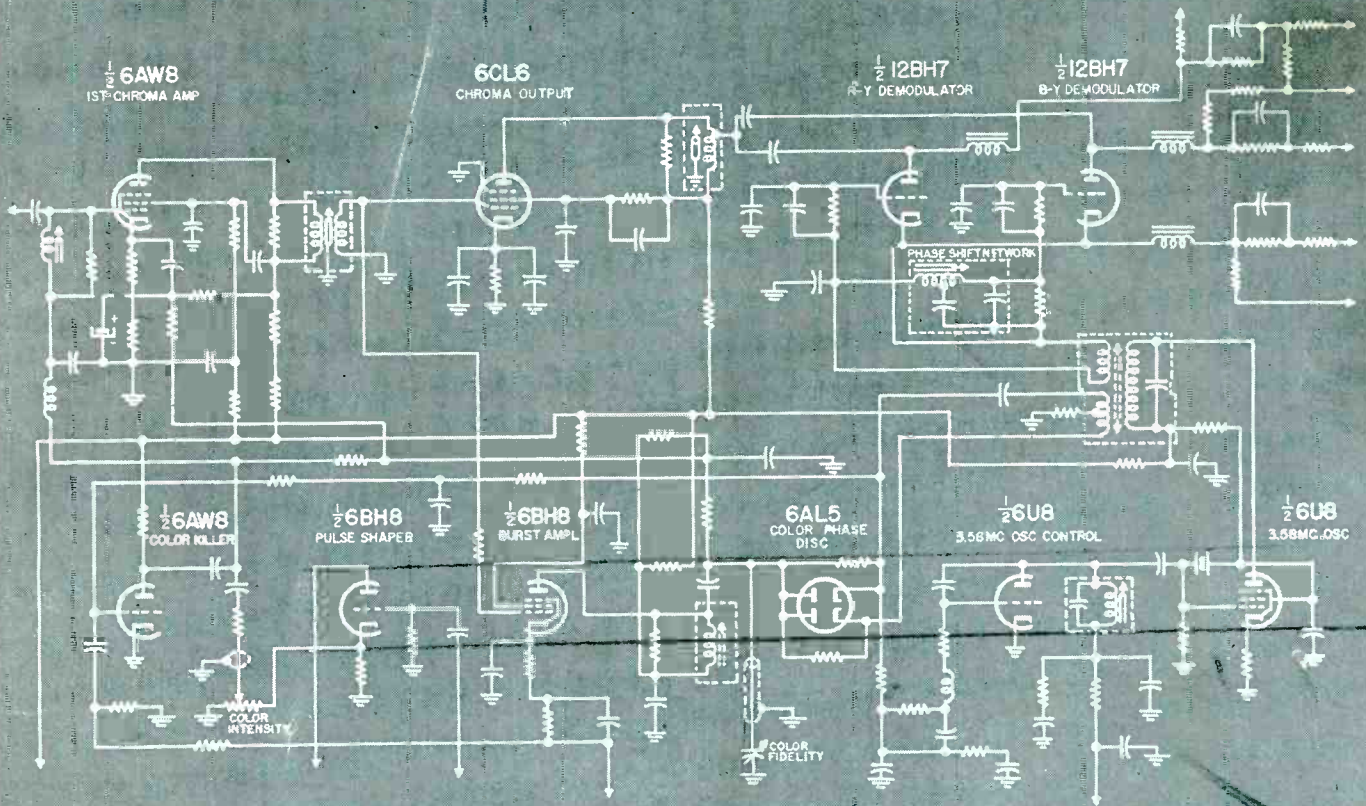
NOVEMBER, 1956

SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE



Color-TV phase detector and sync color-killer circuitry.

See circuit analysis, this issue

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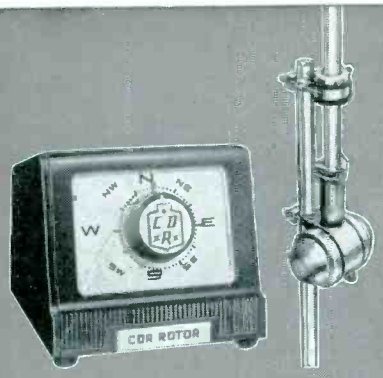

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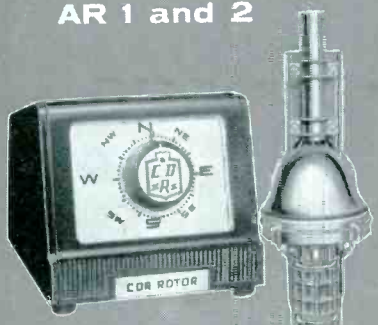

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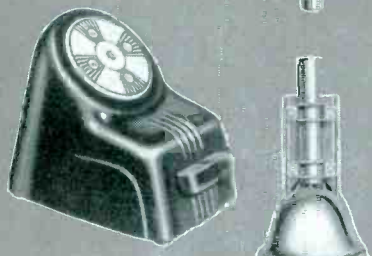

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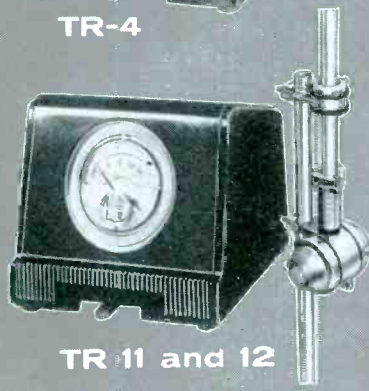

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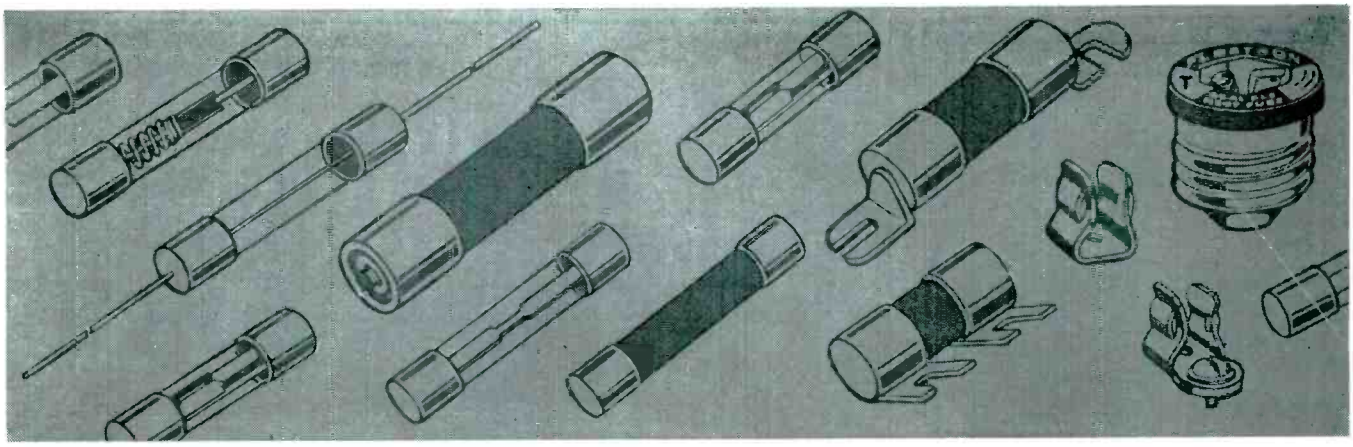

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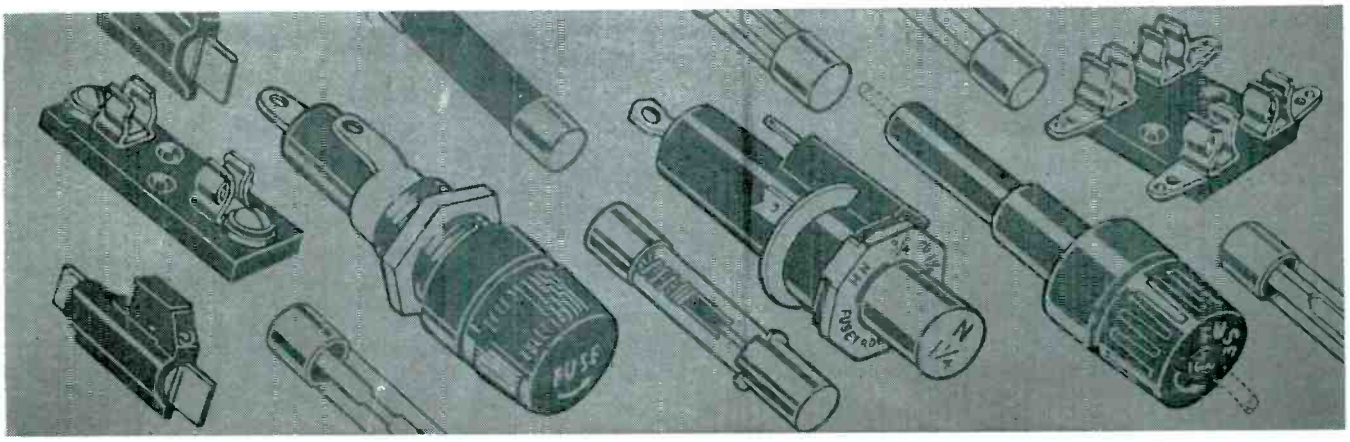

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Vol. 25 No. 11

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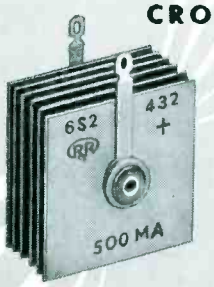

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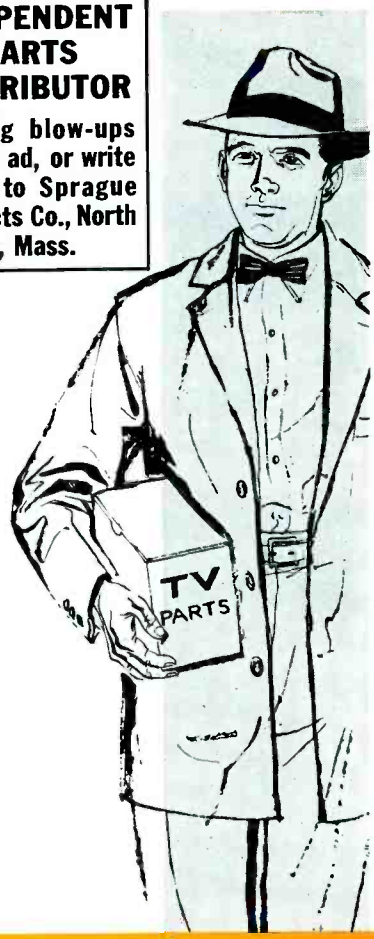

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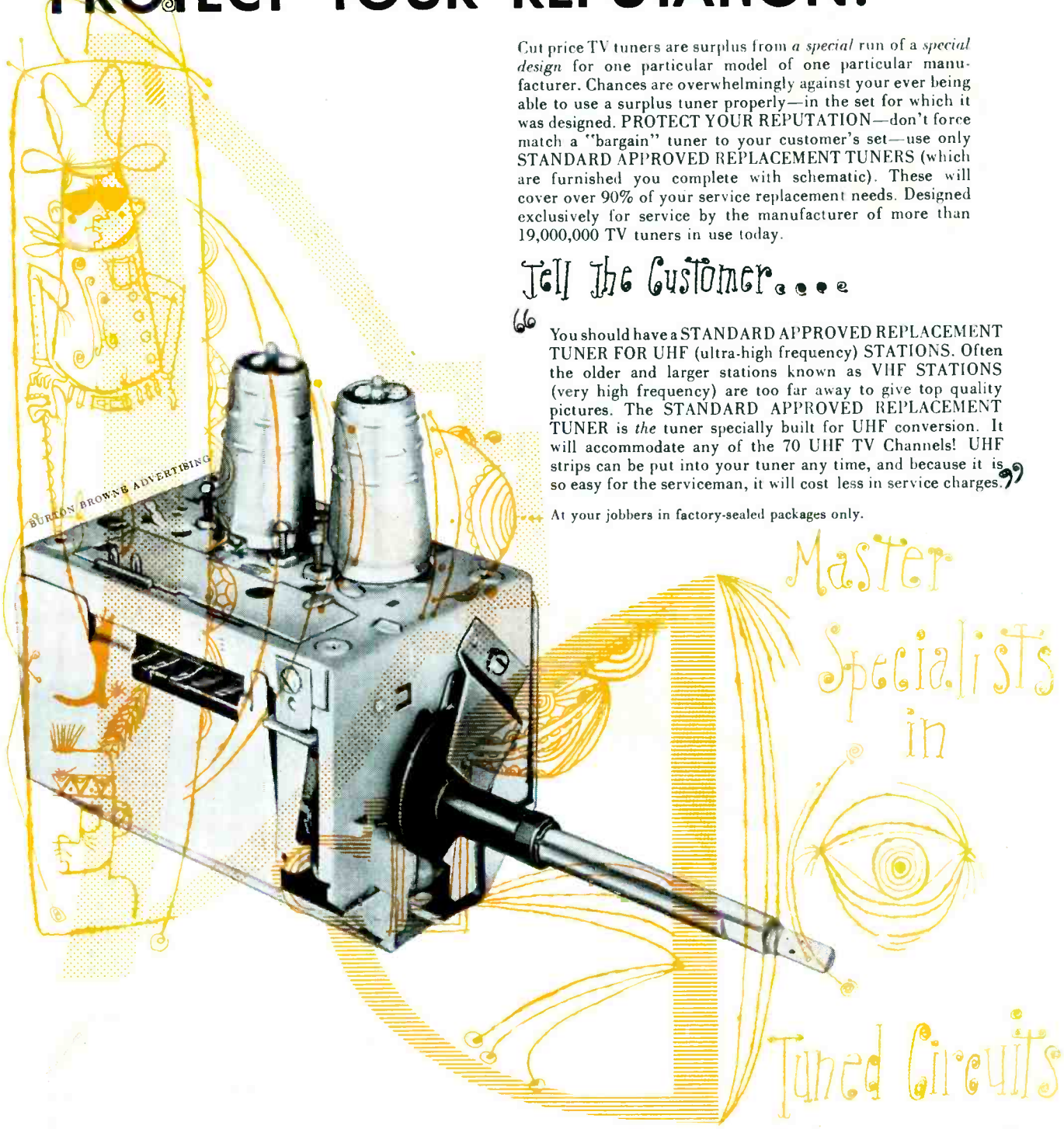

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3901	Blond & Gold	VHF
3902	Ebony & Silver	VHF
3905	Mahogany & Gold	VHF-UHF

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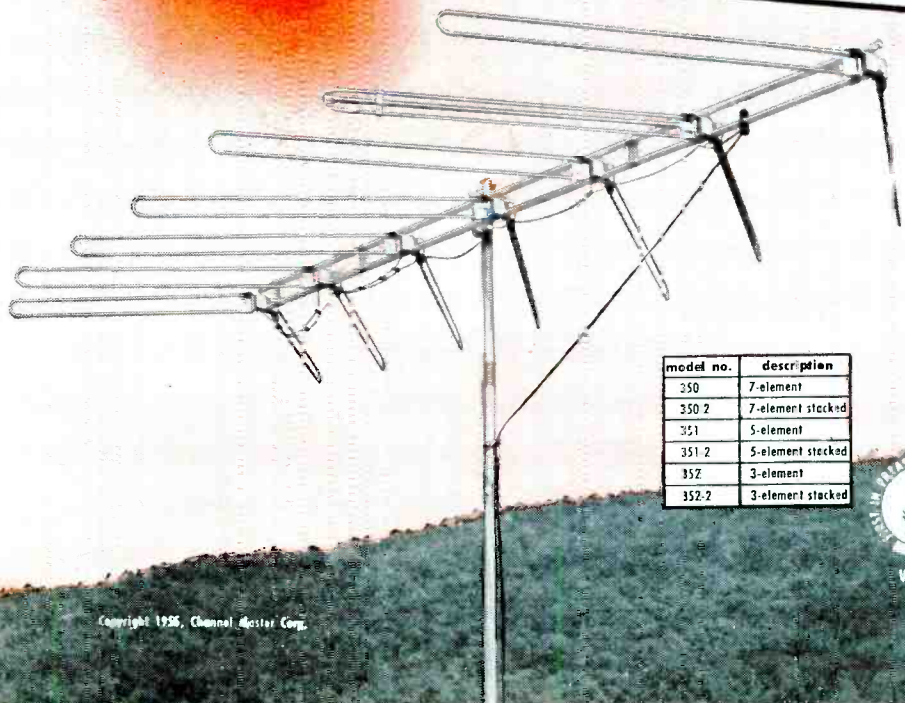

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model no.	description
350	7-element
350-2	7-element stacked
351	5-element
351-2	5-element stacked
352	3-element
352-2	3-element stacked

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The program has been carefully controlled. Membership in the Raytheon Bonded Dealer group has been kept limited and selected for 2 reasons: (1) Raytheon wants only the finest service organizations to bear this proud distinction, and (2) it represents a substantial investment for every dealer registered.

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SERVICE

The Technical Journal of the Television-Radio Trade

The Tremendous Picture-Tube Replacement Market

OF THE 40-MILLION TV receivers in use today, nearly 16-million are three years or older. And 80 per cent of these sets are still using the original picture tube that no longer can provide satisfactory results. Pictures produced by most of these tubes are hazy and lusterless, regardless of the efforts to rejuvenate.

Few of the tubes in the older models were ever capable of providing really bright pictures because of their basic construction. This design problem, coupled with the operational defects resulting from years of usage, have affected the performance of these ancient tubes.

The majority of the tubes used in these early chassis, dating back to '50, are in the 16, 17 and 19-inch family, and today can readily be replaced with the aluminized types that are capable of providing truly brilliant pictures. How such replacements can be made are described in an exclusive technical report in this issue.* Of course, to obtain the best results from the new type picture tubes, the chassis must be in tip-top shape; thus it is important to make a thorough check of the complete receiver by testing every tube and all of the vital components and circuitry, and then replace any defective tubes or parts.

In addition to the need for replacements in the older sets, there is also a sizable market for replacement picture tubes in those receivers that have been installed since '53. The increasing number of hours spent by millions before TV sets has begun to take its toll on the picture tubes. With the long-day long-night schedule of viewing that has become so common, one no longer can expect a tube, with its normal 2000-hour life, to last for years and years.

Based on the number of initial equipment tubes made for TV sets during the past three years, totaling over 30-million, it has been estimated that at least 5 to 6-million replacements will be required for this market during the next twelve months. For this operation, the 17-inch tube will be most called-for replacement, followed by the 19 and 21-inch types.

Thus we find that there's a solid need for nearly 18-million picture tubes as replacements that Service Men can *sell* and *install.*

Vital Role of the Standard-Brand Tube

TO BE SUCCESSFUL in this enormous replacement market, there is one rule that must be carefully observed; only quality standard-brand tubes should be used.

Only in the standard-brand plants will we find the thorough engineering planning, development and design facilities; the painstaking production control; the rigid lab, factory and field test setups; and the tough final inspection checks that must obtain to produce the quality product.

The manufacture of picture tubes is so involved, because the tube is a precision display device that requires the utmost care in its assembly.

Even in the apparently simple step of envelope washing, strict adherence to critical chemical and optical specifications must prevail. Cleansing fluids must be absolutely pure; repeated washings must be made under controlled timing and temperature conditions to remove all impurities.

Racks of special mechanical, electrical and electronic test gear, under the supervision of experienced engineering personnel, must be used to check not only every element in the gun, but the glass bulbs, whose contours must be absolutely smooth and scratch-free. In addition, complete tubes must be subjected to a chain of checks that guarantee conformance with all performance standards.

There are terrific opportunities on tap for Service Shops everywhere who take advantage of the tremendous picture-tube-replacement market we now have, and sell and install *only* quality standard-brand tubes.—L.W.

**Servicing Helps;* page 38.

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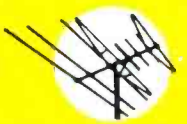

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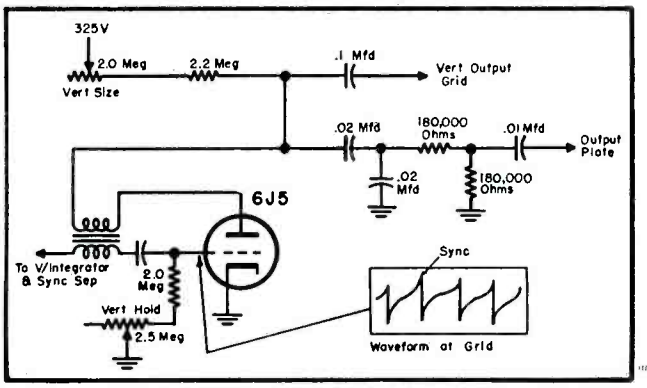

Cures For Vertical

FIG. 1: A TYPICAL TRIODE blocking oscillator used as a vertical oscillator in many TV chassis.

ROLLING, FLIPPING or slow drifts vertically, have been found to be most prevalent on the fringe of the fringe areas, where signals are pretty weak at their best, and subject to fading at any time. This situation aggravates any troubles that might be caused by a vertical sync circuit.

Vertical sync circuits can be extremely simple, but there are some that are quite tricky.

A typical vertical oscillator circuit, with its associated sync feed, as used in '49-'50 TV sets, is shown in Fig. 1. The blocking oscillator uses a triode, 6J5 or its equivalent, and the output of this feeds a pentode output stage, which drives the yoke through an appropriate impedance-matching transformer. Sync pulses are taken from the output of a sync amplifier, fed through a vertical integrator network into the *bottom* end of the grid winding of the blocking-oscillator transformer. As the sync pulses arrive at the grid of the oscillator, they *trigger* the oscillator, so that it runs in sync with the pulses derived from the transmitted signal, locking the picture in place vertically.

The peculiar waveshape of the blocking oscillator lends itself admirably to this type of control; if the pulse arrives at the right time it *fires* the oscillator, so that it runs in sync with the pulses. Let us now assume that the vertical oscillator itself is basically okeh; that is, it can be *locked in sync* by hand, by moving the vertical hold control. If this can be done, the oscillator and output stage themselves are alright; they are capable of making a 60-cycle wave of the proper frequency, and all they lack is the proper control. This is furnished by the incoming sync pulses. What we've got to do is get them onto the grid, at the proper amplitude. This is the function of the sync separator and (sometimes) the sync-amplifier circuits.

The source of the sync signals is usually the video amplifier plate circuit; from here the full video signal, sync and all, is taken off and fed through some coupling device to the input of the sync separators. (This varies somewhat in different sets.) In the sync separators, the horizontal and vertical sync pulses are separated and fed to their respective oscillators. While the horizontal pulses are usually differentiated and shaped in various filter networks, the slower vertical pulses are fed to the oscillator through a *vertical-integrator* network. This changes the basic pulse (as removed from the signal) to a sharp spike for better control of the oscillator.

Parts values for the integrator network have been standardized; the input resistor is a 22,000-ohm unit, the second and third resistors are of 8200-ohm value, while the capacitors are .002, .005, .002 mfd, from the input end. While *printed-circuit* integrator networks are used in the majority of sets, some still use separate parts. Whatever shape you find them in, their function is the same; to shape the vertical pulse.

The vertical oscillator is triggered by a spike at just the proper time, to keep the picture locked in sync, vertically. Anything that interferes with the pulse, on its way to the grid, will upset sync and cause the picture to roll or flip. Because of the characteristics of this circuit, by turning the vertical hold control one should be able to roll the picture slowly *downward;* when the wide blanking bar between frames reaches a point about 3"-5" from the bottom of the screen (21-inch tube) it should suddenly snap out of sight. When the vertical hold control is turned the other way, the picture should *never* roll slowly upward; instead, it should suddenly break out, rolling upward so fast that you can see at least two frames on the screen (superimposed) at the same time. This is the normal reaction. Any set which will *not* behave in this fashion needs attention in the vertical sync circuits. Incidentally, this is one area that should be checked on every service call, whether that was the original complaint or not. It takes only four or five seconds and a slight movement of the vertical hold control to tell if the set is working alright. If any trouble is noted, the best thing to do is fix it then and there to avoid a callback. If nothing else, call the owner's attention to it

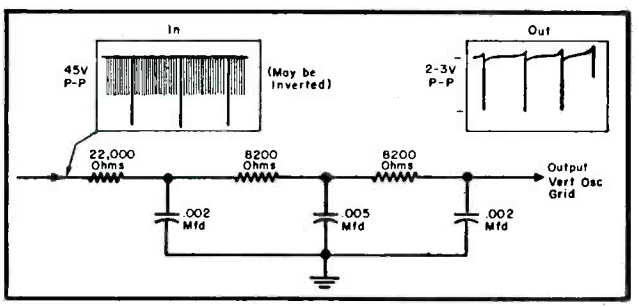

FIG. 2: STANDARD VERTICAL INTEGRATOR. This may be a complete assembly in printed-circuit form or made up of individual components. The output waveform shown appears with the vertical oscillator disabled, either by removing the tube or shorting out. If the signal is applied directly to the grid, this cannot be shorted without shorting out sync; in this case, the large bypass must be shunted from plate to chassis.

