JANUARY, 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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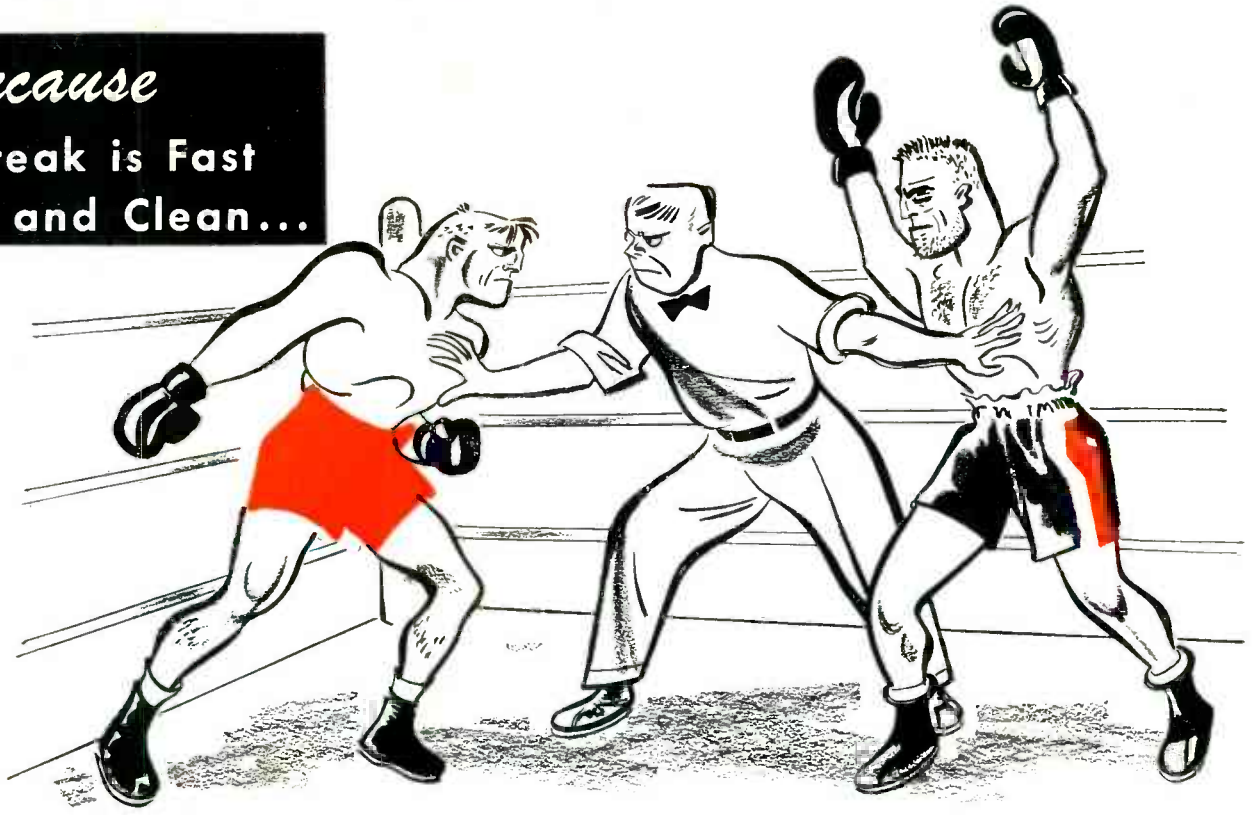

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RADIO BATTERIES **HARRISON, N. J.**

EDITORIAL
by S. R. COWAN

Battery Sets & Batteries MUST Be Made

Torrential rains, hurricane winds, and an extremely heavy snowfall plagued most of the key cities in the Eastern part of the nation late last November. Consequently millions of homes were, for varying periods, completely isolated and without means of communication as telephone and power lines failed.

Several major broadcast stations became silent, some because of toppled radiators, others due to loss of power. Many newspapers were not published; and some that were could not be delivered. For modern times it was a period of unparalleled void in news dissemination. To many millions of people only three means of communications were open: 1) radio on amateur frequencies; 2) radio via sets in autos, and; 3) radio via battery operation (from the BC stations still operating).

We, meaning all of us, — politicians, the military services, radio manufacturers, dealers and just ordinary taxpayers — must without fail take heed and learn a lesson from the emergency conditions that prevailed. And we must accordingly act to eliminate our short-comings should another emergency arise. For example, we should have learned that from now on every home in our country must have in it at all times at least one battery operated radio receiver that is always in operable condition.

Had an A-Bomb struck our key cities instead of the November storms the death toll would have geen greater. But there would not have been a greater stoppage of communications. Radio stations learned their lesson. They, who had none, have purchased gas-powered emergency auxiliary power supplies, so power line failure won't completely incapacitate them again. Now its the public's duty to provide for itself radios that need not depend solely upon utilities to be operable.

So, regardless of any curtailments that may become necessary, even because of a Presidential declaration of national emergency, the fact remains that battery operated receivers must be made in sufficient quantities so that every home not having one now can obtain one — and furthermore, there must be made available a steady supply of batteries to keep these sets in usable condition. If you agree with this contention do something about it! — Tell your customers and urge them to write to General Harrison . . . suggesting that he too recognize the seriousness of the situation, and act accordingly.

TV and the FCC

Some educational institutions are asking, at Washington, that the Federal Communications Committee reserve at least one V.H.F. channel in every metropolitan center for non-commercial educational use of television. To this we heartly subscribe. we also urge FCC to hurry up with the "green light" on stations having TV CP applications pending.

Sanford R. Cowan
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TRADE FLASHES

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

Receiver Production For First 11 Months

Television receiver production in eleven months of 1950 aggregated 6,529,615 sets, according to preliminary industry estimates released recently by the Radio-Television Manufacturers Association. RTMA's estimates represent production by member and non-member companies.

November radio and television production each dropped eight percent below the previous month's output. TV sets produced in November numbered 752,005 units and radio receiver production amounted to 1,304,094, RTMA estimated. Radio receivers, including home sets, auto and portables, manufactured in the 11-month period totalled 12,785,917.

2nd Annual Southwestern Electronics Conference

Historic Fort Clark on the Texas border, once the refuge of warriors, today a western luxury ranch spiced with the color and romance of Old Mexico, will be the setting when approximately 300 manufacturers and distributors attend the 2nd Annual Southwestern Electronics Conference, January 24-January 27, at Brackettville, Texas. The conference is sponsored again this year by the Southwestern Chapter of "The Representatives" of Radio Parts Manufacturers, Inc.

RCA Antenaplex System

Individual high-gain radio-frequency amplifiers, each designed and tuned for a specified local television channel, are featured in RCA's new Type SX-8B Television Antenaplex System, it is disclosed in a description of the equipment just released by the manufacturer.

The new and improved multiple-outlet TV antenna system, initial units of which have already been installed in New York, Philadelphia, Chicago, Detroit and other large cities is capable of furnishing high-quality picture reception at as many as 350 outlets simultaneously with a

single amplifier assembly in use, according to the Sound Products Section of the RCA Engineering Products Department. When additional amplifier assemblies are used, the system will provide service for much larger numbers of wall outlets.

Ray Simpson Becomes "Great Eagle"

Warriers, "Bright Water" and "Fleet Arrow" watch Ray Simpson of the Simpson Electric Company, do part of his tribal initiation duties on the lawn of the Simpson home at Lac de Flambeau, Wisconsin. This ceremony officially entered Ray Simpson into the tribe as an honorary Chieftan. His Indian name is "Me-gese" or "Great Eagle". It took place during the recent Simpson Sales Conference which lasted for three days Sept. 25-26-27. The Simpson Factory at Lac du Flambeau employs approximately 400 of the tribe, which previous to erection of the factory four years ago, were nearly destitute. This was their way of saying "thankyou" to Ray.

Skiatron Subscriber-Vision Given Inaugural Tests

New Yorkers and all those within a 60-mile radius of WOR-TV are being given their first view of box-office television with the inauguration of test broadcasts of Subscriber-Vision, a revolutionary system of home box-office TV.

This patented pay-as-you-see system, developed by the Skiatron Electronics & Television Corporation, marked the debut of the only subscription TV method whose programs are transmitted *entirely over the air, without the use of telephone* lines. In accordance with Federal Communications Commission authorization, the tests of approximately one hour duration will appear on Channel 9, WOR-TV every night immediately

after WOR-TV concludes program transmission, under call letters KE-2XXC especially assigned by FCC, during the 30-day period specified by the Commission.

Lewis & Kaufman Acquires Taylor Tubes Inc.

Jack Kaufman, President of Lewis & Kaufman, Inc., west coast electron tube manufacturing company, has announced that a group headed by him has purchased the entire capital stock of Taylor Tubes, Inc., pioneer Chicago manufacturer of transmitting, industrial and television tubes.

Philco Acquires New Site

A subsidiary of Philco Corporation, Lansdale Tube Company, with its main plant and laboratories in Landsdale, Pa., has purchased a site at Frederick Maryland for a new plant for the manufacture of critically short electronic tubes for the Armed Forces and essential civilian requirements, it was announced by William Balderston, president of Philco.

North American Philips Announces New Receivers

Two complete. compact, self-contained, low-cost television receivers, one producing a picture 30" high and 40" wide, and the other a 21" x 28" picture, have been developed by North American Philips Company, Inc., New York, for use in hotels, clubs, bars, restaurants, schools, institutions, department stores, super-markets and similar locations. Both can be controlled from distances up to 150 feet by a remote tuner measuring 8" x 16" x 10½".

DuMont Requires Contract Service Dealers to Maintain Escrow Accounts

To protect owners of Du Mont television sets from financial failure of service organizations with which the set owners have service contracts, Allen B. Du Mont Laboratories, Inc., announced recently that its authorized service organizations and authorized servicing dealers will in the future be required to maintain escrow accounts in banks to cover every contract customer.

1951 Parts Distributor Show Sellout Indicated

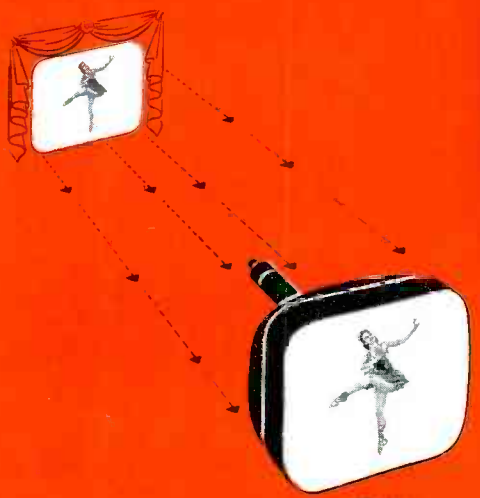
On the basis of reservations received to date for the 1951 Parts Distributors Show here in May, another sell-out of booth and display space is in prospect very shortly.

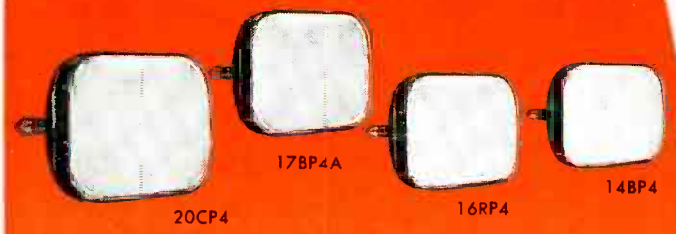
RCA Exec Predicts Black & White TV For Long Time

Black and white television will remain the backbone of the industry for some years to come, with continued

[*Continued on page 42*]

WHAT YOU GAIN WHEN YOU BUY...





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3. **You get A COMPLETE LINE.** Hytron offers you 14-, 16-, 17-, and 20-inch *studio-matched* rectangulars. All the popular rectangulars (and the popular types of round tubes too).

4. **You get THE QUALITY LEADERS DEMAND.** Nine out of ten leading TV set makers choose Hytron. More and more leading service-dealers pick Hytron. Because their own experience proves Hytron *studio-matched* rectangulars give "amazingly clearer, sharper, more brilliant pictures." Demand this same performance for yourself. Demand original Hytron *studio-matched* rectangulars.

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The great Nation-wide TV show, "Beat the Clock," featuring Bud Collyer over CBS-TV, will go to bat for your service and the Sylvania products which you sell. Clever animated cartoon commercials on the CBS-TV station in your area will inform prospects of your expert workmanship and prompt service.

DEALER TIE-IN PROGRAM

"Service business is booming . . . tie-in with Sylvania's national advertising and get a bigger share!"

Tying everything together is the greatest and most colorful dealer tie-in program you have ever seen!

You get FREE giant, full-color displays of the featured stars. You get counter cards . . . bright window streamers . . . spot radio announcements . . . mailing pieces . . . all designed to identify you as the Sylvania Service Dealer advertised on television and in the national magazines.

Ask your jobber for full information about the bigger-than-ever 1951 Service Dealer Advertising Program. If he can't give you all the facts, mail the coupon now!

RADIO TELEVISION SERVICE
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Authorized Dealer

Be sure to display this emblem. Put up these Sylvania decals right now! This seal is the target of the whole Sylvania Service Dealer campaign. Put them on your windows and on your trucks. Made in 8-inch and 12-inch sizes. Order a supply from your jobber TODAY! They're free!

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SYNC PULSES

by San D'Arcy

IN RETROSPECT 1950 was a banner year for most Service Dealers and technicians and despite the fact that all-out war effort is demanded of us and our suppliers for 1951 (at least) the prospects are exceedingly bright. Top radio-TV manufacturers, discounting the knowledge that upwards of $5 billions of Government commitments for electronic components and equipment are about to be issued, concur that during 1951 it probably will be possible to manufacture almost 5 million TVsets, 10 million home and 5 million auto radios. There will be shortages in all catagories, and of 3-speed record-players in particular. Regretably, trends of black-marketing are already apparent in most of the radio and TV "name brand" lines, and things will get worse before they get better.

It is axiomatic that when new equipment is not easily obtainable, or when merchandise is overpriced, the public endeavors to keep in useable condition those appliances which it already owns. In this regard the servicing profession must take a leaf from its book of 1942-45 experiences and be prepared to do an abnormal amount of repair and maintenance work especially by means of "substitution methods". Complexity of present-day circuits will make our jobs more difficult than would ordinarily be the case . . . but, it is possible for the Nation's servicing fraternity to keep in operable condition all the receivers now in use if "reasonable quantities" of certain components and tubes and test instruments are made available. Approachment to RTMA in this regard has already been made by the Publisher of "Service Dealer" on behalf of the Nation's technicians.

CHARLES E. WILSON, DDM. When Mr. Truman appointed General Electric Company's former president, Mr. Charles E. Wilson, to assume the duties of Director of Office of Defense Mobilization — the biggest, most important and most difficult assignment ever relegated to one man in history — it was a stroke of genius, and if Mr. Truman's name is recorded by posterity, it will be for that one, sound selection. Americans, and people in all freedom-loving lands, are again

[*Continued on page 46*]

How De-Coupling Networks Operate

by J. Jacobson
(Instructor, Delehanty Institute)

De-coupling networks are used in almost every circuit where the possibility of feedback from a common impedance is present. This article gives a step by step analysis of what happens to a signal in a typical circuit and how de-coupling networks prevent feedback effects.

ONE of the defects, responsible for regeneration in multi-stage amplifiers, is a faulty de-coupling network. The symptom is usually oscillation and howling in audio amplifiers, and erratic operation, inability to align, and oscillation in r-f or i-f amplifiers. A knowledge of the operation of decoupling filters will aid the technician in recognizing the symtoms, and also enable him to calculate the correct value of condenser and resistor when replacing missing components.

Basic De-Coupler

Figure 1 shows a simple de-coupling unit consisting of R and C. Four terminals are shown, *a* and *b* being input, and *c* and *d* being output. An a-c potential of 10 volts is impressed across the input terminals. The frequency is 1000 cycles. The value of *R* is 30,000 ohms and the capacity of the condenser is .05 μf. The capacitive reactance of the condenser is found to be about 3000 ohms, using the formula:

$$X_c = \frac{1}{2 \text{ pi F C}}$$

Therefore, it may be seen that our network is essentially a voltage divider, and the larger portion of the applied voltage appears across the resistor, with very little voltage appearing across the output terminals. The basic function of a de-coupling network is to do just that; to prevent an unwanted a-c component, which is impressed across the input terminals, from appearing across the output terminals, Of course, if the wrong value of *C* were chosen in *Fig. 1,* say .0005 μf, then practically all of the applied voltage would be across *C,* as:

X_c = 3 megohms at 1000 cycles.

Or similarly if *R* were not proportioned correctly to *C,* with *R* being too large, the applied voltage would appear across the output terminals.

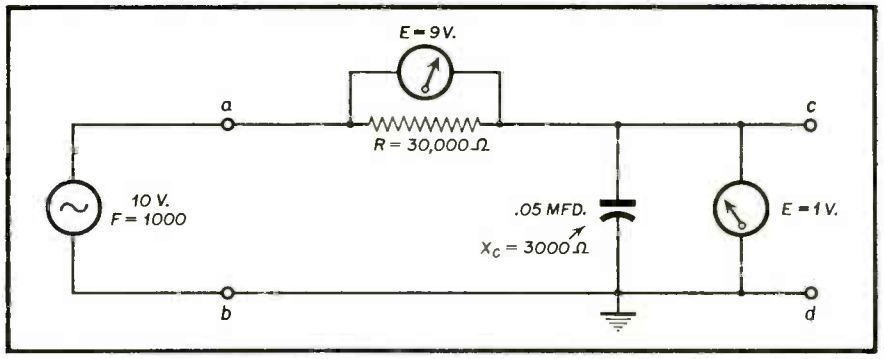

Fig. 1. Basic de-coupling circuit.

Why De-Coupling is Needed

In order to understand the need for de-coupling in amplifiers, two important points concerning the operation of amplifiers should be known:

(a) the impedance of the power supply feeding the amplifier.

(b) the phase relationship of voltage and current in an amplifier.

Power Supply Impedance

Figure 2 shows a typical power supply consisting of a full wave rectifier with a single section condenser input filter. This type of power supply will be found in the majority of receivers and audio amplifiers in use today. A d-c voltmeter and milliameter may be seen to be measuring the output voltage and current with no load on the power supply, with the exception of the bleeder resistor. The values are 375 volts and 25 milliamperes. Switch "S" connects a load resistor R_1 across the output of the power supply and the voltage and current values are now 280 volts at 150 milliamperes. Thus, it may be seen that the voltage, in dropping under loaded conditions, caused the power supply to act as though an impedance was inserted every time "S" was closed. The value of the power supply impedance may readily be found by dividing the *change* in voltage by the *change* in current. Thus,

$$Z = \frac{375\text{-}280}{.150\text{-}.025} = \frac{95}{.125} = 760 \text{ ohms.}$$

The impedance is actually the effective resistance of the choke, rectifier tube, and transformer winding connected in series. The presence of the first filter condenser also contributes to the value of the impedance.

The Impedance is "Common"

When a power supply of this type is called upon to supply plate voltages to a multi-stage amplifier, this series

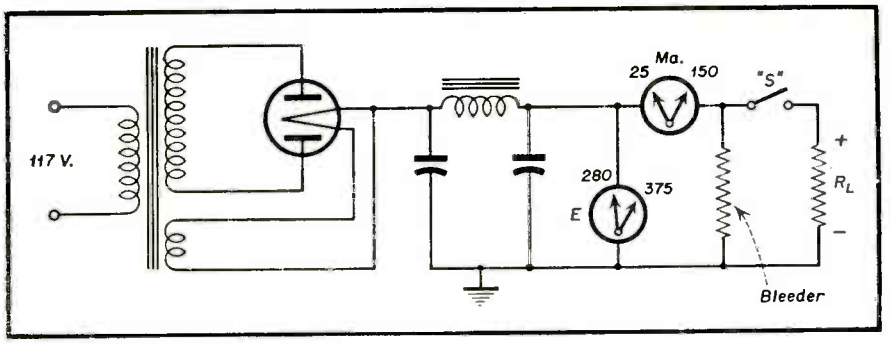

Fig. 2. Typical power supply circuit.

impedance will be common to all of the stages. In other words, current flow to all of the individual tubes will have to pass through this common impedance. Therefore assuming a three stage audio amplifier, the separate stages will have a common coupling impedance between them, which, it will be shown, will have a detrimental effect upon the operation of the amplifier; as if a feedback voltage were purposely allowed to exist between the output and input stages.

Phase Relationship in an Amplifier

Figure 3 shows a three stage amplifier using a conventional resistance coupled amplifier circuit. It may be seen that the power supply, previously discussed, is supplying plate voltage to all three tubes. Assume that a peak sine wave voltage of .0187 volts a.c. is impressed across *R*. The polarity of the grid in relation to the cathode at a given instant is considered negative. The instantaneous phase relationship of plate voltages, plate currents, and signal voltages may be seen at a glance, by the 10 meters indicated in the circuit diagram. It can be seen that the 6F5 plate voltage, and the plate voltage of the 6V6 output tubes are in phase. Precautions should be taken therefore to prevent any of the output signal voltage, present in the 6V6 plate circuit, from feeding back to any in-phase voltage point of the input signal circuit. It will be recalled from basic circuit theory, that an oscillator operates on the basis of an amplifier voltage that is developed in the plate circuit of a tube and fed back in the same phase to its grid. This of course must be guarded against in the amplifier circuit of *Fig. 3* to prevent it from oscillating.

Amplification and Phase

When the relatively small signal voltage of .0187 peak volts is applied to the 6F5 grid, the plate current falls. The voltage across *R1*, the plate load resistor, rises to a value of .75 volts higher than when no signal appeared on the grid. This is due to a voltage gain of 80 which appears across both the two equal resistors, *R1* and *R2*. Thus a signal voltage of .75 peak volts appears across *R2*. The phase of the voltage therefore on the grid of the 6C5 is now positive, due to the 180° phase shift of the 6F5 tube. The 6C5 stage, having a voltage gain of 16, amplifies the .75 volt signal on its grid, and therefore a peak voltage of 10.8 volts appears across *R3*. However, the voltage has again been reversed in phase, and now appears as a 10.8 volt decrease across *R3*. The voltage across *R4*, being in parallel across *R3*, is now a 10.8 peak at a negative phase. The voltage gain of the 6V6 stage is 20 and therefore the peak voltage across Z, the impedance of the primary of the output transformer is 216 volts in a positive phase. The current in the 6V6 plate circuit equals 43.2 milliamps at this same instant and may be seen to be 180° out of phase with the primary voltage.

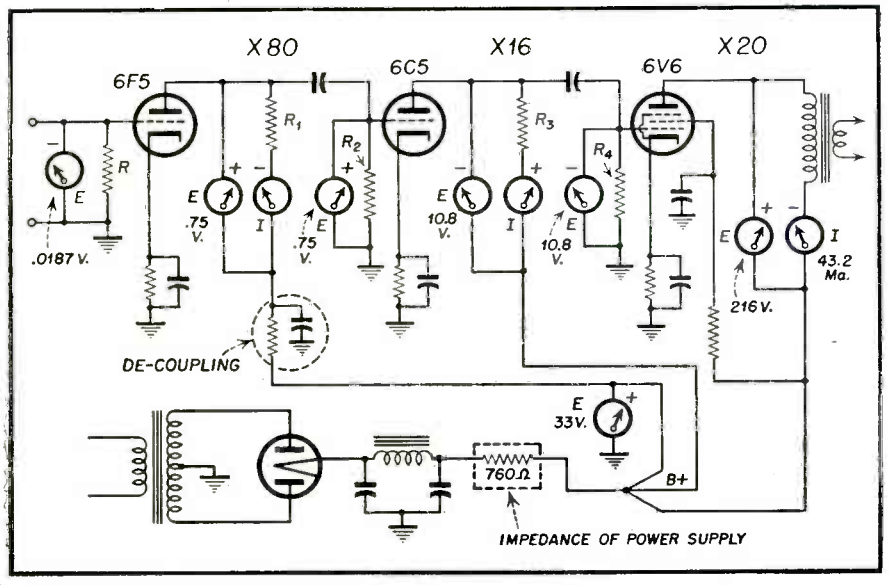

Fig. 3. 3-Stage amplifier using conventional resistance-coupled amplifier circuit, and showing feedback path.

