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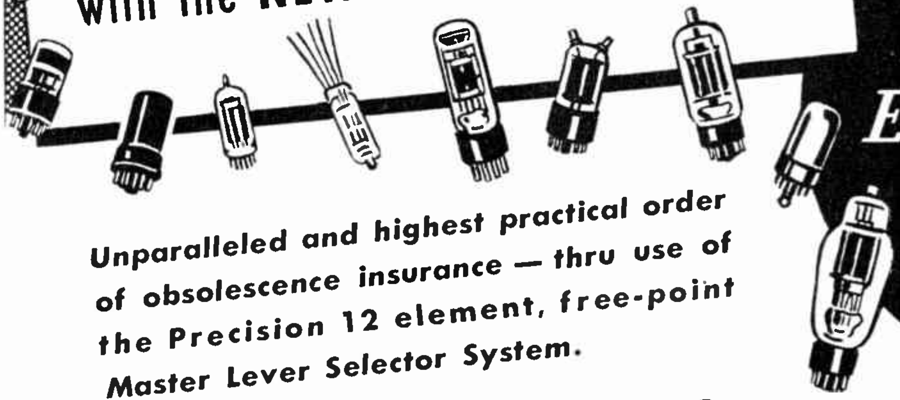

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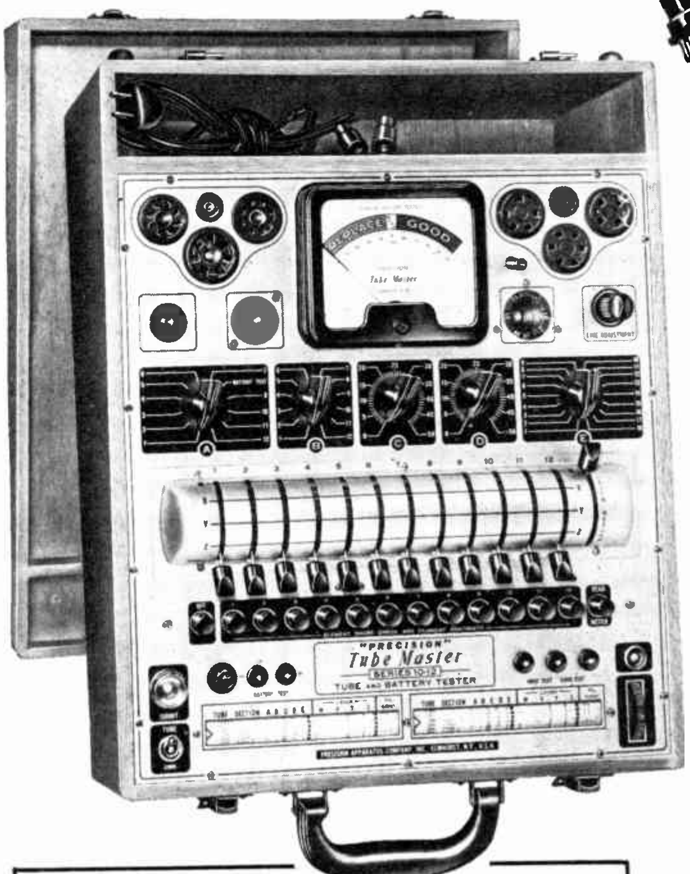

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How to improve your SIGNAL TRACING techniques

by
Irving Dlugatch

Tracing instruments can be most profitable if thoroughly understood

THE service technician has for some time found the signal tracer a valuable aid in his business. Recent advances in equipment design are increasing the scope of this servicing approach. By keeping up to date about signal tracer problems the serviceman will find extra opportunities for efficiency and greater profits. In the following discussion, we will consider some of the problems involved in signal tracing and how to solve them.

Past and present methods of troubleshooting both consist of (1) localization of the trouble, (2) identification of the defective part. The localization can be done either by *static* or *dynamic* methods. In static systems we check operation by meter readings. In dynamic testing, we trace the course of an actual signal through a receiver, thus locating the point at which the signal stops.

Oddly enough, the first dynamic signal tracing was introduced by the so-called "screwdriver mechanics" who had very little equipment. The procedure they used is to touch the grid of each tube and listen for the resulting click in the loudspeaker. The first grid that gives no click indicates a defective stage. Tubes without grid caps and present day high voltages make this system less practical. Also, this method cannot measure stage gain, test superhetrodyne oscillators, or any other special circuits.

Static Methods

As the use of testing meters increased, we turned to static troubleshooting. Early receivers were simple and adapted to multimeter servicing. Meter servicing means we must test at every socket until the fault is located. Results often depend on the amount of information we have from the manufacturer. Many troubles do not show up on voltage or resistance tests. Open coupling condensers, open bypass condensers, shorted coils, and low capacity filter condensers are hard to find with the multimeter.

The "point to point" system of testing is also a static type. It calls for measuring the resistance between tube socket terminals and the chassis, B plus or any other convenient point and comparing with factory data. This method is not very useful because it requires full data on resistance values. These data are not usually available.

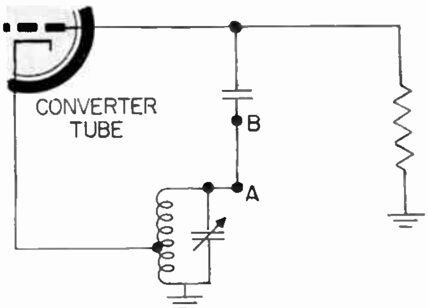

Fig. 1 A signal generator substituted for the local oscillator can be used to check for oscillator failure. The wire between A and B is broken and the signal generator connected to those points.

Dynamic Testing

Dynamic signal tracing "arrived" with reliable signal generators. Now, instead of the audio click supplied by the serviceman's finger at a tube grid, we can feed a modulated signal of the correct frequency into a receiver at any point. We can tell where the signal stops and then proceed to find the defective part with a meter. Defective coils, interstage transformers, tubes, and coupling condensers can be quickly located.

