SUCCESSFUL Servicing

MARCH 1952

HORIZONTAL OUTPUT TRANSFORMERS

Their Use and Replacement

by Albert Friedman and Victor Markosian*

In the early days of radio, one of the first problems to face the industry was one of parts replacement. Initially, the manufacturer of radio receivers was the only source for replacement parts for his receivers and complete anticipatory inventories of all types of items were maintained. However, as the industry grew and radio receiver distribution became nation wide, a sharply defined need for additional sources of replacement parts manifested itself. This need gave birth to replacement manufacturers whose sole function consisted of supplying related components that could be used in all types of radio equipment and still satisfy individual manufacturer's specifications.

The advent of television again brings the replacement situation into focus. In some cases the original parts are easily available; in others, deliveries are slow or they are no longer available. To further amplify this problem, there is still no manufacturer-authorized, centralized source to designate which manufacturer of replacement parts makes units correctly and exactly designed to fill the requirements of each of the various tv receivers.

In allied industries, such as the automotive trade, a factory-authorized index lists the approved exact replacement parts for each manufacturer and thereby eliminates the confusion that exists in our industry. Until some recognized authority in our field publishes this type of information, the serviceman has no choice but to use any information indiscriminately made available to him. There are agencies in our industry whose basic function qualifies them to compile and prepare this information. Until exact replacement information is made available, however, the conscientious serviceman, who wants to do a good replacement job and reduce costly callbacks, must know how to determine what replacement parts to use in various receiver circuits.

In this and subsequent articles we are going to cover the replacement of some of the more important replaceable parts of a tv receiver. The series will discuss the following topics:

1. use and replacement of horizontal output transformers
2. use and replacement of deflection yokes
3. use and replacement of width and linearity coils
4. proper use and application of conversion units.

In this article, we will discuss the replacement of horizontal output transformers used in flyback high-voltage supplies. First, however, it may be helpful to review the operation of a typical flyback circuit.

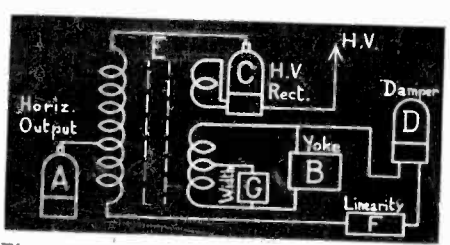

Fig. 1. Block diagram of a typical flyback, horizontal output circuit.

Albert Friedman is National Sales Engineer and Victor Markosian, Chief Engineer of Ram Electronics, Inc. All figures for this article are through the courtesy of Ram Electronics.

Operation of Flyback Circuit

In Fig. 1 is shown a block diagram of a conventional flyback circuit. This circuit supplies the sweep voltage to the horizontal deflection system of the receiver cathode-ray tube, as well as the high-second anode voltage for the crt.

The output amplifier (A) receives a signal from the horizontal oscillator and amplifies it. This signal is impressed across part of the primary of the horizontal output transformer. One secondary draws high current variations by means of step-down turns ratio. This current operates the deflection coils of the yoke

(Continued on page 7)

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17K3, 17K5, 17K6, 17K7 (CH. TS-118A, TS-118B)
17K10E (CH. TS-314)
17K10E (CH. TS-314A)
17T2, 17T3, 17T3X1, 17T4 (CH. TS-118A, TS-118B)
17T5A, 17T5CA (CH. TS-214)
17T5E (CH. TS-314)
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153-16 (CH. 478.341)
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166-16 (CH. 478.339)
166-17 (CH. 478.339-A)
168-16 (CH. 549.100-1)
175-16 (CH. 549.100-5, 549.100-8, 549.100-9)
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176-19 (CH. 549.100-6)
1132-17 (CH. 476.376)
1146-20 (CH. 132.014)
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5165X, 5166X, Sheffield (CH. 26SD171)
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2D2052D, 2D2052E (CH. 17AY28)

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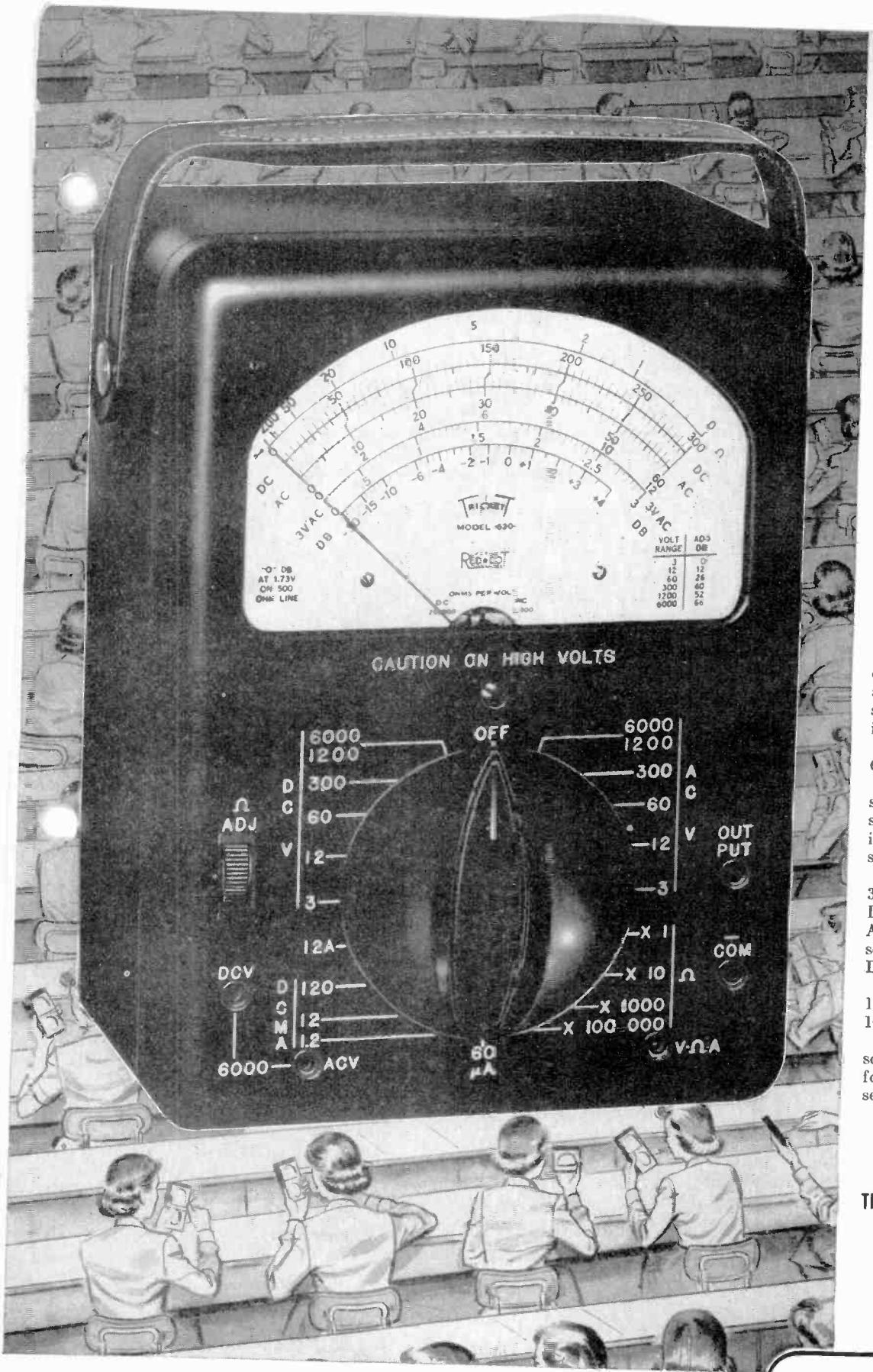

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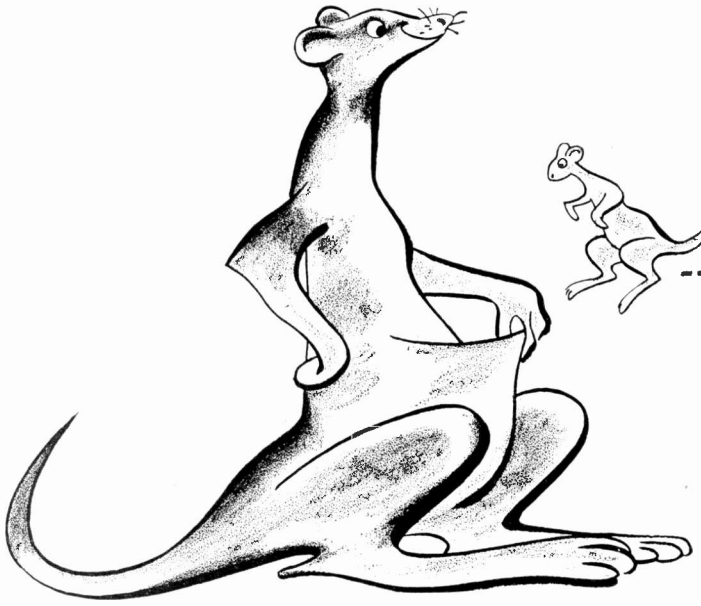

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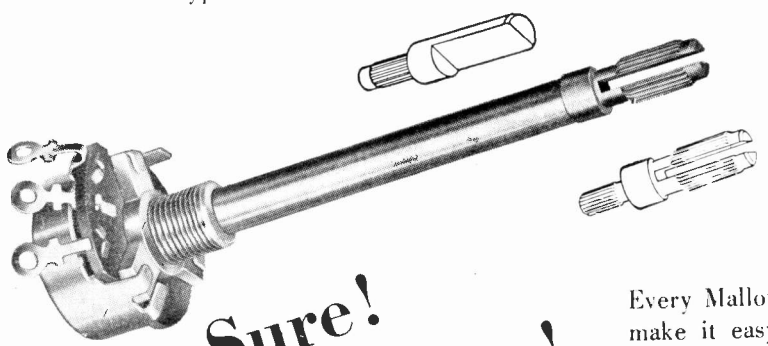

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Volume 13 Number 5 March, 1952

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Curtain Time

Open Letter to Mr. Albert Coumont RTMA Service Manager

Dear Al,

First of all, let me take this opportunity of wishing you the best of success in your new assignment as Service Manager of RTMA. Having had the pleasure of spending a substantial number of hours with you, I feel certain that you will do a grand job for the servicing industry as a whole, and for the RTMA. Heavens knows that the TV servicing industry needs an individual like yourself to carry the ball on many issues!

