JULY, 1951

Radio-Television SERVICE DEALER

The Professional Radio-TVman's Magazine

IN THIS ISSUE:

AM-FM-TV-SOUND

Total Distribution Of This Issue: Over 30,000

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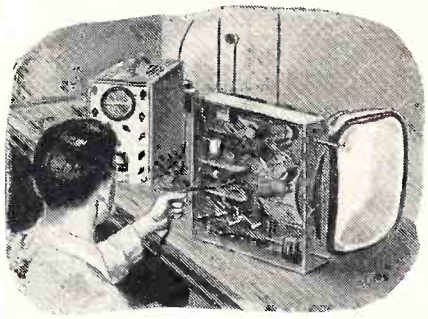
who need qualified TV technicians



. . . here's a quick and easy way to train them

Manufacturers . . . service organizations . . . dealers . . . distributors . . . and other employers of skilled TV technicians who feel the manpower pinch should be interested in this advertisement.

A VALUABLE TRAINING TOOL TO MAKE BEST USE OF MANPOWER RESOURCES

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The object of the RCA Institutes home study course is to train more *good* servicemen and to help make good servicemen *better*. Also to help expand the supply of qualified TV technicians for industry requirements in face of a manpower shortage. The RCA Institutes Home Study Course in TV Servicing provides an effective way to train men now in your employ to use their latent talents to fill positions that require technical training in television.

STUDENTS KEEP JOBS WHILE TRAINING . . . STUDY LESSONS AT HOME

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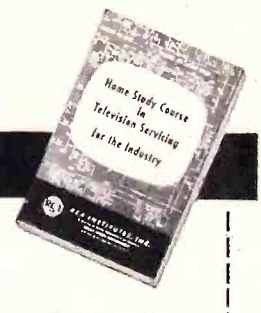
LOW RATES FOR EMPLOYER GROUPS

The cost of the RCA Institutes Home Study Course in Television Servicing has been cut to a minimum. It covers only the cost of preparation, grading and administration. It is offered by RCA Institutes as an economical and beneficial service to the radio-electronics industry at a time when the need for this kind of help is acute.

Employers may enroll any number of their employees. Reduced tuition rates for groups of six or more. Act now to get full benefits of this practical way to improve the over-all efficiency of your organization.

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 men quickly, easily. Mail coupon in envelope or paste on postal card.



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

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EDITORIAL

by S. R. COWAN

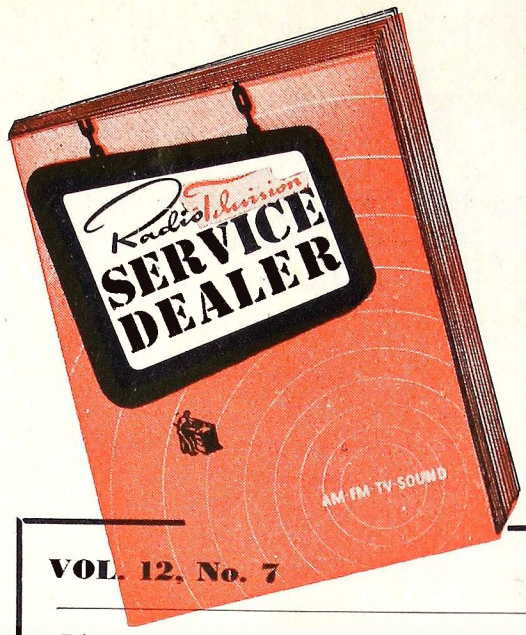
Impending Shortages

Do not allow yourself to be mislead by present-day business conditions. Since mid-March distributors and retailers of TVsets, radios, refrigerators, appliances et cetera have found it almost impossible to sell such items at cost, or at give-away prices. We've had a real "slump." The more prices dropped the more buyers tightened up on their purchases. It's become a vicious cycle.

War Defense Mobilizer Charles E. Wilson, a superbly astute man, has repeatedly tried to make it clear that the real bulk of government war-effort production has not yet started, and that the cut-backs of critical materials effected so far are but microscopic as compared to what lies ahead. Why retailers have not evaluated that fact is beyond understanding. Why they started to cut prices is no longer worth discussion. The fact to bear in mind is this: well-stocked warehouses and display floors now represent a grand investment which will be realized in the months ahead. Intelligent businessmen will act accordingly.

Radio and TV production has been at peak levels for months. Component parts and tube makers have been hard-pressed to meet the enormous demand. But now civilian goods production is beginning to taper off because the tremendous war orders now being placed requires the diverting of components to their proper place in the Defense Order war category. That being so, it is incumbent upon all parts jobbers, servicemen and service organizations to put their houses in order at once—to plan ahead and buy, (or at least order), at once all items needed so they will have a well-balanced inventory from which to draw their needed replacements in the months that lie ahead.

Mark this warning well: whereas in January of this year TV antennas and twin-lead, (as typical examples), were hard to get, and in fact were being black marketed, by mid-June these items were again available in large quantities and consequently some radio folks became panicky and started to "dump" them. This group will be sorry soon because we predict that by the Fall (and during the Winter of 1951) almost all electronic components and accessories will be mighty hard to get. Stock up now! But don't hoard! Seriously consider your own business' particular requirements and act accordingly. Balance your inventory—and don't forget —you are hereby given plenty of warning that soon there will be serious shortages of all tubes and replacements, and furthermore, the short supply may be in effect for a year or two to come. Rate your orders "DO" when they so qualify. This is important.



Sanford R. Cowan
EDITOR & PUBLISHER

Samuel L. Marshall
MANAGING EDITOR

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

AUDIT BUREAU OF CIRCULATIONS

VOL. 12, No. 7 **JULY, 1951**

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vided for use on store counters.

To further aid the service dealer in the local promotion, there has been prepared a comprehensive line of sales and servicing aids which reflect the "Servicing the Community" theme. These include a complete direct-mail campaign, three illuminated signs, the RCA Pict-O-Guides, Vols. I and II, and RCA's Tube Inventory and Movement Guide.

Walsco Offers Anniversary Gift

News of the big Walsco 12th Anniversary gift offer was announced recently by Walter L. Schott, President. This announcement came as Walsco jobbers all over America and Canada were busy displaying the attractive gift package to be given away during the months of June and July.

The package contains five new and popular items in the Walsco line. These include *No-Cx*, the electric contact cleaning fluid; *Tunerlub* for application to noisy TV tuners; *Lubricator* designed to reach the many cramped and hidden points in radios, TV sets and record changers; *Con-*

tactene Injector for application of contact chemicals to volume controls and switches, and a tube of the *New Radio Cement*. Its value is $2.00.

According to Mr. Schott, "the purpose of this 12th Anniversary celebration is to offer radio-TV technicians a useful, attractive gift, and at the same time demonstrate the quality features of the Walco line." The entire gift package of five practical items will be given away free of charge with every $2.00 purchase of Walsco hardware chemicals, dial cords or accessories; or $10.00 purchase of Walsco Antennas.

Standard Tuner Demonstrates U-H-F Changeover

Ultra-high frequencies took over the television picture recently in Bridgeport, Conn. in a convincing demonstration affecting over 4,500,000 owners of contemporary receivers.

Sponsored by Standard Coil Products Co. Inc., of Chicago, the tests proved conclusively that all sets

[*from page 12*]

You get all five ...with RCA Batteries

1. Completely rounded line

(one source for both fast-moving and hard-to-get types!)

2. Radio trade distribution

3. Radio-engineered quality

4. Greatest array of selling aids

5. Top brand acceptance

No other radio battery line offers you as much as RCA! You get a *complete* line . . . *one source* for both fast-moving and hard-to-get types. Seven batteries are designed to minimize your stock requirements . . . meet most of today's demand. The complete line provides a type for almost every portable and farm radio need!

You get radio trade distribution, too, which builds your volume through greater repeat sales. Remember, *RCA Battery distribution always steers customers back to radio dealers and servicemen . . .* away from the non-radio outlets!

You get radio-engineered quality . . . top performance and long-lasting power. Every sale means a satisfied customer for you!

You get the greatest array of selling aids in battery sales history! Signs, displays, merchandisers, and servicing aids . . . all designed to make your selling easier.

And, you get top brand acceptance with "the greatest name in radio . . . RCA" . . . for faster, more profitable sales.

Call your local RCA Battery Distributor *today* for complete details on how you can join the radio trade switch to RCA Batteries . . . and greater battery sales!

RADIO CORPORATION of AMERICA

RADIO BATTERIES

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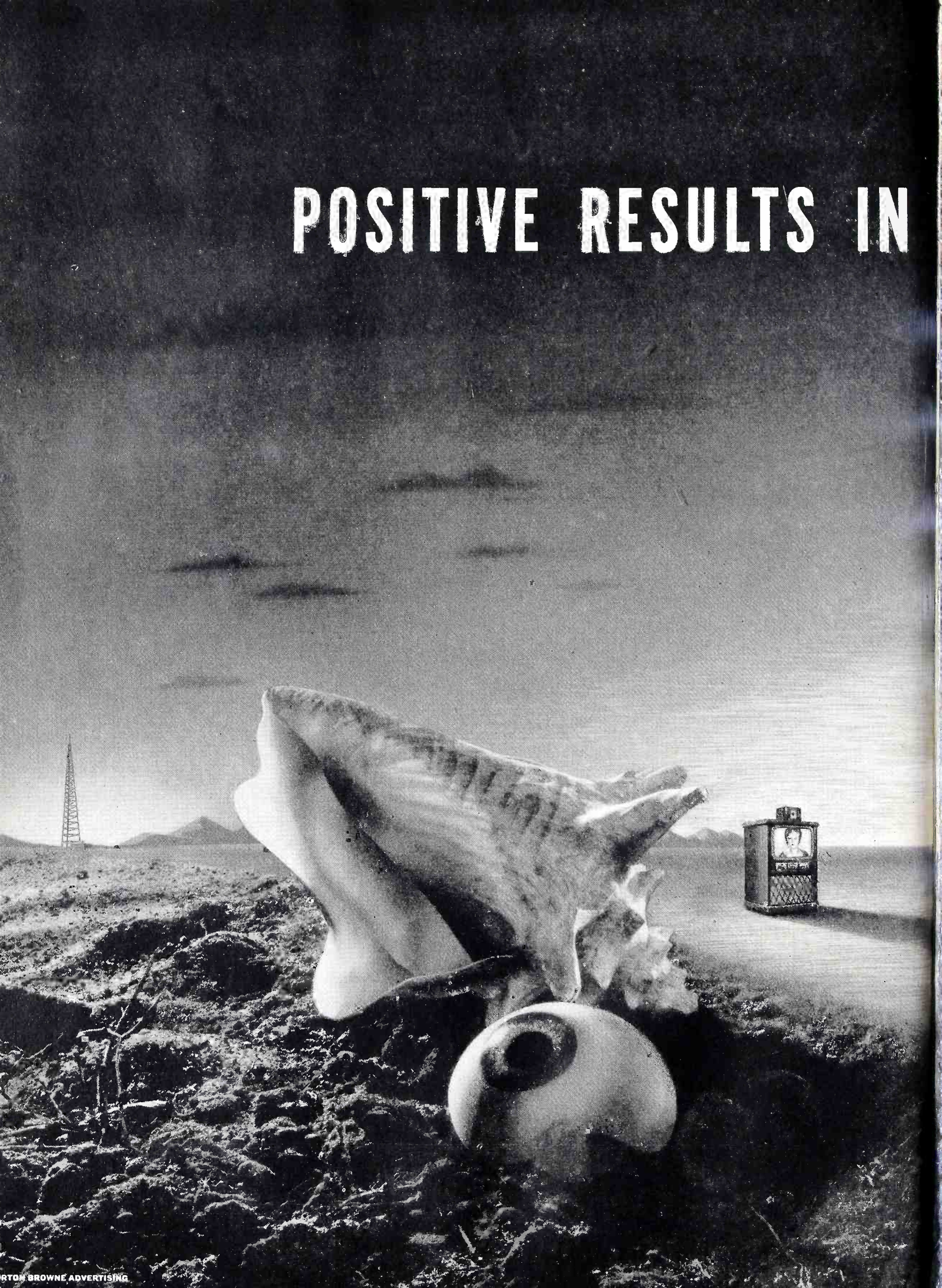

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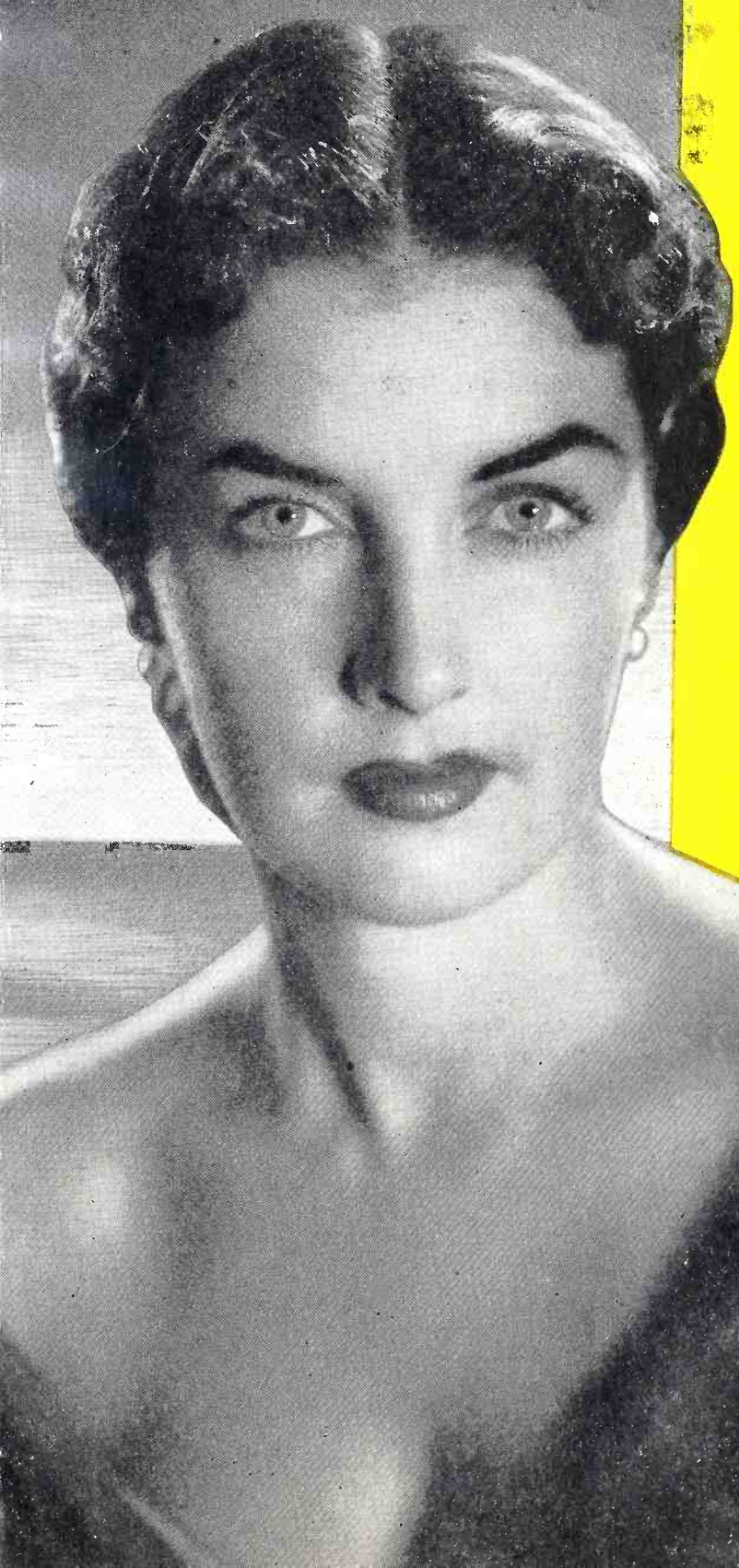

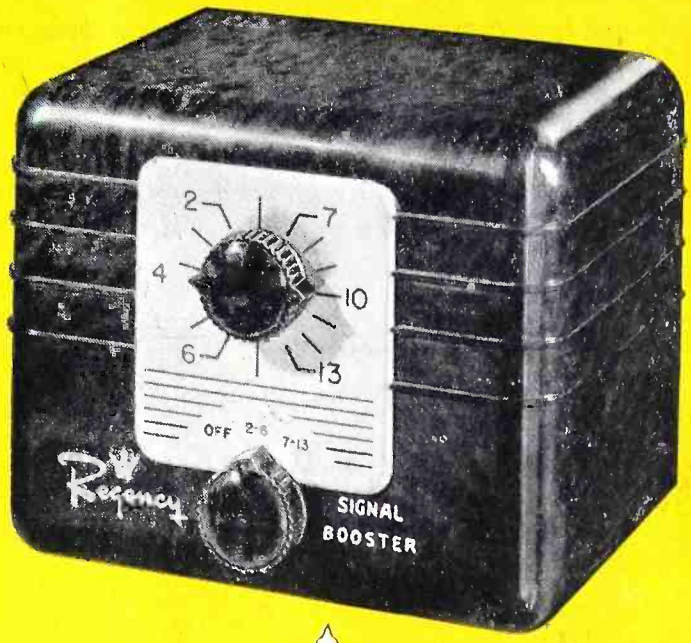

Regency

LARGEST SELLING BOOSTER AT ANY PRICE!

In negative receiving areas where sound signals are reduced to the meaningless murmur of a sea shell, where picture signals diminish into dissolving views —the Regency booster activates these dormant signals, producing strong, clear, lifelike sound and images. No other booster gives such positive results as Regency. That is why Regency is the largest selling booster at any price!

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—a "Must" for TV-Radio Servicemen!

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SELENIUM RECTIFIERS
In TV and Radio Sets

COVERS OVER 20,000,000 UNITS ALREADY INSTALLED

Millions more being added yearly!

A VALUABLE GUIDE *PLUS* HANDBOOK

—packed with authoritative, up-to-the-minute data on how to service the growing, profitable Selenium Rectifier Replacement Market!

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FEDERAL'S Selenium Rectifier Replacement Guide is a book the servicing industry has been waiting for. A copy should be on *every* TV-radio workbench!

Since 1946, when Federal pioneered and introduced the miniature selenium rectifier, the use of this versatile component by leading set makers has grown tremendously . . . a huge replacement market potential has been created. Now this fact-filled book tells how to service it quickly, easily, effectively and profitably.

Get your copy without delay, Mr. Serviceman. You'll be ready to tell at a glance the *right* selenium rectifier to use for *any* job. And remember: It pays to replace with the best . . . to insist on *Federal* . . . the *original* miniature selenium rectifier. Use the handy coupon below:

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I am enclosing $____ to cover the cost of____ copies (at 50¢ per copy) of the Federal Selenium Rectifier Replacement Guide.

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*City*_____ *Zone*____ *State*____

Rauland Now Offers The First

LOW FOCUS VOLTAGE ELECTROSTATIC TUBE

Rauland's new low potential electrostatic-focus picture tube is not just a "defense period" substitute but a permanent and major advance in television cathode ray tube development

FOCUSES with D.C. voltage already available from the receiver's power supply.

ELIMINATES focusing coils and magnets—saves critically scarce copper and cobalt.

REQUIRES NO re-engineering of present television chassis . . . **NO** added high voltage focus circuit . . . **NO** added receiver tubes—**NO** additional components except an inexpensive potentiometer.

BETTER in all ways! Not only saves materials but also gives an actual improvement in picture quality because the over-all focus is better . . . and because it is completely stable in focus under considerable variations in voltage.

This new Rauland development is now available in substantial quantities in 17 and 20 inch rectangular tubes. For further information, address . . .

THE RAULAND CORPORATION

Perfection Through Research

4245 N. KNOX AVENUE • CHICAGO 41, ILLINOIS

TRADE FLASHES

[*from page 6*]

equipped with the Standard tuner since 1949, about 40 per cent of the total now in use, will receive UHF programs by means of a simple and economical adjustment within the tuner.

While the Federal Communications Commission has authorized plans for licensing over 1,800 new stations—the greater part of which will be on UHF frequencies—the general belief in the industry is that no sizeable number of new stations will be in operation before late 1952.

Transmitted from the Radio Corporation of America's station KC2XAK in Bridgeport, the country's sole experimental UHF station operated by the National Broadcasting Company, an ultra-high frequency program was received on several different makes of sets displayed in the nearby Stratfield Hotel. Before the sets had been adjusted to pick up UHF signals, they were tuned in an NBC program telecast on the conventional very high frequencies. The reception of this signal, while adequate, was marred by various types of interference prevalent in any business district. After the sets had been adapted to UHF through tuner adjustment, the resulting signal was much clearer and almost entirely free of distortion caused by outside interference.

Viewing the proceedings were many television and science editors of leading newspapers and magazines, in addition to principal writers of publications devoted to the fields of television and electronics. Accomplished in less than five minutes, the sets were adapted to UHF by an interchange of channel coils within the tuner.

New Du Mont Service School

A new Du Mont Service School to give advanced training to service technicians of authorized Du Mont service organizations and servicing dealers, was opened in Los Angeles, California on Monday, May 28, it was announced recently by Harold J. Schulman, service director, teleset service control department, Allen B. Du Mont Laboratories, Inc. Schulman made the announcement at the Du Mont service control department headquarters, East Paterson, N.J.

In announcing the opening of the new West coast school, Mr. Schulman stressed that the courses are for experienced service technicians and not for beginners. Intensive overall

[*Continued on page 41*]

TELE-ROTOR

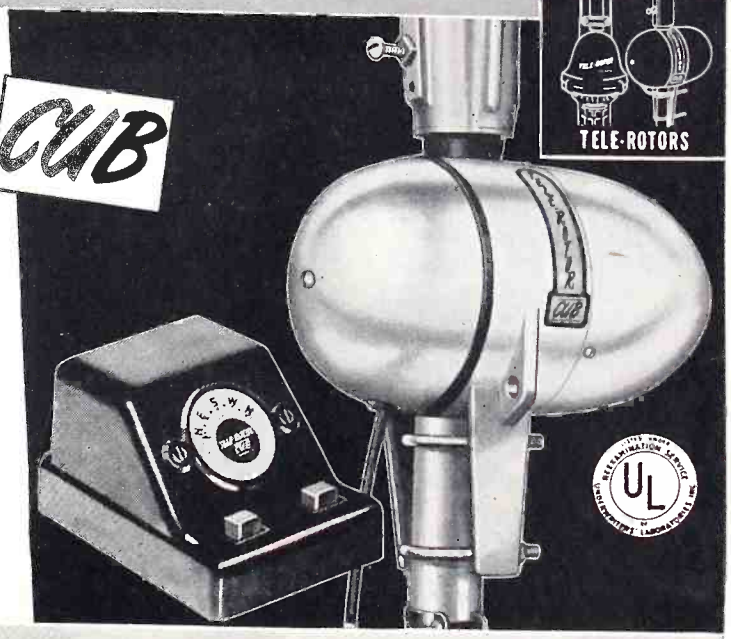
This heavy-duty TELE-ROTOR has no match! It's more powerful . . . will turn any TV antenna array under any weather conditions. Easily installed . . . it is trouble-free in performance. Easiest of all to operate!