Feedback Due to Power Supply Impedance

Note that at this instant, the 6V6 plate current is in a negative phase and is decreasing. Also note the fact that *due to the internal impedance of the power supply* a decrease in plate current that is now occurring in the plate circuit of the 6V6 tube, is accompanied by an increase in supply voltage. The value of increase of plate supply volts equals 33 volts, as $E = I \times Z = .0432 \times 760 = 33$ volts. It is this increase in plate supply voltage to the 6F5 tube at this instant that will result in oscillation. The increase of plate voltage occurs at the same time as the increase due to normal amplification of the 6F5 stage. However the increase of plate voltage due to normal amplification only called for .75 volt as may be seen in *Fig. 4*. The 6F5 stage however at this instant, with the help of the other two stages, actually amplified the .0187 input voltage 44 times greater than the gain of 80 called for. In other words, instead of a .75 volt increase appearing across *R1* due to normal amplification, actually an increase of 33 volts occurs. This same action repeats and builds up until the circuit goes into oscillation.

How The De-Coupling Network Operates

It may be seen that some means must be taken to prevent this instantaneous change in power supply voltage from increasing the plate supply voltage of the 6F5 tube. This may be accomplished with the use of a de-coupling network. Referring back to *Fig. 1* shows that in order for a de-

[*Continued on page 55*]

THE LAST WORD IN TV 'TENNA INSTALLATIONS

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AUTHORITATIVE
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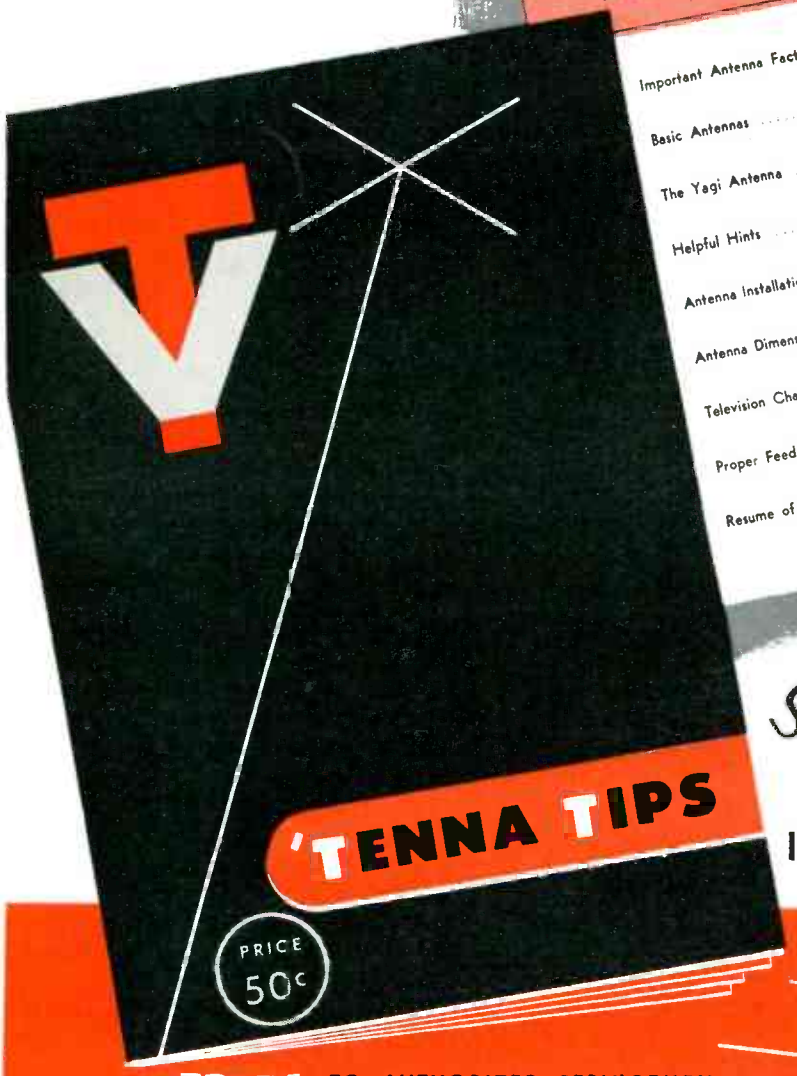

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The CBS FIELD SEQUENTIAL COLOR SYSTEM

Part 1

By Edward M. Noll

In this article, the first in the series on the CBS Color System, the author explains the basic operating principles of this method of color reception. These principles refer to the physiological aspects of color viewing, the scanning sequence, and the frequency requirements. Explained also, in block diagram form, is the system used in the color disc and motor assembly.

THE CBS color system is a field sequential one as compared to the line or dot sequential methods used by CTI and RCA respectively. In the CBS system a different color is transmitted during each field in the order red, blue, and green. See *Fig. 1.* In the CTI system, a new color is conveyed each line; in the RCA system, a new color during each dot element along the line. It is apparent immediately that the rate of color interruption is much faster for line and dot sequential color systems. In fact, the rate of color interruption is so fast that no mechanical means of color interruption is practical. Instead, color interruption must be electronic —at 15,750 times per second for CTI; 10.74 million times per second for RCA. With the CBS system using a much slower rate of color change, color interruption *can be electronic* or a *less expensive mechanical* interruption method.

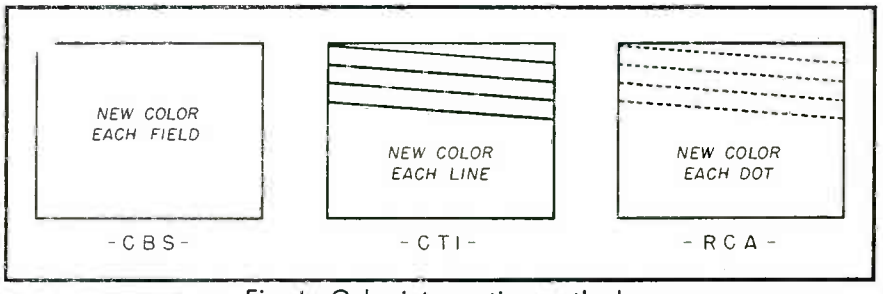


Fig. 1. Color interruption methods.

Basic Operation - - CBS

In the CBS system, *Fig. 2,* an image is evaluated in terms of three basic colors red, blue, and green. This does not limit our color picture to three colors, because it is a fact that our secondary colors can be duplicated with proper relative levels of two or three basic colors. In fact apparent white light is produced when essentially equal levels of red, blue and green are transmitted.

Light reflected from a color scene is evaluated in terms of three basic colors by a color filter that rotates in front of an image orthicon camera tube (same type used in black-white transmission) allowing passage of three basic colors in regular sequence. Thus, field after field, the sensitive surface of the image orthicon is excited by light coming through filters. Each filter allowing light of only one color to pass for each field. Signal variations are formed for each field according to intensity variations along the lines of the image for the color of the specific filter in position. In three fields a set of variations is formed for each color.

At the receiver, the signal is applied to the grid of picture tube, being reproduced as a black-white or monochrome picture on the fluorescent screen (signal variations change beam intensity). However, if this black-white picture is observed through a rotating color filter (moving in synchronism with camera filters) a color picture is reproduced.

For example if signal variations for a complete field representing red intensity changes at the camera are applied to the grid of the receiver picture tube the fluorescent screen will light up (in black-white) according to these variations. Now if the same screen is observed through a red filter the same intensity variations are observed as changes in red. In successive sequence, blue and green images are reproduced at a rapid rate, superimposing on each other to form our color picture (aided by human persistence of vision). If a yellow object is televised at the camera, light is passed to the camera tube at almost equal levels during red and green fields; and none, during the blue field. At the receiver, therefore, a succession of red and green images are formed that blend together to form a visual yellow.

CBS Color Standards

It requires six fields to transmit a complete color picture. We might first assume only three fields are needed — one per color. However it is standard practice to use 2 to 1 interlace and, to form a complete color picture, each line must of necessity be scanned in each basic color

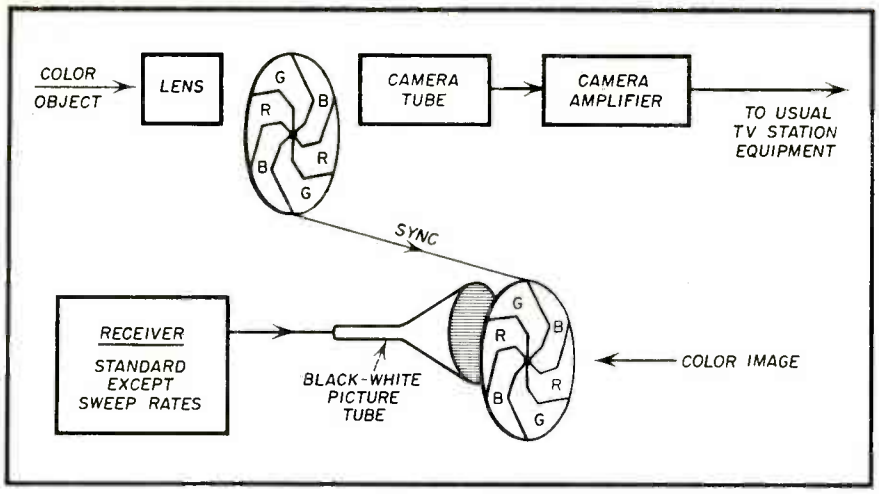


Fig. 2. Block plan of CBS system.

as shown in *Fig. 3*. Field scanning sequence is as follows — red, odd lines - blue, even lines - green, odd lines - red, even lines - blue, odd lines - green, even lines. These six fields comprise a complete color picture. The field rate of the CBS color system is 144 per second, requiring two fields to scan a complete raster but six fields to scan a complete color picture — each line in each color. The color picture rate is 144/6 or 24 color pictures per second.

It was found necessary to increase the field scanning rate to minimize flicker. For example if it is required to transmit a solid basic color such as red, only one of each three fields excites the camera tube and illuminates the fluorescent screen at the receiver. Thus, the screen is in darkness for a greater length of time than it is illuminated and, is only illuminated every third field. To minimize flicker under these conditions (too few interruptions and too long an interruption period), it was necessary to step up the field rate to 144 interruptions per second.

Of course with more fields there must be an increase in the number of lines transmitted per second to retain a suitable number of lines per frame. Horizontal line rate of the CBS system is 29,160 per second, which amounts to 405 lines per frame. Fewer horizontal lines means some vertical resolution must be sacrificed. However, the presence of color in a picture enhances its clarity and appearance so that the loss of resolution goes unnoticed. A black-white presentation of the CBS color signal shows an obvious loss in vertical resolution.

An increase in the line and field rates of a television system steps up the scanning velocity and thereby limits the horizontal resolution to a lower value when the signal must be confined in a six megacycle channel. With dot sampling, referred to as horizontal interlace, this loss is substantially recovered. In fact using dot sampling, horizontal resolution can possibly be made superior to that of a dot sequential color system because the sampling process does not have to contend with color interruption (perfect registration), and mixed highs.

In summary the CBS standards are as follows:

	CBS	MONOCHROME
Color Picture Rate	24	—
Field Rate	144	60
Frame Rate	72	30
Color Picture Rate	24	—
Lines/Frame	405	525
Line Rate	29,160	15,750
Color Sequence	R-B-G-	—

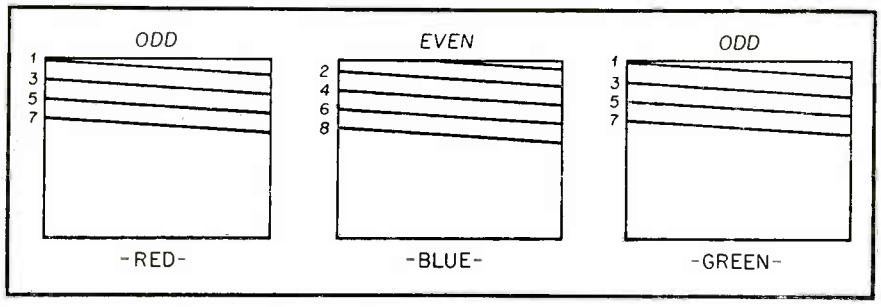


Fig. 3. CBS field sequential color interruption.

Color Disc and Motor Assembly

A field sequential system using a color disc is practical (direct-view) up to and including a 12½" tube. The size of the color disc is approximately twice the diameter of picture tube and consists of six individual color filters *(Fig. 4)*, that rotate in front of the picture tube. The color disc drive shaft is belt-driven from a small motor (1/20 to 1/50 HP) that rotates at a speed of 1440 RPM.

If the color disc contains 6 filters and revolves at the above mentioned speed, 6 x 1440 or 8,640 color filters pass in front of screen per minute. This corresponds to a filter rate of 8,640/60 or 144 filters per second to match the field rate of the color system — one color and filter per field.

Note that the filter segments are neither triangular nor rectangular but

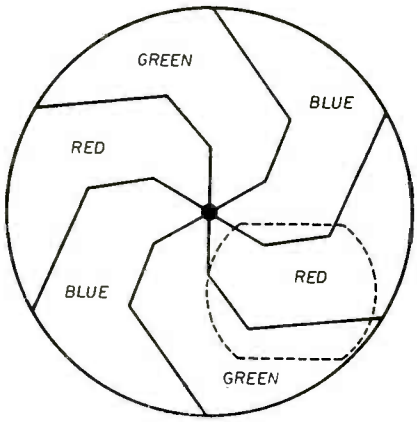


Fig. 4. CBS color disc. Note peculiar shape of color filters comprising this disc.

have their own peculiar shape. This shape is necessary to prevent color contamination. It assures that the edge of the color filter as it moves down the screen will always move parallel with the scanning lines as the beam scans down the screen. Thus, at no time will any line or section be viewed through a filter of one color, while a line is excited by a signal representing another color (despite the fact that screen is rectangular and filters are rotating).

To keep the motor at the receiver in synchronism with the camera motor, a motor control unit is used, *(Fig. 5)*. It consists of a small generator driven by the motor and a two tube control section. The control section is locked in by the vertical sync pulses (144 cycles) from the station. —Lock-In is not made directly from the received vertical sync but by using the positive spiked portion of the negative sawtooth present at the plate of the vertical output tube. The con-

trol section compares a signal generated by the local generator (runs off of color disc drive shaft) with the above pulse taken from the vertical output tube. If there is any phase differential between the two signals the motor control tube receives a different level of d-c bias. The plate circuit of the control tube contains a saturable reactor that is connected in series with the motor windings. When the control tube bias changes the inductance of the saturable reactor and speed of the motor does likewise. With a change in motor speed, the locally generated signal changes in phase ad frequency in a direction to correspond with the vertical synchronization. Thus the motor speed and phase is made to correspond with the incoming vertical sync and no new type of pulse has to be inserted into the transmitted sync signal.

Although the camera and receiver motors are locked in frequency and phase, it is possible to have an incorrect color filter in position at the receiver. To permit correct color phasing a push-button is incorporated with motor. When this button is depressed the motor speeds up and allows a succeeding color filter to catch up. In one out of three presses color phasing will fall in as indicated by the true rendition of skin tones.

CBS has developed an automatic color phasing system that can eliminate the push-button. A special color phasing pulse needs to be inserted between first and second equalizing pulses preceding the red field for automatic operation

Large Picture Practice

A field sequential system is not limited to a small picture. Neither does the motor limit size of picture. The field sequential system can use a three-image method of presentation or a tri-color tube and need not confine itself to a rotating motor.

The truth of the matter is that for a small color picture (12½" and under) a color disc permits low cost color television of high fidelity. For a large picture the same three-image technique that CTI and RCA are forced to use can be employed. The *three-image technique can be used* at the receiver on a *CBS sequential signal* to produce a large picture.

If the three-image system cannot be developed (applies to any type of color scanning) to a point where it is simple, inexpensive, easy to operate, and produce a high quality picture, a color disc and motor might be the direct answer to low cost high quality color television. We do not object to a phonograph motor. Perhaps a small disc and motor, a high brightness projection tube, and an efficient projection system is the direct answer to a large color picture.

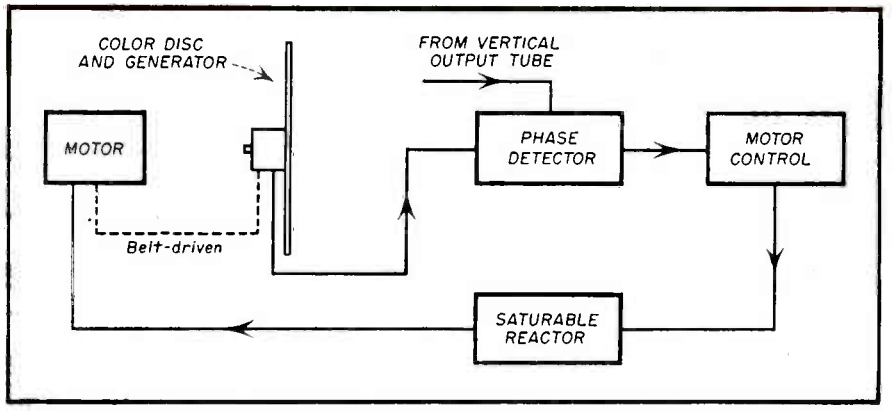


Fig. 5. Motor control system.

One more obvious means of obtaining a larger color picture is to use a magnifier. To convert a large picture receiver to color and still limit the size of the motor, the raster size can be reduced and a small motor and magnifier used to restore picture size.

Compatibility - Adaptability - Convertibility

One of the very definite advantages of the CBS system is that a present receiver can be converted for color reception at low cost. Operation of the converter is quite simple and the picture has excellent color fidelity. The line and dot sequential color systems are not really *convertible*. At most, such a converter would be expensive, complex, bulky, and difficult to operate.

Compatibility is a term applied to a color system the signal from which can be received on a present black-white receiver without any changes whatsoever in that receiver. With CTI and RCA systems, the signal can be picked up on a standard receiver and will reproduce as a black-white picture of good resolution. If the CBS system is used some circuit changes will have to be made on present models to permit reproduction of color signal as a black-white image.

Adaptability refers to the ability to change over a present receiver to make full use of a color signal for black-white presentation. With the RCA And CTI systems no adapter is necessary. To change-over a present receiver for use with CBS color system an adapter is necessary to increase the field and line rates (horizontal and vertical deflection) whenever the color signal is to be received. With this adapter a black-white version of CBS color signal can be obtained. The resolution of this picture, although usuable, is poorer than our present monochrome pictures.

The latter two factors show a definite RCA-CTI advantage. This advantage is balanced by a CBS advantage in terms of *convertibility*.

Sweep Adaptation

A number of deflection circuit changes must be made to adapt or convert a standard receiver for reception of CBS color signal. It might be assumed that the only changes necessary would involve the frequency controlling elements raising the frequency of the vertical generator from 60 to 144 and the horizontal from 15,750 to 29,160 cps. A number of additional factors are involved as a result of the frequency changes. When frequency changes are made it is also required to preserve size and linearity of deflection waveshapes. Proper drive must be obtained for deflection output tubes, particularly horizontal output tube.

In some cases it is necessary to rearrange the horizontal output circuit to prevent losses and arcing. Replacement of horizontal output transformer is at times required. Switching is another problem to be solved so that the customer can switch from standard to color rates at will without having to make any back panel adjustments. On occasion this will involve duplication of some of the pre-set controls so they can be preset at both rates.

Extent of changes is a function of chassis design, there being no universal change-over technique. Despite elaborate changes, converters have been designed that do not even require removal of the chassis from cabinet. If the CBS system is adopted commercially the various manufacturers can design converters for their own models to present the least number of headaches for the service technician.

In next month's installment some actual change-over circuits will be discussed. More details and schematics of CBS system will also be presented.

THE CK 703

Crystal Triode

by Rufus P. Turner

Fig. 1. The CK 703 compared to a match.

Commercial transistors are now available to those interested in its uses. This article gives technical details on physical and electrical characteristics, as well as applications.

THE Raytheon CK 703 germanium crystal triode, shown in *Fig. 1*, is the first commercial transistor we have obtained. In accordance with our promise to keep the radio service dealer informed regarding crystal triode development[1], a technical description of the CK 703 is presented herewith.

Physical Characteristics

The CK 703 follows the basic design and construction described in the transistor articles of a year or so ago. It consists of a germanium crystal with two catwhiskers (the emitter and collector) in pressure contact at closely-separated points on the crystal surface. The emitter (grid) and collector (plates) whiskers are attached to two small protruding external contact pins.

The CK 703 is contained in a cylindrical brass shell which is in contact with the germanium crystal and serves as the base (cathode) terminal. Overall length of the unit is 0.78 inch, and its diameter is 0.255 inch. Each of the two contact pins, which extend through a phenolic disc in the bottom end of the brass shell, is 0.03" in diameter, and the pins are spaced 0.07 inch. No sockets are available at this writing and experimenters are making their own. A bottom view of the CK 703, with identification of terminals, is shown in *Fig. 2*.

[1] *Transistors & the Serviceman*. Turner. RADIO SERVICE DEALER, May 1949 p. 25.

Electrical Characteristics

The *emitter* whisker of the crystal triode is the control electrode and corresponds to the grid of a triode tube. The *collector* whisker corresponds to the plate of a tube. And the crystal (referred to in transistor practice as the *base*) corresponds to the cathode of a tube. A low *positive* d-c bias voltage is applied between the emitter and base, while a high *negative* d-c voltage is applied between the collector and base. These polarities

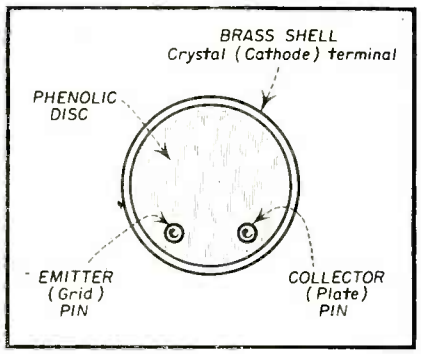


Fig. 2. Bottom view of CK 703 crystal triode.

are just the opposite of tube practice where the plate is positive and grid negative.

Following are *maximum* ratings of the CK 703. Collector voltage -70 v. Collector current 4.0 ma. Collector dissipation 200 milliwatts. Emitter current 10 ma.

Typical operation is shown in the following table:

Collector Voltage	-30 v.
Collector Current	2.0 ma.
Emitter Voltage	0.2 v.
Emitter Current	0.75 ma.
Transconductance	5000 micromhos
Emitter Impedance	500 ohms
Collector Impedance	10,000 ohms
Average Power Output	2.0 milliwatts
Average Power Gain	16 db.

From the preceding set of data, notice that the CK 703 has a low-impedance input and high-impedance output. In a conventional cascaded amplifier of several stages, this necessitates use of some means of match-

[*Continued on page 54*]

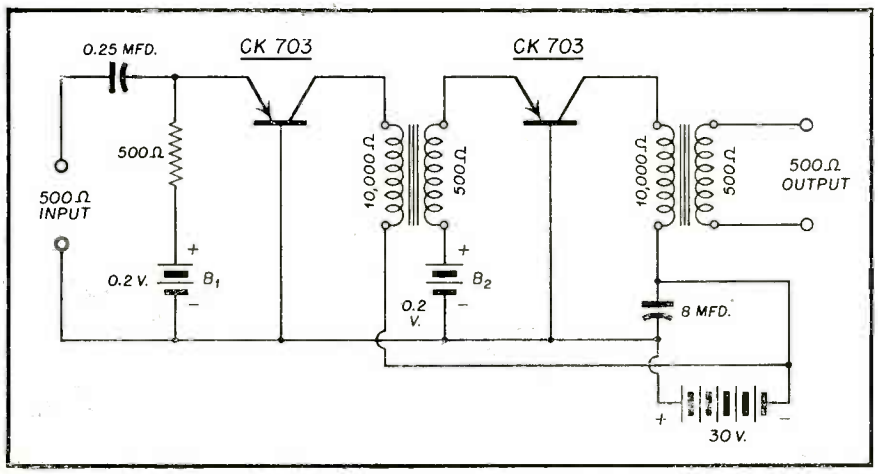


Fig. 4. Typical crystal triode AF amplifier.