We can use signal generator output to check for oscillator trouble. To do this: Break the circuit at point A (See Fig. 1) and connect the output of the signal generator between point B and ground. Stage gain can be checked by comparing the strength of the signal when the generator is fed into the stage output and input circuits respectively. An output meter is desirable for this purpose; but, in any case, watch out for AVC effects!

Dynamic testing with just a signal generator has limitations. It won't often find the causes of distortion, hum or noise. The selection of the proper frequency and modulation slows down the process of troubleshooting. The overloading of tubes which occurs with excessive signal may give confusing results.

Tracing Equipment

The first signal tracing equipment especially designed for the purpose was the Rider Chanalyst which is a tuned signal tracer (see Fig. 2). A special probe is connected to an untuned amplifier followed by three stages of tuned RF amplification. These stages have a flat response over the broadcast band. A detector, followed by a 6E5 "eye" tube indicates signal strength. Sufficient gain is available to observe minute signals from a test oscillator or from a station on the air. Separate circuits are provided for audio amplifier and oscillator checking so the signal can be "watched" at more than one point at the same time. Power supply operation can also be checked. A tuning eye watt meter shows power drain and a DC voltmeter monitors the plate voltage. The serviceman can thus find intermittents as they happen. Fig. 3 illustrates by block diagram how this is accomplished.

Signal tracers which use untuned amplifiers are now available at low cost. This type has the advantage of speed and ease of operation. Since no tuning is necessary, the same probe can be used anywhere in the receiver. But there is no multichannel feature which makes the Chanalyst so useful for finding intermittents. Tuned and untuned tracers have the common disadvantage of requiring an external signal source. On the other hand, using a signal generator for signal tracing does not eliminate the necessity for an output indicator. The signal tracer is in effect a sensitive output indicator. A complete shop must include a signal generator and a signal tracer.

Requirements

It is important that you understand the signal tracer you use and realize its limitations. The requirements of a good signal tracer can be listed as follows:

1. Connecting the instrument to the receiver should not detune, load

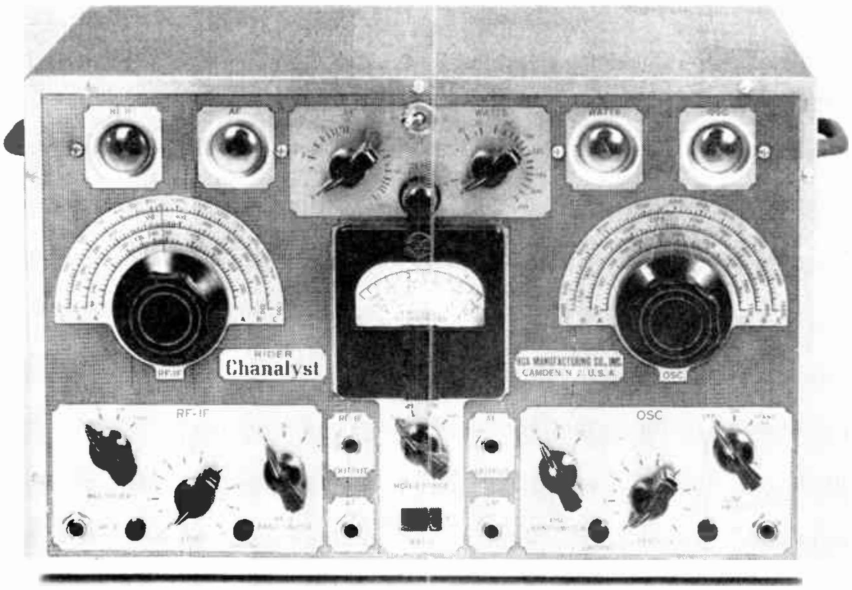

Fig. 2 The Rider Chanalyst is an example of the tuned multichannel type of tracer.

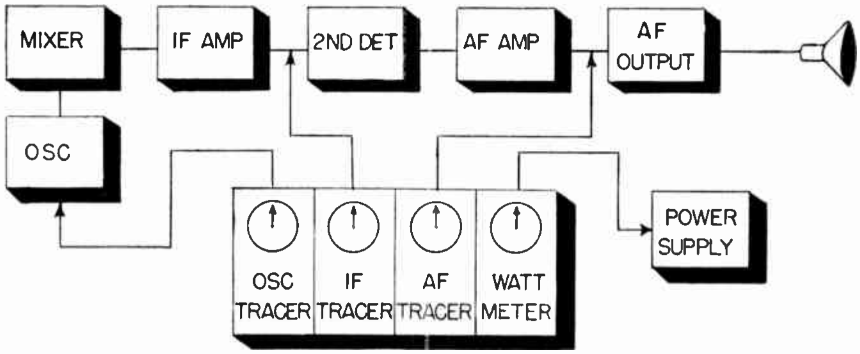

Fig. 3 How the Chanalyst is used to localize intermittents in a superheterodyne receiver.

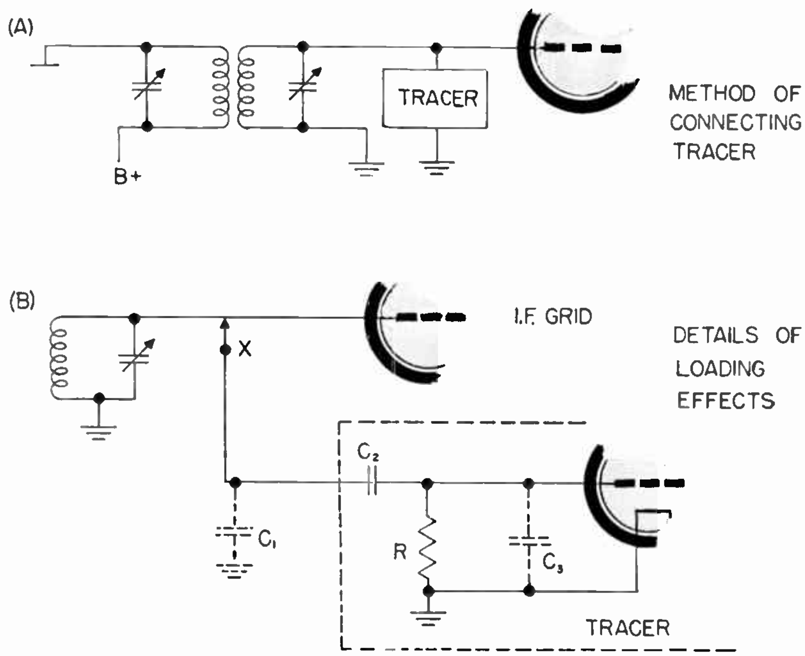

Fig. 4 How the tracer is connected to an IF stage and its effect on the circuit. A, where to connect tracer; B, details of loading effects.

or otherwise affect the operation of the receiver.