MODEL TR-2 . . . rotator with "compass control" cabinet having illuminated "perfect pattern" dial . . . (uses 8 wire cable) $49.95

Give your Customers the Best

You Can't Beat A TELE-ROTOR

TELE-ROTOR CUB



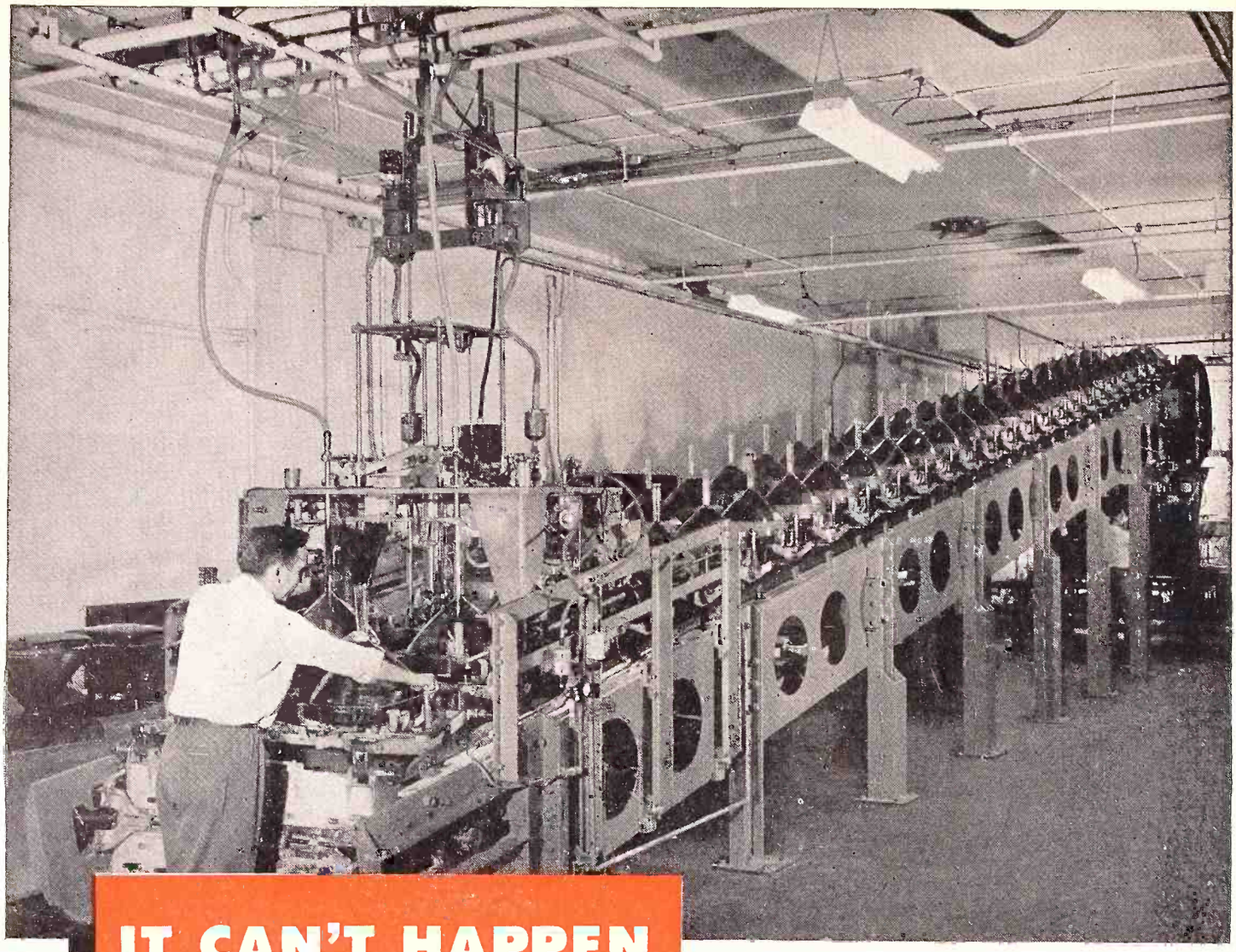
The new TELE-ROTOR "CUB" is ideal for average installations. The same husky motor as the Heavy-Duty model . . . the "CUB" is the fastest and easiest of all rotators to install. All-In-Line design . . . with true in-line thrust between antenna and mast. The ¾" STEEL shaft rotates on a case hardened steel ball . . . with in-line reamed oilless bearings.

MODEL 502A . . . . . Rotator with plastic control cabinet having indicating meter for "hairline" tuning. (Uses 5 wire cable) . . . $44.95

MODEL 501A . . . . . rotator with control cabinet having end-of-rotation signal. Light flashes every 7.2° showing antenna is turning. (Uses 5 wire cable) $34.95

THE RADIART CORPORATION CLEVELAND 2, OHIO

CORNELL-DUBILIER SOUTH PLAINFIELD, N. J.



IT CAN'T HAPPEN HERE!

Hytron's unique automatic settling conveyor. Machine dispenses and settles precisely uniform TV picture-tube screens. Automatic dispenser in foreground is an achievement of Hytron mechanical engineering. Vibration-proof chain-link conveyor was constructed for Hytron by Trutner and Boumans, Inc.

NO LIGHT SCREENS . . . NO HEAVY SCREENS . . . NO HOLES . . . NO UNEVENNESS

Another engineering first for you! Hytron's unique, automatic machine for dispensing and settling the screens of TV picture tubes.

What does it mean to you? A guarantee of the most uniform and finest-textured TV screens in the business. No light screens. No heavy screens. No specks from foreign particles. No unevenness.

Automatic dispenser pours exactly the right amount of chemicals into the big bottles as they travel slowly up the ramp. Conveyor's motion is so smooth a nickel standing on edge can ride it! Phosphors fall uniformly out of suspending solution . . . undisturbed — a "must" for perfect screens. Decanting or pouring off of chemical residue, loading, and unloading are equally shock-free. And there's precise electro-mechanical control throughout . . . with human errors barred!

That is why you can pick *any* Hytron picture tube. Depend on it. Any one will give you the finest screen money can buy. Yes, it pays to buy from Hytron . . . the most modern picture-tube plant in the world.

MANUFACTURERS OF RECEIVING TUBES SINCE 1921

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HYTRON EASY BUDGET PLAN

The easy way to sell picture tubes. No need to miss that profitable picture tube sale — just because your customer doesn't have the cash. Get the details on this original Hytron service for you.

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Calibrating TV ALIGNMENT GENERATORS

by **EDWARD M. NOLL and MATTHEW MANDL**

(Co-authors: TV and FM Antenna Guide)

Practical methods that may be employed by the serviceman to calibrate marker and sweep generators for TV.

WHEN the servicing technician fails to get the desired results after careful alignment of a television receiver, his difficulties can usually be attributed to the inaccuracy of his alignment generators. Precise frequency adjustments are so critical in tuner tracking or i-f alignment that dependence should never be made on the *probable* accuracy of the equipment. The importance of this can be realized by an evaluation of the defects which can be caused by an inaccurate marker generator:

1. *I-F Sound Carrier.* Slight misalignment of the sound i.f. strip can cause a noisy and/or distorted sound and inability to have good sound at best picture setting of fine tuning control. This same frequency is used to align sound traps and if it is inaccurate the sound traps cannot be set properly with the result that sound bars, beat patterns, or poor resolution of picture will appear. *Fig. 1A* shows the proper trap setting which places the sound i-f frequency in a hollow adjacent to the picture response curve. With the intercarrier type response curve shown in *Fig. 1B* the sound carrier should be properly located on the sound shelf to avoid weak sound output or intercarrier buzz.

2. *Picture i-f Carrier.* When picture carrier is not positioned properly on the i-f response curve (40 to 60% level) the defects which can occur include weak picture and synchronization, improper resolution (smear or trailing whites), or inability to attain good picture and sound at the same setting of the fine tuning control.

3. *Tuned Circuits and Traps.* Adjacent channel traps must be tuned exactly to prevent misshaping of picture i-f response curve. In areas where adjacent channels can be received the traps must be aligned quite precisely to prevent adjacent channel spill-over.

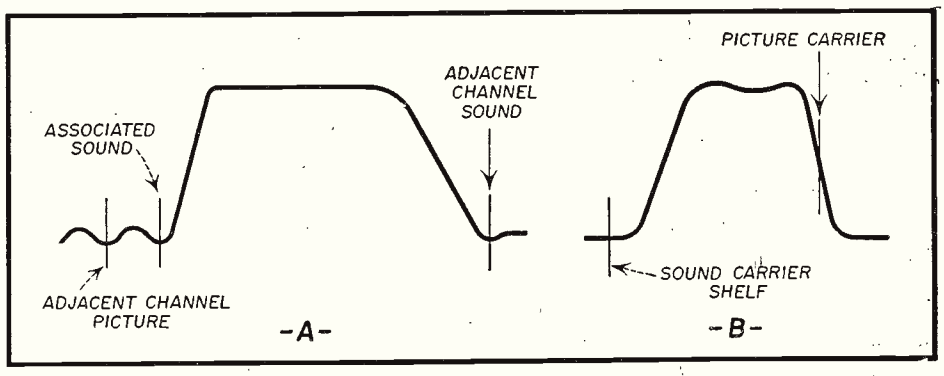


Fig. 1. Important marker points on I-f response curve.

To obtain the very best resolution and freedom from oscillations, the various resonant circuits of a stagger-tuned i-f strip must be set to a high degree of accuracy. Without some means of crystal calibration the average marker generator is unable to provide this accuracy.

4. *Tuner Adjustments.* To obtain adequate sensitivity, good signal to noise ratio, and freedom from interference, the picture and sound carrier points must be located properly on the double-humped tuner response curve (*Fig. 2*). If the response curve is off just one megacycle on a given channel, tuner performance falls down seriously. A one megacycle inaccuracy of marker generator calibration could cause such a defect. Even a half megacycle inaccuracy is serious on those channels which have a narrow band-width for a given tuner type.

In the example shown in *Fig. 2* the broken line section shows how improper alignment has caused a much weaker sound, picture down a bit, and adjacent channel sound very strong at tuner output. Too often the poor reception which results from such misalignment is mistakenly attributed to the antenna, the locale, or to defective components within the receiver when actually the faults could be corrected by proper alignment with accurate-frequency equipment.

How to Calibrate Sweep-Signal and Marker Generators

The all-importance of accurately calibrating marker generators, whether in single units or contained within sweep generators, can be attained with just one or two well-chosen crystal frequencies. An external crystal oscillator can be used, or (as incorporated in some genera-

CRYSTAL FREQUENCY	HARMONICS						
	2nd.	3rd.	4th.	7th.	8th.	9th.	10th.
20 -----	–	2-3	5	–	–	7-8	11
21 -----	–	3	6	–	–	9	12-13
21.25 -----	–	3	6	–	–	9	13
21.9 -----	–	3	–	–	7	10	–
23 -----	–	4	–	–	8	12	–
24 -----	–	4	–	–	9-10	13	–
25 -----	–	–	–	7	11	–	–
25.75 -----	–	5	–	8	12	–	–
26.4 -----	–	5	–	8	–	–	–
27 -----	–	5	–	9	–	–	–
28 -----	2	6	–	10	–	–	–

Fig. 3. Harmonics of i-f frequency crystals, and TV Channels on which they fall.

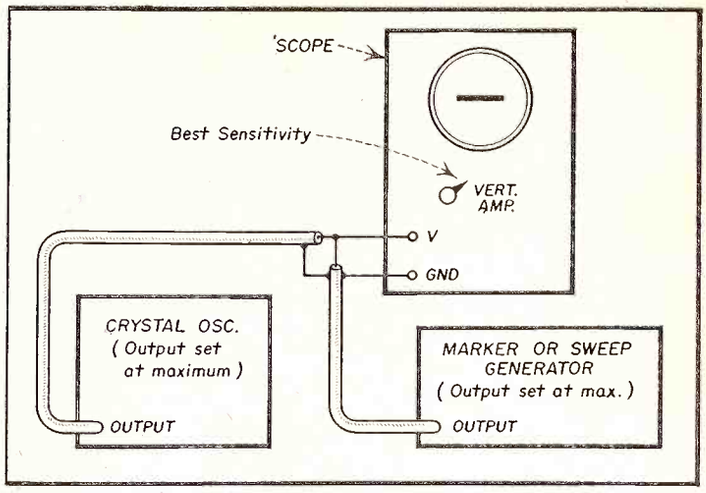


Fig. 4. Connections recommended when calibrating directly with an oscilloscope.

tors) an internal crystal oscillator which can be operated separately from the variable frequency marker oscillator.

A number of factors must be considered in choosing suitable crystal frequencies.

1. Choose a crystal frequency or frequencies that can be used to check calibration on i-f and r-f ranges of sweep and marker generators.

2. Choose a crystal frequency or frequencies which can be used to supply useful response curve markers in the i-f range and useful tuner response markers for your specific channel allocations. If proper choice is made, the i-f frequency crystal can be used to supply a harmonic marker on the various television channels.

Actually, a marker can be obtained on each television channel with just five crystals, as shown below:

21.25 mc crystals has harmonics in Channels 3-6-9-13

23.00 mc crystal has harmonics in Channels 4-8-12

25.00 mc crystal has harmonics in Channels 7-11

25.75 mc crystal has harmonics in Channels 5-8-12

28.00 mc crystal has harmonics in Channels 2-6-10

Thus, the number of crystals that will be of use to you is dependent on your specific allocations. In some areas just one crystal is of great benefit. For example, in the Philadelphia area a single crystal on 21.25 mc can be used as an i-f marker with its third and fourth harmonics placing a marker at the center of Channel 3 and at the center of Channel 6. This same crystal has a harmonic (ninth) just on the low frequency side of Channel 10 and close enough to the latter to appear as a marker on the skirt of the Channel 10 response curve. The channel allocations

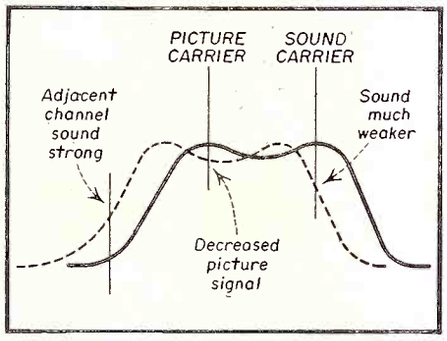


Fig. 2. Defects that arise when tuner response has been shifted.

for this area are 3, 6 and 10. The chart in *Fig 3* will aid in choosing one or more crystals to cover the channel allocations prevalent in your servicing area.

3. Obtain i-f carrier marker crystals in accordance with the most common marker positions needed in your own shop. Perhaps most receivers you repair do not use the 21.25 mc and 25.75 mc combination. If not, choose other crystals to correspond with your needs and check their harmonic possibilities on assigned channels in your area.

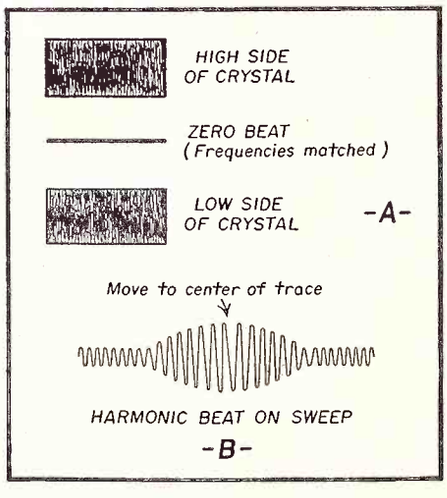


Fig. 5. Zero beat patterns on CRO.

Calibration of Marker Generators using Scope

The oscilloscope is a convenient means for calibrating marker generators against a crystal oscillator and good results will be obtained because a visual indication of zero-beating is indicated. The following sequence of procedures should be employed:

1. Apply outputs of marker generator and crystal oscillator to the vertical input of the oscilloscope as shown in *Fig. 4.*

2. Set both generators at maximum output. Adjust the vertical amplifier gain of the oscilloscope to the most sensitive position. (By thus combining the maximum outputs of the generators in the vertical amplifiers which are running wide open, sufficient overload will occur to give the required non-linearity assential for heterodyning.)

3. Set the marker generator frequency near the crystal frequency (or proper harmonic of crystal frequency).

4. As the marker generator frequency is brought near the crystal frequency a beat pattern will appear on the scope screen. The pattern will swell then fall away to zero or a minimum. As the marker frequency is varied in the same direction the beat pattern will swell again. The dip between the two swells represents a zero-beat, *Fig. 5A,* and indicates setting at which marker oscillator and crystal oscillator are on same frequency. (Signal variation amplitudes are dependent on the vertical gain of the scope. For this reason it makes little difference to what frequency the horizontal sweep control is set.)

[*Continued on page 46*]

Servicing TAPE RECORDERS

by C. A. TUTHILL

PART 3

In this installment the author discusses the maintenance and servicing procedures that should be followed in the proper operation of the Ampex Model 300 tape recorder.

OPERATIONAL maintenance or servicing of the Ampex Models requires little beyond periodic lubrication and cleaning.

All surfaces of the capstan shaft, head faces and tape guides should be cleaned daily using carbon tetrachloride applied with a soft lintless rag.

Speed variations have been minimized through basic design rather than through the requirement for excessive precision. Three motors are used in the drive system, one a dual speed synchronous motor for capstan drive. The other two are induction motors each of which drives one of the two reel assemblies. A physical layout of the drive mechanism appears in *Fig. 1.*

The Rewind and Takeup motors require no attention. Their torque is factory adjusted by means of resistors *R 401* (Rewind), and *R 402* (Holdback), and *R403* (Takeup) shown in *Fig. 1.* Apart from physical damage these resistors should require no attention. Each motor is adjusted for a tension of 5 to 6 ounces pull on the reel hub. Maximum holdback tension, during the *Fast Forward* and *Rewind* mode of operation, will allow the tape to accelerate rapidly when a fully loaded reel is applied. Holdback adjustment is set and varied by resistor *R 402. Start, Stop* and *Record* conditions are relay-operated and therefore may be remotely controlled.

Reels

The turntables supporting the tape reels are attached directly to the shafts of the *Rewind* and *Takeup*

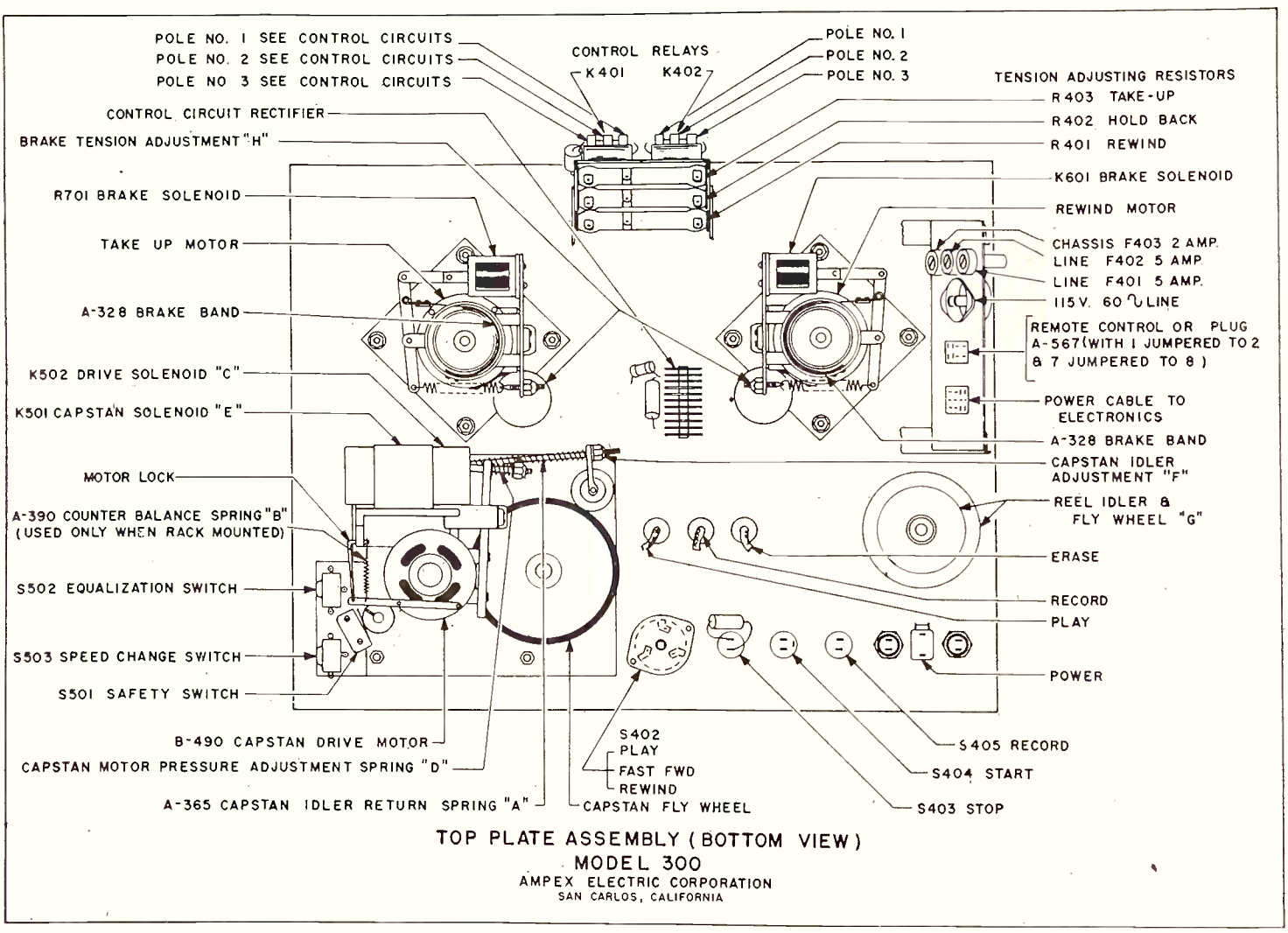


Fig. 1. Physical layout of Ampex Drive System.