For example, here is something which deserves serious consideration by you, the RTMA, and the Better Business Bureau. For many years past, the public has been uninformed on a very important matter — the differential between the *list price* of a radio or tv receiver and the *cost* of having it serviced properly.

The public is aware of the fact that the ability to buy a tv receiver for only $199 or $295 stems from mass production. If a manufacturer produced only one set a day, or even a dozen, the list price conceivably could be $500 or perhaps $1,000. Certainly it would be several times the list price now being charged.

Assuming mass production at the factory, what happens when a tv (or radio) receiver comes into the service shop? Now it is a single item no longer entitled to the advantages of mass production. The service technician *must* treat that receiver the same way he would a custom-made set. The parts used may be similar to parts used in thousands of other receivers, but as far as he is concerned, whatever he replaces in the defective receiver must be handled on an *individual* basis. The public must realize that mass production techniques in receiver manufacturing cannot be applied in repair activity. There is no production line for the diagnosis of the fault or for the accomplishment of the repair. If a service shop handles a dozen or even two dozen receivers a day, production line techniques cannot be applied, because these receivers may be of varied model and circuit designs.

The mass purchasing power of the factory is reflected in the cost of the parts which go into the assembly of the receiver, affecting the list price, but *does not exist* in the service shop. Many parts used in tv receivers are singular, that is only one of a kind is used — but the manufacturer can buy these items in tens of thousands or even million quantities. The service shop owner on the other hand buys singular items individually, because he does not know how many of the same model will come into his shop for repair — and even if a dozen come in for service, the same fault will not be present in all of them. Therefore, his cost per item is higher.

The sum and substance of the whole thing is that the cost of parts to the service shop is substantially higher than the cost of parts at the set manufacturing level. This is reflected in the repair charge, and the advantages accruing to the public because of mass manufacturing should not, and cannot be expected at the servicing level!

There is another extremely important point which must be brought to the attention of the public. . . . You are the man to do this through the RTMA and every other possible medium. I am referring to the relation between the cost of items which are frequently replacements in a receiver and the overall service charge.

The public and some of the investigating bodies have criticized the servicing industry for charging five dollars for time and labor when replacing an item which costs only pennies — say 15 or 20 cents, as for example, a resistor. The same could be true of a tube which costs $2.00 or a capacitor which costs 80 cents.

What the public loses sight of is the fact that the replacement of a part, no matter how small, involves a number of operations prior to the actual replacement — diagnosing the fault, making measurements to determine the precise part gone bad, etc. This all consumes time, and the end result may be merely the replacement of a cheap resistor. Also, time can be spent waiting for the receiver to heat up, tuning the receiver and noting the fault; making minor adjustments here and there.

Also involved is the expenditure of traveling time to the home, examination there, pickup, and eventual delivery to the home. Even disregarding the pickup and delivery time, the fact remains that the effort and time required for the replacement of a cheap item is not based on the cost of the item.

It is entirely possible that it is no more time consuming to replace a $15.00 item than a 50 cent item. But the rent paid by the service shop owner, or the equipment he must buy, or the insurance he must pay is not based on the list price of an item. These factors, and *many others* which are related to time and overhead, are responsible for the disproportionate charge for time and parts in many instances, and it cannot be helped.

Now Al, what the servicing industry needs from you and RTMA, is the publication of a booklet for the public which tells the story of mass production. A booklet of this kind has been needed for many years. It would help make the public understand why a $6.95 midget used tubes which listed for $7.50, or why a $19.95 or even $29.95 receiver may cost $10.00 to service. Today, the public evaluates the *justice* of a service charge, especially the time charge, on the basis of the cost of the part replaced. This is wrong and we hope that you will be able to correct it. . . . We know that it is going to be difficult to do so, but I trust that you, the RTMA and the Better Business Bureau will try. Thanks!

John F. Rider

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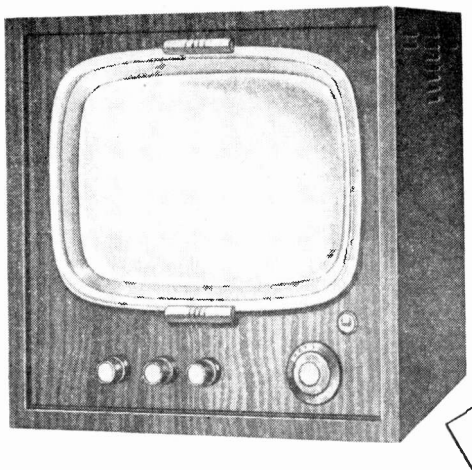

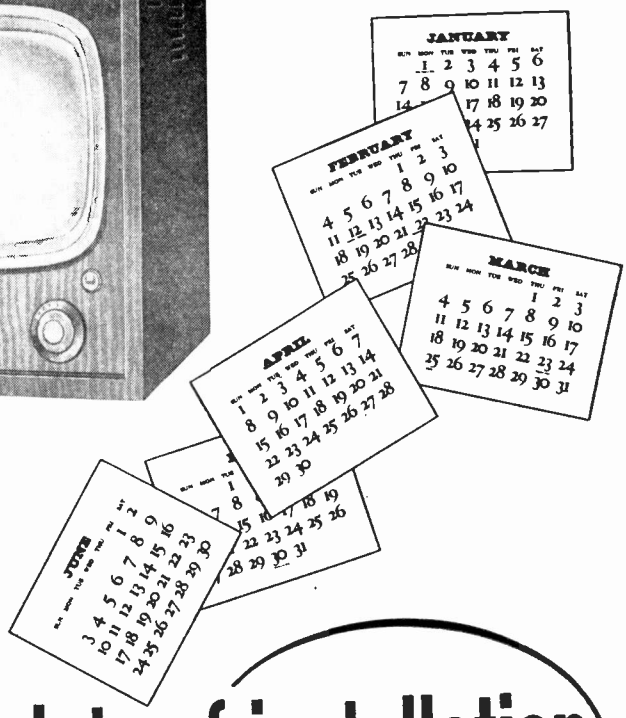

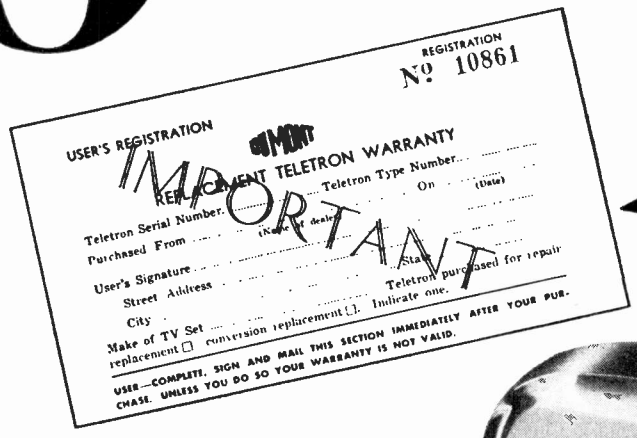

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Horizontal Output Transformers

Their Use and Replacement

(Continued from page 1)

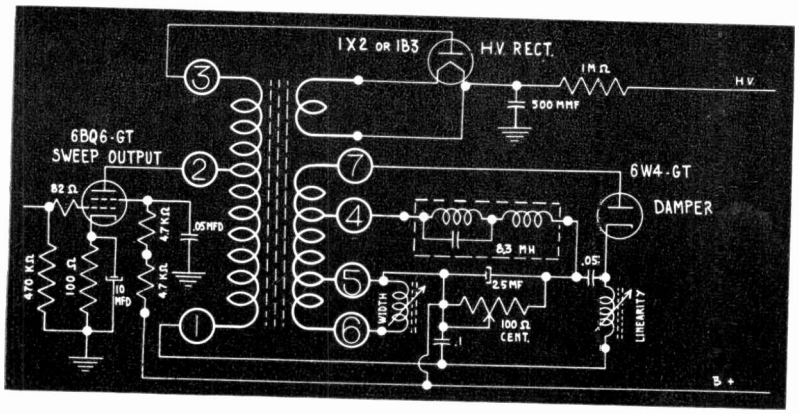

Fig. 2. Schematic of a horizontal flyback circuit using a Ram type X066 transformer.

(B). At the same time, the transformer matches the low impedance value of the yoke to the horizontal-output circuit.

The transformer primary also acts as an auto-transformer; the high potential developed across the entire primary is half-wave rectified and used to supply the second anode of the cathode-ray tube (C).

When the horizontal-output tube stops conducting, due to the drop in signal voltage fed to it, a breakdown of lines of force in the transformer induces a pulse of voltage in the transformer secondary. This pulse tends to set up transient oscillations in the yoke secondary circuit. To avoid these oscillations, the damper tube (D) is used. This tube absorbs the power in these oscillations which otherwise would appear as vertical bars on the picture information. This extra power is rectified and filtered through a network consisting of a linearity coil (F) and two filter condensers. Since this rectified voltage is in series with the B+ of the driver tube it adds to it and, therefore, is called boost voltage.

The linearity coil as part of a tuned filter circuit has a direct adjustable function on the linearity of the waveform in that circuit. The width coil (G) is wired in shunt with a portion of the transformer secondary and therefore provides some adjustment of its output. This adjustment is in direct relation to the resultant width of the sweep.

For purposes of clarity we will condense a wide variety of actual flyback transformers and circuits into three basic groups. These are the ones which find the widest use in present day tv receivers.

A general description of all flyback transformers will note that they are all of the ceramic-core, high-efficiency type. Since the advent of large-screen television tubes, powdered iron cores were found to be inadequate. As a result, to simplify production and increase the efficiency of older chassis, modified ceramic-core units have been developed for use as replacement with smaller size tubes.

