between the elements in the folded dipole can vary from .54 to .145.



or folded dipole cut approximately for channel *13* may be added to the larger array and adjusted at right angles to pick up channel *13* and transfer its signal into the transmission line. The best way to adjust this composite array is:

(*a*) Install larger array and adjust for best reception on channels *2, 4, 5* and *11*.

(*b*) Add high-frequency attachment and adjust for best reception of channel *13*.

(*c*) Recheck channel *2, 4, 5* and *11* pictures to determine if they have been affected by the addition of the high-frequency attachment.

(*d*) If the channel-*13* attachment mars reception on the other channels (*2, 4, 5* and *11*), a separate transmission line may be installed for the high-frequency antenna attachment, and an antenna transfer switch mounted adjacent to the tv receiver.

High-frequency antenna attachments may affect low-frequency or broadband arrays under the following conditions:

(*a*) When the low-frequency array picks up a strong reflected signal on a high-frequency channel, which differs in time and phase delay with respect to the direct signal picked up by the high frequency attachment on the same high-frequency channel.

(*b*) When the larger antenna array picks up a ghost-free reflection on a low-frequency tv station and the high-frequency attachment induces a direct pickup tv signal on the same low fre-

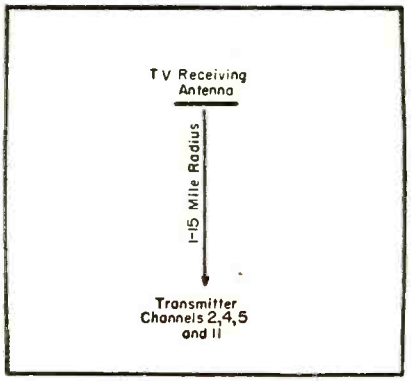
(*Continued on page* 36)

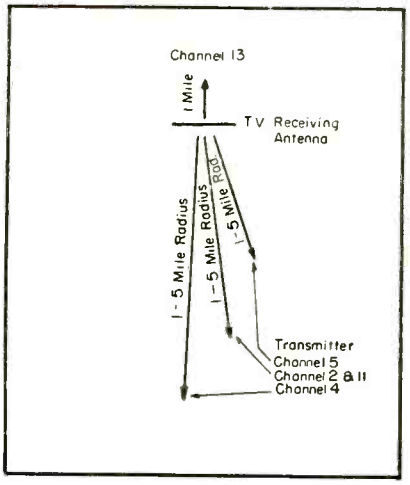
TV Channel	Approximate Dipole Rod Length
2	4.1′
3	3.6′
4	3.4′
5	3′
6	2.8′
7	1.32′
8	1.28′
9	1.24′
10	1.2′
11	1.16′
12	1.13′
13	1.18′

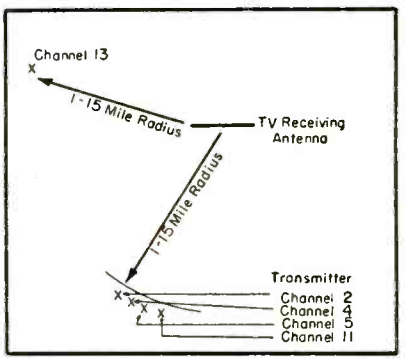
Fig. 7*b*. Dipole rod table.

Tv Channel	xy Outside Dimension
2	16.4′
3	14.4′
4	13.6′
5	12.0′
6	11.2′
7	5.28′
8	5.12′
9	4.96′
10	4.8′
11	4.64′
12	4.52′
13	4.4′

Fig. 7*a*. Folded dipole table.

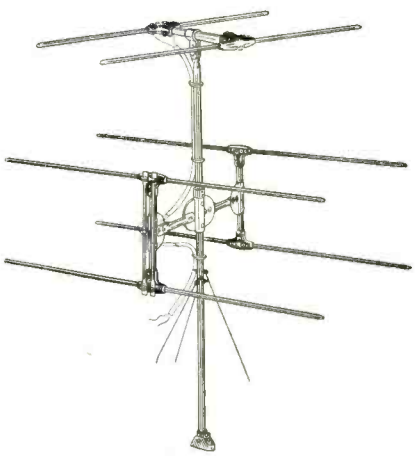






Figs. 8, 9 and 10 (top to bottom). Illustrations of typical antenna location problems encountered in the field.

Fig. 11. High channel (7 to 13) tv antenna attachment to low channel (2 to 6) tv antenna array. *(Courtesy Camburn)*



Now Available! **STANCOR QUALITY**

midget REPLACEMENT TRANSFORMERS

DESIGNED FOR PERSONAL PORTABLE TYPE RADIOS

SINGLE PLATE TO VOICE COIL . . . Two primary impedance ratings are offered in the STANCOR A-3328 and A-3329 output transformers. These will match the majority of output tubes commonly used in personal portable-type radios.

The A-3328 is interchangeable with RCA Part Number 37806. It is designed to match a single tube 4,000 ohm plate impedance to a 3.5 ohm voice coil for use with tubes such as the 1S4 and 3S4. It has 1¾" mounting centers and a small depth dimension to insure a fit in all cases. Overall dimensions are 1 3/16" H. x 2⅛" W. x 1" D.

List Price . . . $1.45

The A-3329 is similar to the A-3328 in all respects with the exception that it matches a single tube plate impedance of 8,000 ohms to a 3.5 ohm voice coil and is used with such tubes as the 1C5-GT, 1G5-G, 1Q5-GT/G, 1S4 and 3S4.

List Price . . . $1.45

DESIGNED FOR SPECIALIZED SERVICE APPLICATIONS

HUM-REDUCING TYPE . . . The STANCOR A-3330 is a special output transformer with an extra tap on the primary winding for use in hum-reduction circuits. The primary matches a single 2,000 ohm plate and the secondary is designed for use with a 3.5 ohm voice coil. Maximum allowable primary D.C. is 50 milliamperes. Used with such tubes as the 25B5, 25B6, 25L6, 35A5, 35L6 and 50L6. Maximum audio power is rated at five watts. Overall dimensions are 1⅜" H. x 2⅜" W. x 1⅜" D. Mounting centers are 2".

List Price . . . $2.10

Combination Plate and Filament

ULTRA-COMPACT SIZE

The STANCOR P-6348 is a special, midget size plate and filament transformer for small four- or five-tube receivers using either a type 6X4 or 6X5 rectifier tube. Primary operates from 117 volts, 60 cycles; high voltage winding delivers 480 volts CT at 60 ma.: 6.3 volts center tap winding delivers 2.75 amperes. Mounting area is 2 3/16" x 2 11/16". Mounts in a STANCOR type "M" mounting by two bolts with 1 29/32" between centers. Overall depth is 2¾".

List Price . . . $5.95

FREE! GET STANCOR'S NEW CATALOG TODAY!

Stancor's new catalog 140H contains important technical data and approximately 400 catalog items. Contact your authorized Stancor distributor or write direct.

standardize on **STANCOR TRANSFORMERS**

STANDARD TRANSFORMER CORPORATION • 3584 ELSTON AVENUE • CHICAGO 18, ILLINOIS

TV Signal and Voltage

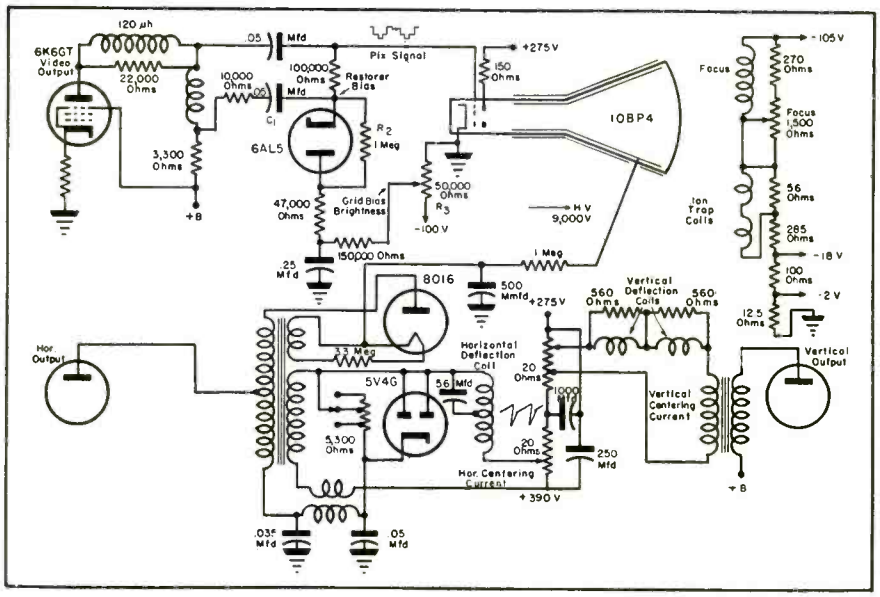


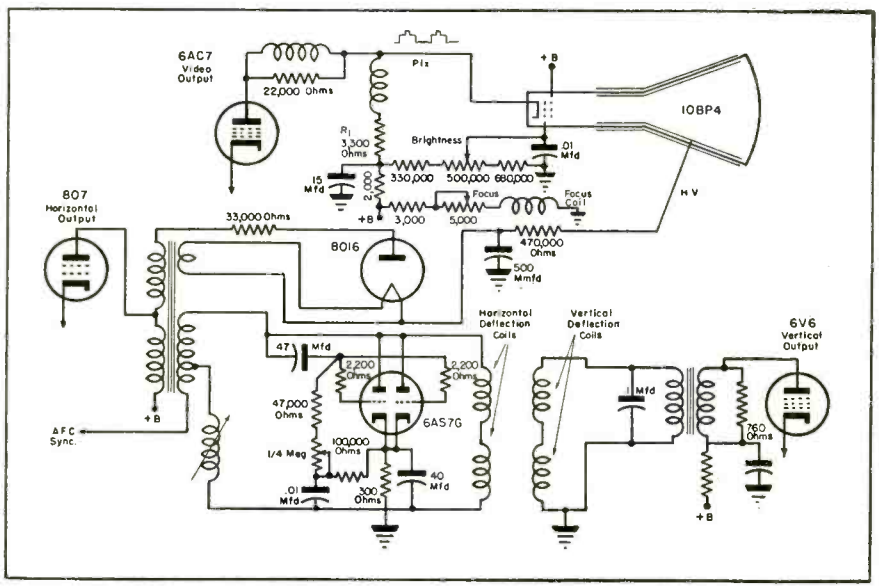
Fig. 1. Signal and voltage circuits used in the RCA 641 receiver.

IN THE PREVIOUS installments, the basic characteristics of tv receiver signal and voltage circuits were analyzed. This month, four typical circuits, used by RCA, G. E., Farnsworth and DuMont, are detailed.

RCA 641

In Fig. 1 appears the picture tube circuit used in the RCA 641 10" model. This schematic shows the many operating voltages and signals required to properly present the picture on the tv screen. To the grid of the picture tube is applied the negative-going composite tv signal from the video amplifier output tube. This negative-going single-polarity signal is augmented with two d-c voltages. One of these voltages is contributed by the d-c restorer circuit which maintains a steady charge on capacitor C_1 because of the diode current drawn through resistor R_2. A d-c component of grid bias is also taken off the brightness control, R_3, which is variable to properly set the negative voltage applied to the grid of the picture tube. The correct d-c potential for the accelerating grid of the picture tube is obtained from the low-voltage power-supply.

Fig. 2. Picture tube circuit of the G.E. 801.



Anode Voltages

The anode voltage for the picture tube of 9,000 volts is obtained from a transient fly-back high voltage supply. The negative transient developed across the horizontal deflection coil during the horizontal retrace is stepped up in amplitude by transformer action and inverted to apply a short interval high-voltage positive pulse to the plate of the 8016 high-voltage rectifier. This rectifier, which only requires approximately a 50-ma current for the heater, obtains it from the same horizontal output transformer by means of a few turn pick-up, coupled near to the high voltage windings. The high-voltage pulse itself is rectified and filtered, and serves as the second anode potential of the picture tube.

Current Flow Control

A sawtooth of current is present in the horizontal deflection coil as developed by the horizontal output tube. Likewise, a vertical sawtooth of current is developed in the vertical deflection coil by the vertical output tube. In addition to the horizontal and vertical sawtooth voltages a d-c component of current must be passed through each set of coils to properly center the picture as a whole on the fluorescent screen. These d-c components of current are taken off two 20-ohm potentiometers which are in series with the *B*-supply voltage between the 300 and 275-volt points. By controlling the amount and direction of current flow with the centering controls the picture can be properly centered horizontally and vertically.

Ion Trap

It is also necessary to pass the proper d-c through the ion trap

Picture-Tube Circuits

Systems Employed In RCA 641, G. E. 801, Farnsworth GV240 And DuMont RA-101 Tv Models.

by EDWARD M. NOLL*

Instructor in Television
Temple University

coil and the focus coil. These currents are obtained off a series of bleeder resistors across the —105 negative-voltage supply. The current through the focusing coil is controlled by means of a focusing potentiometer so it can be adjusted to obtain the sharpest picture. The two ion-trap coils also obtain their current from the same bleeder network. It is evident that the proper operation of the picture tube is dependent on a number of signals and voltages, and what is more troubles can, in most cases, be isolated by observation of the picture on the screen.

G.E. 801

The G. E. 801 picture tube signal and voltage circuit is shown in Fig. 2. In this receiver, the actual composite tv signal is applied to the cathode of the picture tube with positive polarity to properly excite the grid of the tube. A d-c component of grid bias is contributed by the average plate voltage of the video output tube, and a second d-c component is applied to the grid from a bleeder network across the low voltage supply. This latter component can be adjusted for correct brightness.

Focusing Control

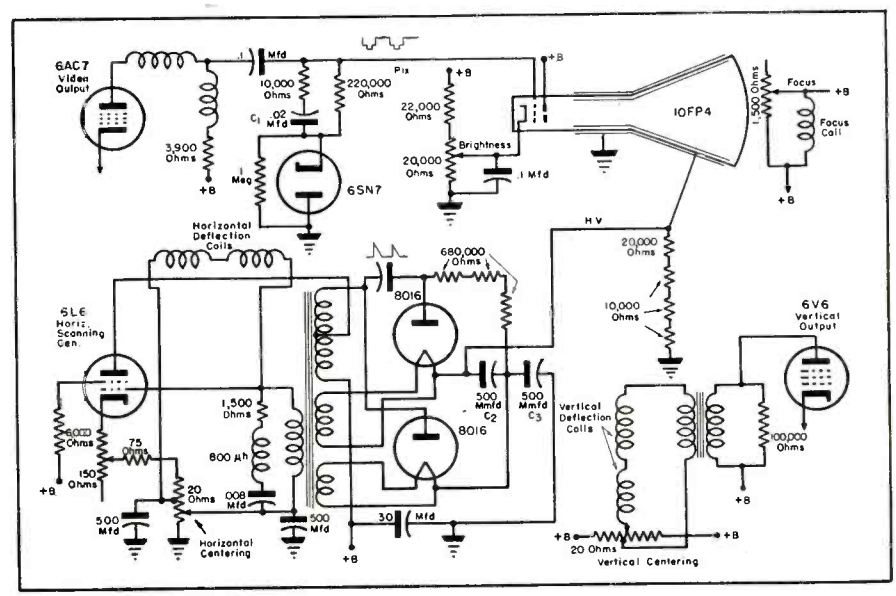
Correct focusing is obtained by regulating the current which passes through the focusing coil by means of a bleeder network connected across the low-voltage *B* supply. In this receiver the magnetic field for the ion trap circuit is generated by two permanent magnets, and no ion trap coils are used. Likewise, there is no d-c component of current passing through the deflection coils from an external current source. Proper centering of the scanning raster is obtained with correct adjustment of sawtooth amplitude and linearity, plus correct positioning of the deflection yoke. Proper deflection currents are obtained from the respective horizontal and vertical output tubes and transformers. In this receiver the transient voltage developed in the horizontal deflection coils during retrace is again used to generate the high voltage for the picture tube.