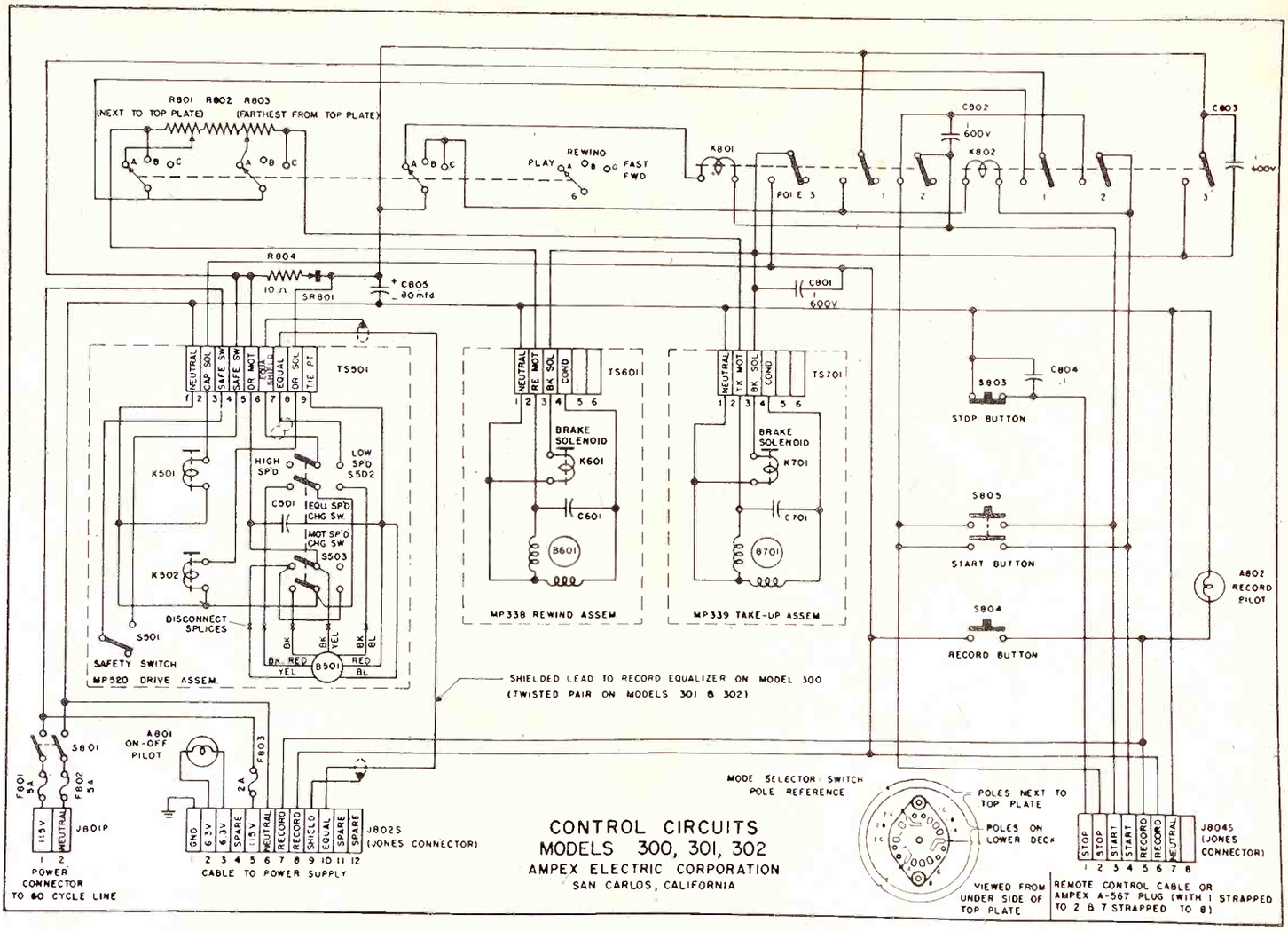


Fig. 2. Control circuits used in Ampex Models 300, 301, and 302 machines.

motors. A holddown knob locks the reels in place. This knob is constructed in such a manner that it centers and locks either the standard NAB or RMA reel without regard to thickness. Motor shafts are 5/16" diameter permitting use of the smaller RMA reel.

Identically sized reels must always be used on both turntables in order to maintain an even holdback tension. The smaller RMA (7 inch) reels cause abnormal holdback tension to occur near the end of a reel due to the smaller hub diameter. Slippage at the capstan idler is likely to occur. Cleaning of the capstan idler weekly with ethyl alchohol will help somewhat. However, if the small type reels are to be used exclusively, an additional 150 ohm 50 watt resistor should be inserted in series with each of the resistors *R 401* and *R 403* which are in series with circuits of Rewind and Takeup motors.

Capstan Idler

The mechanism of the capstan idler is operated by solenoid *E* in *Fig. 1*, and is returned by spring *A*. Capstan idler pressure is adjusted at point *F* that it will barely deform the tape if tape transport is stopped by hand while the machine is running.

Capstan Flywheel

When the machine is turned ON after the tape is properly threaded, solenoid *C* (*Fig. 1*) pulls the capstan drive motor (*B-490*) into engagement with the capstan flywheel tire causing it to rotate. Pressure between the drive motor and flywheel tire, adjustable at spring *D*, may be varied slightly until a normally synchronous (60 cycle) speed is obtained. This speed may be checked by applying a stroboscope over the capstan shaft. When the spokes of the stroboscope appear to stand still, the speed is correct.

Brakes

When the start button is depressed and the machine is threaded, relay control causes a rubber idler to press the tape against the capstan whereupon the tape comes up to operating speed in less than 0.1 seconds. A selector switch controls the mode of operation, - *Normal Play, Rewind* or Fast Forward. The facility for shuttling back and forth at will from *Re-Wind* to *Fast Forward* greatly aids editing. When playing at 15 inches per second the tape travels less than 2 inches after the STOP button is depressed.

Solenoid-operated mechanical brakes are employed and provide quick smooth stops regardless of the speed of tape transport.

The brake bands may be adjusted by tension adjustment nuts at point "H" in *Fig. 1*. The machine can be shifted back and forth from one mode of operation to another with but one exception. From *Fast Forward* winding or takeup to *Normal Play* the machine automatically stops to avoid tape breakage.

When brake bands become glazed a tightening action occurs. Graphite is applied to the brake bands to minimize this action whereupon the proper tension measured on the NAB reel hub is 14 oz., for both the unwinding or energizing direction. After extended service, a tendency to grab or tighten calls for a graphite treatment.

A mixture of one level tablespoon of graphite to eight ounces of carbon tetrachloride can be applied to the felts of the brake bands with an oil can. Following this the motors should

[*Continued on page 45*]

Miniature Tubes for VHF & UHF

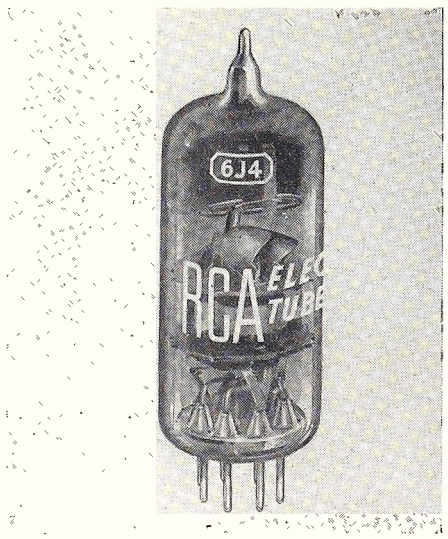
by **ALLAN LYTEL**

The imminence of VHF is evidenced by the stepped-up activities of various manufacturers in research along these lines. In this article the author discusses and illustrates some of the components (tubes and equipment) which the serviceman will have to familiarize himself with.

RECEIVING equipment for the v-h-f and u-h-f bands use smaller tube types for a number of important reasons. Miniature type tubes have long been used in television receiver i-f amplifiers as well as for the front end r-f section. The vacuum tube itself is well adapted to miniaturization since the interelectrode capacitance can be made less by either of two expedients: either the electrodes may be made smaller or they may be placed further apart. Although miniature tubes use smaller spaced elements mounted somewhat closer together than the elements in a normal size tube to increase the transconductance, a typical miniature triode, the 6C4, shown in *Fig. 1,* has many characteristics similar to full size tube. For example, let us suppose that this tube is made ⅓ the size of an original full size tube. The mutual conductance, the amplification factor and the plate resistance will remain unchanged but the interelectrode capacitance will be reduced to ⅓rd. The lead inductance, that is the inductive effect of the wires which connect the tube pins to the tube elements, will be reduced to ⅓rd also; however, it is vitally important to notice that the power handling capability of such a tube be reduced by the factor $(⅓)^2$ or to 1/9th of its original value.

Courtesy RCA

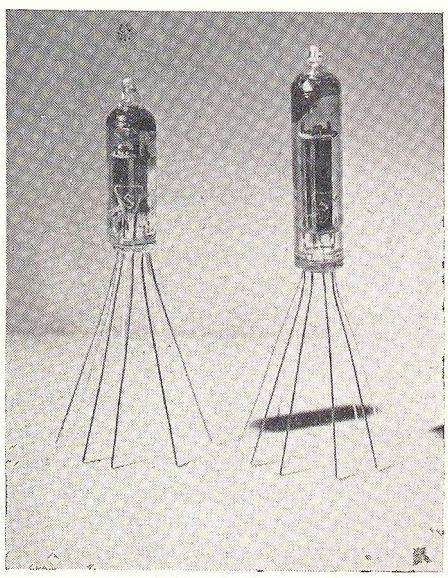
Fig. 1. RCA miniature 6C4



Courtesy RCA

Fig. 2. RCA miniature 6J4

As an example, the 6J4 (*Fig. 2*) is a miniature triode having a very high mutual conductance of 12,000 micromhos. The fact that the power handling capabilities of tubes is reduced in the miniaturization process is not fundamentally important since these tubes are not required to have a very large power output in any case. In receiver work the power handling capabilities of these miniature tubes is usually adequate. In receiver work, the local oscillator, mixer and amplifier stages do not require any relatively large amounts of power. In television receivers, conventional tubes are usually used for sweep circuits

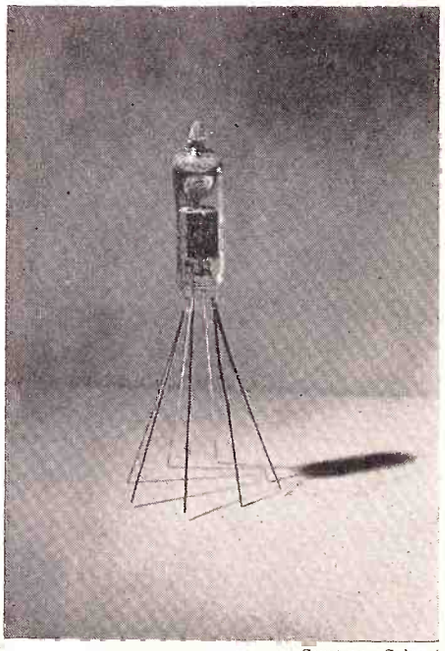


Courtesy Sylvania

Fig. 3. (left) Sylvania 5896
Fig. 4. (right) Sylvania 5641

and audio output amplifiers where the required power output may be beyond the capabilities of some miniature type tubes.

An extension of the requirement which demands that small size tube elements have reduced interelectrode capacitance, quite naturally leads to the sub-miniature tube type. *Figure 3* is the Sylvania type 5896 U-H-F double diode which is designed with a plate current of 9 milliamperes per plate. In *Fig. 4* is the 5641 single diode whose plate current is 45 milliamperes. An u-h-f sub-miniature medium amplification factor triode is shown in *Fig. 5.*; this is the Sylvania Type 5897. These tubes are shown with long connecting wires for the plate pins rather than the short pin normally inserted in the tube sockets. In the absence of a conventional tube socket, the lead wiring may be made

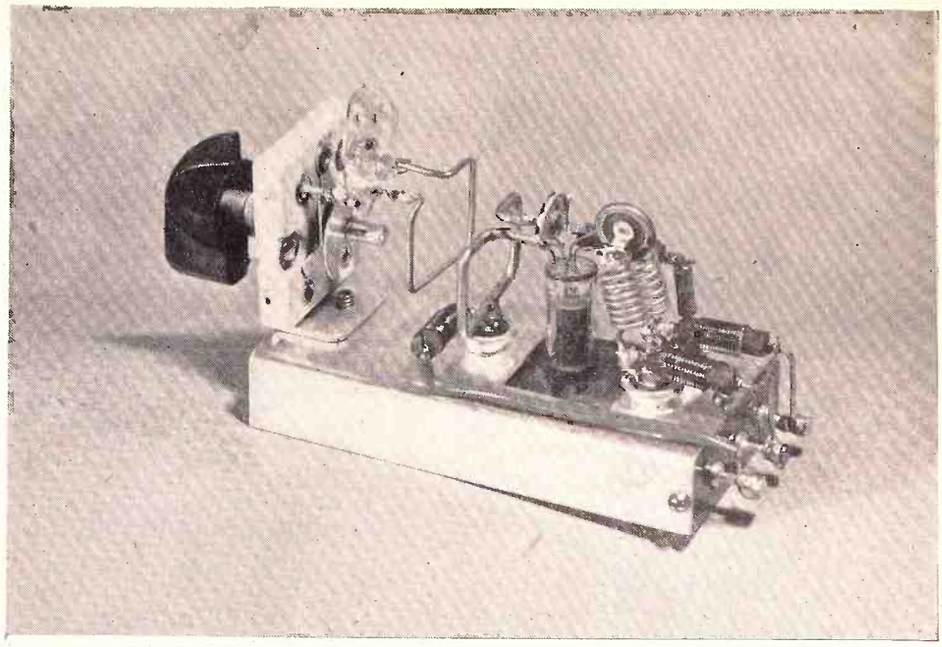


Courtesy Sylvania

Fig. 5. Sylvania 5897

as short and direct as possible for any given circuit. This arrangement makes it somewhat difficult to replace tubes but the advantages of the short leads and direct connections outweigh the necessity of soldering a new tube in place with its leads.

An experimental 465 megacycle oscillator using a sub-miniature triode tube is shown in *Fig. 6.* The unusual features of u-h-f construction may be clearly seen from the photograph. To the left, a lamp load is inductively coupled to the plate tank. An inductive single turn loop is also shown and is made of light gauge wire. A small variable capacitor shown with the tuning knob is used to tune the load to resonance. Connections to the individual tube elements may be seen from the drawing. There is a 3-terminal connector strip with the first connector providing the d-c plate voltage through a series radio frequency choke. The other two connectors on the terminal strip supply filament voltage through the series chokes as shown.



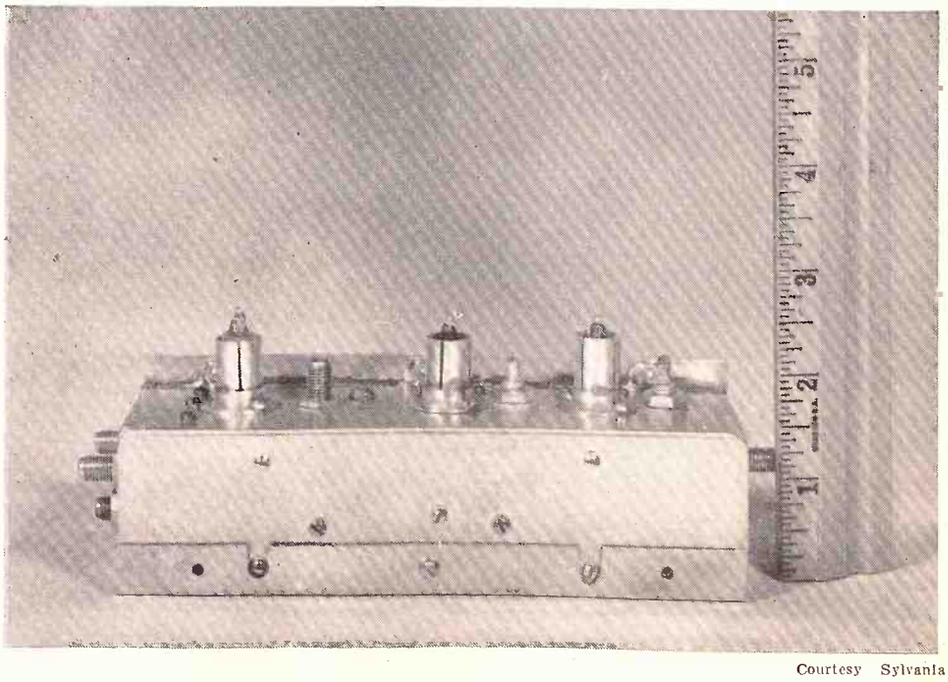
Courtesy Sylvania

Fig. 6. 465 mc oscillator for VHF

The connector on the terminal strip to the rear is the negative or ground terminal since the grid of this triode goes to ground through its series grid leak resistor. At the same time the grid is capacitively coupled to the plate tank.

Sub-miniature tubes by their very nature allow for a reduction in the over-all size of the completed circuit. *Figure 7* is an illustration of an experimental 400 megacycle receiver front end. Three sub-miniature tubes are used as r-f amplifier, mixer, and local oscillator. Connections are made to the tube elements beneath the chassis and together with the tube shields, an exceedingly compact over-all unit is obtained. The over-all dimensions of this unit are less than 3 inches in height and 6 inches in length.

A similar size reduction is obtained in i-f amplifier strips designed for VHF use. A typical i-f frequency employed is 30 mc. Both miniature and sub-miniature tubes are employed in two of the amplifiers observed by the writer, the strip employing the sub-miniature tubes being smaller.



Courtesy Sylvania

Fig. 7. 400 mc front end for VHF

MEN OF RADIO

PART 5

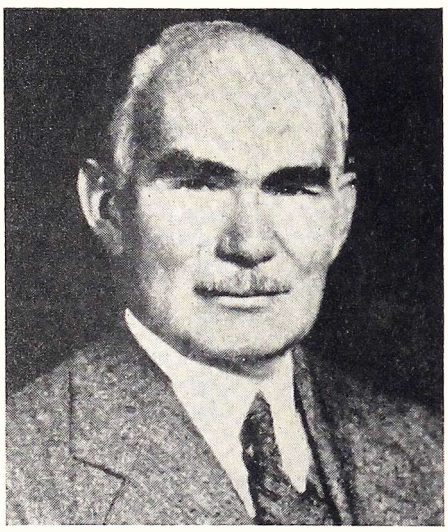
by WILLIAM R. WELLMAN

At this point in our series the author discusses the contributions of Pickard and his crystal detector, Dunwoody and his carborundum detector, the Edison effect, Fleming and his 2-element valve, and the momentous discoveries of a great inventor, Dr. Lee De Forest who gave us the triode vacuum tube.

WITH radio in the commercial stage, development was greatly accelerated. This was, of course, due to the demand for increased and improved services, a demand which did not exist while the art was in the laboratory stages. As an example of the stepped up progress, the case of the spark transmitter may be cited; this transmitter had barely become well established as the principal, if not the sole generator of radio waves when it was threatened with oblivion by the arc and the alternator. And, as might be expected, the march of progress was not limited to transmitting equipment; receiving apparatus made great strides too. The coherer was superseded by the magnetic detector soon after Marconi's trans-Atlantic success, Fessenden's electrolytic detector was soon outmoded by various types of crystal detectors and these, in turn, were eventually made obsolete by the vacuum tube, radio's magic lamps.

It should be clearly understood that the perfection of a new type transmitter did not mean that all the older apparatus was relegated to the scrap heap overnight; nothing could be farther from the truth. Many of us can remember that vacuum tubes, in a rather well developed form, were available at the time broadcasting made its bow in 1920, yet crystal detectors continued to be used for some years thereafter for entertainment purposes and in some commercial installations too. They are still used by students and young experimenters and constitute a valuable training device.

Fessenden, DeForest and many other experimenters had long recognized the weaknesses of the coherer and all were working toward the invention of an improved, more reliable receiving device. Fessenden's development of the electrolytic detector and DeForest's invention of the 'Responder" might, from one point of view, be considered parallel lines of investigation and, almost at the same time, two other experimenters arrived at results that were similar and produced different versions of the now well-known contact detector.



Courtesy of Harper & Brothers

LEE DEFOREST
1873 —

Greenleaf Whittier Pickard

Greenleaf Whittier Pickard, graduate of Massachusetts Institute of Technology and grand-nephew of the famed American poet John Greenleaf Whittier, became interested in radio in 1898 and worked at the Blue Hills Observatory at Milton, Mass. under a grant from the Smithsonian Institution. Later, he became associated with the engineering staff of the American Telephone and Telegraph Company.

During 1903, Pickard began an investigation of the rectifying properties of various kinds of minerals, particularly those occurring in crystalline form. He made early trials with iron oxide and magnetite, a magnetic ore of iron. He found that pieces of some minerals possessed the unique property of conducting radio waves, or any alternating current, much more easily in one direction than in the other. Today, we refer to this characteristic as unilateral conductivity. The crystallized mineral was usually held in a cup or clamp and connection was made to it through the medium of a very light wire contact which barely touched the surface of the crystal; this was the "cat whisker" of early broadcast days.

Further work with hundreds of crystal varieties yielded the famous "perikon" detector in which two dissimilar minerals were held in close contact. The two minerals were usually red oxide of zinc and chalcopyrite, a copper ore. Pickard's most effective detector did not appear until 1906, when he was able to obtain good crystals of silicon; these appeared to be more stable and more uniformly sensitive than most of the other varieties tested.

H. N. C. Dunwoody

While Pickard was going ahead with his experiments, General H.N.C. Dunwoody, of the United States Army (and later a vice president of the early DeForest company) discovered the rectifying ability of carborundum. This mineral is artificially produced by fusing together, in the intense heat of the electric furnace, a mixture of coke, sand, sawdust and salt. It was discovered by E. G. Acheson in 1891. One of the hardest of all known substances, it is now in almost universal use as an abrasive, but at that time was just beginning to displace the less efficient natural abrasives such as emery.

Like Pickard, Dunwoody had learned that many minerals were capable of rectifying radio waves, and he too conducted a long series of tests with many varieties and which eventually led him to carborundum. The result was a fairly sensitive detector which did not require a light contact as did many other substances.

The outcome of the two independent lines of research by Dunwoody and Pickard was that crystals of galena (lead sulphide) were found to be by far the most sensitive and this mineral continued to be popular for most applications until well after the advent of broadcasting. On the other hand, the light, delicate cat whisker contact needed for galena was found to be a distinct disadvantage in some types of work. At sea, for instance, a rugged detector not subject to derangement by vibration was urgently needed and for this purpose the carborundum detector excelled.

Vacuum Tubes

A reader who takes only a casual interest in the history of radio might easily come to the false conclusion that the vacuum tube followed the crystal detector in a rapid sequence. This is far from true, and in fact the roots of vacuum tube development go back to 1880, long before crystals came upon the scene. So that we may gain a proper perspective of tube development, we must now reverse our more or less chronological progression and go back to that period.

In that year, Edison was deeply engrossed in the perfection of the carbon filament incandescent lamp. Early objections to the lamp included the rather rapid failure of the filament on account of breakage at one of the terminals, coupled with a premature blackening of the bulb. This blackening occurred in the form of a deposit on the inner wall of the bulb, and in an attempt to eliminate or reduce it, Edison prepared some lamps with a tinfoil coating on the outside of the bulb and then applied an electrical charge to the foil. There is no record that this procedure served to eliminate or even diminish the blackening, but in 1883 he noticed that when a galvanometer was connected between the foil and the positive leg of the filament (lamps were then operated exclusively on direct current) a minute current flowed through the instrument. When the galvanometer was connected to the negative filament terminal, there was no current flow. This observation is the basis of electronic flow in tubes and has been called the "Edison Effect."

Sir John Ambrose Fleming

Sir John Ambrose Fleming, British scientist, was the first to put the Edison effect to practical use. Fleming had worked under James Clerk Maxwell at Cambridge and later was appointed electrician with the Edison Electric Lighting Company of London. While in the latter position he had occasion to study the odd deposit on the walls of lamps. In his own account of the research, Fleming stated that the discolored, burned-out bulbs almost always had a rather uniform blackish coating over the entire inner surface of the glass, except in an area that lay in the plane of the filament; most interesting of all was the discovery that the clear area was on the side of the filament loop opposite the point of breakage or burn-out.