UHF TELEVISION CONVERTERS

by Allan Lytel

Basic principles and design considerations are discussed in this article on u-h-f converters, together with the circuits used by several manufacturers. The wide-awake technician should not wait until u.h.f. TV is a practical reality, but should get his "know-how" now.

THE u-h-f television converter may be compared to the FM converter which has been widely used with broadcast band receivers. With an FM tuner, an a-f output from the tuner is taken to the a-f amplifier of the receiver. The tuner itself is a complete receiver lacking only the audio amplifier and speaker.

The television tuner, on the other hand, is not in any sense a complete receiver since its fundamental purpose is to take the incoming u-h-f television signal and feed this signal into the i-f amplifier stages of the receiver. *Fig. 1* is a block diagram of such a tuner, showing the necessary stages. An u-h-f antenna separate and distinct from the present v-h-f antenna is necessary, both because of the extremely high frequency of the new station and the very probable need for new antenna orientation. The pre-selector stage is necessary to reduce image response. It would be highly desirable to have this pre-selector as a tuned r-f amplifier stage to assist in image response reduction. For example, if the station is to be tuned in on 500 mc the local oscillator would operate at 470 mc for a 30 mc i.f. However, this local oscillator operating on 470 mc would also beat against a 440 mc signal to produce the same 30 mc i.f. Thus any local oscillator could beat against two signals to produce the same i.f. The undersired signal is of course the image response of the oscillator.

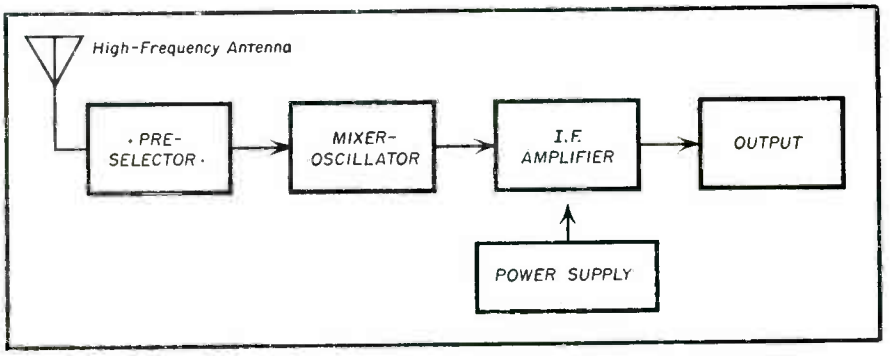


Fig. 1. Block diagram of u-h-f converter.

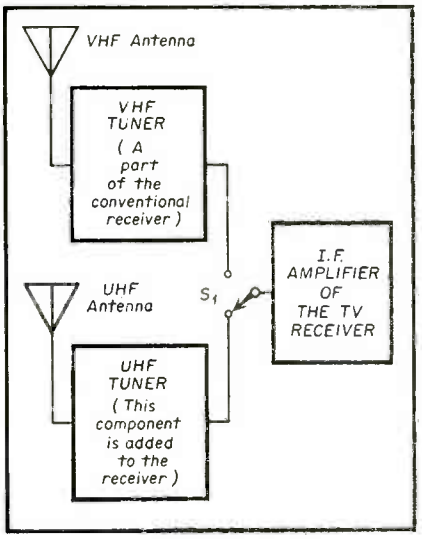


Fig. 2. Alternate method of u-h-f conversion.

The mixer and oscillator are used as in the ordinary superheterodyne to convert the signal to an i.f. It is possible to use a double super-heterodyne involving two mixer stages so that the signal may be brought down to the television receiver i.f. in two stages. Crystal diodes are conveniently used for mixer stages in u-h-f converters, and the local oscillator presents the first difficult design problem. This oscillator must cover the entire frequency band and track reasonably well over this entire band so that a tuning dial can reasonably accurately indicate the desired station. Special types of tuned circuits are necessary to obtain oscillator output at these frequencies. The i-f amplifier which is the following stage is necessary since the output from the mixer oscillator is not sufficiently strong to feed directly to the television receiver. The output may be a cathode follower or link coupling. A separate power supply for the tuner allows adequate regulation of the plate supply voltage which is necessary to prevent frequency drift of the oscillator.

There are two possible ways an u-h-f converter can be used with the ordinary television receiver. The output of the converter may be fed into the antenna terminals of the receiver so that it must pass through the u-h-f tuner and the entire r-f section of the existing television receiver. When used in this manner, the output of the tuner of the new band must be one of the present 12 channels. The tuner is adjusted to the desired new station and the television receiver is turned to the channel whose frequency is the same as the output of the tuner.

The other possibility is to feed the output of the u-h-f tuner directly to the i-f amplifier of the existing tele-

vision receiver. This is illustrated in *Fig. 2* showing the v-h-f tuner and the i-f amplifier which are already a part of the receiver. An u-h-f tuner is added to the receiver together with a switch *S1*. This switch has two functions, an upper or v-h-f position, which uses the output of the tuner feeding directly to the i-f amplifier; and if the switch has several sections, an additional section of the switch may be used to disable the local oscillator of the other tuner to prevent interference. When the switch is thrown to the lower or u-h-f position, this tuner now has its output feed directly to the i-f amplifier. Again the local oscillator of the tuner which is not being used may conveniently be disabled to prevent spurious signals.

The DuMont Television Converter

Several large manufacturers of television receivers have research divisions which are busily engaged in designing and testing UHF television converters. Mr. Robert P. Wakeman of the Research Division Allen B. DuMont Laboratories, Inc. has been responsible for designing and testing a very interesting u-h-f television converter. *

Figure 3 is a block diagram of this tuner which utilizes continuous band tuning. DuMont has pioneered in continuous tuning and such a system is used on all of their present v-h-f television receivers. This method has the advantage for u-h-f of covering the entire band instead of a channel selector band switching arrangement. Thus, any change in frequency allocations which is to be expected with the new type of broadcasting service, can cause no difficulties for continuous band tuner.

The DuMont u-h-f television converter tunes over the entire range from 475 megacycles to 900 megacycles. A tuned r-f circuit feeds a crystal mixer which also gets a signal from the 6F4 acorn type local oscillator. A miniature penthode - type 6AK5- is used for the i-f amplifier.

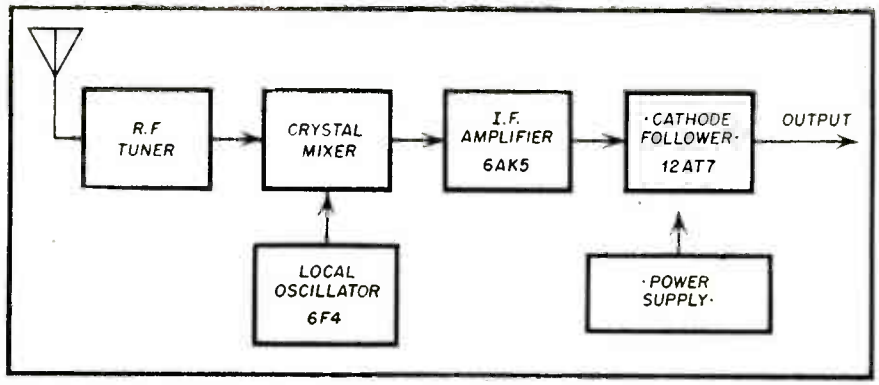


Fig. 3. Block diagram of u-h-f converter designed by Allen B. DuMont Labs.

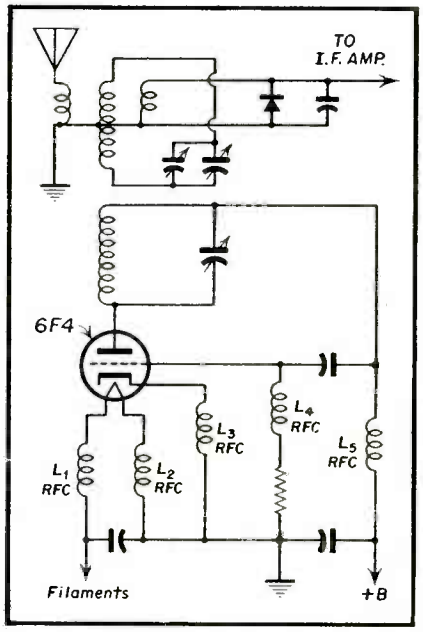


Fig. 4. Equivalent circuit of u-h-f converter.

A 12AT7 cathode follower supplies the signal to TV receiver's i-f amplifier.

Several of these converters are presently being used in the National Broadcasting System- Radio Corporation of America Experimental 535 mc television transmitter in the Bridgeport, Conn. area. The reception of this u-h-f television signal is apparently equal to ordinary television broadcasting within the normal range of this station. The r-f section of this converter system is probably of greater interest and its equivalent schematic is shown in *Fig. 4*. This is called an equivalent schematic since it is electrically the same as the circuit actually is, but it is physically quite different. This is because unusual tuned circuits are necessarily used to cover the band. The antenna input is coupled into the r-f tuned circuit shown with a trimmer capacitor across the tuning element. The 6F4 local oscillator has its plate tuned circuit inductively coupled into the mixer circuit. This mixer circuit is of course, coupled to the r-f tuned circuit as well.

The oscillator is an equivalent of the ultraudion since it has a single tuned circuit in which the plate and grid are tied to opposite ends. Bias is obtained through a series r-f choke and a 18,000 ohm resistor. Both legs of the filament as well as the cathode lead have series radio frequency choke and a 0.001 uf capacitor is used for the filament r-f by-pass. Plate voltage is supplied through a series r-f choke with its by-pass capacitor. A crystal (type 1N23) is used for the first detector or mixer, because of its simplicity and relatively high conversion factor.

Figure 5 shows a cross section of the cylindrical tuning elements which are used in this converter. These cylinders resemble both the butterfly tuned circuit and the parallel wire transmission line tuned circuit. The acorn local oscillator is mounted directly on the tuning cylinder. Inside the outer cylinder, there are two cylinders of smaller diameter. One is the stator and it remains fixed in position while the other is the rotor which is free to turn. Tracking adjustments are two screws which vary the positioning of the stator inside the larger cylinder. As the rotor is turned, the capacity of this tuned circuit and to a smaller extent, the inductance as well, changes value and tuning is accomplished. The capacity for the circuit is the capacity across the slot of a cylinder and the inductance is the effect of the one turn cylinder as viewed from the end as in *Fig. 5*.

Tuning elements of this slotted cylinder variety are used for the mixer, the r-f. and the local oscillator sections of the DuMont Television

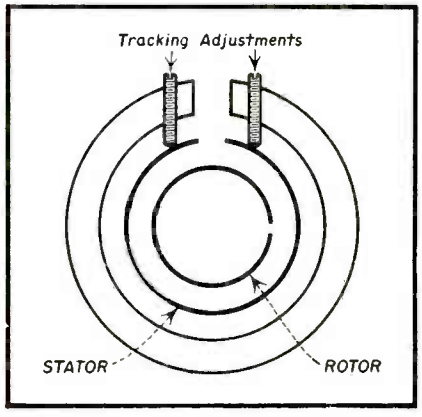


Fig. 5. Cross section of tuning element used in converter.

* Special permission from Mr. Robert P. Wakeman, Research Division, Allen B. DuMont Laboratories. See also July 1949 Electronics.

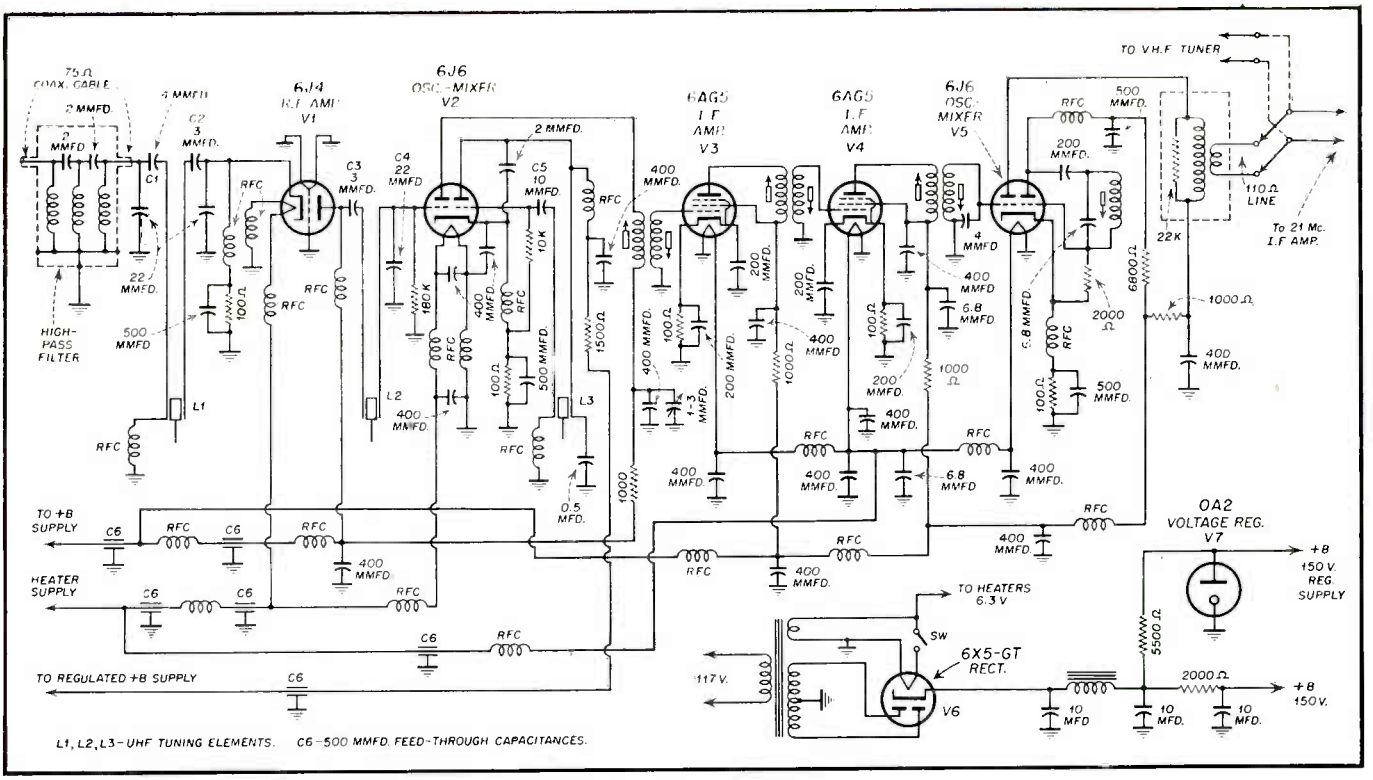


Fig. 6. RCA u-h-f tuner.

Converter. The problems remaining in the design of this converter seem at the present time to be the frequency stability and local oscillator radiation. It is obvious that without any tuned r-f amplifier stage, other local oscillators and image signals still present a serious problew.

The RCA-UHF Television Tuner

As a part of the National Broadcasting System experimental u-h-f television program, the Radio Corporation of America has designed and built several u-h-f television tuners. This tuner shown in *Fig. 6* is not designed for operation over the entire range, although very probably a modified tuner of this type using different vacuum tubes could adequately perform over the entire band. There are four individual stages with an associated power supply in this tuner.

Input to the tuner is by means of a 75 ohm coaxial line from the antenna, and the output is the 21 megacycle to 27 megacycle range. This first stage of the tuner is a hi-pass filter which is a printed circuit. Its cut-off is at approximately 500 megacycles as may be seen from *Fig. 8*. This is a plot of the insertion loss of the high pass filter as a function of frequency and megacycles. The use of a high pass filter prevents interfering signal below the 500 megacycle band This filter feeds an r-f amplifier stage with a tuned input and output using a 6J4 grounded grid r-f amplifier. The tuner operates on a double superheterodyne principal and the r-f amplifier feeds the first oscillator-mixer which uses a 6J6. The first detector heterodynes the incoming signal into a 135 megacycle i.f. which is then amplified by two stages using 6AG5 tubes. As this i.f. remains constant the second local oscillator need not be tuned. This second local oscillator operates at a fixed frequency to produce a 24 mc output.

The tuning elements in this television converter do operate over the entire signal range from 500 megacycles to 700 megacycles so that apparently only slight changes in design would allow this converter to work over the entire band. A switch is used which allows the i-f amplifier of the existing television receiver to be attached to the u-h-f tuner or the v-h-f tuner. Filaments on the new tuner are always kept hot to reduce inevitable drift when the oscillator is first turned on with cold filaments. When the plate voltage of the oscillator is turned on it reaches a stable operating condition in less than 3 minutes.

The design and placement of components is critical in any u-h-f circuit and they are particularly sensitive to change. In the television converter in which tracking over the entire band is necessary, the high pass filter feeds a signal by means of cathode coupling into the grounded grid r-f amplifier. This grounded grid circuit permits satisfactory operation at higher frequencies, since the cath-

[*Continued on page 52*]

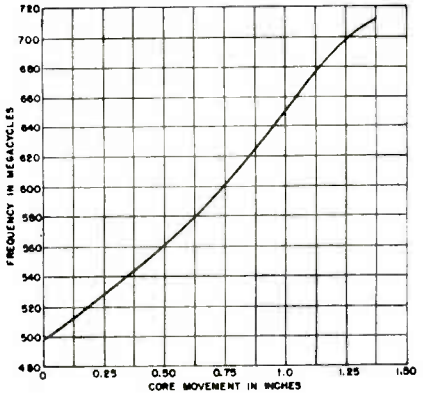


Fig. 7. Tuning curve of RCA tuner. Curve shape is obtained by the use of a suitably wound tapered copper foil coil.

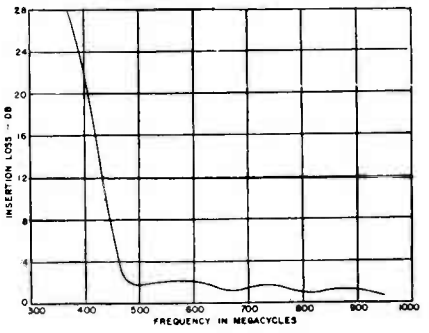


Fig. 8. High pass filter characteristics of RCA tuner. Curve plotted is insertion loss of the filter in db as a function of the frequency in megacycles.

FRONT ENDS

by Samuel L. Marshall

(From a forthcoming book, "Television Installation Techniques")

Part 7

In this installment we begin the discussion of tuner repairs. First, typical symptoms indicating the need for these repairs are given. Following this, proper cleaning and lubrication procedures are outlined, as well as actual mechanical repairs.

FRONT End repairs and service may be divided into two main categories, mechanical and electrical. Mechanical repairs are concerned with cleaning and lubrication, adjusting electrical contacts, and replacing defective components such as wafers, contact springs, detents and dial drive mechanisms. Electrical repairs include locating and replacing defective tubes and other circuit components, alignment in the shop and "touching up" adjustments in the home.

Needless to say, one should be reasonably sure that the trouble is definitely in the tuner before repairs are begun. Furthermore, one should be absolutely sure of the sequence of adjustments, the purpose and locations of the various trimmers, and the accuracy and reliability of the equipment being used. The pitfalls are many in Front End alignment, and the end results, where improper equipment and techniques are employed, is usually a degraded picture. On the other hand, proper adjustment of tuners on all channels will often produce amazing results, bringing in pictures with a measure of depth, clarity, and freedom of distortion previously not obtained.

The experienced technician will readily recognize certain symptoms that point to a defective tuner, enabling him to employ his knowledge of their causes to effect a repair in the quickest possible time.

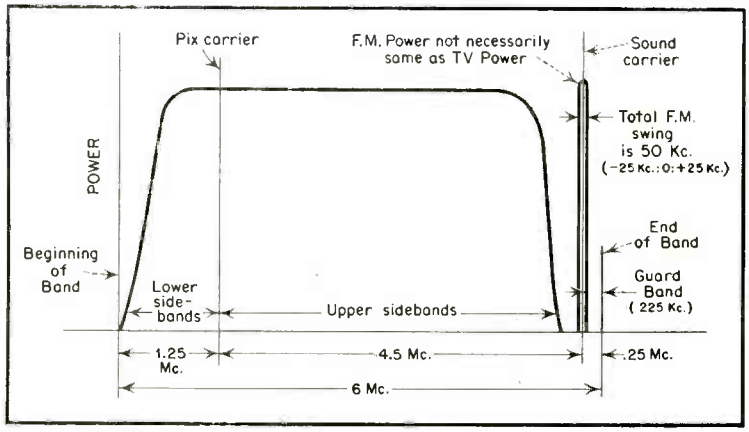


Fig. 3-56: Picture and sound frequency distribution of TV channel. Observe that the pix carrier is located 1.25 mc above the lower end of the band, and that the sound carrier is located 0.25 mc below the upper end of the band.

Symptoms

Symptoms attributable to faulty Front End operation, assuming that the antenna and the station transmission are O.K. are as follows:

1. No Sound, No Pix, Raster O.K.: Reference to the block diagrams of TV receivers as shown in *Fig. 3-55* will reveal that the only sections responsible for this sympton are the power supply and the Front End. Of course the proper procedure in this case is to check the power supply before working on the tuner. Another remote cause of this condition is a faulty a-g-c circuit causing the grid bias to become excessively high in the tuner and cutting off the signal in its stages.

2. Weak Sound, Weak or No Pix, Raster O.K.: In addition to Front End and power supply trouble this condition can be caused by a faulty component in any other part of the receiver which can pull down the voltage normally present in the power supply. Another possibility for this condition, strictly in split-sound receivers, where the sound i.f. is taken off the output of the first or second video i-f stage, is a defective component in these stages.

3. Intermittent or Noisy Sound, Intermittent Pix, Raster O.K.: Assuming that the power supply voltage is constant, the above symptom is definitely characteristic of tuner trouble—primarily faulty tubes or band switches.

4. No Sound or Sound Is Weak, Pix O.K.: In split-sound receivers this condition may be caused by a defective sound section following the mixer, or misalignment of the Front End. Reference to *Fig. 3-56* will reveal that the sound r-f channel takes up a narrow part of the band, so that it does not take much misadjustment of the oscillator to throw the sound i-f out of the range of the response limits in the sound i-f amplifiers. In inter-carrier receivers, on the other hand, misadjustment of the oscillator within cerain frequency limits will not affect the sound signal as drastically as it does in split-sound receivers.