*From a forthcoming book, *Television For Radiomen*, to be published by Macmillan.

Farnsworth GV 240

The picture tube circuit of the Farnsworth tv receiver is shown in Fig. 3. In this circuit a negative-going tv signal is applied to the grid of the picture tube, while d-c components of grid bias are contributed by the capacitor C_1 of the restorer circuit, and by the positive voltage applied to the cathode of the picture tube by way of the brightness control and the bleeder network connected across the low-voltage power supply. The

Fig. 3. The Farnsworth GV-240 picture-tube circuit.



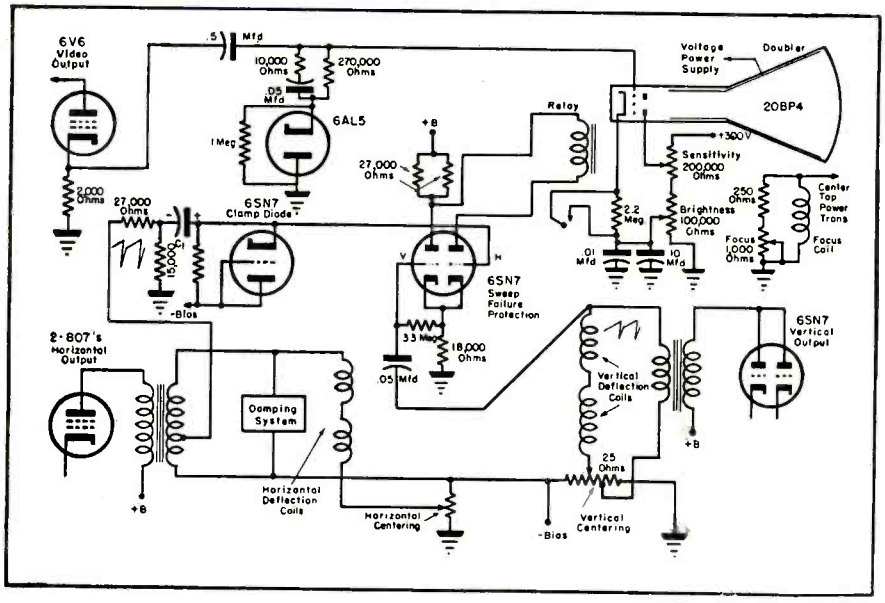


Fig. 4. Picture tube circuit used in the DuMont RA-101.

accelerating grid potential is also obtained from the low voltage power supply.

Low-Voltage Supplies

Focusing coil current is obtained from the second of two low-voltage power supplies. No ion trap circuits are necessary in this receiver because it uses the aluminum-back fluorescent screen of the 10FP4 picture tube to remove ions. The vertical centering current for the picture-tube vertical-deflection coils is obtained from the low-voltage power supply; the horizontal centering current is obtained from the cathode circuit of the beam relaxor horizontal scanning generator. By changing the position of the arm on the potentiometer in the cathode circuit wth respect to the tap, the direction and amplitude of the current passed through the horizontal-deflection coils can be adjusted for proper centering.

Beam Relaxor Circuit

A conventional vertical sawtooth output circuit is used to supply a sawtooth of current to the vertical deflection coils. The horizontal deflection coils are excited by a sawtooth current generated by the Farnsworth beam relaxor circuit. The high voltage for the picture tube is also derived from the same circuit and is obtained by stepping up the sharp positive voltage developed in the plate circuit with auto-transformer action. This sharp positive pulse is applied to two 8016 high-voltage rectifiers connected in a voltage-doubler circuit. The current for both of these rectifiers is obtained by means of pick-up loops which are a part of the horizontal deflection transformer. C_1 and C_2 are charged simultaneously by the sharp transient pulse across the secondary.

DuMont RA-101

The DuMont RA-101 television chassis (Fig. 4) has a number of unusual features. A cathode-follower video output tube is used in conjunction with a d-c restorer. A negative-going tv signal is applied to the grid of the picture tube which can be one of three sizes . . . 10", 15" or 20" direct viewing.

Restorer Circuit

A d-c component of grid bias is contributed by the restorer circuit and by a positive potential applied to the cathode of the picture tube which can be properly set for correct brightness. The potential applied to the accelerating grid of the picture tube is also adjustable by means of a sensitivity control. This control is set once for the individual tube used in the circuit and insures the proper control grid-signal range between beam cut-off and the most brilliantly illuminated point.

Voltage Doubler

The second anode voltage is obtained from a voltage-doubling power supply using a transformer excited by the 60-cycle line. A special beam-protection circuit is used in case the deflection system fails and the second anode voltage continues to be applied to the picture tube. Actually when current ceases to flow in the protective relay, the relay contacts open up and insert a 2-megohm resistor in series with the cathode lead holding a positive voltage on the cathode which cuts off the beam. The relay winding is in series with the second section of the sweep-failure tube, which is held normally conducting by the positive voltage developed when the clamping diode is driven by a negative pulse of the horizontal-output transformer, the diode clamp keeping a positive charge on capacitors C_1 in the same manner as a d-c restorer functions. The first section of the sweep-failure tube is normally cut off because of the current pulled through the common cathode resistor and the two parallel plate resistors by the second section. In addition, the grid is held at an average negative bias because of the grid current flowing during the peak of the vertical sawtooth. If the horizontal sweep were to fail the second section would be cut off, because of the absence of the position change on C_1 and the negative bias applied to its grid from the negative portion of the low-voltage power supply. If the vertical sweep were to fail, the first section of the tube would conduct and the current drawn by it through the large cathode resistor would again cut off the second section and open the relay contact.

Sawtooth Currents

The horizontal and vertical sawtooth current are again obtained from the respective horizontal and vertical-output tubes. Centering current is obtained by means of potentiometers connected in the negative line of the low-voltage power supply. Focusing current for the focusing coil of the picture tube is also obtained from the low-voltage power supply.

[To Be Continued]

Howard W. Sams

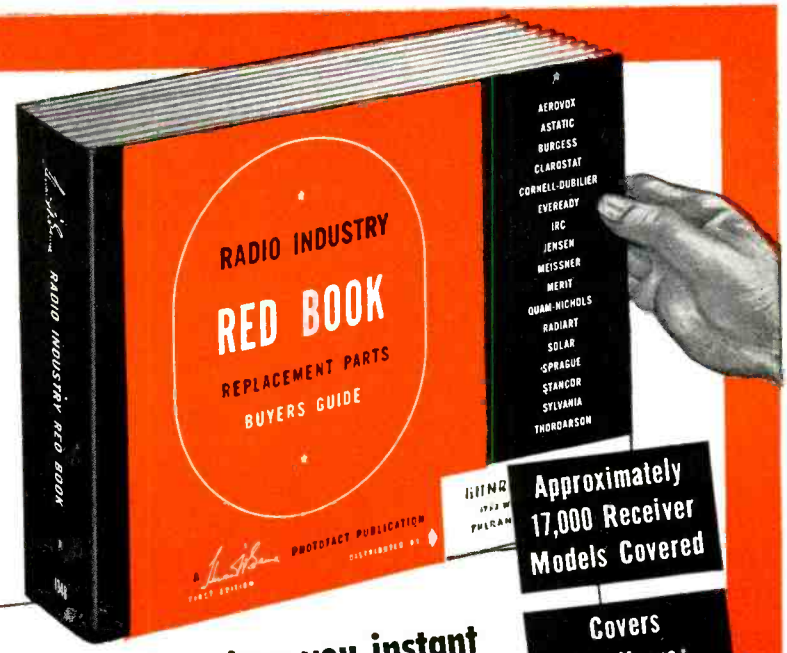
presents the amazing

RADIO INDUSTRY

RED BOOK

REPLACEMENT PARTS

BUYER'S GUIDE



NOW—a SINGLE authoritative volume that gives you instant reliable data on ALL replacement parts for thousands of popular radio receivers . . . more useful data than in all other replacement parts guides and manuals COMBINED . . .

COMPLETE!

The First Cooperative Industry Effort in Behalf of the Radio Service Technician

Approximately 17,000 Receiver Models Covered

Covers Ten Years: 1938 to 1948

Easy to Use: All Data Quick to Find

440 Pages Smythe-bound Opens Flat

FOR THE FIRST TIME IN RADIO HISTORY!

All 9 Major Replacement Components Listed
(not just 1 or 2 components)

17 Leading Parts Manufacturers Represented
(not just 1 manufacturer)

COMPLETE DATA ON ALL RECEIVER REPLACEMENT PARTS—*ALL IN THIS ONE GREAT BOOK!*

Save time! Stop wasteful hunting! Get ALL the parts data you need—quickly—from this single book. NOW—for the first time—have all the replacement parts data you need—ALL in one single, authoritative volume. No more waste of valuable time searching through dozens of incomplete manuals and catalogs. The RED BOOK, first and only complete parts guide ever produced, covers approximately 17,000 radio models made from 1938 through 1947—10 full years. Lists parts made by 17 leading manufacturers—not just one! Gives you complete, accurate data on all 9 major replacement components—not just one or two! Clear, concise, easy-to-use—over 440 pages (8½" x 11") bound in a sturdy sewed cover, arranged alphabetically by manufacturer and model number for quick reference. Does away with confused collections of separate books and manuals—gives you *complete* information—PLUS data that cannot be found in any other source—at a fraction of the price you'd pay for the books it replaces. There's never been anything like it—absolutely indispensable for every service shop!

Only the RED BOOK gives you ALL this invaluable data. Here's everything you need to know about the replacement parts for the receivers you service daily. The RED BOOK gives you original manufacturers' parts numbers, proper replacement parts numbers and valuable installation notes on *Capacitors, Transformers, Controls, IF Coils* (including Peak Frequencies), *Speakers, Vibrators* and *Phono Cartridges. Tube* and *Dial Light* data includes number of tubes in each chassis, with type number for each tube, plus dial light numbers. *Battery* data includes replacement numbers on A, B, and AB packs. The following leading replacement parts manufacturers are represented in the RED BOOK:

AEROVOX, ASTATIC, BURGESS, CLAROSTAT, CORNELL-DUBILIER, IRC, EVEREADY, JENSEN, MEISSNER, MERIT, QUAM-NICHOLS, RADIART, SOLAR, SPRAGUE, STANCOR, SYLVANIA, THORDARSON

18 months in preparation—over $90,000 to produce. The RED BOOK is the product of thousands of man-hours spent in laboratory research and in cooperation with 17 participating manufacturers to produce the most complete, accurate, authoritative parts replacement guide ever published. Every bit of information in this amazing book has been painstakingly checked to insure maximum accuracy and usefulness. Over $90,000 was spent to prepare the RED BOOK—the only book that brings you everything you need to know—every bit of replacement parts data you want to make your work easier and more profitable. You can't afford to be without the RED BOOK. It's the indispensable guide you'll use profitably every single day. Stop hunting for the right answers *now—order your copy today.*

THE INDISPENSABLE RED BOOK . . . ONLY . . . $3.95

BE SURE TO ORDER YOUR RED BOOK TODAY

Mail This Order Form to Your Parts Jobber Today or send directly to HOWARD W. SAMS & CO., INC., 2924 E. Washington St., Indianapolis 7, Ind.

My (check) (money order) for $..... enclosed.

☐ Send.....RED BOOK(S) at $3.95 per copy. (I understand that delivery will be made to me in September.)

Name.....

Address.....

City.....State.....

HOWARD W. SAMS & CO., INC.
INDIANAPOLIS 7, INDIANA

Servicing Helps

Using A Signal Tracer For Capacity Checking, Code Practice And Auto Set Testing. Service Notes on Philco, Admiral And Chevrolet Receivers.

by P. M. RANDOLPH

IN THE FEBRUARY ISSUE OF SERVICE appeared several interesting applications of a signal generator originally described in the May, 1947, issue of SERVICE.

Franklin H. Stewart, who sent in the May issue circuit, reports that he has included a few innovations which have amplified the circuit's uses. In Fig. 1 appears one of the circuit changes.

Considerably more gain was obtained by using a 6AC7 instead of the 6SK7 in the r-f stage. Other alterations include an r-f choke used in place of the plate load resistor.

In checking capacitors Stewart says he inserts the unit under test in series with the high voltage supply, and the potentiometer and neon-lamp combination; Fig. 2. If the capacitor is good, there will be an initial flash of the lamp and no further indication. An open capacitor will not cause the flash. A leaky capacitor will cause a series of flashes and a shorted one will cause a continual glow. For replacement purposes capacitors of at least 600-volt ratings are used, each one being checked before installing, with 250 volts applied from the voltage divider.

Capacitors in the receiver, says Stewart, may be tested by disconnecting one lead. This circuit may also be used as an aid in locating shorts in variable capacitors. Plates are straightened until rotor may be turned all the way in or out without neon glow at any position.

The tracer can also be used as a code-practice oscillator, by making the changes noted in Fig. 3. A key is inserted in series with the connection to the plate coupling capacitor on the 6K6 and the connection to the diode detector section of the 6SQ7. Audio gain control must be reduced to minimum before inserting key. Then the volume can be increased to desired level with key closed.

Another interesting modification and application is shown in Fig. 4. The 6.3-volt a-c filament secondary of the power transformer may be used to operate an automobile receiver, if the receiver has a rectifier tube. One side of this 6.3-volt a-c is connected to the lead which ordinarily goes to the ammeter or other source of supply. A two-lead connection is made to the other side of the 6.3 terminal. One of these has a clip on it and clips to the chassis. The other of this pair has one prong of an old battery plug on the end. Vibrator should be removed and pin inserted into either of the small terminals.

We now have 6.3 volts on all filaments and 6.3 volts a-c from one side of the primary winding to center tap on the power transformer.

•

Service Notes

JOHN W. FINDARLE of Modesto, Calif., has forwarded an assortment of very useful services notes on Admiral, Philco and Chevrolet receivers.

On the Admiral 7TO1C, E, M models, Findarle states there are several troubles common to this series.

Set dead: If pilot light flickers when the set is tuned to a point on the dial

Fig. 1. Revision of signal tracer using a 6AC7 instead of a 6SK7 in the r-f stage.

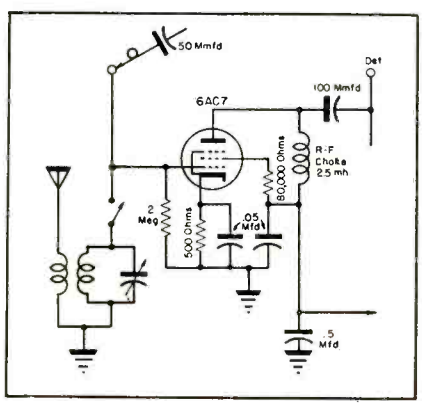


Fig. 2. Circuit of capacitor checker in the signal tracer.

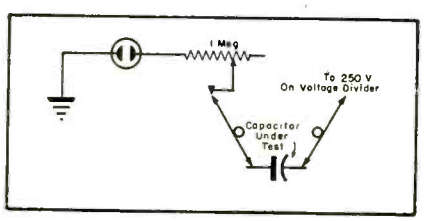
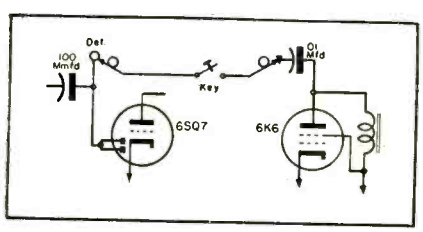


Fig. 3. How to hook up a code practice oscillator in the signal tracer.



where a powerful local is normally heard, the set is probably okeh up to the secondary winding of the output transformer. (This is a rapid and positive method of determining the same trouble on other a-c/d-c sets having the conventional pilot light hookup.) The cure is a rather odd one; application of a soldering iron to the voice coil terminals on the speaker frame. It seems that no flux was used on the original joint, and the leads from the secondary of the output transformer do not make good contact.