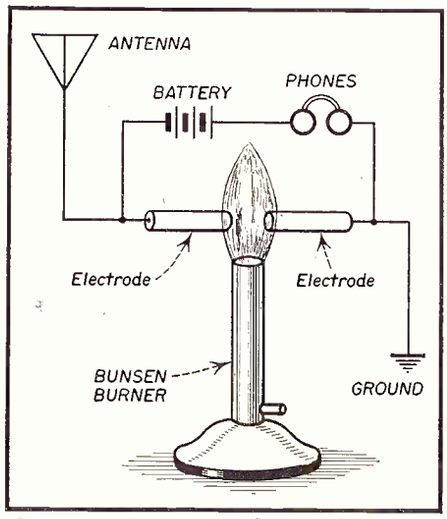


Fig. 1. DeForest Flame detector.

Fleming dropped his investigation for a while, and in the interim Sir William Preece offered the opinion that the deposit was caused by the throwing off of carbon molecules by the filament. In 1888 Fleming resumed his study, using specially constructed lamps with metal collector plates sealed within the bulbs. Eleven years later, when he became advisor to the Marconi Wireless Telegraph Company he went to work on the problem of developing an improved detector. After a long series of tests involving many types of rectifiers, he hit upon the idea of using his special lamps for the purpose. His "oscillator valve" was immediately successful and from that time on was used in many Marconi installations.

Lee DeForest

The tube detector might have remained a mere competitor of the crystal except for the work of Lee DeForest who added the grid and thereby paved the way for the more important applications of the tube: amplification and oscillation. DeForest's achievement has been called the most important in the whole history of radio and all technicians will agree that this statement is by no means exaggerated.

DeForest was born on August 26, 1873 at Council Bluffs, Iowa and spent most of his boyhood at Talladega, Alabama. His father, a Congregational minister, was president of Talladega College for Negroes and it was expected that Lee would follow in his father's footsteps and become a minister also. It was soon evident that his interests were in things mechanical and for some time he was a participant in a struggle between his own desire to become an inventor and his father's wishes. Finally, at the age of sixteen, he composed a rather formal letter to his father setting forth his ambition to attend Sheffield Scientific School at Yale. His father finally gave in but not before giving him a lecture on the cultural values of a classical education.

He entered Yale in 1893 and his record there for the most part indicates that he exercised good judgment in selecting a scientific course but his progress was far from easy due to the limited family finances. By working after school and during summer vacations he was able to keep going and soon embarked upon a series of inventions that in his mind, were designed to make him financially independent. Unfortunately, not one was a success. His financial troubles were increased by the sudden death of his father during his senior year. Mrs. DeForest, with three other children, moved to New Haven and it was largely due to her efforts and management that he was able to continue with his college work and go on to post graduate courses. He received his doctorate in 1898.

It is certain that Dr. DeForest's interest in radio began during his years at Yale. He was fascinated by the lectures on Hertzian waves given by Professor Bumstead, and for his thesis selected a research project in the reflection of Hertzian waves from the ends of parallel wires. Early in his career he determined to make contributions to the art that would at least rank with those of Marconi.

The "Responder"

His first job after leaving Yale was in the dynamo department of the Western Electric Company, in Chicago. The salary was small - eight dollars a week - but he was at least able to support himself and even went ahead with plans for engagement to the girl of his choice. Within

a short time he was promoted to the telephone laboratory of the company, but although the work was cleaner and lighter he did not show a keen interest in it. Instead, he was spending much of his free time, evenings, at the library searching through old periodicals for records of experiments in wireless detectors. At length he came across what he was looking for- a description of an obscure test made by a German. The magazine article described a rectifier made up as follows: a piece of tinfoil was laid upon a glass plate. A razor cut was then made across the foil and a drop of water placed over the cut, bridging the gap. DeForest had absolutely no facilities for experimenting in the rooming house where he lived, but by using his lunch period and other spare moments at the plant he constructed the detector and found that it really worked, although it was crude and unreliable. In his enthusiasm, he began to work feverishly on the "Responder", as he called it until finally he began to encroach more and more upon company time. His superior could see no value in the work, at least to Western Electric Company; he could not visualize that firm ever becoming interested in wireless. In a rash moment he told DeForest to do as he pleased. DeForest took him at his word, and from that moment on devoted the full eight hours to the "Responder".

Very soon he came to the conclusion that a new job was in order- one that would lead to recognition of his abilities. He made a new connection with a Professor Johnson, manufacturer of heating controls and president of a newly formed wireless company. The Johnson wireless system was based upon clearly unworkable principles, and DeForest soon tired of making endless unsuccessful tests. One day he secretly substituted his "Responder" for Johnsons detector, with excellent results. It happened, however, that the test was witnessed by one of Johnson's assistants, who reported the matter to his boss. Johnson immediately demanded that DeForest turn over the "Responder" to the company; the demand was refused and DeForest was again out of a job.

For a while he managed to get along on a ten-dollar a week job as assistant editor of an electrical journal, meanwhile continuing his research. He applied for his first patent, on the "Responder", in 1900 and soon after gave up the editorial job so that he could devote full time to his career as an inventor. During this period he was financed mainly by friends.

In 1902 an association with Abraham White, a Wall Street promoter, led to the formation of the American DeForest Wireless Telegraph Company. The objective of the company was the development of a wireless communication system based upon two ideas: the "Responder", and an alternating current transmitter as opposed to the prevailing d.c.-powered spark coil using the hammer-type vibrator. The soundness of the latter idea was borne out in the early transition from induction coil to transformer. Stations were installed atop the Castleton Hotel on Staten Island and on the roof of 17 State Street, Manhattan. From a publicity point of view, at least, the new company was a huge success. Certainly, DeForest

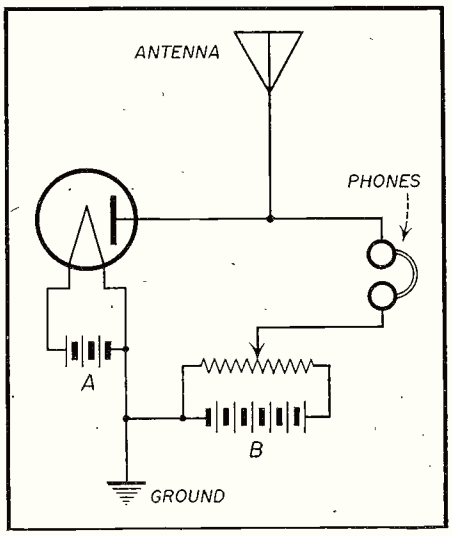


Fig. 2. DeForest tube detector. First use of plate battery.

did receive a great deal of valuable publicity and recognition from the operation. He was hailed by large sections of the press as the American rival of Marconi and much stress was placed on the speed of communication; according to the accounts, DeForest apparatus permitted transmission at 40 words a minute as compared to 15 for the Marconi system.

During the lifetime of the first DeForest company, many historic "firsts" were achieved; these included: the first wireless system operating as part of a commercial telegraph system; the first point-to-point commercial circuit on the American continent and the introduction of an American system in the U.S. Navy in competition with British and German systems.

In his new venture, Dr. DeForest encountered disappointments, too. The Marconi company claimed sole rights to the use of the coherer in combination with the elevated antenna and ground connection; a long court fight followed. Then, DeForest, in the belief that Vreeland, and not Fessenden had invented the electrolytic detector and encouraged by some improvements he himself had made, began to use the device in his system. Fessenden's firm sued successfully, at some financial loss to the DeForest company. As a fitting climax, the financial fortunes of the company took a further downward trend due to stock-jobbing operations of promoter White and raiding of the company treasury by one of the officers. The result was the eventual collapse of the enterprise and prosecution of DeForest and other company officials by the Federal government.

The charges against DeForest, brought by the government in 1913, included the claim that he had attempted to defraud through the use of the mails in advancing "the ridiculous claim that it would be possible to transmit the human voice across the Atlantic before many years." Dr. DeForest was completely cleared of the charges and less than two years later radio telephony across the Atlantic from Arlington to Paris, once a "ridiculous claim", became an accomplished fact.

The "Audion"

These developments have taken us a bit ahead of the principal theme in this story - the development of the three-electrode tube. Although the "Audion" first appeared in 1906, the original idea came as the result of an experiment made in 1900 while DeForest was still working on the "Responder". His account of this experiment states that on September 1900, he and an associate were trying to discover what effect, if any, the operation of a spark coil transmitter had on the light produced by a Welsbach burner. Apparently there was some effect, because the light of the burner increased when the coil was energized. DeForest and Smythe, the associate, followed this line of research enthusiastically for a while in the hope that the effect was due to radio waves; DeForest had an idea that it might be developed into some kind of flame-type detector. One thing they failed to take into account was the effect on the burner produced by the sound waves set up by the spark. This, DeForest said later was a very fortunate omission, for otherwise he might never have resumed the research which eventually led to the invention of the audion.

Although it is not generally recognized, it is a fact that the audion was the result of attempts by De-

Forest to develop a detector based upon the action of ionized gases in an open flame. He returned to the subject in 1903, convinced that the use of hot gases offered good possibilities for detection. When he took stock of the possible methods, he saw that there were three avenues of approach: (a) an open flame; (b) a carbon arc; and (c) gases heated by an incandescent filament within an enclosed area.

A gas flame detector corresponding roughly to the sketch of *Fig. 1* was arranged and afforded good results. As will be noted from the diagram, the device consisted of two electrodes introduced into the flame of a Bunsen burner; a local battery, *B*, was the source of current. With this device, DeForest was able to copy signals from ships in the harbor. More important was his enthusiasm which led to further experimentation.

A carbon arc was tried, but the idea was dropped almost immediately on account of the noise generated. He and his assistant, Babcock, then turned to the third possibility - a detector based upon the employment of gases heated by means of an incandescent filament. Numerous attempts to make their own special lamps resulted in failure and this part of the work was then turned over to McCandless, a manufacturer of miniature lamps. Dr. DeForest states that at this point in his investigations he was totally unaware of the existence of the Fleming valve; at any rate, it is obvious that the use of a plate battery distinguished his invention from Fleming's.

The McCandless firm turned out for DeForest a special lamp with a platinum electrode sealed within the lamp bulb and this became the first vacuum tube detector to use two local current sources - one for the filament, the second for the plate. This was developed in 1905 and the method of using it is illustrated in *Fig.2*.

The Triode

Next step in the development of the audion was the addition of the third electrode; at first it was not perforated as a modern grid would be, but was a solid electrode, similar to the plate and placed on the opposite side of the filament as shown in Fig. 3. At this time, the first use of a third, or *C* battery was recorded; this was connected as shown in the sketch. Needless to say, this tube was a decided improvement over its predecessors.

The third electrode just described was not only a solid element, but was

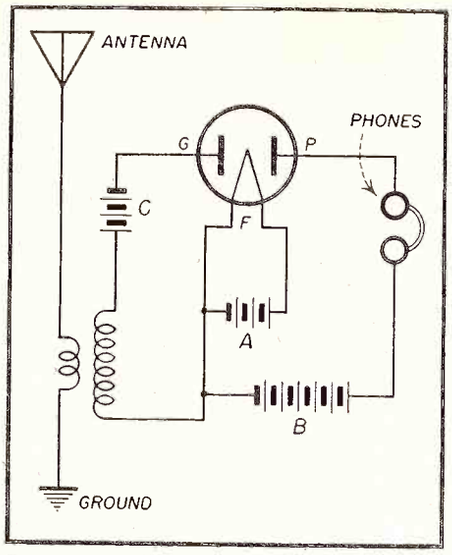


Fig. 3. DeForest Audion with solid grid. First use of "C" battery.

evidently located about as far from the filament as was the plate. DeForest then arrived at the conclusion that more efficient operation would be attained by locating the control electrode between the filament and the plate. It was obvious from the first that the electron flow would be impeded by imposing a solid piece of metal between filament and plate. A piece of sheet platinum was then made up and drilled with numerous holes to permit passage of electrons. This was sent to McCandless and sealed inside a lamp. The discovery that this device with its control grid was not only a superior detector but that, most important of all, would amplify feeble currents, led to vast changes in the radio industry. The patent on the audion amplifier, No. 841,387, was granted on January 15, 1907 - the most valuable patent in the entire radio field and one of the most valuable ever issued by the United States Patent Office.

An inventor who has just developed

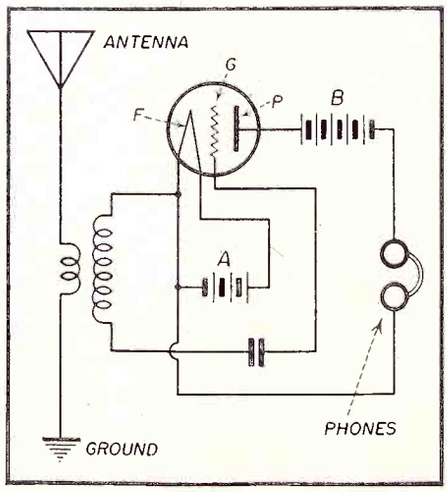


Fig. 4. DeForest Audion. About 1907.

what he feels is a revolutionary device would naturally look around for the firm that he feels is in the best position to use it. In Dr. DeForest's case, the logical choice was the American Telephone and Telegraph Company. He took his audion amplifier to the company at a time when his own firm was in severe financial difficulties. The telephone engineers looked and listened with evident interest, but with no comment. When DForest demonstrated the tremendous gain of his amplifier by dropping a handkerchief in front of the input device and producing a loud thud in the headphones, they were incredulous, but weeks and even months passed without an offer. After a nerve-wracking wait, De Forest was approached by an attorney who claimed to have no connection with the telephone interests, but who said that he had a client who appeared to be interested. The offer was $50,000, and in his financial circumstances, DeForest had no choice but to accept. Later, it was discovered that the rights had indeed been bought by AT&T and the story leaked out, according to DeForest and his biographers, that the AT&T board of directors had been prepared to pay, and in fact had voted $500,000 for purchase of the rights. It should be noted here, that the arrangements between AT&T and DeForest gave the former the rights to use the audion only for telephone purposes; DeForest retained the rights to use the invention in radio work. But it is almost impossible to emphasize the tremendous advancement that resulted from the use of the invention in telephony; to put it quite plainly, DeForest's invention made trans-continental telephony possible and by 1915, coast-to-coast conversations had become a reality.

Dr. DeForest went on to make other very valuable contributions to radio, and particularly radio telephony in his laboratory in the Bronx. He was a pioneer in the field of radio broadcasting and was the first to broadcast grand opera. His work in the field of sound motion pictures is too well-known to require discussion. But of almost equal significance was his discovery of the principle of feed-back, or regeneration. It is true that a gigantic battle over the possession of the feed-back patent rights raged for years with DeForest and Armstrong as the contestants. In the end, the U.S. Supreme Court decided, in 1934, that DeForest and not Armstrong was the prior inventor. That, however, is another story that will be covered in a later installment in this series.

Effective SHOP-BUILT ANTENNAS *for* TV

PART 2

by RANSOM BEERS

In this installment the author develops the theory of various types of Yagi antennas and their characteristics.

AS TV signals from high band stations are attenuated much more over long distances than those from lower band stations, more antenna gain is most desirable. The stacking of Yagis on the low band beyond two bays makes the mechanical structure much too large to be practical. Four bay Yagis are of quite practical size on the high band. For the same reasons low band antennas seldom employ more than two directors ahead of the driven elements, while six directors can be employed on a high band Yagi within reasonable mechanical size.

Theoretical Development Of Yagi Antenna

The Yagi antenna is esentially a narrow band antenna with most efficient reception over a narrow band width. By proper design high gain can be secured for single channel TV reception. Care must be made in building and adjusting element lengths and spacings, in order that sound is not attenuated too much for sake of picture gain or vice versa. In remote fringe areas it is quite difficult to obtain this best compromise by picture observation and listening to the sound, as signals are too variable. By observing the readings on a vacuum tube voltmeter connected across the input to the picture tube, and at the same time observing the readings of a low voltage a-c voltmeter connected across the voice of the loudspeaker when a test pattern is on the air, the antenna can be quite accurately adjusted for the best compromise. Some builders prefer adjusting the element lengths by sliding concentric stubs in and out of the elements for best adjustments. The author feels that by his method of mounting the elements, it is more convenient to adjust the element spacings. These adjustments must be done while a test pattern is on the air, and care must be taken not to let variations in received signal strength be mistaken for variations due to antenna adjustments. The antenna dimensions on *Table 2* serve as a guide to construction, and may need to be changed slightly.

The author used 300 Ω line to couple the antennas to the receiver. Most receivers on the market now have 300 Ω input impedances. For those receivers with 72 Ω input, coaxial cable may be used between the receiver and the antenna and matching sections used at the antenna to match the 300 ohm antenna impedance with the 72 ohm line. Most coaxial cable on the market attenuates the signal

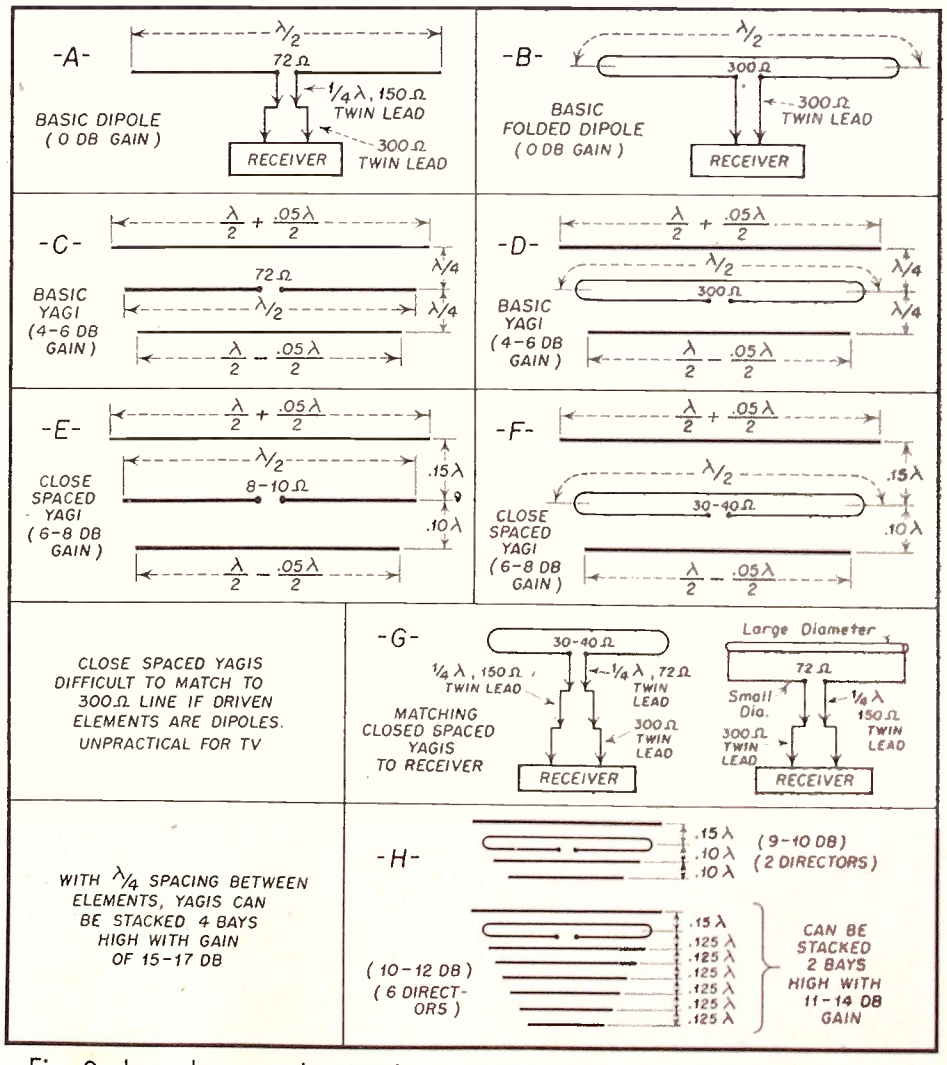
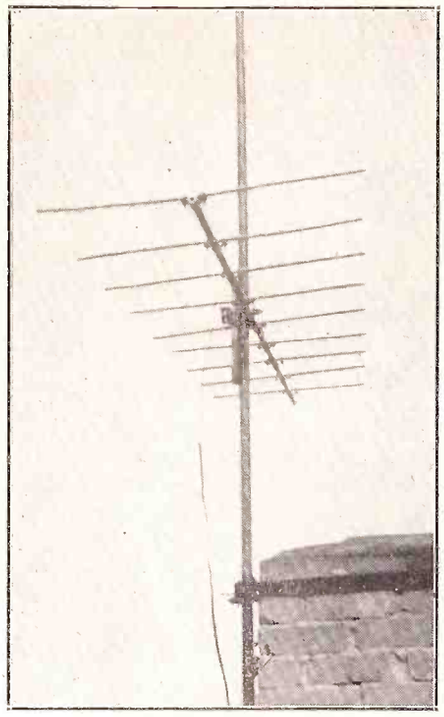


Fig. 9. Impedance and gain characteristics of various types of antennas.



An unusual type of Yagi antenna employing one reflector and seven directors. If more than one reflector is added behind the first reflector no practical gain is observed.

more than 300 Ω lead. A λ/4 section of 150 Ω twin lead inserted between a 300 Ω twin lead and a 72 Ω receiver will afford a good line to receiver match.

The discussion to follow assumes that 300 Ω twin lead is used to couple the antenna to a receiver having 300 Ω input impedance. For weak signal reception the 300 Ω transmission line should as closely match the impedance of the antenna as possible.

A dipole has 72 ohms impedance, and a folded dipole has 300 ohms impedance. (See *Figs. 9A, 9B*) while the 300 ohm line matches the folded dipole, it mismatches the dipole 4 to 1. The 72 ohm dipole can be matched to a 300 Ω line by inserting a λ/4 section of 150 line between antenna and 300 Ω line (See *Figs. 9A, 9B*).

Placing a reflector behind the dipole or folded dipole, the gain of each will be raised 0 to 4 db. (See *Figs. 9C. 9D*). If more than one reflector is added behind the first reflector no additional practical gain is observed; however, adding more directors ahead of the first director will materially increase the gain and decrease the beam width.. Adding a quarter wave director ahead of each antenna (usually a straight rod 5% shorter than the overall dipole length) will further increase the gain from 3 or 4 db to 6 db (See *Figs. 9C* and *9D*. The number of directors used is most often limited by mechanical size especially on the lower TV bands. Each director added is 5% shorter than the previous director, (See *Table 2*) and the spacing from previous director the same as the director to driven element spacing.

If the spacing between elements is reduced the gain increases but the impedence at the driven elements and band width decreases. The closest spacings usually used are: driven elements to reflector- .15λ; and driven elements to director-.10 λ. For these spacings the gain increases from 4 to 8 db. The impedance at the dipole drops to about 8 or 10 ohms, and at the folded dipole 30 to 40 ohms. The impedance at the dipole is so low and the band-width so narrow, that the standing waves in the transmission line make it useless for TV reception. (See *Figs. 9E, 9F.*)

The Yagi using a folded dipole as driven elements can be used with close element spacing by inserting a λ/4 section of 150 Ω line between driven elements and 300 Ω transmission line. For a better match a second matching section of 72 Ω line can be inserted between the driven elements and 150 Ω line. A better method than using 72 Ω line, is to make the half of the folded dipole feeding the transmission line of smaller diameter that the remainder of the folded dipole (See *Fig. 9G*). The exact ratio of impedance stepup depends upon the ratio of diameters and spacings of each half of the driven elements. This information can be found in many books on antenna engineering. The author used #8 copper wire for stepup from 1/2" copper tubing. (See *Table 2*)

With closer spacing of elements more directors can be employed without increasing the physical size of the antenna beyond reason. A second director added will increase the gain of the close spaced Yagi from approximately 7 to 10 db. The author has added as many as 7 directors to a single bay Yagi using a folded dipole as driven elements. Each director added increased the sound and picture strength until the seventh was added which produced no noticable increase. (See *Fig. 9H*).