5. Sound O.K., Pix Poor Due to Loss of Highs or Lows, Raster O.K.: Misalignment of the r-f trimmers in both split-sound and inter-carrier receivers can result in a relative attenuation of the high or low video frequencies. Loss of lows results from peaking

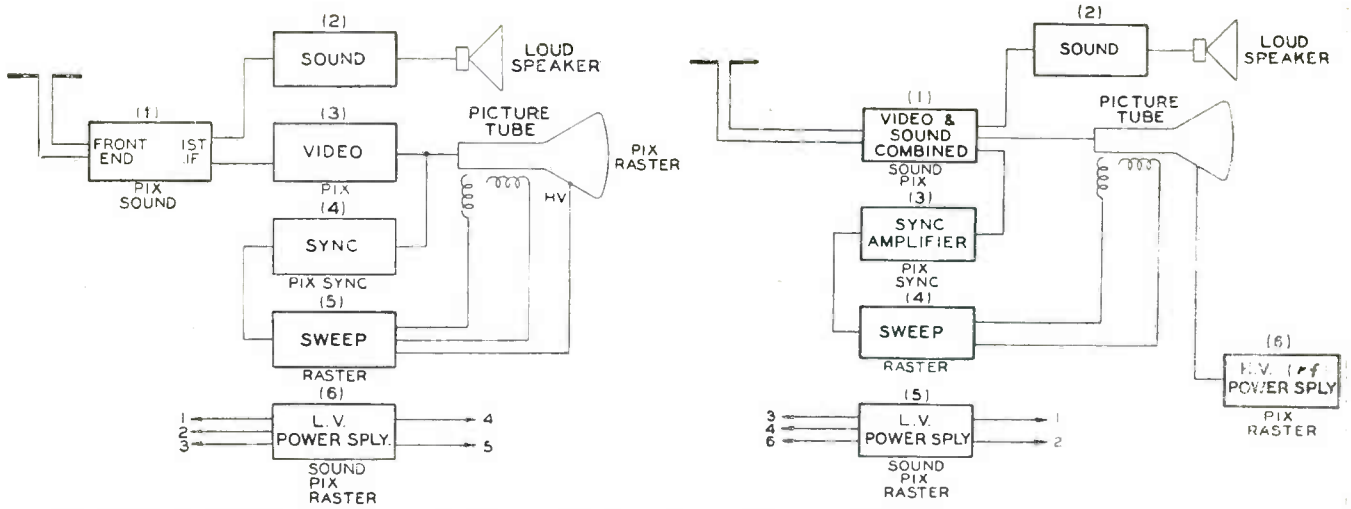


Fig. 3-55: (Left) Block diagram of split-sound TV receiver. (Right) Block diagram of intercarrier receiver.

the r-f response towards the sound carrier and attenuating the signal near the pix carrier. Recalling that the low video modulating frequencies as well as the sync pulses are near the pix carrier, the low frequency content of the picture will be poor, causing smear, and a loss of sync will be apparent. Loss of highs can result from peaking the r-f response towards the pix carrier and attenuating the signal near the sound carrier. The high video frequencies being absent will result in the vertical wedges near the center of the picture becoming blurred. Most often no apparent loss of sound will be noticed in spite of the fact that the signal energy has been reduced, because the sound signal is usually relatively stronger than the video signal.

In this discussion it must be borne in mind that the last symptom can be caused by defects in the video i-f and amplifier circuits. For this reason a check on the proper operation of these circuits should be made before starting work on the Front End.

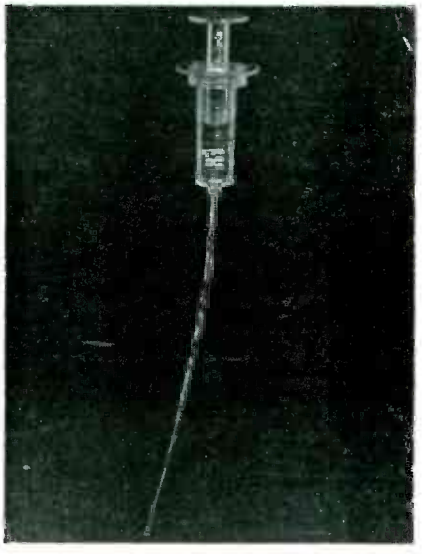
6. Microphonics: The typical ringing sound indicative of a microphonic condition in any receiver, plus the appearance of sound bars on the screen has been traced in many cases to vibrating mechanical and electrical components located in the tuner.

7. Frequency Drift: This might result in loss of sound, sync, or picture fidelity during the course of program. When this condition occurs it is safe to blame the Front End. It might be added that split-sound receivers are more vulnerable to this type of annoyance than intercarrier.

8. Modulation Hum and Sync Buzz: Some cases of modulation hum and sync buzz have been reported which were caused by poor contacts and connections in the tuner. A poor connection can result in detection, and stray fields such as 60 cycle hum, vertical sync, and horizontal sync will modulate the incoming signal, thus producing modulation hum and sync buzz.

Cleaning and Lubricating

A typical Front End contains approximately 300 parts, 150 switch contacts, and 50 tuned circuits. One little switch not making proper contact is enough to warrant a service call. For this reason the subject of cleaning and lubricating the wearing and movable parts in Front Ends should be of immediate concern to all engaged in their maintenance.



Walter L. Schott Co.

Fig. 3-57: Front End lubricator.

Materials which serve as contact surfaces may be effectively cleaned with Xylol or carbon tetrachloride in conjunction with a stiff brush small enough to get in at the switch contacts, coil connections, trolley, etc. Following this a *very thin* film of switch contact oil such as Viscosity Oil Co. #7069 may be added to prevent oxidation. Other contact oils recommended by various manufacturers are Lubriplate, Sta-Put 512, Penola #305 grease, Walscolube B-22, and Lub Rex 100. However, it must be pointed out that at least one manufacturer advises against the use of contact lubricants containing zinc or cadmium; and some of the above products do contain these ingredients.

Another expedient often employed is to mix equal solutions of oil and cleaning fluid in a container. This mixture is then injected as a fine spray by means of a syringe, hypodermic or atomizer (see *Fig. 3-57*) into the various contacts to be cleaned and lubricated. The switch is rotated a number of times, and as the cleaner evaporates, a fine surface of the lubricant is left on the switch contacts. It must be emphasized at this point that the use of too much of this mixture will produce detrimental effects on the tuner's operation.

It is comparatively easy to detect a tuner which requires cleaning and lubricating. As the switch or dial is rotated the sound is raspy, the picture tears, and the entire operation of the receiver is erratic and intermittent. It might also be found that a slight pressure on the tuner dial often produces the same intermittent operation, depending on whether or not the switch makes and breaks contact with this action. We might interject at this point that drum-type switches with improper indexing (mechanical alignment of the coil contacts on the drum with the spring contacts on the frame) and warped wafer-switch shafts behave in the same way, that is, cause the receiver

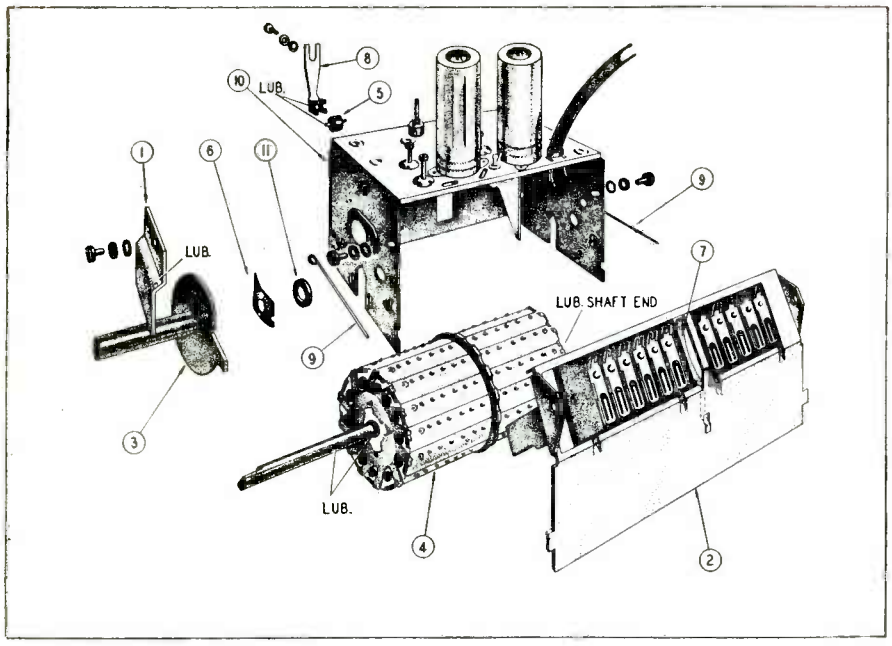


Fig. 3-58: Exploded view of Philco 12-position turret tuner.

to fade in and out with slight pressure applied to the dial.

In addition to keeping the contacts and other electrical wiping surfaces clean and lubricated with a thin *electrical conducting* film of contact oil, the bearings, shafts, and other similar surfaces must also be lubricated with a fine grade of surface lubricant such as light vaseline or Viscosity Oil Co. #8072.

The principles of cleaning and lubrication outlined in this section can perhaps be better understood by applying them to the exploded view of a typical turret tuner as shown in *Fig. 3-58.* As shown in the figure, *mechanical lubrication* (vaseline or Viscosity Oil Co. #8072 lubricant) is applied between the outside bracket of the fine tuning condenser (1) and the rotor of same; to the turret indexing roller (5) and its supporting spring (8); and the shaft on one side of the turret and the shaft end on the other side.

Cleaning with carbon tetrachloride and lubricating with contact oil applies to the coil contacts on the turret (4); the turret grounding spring (7); and the spring contacts shown on both sides of the turret grounding spring. Again, it must be emphasized that this oil must be used sparingly.

Other types of tuners are cleaned and oiled along the same principles. Thus, wafer-switch type mechanisms require that all switch and other sliding electrical contacts be given the same treatment, as do the coil wires and trolleys in continuously-tuned inductance mechanisms, or the end plate grounding surfaces in variable condenser tuners. It might be added that other switches, such as those which throw the tuner from high band to low band operation and vice versa, are subject to the same dirt-accumulating and oxidation effects as the mechanisms just discussed, and should be cleaned and oiled in the same manner.

We might well conclude this section by stating the following rules:

1. All electrical switch and wiping contacts (including grounds) subject to dust or dirt accumulation should be cleaned with a suitable cleaning fluid and lubricated with a thin layer of contact oil.

2. All mechanical bearing, wiping, and shaft surfaces should be cleaned of dirt and grit with cleaning fluid and lined with a suitable lubricant.

Mechanical Repairs

1. *Contact Springs:*

It often becomes necessary to repair a tuner because of sprung contacts or inadequate spring tension. Stationary contact springs in wafer-type switches may be repaired as follows. First the stationary contact is disengaged from the moving contact. Following this the spring is bent carefully in the proper direction with the aid of a pair of tweezers or fine pliers until adequate pressure is obtained between the stationary and moving contact when the switch is re-engaged into position. This operation should be done most carefully, otherwise the contact spring may be broken off or bent at an angle. If bent over too far the spring can cause jamming of the switch as it is rotated.

Figure 3-58 illustrates the location of the contact springs in the Philco 12-position tuner (Standard Tuner). Notice that all contacts are mounted on the panel assembly. Should these springs make poor contact to the coils because of insufficient tension, several sets of coils should be removed to get at the springs. The springs should then be bent inward with a narrow-bladed screw driver RSD 4 Marshall
until the highest point of the spring extends about 9/64" above the plastic surface of the contact plate. The spring will then clear the flat surface of the turret coil by 1/64" which will assure adequate contact with the coil terminals.

Sometimes it will be found that the springs are damaged beyond repair. In such cases it becomes necessary to replace the entire contact panel assembly. See (2) in *Fig. 3-58.*

2. *Frozen mechanisms:*

The serviceman will often encounter tuners which are difficult and sometimes impossible to turn. This indicates a jammed or frozen mechanical link in the assembly.

Mechanisms will freeze or bind because of:

a) jammed switch springs and contacts. (all types)
b) locked control shafts due to dirt grit, etc. on their surfaces. (all types)
c) defective detents. (all types)
d) defective mechanical drives (all types)
e) broken or stripped gears (all types)
f) broken wafers (wafer-switch mechanisms)
g) warped shafts (wafer-switch mechanisms)
h) loose coils in turret (turret mechanisms)
i) poor indexing (turret mechanisms)
j) shorted plates (variable condenser mechanisms)
k) jammed cores (permeability tuned mechanisms)
l) defective locking on latching bars (push-button tuners)
m) sticking on bent selector rods (push-button tuners)
n) weak coil or flat springs (push-button tuners)

3. *Miscellaneous mechanical troubles:*

Other troubles encountered which result in faulty mechanical operation of the tuner are:

a) stretched springs which have lost their tension
b) loose set screws
c) slipping or broken dial cords

[*To be continued*]

Selling 3-Speed RECORD PLAYERS

by W. S. HARTFORD

(Vice-President, Webster-Chicago Corporation)

This article should be read by every servicing technician interested in adding to his income by selling, with little effort, a fast-moving item.

W. S. HARTFORD

THE service dealer has been traditionally chained to the clock, his profits limited mostly to the number of man hours put into his operations. More man hours spent in repairs and installations meant more money. Fewer man hours meant less money. Fortunately, that system no longer completely dominates the service dealer's operations.

Added to his profits today is the money he can make on sales of products in his line of work. And right outside his door waits the biggest market for radio components in the history of the industry, by every known estimate This is the market for phonograph replacement and plug-in units, a market that, happily, can be regarded as even more the field of the service dealer than of the music or radio dealer

The introduction of microgroove records left a national total of 15,000,000 families with obsolete phonographs that could play only 78 r.p.m. records. How many of these are in each service dealer's territory is a matter of guesswork but, certainly, the figure is large enough to be important.

Microgroove records have had wide spread publicity. One-speed phonograph owners are well aware that they are not taking full advantage of the entertainment records can provide. They are aware, too that their records are costing more, are taking up more storage space and are not providing the high-quality reproduction they could get from the microgroove records.

Then why don't they have three-speed phonographs? They already have phonographs for which they paid a fair amount of money and which are still in good condition. They don't want to buy a brand new radio-phonograph or a brand new three-way combination to replace one that is still a nice-looking piece of furniture and still operates well.

If fully aware of the possibilities of replacing their one-speed changer with a three-speed changer at a reasonable price, one that would be completely repaid in record savings, a large percentage of them would be inclined to buy. That is where the service dealer comes in.

When a call comes in for service on a phonograph unit contained in an expensive console, the service man goes out on the call prepared to put the unit back into working condition. He exerts time and energy on extensive repairs on a worn changer, collects his money and returns to the store not very much richer.

How To Sell 3-Speed Units

Contrast that with the serviceman who goes out on that same call, equipped with literature on the replacement units. Using the prices of Webster-Chicago Corporation, manufacturer of phonograph units, as an example, for $46.50, plus the installation charge if the dealer wants to make one, he can give that phonograph owner a three-speed automatic Webster-Chicago replacement unit instead of merely repairing the one-speed unit. Selling that Webster-Chicago won't be too hard if the serviceman understands just what he has to offer and all the advantages of having it. Besides the more obvious advantages already mentioned, he can point out that the same unit is contained in brand new prestige label phonographs selling at high prices. He can point out that it is the one unit accepted for installation in most expensive custom-built phonographs. He can explain that from the cost of this new replacement unit can be deducted immediately what the owner would have to spend on the current repair job. He can remind the prospect that any unit as old as the one now in the phonograph will have to be repaired again because other parts will eventually wear out and that will mean another repair bill.

He can be specific about the savings in the purchase of records, which will eventually pay for the replacement unit. Some classical record albums are as much as $2.50 cheaper on microgroove records than on 78 rpm disks. Almost all popular disks are a dime each cheaper on microgroove than they are on 78 rpm records. Children's albums are considerably cheaper on microgroove pressings.

Another selling angle the service dealer may use is pride. It is practically a national characteristic to want to be completely up-to-date, to have the newest model car, the latest fashion dress. This same idea can be applied to a record changer. When being up-to-date is possible at no added cost in the long run and with considerably more enjoyment promised, few will resist.

There is the basic theory on the replacement changer campaign for the service dealer. It takes no more, and probably less, of his time, than would repairing the one-speed unit. It will cost him nothing more than the price of literature on the replacement units he may want to leave with set owners who might think about his suggestion for a while before making up their minds.

But he will make a lot more money. For example, if he is handling Webster-Chicago replacement changers, he will make $18.16 profit on the highest-priced unit, which retails for $51.75. He will make $16.28 on the Webster-Chicago three-speed automatic replacement changer that sells for $46.50. Comparable profits are made on that firm's other units, which sell for $27.50 and $37.75. In addition, he makes whatever he wishes to charge

[Continued on page 51]

RADIO SYMBOLS
and their meanings

RADIO SYMBOLS AND THEIR MEANINGS

ANTENNA, General

Dipole

Loop

ARRESTER, or Protector

BATTERY

CABLE, Coaxial

Coaxial, twin conductor

Pair

Pair with grounded shield

CAPACITOR, General

Electrolytic

Variable

CONTACT, Normally closed

Normally open

Adjustable or sliding contact for resistors, inductors, etc., also fixed contact for jacks, keys, plugs, relays, switches, etc.

CRYSTAL, Detector
(Arrow points in direction of forward current flow)

Piezoelectric

FUSE

AC SOURCE

GROUND

INDUCTOR, General

With variable powdered iron core

Laminated iron core

JACK, Two conductor

COMPONENTS

RMA STANDARDS PREFERRED VALUES

An orderly progression of sizes is maintained by the use of preferred numbers which are used for nominal values of many components. Table I shows the basic preferred values for tolerances of 5%, 10%, and 20%. To obtain the desired value, these basic numbers are multiplied by a decimal multiplier as shown in the color code table (Table II).

TABLE I—PREFERRED VALUES

5%	1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.7	3.0	3.3	3.6	3.9	4.3	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1
10%	1.0		1.2		1.5		1.8		2.2		2.7		3.3		3.9		4.7		5.6		6.8		8.2	
20%	1.0				1.5				2.2				3.3				4.7				6.8			

TABLE II—RMA STANDARD COLOR CODE

Black 0	Yellow 4	Gray 8
Brown 1	Green 5	White 9
Red 2	Blue 6	Gold 5%
Orange 3	Violet 7	Silver 10%
		No Color 20%

COLOR CODE

COMPOSITION RESISTORS

AXIAL LEAD RESISTORS (Fig. 1a) have three or more bands of color around the body of the resistor. Band A as shown in the figure indicates the first significant figure of the resistance. Band B indicates the second significant figure. Band C indicates the decimal multiplier. Band D., if any, indicates the tolerance limits about the nominal resistance value. The body color of insulated resistors is usually tan, but may be any color except black. The body color of non-insulated resistors is black.

RADIAL LEAD RESISTORS, shown in Fig. 1b, use a body color for the first significant figure, and end color for the second significant figure and a body dot for the decimal multiplier. The tolerance is indicated by o color (gold, silver, or no color) at the other end.

Figure 1a (a) Axial Leads

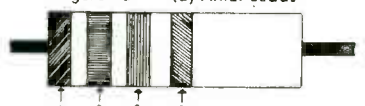
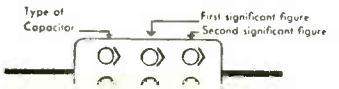


Figure 1b (B) Radial Leads

EXAMPLES	AXIAL LEADS	BAND A	BAND B	BAND C	BAND D	RESISTANCE	TOLERANCE
	RADIAL LEADS	BODY	END	BODY DOT	END		
		Brown (1)	Black (0)	Black *(No ciphers)*	—	10 ohms	20%
		Yellow (4)	Violet (7)	Yellow *(4 ciphers)*	Silver	470,000 ohms	10%

MOLDED MICA CAPACITORS are color coded to give the value of capacitance in micro-microfarads. To translate this into microfarads move the decimal place six places to the left. The color markings are in form of six dots arranged in two rows of three each parallel to



METER, Ammeter (A)

Voltmeter (V)

MICROPHONE

RECEIVER, Double headset

RECTIFIER

(Arrow points in direction of forward current flow)

RELAY, With break contacts

With make contacts

PICKUP, Phonograph

RESISTOR, Fixed

Tapped

Variable or adjustable

LOUDSPEAKER

SWITCH, Key

Multipoint

TRANSFORMER, Air Core

Laminated iron core

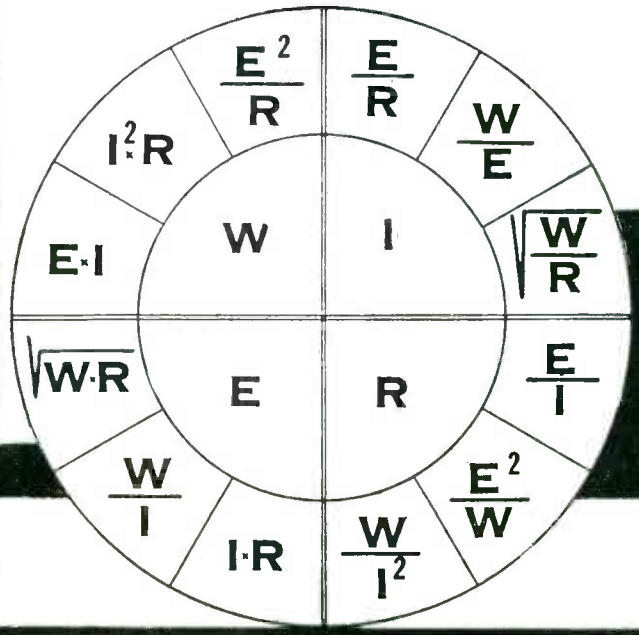
Powdered iron core

VIBRATOR

WIRES, Joined

Crossed, Not Joined

THE SYMBOL (S) OF QUALITY



cate that the component is an RMA standard Molded Mica Capacitor. The upper middle and rightmost dots indicate respectively the first and second significant figures of the value of capacitance. The lower leftmost dot indicates the RMA class of capacitor. The lower rightmost dot indicates the number of ciphers after the first two significant figures to give the value of capacitance in micromicrofarads.

Fig. 2—Molded Mica Capacitor

An obsolete RMA standard for molded mica capacitors used the three-dot system in which the capacitance only was indicated. Many older mica capacitors carry this color code.

FIXED CERAMIC CAPACITORS carry a color code to indicate the temperature coefficient as well as the capacitance and the tolerance. The color bands are shown in Fig. 3.

Fig. 3 Fixed Ceramic Capacitor

The end band A, marks the end of the capacitor which carries the inner-electrode terminal and its color designates the temperature coefficient of the capacitor in accordance with Table III. Bands B and C indicate respectively the first and second significant figures of the capacitance, band D indicates the number of ciphers after the two significant figures, and Band E indicates the capacitance tolerance.

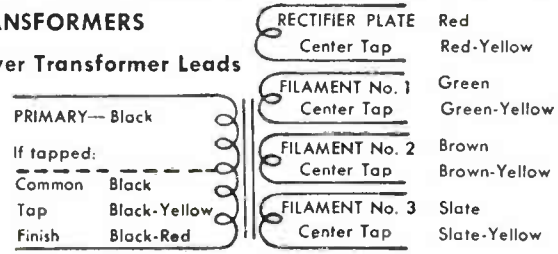
TABLE III—COLORS FOR TEMPERATURE COEFFICIENT

Color	*Temp. Coeff. Parts/million/°C.*	*Color*	*Temp. Coeff. Parts/million/°C.*	*Color*	*Temp. Coeff. Parts/million/°C.*	*Color*	*Temp. Coeff. Parts/million/°C.*	*Color*	*Temp. Coeff. Parts/million/°C.*
Black	0	Red	−80	Yellow	−220	Blue	−470	Gray	+30
Brown	−30	Orange	−150	Green	−330	Violet	−750	White	General Purpose See Note

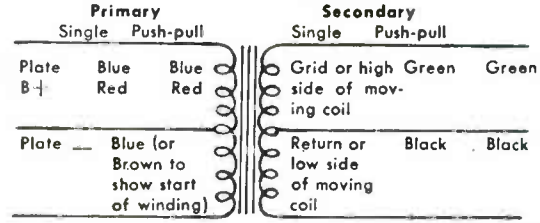
Note—General purpose capacitors may have any nominal temperature coefficient between +120 and −750 parts/million/°C at the discretion of the capacitor manufacturer

TRANSFORMERS

Power Transformer Leads



AUDIO TRANSFORMER LEADS



EQUATIONS BASED ON OHM'S LAW

Chart, combining Ohm's Law ($I = \frac{E}{R}$) and Joule's Law ($W = I^2R$), shows 12 equations for quick solution of radio math problems.

I = Current in amperes
R = Resistance in ohms
E = Voltage in volts
W = Power in watts

I-F TRANSFORMER LEADS

Primary		Secondary	
Plate	Blue	Grid (or Diode Lead)	Green
B+	Red	Grid Return	White

For full-wave transformer the second diode lead is Violet. Note—The previous standard was the same as above except that the grid return was Black and the second diode was Green-Black.

PREPARED BY THE EDUCATIONAL STAFF EMPORIUM, PA.