Set dead, pilot light does not flicker: The resistance of the i-f transformer windings should be checked, especially the secondaries. It should be about 15 ohms. Comparing the value of one winding with that of the others will disclose the correct value.

Chevrolet Auto Radio, Model 985255

A common complaint on this model is the lack of sensitivity over part of the dial. A preliminary check will usually indicate improper alignment. However, when alignment of the i-f transformers is attempted, it may be found impossible to peak at the 262.5 kc i-f specified for this receiver. In fact the lowest possible frequency at which the i-fs can be peaked may be 310 kc.

Normally this would indicate shorted windings on the transformers, but the possibility of all the coils being shorted is seldom the case. In one receiver under test, a resistance check proved the i-f transformers and associated trimmers to be okeh. The set was therefore peaked at 315 kc and on the completion of the alignment, found to not only play normally throughout the dial, but be less subject to ignition interference.

Philco Models 47-1226, 1227, 1230 and 48-1264

It has been found that most complaints in these models are caused by the original tubes in them. Replacements have cured intermittents, frequency drift noise, etc.

Intermittent, comes back on only after turning set off and allowing to cool: Replacing the 7R7 tube will remedy this every time. A tube checker will not disclose a defective tube and neither will tube tapping every time.

Intermittent, cutting on and off is periodic: The 6BA6 should be tested. These tubes seem to develop an intermittent open after being in service for awhile. Tapping the tube while the set is in operation will readily disclose if this tube is at fault.

Frequency drift accompanied by mushiness: This is another tube replacement item, with the 7F8 at fault. No amount of tube tapping nor a tube test will disclose a defective tube. After replacing the tube, the set should be kept on for a couple of hours. Old tubes usually do not act sick until they have been used for an hour or so either, and some new tubes will act the same way.

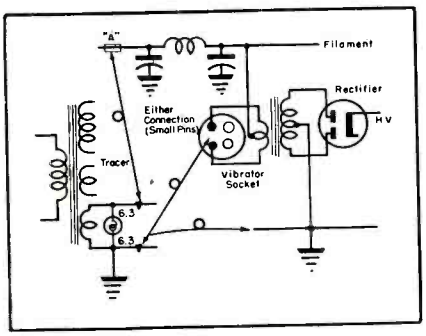
Intermittent noise: If the noise sounds like bursts of static, the 7F8 should be tapped. In seven out of eight cases the tube was found to be at fault.

Mushiness and noise: In some cases this can be traced to one of the 6V6GT or 6K6GT output tubes. The best way to locate the bad tube is to find a quiet spot on the dial, then turn the volume control full on and tapping and listening; tapping each of the output tubes in turn and listening for a change in noise level and a click each time that the defective tube is tapped.

Philco Model 48-200

Set dead: If the dial light flickers with the volume control wide open and the set tuned to a point on the dial where a powerful local is normally heard, the speaker voice coil can be suspected. A check with a low reading ohmmeter will invariably disclose it to be shorted. Replace it with a 5" p-m Alnico V (1 ounce) speaker having a 3.2-ohm voice coil. This defect occurs before the sets are sold or very soon after.

Fig. 4. Use of the 6.3 volt a-c filament secondary of the power transformer for operation of an auto receiver.



Chevrolet Model 985284 Auto Radio

Weak or no reception: This was traced to the lugs of the antenna coil which were found to be shorting to the shield can under vibration. This also causes an intermittent condition in some cases. The remedy is to bend the lugs in.

Admiral Model 7C64W-UL

Set dead: On checking it was noticed that the following tubes and the pilot lamps were cold: 6BA6 i-f, 6BA6 i-f/a-m detector, 6AL5 discriminator, 6SJ7 a-f and 6V6GT output. This was caused by a snap in the lead of the capacitor-choke combination at lug 4 of the 6BA6 i-f tube socket due to vibration. To repair, it is best to drill a hole in the chassis and mount a single lug tie-point strip and use this as a terminal for the capacitor-choke wire and then run a wire to the socket lug.

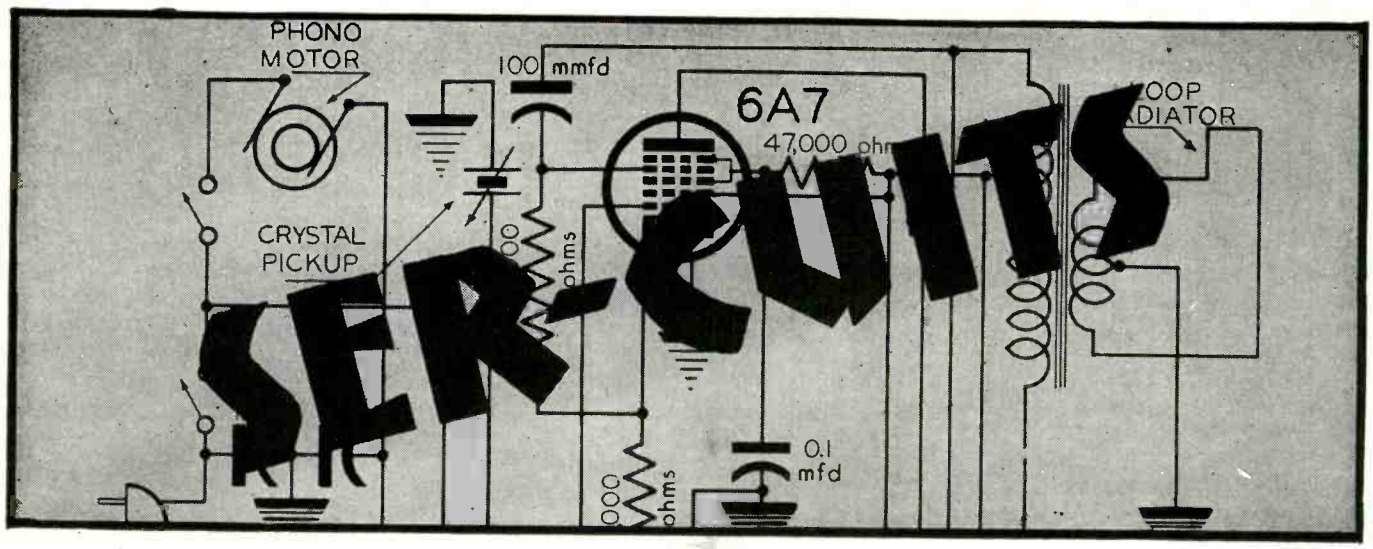
Remedy for Fogging Dials

THE DIAL WINDOWS of the Admiral 8B1, 9A1 and 9B1 chassis build up a small electrostatic charge, thus causing the plastic to attract fine dust particles. These are so fine that the dial windows appear milky or foggy. This often occurs within a few days.

A solution called Hexco Dust-Ded[1], has been found to be an effective remedy. This solution is used on television magnifying lenses to reduce their affinity for dust. When testing this solution, it was found that it will materially reduce the amount of fine dust collecting on the dial windows, thus preventing the foggy appearance. Admiral service engineers report that one application will last indefinitely. However, it is possible that reapplication may be necessary. At the present time, Admiral is treating all dial windows in production with this solution.

To apply the solution, the dial window will have to be removed from the cabinet. The window should be cleaned by wiping off the dust thoroughly on both sides, with a damp (not wet) cloth or chamois skin.

[1]Solution available from Admiral Corp. Service Department; part number *98A11-2*.



TV Circuit Features of Stromberg-Carlson TV-12, G. E. 803 and Philco 48-2500 (Projection Model).

DURING THE PAST few months many new types of tv receivers have appeared featuring a variety of circuit innovations.

The Stromberg-Carlson TV-12 model is an excellent example of the recently-announced receivers with quite a few advanced circuit features.

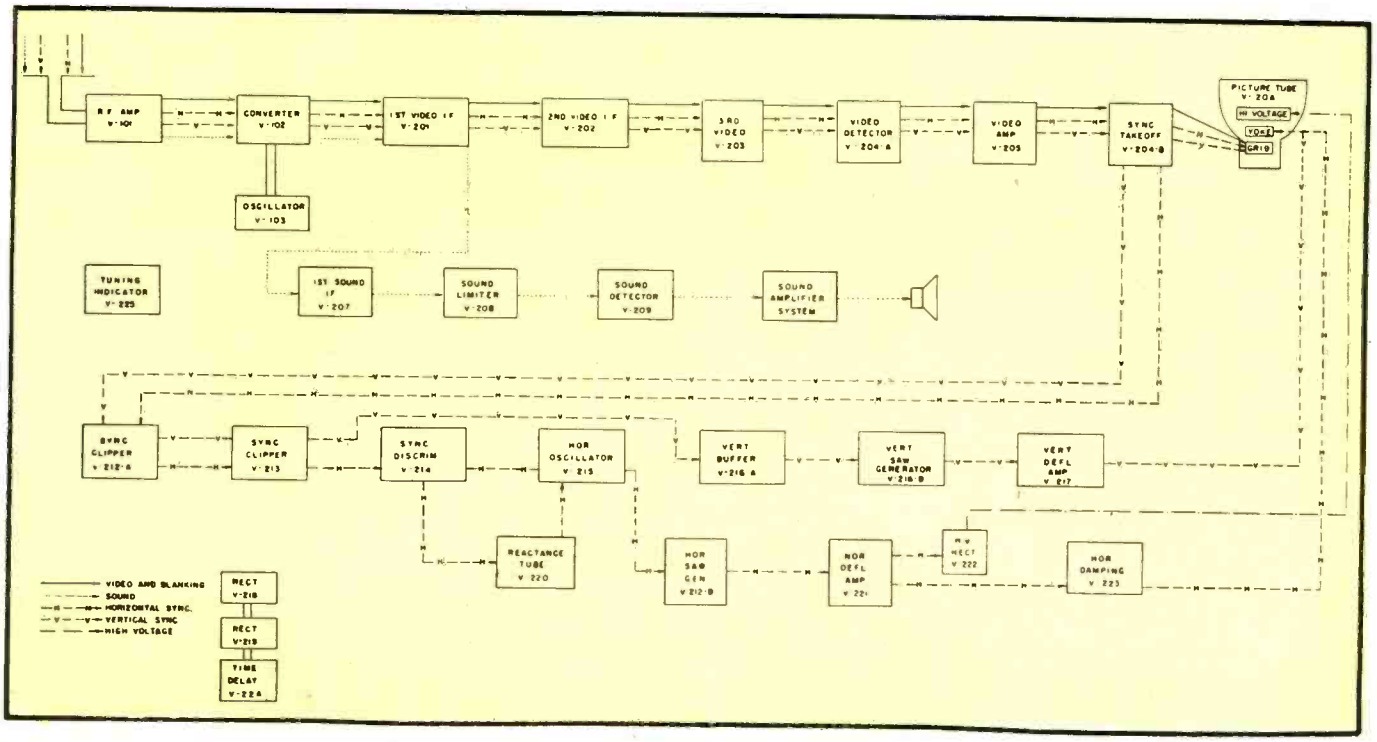
In this receiver twenty-eight tubes are used:

6J6 r-f amplifier; 6AK5 converter; 6J6 r-f oscillator; three 6AG5s for first, second and third video i-fs; 6AL5 video detector and d-c restorer and sync takeoff; 6AC7 video amplifier; 12JP4 picture tube (providing a 7½"x 10" picture); 6AU6 first sound i-f; 6AU6 f-m sound limiter; 6AL5 f-m sound detector; 6SJ7 first sound amplifier; 6V6GT/G sound power amplifier; 6SN7GT sync clipper and horizontal saw generator; 6SJ7 sync clipper; 6AL5 sync discriminator; 6K6GT/G horizontal oscillator; 6SN7GT vertical buffer and vertical saw generator; 6SN7GT vertical deflection amplifier; two 5U4GS as low-voltage rectifiers; 6AC7 reactance tube; 6BG6G horizontal deflection amplifier; 1B3GT/8016 high-voltage rectifier; 5V4G for horizontal damping; 6AL5 time delay relay and 6AL7GT tuning eye.

R-F Tuner

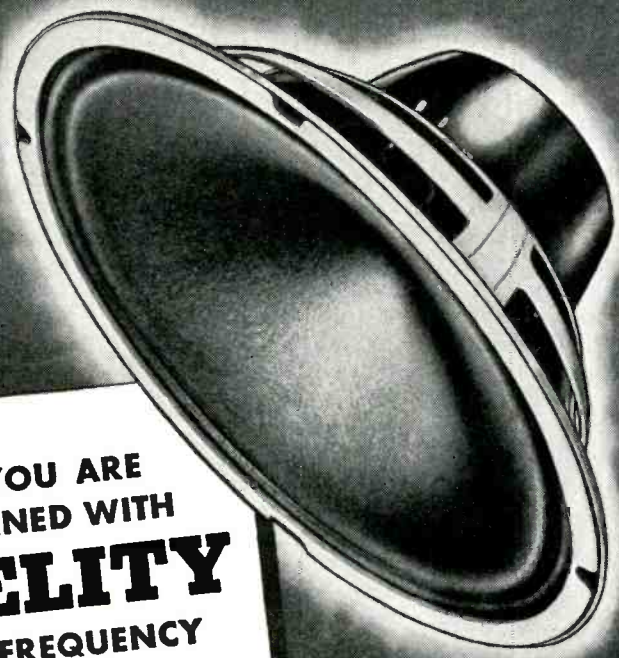
A 75-ohm low-loss transmission line (coax) used between antenna and in-

Fig. 1a. Block diagram of the Stromberg-Carlson TV-12 (Series 10-11). This circuit is similar to the DuMont RA-103.



Specify the GE 1201

DELUXE ALNICO 5 LOUDSPEAKER



WHEN YOUR JOB DEMANDS

POWER

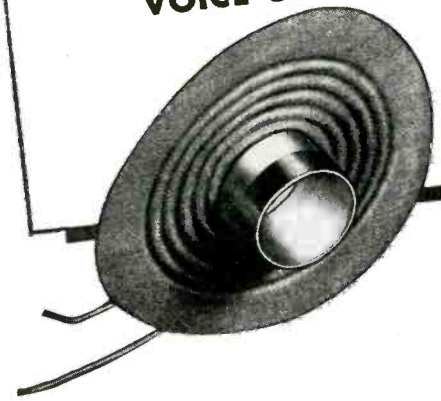
25 WATTS POWER HANDLING CAPACITY

WHEN YOU ARE CONCERNED WITH

FIDELITY

BROAD FREQUENCY CHARACTERISTIC 50—13,000 CYCLES

EQUIPPED WITH THE FAMOUS GENERAL ELECTRIC ALUMINUM FOIL BASE VOICE COIL



POWER, fidelity and a price that will amaze you for a speaker of this exceptionally high quality—it's the G-E 1201.

It's a wide range speaker with the frequency response stretched out at both ends of the curve to give intense realism, smooth, full lows and "high fidelity." A curvilinear cone is employed to provide this extended frequency response. Alnico 5, 14½ ounces of it, gives high sensitivity and smooth response.

The moving parts in the speaker assembly are ruggedly designed to take high power without damage to the speaker in any way.

Note: Frequency response 50—13,000 cycles.

For complete information on this outstanding speaker write: *General Electric Company, Electronics Park, Syracuse, New York.*

GENERAL ELECTRIC

169-GB

put is terminated by the cathode input circuit of a grounded-grid 6J6 r-f amplifier. This input circuit is capacity coupled to the transmission line by means of a 470-mmfd capacitor. The inductance in parallel with the antenna input provides a high-pass r-f filter to suppress broadcast-band or other low-frequency, cross-modulation interference which may arise when the receiver is located in an extremely intense field of an a-m broadcast station or other radiator.

The plates of the 6J6 r-f amplifier are coupled to the grid of the 6AK5 converter by means of a 6-mc wide coupling network. A variable series coil combination tunes to the desired signal frequency in conjunction with the associated tube capacities and a coupling network. A pair of 12,000-ohm resistors are used to reduce the Q of the respective coils considerably so that the coupling network can maintain the very wide pass band.

