

You wouldn't buy a business blindfolded!

Of course not. But a survey of hundreds of servicemen found that 57% order capacitors simply by rating, without specifying a brand. Don't forget you are staking your business reputation on the performance of the parts you use!



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Depend on your Mallory Distributor for precision quality at competitive prices.



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APPROVED PRECISION PRODUCTS

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

To Servicemen... Who want to protect their future in Television Servicing

MEN who are interested in continuing their careers as TV service technicians and desire to increase their earnings, will find the information in this page calls for serious thought—and for action.

Your future, the future of your business in television servicing depends on what you do about it.

LICENSING OF SERVICEMEN IS A GOOD REASON WHY YOU SHOULD ACQUIRE TECHNICAL KNOWLEDGE NOW

In New York City, it is proposed that licenses and permits be required of TV contractors, subcontractors, service shops, technicians and apprentices. Once licensing becomes law in New York City this requirement is sure to spread to other municipalities. Licensing and permits mean passing a technical examination. Stiff penalties are cited in the licensing bill upon conviction of a violation. The required technical knowledge can easily and quickly be learned through study of the RCA Institutes Course in Television Servicing. One of the advantages of the RCA Institutes Course, to you as a working serviceman, is that you can study this course at home, in your spare time, and still keep working on your regular job. Now is the time to prepare for license examinations and protect your future in TV servicing.

TELEVISION SERVICING IS SPREADING TO NON-TV AREAS

The Federal Communications Commission recently announced plans for setting up 1,807 new TV broadcasting stations, most of them in the new UHF channels. This will open up areas that have never been touched by television. Radio servicemen in those locales should take a

lesson from servicemen in areas now served by television. In these areas, TV servicing has substantially replaced radio servicing as a means of income. Practical experience in radio servicing is not the important qualification for a successful and profitable career in TV servicing. Practical radio experience *plus* the technical training of the RCA Institutes Home Study Course in Television Servicing, will put you on the right track to be successful in TV servicing.

PRACTICAL, PRE-TESTED DATA MAKES TV SERVICING EASY

The RCA Institutes Home Study Course in Television Servicing is a "down-to-earth" course in the underlying principles of television. It is printed and illustrated in easy-to-understand, non-mathematical language. You learn pre-tested "How-to-do-it" techniques interwoven with "How-it-works" information. The course is based on the actual experience of the RCA Service Company in servicing thousands of home television receivers. You learn the "short-cuts" in TV trouble-shooting that enable you to do a good job in less time, saving you many hours of on-the-job labor. *This up-to-the-minute course contains material on the latest developments in color TV and UHF.*

APPROVED BY LEADING SERVICEMEN'S ASSOCIATIONS

Such well-known associations as—National Appliance & Radio Dealers Association; Television Contractors Association; National Alliance of Television & Electronic Service Associations—are already using the RCA Institutes course for upgrading the standing of their members. *Tell the Secretary of your local or State association to write us for low rates for group enrollment.*

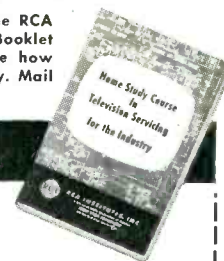
RCA Institutes conducts a resident school in New York City offering day and evening courses in Radio and TV Servicing, Radio Code and Radio Operating, Radio Broadcasting, Advanced Technology. *Write for free catalog on resident courses.*



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A SERVICE OF RADIO CORPORATION of AMERICA
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Send for FREE BOOKLET

Mail the coupon—today. Get complete information on the RCA INSTITUTES Home Study Course in Television Servicing. Booklet gives you a general outline of the course by units. See how this practical home study course trains you quickly, easily. Mail coupon in envelope or paste on postal card.



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Home Study Department, RSD-851
350 West Fourth Street, New York 14, N.Y.

Without obligation on my part, please send me copy of booklet "RCA INSTITUTES Home Study Course in TELEVISION SERVICING." (No salesman will call.)

Name _____
(Please Print)
Address _____
City _____ Zone _____ State _____

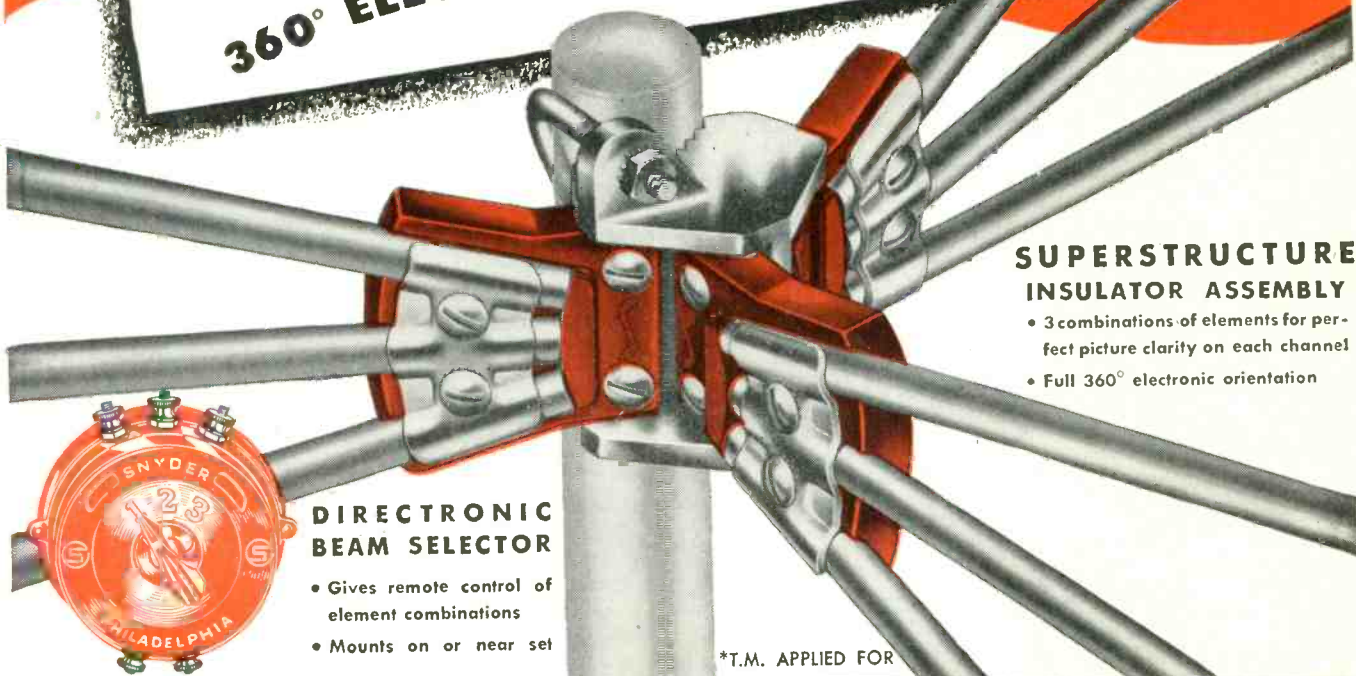
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MOTORLESS

TV AERIAL SYSTEM

360° ELECTRONICALLY SWITCHED BEAM



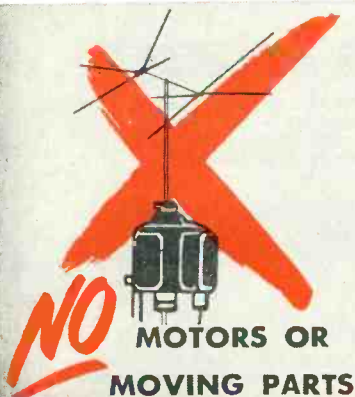
**SUPERSTRUCTURE
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**DIRECTRONIC
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- Gives remote control of element combinations
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**P. S. ONLY ONE
LINE TO INSTALL**

EDITORIAL

by S. R. COWAN

Material "Squeeze" Begins

Several readers who have been feeling the slump wrote us, after reading our July issue editorial about "Impending Shortages", that we were needlessly trying to scare them into making purchases—and that they simply did not agree that there will be a tightening of components, etc., in the near future. So, we rechecked our sources of information. Now we report that, if anything, the future is going to be "all-out war effort production" and the supply lines for civilian goods and replacement parts will be even much tighter than was originally anticipated. To prove this point let us quote, in part, from a "N. Y. Times" special article published July 22nd: "Pittsburgh—Those who for months have been saying that steel products would be in a very tight position by the third quarter of this year found their predictions coming true with a bang . . . under Gov't allocations long term customer relationships have been knocked completely askew . . . practically all groups were insisting they should have more steel than was being allocated for the third quarter — all of it will be covered by control allotments." This "Times" report on steel shortages is typical of the problems that face suppliers of other materials — and if that isn't a tip-off that there will be short supply lines, what does?

F. C. C. Hints of TV CP "Green Light"

The FCC Chairman, in a recent release, stated that unless some unforeseen development occurs soon, "there is no reason why resumption of Construction Permits for the hundreds of pending new TV outlets cannot be granted later this year, possibly by October 1st." This is grand news, long awaited.

In dollar and cents the "green light" on new TV stations should mean to service dealers located where there has been no TV transmission upwards of \$100 a day or more increased net income for an indefinite period. Stated another way, if 108 TV outlets located in 64 market areas has meant over 2 Billion Dollars in the pockets of service dealers since 1945, it should mean that much or more to the service dealers who are at long last about to get their share of the new business potential. Also, as UHF stations open and establish broader fringe areas, this will aid present-day TV service-installers to the tune of an additional half-billion dollars annually. TV is a sweet word.

Those of us who are in it, or who soon will be in it, should shout Hallelujah!

G. I. Training Ends

Although no more G.I. training courses will be paid for by the Government we repeat what we have urged for years: If you hope to be a TV technician or if you want to run a TV business and hope to handle service work, learn all their is to know about the subject by enrolling in an accredited TV training course given by a reputable, established school. Only in this way can one hope to become an expert in TV's complex sphere.



Sanford R. Cowan
EDITOR & PUBLISHER

Samuel L. Marshall
MANAGING EDITOR

COWAN PUBLISHING CORP.
67 WEST 44TH ST.
NEW YORK 18, N. Y.



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New 3rd Edition SPRAGUE TV CAPACITOR REPLACEMENT MANUAL

Here—just off press—is the NEW (3rd edition) of this famous Sprague manual with complete recommendations on critical capacitor replacements on 964 TV receivers. Don't guess! Don't waste time! Let the Sprague manual tell you in a jiffy exactly what replacement capacitor to use!

GET YOUR COPY... NOW!

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 Street _____
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(This Manual can be obtained free from Sprague distributors)

FLASHES TRADE

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

Audio Fair Scheduled For Nov. 1-3

Fifteen thousand high quality-sound enthusiasts, engineers, technicians, students and lovers of good music reproduction will gather together for a 3 day convention of "looking and listening" at the Hotel New Yorker this November 1st, 2nd and 3rd. The occasion is the third annual convention of the Audio Engineering Society, an association with members all over the world. It was announced by Mr. Harry N. Reizes, Fair Manager, that the *Audio Fair* will take place at the same time and that it will be "bigger and more exciting than ever, with many new things to see and hear".

During the three day period in November, the Audio Engineering Society will conduct a technical session of engineering papers, written and delivered by outstanding engineers in the field. The *Audio Fair* will simultaneously conduct an exhibit of high quality-sound recording and playback equipment, occupying the entire fifth and sixth floors of the Hotel New Yorker where it is expected that over 200 manufacturers and publishers will participate. A charge will be made for attendance at the technical sessions of the Audio Engineering Society, however, the *Audio Fair* will be open to the public without charge.

RCA Demonstrates Color TV System

Field tests of the RCA compatible, all-electronic color television system, showing for the first time the new 21-inch tricolor picture tube and other advances, were begun in New York by the Radio Corporation of America.

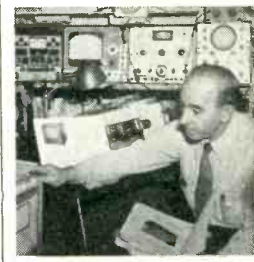
The program, one of a series of tests in the metropolitan area, revealed the flexibility and effectiveness of the RCA system under regular broadcasting conditions, and brought into practical use improved equipment and techniques.

Viewing the tests, representatives of the press were assembled before

[Continued on page 8]

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TRIPLETT

Load-Chek

introduces
**Servicing
by
Power
Consumption**

MODEL 660



LOAD-CHEK for the first time makes it possible for every technician to utilize what is perhaps the simplest and quickest of all service methods—Servicing by Power Consumption Measurements.

Power consumption measurement has long been proved by auto-radio servicemen as a rapid method of localizing troubles in auto radios. But Triplett's new **LOAD-CHEK** is the first Wattmeter to be produced at moderate cost, and with the proper ranges, to bring this short-cut method within the reach of every radio and TV service man.

Basis of the **LOAD-CHEK** method is the tag or label on every radio and TV chassis which shows the normal power consumption. The following examples are only two of many time-saving uses of this new instrument.

LOCATING A SHORT—The chassis tag may show a normal consumption of 225 Watts. Simply plug the power cord of the chassis into **LOAD-CHEK** (there are no loose ends to connect or be in the way). Note the reading—which should be possibly 350 Watts. By removing the

rectifier tube you can determine at once which side of the tube the short is on. With a soldering iron and long-nosed pliers you can check through the chassis, locate and correct the trouble without having to lay down tools or to check with lead wires!

REPLACING BURNED OUT RESISTORS—With the chassis to be repaired plugged into a **LOAD-CHEK MODEL 660**, note the wattage reading with the burned out resistor circuit open. Now replace the resistor. Should the increase in watts be greater than that of the resistor rating being installed, it indicates that an extra load has caused the trouble which has not been cleared.

LOAD-CHEK is made-to-order for the busy service man and can help stop costly "come back" repair jobs. It's a profit-maker because it's a Time-Saver. And at its moderate cost **LOAD-CHEK** can be standard equipment on every service bench. By all means, inspect this versatile instrument at your distributor and place your order, for under present conditions we must fill all orders on a basis of "First Come, First Served."

SEE MODEL 660 LOAD-CHEK AT YOUR DISTRIBUTOR'S

FOR THE MAN WHO TAKES PRIDE IN HIS WORK

Triplett

TRIPLETT ELECTRICAL INSTRUMENT COMPANY - BLUFFTON, OHIO, U.S.A.

Proved Combination for FINE TV RECEPTION

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'AUTO-DIAL'
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SYNC PULSES

by San D'Arcy

Plunging necklines of some femme telecasters reached such low levels recently that a special committee of Nat'l Assn. of Radio-TV Broadcasters decided to work on "proposed standards" to correct the situation before FCC stepped into the picture. Now wags in the industry are trying to figure out whether the proposed standards are to be established for the gals themselves or for the dresses they are to wear. Any way you look at it, the situation has its points. The only other thing of a plunging nature that is concerning the industry now-a-days is TVset list pricing, which is falling to new lows hourly despite the fact that production is holding up to high levels. For example, in January TVset production was 645,716 units; in February it was 679,319 units and in March 874,634. Thus 2,199,609 TVsets were produced during the first quarter of this year as compared to 1,605,200 for the corresponding period of last year. Were production for the balance of the year to stay up to first quarter levels almost 9 million TVsets would be made this year. Wow!

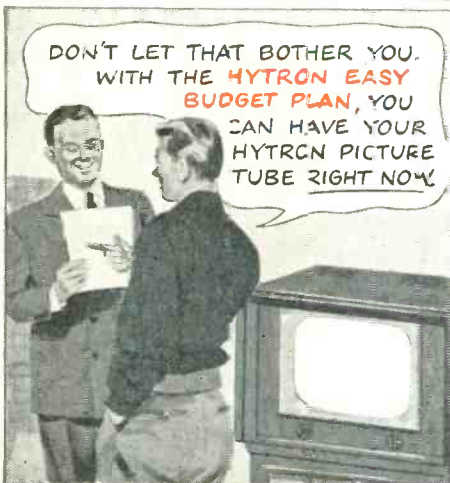
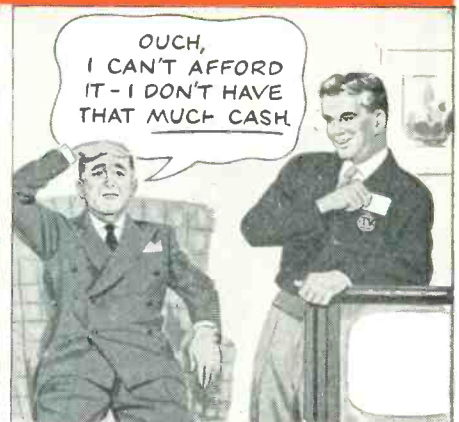
Increased receiving range is claimed by a mid-west TVset maker for his new line. How valid the claim is cannot be determined at this writing for no field tests data or factual proof has been offered. However, service dealers would like to have TVsets with greater selectivity and sensitivity in order to expand their sales potential pending the thaw of the "freeze". TVset sales in big cities have bogged down to an alarming degree, and most of the big money is being made now-a-days in the fringe areas. It would be a blessing if transmitters were to be allowed increased power to increase their fringe areas, but such is not a likelihood for some time. Instead, service dealers must force the expansion of fringe markets by using boosters and better antennas and higher masts. This they are doing, despite shortages of good antennas and transmission line. More important, however, is the fact that service installers have gotten wise to the fact that substantial prices must be charged for a fringe area installation in order to insure a profit margin on every job.

RCA calmed the fears of TVset owners by announcing that comprehensive experiments prove that a converter is the best means of enabling present sets to receive stations operating in the new higher frequency channels as proposed by FCC. The company assured consumers that a high quality converter will be marketed in time for UHF service in late '52 or early '53. W. A. Buck, vice-president and general manager of the RCA Victor Division pointed out that some modification will have to be made in all sets, regardless of make. He said, "No receiver currently manufactured has provision for conversion to UHF without additional cost and for equipment and installation, normally including the addition of a special outdoor antenna."

Early in April Crosley demonstrated a new ultra high frequency TV tuner, small in size, which would enable many current TVsets to get reception on some 70 more channels. Just prior to then FCC proposed the allocation of more than 1,000 TV stations in the UHF band to supplement the present number available on the VHF band. Crosley explained that their tuner was designed to function better with receivers having a continuous tuning system rather than with those that "click" into place by band-switching devices. If produced in quantities the new Crosley tuner should sell for much less than \$50.