The larger the diameter-length ratio of the elements the greater the bandwidth of the antenna. As a 6 mc bandwidth is needed for TV the use of large diameter elements is quite important. The impedance of the driven elements increases some with increase in diameter also. Because of the mechanical size and cost of using elements of tubing of large diameter per length ratio, stacking Yagis and using multiple directors on low band TV stations is not too practical.

(To be continued)

TABLE 2
MECHANICAL DIMENSIONS OF ANTENNAS

ANT. USED ↓	CHANNEL →	7	8	9	10	11	12	13
	VIDEO FREQUENCY In Megacycles →	175.25	181.25	187.25	193.25	199.25	205.25	211.25
4 BAY YAGI	$\frac{\lambda}{2}$ IN INCHES = $\frac{5430}{f_{MC}}$	31"	30"	29"	28.1"	27.3"	26.5"	25.7"
4 BAY YAGI	$\lambda/4$ = DIRECTOR, REFLECTOR SPACINGS	15.5"	15"	14.5"	14"	13.6"	13.3"	12.8"
4 BAY YAGI	LENGTH OF EACH DIPOLE LEG = $(\lambda/2 - 1\frac{1}{2}") / 2$	14.7"	14.3"	13.8"	13.3"	12.9"	12.5"	12.1"
4 BAY YAGI AND 1 BAY YAGI	REFLECTOR LENGTH = $\frac{\lambda}{2} + \frac{.05\lambda}{2}$	32.6"	31.5"	30.5"	29.5"	28.7"	27.8"	27"
4 BAY YAGI AND 1 BAY YAGI	DIRECTOR No.1 LENGTH = $\frac{\lambda}{2} - \frac{.05\lambda}{2}$	29.4"	28.5"	27.5"	26.7"	25.9"	25.2"	24.4"
4 BAY YAGI AND 1 BAY YAGI	DIRECTOR No.2 LENGTH = $D_1 - .05\,D_1$	28"	27.1"	26.1"	25.4"	24.6"	23.9"	23.2"
1 BAY YAGI	DIRECTOR No.3 LENGTH = $D_2 - .05\,D_2$	26.6"	25.7"	24.8"	24.1"	23.4"	22.7"	22.0"
1 BAY YAGI	DIRECTOR No.4 LENGTH = $D_3 - .05\,D_3$	25.3"	24.4"	23.6"	22.9"	22.2"	21.6"	20.9"
1 BAY YAGI	DIRECTOR No.5 LENGTH = $D_4 - .05\,D_4$	24.0"	23.2"	22.4"	21.8"	21.0"	20.5"	19.9"
1 BAY YAGI	DIRECTOR No.6 LENGTH = $D_5 - .05\,D_5$	22.8"	22.1"	21.3"	20.7"	20.0"	19.5"	18.9"
1 BAY YAGI	.15λ = REFLECTOR SPACING	4.7"	4.5"	4.3"	4.2"	4.1"	4.0"	3.9"
1 BAY YAGI	.125λ = DIRECTOR SPACING	3.9"	3.8"	3.6"	3.5"	3.4"	3.3"	3.2"
1 BAY YAGI	LENGTH OF SECTION OF FOLDED DIPOLE USING ½" TUBING	30.1"	29.1"	28.1"	27.2"	26.4"	25.6"	24.8"
1 BAY YAGI	LENGTH OF SECTION OF FOLDED DIPOLE USING No.8 WIRE	31.9"	30.9"	29.9"	29"	28.2"	27.4"	26.6"

THE IMPACT OF REARMAMENT on the
ELECTRONIC INDUSTRY

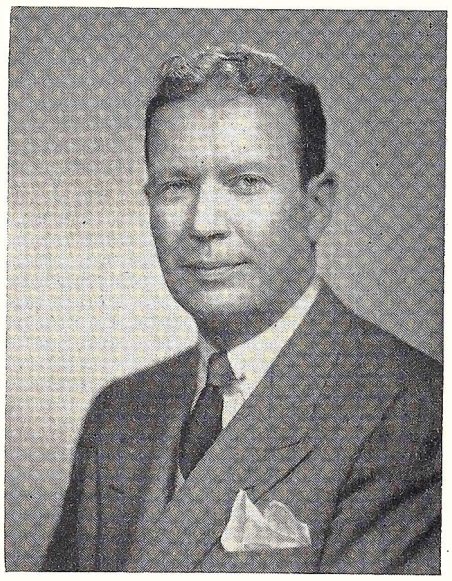
by ROBERT C. SPRAGUE

Text of address delivered Friday evening, April 20, by Robert C. Sprague Chairman of the Board of Directors of the Radio-Television Manufacturers Associations at the annual banquet of the Armed Forces Communications Association at the Drake Hotel, Chicago.

MODERN military communications extend far beyond the mere exchange of information between field commanders. The use of electronic devices also for detection, navigation, and identification has broadened the meaning of communications far beyond its definition of even a generation ago. Further, the use of electronics for the timing of explosives, for guided missiles, automatic pilots and computers, radar bombing and radar aiming has developed rapidly since the end of World War II. Today it is the nerve system of warfare.

I have no way of knowing with accuracy the facts as to the greatly increased importance of electronics in present military operations as compared with World War II. Only the military establishment has the true facts and many of you here are experts in the subject I am now touching upon. However, it seems to me not only desirable but very important that those of us who work in electronics try to understand the far-reaching implications of these trends in military development. That understanding will help us to discharge our responsibility.

Last year one government official said that since 1943 the number of electronic devices in large aircraft has multiplied four times. He said that in a patrol bomber there are forty-five complex electronic devices composed of more than 25,000 components, all of which must be accessible for replacement in the event of failure. The New York Times recently observed that jet-powered aircraft are packed with radar and electronic devices and that on some of today's war planes the radar and electronic equipment accounts for half the cost of the entire airplane. Last month an Air Force Official made the same statement. Other public statements indicate that some airplanes incorporate electronic equipment which costs $500,000 per airplane.



Robert C. Sprague
Chairman of the Board, RMA.

There is now general public knowledge of new electronic devices, like the one which, when dropped into the sea from an airplane, picks up the throbs of a submarine and broadcasts the information to our aircraft, enabling them to locate the submarine.

Thus electronics extend the perception of man—over the horizon, under the water and through the fog—and give him information he cannot obtain with his own eyes and ears. This extension of human perception becomes more necessary and more critical as we develop military devices operating at such speeds and with such complexity that our eyes and ears alone cannot control and use them. Upon the efficiency and reliability of the electronics equipment depend not only the lives of our men but in large part the effectiveness of their fighting instruments.

Thus the people who design, develop and build electronics equipment therefore have a greater responsibility than ever before.

For the second time within a decade, the electronics industry is now being called upon to lend its production facilities and know-how to the arming of the nation. I think we can point with pride to the job done in World War II, but we must recognize the still greater military requirements for electronics today.

The problems of adjustment to a partial mobilization, however, are distinctly different from those of converting for an all-out war. The latter is relatively simple. The goals are better defined and everyone can apply himself wholeheartedly to the job at hand.

In a "cold war," or a limited war such as that in Korea, the problems of mobilizing industry are more complex, and the problems of adapting a business to a mixed civilian-military economy are more difficult than they would be in the case of a complete conversion to wartime production.

No doubt uncertainty and confusion are inevitable in any gigantic undertaking, such as the arming of a nation of 150 million persons, but they become more acute when it is impossible to predict when or where the arms may be needed or in what quantity.

The men in Washington who are charged with the responsibility of carrying out this difficult task deserve our active and sympathic support.

The electronic industry is today

faced with many uncertainties resulting from the present rearmament program and the inescapable controls which accompany any mobilization effort.

No doubt many persons outside the industry may question that statement in the light of the high production of radio and television receivers during the first quarter of this year. Frankly, it has surprised many of us in the industry.

However, an explanation of the high production of sets during the first quarter is not hard to find. With the outbreak of the Korean War, manufacturers began preparing themselves for widely-predicted shortages to come. They knew that military contracts would not be immediately forthcoming to fill the gap caused by these shortages. They bought all the components they could find and afford, and even with the high production of last fall and winter were able to put some of these components into inventory. Parts and tube manufacturers also increased their production in response to heavy orders from set producers, and in anticipation of material shortages. These actions were perfectly natural and to be expected of alert business men.

In addition, both set and parts manufacturers speeded up their efforts to reduce the use of critical materials. They found that through redesign of equipment and components they could conserve hard-to-get materials and substitute less critical materials without in any way impairing efficiency or performance. Our industry has a reputation for ingenuity. When the stimulus of necessity is added to the continuing incentive of cost saving, that ingenuity can achieve spectacular results.

The post-Christmas season is normally a slack one. This year, however, the circumstances cited above, induced everyone to produce beyond the immediate market needs in anticipation of increasing shortages. Meanwhile, production costs have risen, credit restrictions have been tightened, and the 10 per cent excise tax on TV sets was beginning to be felt. Consequently, the accumulation of heavy inventories by many dealers and distributors and some manufacturers has not been surprising.

In our industry, the feast-or-famine pattern seems to be traditional. There is seldom a period that might be called normal—that is, when supply and demand are in perfect balance. Last fall TV sets were short and on allocation to dealers, during the first quarter of this year there was an over-supply, and by mid-year or early fall they will probably be in short supply again.

So much for the immediate commercial situation. The $64 question is, what will the total military and civilian production be for the third and fourth quarters of 1951? And for 1952? For our industry? And for individual companies in our industry?

Despite the rather sizeable allotment of public funds for the purchase of military electronic equipment and components, it seems apparent that the nation's military needs, short of an all-out war, will not absorb the industry's production facilities.

Our latest information indicates that military electronics production will reach a peak annual rate of about $2.5 billion in the fall of 1952, and thereafter decline to an annual rate of around $1.5 billion. This might appear to be a very heavy schedule of military production, if merely compared with the 1950 total output of about $2¼ billion. Actually it probably will not absorb more than half of the industry's production facilities, even at its peak, due chiefly to the fact that military production dollars have about half the impact on our industry as civilian production dollars. This is due to several factors, but principally because a considerable portion of special and elaborate mechanical gear is obtained from manufacturers not generally considered a part of our industry.

"This is it. I hope you know something about upholstering too."

A disturbing aspect of the present rearmament program is that the military load is not, for a variety of reasons, evenly distributed throughout the industry. Perhaps it cannot be evenly distributed. Nevertheless, many manufacturers are in danger of being caught in a squeeze between material shortages on the one hand, and insufficient or no military orders on the other. Already some of the smaller manufacturers are in this difficulty.

This condition might not be alarming were it not for the recognized essentiality of electronics to modern warfare.

Because of the importance of electronics to our national defense, however, it is dangerous to permit any significant number of manufacturers of either end equipment or components, to fall by the wayside. While the industry has doubled its capacity since World War II and consequently is better prepared than it was to meet any emergency, military requirements for electronic equipment and parts have grown even more rapidly, and in the unfortunate event of an all-out war, the electronics industry would have to be still further expanded by a ratio of at least two to one.

Perhaps a brief review of what happened in World War II will emphasize my point.

During 1941-45 our industry produced about $7.5 billion worth of electronics equipment, not including wire communications, and in 1944 military electronics production reached a peak annual rate of about $3½ billion. The War Production Board during these war years authorized expenditures of $227 million for radio-electronics expansions, of which $142 million was spent for equipment and $85 million was for buildings.

An indication of the expansion needed for radio and radar equipment and parts in the last war is apparent in a comparison of the peak production rate of $3½ billion, with the total manufacturers' value of radio sets produced in 1941—the last full production year before the war when it was only $234 million.

Actually an expansion of production capacity in the electronics industry is already under way. To spur this expansion the Government is, in some cases, allowing bigger tax deductions on new plants and in some instances is buying machinery for the manufacture of special types of military devices or part which normally would have little or no commercial value.

It appears that one of the principal expansions needed in our industry will be for the increased production of basic components which will be required by the armed services in vast quantities in the event of a full-scale war.

There is another field in which expansion doubtless will be necessary and where any loss at this time may well prove damaging to the military

[*Continued on page 43*]

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."

Crosley LD Models-Improve Contrast Control Operation

The LD models on the '49 series television receivers such as the model 9-419M1LD, 9-409M3LD and the 9-422MLD were designed especially for fringe area reception.

In some cases where these sets are operated in areas where the signals from one or more stations is exceptionally strong it may cause the contrast control to operate very critically, sound output weak, picture fading, or critical vertical sync.

Since these sets were built, some local stations may have gone into operation, the then existing stations may have increased their power or the receiver may have been moved into a strong signal area producing this condition. This condition can be corrected without the receiver losing sensitivity

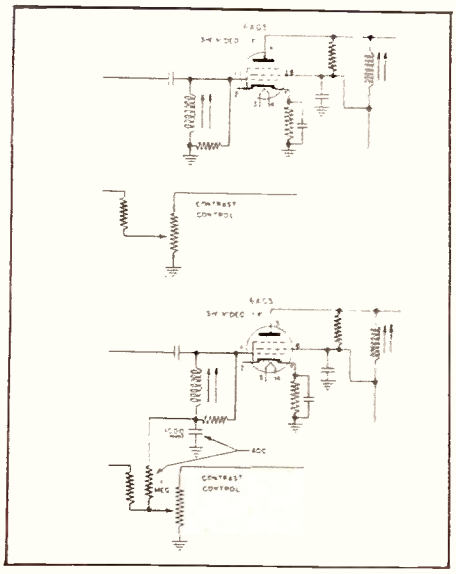


Fig. 1. Top: Original circuit, showing grid return grounded to chassis. Fig. 2. Bottom: Revised circuit, showing grid connected to center terminal of contrast control.

by adding a variable bias to the 3rd. picture I.F. stage. This can be accomplished by making the following wiring change.

1. Disconnect the 3rd. I.F. grid coil from ground.
2. Connect a 1,000 mmf. capacitor (Part No. 160034)) between low side of the 3rd. I.F. grid coil and ground.
3. Connect a one megohm resistor (Part No. 39374-61) between low side of the 3rd. I.F. grid coil and center tap of the contrast control.

A schematic for this change is shown in figures 1 and 2. If picture brightness fluctuation is still encountered due to line voltage changes, disconnect the 470,000 ohm picture tube grid resistor from the cathode of the DC Restorer tube (6AL5) and connect to chassis.

Crosley Service Dept.

Admiral—Improving Reception In Weak Signal Areas

The following information applies to 20T1, 20V1, 21B1, 21C1, 21D1, 21E1, 21H1, and 21J1 chassis.

In weak signal areas, where the noise level is high, the AGC diode, V304 develops an AGC voltage which is proportional to the peak to peak noise voltage.

When the high AGC voltage is applied to the controlled stages, the gain of the receiver is controlled by the noise level and not the sync pulse level.

This may result in loss of sync, poor contrast or low sound level.

When this situation is encountered it may be corrected by using the voltage developed across the video detector load for the AGC voltage instead of the normal AGC voltage developed by the AGC diode.

WARNING! This change should not be made where strong signals may be received or overloading will result.

Circuit Change for 20T1 & 20V1 Chassis:

(1) Locate *V304* (6AL5). See *Fig. 3*
(2) Disconnect resistor *R314* (680K) from pin 7 of *V304*
(3) Connect *R314* as shown in *Fig. 3* left.
(4) Remove tuner AGC lead (white) from AGC lug and ground the wire to the chassis.

Circuit Change for 21B1, 21C1, 21D1, 21E1, 21H1, 21J1 Chassis:

(1) Locate *V304* (6AL5)
(2) Disconnect resistor *R313* (560K) from pin 7 of *V304*
(3) Connect *R313* as shown in *Fig. 3* right.
(4) Remove tuner AGC lead (white) from AGC lug and ground the wire to the chassis.

Admiral Service Dept.

DuMont Chatham RA-103-defective relay circuit

A relay, used with a 6AL5 supply delay tube, on this model loses its magnetic pull when a 4μf 150V condenser across relay opens resulting in chattering of relay and intermittent brightness. Replace above condenser for cure.

Submitted by
I. Horowitz
Brooklyn, N. Y.

Checking For Intermittent Vibrators

Intermittent vibrators in car radios will sometimes operate perfectly on the bench if the set is not tested in the same physical position that it is mounted in the car. This will also apply to other intermittent troubles.

Submitted by
Glen A. Brink
Boulder, Colo.

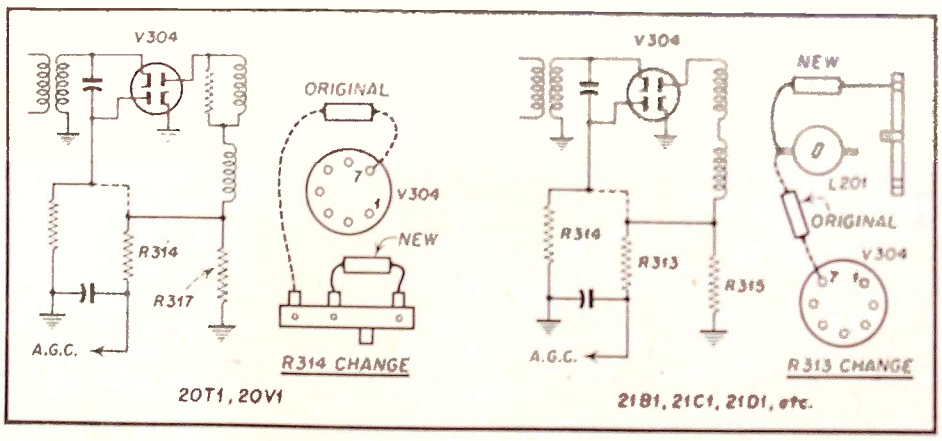


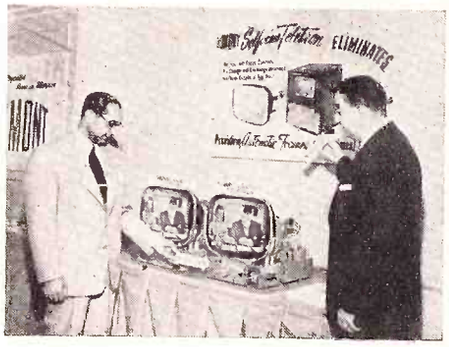
Fig. 3. Admiral Model 20T1 and 20V1 circuit change (left). Models 21B1, 21C1, 21D1, etc. changes shown at right.

NEW PRODUCTS

AUTOMATIC-FOCUSING TV PICTURE TUBE

Representing a complete departure from the usual TV picture tube design, a new Du Mont Teletron boasts 100% built-in automatic focusing. Eliminating all focusing controls, coils, mechanical focusing devices, this new tube maintains a perfect edge-to-edge focus at all times regardless of line-voltage fluctuations, contrast or brightness settings, or installation procedures.

The Cathode-ray Tube Division of the Allen B. Du Mont Laboratories, Inc., Clifton, N. J., are now manufacturing the new automatic focusing tube in the 17" rectangular size, in limited quantities. Other sizes will be announced shortly. The present 17" size is a direct replacement for any 17" all-glass rectangular picture tube whether electromagnetic, or electrostatic focusing. The base is a standard 5-pin duodecal type, requiring no changes in replacement installations.



For the serviceman a new sales field is opened with the sharper, automatically-focused Teletron. Sales can be made on the strength of those advantages once demonstrated to the TV receiver owner, before the original tube is actually burned out. The replacement installation is far simpler than replacing with the old-fashion externally-focused type picture tube. The new tube is slipped into place, while the focusing coil is laid to one side on the chassis. There is absolutely no focus adjustment to be made. The sharper, overall picture resulting is clearly seen as soon as the receiver is turned on.

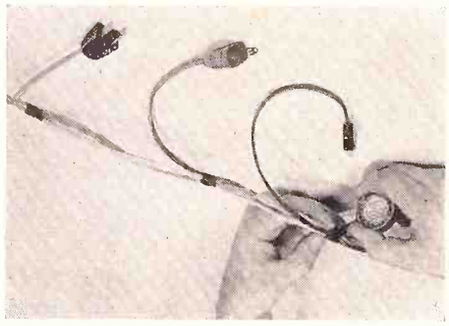
The new Du Pont Selfocus Teletron shown at the Chicago Parts Show. Mr. Irving Rosenberg, General Manager of the Du Mont Cathode-Ray Tube Division, and Mr. Bill Scales, Sales Manager, point out a couple of the many features of the new tube.

ELECTRICAL TAPE

An electrical tape used in industry for six years is now being introduced to the home and farm market nationally. The tape is waterproof, giving it both non-electrical and electrical uses in the home, it was announced.

The tape is No. 33 "Scotch" brand electrical tape, made by Minnesota Mining and Manufacturing Co.—the first of the firm's 40 electrical tapes to be released nationally for home use. A 150 ft.-½" roll sells for 39c.

It is black and glossy, with a smooth surface that doesn't tend to pick up dust or lint when wrapped on electrical cords in the home, it was pointed out. It has a dielectric strength of 10,000 volts and an insulation resistance



of 200,000 megohms, and is listed as sole insulation for wire-splicing by Underwriters Laboratories, Inc.

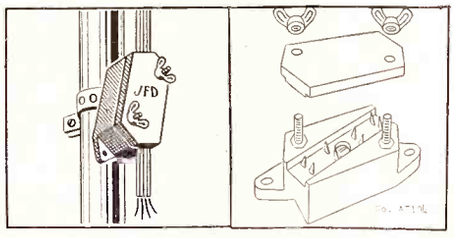
Electrical uses for the tape in the home are expected to include installing electrical fixtures, repairing and reinforcing the insulation on extension cords, splicing cords, making splices in junction boxes, and reinforcing and repairing auto wiring.

The tape resists water, oil and chemicals, and withstands temperatures up to 170 degrees F. It has a stretchy, rubbery backing of vinyl plastic that enables it to conform snugly to odd-shaped objects, it was pointed out.

4-WIRE, 8-CONTACT LIGHTNING ARRESTER FOR ROTATOR LEAD-INS

The JFD Manufacturing Company of Brooklyn has produced a new lightning arrester, Model No. AT104, designed especially to protect television antenna rotator installations from lightning hazards.

The new JFD 4-Wire 8-Contact Lightning Arrester employs eight precision-spaced teeth which maintain double contact with each of the four lead-in wires. No wire cutting, stripping or spreading of wires is necessary. The lead is simply slipped in and the cover tightened down by means of two wing nuts The balanced bleeder and gap electrical design safely grounds dangerous lightning charges.