Figure 2 shows a transformer used in conjunction with an 8.3 mh deflection yoke. This diagram shows a 6BQ6 as the driver tube, however, it is also common to use either a 6BG6 or a 6AU5 in such circuits. For purposes of maximum damping, the damper tube is connected to the highest tap on the transformer while the deflection coil is connected to the next lowest tap. Under these conditions, the voltage at the output of the linearity coil will be about 500 volts with a B+ voltage of only 320 volts.

Figure 3 illustrates a somewhat different circuit. This is an early type of high-efficiency flyback unit. Its principle of operation is similar to that of the circuit in Fig. 2. The transformer shown works well with horizontal deflection coils having inductances from 8 to 30 mh and will deflect a 21" picture tube. It produces about 14KV with a B+ supply of 325 volts. The insertion of the HV filter capacitor on the highest tap of the secondary helps to produce this high voltage. Pin 4 tap on the HV flyback has a sharp negative pulse of about 3KV at the same instant that the positive pulse is delivered to the 1B3. The addition of this voltage across the high voltage filter boosts the HV to 14KV.

The width and linearity coils used in this circuit differ from those used with the previous transformer. Whereas that circuit employs the same type coils as used in early TS-630 type circuits, the width coil used with the transfer shown in Fig. 3 has much higher inductance because of greater voltage between taps.

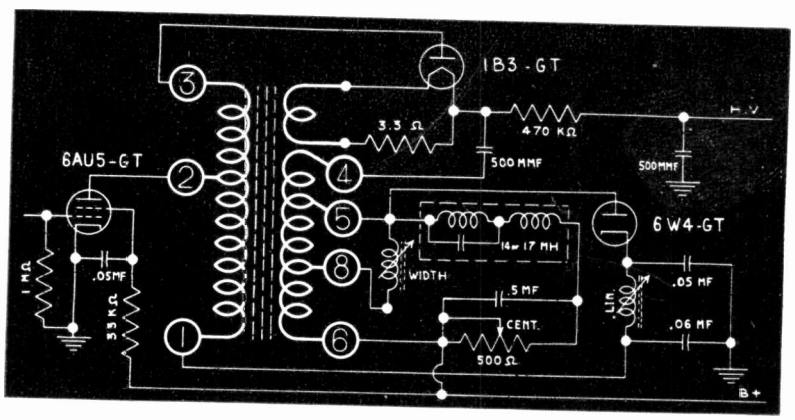

Fig. 3. Early type, high-efficiency flyback circuit. (Ram X045 transformer)

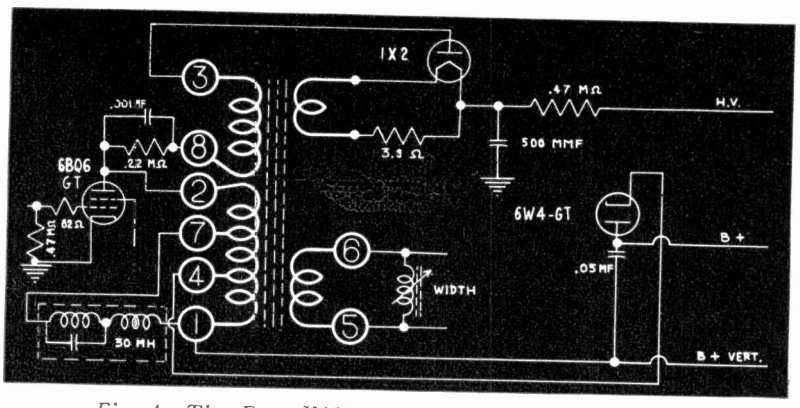

Fig. 4. The Ram X054 autotransformer flyback circuit. This type is useful in large-tube circuits.

The third basic type of flyback transformer is illustrated in Fig. 4. Employing the principles of an autotransformer, it still retains

the function of a regular flyback transformer. Because of its autotransformer design, the horizontal deflection yoke must be reversed. Therefore, the pulse on the "hot side" of the yoke will be positive. In conformance with this reversal in polarity, the damper tube must also be inverted. B+ is applied to the plate of the damper and the developed boost voltage appears on Pin 1 of the transformer. The deflection yoke used in this circuit has a 30 mh horizontal winding.

The autotransformer design reduces leakage reactance and distributed capacitance resulting in lower retrace time and ultimately, in fewer foldover problems. The resistor-capacitor combination connected between Pins 2 and 8 on the transformer is a current limiting device to reduce HV danger and is required by Underwriters Laboratories. The circuit shown will sweep up to a 24" tube and supply 14 to 15KV with a B+ supply of approximately 320 volts.

There are many variations of the three types of transformers we have discussed. Basically they all perform the same functions. Some have additional windings for keyed automatic gain control, feedback voltages, additional filament windings and other such variations including a separate winding for the width coil. With the latter arrangement, the width coil can be operated with one side connected to ground.

We cannot stress too strongly the fact that one of the most important functions of the flyback transformer is to match the deflection yoke to the plate impedance of the driver tube. A mismatch of these components can be evidenced in many ways. One very frequent result of mismatch between these units is nonlinearity or crowding at one side of picture information. This condition can also be caused by a mismatch between output tube and transformer. Before a transformer replacement is considered therefore, correct impedance, turns ratio and current capacity for the transformer must be determined.

Replacement Considerations

If a flyback transformer is found to be defective, the following points should be considered to obtain the correct replacement:

1. Check the receiver circuit diagram to determine the type and size of windings on the transformer to be replaced. In many cases, the receiver schematic found in manufacturer-authorized service data (such as Rider Manuals or TEK-FILES) shows not only the impedance values for the transformer windings but also the color coding.
2. Determine the tube type, and the impedance of the yoke used, from the receiver schematic or parts list.
3. Be sure to check whether the unit has special windings for AGC, width control or feedback purposes.
4. Consult a catalog listing horizontal output transformers for a transformer with the windings required. The terminal arrangement may vary but if the winding data per section is within 15-20% of that required, the unit can be used.
5. *We emphasize at this point that the driver plate winding should be held as close as possible to required value in order to assure proper impedance match.* Also, the taps used for the width coil should have the proper impedance to match the coil, as should the windings used for the yoke. All of these impedance values may be obtained from the schematic given with manufacturer-authorized service data.
6. Examine the outline characteristics of the transformer replacement, to be sure that the new unit can be mounted in the space available, and will fit onto the bracket already in place.
7. Do not under any circumstances select a transformer designed to operate with a tube having a lower current rating than the one used in the set. If the current drain on the transformer is too high its operating life will be shortened due to overheating.
8. Some original equipment is made with a resistance wound filament. It usually appears wound on the sleeving of the filament lead. In replacement, connect a 3.3 to 3.9 ohm, 1 watt resistor in series with the filament circuit.

Trouble-Shooting Replacements

If all the foregoing considerations are made, the receiver should operate satisfactorily. However, due to circuit disturbances or slight mismatches, certain adjustments may have to be made. Following are some of the variances and the remedies for them.

Insufficient Width

Use one, two, or all of the following:

1. Shunt the width coil a .05 mf capacitor.
2. Adjust the drive trimmer to provide more drive on the grid of the output tube.
3. Increase the screen voltage of the output tube by replacing the screen resistor with one of lower value. This is a trial and error process, try succeedingly smaller values until the one giving the best results is found.

CAUTION!!! Increase voltage in steps of no higher than 10% by change of resistance value.

Low Second Anode Voltage

1. Remove or reduce capacitance across width coil.
2. Replace or remove width coil.
3. Increase boost voltage by connecting the vertical sweep to another B+ source. Increasing the drive or screen voltage will also increase HV.
4. Connect the cold or ground side of the HV capacitor to the top of the flyback secondary. This is usually where the damper plate is connected.

Excessive HV

1. Reduce drive on grid of output tube by adjustment of driver trimmer.
2. Reduce driver screen voltage by replacing the existing resistor with one of higher value.
3. Shunt the width coil with various sized mica capacitors, selecting the one rendering best results. Shunt the damper tube with a 15K ohm, 10 watt resistor.
5. Reduce B+ voltage to flyback with a series 500 ohm, 10 watt resistor.

HV Arcing or Corona

Check for sharp points on soldered connections. Dirt, excessive rosin flux or dust near HV coils will also cause this condition.

1. Clean all soldered connections in HV section with carbon tetrachloride.
2. Smooth and round all connections.
3. Insulate core side from coil with high-frequency vinyl tape. Use anti-corona dope on spots where tape cannot be applied.

Non-Linearity

1. Substitute shunt condensers on linearity coil. Use lower or higher value to effect desired result.
2. Adjust drive trimmer for desired linearity. then readjust to proper width.
3. Non-linearity is also a condition of mismatch between flyback and yoke. Check to determine whether variations in taps on secondary of transformer can be used to correct this condition. If this cannot be accomplished, a matching yoke replacement is necessary.

Foldover

Before any component replacement is made be sure that the horizontal oscillator coils are properly adjusted. Special emphasis is made regarding syncrolock or syncroguide circuits. Tune both coils carefully to prevent lock-in action. This condition can be blanked out by connecting the negative side of the yoke to the first anode of the picture tube by means of a voltage divider between the "hot" side of the yoke and the normal source of first anode potential.

Damping Bars

This condition appears as vertical bars on the screen. It is usually caused by component mismatch, excessive drive, or failure in the damper circuit.

1. Check the damper tube for efficiency of operation.
2. Check adjustment of drive trimmer.
3. The value of the capacitor in the deflection yoke may have changed in value. Replacement with one of higher value may correct this condition. Yoke and transformer matching is of course the basic check before any rewiring is attempted.

Careful consideration should be given to all aspects before the replacement of a flyback transformer is made. We have purposely avoided related effects of deflection circuits as much as possible. This will be treated in the next article.

TV versus Radio Repair

by John F. Rider

How much time can a tv service technician afford to lose? The answer is none. The reason is simple: time is money in the servicing business. All of us know that it is impossible to make every minute of the day pay off; but if we're given the job of taking the bugs out of a tv receiver it just doesn't make sense to plunge into it without looking around a little bit.