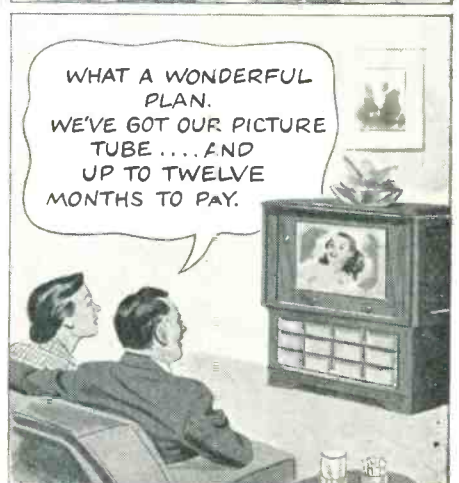
Here's how YOU can sell more Picture Tubes WITH HYTRON'S NEW EASY BUDGET PLAN!



ANOTHER HYTRON FIRST FOR YOU!

No need to miss that profitable picture-tube sale — just because the customer doesn't have the cash. The original Hytron Easy Budget Plan saves the sale. Gives you a competitive edge. Hytron has arranged the details for you. A national credit organization, with facilities in all TV areas, stands ready to serve you.

Find out how you can put this wonderful, timely Hytron plan to work right now! Write for complete information today.



ANOTHER HELPFUL SERVICE FOR YOU FROM . . .



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HYTRON
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MAIN OFFICE: SALEM, MASSACHUSETTS

Hytron Radio and Electronics Co.
Salem, Massachusetts

Please rush me details on the Hytron Easy Budget Plan.

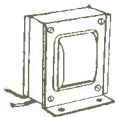
Name (please print)
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AN Original...



Always look for the RCA monogram on the red-black-and-white carton

It takes an RCA Original... to insure top TV performance



Performance-proved in millions of television receivers of many makes—RCA “original” TV components will cut your service call-backs and insure customer satisfaction. That’s because RCA TV components are designed to work perfectly with the tube types and circuits used in the top television receivers...and rated to withstand abnormally high peak voltages.

When replacements are called for...play safe...use genuine RCA television components...they cost no more than substitutes.

SEE YOUR LOCAL RCA PARTS DISTRIBUTOR
FOR “ORIGINAL” RCA TV COMPONENTS



RADIO CORPORATION of AMERICA
ELECTRONIC COMPONENTS HARRISON, N. J.

TRADE

[from page 4]

color television receivers in the RCA Exhibition Hall in Radio City. The program came to them over the facilities of the National Broadcasting Company’s experimental station KE2XJV, atop the Empire State Building. It consisted of scenes and action selected to provide a wide range of color and studio techniques.

The tests are being conducted by RCA under experimental license issued by the Federal Communications Commission. RCA has previously conducted experimental color broadcasts in Washington, D. C.

Association Emblems

The top emblem is used by the Radio and Television Technicians



Guild of Florida, and is displayed on the store fronts of all its members. The bottom emblem was recently



adopted by the Empire State Federation of Electronic Technicians Associations (N.Y.).

RCA Merchandizing Aids

An illuminated “Professional Television Service” sign has been made available to television service dealers through RCA Tube Department.

The sign is available to all servicemen using RCA test equipment. It carries the legend “Professional Television Service” and the well-known RCA trademark in bright red on a white plastic background. Suitable for mounting in the window or on the wall, this sign calls attention to the fact that, when a service dealer uses RCA quality test instruments, he is equipped to provide better and

When It's A Fuse
You Need . . . think first of

BUSS

A COMPLETE LINE OF FUSES TO CHOOSE FROM

For Television . . . Radio
Radar . . . Instruments
Controls . . . Avionics

It's easy to select a BUSS fuse to do the job right for BUSS makes a complete line of fuses and behind each BUSS fuse is the world's largest fuse research laboratory and fuse production capacity. That's why the BUSS trademark has for 37 years stood for fuses of unquestioned quality that can be depended upon to protect but not to blow needlessly.

Every BUSS Fuse Electronically Tested

Each individual BUSS fuse is tested in a highly sensitive electronic device that records if the fuse is calibrated correctly, if the solder joints are properly made, if the mechanical dimensions of the fuse are right, and if the fuse can be depended upon to operate properly under all service conditions.

AND A COMPANION LINE OF FUSE CLIPS, BLOCKS AND HOLDERS

BUSS Fuses are made to protect
. . . not to blow.

**WHY IT IS MORE PROFITABLE FOR YOU TO
USE BUSS FUSES FOR SALES AND SERVICE**

Millions of BUSS house fuses, industrial fuses and fuses for the automotive trade have firmly established the BUSS reputation for quality. This, plus their dependability, means sales easier to make and with never a "comeback".

And in service work when you install BUSS fuses and something goes wrong, you and your customer both know you can depend on the fuse to clear the circuit.

Beware of "off-brand" fuses — they may blow when nothing is wrong, causing trouble and delay . . . or they may not blow quick enough to protect. Why chance losing a customer's good will? Be safe — and be profit wise — furnish only BUSS fuses.

USE THIS COUPON — Get All The Facts

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

SD 851

Please send me Bulletin SFB containing complete facts on BUSS Small Dimension Fuses and Fuse Holders.

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Replacement Manual



LISTS OVER 1,500 PHONOGRAPHS

and phonograph combinations which are equipped with, or which can effectively use, Shure crystal and ceramic pickup cartridges. Shure cartridges are equal to or superior (in most cases) to the units they replace. This Replacement Manual covers the period from 1938 to 1951—and lists models made by over 120 manufacturers.

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SHURE
DISTRIBUTOR
for Manual
No. 66



SHURE BROTHERS, Inc., Dept. A ★ Manufacturers of Microphones and Acoustic Devices

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faster service. The sign comes complete with six feet of hanging chain.

Also made available is a new RCA window and counter display which portrays a flashing, simulated stroke of lightning on a typical TV installation. Announced in conjunction with RCA's new outdoor-type lightning arrester, which is listed by Underwriters Laboratories, Inc., the dramatic display is being made available to television and radio dealers through RCA distributors by the RCA Tube Department.

This attractive display points up the advantages of the RCA Lightning Arrester (Type 215X1) as an adjunct to any television-equipped home.

A Letter From Hytron President:

On June 15, 1951, Hytron became: Hytron Radio & Electronics Co., A Division of Columbia Broadcasting System, Inc. A natural question arises as to how this will affect Hytron's future operations.

Management and general policies of Hytron will remain the same as before the acquisition.

As you may know, Hytron is now building at Danvers, Massachusetts an ultramodern plant for manufacturing receiving tubes. This plant, when it goes into operation early in 1952, will about double Hytron's facilities for receiving tube production.

At Newburyport, Massachusetts, Hytron has one of the most modern TV picture-tube plants in the world, with adequate mass-production facilities.

Under normal conditions, therefore, Hytron soon will have adequate production facilities for both receiving and picture tubes to serve its customers even better than in the past.

Cordially yours,
Bruce A. Coffin
President

Dave Krantz Directs

NETSDA Publicity

Mr. Dave Krantz of Philadelphia, representing P.R.S.M.A., has been appointed Chairman of the Publicity Committee for the National Electronic Technicians and Service Dealers Associations.

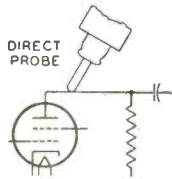
All future publicity on N.E.T.S.D.A. activities and that of its many Chapters will be released through his office to this publication as soon as possible.

Ram Produces Color Components

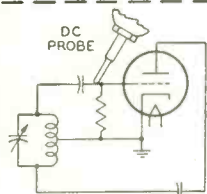
RAM Electronics Sales Company, national sales agents for RAM television components, has just announced that preparations have been completed for production of Color

Now ... a NEW Junior VoltOhmyst* ...the WV-77A

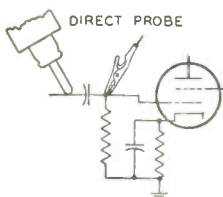
For all regular measurements and specialized measurements as illustrated.



MEASURES AC VOLTS... such as signal voltage on plate of tube.



MEASURES DC VOLTS... such as oscillator grid bias. One-megohm resistor in probe prevents circuit loading.



MEASURES RESISTANCE... such as leakage in coupling capacitor up to 1000 megohms.



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The RCA WV-77A VoltOhmyst* provides the extra features you have tried to find in an inexpensive VTVM. Using the famous Volt-Ohmyst electronic bridge circuit, 200-microampere meter movement, and carbon-film multiplier resistors, the WV-77A incorporates features you would expect to find only in more expensive instruments. Sturdily built... calibrated against laboratory standards... and backed by a 12-month warranty... the WV-77A has the durability, versatility, and accuracy to please discriminating customers such as service technicians, engineers, amateurs, and military personnel.

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Promotion For L. B. Calamaras

The Board of Directors of National Electronic Distributors Association, Chicago, meeting in Washington, D. C., announced the promotion of L. B. Calamaras to the post of execu-

tive vice president of the Association, effective July 1, 1951, under a new five-year contract. Mr. Calamaras has served the Association as its executive secretary since 1944.

In his new position he will represent NEDA in all Government activity affecting the radio and television replacement parts industry. Mr. Calamaras will also work on the development of a special weekly Washington letter to report and analyze legislation, regulations, and other matters for NEDA membership throughout the country, representing approximately 400 of the country's leading distributors of electronic components and radio and television replacement parts and accessories.

Tele-Matic Sponsors Technical Forum

Shown below is a group of technicians who attended a lecture on TV



antennas and installations given by James J. Hill, Engineer of Tele-Matic Industries, Inc., 1 Joralemon St., B'klyn, N. Y., manufacturers of TV antennas and accessories, wave-traps, and other components. Held at the Bond Radio Supply in Waterbury, Conn., this meeting which was officiated by Bill Keats, Tele-Matic salesmanager, attracted more than 200 dealers and servicemen.

Sylvania To Open New Plant

Sylvania Electric Products Inc. announced today it had selected the city of Nelsonville, Ohio, as the site of a plant for the manufacture of welded lead-in wires for lamps, radio tubes and other electronic devices.

UHF Conversions Proved Simple

Conversion of VHF television receivers for UHF reception in areas where UHF stations eventually will be built will be relatively simple and inexpensive, Glen McDaniel, president of the Radio-Television Manufacturers Association, said during a demonstration of UHF reception equipment.

The RTMA-sponsored demonstration of UHF converters and other reception equipment was held at the suggestion of Chairman Wayne Coy of the Federal Communications Commission who expressed interest in observing the progress of television manufacturers in preparing for the additional television broadcasting service expected to be authorized by the FCC early in 1952.

Demonstrations by eight manufacturers, in the Barnum and Stratfield Hotels, were witnessed by five members of the Commission and five members of the FCC staff.

CBS-Columbia Introduces Two New Models

CBS-Columbia Inc., formerly Air King Products Co., now the manufacturing subsidiary of the Columbia
[Continued on page 36]

E-ZEE-ON

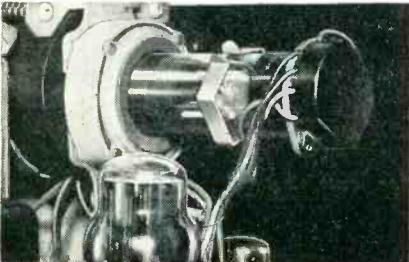
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Here's another important development from the world's largest producer of permanent magnets — a slip-on, grip-snug Ion Trap that outperforms them all. It permits precise, ONE-HAND ADJUSTMENT . . . stays put and in adjustment because its weight is uniformly distributed. It's made of one piece permanently magnetized Cunife and can't be put on backward . . . requires no manual clamping . . . can't damage tube neck . . . eliminates danger of over-tightening.



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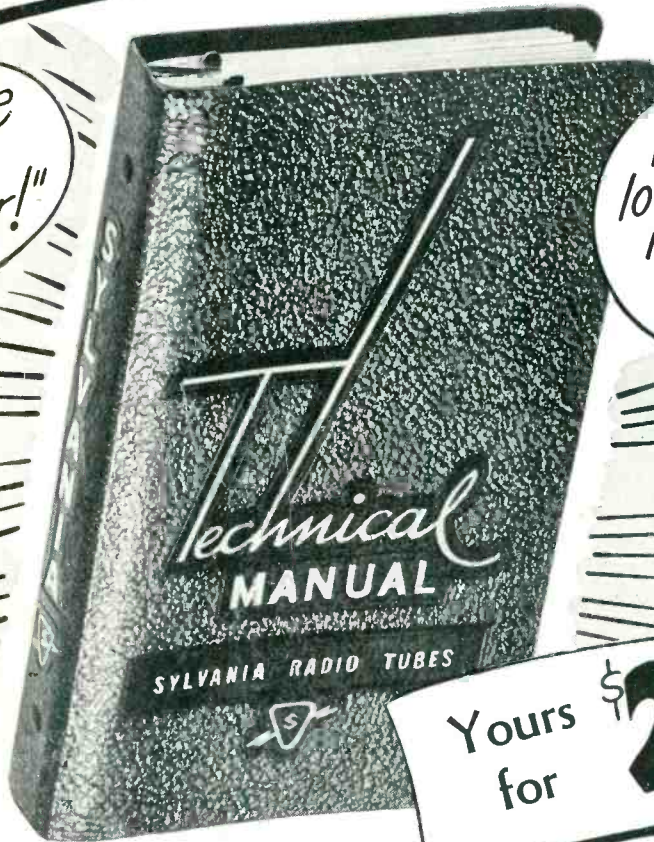
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Typical pages show tube base diagrams, give physical specifications, ratings, typical operation data and curves, application and design details. Tubes listed in numerical order for quick, easy reference.

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5AX4	6BA5	12BN6	5642
6AB4	6BF7	19BG6	5692
6AJ5	6BQ7	25AU5	5719



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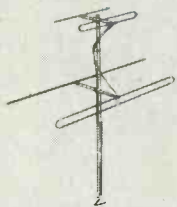
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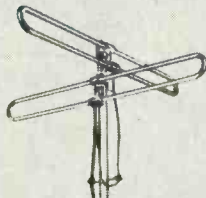
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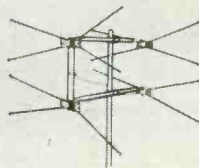
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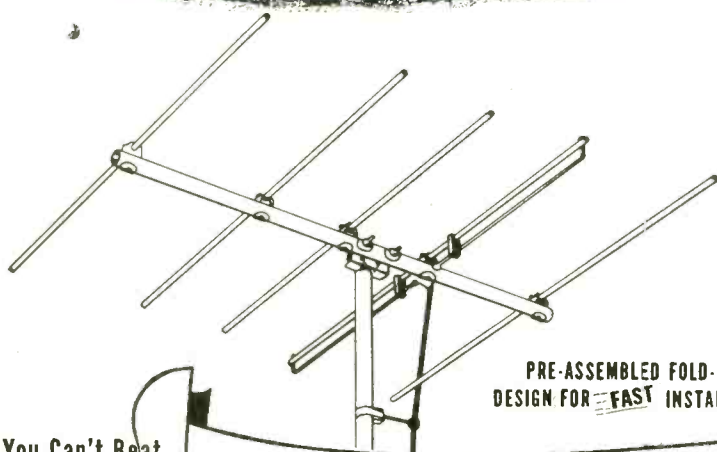
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OSCILLOSCOPE CIRCUITS

PART I

by ALLAN LYTEL

In this two part series the author discusses the power supplies and sweep circuits of various commercial cathode ray oscilloscopes. This installment is confined to 60 cycle power supplies such as those used in the Du Mont and Sylvania scopes.

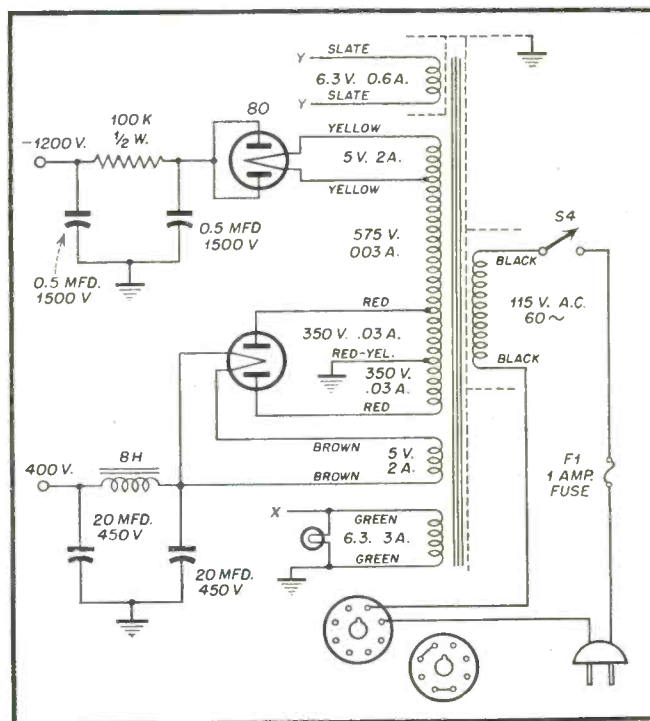
THE cathode ray oscilloscope has a power supply which fundamentally may be divided into two parts. A high voltage source with low current drain is necessary for intensification applied to the high voltage anode of the cathode ray tube. A low voltage power supply is necessary for all of the other circuits. This low voltage source supplies energy for the plate, screen, and filaments circuits.

Complete Power Supply

One power transformer may be used for both the low and high power supply circuits or separate power transformers may be used. The power transformers must be designed and used with a special care in cathode ray oscilloscopes, since the cathode ray tube itself is effected by both electric and magnetic fields. A magnetic shield is sometimes used on the power transformers to reduce the magnetic field effect. The mounting of the transformers is chosen with special care so that the magnetic fields which *do* exist are oriented in such a manner so as to not interfere.

A transformer which feeds both a low and high power supply system is shown in *Fig. 1*. A grounded electrostatic shield is used on the primary winding to minimize capacitive coupling. Interference coming from the power line is reduced to a minimum. Filament windings supply comparatively large amounts of power to all of the filaments in the oscilloscope circuit. One high voltage winding with appropriate taps is used to supply all of the necessary high voltages. A complex oscilloscope using many tubes requires more power for the filaments and plates. A simpler instru-

Fig. 1. 60 cycle power supply used in DuMont Type 274 oscilloscope. A single power transformer is used in the scope as shown. An interlock switch is provided for safety. Notice the 5 volt, 2 ampere tapped connection on the secondary.