Improving TV BOOSTER PERFORMANCE IN FRINGE AREAS

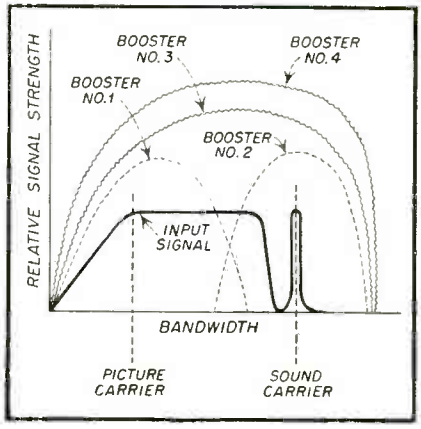


Fig. 1. Effect of adding boosters to increase signal strength in fringe area reception.

By RANSOM BEERS

Every microvolt of signal strength should be conserved in fringe area reception. This article describes how to make the best use of boosters for this purpose.

THE booster is probably the most important aid to securing good long distance TV reception. Of course as high gain a stacked array as practical and mounted as high as possible must be employed.

Connecting Receiver For Maximun Sensitivity

Assuming a good stacked array is employed and mounted at least 25 feet high; and a station on channel 9 at 100 miles and one on channel 3 at 100 miles are to be received. Channel 9 would be the weaker in strength due to the higher frequency waves being attenuated more over a long distance and the receiver gain dropping at the higher frequency. Several boosters may be employed ahead of the receiver. The tuned plate tuned grid type are the most sensitive to weak signals. Because of their sensitivity and narrow band pass usually over two cannot be cascaded without running into serious difficulty with oscillations between boosters or between set and boosters.

More boosters can be employed but the third booster should not have both grid and plate circuits tuned; and in some cases it may be necessary to disconnect the single tuning condenser from the circuit. Further boosters added will of course require no tuning condenser and may need a lower resistance shunted across the tank circuit to broaden the band width. The value of added boosters can be appreciated by referring to *Fig. 1.* Observe that it takes two boosters stagger tuned to cover the sound and video both. Added broadbanded boosters will then raise the total amplification over both the video and audio.

To successfully cascade several boosters the lengths of the transmission lines between boosters, between the last booster and receiver input coil, and between first booster and antenna are very important. The transmission line to the antenna should preferably be of exact multiples of $\lambda/2$ of the frequency being received. If more than one channel is to be received, some compromise must be made. In the example here channel 9 is the weakest channel to be received. Since the electrical length of the transmission line to the antenna from booster #1 is difficult to cut to the exact multiple of $\lambda/2$ due to metal being in the antenna mast and the obstructions over which the line will pass, the following method will aid in securing a good match to the input of booster #1 for the weakest signal. See *Fig. 2A.*

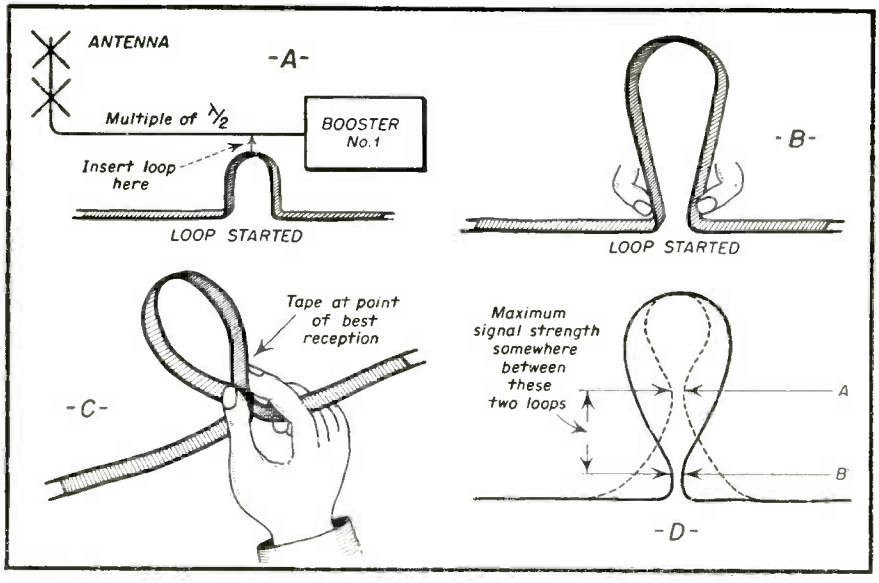


Fig. 2. Method of making loop in transmission line in order to obtain maximum signal strengh at a given frequency.

Make a loop in the line folding the line back on itself between the thumb and forefinger as shown in *Figs. 2A, 2B, 2C* and *2D*. Increase the length of loop while watching the receiver screen for maximum signal strength. The length of loop which gives the best picture is the best match of antenna to the booster input. When this point is found the loop juncture can be taped together with electrical tape.

This method can also be used between boosters and receiver, however the following method for line length is preferable. For the line length between boosters, the transmission line should be cut in lengths of exact multiples of $\lambda/2$ for the weakest station. A line of much less than $\lambda/2$ length will have standing waves on it causing oscillations between boosters or between boosters and receiver. Under

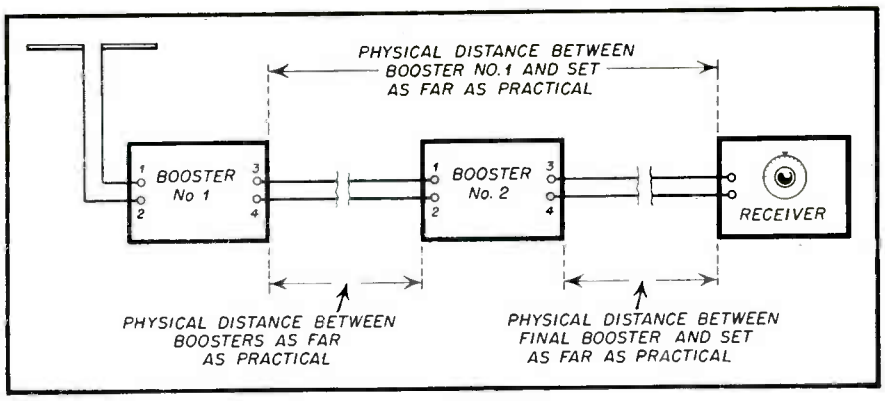


Fig. 3. Keep physical distance between boosters as far as possible.

Table I

CHANNEL	LINE LENGTH
2	106.7"
3	96.4"
4	87.8"
5	77.0"
6	70.8"
7	33.6"
8	32.6"
9	31.6"
10	30 6"
11	29.7"
12	28.8"
13	28.0"

Line lengths of transmission line for different channels.

weak signal conditions a line shorter than $\lambda/2$ will often mean no picture while one exactly $\lambda/2$ will produce an entertaining picture. Between the final booster and receiver the length of line is found by subtracting the length of line from receiver input terminals, to the input coil from the original multiple of $\lambda/2$. Table I gives the lengths of $\lambda/2$ for each channel.

In the example here channel 3 is also to be received. Since $\lambda/2$ for Channel 9 is 31.6" and $\lambda/2$ for channel 3 is 96.4" the line between boosters and between set and final booster would be $3 \times 31.6" = 94.8"$. If the lines were cut to only 31.6" for channel 9, they would be too short for channel 3 and the boosters would tend to oscillate seriously on channel 3. If the lines were out to 96.4", $\lambda/2$ for channel 3, channel 9 would be mismatched reducing its weaker signal, a 94.8" length line for channel 3 would not as seriously mismatch channel 3 signal or reduce its signal strength seriously.

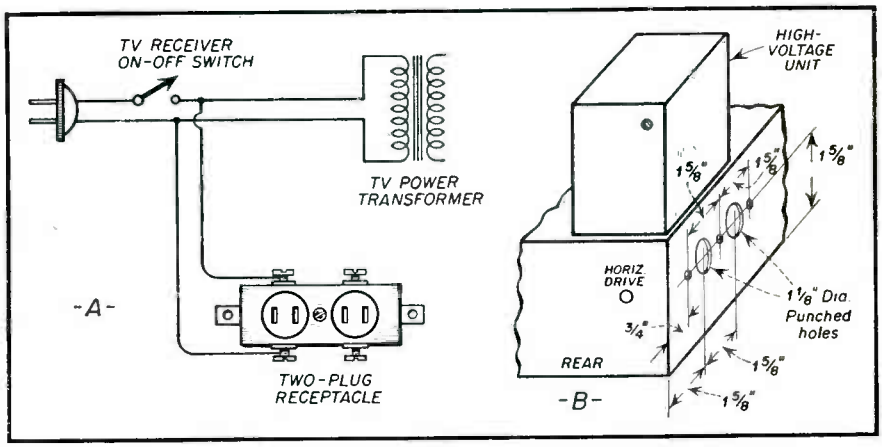


Fig.4. (A-left) Connecting booster power source in series with TV receiver on-off switch. (B-right) Details of mounting a 2-plug receptacle on an RCA 630 TS chassis.

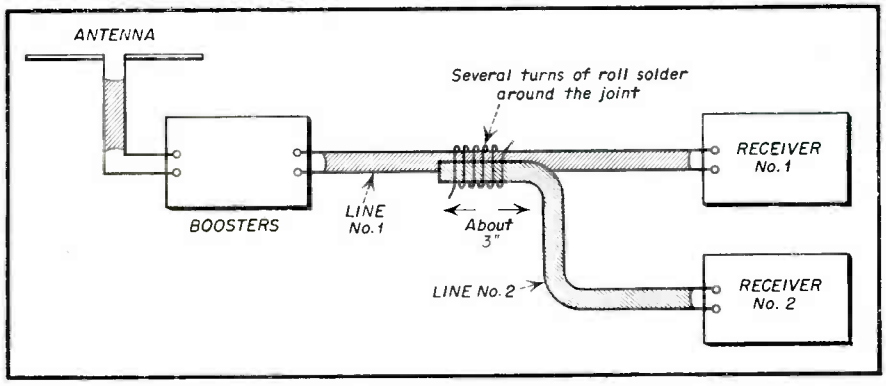


Fig. 5. Simultaneous operation of multiple TV sets from one antenna in weak signal strength areas.

It is very important to keep boosters separated as much as possible from each other and from the receiver to prevent oscillations. Boosters #1 must never be near the T.V. receiver. often if oscillations are troublesome reversing the lines between boosters 1 and 2 and, or set and booster 2 will cure the trouble (ie, instead of 3 going to 1, and 4 to 2, make 3 go to 2 and 4 to 1). See *Fig. 3.*

Simplifying Receiver Operation

When several boosters are added to a set the set owner is apt to complain of the complexity of turning off one when he or she is through viewing the program. To overcome this the following expedient is used: Mount an ordinary two plug receptacle on the T.V. chassis and wire the receptacle in series with the on-off switch of the T.V. receiver. See *Fig. 4A*. With the boosters plugged into

[*Continued on page 48*]

TELEVISION PROSPECTS FOR 1951

by Dr. ALLEN B. DuMONT

(President, Allen B. DuMont Laboratories Inc.)

TELEVISION, like all American industry, will contribute to the National Emergency effort in 1951. The defense effort will be greatly expanded, but until we get out of the planning stage and into full swing in terms of men and materials, it will be difficult to gauge its effects on television accurately.

The big problem for television in 1951 is, of course, production. The full impact of the defense effort will not be felt until Spring or early Summer. But restrictions on basic materials and shortages of small parts used in receivers already have made it obvious that production figures will have to be cut drastically. There will also be a growing shortage of television technicians who will be concentrating on government work in electronics undertaken by television manufacturers.

Just how much this will effect production is anybody's guess. But it may be that 25% fewer sets will be made than in the 1950 September-October period when receivers came off the assembly lines at the rate of 9 million a year.

Increasing costs of essential materials and shortages of component parts will add up to moderately higher consumer prices. But that picture is changing so fast that it is impossible to say when price raises are coming or what they will be.

It is to be hoped that the shortages will not give rise to black market operations, thereby driving prices up further. In any event, the Du Mont company will adhere to its present policy of merchandise control to keep such possibilities to an absolute minimum.

Dr. Allen B. DuMont

The shortage situation should not affect sets already made because there are sufficient replacement parts for all sets now in existence. Authorized Du Mont service organizations and servicing dealers will receive priorities in obtaining replacements.

It may be necessary in some cases to use substitutes in order to continue production. The Du Mont company will use them only if it can do so without any lowering of quality.

Where color TV is concerned, the recent demonstration of a vastly improved all-electric and compatible system of color, coming on the heels of statements that such a system wasn't feasible and an FCC decision in favor of mechanical color, has thrown the whole color situation into a state of complete confusion. It will take considerable time to settle this question. In any case, the abundant problems now facing the industry make it evident that the color question for 1951 will be mostly an academic one.

Despite the fewer number of sets to be produced in 1951, there will be sales retarding factors such as credit restrictions, drops in family income due to increased income taxes, induction of wage earners into the armed services and buyer resistence due to higher prices. Manufacturers and dealers will find it important to continue and even to step up advertising, promotional and sales efforts.

Lifting of the freeze which, it is hoped, will take place in 1951, will do much to increase the demand for sets.

Naturally every manufacturer would like to make more sets in 1951. But the important thing right now is make sure our defenses are strong first. Events of the past few weeks have made it clear that, if we don't increase our nation's strength, we very soon won't have a nation.

The electronics industry, of which television is a part, did a good job in the last war. You can be sure it will do a good job in this present emergency year of 1951.

Editor's Note: As a further thought in regard to the above article, the Editor would like to point out that in conversations with planning and sales personnel of various manufacturers who are advertisers in RTSD, the 25% cutback will probably result in an easing of the parts replacement problem for the servicing technician. The reason for this is as follows: The manufacturer will have to cut back production 25%. This means that 33⅓% of original components provided for full production will now be available, which would not have been the case had no production cut back come into effect. A portion of these components will certainly find their way to servicemen for replacement parts in sets now in use. The immediate future, at least one year of it, should therefore not be too dark for the serviceman as far as obtaining replacement components is concerned.

Book Reviews

TV and Other Receiving Antennas (Theory and Practice) by Arnold B. Bailey, John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y., 606 pages, 310 illustrations, $6.00.

This book is primarily concerned with the theory, design and applications of VHF and UHF antennas, with emphasis on Television applications. Its contents includes chapters on the following: Review of Definitions and Terminology, The Television Signal and its Bandwidth, problems of Television Reception, The Electromagnetic Wave, The Radio Path, The Theory of Signal Interception, The Center-Fed Zero-db Half-wave Antenna, Comparison of Zero-db Half-wave Antennas, Parasitic-Element Antennas, Horizontally Polarized Antennas, Vertically Polarized Antennas and Special Types, and Practical Aspects of TV Receiving Antennas. Included in its covers are data sheets on approximately 50 different basic type antennas. Each antenna type is illustrated and its performance characteristics, impedance, directivity patterns, requirements and proper matching frequency bandwidth characteristics and other important details tabulated.

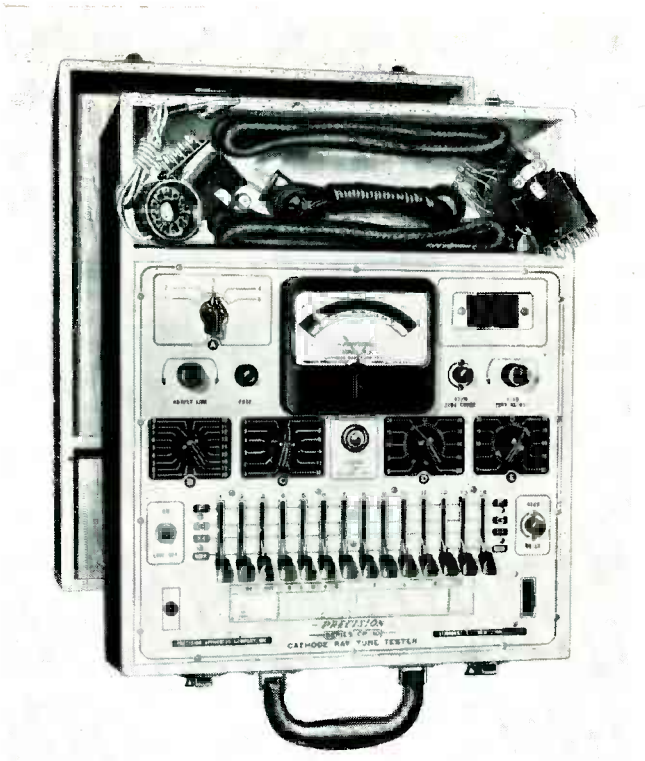
This book is written for the engineer and the technician alike. The more technical aspects of antenna

[*Continued on page 48*]

A New CATHODE RAY TUBE TESTER

by J. PEIKON

Applications Engineering
Precision Apparatus Company, Inc.



Precision CR-30 CR Tube Tester

A new type of instrument has been added to many now required for fast and efficient radio, television and electronic servicing. In this article is described the basic theory and applications of the cathode ray tube tester.

A cathode ray tube checker that tests *all* cathode ray tubes, electromagnetic and electrostatic, with the ease and facility of a conventional tube checker, has been a long felt need in the industry. The serviceman will welcome it because it will answer that ever-recurring question, "Is it the TV set or is it the picture tube?" In addition, it provides for him a convincing item of authority for the type of customer who is impressed primarily by test equipment findings, thereby making his selling job that much easier. Dealers and distributors will find it an answer to how deteriorated or defective a CR tube is, and whether or not it is bad enough to warrant replacement by the manufacturer. This tester, in providing a definite answer to this question should pay for itself in eliminating unnecessary transportation costs alone. Finally, the manufacturer will welcome it because it affords a convenient, rigid, economical and technically sound basis for sorting the mass of "field rejected" CR tubes which tend, at times, to load the floor. Such an instrument is the Model CR-30 Cathode Ray Tube Tester recently developed by Precision Apparatus Co., Inc.

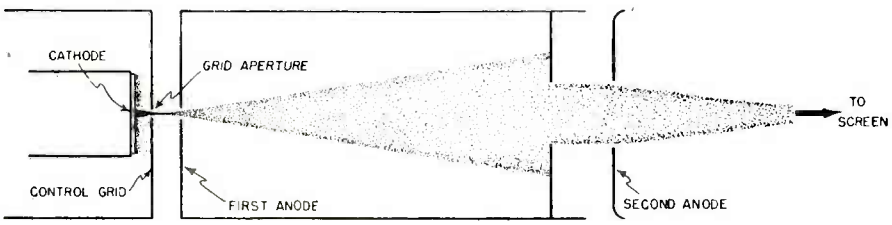


Fig. 1. Electron gun structure, illustrating why most effective portion of cathode cathode consists of central area.

Design Considerations

The design of this tester centers around the electron *beam* characteristic of a CR tube whereby the most copious and useful emission (because of the electronic focusing structure of the tube) comes from only the center area of the cathode surface. (See *Fig. 1)*. Thus, the total overall surface emission might be high, yet the tube will be poor if the stream of electrons derived from the center area of the cathode is low. On the other hand, a tube with low *overall* cathode surface area emission, but with high *center* area emission, will perform satisfactorily.

Beam Current Test

Making use of this characteristic, the electron beam is obtained by connecting the control grid to ground through a suitable series resistance and making the first anode the collecting element. It is of interest to note that under these conditions the normal beam currents obtained will vary from a few microamperes (poor to dead tubes) all the way up to approximately 1700 microamperes (new good tubes).

This beam current is measured by means of a VTVM connected in the circuit shown in *Fig. 2.*

The actual beam current test procedure is as follows:

1. All necessary test potentials are determined by setting the circuit selectors to designated positions given on the roller chart. (see photo of front panel).
2. Balance the VTVM
3. Press READ METER button
4. Read specially designated CR tube quality scale

Element Continuity Test

Additional tests include checks for element continuity, shorts,, leakage and filament continuity. In order to obtain truly complete test on the CR tube, all elements, which do not contribute to the Beam Current test must be continuity tested via an extremely sensitive indicating circuit. The built-in VTVM is employed for this purpose and is capable of indicating minute currents. In fact just 1/10th of one microampere will create a meter deflection of approximately 5 divisions on the 120 division meter scale. The basic test circuit is shown in *Fig. 2.*

Suitable potential fields are obtained for the various elements by means of a selector switch which applies predetermined, in-phase, accelerating potentials to the various elements following the first grid. Other elements, previous to the element being checked for continuity, are shorted to anode *No. 1* and become accelerating electrodes. Thus, to check one of the deflecting plates for continuity (see *Fig. 3*) anode *No. 1* and anode *No. 2* are connected together, following which a voltage is applied to the two sets of elements by means of the in-phase transformer windings. The resultant beam current, flowing through the element being tested, is then read on the VTVM. If the element is open the meter will not read.

The use of a VTVM has another advantage — if the tube were gassy the beam current would be inordinately high and an ordinary meter would slam. In the circuit used in this instrument, the VTVM is biased so that any current over 1700 microamperes will not cause the pointer to go beyond full scale. Thus, if a full scale reading is obtained the tube may be considered gassy. If the tube is saturated with gas, an opposite effect is obtained, that is the electron beam is blocked and the scale reading will be very low (dark to dim). There is a remote possibility that an unused tube might read full scale because of an extraordinarily high beam current characteristic, but this possibility is rather remote. Thus a gassy tube will either read absolute full scale or very low.

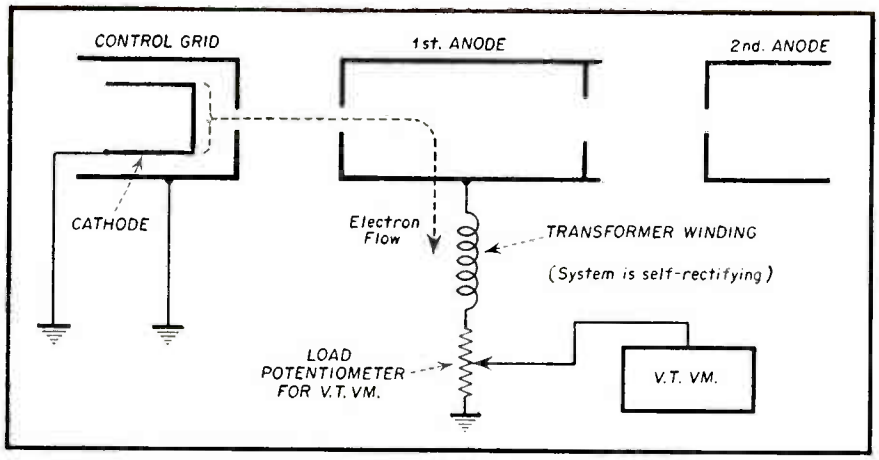


Fig. 2. Measuring beam current with VTVM.

Shorts, Leakage, and Filament Continuity Tests

Shorts, leakage, and filament continuity tests are made in conjunction with an appropriately sensitive neon lamp circuit. To test for shorts and leakage, each element lever is raised individually to the H position and the operator watches for the neon tube to glow. Then, to determine the actual leakage path, the lever already raised in the H position is kept in that position and each of the remaining levers are successfully thrown to the H position, the operator watching for the glow to be extinguished. The lever which causes the glow to be extinguished corresponds to the other shorted element. Levers are numbered in accordance with RTMA basing, which enables the operator to identify the exact elements that are shorted or defective.

The filament continuity test utilizes the above principles to check for continuity between the pre-determined filament connections given in the chart under the column, FIL. CONT. The filament voltage selector switch is adjustable to include the voltages used in present day tubes (2.5 and 6.3 v.) and in addition includes provisions for future CR tube filaments up to 25 volts. See *Fig. 4.* Discussions with CR tube manufacturers makes it appear most improbable that CR tube filament voltages will ever go higher and in fact highly doubtful that they will even go up to 25 volts, for technical reasons.

Flexibility

This instrument has facilities for independent variation of base pin terminations which, according to best predictions, will accommodate all picture tubes to be manufactured in the forseeable future. Thus, the possibility of obsolescence is reduced to a minimum. At present the maximum number of element circuits used is eleven.