TV receiver diagnosis and repair is vastly different from radio-receiver diagnosis and repair. Most a-m radio receivers produced during the past six years are table models and contain 5 or 6 tubes; diagnosis of these is simple in comparison to the 22-30 tube tv receivers. The same can be said about the repair. Radio-receiver repair is replacement or adjustment; occasionally it entails modification in the circuitry as the means of effecting permanent cures of performance peculiarities. These radio repairs still mean recourse to service information of course—for, after all, differences do exist in these receivers; and it is to the distinct advantage of the service technician to know everything possible about the receiver being repaired.

On the other hand, TV receiver diagnosis and repair is much more complicated. It's not that the video receiver contains circuitry which is beyond understanding by the service technician, but it is a case of *taking advantage* of every bit of known art. By "known art" we mean what the receiver manufacturer *knows*. Utilizing this information is the difference between making every minute on the job produce results—or wasting a lot of time on a job and in repeat calls.

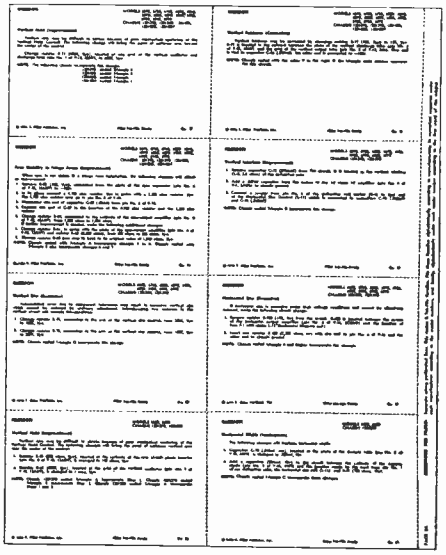

Fig. 1. Layout of a typical HANDY sheet which is included in various TEK-FILE packs.

WESTINGHOUSE

MODELS H-640T17, H-641K17
CHASSIS V-2192, V-2192-1,
V-2192-2, V-2192-3

Sound Bars (Elimination)

Sound bars in the picture may be eliminated when caused by adjacent channel interference in the following manner:

1. Obtain slug-tuned reactor L-308 (adjacent channel sound trap).
2. Connect one end of L-308 to chassis ground.
3. Connect other end of L-308 through capacitor C-320 (1.5mmf) to pin no. 1 of the 2nd i-f amplifier (6CB6).
4. Connect capacitor C-321 (12mmf) in parallel with L-308.
5. Turn the TV receiver on and tune it accurately to the station on which the adjacent channel interference occurs.
6. Turn L-308 to its extreme counterclockwise position; then rotate slowly clockwise until sound bars disappear.

NOTE: The alignment of T-302 may be affected. If so, it will have to be realigned. Later production chassis incorporate this change.

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WESTINGHOUSE

MODEL H-630T14
CHASSIS V-2176

Circuit Changes (Deflection Yoke)

1. a. In chassis using a deflection yoke (Z-402) marked V-10045-3, the 110 ohm resistor (R-453), which is shown on the schematic shunting the width control, is omitted. This is done to obtain correct picture width.
   b. In most of these chassis, the low-potential lead of the high-voltage filter capacitor (C-431, 500mmf) is connected to ground rather than to terminal 7 of the high-voltage transformer (T-402) as shown.
2. a. In chassis using a deflection yoke marked V-10045-1, resistor R-453 will be omitted in some cases for correct width.
   b. In these chassis, the lead from the horizontal winding of the yoke goes to terminal 7 of the high-voltage transformer (T-402), instead of to terminal 5, as shown.
3. When it becomes necessary to replace a yoke, it is recommended that an assembly bearing the same Part number is used.

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Fig. 2. A couple of TEK-FILE HANDIES (actual size) showing two explicit type changes written up.

The issue at the moment is not one of profit. We take it for granted that every service operator does everything he can to earn a profit. What we are talking about is a practice which is followed by every engineering outfit which has occasion to work on electronic equipment, to develop or modify equipment to fit a need. These organizations make life easy for themselves by first determining the *known art*—and known art means information relating to what already has been done. The bigger these organizations are, the more they do this.

The tv service technician can well afford to follow the practices of electronic engineering outfits. Why waste time and money pondering and trying to locate cures for tv receiver troubles when specific information is at hand? It's bad enough when this has to be done because the necessary information is not available, but when the information is available—it is throwing money away not to use it.

We are referring specifically to the HANDIES contained in many Rider TEK-FILES, and the CHANGES in the Rider Manuals. Beginning with Volume 9, each Rider TV Manual will contain the HANDIES applicable to the receivers in the manual. Earlier Rider TV Manuals contained these as change notices. Rider TV Manual Volume 9 will be released in late April.

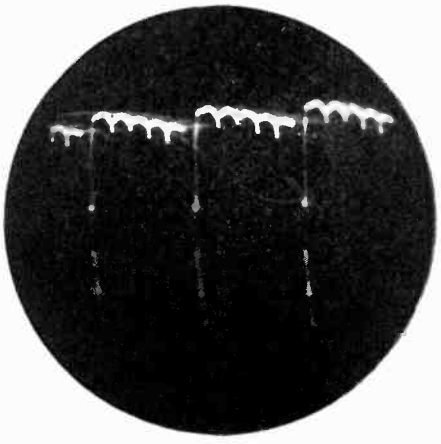
Several HANDIES are shown on this page. They are the equivalent of 3" x 5" cards, which can be filed in a card file. Each is identified with a manufacturer, a receiver model and a trouble symptom and fault—and each card states the permanent cure as described by the set manufacturer.

Examine the cards shown on this page. They are just a few of the 240 Handies which

(Continued on page 24)

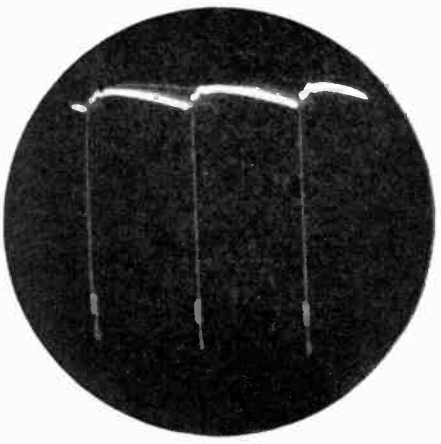
(A)

Fig. 1A. Picture distortion observed when stray-capacitance balancing capacitor across horizontal deflection coil is too large.



(B)

Fig. 1B. Voltage across horizontal deflection coil displays four troughs, each corresponding to a foldover in the picture.



(C)

Fig. 1C. Normal voltage waveform across horizontal deflection coil. A certain tendency to ring at the end of retrace appears, due to tolerances of circuit components.

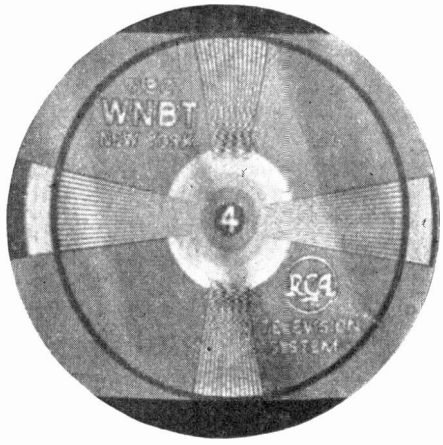
Interpreting Scope Waveforms in TV Servicing

by Bob Middleton

The importance of knowing how to interpret waveforms seen on a service oscilloscope is not fully appreciated by most tv service technicians. There is a tieup between the picture observed on the screen and the oscilloscope waveforms observed at various test points on a chassis. Knowing how to interpret these waveforms will cut service time to a minimum and make for better servicing.

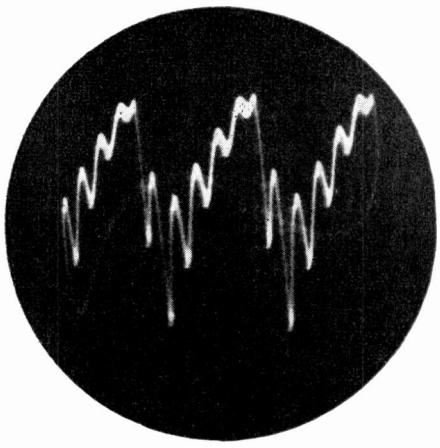
As an example of the relationship between the picture on the tv screen and the waveforms in the circuit, refer to Fig. 1, which shows the picture and voltage and current waveforms resulting from distortion introduced by the horizontal deflection circuit. The various waveforms and the circuit conditions causing them are described in the captions.

The shape of the sync pulse of a tv receiver is closely related to picture reproduction. If the picture rings, the sync pulse will also ring. Ringing is increased as the bandwidth of the amplifier is narrowed and as the picture carrier is run further down on the response curve. The various scope patterns reproduced in Fig. 2 show the effects of ringing on the picture tube as well as on the chassis waveforms.



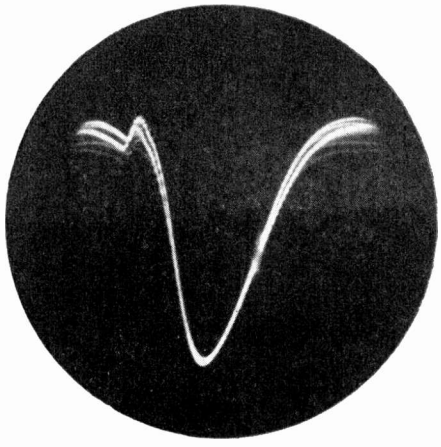
(C)

Fig. 2C. Ringing produced in test pattern when i-f amplifier bandwidth is narrowed. (See Fig. 2D)



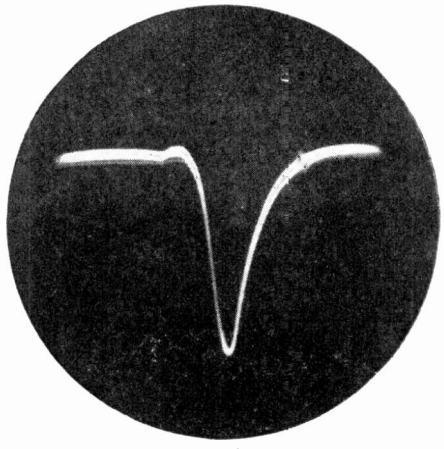
(D)

Fig. 1D. Current through the horizontal deflection coils when excessive balancing capacitance is used. Four troughs are displayed, as in the voltage waveform (Fig. 1B), but the waveform details differ, due to current and voltage association with a reactive (inductive) circuit.