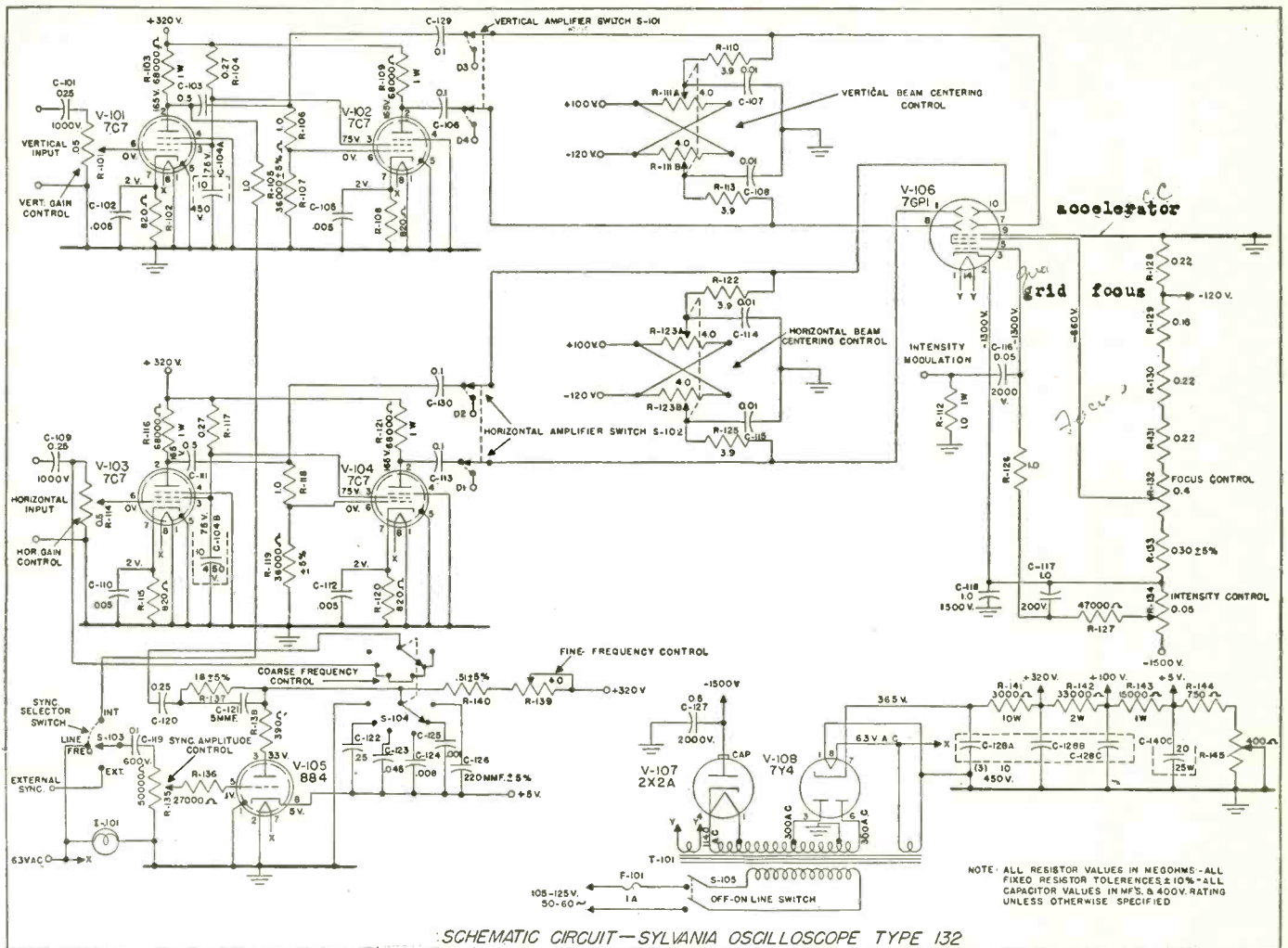


ment using fewer tubes has a lower power demand.

Figure 1 is the power transformer and associated circuit which is a part of the DuMont cathode ray oscilloscope Type 274. A single power transformer is used, with the primary winding 1 ampere fuse (F-1) and an on-off switch (S-4). An interlock arrangement prevents any power from being applied when the case is removed.

The main secondary winding which is the section having the greatest number of turns, is arranged for maximum effective use. By means of a tap connection the upper section of

this winding supplies 5 volts at 2 amperes for the filament supply of the type 80 rectifier tube. This filament, however, is not at ground potential; its potential above ground is 575 volts by virtue of having the entire secondary winding (save for a small bottom section) in series. Thus we have two of the functions of this secondary winding. The top section is a filament supply for a rectifier tube and this section is in series with a high voltage winding supplying 575 volts at 0.003 amperes which is the high voltage source for rectification by the 80 tube. This tube has its plates connected together and



SCHEMATIC CIRCUIT—SYLVANIA OSCILLOSCOPE TYPE 132

Fig. 2. Circuit diagram of Sylvania Type 132 oscilloscope.

functions as a half wave rectifier.

Because of the low power requirements of the cathode ray tube, a simple pi resistance and capacitance filter is sufficient. The resistor is 100,000 ohms at one-half watt, the filter capacitors are 0.5 μ f at 1500 volts.

The bottom section of the secondary winding has 3 taps, the center tap is common ground for the entire secondary winding. Therefore, the cathode of the high voltage rectifier 80 tube is above ground potential because of two voltages. The 575 volts is in series with the 350 volts for a total of 925 volts. However, this is an R. M. S. voltage and peak voltage is 1295 volts which is the peak voltage to which the filter capacitors of the high voltage rectifier circuit may charge.

The 80 tube supplies the low voltage for the plates of the amplifier tubes with a special secondary winding. However, these two tubes, the high voltage rectifier and the low voltage rectifier cannot have a common filament source because the filament of the high voltage rectifier is

at a high potential above ground. Therefore a separate winding is used for filament power on the low voltage rectifier. There is available 350 volts at 0.030 amperes for each plate of this rectifier.

Voltage Analysis of a Cathode Ray Tube

One of the current trends in cathode ray oscilloscopes is the use of a large diameter screen which allows a bigger visual pattern and is useful for alignment purposes. The Sylvania Electric Products Co. Oscilloscope Type 132 is representative of this trend using a 7GP1 cathode ray tube.

There are two general classifications of voltages which are necessary to apply to the cathode ray tube; a series of different values of d-c voltages is necessary in order to control focus and accelerate the electron beam on its way to the fluorescent screen. Other d-c voltages are used to position the electron beam up and down and from side to side. A second classification of applied voltages are the various signals or alternating current potentials which are applied to move the electron beam across the

tube face. These include the vertical signal, the horizontal signal or the sweep, and the intensity modulation.

In Fig. 2, the Type 132 oscilloscope is shown with its associated power supply and cathode ray tube. The half wave rectifier supplying the high voltage is a type 2X2A having an output of -1500 volts. The full wave rectifier for the low voltage supply is a 7Y4 whose output is + 356 volts. Each rectifier tube output has a series of resistors to ground which forms a bleeder network across the filter capacitors. This high voltage bleeder network supplies the individual d-c voltages necessary for the electron gun. The low voltage power supply provides voltage used for positioning and supplies the necessary plate and screen voltages for the associated amplifier tubes.

In order to designate the tube electrodes properly, the individual pin connections on the tube face of the cathode ray tube will be used to name the individual electrode to which it is attached; for example the filament is connected to pins 1 and 14 and goes directly through connections

marked Y-Y to the filament winding of the single power transformer. This winding is used for no other purpose and must be insulated for high voltage. The element nearest the heater is of course, the cathode connected to pin 2. In succeeding order toward the fluorescent screen, the electrodes are the control grid, (pin 3) the focusing electrode (pin 5), and the accelerating electrode (pin 9) which is at ground potential. The vertical deflection plates connected to pins 7 and 8 are nearest the electron gun and the horizontal deflection plates which are connected to pins 10 and 11, are the last electrode set in the series.

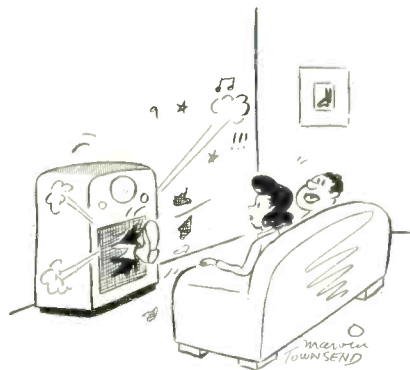
A difference of potential is necessary to accelerate the electron beam and either the positive side of this high voltage or the negative side may be grounded. In either case the value of the high voltage remains the same, however, there are certain circuit simplifications which may be obtained by operating the accelerating electrode at ground potential. The cathode is connected to a point of 1300 volts on the high voltage power supply bleeder. Only the one resistor, the *Intensity Control*, is between the cathode and the plate of the 2X2A diode. In order to obtain the necessary potential difference, relative to the cathode, which is necessary for visual cut-off, the grid is operated at a more negative potential than the cathode. This element is connected by means of a series resistor to the center arm of the potentiometer *R-134* which is the *Intensity Control*. In this manner, the control electrode or the grid, may have a voltage relative to ground between the limits of -1500 volts and -1300 volts. The control grid may be the same potential as the cathode or it may be approximately 200 volts more negative.

By means of the *Focus Control* which is resistor *R-132*, the focusing electrode has a variable potential. This average value is approximately -660 volts in normal operation and it may be varied depending upon the setting of the potentiometer.

The highest voltage in this electron gun is on the accelerating electrode which in this case is at ground potential. As shown in the schematic, an electron gun of this type has two sections for the accelerating electrode; one section is on either side of the focusing electrode. The overall potential difference between the accelerating electrode and the cathode is -1300 volts with the cathode being negative and the accelerator electrode being positive. The power supply has an output of -1500 volts but 200 volts

of this total amount is reserved or set aside for use with the control grid.

There are several interesting features of this high voltage system used with the 7GP1; the only resistor in the circuit which is sufficiently critical so that a plus or minus 5% tolerance is used is *R-133* placed between the *Focus Control* and the *Intensity Control*. The value of this resistor is critical since proper relative potentials must be maintained between the individual elements which control the focus of the electron gun in order to obtain normal operation. Both of these controls are of course potentiometers, and with this 0.30 megohm resistor between them proper operation of the cathode ray tube within range of these controls is assured. A voltage tap is provided between *R-129* and *R-128*; the value of the



"I wonder if our radio is disturbing the tenants in the next apartment?"

voltage at this point is -120 volts and is later used for a positioning voltage.

The high voltage power supply and bleeder in an arrangement of this type has a very low current drain hence small values of capacitance are sufficient. There are effectively 3 filter capacitors in the circuit, the first, *C-127* is a 0.5 μf capacitor from the plate of the rectifier tube to ground. The voltage rating of this capacitor, it will be noted, is 2000 volts, providing an adequate safety factor since the output is only 1500 volts. The second filter capacitor, *C-118*, is a 1.0 μf condenser with a rating of 1500 volts, this being the voltage between the cathode of the 7GP1 and ground. A final filter capacitor *C-117* of the same value but with a voltage rating of 200 volts, is used between the control grid and cathode. Since the accelerating potential is zero or the same as ground potential, the deflection plate must have a d-c voltage of approximately this value also in order to prevent defocusing. One of the

advantages of operating the final electrode of the electron gun at ground potential is the low value of a-c voltage which may be applied, so that direct connections may be made to the deflection plates without danger. The vertical deflection plates, by means of the *Vertical Beam Centering* controls use a variable d-c voltage to move the electron beam up and down the tube. There are two high value potentiometers connected in parallel; these resistors are ganged on the same shaft. Across each of the potentiometers, there is a potential difference of 200 volts for centering.

The vertical deflection plate connected to pin 7 is tied to the center arm of the variable potentiometer *R-111A*, through a series resistor. As this arm is moved to the left in the drawing, it reaches a voltage point of +100 volts. As this center arm of the potentiometer is moved to the right, it reaches a value of -120 volts.

The opposite vertical deflection plate is connected in a similar manner to *R-111B* which is part of the gang vertical centering control. A criss-cross of the wiring on this dual control is necessary for balanced positioning voltage. Since the electron stream is negative, it will move toward the more positive plate and away from the more negative plate. In order to provide balanced positioning, and to prevent defocusing, one plate must increase in value, or go positive while the other plate decreases in value or goes negative.

The horizontal or X axis circuit has a centering system which is almost identical. The part values are the same and the ganged *Horizontal Beam Centering Control* is on the upper right hand corner of the front panel of this instrument. Clockwise rotation of this control moves the electron beam to the right or toward the more positive plate and away from the more negative plate. If we assume that clockwise rotation is from left to right in the drawing, potentiometer *R-123B* will be at its most positive value at the extreme of right hand travel and is applied to the horizontal deflection plate connected to pin 11. At the same time, the opposite deflection plate is at its maximum negative value in the same position of the control. These positive and negative voltages aid each other in controlling the horizontal motion of the electron beam.

This action is often referred to as "push-pull" by various writers. However, there is no identity between this type of push-pull circuit and the one used in audio.

[To be continued]

SERVICING TAPE RECORDERS

by C. A. TUTHILL

PART 4

Operation and adjustment of the Concertone Model RP-401-C magnetic tape recorder is discussed in this fourth installment on tape recorders. Throughout the article explanations of various circuits and their functions are given by the author.

THE Concertone tape recorder Model 1401 employs an electronic unit (RP-401C) and a power supply (PS401). The two are interconnected by a six conductor cable as indicated in *Fig. 1*. The electronic unit (RP-401C) is comprised of three sections:

- A. Recording Amplifier
- B. Playback Amplifier
- C. Bias and Erase Oscillator

Circuit details of these three sections are discussed in a later section.

Switching System

A switching system has been included for adaptation of the Concertone to a custom-built installation. The switching system is grouped into three sections which function as now listed:

1. *Record Position* - Applies screen voltage to the oscillator tubes causing them to generate a sixty kilocycle (50V/8ma) bias current to the record head. Applies plate voltage to the final record amplifier tube (12AU7, second section). Connects playback amplifier output (12AX7) to output jack.

2. *Standby Position* - Oscillator and final record tubes are disabled. Low input jack is connected straight through to the output jack enabling an external power amplifier to be used for normal listening. With the tape recorder turned *OFF* this amounts to a shorted link in the audio system. With the recorder *ON*, the microphone channel is *alive* and therefore feeds amplified microphone output to an external power amplifier for monitoring purposes. For this function, this manufacturer offers a model MA 601 monitor amplifier.

3. *Playback Position* - Oscillator and final record tubes are disabled. Playback amplifier output is connected to the output jack identically as under condition (1) above.

Input Stages

The record amplifier employs two dual triodes (12AX7 and 12AU7). The first two stages are of standard *unequaled* high gain design employing a 12AX7 hi- μ dual triode connected in cascade to drive the final record current stage. The cathode of the first stage is heavily bypassed by a 20 μ f capacitor for reduction of hum and extraneous noise. The low level input jack is shorted out when not used for microphone pickup. Otherwise the first 12AX7 section provides preamplification. The higher input jack is connected to the second stage grid (12AX7) through a 500k level control which serves whether one or both initial stages are used. Both the high and low inputs are of 0.5 megohm impedance. Accessory input and output transformers of the plug-in type are available for the matching of 500/600 ohm unbalanced lines. The gain per stage for the first and second stages is approximately fifty and is essentially flat with respect to frequency.

Level Indication

Stages three and four employ a dual triode medium- μ tube (12AU7) which serves two functions. The earlier section, as shown in *Fig. 1*, is connected as a diode and serves as a rectifier for the record level indication circuit. Voltage from the record current amplifier (final stage) is supplied to the diode section (12AU7)

and the diode plate return is through the 10 megohm resistor shunted by an 0.02 μ f capacitor.

When a sudden voltage appears across the diode, the capacitor takes a charge and rapidly builds up a negative voltage. This negative voltage is fed to the record level indicator, (6E5, eye-tube) which varies its shadow pattern thus indicating relative voltage. The capacitor charges rapidly through the diode but discharges slowly through the 10 megohm resistor. The result is a floating action which does not offer eye strain to an operator *riding gain*. Full eye closure (6E5 is obtained when a five millivolt signal is introduced into the *High Gain* input. When a crystal microphone is used, the 470k *low noise* resistor provides a return grid path. When a microphone is not used, it is advisable to keep the *Low Gain* input shorted in order to minimize thermal noises while recording from a radio or other high level source. The *Low Gain* input requires a signal of approximately .25 volts for full eye closure.

Record Head Drive

The second section of the 12AU7 tube serves the final equalized stage providing adequate current to drive the record head. The cathode return of this final stage is through a 15k resistor bypassed by an LC resonant circuit comprised of a 22mh inductance and two capacitors, .004 μ f and .01 μ f respectively. At the lower frequencies a negative feedback voltage is developed (series feedback) across the 15k resistor which reduces the stage gain by over 20db. Distortion

first and second stages of the amplifier.

The recording deficiency for low frequencies, characteristic of magnetic tape, must be corrected during reproduction. Post-emphasis is therefore introduced through an amplifier having greater gain output for the lower frequencies. In this case this correction is accomplished through the RC network consisting of a two megohm resistor, .003 μ f capacitor and 5600 ohm resistor introduced between the first and second sections of the second 12AX7. Shunted across the two megohm resistor is a small variable trimmer capacitor which allows for fine adjustment of treble response or high frequency gain.

The output stage (12AX7) is a modified cathode follower with considerable cathode degeneration resulting in a minimum of distortion. The cathode bypass capacitor (.002) retards sensitivity of the output stage to a capacitive loading due to the use of a shielded cable between this amplifier and any external power amplifier. Voltage at the output jack is between one and two volts RMS as measured with a high impedance VT voltmeter. Heaters are energized by filtered direct current for elimination of hum.