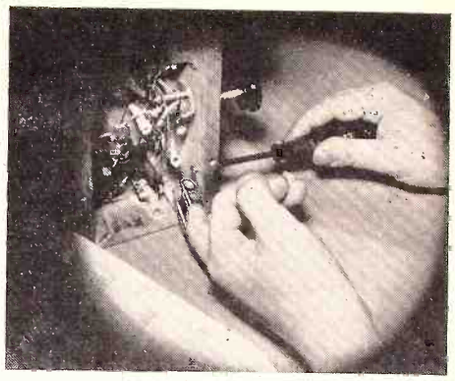


The 4-Wire 8-Contact Lightning Arrester is available without the perforated hanger strap, Model No. AT104 at $1.50 list; and with the strap, Model No. AT104S at $1.75 list.

Literature describing the No. AT104 lightning arrester is available from the manufacturer.

FINGERTIP WRENCHES

Designed to aid the radio and television service dealer in working in "tight spots," a unique set of fingertip wrenches is being offered to servicemen as part of the RCA Tube Department's new promotion campaign.

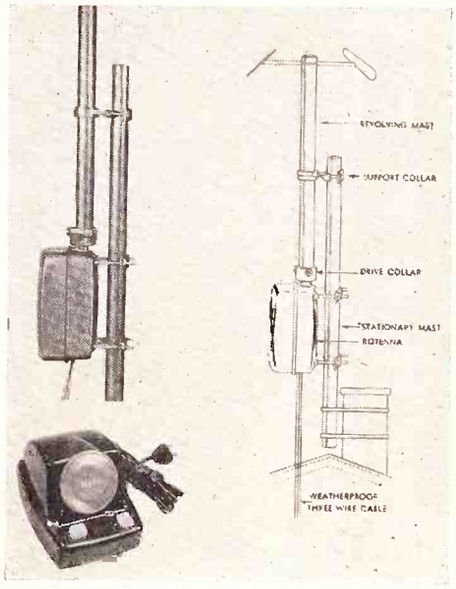


The new fingertip wrenches are practical time-saving devices which neatly solve the problem of holding, placing, and adjustng nuts in hard-to-reach corners of radio and television sets. The wrenches are worn on the finger and are used to steady the nut or bolt as it is tightened or loosened. Each set consists of five wrenches for the most commonly used nut and bolt sizes—3/16", 1/4", 5/16" 11/32", and 3/8". The wrenches are made of steel and are nickel-plated for rust resistance. They are adjustable for individual finger size.

Furnished in a colorful self-storing container, the new RCA Fingertip Wrench set fits easily into a corner of a tool kit. It is available from local RCA Tube distributors.

ANTENNA ROTATOR

Walco Products, Inc. of 60 Franklin Street, East Orange, New Jersey, announces full production on a new television antenna rotator, carrying a list price of 47.50.



Called the Walco Rotenna, mighty midget of antenna rotators, this unit supplied a guaranteed minimum of 50 inch pounds of starting torque from a small, but powerful, motor weighing less than 3½ pounds and measuring only 4" by 4" by 7½". It is equipped with a selsen motor type dial indicator which shows the exact position of the antenna at all times. The indicator is easily calibrated at each individual location, and small numbers are supplied loose and may be fixed to the dial face when each channel position has been established.

The Rotenna has successfully passed a three-year endurance test under extreme weather conditions by a leading independent testing laboratory. The unit carries the standard RMA one-year guarantee. Only the finest materials are used throughout: stainless steel drive shaft, bronze bearings, nylon drive gear, plated (rust-proof) hardware.

The Rotenna accommodates mast sizes from one inch through one and three-eighth inches.

Uses six conductor rotor wire supplied by the manufacturer. May be ordered in 100 foot lengths or in 1,000 foot spools. The Walco Rotenna And Rotor Wire are available through radio-TV parts jobbers for immediate delivery.

TV MAST COVERS

Telematic Industries, Inc., 1 Joralemon St., Bklyn N.Y., introduces a very useful low priced manner of capping the open top of masting. Made of weatherproofed steel con-

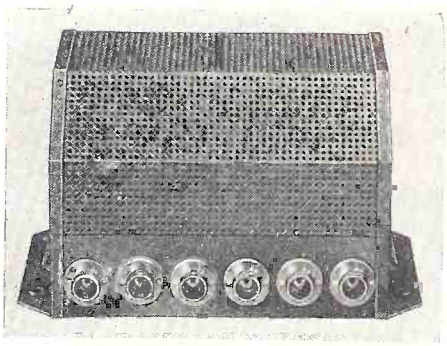
struction this mast cover snaps into place to close off the open end of the mast to prevent mast howl, and eliminate rust streaking on side of house. No hardware required. Immediate delivery.

TV DISTRIBUTION SYSTEM

A new Model 3100 TV Distribution System is announced by Electro-Voice, Inc., Buchanan, Michigan.

The Model 3100 permits extreme flexibility in installation. One Model 3100 Distribution System will service four TV Receivers. In more elaborate installations, combinations of distribution systems in series serve a large number of receivers, simplifying the technician's service problems.

Normal installations in primary signal areas will not require line amplifiers in addition to the Model 3100 Distribution System. In large installations and in installations in fringe areas, line amplifiers should be used in conjunction with the Distribution System



to supply adequate signal level to all receivers. In such hook-ups the E-V Model 3000 Self-Tuning Booster can be used very effectively to provide additional gain.

The Model 3100 Distribution System is housed in a well-ventilated gray Hammerton steel case. Six Cinch-Jones coaxial sockets provide access to four receiver outlets, the signal input and the signal output. The unit includes an AC line cord and plug and a terminating resistor. The case of the Model 3100 is equipped with four rubber grommet feet and may be mounted horizontally or vertically. The use of 72 ohm shielded coaxial cable for all leads assures best results. E-V Model 3100 TV Distribution Systems list at $69.50.

For full details, write for free bulletin to Electro-Voice, Inc., Buchanan, Michigan.

1000 OHMS/VOLT MULTIMETER

The Electronic Instrument Co., Inc., 276 Newport Street, Brooklyn 12, N.Y., designers and manufacturers of the famous complete EICO line of laboratory-precision instruments and kits, has engineered the new Model 526 1000 ohm/volt Multimeter. Model 526-K, Kit, is only $13.90; Model 526 (factory wired) is only $16.90.

Model 526 has 31 different ranges, with a Zero-to-one volt range in both its a-c and d-c Voltage Ranges.

Another outstanding feature of this instrument is its new "open" design that permits complete accessibility to every component with no sacrifice in strength of connections or firmness of assembly. Furthermore, no cable wiring is used.

The 3½" meter has a 400 ua movement for dependable accuracy. All resistors have 1% or better accuracy. The integral dual rectifier has separate low and high voltage calibration in a-c ranges. The ohm ranges are specifically designed to achieve a new low in minimum

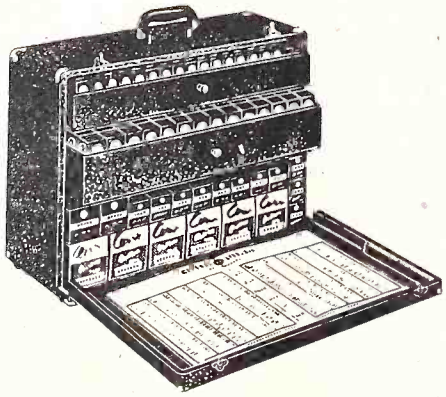
battery-drain. There are separate jacks for high current and high voltage positions. The special ohms-adjust battery potentio-meter insures maximum battery life. Ruggedly constructed, the instrument is housed in a beautiful durable high-impact Bakelite case and panel, into which all figures and symbols are molded for extra-long wear and legibility.

Ranges: a-c & d-c Voltage: Zero to 1, 5, 10, 50, 100, 500, 5000, at 1000 ohms/volt. DC Resistence: Rxl, Rx10, Low Ohms. a-c & d-c Current 0-1 ma, 10 ma, 0.1 A, 1 A. D. ranges: -20 to +69 db. d-c Accuracy: -3% of full scale. a-c Accuracy: 5% of full scale.

Both Model 526-K (Kit) and Model 526 (factory wired) come complete with battery. Dimensions are: 6¼ x 3¾ x 2".

NEW TUBE CARRIER

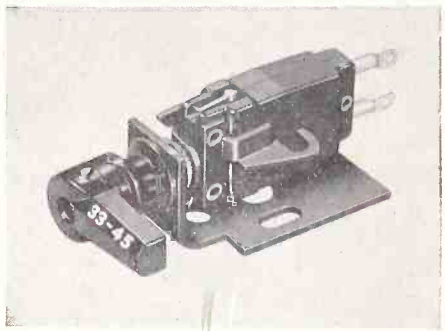
A handy new television tube carrier manufactured by Radio Merchandise Sales, Inc., is said to be a boon to all servicemen because it helps them to service right out of their portable stock.



The carrier case is of durable plywood construction, finished in a tough wearing grade of leatherette. Further strength and protection are afforded by the addition of metal shields at all corners. The carrier holds over 200 tubes and accommodates every commonly used size. Variations of the standard model TC-1, are fitted with a mirror in the lid for service alignment of the set (Model TC-2). Complete details may be obtained by writing Radio Merchandise Sales, Inc., 1165 Southern Blvd., New York 59, N. Y.

3-SPEED CARTRIDGE REPLACEMENT

A new cartridge has been announced by Webster Electric Company, known as Model



AX, which is a universal replacement cartridge for two-needle, three-speed record changers and players. It is estimated that the new Model AX will replace ninety percent of the two-needle, three-speed cartridges on the market today. The Model AX comes as a complete unit, including twist mechanism cartridge, needles and instructions for easy installation. Twist mechanism is easily removed when cartridge is to be installed in tone arms in which twist mechanism is integral. It is doubly protected against moisture by the Dri-Pack package and Dri-Seal crystal. It eliminates the need for large stocks of replacement cartridges, and no replacement chart is needed. The cartridge is expected to be available around June 15th.

DYNAMIC HEADPHONES

Flat frequency response of Permoflux Dynamic Headphones from 100 to 7000 - is assured in the Permoflux High Fidelity Dynamic Series and up to 4500—in the Standard Series.

Uses for the above units include of course the military as well as the following civilian applications: Broadcast, television and recording uses, as well as monitoring audio metric work and auditory training.

Permoflux Dynamic Headphones are considered satisfactory for all audio metric work. They are capable of taking even minute

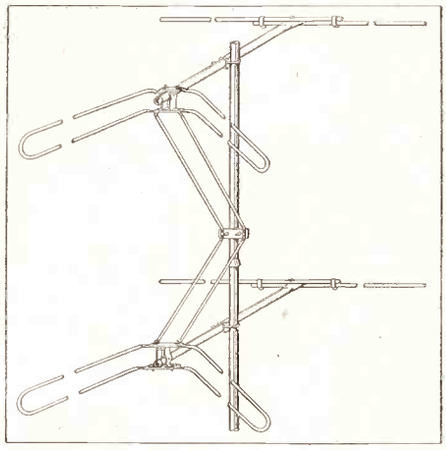
electrical impulses and converting them into sound over a wide frequency range at uniform response and high intensities. Sound reproduction is free from irritating blasts and rattles.

Endorsement by leading Orchestral conductors is another tribute to these outstanding units.

For further information write for your free copy of the New Permoflux Catalog J203 entitled "Permoflux, Sound In Design." Address your letter to Permoflux Corporation, 4900 W. Grand Avenue, Chicago 39, U.S.A.

FOLDED-VEE ALL-BAND ANTENNA

A new all-band television antenna is announced by Technical Appliance Corporation, Sherburne, N. Y., designers and manufacturers of TV, FM, AM antennas and master antenna distribution systems.



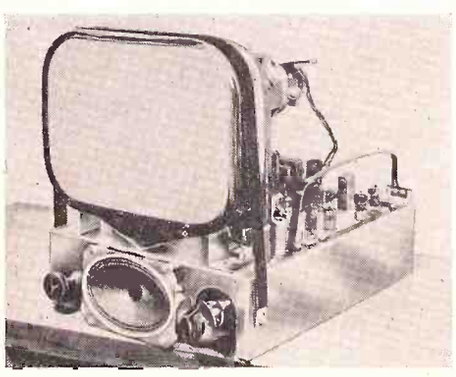
The new antenna is known as the Folded Vee and is available as either a single antenna, or stacked array. The antenna element is a folded dipole with a forward angle for covering all 12 vhf television channels. The reflector is a straight rod spaced for maximum gain and front-to-back ratio.

The Folded Vee is recommended for strong to medium signal strength areas. As a single antenna it is ideally suited for use with a rotator due to its low wind resistance. The folded dipole design is far more rigid than open dipole antennas.

The new Taco antenna is constructed in the well-known Taco Jiffy-Rig manner, making possible assembly in a few minutes. By swinging the antenna elements open, and tightening the pre-assembled screws.

AC-DC TV KIT

The engineers of Tech-Master Products Company of New York City have developed a long sought budget-priced television kit that will provide the quality of picture and sound that most people felt was to be found only in expensive units. It will accommodate tubes up to 14" rectangular.



Tech-Master's "Universal" kit is carefully engineered. The features of this set include the latest hi-gain stagger tuned IF system, new 12 channel turret type tuner, AGC system, and two knob control providing automatically synchronized picture and sound. The main chassis is completely "above ground", and convenient test points are located on top of the IF "Synchro Strip" for ease and efficiency testing. Absolutely no further IF alignment is necessary since the tuner and IF "Synchro-Strip" come completely pre-wired, tested and aligned.

This kit is supplied complete with instructions, components, hardware, speaker, picture tub mounting brackets, and all tubes (less kine, wire, and solder). Shipping weight of this small chassis (17"x14"x4") is 30 pounds. Priced to sell for less than $90.00.

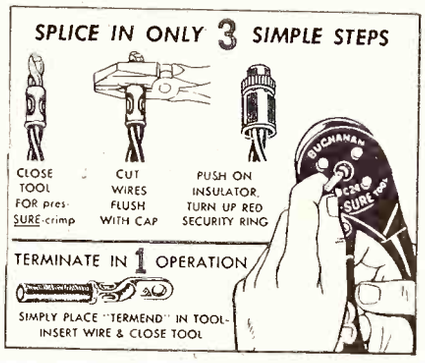
SPLICING COMPONENTS

The Buchanan Elec. Products Corp., Hillside, N. J., announces that their Splice Caps for "pigtail" splicing of electrical wires are now available in an improved open-end construction which considerably facilitates their installation and inspection.

These new open-end Splice Caps insure that wire insulation is always flush with the Splice Cap for maximum circuit protection and that wires are always inserted to the full depth of the Splice Cap for maximum joint efficiency.

Only two sizes of Splice Caps are required for all most frequently used combinations of two or more wires ranging all the way from two No. 18 to three No. 8. Quickly applied snap-on insulators of fixed insulating value eliminate necessity for taping of joints and insure against insulation breakdown in service.

The hand operated "pres-SURE-tool" which installs both sizes of Splice Caps also installs



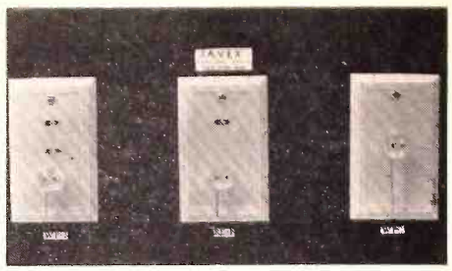
manufacturer's Termend lugs on all sizes from No. 16 to No. 8. This tool features an exclusive four-way 'pres-SURE-crimping" action which insures permanent connections of maximum electrical and mechanical efficiency and is equally effective on solid or stranded or on combinations of solid and stranded wires. Weighing just one pound, this tool is only 8 inches in overall length and is provided with easy-grip handles protected with vinyl tubing.

All Splice Caps and Termend Lugs are fully approved by both Underwriters' Laboratories, Inc. and Canadian Standards Association.

TV ANTENNA DISTRIBUTION SYSTEM

Completeness is the distinguishing characteristic of the new Javex Antenna Distribution Systems just announced by Javex of Garland, Texas. Designed to mount flush, with or without the use of the usual wall box, this new product incorporates a 300 Ohm distribution system integral with a wall plate of conservatively modern design. The units come in Ivory or Brown, complete with plugs and mounting screws, and are very moderately priced.

The unique feature that Javex has developed centers around their surface box design which eliminates cutting into a wall or using a wall box. A ¼" lead-in hole is easily covered by the plate, making for a very neat and easy installation. Hence, a service man installing an antenna, can, without any change can be used on any surface regardless of contour. It is listd by Underwriters' Laboratories, Incorporated.



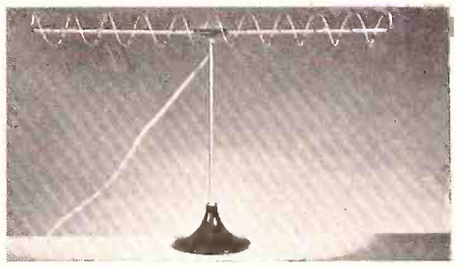
in present practice, and with very little expense, give a complete antenna installation that the homeowner will appreciate.

If, as in the case of some masonry walls, a twin lead has to be run on the surface, then the Javex surface box, being scored and recessed, will neatly accept the lead-in from any direction.

Also available are double and triple arrangements for multiple or bi-directional installations.

HI-LO TV SPIRAL ANTENNA

Unique in design, with its spiral effect as illustrated, the HI-LO TV SPIRAL ANTENNA is being purchased more and more by both new and old television owners who require an indoor antenna.

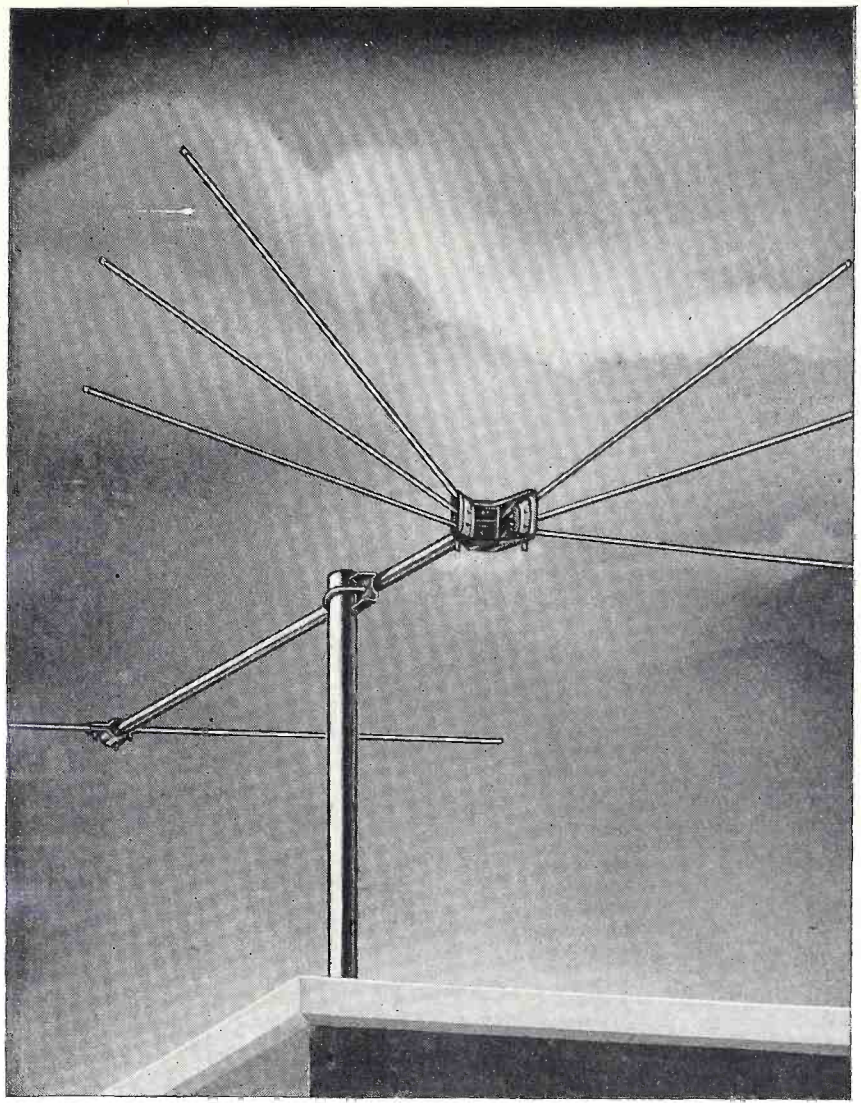


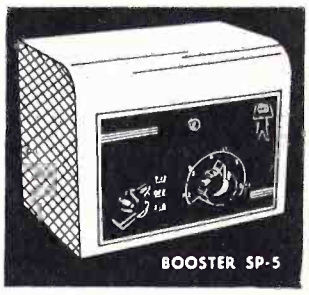
The HI-LO TV Spiral Antenna list price is only $9.95 and it is manufactured by the Hi-Lo TV Antenna Corporation of 3540 N. Ravenswood Avenue, Chicago 13, Illinois.

LADDER STABILIZER

A new ladder stabilizer that makes any kind of ladder sure footed for greater safety is now being distributed by Mine Safety Appliances Company, Pittsburgh, Pa.

The Hydra-Lizer (hydraulic ladder-stabilizer) is an adjustable steel attachment for the lower end of straight or extension ladders. It provides safe footing for ladders in places where the two legs would not be on the same level, and





Everything you need for safe, sure, TV installation

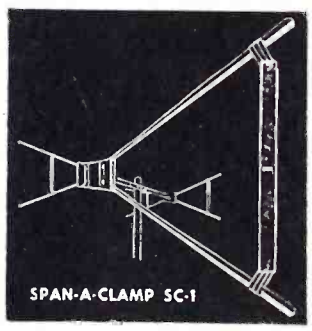
Everything you want..in Antenna Design

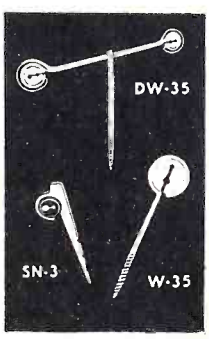
MASSIVELY CONSTRUCTED

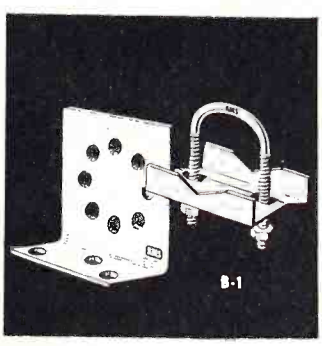
RMS CONICAL ANTENNA - MODEL VF 10

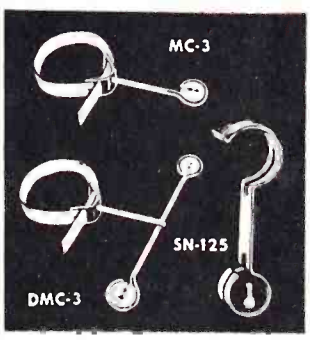
Under the most severe conditions, massively constructed all-channel Versacone (VF 10) proves its rugged power. Quick assembly with new type locking device. All elements are 1/2" hard wood dowel reinforced.

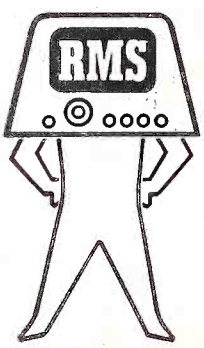
For complete line of antennas write for RMS catalog.











RADIO MERCHANDISE SALES, INC.