Two cables are provided for connecting various CR tubes to the tester. The first is a duo-decal terminated

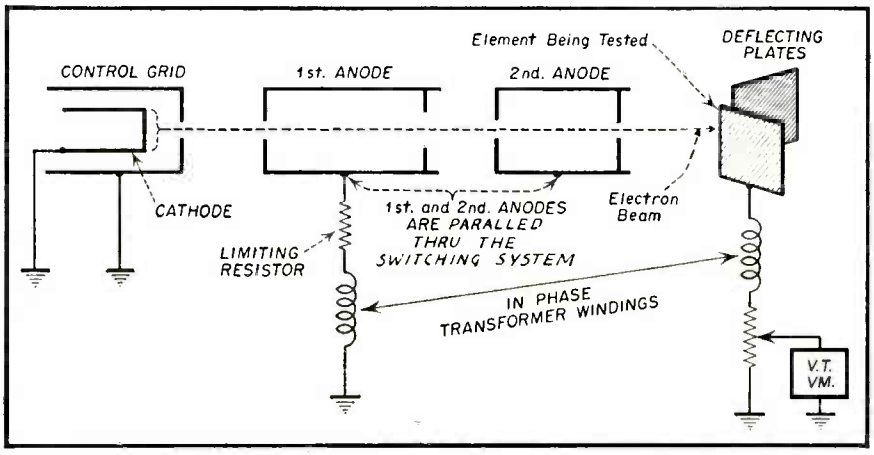


Fig. 3. Continuity testing of CR tube elements.

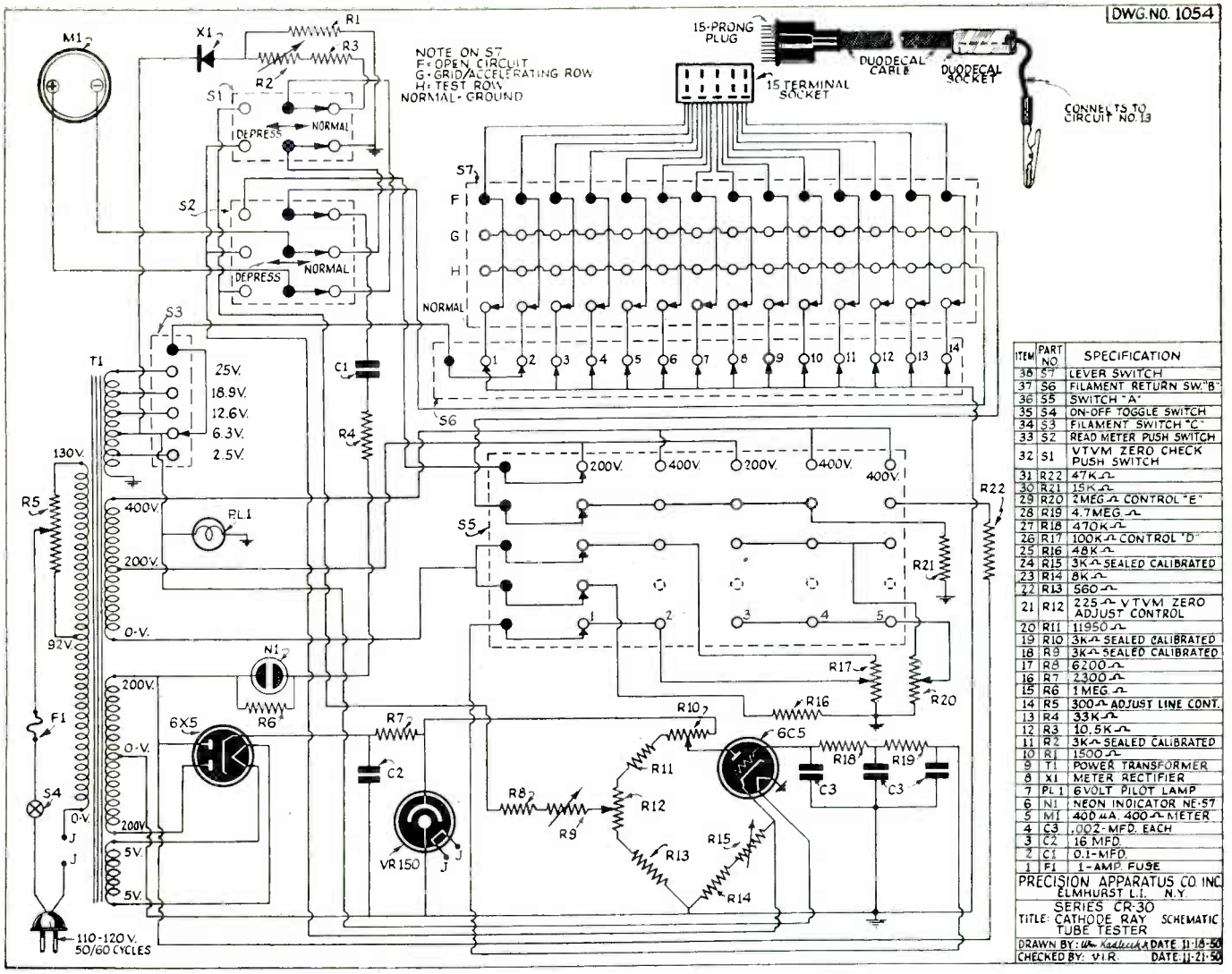


Fig. 4. Circuit diagram of Precision Apparatus Co. Model CR-30 CR tube tester.

cable and will accommodate the greater majority of tubes used at present. The second is a special type of universal cable which utilizes individual grip-tip connectors which are connected to the tube base pins and which are numbered in accordance with RTMA basing figures. These cables are shown in the photograph illustrating the instrument.

Intermittent Connections

An interesting application of this instrument is its use in checking for intermittent connections, particularly the connection between the internal spring clips which connect the anode plate and the high voltage inside coating (see *Fig. 5*). A continuity test, as described under the section heading: "Shorts, Leakages, etc.," is made between the anode plate and the high voltage cap (which connects to the inside lining), and the tube is tapped for intermittency.

Reject Limits of CR Tubes

All else being normal, screen brightness is proportional to the beam current. The question that had to be answered by the designers of this instrument was, "What are the limits of beam current with respect to a tube's rejection or acceptance?" This was determined through consultation with several prominent CR tube manufacturers and also determined through actual tests conducted on a large number of good and bad tubes. Exhaustive experiments helped determine the apportioning of the scale limits as shown in the photo. Thus, all tubes reading from zero up to the line separating the DARK TO DIM (red) and DIM TO BRIGHT region (yellow and green) should be rejected. All tubes in the DIM TO BRIGHT region may be rejected or still be kept in use depending on how demanding the owner is for maximum brightness and highlight contrast. Tubes reading in the lower portion of the BRIGHT region, up to the 45 mark on numbered divisions of the scale, will be satisfactory to most viewers. However, the more critical observer may notice a loss of peak whites. Tubes reading above the 45 mark on the scale are good and should yield *in a normally operating receiver,* requisite brightness and highlight contrast.

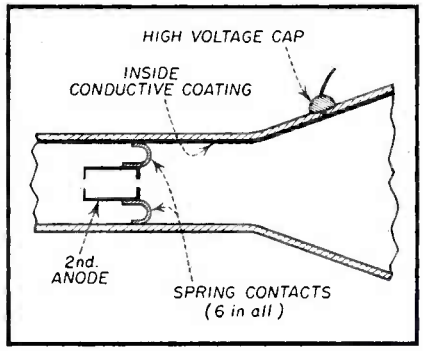


Fig. 5. High voltage cap is connected to the 2nd anode by means of an inside conductive coating making contact against 6 or more concentric spring clips mounted on 2nd anode and pressing up against inside coating.

SHOP NOTES

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

Philco-Care Of Optical System

Extreme care must be taken at all times in handling the precision-ground optical parts of Model 48-2500. Avoid contact with the optical surfaces of the screen, mirrors, and corrector plate, since the body acid contained in fingerprints is harmful to these surfaces. The units must be handled only by their unused areas.

Since the prejection screen has a lacquered surface, it can be damaged by vigorous rubbing. Therefore, under normal conditions, it should never be touched. If it does accumulate dust, the dust should be removed by flicking vertically with a clean, soft, flannel cloth. In a normal location and with proper handling, the screen should never acquire fingerprints or smudges. But in case prints or smudges do appear on the screen in such a manner that the quality of the picture is affected, they may be removed by breathing on them and gently rubbing vertically with a soft, clean, cotton flannel cloth.

Dust may be cleaned from the dust cover and the flat and spherical mirrors by dusting them with a piece of soft, clean, cotton flannel cloth. The spherical mirror must be removed to be dusted, and the dust cover must be removed to dust the flat mirror. The flat mirror may be cleaned in its normal position.

In cleaning the dust cover and the flat and spherical mirrors, use a slight application of water on a piece of soft, clean, cotton flannel cloth and rub gently over the entire surface. Then, using another strip of the same type of cloth, gently wipe the surface dry and free of smears.

When the corrector plate accumulates dust, it causes a very noticeable deterioration in contrast and resolution, and a less noticeable decrease in brilliance, because the diffusion of light by the dust particles tends to lighten those portions of the picture which would normally be black. As a result, the black tones become gray. It is recommended that the corrector plate be cleaned every two to six months, to preserve the quality of the picture. The period between cleanings depends on the amount of dust present at the receiver location.

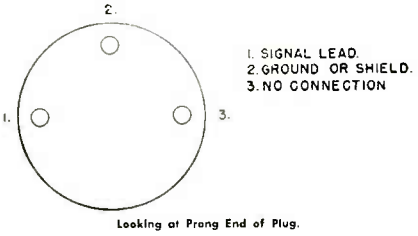
The corrector plate may be cleaned in the same way as the dust cover and the flat and spherical mirrors, without removing it from its normal location. Use a light application of water on a clean, soft, cotton flannel cloth and rub gently over the entire surface. Using another strip of the same cloth, gently rub the surface dry and free of smears.

Remember that careful and intelligent handling of all optical components is imperative!

Philco Service Dep't.

The Console Coupler

In order to use the television jack on radio receivers, Stromberg-Carlson has announced the Console Coupler in conjunction with its table model television receivers.



The Console Coupler is a connecting link which permits the sound of the television table model to be played through a console radio and thus receive the benefits of the larger speakers which are used in consoles. If desired, the sound can at the same time be played through the smaller speaker of the television receiver. The Console Coupler, part number 71175, can be purchased from the Stromberg-Carlson Service Department. It is a twelve foot length of flexible, low-loss, shielded cable with a plug at one end which fits into the receptacle of the table television receiver marked "Console Coupler". The other end has no plug connected to it so that it will be readily adaptable to any Console. All Stromberg-Carlson console receivers have been shipped with this plug in place so that it can be soldered on to the Coupler and plugged into the radio receiver at the place marked "Television".

On all models except the 1210, this will be a plug with one prong. The shell of the plug should be connected to the shield of the Coupler cable and the prong should be connected to the inside lead. On the 1210, use the following diagram to make connections:

NOTE: On a very few early table model television receivers, the small speaker was made to cut out when the Console Coupler was plugged in. If it is desired to have both speakers playing at once, the inside ends of the Console Coupler jack can be soldered together to keep the connection from breaking when the plug is inserted.

Excessive Hum 1220-T AM Chassis Used in TV-12 Combinations

To reduce excessive hum in 1220-T AM Chassis used in TV-12 Combinations, the Engineering Department by virtue of Engineering Change R-15631, dated June 7, have made the following addition to this chassis:

Connect our P-111026, 25 mfd, 25 volt capacitor between cathode terminal of 6SC7 tube and ground. In most cases this will reduce hum to a point where it will no longer be objectionable. Because of variations in 6SC7 tubes, hum may sometimes be noted after this capacitor has been added. However, in these cases, changing tubes will invariably eliminate this complaint.

Stromberg-Carlson Model TC19 Receivers—Focus Coil Position.

A greater "in-focus" picture area can be obtained if the focus coil assembly is separated by approximately three-quarters of an inch (¾") from the deflection yoke on the picture-tube neck. The separation distance is best determined by observing the picture while adjusting the focus coil position.

Stromberg-Carlson Svc. Dep't.

Westinghouse MODELS H-217 AND H-226—Picture Width

With early production versions of the Models listed, some difficulty may be experienced in obtaining sufficient picture width. If this condition occurs, check the voltage divider (R501, R502, R503 and R504) in the voltage doubler circuit of the high voltage supply. In original production, the plate of the 1B3GT doubler tube was connected to the junction of R501 and R502. To increase the picture width, move the plate connection down to the junction of R502 and R503. This is being done in later production.

Westinghouse Elec. Svc. Dep't.

QUALITY

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Because...

They're Produced by the World's Largest Manufacturer of Both Antennas & Rotators

C·D·R TELE-ROTOR

HEAVY DUTY MODEL

This heavy-duty TELE-ROTOR has no match! It's more powerful . . . turns any TV antenna array under any weather conditions! Recommended by servicemen everywhere because of its dependable, TROUBLE-FREE performance. Handsome control cabinet gives quick, easy control . . . indicates antenna position instantly.

Model TR-2 . . rotator with "Compass Control" cabinet having illuminated "perfect pattern" dial . . . (Uses 8 wire cable) $44.95

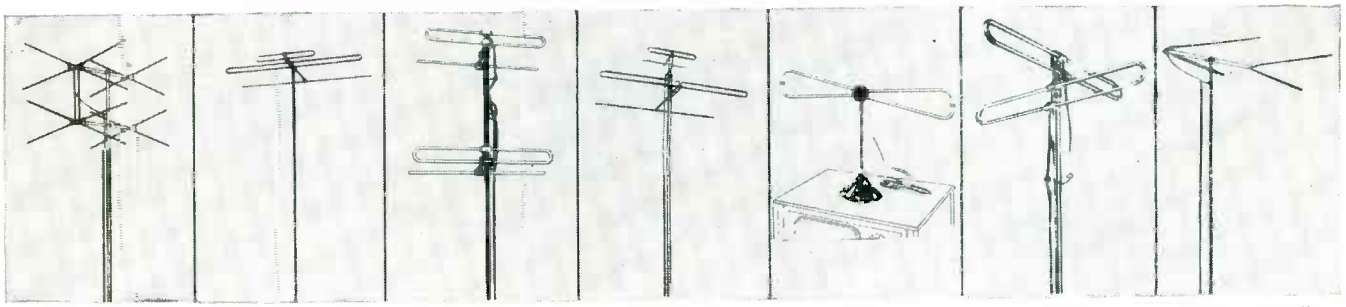
Model TR-1 . . . rotator and control cabinet with end of rotation light . . . . (Uses 4 wire cable) $39.95

C·D·R TELE-ROTOR CUB

New TELE-ROTOR CUB for average installations. Same husky motor as heavy-duty TELE-ROTOR. **FASTEST, EASIEST ROTATOR TO INSTALL.** All-In-Line design . . . with true in-line thrust between antenna and mast. ¼" STEEL shaft rotates on case hardened steel ball . . . in-line reamed oiless bearings. Plastic control cabinet offers easy, accurate control.

Model 502-A . . . rotator with control cabinet having indicating meter for "hairline" tuning. (Uses 5 wire cable) $44.95

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



"Lazy-X" Conicals | "Strate-Line" Antennas | Double-Stacked Arrays | "Hi-Lo" Antennas | Indoor Antennas | FM Antennas | "Super-Vee" Antennas

You Can't Beat a RADIART Antenna on a TELE-ROTOR IT'S TOPS

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NEW PRODUCTS

7-INCH ELECTROSTATIC CR TUBE

The RCA 7JP1 is a 7-inch cathode-ray tube of the electro-static focus and deflection type designed to provide exceptional brightness when operated with an anode-No. 2 voltage near the maximum of 6000 volts, and good brightness at anode-No.2 voltages as low as 1500-2000 volts. Intended for general oscillographic applications, the 7JP1 has a small,

brilliant, focused spot and high deflection sensitivity for its relatively short length. The screen is of the medium-persistence, green-fluorescence type and provides high contrast.

The 7JP1 utilizes an electron gun which has a grid No.2 operated at anode-No.2 potential so that the beam current and grid-No.1 cutoff voltage will not be affected by focusing adjustment. The gun also has an anode No. 1 which takes negligible current. As a result of these features, the spot can be sharply focused on the screen, and remains sharp when beam current is varied over a wide range.

HEAVY DUTY DUAL SPEAKER

The new Racon Model RR-40 Dual Speaker is designed primarily to meet the rigorous 365-day requirements of railroad sound systems. Exhibiting high intelligibility, and unusual clarity and sensitivity for "talk back" purposes, it is also admirably suited for other

industrial installations, such as open pit mines, steel mills, factories, etc. Extreme ruggedness, immunity to acid fumes and easy serviceability are other outstanding design features.

Manufactured by Racon Electric Co., Inc., 52 East 19th Street, New York 3, N.Y., the Model RR-40 consists of a heavy non-corrosive center aluminum casting with a weather-proof steel-bell re-entrant speaker at each end of the opening. There is ample room internally for a line transformer, terminal strip and minor accessories, which may be installed on the inside of the back cover plate to permit ready access. Heavy velumoid gaskets between each cover plate and the casting prevents any water seepage.

For full details on this model and the rest of the complete Racon line, write directly to Racon Electric Co., Inc. 52 East 19th St. New York 3, N.Y.

FIELD STRENGTH METER

The Simpson Electric Company of Chicago has introduced a Television Field Strength Meter which will measure Television signals in any localty and in all types of installations. New engineering design which has given special consideration to fringe area applications, include such functions as location of maximum signal areas, antenna orientation, comparison of antenna systems, adjustment of boosters and checking antenna and lead-in installations.

Model 488 incorporates a 12 channel television tuner with each channel separately adjustable, for maximum flexibility and uniform results.

A phone jack is included for making audible tests so that the operator can quickly identify the type of signal being measured.

The large 4-1/ inch modernistic meter is easily read from a considerable distance. All controls and connections arranged for greatest accessibility.

Model 488's case is of gray hammerloid, with leather handle. Weight is 11-1/2 lbs., (shipping weight, 13 lbs.). Case measures 8" x 11" x 8-1/2". Dealer's price $89.50.

R-C-L COMPARATOR BRIDGE KIT

The new Model 950-K R-C-L Comparator Bridge Kit was recently announced by the Electronic Instrument Co., Inc., 276 Newport Street, Brooklyn 12, New York, manufacturers of the famous complete EICO line of kits and instruments.

The Model 950-K tests every type of resistor over the full range of .5 ohms to 500 Megohms, in 4 convenient steps: 0.5-500 ohms; 50-50,000 ohms, 5K-5M; and 5M-50M.

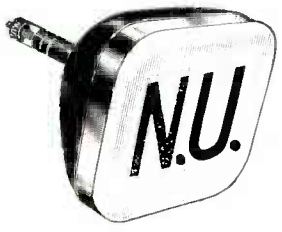
The Capacitance Range tests every type of condenser - paper, mica and electrolytic -

over the full range of 10 mmfd to 5000 mfd, in 4 convenient steps: 10 mmfd - 5000 mmfd; .001 - .5 mfd; .1 - 50 mfd; and 50 - 5000 mfd. For leakage test and polarization, a source of variable voltage is incorporated with the complete range of 0-500 volts. This also provides for the precise measurement of the power factor of electrolytics from 0 up to 80%.

17-INCH RECTANGULAR TUBE

Type 17BP4A, a 17-inch rectangular tube has been announced by National Union Radio Corporation of Orange, New Jersey.

The N.U. 17BP4A is a direct-viewing television picture tube providing a 11-3/5" x 14-1/4"



rectangular picture having the standard 3 x 4 aspect ratio. It features a face plate having an integral neutral gray filter which increases the contrast ratio when viewing under ambient light conditions.

The N.U. 17BP4A utilizes the new tilted-beam type gun to obtain improved picture detail. It requires only a single-field ion trap. The N.U. 17BP4A is electrically similar to the now-popular N.U. 16KP4/16RP4 and therefore a suitable replacement in new set designs where the larger dimensions can be taken care of.

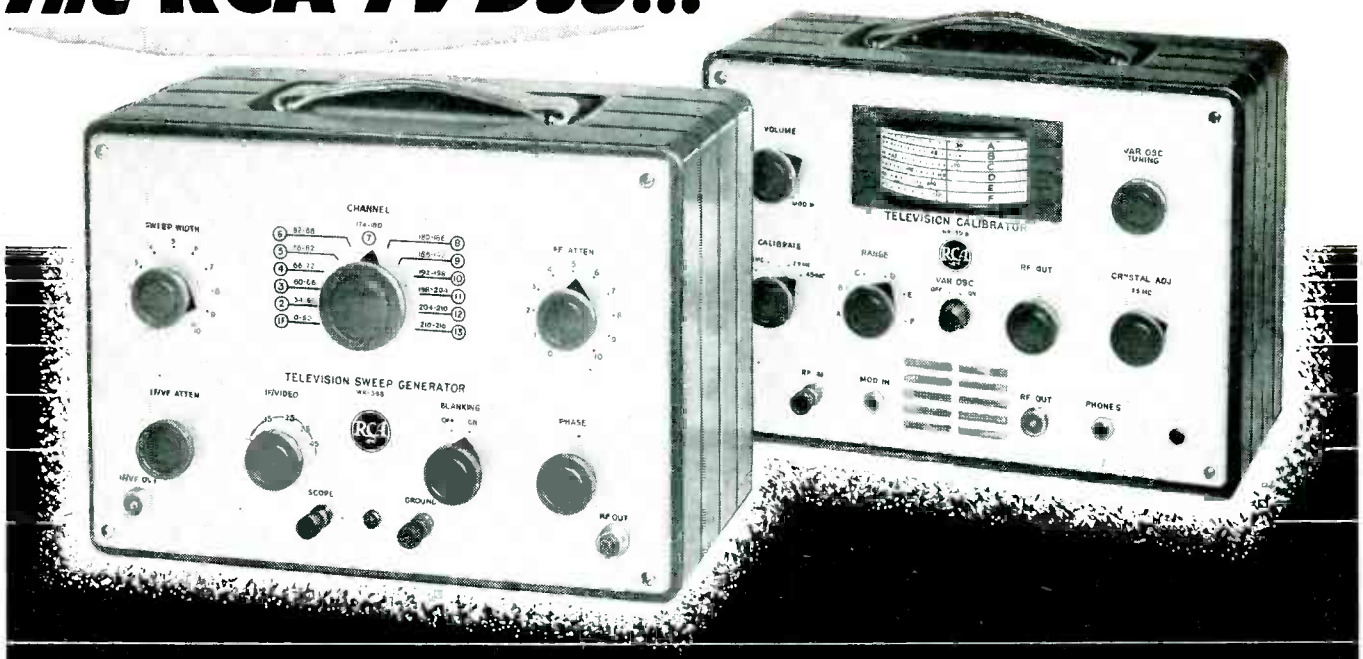
MULTIPLE RECEIVER TV SIGNAL SOURCE

An entirely new concept of closed-circuit television is provided by the new addition to the Du Mont television equipment line, the Dumitter. This unit, just announced by the Television Transmitter Division, Allen B. Du Mont Laboratories, Inc., Clifton, N. J., permits TV camera signals to be distrihuted to a large number of standard TV receivers, over

connecting cables, thereby eliminating costly and bulky equipment heretofore required for the same function.

The Dumitter is a single, compact, completely portable unit. It takes the composite

The RCA "TV Duo"...



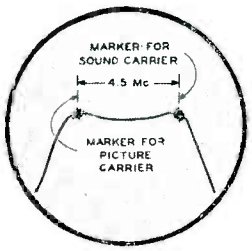
...the last word in *precision* and *versatility*

RCA WR-59B Television Sweep Generator

What it does—Provides fast and accurate sweep alignment and trouble shooting of TV front ends . . . sound and picture if amplifiers . . . discriminators and ratio detectors . . . trap circuits . . . video amplifiers . . . and if amplifiers in FM sets.

What it features—Preset switch positions for TV channels 2 to 13 . . . continuous tuning from 500 kc to 50 Mc . . . flat output, within ±1.5 db even at maximum sweep width . . . fundamental oscillator output on all TV channels . . . filtered beat-frequency-fundamental output on if/vf range . . . zero-voltage reference line provided by return-trace blanking . . . dual piston attenuator with maximum attenuation ratio of 20,000 to 1 . . . continuously variable sweep width up to 10 Mc . . . output frequency-modulated at the fundamental frequency by a precision-type vibrating capacitor, for long life and good linearity . . . balanced rf output cable terminated in 300 ohms . . . fully shielded circuits and filtered power line . . . resistance-terminated if/vf output cable.