2. The gain of the tracer should be sufficient to permit its use with extremely weak signals.

3. The tracer should have a sensitive signal strength indicator.

4. It should provide means for listening to the signal.

Suppose we connect the input lead of the tracer across the secondary of an IF transformer as in Fig. 4A. The result will be as though a capacitor were placed in parallel with the tuning condenser. Increasing the capacity lowers the frequency to which the secondary is tuned and reduces the signal. It is the same effect you get when aligning receivers if your hand is placed close to the coil being tuned or you are using a metallic screwdriver to adjust trimmers.

Fig. 4B shows in detail what is taking place. C1 is the capacity between the test lead and the chassis. The use of shielded cable may increase this capacity considerably. C3 is the input capacity of the tracer's amplifier tube, and depends on what tube is used. R is the grid resistor shunted by the input resistance of the tube. We have C2 in series with C3; this combination is in parallel with C1 and detunes the transformer. The effect of R is to reduce the Q of the circuit, thus reducing the signal further. By making C2 small, the effect of C3 is made negligible, but C1 can only be offset by the use of special probes.

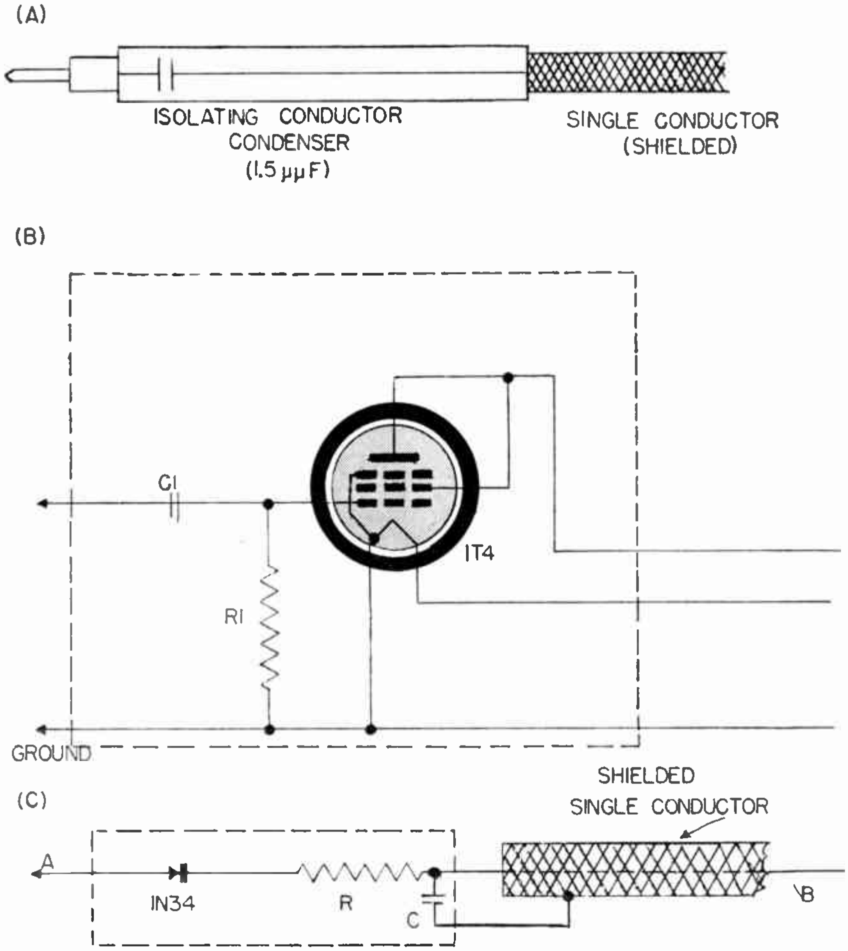

Fig. 5 Three types of probes used in signal tracers. A, capacity type; B, tube detector type; C, Germanium crystal type.

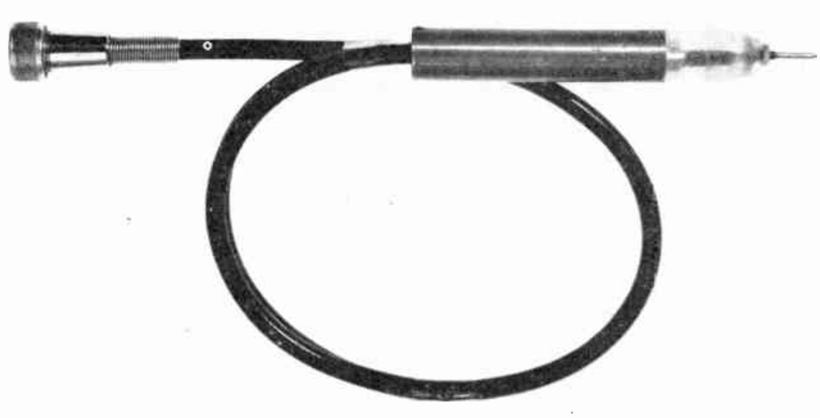

Fig. 6 A high frequency probe used with Jackson signal tracers.

Reducing Capacity Effects

The probe illustrated in Fig. 5A is one means of reducing the effect of C1 (Fig. 4B) since the isolating condenser will be in series with C1 when placed in the circuit at point X in Fig. 4B. Being small in value and placed right at the tip of the probe, it offsets hand capacity introduced in holding the probe. The small value of capacity (large reactance) cuts down the amplitude of the signal carried by the test lead; and, therefore, prevents feedback by induction from the lead to receiver wiring. Otherwise even with shielded wire, high signal levels can introduce feedback. Further reduction of the signal can be obtained by holding the probe near the terminal without touching it. At audio frequencies, the input capacity of the tracer offers a high impedance and there are no detuning effects.