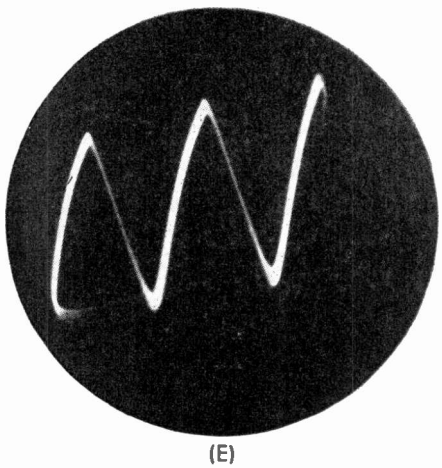
(A)

Fig. 2A. I-f amplifier bandwidth wide enough to avoid ringing. Picture carrier is seen halfway up curve



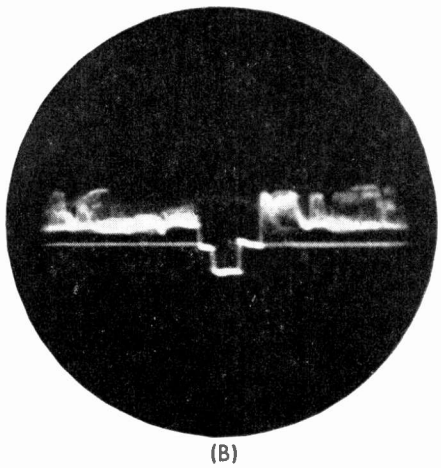
(D)

Fig. 2D. Narrowed i-f amplifier bandpass which produces ringing in test pattern, as well as overshoot and ringing in sync pulse. Picture carrier, seen very low on curve, aggravates the distortion.



(E)

Fig. 1E. Normal sawtooth. The sawtooth is somewhat non-linear, due to misadjustment of the drive and linearity controls.



(B)

Fig. 2B. Sync-pulse waveform produced by response curve of Fig. 2A.

(E)

Fig. 2E. Distorted sync pulse produced by response curve of Fig. 2D. Low placement of picture carrier attenuates sync pulse, and causes instability of sync action in many cases. Scope gain was advanced to obtain sufficient height of display on screen.

Chassis Coding

How does the radio and tv receiver manufacturer code his chassis? Some use the RTMA numbering, others use letters, numbers, triangles, etc. This information is very important to every service technician because it is the best means for correlating the service data which appears in RIDER MANUALS, TEK-FILES, and other of our literature with the actual chassis at hand. It is especially important in the association of circuit changes and trouble cures applied to different production runs of a receiver.

We are surveying the manufacturers for such information and shall print this data in SUCCESSFUL SERVICING. Make certain that you keep these data on hand. File them with your Rider Manuals or Tek-File Folders.

Alliance Mfg. Co. rubber stamps the bottom plate of their tv booster with an *AB* or *AB-1* if the booster is the original Tenna-Scope design or *AB-2* and *AB-5* for later production models.

It is the practise of the *Altec Lansing Corp.* to include a schematic diagram with each tuner, and this drawing indicates the serial numbers to which the drawing applies. The schematic is changed every time any principal change is made in the circuit and the identificaton of serial numbers is put in the lower right-hand corner.

Any major change in circuit or mechanical design which would render original drawings obsolete, is accomplished with a change in Model No., advises the *Anchor Radio Corp.* Minor substitutions or changes in mechanical parts, that still leave all components of a particular unit interchangeable, are not indicated in an original Model No. or a particular serial no. Only the individual part is so identified (A, B, C, etc.) and the replacement parts shipped will always be of the latest type.

Arvin Industries, Inc. identifies changes of consequence in production runs by a dash (—) number following the chassis no. For example, take the TE 302 chassis. On the schematics applying to the different production runs of this chassis, changes are outlined showing how they differ from the preceding dash number. The added number (now TE 302-1) is "impressioned stamped" on the back flange of the chassis.

Motorola, Inc. rubber stamps their chassis for the initial runs with a plain chassis number, such as TS-314. When subsequent changes are made, a letter is added behind the chassis number, such as TS-314A, TS-314B, etc.

The *Crosley Division* of the *Avco Mfg. Corp.* indicates major changes by a change in the suffix number of the chassis model. For example, 356-1 used 17" rectangular glass picture tube. When a 17" rectangular metal tube was used, the chassis number became 356-2 and when a 17" rectangular glass tube with electrostatic focusing was used, the chassis number became 356-3. On minor changes, such as changing resistor values or other changes that affect the wiring diagram, the change is indicated by a code letter rubber stamped on the top of the chassis at the right-hand corner as viewed from the rear of the set.

The *Fada Radio and Electric Co., Inc.* identifies their radio receiver models by a white licensee label or tube layout label. These labels are glued on either the bottom or inside wall of the cabinet and have the Model No. printed on them. Circuit changes are indicated by a large alphabetical letter stamped on either the Rear Chassis Apron or Loop Backing. Their tv receiver models are identified by a white model and licensee label glued on the Rear Apron of the tv chassis. Circuit changes are indicated by a large alphabetical letter (or double lettering if more than one circuit change has been made) on the Rear Apron of the tv chassis. Serial numbers on both radio and tv chassis only serve to individualize the chassis.

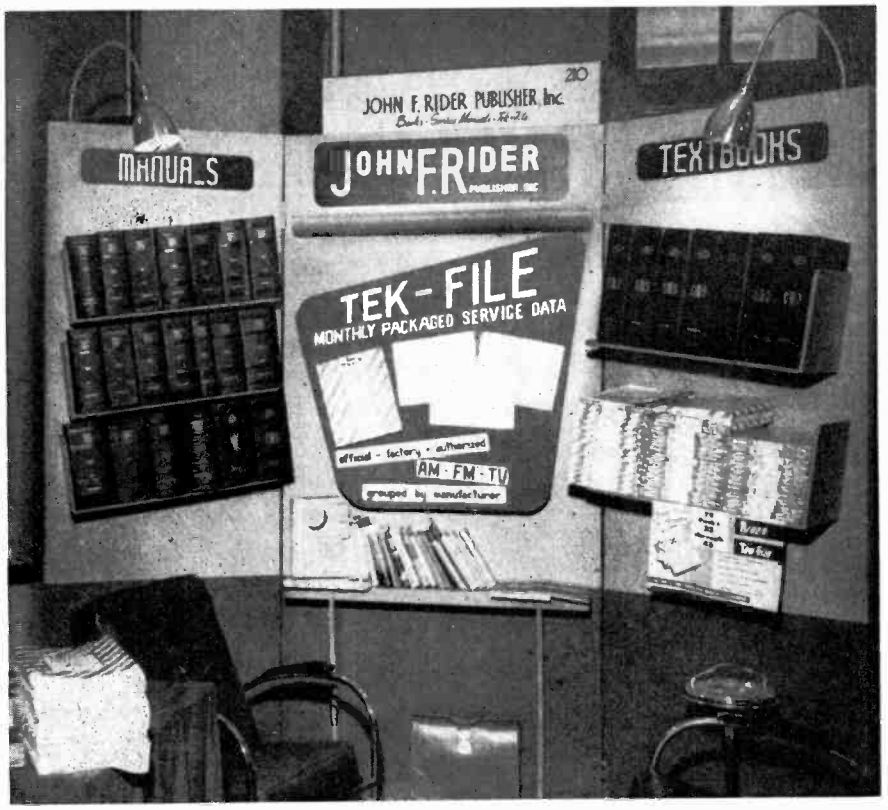
As of January 1, 1951, the *Tele-Tone Radio Corp.* has been using a new system for coding their receiver chassis. The 7000 series of chassis numbers indicate tv receiver chassis with no power transformer and the 8000 series indicate tv receivers with power transformers. Prior to this date, a letter system (TAO, TAH-UL, TAP-2-UL, etc.) was used. The new, rubber-stamped series can be found on the rear apron of the chassis or next to the power transformer.

In order to indicate a major change, such as substitution of a tube and associated circuits, the *Zenith Radio Corp. adds a Z, Z1, Z2* or even double Z's to their model numbers. A corresponding service note is printed and sent out to the field. These numbers would definitely allow the service man to be able to identify a chassis for its original design and subsequent modifications.

Western Auto Supply's principal method of coding is by the use of letters following the Truetone Model No., that is, original production runs will be identified by the Model No followed by either no letter designation or the letter "A." Any changes in design or circuitory which would make service literature as originally published no longer correct, will result in the changing of the Model No. by adding the letter "B." An example of this would be as follows: 2D2052A would be the original production run. 2D2052B would be a suppliance production run in which major changes have been incorporated. Each of these would have its own set of serial numbers. Minor changes in any given Model are handled by issuing a supplement to the original manual.

The method of coding used by *Gamble-Skogmo, Inc.*, is to have the Stock No. attached to the base on the back of the chassis. The initial run of a given set carries their regular Stock No. such as 43-1000. Any subsequent changes in circuits or parts are designated with alphabetical suffixes such as "A" for the first change, "B" for the second change, etc.

I.R.E. SHOW AT PALACE *HUGE SUCCESS*



The John F. Rider Booth at the I.R.E. convention, showing Rider Manuals and TEK-FILE in background.

Over 27,500 members of the Institute of Radio Engineers, including scientists, engineers and executives from nearly every country of the world, attended the I.R.E. annual convention from March 3-6. The forty year old I.R.E. is the world's most influential and fastest growing organization devoted to radio, television and allied sciences.