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Instability In TV Chassis

by JACK DARR

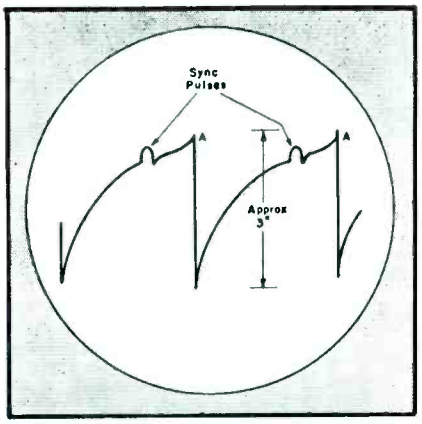

FIG. 3: NORMAL APPEARANCE of sync pulse at grid of vertical oscillator; waveform was made with picture out of sync to show height of sync pulses. With picture locked in, sync pulses will blend into peaks at point A, and disappear. Vertical hold should be adjusted to roll picture very slowly downward; 'scope should be locked in on sync pulses for best visibility. Note proportion of amplitude of sync to oscillator waveform.

and let him know that he is going to have trouble in that section soon. When it does occur, as it inevitably does, your reputation as a prophet will will be considerably enhanced.

Typical Problems and Solutions

In one model, where a vertical-hold problem was encountered, a 6SN7GT served as the vertical sync amplifier and oscillator and a 6AQ5 as the vertical output amplifier. The picture floated up and down the screen, but could be *balanced* in place using the hold control; it would not stay there, however. The 6SN7 was checked and it was discovered that the sync-separator half of the tube was very weak, while the oscillator half was very good. Replacing the tube cured this one quickly.

Another chassis, offering the same symptoms, was found to be fairly stable when first turned on; but as it warmed up, the sync grew worse. This led to a suspicion of a tube with a *hot leakage*. Tubes were checked and replaced, but the trouble persisted. The blanking bar, when rolled into view, had a peculiar look; the normal *hammer-head* of the sync pulse was distorted and compressed. The set was removed from the cabinet and a 'scope was hooked in for a check. At the vertical oscillator grid the sync pulses were visible, but they were very small; they were so small that they were unable to trigger the oscillator with enough authority to make it hold. There was the trouble; now, how to find it.

Tracing the sync pulse, back through the integrator network to the video stage, showed a normal-appearing signal at the video plate and also at the integrator input. The pulse appeared to grow weaker as it passed through the integrator, especially at the second capacitor. This set used a network made up of individual resistors and capacitors; so they were disconnected and checked. The second capacitor, (with a .002-mfd value) was found to have a very low insulation resistance, although the capacity seemed about normal. After checking a new capacitor *before* installation, replacement was made and the sync pulse popped up at the oscillator grid at least four times as large as before. For oscilloscopic observation of the sync pulse itself at the oscillator grid, the picture must be rolled down slightly with the hold control. If the picture is locked in sync, the pulse becomes part of the little spike above the baseline and will not be visible. The hold control should be set to roll the picture *very slowly* downward, and the 'scope sweep locked to hold the *sync pulse* stationary, while the oscillator waveform moves slowly to the left. In this way, the two will be seen easily and their comparative amplitudes easily checked. On a 5" 'scope, if the vertical oscillator waveform is set up so that it is about 3" high, the sync pulse should be at least ½" high for good trigger action.

Still another set with hold trouble had a *pec* integrator network and a twin-triode oscillator, using a blocking oscillator. The circuit was similar to that shown in Fig. 4. This time the picture acted peculiarly. Observation with the 'scope showed an oddly-shaped waveform, with a slight bend in the oscillator output. Sync pulses were apparently okeh, as far as height was concerned, but seemed to have little effect on the oscillator frequency.

In this circuit, the cathode of the vertical oscillator is returned to ground through the winding of the oscillator transformer, while the oscillator plate is *dc*-coupled to the output grid. Tracing the circuit with a 'scope showed an unusual curvature of the waveform. At this point the tube was checked. The trouble showed up immediately in the form of a very heavy heater-cathode leakage. Apparently

(*Continued on page 49*)

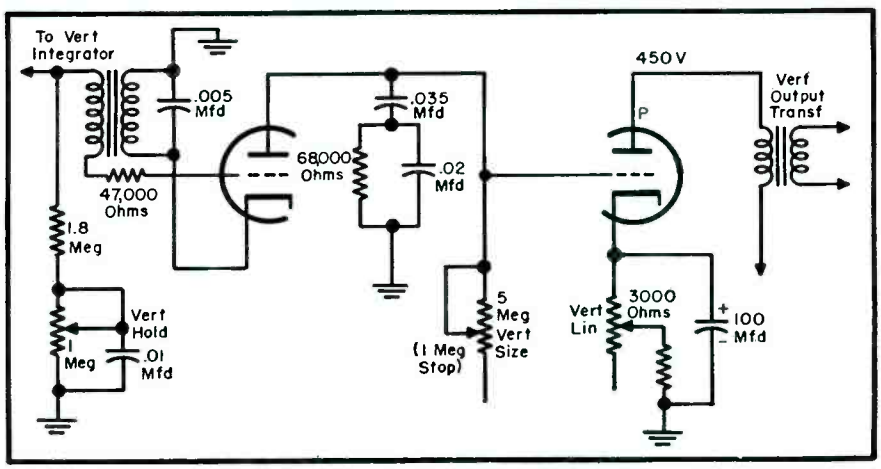

FIG. 4: A TYPICAL twin-triode vertical oscillator-output circuit using a 12BH7. Note that the cathode of the oscillator tube returns to ground through a winding of the vertical oscillator transformer, thus enabling the heater cathode leakage to affect sync.

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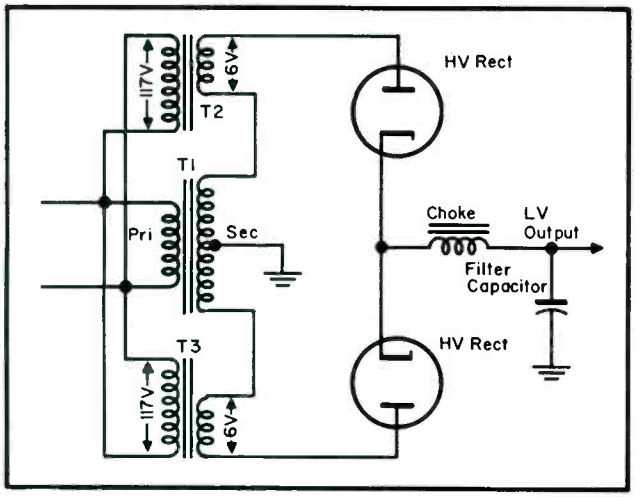
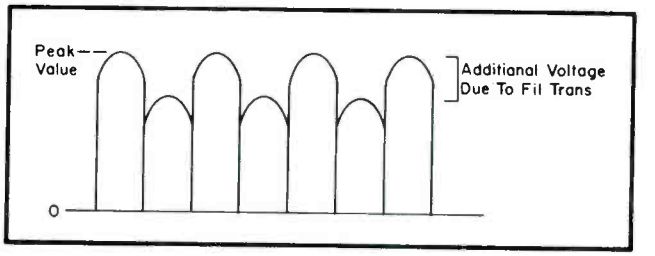


(Left)

FIG. 1: TWO 6-VOLT filament transformers connected to a power transformer to produce an additional 10 volts dc.

(Below)

FIG. 2: DC VOLTAGE output (before filtering) of a power supply using only one filament transformer.



How To Boost Low TV Set Voltages

By Using Separate Filament Transformers, Unused Power Transformer Windings or Through Alteration of Selenium Circuits

by JESSE DINES‡

OCCASIONS ARISE where it becomes necessary to raise (or lower) the output of *dc* supplies. These problems occur in intercom systems where more power is needed to drive additional speakers; TV set conversions when increased height and width are needed; and low-voltage supplies which have lost some of their efficiency due to age and deterioration.

The standard methods of increasing *B+* include increase of the size of the input filter capacitor; use of a filter choke with a lower *dc* resistance, and application of buffer capacitors across the power transformer secondary. Other methods that have been found particularly effective include the use of separate filament transformers and unused power-transformer windings, and the modification of selenium rectifier circuits.

Separate Filament Transformers

A pair of small 6-volt filament transformers mounted next to the power transformer, connected as shown in Fig. 1, can be used to boost low voltage. The 117-volt windings of the filament transformers are connected in parallel with the windings of the power transformer. And the 6-volt windings are connected in series with the secondary of the power unit. If a lower than anticipated voltage results, then phasing must be corrected by reversing leads of the 6-volt windings. (Reverse phasing may be used to advantage when a lower-than-normal *dc* voltage is needed.) In effect, the use of the additional transformers provides an increase in the turns ratio of the power transformer; one connected to each side of the power transformer to insure proper balancing. The voltage increase which may be expected from such an arrangement is about 10 volts.

If an increase of more than 10 volts is desired, then 12-volt (or even higher voltage) filament transformers may be used. For a 12-volt transformer, twice the output of a 6-volt transformer will be obtained, or about 20 volts.

It is possible to omit one of the filament transformers and obtain a boosted *dc* voltage output. Approximately the same voltage output can be obtained, since the filter capacitor will charge to a peak voltage value. But there is a disadvantage in this method; the power transformer saturates more and can overheat due to circuit imbalance. Thus, one should exercise caution and avoid this single-transformer method, since resulting excessive overheating can ultimately burn up the transformer.

Some power transformers have an additional 5- or 6-volt winding which

(*Continued on page 32*)

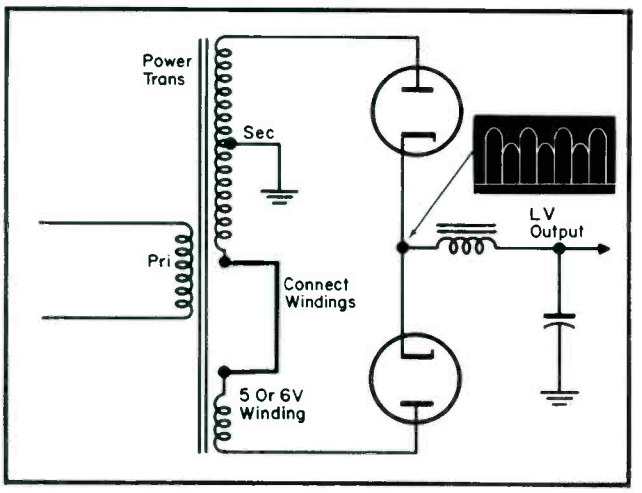


FIG. 3: POWER TRANSFORMER low - voltage winding added to the secondary to produce a greater dc voltage output.

‡*Author of Servicing TV Sweep Systems.*

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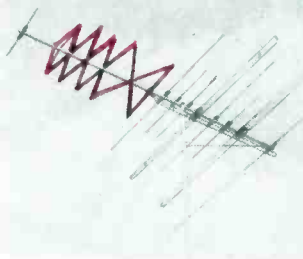
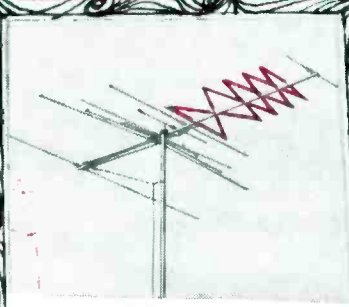
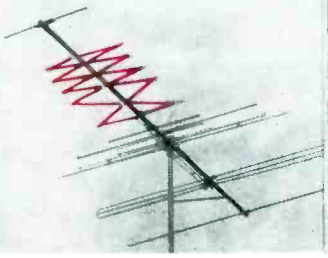


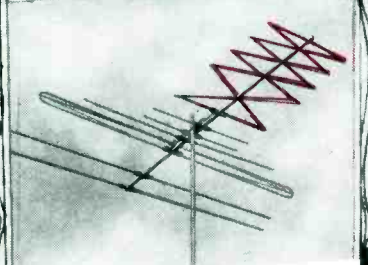
for deep-fringe areas
Wonder Helix
Model WX811
40 points



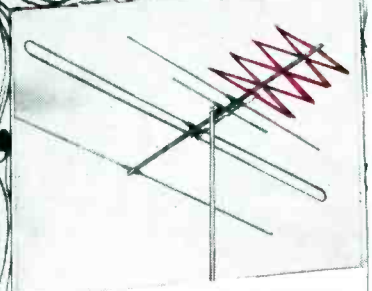
for fringe areas
Power-Helix
Model PX911
40 points



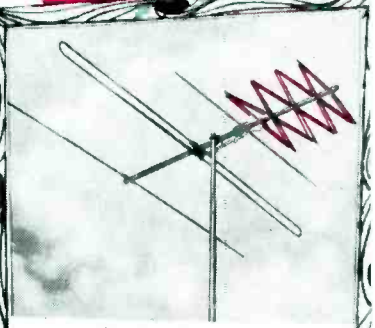
for deep-fringe areas
Shut-Out Helix
Model SX992-SX996
50 points



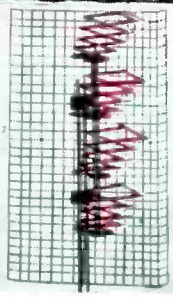
for fringe areas
Star-Helix
Model SX711
30 points



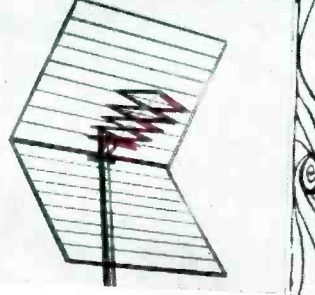
for near-fringe areas
Super-Helix
Model RX511
20 points



for local areas
Junior Helix
Model JX311
10 points



for fringe areas
UHF 4-Bow Helix
Model UX211
10 points



for local UHF areas
UHF Corner Helix
Model UX411
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THIS MONTH IN SERVICE

NATIONWIDE EDUCATIONAL PROGRAM UNDER STUDY BY INDUSTRY TRADE GROUPS--A hard-hitting industry-sponsored educational plan, that would bring the country's best technical and business talent to service associations across the nation, has been blueprinted by special educational committees of RETMA and NEDA. . . Believing that the advent of color-TV, transistorized chassis and other new devel pments have created an urgent need for on-the-spot talks and demonstrations, the industry groups propose to provide a pool of speakers and equipment that will be shuttled around the country to every association, large and small. . . Those sparking the idea say that the intensive drive should be of significant value to Service Men, serving to resolve the many technical and business problems that they always face, enabling them to cope with neighborhood problems that will strengthen their position in their community. . . . A key role is being drafted into the plan for distributors because of their knowledge of local conditions and their public relations facilities that are available to promote the program. . . In view of the obligation all have to help the Service Man, the committee's spokesmen said, it is hoped that everyone in industry will support the campaign.

TRANSISTORIZED PORTABLE TV SETS EXPECTED WITHIN TWO YEARS--A bold forecast that industry can expect by '58 portable transistor-TV models that will operate on their own battery-supplied power source, was made recently by the prexy of RETMA. He felt that current problems, particularly in the development of transistor horizontal sweep and high-frequency circuits, should be overcome within the next twenty-four months. Now, he said, transistors operating from a low-voltage battery do not provide enough picture drive for full contrast pictures. . . According to one lab, it is now possible to transistorize vertical deflection systems and the sync circuits; it is claimed that both are practical and comparable to tube circuits in performance.

WIDE-ANGLE 110° DEFLECTION PICTURE TUBES DEVELOPED--The long-awaited aluminized 110° diagonal-deflection rectangular glass-type picture tubes, having an overall length of 14½ inches, will soon be on the market. . . Announcement of the finalized design of the tube was made a few weeks ago. . . The tube's overall length was said to compare with 20 inches for a tube having the same overall diagonal dimension, but with only 90° deflection angle. . . A feature of the new tube is the use of a straight gun with an improved electrostatic focusing-lens system and incorporating a pre-focus structure to maintain image sharpness over the complete screen area. The new gun was also said to eliminate the need for an ion-trap magnet. . . Another design feature of the tube is its neck diameter of 1⅛ inches, which makes possible the use of a deflecting yoke with an increased deflection sensitivity. . . The wide-angle tubes will be available in 14, 17 and 21-inch types.

UHF TV TRANSLATOR DEMONSTRATED--The new translator service that was recently authorized by the FCC to permit small, inaccessible communities to receive big-city TV, was demonstrated a few weeks ago in the 3500-population town of Quincy, Washington. . . The system, picking up a channel-4 signal, radiated 200 watts on channel 78 and delivered a three-millivolt signal 6½ miles away and nearly 2-millivolts 18 miles away. Engineers on the scene reported that the pictures were steady and did not suffer from any local interference. . . Translator systems are scheduled for installation in over 100 areas in the far west.

NEW ASSORTMENT OF COMPONENTS FEATURING FERRITES ON WAY--The unusual magnetic properties of ferrites that have made it possible to build highly-efficient antenna rods and TV flyback transformers and deflecting yokes, will soon be identified with many new parts. Because of the material's high stability with respect to temperature changes and residual magnetic shock from high ac or dc magnetization and its high saturation, it will be widely used in wide-band transformers, tuners, miniature transformers, choke coils and recording heads. . . Isolators, using low-frequency ferrites, will also appear for use in ultrahigh color-TV to reduce ghost effects caused by reflected signals on the line between the TV set and the antenna.

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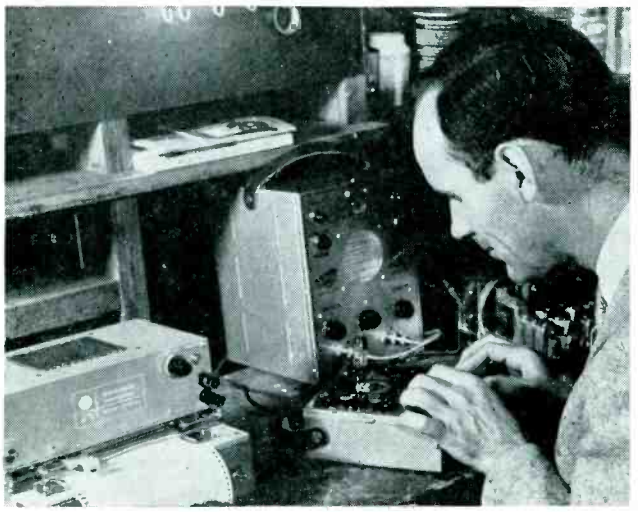


Special Tests For

That Can Provide Vital Tube

TESTING TUBES for grid emission, often the cause of hard-to-find troubles in TV sets, mobile radio equipment and industrial electronic apparatus.

THE TUBE has been noted as the most frequent cause of failures of radio and TV sets and other electronic devices. How long a tube will last is difficult to guess and impossible to predict with accuracy. It is said that the burnout of a tube is the most common cause of complete failure. However, filament burnout is not the most common tube failure, not by a wide margin. Most tubes are replaced because they no longer are capable of operating within specified electrical limits. Many tubes are unuseable because of loose elements, bad internal connections, short circuits between elements, gas, broken glass, leakage or grid emission.

To determine if a tube needs replacement, any or a combination of the following techniques are normally employed: (*1*) each tube is checked in a tube tester; (2) the tubes are left alone if the equipment seems to operate satisfactorily; (3) performance is observed as new tubes are substituted, one at a time; (*4*) certain tubes are replaced arbitrarily, based on previous experience with a particular type of set or equipment, or (5) as many tubes as the customer will pay for are replaced, on the assumption that the tubes have already been in use longer than their rated life.

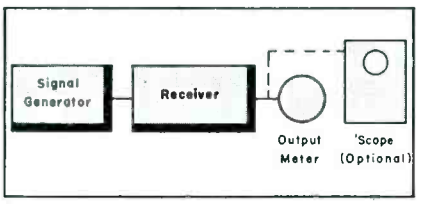
When in doubt and cost is not a factor or labor cost to find the defect is greater than new tube cost, all tubes can be replaced. But will this fix the trouble? Not necessarily. Assuming that all new tubes in stock are good, which they seldom are, they are not all necessarily uniform even if of like type numbers. Some new tubes will perform well in one application and not in another.

One television set manufacturer was recently reported to have a carload of tubes on hand which would not function in the TV sets then in production. They were of the right type number, but were of a different manufacture. The TV set had been designed around the characteristics of a particular brand of tube on hand. Allowance had not been made in a critical circuit for the unexpected variance between brands.

Of course, both brands were rated identically in the tube manuals. However, in mass production tube manufacturers cannot always maintain the closest tolerances without retarding production and raising costs. To overcome these problems the set manufacturer may really mean it when a label is stuck inside the cabinet which reads: "For best results use only X brand tubes".

Prechecking Tests

One test equipment manufacturer carefully prechecks each tube and advises its customers to do so too. A manufacturer of aviation electronic equipment issues a manual to its customers which gives detailed instructions on how to precheck tubes, burn them *in* and then recheck them before installation.



TUBE TESTING system most applicable to communication receivers.

In the interests of greater customer satisfaction and reduction of callbacks it behooves the Service Man to take a new look at tube testing, both old and new tubes.

First, what does a tube tester do? Is a tube tester supposed to be a tube merchandiser or an instrument with which one can determine with some accuracy the relative merit of a tube? It can be both. Only a well-designed tube tester is capable of testing most tube types with any degree af accuracy.

There are tube testers that measure emission, some indicate power output, and some are calibrated to read mutual conductance directly in micromhos.

Some testers measure the characteristics of dual triode tubes with the elements in parallel, on the assumption that both halves deteriorate almost equally, or that if the tube tests okeh neither half can be far below allowable tolerances. In general, such a test may be adequate, but not so in critical circuits where each tube half is used independently or where both halves must be almost identical.

In one general-purpose tube tester being readied for production, dual triodes will be paralleled for grid testing, connected in series for emission test, or both halves can be checked independently if desired.

It is a safe assumption that a tube rejected by a conventional tube tester as having low emission, mutual con-

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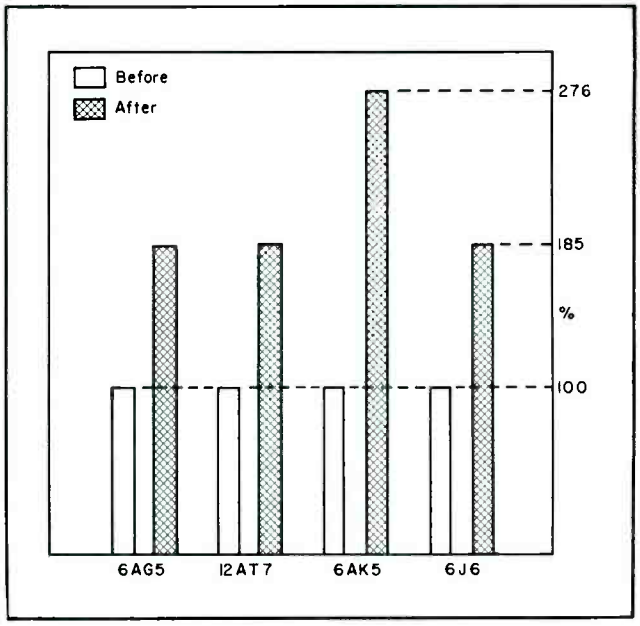
Tube Elements

Performance and Reliability Information

by E. A. BRAMSEN

Chief Engineer
Seco Manufacturing Company



IMPROVEMENT in tube life can be attained by more rigid tube testing before placing new tubes in service, as shown in this bar graph. For example, when 6AK5s are pre-service tested for grid emission, the average life of the tubes, which test okeh when new, can be effectively extended 176%. New tubes with slight grid emission may operate satisfactorily when installed, but it has been found generally fail to last as long as tubes which do not have this defect.

ductance or power output should no longer be used. Even if it is still operative in the equipment in which it was used, the fact is that its performance is out of electrical limits and its future life expectancy is short. In addition to merit, most tube testers check for interelement shorts and some are provided with a gas test feature.

One method that is used for determining if a tube is nearing the end of its life is to test it first at rated filament voltage and again at 10% or more below rated filament voltage. If the merit reading is far below allowable limits at the lowered filament voltage, the tube should not be expected to last much longer.

If a tube checks out on a conventional tube tester as being satisfactory, it is not a positive indication that the tube will operate satisfactorily in all applications. For example, the tube's performance may taper off or a short may develop after extended use. Hence, a tube preheating rack on which tubes are warmed up before testing can be used to help detect such faults.

However there is another phenomenon which occurs in new tubes as well as old ones. It may be present as soon as the tube reaches operating temperature or after an extended period of operation. In some circuits it may not cause appreciable trouble; in others it may cause hard-to-find troubles and in some instances causes serious circuit malfunction.

This phenomenon is called *grid emission* and is common in high gain tubes like the 6AK5, 6KB6, etc. It is a common trouble in TV sets, mobile radio receivers, electronic control devices and some types of computers.