Probe leads which carry RF current are inefficient and radiate too much. That's why the detector probe was developed. This type of probe changes modulated RF to AF; detection takes place right in the probe. The shielded lead then carries only audio frequency currents. A typical probe for use in testing high frequency circuits is shown in Fig. 6.

Fig. 5B shows one type of probe containing a grid leak detector. The tube used is a 1T4 pentode, connected as a triode. A probe of this type is used in the Feiler "pocket stethoscope" shown in Fig. 7. Another tracer with a detector probe is illustrated in Fig. 8.

The response of vacuum tube probes is usually flat to about 10 mc; above this frequency, the output drops off. This makes them unsuitable for signal tracing in modern FM and television receivers. While high frequency tubes are available, a much simpler substitute is the germanium crystal "diode."

Crystal Probes

Those of us who have used crystal sets are familiar with the galena crystal detector. Its ability to pass current readily from the catswhisker to the crystal, but not so easily in the reverse direction, makes it suitable as a detector. During the war, the crystal detector became valuable in high frequency work; and, therefore, its development was speeded. The germanium crystal detector is the result. The construction of a 1N34 germanium crystal is shown in Fig. 9A, and its equivalent electrical circuit in Fig. 9B. C1 is the capacity of the crystal's container. L is the inductance of the whisker used to make contact with the crystal. The whisker is necessary to maintain constant pressure on a small area. C2 is the capacity between the anode and cathode of the "diode." R1 and R2 are equivalent series and parallel resistance of the crystal respectively. Some representative values are:

C1 — 0.4 mmf
L — 0.01 mh
R1 — 10 ohms

R2 and C2 depend on the voltage and frequency, but C2 may be around 2 mmf.

From the above, it is apparent that the crystal does not introduce any serious capacity effects. The 1N34 can be used to over 200 mc. Being no larger than a 1 watt carbon resistor, it is especially suited for use in a signal tracer probe. The circuit is shown in Fig. 5C. Since there is no heater voltage needed, the probe cable is reduced to a single shielded conductor. R is needed to reduce loading while C is to prevent RF from getting through. In using it, a complete DC path must be provided between points A and B. From B to ground, the grid resistor of the tracer amplifier will act as a "diode" load. From A to ground, there must be a DC return in the circuit under test. The crystal does not amplify the signal as does the 1T4; therefore additional gain must be available in the tracer amplifiers.

An important characteristic of a signal tracer is its sensitivity. The

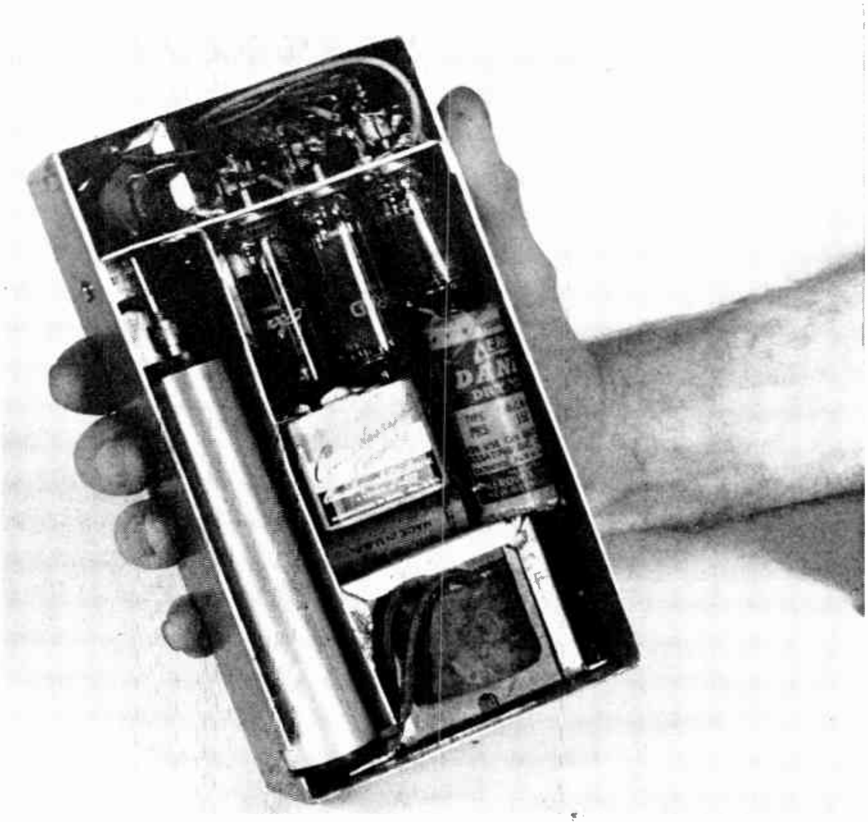

Fig. 7 Internal view of the Feiler "pocket stethoscope."

Fig. 8 A Radio City Products tracer which uses a detector probe.

IF voltage output of a converter may vary from 150 to, say, 1000 microvolts. Sufficient tracer gain must be provided to give a good meter reading. You cannot test parts of a receiver in which even normal signals do not produce an indication. A tracer with a gain of 300 or better will usually produce results even with weak broadcast stations. When crystal or diode detectors are used, there is no gain in the detector and the rest of the tracer must be that much more sensitive. Of course, with high gain, the usual care in shielding and decoupling is necessary.

A high gain tracer can test antenna coils or loops. If the tracer is across the primary, no signal, but a loud hum, indicates an open.