Equalization

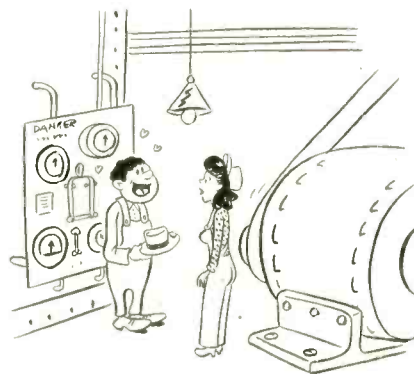
In a previous item of this series the need for equalization has been stressed. The reader may recall that an unequalized output from a tape reproducer is proportional to frequency up to the point of optimum output. This point is approximately three kilocycles for a tape speed of 15 inches per second. An unequalized output would be inversely proportional to frequency above the optimum point. The corrective system of equalization used in this instrument is to provide most of the required treble boost within the circuits of the recording amplifier. Necessary bass boost is derived from the circuits of the playback amplifier. Response is not only flattened out but the drooping playback curve attenuates thermal noise within the amplifier and also the hiss inherent in the tape output.

The bass boost (around 30 decibels) included in the Concertone playback amplifier circuits will not appreciably vary in value with time or with wearing of heads and therefore is not made adjustable. The treble boost included in the recording amplifier is set at the factory and should not be altered unless the peaking coil or its associated capacitors are replaced. However, the treble response is an element subject to change for various reasons including head wear. Therefore a

rather wide range treble adjustment has been included in the playback amplifier circuits as detailed under *Playback Amplifier*.

Noise

Various steps have been taken to decimate output noise. The 100k plate resistor in the first stage is of a special *low noise* type and should be replaced only by another of the same type. Due to the very high gain inherent in tape machines, other resistors must be reasonably quiet. If output noise increases after a period of time, first check the tubes then the resistors. A noisy resistor can be indicated by an irregular frying noise lower in pitch than normal tube hiss. A leaking capacitor can cause a resistor to appear noisy due to abnormal direct current allowed to pass through the leaking capacitor. The .003 μ f capacitor in the RC equalizer circuit is the most critical and should be suspected first in the event of noise not chargeable to resistors.



"How about a little kiss, Mary? Say about 120 volts D.C.?"

Noise Adjustment

To adjust the erase balance control between the cathodes of the two 6AR5 oscillators, disconnect the record head by pulling off one of the leads. With the record level control in the *OFF* position, adjust the erase balance control until the noise level is minimum. A definite *null* should be found at some position on the variable control unless the record head has become permanently magnetized.

After the erase circuit is balanced, reconnect the record head and vary the 25k noise adjustment until the residual noise from the oscillator drops to a negligible point. In Fig. 1, this noise adjustment is shown beneath the record head. During these adjustments the playback level should be above normal to aid acuity.

The hum adjustment consists of a piece of magnetic steel material fastened by a screw on the pressure arm assembly. This factory adjustment

should not require attention unless a motor has been replaced. In case of necessary adjustment, first start and run the motors as they would be in normal use. Connect an oscilloscope to the playback amplifier output and move the piece of steel material around until the lowest hum level is attained.

Head Alignment

The three magnetic heads of this machine are enclosed within one housing but individually mounted on adjustable saddles in order to allow for azimuth correction. To align these heads so that their gaps are precisely vertical, a true test tape must be run through and several checks made. The test tape should contain a constant tone of 10,000 cycles and be recorded on a machine which is known to be in true vertical alignment. The machine to be checked for head alignment should be threaded with the test tape and run normally under *Playback* mode of operation while the playback head is adjusted for maximum output by slowly turning the non-spring loaded screw holding the playback head clamp. Accurate adjustment calls for an output meter but the ear is a fair substitute.

Reload the machine with virgin tape and set the control to the *Record* position. Introduce a 10 kc signal from an oscillator to the *High Level* input and start recording. During this action adjust the record head for maximum output from the playback amplifier. Bear in mind the time delay between tape contact with *Record* and *Playback* heads. If the *Record* head is slightly swung back and forth, proper allowance for this factor can be included in the final adjustment. The azimuth of an erase head is not critical and can adequately be set by eye.

When new heads are installed or similar changes are made an overall frequency response check should be taken. To accomplish this, make a recording of 1000, 8000 and 15,000 cycles at a level so low that the level indicator *eye* barely starts to show indication during the recording of 1000 cycles. Play this tape back and measure the relative output of the three frequencies using a high impedance vacuum tube DB meter or an oscilloscope. Measurements are made under *Playback* conditions instead of *Record* in order to prevent bias leakage from affecting the readings.

If the comparative readings are more divergent than allowable, adjust the treble control until the readings agree closely. Bear in mind that

[Continued on page 40]

MEN OF RADIO

PART 6

by WILLIAM R. WELLMAN

MUCH of the research and improvement in radio between 1907 and 1920 centered around the improvement of the DeForest audion. This statement is not to be misconstrued; there is no attempt to depreciate the importance of DeForest's invention, but like many other great discoveries it was not given to the world in a perfected form. This lack of perfection would be most likely to exist in such a complex, delicate device as the electron tube.

The early tube had a number of weaknesses, and chief among these was its inability to handle appreciable amounts of power. Then too, the filament which at that time served as the direct source of electrons, needed improvement. It was quite delicate, short-lived and required the expenditure of considerable power for the quantity of electrons released.

It would be almost impossible to consider the evolution of the electron tube without keeping in mind its relationship to the progress of the incandescent lamp. Remember that experimentation in lamp improvement in 1883 led to the discovery of the principle upon which the operation of the tube is based. Furthermore, the lamp and the tube are almost inseparable when considered from one point of view: both depend for their functioning upon an exceedingly fine, delicate conductor, the filament. Therefore it is logical to expect that as the lamp filament developed, so did the tube.

Original Edison lamps used filaments made of carbon—quite fragile, and having a life span that was all too short. Edison and those who followed him worked for two decades in an attempt to lengthen the life of the carbon filament lamp, and at the end of that time they had succeeded in extending it to 600 hours. The great inventor then thought that the ultimate had been attained. In his opinion, the lamp reached such a stage of perfection that no further improvements were likely.

Then, about 1905, the metallized filament lamp made its appearance.

In this installment the contributions of Dr. W. D. Coolidge, Dr. Irving Langmuir, Dr. H. D. Arnold, and Dr. A. W. Hull are traced, as the vacuum tube is brought to a point of high efficiency by improved vacuum processes.



(Courtesy General Electric Co.)

Dr. William David Coolidge

This lamp had a carbon filament that had been passed through the intense heat of the electric furnace and in the process took on a metallic appearance. It was fairly successful, and sold well for a dozen years or so, until it was crowded out of the market by the tungsten-filament lamp. Meanwhile, European lamp manufacturers had offered several types of true metal-filament lamps, among which were the tantalum and osmium types. While these were satisfactory on the direct current so prevalent in Europe, their life span was markedly shorter when used on alternating current.

The European attempts, however, apparently stimulated thinking of lamp engineers in this country; evidently a true metal filament was the answer, but which metal to use was the problem. Tungsten was the logical choice for the simple reason that tungsten has a melting point higher

than that of any other metal—about 3350 degrees, centigrade. Obviously, such a metal could easily withstand the high temperatures produced by incandescence. Tungsten, however, has another property which complicated matters; it is extremely difficult to work. For a while, an attempt was made to unravel the knotty problem by using powdered tungsten, held together by a binder. The resulting product was squirted through a die and resulted in a reasonably good filament.

Wm. D. Coolidge

Dr. William D. Coolidge, of the General Electric research staff recognized the desirable properties of tungsten, but thought that a much better method of using it might be devised. Coolidge, a graduate of Massachusetts Institute of Technology, had majored in electrical engineering and received his doctorate at Leipzig, Germany in 1899. After joining the G-E staff, he went abroad to study European lamp developments.

The most advanced thinking on the subject of tungsten inclined toward the view that impurities in the metal interfered with its workability, but Coolidge was not convinced and later was able to show that the excessive brittleness of the metal was an inherent quality, rather than the result of any impurities.

After two years of experimentation, Dr. Coolidge created what amounted to a metallurgical marvel—ductile tungsten that could be drawn through dies into wire just like other metals. In so doing, he supplied the groundwork for present day lamp and tube production. His procedure reversed usual metallurgical methods; most other metals became harder and lost

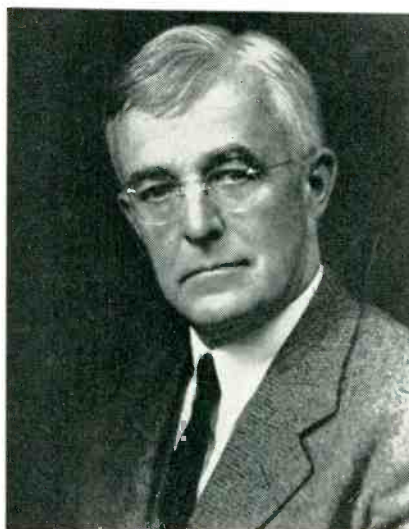
their ductility when worked upon. Normal workability was then restored by heating or annealing. Tungsten, by way of contrast, lost its ductility after heating. The process of making ductile tungsten is quite complicated, but reduced to simplest terms the steps are about as follows. The oxide of tungsten is reduced in hydrogen, leaving tungsten powder which is then pressed into slugs in molds. The tungsten slugs are hardened and sintered by heating. During sintering, the grains of tungsten "grow" together. Swaging by rapid-acting power-driven hammers is the next step. This is repeated many times, until the ingot has been reduced to a rod about 1/25 of an inch in diameter. Finally, the rod is drawn into wire while subjected to heat; during this step, the dies as well as the tools used to grasp the tungsten must also be kept heated. It is interesting to note that in developing the process, Dr. Coolidge really produced a new kind of tungsten. The metal had always appeared in crystalline form; his tungsten was fibrous.

Significant as Coolidge's work was, it did not constitute his sole contribution to the electronic art. Closely allied to radio is the vast field of x-ray work; in fact, industrial uses of x-rays are an important branch of industrial electronics. Once he had solved the lamp filament problem he delved into a study of the use of tungsten as a target material in x-ray tubes. From then on, this great investigator spent most of his time in developing x-ray apparatus and technique. Very little was then known of proper safeguards, with the inevitable result that he developed a case of x-ray burn which fortunately was cleared up by the eminent Dr. Francis Williams. Coolidge produced the radically new type of tube which bears his name and the utilization of the rays passed from an art into a science, largely as a result of his efforts.

The tungsten filament resulted in a vacuum tube that had a satisfactory life span, but there still remained the problem of higher efficiency in electron emission for the wattage expended. Tubes of the early broadcast period had to be operated at such high temperatures that the filament gave off a considerable amount of light. Old-timers will surely remember the illumination provided by the UV-200A (00A in present day numbering systems). Other researchers who followed Coolidge developed the thoriated filament, which could be operated at a much lower temperature. Finally, the much more efficient oxide-coated filament material made its appearance,

the latter being suggested by Dr. H. D. Arnold.

Early experiments with the DeForest audion indicated that in its original form it was wholly unsuited to the job of power amplification because the plate potential was limited to about thirty or forty volts. Whenever the plate voltage was raised above that value, the tube showed a blue glow or "haze"; operation became erratic and in a short time the tube reached the end of its life. In that early day, theories concerning the operation of tubes pointed to a small quantity of residual gas as being essential to performance. In other words, it was thought that if a relatively good degree of vacuum existed within the envelope the tube would not function correctly. It should be



(Courtesy General Electric Co.)

Dr. Irving Langmuir

noted, parenthetically, that at that time suitable equipment for developing a degree of vacuum approaching that presently used was totally lacking.

H. D. Arnold

One of the earliest experimenters to tackle the problem of improving the audion was Dr. H.D. Arnold, of the Bell Telephone Laboratories. Dr. Arnold was, of course, interested in improving the tube primarily for use in long-distance telephone work. One of his assignments was the design of amplifiers for use on long lines, and he soon recognized and attempted to overcome the weaknesses of the then available tubes. He had just completed courses in electronic physics under the noted Dr. Robert A. Millikan, and approached the problem of amplifier design with a totally new view. He felt that the tube should be operated under purely thermionic effects, com-

pletely divorced from the complications of gas within the envelope. Of course, in order to realize such conditions, the gas would have to be almost entirely removed, and this he set about to accomplish. His aim was to remove all possible traces of residual gas through the use of improved methods of exaction, and in this aim he succeeded.

Irving Langmuir

At about the same time (1912) Dr. Irving Langmuir, of the General Electric Company, was working on the identical problem. Langmuir was born in Brooklyn, N.Y. on January 31, 1881, the son of Charles and Sadie Langmuir. His first scientific experiment ended almost disastrously when he was six. He took a deep whiff from a bottle of chlorine, probably inspired by his scientific-minded brother, Arthur. Part of Langmuir's early education was received at a small boarding school in a suburb of Paris. Concerning that period, he wrote: "... being an American and having a friend who was influential with the head of the school, I was freed from much of the absurdly rigorous discipline to which the French boys were subjected. Thus I could spend time alone in the school laboratory and was encouraged by one of the teachers to learn the use of logarithms and solve problems in trigonometry, subjects not required by the curriculum."

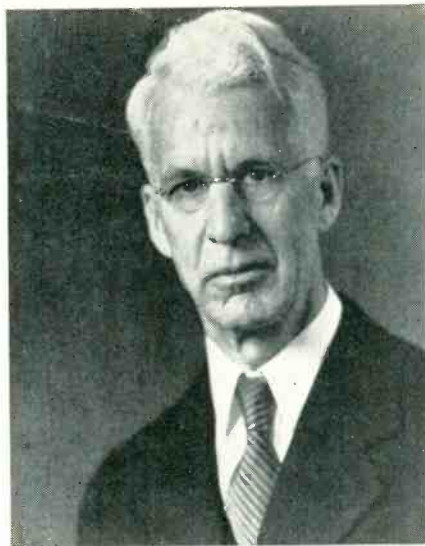
Langmuir completed his education at Chestnut Hill Academy, Pratt Institute, in Brooklyn, N.Y. and at the Columbia School of Mines. He received his M.A. and Ph.D. degrees at Gottingen, Germany in 1906. For the next three years he taught chemistry at Stevens Institute, then joined the research staff at General Electric.

Upon his entrance into the laboratory he became intensely interested in the problem of incandescent lamp blackening and other phases of lamp development. It is more than possible that Langmuir's outlook on the lamp problem was influenced to some degree by his studies, in Germany, under the eminent Professor Nernst, inventor of a well-known lamp of that day. Many lamp engineers believed that premature blackening of lamps was due to the imperfect vacuum attainable at that time, but Langmuir did not wholly agree with this theory. In his own words, he felt that he did not know "how to produce a better vacuum and instead proposed to study the bad effects of gases by putting gases in the lamp." He went on to say that "if you have in lamps a vacuum as good as you know how to produce, but suspect

that the lamp would be better if you had a vacuum, say, one hundred times as good, it may be the best policy to ...destroy the vacuum deliberately ...and you may then find that no improvement in vacuum is needed." This method of purposely studying the bad effects of an unwanted condition when unable to correct it led to the invention of the gas-filled incandescent lamp, and resulted in a tremendous gain in efficiency in certain types.

But in spite of Langmuir's unorthodox approach to the problem of lamp evacuation, he eventually got around to the improvement of vacuum, not only in lamps but in electron tubes as well and thereby paved the way for the introduction of high-power tubes. He was attracted to electron tube research through meeting Dr. Alexanderson, who was then considering the use of DeForest audions in controlling the output of his alternator. He agreed with other scientists, including Arnold, that residual gas was not at all essential to the performance of tubes. By this time, he had acquired considerable knowledge and experience in methods of producing a high degree of vacuum in lamps. One of his developments, the mercury condensation pump, was capable of exhausting a lamp or tube to a higher degree than ever before achieved. The basic principle of this pump is shown in Fig. 1. Many previous methods of producing a vacuum were based upon purely mechanical means, while Langmuir's pump depended for its operation upon the fact that mercury vapor, when condensed, will remove gases from a chamber. When heat is applied at the lower end of the pump, the mercury, M, is vaporized. The vapor rises through the inner chamber, A, until it reaches the baffle, B. Here it recondenses, due to the cooling effect of the outer water jacket and is diverted downward by the baffle; the condensed mercury then returns to M, where it is reused. As the condensed vapor falls, it takes with it particles of air or other gases removed from the vessel to be evacuated through the intake; these gases are then drawn out through the discharge line by a mechanical pump.

Through the use of his improved methods of evacuation, Coolidge proved what he had already suspected: that residual gas in a tube has no effect on the emission of electrons, since this is primarily dependent upon the filament material and the filament temperature. He learned one more thing that was to have a profound effect upon the future of electronics, especially in the industrial field. This



(Courtesy General Electric Co.)

Dr. Albert W. Hull

was the fact that residual gas in a tube does effect the passage of electrons from filament to plate. The residual gas, he found, is ionized by the electrons and the gas molecules, through ionization, lose one electron, thus making them positive. These positive ions serve to neutralize the "space charge" existing in the tube, and it is the space charge which reduces electron flow and attainable power. Dr. Langmuir may be regarded as the discoverer of the space charge effect and his discovery led indirectly to important developments in another field, for when he told Dr. Coolidge of his discovery, the latter applied it in making revolutionary changes in x-ray tubes.

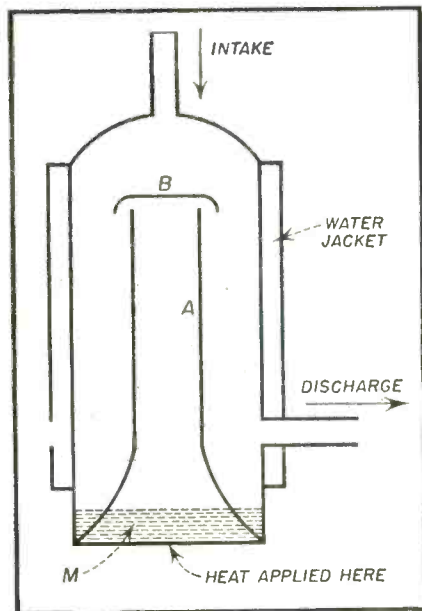


Fig. 1. Simplified diagram of Langmuir Mercury Condensation vacuum pump.

Langmuir carried his research to the point where he was able to demonstrate that when the electrodes of a tube were placed closer together, a sufficient quantity of electrons could be pulled across the space so that a high current could be carried. Further, his techniques permitted the use of higher voltages and the higher current plus higher voltage of course meant high power. Through these discoveries, Langmuir provided radio broadcasting with the indispensable tool it was destined to need just a few years later.