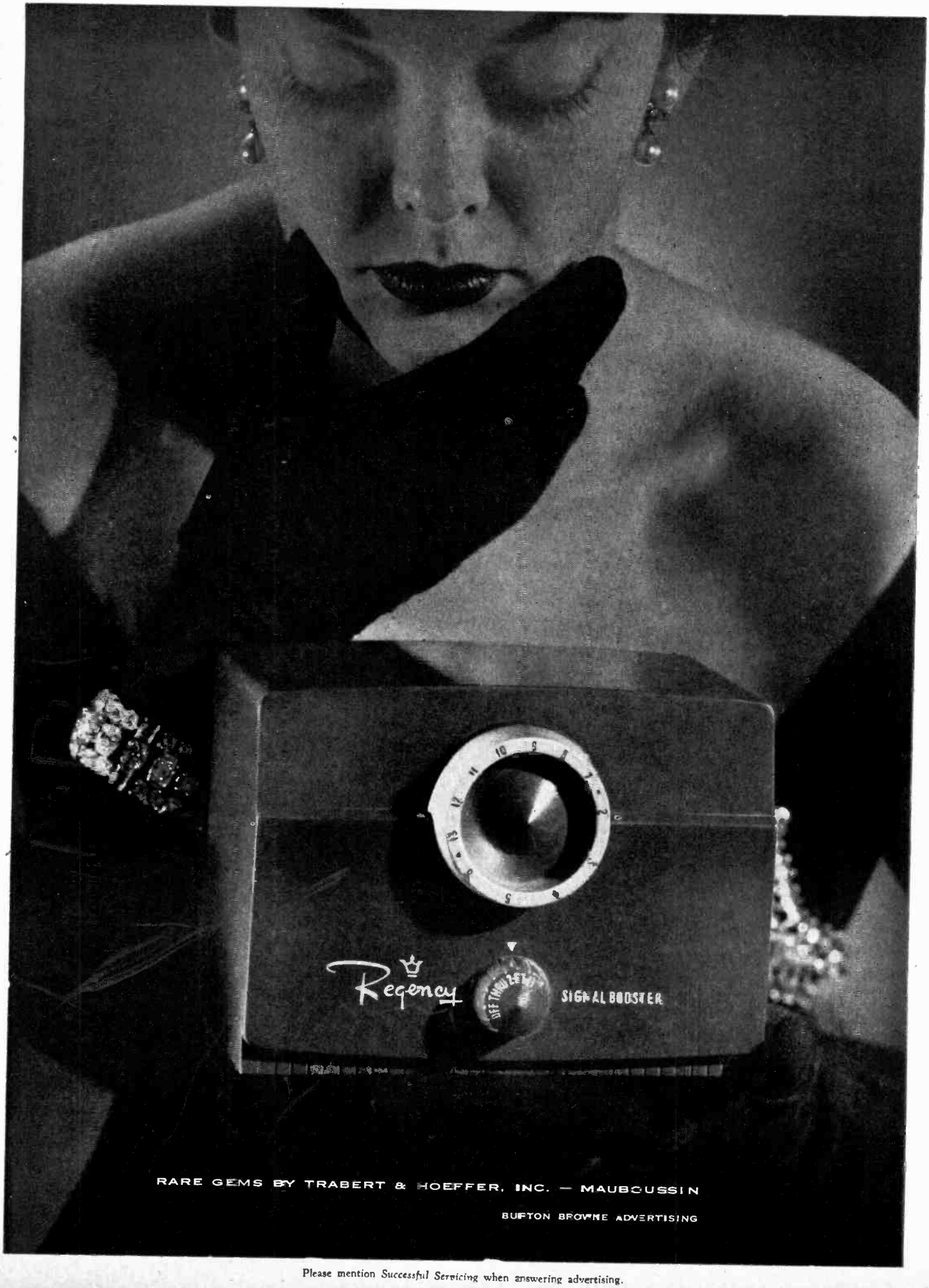
The convention enabled over 350 companies to exhibit and demonstrate more than ten million dollars worth of radio and electronics apparatus on four floors at Grand Central Palace. The Radio Engineers' show featured exhibitions of special military radio equipment, including atomic radiation detection devices and guided missile trajectory plotters. Demonstrations from the countries leading electronics manufacturers and research laboratories included items ranging from small "transitors," which someday may replace vacuum tubes, to full sized television transmitters.

Another major feature of the I.R.E. convention was the extensive series of technical sessions and forums on research, production and design in the radio and technical fields. Over two hundred papers, covering nearly every phase of the radio electronics field, were presented in meetings at the Waldorf-Astoria. Color television was discussed and an emphasis given to UHF transmitters and receivers with the description of a new, compact UHF receiver tuner to be assembled in new sets at the factory and a forum on new UHF antennas and experimental amplifiers. Other meetings included discussions on instrumentation, information theory, circuits and microwave-guides.

All in all, the convention was pretty terrific, and if an editorial note may be added, the staff at the John F. Rider booth certainly enjoyed "meeting you at the show."

Attention TV Service Technicians!

Please bear with us a little longer. The publication of the TV TROUBLESHOOTING AND REPAIR GUIDEBOOK is being delayed because we are making it the most complete possible. It is a broad subject and filled with variations. We'll be off the press very shortly.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2. Return tubes may be of ANY MAKE but must be types shown on the suggested Sylvania Glass Allowance Price List. (See list below.)
3. Returned tubes must be under vacuum and free from chips, scratches, etc.
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Here's your Suggested Glass Allowance PRICE LIST

(Clip this list and keep it handy)

12KP4A	$2.25	17AP4	$2.25	20CP4	$4.25
12LP4A	2.25	17BP4	2.25	20CP4A	4.25
12VP4A	2.25	17BP4A	2.25	20DP4	4.25
		17BP4B	2.25	20DP4A	4.25
16JP4A	3.25	17FP4	2.25	20FP4	4.25
16KP4	3.25	17FP4A	2.25	20GP4	4.25
16KP4A	3.25	17HP4	2.25	20HP4	4.25
16LP4A	3.25	17JP4	2.25	20HP4A	4.25
16QP4	3.25	17KP4	2.25	20JP4	4.25
16RP4	3.25	17LP4	2.25	21EP4	5.25
16TP4	3.25	17QP4	2.25	21EP4A	5.25
16UP4	3.25	17RP4	2.25	21FP4	5.25
16XP4	3.25	17SP4	2.25	21FP4A	5.25
16ZP4	3.25			21KP4	5.25
				21KP4A	5.25

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Gentlemen:

I would like to take this opportunity to thank you for making SUCCESSFUL SERVICING available to us independent service men. The articles are of the utmost interest to me, and the world of help.

I'd like also to congratulate you on the wonderful job you are doing for service men through the use of TEK-FILES. I used TEK-FILE #1 on an Admiral. It contained such a wealth of information that I completed the repairs in one fourth the usual time. The owner of the Admiral was so pleased that through his recommendation I received several more Admirals for factory—recommended changes listed in TEK-FILE. Now I use TEK-FILE on every set I repair if the model is available. I anxiously watch for the new releases each month.

Thank you sincerely.

Respectfully,
HENRY E. SIMS

Please Pardon Us . . .

Our apologies to Mr. Richard Blitzer. Through no fault of his own, a technical error occurred in his article, "Troubleshooting TV AFC Circuits," which ran in the March issue of SUCCESSFUL SERVICING. Two paragraphs dealing with Fig. 1 and beginning with "If the horizontal oscillator frequency changes . . ." should have read as follows:

If the horizontal oscillator frequency changes, say it attempts to *decrease*, then the phase relationship between the sine waves and the stable sync pulses also changes. The sync pulses are now *higher* in frequency than the sine waves. This results in V1 conducting more heavily than V2. As a result, the voltage across R1 is larger than that across R2. The discriminator's output is now the —2 volts added to the net voltage developed across R1 and R2. This results in a smaller negative voltage being applied to the grid of the control tube. Consequently, the plate current of V4 rises. This causes a change in the amount of injected reactance so that the oscillator's frequency is *increased*.

Under opposite conditions, when the oscillator frequency tends to *increase*, V2 conducts more heavily than does V1. The net output voltage of the discriminator is then negative. This increases the negative bias on the reactance tube which causes the oscillator frequency to *decrease*.

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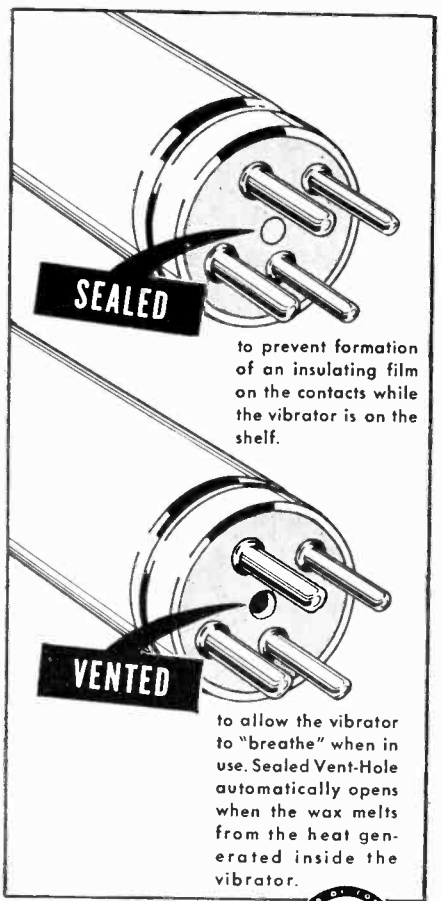