The r-f oscillator utilizes one section of the twin triode 6J6 in a modified Colpitts oscillator circuit, and its frequency is on the high side of the signal. The feedback voltage of the oscillator is accomplished by means of the interelectrode capacity of the tube. The oscillator frequency is tuned by movement of a tap on the coil which short circuits a portion of the coil.

The oscillator output is coupled to the grid of the converter by means of a 1-mmfd capacitor. The incoming signal is also fed into the grid of the converter tube and the resulting i-f signal appearing on the plate is fed into the first video i-f transformer.

Video I-F Amplifier

The video i-f amplifier chain consists of three stages, using the type 6AG5 sharp cutoff high-gain pentode. Each video i-f coupling network consists of two adjustable coils which are resonant with their respective tube capacities and coupling networks. The first video i-f coupling network utilizes shunt inductive coupling. The second, third and fourth video i-f coupling networks use the series type of inductive coupling. The two parallel resonant traps in the series arm of the *pi* network in the third coupling network provide a high degree of attenuation to the associated sound carrier and to the sound carrier of the adjacent channel.

The grids of the first and second video i-f stages are returned to a variable negative bias provided by the

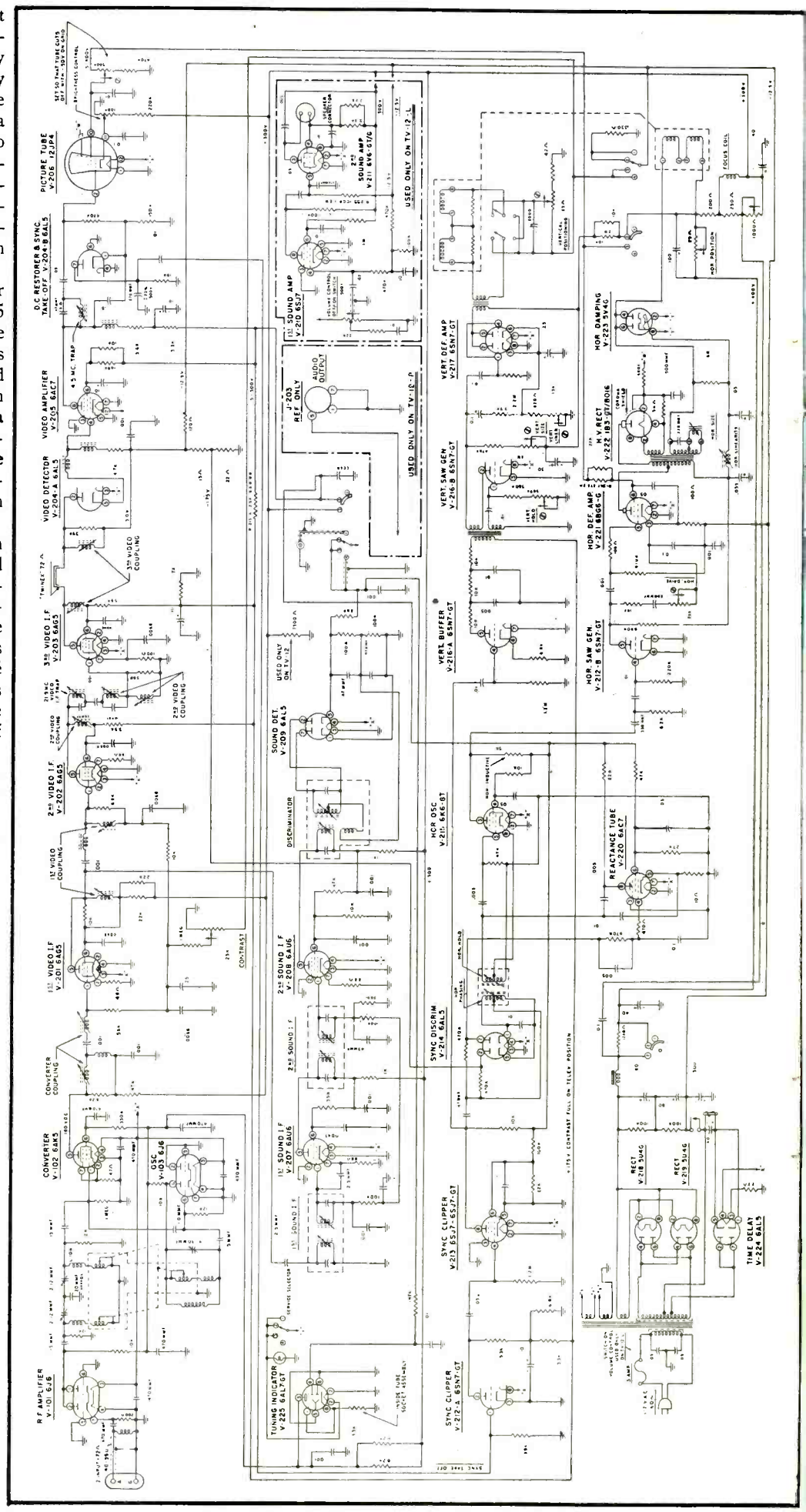


Fig. 1b. Circuit diagram of the Stromberg-Carlson TV-12 receiver.

contrast control, which thus varies the gain of the i-f amplifier. The third video i-f amplifier stage is operated at maximum gain. The input to the f-m sound i-f amplifier system is taken from the plate of the first video i-f amplifier.

The output of the fourth video i-f coupling network is fed into one diode section of the 6AL5 video detector and the diode load which consists of a 4,700-ohm resistor and a pair of peaking coils.

Video Amplifier

The grid of the 6AC7 video amplifier is directly connected to the diode load. A fixed bias of –3 volts (when no signal is present) is maintained on the grid of the video amplifier by returning the low-potential end of the diode load resistor (4,700 ohms) to the –3 volt point of the bleeder resistor network consisting of 120-ohm, 15-ohm and 22-ohm resistors.

The plate of the video amplifier is coupled to the 12JP4 picture tube by means of a resonant trap, consisting of an iron-cored coil and a 47-mmfd capacitor and a .05-mfd unit. This resonant trap provides the video amplifier section with an extremely sharp cutoff characteristic at 4.5 mc and thus attenuates the beat of the sound carrier and video carrier to prevent it from interfering with the picture.

D-C Restorer and Sync Separator

The plate of the video amplifier is also coupled to the second section of the 6AL5 diode and its associated circuit containing a 150,000-ohm and 10,000-ohm resistor and a 270-mmfd capacitor. This circuit rectifies the composite video signal and reinserts its d-c component on to the grid of the picture tube. This diode also serves as a sync separator, only negative sync pulses appearing across the 10,000-ohm output resistor.

Picture Tube Controls

The brightness control, a 100,000-ohm pot, varies the positive d-c bias on the cathode of the picture tube so as to vary the picture background brightness. The bias control, a 500,000-ohm unit, varies the positive voltage on the second grid of the picture tube. The purpose of this control is to adjust the second grid voltage of each picture tube so that they all will have a standard grid-control characteristic.

Sync Clippers

The sync pulses developed across the 10,000-ohm output resistor and 270-mmfd capacitor are coupled into the two sync clipper stages. The clipper stages amplify and clip both top and bottom of the sync pulses. The sync pulses developed on the plate of the second stage remain substantially constant in amplitude over a wide range of input signal levels.

Vertical Deflection

The output of the second sync clipper is fed into the 6SN7 vertical buffer with an integrating network used as the plate load. The integrating network adds the six vertical pulses into one pulse which is then fed into the primary of a vertical sawtooth generator transformer. The 6SN7 vertical sawtooth generator then can be locked into synchronization with this pulse by adjusting a vertical hold control. A vertical size control varies the *B* supply voltage to the sawtooth generator and thus varies the vertical size.

The vertical deflection amplifier amplifies the incoming signal so that it will have the power to deflect the picture tube to the correct height. A vertical linearity control varies the cathode bias of the vertical deflection amplifier. This control interacts with the vertical size control, so that when changing either the vertical size or the linearity, both controls will have to be adjusted.

The signal coming from the vertical deflection amplifier is fed into the vertical deflection coils by means of a vertical output transformer. A vertical positioning control, in conjunction with a vertical positioning switch adjusts the amount and polarity of d-c current so the picture can be centered in the vertical direction on the screen of the picture tube.

Horizontal Sync and Deflection

The output of the sync clippers is also fed into a 6AL5 horizontal sync discriminator through a pair of 470,000-ohm resistors and a 47-mmfd capacitor. The time constant of this combination is such that if either a wide vertical pulse or a narrow horizontal pulse is applied from the sync clipper plate, only sharp pips will result.

The resulting pulse is fed into a horizontal sync transformer. At the same time the sine wave 6K6 horizontal oscillator impresses a sine wave on the secondary of the sync transformer, making one end of the transformer primary have a sine wave 180° out of phase with the sine wave at the other end. The combination pulse and sine wave causes current to flow in each diode, the resultant being *0* at pin *7* of the 6AL5 sync discriminator if the currents are equal. If the frequency of the oscillator tries to change, the pulse will ride at a different point on the sine wave, causing a change of current in each diode resulting in a change of potential at pin *7*. This voltage is then applied to the grid of the 6AC7 reactance tube through a resistor-capacitor network (.005 and .1-mfd capacitors and 470,000-ohm resistor) which filters the voltage. The change of voltage on the grid causes a change of plate current which changes the inductive reactance of the tube (which is connected across the tuned circuit of the oscillator) in such a way as to bring the tuned circuit resonance back to where it was. This automatically keeps the oscillator at the horizontal sync or line frequency rate.

Sync Phase Control

The phase control on the sync transformer adjusts the phase of the pulse with respect to the sine wave. This is adjusted so that the picture tube will have its horizontal sweep at the correct moment in order to place all the picture information on the screen and one in the blanking interval. The hold control on the transformer adjusts the frequency of the oscillator.

The output from the plate of the horizontal oscillator is fed into a differentiating network consisting of 330-mmfd capacitor and 6,800-ohm resistor. The tips of the differentiated pulses shown cause the horizontal sawtooth generator to discharge a sweep generating capacitor, a 680-mmfd unit, in the plate circuit. A discharge network, consisting of the 680-ohm resistor, 10,000-ohm resistor and the 20,000-ohm horizontal drive control, is returned to the most negative point in the power supply through a 100-ohm cathode bias resistor. The horizontal drive control adjusts the shape of the wave being applied to the grid of the horizontal deflection amplifier and therefore affects the horizontal linearity and size. This wave applied to the grid causes the tube to be conducting except for the time the negative pip of the wave is present. Current is made to flow in the horizontal yoke when the tube is conducting. When the tube is cut off, the current in the yoke collapses in a very short time, resulting in a very high negative voltage pulse across the yoke. This high voltage pulse becomes opposite in polarity and therefore positive on the priming of the output transformer

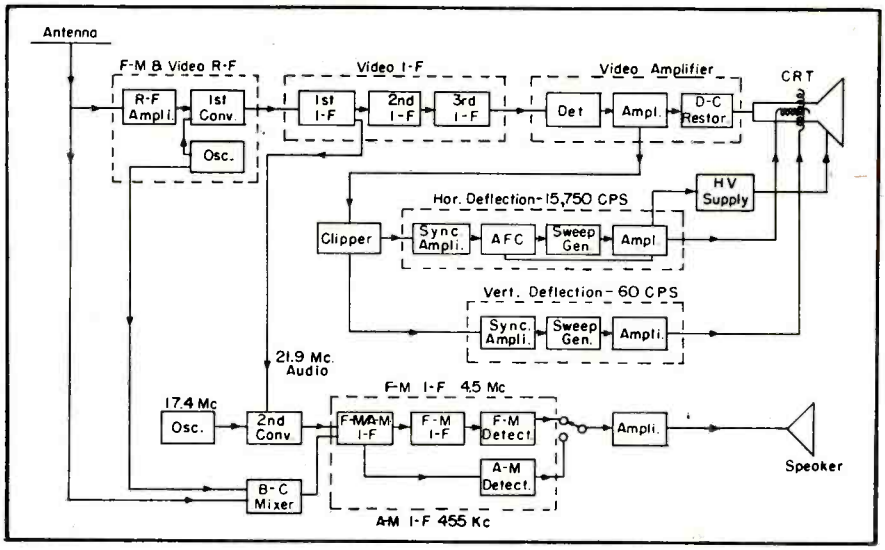


Fig. 2. Block diagram of the G.E. receiver, model 803.

and reaches an amplitude of about 4,000 volts.

Horizontal Damping and High Voltage Power Supply

The 5V4 horizontal damping tube and a 6,000-ohm damping resistor critically damp the overshoot of the horizontal deflection yoke, which takes place as a result of energy storage in the yoke.

A horizontal linearity network is used to set the time at which the damper will start conducting. By so doing the waveform of the current in the deflection coil is governed to give good linearity. The horizontal positioning control controls the d-c current through the horizontal deflection coils and thus the position of the picture in the horizontal direction.

The high voltage is obtained by first applying a pulse of 4,000 volts at the plate of the horizontal deflection amplifier. By adding more turns to the primary of the transformer feeding the h-v rectifier, the voltage of this pulse can be increased. Then, this high voltage pulse is rectified by the h-v rectifier and then filtered by a 500-mmfd capacitor and applied to the picture tube anode. The heater for the high voltage rectifier is obtained from the energy in the transformer.

Sound I-F Channel

The sound is taken off at the plate of the first video i-f and fed into the first sound i-f through a small coupling capacitor. The transformer is tuned to 21.9 mc which is the sound carrier frequency. After the sound signal is amplified in it is limited in the second sound i-f and detected. A 68,000-ohm resistor and .001-mfd capacitor are used in a deemphasis network.

Power Supply

The low-voltage power supply of the receiver is obtained from a pair of 5U4G rectifiers connected for full wave, high current rectification, with conventional filtering.

The low voltage power is applied to the receiver by the closing of a time delay relay. This relay is energized by the diode current of the 6AL5. The relay circuit has been designed so that the relay is energized approximately ten seconds after the power is applied to the television receiver. In this way all tubes have heated up and the capacitors are thereby protected from the initial high surge voltage.

Focus Coil and Control

A focus coil is in series with the section of the power supply which delivers 300 volts to most of the circuits, the current drain of these circuits thus providing the focus current. The focus current is adjusted to bring the picture tube to precise focus by means of a 1,000-ohm focus control, which is variable shunted, together with a 250-ohm unit across the focus coil.

G.E. 803

Another interesting new tv model is the G. E. 803. The circuits in this receiver are divided into nine sections: (*1*) R-f amplifier, converter and oscillator; (*2*) video and audio i-f amplifier; (*3*) video detector and amplifier; (*4*) sync pulse clipper-amplifier; (*5*) horizontal multivibrator and afc sync; (*6*) horizontal sweep output; (*7*) vertical multivibrator and sweep output; (*8*) high voltage power supply; and (*9*) low voltage power supply.

R-F Amplifier, Converter and Oscillator (Fig. 3)

The television and f-m r-f amplifier use a 6AU6 connected as a triode grounded-grid amplifier. The antenna is connected into the cathode circuit so as to provide a substantially constant input impedance of 300 ohms to the antenna at all frequencies. With a 300-ohm antenna and transmission line system, this coupling arrangement permits 13 channels and also prevents reflections from being set up on the transmission line. R_2, a 200-ohm resistor, is used for normal bias. A

Fig. 3. The television and f-m r-f amplifier, converter and oscillator circuits of the G.E. 803.

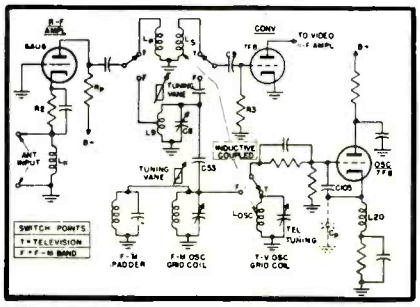


Fig. 4. Broadcast converter and oscillator circuits used in the G.E. 803.