The control grid in a high-gain tube is necessarily close to the hot cathode. Sometimes some of the cathode coating or impurities get on the grid. The hot cathode also warms up the grid and under some conditions the grid performs like a cathode and emits electrons too. This causes current to flow in the grid circuit in a reverse direction which can upset bias conditions and cause the tube to operate in an undesired portion of its characteristic curve and in some circuits to behave far from the intended manner.

In a TV receiver, a single tube with grid emission can cause instability, overloading and insensitivity. When a *vhf* mobile radio receiver loses sensitivity after a period of operation, the trouble can often be traced to a tube with grid emission. In fact, one tube with grid emission can affect the bias on several tubes tied to the same *agc* buss.

If the condition is very severe, it can sometimes be detected with a tube tester which has a gas test feature. However, this kind of test normally is not sensitive enough to find this fault. To take care of this problem a special type of tester for detecting grid emission has been developed.

The tester consists of a *dc* amplifier with an electronic eye as an indicator. Both the tube under test and the *dc* amplifier are biased to cutoff. If the tube has grid emission, the bias drops and causes the eye to open.

To cut down callbacks and to build a better reputation with customers, more comprehensive tube testing is a good idea. It is time well spent because it really saves time that is often spent doing a job over.

As tubes are put into stock they can be checked for merit and shorts and applicable types can also be checked for grid emission. It might be smart to mark the tubes to indicate that they have been pretested.

Lab methods can be employed in the shop when servicing radio and TV receivers. After tubes have been checked on a standard tube tester for merit and shorts, applicable types can be checked for grid emission and interelement leakage with a grid circuit tester. Then to assure maximum performance, new tubes, known to be good, may be substituted one-at-a-time noting any change in performance, by observing a *vtvm* or scope tied into an appropriate receiver circuit. This is the best test, of course, of tube performance at any given time. After allowing the set to operate a couple of hours, a recheck of all applicable tube types for grid emission may reveal interesting results.

More critical and comprehensive tube testing is becoming a necessity as b-w TV set manufacturers try to get more performance out of fewer

(*Continued on page 37*)

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Hi-Fi Amplifiers for PA: Features of Circuits For Small and Large Systems

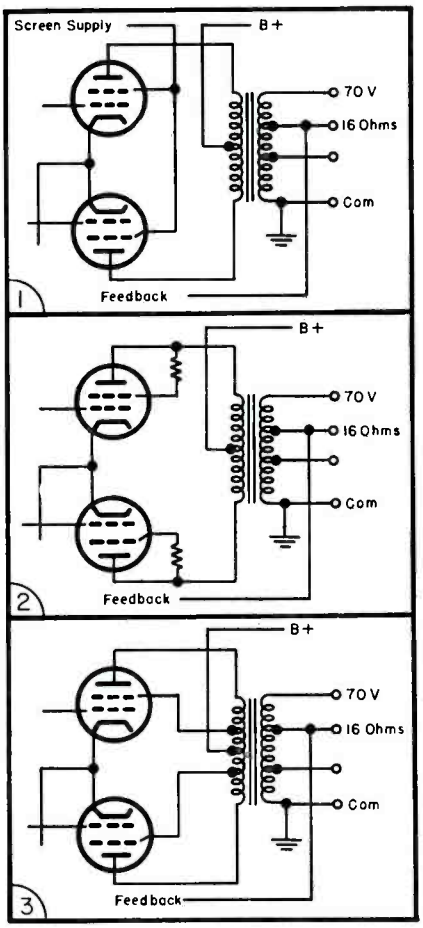
IN COMMERCIAL SOUND, *quality* is of the essence, because any deviation from uniform response can develop the same kind of trouble as a poor loudspeaker or microphone.

However, this does not mean that amplifiers designed for *hi-fi* application are necessarily good public address amplifiers. Amplifiers for public address are really specialized equipment and, while many high-fidelity amplifiers suit the purpose admirably, one must exercise great care in making a selection.

It is important, initially, that the amplifier carry all of the facilities that will be necessary for public-address work. It should have microphone inputs of the correct impedance and level for the microphones to be used. You may elect to have a separate preamp and power amplifier, or a combined unit to serve the purpose, according to the kind of application in mind. If all the jobs you are likely to do call for a compact and readily portable arrangement, then the single unit is probably the best bet. But on some large installations it is an advantage to have a separate preamp so that the control point need not be located in the same position as the power feed to the loudspeakers.

The control or preamp end of the amplifier should provide for independent gain control for as many microphone circuits that may be required; separate bass and treble control (there is usually no need for phono equalization in the detail required for high-fidelity systems); and possibly a master gain control.

The amplifier output should provide impedances of 4, 8 and 16 ohms, which are particularly suitable for small jobs and also a 70-volt constant-voltage line output. Variable damping is of no particular advantage to the public-address man. It is an additional control that can cause trouble by being incorrectly adjusted or overlooked. However, if the circuit is a good one, it is not a serious disadvantage; the variable damping control can simply be left at the maximum damping position and then dismissed from the control program.



(Right)

FIG. 1: STRAIGHT pentode output circuit with overall feedback. Amplifiers with this output are not satisfactory for commercial sound.

FIG. 2: TUBES strapped as triodes, as shown, are well suited for pa work; but the output from amplifiers with such a circuit may be inadequate for some jobs.

FIG. 3: THE ULTRA-LINEAR approach, which splits the difference between pentode and triode operation; it affords good power for the tubes used, and is well suited for pa work.

Output Stage

The power output stage should supply sufficient power to handle all the jobs for which the amplifier is required. As to frequency, a deviation of as much as 1 db between 20 cps and 20 kc is quite acceptable.

However, amplifiers in which there are no specifications for frequency response or distortion may not be good enough; failure to provide such data often indicates that the manufacturer does not make a practice of measuring his frequency response or distortion. This can mean that the frequency response may be almost anything.

Fixed Damping Factors

If an amplifier has a fixed damping factor, it should preferably be greater than 5; although, provided the damping is relatively high, it is not critical for public-address work.

There are some amplifiers on the market that might appear to give a satisfactory performance according to the foregoing information; they may have a 70-volt line output provided. But the amplifier may really have been designed as a low cost model for the high-fidelity market and the

(*Continued on page* 54)

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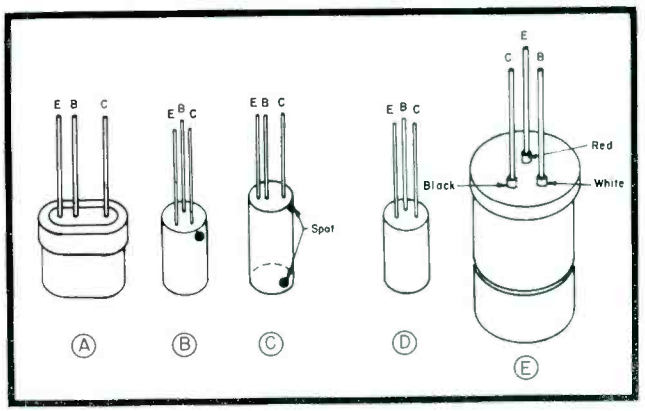


Transistor-Tube Tester

Provides Leakage Measurements of Transistor Collector Current and Direct Reading of Current Amplification Factor

FIG. 1: ASSORTED TYPES of npn and pnp transistors. A = 2N34 type; B = 2N47/2N105 family; C = 2N37, 2N108, HD-398, CK-721, TS-161 group; D = 2N41/2N204 series and E = 2N156/2N158.

No longer can the transistor be considered as purely an experimental plaything or just a lab item. Stepped-up production of all-transistor portables and table-model radios, as well as, car radios and phono-amplifiers, have changed that picture.

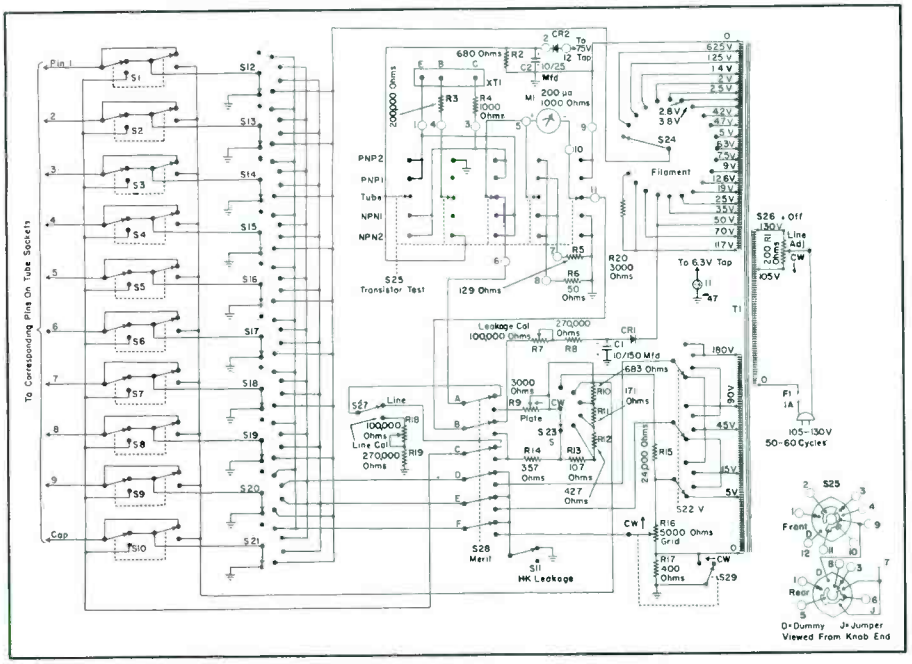
This trend has resulted in the design of instruments that can check the variety of transistors now being used. The newly developed designs indicate that it is no longer feasible to use the ohmmeter as a transistor testing device, since they normally generate heavy currents (1000 milliamps on the R x 1 scale) and such current can permanently change the characteristics of a transistor under test. Another inherent disadvantage of the ohmmeter check is that the transistor is a non-linear device and it's apparent resistance can vary widely as a function of the voltage across it. Because of this non-linearity different readings will be obtained on different scales of the same meter or when the reading of one multimeter is checked against the reading of another.

Testers now available usually check for opens, shorts, and transistor gain. Some units incorporate separate battery supplies for the transistor test, while others utilize the main power source of the tube tester portion of the instrument. A tester[1] that uses line voltage is illustrated in Fig. 2. This instrument makes use of one of the most significant characteristics of a transistor, namely the collector current that flows when the emitter is grounded and no signal is applied to the base. This current depends upon the temperature, resistivity of the germanium, the resistance from base to ground and the extent of contamination on the surface of the transistor; it is comparable to the grid current that flows in a tube and is equally undersirable. The circuits used for this test are shown in Fig. 3.

The figure of merit can also be measured; this is the common emitter current-amplification ratio. Various symbols are used to denote this quantity; β (beta), α cb (alpha cb), h_{21} and h_{fe}. Using beta as the quantity, we find that it is related to the common base current-amplifica-

(Continued on page 48)

[1] *Eico 666.*



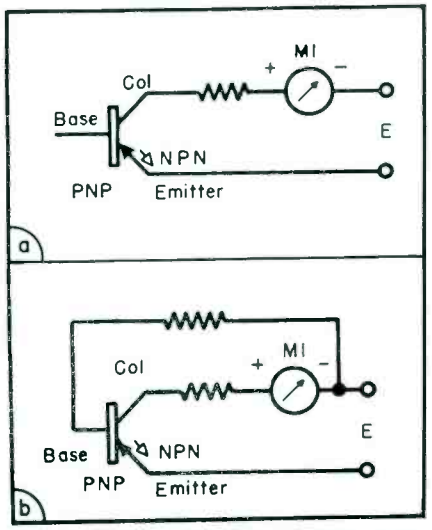


FIG. 2 (left): CIRCUIT of Eico tube-transistor tester.

FIG. 3 (above): Test circuits designed to reveal transistor collector-current information.

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COLOR-TV Chassis with New Phase Detector and Sync Color Killer

[See Front Cover and Pages 24 and 25 for Complete Diagrams]

by JOHN SCHUMACHER

Engineering Department
Admiral Corp.

This article, prepared as a supplement to the *Circuitry Report on the Admiral Color-TV Receiver*, published in March, 1956, SERVICE, which detailed the fundamental engineering principles behind the receiver, offers an analysis of a refinement of the original design that has been included in a new color chassis.

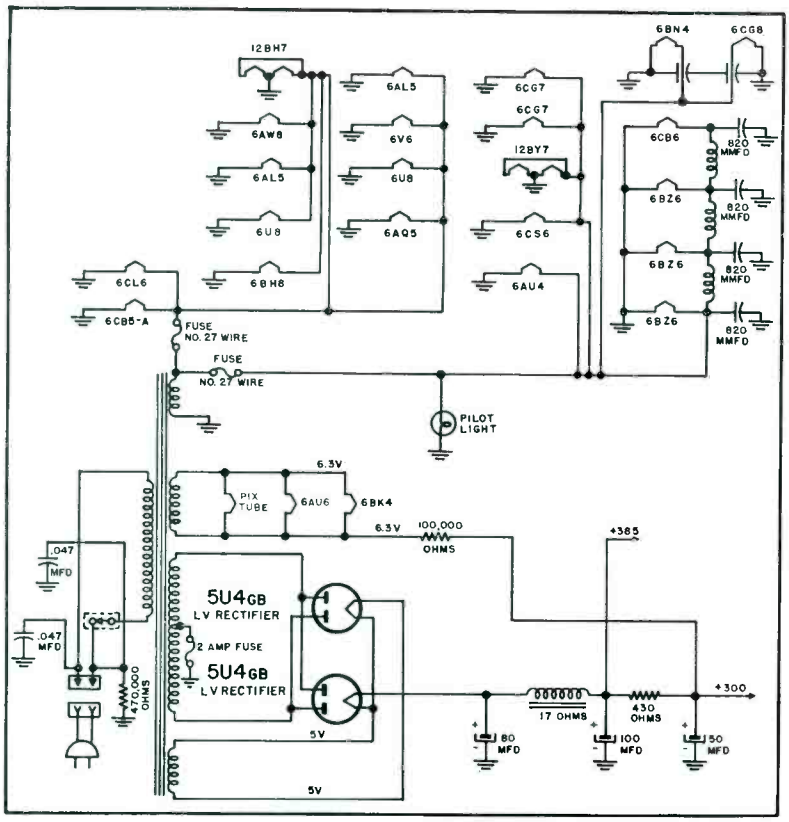
IN THE COLOR-SIGNAL producing circuits, changes are apparent in the subcarrier phase detector, oscillator control tube, and color killer circuits. A 6AL5 color phase detector included in our new line of color models[1] represents some new ideas in balanced phase detectors. It eliminates the balancing control, gives an output independent of any non-symmetry in the incoming burst signal and has twice the gain of the previous more conventional phase detectors. The previous phase detector consisted basically of two peak detectors fed by burst 180° out-of-phase, to which was added a common reference voltage from the sub-carrier crystal oscillator. This circuit (when viewed from its control voltage or output terminal; Fig. 1) shows that the two detectors and their loads are in parallel with one another. Thus it is necessary that the loads for both detectors be matched or balanced, (original circuit had balancing control) and the output voltage should be equal to one-half the voltage difference between the two detectors. The new phase detector system also consists of two peak detectors; however, they are fed with single-ended burst and sub-carrier 180° out of phase, and when viewed from its control voltage or output terminal, (pin No. 1 of 6AL5) the two load resistors are seen to be in series to ground. These changes have been found to produce the following advantages:

(*1*) The values of the load resistors no longer need to be balanced and thus no balancing control is needed.

(2) As the two loads are in series the output voltage is equal to the actual voltage difference between the two detectors.

(3) As the burst is fed single-ended into both plates of the two detectors, the system only

(*Continued on page* 36)



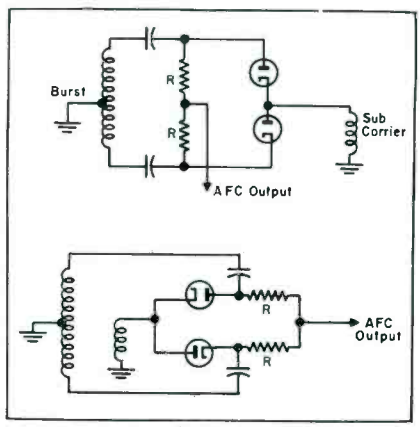


FIG. 1: PHASE DETECTOR circuits. Type shown below is standard, which when viewed from control voltage or output terminal reveals that the pair of detectors and their loads are in parallel with one another and must be balanced. At top, circuit of improved system is shown. Load resistor values do not have to be balanced here and thus no balancing control is required.

FIG. 2 (LEFT): LV power and filament supply circuit of Admiral 29Z1 color-TV receiver diagrammed on pages 24 and 25.

[1]*Admiral* 29Z1

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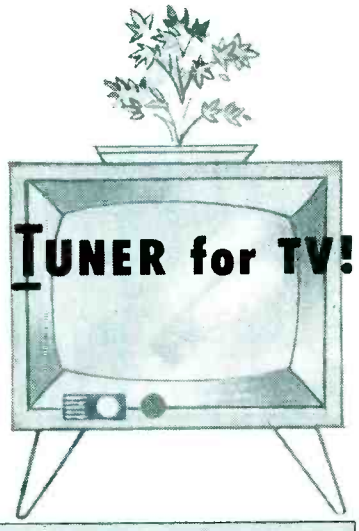

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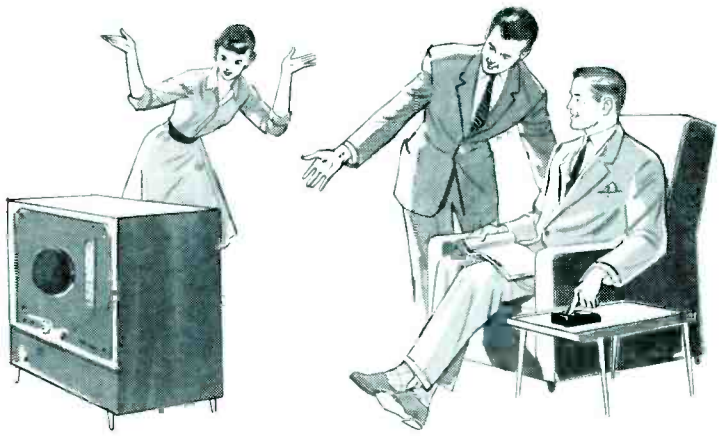

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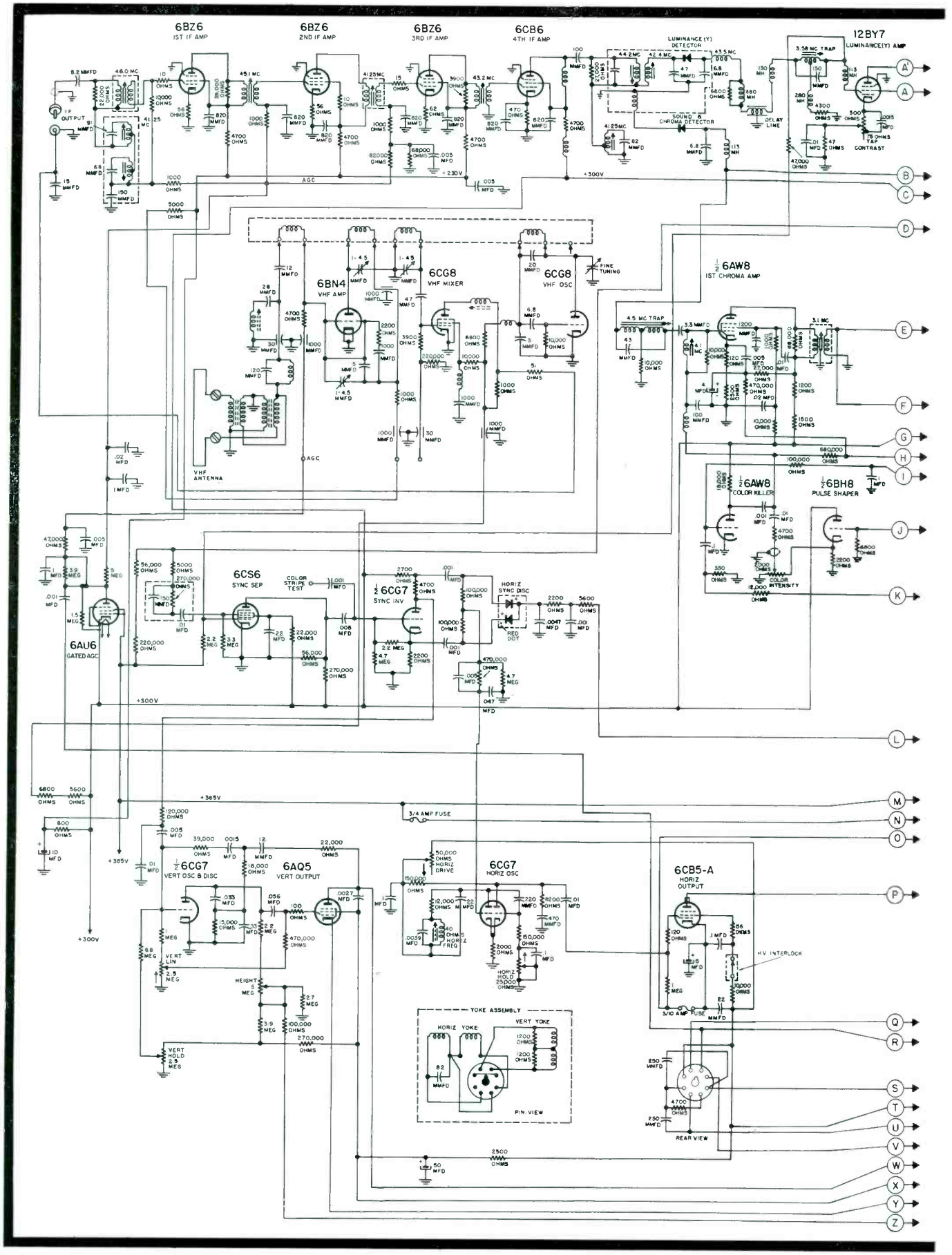

COMPLETE CIRCUIT of Admiral 29Z1 which

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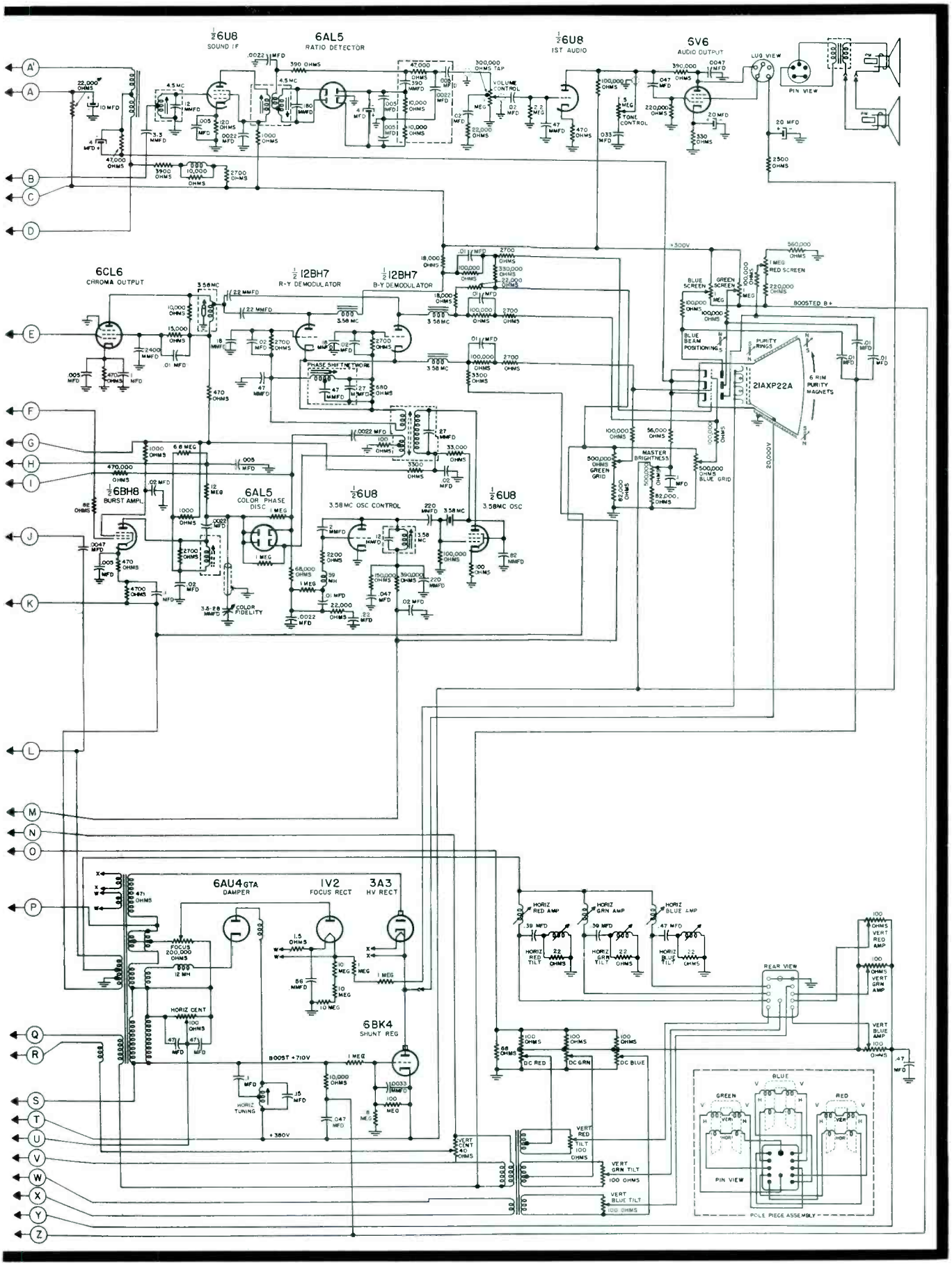

features a new phase detector and sync color killer.