For complete details ask your RCA Test Equipment Distributor for Bulletin 2F753.



"Scope pattern of dual markers for rf picture and sound carriers, produced by the "TV Duo."

RCA WR-39B Television Calibrator

What it does—Provides dual markers for rf picture and sound carriers . . . provides signals for peak alignment of stagger-tuned if amplifiers . . . develops vertical bar pattern for horizontal linearity adjustments . . . generates a crystal-controlled AM signal for alignment of inter-carrier sound if's . . . provides triple markers for sound discriminator adjustment . . . allows adjustment of local oscillators in TV front ends with crystal accuracy . . . checks reception on all 12 channels by means of video signal obtained from single channel of a TV set.

What it features—Variable-frequency oscillator operating on fundamentals over entire range . . . sound and picture carrier frequencies marked on expanded, easily-read scale . . . two crystal oscillator stages with 3 crystals supplied . . . wide-band modulator stage with range of 0 cps to 30 Mc . . . crystal standard supplying over 600 calibration check points at 0.25-Mc intervals . . . bar-pattern generator for linearity adjustments.

For complete details ask your RCA Test Equipment Distributor for Bulletin 2F751.

Available from your RCA Test Equipment Distributor

RADIO CORPORATION of AMERICA

TEST EQUIPMENT **HARRISON, N. J.**

video signal from any standard TV camera chain and feeds it via cable to the regular antenna terminals of any standard TV receiver. Transmission is excellent over several thousand feet.

Each receiver is tuned to either Channel 2 or 3, depending on the setting of the Dumitter, and the closed-circuit program is received. The antenna lead-in is disconnected from the receiver while the Dumitter signal is being received. For merchandising promotions, it can distribute the camera picture to standard TV receivers located at strategic spots throughout the largest store.

CR TUBE CHECKER

Thomas Electronics, Inc. announces a new CR tube checker, the "Catho-Chek". One quick check of the tube, made simply by completing the connection of the Catho-Chek to the terminals at the tube base, shows immediately

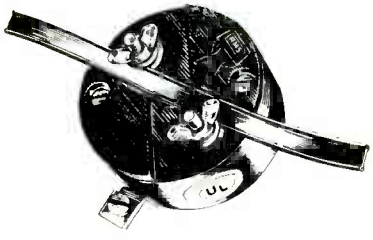
the exact condition of the tube in checking emission (reading directly on a 0-1 Ma. meter scale), gas ratio, shorts and leakages (reading directly on a 0-100 Micro-ammeter). All readings require only unplugging of the power cable from the studs in the tube cap and hooking up of the Catho-Chek lead wires which come equipped with standard snap-on test clips. Removal, loosening, or shifting of the picture tube from the chassis is unnecessary with any tube now in use.

The Catho-Chek is finished in grey, wrinkle-finish, baked enamel and comes equipped with all necessary lead wires of adequate length, and sturdy handles for easy carrying. The entire unit weighs 14 pounds.

Further information and prices may be obtained by writing direct to Thomas Electronics, Inc., 118 Ninth St., Passaic, New Jersey.

LIGHTNING ARRESTER

A new, all-weather radio-tv lightning arrester featuring two-way protection has just been developed by Radio Merchandise Sales Inc., New York 59, N. Y.



The arrester, streamlined and sturdily constructed, incorporates neon gas discharge and air gap to assure positive protection against lightning and static. Infinite resistance is maintained before and immediately after discharge - input impedance is constant.

The RMS arrester is completely waterproof, requires no wire stripping and mounts easily on walls, masts and sills. The unit takes both regular and jumbo size twin lead and is Underwriters Laboratories approved for both indoor and outdoor use.

OXFORD INTRODUCES NEW SPEAKERS

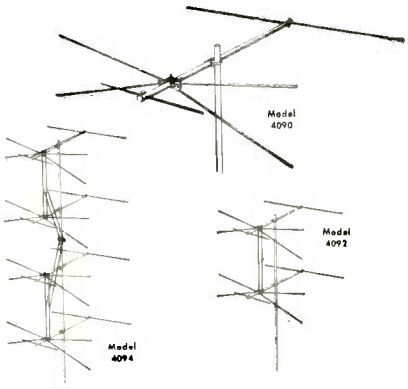
Oxford Electric Corporation, manufacturers of speakers, announces the development and availability of eight new models.

These are: Model 3CMWS - weatherproof speaker; Model 6CMWS - weatherproof speaker; Model 82EVS - pin cushion type for automobile replacement; Models 46V45S, 60A45S, 80A45S, 10E45S, and 12E45S- electro dynamic speakers.

Inquiries and further information are available upon request. Address your correspondence to: Oxford Electric Corporation, 3911 South Michigan Avenue, Chicago 15, Illinois.

WALSCO TV ANTENNA

The Walter L. Schott Company, Beverly Hills, has unveiled the new Walsco Signal King antenna capable of receiving all channels. A new signal "director" has been added to improve gain on high band channels and eliminate "ghosts". Preliminary tests indicate no weak spots over entire TV spectrum. Ease of stacking makes the Signal King an excellent fringe area antenna as well.



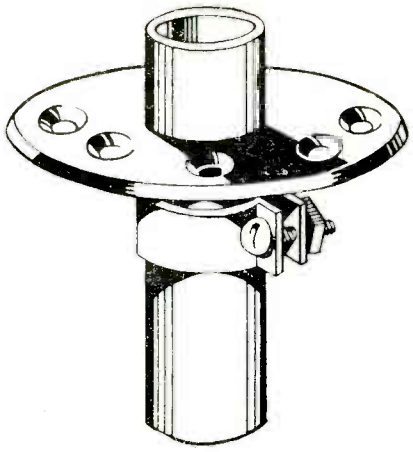
Another new feature of the Walsco Signal King includes the patented insulator which is guaranteed unbreakable under all operating conditions. Its lasting dielectric properties are not affected by climate.

Catalog information on the Walsco Signal King antenna may be obtained by addressing the Walter L. Schott Company, 9306 Santa Monica Blvd., Beverly Hills, California.

ROTATABLE GUY ANCHOR

Technical Appliance Corporation, Sherburne, N. Y., manufacturers of TV, AM, and FM antenna systems, are now making available a guy anchor that allows free rotation of the mast after guy wires are attached.

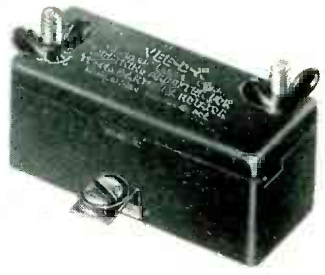
Known as Cat. No. 867 Guy Anchor, it is made of heavy gauge steel and provides the strength necessary for high installations where guy wires are necessary for steadying the antenna while antenna is oriented. This device also proves worth many times its price in



cases where reorientation may have to be done at a later date as is so common. Without removing any of the guys, it is possible to rotate the antenna mast without relocating guy wires on the roof. When guy-wire turnbuckles are tightened the circular plate is pulled down on the mast collar, thus acting as a further assurance of direction stability, in addition to the mast mount.

LIGHTNING ARRESTER

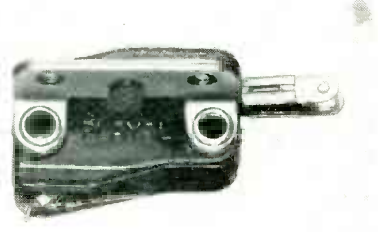
Jerome E. Respess, president of the La-Pointe-Plascomold Corporation, Windsor Locks, Conn., announced the addition of another new lightning arrester to the VEE-D-X line of TV antennas and accessories.



This new arrester, he stated, is similar in design to the popular 4-wire RW-204, but is constructed with only 2 saw-tooth contact points instead of 4. The RW-200 provides positive protection for all standard installations and lists for $1.25.

PHONO PICKUP

Sonotone Corporation, leading manufacturer and distributor of hearing aids, has announced two additions to its line of Titone phonograph pickups—the "Playal" with replaceable needle and the Super Titone "Turnover."



Pickups made with Titone, the original piezo-electric ceramic element, have these advantages, according to Sonotone: They provide a wide frequency response, eliminate "needle talk" and are easy on records, rugged and unaffected by humidity and temperature changes.

uniform

Yes, UNIFORM! There's no such thing as a "better tube" or a "poorer tube" when you insist on Du Mont Teletrons. Advanced engineering, precise mechanization second to none, and the most rigid quality control account for *uniformly dependable performance* that has made the Du Mont label symbolic of the finest in TV tubes. Best of all, with a productive capacity in excess of one million BIG picture tubes a year, the giant Du Mont Allwood plant meets *quantity* as well as *quality* requirements. Literature on request.

DUMONT

Teletrons*

*TRADE-MARK

FIRST WITH THE FINEST IN TV

ALLEN B. DU MONT LABORATORIES, INC.

Cathode-ray Tube Division, Clifton, N. J.

TRADE FLASHES

[from page 8]

expansion and improvement of black and white program service, Walter A. Buck, Vice President and General Manager of the RCA Victor Division, Radio Corporation of America, said in a letter mailed recently to all RCA Victor distributors.

ESFETA TV Lectures For February & March

The schedule of lectures for the Empire State Federation of Electronic Technicians Associations for the months of February and March are as follows:

New York Area: Feb. 1, DuMont. March 1, Ward Products Co. March 15, RCA.

Long Island Area: Feb. 27, Philco.

Poughkeepsie-Kingston Area: Feb. 13, Philco. March 12, Sylvania.

Endicott-Binghamton Area: Feb. 20, Philco.

Rochester Area: Feb. 6, Philco. March 6, Sylvania.

Simpson Announces Servicing Lecture Program

Mel Beuhring, Sales Manager of Simpson Electric Co. of Chicago, Ill., has announced that Simpson, in cooperation with its Representatives, will sponsor a series of lectures on "Television Servicing" to be delivered by Jack Whiteside, senior engineer with the company. A Vu-Graf projector and 30 illustrative slides will be used to clarify important points.

The New York lecture will be held at the Engineering Society Building at 29 W. 39th St. on the evening of Jan. 23, 1951, at 8.00 P.M. The Newark meeting will be held at the Robert Treat Hotel, Newark, N. J. on the evening of Jan. 24, 1951, at 8.00 P.M. Free refreshments will be served. Door Prizes consisting of Simpson test equipment will be given away.

Precision Apparatus Company Lecture Schedule

The lecture schedule of the Precision Apparatus Co., in which R. G. (Bob) Middleton, senior engineer with this company, will speak on, "Television Circuitry, Alignment Practice and Trouble-Shooting, has been released for February, and is as follows:

Feb. 1, 1951, Flatbush Terrace, B'klyn, N. Y. Feb. 5, Hotel Kenmore, Boston, Mass. Feb. 7, Carpenters Union Hall, Providence Rhode Island: Feb. 8, Aurora Hotel, Worcester, Mass. Feb. 15, Hotel Garde, New Haven, Conn. Feb. 19, Concourse Plaza Hotel, Bronx, N. Y. Feb. 21, Hotel Douglas, Newark, N. J. Feb. 26, S. R. Ross Co. Inc., Salt Lake City, Utah. Feb. 28, Vets of F.W. Audoritorium, Phoenix, Arizona.

Sylvania Award

Believing that the most effective way to improve the quality of Television Programs is by positive action rather than by destructive criticism Sylvania Electric Products Inc. has established the Sylvania Television awards to honor those who have contributed most to the Television Art.

At a gathering in which the awards were announced, Don G. Mitchell, President of Sylvania said, "Because Television is a new art, the top Award will be given to the program deemed best as Creative Television Technique."

Don G. Mitchell

Other Awards will be given to individuals on any TV program — to a writer, a producer, a director, an actor or actress, a camera man, a scene designer, a lighting expert and a make-up man — considered to have made the greatest contribution in the period from January 1st, to June 30th, 1951 in each of these departments. The winners will be honored at a dinner to be held next August Duplicate Awards will be given to the network or station on which the winning program is seen and, if sponsored, to the sponsor and his advertising agency Television stations not yet on networks will be invited to send kinescopes for the consideration of the judges.

Mr. Mitchell further pointed out that, "Leaders in the field of entertainment — Music, Drama, Comedy — educators, Officials of Parent-Teachers and Women's Club groups, Critics, Business Men, as well as Specialists in various phases of Televi-

RADIO-TELEVISION SERVICE DEALER

announces

a new Department

"TUBE TOPICS"

by

James Corey

●

Beginning with the forthcoming issue of RADIO-TELEVISION SERVICE DEALER, and to appear monthly thereafter, we are happy to announce a new regular department edited solely in the interests of the Radio-Television Service Dealer who finds himself beset with tube shortages.

This department will deal with technical data in connection with tube replacements and substitutions of all types including picture tubes, presenting up-to-the-minute information based on availability.

The editor of this department will gladly answer tube replacement and substitution problems arising in the field.

●

New 1951 • • MODEL V-4A

Heathkit VTVM KIT

HAS EVERY EXPENSIVE Feature

- ★ Higher AC input impedance, (greater than 1 megohm at 1000 cycles).
- ★ New AC voltmeter flat within 1 db 20 cycles to 2 megacycles (600 ohm source).
- ★ New accessory probe (extra) extends DC range to 30,000 Volts.
- ★ New high quality Simpson 200 microampere meter.
- ★ New ½% voltage divider resistors (finest available).
- ★ 24 Complete ranges.
- ★ Low voltage range 3 Volts full scale (⅓ of scale per volt).
- ★ Crystal probe (extra) extends RF range to 250 megacycles.
- ★ Modern push-pull electronic voltmeter on both AC and DC.
- ★ Completely transformer operated isolated from line for safety.
- ★ Largest scale available on streamline 4½ inch meter.
- ★ Burn-out proof meter circuit.
- ★ Isolated probe for dynamic testing no circuit loading.
- ★ New simplified switches for easy assembly.

New LOW PRICE $23.50

The new Heathkit Model V-4A VTVM Kit measures to 30,000 Volts DC and 250 megacycles with accessory probes — think of it, all in one electronic instrument more useful than ever before. The AC voltmeter is so flat and extended in its response it eliminates the need for separate expensive AC VTVM's. + or − db from 20 cycles to 2 megacycles. Meter has decibel ranges for direct reading. New zero center on meter scale for quick FM alignment.

There are six complete ranges for each function. Four functions give total of 24 ranges. The 3 Volt range allows 33⅓% of the scale for reading one volt as against only 20% of the scale on 5 Volt types.

The ranges decade for quick reading.

New ½% ceramic precision are the most accurate commercial resistors available — you find the same make and quality in the finest laboratory equipment selling for thousands of dollars. The entire voltage divider decade uses these ½% resistors.

New 200 microampere 4½" streamline meter with Simpson quality movement. Five times as sensitive as commonly used 1 MA meters.

Shatterproof plastic meter face for maximum protection.

Both AC and DC voltmeter use push-pull electronic voltmeter circuit with *burn-out* proof meter circuit.

Electronic ohmmeter circuit measures resistance over the amazing range of 1/10 ohm to one billion ohms all with internal 3 Volt battery. Ohmmeter batteries mount on the chassis in snap-in mounting for easy replacement.

Voltage ranges are full scale 3 Volts, 10 Volts, 30 Volts, 100 Volts, 300 Volts, 1000 Volts. Complete decading coverage without gaps.

The DC probe is isolated for dynamic measurements Negligible circuit loading. Gets the accurate reading without disturbing the operation of the instrument under test. Kit comes complete, cabinet, transformer, Simpson meter, test leads, complete assembly and instruction manual. Compare it with all others and you will buy a Heathkit. Model V-4A. Shipping Wt., 8 lbs. Note new low price, $23.50

New 30,000 VOLT DC PROBE KIT

Beautiful new red and black plastic high voltage probe. Increases input resistance to 1100 megohms, reads 30,000 Volts on 300 Volt range High input impedance for minimum loading of weak television voltages. Has large plastic insulator rings between handle and point for maximum safety Comes complete with PL55 type plug.

No. 3366 High Voltage Probe Kit. Shipping Wt., 2 pounds. **$5.50**

Heathkit RF PROBE KIT

Crystal diode probe kit extends range to 250 megacycles ± 10% comes complete with all parts, crystal, cable and PL55 type plug.

No. 309 RF Probe Kit. Shipping Wt., 1 lb. **$5.50**

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE: ARLAB-N Y.

The HEATH COMPANY
. . . BENTON HARBOR 12, MICHIGAN

sion Production will be invited to serve as judges who will make their selections from Television programs broadcast between January 1st to June 30th, 1951.

"Deems Taylor — author, composer, critic and commentator — has consented to serve as Chairman of our Committee of Judges.

"The motion picture industry has its 'Oscars'. Television will now have its 'Sylvias'.

"We have decided to offer these Awards with a sincere desire to make a concrete contribution, not merely to our own industry but for the good of Television's impact on American family life. Further announcements will be made as the details of this project are perfected."

Raytheon Sponsors Bonded Dealer Meetings

The Electrical Supply Corporation, 1739 Massachusetts Avenue, Cambridge, Massachusetts, distributor of tubes in the Boston area, last month launched the first of a planned series of Bonded Dealer meetings.

In answer to the growing wave of customer dissatisfaction to *what they consider* unfair practices of T.V. service organizations. Raytheon Bonded Dealer meetings are being launched throughout the country by a number of independent parts distributors who handle Raytheon tubes and are authorized to service the famous Bonded Dealer program sponsored by Raytheon.

This dealer promotion program is primarily designed to help dealers build up more customer confidence and generally create better customer relations through registered dealer bonds issued by the American Mutual Liability Insurance Company through the Raytheon Tube Division.

Personnel Changes & Promotions

The promotion of Harry E. McCullough to manager, radio and television sales section, for the Crosley Division of Avco Manufacturing Corporation, has been announced by W. A. Blees, Avco vice president and Crosley general sales manager.

V. L. Walker, former sales engineer, radio parts, of United Motors Service, has joined The Triplett Electrical Instrument Co., Bluffton, Ohio, as a sales engineer.

William J. Halligan, president of The Hallicrafters Company today announced the appointment by the Board of Directors of Rollie J. Sherwood as Vice President in charge of sales. Mr. Sherwood, joined the company in 1944 as communications sales manager, and has been general sales manager since 1946.

O. O. Schreiber, who has been with Philco for the past 17 years and during the past year has been assistant secretary has also been appointed assistant to the president, it was announced today by William Balderston, president of Philco Corporation.

Frank H. Russell of Philco, author of the "Shop Overhead Analysis" article which appeared in Nov. RTSD, has been promoted from "Promotion Manager, Service Division" to Assistant to the Director of Sales Training. The title listed under his name in the article was an error.

John P. Boksenbom, has been elected a Vice-President of the RCA Service Company in charge of its Consumer Products Service Division, it was announced recently by E. C. Cahill, President.

Simultaneously, Mr. Cahill announced the election of Donald H. Kunsman as Treasurer and Controller.

Jack M. Williams has been appointed Advertising and Sales Promotion Manager of the RCA Victor Home Instrument Department.

Clifford M. Rigsbee, veteran department store executive, has been

THE BIG 4

FROM JFD

WORLD'S LARGEST SINGLE SOURCE OF TV ANTENNAS and ACCESSORIES

JFD AIR COOLED TELEVISION BALLASTS

Choice of Manufacturers for ORIGINAL Equipment

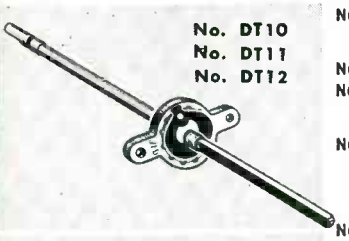
Cash in on the growing TV ballast replacement market. You can't go wrong when you use the EXACT TV Ballast ORIGINALLY Used by the Manufacturers themselves. Models for EMERSON, MOTOROLA, TELETONE, BELMONT, STEWART-WARNER, PILOT, and others.

LIST $2.25 Each

JFD DETENT SWITCH CONTROLS

★ **DURABLE BRASS SPRING**
★ **BRASS and PHENOLIC SHAFTS**

JFD has the most complete line of Detent Switches on the market . . . exact replacements for RCA, Emerson, Admiral, Teletone and other TV sets. Designed for RCA Tuners used in 630 700 and 721 type chassis. Available with or without locating plates. Write for FREE Replacement Reference Chart No. 60R.



Write for FREE Replacement Reference Chart #60R

No. DT10 . . . Short shaft, complete with locating plate. (Replaces RCA part No. 71463.)

No. DT20, without locating plate.

No. DT11 . . . Long shaft, complete with locating plates. (Replaces RCA part No. 72743.)

No. DT12 . . . Extra long shaft, complete with locating plate. (Replaces Admiral part No. 76B14 used in entire Model Series No. 30A and 8C.)

No. DT22, without locating plate.

(Designed for use with RCA TV Tuner part No. 71531—Replacement Type 201E1.)

No. DT13 . . . All phenolic shaft, complete with locating plate. (Replaces RCA part No. 73440.) Designed for use with RCA Tuner Replacement Types No. 74941, 73435, 74571.

No. DT14 . . . All phenolic shaft, complete with locating plate, for new RCA TV sets. (Replaces RCA part No. 75162.)

Write for Complete Catalogue of JFD Television Antennas and Accessories, No. 58G

TV Voltage Regulators

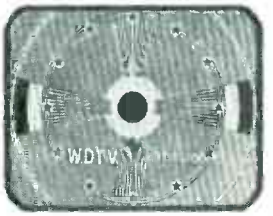
FOR REALLY STEADY TV PICTURES

Produces steadier TV pictures despite line voltage changes. Male and female connections. Operates on either 110v AC or DC. Plugs in between the TV set line cord and outlet. Recommended for use with all leading makes of TV sets: RCA, DUMONT, PHILCO, ADMIRAL, EMERSON, ZENITH, etc.

Model **93-7,** 300 watts. List price, each **$2.85**
Model **93-8,** 375 watts. List price, each

JFD "Cleer Beam" WAVE TRAPS

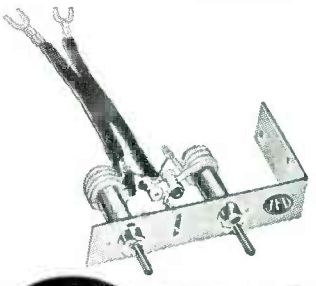
"YOU CAN SEE THE DIFFERENCE!"



Without JFD Wave Trap

With JFD Wave Trap

JFD "Cleer Beam" Wave Traps filter out FM image and amateur harmonic interference easily and effectively. Simply attach universal mounting bracket to television cabinet or chassis, then attach lugs to antenna input terminals. Result: clear, bright pictures with sustained signal strength. *List,* **$2.75**



- **BR 106-10-30 Traps out amateur Harmonic Interference from 14 and 28 mc bands.**
- **BR 106-80-110 Traps out FM Image Interference.**
- **BR 106-30-60 Traps out 30-60 mc amateur Harmonic Interference.**
- **BR 106-60 90 Traps out 60-90 mc. Diathermy Interference.**

JFD MANUFACTURING CO., Inc.
6125A 16th Ave., Brooklyn 4, New York
FIRST in Television Antennas & Accessories

appointed manager of the Radio-Phonograph-Television Group of the RCA Service Company, Mr. Rigsbee succeeds Thomas Whitney, who has been appointed Operations Manager for Government Service in the company's newly-formed Government Division.

Electro-Voice, Inc., Buchanan, Michigan, announces the appointment of Fred Lester as factory manager. Karl Schaefer and Ted Faber have been named buyers in the expanded E-V Purchasing Department to assist J. N. Grieveson, Purchasing Agent.