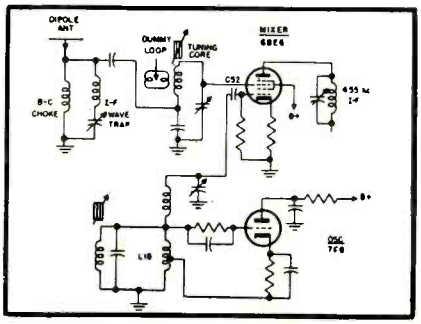
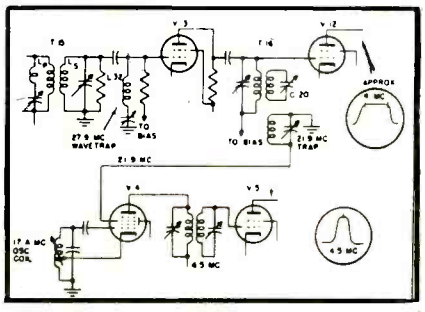
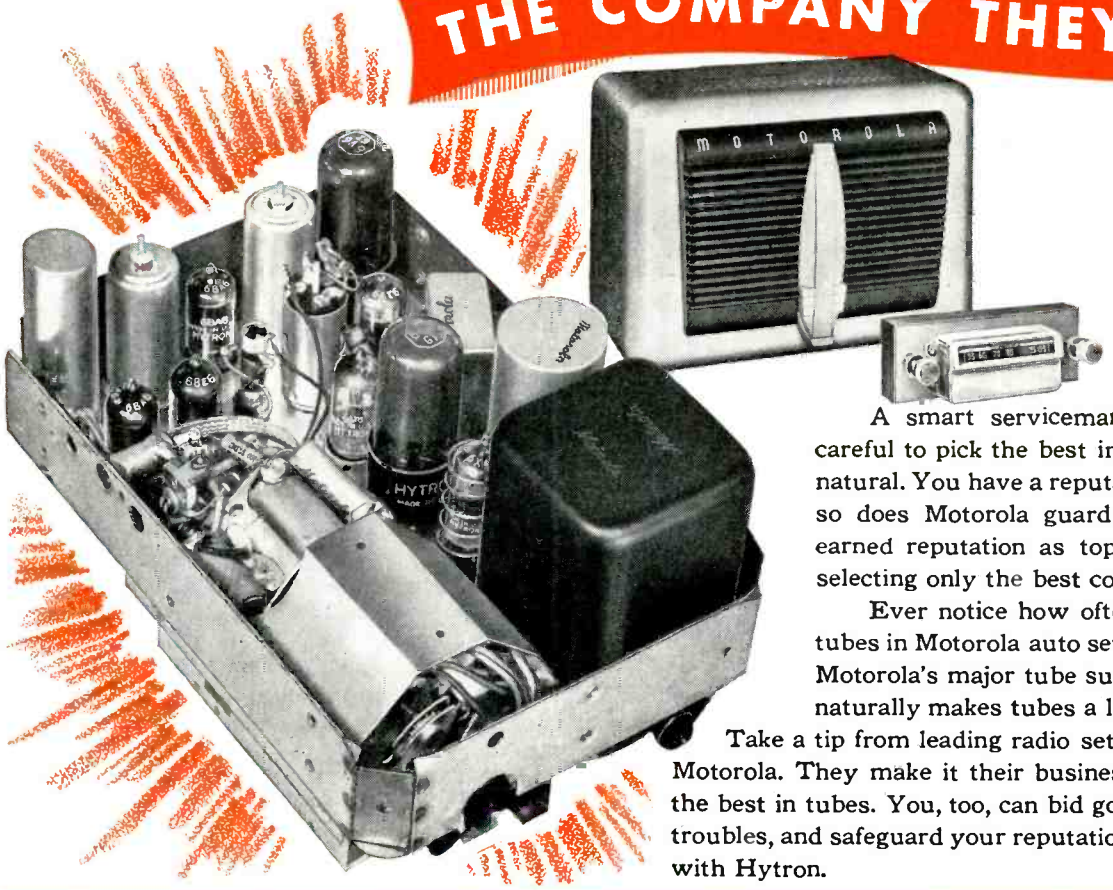


Fig. 5. Video and audio i-f amplifier of the G.E. 803



TUBES ARE KNOWN BY THE COMPANY THEY KEEP

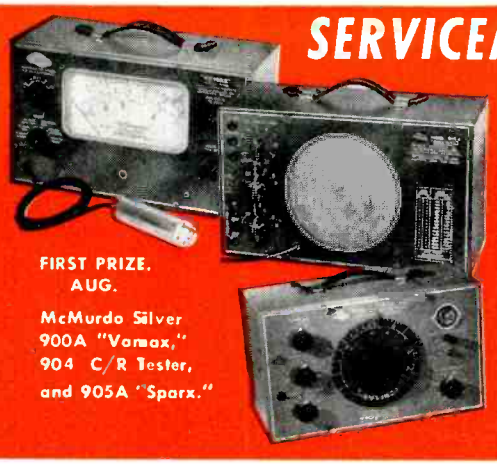


A smart serviceman, you are mighty careful to pick the best in tubes. That's only natural. You have a reputation to protect. Just so does Motorola guard jealously its well-earned reputation as tops in auto radio by selecting only the best components.

Ever notice how often you find Hytron tubes in Motorola auto sets? To rate as one of Motorola's major tube suppliers, Hytron just naturally makes tubes a lot better than good.

Take a tip from leading radio set manufacturers like Motorola. They make it their business to know and use the best in tubes. You, too, can bid goodbye to your tube troubles, and safeguard your reputation by "going steady" with Hytron.

SERVICEMEN—Win These Monthly Prizes!



FIRST PRIZE, AUG.
McMurdo Silver 900A "Vomax," 904 C/R Tester, and 905A "Sparx."

FIRST PRIZE, SEPT.
Jackson 641 Universal Signal Generator.

FIRST PRIZE, OCT.
Weston 769 H-F Electronic Analyzer.

Want one of these deluxe first prizes? Perhaps a $200 U. S. Savings Bond grand prize? Or one of three $50 and three $25 U. S. Savings Bond second and third prizes? Try your hand at any or all of Hytron's monthly contests exclusively for radio servicemen. It's easy. Here's how. Get entry blank with complete details from your Hytron jobber, or write us. Describe your proposal for a simple, economical shop tool like the Hytron Tube Tapper or Miniature Pin Straighteners. Mail entry to Hytron Contest Editor. Then hold your breath. The finger of the judges may point at you.

SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921

HYTRON RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS

NEW 9-PIN Miniature Pin Straightener

Only 49¢ at Hytron jobbers

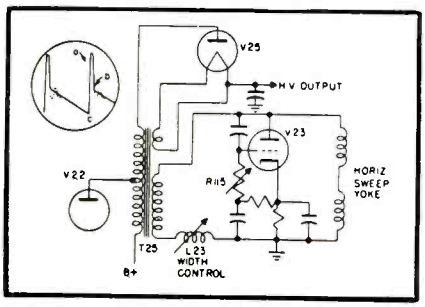


Fig. 8. Horizontal sweep circuit in the 803.

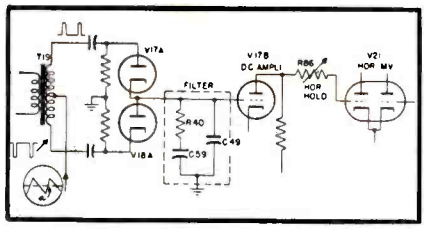


Fig. 7. The horizontal multivibrator and syno circuits of the G.E. 803.

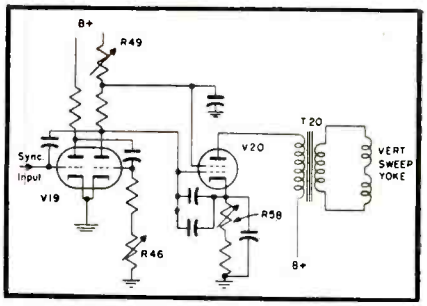


Fig. 9. The vertical multivibrator and sweep output circuit of the G.E. 803.

choke, L_k, is placed in series with this cathode resistor to prevent the input impedance from being lowered by the shunting effect of the total stray capacity to ground of the cathode of the tube. The choke value is changed for different channels.

For television operation, the r-f amplifier is coupled to the converter tube by a wide-band transformer consisting of windings L_p and L_s. The windings are overcoupled and self-tuned by the distributed and tube capacities to provide optimum gain and bandwidth. On channel *2*, the transformer is triple tuned to prevent the image frequencies of the 88- to 108-mc f-m band from interfering with this channel. For f-m reception in the 88- to 108-mc band, the r-f amplifier is coupled to the converter through the guillotine tuner unit, L_g.

The triode converter is one section of a 7F8 dual triode. Bias for this tube section is provided by the oscillator voltage appearing in the grid of the converter tube, causing grid rectification charging the grid resistor-capacitor combination, R_3 and C_9 (220,000 ohms and ceramic 47 mmfd).

The oscillator uses the remaining half of the 7F8, and for tv operation, the oscillator voltage is coupled inductively to the converter grid by locating the oscillator grid coil, adjacent to the converter grid coil. For f-m operation, the oscillator voltage is coupled through capacitor C_{53} (3 mmfd ceramic) into the grid circuit tuning circuit, L_9. The oscillator is a modified Colpits oscillator, oscillation being produced by the cathode-to-grid and cathode-to-plate interelectrode capacities of the oscillator tube. C_{105} (ceramic 6 mmfd) shunts the cathode-to-grid capacity to provide uniform operation. The choke, L_{20}, provides a d-c ground to the cathode of the oscillator tube, but maintains the cathode off-ground at the r-f frequencies. The oscillator operates on the high-frequency side of the r-f signal on all bands.

For broadcast reception (Fig. 4) no r-f amplifier stage is used, the r-f signal being applied directly to a 6BE6 mixer. Here the broadcast signal is converted to 455 kc in the plate circuit. The oscillator section of V_2 operates as the local oscillator for broadcast, operating on the high-frequency side of the incoming signal. The oscillator is connected in a Hartley circuit by taking off the cathode tap on L_{18} which forms part of the grid tank circuit. The oscillator voltage is capacity coupled to mixer grid through C_{52} (ceramic 3-mmfd).

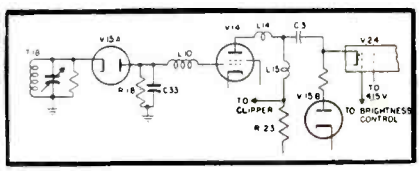
Video and Audio I-F Amplifiers (Fig. 5)

The video i-f amplifier consists of a three-stage band-pass amplifier using three 6AC7 tubes. The transformers are overcoupled and then loaded with resistance to give adequate (approx. 4 mc) band-pass frequency characteristic. A series tuned trap tuned to 27.9 mc is connected in the first i-f amplifier grid circuit to provide rejection of the adjacent channel sound. T_{16} is a broad-band, single-tuned inductance with two 21.9-mc traps coupled to it, which are used to provide rejection of the channel audio. A series tuned 21.9-mc trap is used at the diode stage.

Bias for the video i-f is taken from the horizontal multivibrator. This bias is shorted out on f-m to prevent positive voltage from appearing on the grid of V_8. The horizontal multivibrator does not operate on f-m so that the bias circuit is returned to B+.

The audio i-f frequency is developed by taking the 21.9-mc sound i-f signal from across one of the traps at T_{16} and applying it to the second converter tube, V_4. At this tube, the 17.4-mc local oscillator combines with the 21.9-mc to form a difference frequency of 4.5 mc. At this frequency it is amplified by V_6, applied to the limiter tube V_6 and then detected.

Fig. 6. Video detetctor and amplifier of the G.E. tv receiver.



Video Detector and Amplifier (Fig. 6)

The video i-f amplifier output is applied to a diode rectifier, V_{15A}, and the diode load, R_{18} (15,000 ohms) is connected so as to develop a negative-going signal at this point. This signal is amplified by pentode amplifier, V_{14}, and then applied to the cathode of the picture tube, V_{24}, through a coupling capacitor, C_3 (1 mfd). The remaining diode section of V_{15} is used to provide d-c reinsertion to the picture at the picture tube.

The chokes L_{10} and L_{14} are series-peaking chokes, while L_{15} is a shunt-peaking choke. These are used to obtain good-high-frequency response. L_{10} in combination with C_{33} (10 mmfd) also prevents harmonics of the i-f frequency from being passed through the video amplifier. R_{23} (3,300 ohms) is the V_{14} tube plate-load resistor.

Since the cathode of the picture tube is normally at a positive voltage, by the fact that it is returned to a $B+$ source, a variable positive voltage is also applied to the grid of V_{24} for control of the brightness or beam current. As long as this grid voltage is less positive than the cathode voltage, the tube beam current will be within its rating. This positive voltage on the grid is controlled by brilliance control potentiometer, R_{108B} (500,000 ohms).

Clipper and Sync Amplifier

The triode section of a 6SN7GT is used to separate the sync pulses from the composite video signal taken off at a 3,300-ohm load resistor. The clipper tube is operated at a very low plate voltage and its bias is derived by grid rectification of the positive polarity video signal applied to the grid. Thus, conduction will occur only during the

sync pulse intervals which are the most positive component of the video signal.

Another portion of the 6SN7GT is used as a horizontal synchronizing amplifier which operates into an afc input transformer. This transformer by virtue of its low inductance acts as a differentiator; that is, in the secondary, the original sync signals become positive and negative pips. Only the pip that is representative of the leading edge of the synchronizing pulse is used.

The vertical synchronizing amplifier tube receives the sync pulse at its grid circuit through an integrator circuit. This integrating circuit accepts the wide vertical pulses and further amplifies them, while the horizontal pulses do not have sufficient energy to charge the integrating circuits and are, therefore, attenuated. The tube is operated as a cathode follower and further integration of the sync signal is provided in its cathode circuit.

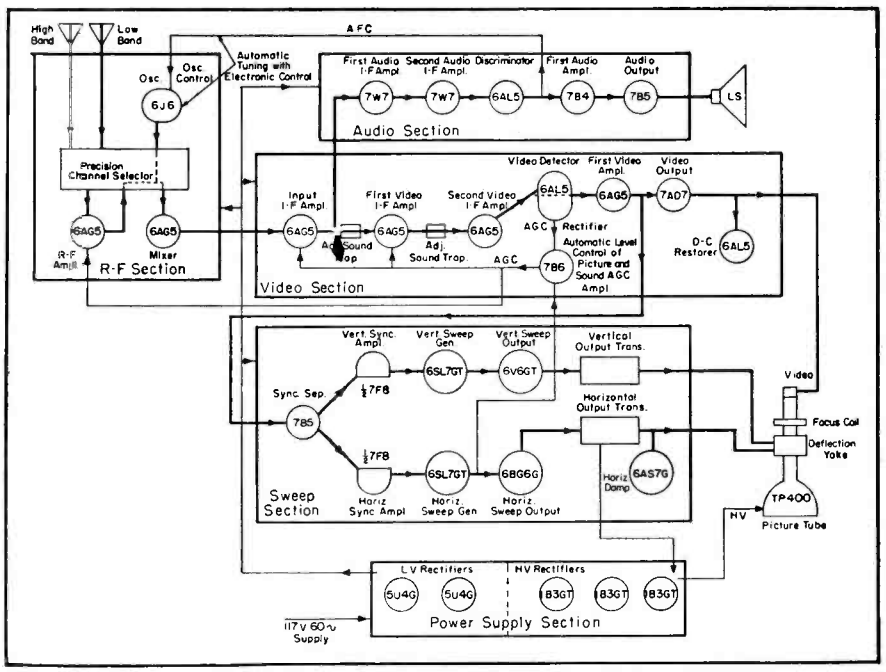


Fig. 10. Block diagram of the Philco projection tv receiver, model 48-2500. (*Courtesy Philco*)

Horizontal Multivibrator and AFC Sync (Fig. 7)

In the horizontal sawtooth oscillator there is a 6SN7GT in a conventional cathode-coupled multivibrator circuit. Instead of its frequency being controlled directly by the horizontal sync pulses, it is controlled by a d-c voltage on its controlling grid, the d-c voltage being a resultant of the phase error between the incoming sync signal and a sawtooth voltage derived from the output of the horizontal sweep amplifier. This voltage is the automatic frequency control (afc) voltage.