Together, Coolidge, Arnold and Langmuir provided the industry with tubes that were far ahead of earlier types. Both Arnold and Langmuir attempted to patent the discoveries they had made, but both failed. This was not the first time that two radio pioneers had worked for years upon similar ideas, and it was almost inevitable that their rival claims would end in litigation. The patent contest dragged on for years until, in 1931, the U.S. Supreme Court decided that the discoveries of neither scientist constituted invention.

Arnold, Coolidge and Langmuir had just about completed investigations that helped to perfect the vacuum tube when World War I broke out in Europe. America for the first time became the arsenal of democracy and it soon became evident that large quantities of radio apparatus and tubes would be needed.

One of the plants able to contribute to this need was the Marconi manufacturing division at Aldene, New Jersey. Under the guidance of Roy A. Weagant, chief engineer, this factory alone turned out more than ten million dollars worth of apparatus. This may not sound huge when measured by today's standards, but it should be remembered that the use of radio in the first world conflict was on a scale much smaller than the one recently concluded and then too, the monetary value is expressed in 1914 dollars. Weagant, by the way, had been associated with Professor Fessenden at Brant Rock before joining Marconi. Another interesting sidelight is that Weagant once made an attempt to circumvent the DeForest audion patents by designing a special type of tube in which the grid was wound on the outside of the glass tube. Of course, it was offered for sale as a Fleming valve, with only a filament and plate but presumably it was accompanied by an instruction sheet that told the purchaser just how to convert it into a three-electrode tube. Some of you

[Continued on page 37]

LOOKING FOR Trouble?

No. 5

by **Cyrus Glickstein**

(Instructor, American Radio Institute)

THE object of the quiz, as usual, is to pick out the best answer to each question and so find the trouble in the TV receiver which is being serviced. The receiver is on the bench and the questions follow the usual steps in TV trouble-shooting.

Since the answers to some questions are given in the following question, each question should be answered before going on.

Type of Receiver: Tele-King, Model 410. Split-sound receiver, a-c transformer-type low voltage supply, kick-back high voltage system.

Trouble: Sound O.K. Screen blank (no pix, no raster)

1. As usual, the first step in trouble-shooting is to check the controls governing the fault which is indicated on the screen or by the sound. Since the fault is a blank screen, the intensity control is first turned to maximum. The screen is still dark. The horizontal drive control is varied but has no effect. With the contrast control at maximum, sound is normal on all stations, but there is no picture or raster. On the basis of information on the screen, from the speaker, and from manipulating controls, the trouble can be in any of the following circuits:

- (a) CRT, low voltage, front end
- (b) High voltage section, low voltage supply, vertical sweep section
- (c) Horizontal sweep section, high voltage section, CRT
- (d) Video strip, low voltage supply, high voltage section.

2. In this type of receiver, there are 3 possibilities of trouble—the CRT, the high voltage section, and the horizontal sweep circuit. The next step is usually to try to narrow the possibilities, even before the usual tube changes are made. The first step

in eliminating the possibility of a defective CRT is:

- (a) Substitute new CRT
- (b) Check voltages around CRT socket
- (c) Check to see if CRT filament is lit and make high voltage spark test
- (d) Adjust ion trap.

3. The CRT filament was lit and a spark test (holding high voltage anode lead close to its connection point) showed no high voltage. For the time being the CRT is ruled out as a source of the trouble. Without high voltage the picture tube cannot be expected to operate. The next step is to check if there is high voltage a-c input to the plate of the high voltage rectifier, 1B3, and output from the plate of the horizontal output stage, 6BG6.

The simplest way to check is:

- (a) Spark test with screwdriver at plates of 1B3 and 6BG6
- (b) Scope at both plates to check amplitude and shape of waveform
- (c) A-C voltmeter at plates to check presence and amount of a-c voltage.
- (d) Resistance checks around the horizontal output and high voltage rectifier stages.

4. Spark tests are made at the plates of the 1B3 and 6BG6 with a screwdriver. No sparks are present. The following tubes are changed—Horizontal oscillator, 6SN7, Horizontal output, 6BG6, Horizontal damper, 6W4, and the high voltage rectifier, 1B3. It is still not possible to draw an arc with a screwdriver at the plate of the 1B3 or the plate of the 6BG6. With the new tubes remaining in the set, the next step is to check where the horizontal sawtooth is being lost—the horizontal

oscillator stage or the horizontal output stage. The quickest method for verifying this is:

- (a) Resistance checks around the horizontal osc. and horizontal amp. stage
- (b) Check for negative d-c voltage on the horizontal osc. grid (pin 4, 6SN7, V-14) and on horizontal amplifier grid (pin 5, 6BG6, V-15)
- (c) Voltage checks around the horizontal osc. tube socket
- (d) Voltage checks around the horizontal output tube socket.

5. The horizontal output grid shows 0 v., indicating no sawtooth input. The horizontal oscillator grid, pin 4, shows 0 v., indicating the oscillator is not operating. Voltage checks are taken around the horizontal oscillator tube socket and compared to normal readings (see Fig. 1).

Measured voltage	Readings given by Mfr.
pin 1 - +15 v.	not given
2 - +90 v.	+245 v.

The 6SN7 is removed from the tube socket and the positive voltage on the first grid, pin 1, increases. Positive voltage is also found at the 6AL5 tube socket (V-11, Horizontal phase detector). Pins 5 and 7: + 275 v. Pins 1 and 2; + 285 v. (normal readings - 0 v.) The 6AL5, which had not been changed before, is removed from its socket and voltages re-taken. There is now no positive voltage on the 6SN7 grid, pin 1, and no voltage on pin 5 and 7 of the 6AL5. Voltage on pins 1 and 2 of the 6AL5 remains high. The most likely trouble is:

- (a) C-331 shorted (between pin 7 6AL5 and Sync Amp. plate circuit)
- (b) 6AL5 cathode to plate (pin 5 to pin 2) short

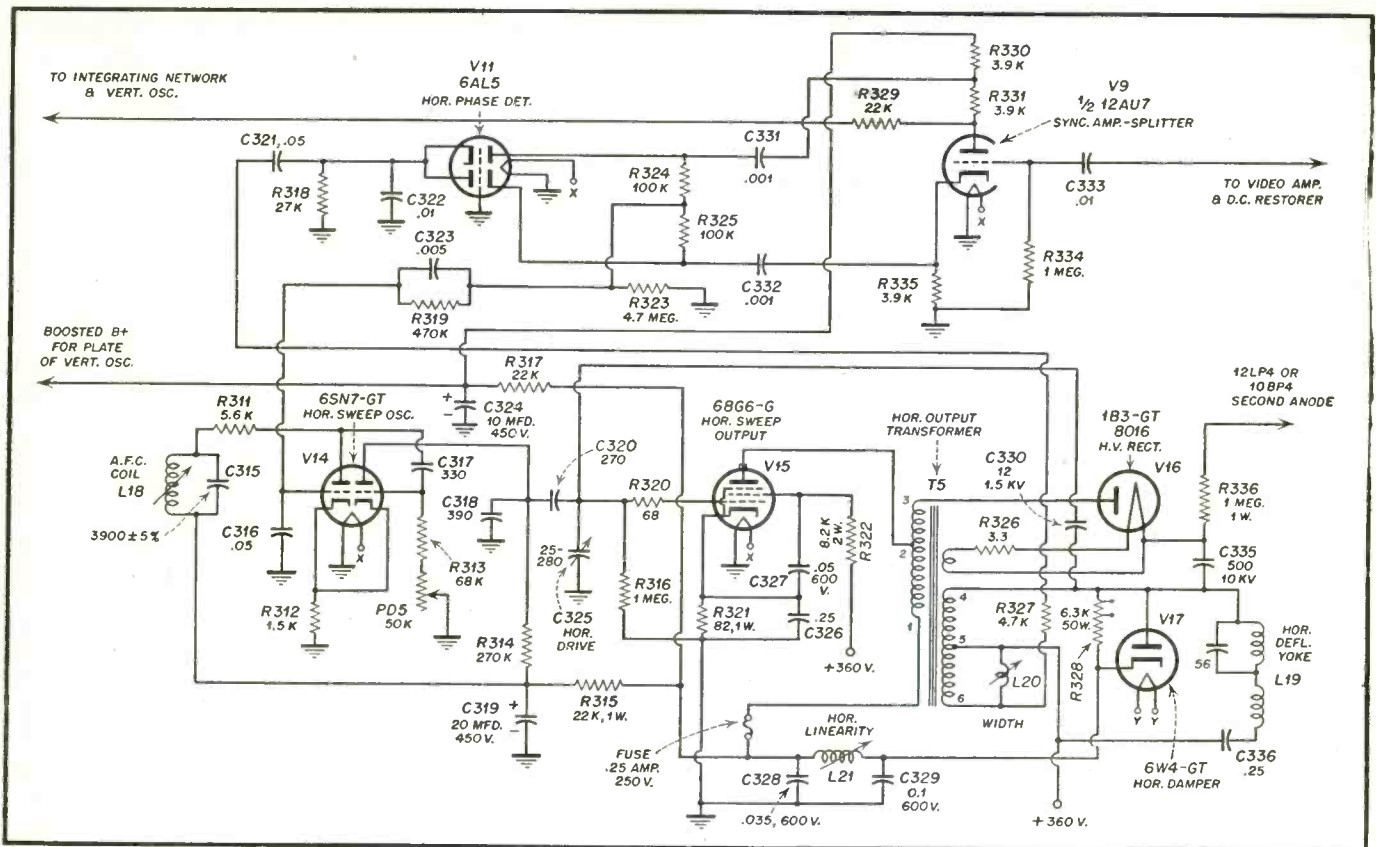


Fig. 1. Partial schematic of Tele-King Model 410 receiver.

- (c) C-321 shorted (between pins 1 and 2 of 6AL5 and the junction of width control and horizontal output transformer secondary)
- (d) High resistance short between grid (pin 1) and plate (pin 2) of 6SN7, horizontal oscillator V-14.

Answers and Discussion

Answer: 1-c

In TV receivers of this type - a-c transformer, low voltage supply, kick-back high voltage system - sound and blank screen indicate trouble in one of the following: CRT, high voltage, or horizontal sweep sections. With sound coming through, it can be assumed the front end and low voltage supply are functioning. A failure in the vertical sweep circuit or video strip should not cause a blank screen.

Answer: 2-c

With a blank screen, the usual procedure is to first eliminate the possibility of a defect in the CRT or its associated circuits. The first step is to see if the CRT filaments are lit. If lit, the next step is to see if there is high voltage d-c at the anode cap. This is simply done by turning set off. The high voltage anode lead is disconnected from the CRT and the rubber cap is held at its base with one hand. The set is turned on and the cap is brought

close to its connection point. If there is a thin spark when the cap is about 1/4" away from the connection point, high voltage d-c is present. Obviously, since the anode cap is a high voltage point, servicemen are careful in handling it. The rubber cap provides sufficient insulation to prevent a shock. If there is high voltage and the filament is lit, but the screen blank, then the CRT tube or its circuit must be causing the trouble. In such case, the next step is to measure the voltages around the CRT socket. The CRT socket is removed, the set turned on, and voltage readings are taken from each pin in the socket to ground. As part of the voltage check, the brightness control is varied and the voltmeter kept in the cathode pin of the CRT to see if the voltage changes as the brightness control is rotated. As a general rule, the cathode to grid voltage should vary from close to zero to +50 v. or more. In most CRT's, approximately 50 v. of bias will cut the tube off. Occasionally, a defect in the brightness control circuit keeps the tube at cut-off. If the tube socket voltages are normal, the next step is to check the placement of the ion trap. The trap is slowly revolved around the neck of the tube and slowly shifted back and forth. It is usually not advisable to rotate the ion trap as a first step unless it is

obviously out of position. When tube socket voltages are O.K., there is high voltage at the cap, and rotation of the ion trap does not bring up brightness, then there are two possibilities of trouble - bad ion trap or bad CRT. Both should be changed in turn. It might be remembered that a CRT does not generally lose brightness suddenly, unless a filament opens.

On the other hand, if there is no spark from the rubber anode cap when brought close to its connection point, then there is no high voltage. In such cases, trouble is indicated in a section which feeds into this point - either the high voltage section or the horizontal sweep section.

Answer: 3-a

A simple test to find if there is high voltage a-c input to the high voltage rectifier, 1B3, V-16, is to use a screwdriver with a heavy wooden or plastic handle. The screwdriver is brought close to the anode of the 1B3. When about 3/8" away, it should draw off a thin spark, if there is high voltage a-c input present. If there is such a spark but a blank screen, trouble is in the high voltage rectifier section. If there is no spark, the same test is made at the anode of the 6BG6. The spark here is normally smaller, about 1/4", since the high voltage a-c here is smaller. If there is no spark

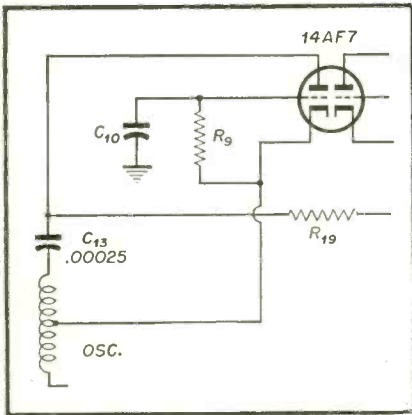
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SHOP NOTES

Write up any "tricks-of-the-trade" in radio servicing that you have discovered. We pay from \$1 to \$5 for such previously unpublished "SHOP NOTES" found acceptable. Send your data to "Shop Notes Editor."

Philco Model 41-605—Oscillation

When this set comes in with oscillation at the high end of the dial and is using a 14AF7 tube in place of the type XXD, it can be eliminated by using a 5000 ohm resistor in the plate



Recommended change in circuit values for Philco 41-605.

circuit of the osc. section in place of the 10,000 ohm resistor used in the original circuit (R_{19} in the diagram).

Submitted by
George Raymond
Biloxi, Mass.

Clock Ticking in Pontiac Radio

Believe it or not, this actually has occurred on three different occasions to my knowledge in 1949-50 Pontiac radios. I did not realize until recently that it was actually the clock ticking, and not a feedback condition, that was heard in the radio. I discovered the remedy and promptly forgot about the incidents. Then a Pontiac owner in a nearby city came here with a complaint that his clock was ticking in his radio. My first impulse was to tell him that it wasn't possible but I remember that anything can happen in radio and usually does so I went out to listen to this. There it was, a perfectly good hillbilly tune being mared by the regular and monotonous click of the clock. It was then that it dawned on me that I had heard that song before, I removed the antenna cable and forced it back into the socket as far as it would go.

That ended the trouble. Evidently there is a chemical reaction between the plug of the antenna cable and the jack on the radio that causes a high resistance joint. Strangely enough there was no motor noise present in the radio. The clock is completely shielded but is mounted on rubber but why the balance staff makes noise to begin with I guess I'll never know, but one thing certain it does make noise, when the clock stops the noise stops.

Submitted by
Wayne E. Lemons
Buffalo, Mo.

Carbon Tet Affects Plastics

I have found that several of the new "portables" out, have cases made of plastic which is dissolved by carbon tetrachloride. So when you're repairing a portable and cleaning a switch with carbon tetrachloride be careful. It will permanently mar the finish of the case.

Submitted by
Thomas D. Hefter
Compton, Calif.

Pix Tube Shorts

Evtry once in a while a TV set is encountered where the focusing and brightness controls have no effect on the beam, and the picture appears smeared on the screen with a paint brush. Usually, a resistance check between control grid and cathode of the CRT will show a conducting path of a few thousand ohms, thus indicating a particle of conducting material is shorting the two elements. While a new CRT will solve the problem, we have been able to salvage a few hundred additional hours of life from these tubes by burning out this "short".

The base was removed from a defunct octal tube and two pieces of HV line soldered to pins 4 and 6. The other ends of these wires were terminated with test clips. To use the device for the purpose outlined above is a simple matter.

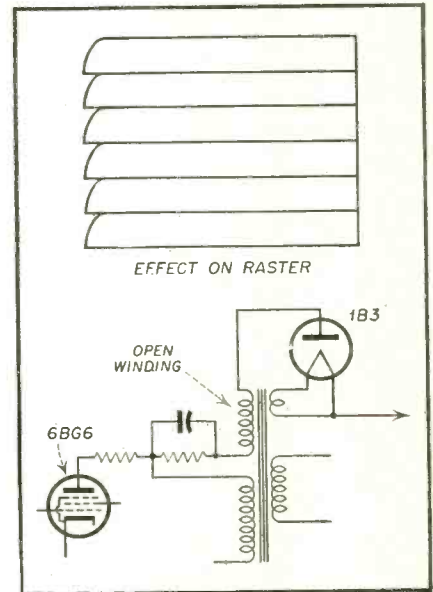
With the TV set turned off, the 5U4G is removed and the base plug-

ged in its place. The socket is then slipped off the CRT and the leads from the test base connected to the cathode pin and control grid pin (CAREFUL). The TV set's switch is then flipped on and off, rapidly ONCE. A resistance measurement will tell you whether the particle has been burned out, or if another treatment is necessary. It really works and takes up little room in the kit.

Submitted by
C. W. Bacon
Fair Lawn, N. J.

G. E. Model—810 Flyback transformer trouble

A G. E. Model 810 came in the shop with horizontal streaks about one-half to three-quarters of an inch apart, the left edge of the raster was sawtoothed and the circular portions of the patterns looked similar to gearwheels. As the brightness control was turned up the effect would get worse, as the brightness was turned down the trouble would almost correct itself at the point just before the picture got too dark to be seen. Waveforms taken thru the entire horizontal



Raster pattern and circuit detail of open 810 trans. winding.

circuit showed spurious oscillations. Measurement of the high voltage at the anode of the CRT showed 6000-6750 volts (depending on the setting of the brightness control) rather than 9000 volts given in the service notes. Resistance measurements showed an open winding in the flyback transformer between the cap of the 1B3 GT and the center tap of the primary.