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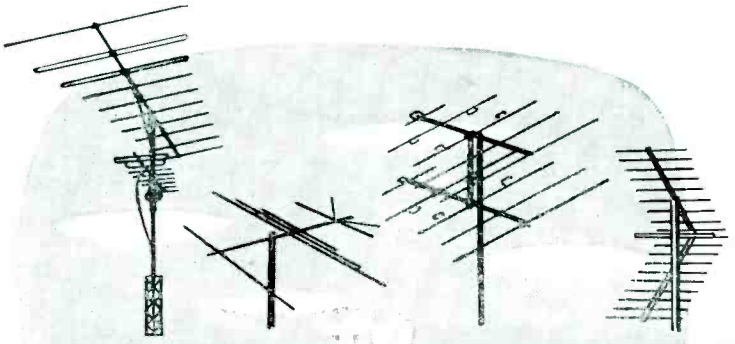


UHF-VHF TV ANTENNA DIGEST

DESIGN • APPLICATION • INSTALLATION • SERVICE

Coax Cables For Community-TV Systems

by **ROBERT FELBER**

Products Manager, Community TV
Amphenol Electronics Corp.

SEVERAL YEARS AGO, as the wonders of television became a household necessity for those in the larger metropolitan centers, residents of the fringe areas were still struggling with TV pictures that ran a poor second to the first motion pictures. Those who were willing to invest in an antenna system, which in many cases exceeded the cost of the receiver, were privileged to watch snowy, fading pictures, which often disappeared completely for a period of time ranging from minutes to days. Strangely though, certain persons in that same area were blessed with outstanding reception which their neighbors couldn't enjoy.

From a situation such as this sprang the first community-TV system. Ingenious Service Men were able to connect two or even three adjoining TV receivers to the same antenna system, and it wasn't long before the idea of a wired community took hold.

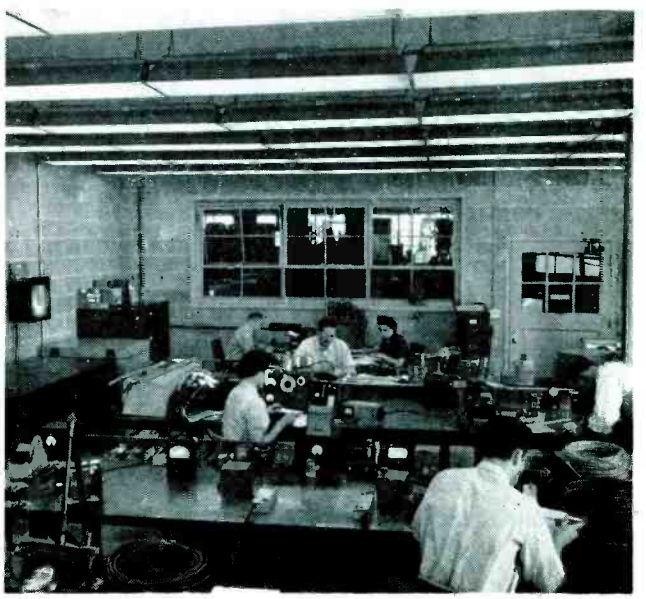
Hotel and apartment-house master antenna systems were already being installed in large metropolitan areas, with varying degrees of success. Why not use this principle for house-to-house TV signal distribution? With high hopes and a strong heart (and constitution), a few rugged individuals embarked on such a venture which was shortly to change the living habits of these people who lived on the TV frontier, particularly those in hilly terrain where signals were usually blacked out.

Little did these Service Engineers realize the many problems with which they would be confronted. Nothing had ever been done on such a scale, particularly at these high frequencies and with a medium as fickle as television. Aside from the fact that the electronic equipment had not been designed for that specific application, cable problems which were previously unheard of, were met.

Having selected 75-ohm cables as the standard for a system, it was next necessary to select those which offered the lowest attenuation at a price which would make the operation financially practical. Since the signals were usually picked up outside

(*Continued on page* 42)

OUTDOOR CABLE test facilities where coax performance is studied.



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Complete service information on all Hotpoint TV sets is now available from Hotpoint TV Distributors. If you have not yet ordered yours, clip this chart for temporary reference, then contact your Hotpoint TV Distributor immediately.

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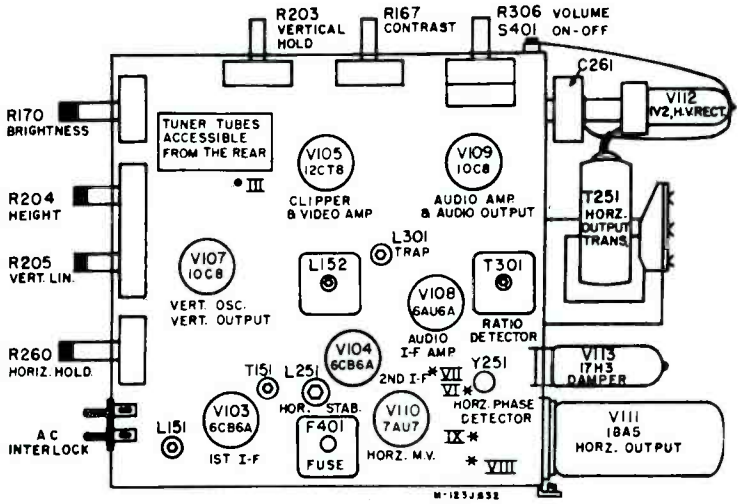

CHASSIS HS-T-56—Covers Hotpoint TV Models 9S101 and 9S102.

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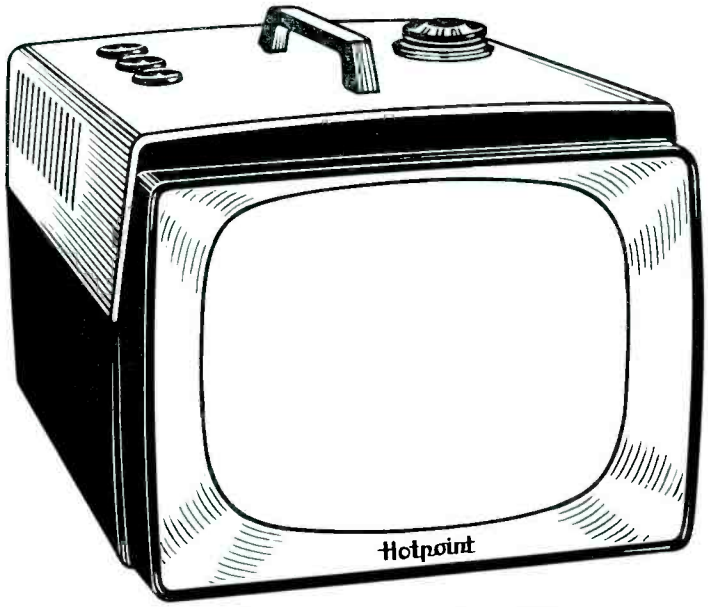

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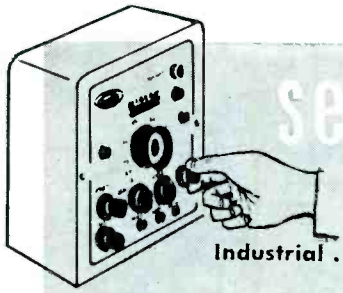
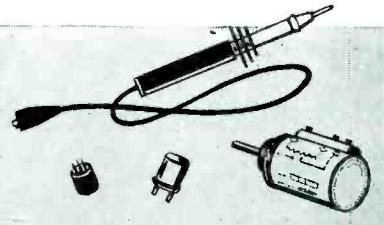


service engineering

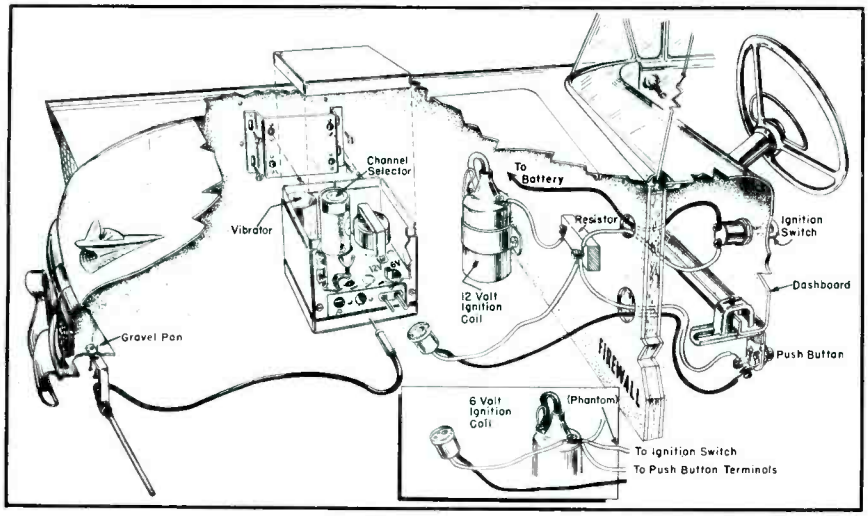
FIELD AND SHOP NOTES



Industrial . . . Commercial . . . Institutional

Communications . . . Audio . . . Television Installation . . . Maintenance . . . Repair

Garage Door Opener Receiver-Transmitter Circuitry . . . Maintenance-Repair Notes

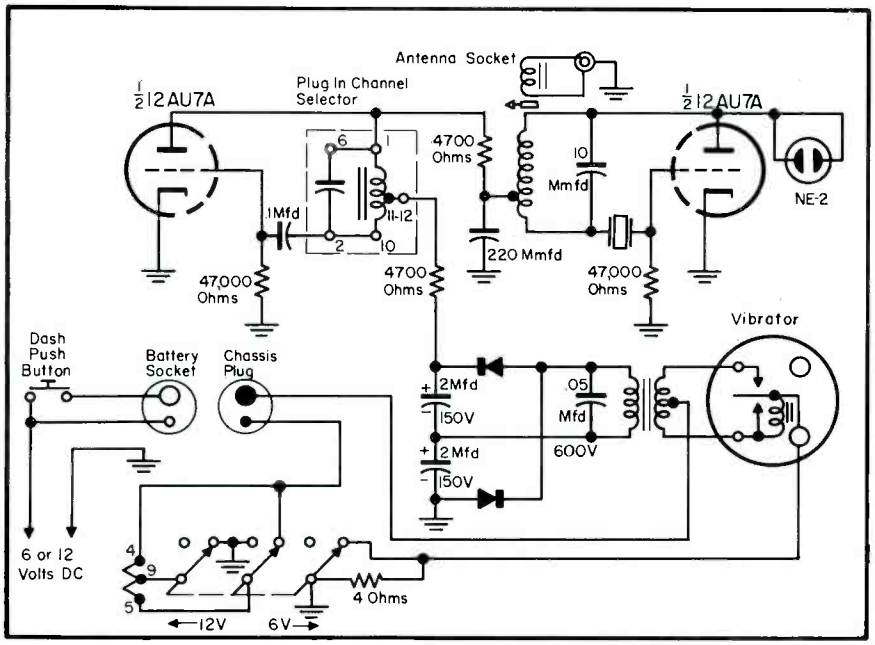


(Above)

DETAILED DRAWING showing position of the garage opener remote-control transmitter and accessories in car.

(Below)

COMPLETE CIRCUIT of the Perma-Power tone-modulated transmitter used in garage operator system.



THE INSTALLATION and maintenance of automatic radio-control devices for garage doors has become a flourishing activity among service shops.[1] The expanding interest has been prompted by the growing number of private garages and the development of soundly-engineered systems.

Properly installed, the controls will operate at any distance up to at least 75′ from the garage. Depending upon installation and location the operating distance may be as great as 250′.

So that neighboring installations will not interfere with each other, one system[2] employs ten different channels or *keys*. A channel can be changed by means of plug-in channel selectors.

Two or more cars can be equipped to operate the same door. Additional cars may be equipped for remote control at any time without altering or adjusting the original installation.

By utilizing different channels, separate doors, side-by-side, can be controlled independently. Each car will then operate only its own door.

The remote-control unit in this system consists of a tone-modulated transmitter and a fixed frequency receiver operating in the class C Citizen's Band at 27.255 mc, as authorized by the FCC for such purposes. The carrier, transmitted with a frequency accuracy of ±.04%, is obtained by crystal control of an *rf* oscillator; the carrier is modulated at one of ten predetermined tone frequencies between 600 and 4700 cps. These tones are distributed between the foregoing limits on a logarithmic scale with a frequency ratio of 1 to 1.25 between any two adjacent tone channels. The modulating and detecting tuned audio circuits are pro-

(*Continued on page* 31)

[1] *See report by* ***John Sevec*** *in September, 1956,* SERVICE.

[2] ***Perma-Power*** *RC 201.*

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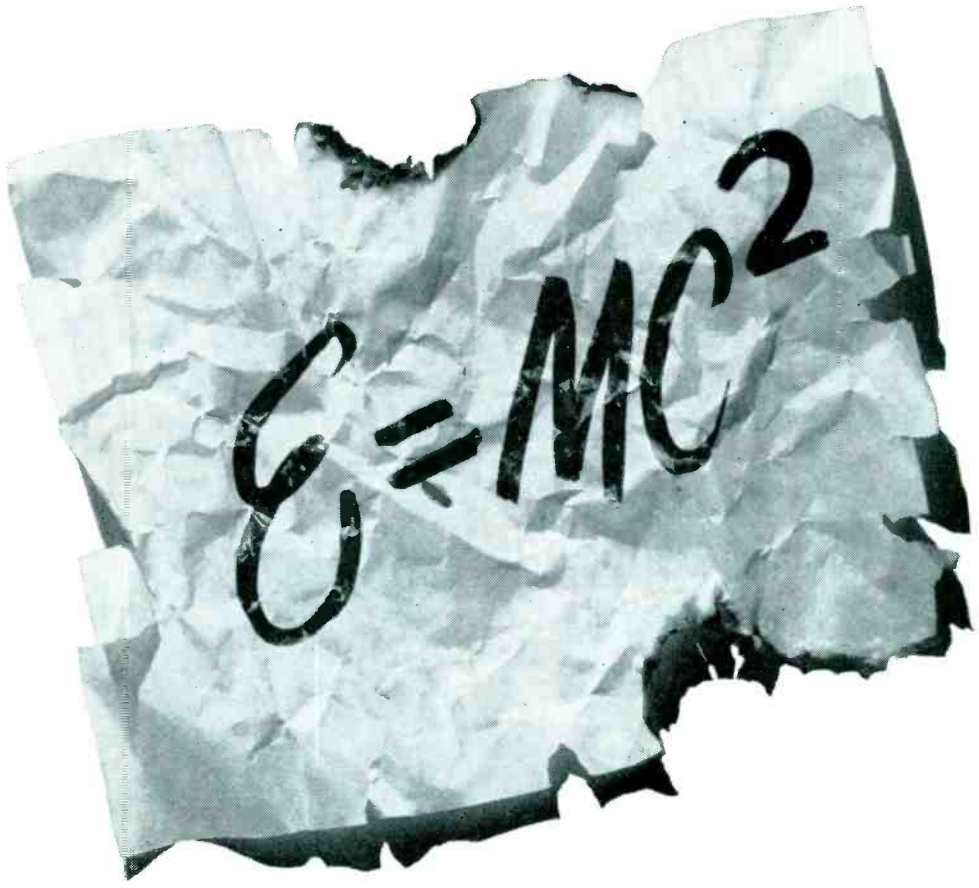

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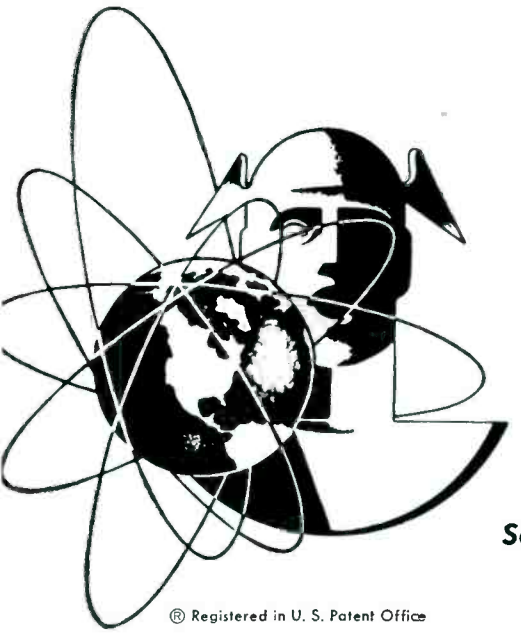

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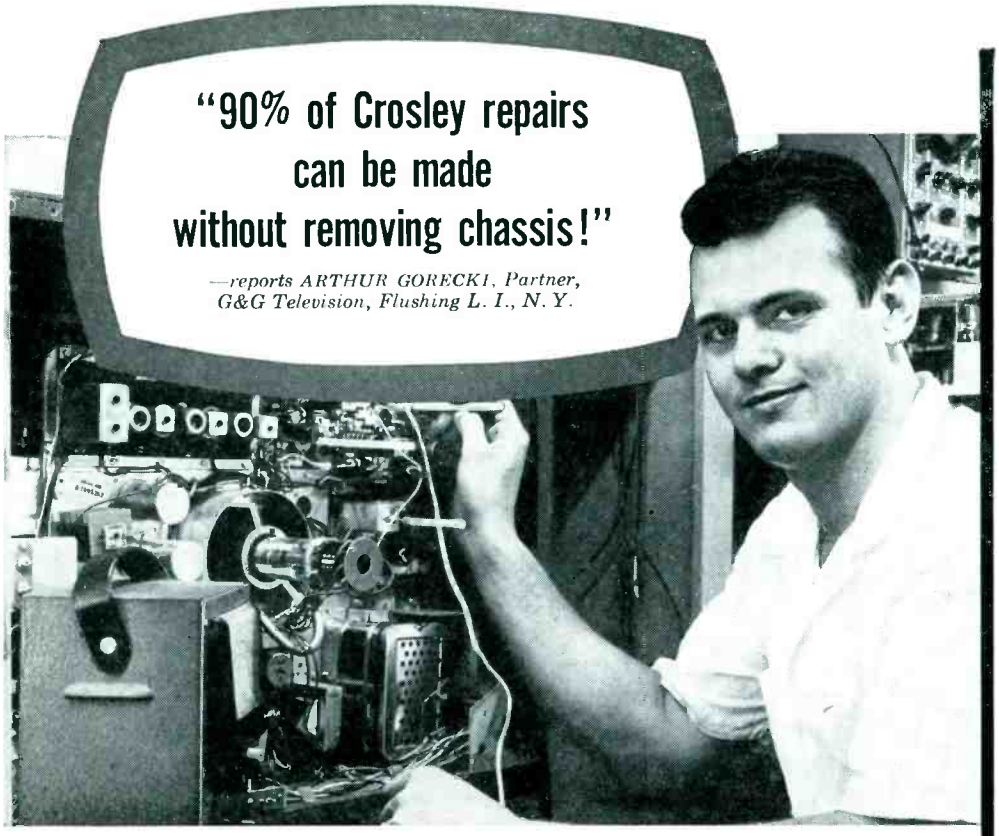

Now, more than ever, the welfare and importance of the TV serviceman takes top priority with Crosley! By designing a TV chassis that's the easiest to service, Crosley makes it easier than ever for servicemen to make repairs in the home, cut repair time way down (for more profit per call) and drastically reduce shop time. With this amazing chassis you not only give faster service, but *better* service —eliminating costly call-backs and irate customers! Note the features described here . . . and see for yourself why Crosley is

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Has all the features servicemen want—AND MORE!

- Printed circuit board is translucent. Just place light behind it to trace circuitry.
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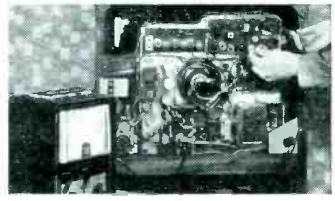
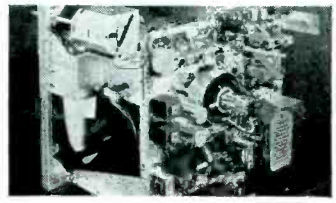
Test points are labeled and easily available from the rear without removing chassis. Quick circuit analysis and trouble-shooting make for simplified servicing.



95% of all parts replaced without removing chassis, without touching a chassis bolt. Provision is even made for changing the power supply parts easily.

Find tube blowouts with a screwdriver. Open heater tubes are a cinch to locate with the marked special test points. All receiving tubes easily replaced.



Picture tube comes out with the chassis. The tube mounting is a part of the chassis assembly for quick handling. Replacement and set-up are quicker and easier.

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(*Continued from page 28*)

vided in plug-in form. Factory adjusted and sealed, they have a frequency stability of better than ±1%.

The transmitter employs a single 12AU7A. One triode section serves as a crystal-controlled *rf* oscillator; it is plate modulated by the second triode section functioning as the tone oscillator in conjunction with a plug-in tuned circuit.

Plate power is obtained from a full-wave doubler circuit utilizing two selenium rectifiers. A transformer and vibrator provide for operation from the car's battery.

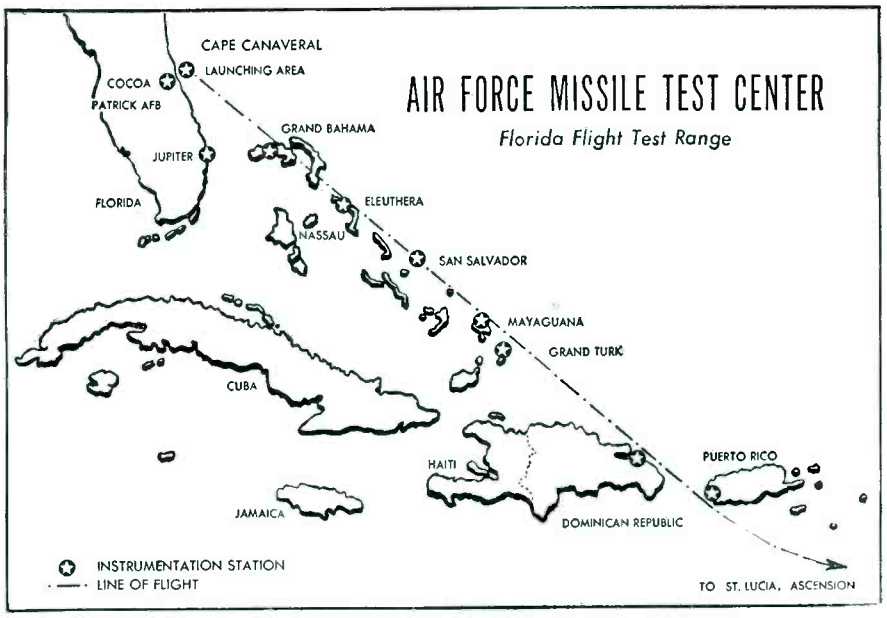
Accomodation of both 6 and 12-volt batteries is provided by a two-position slide switch mounted on the transmitter chassis. This switch connects the heater in series for 12-volt operation and in parallel for 6 volts; a dropping resistor is inserted in the power-transformer circuit in the 12-volt position.

Tuning Indicator

A novel feature of the transmitter's design is a built-in tuning indicator, which shows when the tank circuit is adjusted to resonance at the crystal frequency. The indicator consists of a miniature neon glow lamp connected to the high-potential terminal of the tank coil. Maximum *rf* voltage is indicated when the lamp glows brightest.