The afc voltage is developed by the diode-connected triodes by mixing the horizontal sync pulses at the transformer secondary with a sawtooth voltage waveform derived at the output of the sweep amplifier tube. When the sync pulse occurs at the time *a*, shown in the sawtooth waveform drawing in Fig. 7, no voltage will be developed at the output of the filter. However, if the multivibrator runs faster or slower so that the pulse falls at a point other than at *a*, a positive or negative voltage will appear at the filter, which will be amplified by the d-c amplifier V_{17B} and then applied to the grid of the multivibrator. This change in d-c voltage on the grid of the multivibrator will cause it to speed up or slow down so as to cause the sawtooth wave to combine with the incoming sync pulses until the correction voltage becomes zero. With the filter consisting of R_{40}, C_{59} and C_{49} (470 ohms, 1 mfd and .05 mfd), the change is relatively slow in controlling the speed, permitting the equivalent of individual frame synchronization instead of each component line. This gives a picture characterized by greater detail than is possible where random noise triggers the directly synchronized sweep generator. The horizontal hold control, R_{86} (100,000 ohms), in conjunction with the cathode-tuned circuit, C_{98} (.05 mfd) and L_{33}, control the free-running speed of the multivibrator. They are adjusted near to the correct frequency during the time when no sync pulses are available.

Horizontal Sweep Output (Fig. 8)

The horizontal sawtooth voltage generated by the multivibrator is shaped and then amplified by a 6BG6G. The output of this tube is coupled to horizontal deflection coils through an impedance-matching transformer, T_{25}. An oscillatory voltage, as shown in the dotted line in the waveshape at the upper left of Fig. 8, which results from the rapid retrace in the transformer T_{25}, is removed by the damping tube, V_{23}. This tube is a dual triode, 6AS7G, and by its use the transient may be dampened, linearity controlled, and the positive overshoot voltage retained for use in the high voltage supply. The linearity of the horizontal trace is controlled by varying the voltage waveshape applied to the grid of V_{23} by potentiometer, R_{115} (250,000 ohms). The horizontal size is controlled by the adjustable iron core inductance, L_{23}, which is in series with the output to the yoke.

Vertical Multivibrator and Sweep Output (Fig. 9)

The vertical sawtooth voltage is generated by a 6SN7GT, V_{19}, connected as a multivibrator. This voltage is coupled directly to a 6V6G vertical sweep output tube, V_{20}, and then to the vertical sweep coils through a impedance-matching transformer, T_{20}. Vertical speed is controlled by changing the time constant of the multivibrator grid circuit by the potentiometer, R_{46} (250,000 ohms). Sweep size is changed by a 100,000-ohm potentiometer, R_{49}, which changes $B+$ voltage applied to the charging network of V_{19} simultaneously with the screen voltage on V_{20}. Vertical linearity is controlled by a correction voltage developed in the cathode of V_{20} being fed back through a capacitor to the grid of the output tube.

Philco 48-2500

Many novel circuit developments are also used in the Philco 48-2500 tv projection model. For instance, channel tuning is used, with an eight-position channel selector supplied with snap-in coils for channels allocated to area in which receiver is to be used.

The video i-f is 26.6 mc, adjacent-channel sound trap 28.1 and the audio i-f 22.1 mc.

In the sound portion, the detector is a ratio-type f-m, 500-kc peak-to-peak

(*Continued on page 39*)

ASSOCIATIONS

RTSEA, Anderson, Indiana

W. D. RENNER and W. W. Hensler of Howard W. Sams & Co., Inc., addressed a recent meeting of the Radio and Television Service Engineers Association, Inc., of Anderson, Indiana, on tv installation and signal distortion. Basing his talk on data developed in the *Photofact* program of tv receiver installation and servicing analysis, Renner pointed out that successful reception of a usable signal at points as far as 150 miles from the telecasting antenna may bring about a modification of the previously considered requisite of line-of-sight limitations for satisfactory television receiver installations. Hensler spoke on the technical aspects of some of the present receivers and apparent trends in design.

At the conclusion of the meeting, honorary memberships in the association were presented to Howard W. Sams, W. D. Renner and W. W. Hensler.

RTSEA officers are Roy Shepherd, president; John Hart, vice president; Vernal Layton, recording and corresponding secretary; John Jones, sergeant-at-arms; William Stevenson and Clyde Nottingham, three-year trustees; Dawson Lewis and Charles Mahoney, two-year trustees; and Myron Seybert and Walter Goodwin, one-year trustees.

MSRSA, Harrisburg, Pa.

GEORGE E. HARDY, secretary of the Mid-State Radio Servicemen's Association of Pennsylvania, reports that the nomination of officers took place at the July meeting, and an election was scheduled for August.

At the July meeting Willie Fleicher of Friends Radio of Philadelphia spoke on *record changers.*

At the August session, Robert Miller of D & H Distributing Company of Harrisburg was scheduled to talk on *oscilloscopes* and their use to the Service Man.

In September the installation of officers will take place. And at this meeting Russell Knerr of Knerr's, Inc., of Harrisburg will speak on *multivibrators* and their use in television.

•

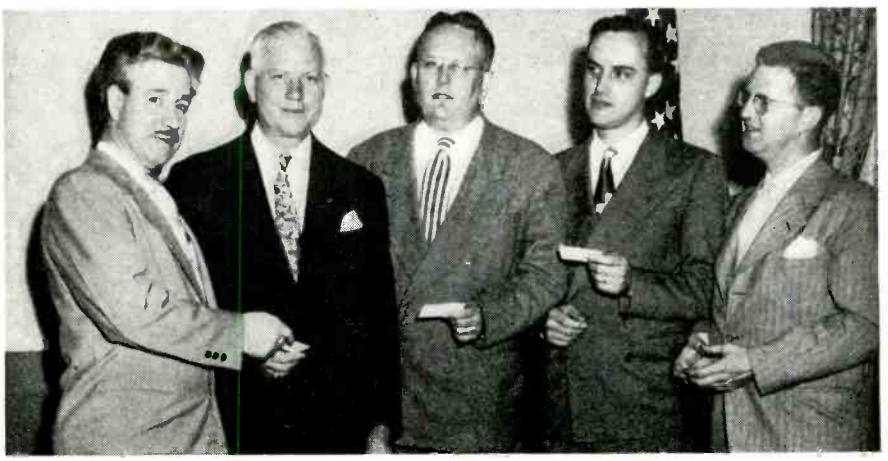
REAW, Waco, Texas

THE FIRST MEETING of the recently organized Radio Electronic Association of Waco was held recently.

The association was formed because of a projected licensing law, which O B. Howell, REAW treasurer, reports was planned only to add income to the city treasury.

At one of the meetings two sound films were shown: One on transmitters, the other on television.

Roy Shepherd, president of the Radio and Television Service Engineers Association, Inc., of Anderson, Indiana, presenting honorary memberships in the association to Charles H. Hartley, Indiana State Representative; J. Cromer Aldridge, Indiana State Deputy Attorney General and W. W. Hensler and W. D. Renner of Howard W. Sams & Co., Inc., at a recent meeting during which Hensler and Renner discussed television installation techniques. An honorary membership was also awarded to Howard W. Sams at this meeting.



TEN YEARS AGO
From the Association News Page of SERVICE, August, 1938

RSA REPORTED that six more associations voted to affiliate with them: Green Bay, Wisconsin; Danville, Illinois; Decatur, Illinois; Pittsburgh, Pa.; Fargo, North Dakota and Minneapolis, Minnesota. . . . An extension course for the professional Service Man announced by RSA, was available to members at a nominal charge. . . . A National Speakers Bureau was announced by RSA. . . . WGN, WMAQ, WENR and WLS of Chicago concluded a very successful *Better Radio Reception Week* in cooperation with RSA. Some 30 spot announcements, commenting on the abilities of RSA men and mentioning a central 'phone number for membership contact, were heard over these stations during the week. . . . The Duluth Chapter voted to have one meeting a month during the summer. . . .H. B. Eilers delivered a talk on facsimile before the boys. . . . The National Radio Service Association of Houston had its name changed to the Houston Chapter of RSA. . . . The Lansing Chapter held its third regular meeting and elected a vice chairman, Clarence Kachelski to preside in the place of the chairman. . . . Harry P. Bridge, president of the Harry P. Bridge Company, delivered a talk before the Philadelphia Radio Servicemen's Association urging Service Men to spend not less than 5% of their gross receipts for some form of advertising or promotional activity. . . . A television course had been planned by the Radio Service Association of California. Dave Atkins of Atkins and Brown delivered a talk on r-f amplifier and transmitter design at one meeting. . . . Officers of the Fremont Chapter were announced: John Mutschler, chairman; Harold Kelsey, vice chairman; Don Daymon, secretary; Frank Marx, treasurer; and Gilbert Anderson, sergeant-at-arms. . . . A report on the excellent response to the RSA display at the June Trade Show was issued.

•

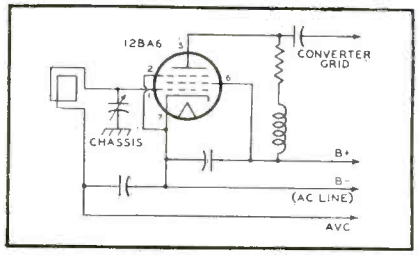
RTG, Rochester, N. Y.

THE ANNUAL RADIO TECHNICIANS GUILD picnic was held in July at Durand Eastman Park.

The membership committee is planning a drive for early in the fall.

According to Ed Fisk, chairman of the publicity committee, each member is being asked to get at least one petition in an attempt to double membership.

Fig. 2. In this circuit of an a-c/d-c receiver, we see how the cathode terminal of the r-f amplifier socket is generally connected to one side of the power line either directly or through a small biasing resistor. The accidental insertion of a 35B5 or 50B5 into the 12BA6 socket would connect one side of the power line to the tuning capacitor and loop antenna.



Tube News

(*Continued from page 12*)

the wrong tube in the socket. The hazard can be eliminated by the use of blocking capacitors between the 12BA6 grid *1* and the tuning capacitor, and shunt-feed resistors between the avc line and the signal or control grid of the first stage (r-f or converter).

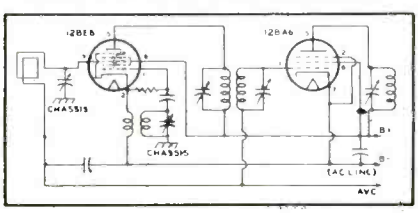
With either the 35C5 or the 50C5, a possible, but easily avoidable hazard exists in a circuit similar to that of Fig. 4. In such a circuit, insertion of either tube into the 12AT6 socket can result in a connection of the power line to the loop antenna and tuning-capacitor terminal, if the diode plate connected to pin *5* is used to keep the avc line from going positive in case of a gassy tube (gas-gate diode). This possibility, however, can be easily avoided by using diode D_1 connected to pin *6* as the gas-gate diode[1] and diode D_2 connected to pin *5* as the detector diode, as shown in Fig. 4.

Types 6BJ6, 6BH6 and 12AW6

At high frequencies, the inductances of the lead wires and the mutual inductances between the lead wires of a tube can cause feedback currents and voltages of appreciable magnitude. It has been discovered that the mutual inductance between the control-grid leads and the suppressor-grid leads in types 6BA6 and 6AU6, in combination with the plate-to-suppressor capaci-

[1]Insertion of a 35W4 in a 12AT6 socket can also cause a shock hazard. In this instance the gas-gate diode should be eliminated.

Fig. 3. Here we note how the accidental insertion of a 35B5 or 50B5 would also cause damage to the receiver, with one side of the power line being connected from the cathode of the i-f amplifier through the i-f grid, avc line and loop antenna to the signal grid of the converter.



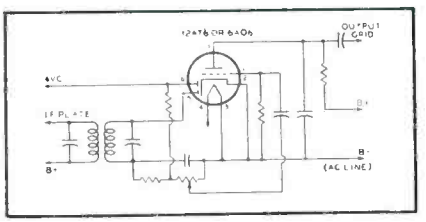


Fig. 4. Avoiding the Figs. 2 and 3 hazards by using diode D_1 connected to pin 6 as the gas gate diode and diode D_2 connected to pin 5 as the detector diode. The 35C5 or 50C5 could be used in this type of circuit without any fear of damage.

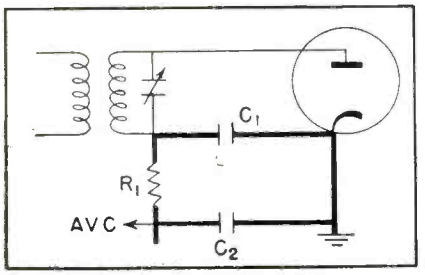
tance and the control-grid-to-suppressor capitance, causes feedback. This feedback, though negligible at the normal operating frequencies of these tubes, is equivalent to an increase in control grid-to-plate capacitance at high frequencies. At high frequencies, alternating voltage at the plate causes an appreciable current to flow through the plate-to-suppressor capacitance and the suppressor-grid lead. This current induces voltage in the control-grid lead because of the mutual inductance between these two leads, and the induced voltage causes a current to flow in the control-grid circuit through the grid-to-cathode capacitance of the tube.

In the 6BA6, 12BA6, 6AU6, and 12AU6 r-f pentodes the control grids and suppressor grids are connected to adjacent pins. In the newer types, 6BJ6, 6BH6, and 12AW6, pin 2 is used for the cathode connection and pin 7 is used for the suppressor-grid connection (Fig. 1), providing a low feedback capacitance at 20 mc or higher.

The increase in feedback capacitance for the 6BA6 is negligible at 10.7 mc, the usual i-f for f-m receivers. However, the increase may be significant at tv sound intermediate frequencies in the vicinity of 20 mc when a narrow bandwidth is used. At frequencies of 20 mc or higher, the use of the 6BJ6, 6BH6, and 12AW6 will prove beneficial where the gain is limited by

(*Continued on page* 36)

Fig. 5. A diode filter circuit. C_1, C_2 and R_1 are contained in a three-terminal unit.



Tube News

(*Continued from page* 35)

feedback considerations rather than by bandwidth requirements.

[*Data based on copyrighted material prepared by RCA.*]

Diode Filters

THE ERC[1] DIODE FILTER is a π section filter circuit whose function is to filter the carrier frequency from the demodulated signal at the detector stage; Fig. 5. The diode filter is made in two types, tubular and flat. The tubular has a maximum o.d. of .250" and length of .725". The flat diode is .250" square. The flat diode filter normally is made of two equal 100-mmfd capacitors and a 47,000 ohm resistor. The tubular diode filter is furnished in capacities ranging from double 50 mmfd to double 100 mmfd and resistances from 200 ohms to 22 megohms.

[1]Electrical Reactance Corp.

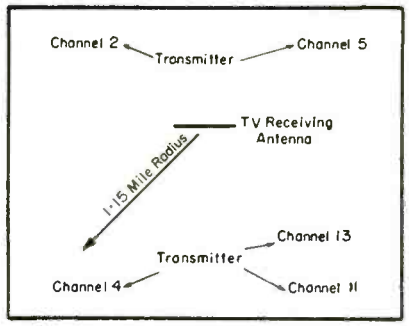


Fig. 12. Another typical problem of antenna spotting for reception of channels *2, 5, 4, 11* and *13*.