Submitted by
John Wizemann
New York City

NEW PRODUCTS

RCA INDOOR-OUTDOOR LIGHTNING ARRESTER

A new, improved lightning arrester designed for outdoor as well as indoor use, and patterned after RCA's time-tested indoor lightning arrester, used in nearly a million homes, has been developed and is now being marketed by the RCA Tube Department. Designed to fit quickly and easily into TV and



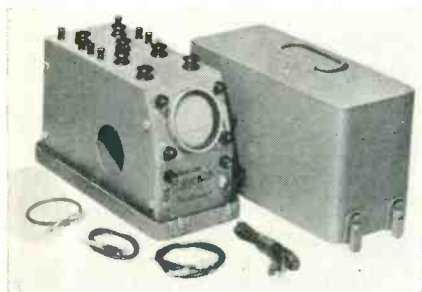
FM installations, this newest arrester (215X1) is listed by the Underwriters Laboratories for both indoor and outdoor mounting.

An inexpensive plastic and metal device, the new lightning arrester is designed to match 300-ohm transmission lines, such as the RCA "Bright Picture" line. The device uses the familiar RCA method of attaching the arrester to the transmission line so that it does not have to be cut or spliced. The transmission line is simply placed in an open slot in the plastic body, and the plastic cap is screwed down firmly, causing four prongs in the device to pierce the insulation and contact the wires.

Suggested list price of the new lightning arrester (215X1), which will be sold through RCA Tube distributors, is \$1.10.

PORTABLE 3" OSCILLOSCOPE

Called the Model 380 "Miniscope", this fine new instrument has frequency coverage to 2.5 mc and features: Sensitivity of 0.1 RMS volts per inch * Direct connection to CR



tube elements * Provision for Z-axis modulation * Telescopic light shield. Shock mounted and housed in a strong moisture-proof aluminum case. This highly accurate and dependable instrument is built entirely of highest quality components. Though designed to exacting military specifications, the Model

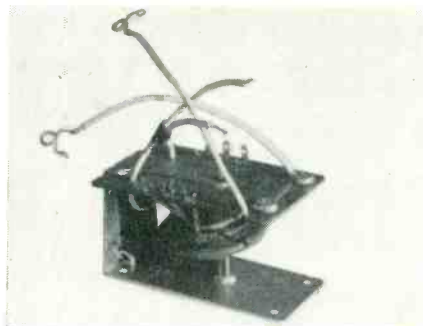
380's versatility makes it an ideal, low-cost 'scope for industrial and laboratory engineering use. Built in a handy, portable size, narrower than a telephone—6" W. x 9" H. x 13 1/4" D.; weighs only 14 pounds, leads included.

For complete information, write The Hickok Electrical Instrument Co., 10533 Dupont Avenue, Cleveland 8, Ohio.

NEW DU MONT DEFLECTION TRANSFORMER

A new Du Mont Horizontal Deflection Output and High Voltage Transformer known as the Type H1A1 is now available to the trade for conversion or replacement purposes, as announced by E. B. Hinck, Sales Manager of Electronic Parts, Allen B. Du Mont Laboratories, Inc., 35 Market Street, East Paterson, N. J.

The new type H1A1 features a high-efficiency design utilizing a Ferrite core and special windings. It is capable of supplying 12 to 13 kilovolts to a 70° tube with ample horizontal size. The new Du Mont Flyback is ideal both mechanically and electrically for quick, easy conversion of a TV receiver using smaller size C.R.T. to the larger modern size. Mounting has been so designed so that the unit lends itself to either horizontal or vertical mounting without any special hardware. Holes are provided for the use of #8 selftapping screws.



Through the utilization of the Ferrite core and special windings, size and weight have been kept to a minimum, while the dependability and life have been greatly increased over previous flyback designs.

AUTOMATIC, SELF-FOCUSING

ELECTROSTATIC TV PICTURE TUBE

James B. Lindsey, V.P. in charge of Thomas Electronics Inc. Engineering Staff and Development Laboratories holds the new Thomas Automatic, self-focusing electrostatic TV picture tube.

Shown with him is Robert E. Burrows, Sales Manager for Thomas, holding the focus coil and potentiometer which, with the new tube, are no longer necessary components within the set.

In a statement to the industry, Mr. Lindsey said that this tube which operates on a low voltage, is totally unaffected by normal-line voltage changes or anode voltage fluctuations and will not drift out of focus. He said that the significance of this tube to set makers is self-evident: set design is simplified



due to the low voltage requirement and elimination of focus coils, potentiometers and focus leads to power supplies. Obviously, there is a significant saving of critical material. Resultant lowered costs, the new ease of operation and higher performance standards will enhance consumer satisfaction in set ownership.

PORTABLE TUBE CHECKER

A new portable checker for picture tubes selling for the low price of \$28.75 has just been announced by the National Union Radio Corporation, 350 Scotland Road, Orange, New Jersey.

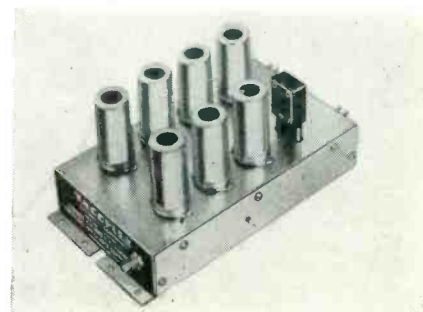


Both rugged and compact in design, the N.U. Cathode Ray Tube Checker is designed for use not only in the shop but also in the customer's home. This new checker will enable the serviceman to determine in the home whether or not the picture tube is defective. As the N.U. checker tests independently of the set, it is not necessary that the TV set be in an operative condition.

The dealer and distributor can test picture tubes in the carton without removal, thus making it possible to easily check for damage in transportation.

CHANNEL CONVERTER FOR USE WITH TACOPLEX SYSTEM

In the development of community master antenna systems, the losses of signal strength at the higher TV channel frequencies when being transmitted through long lengths of cable



have presented some problems. In order to overcome this difficulty, Technical Appliance Corporation, Sherburne, N. Y., manufacturers of the Tacoplex Antenna Distribution System and Taco Antennas, have designed a Channel Converter.

The new Taco Channel Converter for use with the Tacoplex System beats the higher channel signals down to a low-band open channel. For example: if Channel 13, is operating in a region where the only other channel is 4, the Channel Converter at the antenna station converts the signal to Channel 2 and transmits that signal through the cables. The receiver operator tunes his receiver to Channel 2 to pick up the Channel 13 signal.

The converting is done by means of a crystal oscillator so that there is no drift in the frequency. Power connections are provided from the Tacoplex Amplifier Chassis for this unit.

NEW TRIPLETT WATT-VOLTMETER

The Triplett Model 660 Load-Check permits every radio technician and TV serviceman to service by power consumption measurement



—simplest and quickest of all methods for localizing troubles in auto radios. Three outstanding advantages are: **FIRST**—It will tell you immediately what trouble you should look for: **SHORT** or **OPEN** circuit. **SECOND**—with no extra tools or test leads you can localize the trouble. **THIRD**—Operation of the 660 Watt-Voltmeter is very simple. No extra leads to connect. Just plug the power cord of the unit to be tested into the 660 panel outlet socket, and the 660 power cord into a 110-volt socket.

For further information write: The Triplett Electrical Instrument Co. Bluffton, Ohio.

MALLORY VIBRATOR TESTER

A vibrator tester has been announced by P. R. Mallory & Co., Inc., of Indianapolis as an addition to its line of electronic products.

This tester gives direct readings on "good-bad" conditions of doubtful vibrators. It is featured as a companion unit to the popular Mallory 6RS10 and 6RS25 filtered rectifier DC power supplies.

With this Mallory vibrator tester, a direct test, without adapters, may be made of most



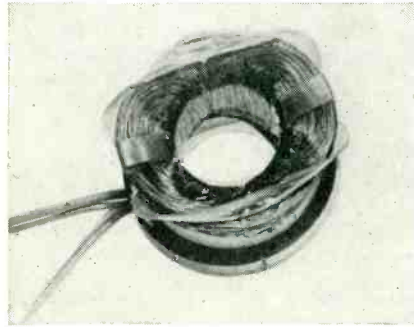
popular vibrators used in passenger car radios manufactured since 1940. By plugging the rectifier tube into the front panel, inter-

rupter type vibrators can be tested in conjunction with the same rectifier tube used in the car radio. The condition of the vibrator being tested may be determined directly from the "good-bad" meter scale.

This tester may be used with the Mallory filtered rectifier power supplies, or will operate from any 6 volt DC source which can be adjusted between 4 to 6 volts.

MERIT COSINE YOKES

The Merit Transformer Corporation is now manufacturing two Cosine Yokes—MDF-70 and MDF-30.



The MDF-70 is a newly designed cosine yoke with distributed winding for edge-to-edge picture focus. High efficiency ferrite core permits use with all picture tubes up to and including 24 inches where they require 70° deflection. It is recommended for use with HVO-6 and HVO-7 ferrite core flybacks.

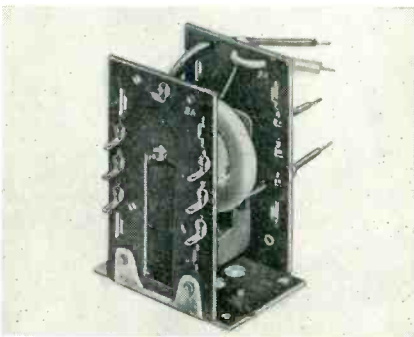
The MDF-30 is of the same design as MDF-70 but has high horizontal and low vertical inductance for use with HVO-8 air core fly-back in direct drive systems.

All Merit Yokes are now equipped with network leads.

NEW STANCOR DEFLECTION TRANSFORMER

A new TV replacement unit, the A-8130 Horizontal Deflection Output and High Voltage Transformers, has been added to the Standard Transformer Corporation line, Jerome J. Kahn, president, announced recently.

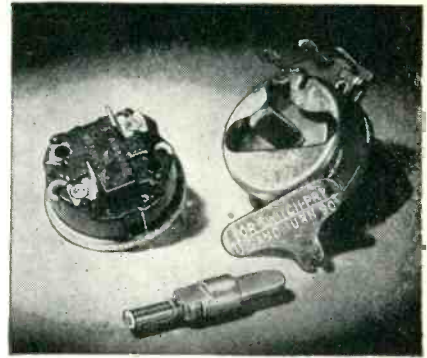
The Stancor unit is for use in pulse-operated single-rectifier power supplies to deliver up to 14,000 volts of anode potential with adequate



sweep for full horizontal scan of 65-70° kinescopes having up to 24 inch screens. It may be used for conversion of older TV receivers to take newer picture tube types, it was announced, and requires 3-27 Mh. width control coil. Overall height of the unit is 4-1/16 inches, with a base area of 2 7/8 x 2-3/16 inches.

15/16" CONTROLS WITH ATTACHABLE SWITCH AND SHAFT

The flexibility of choosing the desired combination of control, switch and shaft, heretofore available with larger of 1 1/2" dia. volume control replacements, is now extended to the smaller 15/16" dia. size as well, according to



Clarostat Mfg. Co., Inc., Dover, New Hampshire.

For some time past the Clarostat Series G (built-in-shaft) and Series AG (attachable Pick-A-Shaft) controls in the 15/16" dia. size have been available in regular jobber stock. The Ad-A-Switch, has not been available until now when Clarostat has such an attachable switch which has Underwriters' approval, and in stocking its jobber with same.

The Series SWB or 15/16" Ad-A-Switch is obtainable in S. P. S. T., Three-way no "Off" position S. P. D. T., and D. P. S. T. A T-shaped section of the control's dust cap is simply pried off, turned 90 degrees and taken off, exposing the switch-throwing mechanism. The Ad-A-Switch readily slips in place.

CONICAL ANTENNA STABILIZER

A practical light weight stabilizer to reduce vibrations of elements on conical antennae, weather proofed wooden center, steel

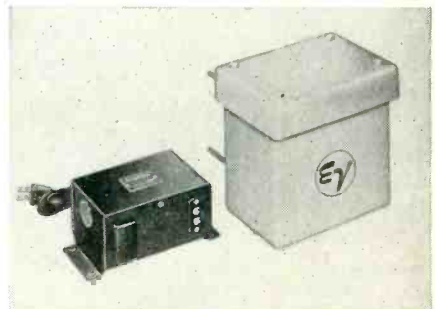


jaw retains grip on both 3/8 and 1/2" elements, preventing element breakage and elements noise. Aluminum arms for durability and light weight. Cat. No. CS-21 Immediate delivery. For further information write: Tele-matic Industries, 1 Joralemon St., Brooklyn, N. Y.

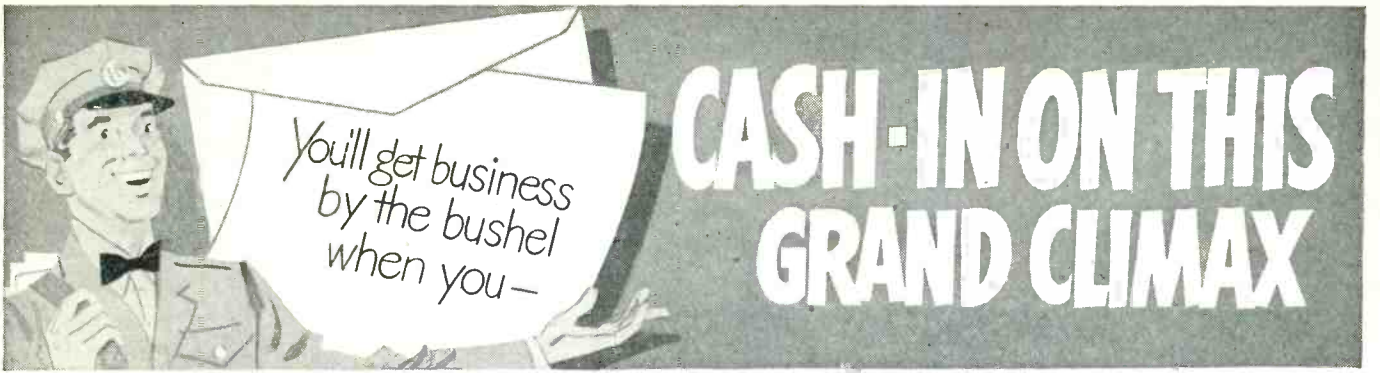
E-V TENNA-TOP AUTOMATIC TV BOOSTER

The TENNA-TOP is a low-noise, automatic, all-channel, antenna-mounted TV Booster produced by Electro-Voice, Inc., Buchanan, Michigan.

The Booster mounts right at the antenna top ahead of the lead-in...boosts the signal, not the local noise...gives increased signal-to-local-noise picked up by the lead-in equal to the gain of the booster. Impedances are closely matched at all frequencies to provide even further gain.



E-V Tenna-Matic self-turning is completely automatic for all channels. No knobs—no switches—no manual turning. Junction control box may be concealed behind the TV



CASH-IN ON THIS GRAND CLIMAX

of Sylvania's big brilliant campaign for Service Dealers

Now begins the second half of Sylvania's greatest and most appealing ad campaign ever offered to Service Dealers.

Featuring 2 famous celebrities, Paulette Goddard and Patrice Munsel, this campaign ties in with big ads soon to appear in the Saturday Evening Post, Look, Life, and Collier's magazine, and is backed by the nation-wide weekly TV show, "Beat the Clock."

Everything included

Here's everything you need for a record harvest of fall service business. You get big, smashing life-like displays of the famous stars. You get counter cards, streamers, direct-mail pieces . . . even radio spot announcements.

Remember, you pay only one cent each for the mailing pieces. All the rest is FREE! So don't let another minute go by without calling your nearest Sylvania distributor . . . or mail the coupon NOW.



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receiver or in any inconspicuous place. Plugs in between receiver and electric outlet—and is turned "On" or "Off" by the receiver switch. Instantly boosts the signal on any channel.

For complete information, write for Booster Bulletin to Electro-Voice, Inc., Buchanan, Michigan.

CECO INTRODUCES EVER-QUIET

The Chemical Electronics Corporation, New York City, is introducing the CECO line of chemical products for industry, among which is EVER-QUIET, a volume control and contact restorer for electronics servicing. EVER-QUIET, according to a company spokesman, restores excellent contact to potentiometers, continuous tuners, switch-type front ends, contact points, record changers, relays etc.

Deliveries of the new product are now being made to leading radio and television Jobbers throughout the country. Packaging is in

two-ounce bottles or 32 oz. metal containers. Further information may be obtained by writing CECO, 521 Fifth Avenue, New York City.

G. E. TONE ARM

General Electric is offering a new Professional Tone Arm, the FA-21-A, to dealers and distributors throughout the U. S., it was disclosed today by E. A. Malling, sales manager of component parts for the Receiver Division, at Electronics Park here. The FA-21-A is designed to mount the G-E Variable Reluctance Cartridge (RPX-050).

This G-E transcription arm is made for lateral transcriptions and recordings. The mass of the transcription arm has been reduced to the ultimate point through functional design and the use of magnesium alloy for the moving parts. Both the lateral and vertical planes have very low bearing friction due to the precision, hand-adjusted cone-type bearings.



The principal features of the G-E tone arm are easy installation on popular turntables; the absence of arm resonances in audio range, thus providing a clean quality; easy groove location, a low mass, low friction arm, and a highly damped and complaint cartridge producing a combination relatively immune to groove jumping.

The General Electric transcription arm will mount on transcription machines whose dimension from the center of the turntable to the edge of the mounting surface is approximately 15 inches or less.

The stylus is located by an arrow on the arm so that it may be accurately positioned for the play-back of transcriptions.

The load on the cartridge stylus is adjustable by a precision spring loading system which is calibrated in ounces and grams.

PORTABLE PHONO

A new, portable, completely self-contained 3-speed phonograph is announced by Sun Radio & Electronics Co., Inc., 122-124 Duane St., New York 7, N. Y. The new Sun Radio phonograph features a high quality of reproduction.

Housed in a rich, tan, leatherette luggage-type case, the new phonograph boasts an 8" British Hi-Fi speaker, a British designed amplifier and a Garrard 3-speed automatic record changer. Internal baffle arrangement provides clean, crisp high and rich, resonant bass tones from the high magnetic flux speaker. The



circuit design of the amplifier includes inverse feedback, low distortion and low hum level. Combined bass and treble control permits tone compensation for individual taste.

The standard model is equipped with an Astatic LQ-D wide-range crystal pickup, while a second model at slightly higher cost is equipped with a G. E. RPX-050 triple play cartridge and built-in G. E. UPX-003 pre-amplifier.