The indicator lamp also serves an important secondary purpose. It is well known that in crystal circuits of this type or of the similar tuned plate-tuned-grid type, the output (plate) circuit should be resonated at a frequency slightly higher than the crystal frequency. Although the output is then slightly less than when the tank is tuned to exact resonance at the crystal frequency, the oscillator is more stable, particularly with regard to *starting* when keyed *on-off*. This is so because the tank circuit must appear as an inductive plate load so that we have a negative conductance component of the tube input admittance to cancel the grid circuit losses and insure that oscillation will start. Once the oscillations have built up to a high value and are limited by non-linear tube characteristics, the tank circuit may be safely operated much closer to resonance at

(*Continued on page 51*)



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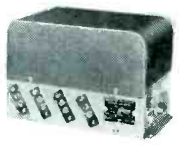
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Increasing TV Voltage

(*Continued from page* 14)

is not being used in the circuit. This winding can be connected in series with the power transformer secondary (Fig. 3; p. 14) to produce additional voltage. This circuit operates in approximately the same way as the set-up shown in Fig. 1; however, only one 6-volt filament transformer is used.

The output waveform shown will be the same as that obtained from the Fig. 1 system, where every other pulse of rectification is greater in amplitude than the alternate pulses. The additional *dc* voltage gain which can be realized in this circuit can be calculated by multiplying the voltage of the winding by 1.4. Thus, a 5-volt winding will produce a *dc* voltage gain of approximately 5 x 1.4, or 7 volts.

Effective operation of this method centers on correct phasing. The 5- or 6-volt winding (or any other winding that may be used) must be properly connected to the power transformer. Otherwise, power transformer burnout may occur.

To obtain the correct phase all leads to the power transformer must be disconnected; Fig. 4. Any terminal of the unused filament winding (in the indicated case, terminal 4) must be jumped to one side of the power transformer secondary (terminal 3). With an *ac* voltmeter, the voltage measurement across terminals 2-5 should now be compared with that across 2-3. If the phase is proper, the former voltage will be greater than the latter. If the voltage across terminals 2-5 is less than that across 2-3, then phasing is improper and the connections to terminals 4 and 5 must be reversed.

A separate 6-volt filament winding may be used together with an unused filament winding of the power

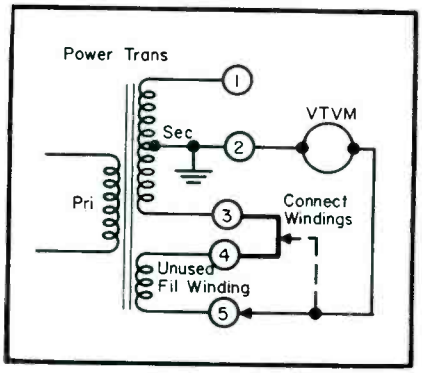

FIG. 4: METHOD OF determining phase of a power transformer unused winding.

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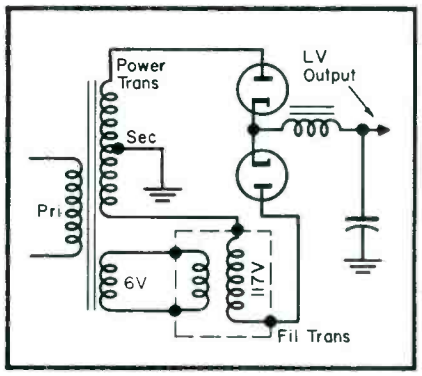

FIG. 5: SIX-VOLT FILAMENT transformer connected to power transformer to produce an additional 100 volts dc.

transformer to obtain a greater *dc* voltage. In this instance, the filament transformer 6-volt primary is connected across the 6-volt winding of the power transformer; the 117-volt secondary of the filament transformer is connected in series with the power transformer secondary, as indicated. Phasing is important here, too; the connections of the filament transformer must be in order to prevent power transformer burnout. To determine phase, the check procedure outlined for the previous boost method should be followed. A *dc* voltage increase of about 100 may be anticipated by using this method.

To increase the output of a selenium rectifier circuit, the circuit need only be converted into a tripler system. By adding a capacitor and rectifier, as shown by the heavy lines (and removing the ground, shown in dotted lines) in Fig. 6, a tripler circuit is established. A voltage increase of about 100 may be realized from this change.

To increase the *dc* to only about 15 volts, a 6-volt filament transformer may be connected so that the 6- and 117-volt windings are in series to form an autotransformer. If a *dc* voltage lower than the original results, then the connections to one of the transformer windings should be reversed.

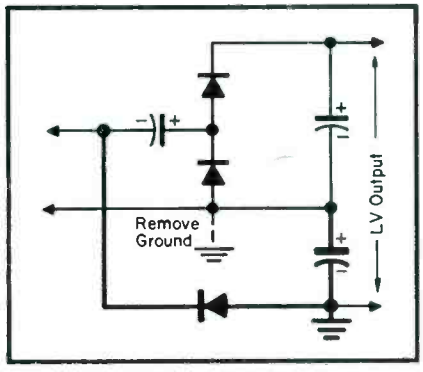

FIG. 6: FORMING A TRIPLER selenium-rectifier circuit from a doubler.

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Traffic Appliance Servicing

How To Repair Automatic Electric Toasters That Use Clock Timers And Clock-Thermostat Systems

by MILTON WALLACH

COUNTER in traffic-appliance service shop designed to expedite incoming-outgoing repairs and consumer part sales. Note variety of appliance types which this shop is authorized to service.

AUTOMATIC ELECTRIC household toasters are the most difficult type of portable appliance to service. We are faced with this problem because of the assorted types of pop-up and timing mechanisms employed and the number of different models some manufacturers make.

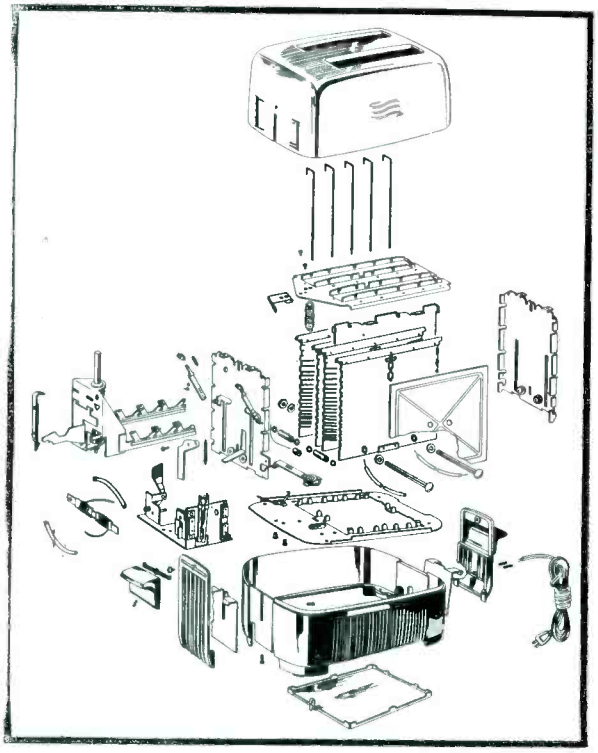
There are two basic groups of toasters. In one family are clock timers and in the second we have the clock-thermostat (bi-metal type) arrangements.

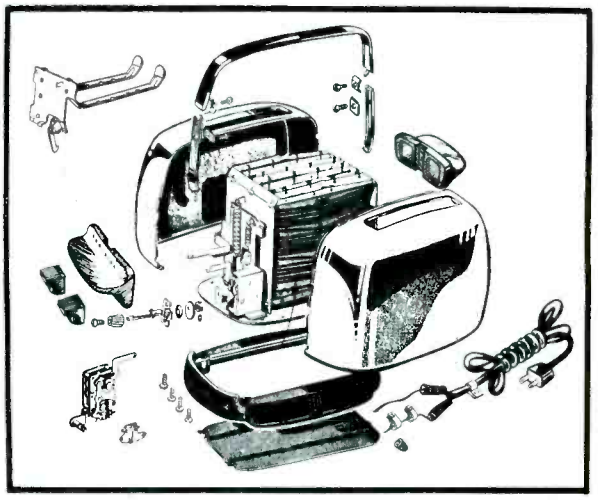
The clock timer pop-up mechanism is found on many popular inexpensive toasters. In a simple arrangement a push down lever of the carriage assembly serves to actuate the clock. At a predetermined time, set by the manufacturer, the clock trips a lever which releases the carriage assembly. A dampening device consisting of springs or dashpot (cylinder) assembly prevents the toast from popping out of the unit.

In this type of toaster preheating is necessary before bread can be toasted properly. Also, since the toasting period is set by a non-automatic adjusting clock timer, the quality of the toast varies depending on the texture of the bread; thus to obtain satisfactory results constant manual adjustment is required.

In the clock timer and thermostat arrangement, used on better-quality toasters, a number of refinements are included. The thermostat, which usually is a bi-metal type, is actuated by either reflector-element plates or resistance wires located directly in the toaster well. It compensates for heat and controls the speed of the clock, increasing the time element, when

(*Continued on page* 35)





DETAILED drawings of clock type (above) and thermostat bi-metal type (left) toasters.

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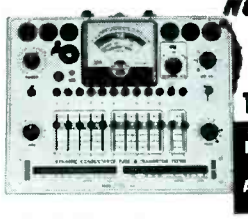

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Traffic Appliance Servicing

(*Continued from page* 34)

necessary, if the toaster is cold, or cold or moist bread are used. The timer element also decreases heat, when required, when the toaster is hot or the bread is dry or thin.

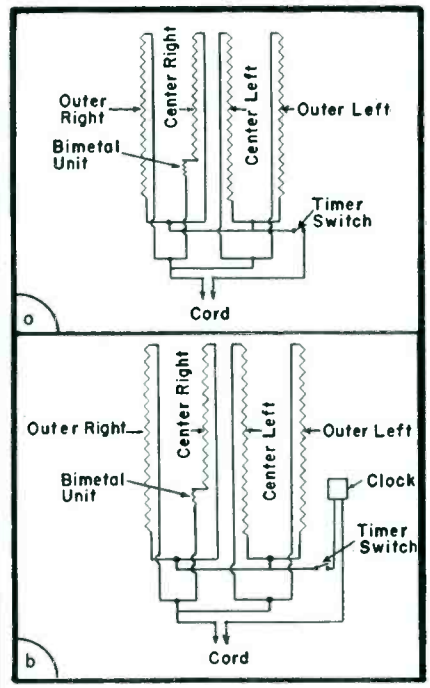
In the thermostat type of toaster the pop-up mechanism is controlled entirely by the thermostat. Most toaster thermostats, which are of the bi-metal type, are generally actuated by resistor wires wound around or near the bi-metal. This feature found on many popular brand toasters also compensates for heat and bread textures.

Repair Hints

In many cases the causes of inoperative units can be traced to dirty mechanisms due to an accummulation of bread crumbs, oils and sugar from sweet breads, corrosion, dirty and pitted contacts, bound carriage guides and rails.

In the initial inspection of a toaster to be serviced an electrical check must be made to determine whether there are any breaks in the circuit. This can be accomplished with a continuity tester and with the carriage assembly in toast position. If the circuit is open, one should check for breaks in the cord set (male plug), elements and connectors. Also the contact points should be checked, as a small particle of foreign matter can prevent current from flowing through. Pitted contacts can be repaired by filing with an ignition file (not emery paper); they should not be filed flat, but rounded out so that a minimum of contact is made. Such filing will not only increase the contact life, by reducing excessive arcing, but also make it more difficult for foreign matter to collect between the contacts. If, up to this point the toaster appears

(*Continued on page* 39)



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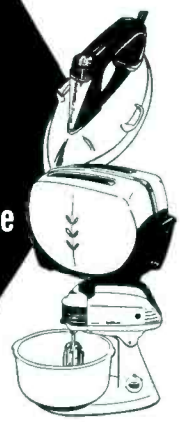

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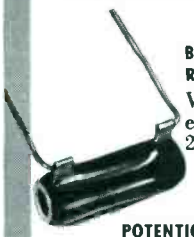

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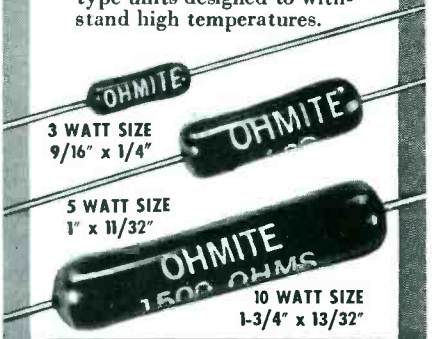

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5 WATT SIZE 1" x 11/32"

10 WATT SIZE 1-3/4" x 13/32"

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3642 Howard Street, Skokie, Illinois

Color-TV

(*Continued from page 22*)

conducts on one side of the burst signal and therefore, symmetry in the incoming burst signal is not important.

Both phase detector circuits also provide an output which is a measure of the amount of burst in the signal. This is the output of the detector which develops a negative voltage with respect to ground across its load resistor. This voltage applied through a voltage referencing network is connected to the grid of the first chroma amp as an automatic color-gain control or *acc*.

The changes in both the color killer circuit and in the oscillator control tube circuit are related and are the result of the use of sync color killers. In the past, color killers have been activated by one-half the output of the balanced phase detector, which when burst was present gave a comparatively high output, usually negative, and when no burst was present, gave a comparatively low output. This type of color killer has been found to present a problem; the bias voltage on the color killer must be so adjusted that it does not kill when there is still usable chroma present and at the same time kills the color circuits on a noisy monochrome transmission. To make a good compromise in this color killer bias, for widely divergent conditions met in the field, a color killer threshold control was used. To overcome these shortcomings and to eliminate a difficult adjustment, the sync color killer circuit was developed. This color killer makes use of the following properties of a balanced phase detector to obtain an actuating or sensing voltage. Whenever the two signals supplied to the phase detector are non-synchronous or exactly 90° out of phase, the output of the detector is zero. Whenever the signals are synchronous and not 90° out of phase, the output of the phase detector is some definite voltage, either positive or negative, depending on the phase difference between the two signals and the overall sensitivity of the control circuit. If the phase between the two signals could be so adjusted that the output of the phase detector was sufficiently negative when burst was present, (oscillator synchronized to burst), so that it would bias the color killer tube to cutoff, we would have a color sensing voltage practically immune to noise and other interfering signals in monochrome transmissions, and at the same

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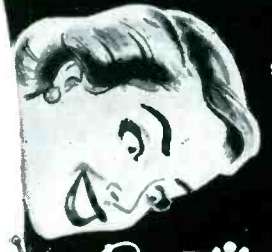

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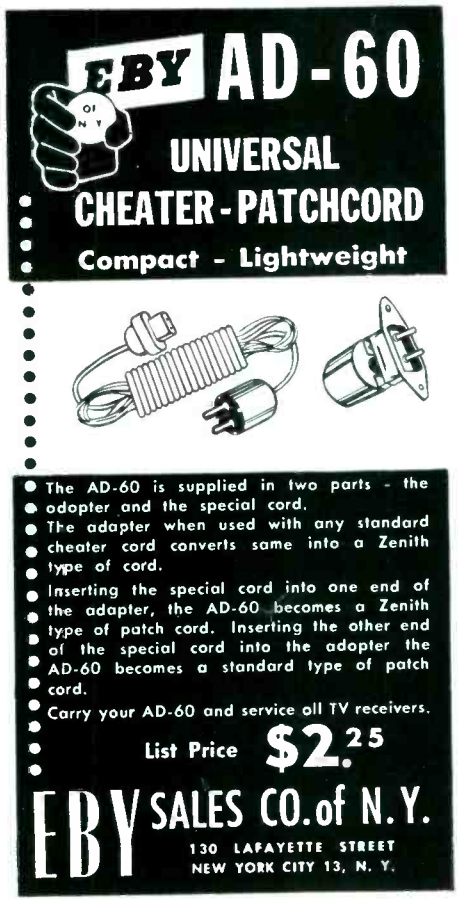

time would never kill on color signals unless the subcarrier oscillator could not be synchronized to burst, which would make the signal unusable for creating color. The difference in phase can be set up by adjustment of the oscillator control tube plate circuit. All of the foregoing, however, has not been accomplished without some disadvantages, since the oscillator control tube has been set up to operate with some negative voltage on its grid during color, and zero volts when no color is present. Therefore, the oscillator is not at burst frequency when monochrome is present and must be pulled into frequency by the burst on color transmissions. To aid pullin, a network has been added at the low side of the plate coil of the oscillator control tube to furnish a load to the low-frequency beat between burst and oscillator frequency, when the two signals are out of sync, so that this amplified beat can sweep the oscillator into sync with the burst. The addition of this network, together with a change in sensitivity of the oscillator control tube, produces color sync performance equal to the older system; at the same time we have lost none of the advantages of the synchronous color-killer circuit.

The circuit of this new chassis also offers another new feature: the B+ supply return is to tube rectifiers instead of selenium rectifiers. This has become possible, because of the use of a new power-transformer design, which through the use of a heat-conducting potting material enables the heat to be conducted away from the windings and core of the transformer.

•

Special Tests for Tubes

(*Continued from page* 19)

tubes. In color-TV sets, proper tube performance is of even greater significance.

The independent shop owner interested in developing mobile radio, computer or industrial electronics service business can profit by paying special attention to tube-testing methods. What worked for radio and television sets which operate only a few hours a day and are not used for returning a profit to the owners, may not work in industrial servicing. Besides industrial customers will not and cannot afford to tolerate frequent equipment failures. Since well over 90% of all electronic equipment failures are caused by tubes, here is the department which warrants the most consideration.

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Servicing Helps

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THERE ARE MANY TV sets in the field with metal picture tubes suffering from diminished brightness. Improved picture quality can be obtained by replacing with aluminized glass types. The 21AP4 may be replaced by a 21ZP4B, and the 21MP4 by a 21YP4A.

To install a glass tube in place of the metal type, the chassis, yoke assembly, old picture tube, and the plastic mark must be removed; *one must wear safety goggles during this operation and handle picture tube with care.* All of the old metal tube retainer springs and high voltage contact should be snapped out from the mask. The plastic mask should be placed face down on a clean surface, and the new picture tube should be carefully set, face down, on the mask. There are two areas of interference near each corner that prevent the entry of the tube face. One should be sure that the tube is rotated so that the high-voltage connection is on the proper side, for the tube face may not be symmetrical. The areas of interference should be marked on the plastic with pencil for reference; then the tube should be set aside.

Now the interfering wall of the plastic mask should be ground away using a coarse wheel in a bench motor arbor, or electric drill and arbor held in a vise. One should check the removal of the plastic periodically with the picture tube until enough material has been removed to allow the picture tube face to enter easily and seat against the little bosses in the corners; do not force the tube in place. The contour of the tube is such that material needn't be removed all the way in to the mask face. By starting near the mask face and working back, a slip is less likely to cause damage. The mask should be held in the same plane as the grinding wheel, working laterally. The plastic tends to gum and smear, but cools rapidly to a brittle sponge which readily flakes away. The surface of the mask that must be ground away is not visible in the set, so no skill or precision workmanship is required here.

The fitted mask (and safety glass) should be washed free of finger marks with a gentle detergent and reassembled into the cabinet.

The bracket suspending the yoke assembly from the top of the cabinet should next be moved exactly 1" to the rear. It is well to drill pilot holes for the screws to avoid splitting the wooden mounting block. Next, it is necessary to drill out the rivets which fasten the plastic cup to the set's rear cover. To space the cup approximately 1" away from the cover, 1½" No. 6 screws and three nuts (each) should be used.

The new picture tube face should now be cleaned and inserted in the mask. The yoke should be placed over the neck of the tube, attaching it loosely to the suspension bracket. The nuts on the diagonal pressure rods will be close to the end, so they should be checked to be certain that a safe minimum of three threads are engaged. All of the sets that have been converted have been found to have ample thread engagement; should one be encountered that does not, the rod brackets can be spaced out with ordinary washers to lengthen effectively the rods. The two diagonal rod and the suspension bracket nuts should then be tightened in a manner to center the yoke on the neck of the picture tube.

The high voltage lead wire should now be cut loose from the old metal tube contact spring. The insulation should then be stripped approximately 1½" back from the cut end; the tip should be tinned to prevent fraying, and the bare end formed into a loop which can be inserted into the picture tube *ultor* (high voltage) cavity cap.

Now the ion trap should be installed and adjusted, the picture sized, and then the rear set cover can be put on.

Small Electrolytic Forming

ELECTROLYTIC CAPACITORS employed in transistor equipment should be

‡*Based on notes prepared by* ***Serge L. Krauss,*** *electronic product design engineer, C. G. Conn, Ltd.*

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formed and tested for leakage prior to use. A circuit such as shown by Fig. 1 may be employed. The battery (*B*) or one of less voltage than the rated working voltage of the capacitor should be used.

A current limiting resistance (*R*) must be placed in series with the capacitor and a microammeter. The total resistance should be enough to allow about 50 *ua* maximum to flow during the forming and charge period if already formed. (A formed capacitor will discharge through its shunt resistance, and even in testing, the protective resistance must be used to safeguard the meter.) For 50 *ua* to flow at 9 volts (a handy battery size) a 180,000-ohm resistor is required, as the following mathematical explanation reveals:

$$E/I = R$$

$$9/50 \times 10^{-6} = 1.8 \times 10^{5} =$$

180,000 ohms.

As the current becomes reduced, a shorting switch may be closed allowing the capacitor to form up to full battery voltage. The leakage at that voltage may be read directly on the meter. *Caution*: The meter must be kept on a higher range and one must switch to the microampere range after ascertaining that the current is low enough not to damage the meter movement.

Most capacitors run about .03 to .04 *ua* per mfd per volt. At 9 volts, applied to a 10-mfd capacitor, we have

$$9 \times 10 \times .03 = 2.7 \text{ ua leakage.}$$

Or for the higher figure (.04) we have a leakage of 3.6 *ua*.

Another factor that must be considered in choosing capacitors for duty with transistorized circuits is the working voltage versus rated voltage. The leakage increases rapidly as the working (applied) voltage approaches the rated voltage. Above the rated voltage, the capacitor may break down and have a high leakage thereafter; rated voltage should be greater than the battery voltage applied.

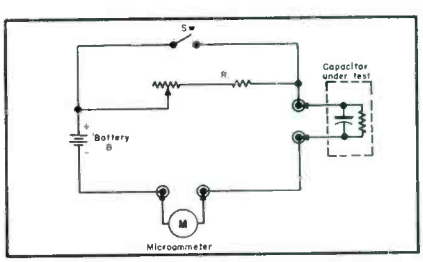

FIG. 1: LEAKAGE TEST and forming circuit for small electrolytics. The meter should be used on a higher range until you are certain of the current.

Appliance Servicing

(*Continued from page 35*)

to be electrically satisfactory, then a complete cleaning must be made. All of the foreign matter should be removed with a soft pencil type artist brush, being careful not to damage the nichrome element wires or disturb the compensating devices. Compressed air should not be used for this job as it will damage the toaster, particularly those using the mica-wound elements. Greasy par be dissolved with a good non-oily vent, such as carbon tet. Moving parts, such as the latch mechanism, carriage guides and rails should be relubricated with graphite oil. Any worn parts should be replaced. Clock timers, after a thorough cleaning, should be lubricated very lightly at the pivot or shaft points with silicon oil. In the final test stage the toaster should be assembled and bread tested, making all adjustments with the color control in medium position.

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CATALOGS—LEAFLETS—BOOKS

NATIONAL APPLIANCE TRADE-IN GUIDE CO., 2105 Sherman Ave., Madison 4, Wis., has published the *1957 Official NARDA TV Blue Book* containing latest trade-in values of sets produced by 47 manufacturers from 1947 to date. 152 pages; priced at $5.

* * *

ELECTRO PRODUCTS LABORATORIES, 4500 Ravenswood Ave., Chicago 40, Ill., has released an illustrated catalog sheet describing the *D612T* 8 and 16 *v dc* power supply for servicing transistor, as well as tube model auto radios.

* * *

UNITED CATALOG PUBLISHERS, INC., 110 Lafayette St., New York 13, N. Y., has issued a 1546-page 1957 edition of the *Radio Electronic Master*. New edition lists more than 125,000 items of 350 manufacturers. Included are detailed descriptions, specifications and prices on tubes, test equipment, capacitors, resistors, relays, coils, antennas, transformers, recording and *pa* systems, hi-fi equipment, hardware, tools, transmitters, communication receivers, wire and cable, speakers, microphones, rectifiers, converters, amateur gear, switches and volume controls. Available through parts distributors.

* * *

HEATH CO., Benton Harbor, Mich., has released a 14-page illustrated brochure, *Heathkit 1956 Fall Flyer*, with specifications, descriptions and prices on 'scope voltage calibrator, voltmeter, multitester, harmonic distortion meter, audio oscillator, signal generator, linearity pattern generator, cathode ray-tube and receiving tube checker, condenser checker, impedance bridge, battery eliminator, audio amplifier speaker, crossover and preamp kits.

* * *

PYRAMID ELECTRIC CO., 1445 Hudson Blvd., North Bergen, N. J., has issued an 18-page booklet, *TMR-1*, with data on *Twist-Mount* electrolytic capacitors.