TV Antennas

(*Continued from page* 16)

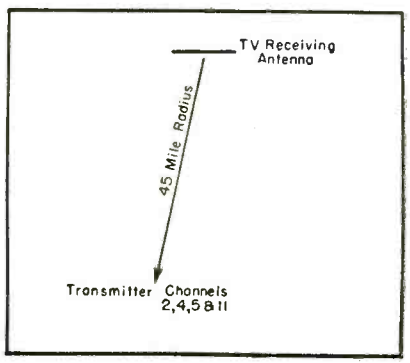
quency tv station, when the high-frequency attachment is properly positioned for best high-frequency channel reception. This condition manifests itself by a *leading ghost* appearing on the tv pattern of the low-frequency tv station, when the high-frequency attachment is installed.

(A separate transmission line for the high-frequency attachment will alleviate this interaction, provided a 200-mc anti-capacity switch is used at the set end of the transmission line, so that the signal cannot combine through the antenna switch. Some switches used successfully on the low-frequency tv channels (54-88 mc) are inadequate for high-frequency channel (174-216 mc) isolation. In selecting antenna switches it is important to remember that a switch capacity of 10 mmfd has a reactance of less than 100 ohms at 200 mc.)

(*c*) When the loading effect of the high-frequency attachment reduces the signal strength on any of the tv stations, picked up by the larger antenna array.

Problem: Fig. 12 shows an antenna located at a point with high and low-frequency tv stations in all directions.

Fig. 13. Problem encountered for antenna location when 45 miles from transmitters.



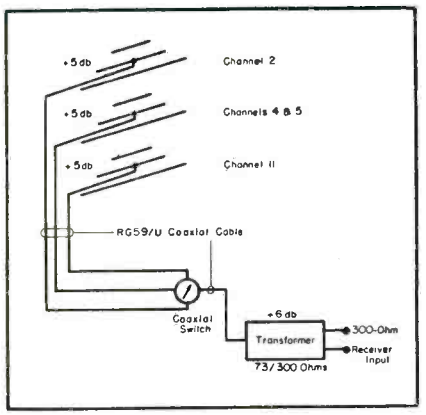


Fig. 14. Three-array system for channels *2*, *4*, *5* and *11* fed to coaxial switch and a triflar transformer (*RCA*).

This is currently a problem in the Baltimore-Washington area and will shortly be as serious a problem in the New York and N. J. area when WOR-TV installs its tv station in New Jersey.

A simple rotating dual dipole assembly which is remotely controlled at the tv receiver is a favorite solution to this problem. The longer dipole arms are cut to the mean frequency of the low tv channel band (2-6) and the shorter dipole arms are set for the mean frequency of the high tv channel band (7-13). The high and low channel dipoles, being at right angles to each other, have no interaction.

A simple wide-band array without reflectors may pick up sufficient signal on all tv channels if the tv stations are close enough and of sufficient signal strength to withstand a compromise antenna adjustment. The wideband antenna array (selected in accordance with *Rule of Thumb* item *d*) should be directed toward the stations transmitting the weakest signals into the area. High-frequency attachments with reflectors may also be installed on top of a low-frequency array (without reflectors) with the considerations described under *problem 3.*

Problem 5: Fig. 14 shows a tv receiver located in a secondary signal area for all tv stations.

When a relatively expensive installation can be made to solve this type of installation problem, a stacked array should be used. In this setup there should be one dipole, director and reflector for channel *2*, a second for channels *4* and *5* and a third for channel *11* which may be circuited as shown in Fig. 14. It will be possible to secure a gain of approximately 11 db for each channel with this arrangement.

F-M Tuner

[*See Front Cover*]

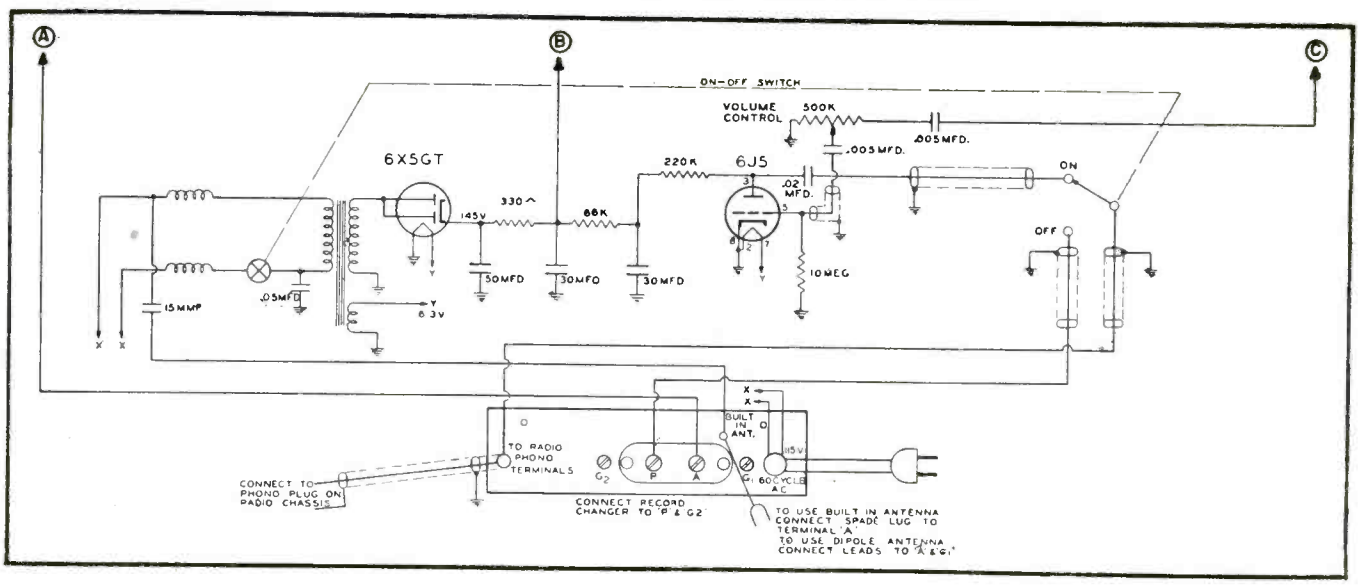
THE SEVEN TUBE a-c f-m tuner, shown on the cover (Howard Radio, model 482) features a 6J5 audio booster stage and volume control system.

There is one stage of r-f in the tuner, a 6BA6, feeding into a 12AT7 dual diode which is used as a converter and oscillator. This is followed by two stages of iron core i-f with a pair of 6BA6s. Then we have an iron-core discriminator transformer, feeding a 6AL5 in a ratio-detector stage.

A heavy duty three-section capacitor is used in the power supply filter system; 50 x 30 x 30 mfd at 130 volts.

The tuning drive has a 14:1 ratio. Sensitivity of the tuner is less than 5 microvolts.

Circuit of the audio booster stage and power system for the f-m tuner.



Ser-Cuits

(*Continued from page* 31)

bandwidth. A diode-type a-m is used as a video detector.

The projection system is a modified, wide-aperture, Schmidt optical, using a 12″ spherical mirror and 7″ corrector lens. Throw is 33.5″. A 4″ projection tube, TP400, is used with magnetic deflection and combined electro and permanent-magnet focus.

The transmission line is a non-resonant, 300-ohm, balanced type.

There are 29 tubes in this model: Eight loktals (1-7AD7, 1-7B4, 2-7B5, 1-7B6, 1-7F8, 2-7W7); ten octals (3-1B3GT, 2-5U4G, 1-6AS7G, 1-6BG6G, 2-6SL7GT, 1-6V6GT); ten miniatures (6-6AG5, 3-6AL5 and 1-6J6).

R-F Section

The entire r-f assembly is contained on a separate sub-chassis, which is shock-mounted onto the main chassis.

The output of the r-f amplifier is impedance-coupled to the mixer. The mixer and oscillator coils are wound on the same snap-in coil form, and are inductively coupled on channels 2 to 6 and capacitively coupled on channels 7 to 13 to secure the proper amount of oscillator injection. The triode oscillator, which is of the Colpitts type, is shunted by a reactance tube (oscillator control), which is controlled by the d-c voltage obtained from the output of the f-m ratio detector. When a positive voltage is applied to the grid of the reactance tube, the oscillator frequency is decreased; conversely, with a negative voltage the frequency is increased. Since the output of the f-m detector, at the point from which the control voltage is taken, varies in polarity from a negative maximum through zero to a positive maximum in accordance with the frequency of the signal, any change in oscillator frequency changes the frequency of the sound carrier i-f and produces a correction voltage. In this manner, the oscillator is maintained constantly at the correct frequency, and a maximum of stability is obtained, regardless of the aging of tubes or other components.

The output of the mixer is applied to input i-f impedance coupler.

Video Section

The i-f signals present in the plate circuit of the mixer are selected by the input i-f impedance coupler and applied to the grid of the input i-f amplifier. The amplified i-f signal

(*Continued on page* 40)

Ser-Cuits

(*Continued from page 39*)

in the plate circuit of the input i-f amplifier consists of both video and audio i-f signals, together with adjacent-channel and audio i-f signals, if present (adjacent-channel video i-f signals, when present, are not within the receiver pass band). The plate and grid windings of the first video i-f impedance coupler are adjusted to accept the video i-f signal, while the sound trap is adjusted to reject the audio-i-f signal (22.1 mc). Since the plate supply to the input i-f amplifier is connected through the first audio-i-f transformer, the audio i-f signal is transferred to the first audio-i-f stage, and very little, if any, of the audio-i-f signal remains in the video section.

The video-i-f signal is amplified by the first video-i-f amplifier stage, and passed through the second video i-f impedance coupler. This transformer is tuned to pass the video signal, but is peaked at different frequencies to achieve the desired pass band. The adjacent-channel-sound trap is tuned to the adjacent-channel audio-i-f signal (28.1 mc), and offers a high impedance to the adjacent-channel audio-i-f signal, if present. (Because of channel allocation, the adjacent-channel sound appears on some channels as a 32-mc i-f. Since this frequency is not within the pass band of the receiver, no interference results.) The amplified video i-f signal is applied to the third video i-f impedance coupler, which is tuned to slightly different frequencies. (In later receivers, an additional sound trap has been included. The trap is tuned to 22.1 mc to afford further protection against any audio-i-f signal which may have passed the first sound trap.)

The video detector rectifies the negative portion of the video i-f signal. The resultant negative video signal is amplified by the first video amplifier and the video output tube, and is applied to the grid of the picture tube. The first video-amplifier circuit contains a sharply tuned rejector trap, adjusted for 4.5 mc. This trap is placed in the plate circuit of the first video amplifier to eliminate interference that might be produced by the beating together of the sound and picture carriers, which on all channels are 4.5 mc apart. High and low-frequency compensation is employed to provide a video response from approximately 30 cycles to 4 mc. D-c restoration is accomplished by using a diode to establish a d-c bias according to picture content on the grid of the picture tube, thus insuring that the picture brightness changes only with each change of scene, not with each frame.

Automatic control of picture and sound (agc) is achieved by using the sync tips to provide a control voltage. Since the sync tips are always at the same modulation level but vary in amplitude with the strength of the signal, they provide a suitable reference for agc. One half-section of the video-detector diode is used to rectify the sync tips and to furnish the control voltage for the agc amplifier tube. The agc amplifier is supplied with a portion of the horizontal-sweep-generator voltage, which it amplifies and rectifies under control of the agc voltage output from the agc rectifier. Enough agc voltage is available at all times to regulate the gain of the r-f amplifier, input i-f amplifier, and first video i-f amplifier stages, so that any fading or change in strength of the incoming signal is compensated for by a change in the gain of these stages.

Sweep Section

A portion of the video signal is taken from the screen of the first video

amplifier and applied to the grid of the sync-separator tube so that the synchronizing-pulse portion of the video signal may be used to control the horizontal and vertical-sweep generators. The sync-separator-tube potentials are such that the video portion of the composite video signal applied to its input circuit is insufficient to operate the tube, and only the *blacker-than-black* portion of the tv signal is passed. This blacker-than-black portion contains the horizontal and vertical synchronizing and blanking signals, each of which is greatly different in duration and recurrence rate from the others. The output of the sync separator is applied to the vertical-sync amplifier and the horizontal-sync amplifier through separate *r-c* coupling circuits, each with a different time constant.

The sweep generator is a blocking oscillator operating at a free-running frequency slightly lower than the horizontal-sweep rate of 15,750 cps. When the pips are applied to the grid, the blocking oscillator operates in synchronism with the horizontal sync pulses.

The Micro-Lens Projection System

A TP400 projection-type picture tube is mounted at a slight angle to the axis of the spherical mirror to provide proper optical positioning. The mounting of the tube is such that for correct optical focusing it can be moved through three axes: The Z axis (in and out), the Y axis (top and bottom) and the X axis (side to side). This projection tube produces an image which is approximately fifteen times more brilliant than that of a direct-viewing picture tube, an extreme brilliance required because of unavoidable reduction of light intensity in the optical system.

[Data based on copyrighted material prepared by Philco.]

[To Be Continued]

New Products

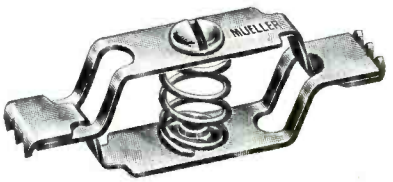
MUELLER ELECTRIC TWIN-CLIP

A clip, No. 22 Twin Clip, with jaws on both ends has been announced by the Mueller Electric Company, 1583 E. 31st St., Cleveland 14, Ohio.

Both jaws may be opened at the same time by pressing at the center of the clip or either jaw may be opened separately without disturbing the grip of the other.

Clip made of cadmium steel is 2" long and has a screw connection.

Free samples may be had by writing the manufacturer.

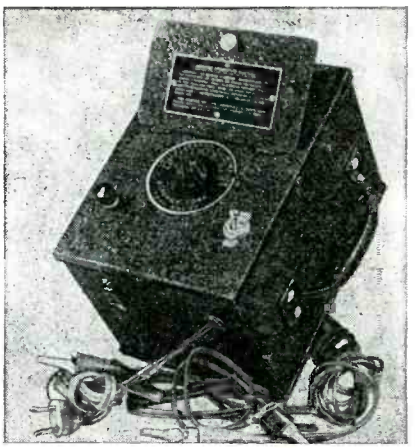


* * *

AEROVOX RADIO NOISE FILTER SETUP

An interference filter with provision for choosing the proper combination of circuit elements for the job, has been announced by the Aerovox Corp., New Bedford, Mass.

Supplied in a metal cabinet with hinged-cover compartment holding assortment of connecting cords, plugs, receptacles and clips. Knob turned through the series of different settings brings into circuit the same circuit elements as found in Aerovox interference filters of corresponding type numbers.



* * *

E-V DYNAMIC MICROPHONES

Two high output dynamic broadcast microphones, models 650 and 645, have been announced by Electro-Voice, Inc., Buchanan, Michigan.

Models are equipped with a shock mount. It incorporates dual Lord shear type mountings which are said to eliminate undesirable vibrations transmitted from the stand, and reduce side sway of the microphone without reducing the efficiency of the isolation unit. The microphone head may be tilted through an angle of 45°.

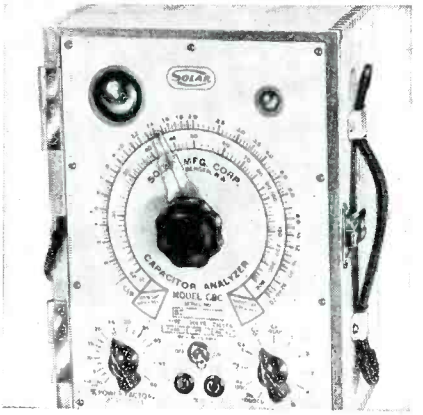
Model 650 frequency response is said to be flat from 40 to 15,000 cps.

Model 645 frequency response is said to be flat from 50 to 15,000 cps.

SOLAR CAPACITOR ANALYZER

A capacitor analyzer, model CBC, which measures capacitances from 10 mmfd to 800 mfd, using a magic eye indicator for capacitance bridge balancing, has been announced by Solar Manufacturing Corporation, 1445 Hudson Blvd., North Bergen, N. J. Power factor measurements on electrolytic capacitors are made by the bridge method. Also incorporates simplified neon lamp test circuits for visual checks of the insulation resistance of paper and mica capacitors and of the leakage current of electrolytic capacitors. The instrument also has a line frequency resistance bridge covering a range of 100 ohms to 7 megohms.