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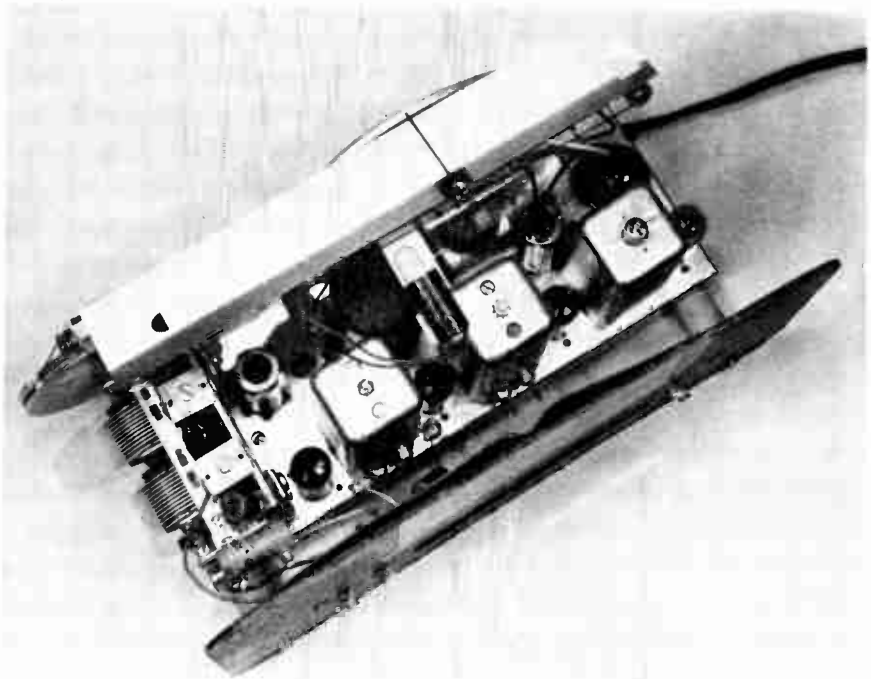


New and different circuit ideas are incorporated in the latest FM receivers

SPECIAL FM CIRCUITS

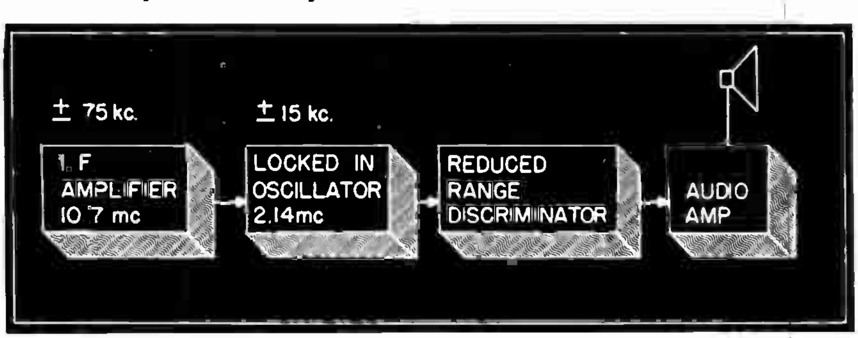
by Milton Kaufman

A SPECIAL circuit designed by G. L. Beers for FM detection is known as the "Locked-In" oscillator. Advantages of this system are: (1) a substantial improvement in selectivity over conventional circuits, (2) an output which is free of amplitude variations when the input voltage is from about .5 to 1 volt and (3) a voltage step up of approximately 20 under weak input signal conditions.

A block diagram of this system is shown in Fig. 1. Here it is seen that the conventional limiter-discriminator combination is replaced by the Locked-In oscillator and reduced range discriminator respectively. The basic operation is as follows: In the second detector, a local signal is provided by an oscillator which is operating continuously and at a constant amplitude. After the received signal has been selected and amplified by the RF and IF amplifiers, it is applied to this oscillator. This causes the oscillator frequency to change in accordance with the incoming signal. The frequency at which the oscillator locks in with the received signal is equal to 1/5 of the IF. Thus in a receiver using a 10.7 mc IF, the oscillator locks in at 10.7 divided by 5 or 2.14 mc. In this way the maximum frequency deviation is reduced from plus and minus 75 kc to plus and minus 15 kc. It should be noted that this does not change the *modulation frequency* in any respect. The oscillator is designed to lock in only with frequency deviations occurring within the desired signal channel. It is this feature which provides the improvement in selectivity by preventing the oscillator from following frequency deviations on an adjacent channel.

A simplified schematic of this system is shown in Fig. 2. Assuming an intermediate frequency of 10.7 mc. the oscillator plate tank circuit, L3-C3 is tuned to 1/5 of this or 2.14 mc. With no signal input, this circuit will function as a normal oscillator at 2.14 mc. and at this center frequency the discriminator output will be zero. Because the amplitude of oscillations is rather large, the tube is driven into the cut off and saturation regions of its characteristic. The oscillator operates at class "C" bias which is established by No. 3 grid drawing current on the positive swings of the oscillations. This bias is maintained by the combination of R1 and C4. Since the tube operates class "C," the plate current flows in

Fig. 1. Block diagram of an oscillator detector receiver.