* * *

ATLAS SOUND CORP., 1451-39th St., Brooklyn 18, N. Y., has released bulletin *756* describing a dispatcher and switchboard microphone support, neck-supported microphone stand and microphone foot switch. Also contains application information.

* * *

RCA SERVICE CO., INC., Commercial Service, Camden 8, N. J., has issued a reference book on the setup and servicing of *The 700 Series Color Television Receivers*, illustrated with 148 photos and diagrams. Contains a circuit-by-circuit description of the two types of chassis used in the *700* series receivers, an illustrated description of setup procedure and a section detailing step-by-step practical methods for analyzing, localizing and correcting malfunctions.

* * *

HOWARD W. SAMS AND CO., INC., 2201 E. 46th St. ,Indianapolis 5, Ind., has released a *Transistor Circuit Handbook* by *Louis E. Garner, Jr.* Contains more than 200 basic circuits with practical applications and data on transistor uses. Book is divided into four sections covering lab practice, basic circuits, circuit applications and reference material. 430 pages; priced at $4.95.

* * *

AMERICAN TELEVISION AND RADIO CO., 300 E.. Fourth St., St., Paul, Minn., has released a 6-page folder illustrating and describing an aluminized 21-inch 26-tube 41-mc TV model and a line of custom consoles available for the chassis.

* * *

BLONDER-TONGUE LABORATORIES, 526-536 North Ave., Westfield, N. J., has issued a general catalog covering TV distribution units, TV installation accessories and closed-circuit TV equipment. Illustrations, specifications and prices are included.

* * *

SHURE BROTHERS, INC., 222 Hartrey Ave., Evanston, Ill., has published a pocket-size replacement manual, *RM-56*, with complete information and technical data on ceramic and crystal pickup cartridges and magnetic recording heads.

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PERSONNEL

ROBERT L. SHAW has been appointed national sales manager of the radio and television division of Sylvania Electric Products, Inc., 254 Rano St., Buffalo 7, N. Y. . . . THOMAS P. RYAN is now central regional sales manager with offices in Chicago. . . . RAYMOND B. HUEY has been promoted to western regional sales manager with headquarters in Los Angeles. . . . RICHARD M. KLEIN has been named product engineering manager of the electronic product sales department at 1740 Broadway, New York 19, N. Y.

° ° °

DON LARSON has been appointed general manager of the Western Electronic Show and Convention. . . . Larson's former ad agency has changed its name to Bill West Advertising and BILL WEST has assumed agency operation.

° ° °

A. R. HOPKINS has been named manager, commercial electronic marketing department, Radio Corporation of America, Camden, N. J.

° ° °

HARRY STOCKMAN, H. PHILIP HOVNANIAN and E. JAMES JOHNSTON have announced the formation of Neutronics Research Co., 165 Lake St., Waltham, Mass.

° ° °

JOHN SEARING has been named sales manager for insulated chokes, fixed composition and wire-wound resistors manufactured by International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa.

° ° °

JAY CARVER has been appointed ad and sales promotion manager of Electro-Voice, Inc., Buchanan, Mich. Carver was formerly ad manager of Cabinart.

Carver

Searing

Adkins

DAVID C. ADKINS has been named public relations manager of CBS-Hytron.

° ° °

EDWIN B. HINCK, formerly sales manager, replacement tube division, Allen B. Du Mont Laboratories, has joined C & M Industries, Inc., 141 E. 44th St., New York 17, N. Y., as vice president.

° ° °

PETER G. BUTTACAVOLI has been promoted to national service manager of the receiver division of Allen B. Du Mont Laboratories, Inc.

° ° °

J. R. JOHNSON has been promoted to vice president in charge of sales and merchandising for Standard Coil Products, Co., Inc., 2085 N. Hawthorne Ave., Melrose Park, Ill.

° ° °

NILS HILLSTROM has been named national sales manager of Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif.

° ° °

ROBERT B. CODY has been appointed district sales manager of the General Electric Co. tube department office at 106 W. 14th St., Kansas City, Mo. . . . D. J. WHALEN is now district sales manager of a new tube department office at Farmers Union Building, 1575 Sherman St., Denver, Colo. . . . E. D. TREANOR is now district sales manager in charge of a new office at Brown-Marx Building, Birmingham, Ala.

° ° °

LAWRENCE LEKASHMAN has been named vice president in charge of sales for David Bogen Co., Inc., and Presto Recording Corp., both affiliates of Unitronics Corp. . . . DAVID PEAR is now manager of advertising and sales promotion for both companies.

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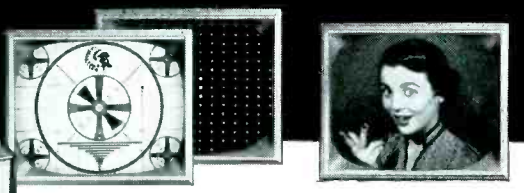

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B&K

TV Antennas

(*Continued from page 26*)

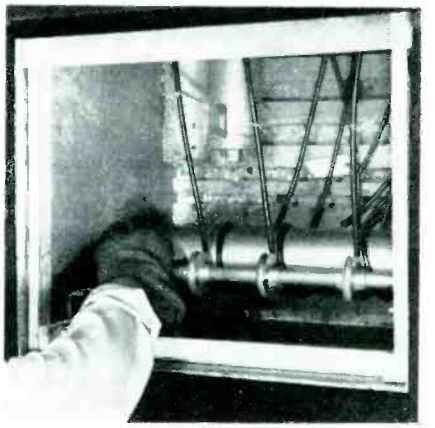
of town on some tall hill or mountain, it was necessary to install a system which required little maintenance over these long, often inaccessable spans. For this application, low loss, large diameter cable[1] was selected. Although these low-loss cables are relatively expensive, this choice allowed a minimum of amplifiers to be used, and consequently maintenance service in this area would be at a minimum. Once the signal had reached the edge of town, it was possible and desirable to resort to the higher loss, but less expensive RG-11/U type cable. From here on, maintenance service would be no unusual problem and since the signal would be distributed in many directions, amplifiers were a necessity. With this RG-11/U type cable strung from utility poles on streets and in alleys, house drops were made with the still less expensive but higher-loss RG-59/U type cable.

The great moment had arrived when the first system check would be made. All amplifiers had been checked prior to installation, and a continuity check showed the cable circuits were intact. With a flick of the switch, channel 2 was viewed with clarity never before realized in this area. A twist of the channel selector and there was channel 4, another twist and nothing. What had happened to channel 5? If channel 2 and 4 were good, why not channel 5? Could the system be frequency sensitive? It could be and it was.

It was at this point that a cable phenomenon was noted. Heretofore, the relatively short cable lengths used never caused this condition to appear. But now, with cable measured in miles instead of feet it was found that a cable could have low response or *traps* at certain frequencies. Now the problem was presented to the cable manufacturer for solution.

An investigation was undertaken by our lab. The fact was eventually established that high attenuation peaks were directly related to minute irregularities in the extrusion of the cable core. As an example, any slight change in the core diameter will change the impedance of the finished cable at the point. If this change in diameter appeared at regular intervals along the length of the cable, the effect would be cumulative. In short cable lengths these slight variations would not be noticed since the total effect was still small, but now that the cable lengths were extremely long, their presence was very obvious. When these irregularities appeared at intervals, equal to a half wavelength of the frequency to be transmitted over the cable, the effect was such as to cause high attenuation at that point. Calculations of this attenuation

[1] *Such as* ***Amphenol*** *21-125.*



TO ELIMINATE coax failure due to cracking of jacket or core at extremely low temperatures, cables are subjected to a cold-bend test. Length of cable is conditioned at a temperature of -40 F for one hour in the cold box illustrated.

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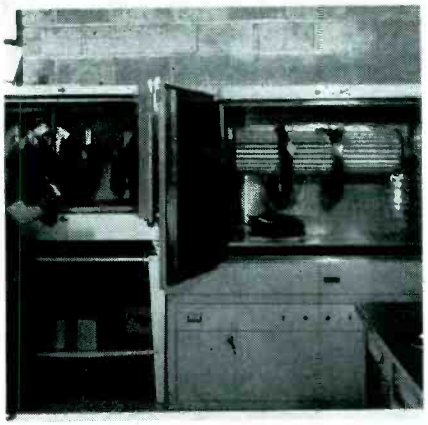


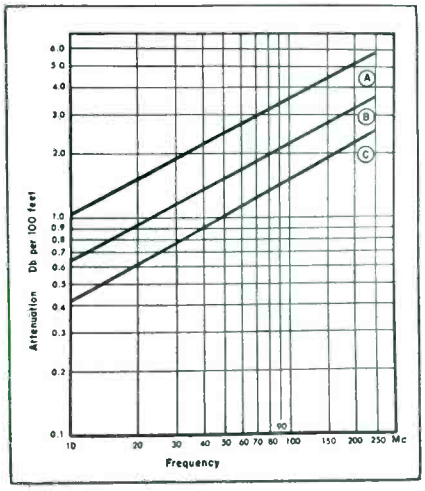
HEAT AGING OVEN. Samples of coax are placed in this oven and held at a temperature of 205° F for seven days.

involve factors such as the velocity of propagation of the cable, and in the case of more severe irregularities, a harmonic and subharmonic relationship.

In cable production, it is possible to control various parameters of extrusion to shift these irregularities outside of the range of a particular band of frequencies. However, an elaborate electronic control system has been devised to eliminate the variations entirely. Every foot of community-TV cable is subjected to sweeptests which require that the cable attenuation must remain within 5% of the nominal value at any given frequency in the entire *vhf* spectrum.

This is only one of the exacting requirements of cable such as is required for the distribution of TV signals. In addition, a minimum requirement has been established, following the standards set up by Washington in the specification covering *rf* coax cables; MIL-C-17B. Over a period of years, it has been found

(*Continued on page* 44)



ATTENUATION VERSUS FREQUENCY plot for foam (c) and standard coax cables (a and b).

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TV Antennas

(*Continued from page* 43)

that this specification has satisfied the great majority of cable applications, and as a consequence they have been adopted as a minimum requirement, even for those cables which do not fall in the category of military nomenclature.

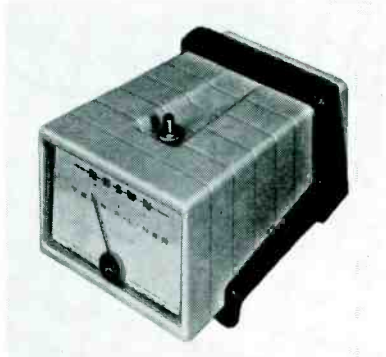
Such has been the case in the development of cables which use a semi-solid dielectric for the cable core. This dielectric is composed of minute particles of polyethylene, each of which contain an inert gas. These particles, when subjected to heat, will soften and enlarge as the gas expands. Upon cooling, the polyethylene again hardens, forming a permanent bubble, which in conjunction with millions of others, forms a solid, lightweight mass. This construction has been found to lend itself well to use as a cable core, since the volume of dielectric has been minimized. This, in turn, results in a cable with lower attenuation for a given size of cable inner and outer conductor.

The advantages of a foamed dielectric have long been recognized by cable manufacturers, but the control of this expanding dielectric during the extrusion process has presented a problem that has only recently been resolved. These foam-dielectric cables offer an opportunity to design a more passive system. The lower loss of these cables reduces the number of amplifiers required, thereby reducing the original system cost and the cost of subsequent maintenance.

Prior to the release of these cables, they are subjected to tests[2] in a

(*Continued on page* 46)

[2]*Following the MIL-C-17B specification.*



Antenna rotator control with dial designed to offer improved readibility. Other features are said to be finger-tip operation, and a positive action brake which is to prevent wind-milling and assure proper antenna alignment. (CAR6B Tenn-A-Liner; Crown Controls Co., Inc., New Bremen, O.)

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Associations

ARTS, CHICAGO, ILL.

AT THE SEMI-ANNUAL business-election meeting of the Associated Radio and Television Servicemen, Chicago, Ill., *Howard Wolfson* was elected chairman for the '56-'57 fiscal year. *Joe Ehlinger* was named vice chairman; *Delmar Kotrba*, secretary-treasurer, and *George Neize*, sergeant-at-arms.

Member reps for the south, west, and north sections of the city were also appointed for the ensuing year. They are: *Martin Nebojsic*, *Anthony Bauman*, and *Yuki Minaga*.

° ° °

RTASCV, Calif.

AL LIMBERATOS has been elected president of the Radio and Television Association of the Santa Clara Valley in California.

Newly elected board of directors include: *Bob Swift*, *Harold Kelly*, *Ben Floyd* and *Richard Kelso*. Reelected to the board for a second term were: *H. Lawrence Schmitt*, *Quentin Muchow*, *Tom Miner*, and *Jim Wright*.

Muchow was elected vice president and *Jim Wright* was reelected secretary. *Harold Kelly* is now sergeant-at-arms.

° ° °

RTG, Long Island, N. Y.

AT THE FORTHCOMING electronics fair (Dec. 6-7-8) at the New York State University at Farmingdale, New York, under the sponsorship of the Radio and Television Guild of Long Island, over a dozen industry experts have been scheduled to appear.

Subjects to be covered include new developments in the Lawrence single-gun color tube, antenna design for b-w and color-TV, RCA color circuitry, the Sylvania color-TV receiver, test equipment for b-w and color-TV, and use of color test equipment and new transistor devices.

° ° °

RTTA, Pasadena, Calif.

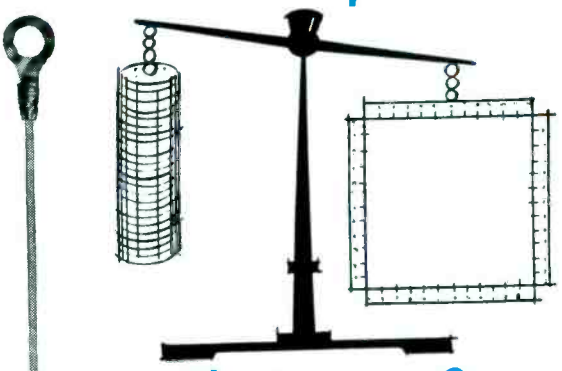
AT A RECENT MEETING of the Radio Television Technician Association, Pasadena, Calif. a proposed bill for licensing of Service Men and service dealers was presented. This bill is to be presented for enactment at the California State Legislature, under the auspicies of the California State Electronics Association. At present, the measure is under discussion and consideration by allied groups of the state association. Copies of the proposed bill are being mailed to all members for study.

Installation of RTTA officers for '57 will be at a dinner-dance at the Altadena Country Club on January 12.

TEN YEARS AGO IN SERVICE

THE FIRST COMPLETE explanation of the TV service plans that would be set up by set makers, detailed during a TV clinic program arranged by *ye ed* at the Waldorf Astoria Hotel in New York City, appeared in an exclusive SERVICE report. *W. L. Parkinson*, speaking for G. E., and *W. L. Jones*, spokesman for RCA Service Company, disclosed that their companies would enter the contract business for installation and repair. *Ernest Marx*, commenting on the DuMont plan, said that the independent service shop would be used, but a contract arrangement might possibly be set up. Typical problems that would be encountered in the field, and time and material involved in making repairs, were covered by *George Duvall* of Television Technicians, Inc. . . . Webster-Chicago Corp. demonstrated a wire recorder offering 50 minutes of recording time. . . . FTR released a series of booklets and counter displays on its miniature selenium rectifiers. . . . *Kenneth C. Prince*, show manager of Radio Parts and Electronic Equipment Shows, Inc., announced members of the board for the May, 1947 show. Serving on the board were: *Jack Berman*, Shure Brothers; *Charles Golenpaul*, Aerovox; *Jerome J. Kahn*, Standard Transformer Corp.; *Sam Poncher*, Newark Electric; *Walter Jablon*, Hammarlund Manufacturing; *Robert C. Sprague*, Sprague Products; *R. J. Sherwood*, Hallicrafters; and *William L. Schoning*, Lukko Sales Corp.

what's a square foot



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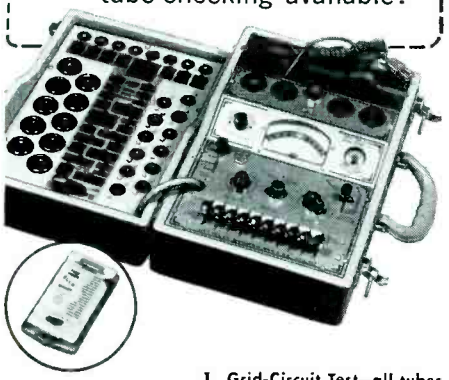

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1. Grid-Circuit Test—all tubes
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3. Cathode Emission Test by free point selector system

Contained in handsome portable carrying case!

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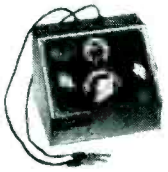

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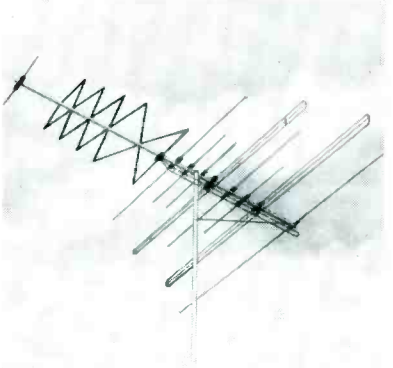
TV Antennas

(*Continued from page 44*)

quality-control laboratory. Upon completion of every 5,000 to 10,000 feet of continuous cable, a 110-foot sample is sent to the quality-control lab. After complete dimensional checks the cable is tested for such important quality factors as nominal impedance, velocity of propagation, attenuation at ultrahigh frequency, nominal capacitance, low capacitance unbalance, absence of cracks and fractures of dielectric and jacket after cold bend tests, close centering, minimum displacement of inner conductor after flow test, attenuation stability, capacitance stability and absence of corona effect at high voltage.

Many of these tests are of specific interest to the community-TV operator since they assure him of satisfactory cable performance under some of the conditions peculiar to his application. Since these cables will be exposed to the elements and will be subjected to a wide range of temperatures, the heat aging, flow and cold bend test are of considerable significance.

In the heat-aging test, a sample of the cable is placed in the oven and held at a temperature of 98°*C* (205°*F*) for a period of seven days. At the conclusion of this period, the



Helix-type antenna designed for both color and b-w performance in deep fringe areas. On the low band the antenna utilizes a pair of double driven folded dipoles phased for signal addition. A reflector, director and deflector (director-reflector) are used to flatten the bandpass characteristic at a high level. Since the loading effect of these elements would bring the impedance down, the dipoles themselves are 600-ohm units said to make possible a close impedance match. By maintaining an inline yagi-type configuration construction, the dual receiving elements are shielded by reflectors to realize maximum back rejection and minimum wind resistance. The helical section is composed of individual non-linear additive collectors each tuned separately for a high band channel.
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cable is wound and unwound ten times from a test mandrel whose diameter is approximately 10 times the outside diameter of the cable. The jacket and core material must then show no loss of pliability or signs of cracking.

The flow test is also conducted in this oven, and its purpose is to assure minimum migration of the center conductor under extreme conditions. A length of cable is hung over a horizontal mandrel, whose diameter is 10 times the outer diameter of the cable. Specified weights are hung from each end of the center conductor and the assembly is then subjected to a heat of 98°C (205°F) for a period of 7½ hours. After this, the assembly is allowed to cool in position and then X-rayed to ascertain that any center conductor migration is within specified limits.

Low Temperature Tests

To eliminate the possibility of cable failure due to cracking of the jacket or core at extremely low temperatures, the cable is subjected to a cold bend test. First, a length of cable is conditioned at a temperature of -40°C (-40°F) for a period of one hour in a cold box. While still in the cold box, the cable is wound around a mandrel ten times the cable diameter, at a rate of 15 *rpm*. The appearance of cracks or fractures in either the core or jacket constitute reason for rejection of the entire cable run. Even after these tests, still another test is conducted just prior to placing the cable on shipping reels. In this case, a high voltage is applied between the shield braid and the outer surface of the jacket. Every foot of cable is so tested, and a puncture of the jacket by the applied voltage requires that the faulty cable be cut out and rejected.

Outdoor Tests

To evaluate further cable performance, there has been established an outdoor test facility where cables are actually strung on specially prepared utility poles for study under actual field conditions. One of the current projects is the determination of cable radiation characteristics which is of considerable interest to community-TV system operators, now that the FCC has issued specific regulations concerning same. Results of these tests will provide cable users added assurance that they can design systems to conform to applicable requirements.

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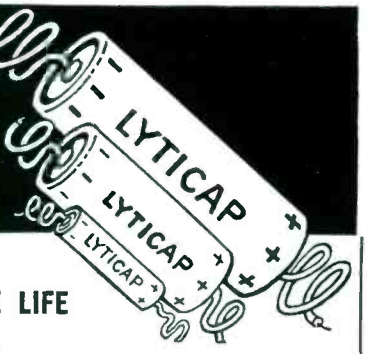

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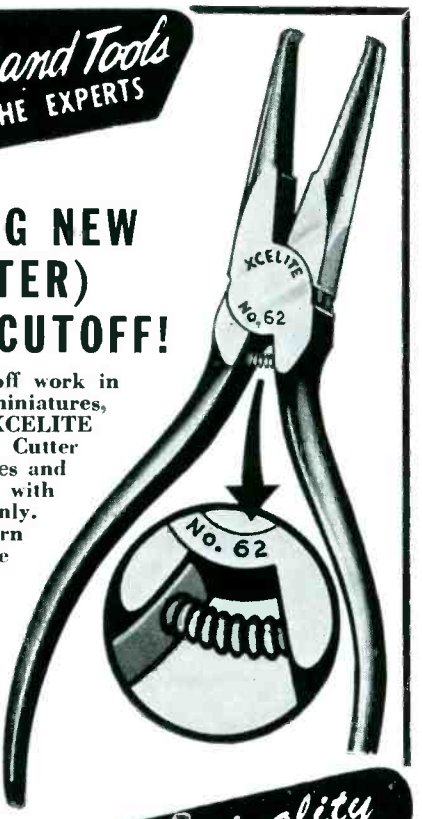

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Transistor—Tube Tester

(*Continued from page* 21)

tion ratio by the following expressions:

$$\beta = \frac{\alpha_{ce}}{1 - \alpha_{ce}} \qquad \alpha_{ce} = \frac{\beta}{1 + \beta}$$

Either quantity may be specified by the manufacturer, depending upon the use for which the transistor is intended. In either case, present manufacturing tolerances are very broad; therefore even if a transistor falls outside of the indicated range, it may still be usable. In all cases considerable latitude should be given before a transistor is discarded as defective.

Collector-Base Amp Factor

In this test a small current is applied to the base by means of a 200,000-ohm resistor to permit the measurement of the collector-to-base amplification factor.

These tests will determine if the transistor is good or bad, but will not, of course, duplicate the factory tests of frequency response, input or output resistance, collector capacitance and other characteristics that are necessary for specific grades of transistor.

This transistor tester also provides for tube tests for 4, 5, 6, 7-pin octal and loctal, miniature 7 and 9 pin, also subminiature 5, 6 and 7 pin (in line base) and 8-pin (circular base) types.

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Leakage Readings

Direct reading of interelectrode and cathode-to-heater leakage can be measured in ohms on a 0 to 20= megohm scale meter. A filtered *dc* voltage of -70 is obtained by rectifying and filtering 50 *v ac* obtained from the filament-winding tap. This voltage is applied between the tube element, isolated by its transfer switch and the remaining tube elements, whose lever switches are set at the plate, screen and grid voltage buses, which are grounded through the *merit* leakage switches at their normal positions. The current through the circuit is measured in ohms on the meter.

Emission Information

In general, each test furnishes a composite indication of cathode-emission capability and the ability of each grid to control the plate current, in accordance with the design of the tube, plus the ability of the plate to receive the regulated current. For diodes and rectifiers the test is an

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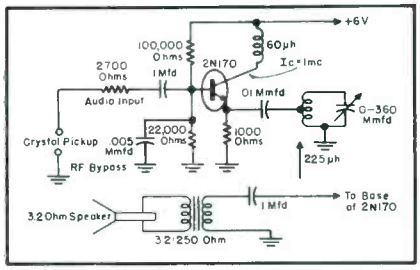
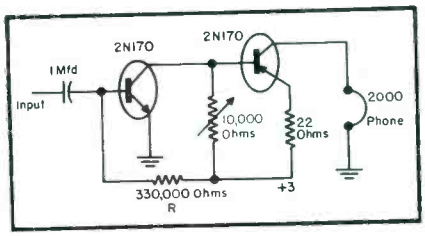
emission test. To test properly a variety of tube types several plate, screen and grid voltage ranges are available from taps on the plate secondary winding of the transformer.

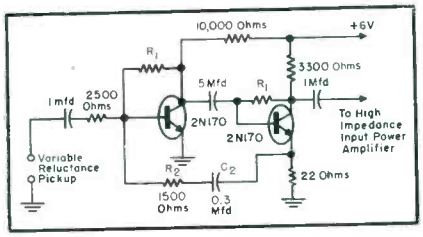


ABOVE: PHONO OSCILLATOR using 2N70 transistor. Range is 6′ to 20′. For a mike input, circuit at bottom should be used in place of crystal pickup and resistor.