1165 SOUTHERN BOULEVARD • NEW YORK 59, N. Y.

TRADE LITERATURE

A new 107-page pocket-size *handbook,* listing the essential characteristics of every type of receiving tube likely to be found in any home receiver—AM, FM or television, has been published by the *General Electric Tube Division.*

Prepared primarily for the service technician, the reference contains ratings and other data essential to fast, efficient, trouble shooting. Basing diagrams for each of the 856 different tube types listed, are shown on the pages with the data.

The electronics engineer, amateur and experimenter will also find this book a valuable quick-reference for tubes currently in use.

Included in the new edition of the handbook are the many receiving tubes recently announced for use in television applications; a comprehensive coverage of subminiature tubes; and a section listing the essential physical and electrical characteristics of television picture tubes.

To aid in the proper evaluation of the information presented in this handbook, a section entitled "Interpretation of Ratings and Technical Data" has been included. Following this section is a chart of Recommended Types which will provide the service technician with a valuable guide to tubes likely to be found in the late-model receivers.

It was pointed out that the information presented in the handbook is industry-wide in scope, so the inclusion of a tube in the publication does not necessarily imply the availability of that type from General Electric. Priced at 35 cents, the book is available only through General Electric and Ken-Rad electronic tube distributors.

* * *

The part electronics will play in America's defense economy, and General Electric's contributions in this period, are explained in the booklet, *"Electronics in the Public Interest"* which is based on a recent talk to foremen at Electronics Park, Syracuse, by Dr. W. R. G. Baker, G-E Vice President and General Manager of the company's Electronics Department.

* * *

John F. Rider Publisher, Inc., 480 Canal St., New York, announces an up-to-date supplement to their publication *Radio Operator's License Q&A Manual—F.C.C. Element VIII—Ship Radar Techniques.*

Available in a separately bound booklet, Element VIII employs the same comprehensive treatment used in the book. It lists questions, answers, and valuable follow through discussions, so vital to a complete understanding of the answers.

This handy supplement, 5½" x 8½", contains 40 liberally illustrated pages in a heavy durable cover. It is priced at 78c, and will be available from the organization's distributors.

* * *

Vacuum-Tube Voltmeters (2nd Edition), by *John F. Rider,* published by *John F. Rider Publisher, Inc.,* 480 Canal St., New York 13, N. Y., is now available at the organization's distributors.

Thoroughly revised and almost completely rewritten, it is right up to the minute in its coverage of all types of vacuum-tube voltmeters (diode, triode, rectifier-amplifier, tuned, amplifier-rectifier, slide-back).

Starting with the underlying theory of the instrument, the text goes on to discuss design, construction, calibration, testing, maintenance, and applications. Of particular value to the service technician, engineer, and student are the step by step procedures applying the device to many uses, as explained in the chapter on applications.

A completely new chapter on d-c and r-f probes discusses the different types of probes and what measurements they can make. It also explains how to adapt the probe to particular jobs and extend its range.

A chapter is devoted to more than 40 commercial vacuum-tube voltmeters. Each is listed by manufacturer and model number with an accompanying schematic and parts values.

A comparison tabulation of operating characteristics of all the models discussed enables the user to have at his finger tips such information as circuit type, input impedance for a.c. and d.c., frequency response, accuracy on a.c. and d.c., voltage range and number of ranges for a.c. and d.c., ability to measure resistance, and special features of each particular model.

Review questions at the end of each chapter enable the reader to check his knowledge of the subject discussed. An extensive bibliography of more than 200 listings permits him to further investigate particular topics. The complete index pinpoints all phases of the subject.

Vacuum-Tube Voltmeter (2nd Edition) contains 432 pages and 215 illustrations in a cloth binding (5½" x 8½"). It is priced at $4.50.

* * *

A new *"1951 Tube Movement and Inventory Guide"* for the radio service dealer has been announced by the *RCA Tube Department.* The 16-page book, in chart form, is designed as a year-round master control covering more than 400 receiving tubes and kinescopes.

Through a simplified record-keeping system, the new RCA Guide provides the dealer with at-a-glance control of his electron-tube stocks, and enables him to maintain balanced inventories with a minimum of bookkeeping.

The new "1951 Tube Movement and Inventory Guide" is now available from RCA Tube and Parts distributors.

* * *

Bulletin 750, four pages:–Describes manufacturers' improved line of Underwriters' approved "pres-SURE-connectors" for solderless splicing and terminating of electrical wires. Contains detailed descriptive data, installation instructions and ordering information. Write *Buchanan Electrical Products Corp.,* Hillside, New Jersey.

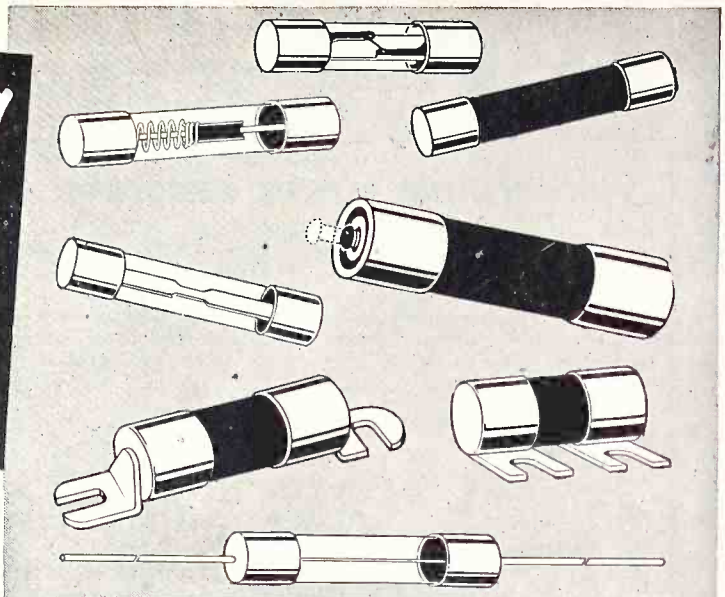
* * *

A new *Du Mont Teletron Catalog* is now being offered to the trade by the *Cathode-ray Tube Division of Allen B. Du Mont Laboratories, Inc.,* 750 Bloomfield Avenue, Clifton, N. J. This latest picture tube literature lists the latest types, including the 30-inch Teletron, Type 30BP4. Comprehensive technical information is given for the various Teletron Types with complete data on the two new electrostatic-focus types 17FP4 and 20GP4.

This 12-page publication also provides complete ion-trap-adjustment

[*Continued on page 39*]

When you need a FUSE—think of BUSS



THE MOST COMPLETE LINE OF FUSES FOR THE *Electronic Industries*

- RADIO
- TELEVISION
- RADAR
- INSTRUMENTS
- CONTROLS
- AVIONICS

Whatever your needs in electrical protection there's a Buss fuse made to fit.

Send for Bulletin SFB—showing full line of fuses and fuse mountings.

A complete line of fuses made to dimensions smaller than National Electrical Code fuses.

These fuses are SPACE SAVERS.

They are particularly well suited to the protection of instruments, radios, television and electronic equipment of all kinds, aircraft, automobiles, coin-operated devices and any apparatus where space for the protective device is at a premium.

Fuses of the Dual-Element, Renewable and One-Time type are available.

Companion lines for FUSETRON and BUSS small dimension fuses are BUSS Fuse Clips, Blocks and Fuse Holders. They are made in many types and sizes to make it easy to select the fuse and fuse-mounting needed to give the required protection.

For full information ask for the BUSS Bulletin on Small Dimension Fuses and Fuse Holders — Form SFB.

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

A customer instantly recognizes quality when he sees Buss fuses. Millions of Buss house fuses, industrial fuses and fuses for the automotive trade have firmly established in his mind the unusual merits of Buss fuses. The Buss reputation for quality 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. Each individual Buss fuse is tested in an electric circuit before it leaves the factory to make sure it will operate properly.

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 take a chance? The smallest trouble that results may cause you to lose a customer's good will. Be safe, furnish only Buss fuses — the trade mark known everywhere as standing for the highest quality in fuses.

USE THIS COUPON — *Get all the facts*

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.) ED-751

Please send me Bulletin SFB containing complete facts on Buss Small Dimension Fuses.

Name_____

Title_____

Company_____

Address_____

City_____ State_____

ESSE *Electronic Bargains-ALL BRAND NEW*

WIRE-WOUND POWER RESISTORS

Listed below is an assortment of most any wattage or value of power resistor desired. This merchandise is all top quality, nationally advertised brand. Not war surplus but fresh manufacturer's surplus, obtained from local manufacturer. We guarantee satisfaction or money back. Don't let the low price influence your judgment of quality. We purchased a half-million dollar inventory of resistors to bring you these prices. The manufacturer's name is still on the merchandise; however, we cannot advertise under this name.

10 WATT ..... 20c each

1AV	-	1	ohm adj.	1HJ	-	2000	ohm	
1HJ	-	2	"	1AV	-	2250	"	adj.
1HJ	-	3	"	1HJ	-	3000	"	
1HJ	-	4	"	1AV	-	3000	"	adj.
1AV	-	5	" adj.	1AV	-	3500	"	"
1HJ	-	7.5	"	1HJ	-	3500	"	
1HJ	-	12	"	1AV	-	6000	"	"
1AV	-	15	" adj.	1HJ	-	6000	"	
1HJ	-	20	"	1HJ	-	7000	"	
1HJ	-	50	"	1AV	-	7500	"	adj.
1AV	-	75	"	1HJ	-	8000	"	
1HJ	-	150	"	1AV	-	9000	"	adj.
1AV	-	150	" adj.	1HJ	-	10000	"	
1HJ	-	200	"	1HJ	-	11000	"	
1AV	-	250	"	1HJ	-	12500	"	
		500	"	1HJ	-	13500	"	
1HJ	-	700	"	1HJ	-	15000	"	
1HJ	-	750	"	1HJ	-	16000	"	
1AV	-	800	"	1HJ	-	25000	"	
1HJ	-	1000	"	1HJ	-	30000	"	
1HJ	-	1100	"	1HJ	-	35000	"	
1HJ	-	1500	"	1HJ	-	45000	"	

25 WATT ..... 25c each

		3	ohm	2AV	-	2000	ohm adj.	
2AV	-	5	" adj.	2HJ	-	2250	"	
2AV	-	10	" "			2500	"	
2HJ	-	25	"	2HJ	-	2750	"	
2AV	-	50	" adj.	2HJ	-	5000	"	
2AV	-	75	" "	2AV	-	6000	"	adj.
2HJ	-	150	"	2AV	-	7500	"	"
2AV	-	150	" adj.	2AV	-	12000	"	"
2AV	-	200	" "	2HJ	-	12500	"	
2HJ	-	750	"	2AV	-	15000	"	adj.
2HJ	-	1500	"	2AV	-	20000	"	"
2AV	-	1500	" adj.	2HJ	-	50000	"	

50 WATT ..... 50c each

5AV	-	5	ohm adj.	5AV	-	2000	ohm adj.	
5HJ	-	50	"	5HJ	-	10000	"	
5AV	-	100	" adj.	5AV	-	10000	"	adj.
5HJ	-	750	"	5HJ	-	15000	"	
5AV	-	1000	" adj.	5HJ	-	30000	"	
5HJ	-	1500	"	5HJ	-	40000	"	
5AV	-	1500	" adj.	5HJ	-	50000	"	
5HJ	-	2000	"	5AV	-	75000	"	

80 WATT ..... 75c each

8AV	-	15	ohm adj.	8AV	-	2500	ohm adj.	
8AV	-	25	" "	8AV	-	3500	"	"
8AV	-	50	" "	8AV	-	7500	"	"
8AV	-	100	" "	8AV	-	15000	"	"
8AV	-	250	" "	8AV	-	20000	"	"
8AV	-	300	" "	8AV	-	25000	"	"
8AV	-	500	" "	8AV	-	30000	"	"
8AV	-	750	" "	8AV	-	40000	"	"
8AV	-	1000	" "	8AV	-	60000	"	"
8AV	-	1500	" "	8AV	-	15000	"	"
8AV	-	2000	" "	8AV	-	80000	"	"

100 WATT ..... $1.00 each

10HJ	-	75	ohm	10AV	-	10000	ohm adj.	
10HJ	-	150	"	10HJ	-	10000	"	"
10HJ	-	1000	"	10AV	-	20000	"	"
10AV	-	1000	" adj.	10HJ	-	20000	"	
10HJ	-	2000	"	10HJ	-	25000	"	
10AV	-	3000	" adj.	10HJ	-	30000	"	
10AV	-	4000	" "	10HJ	-	40000	"	
10AV	-	7500	" "	10HJ	-	75000	"	

200 WATT ..... $1.25 each

20HJ	-	500	ohm	20HJ	-	3000	ohm
20HJ	-	750	"	20HJ	-	5000	"
20HJ	-	100	"	20HJ	-	7500	"
20AV	-	2000	" adj.	20HJ	-	10000	"
20HJ	-	2000	"	20HJ	-	20000	"
20HJ	-	2500	"				

An additional discount will be allowed of 25% on all orders of 100 or more of the above listed resistors.

POTENTIOMETERS

20 ohm Rheostat, 1⅝" dia., ⅜" shaft length 25c
100 ohm 1½" dia. screwdriver adj. 25c
1000 ohm 1¼" dia. ⅜" shaft length 25c
1000 ohm 15/16" dia. screwdriver adj. 25c
5000 ohm with switch, 1¼" dia. 5/16" shaft length 35c
10,000 ohm, 15/16" dia. screwdriver adj. 25c
75,000 ohm 1¼" dia. 2" shaft length 25c
100,000 ohm 1-1/16" d. 1" shaft length 25c
500,000 ohm, 1-3/32" dia. 9/16" shaft length 25c
1 Megohm 15/16" dia. 9/16" shaft length 25c
2 Megohm 1-1/16" dia. 13/16" shaft length 25c
2 Megohm 15/16" dia. screwdriver adj. 25c
2 Megohm with switch, 15/16" dia. 9/16" shaft length 35c
2 Megohm tapped 400,000 ohm, with switch, 1-3/32" dia. 1" shaft length 40c

DUAL POTENTIOMETERS

3000 ohm each section, 1½" dia. 2" shaft length 35c
25,000 ohm each section, 1⅝" dia. 5/16" shaft length 35c

CONDENSERS

FP type 30 mfd.-15 mfd 450 V.)
15 mfd.-350 V.) 75c
4 mfd.- 25 V.)
FP type 30 mfd. 450 V. 45c
FP type 20 mfd. -20 mfd. 400 V. 60c
FP type 30 mfdd. 150 V. 35c
FP type 20 mfd. -20 mfd. -20 mfd. 25 V. 25c
FP type 1000 mfd. 25 V. 60c

PAPER CONDENSERS

	.14 mfd.	50 V.		.05c
	10 "	60 V.		.10c
	.002 "	100 V.	miniature	.05c
	.5 "	100 V.		.05c
	.5 "	120 V.		.10c
	.5 "	150 V.		.10c
	.1 "	200 V.		.10c
	.035 "	400 V.		.15c
	.05 "	400 V.		.15c
	.25 "	400 V.		.15c
	.1 "	400 V.		.15c
	.5 "	400 V.		.20c
PT-621	.001 "	600 V.		.18c
	.005 "	600 V.		.15c
	.005 "	600 V.		.10c
TP-410	.01 "	600 V.		.18c
TP-412	.02 "	600 V.		.18c
TP-415	.05 "	600 V.		.18c
	.05 "	600 V.		.15c
	1 "	600 V.		.30c
	.0018 "	800 V.		.10c
	.0035 "	1000 V.		.10c
	.001 "	1000 V.		.15c
	.1 "	1500 V.		.20c

PAPER ELECTROLYTIC CONDENSERS

40-40 mfd. 150 V.	45c ea.	$35.00	per 100
5 mfd. 50 V.	15c ea.	$10.00	per 100
20 mfd. 250 V.	30c ea.	$20.00	per 100
30 mfd. 250 V.	30c ea.	$20.00	per 100

MICA CONDENSERS

Assortment of 100 various mica condensers such as .0025—1250 V.; .02—600 V.; .006—600 V.; .002—750 V.; .002—600 V.; 2200 mmfd.; 780 mmfd.; 56 mmfd.; 1500 mmfd. and other useful micas $3.95
Assortment of 100

BATHTUB CONDENSERS

Assortment of 25 bathtub condensers consisting of values such as .3— 50 V.; 2x.1—600 V.; .1—1000 V.; 3x.1—400 V.; 2x.5—400 V.; 2x.125—400 V.; .5—600 V.; .9—100 V.; 4 mfd. 50 V. and .01—100 V.
Assortment of 25 ..... $1.25

MOTOR STARTING CAPACITORS

CHOICE 35c EA.

Here's a chance to stock practically a full line of motor starting capacitors at very little money. Stock is clean and fresh, guaranteed quality merchandise. Application: These capacitors are for use in starting AC capacitor type motors and replacement wherever motor capacitors are used.

ROUND TYPE

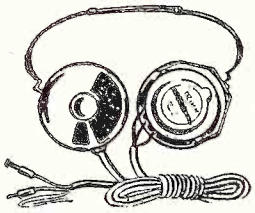
Catalog No.	Mfd.	Volts AC.	Size (Dia. x L.)
MSU121	26	110	1⅜ x 2¾"
MSU122	32	110	1⅜ x 2¾"

RECTANGULAR TYPE

Catalog No.	Mfd.	Volts AC.	Size (W. x L. x H.)
MSG220	32	110	2 x 3½ x 3½"
MSG221	53	110	2 x 3½ x 3½"
MSF224	86	110	1¼ x 4½ x 4½"
MSF227	108	110	1¼ x 4½ x 4½"
MSF229	124	110	1¼ x 4½ x 4½"
MSG230	145	110	2 x 3½ x 3½"
MSG231	161	110	1½ x 4¼ x 4¼"
MSF232	161	110	2 x 3½ x 3½"
MSG250	26	220	2 x 3½ x 3½"
MSG251	32	220	1¼ x 4½ x 4½"
MSF252	32	220	2 x 3½ x 3½"
MSG253	43	220	2 x 3½ x 3½"

NOW *is the time to buy-ALL BRAND NEW VALUES*

TRIMM HEADSETS



Dual with cloth covered headband. Trimm Rex type low Z. Brand new. **$1.19**

METERS

0-40 V. Hoyt and 0-30 Amp Hoyt 3" round panel meters, brand new. Choice **$1.50** ea.

CO-AXIAL CABLE TUBE SOCKETS

Here is a bargain on hard to get co-axial transmission line. Ideal for noise-free TV lead-in and transmitter antenna transmission line.

	per 100 ft.
RG-29/U 53.5 ohm	$ 5.00
RG-8/U 52 ohm	12.95
RG-7/U 90-105 ohm	12.95

No length less than 100 ft. sold.

WIRE

Army Assault wire W-130-C 10,000 feet single conductor twisted, plastic covered, weather resistant. Wire used for telephone, intercom, etc. 10,000 ft. metal reel....**$29.75**

WILLARD BATTERY

Re-Chargeable 2 Volt storage battery used in many portable radios and Army surplus equipment. Adaptable to other uses. Shipped dry-charged. Size 4" x 3" x 5-1/16". Shipping wgt. 4 lbs. **$1.39**

ASSORTMENT OF 'IF' TRANSFORMERS

12 for $1.95

Assortment contains 142.5 Kc., 243.5 Kc., 455 Kc., 10.7 Mc. IF transformers, all new, useable. Many from nationally advertised currently manufactured receiver stock list.

RADIO KNOBS

Assortment of 25.....**$1.39**

All useful wood, bakelite and lucite radio knobs, both plain and pointer type. Assortment diameters. All have ¼" shaft dia.

25 for $1.39

DRY DISC RECTIFIERS

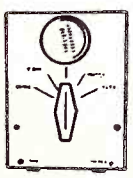
6 V. 7.5 amps BL copper sulphide rectifier **$3.75**

IS48C7 Rectifier, 24 V. output 8 amps; input 36 V.....**$9.75**

SPST CH TOGGLE SWITCH, 3 amp. 250 V. **28c**

BC-2 BIAS CELLS, packaged 10 for **50c**

JACK BOX BC-366



Contains 2-pole 5-position switch, Rheostat, 2 phone jacks, etc. In aluminum case 3¼" x 4⅜" x 2¼". Brand new **39c**

RADIO RECEIVING TUBES

Below are listed types of tubes presently in stock. All nationally advertised, unconditionally guaranteed. Price 50% off current list. Quantity purchasers write for additional discounts.

0Y4	2X2/879	6C5GT	6SK7GT	12AT6	25A6	57
0Z4	3A4	6C6	6SL7GT	12AU7	25L6GT	59
1X4A	3B7	6C8G	6ST7	12BA7	26	70L7GT
1A3	3D6	6CB6	6SU7GT	12BE6	27	76
1A5GT	3Q4	6DC	6U6G	12BF6	30	77
1B4	3Q5	6D8	6U6GT	12C8	31	78
1B5	3S4	6F5GT	6U7GT	12F5GT	32L7GT	79
1C5GT	3V4	6F8G	6V6-G/GY-/GY/G	12H6	35	80
1C6	5R4GY	6G6G		12J5GT	35/51	84/6Z4
1D8	5T4	6H6GT/G	6V7G	12J7GT	35B5	84
1F4	5W4GT	6J5GT	6W7	12K7GT	35C5	89
1G6GT/G	6A3	6J6	6X4	12K8	34	117Z3
1H5	6A4	6J8GT	6X5GT	12SF7	36	VR150
1J6G	6A6	6K6GT	6Y6	1201/7E5	37	VR105
1J6GT	6AC5GT	6K7	6Y7G	12S8GT	38	182B
1L4	6AC7	6L6G	6ZY5-G	12SC7	38A	183
1LC5	6AK5	6L7G	7A4	12SF5GT	39/44	874
1N5	6AL5	6N7G	7C4	12SF7	40	9001
1R4	6AQ5	6P5GT	7C5	12SH7	43	9002
1R5	6AT6	6Q6GT	7C7	12SL7	45	9003
1S5	6AU6	6S7G	7E6	12SN7GT	46	9004
1T5	6AV6	6S8GT	7F7	12AQ7GT	48	9005
1TV	6B8G	6SA7GT	7H7	12Z3	50A5	9006
1U5	6BA6	6SD7GT	7J7	14Q7	50	
1V	6BA7	6SF5GT	7L7	14X7	50C5	
2A4G	6BE6	6SF7	7N7	19	51	
2A6	6BG6G	6SH7	12A6	19T8	53	
2A7	6C4	6SJ7	12A8GT	22	56	

TRANSMITTING TUBES

832A	826
829	852
3C24	701A
316A	872A
304TL	813
211	10Y
860	1625

Prices upon request.

AR-1 ARGON BULB

Lots of 100 .....**15c**

2½ Watt Argon lamp, useful for nite hall lights. RF indicator or AC-DC indicator.

PRICE **15c**

In lots of 100 .....**10c**

KIT-LUMINOUS PAINT

Contains pigment, vehicle, thinner, top-coat, primer. For painting dial faces, switches, etc. for easy location in darkened room. Price per kit **$1.95**

BUSS 3AG 10 Amp. FUSES **$1.95 per 100.**

ASSORTMENT MISC. RADIO HARDWARE. 5 lb. package **$1.49**

TUBE SOCKETS

4 prong Ceramic lo-loss	10c ea.
5 prong Ceramic lo-loss	10c ea.
*Octal Ceramic lo-loss	10c ea.
*Octal Black Composition	05c ea.
Octal Wafer	10c ea.
7-pin miniature	10c ea.
Acorn	30c ea.