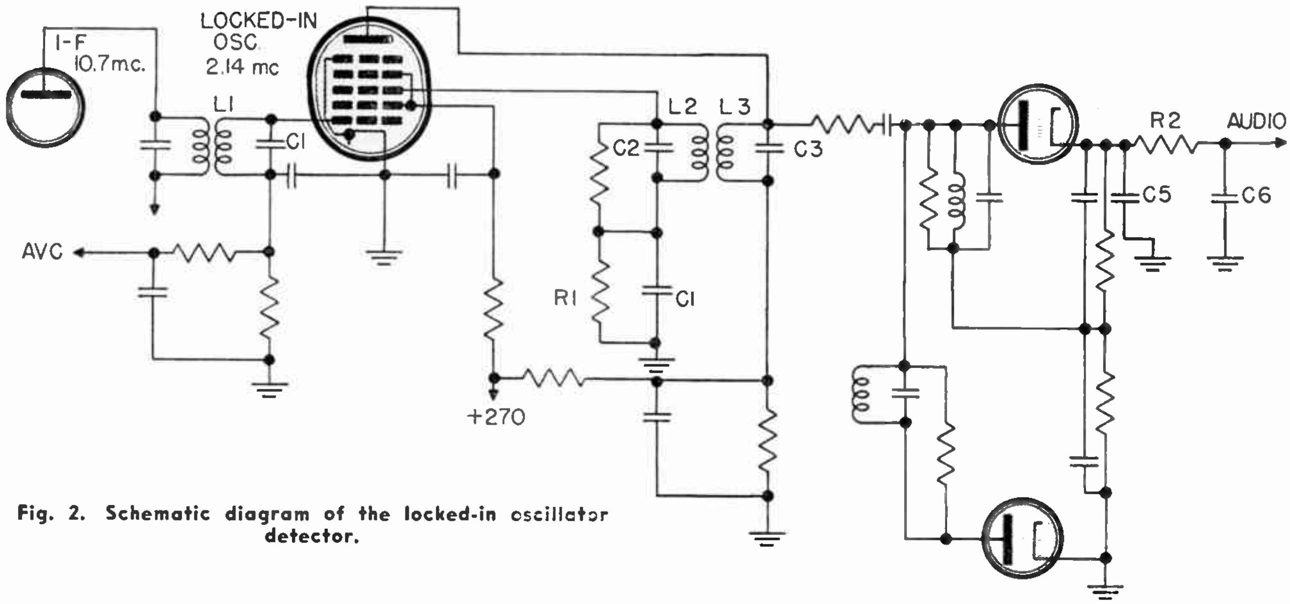


Fig. 2. Schematic diagram of the locked-in oscillator detector.

short pulses. The pulses not only contain the fundamental frequency of 2.14 mc. but also the 2nd, 3rd, 4th, 5th, etc., harmonics of 2.14 mc. The grid tank circuit L2-C2 is tuned to the second harmonic of the oscillator or 4.28 mc. This is done in order to increase the range of frequencies to which the oscillator will lock in and to accentuate the even harmonic (2nd, 4th, etc.) output of the oscillator.

If an input signal of 10.7 mc is now applied to the No. 1 grid, the tube will act as a mixer and combination frequencies will be produced. However, it must be remembered that the plate circuit L3-C3 is tuned to 2.14 mc, and this is the only frequency which will be amplified. All other frequencies will be effectively by-passed This means that in order to have an output frequency of 2.14 mc due to the mixing process, the incoming 10.7 mc signal must beat against either the 4th or 6th harmonic of the oscillator.

4th harmonic	=	8.56 mc
10.7 minus 8.56	=	2.14 mc
6th harmonic	=	12.84 mc
12.84 minus 10.7	=	2.14 mc

This additional 2.14 mc component caused by the incoming signal beating against the 4th or 6th harmonic of the oscillator is in phase with the original 2.14 mc oscillation. Therefore, the incoming 10.7 mc will lock in the 2.14 mc of the normal oscillations, and the only result will be an increased output from the plate circuit. If the incoming signal deviates above the center frequency to a maximum of 10.7 mc plus 75 kc or 10.775 mc, the oscillator will lock in at 1/5 of this frequency of 2.14 mc plus 15 kc. Similarly the oscillator will follow the incoming signal toward the low frequency deviation of 2.14 mc minus 15 kc.

Thus a deviation of plus and minus 75 kc is reduced by the Locked-In oscillator to plus and minus 15 kc. The use of a reduced range discriminator operating at a much lower frequency than the IF permits greater adjacent channel selectivity.

De-emphasis

In a previous article it was stated that most of the noise present in FM systems is concentrated in the higher audio frequency range and to help overcome this noise, a pre-emphasis network is used at the transmitter. By this means, the higher audio frequencies are amplified to a greater degree than the lower audio frequencies. At the receiver, therefore, it is necessary to incorporate a de-emphasis network which will have the opposite effect and serve to bring the highs

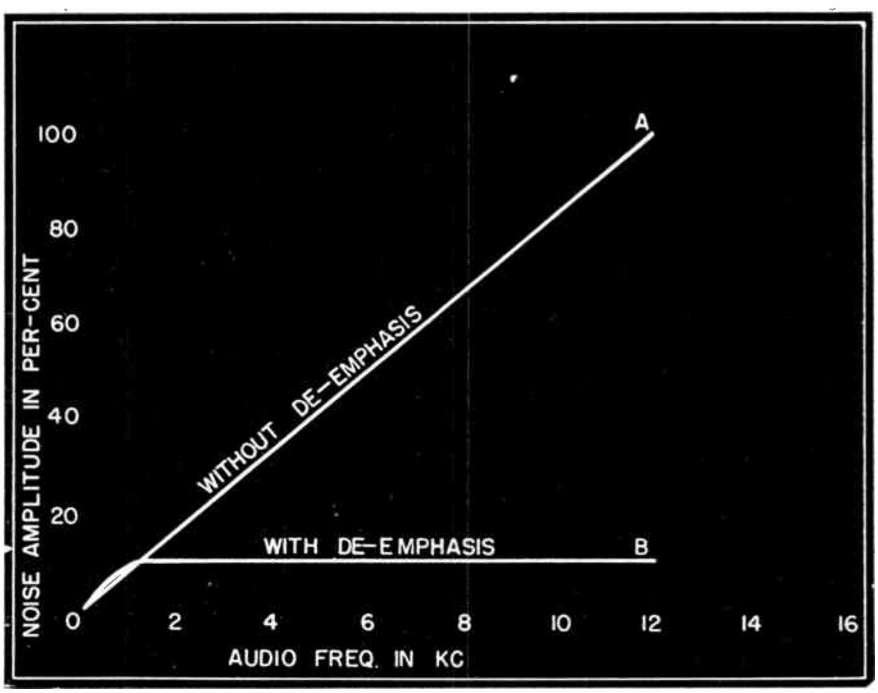


Fig. 3. Effect of de-emphasis on receiver noise content.