BELOW: TRANSISTORIZED direct-coupled battery-saver amplifier. R must be adjusted for maximum results.



BELOW: TRANSISTOR VARIABLE reluctance compensated preamp. R_1 (100,900 to 500,000 ohms) should be chosen to produce collector voltage of 2.5 to 3.5. Changing C_2 and R_2 will vary compensation curve. (Diagrams courtesy G.E.)



Vertical Instability Cures

(*Continued from page 13*)

the 60-cycle voltage impressed on the cathode through the leakage was *overpowering* the tiny sync pulses and causing the oscillator to lock at the local line frequency, instead of with the sync pulses.

One troublesome chassis with hold troubles, using two halves of a 6SN7 in sync amplifier stages, delivered an odd-looking vertical sync pulse, as see on the blanking bar; it was weak and washed-out in appearance and quite distorted. The familiar *hammerhead* looked more like a geologist's rock-hammer. Checking the sync pulses at the oscillator stage confirmed a suspicion; they were very weak. Tracing them back through the two sync separator stages showed that these stages were apparently alright; there seemed to be plenty of video signal applied to them. At the video amplifier plate the 'scope picture seemed to be alright at first, but a comparison with the waveform shown on the schematic showed that there were differences, especially about the sync pulses, etc. At a glance the picture seemed to be fairly good, until the position of the contrast control was checked. It was turned all the way up. At this point the voltages were measured on all stages concerned and the video amplifier plate voltage was found quite low. Resistance measurements showed that the first peaking coil, a small unit wound on a 5000-ohm resistor, was open. This not only lowered the plate voltage, causing the picture on the screen to be washed out, but also lowered the vertical sync amplitude to the point where it no longer had control over the oscillator.

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COMPONENTS

PRINTED WIRING ELECTROLYTICS

Hermetically-sealed electrolytic capacitors, *EY*, designed for printed-wiring boards and automatic assemblies, have been announced by Astron Corp., 255 Grant Ave., E. Newark, N. J.

Units are said to use pure foil and a high-grain etch process.

° ° °

CLOCK-RADIO REPLACEMENT KNOBS

A line of clock radio replacement knobs, consisting of four types (including a metal jacket double-barrier style in gold), has been announced by Gee-Lar Manufacturing Co., 400 S. Wyman St., Rockford, Ill.

Other knob styles are plastic and available in six colors; included in the line are single and double barrier and spring types. A kit, *1630*, containing an assortment of 25 knobs is available through parts distributors.

° ° °

PUSH-PULL SWITCH CONTROL

A push-pull switch control that serves to turn controls on or off at any given setting has been introduced by the Clarostat Manufacturing Co., Inc., Dover, N. H.

Unit can be combined with *Series 47* composition element 15/16" diameter controls. Has concentric shaft which push-pulls for switching action and rotates for control setting, each function being independent of the other.

Switch is available in three types: *Series AG-17* SPST, .5 amp 125 *v dc* or 1 amp 125 *v ac; Series AG-18* SPST, .5 amp 125 *v dc* or 3 amp 125 *v ac; Series AG-19* SPST, .5 amp 125 *v ac*.

° ° °

UNIVERSAL REPLACEMENT KNOBS

A line of universal replacement knobs, featuring a variety of stem lengths and types, has been developed by Colman Tool and Machine Co., Amarillo, Tex.

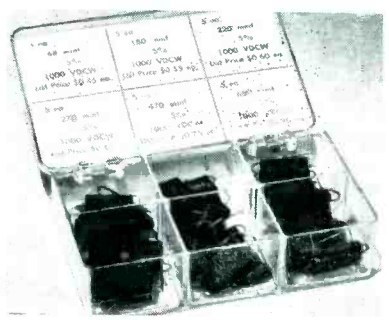
Featured are a number of knob heads that can be assembled with any one of an assortment of stems. Available in stock assortments of two sizes and ten colors.

° ° °

SILVERED MICA CAPACITORS

A replacement kit of TV-high-voltage silvered micas, No. 14, has been announced by Arco Electronics, Inc., 64 White St., N. Y. 13, N. Y.

Kit contains five each of 68,180, 220, 270, 470 and 680- mmfd capacitors. Supplied in plastic container.



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(*Continued from page* 31)

the crystal frequency. It is desirable, however, to provide a tuning indicator which will allow non-technical personel to tune for maximum output.

The arrangement described has been found to achieve this, with no sacrifice in *starting* characteristic, by the non-linear behavior of the glow lamp. During the build-up period of starting oscillation, the *rf* voltage is below that required for the lamp to strike. The stray capacitance contributed by the lamp is slightly less under this condition, than when the lamp is glowing and therefore the tank circuit is tuned to a slightly higher frequency. Thus, starting is assured and, as the lamp strikes, the tank resonance is automatically shifted toward the highest output adjustment. Adjustment of the tank circuit to achieve proper starting is thus a natural consequence of resonating the tank for maximum brightness of the glow lamp.

Transmitter Antenna

The transmitter antenna consists of a short wire embedded in fibreglass and integrally connected to a coax cable and fittings for mounting and plugging into the transmitter. The entire assembly including the signal radiating surface has been designed for under-car installation. The fractional wavelength radiator is matched to the transmitter by the coax line.

The receiver uses a 6BA6, 12AU7A and 2D21;

(*Continued on page* 53)

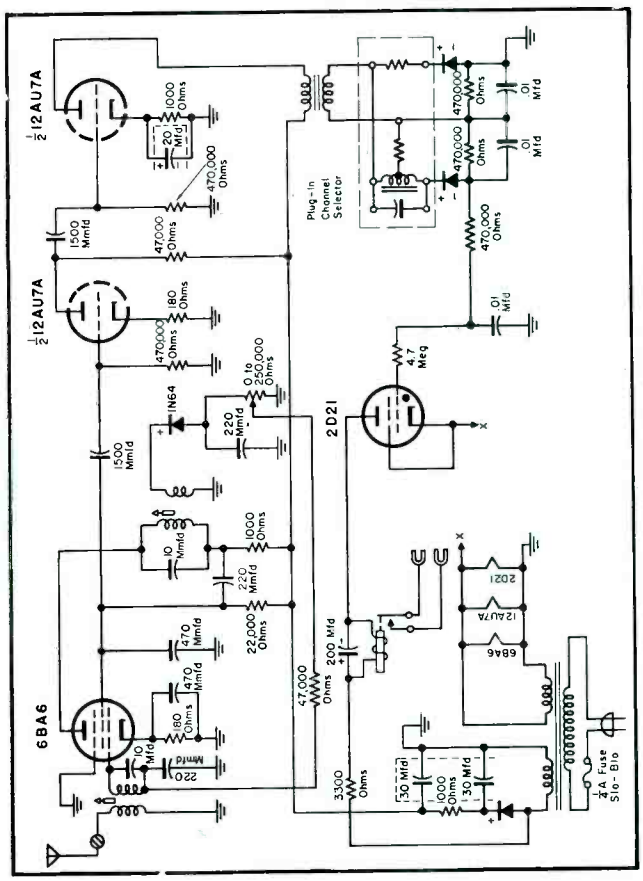

DIAGRAM of receiver developed for remote-control garage-door opener.

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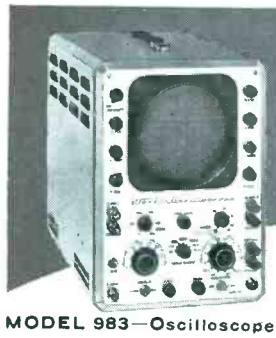

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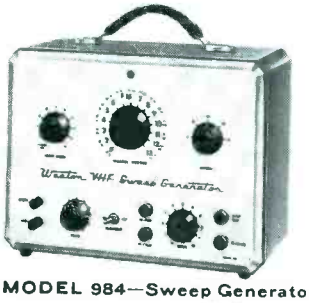

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MODEL 985—Calibrator

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TEST EQUIPMENT
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BENCH-FIELD TOOLS

PW SERVICING KIT

A printed-wiring board servicing kit, *13-K*, has been introduced by Walsco Electronics Corp., 3225 Exposition Place, Los Angeles 18, Calif.

Contains *solder-ease* tool with probe for tightening contacts and a fork on opposite end to handle wires while soldering; silicone resin lacquer; copper foil with thermoplastic backing; solder wires and washers with a flux layer; tweezers; fiberglass brush and solder solvent. Another kit, *12-K*, includes an Ungar soldering iron, a special tip, a can of spray lacquer and a practice wiring board.

SELFHOLDING CONNECTOR TEST PROBE

An insulated probe equipped with a selfholding connector has been developed by E-Z Hook Test Products, 1536 Woodburn Ave., Covington, Ky.

Probe features hook type design. Has a built-in terminal board that can be used to assemble test probe setups.

SOLDERING/ELECTRICAL KIT

A soldering and electrical kit, *507*, has been introduced by Ungar Electric Tool Co., 4101 Redwood Ave., Los Angeles 66, Calif.

Kit contains a heavy-duty pencil soldering handle, heavy work and precision tips, electrical terminals, trouble light, circuit tester, electrician's tape, resin core solder and a 20-page manual. Package is supplied with a protective slip cover.

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(*Continued from page 51*)

a germanium diode (1N64) for signal detection; two small selenium diodes (1S1) in the tone selector network; and a selenium rectifier (H5OB) in the power supply.

A simple half-wave (8′ wire) antenna is connected to an input tuned circuit. The signal is amplified by a fixed frequency, screen-grid-neutralized 6BA6 stage.

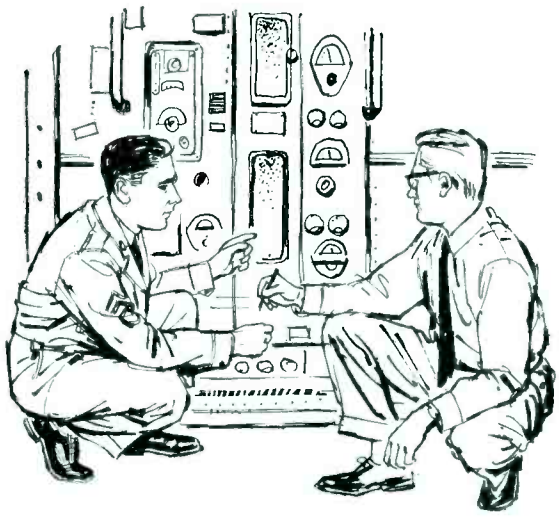
Diode RF Detector

A germanium diode serves as an *rf* detector, with a potentiometer load resistance functioning as a sensitivity (distance) control. The detected signal is fed back to the 6BA6 grid along with the *avc* voltage and further amplified by reflex action with the screen-grid functioning as a triode plate.

Audio signal voltage from the 6BA6 screen is fed to a resistance-coupled amplifier (½ 12AU7A) and then to a transformer-coupled stage (½ 12AU7A), which drives the decoding or tone-selecting apparatus. The secondary of the transformer feeds the signal to the decoding circuit; this circuit operates in conjunction with the 2D21, which is used to actuate a relay connected in the plate circuit. The circuit operates in such a manner that a certain *yes-no* bandwidth is achieved where *yes* and *no* correspond to relay contacts closed and open, respectively. A tone corresponding to the frequency of the plug-in channel selector will cause operation of the relay. If the signal level rises to a value equal to twice the threshold level, the tone frequency will also cause operation of the relay when it is varied approximately at 3% of the exact channel frequency, but will not operate the relay at deviations greater than about 5% from the center frequency, even if the level goes up to the maximum that is obtainable when the signal is limited by *avc* action and saturation of the audio amplifier.

The signal from the secondary of the audio transformer is applied to two channels in the decoding network. One channel is essentially *all-pass,* and the other is a very selective band-stop filter. The output from each channel is rectified and combined in series in such a manner that the net output, when there is no at-

(*Continued on page 61*)



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Response . . . 40-12,000 cycles
Output . . . 1-1.2 volts

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Output . . . 1-1.2 volts

Turnover type features "throw-away" element offering snap-in replacement of both element and needle assembly for essentially the price of a good replacement needle. Single needle type features simplified self-locating needle replacement.

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ELGIN NATIONAL WATCH COMPANY
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2435 N. NAOMI STREET,
BURBANK, CALIFORNIA
Sales representatives in principal cities.

Audio

(*Continued from page 20*)

70-volt tapping just provided so as to attract the public-address market.

Such an amplifier will work of course, but reasonably satisfactory performance of the amplifier may be dependent upon accurate loading, by using, say, 16 ohms on the 16-ohm tap. This amplifier would not be very satisfactory for use in public-address work, where maybe only 5 or 10 watts would be taken from the 70-volt line out of the amplifiers's maximum rating of, say, 25 or 30 watts.

Tube Types

Tube types represent a key design factor to study carefully before selecting a commercial sound amplifier. Some amps use a straight pentode output, either single ended or pushpull (most of the large power units, of course, being pushpull) with single overall feedback loop. This amplifier has a serious disadvantage for public address work; its stability characteristics are fairly critically, dependent upon the output being correctly loaded.

The amplifier may not oscillate with any value of load from nominal to open circuit, but this does not mean that its frequency response will be accepted under all these conditions, nor will its distortion necessarily maintain the low value given in the specification.

So, in selecting an amplifier for public-address work, it is important to examine the schematic and note the type of output used.

If a straight pushpull pentode with overall feedback, is used (Fig. 1;

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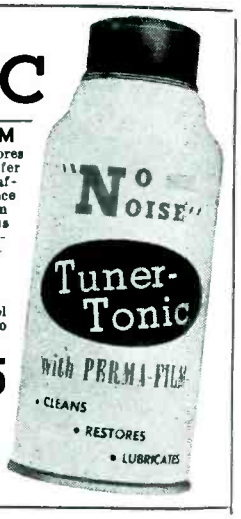

ELECTRONIC CHEMICAL CORP.
813 Communipaw Avenue Jersey City 4, N. J.

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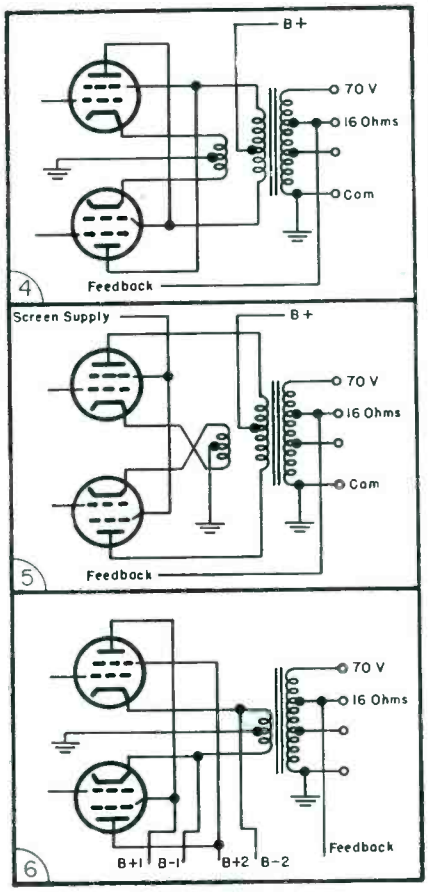
p. 20), this amplifier should be avoided. If the output tubes are strapped as triodes, as shown in Fig. 2 (p. 20) the amplifier should be quite good for public-address work, provided it carries the required facilities.

However, the output stage need not necessarily use tubes strapped as triodes, because better output can be obtained for the corresponding plate dissipation by using the tubes some way as pentodes. To illustrate, the ultra-linear design is very good for a *pa* amplifier; Fig. 3 (p. 20). Unity coupled arrangements (Fig. 4) in which the tubes are essentially working as pentodes, but half the load is in the cathode and half in the plate, are also well suited for public-address work. Other useful arrangements are

(*Continued on page* 56)

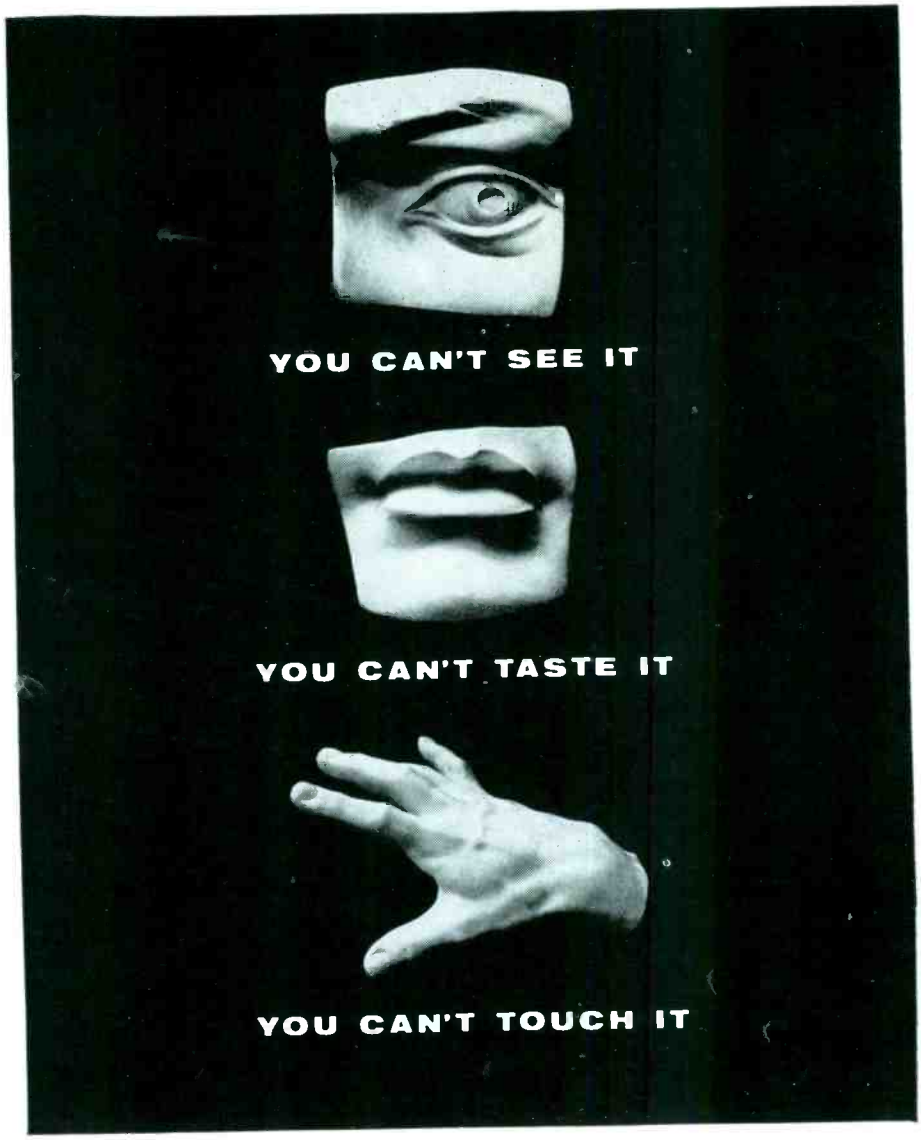


FIGS. 4, 5, 6.

FIG. 4: THE UNITY-COUPLED circuit, which uses pentodes in what may be viewed as semi-cathode-follower operation. This circuit is well suited for pa work.

FIG. 5: A CROSS-COUPLED variation of an ultra-linear circuit that is also well suited for commercial sound.

FIG. 6: CIRCLOTRON method, another effective pa circuit, which uses two separate B+ supplies.



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Integrity starts at the top and filters down, enhancing everything it touches. It serves notice on its customers that every product bearing its label has a team of responsible people behind it.

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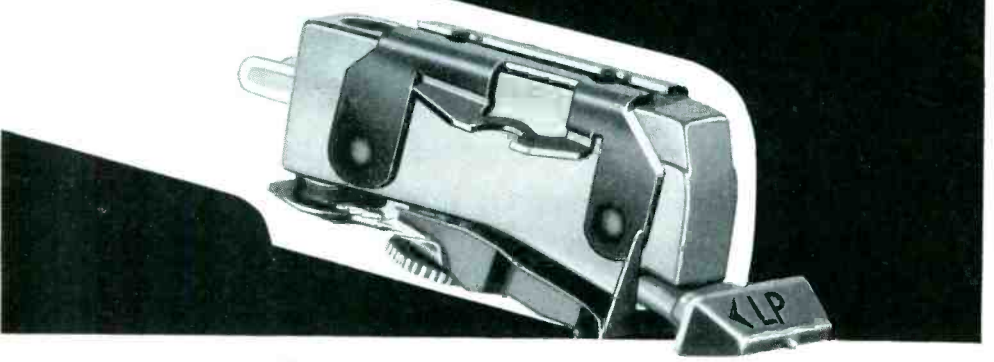

SPECIFICATIONS

Output: 5.0V for 78 rpm, 3.5V for microgroove*

Needle Force: 9 grams

Response: 40-10,000 cps

Net Weight: 7 grams

List Price: $9.50 with two synthesized sapphire needles

*Model W9 has capacitor furnished as an accessory. With capacitor, output is 1.7V for microgroove, 2.5V for 78 rpm.

This three-speed, dual-needle, dual-voltage crystal cartridge creates a whole new market for you! With the Shure W9, you can dramatically improve the sound of low-cost, low gain phonographs. The W9 replaces sixty-nine frequently used, high output cartridges of twelve manufacturers.

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Microphones — Electronic Components

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"In Electronics since 1925"

(*Continued from page 55*)

the cross-coupled ultra-linear shown in Fig. 5 and the *circlotron* design illustrated in Fig. 6.

Source Resistance

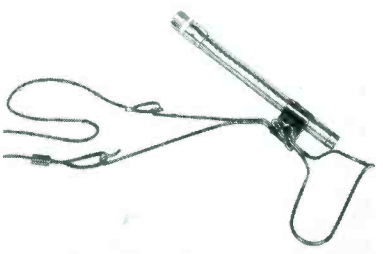
All of these circuits yield a basic source resistance for the output stage, before the application of overall feedback, that is quite low; somewhere in the region around the nominal loading impedance. Such a circuit, with additional overall voltage feedback, will be found to be an effective public-address amplifier.

Variable Damping Control

The final consideration is the application of the variable damping control. If the amplifier does not use variable damping, this feature need not be considered; but if variable damping is included, it should be of one of the types shown at Fig. 7, in which control is achieved by varying the quantity of negative voltage and current feedback. This type of control can be turned to the maximum damping position, which is entirely voltage feedback with the current feedback short-circuited.

Alternate Damping Methods

An alternate variety of damping factor control uses positive or negative current feedback, as shown in



MICROPHONE CHEST support with a braided neck cord, phenolic adjustment slide, polished chrome goose neck, and black nickel-plated wire frame. Mike can be placed on speaker's chest, in hand, or on any flat surface such as a table. (Model NS-1; Atlas Sound Corp., 1451 39th St., Brooklyn 18, N. Y.)

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CONTROL CENTER for hi-fi home music systems with eleven positions for bass and treble record equalization. Has five input channel selectors for tape, tuner, microphone, and two phono cartridges; and a master on-off switch, with volume control. (Model C-4; McIntosh Laboratory, Inc., 320 Water St., Binghamton, N. Y.)

Fig. 8. This design is not good for public-address work, because while public-address application requires a maximum damping factor, the maximum position of this control is not the best operating condition for the amplifier.

In some instances it may even go unstable with some load value. This means that an amplifier using this type of control will need careful adjustment for every different loading condition, which is obviously an undesirable feature for public-address application.

(Below)

FIG. 7: TWO VERSIONS of an acceptable form of variable damping for pa amplifiers. The control swings the feedback from all current to all voltage; minimum and maximum damping, respectively.

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In the Quality of Diamond Needles

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Record Editor
Herald Tribune

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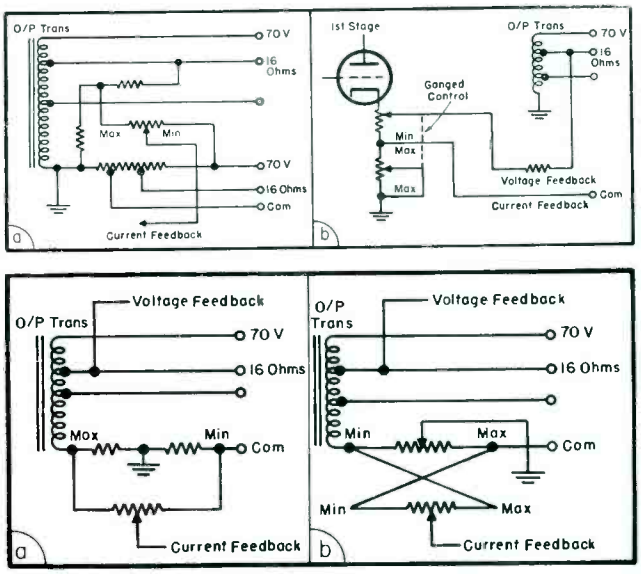

(Left, bottom)

FIG. 8: TWO VERSIONS of a type of variable damping control, not recommended for pa work. It uses variation between positive and negative current feedback.