*No mounting rings.

Additional discount of 40% for quantities of 100 or more of any above types.

OUTPUT TRANSFORMER 39c

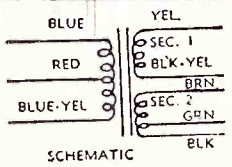
For 12,000 ohm plate to B+ single ended 7B5 or equivalnt at 10 Ma.

Sec. 200 ohm headset at 50 Milliwatts level.

Dimensions: 1-5/16"x1⅛"x1-13/16".

Vacuum impregnated with varnish.

Wire lead lengths 3½" to 9½" stripped and tinned.

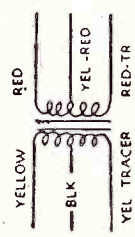


SCHEMATIC

9G1006—BRAND NEW **39c**

VIBRATOR POWER TRANSFORMER

Manufactured for Harvey-Wells for use in aircraft transmitters. These are brand new quality merchandise. Dimensions 2⅝" x 2½" x 2-3/16". Secondary consists of 3320 turns No. 34 wire center tapped. Primary 6 V. consists of 54 turns No. 16 or larger center tapped. Pri. 12 V. consists of 126 turns No. 20 or larger center tapper. Core 1" stack with electrostatic shield between windings. Will deliver 300 V. 65 Ma. with 4.6 Amp. at 6 V. input, or 1.8 Amp. at 12 V. input.



E-807S—1 12 V. .....**49c** ea.

MODULATION AND OUTPUT TRANSFORMER 50c

Transceiver transformer originally manufactured for Harvey-Wells aircraft transceivers.

Notes: Pri. 10,000 ohms P-P, push-pull 7C5's or equiv. 79 Ma.

Freq. 300-3000 CPS.

Sec. 1—6000 ohm 50 Ma. DC modulation wind.

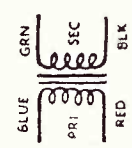
Sec. 2—200 ohm .5 Watt level tapped at 3.2 ohm 3 Watt level. Used in 3 modes of operation:

1. Pri. 2—7C5's Sec. 1 6000 ohm load Sec. 2 open.
2. Pri. 2—7C5's Sec. 1 open Sec. 2 3.2 ohm load.
3. Pri. 2—7C5's Sec. 1 open Sec. 2 200 ohm load.

Transformer vacuum impregnated with varnish.

Dimensions: 2-13/16" x 1⅝" x 1¾".

Wire leads approx. 4-6" long.



9D1003—BRAND NEW **50c**

ESSE'S GUARANTEE

If not satisfied with any equipment purchased from us—you pay transportation both ways and return within 5 days for cheerful refund.

TYPE VIII SYNCRO-MOTOR

Selsyn type motor made to operate on 50 V. 60 cycle AC. Ideal for TV beam direction indicators and rotaters. Manufactured by Diehl Mfg. Co. Moisture-proofed canned and boxed.

PRICE - $7.50 ea.

AN-80 CITIZENS BAND ANTENNA

465 Mc. Antenna designed to be used with BC-645. Use on roof-top of car. Rubber gasket for mobile mount included. Made to match RG-8U cable. 5⅛" element. Length overall 8½". Packed 2 per carton.

PRICE - $ .39 each antenna.

ESSE RADIO COMPANY

41 WEST SOUTH STREET

INDIANAPOLIS, INDIANA

TERMS:

Cash with orders for prompt delivery. Or 25% deposit with orders, balance C.O.D. No orders under $2.00 can be accepted due to these special price concessions.

Guard Your Family STRIKE BACK!

GIVE to Conquer Cancer

IF SOMEONE IN YOUR FAMILY HAD CANCER, you would do anything . . . everything that would help. And today there is so much that you can do to help. Tens of thousands of families just like yours meet cancer every year and triumph over it. But we are still losing too many men and women we love.

Doctors can now cure half of those who develop cancer if the disease is diagnosed in its early stages. Yet in 1950 some 210,000 families lost a father, a mother or a child to cancer. Many of them—probably 70,000—could have been cured.

To save more lives, we all must help.

Your gift to the Cancer Crusade will help guard your family by providing more research, more life-saving education, more training for scientists and physicians, more equipment, more services for those already striken with the disease.

Cancer is man's worst enemy. Striking back at cancer costs money. Any contribution is welcome but, the fight against this major threat deserves major support: dollars—tens—twenties—hundreds of dollars. Will *you* help?

AMERICAN CANCER SOCIETY

RADE LIT

[*from page 34*]

directions for all Du Mont Teletrons, and basing details for both electrostatic-focus and magnetic-focus types.

* * *

Permo, Incorporated, manufacturers of Fidelitone Conventional and Special Type Phonograph Needles announces their new catalog sheet, *"Fidelitone Phonograph and Needle Facts"* which supply the positive, correct answer to the oft-repeated question "What phonograph needle is used in which set?" Permo supplies the model, changer and cartridge numbers.

The radical change from a standard open chuck for one conventional type of needle to special sizes and types of chucks for special type needles imposes new problems for the trade and public. Permo, therefore, supplies tools, nuts, washers and other accessories (when and as required)) and instructions for easy home installation of Fidelitone Special Type Needles.

Free copies of "Fidelitone Phonograph and Needle Facts" will be available at Permo's Exhibit (Booth 43) at the Palmer House, Chicago, July 16th through July 19th.

* * *

Television Antennas (2nd Edition), *Howard W. Sams & Co., Inc.,* publishers. This revised Edition has been brought up-to-date to help the TV service technician keep abreast of the rapidly expanding TV installation and service problem.

Chapter headings include: Receiving Antenna Principles, Antenna Construction, Commercial Antenna Installation, and Common Installation Problems (Trouble Shooting).

The book is paper bound, contains 174 illustrations, and is priced at $2.00.

* * *

A new and interesting brochure, *"Metallized-Paper Capacitors,"* is announced by the *Aerovox Corp.,* New Bedford, Mass. The contents include: Early History (Chapter I), Manufacturing Process (Chapter II), Characteristics of Metallized-Paper Capacitors (Chapter III), P83Z "Microminiature," and Applications (Chapter IV).

For the most part the material contained in this brochure is based on papers and discussions presented at recent symposiums on metallized-paper capacitors.

* * *

"Rapid TV Trouble Shooting Method" by H. G. Cisin. Published by H. G. Cisin, 200 Clinton Street, Brooklyn 2, N. Y. Price $1.00

This book shows the television serviceman how to locate the causes of TV troubles with speed and efficiency by means of a novel method originated by the author after many years of practical trouble shooting with electronic apparatus.

Television troubles are located in this method by means of three basic steps. *No. 1* consists of recognition of the nature of the trouble through the utilization of tabulated trouble symptoms. Approximately 85 picture trouble symptoms are listed alphabetically, each being given a separate *Code* number. In like manner, 58 distinctive raster troubles and 17 sound troubles are listed and coded. By consulting these lists and combining the code numbers, a *Code Designation* is obtained which is the *Key* which tells in which of the eleven sections of the television set, the trouble will be found.

Step *No. 2* involves the application of one or more of 13 *Special Checks*

to be applied only to the particular section of the receiver known to contain the defect. Very often, it is possible by means of this step, to complete the TV servicing job in a matter of minutes instead of hours. However, many TV troubles are more intricate, in some instances arising from two or even more separate simultaneous faults. Steps *No. 3* provides detailed instructions for efficiently and rapidly locating such faults. This step shows how to analyze, sub-classify and diagnose the trouble, so that the serviceman can track down the faulty components without resorting to out-of-date methods. Step-by-Step rapid checks are described for locating over 114 different types of TV troubles. This book also contains over 69 valuable *Rapid Checks,* including various types of overall *Alignment* checks. Over 25 waveform illustrations are included in the Rapid Check section.

* * *

Sylvania Electric has announced a new vest pocket *TV Tube Selector* listing more than 100 TV picture tube types, and indexing them as to round or rectangular shape; metal or glass construction; clear, grey, aluminized or frosted face plates; and presence or absence of external conductive coating. The selector was prepared particularly for the convenience of television servicemen and dealers.

The TV tube guides are supplied by Authorized Sylvania Tube Distributors as a free service item for use by dealers and TV servicemen. It was designed to give them a quick indication of the differences between similar tube types having different suffix letters, such as, 19AP4, 19AP4A, 19AP4B, etc.

* * *

Hytron Radio and Electronics Corp., Salem, Mass., makes available a catalog sheet describing its line of servicing aids for the radio-TV technician. Listed on this sheet are: The Auto Radio Tool, The Pen Straighter, The Tube Stacker, The Soldering Aid, The Tube Lifter, and The Tube Tapper.

* * *

The Astatic Corporation, Conneaut, Ohio, has just published a new *Phono-Graph Cartridge Directory and Replacement Guide.* Printed on heavy stock to withstand repeated usage, the directory has a complete listing of cartridge models of all major cartridge manufacturers. Cartridges made by Astatic competitors are listed alphabetically and numerically, and the recommended Astatic replacement for

each is indicated.

The new Phonograph Cartridge Directory and Replacement Guide includes illustrations of all Astatic Cartridges and Needles, together with complete performance data on each. Another section carries a listing also in table form for easy, quick reference, of discontinued Astatic Cartridges and the proper, current replacements for them.

Available in quantities, the new directory may be obtained by writing The Astatic Corporation, Conneaut, Ohio, specifying form No. S-168.

* * *

The Halldorson Company, 4500 Ravenswood Avenue, Chicago 40, has recently brought out a new *catalog #19.* It lists a complete line of Radio and Television transformers. Many items are listed therein that are of interest to a wide range of industries. Among such items are Isolation, Step-down, filament and voltage-regulating transformers. A copy may be had on request.

TRADE FLASHES

[*from page 12*]

training in Du Mont sets will be given all students and there will be a number of elective courses in special subjects. Students may take any or all of the elective courses which will include adjustment procedures, alignment principles and practices, and Inputuner, receiver and installation troubleshooting practices and procedures.

Students attending the school will come from all Southwestern, Northwestern and Pacific Coast areas now serviced by television.

Mr. Schulman emphasized that the courses should not be confused with the 450 Du Mont service clinics now being held throughout the country. The De Mont school, he pointed out, will give practical courses in which students will actually handle Telesets and test equipment. The service clinics, Schulman said, are composed of various types of lectures.

Aerovox Acquires Subsidiary

Aerovox Corporation of New Bedford, Mass., announces through its president, W. Myron Owen, its acquisition of Wilkor Products, Inc., of Cleveland, O. Organized in 1945, the latter company manufacturers precision resistors of critical value to the present rearmament program as well as to instrument and precision equipment manufacturers. Under license from Western Electric, Wilkor

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produces Carbofilm resistors to an accuracy of 1% tolerance, as well as Corohm wire-wound precision resistors to 2.5% tolerance.

Hutmacher New Permoflux Salesmanger

Appointment of Ray R. Hutmacher as sales manager of the Jobber Division, Permoflux Corporation, has been announced by R. S. Fenton, vice-president and general sales manager.

New Radio-TV Guild

A new Radio-TV technicians' organization was formed in Bristol County, in the Commonwealth of Massachusetts. The name of this organization is the Radio and Television Guild. Its primary aims are to promote good fellowship educational programs for its members. Its By-Laws were taken from the Chicago Radio-TV Guild.

Officers elected are as follows:

President .....Mr. Charles Boitano.
1st, Vice President.....
Mr. Alfred A.F. Feisal.
2nd, Vice President .....
Mr. Donald Burke.
Secretary .....Mr. Maurice Prevost
Treasurer .....Mr. Arthur Sullivan
Publicity .....Mr. Harvey Fortier
Sgt. At Arms .....Mr. George Cote
Chaplain ....Mr. Norman Patenaude

P. R. S. M. A. Hears Sprague Engineer

The last open meeting of P.R.S. M.A. was held at KYW Studio 'A' Tuesday, May 1st, 1951, and P.R.S. M.A. presented The Sprague Products Co. of North Adams, Mass., who had as their speaker for the evening, Leon Podolsky, Manager of Field engineering, who gave a very interesting lecture on "Capacitors for TV Circuits."

Burgess Battery Displays

Colorful window streamers, counter and window display cards and envelope enclosures to tie the dealer in with a terrific national advertising campaign are the center of attention for the 1951 Burgess Battery Company portable radio battery promotion.

The familiar red-headed zebra shouts for attention on colorful yellow, red, black and white display material. Burgess emphasizes longer listening pleasure through the use of the exclusive chrome protection which curbs interior action in the battery when the radio is not in use.

REARMAMENT

[*from page 28*]

program. I refer to the engineers and trained technicians of our industry without whom neither our great production nor our famed technical advances would have been possible.

When a radio-television plant is forced to curtail its production, its skilled manpower is apt to be lost to the industry. The New York Times recently quoted a prominent aircraft producer as saying "The electronic engineer or technician is one of the most sought-after workers in the United States. Thank God for the television industry! It has trained many men who will wind up in airplane plants."

While I do not wish to under-rate the essentiality of aircraft in our rearmament program, I cannot avoid being alarmed at such a statement. Even an aircraft manufacturer will admit, I believe, that electronics equipment in military aviation today is equally important to frame and engine construction.

The RTMA recently appealed to the Senate and House Armed Services Committees to make legislative provision for a Reserves Specialist Training Corps, because of our anxiety that the electronics industry, along with other industries in which technical training is essential, would

suffer from short-sighted draft policies.

One authoritative observer said a few days ago that the serious shortage today of scientists, engineers and technically trained personnel is partially the result of mistaken draft policies in World War II. He cited Government statistics indicating that there are only about 575,000 engineers and scientists in the nation, and less than ten per cent of these hold doctorate degrees. I believe we are warranted in saying that despite the obvious lessons of World War II, the Government as a whole gives no indication that it will carry out a draft deferment and training program designed to avoid the mistakes of World War II.

While I realize that the military services also need qualified radio engineers, I need not point out to this group that wars today are won in industrial plants just as much as on the battlefields.

Also, the engineering content of military electronics equipment is at least two or three times as high as civilian equipment. And I must point out that the extensive use of competitive bids ties up our already very limited engineering personnel through a serious duplication of effort within the industry.

There is some slight indication that the Government is beginning to recognize the necessity of conserving our scarce engineering manpower. For example, we learned only this week that the Air Navigation Development Board intends to defer certain long-range research and development programs because of the shortage of electronics engineers and technicians during the rearmament program.

Perhaps an ideal balancing of the civilian and military economy is impossible in such times as these or at any time. Dislocations seem inevitable in periods of national emergency, but they can be alleviated by long-range planning. Such planning is needed today in both military and industrial circles.

An encouraging move in this direction is the recent establishment by General William H. Harrison, as Defense Production Administrator, of an Electronics Production Board. This board should do much to bring about better coordination in the activities of the various agencies concerned with electronics production, and to implement the development of policies which will strengthen the industry's military potential.

One fact, I'm sure, is apparent to all Government agencies; that we must have a healthy and robust civilian industry if we are to have a strong and well-prepared military machine when it is needed.

This dual objective can be obtained, I believe, if present orders are spread throughout the industry to the fullest extent possible, both in prime and subcontracts, and if sufficient materials are made available for civilian use to enable manufacturers to maintain their production facilities and their skilled manpower.

I also believe that Government agencies charged with administering controls on our civilian economy should weigh the possible disastrous effects of too stringent curbs on credit and spending. I fully realize the dangers of inflation, but in fields where shortages have ceased to exist there is little need for restricting purchases.

There is an additional argument for encouraging, rather than hampering, the sales of both television and radio receivers. That is their recognized value as the most effective media for transmission of Governmental information and for civil defense. I doubt that there is any other manufactured

product which has such a practical value to the Government as well as to the public.

Perhaps this emphasis of the needs of the electronics industry may seem to be an appeal for special treatment. It definitely is not. All we ask is that the industry be left unhampered by unrealistic controls and strengthened by sound policies in military procurement. I assure you that on this basis the electronics industry can take care of itself and will build up its capacity in a way that will strengthen both the civilian economy and the military potential of our great nation.

TAPE RECORDERS

[*from page 18*]

be run for 10 minutes with the brakes ON so to wear in the graphite.

Lubrication

In some Ampex models, the synchronous capstan-drive motor has sleeve bearings in which case SAE #30 oil is required every three months. If the motor has a sealed ball bearing no lubrication service is required. The upper bearing on the capstan shaft is a precision bronze sleeve bearing requiring SAE #30 motor oil every six months. To oil this upper capstan-shaft bearing, loosen the setscrew in the dust cap surrounding the capstan shaft just below the tape contact point. Push the idler wheel away from the shaft just enough to allow the cap to be removed. Remove a felt washer covering the oil hole and apply oil through the larger of two holes beneath the washer until no more oil will enter. In general, one drop of oil should be applied to all bearing surfaces every six months. Great care must be taken that no oil is ever allowed to contact any rubber surfaces such as capstan idler and flywheel.

To reach the upper bearing in the Ampex Console model, use a pump-type can with a flexible spout or attach a piece of spaghetti to the end of the spout. For lubrication of the portable models it is necessary to unbolt the top plate and tip it up by raising the right hand corner while facing the front of the machine. Grasp the holddown knob on the take-up motor spindle to serve as a means for lifting the top plate. A few inches of clearance will clear the bearing for lubrication.

Head Alignment

The physical alignment of the record and playback heads is accomplished through application of a ½" spintite socket wrench to the left hand elastic stop nut in each head. Play back a standard 15,000 cps tape and adjust the playback head back and forth until the proper aximuth is indicated by maximum response. Next the record head is aligned with the playback head by recording 15,000 cps on a blank tape and adjusting the record head for maximum playback output. The triple head assembly is a plug-in unit hence readily replaceable.

Head Magnetization

Magnetic heads often become magnetized through electrical faults or contact with magnetized objects. Magnetization will occur when a sufficiently high signal saturates the recording amplifier or pulses cause an unbalance to traverse the head windings. The manufacturer of Ampex machines warns the operator not to depress the Record button until after the Start button is depressed. Thereby the transient caused by switching control circuits is allowed to die out before the record head is connected. As heads become magnetized the noise level of the finished record rises. A saturated amplifier may introduce a signal 10 db in excess of that neces-

sary to saturate a tape.

The first basic requirement for a quiet tape record is that the heads be unmagnetized. Demagnetization is discussed under that heading in another section.

CALIBRATING TV GEN.

[*from page 16*]

5. Observe and record dial inaccuracy and make due consideration when setting marker generator on a specific frequency.

A good idea is to arrange test equipment so that frequency checks can be made easily each time equipment is used. The assured accuracy achieved by this procedure will save many servicing man hours.

6. So far as marker calibration is concerned two crystals could be chosen—one at each end of the i-f response spectrum. For example, 21.25 mc and 25.75 mc crystals could be used. They could serve as calibration crystals as well as carrier markers for i-f alignment of certain receivers.

7. A sweep signal generator can also be calibrated by applying its output along with that of a crystal oscillator to the vertical input of the oscilloscope. Set the sweep width for a moderate deviation and again adjust sensitivity of scope and output of generators to maximum. When checking sweep signal generator against a high order harmonic of the crystal a strong beat is not obtained. Instead, as the center frequency of the sweep is brought near the harmonic of the crystal a group of sine-waves will appear on the oscilloscope screen. These sine-waves seem to have a lower and lower frequency as they near the center of the beat pattern. This lowest frequency sine-wave at the center is the *beat point* and when the beat point is centered on the scope trace as shown in *Fig. 5B*, the center frequency of the generator matches the harmonic of the crystal frequency. A stronger beat pattern can be obtained by using a crystal probe with the oscilloscope.

Use of Commercial Calibrators

Many excellent sweep generators combined with internal variable marker oscillators are available which have jacks on the front panel for plugging in crystals. The jack connects the crystal to a separate crystal oscillator circuit so that accurate marker pips may be available during alignment as well as providing for calibration of the variable frequency oscillator. These can also be used to calibrate the older type markers which

have no provision for crystal insertion by following the procedures detailed earlier.

If your service shop has the older type marker generator it would be highly important that you check its accuracy periodically against the crystal type mentioned above. If such a unit cannot be borrowed for this purpose a replacement of the older type for a purchase of the crystal kind will more than make up for its cost in the busy shop because of the time saved when working with accurate gear.

Besides using an oscilloscope, calibration can also be achieved by the audible zero-beat method. One unit, specifically designed for this purpose, is the RCA WR-39B Television Calibrator. This unit (shown in *Fig. 6*) is not a sweep generator, but is primarily intended for use as a marker or as a marker calibrator. It has a variable frequency oscillator, two crystal oscillator circuits, a detector, and two stages of audio amplification feeding a small speaker. One crystal oscillator contains a 2.5 mc crystal, and the other crystal oscillator circuit has a switch to select either a .25 mc crystal or a 4.5 crystal.

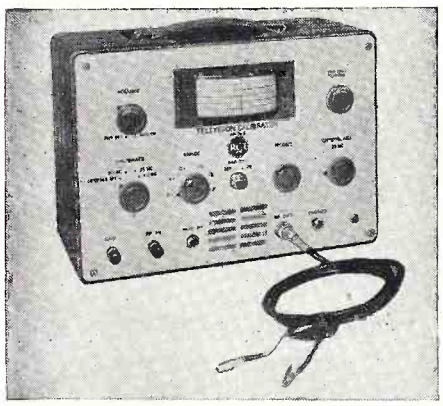

Fig. 6. R.C.A. WR-39B Television Calibrator

The 2.5 mc crystal is the standard and the .25 mc crystal is tunable over a small range by a front panel adjustment. This permits zero-beating the tenth harmonic of the .25 crystal with the 2.5 mc standard. After calibration of one crystal with another, the relatively weak harmonics of the .25 crystal are changed to audible beat notes by *modulating* the 2.5 crystal and its harmonics with the .25 crystal and *its* harmonics. Thus sideband components are produced .25 mc apart which are of greater relative strength than could be procured from the weaker .25 crystal harmonics.

For calibration of other signal generators the detector circuit of the

Calibrator heterodynes the 2.5 mc crystal circuit internally with any marker generator signal applied to the RF input jack and ground terminal. The internal variable sweep oscillator is turned off, and as the external marker generator which is to be calibrated is tuned near the crystal frequency (or harmonics) audible beat notes are produced from the loudspeaker. Thus, precise zero beating permits accurate adjustment of the external generator. An earphone jack is provided for better evaluation of zero beat tones, and a volume control permits adjustment of speaker output.

The modulation of the 2.5 crystal with the .25 crystal is secured with the crystal selector switch on the .25 mc setting. The 4.5 mc crystal circuit is not used for calibrating purposes, but is intended to provide marker pips of this frequency by modulating the variable frequency oscillator of the Calibrator.

AD INDEX

MERIT

Merit TV full-line* Components For Conversion or Replacement

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THE QUALITY OF RCA TUBES IS UNQUESTIONED

Life expectancy... plus!

RCA kinescopes incorporate the experience of the 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 4½ 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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