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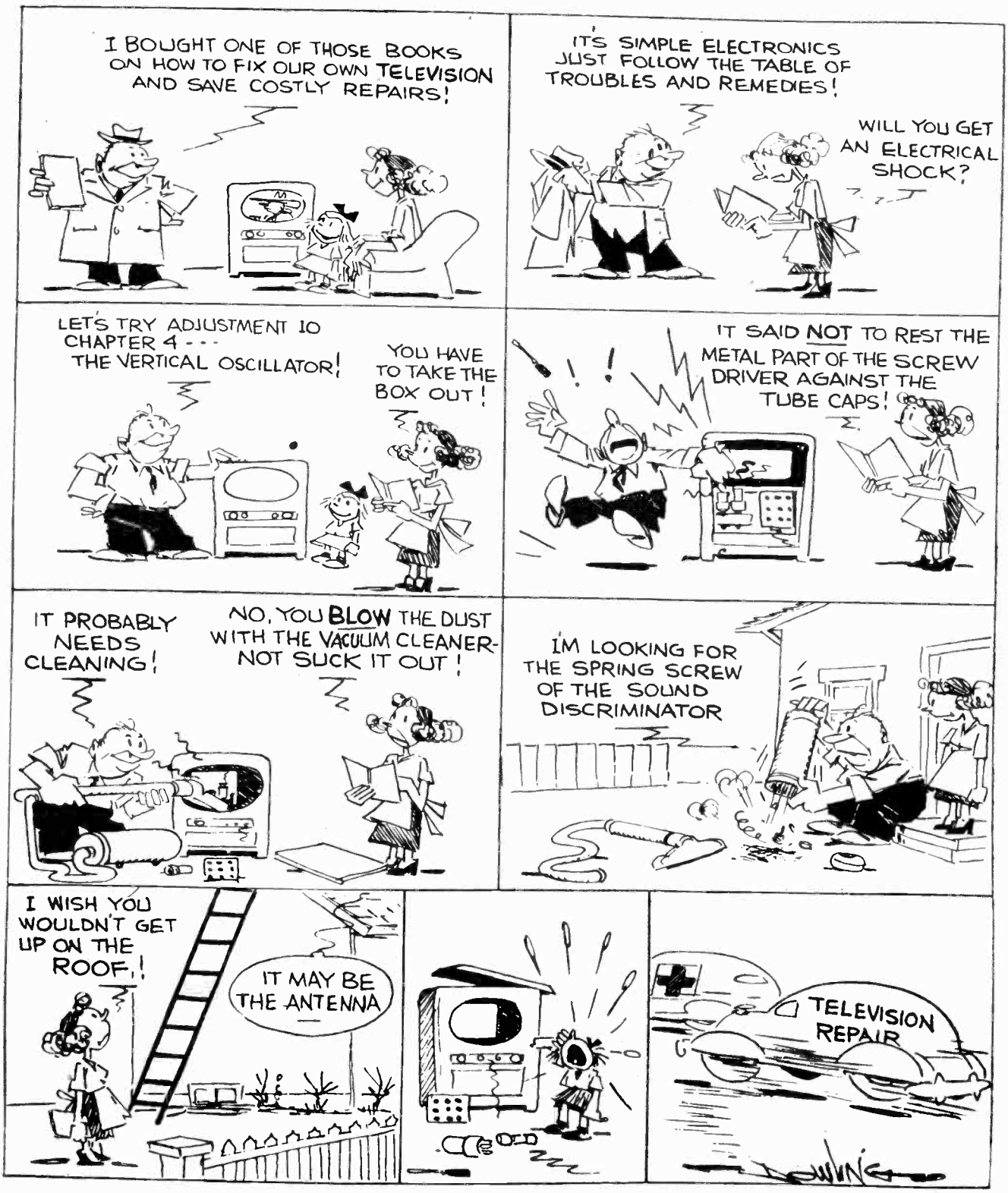
HOW TO FIX YOUR OWN TELEVISION SET

We know of no better way of indicating the status of home TV service by the set owner than this cartoon by Dowling of the *N. Y. Herald Tribune*. It appeared in the aforementioned newspaper. We think it's terrific!



FRANK J. MOCH, president of the National Alliance of Television and Electronics Service Associations.

Frank J. Moch says— "there is no other OSCILLOSCOPE like the NEW Simpson MODEL 476 MIRROSCOPE"

Simpson's new and completely advanced type of oscilloscope—Model 476 MIRROSCOPE—is designed to eliminate certain inherent disadvantages found in the conventional type of oscilloscope by use of the "Mirroscope principle." In this kind of construction the 5-inch cathode ray tube is mounted in a vertical position, thus reducing bench space requirements to an area of only 9" x 8" thereby permitting better concentration of associated equipment for any type of test procedure. The cathode ray image is reflected from an optical type front surfaced mirror mounted in the adjustable cover at the top of the cabinet bringing the viewing surface of instrument near eye level when instrument is used on benches of normal height. The mirror angle is quickly and easily adjusted to any position of the operator. The cover with integral side wings forms an effective shield against external light sources or may be closed down for protection of the tube and mirror when the instrument is not in use. The upright construction permits location of controls and connections for maximum convenience and allows for internal cathode ray tube connections at the front of the panel instead of the rear.

SENSITIVITY:

Vertical direct.....12 volts rms per in.
Vertical amplifier.20 millivolts rms per in.
Horizontal direct.....14 volts rms per in.
Horizontal amplifier.....38 millivolts rms per in.

INPUT IMPEDANCE:

Vertical direct.....10 megohms, 15 mmf.
Horizontal direct...10 megohms, 15 mmf.
Vertical amplifier.300,000 ohms, 30 mmf.
Horizontal amplifier.....500,000 ohms, 15 mmf.

Horizontal trace expansion is over 4 times tube diameter. This makes it possible to examine minute portions of a response pattern for finer detail.

Linear Sweep frequency is continuously adjustable in five overlapping ranges from 15 cycles to 60,000 cycles. Internal, external or line frequency synchronization with variable amplitude is available.

Means for intensity or "Z axis" modulation is provided. Approximately 14 volts peak will blank a trace of normal intensity.

The vertical amplifier frequency response is within 3 DB from 20 cycles to over 300,000 cycles and is usable to well over three megacycles. Square wave slant and over-shoot is held to less than 5 per cent of amplitude. This response will be found adequate for all phases of television receiver service including observation and diagnosis of Sync. signals.

TUBE COMPLEMENT:

5UP4	Cathode Ray Tube.
4—6J6	Horizontal and Vertical Amplifiers.
1—12AU7	Vertical pre-amplifier.
1—6J6	Linear Sweep oscillator and Sync. injector.
2—6X4	High voltage rectifiers.

LINE VOLTAGE: 105-125 volts, 50-60 cycles.

SIZE: Height 16¼"; Width 9⅛"; Depth 8" over all

WEIGHT: 25 lbs.; Shipping weight 30 lbs.

Hight Frequency Crystal Probe...$7.50

DEALERS NET PRICE including operators manual $179.50

CONSERVE CRITICAL MATERIALS

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie St., Chicago 44, Ill.
Phone: Columbus 1-1221
In Canada:
Bach-Simpson Ltd., London, Ontario

BURTON BROWNE ADVERTISING

ASSOCIATION NEWS

The recent huge success of the first two meetings of the *Elmira Television Dealers Association* has prompted a local group of servicemen to start a similar and parallel organization devoted to television and radio servicing. It has been over ten years since such an organization existed in this city. In the not too distant past, The Relay tried to stimulate interest in such a club but was unsuccessful. It appears, however, that the servicemen are now becoming aware of the importance and even the necessity of such an organization.

The first meeting will be limited to servicemen and service shop operators of Elmira, Elmira Heights, Horseheads and the immediate area around these three cities. This is only temporary and it is expected that as soon as an operating policy and meeting nights, etc. are agreed upon, all servicemen in the area served by The Relay will be invited to membership. It is to be emphasized that this group is meeting to decide on the future of such an organization, its policies, and its possible advantages. If this meeting is successful and an organization is decided upon, it is probable that meetings will be held at least once a month.

In his new job as RTMA service manager, Albert Coumont will coordinate the association's activities "aimed at improving industry practices and policies on TV servicing." Coumont brings twenty years experience in the radio and tv field to his new duties: he's owned his own home radio repair company and participated in home radio service divisions of set manufacturers. Coumont comes to RTMA from a sales manager position at G.E.; his first project for RTMA will be to promote training courses for service technicians in the nation's trade schools.

In the South, the *Radio and TV Technicians Guild of Central Texas* has elected new officers. Marvin F. Hoffman is President, Leslie Fields, V.P. and "Doc" Oliver, secretary-treasurer. This guild assists the service technician in his business management and in exchanging information. It has also voted to maintain a credit similar to that of merchants associations. All dealers and servicemen in Central Texas are invited.

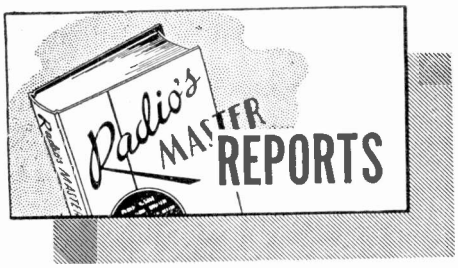
From the West Coast comes word that the *Society of Radio and Television Technicians Inc.* has formed a new technicians group in the Fernando Valley. Twice-monthly meetings are aimed directly at the active technician, with discussions on both his business and technical practices. However, jobbers, salesmen and apprentices are welcome as associate members.

In the mid-West, the Chicago City Council is discussing the writing of a licensing law for service men and companies. *TISA* of Illinois has offered its knowledge on the matter and will take whatever action necessary to serve the interests of the service industry best.

At Elkhart, Indiana, Floyd J. Hutchison, of the Chamber of Commerce, saved the city the expense and trouble of monitoring tv antenna installations by taking action to the organized local dealers and service men under the "Certified TV Installation and Service Program" initiated by *NARDA*. Hutchison secured the city's agreement to hold the proposed licensing measure in abeyance until the dealer organization could present a counter plan to have the dealers themselves police installations.

The Associated Radio and Television Service Dealers of Columbus, Ohio report that appliance dealers in that area are turning all

(Continued on page 24)



A monthly summary of product developments and price changes of radio, electronic, and television parts and equipment, supplied by United Catalog Publishers, Inc., New York City, publishers of RADIO'S MASTER.

These REPORTS will help you to buy and sell to best advantage. They will also help you to keep your inventory up to date. A complete description of most products will be found in the Official Buying Guide, RADIO'S MASTER, available through local parts distributors.