A SPEAKER SELECTOR designed for temporary or permanent speaker coupling and comparison checks. Can be used in connection with any audio output for switching to up to 3 speakers at remote points. (Model DS77; Dynamic Electronics-New York, Inc., 73-39 Woodhaven Blvd., Forest Hills, Long Island, N. Y.)

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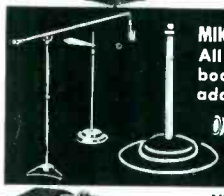

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TV PARTS... ACCESSORIES

REPLACEMENT FLYBACKS

Replacement flyback transformers, *EFR-124*, designed for use in 109 Emerson TV models, have been announced by Rogers Electronic Corp., 43 Bleecker St., New York 12, N. Y.

Said to replace Emerson parts numbers 738091, 738096, 738099, 738100, 738106, 738107 and 738111. Included with each flyback is a schematic showing connection in Emerson circuit. Also listed on the data sheet are the 109 Emerson sets covered.

° ° °

FUSE RESISTORS

Insulated fuse resistors, type *FR*, which function as a resistor under normal conditions and as a fuse under abnormal conditions, are now available from the International Resistance Co., 401 North Broad Street, Philadelphia 8, Pa. Recommended as a surge-limiting resistor in voltage doubler circuits for TV receivers.

° ° °

70° DEFLECTION YOKE REPLACEMENTS

Exact 70° cosine deflection yoke replacements (*MDF-78*) for over 200 Motorola, Hoffman, and Hallicrafters chassis have been developed by the Merit Coil and Transformer Corp., 4427 North Clark St., Chicago 40, Ill.

For exact replacement in over 50 Motorola models and chassis, Merit has developed a *MDF-79* cosine deflection yoke with plug.

Also available are exact replacement flybacks (*HVO-59* and *HVO-61*) for G. E. parts RTO-125, 126, 127, and RTO-129, 130, respectively. Both feature an anti-corona ring and exact lead color coding.

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STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF SERVICE, published monthly at New York, N. Y., for October 1, 1956.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher: Bryan Davis Publishing Co., Inc., 52 Vanderbilt Ave., N. Y. 17, N. Y.; Editor: Lewis Winner, 245 W. 107th St., N. Y. 25, N. Y.; Managing Editor: None; Business Manager: Lewis Winner, 245 W. 107th St., N. Y. 25, N. Y.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Bryan Davis Publishing Co., Inc., 52 Vanderbilt Ave., N. Y. 17, N. Y.; B. S. Davis, Ghent, N. Y.; M. T. Davis, Ghent, N. Y.; J. C. Munn, 2253 Delaware Drive, Cleveland 6, Ohio; Lewis Winner, 245 W. 107th St., New York 25, N. Y.

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(Signed) LEWIS WINNER, Editor

Sworn to and subscribed before me this 26th day of September, 1956.

(Seal) Beatrice E. Earley, Notary Public

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PHONO-TAPE Repair Tips

If the needle setdown adjustment is correct for 10″ and 12″ records, but the needle lands outside of 7″ 45 *rpm* records on Magnavox-Collaro changers, the pickup height should be backed off, adjusting shaft about ¼ turn.

Stylus Installation

Incorrect stylus replacement often affects *hf* response. The results that can occur are illustrated in Fig. 1 (p. 60). Curve *A* represents a good response that should obtain when a high quality pickup is used with its correct stylus.

Use of an incorrect stylus may cause the dip and peak response of curve *B*. In some instances, the peak may be higher or the dip shallower, or perhaps the peak will not be so high and the dip will be deeper. This will depend upon the proportion of the stylus and the extent of the error in its dimensions.

Listening-Test Record Checks

The important thing to notice about curve *B* is that an unnatural effect occurs on the high-frequency response. One should listen carefully to the reproduction to check this, if it is not possible to take an actual frequency run with a test record.

One's first reaction, when listening to a disc played by a pickup producing the response of curve *B*, is that the high-frequency response is good. This will be so because the peak tends to accentuate the record surface noise.

You will probably find that the sound offers more surface noise, than a pickup with the *A* response, but careful listening will disclose that this surface noise has substantial coloration, and the general level of the higher frequencies in the program material is not as good as you would expect from the surface-noise level. This condition obtains, because the effective rolloff is really at a lower frequency than would first appear by the position of the peak, and the peak only *appears* to sustain the response.

A good response, as at curve *A*, gives the best reproduction of high-frequency components in the

(*Continued on page* 60)

Webcor Imperial Diskchanger 1632-21

The amazing new **WEBCOR** "MAGIC-MIND" diskchangers select 33⅓ and 45 rpm speeds—automatically!

For new installations . . . for replacements . . . here's the most sensational record changer since Webcor first developed a practical, low-priced diskchanger years ago!

Just stack any assortment of 33⅓ and 45 rpm records . . . of all sizes . . . in any sequence. Turn on the Magic Mind Diskchanger . . . and it automatically selects the right turntable speed . . . as each record drops gently onto the turntable! What's more . . . regardless of record size . . . the tone arm sets down accurately on the starting groove!

It's sheer magic! For the first time—and only Webcor has the Magic Mind Diskchanger . . . it's possible to hear hours of recorded music . . . without raising a finger!

(Plays 78 rpm records, too, of course.)

SEE or CALL your Webcor distributor today. Have him give you the complete story on Webcor's new Magic Mind Diskchangers . . . designed to fit all standard wells. Mounting boards precut to exact dimensions of Webcor diskchangers.

WEBCOR VHF

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Specifications:
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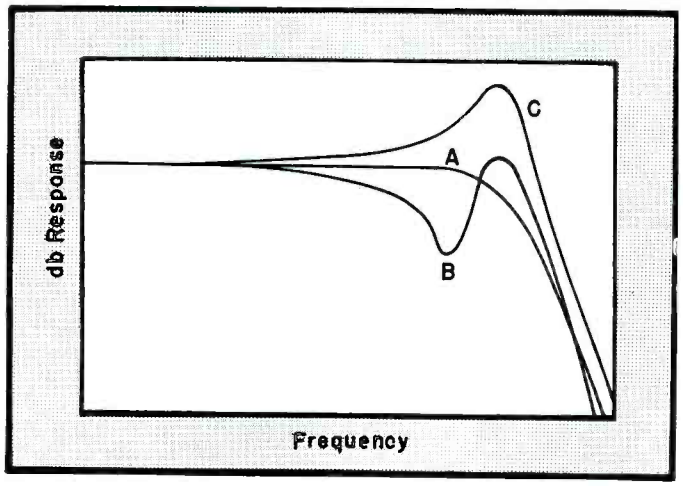

IDEAL AND POOR response curves found in phono systems: A is the ideal curve; B can be caused by improper combinations of needle and cartridge; C usually reflects loss of damping in the pickup, and indicates it is time to replace not only the stylus, but the cartridge, too.

Phono-Tape Repair Tips

(*Continued from page 59*)

program material, and at the same time minimizes the apparent surface noise.

Curve *C* shows a peak that can occur due to insufficient damping. The use of too long a stylus arm can produce insufficient damping for the tone-arm resonance. But this is not true of high-frequency resonance; if the stylus arm is too long, its increased mass will pull the freqeuncy down and the peak will not as a rule be excessive. The peak shown in curve *C* can occur even when the correct stylus is inserted. This happens because, even in the best of cartridges, damping material deteriorates with age.

Checking Tape Capstan Speed

A strob disc (circular fan-like metal disc) placed on the metal drive capstan (for 7½ ips only), can be used to check capstan speed on tape recorders. When the recorder is operating, and the disc is viewed under a fluorescent light, spokes will appear to form on the disc as it spins. If the spokes seem to turn counter-clockwise the capstan is rotating too slowly. If they appear to turn clockwise, at a ratio greater than two revolutions per minute, the capstan is rotating too fast.

If the capstan speed is not correct, the condition of the drive idlers should be checked for cleanliness. Also the end play of the capstan flywheel should be checked. If it is too tight or too loose, the flywheel should be adjusted by tightening or loosening the adjusting set screw.

Other Causes of Improper Speed

Improper capstan speed can also be due to incorrect pressure on the pressure roller; the correct pressure is one pound. To adjust the roller, one should either stretch or remove loops from the pressure arm springs.

Slow Winding Speed

It is normal for a reel to start slowly when winding the tape towards a comparatively full reel. However, the recorder should pick up in speed soon after. When the winding continues to be slow, the rubber drive wheel under the reel chucks should be checked. If the rubber has shredded to any great extent, the wheel assembly should be replaced.

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(*Continued from page 53*)

tenuation in either channel, is zero (or slightly negative). The net *dc* output of the two channels is applied to the grid of the relay tube. The 2D21 thyratron is maintained nonconducting by *ac* bias from the heater winding of the power transformer applied to its cathode. A signal whose frequency is different than the band-stop frequency will suffer relatively little attenuation in either channel.

Bias Cancellation

However, if the signal is attenuated in the band-stop channel, the net *dc* output will be positive and cancel the bias, causing the relay to operate. The plug-in decoding network is factory adjusted to correspond to the modulating frequency of the transmitter and attenuates only that particular tone.

Capacitive Time Delay

To avoid possible operation from transients and interference, particularly that of the familar *squeal* or *whistle* variety, a time delay of approximately one-half second is provided by a capacitor across the relay.

The *dc* power for the receiver is obtained from a half-wave rectifier and single section resistance-capacitance filter.

Premium Tubes

The remote-control units are designed for maximum tube life. However, for critical applications in commerce and industry or when extraordinary tube life is desired, the original *entertainment* type tubes may be replaced with *high-reliability* industrial types as noted below. These tubes may be directly interchanged with their entertainment type equivalents.

Entertainment Type	*Equivalent High Reliability Industrial Type*
6BA6	5749
12AU7A	5814A
2D21	5727

TABULATION of entertainment and equivalent high-reliability industrial type tubes that can be used for critical applications or when unusually long tube life is required.

THIS DFF

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MEANS MORE OF THIS FOR YOU

DFF—Duotone Fidelity Focus is big—big as Life where it's being advertised in the biggest program of its kind in needle history. For DFF brings music out of the shadows into focus. It's the big needle news. Put it to work for you. It's the perfect door opener. So is the free DFF Needle Test Card. Lets you test customer's needle right in his machine. Then send test card to us (with 25¢ to cover handling); and we will rush you back a complete report on the customer's needle. Gives you chance for second visit—second sale. Ask us about free DFF Needle Test Cards and DFF Program—it's big—

SPECIAL SERVICE MAN'S KIT The all-in-one needle repair kit with the famous four free extras. Includes free—one 50X microscope to check needle. Jeweler's screwdriver. Professional Tools. Plastic carrying case. 13 of the most used needles. List $25.00.

DUOTONE T-V CLOTH An extra on every service call. New especially treated cloth that removes T-V Smog like magic. Gives brighter picture. Reduces reflection glare. Keeps dust from clinging. A quick wipe by servicemen inside and outside of protective glass and on picture tube. Sell one for home use to remove fingerprints—keep off dust. $1.00 list.

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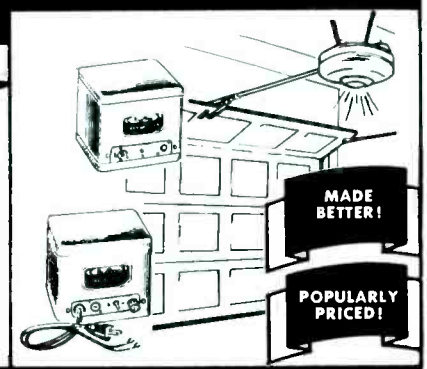

Here is the ultimate in design for remotely operating garage doors with maximum convenience and safety. All mechanism is concealed in a modern spun-aluminum fixture that beautifies as well as illuminates the garage interior. The motor is a ¼ HP, 117 volt, capacitor-start type with ample power to operate the largest of modern residential garage doors. Also in the fixture is the radio receiver which turns on the motor when it gets a signal from the transmitter in the car.

The radio-control transmitter is crystal-controlled, sending out its signal on an FCC authorized frequency of 27.255 mcs. Being small, it mounts under the hood and operates directly from the 6 or 12 volt car battery.

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INSTRUMENTS

VTVM

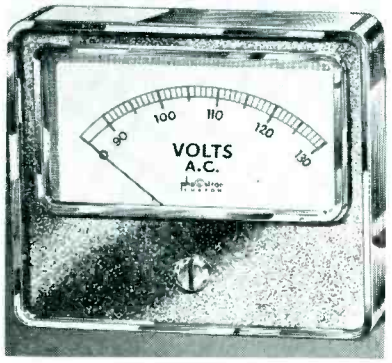
A vacuum-tube voltmeter, *V-500-VTVM*, featuring a single range and function control, has been announced by Anchor Products Co., 2712 W. Montrose Ave., Chicago 18, Ill.

Meter has a separate 3-volt *ac* scale; zero centering for TV and FM alignment and a 30 to 100-mc operation range. No batteries are used. Unit has an on-off indicator light, polarity-reverse switch, db scale and overload protection. Measures *ac* and *dc* voltages and resistances. Comes with test leads and isolation probe.

* * *

EXPANDED-SCALE VOLTMETERS

Expanded-scale voltmeters, for both *ac* and *dc*, in a variety of ranges and case styles have been introduced by Phaostron Instrument and Electronic Co., 151 Pasadena Ave., S. Pasadena, Calif.



* * *

VOLTAGE CALIBRATOR

A voltage-calibrator (kit), *VC-3*, for producing square-wave signals of known amplitude, has been developed by Heath Co., 305 Territorial Rd., Benton Harbor, Mich.

Unit features 1% attenuator resistors and multivibrator circuit. Output frequency is approximately 1000 cps. Fixed outputs are .03, .1, .3, 1, 3, 10, 30 and 100 *v p-p*. Measurement of unknown signal amplitudes is said to be possible by comparing to known *p-p* output of calibrator on 'scope. Unit is also said to serve as a square-wave generator at 1000 cps for determining gain, frequency response or phase-shift characteristics of audio amplifiers.

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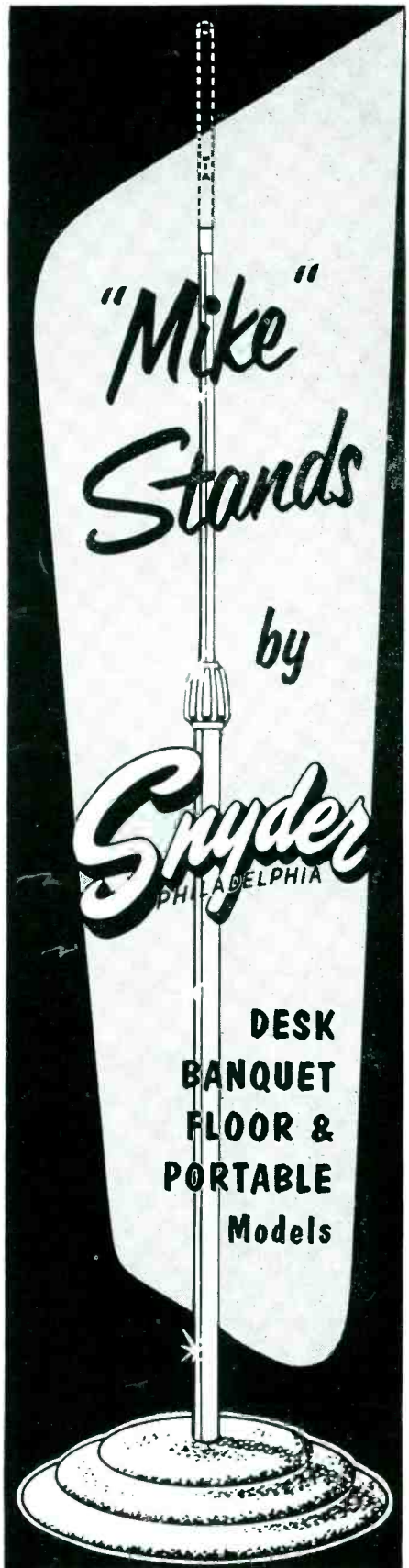

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NOVEMBER, 1956

INDUSTRY NEWS

CONELRAD WALL CHART

A wall chart, containing instructions on what to do in case of a Conelrad alert, has been made available for operators of base radio stations by Kaar Engineering Corp. Chart outlines procedures which must be followed to comply with FCC rules. Copies can be had by writing Kaar Conalert, P. O. Box 1320, Palo Alto, Calif.

* * *

NEW TUBE PLANT IN ALTOONA, PA.

Sylvania Electric Products, Inc., recently broke ground for a new receiving tube plant at Altoona, Pa. New manufacturing unit will contain 190,000 square feet of production space.

* * *

SALES-INCENTIVE CAMPAIGN

A national sales-incentive *Sell-A-Bration* program designed to spark replacement-antenna installations has been announced by JFD Manufacturing Co., Inc., 6101 16 Ave., Brooklyn 4, N. Y.

Based on a point system, Service Men will be given bonus points for each antenna of the Colortenna family sold; eleven antenna models are included in plan.

Merit points will be redeemable in over 900 premiums ranging from fishing rods to sports cars to national and overseas pleasure trips. Distributor salesmen will receive the same amount of merit points as his dealers.

Sales campaign features use of displays, streamers, newspaper mats and direct mail.

The promotion will end March 15, 1957.

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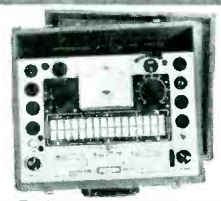

Fastest Dynamic Tube Tester made, yet it's fully flexible for all receiving types, new and old. The set-up time is actually less than the warm-up time of the tube. New Variable Sensitivity Shorts Test shows leakage up to 2.0 megohms. Metered plate current shows tube condition. Meter calibrated in Good-Bad as well as Percent of relative micromhos. Automatic Line Voltage Indicator, Life Line Indicator, New Zig Zag Roll Chart locates tube types much faster. Twenty-three heater voltage settings cover all series-string tubes.

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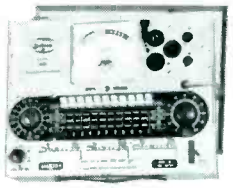
with Plug-In Accessories



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A good, basic tube tester, with plug-in accessories for performing a wide variety of additional tests. Accessories may be added any time, permit testing tubes for filament current and high resistance shorts, as well as checking selenium rectifiers. Lever action shows which pins are connected. Sensitive shorts test. Line Voltage Indicator. A tremendous value.

3 New, Portable
Dynamic Model 561
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Test Data on New Tube Types for All Jackson Testers Appears Monthly on Page 65 of PF Reporter
For more information, write:
JACKSON ELECTRICAL INSTRUMENT CO.
"Service Engineered" Test Equipment
16-18 S. PATTERSON BLVD., DAYTON 2, OHIO
In Canada: The Canadian Marconi Company

Tube News

THE INCREASING popularity of TV portables has prompted the introduction of a number of 450-*ma* replacement tubes for these chassis.

Three types that have recently become available are the 6J6A, 6V6GTA and 8AW8A[1].

A fourth tube, announced as a replacement, is the 8CG7[2], a heater-cathode type medium-mu twin triode of miniature construction, designed for use as a vertical and horizontal deflection oscillator. The tube is identical to the 6CG7 except for its 450-*ma* heater rating.

Another reduced size type that has become available is the 6CD6GA[3], a high-perveance glass-octal beam power tube, for horizontal-deflection amplifier use with 90° deflection-angle picture tubes. Utilizing a button-stem construction in a T-12 envelope, the 6CD6GA is smaller than the 6CD6G, and features a modified mount design. It has a maximum peak positive-pulse plate voltage rating of 7000 and a maximum plate dissipation of 20 watts. The tube is unilaterally interchangeable with the 6CD6G.

Also developed for the horizontal-deflection circuit is a damper diode, the 19AU4[3] (half-wave rectifier) with an 18.9-*v*/600-*ma* heater.

Rated to withstand a maximum peak inverse plate voltage of 4500 (absolute), the 19AU4, it is claimed, can supply a maximum peak-plate current of 1050 *ma* and a maximum *dc* plate current of 175 *ma*.

Tube engineers have also been active in developing new types for audio and *ac/dc* chassis.

A beam power tube of the glass-octal type, the 6DG6GT[3], has been designed for service as an output tube in audio amplifiers. Having a 6.3-*v*/1.2-*a* heater and a maximum peak heater-cathode voltage of ±90, but otherwise like the 25L6GT, the 6DG6GT is intended for the use in audio equipment requiring a power sensitivity and efficiency at relatively low plate and grid-No. 2 voltages.

For example, it is said, in a class *A1* application, a single 6DG6GT operating at a plate voltage of 200 and a grid-No. 2 *v* of 25, will deliver 3.8 watts of power.

Another new audio tube recently announced is the 17C5[2], a heater-cathode miniature beam pentode. It was designed for use in the *af* power output state of *ac/dc* receivers, and is identical to the 50C5, except that it has a 450-*ma* heater rating.

[1]Sylvania [2]Raytheon [3]RCA

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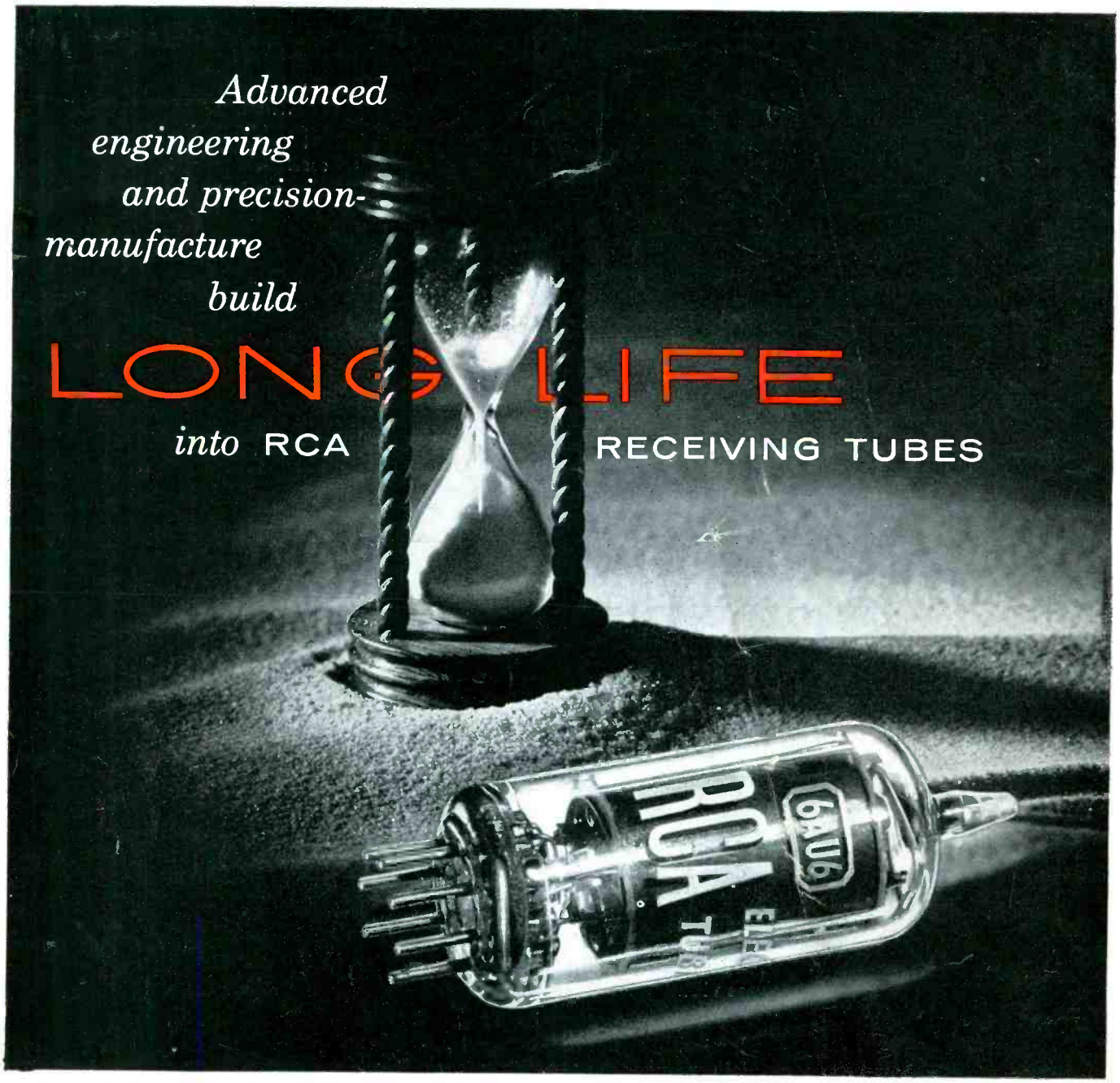

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