The Sun Radio Portable Phonograph operates on 110 volts, 60 cycles AC, and is also available for operation on 50 cycles AC. Price of this item is in keeping with ordinary portable phonographs.

IF YOU BUY, SELL OR INSTALL TV ANTENNAS YOU KNOW

THE COST OF A DISSATISFIED CUSTOMER. ONE CALL-BACK

TO REPAIR OR REPLACE A FAULTY ANTENNA IMMEDIATELY

REDUCES OR ELIMINATES YOUR PROFIT. MORE THAN 1

MILLION TROUBLE-FREE WALSCO ANTENNAS ARE

INSTALLED THROUGHOUT THE NATION. JOBBERS,

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ANTENNAS TO GIVE CUSTOMERS LASTING SERVICE AND

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PRODUCT OF THE LEADER. TO BE SURE, SPECIFY WALSCO.

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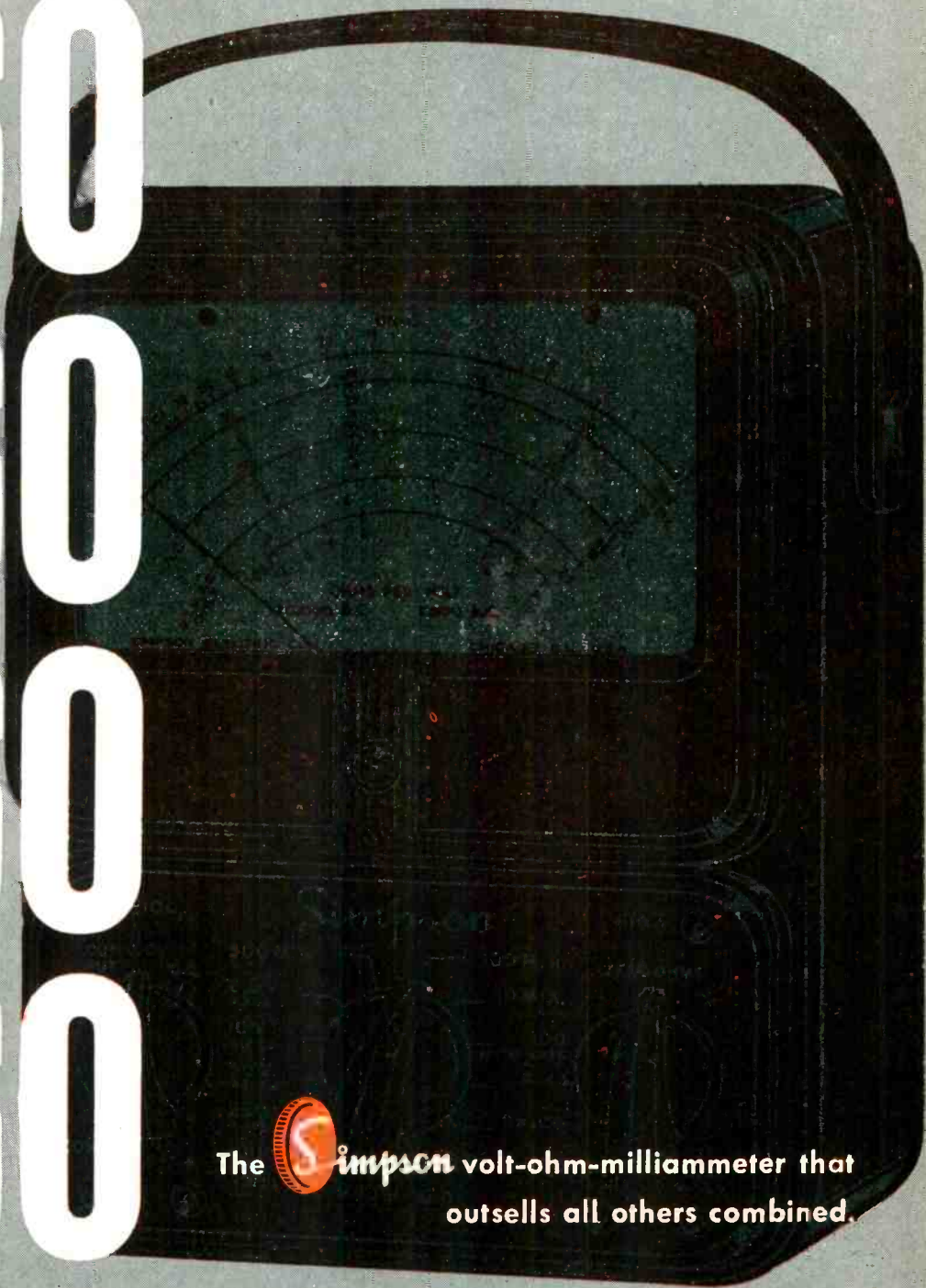
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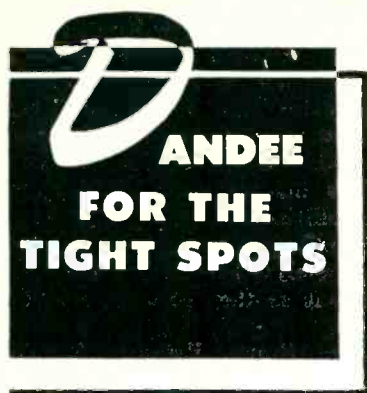
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The  **Simpson** volt-ohm-milliammeter that
outsells all others combined.



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Especially for a
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electrolytic?
And the job's got
to stand up,
regardless?**



Your best bet is the new SMALLER Type PRS Dandee. Metal-can electrolytic. Single, dual, triple and quad combinations. Stranded-wire leads and safety sleeves. High-purity aluminum. Vented. Ask your Aerovox jobber for PRS Dandees!



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In Canada: AEROVOX CANADA LTD.
Hamilton, Ont.**

TRADE LITERATURE

A new general catalog covering all products manufactured for civilian markets has just been published by *The Astatic Corporation*, Conneaut, Ohio.

Printed in three colors, it includes illustrations of all items, as well as full descriptive and performance data on all models of TV and FM boosters, microphones and stands, phonograph pickups and cartridges, needles, recording heads and related equipment.

Several features in the make-up of the new catalog are worthy of note. An index of products, and pages on which they appear, is handily located on the front cover. A helpful innovation on inside pages is that beside each phonograph cartridge illustration is a picture and identification of the needle it contains.

Ask for Astatic Catalog No. 51 by writing Sales Department, *The Astatic Corporation*, Conneaut, Ohio.

* * *

Walco offers an attractive, colorful, 11" x 17" chart, showing not only all of the phonograph needles in use by leading record-player manufacturers, but cartridge makers as well.

So up-to-date is this new chart, that it covers several needles now being installed in new models. It gives the name of the maker, the needle model by maker's number, illustrates the actual needle, gives *Walco's* replacement number and the list price. It also bears a diamond symbol alongside those needles which *Walco* is now making available with diamond tips to alert the dealer to every opportunity to sell a higher unit and earn a larger profit.

Jobbers and dealers desiring a copy are invited to write to *Electrovox Co., Inc.*, 60 Franklin Street, E. Orange, New Jersey and it will be sent free of charge.

* * *

The *JFD Manufacturing Company* of Brooklyn announces the availability of a new brochure No. 92 describing and illustrating two new types of all-channel television window antennas: the *JFD* Conical Model No. C119 and the *JFD* Hi-Lo Model No. C120.

* * *

The latest volume in *Rider's Television Manual Series*, Volume 7, is

now in production, announced *John F. Rider Publisher, Inc.*, 480 Canal St., New York 13, N. Y.

This volume, the largest to date, was scheduled for publication in July. 74 manufacturers contributed their factory-authorized servicing data for the period Fall 1950 to Summer 1951. Taking up where TV Manual Volume 6 leaves off, the latest manual, 12 x 15 inches in size, includes servicing information on 776 models. The equivalent of 2,352 pages (8½x11) are filed in proper sequence, enabling the service technician to use it immediately. All models are accessible instantly with the cumulative index for *Rider TV Manual* Volumes 1 through 7.

TV 7 contains schematics, chassis views, voltages, resistance readings, alignment procedures, test patterns, waveforms, parts lists and parts values, boosters, tuners, and up-to-date changes on previously published information. Circuit action descriptions and unpacking and installation data round out the features of this volume. It is priced at \$24.00.

* * *

The *General Electric Company* demonstrated its new *Stylus and Cartridge Replacement Guide* at the Parts Distributors Conference and Show in Chicago, May 21-23, according to E. A. Malling, Parts Sales Manager for the Receiver Division at *Electronics Park* here.

The *Stylus and Cartridge Replacement Guide* charts the complete use of styli and cartridge in *General Electric* as well as competitive phonograph combinations and depicts the advantages of the Variable Reluctance Cartridge with the *Baton* stylus over other cartridges.

Shown with the *Guide*, to be sent shortly to distributors, dealers, and servicemen, is a revised Variable Reluctance Cartridge folder which includes a finger-tip index for cartridge use.

* * *

A markedly simplified phonograph needle chart and replacement guide has just been developed for the retail and jobbing trade by *Jensen Industries, Inc.*, prominent Chicago needle manufacturer. Designed to fit

either pocket or service kit, as well as for counter use, the new "Jensen Needle Guide" will prescribe the proper replacement for every make of phonograph and cartridge.

The new "Jensen Needle Guide" resembles a graphic calculator type of slide rule. It embodies all the necessary variables and characteristics that a serviceman or clerk needs to know in the absence of the exact model or replacement number, including the three turntable speeds, and the methods of switching and of mounting needles. In addition, silhouettes of the 70 different needle styles are shown with their respective cartridges.

* * *

The outstanding feature of the "Jensen Needle Guide" is that it is not necessary to know model number of the phonograph, cartridge number, or any other information that is not readily available. Anyone can determine the exact needle needed. The "Jensen Needle Guide" is as simple as A, B, C, and is absolutely infallible.

The new "Jensen Needle Guide" and full information on the Jensen line of replacement needles may be obtained from local distributors or by writing direct to Jensen Industries, Inc., 329 South Wood Street, Chicago 12, Illinois.

* * *

Eighteen supplementary pages to the General Electric Company's "Radio and TV Replacement Parts Catalog" have been mailed to G-E distributors and holders of the catalog.

These pages bring parts information for all postwar GE radios and television sets up-to-date as of May 1, 1951. Mailing advised that holders of unregistered catalogs can obtain the additional pages by writing Mrs. E. B. York, General Electric Company, Building 1, Syracuse, N. Y.

* * *

Senator Estes Kefauver of Tennessee, exchairman of the Senate Crime Committee, was awarded the *Television Mis-Information* "Bouquet of the Month" according to the announcement in the June issue of this quarterly journal mailed to 100,000 free subscribers by its publishers, *Sheldon Electric Division of Allied Electric Products Inc.* of Irvington, N. J.

Other articles cover items of concern to service technicians, engineers, dealers, jobbers, distributors and manufacturers in the television industry. The publishers of *TELEVISION MIS-INFORMATION* state that a copy of its journal can be had by writing to *Allied Electric Products Inc.* of Irvington, N. J.

The laws that govern the business activities of retail establishments are analyzed and explained for the benefit of buyers and merchants in a new book, "What Every Retailer Should Know About The Law," by J. Norman Lewis and R. Duffy Lewis, just published by *Fairchild Publications, Inc.*

Pooling their knowledge and wide experience, J. Norman Lewis, a well-known attorney, and R. Duffy Lewis, a department store general merchandise manager, have come up with a text that is written in clear, non-legal language which is completely understandable to the average retailer who may not be thoroughly acquainted with his rights and obligations under the present law.

The book has been divided into four

separate categories. The first section examines the laws that determine the retailer's liability to his customers. His obligations and dealings with his employees are reviewed in the second part, while the third section discusses the laws that determine his rights and liabilities in his dealings with merchandise sources. Finally, the authors analyze government laws and regulations as they pertain to retail business.

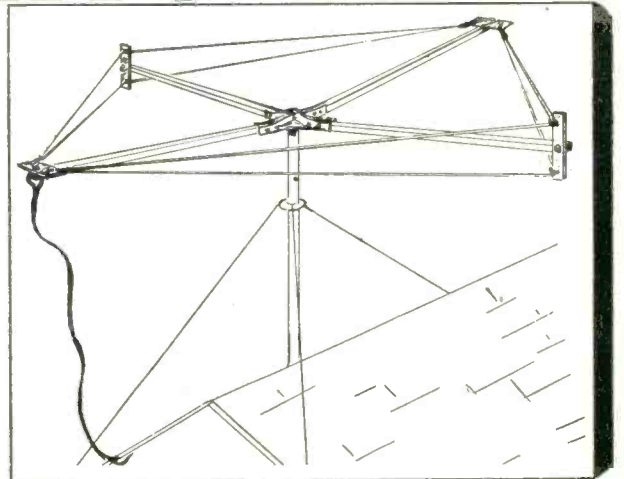
"What Every Retailer Should Know About The Law" is cloth bound, contains 72 pages, and is priced at \$2.50 a copy.

* * *

Radio Merchandise Sales, Inc., New York City, having sold virtually carloads of their lightning arrestor

It's SENSATIONAL! CLEARBEAM'S NEW ALL-CHANNEL
RHOMBIC

**ELECTRONICALLY
ENGINEERED
for
LONG
DISTANCE (DX)
RECEPTION
and
SHARP
DIRECTIVITY
over the entire
TV SPECTRUM**



SENSITIVE
7-Strand copper
receiving elements

STURDY
Heavy-duty Alum casting
fram. Alum reinforced
structural grade
waterproof Douglas Fir.

PREASSEMBLED
for ease in installation.

"Remember the Rhombic" has long been the phrase used by electronic engineers wherever the problem involved long distance (dx) and sharp directivity. Now, for the first time, Clearbeam has engineered this all-time favorite in an exclusive design to cover the entire high and low TV band—bringing you a Horizontal, Multi-Wire Rhombic TV Antenna with exceptionally high gain for low signal areas, and unusually sharp directivity to rid reception of ghosts! For picture-perfect long distance all-channel reception, remember the Rhombic—specifically "CLEARBEAM"!

A COMPLETE LINE OF QUALITY ANTENNAS & ACCESSORIES
FOR EVERY RECEPTION REQUIREMENT

Clear Beam

**TV ANTENNAS
& ACCESSORIES**

NOW IN OUR NEW HOME: 100 PROSPECT AVE., BURBANK, CALIF. ROCKWELL 9-2141
Charleston 0-4886

PLANET'S 100% Testing Guarantees Perfect Performance



No wonder Planet guarantees each capacitor for 1 year! For under the supervision of Planet's inspection and quality control director, a man with over 20-years of electrolytic experience, each unit must be perfect or be rejected. (The fact that less than 1/10 of 1% are rejects proves Planet quality control throughout production.)

Each capacitor is 100% tested for leakage, capacity and mechanical defects, so that when you specify Planet capacitors you are guaranteed perfect performance or we replace.

For complete information send for free catalog C-2

PLANET MANUFACTURING CORPORATION
225 Belleville Avenue, Bloomfield, N. J.



A MUST for every radio man

CQ is a monthly publication for Radio Amateurs, Technicians, Engineers, and Communications personnel. As radio-television servicemen you will be interested in knowing that the FCC has recently initiated both Novice and Technician Class licenses for radio amateurs. Since these licenses are easily obtained, many of you will undoubtedly be interested in preparing for them. (These are discussed fully in the March issue.)

For many years CQ has served radio amateurs and communication men throughout the world. Its articles are a constant reading necessity for all men in the radio profession.

Enter your subscription to CQ NOW!

Regular Subscription rates:

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models, is now promoting this vital accessory with a new twist aimed at fostering proper UL approved methods.

Feature of the new promotion is a large, colorful, wall chart pointing out a section from the National Electrical Code and illustrating a typically approved method for installing the television lightning arrestor.

Copies of the attractive, educational charts are available in quantities to all jobbers or may be obtained by writing to Radio Merchandise Sales, Inc., Promotion Dept., 1165 Southern Blvd., New York 59.

* * *

A readily understandable notebook on uhf television characteristics and uhf-vhf tuners, generously illustrated with basic and comprehensive circuit schematics, block diagrams and wave forms has been announced by the Paul H. Wendel Publishing Co., Inc. of Indianapolis, Indiana.

The new notebook, which has been prepared by Edward M. Noll, author of "Television for Radiomen" and "Color Television Notebook", describes the characteristics of vhf tuners with respect to gain; sensitivity; bandwidth; signal-to-noise ratio; various types of interference; and alignment. The vhf tuner section also details typical commercial tuners including RCA; Sarkes Tarzian; Standard Coil; Zenith; Stromberg-Carlson permeability tuner; Halli-crafter printed circuit tuner; Philco tapered line tuners; and General instrument.

The Notebook contains a bibliography of uhf; table of proposed channels for vhf-uhf television indicating frequency ranges; and a comprehensive tabulation of proposed allocations of vhf-uhf channels by cities and states. The Notebook on UHF Television and UHF-VHF Tuners measures 8½ x 11 inches and is bound to lay flat when opened for study or reference. Copies may be obtained by sending \$1.00 to the Paul H. Wendel Publishing Co., Inc., P. O. Box 1321, Indianapolis 6, Indiana.

* * *

Eleven new technical bulletins covering three product classifications have been released to the trade by the Centralab Division of Globe-Union Inc., Milwaukee, Wisconsin.

They are as follows: Ceramic Capacitors: transmitting capacitors (high voltage type) bulletin No. 42-102; stand-off capacitors, tubular type, bulletin No. 42-121; solder-sealed button capacitors, bulletin No. 42-122.

Printed Electronic Circuits: Model 2 Ampec, three-stage P.E.C. Ampli-

fier, PC-200, PC-201, bulletin No. 42-117; P.E.C. TV vertical integrator networks, PC-100 and PC-101, bulletin No. 42-126; P.E.C. triode couplers, PC-70 and PC-71, PC-80 and PC-81, Bulletin No. 42-127; P.E.C. pentode couplers, PC-90 and PC-91, bulletin No. 42-128; Audet P.E.C. PC-150 and C-151, bulletin No. 42-129; Model 3 Ampec, three-stage P.E.C. amplifier, PC-202, PC-204, bulletin No. 42-130.

Switches: Centralab Lever Action Switch, 1452 Series, bulletin No. 42-141.

Any of these bulletins may be obtained free of charge by writing to the Advertising Department, Centralab Division of Globe-Union Inc., 900 E. Keefe Avenue, Milwaukee, Wis.