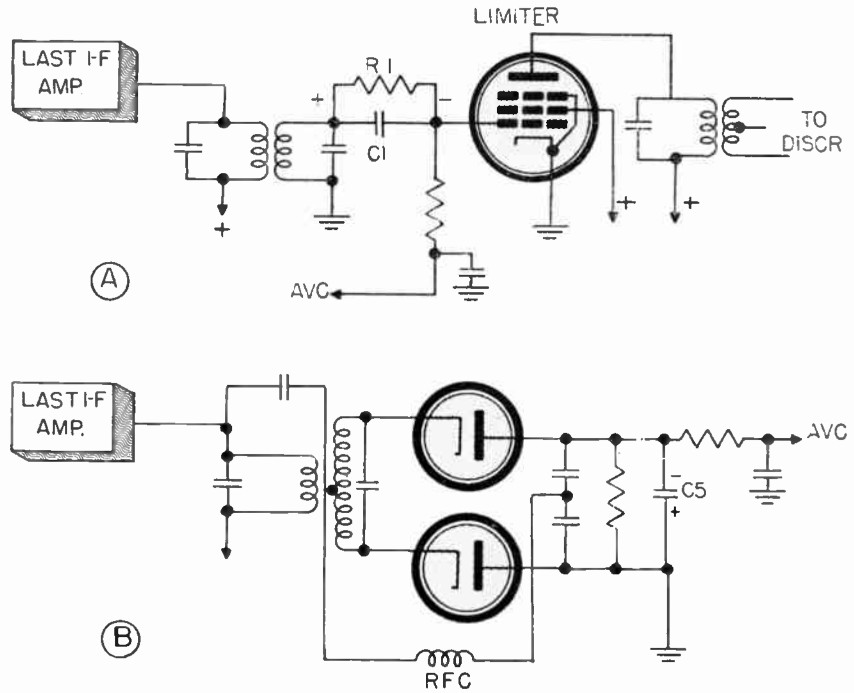


Fig. 4 How AVC is obtained in FM receivers.

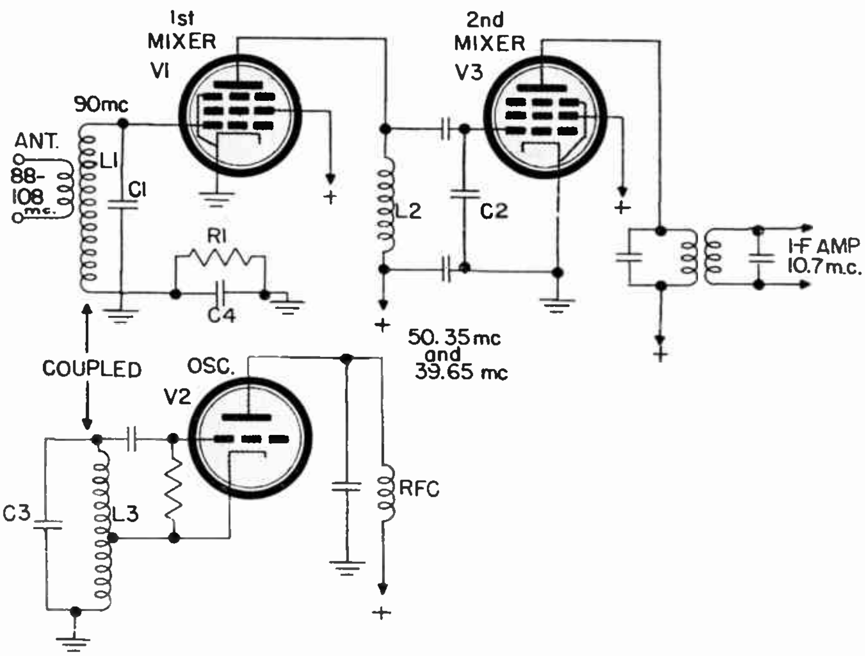


Fig. 5 Double superheterodyne circuit.

down to the proper level with respect to the low frequencies. Such a network is made up of an RC combination and may be identified in Fig. 2 as R2, C5, C6. The de-emphasis network must have the same time constant as the pre-emphasis network, and this is at present standardized at 75 μs for FM broadcasting. With capacitors C5 and C6 connected across the audio output to ground the higher audio frequencies will be partially by-passed and thus attenuated to the proper degree. The graph of Fig. 3 shows the effect of the de-emphasis circuit on high audio frequency noise components. By reference to curve "B," it is clearly seen that the use of de-emphasis reduces the noise level at 15,000 cycles to 1/10 of its original value.

AVC in FM

It might be thought that since all amplitude variations are removed from the FM wave before or during detection, it is not necessary to provide any AVC action for the receiver. All signals exceeding a certain minimum strength will be held to the same amplitude, thus preventing fading. However, the use of AVC is desirable, because first, AVC aids in keeping interference bursts below a certain critical level at each AVC controlled tube grid. These interference bursts may become phase modulated by changing the tube input capacitance and will be detected and heard. AVC also reduces the possibilities of cross modulation of an FM signal by noise in the first stages of the receiver. The method of obtaining AVC control voltage will depend entirely upon the detection and limiting system used.

Two methods of obtaining AVC control voltage are illustrated in Fig. 4. In Fig. 4A, AVC is obtained from the limiter grid biasing network. A negative potential is developed across R1-C1 which is proportional to the average strength of the incoming carrier wave. This potential may be fed through RC filters to the grids of IF and RF amplifiers in the conventional manner. Fig. 4B illustrates the method used to obtain AVC when the Ratio Detector is employed. The charge in capacitor C5 is proportional to the average carrier strength and is, therefore, suitable for AVC.

Double Superheterodyne

It is sometimes desirable to design an FM receiver of exceptionally high sensitivity. This is especially true when the receiver is to be used in outlying districts where the signal strength may be quite low. However, as previously mentioned, there is a definite limit to the amount of gain which can be accomplished at any one frequency because of the danger of regeneration or oscillation. If the desired amplification can be distributed among stages operating at different frequencies, this difficulty will be greatly minimized. This system is called the "double superheterodyne" and is shown in Fig. 5.

Basically, the principle of operation is as follows: The incoming signal at 88-108 mc is first heterodyned to a lower IF of moderate value amplified and then heterodyned again to the standard IF of 10.7 mc. The same oscillator is used for both mixing operations. Regeneration is minimized and sensitivities in the order of 1/10 microvolt or less may be realized. In the illustration of Fig. 6 are shown the relationships between the various frequencies, and the frequencies for one FM station operating at 90 mc. To find the oscillator frequency for any given station, subtract 10.7 mc from the station carrier frequency and divide by two. In order to find the 1st IF for any station, add the carrier frequency to the 2nd IF (10.7 mc) and divide by two.