New Items

ASTATIC CORP.—Introduced Carbon Hand Microphone Model 10M5 at $17.70 net.

CHANNEL MASTER—Added 14 new models to their line of Television Antennas and Accessories.

DUOTONE CO.—36 new Diamond Replacement Needles added.

EDITORS & ENGINEERS—"World's Radio Tubes," 9th Edition now available.

ELECTRONIC MEASUREMENTS CORP.—Models 205 and 205P Tube Testers and HVP, High Voltage Probe added.

ELECTRONIC TRANSFORMER CO.—Added 4 new items to their line of Step-Down Auto Transformers.

JENSEN INDUSTRIES—Added 6 new "Jensen" Replacement Needles (Shure Bros.) for Standard, All Purpose and Micro-Groove. Also added Jensen cutting needles No. WG-65, Wilcox Gay (Stellite) cutter playback combination for 78 RPM records . . . and WG-652, Wilcox Gay (Stellite) cutter playback combination for 33-1/3, 45, and 78 RPM records.

J F D—Added 2 Indoor Antennas . . . 7 Zoom-up Masts . . . 3 Screw Eye Standoffs #NUT 350-550-750 . . . Screw Eye Standoff Insulators #DNUT 350-550-750 . . . Pre-Amplifying Coupler EC4 and Open Line Wire Lead In OL-100 and OL-250.

OXFORD ELECTRIC—Added 16 new items to their line of Loudspeakers.

PERMOFLUX—Added 3 new Speakers, #4CM and 45CM to their "Champion" line and 15WP-8-1 to their "Royal" line.

PRESTO RECORDING—Added #CS-10 at $52.00 net to their line of Recording Equipment.

RADIART CORP.—Lightning Arrestors TA-5-DP and TA-5WS added at $.75 and $.81 net . . . added Yagi 4YG45 for Channels 4 and 5.

R. C. A.—21 Electron Tubes and 4 Kinescopes added.

RECOTON CORP.—Recoton Replacement Phoneedle Kits #150 and 550 added . . . also 11 "Recoton" Replacement Needles.

RIDER, JOHN F.—TEK-FILE Packs 49 thru 56 available at jobbers this month ($2.00 per pack).

SHELDON ELECTRIC—Added TV Tubes 16AP4A and 21KP4A to their Blue Label and White Label series.

TELREX INC.—Added ¼ wave and ½ wave Transmission Line Coupler and E-Z Rig "Clover-V-Beam." Also TVB-1 and TVB-2, Telrex "V-Beam" w/Hi-V Reflector, and "Hi-V-Reflector" Adapter added to their line of "Conical-V-Beams."

THORDARSON-MEISSNER—23 TV Replacement Coils added.

TRIPLETT—Introduced Model 650 at $69.50 net to their series of Test Equipment.

VACO PRODUCTS—Added Lynn Lightning Solderless Terminals #2600 at $1.00 net per pack of 50 and #3300 at $1.00 net per pack of 50.

VAN CLEEF—Added line of Dutch Brand Rubber Bonding Cement . . . Dutch Brand Rub'r Shim and Dutch Brand .010 Plastic Electrical Tape.

Discontinued Items

AMPHENOL—Withdrew 4 Steatite "CP" Type Plugs 49-245, 255, 265, and 285 . . . also packaged 300 Ohm Twin Lead #184-803 and 184-804.

CHANNEL MASTER—Withdrew 7 models from their line of Television Antennas and Accessories.

E. F. JOHNSON CO.—Temporarily discontinued 97 items on their line of Radio-Electronics Products.

OXFORD ELECTRIC—Withdrew 15 items from their line of Loudspeakers.

PERMOFLUX—Withdrew 17 Permoflux Speakers.

RAM ELECTRONICS—Withdrew X052 and X055 Horizontal Output Transformers.

T-V PRODUCTS CO.—Withdrew MJ-1, Mast Joiner Mount and RM-5, Roof Mount.

UTICA DROP FORGE—Tools #43-5", Wire Stripping Diagonal Cutting Pliers . . . 49-5", Plastic Cutting End Nippers . . . 52-7", Side Cutting Pliers . . . 26-7", End Cutting Nippers withdrawn.

Price Increases

BEAM INSTRUMENT CO.—Increased prices on Loading Casettes and Receiving Casettes in their series of Cossor Oscillographs and Accessories.

ELECTRO-VOICE—Increased prices on 24 items on their line of Mikes, Phonograph Pickups and Cartridges.

GARRARD SALES CORP.—5 items on their line of Record Playing Equipment increased.

KENYON TRANSFORMER—Revised their entire price line up in accordance with CPR 22 Sup. Reg. 17.

KESTER SOLDER CO.—Increased prices on 1 lb., 5 lb., and 20 lb., spools of Rosin Core, Acid Core and "Resin-Five" core Solder Spools.

PERMOFLUX—Increased prices on Monaural Headsets #DHS-1B, DHS-15B, DHS-17B and DHS-28B.

R. C. A.—52 Electron Tubes and 191 Receiving Tubes increased.

RAYTHEON—15 Special Purpose tubes increased "due to higher material and manufacturing costs."

RIDER, JOHN F.—Increased price on "FM Transmission and Reception" to $4.95, March 1st.
April 1st increases:
"TV Installation Techniques" to be $4.50;
"TV and Other Receiving Antennas" to be $6.60;
"Receiving Tube Substitution Guide Book" to be $3.00.

SHELDON ELECTRIC—Increased prices on TV Tubes 19AP4A, 19AP4B and 19AP4D in their Blue Label and White Label series.

SYLVANIA—51 Receiving tubes increased in price.

WINCHARGER CORP.—Increased price of Roof Mount Towers 15805 to $8.95 net and 15810 to $17.90 net.

Price Decreases

ELECTRONICS, INC.—Decreased prices on 26 items on their line of Rectifier Tubes and Grid Control Rectifiers (Thyratrons).

ELECTRO-VOICE—22 items on their line of Mikes, Phonograph Pickups and Cartridges have been decreased in price.

GARRARD SALES CORP.—Decreased prices on #RC80-C and RC80-DC on their line of Record Playing Equipment.

G. E.—Two 10" TV Tubes, two 12" TV Tubes and two 16" TV Tubes decreased in price.

PERMOFLUX—14 Speakers on their line decreased in price.

PHILSON MFG. CO.—Decreased prices on #101, 102 and TWM 4 in their line of antennas.

PRECISE DEVELOPMENT CORP. — Reduced #999-R to $2.80 net on their line of Electronic Test Equipment.

R. C. A.—19 Receiving Tubes, 8 Electron Tubes and 13 Kinescopes reduced in price.

RECOTON CORP.—Decreased prices on 4 "Recoton" Replacement Needles #305, 6, 7, and 10.

SARKES TARZIAN—Reduced prices approximately 20% on Universal Replacement Tuners TT5R21 and TT5R41.

SHELDON ELECTRIC—Decreased prices on 4 TV Picture Tubes in their Blue Label series, and 5 TV Picture Tubes in their White Label series. . . . also price of Microphone Replacement Cart-Cartridge (carbon) #101C and 102C to $16.50 net . . . also price of Microphone Replacement cartridge (carbon) #R10 to $4.80 net.

SOLA ELECTRIC—Added quantity discount for 5 and up on 31 items on their line of Constant Voltage Transformers.

SYLVANIA—Decreased prices on 7 Subminiature Tubes, 7 Radio Receiving Tubes and Special Purpose Tubes OD3 and 6X5WGT.

TRIO MFG. CO.—Towers 101-A-B and 101-CUC reduced to $7.50 net.

UTICA DROP FORGE—91 Series of Adjustable Wrenches (7 Wrenches) reduced approximately 5% list.

VIBRALOC CORP.—Decreased prices on 8 items on their line of Loudspeaker Baffles.

Miscellaneous Changes

SYLVANIA—Announced that 41 TV Tubes are now subject to Dealer Glass Allowance on purchases of new Sylvania TV Tubes.

TV *versus* Radio Repair

(Continued from page 9)

have been released in Rider TEK-FILE PACKS 1-48. Thousands more are coming. Wouldn't it be a horrible waste of time, money and effort to ponder and experiment in an attempt to cure these faults when you run into them in these receivers? All you have to do is to get the proper TEK-FILE or Rider Manual, and these examples of *known art* are ready to serve you. They'll make your whole servicing job easier—they'll make your whole day better.

TEK-FILE HANDIES reflect what the receiver manufacturer has learned about troubles in his receiver. It is the kind of known art which helps the man who is not thoroughly familiar with tv receiver design. It is the kind of known art which saves hours of effort and aggravation. It is the difference between making a TV receiver repair job temporary and troublesome—or making the repair permanent, and a prestige builder.

Make Rider Manuals and TEK-FILES your background, your technical know-how. They'll serve you day after day, month after month, and year after year—and with exactly the same information as the receiver manufacturer uses in his own plant and in the shops of his distributors.

Association News

(Continued from page 22)

their "retail" service calls over to ARTSD members with good results.

On its second anniversary, the *Radio and TV Technicians Guild of Florida* was unanimously accepted into the NETDSA this month.

NETSDA itself, at its regular monthly meeting in Harrisburg, acted upon the matter of its own incorporation, moving to make an application as a non-profit corporation with the State of N. Y. National Headquarters of the association have been moved from Washington to New York City. At the annual election of officers, Max Liebowitz was re-elected president and Roger Haines V.P. At an earlier meeting, in Philadelphia, a report was made on the progress of Radio-TV Licensing in New York City and the State of Pennsylvania.

Have you written your Congressmen expressing your opposition to House Bill #HR 6219? This bill would require all electrical appliance manufacturers to include a repair booklet with each sale of a radio or tv set. Such a bill would license all set owners to attempt to repair their own receivers; it would endanger set value by causing the general public to attempt repair without qualification; it would cause untold loss to dealers selling sets on time to tampering customers. For the set owner, radio and TV receivers are conveniences to be enjoyed, not jig-saw puzzles to be played with.