Complete description of the analyzer appears in catalog IN-3, available upon request.



* * *

RUF SADL ANTENNA MOUNTING

A tv or f-m antenna mount adjustable to any pitch of roof and any width of metallic capping has been announced by Crums, Inc., Manufacturing Division, Wooster, Ohio.

* * *

WRIGHT FLUSH MOUNTING GRILLE

A 10" chrome-plated 18-gauge steel disc, model 10-P, for speaker flush-mounting installations has been announced by Wright, Inc., 2233 University Avenue, St. Paul 4, Minn.

WEBSTER-CHICAGO MICROGROOVE RECORD CHANGER

An automatic microgroove record changer, model 133, has been announced by Webster-Chicago Corp.

Changer features a carefully-balanced tone arm which applies no lateral pressure on the thin walls. Has a nylon knee-action needled.

The drive is said to have the same single-speed torque characteristics and wowless performance of the standard Webster-Chicago record changer models. Changer unit is mounted in an all metal base which is finished to blend with home furnishings and may be used on table top or in radio console compartment for amplification through the receiver.

* * *

EICO VTVM KIT

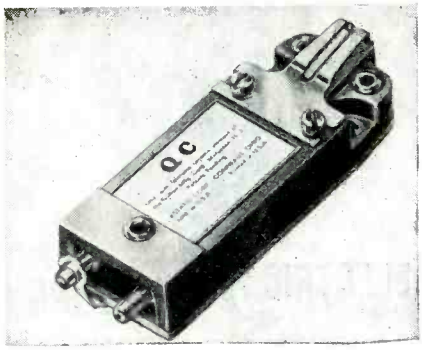
A vtvm kit, 221-k, has been announced by Electronic Instrument Co., 377 Blake Ave., Brooklyn 12, N. Y.

Kit is the Eico model 221 vtvm in disassembled form.

ASTATIC PICKUP CARTRIDGE

A phonograph pickup cartridge with ceramic elements has been announced by The Astatic Corporation, Conneaut, Ohio.

Model QC pickup cartridge, with ceramic element, is said to have a frequency range of 50 to 10,000 cps and a needle pressure of one ounce.



* * *

OLSON AKRAD CAPACITORS

Four new values of Akrad capacitors have been announced by Olson Radio Warehouse, Inc., 73 E. Mill Street, Akron 8, Ohio: 20 mfd, 450 volts; 30 mfd, 450 volts; 40 mfd, 450 volts, and a 50-30 mfd, 150-volt tubular.

TELEVISION ASSEMBLY CO. PROJECTION TELEVISION UNITS

A projection television assembly has been announced by Television Assembly Company, 540 Bushwick Avenue, Brooklyn 6, New York. Projects 520 square-inch picture onto an Eastman Kodak projection screen. Optical-electronic system consists of a Bausch & Lomb F/1.9 projection lens, RCA 5TP4 projection tube, tripler 30 kv power supply, and an aluminum-top coated mirror.

The 30 kv power supply is pre-wired.

Projection television assembly consists of 36 tubes (including the projection tube) and features a 13-tube pre-wired, pre-tuned i-f picture and sound strip (pat. pend.) having 5 stages of i-f picture amplification, with a 4.25-mc bandwidth; Dumont inputuner, with three continuously tunable circuits, tuning from 44 to 216 mc; ratio-detector f-m circuit; three-stage audio amplifier, with two 6V6GTs in push-pull, class AB1, delivering approximately 8 watts undistorted output.

* * *

DEMARIA TECH-BENCH

A *Tech-Bench* in both right and left-handed models, has been announced by The DeMaria Co., 711 Main St., Houston 2, Texas. The entire bench is constructed of corrosion resistant non-magnetic aluminum.

Has a durable hardwood replaceable top surrounded by guard rails on three sides with a grooved slot in front, and eighteen well proportioned drawers, eight of which can be used for small tools and materials are made spill proof by individual stops.

The overall specifications are length 40", depth 20", height 38" and weight 90 pounds.

NEWS

RCA TUBE DEPT. APPOINTS J. R. MEAGHER TV SPECIALIST

John R. Meagher has been named television specialist in the Renewal Sales Section of the RCA Tube Department.

Meagher was previously training coordinator on television for the RCA Service Company. He developed the RCA *Dynamic Demonstrator* radio-instruction panels, and is the author of *Television Troubleshooting and Alignment*. His lectures include appearances before such Service Men's groups as the RMA-sponsored television clinic held recently in Philadelphia.

* * *

ROSE KORSGREN NOW ALASKA RADIO SALES MANAGER

Rose Buss Korsgren has been appointed sales manager of Alaska Radio Supply, Box 84, Anchorage, Alaska.

Mrs. Korsgren was formerly sales promotion director of the Hallicrafters Company.

The firm has branch offices in Juneau and Ketchikan.

* * *

J. K. POFF HEADS ERIE RESISTOR DISTRIBUTOR SALES DEPARTMENT

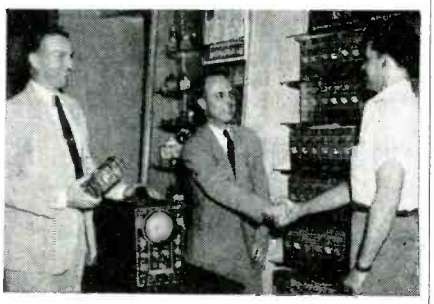
J. K. Poff has been appointed to head a new Distributor Sales Department at Erie Resistor Corporation, Erie, Pa. Department will handle parts jobbers sales of tubular ceramic bypass and coupling capacitors, high voltage television capacitors, ceramic trimmers, temperature compensating ceramic capacitors, button silver micas, insulated and non-insulated carbon resistors, etc.

Poff was formerly sales-service engineer with the Astatic Corp., Conneaut, Ohio. During World War II he was a Chief Specialist in the U. S. Navy.

FIRST WINNER IN HYTRON SIX-MONTH SERVICEMEN'S CONTEST

Harry L. Smith of 25-26 Steinway St., Long Island City, New York, won first prize, a DuMont type 274 five-inch oscillograph, in the first contest of the six-month Hytron Service Men's contest.

There are still many first prizes to be won and a $200 U. S. Savings Bond as the grand prize in the contest. All Service Men have to do is get an entry blank with complete details from Hytron jobber or write Hytron direct. Wanted are designs for a simple, economical shop tool like the Hytron tube tapper or miniature pin straighteners.



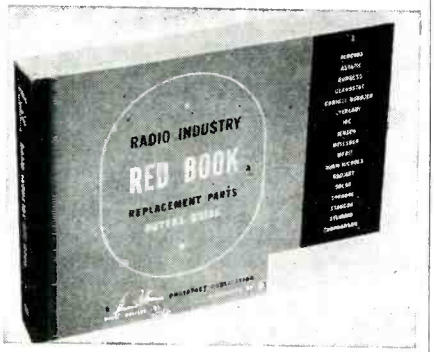
Left to right: Bill Harrison of Harrison Radio Corp., New York; Everett B. Boise, Hytron commercial engineer in New York area, and Harry L. Smith, who was prize winner for May in the Hytron contest.

* * *

HOWARD W. SAMS' RADIO INDUSTRY RED BOOK

The *Radio Industry Red Book* with listings on nine major replacement components for approximately 17,000 models made during the ten year period 1938 to 1948 will be published in September by Howard W. Sams & Co., Inc., 2924 East Washington St., Indianapolis 6, Indiana. Lists original parts, together with numbers for proper replacement parts made by 17 leading manufacturers, covering capacitors, transformers, controls, i-f coils (including peak frequencies), speakers, vibrators, phono cartridges, tubes and dial lights, batteries.

Parts manufacturers represented include Aerovox, Astatic, Burgess, Clarostat, Cornell-Dubilier, Eveready, IRC, Jensen, Meissner, Merit, Quam-Nichols, Radiart, Solar, Sprague, Stancor, Sylvania and Thordarson. All data are arranged alphabetically and by model numbers for quick reference. Price, $3.95.



* * *

WALSCO CATALOG

A 16-page catalog listing hardware, chemicals, tools, finishing materials and service items has been prepared by Walter L. Schott Co., 9306 Santa Monica Blvd., Beverly Hills, Calif.

JOTS AND FLASHES

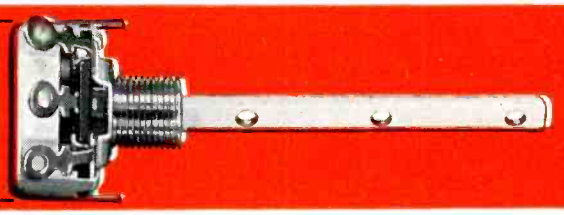
CHICAGO will be the scene of a gigantic tv show in September during which eighteen set makers will display and demonstrate their receivers and accessories. The show, to be known as the National Television and Electrical Living Show, will be held at the Chicago Coliseum, September 18th through 26th. Among the manufacturers who will be represented are G.E., Westinghouse, RCA Victor, Crosley, Motorola, Sylvania, Philco, Bendix, Hallicrafters, Farnsworth, Admiral, Magnavox, Garod and Stewart-Warner. . . . William A. Browne is now merchandising supervisor for the Radio Division of Sylvania Electric . . . Dave M. Lee Co., of Seattle, Washington, and Portland, Oregon, has been named northwest representative of Solar Manufacturing Corp. . . . Wes Alderson of the W. Bert Knight Co., Los Angeles rep for Taco, is lecturing to jobbers on television antenna techniques . . . John J. Moran has been named special television representative for Philco . . . Admiral Corp. has purchased the domestic appliance division of Pressed Steel Car Co., Inc., to permit expansion into the electric range business . . . Morhan Exporting Corp., New York, now have the exclusive export sales rights for Utah Radio Products Division of International Detrola Corp. in every country throughout the world except Canada and Mexico. . . . The radio receiving tube warehouse of Raytheon is now located in a new streamlined building at Newton, Mass. . . . The RCA projector model (TLS-86) on view in the lobbies of the Philadelphia hotels during the recent national conventions, is now being produced on a quantity basis. The unit provides pictures from 3 x 4 feet to approximately 7 x 9 feet . . . Edlie Electronics is now located at 154 Greenwich Street, N. Y. C. . . . The April-June issue of the "Oscillographer" prepared by DuMont, features articles on the 256D 'scope, projection screens and the servicing of DuMont instruments . . . Tore Lundahl of Taco, is now visiting in Sweden . . . Ed Berliant has been named general manager of Fada of New Jersey, Inc., which will distribute Fada radio and tv receivers exclusively in N. J. . . . Tv and radio receiver manufacturers displayed their equipment at the recent World's Fair of Music at the Grand Central Palace in New York City . . . National Radio Week will be held from November 14th to 20th and will be sponsored by RMA and NAB. W. B. McGill is chairman of the RMA-NAB National Radio Week Committee. . . . R. I. Parker has been elected a commercial vice president of G.E. . . . RCA recently held three tv meetings for 800 dealers in Dallas, Fort Worth and Memphis. Henry G. Baker, general sales manager of the Home Instrument Dept., headed the delegation, which also included Dan Halpin, tv receiver sales manager and Jack M. Williams, advertising and sales promotion manager . . . James M. Skinner, Jr., is now vice president of the service and parts division of Philco . . . The Lund-Hansen Co., 549 W. Washington Blvd., Chicago 6, Illinois, has been formed to succeed the Ralph T. Brengle Sales Co., and represent Precision Apparatus, University Loudspeakers, Marion Electrical Instrument, Premax, Special Products Co. and Potter & Brumfield.

ADVERTISERS IN THIS ISSUE

SERVICE INDEX—AUGUST, 1948

All New! Mallory Midgetrol Revolutionary

The First 15/16" Replacement Control Line



Quietest and Smoothest . . . by Test!

THE SIZE IS . . . . . NEW
Only 15/16" in diameter, it easily services the increasingly popular small sets where ordinary controls will not fit.

THE DESIGN IS . . . . . NEW
Brand new shaft style saves valuable time in installation—reduces inventory since one shaft fits all knobs.

THE CONSTRUCTION IS . . NEW
Extra quiet—no metal-to-metal contact between shaft and cover or bushing. Special Mallory contact material.

THE SHAFT IS . . . . . NEW
Unique—two simple fittings—for all type knobs. No need for extra controls for different knobs.

THE EXTENSION IS . . . . NEW
Easy to apply with self-tapping screws. Supplementary shafts available for installations which require them.

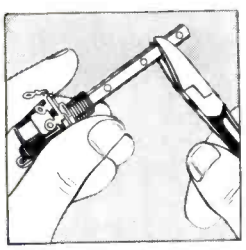
THE SWITCH IS . . . . . NEW
No chance of failure—it's Mallory engineered and Mallory manufactured. Pushes on—stays on—and *works*.

THE ELEMENT IS . . . . . NEW
More accurate over-all resistance, smoother tapers, ample power dissipation.

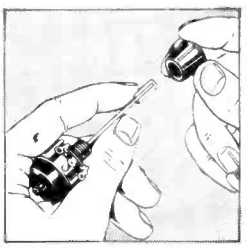
THE CONTACT IS . . . . NEW
Laboratory tests prove that the Mallory Midgetrol is the quietest control on the market.

THE TERMINAL IS . . . . NEW
Won't break—twist 'em all you want in close working space. Away from panel to avoid shorting.

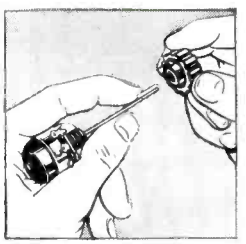
THE SUSPENSION IS . . . NEW
Two-point—insures even contact pressure at all points of rotation. Larger bushing area—added support—no wobble.



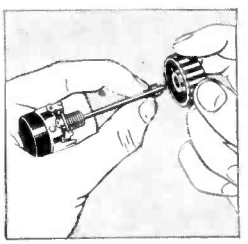
Side snips neatly cut shaft to length desired.



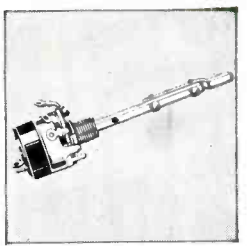
U-clip furnished to slide over end of shaft—holds set-screw knobs.



Use half the U-clip to hold push-on type knobs.



Spring steel clip included for use with knurled knobs.



Extension shafts with two self-tapping screws available when needed.

It's the NEW Standard in Carbon Controls. **See your Mallory distributor.**

P.R. MALLORY & CO. Inc

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

You can sell more RCA Batteries

Get the complete catalog of RCA Battery Sales Promotion Material from your RCA Distributor

Powerful Sellers . . . all geared to the radio trade!

Greatest Radio Battery Promotion Program in the Field!...

✓ Banners ✓ Streamers ✓ Cartoons ✓ Counter Displays ✓ Counter Merchandisers ✓ Direct Mail Post Cards ✓ Advertising Mats ✓ Battery Guides ✓ Dealer Price Lists ✓ Battery Cartons

Again RCA leads the battery field in progressive merchandising with a *complete* line of powerful selling aids specifically designed for the *radio trade!*

Now you can get everything you need to sell *more* RCA Batteries than ever before . . . compelling full-color displays to lead more customers your way . . . self-serving counter merchandisers that sell batteries on sight...banners and seasonal window streamers to let all radio owners know you're headquarters for RCA Radio Batteries.

Don't miss the *extra* business these new sales aids will bring you. Ask your RCA Battery Distributor for Bulletin No. 2F406 that contains the complete story on the most comprehensive *sales promotion plan* in the radio battery industry today!

SELL RCA BATTERIES—*THE COMPLETE LINE FOR THE RADIO AND ELECTRONIC TRADE*

RADIO CORPORATION of AMERICA

HARRISON, N. J.