SYNC PULSES

[from page 12]

indebted to Mr. Wilson. In accepting this assignment he does so at great personal sacrifice, and there remains practically no token of esteem or appreciation great enough to repay him in part for his contribution, save possible one. In this regard let us refer to the Editorial that appeared in the January 1944 issue of "Service Dealer" — it reviewed Mr. Wilson's accomplishments in his work of that period, (Executive Vice President of War Production Board), — and the editorial explained why both of the major political parties of the U.S. should draft Mr. Wilson as their candidate for the position of Chief Executive of the United States in the then impending 1944 elections.

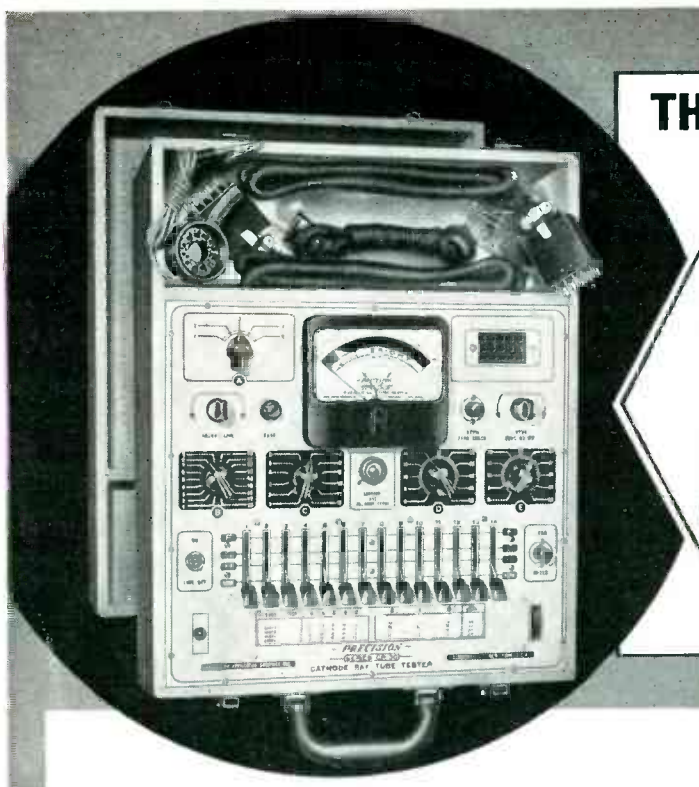
Time is running out. Rumor has it that Mr. Truman does not plan to seek re-election in 1952. Whether he does or not makes no difference. The one American whose record of accomplishment proves beyond a question of doubt that he is qualified to be our Nation's president is none other than our present DDM, Charles E. Wilson.

THE STORMS' TOLL —November 1950 will long be remembered because of the unprecedented damage suffered by millions of radio and TV equipped homes in the storm-stricken areas, East, West and Mid-west. Millions of TV aerials blew down. The storm's intensity was so great that in many instances heavy guage steel masts were blown into pretzel shapes. Repair bills not covered by service contracts cost set owners enormous sums, and records now show that only a relatively few TV service policies were drafted in such a way as to make liable for repairs the contract issuer. So, the radio-TV service profession enjoyed (sic) a storm-caused boom period amounting to many millions of dollars that it did not relish and would have preferred not to have had. But such is fate! Actually because of the storm, and his immediate response, the public began to appreciate how important is the Service Dealer who serves it, and once the Better Business Bureau and like protective associations made clear the degree of responsibility of the servicer under policies and contracts bearing "Act of God" and "Storm Clauses", — a better understanding was enjoyed by all parties. Although not obligated to do so, many Service Dealers and service organizations undertook the job of repairing blown down antennas without charge, and that is to their everlasting credit, a fact that we hope the public will appreciate.

The storms taught us all a lesson: for example, that most masts that did not blow down were those that were properly guyed; that most dipoles that did not bend or break were those manufactured by national advertisers, reputable firms, who use high quality materials.

WITH REFERENCE TO COLOR TV, on Dec. 5, our correspondent saw a demonstration of the improved RCA compatible all-electronic color TV system in Washington, D.C. A full

THE NEW PRECISION CR-30 CATHODE RAY TUBE TESTER

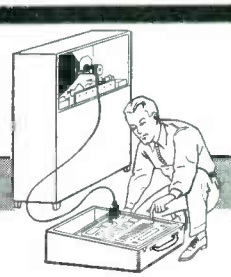


TESTS ALL TV PICTURE TUBES

(MAGNETIC AND ELECTROSTATIC)

'SCOPE TUBES AND INDUSTRIAL CR TYPES

for True Beam Current (Proportionate Picture Brightness. Tests ALL CR Tube Elements—Not Just a Limited Few



IN FIELD OR SHOP

Tests CR Picture Tubes Without Removal from TV Set or Carton!

The new Precision CR-30 fills an obvious gap in the test equipment facilities employed by TV service and installation technicians.

Because of the absence of a reliable cathode ray tube tester, up to 50% of so-called "rejected tubes" are found to be fully serviceable and should rightfully never have been "pulled out."

Proven product of extended development, the CR-30 has been specifically engineered to answer the question, "Is It the TV Set or is it the Picture Tube?"

The *Precision* CR-30, a complete and self-contained *Electronic Instrument,* incorporates a TRUE BEAM CURRENT Test Circuit. The CR-30 checks overall electron-gun performance for *proportionate picture brightness* as well as additional direct testing facilities for accelerating anodes and deflection plate elements.

The Precision CR-30 should not be confused with mere adapters connecting to ordinary receiving tube testers which were never designed to meet the very specialized needs of CR tube checking. Similarly, it is not to be confused with neon-lamp units or similar devices of limited technical merit and which do not check all CR tubes or all tube elements.

GENERAL AND TECHNICAL SPECIFICATIONS

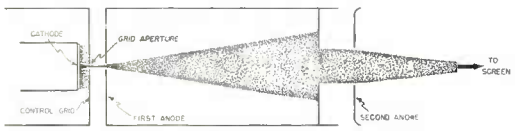
★ **Tests All Modern Cathode Ray Tubes:**—Magnetic and Electrostatic, 'Scope Tubes and Industrial Types.

★ **Tests All CR Tube Elements:**—Not just a limited few.

★ **Absolute Free-Point 14 Lever Element Selection System,** independent of multiple base pin and floating element terminations, for Short-Check, Leakage Testing and Quality Tests. Affords maximum anti-obsolescence insurance.

★ **True Beam Current Test Circuit** checks all CR Tubes with Electron-gun in operation. It is the **Electron Beam** (and NOT total cathode emission) which traces the pictures or pattern on the face of the CR tube.

Total cathode emission can be very high and yet Beam Current (and picture brightness) unacceptably low. **The CR-30 will reject such tubes** because it is a true **Beam Current** tester. Conversely, total cathode emission can be low and yet Beam Current (and picture brightness) perfectly acceptable. **The CR-30 will properly pass such tubes** because it is a true **Beam Current** tester. The significance of the above rests in the fact that Beam Current (and picture brightness) is primarily associated with the condition of the **center** of the cathode surface and not the overall cathode area. (See illustration below)



★ **Voltage Regulated, Bridge Type VTVM** provides the heart of the super-sensitive tube quality test circuit. Such high sensitivity is also required for positive check of very low current anodes and deflection plates.

★ **Micro-Line Voltage Adjustment**
Meter-monitored at filament supply.

★ **Accuracy** of test circuits closely maintained by use of factory adjusted internal calibrating controls; plastic insulated, telephone type cabled wiring; highest quality, conservatively rated components.

★ **Built In, High Speed, Roller Tube Chart.**

★ **Test Circuits** Transformer Isolated from Power Line.

★ **4⅝" Full Vision Meter** with scale-plate especially designed for CR tube testing requirements.

★ **Heavy Gauge Aluminum Panel** etched and anodized.

★ **PLUS** many other **"PRECISION"** details and features.

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SERIES CR-30—In hardwood, tapered portable case, with hinged removable cover. Extra-Wide Tool and Test Cable Compartment. Overall Dimensions 17¼ x 13¾ x 6¾". Complete with standard picture tube cable, universal CR Tube Test Cable and detailed Instruction Manual.

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report of this showing appeared in most newspapers, so that a further description, other than to say that the color fidelity was good and the physiological effects breathtaking, would be redundant. However, taking a tack from the procedure followed by the FCC in which they based their decision on their belief that the CBS system was much superior to the RCA system *at that particular time* — the all-electronic RCA system, *at the present state of the Art,* is so far superior to the CBS mechanical system, that we believe that tthe FCC should retract its decision.

BOOK REVIEWS

[*from page 31*]

theory are duly treated mathematically, yet the basic theory is explained in language so simple and analogies so clear that a high school student can understand it. The author writes well, his style being one of ease and facility of expression which helps him convey his thoughts to his readers so that the reading itself becomes almost as fatigueless as when reading a novel.

S. L. M.

Automatic Record Changer Service Manual Volume 3 (1949-1950). Including Latest Multi-Speed Changers, Wire and Tape Recorders. October, 1950. Howard W. Sams & Co. Inc., Indianapolis, Indiana. $3.00.

Service data on the following products is presented in this Manual: Admiral, Crescent, Crestwood, Eicor, Markel, Masco, Milwaukee, Oak, Philco, RCA, Silvertone, Trav-ler, VM, Webster, Webster-Chicago, and Zenith.

Each unit is analyzed with respect to general information, operating instructions, change cycle, adjustments, troubles, and lubrication. Illustrations include top and bottom views to more clearly explain the subject matter discussed under the above topics. In addition, a parts list is supplied with each unit with reference numbers corresponding to the part numbers appearing in the various illustrations. Circuit diagrams are given where required.

Servicing technicians will find this Manual a valuable aid in the repair, adjustment and maintenance of record changers and recorders described in this book for many reasons: First, because of the technical information contained within its covers; and second because of the clear and well-defined methods of presentations. The evident planning entering into its preparation, examples of which are the excellent "exploded views" of the complete mechanisms, should be reflected in speedier and more lasting repairs made by the serviceman. S. L. M.

BOOSTERS

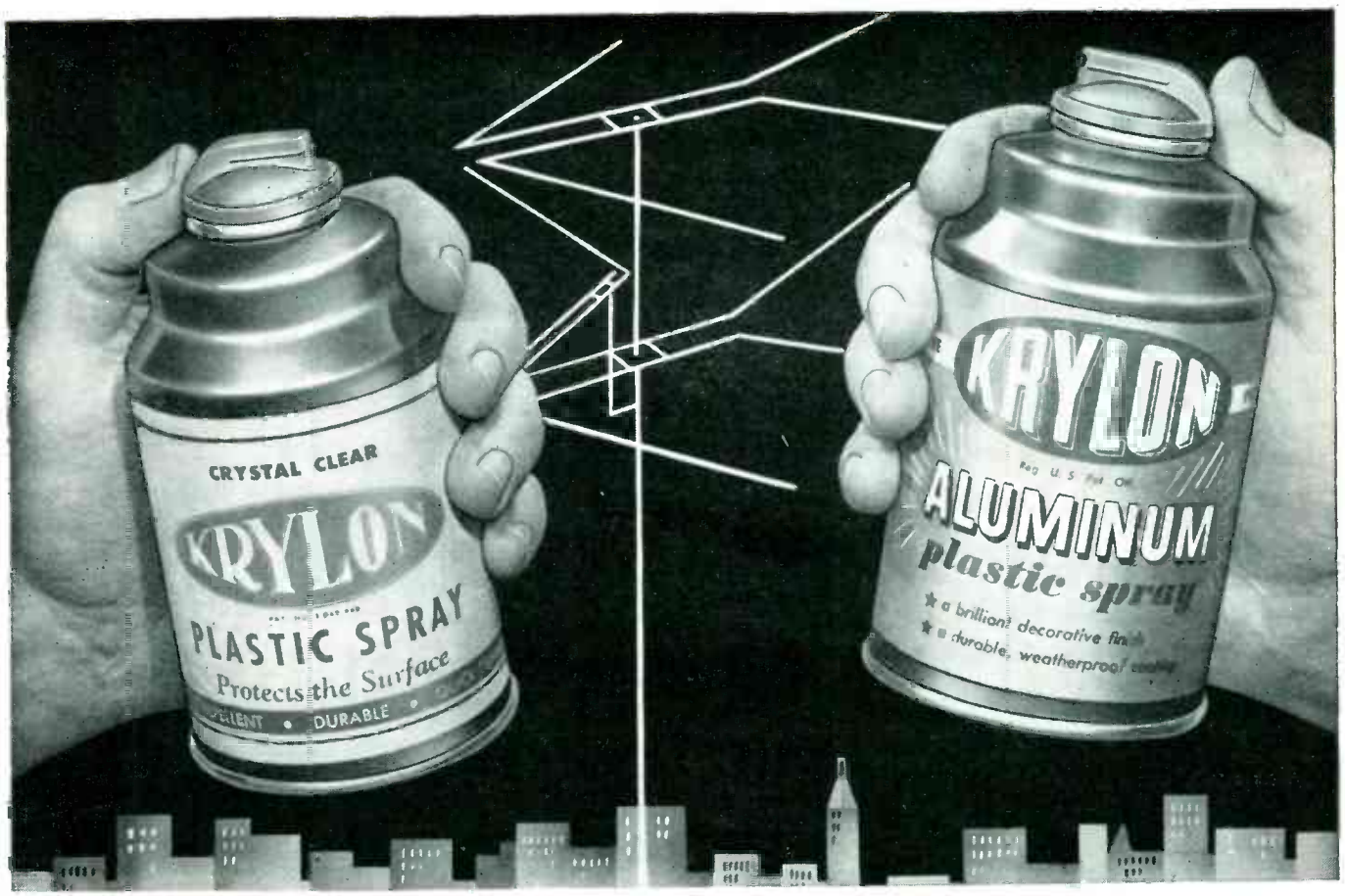
[*from page 31*]

this receptacle they will automatically turn on and off greatly simplifying operation. For mounting on the popular fringe area R.C.A. 630 T.S. set see *Fig. 4B* for dimensions.

Simultaneous Demonstrations

The problem of simultaneous demonstration of more than one TV set from one antenna in fringe areas is not practical with the conventional methods which employ pads or isolation amplifiers as the weak signal cannot be sacrificed in any way.

The following method is quite successful and no noticable decrease in signal strength is apparent. Refer to *Fig. 5.* Line #2 to receiver #2 is inductively coupled to line #1 to receiver #1. This coupling must be made between the final booster and receiver #1, otherwise an effective transfer of energy will not take place. About three inches of line #2 is laid



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flat on line #1. Several turns of roll solder, wrapped around the coupling will hold line #2 on line #1. Notice that there is no direct connection between lines #1 and #2. For best signal on receiver #2, line #2 is slid along line #1 until best reception is observed on Receiver #2. With this method no difference in signal strength between receivers is noticable.

RECORD CHANGERS

[from page 27]

for the installation. Some dealers, however, install the units without extra charge, finding that this makes it easy to make the sale.

Contrast that with the profit a service dealer makes for the time and energy he puts into repairing a failing one-speed unit.

Nor do his sales end with the replacement unit. Plug-in phonograph units, too, can be sold on television repair calls where the customer has no phonograph. There are more table-model television sets in homes today than console models with phonographs. Many of the owners of these table models have no phonograph but most of them would like to have one, if they could get one at a reasonable price. The serviceman on a TV call can casually mention that such units are available and give the prices. Here, his sales literature will be particularly valuable because the decision on such a purchase won't be as hurried as the decision on whether to buy a replacement unit or to get the old unit fixed, which requires a quick answer. It will probably be made after he leaves; a graphic piece of sales literature left with the prospect can do the final selling job. Profits and prices on these units generally run about the same as those on the replacement units but here the service-man usually doesn't need to bother with the installation, since the units are simply plugged into a television set or radio phono jack.

If the service dealer can conduct a direct-mail program in connection with his sales campaign on replacement and plug-in changers, it will increase the returns. Webster-Chicago and some of the other replacement changer manufacturers have literature available that can be simply imprinted with the service dealer's name and mailed to everyone who has had a single-speed phonograph repaired in the last few years or has acquired a table model TV set recently.

UHF CONVERTERS

[*from page 23*]

ode is operating at both signal and direct current ground potential so that it effectively shields the cathode from the plate. Bias is obtained for the cathode through a 100 ohm resistor with its associated 500 uuf by-pass filter capacitor. A series r-f choke is used so that the applied signal input is present at the cathode terminal, and effectively isolated from ground by means of this choke. In its signal potentials, the tube operates as a conventional triode with a signal applied to the grid. A changing signal on the cathode allows the tube to operate as an amplifier since in any vacuum tube, signal voltage causes plate current variations by changing the potential difference between plate and cathode. Normally, there is no signal potential applied to the cathode but it is rather applied to the grid. There is a varying signal potential between grid and cathode in a conventional vacuum tube arrangement and in this grounded grid circuit, there is still a varying signal potential between grid and cathode. However, the cathode is at signal potential and the grid is at ground potential.

The tuned circuits for the r-f amplifier stage and the first oscillator are of a copper foil slug tuned variety. Since the second oscillator is fixed in frequency, the only variable is a slug tuning its tank circuit which permits sufficient variation with proper adjustment. The output from the u-h-f tuner may be link coupled into the first stage of the picture i-f amplifier strip of the television receiver. If the television receiver uses a different i-f than the output of this converter, only the second local oscillator of the tuner needs readjustment. By means of the slug tuning, this frequency is adjustable through a ring sufficiently wide to allow the output to match the i.f. of the picture amplifier.

The three u-h-f tuning elements are rather unique although there are many types of tuning elements which could cover this range. For example, butterfly tuners, rolled up transmission lines, and tuned transmission lines could be used to cover this frequency band. However, the ever-present problem of economics and space requirements as well as shielding has led to this rather physically simple tuning


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arrangement. These tuning elements consist of very thin strips of copper foil mounted on bakelite tubes. This foil represents less than a full turn and its longitudinal shape is tapered to produce the desired tracking. As the slug moves in or out by means of its attached threaded screw, the frequency is varied. Tapered copper foil is used to obtain both a desirable tuning

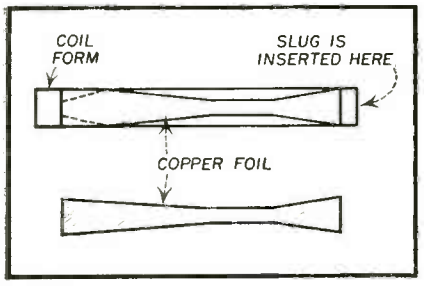

Fig. 9. Detail of u-h-f tuning element

curve and the proper tracking of the radio frequency section and the oscillator. *Fig. 7* illustrates the tuning curve and *Fig. 9* is a drawing of one of these u-h-f tuning elements.

Since even a section of straight wire is an inductance in a u-h-f band, a coil can and does consist of only a portion of a turn in this frequency range. The electrical equivalent of these tuning elements is a slug tuned coil having a number of turns. Direct connection is made from these "coils" to the other circuit elements and vacuum tubes.

CRYSTAL TRIODE

[*from page 20*]

ing the high output impedance of one stage to the low input impedance of the following stage. In most instances, step-down interstage transformers will be the most convenient method. Furthermore, if no input and output transformers are employed at the terminal points of a multistage crystal triode amplifier, the amplifier input impedance will be 500 ohms and its output impedance 10,000 ohms.

The recommended circuit symbol for the crystal triode is given in *Fig. 3.*

Applications

The crystal triode will be useful as a detector, amplifier, and oscillator. The CK 703 is recommended for use at frequencies up to the video range. Several circuits have been worked out for crystal triode amplifiers and oscillators. The simplest amplifier, perhaps is the circuit shown in *Fig. 4.* While fixed emitter bias (batteries B_1 and B_2) is shown here, and may be obtained in each instance from a 1½-volt cell and low-resistance

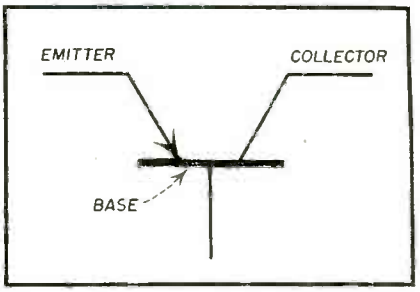

Fig. 3. Recommended crystal triode symbol.

potentiometer, "cathode" bias (obtained by means of a suitable resistor in series with each CK 703 base lead) might also be used.

The crystal triode has the advantages of small size, light weight, simplicity, instantaneous operation, and

freedom from objectionable heating. Its noise level is somewhat higher than that of a vacuum tube. However, the latter is a relatively small disadvantage. This device seems certain to find a host of radio and television applications. It should prove especially useful to the radio service dealer in small, pocket-size test oscillators operated from self-contained hearing-aid batteries.

DE-COUPLING

[*from page 15*]

coupling network to be effective, the proper value of *R* and *C* must be chosen. A glance at *Fig. 4* shows that the undesired 33 volts variation of the power supply, must be reduced below a point that will not exceed the amplified signal voltage of .75 volts appearing in the same phase across *R1*. Under these conditions, no regeneration will occur. Assume that the frequency of the applied signal voltage to the 6F5 grid to be 200 cycles, which is the lowest frequency that the amplifier is expected to pass. Also assume that at this frequency, the coupling condensers do not affect the gain of each stage. Therefore,

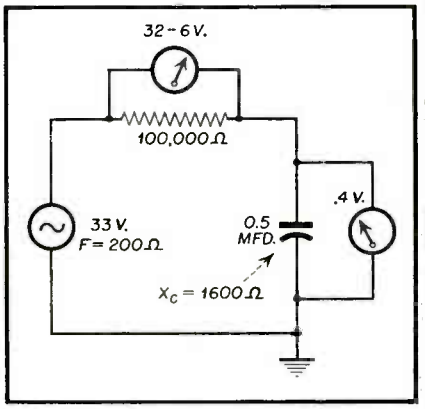

Fig.4—Voltage across .5 uf cap.

the voltage variation of the power supply occurs at a 200 cycle rate, and the de-coupling network must be designed for this frequency.

Values For R and C

The 33 volt variation must be reduced to a value below .75 volt, which is a ratio of 44 to 1. Therefore the capacitive reactance of the condenser in the network must be $\frac{1}{44}$ the value of the resistor in ohms. If the resistor is chosen as 20% of *R1*, the plate load resistor, then R of the de-coupling network equals 100,000 ohms. or 2270 ohms. This calls for a .35 μf

Therefore X_c must be $\frac{1}{44}$ of this value condenser as C in farads is equal to $\frac{1}{2 \text{ pi } F X_c}$.

Figure 4 shows an equivalent circuit of an a-c generator impressing 33 volts across R and C in series. R is equal to 100,000 ohms and C is equal to .5 μf. The reactance of the .5 μf condenser at this same frequency of 200 cycles is about 1600 ohms. Therefore the output voltage across C = .40 volts. Referring back to *Fig. 4* shows that the de-coupling network, placed in the plate supply lead of the 6F5 tube, will effectively reduce this in-phase feed-back voltage to a negligible value.

AD INDEX

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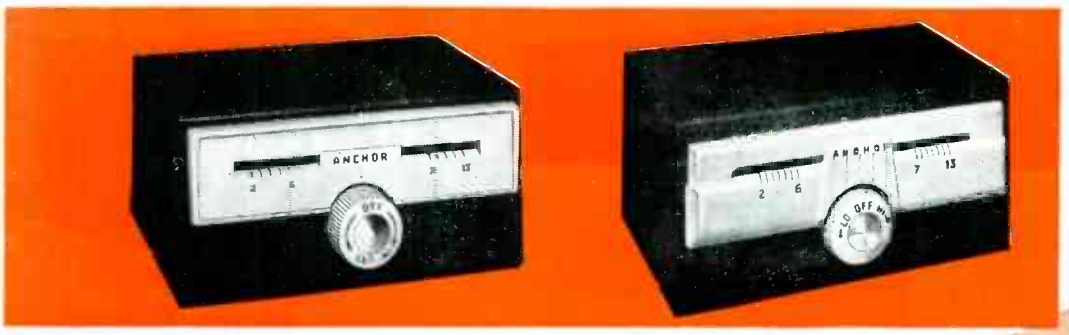

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