* * *

The current *Telrex News*, (Volume 1, Number 9) in addition to its excellent antenna design, construction and TVI information contains a chart of Voltage & Power Ratios expressed in Decibels.

* * *

The Defense Production Administration makes available to all a booklet entitled, *Mobilization Guide for Small Business*. The information contained in this booklet pertains to defense contracts and procurement, materials assistance, loans and tax privileges, management assistance, and conversion assistance.

* * *

Element VIII Ship Radar Techniques, is a new supplement to Radio Operator's license Q & A Manual by Milton Kaufman, publisher by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y. This publication contains 32 pages, 17 illustrations, is paper bound and priced at 78¢.

* * *

Maintenance and Servicing of Electrical Instruments, by James Spencer, Third Edition, published by The Instruments Publishing Co., 921 Ridge Ave., Pittsburgh 12, Pa. This book provides practical information on the maintenance and service of electrical indicating instruments. From the Chapter headings: D-C Instruments, A-C Ammeters and Voltmeters, A-C Wattmeters, Brief Summary of A-C Types, Instrument Transformers, Frequency Meters, Synchroscopes, Power Factor Meters (and RVA Meters), Reactive Factor Meters, Dial Marking, Plug-In Detachable Instruments, Damping Means, and a final chapter written by M.F. Behar on Pivots and Bearings, it will be evident that the field is adequately covered. In addition, the explanations and illustrations are

very good. This book is a worthy addition to the library of every mechanic who constantly uses electrical instruments.

* * *

TV Replacement and Conversion Guide dated May, 1951, is made available by Ram Electronic Sales Co. South Buckhout Street, Irvington-On-Hudson, N. Y. This guide catalogues the Ram line of deflection transformers, yokes, width and linearity coils for various TV receivers. In addition, circuit information and instruction is given for converting

RCA 630 Type, Philco and G.E. receivers.

* * *

Radio and Television Receiver Circuitry and Operation, by Alfred A. Gherardi and J. Richard Johnson, is a basic and complete coverage of modern TV and radio systems and receivers. The treatment is practical, written for the radio service technician, and the student; and the coverage includes the latest developments in circuits, antennas, materials of construction, principles of operation and explanations of the AM, FM,



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and TV forms of transmission. Because of their importance in the servicing field, modern recorders, record changers, and pickup devices are also thoroughly discussed, with a wealth of information on new magnetic recording devices. Containing 669 pages (including index) this book is priced at \$6.00. Published by *Rhinehart Books, Inc.*, 232 Madison Ave., N. Y. 16, N. Y.

TRADE

[from page 12]

Broadcasting System today announced the introduction of two new Television models according to D. H. Cogan, president.

These two models which are the first to be introduced since Air King merged with the Columbia Broadcasting System are both twenty inch receivers. The first, a mahogany table model, known as model 20TL will carry a list price of \$299.95. The other, a French Provincial console in maple, model 20C3 will carry a retail price of \$469.95.

Zetka Rebuilds Used Pix Tubes

Zetka Television Tubes, Inc., 131-137 Getty Avenue, Clifton, New Jersey, have set up a special department to rebuild used picture tubes.

New Jensen Needle Pack

Jensen's newest aid to phono needle dealers is the No. 32 Dealer Pack with automatic inventory. As each needle is removed, the information on what to reorder appears on the bottom of the case. The case itself, made of clear plastic, is exceptionally sturdy and attractive and contains a balanced assortment of 32 needles. Jensen No. 32 Dealer Pack can be obtained from your nearest distributor or by writing to Jensen Industries, Inc., 329 S. Wood St., Chicago 12, Illinois.

Annual Electronic Parts

All signs point to a record breaking NEDA parts show in the Cleveland Public Auditorium on September 11, 12, and 13, 1951. Every available booth has been filled. All requests for hotel suites, or display rooms should be cleared through NEDA.

Groth Becomes Erie Exec.

Gordon Groth has been appointed Executive Vice President of the Erie Resistor Corporation, it was announced by G. Richard Fryling, President of the firm. He will take up his duties in Erie on Monday, July 2.

Mr. Groth will be responsible to Mr. Fryling for all phases of the activities of the company.

Sylvania Announces Replacement Pix Tube Deal

Effective from July 15 to September 1, the Radio Tube Division of Sylvania Electric Products Inc. will offer, through authorized distributors, a heavy duty 40' extension and trouble light free with three Sylvania Television Picture Tubes purchased by television service-dealers. The heavy duty extension cord and trouble light is molded of soft rubber and includes off-on switch and two outlets for convenient plugging-in of radio or TV sets; test equipment; soldering iron or other electrical accessory. Bulb shield is made of heavily plated steel.

Walsco Opens New Plant

Walsco opened the doors to its new Los Angeles Plant while hundreds of local jobbers and dealers accepted the invitation to enjoy "open house" festivities and witness the expanded facilities of the company's modern headquarters.

The new location, at 3225 Exposition Place, Los Angeles, occupies 31,000 square feet of space.

Production facilities include the newest fabricating, molding and packaging equipment for Walsco's extensive line of radio, TV parts and antennas. A modern machine shop and assembly section employ only the latest techniques for efficient plant operation.

Bonus Plan Spurs TV Sales

Two wholly unrelated companies are cooperating on a merchandising plan. The two companies are the Simpson Electric Company and Thomas Electronics Inc.

The Bonus Plan is in the form of a certificate which has an actual cash value to the Serviceman when he purchases any Simpson Test Equipment for TV Servicing. The certificate is packed in each carton containing a "PHOTOTRON", the cathode ray picture tube made by Thomas Electronics.

Parts Distributors who do not have their sales-stimulating banner at present, can get it by contacting Thomas reps or by writing direct to the Thomas factory.

JFD Acquires Site For New Plant

Mr. Julius Finkel, president of the JFD Manufacturing Company, Brooklyn, announced the purchase of a Brooklyn site for the construction of a new 120,000 square foot plant.

Another phase of the 1951 JFD sales program, under the direction of Mr. James Sarayiotos, advertising manager, is resumption of the television antenna installation forums initiated three years ago.

MEN OF RADIO

[from page 23]

real old-timers may remember this gem, now a museum piece and in the same class with the old two-filament audiotron, which had a spare filament for reserve use. Then there was another antique (memory seems to point to the Myers tube) which had a red and a black end of insulating material and fitted into a set of clips just like a cartridge fuse.

When America was drawn into the war in 1917, the Navy and the Signal Corps clamored for tubes. Manufacturing facilities were limited, as might be expected, but the urgencies of the situation demanded that such facilities be developed as fast as possible. After a survey of the situation, it was agreed that orders for tubes were to be divided between General Electric and Western Electric, manufacturing arm of the American Telephone and Telegraph Company. General Electric concentrated principally upon transmitting tubes, while Western Electric made mostly receiving types.

These two tubes were mighty good in their day, and since many of the manufacturing techniques were based upon the discoveries of Arnold, a brief description of the exhaust process might be interesting at this point. Generally, six such tubes were pumped at a time and were connected to the pumping apparatus by means of blown glass seals. A preliminary vacuum was drawn by means of a rotary pump, after which a mercury condensation pump was set into operation. An electric heating element vaporized mercury, which then passed up into the vacuum line, where it encountered a trap immersed in a flask of liquid air. The extremely low temperature of the liquid air condensed the mercury, which returned, drop by drop, into the electrically heated receiver; each condensed drop carried some gas with it, and this gas was removed by the mechanical pump. When a fairly high degree of vacuum had been drawn, additional gas was removed by heat. An insulated oven, heated by electricity, was placed around the six tubes and raised to a temperature of about 500 degrees, Centigrade. At the same time the tube filaments were put into operation. Finally, the plates were bombarded by applying several hundred volts between filament and plate. At first, the application of this voltage resulted in a pink glow, or "haze"; later this haze turned blue as the degree of exhaustion increased. At length, when



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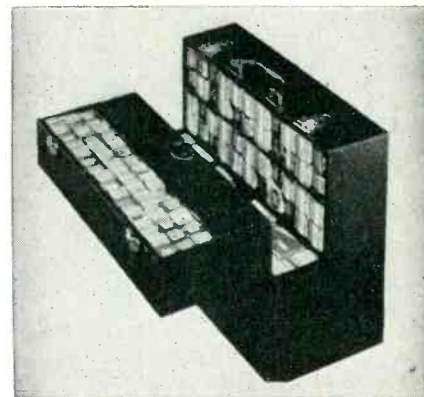
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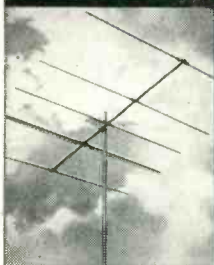
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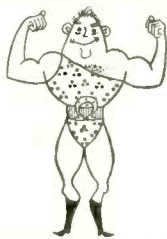
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the tube showed no haze at all, it was ready for sealing off. Of course, in those days, sealing was at the top of the tube.

Albert W. Hull

The problems confronting tube engineers and scientists ever since DeForest's original invention are innumerable and have always been fascinating. Dr. Albert W. Hull of G-E ran into another such enigma, and in unraveling it changed the course of radio history. In 1923, Hull was given the assignment of studying noise in superheterodyne receivers. Although the circuit was not extensively used in mass-produced sets until a few years later, some firms were already making receivers incorporating the principle.

The noise was disturbing and the so-called "shot effect" was supposed to be responsible; this was thought to be caused by the impacts of individual electrons within the tubes. Hull's plan for research in this field included the construction of special amplifiers capable of building up a signal 100,000 times at relatively high frequencies. No such amplifiers were available, so Hull proceeded to design his own. Here he ran into a snag: the high gain and the high frequency to be employed made the amplifiers liable to oscillation. Various methods of neutralizing the tubes inter-electrode capacitance, (which caused the oscillation) had been devised by Rice, Hazeltine and others, but Hull did not believe that any of these would do the job.

Dr. Hull then proposed a most direct (and in this day a seemingly simple) solution of the difficulty: reduce the inter-electrode capacity, internally, rather than attempt to neutralize it externally. This was done by the addition of a shield between the plate and the grid, and resulted, as you have probably already surmised, in the invention of the screen-grid tube. Not only were the special

amplifiers satisfactory for Hull's purposes, and not only was he able to show that the shot effect was responsible for the mysterious noises, but he also found, to his surprise, that the screen-grid idea was broadly patentable.

The screen-grid tube would be sufficient to guarantee Dr. Hull a place in radio's hall of immortals, but this was not the sum total of his contribution to the art. He had already invented (1920) the magnetron tube, and was able to build magnetron oscillators capable of delivering ten kilowatts at fifty kilocycles. In 1928 it was discovered that split-anode magnetrons could generate very high frequencies. The basic circuit is shown in Fig. 2. British scientists later developed the magnetron to the point where, early in World War II, it became invaluable in radar.

The employment of the electron tube in a wide variety of industrial applications was made possible by Hull's invention of the thyatron. The ability of a gas content tube to conduct very high currents had long been recognized, but his addition of a grid made of it a controlled rectifier which has become the heart of electronic controls for resistance welders and motor controls. The radio man is more familiar with the thyatron as a sweep generator in oscilloscopes and is likely to become more intimately acquainted with it when color television becomes a commercial reality.

Dr. Hull has been awarded 92 patents and is credited with the invention of more types of tubes than any other man. He retired as assistant director of the General Electric research laboratory on December 30, 1949, after 35 years of service with the organization.

TROUBLE

[from page 25]

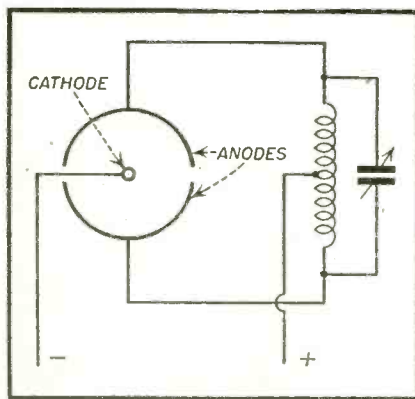


Fig. 2. Split anode magnetron oscillator.

here, there is no high voltage a-c output from the horizontal output stage. Therefore the trouble is not in the high voltage section-high voltage rectifier stage-but in the input to the rectifier, the horizontal sweep section. It is usually not advisable to use a scope at the plates of the 6BG6 or 1B3 because of the high a-c voltages there. If, on rare occasions, it may be desired to inspect waveforms at these points, a voltage divider should be used from plate to ground. Output for the scope should be taken off a low point on the divider. In the same way, an a-c voltmeter is not used because the meter does not

measure pulses accurately and the meter may be damaged. Resistance checks are not advisable at this time in trouble-shooting. It is usually more efficient to first find the defective stage before using a specific procedure like resistance checks.

Answer: 4-b

To make a quick check for sawtooth input to the horizontal output stage, after tube changes are made, grid voltage of the 6BG6 should be measured. With no sawtooth input, the grid voltage is zero (measured across grid return R-316). If there is normal sawtooth input, grid voltage is about -10 v. The negative voltage is caused by grid leak bias across the grid return and is characteristic of this type of horizontal sweep circuit. To make a quick check for operation of the sawtooth oscillator, 6SN7, V-14, the same check is made as for operation of any kind of oscillator - negative voltage on the grid. Most sawtooth oscillators (blocking oscillators or multivibrators) consist of a twin triode stage. Only one grid usually has the negative voltage in multivibrator sawtooth generators - the grid connected to the hold control. As the hold control is varied, the amount of negative voltage on the grid should vary, when the sawtooth oscillator is operating normally.

Of course, an oscilloscope can be used to check for the presence of a sawtooth at the grid of the horizontal output stage and at the plate of the oscillator. However, setting up the scope may take a little more time than is necessary for making the simple negative d-c voltage checks on the two grids, as indicated above. Checking other voltages around the tube socket and taking resistance checks are not necessary just to determine whether the sawtooth is present or not.

Answer: 5-c

With C-321 shorted, a high positive voltage appears on pins 1 and 2 of the 6AL5, V-11, Horizontal Phase Detector. C-321 connects to the width control and bottom of the secondary of the horizontal output transformer (flyback transformer). This point, in turn, is connected to +360 v. The reason for a positive voltage appearing on pins 5 and 7 of the 6AL5 while the 6AL5 was in the socket, as well as on pins 1 and 2 is interesting. The high positive voltage on pin 2, the plate of one diode, caused that diode to conduct continually. There are two conduction paths: (a) from ground up through R-323, through R-325, to the cathode of the diode, pin 5, to the plate, pin 2; and (b) from ground, through the cathode resistor R-312 of the horizontal os-

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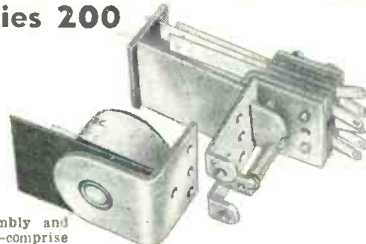
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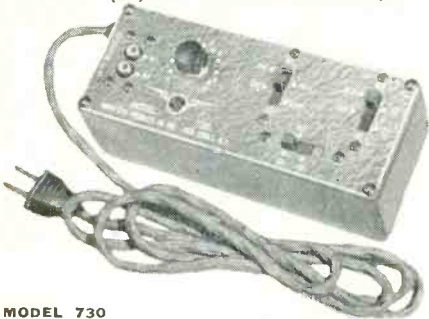
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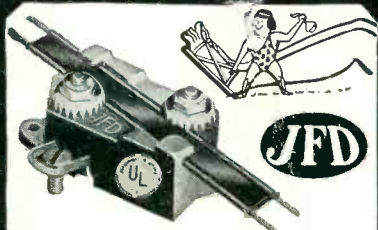
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illator stage (6SN7, V-14), to the grid of V-14 (grid draws current), through R-319, through R-325, to the cathode of the 6AL5, pin 5, to the plate, pin 2. Since the two pairs of cathodes and plates are connected to each other, the same voltages appeared on the other diode. When the 6AL5 was removed, the two conduction paths were broken and the positive voltage on the grid of the 6SN7, V-14, disappeared. A cathode to plate short of the 6AL5 would not explain the high positive voltage on both plate and cathode without some other trouble also being present. C-331 shorted would put positive voltage on all pins of the 6AL5 and on the grid, pin 1, of the 6SN7. However, the positive voltage would remain on the grid of the 6SN7 when the 6AL5 is removed.

A high resistance short between grid, pin 1, and plate, pin 2, of the 6SN7 is not a possible trouble because, (a) a new tube was in, and (b) positive voltage still remained on the grid with the 6SN7 out of the socket. There is a simple method to determine whether positive voltage on the control grid originates inside the tube or comes from another stage through a defective component. The tube is removed from the socket and the grid voltage measured again. If the positive voltage disappears, the trouble is in the tube. If it still remains, it is coming from another circuit and should be tracked down accordingly. The shorted condenser, C-321, is an example where a fault in another circuit (Horizontal phase detector) disabled the horizontal oscillator. However, once the fault had been traced to a non-functioning oscillator, it was a simple matter to track down the defective part by a voltage check.

T A P E

[from page 20]

the treble control will not compensate for a defective head or an incorrect azimuth adjustment. Unreasonable correction with the treble control will introduce a peak in the middle register.

In the absence of proper test equipment, a passable adjustment can be made by turning the control switch from *Record* to *Standby* and back again while comparing the response. The volume levels at both switch positions must be identical for this test to be satisfactory. During this check, adjust the treble control until the two positions show equal output.

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oldest mass-producer of
picture tubes in the industry



It is a well-established fact that more RCA kinescopes are now in active service than any other brand . . . over 4 1/2 million since the advent of commercial television, when RCA pioneered the first large-scale production of kinescopes.

Significantly, many RCA kinescopes installed *four and five years ago are still giving good performance today*, providing continuous reliable service year after year. Yes, RCA picture tubes of all types have consistently given outstanding performance.

RCA's kinescope quality means substantial savings to dealers and servicemen, in fewer call-backs and "out-of-pocket" replacements. In the long run, it amounts simply to this . . . stocking RCA picture tubes is good business . . . as any long-term user of RCA kinescopes will tell you.

Your local RCA Tube Distributor carries a complete line of RCA picture tubes. See him the next time you buy kinescopes for replacement.

Keep informed . . . keep in touch with your RCA Tube Distributor



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HARRISON, N. J.