Assume that the station carrier is equal to 90 mc (Fig. 6). This signal is first applied to the control grid of V1, which is called the first converter stage. L1-C1 is tuned to 90 mc. Grid leak bias is used for this stage which operates along the lower bend of the tube characteristic curve. This bias is furnished by R1-C1 from grid current. The oscillator V2 is a shunt fed Hartley of conventional design and is tuned to 39.65 mc by L3-C3. The two coils L1 and L3 are loosely coupled and thus the oscillator frequency (39.65) is impressed on the grid of V1 together with the carrier frequency of 90 mc. The difference frequency of 50.35 mc is produced by mixing, and is the first IF. The first IF is passed along to L2-C2, which is resonant to this frequency together with some of the original oscillator frequency (39.65). V2 acts as a second converter stage producing the difference frequency, (10.7 mc), which is fed to the IF amplifier.

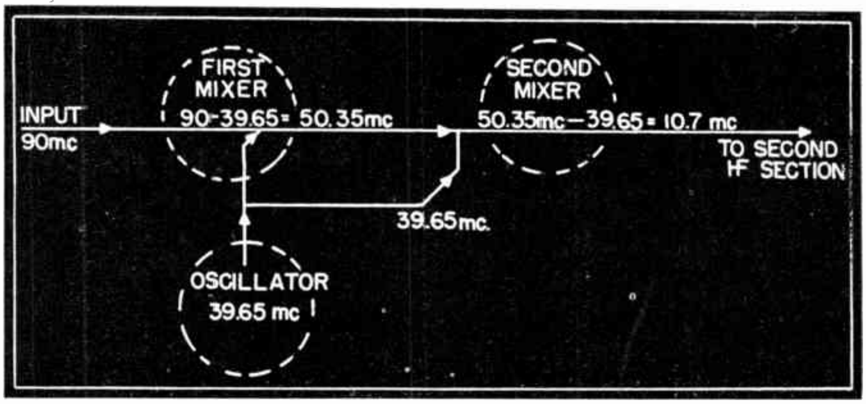


Fig. 6 Relation of various frequencies in a double superheterodyne receiver.

Automatic Squelch System

Most FM receivers have a very high noise level when not tuned to a station. This will be accentuated in receivers which use AVC. If AVC is employed, the receiver will operate with maximum sensitivity when no carrier is present. This noise is evident when the receiver is tuned between stations and is extremely annoying. This undesired interstation noise may be eliminated by using a squelch system. One of the many varieties of suitable squelch circuits is illustrated in Fig. 7.

Whenever a signal is being received, the rectifier tube V1 conducts strongly and a high negative bias is developed across R1-C1. This negative voltage is sufficient to cut off the squelch tube V2. Under this condition the normal fixed bias is supplied to audio amplifier tube V3 and amplification of the audio takes place. If there is no bias developed at the grid of the squelch tube due to the lack of a station carrier, the squelch tube conducts heavily and plate current flows through R2, R4, and R3 to B plus. The added drop across R3 is sufficient to cut off the audio amplifier V3.

A disadvantage of squelch systems is that weak signals cannot be heard, in which case the squelch circuit may be made inoperative by opening switch S1. When a Ratio Detector is employed, a squelch system is unnecessary because the Ratio Detector is quiet even when the carrier wave is not present.

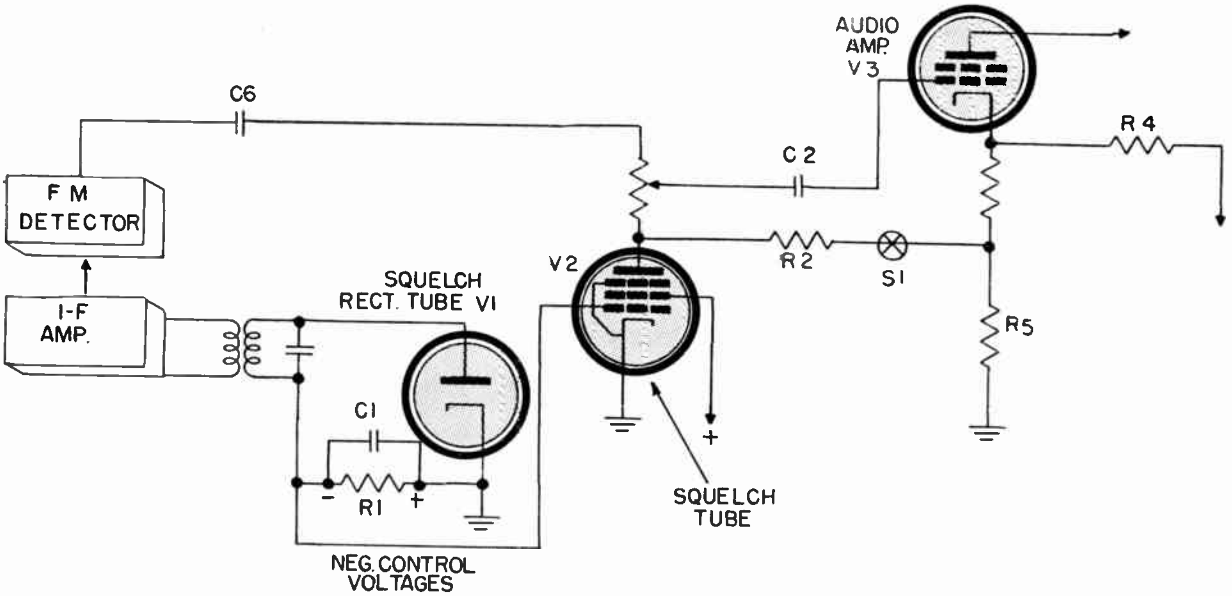


Fig. 7 Schematic diagram of a squelch system.

what's new in VIDEO SECTIONS?

Amplifiers designed to pass a wide range of frequencies offer a new challenge to the serviceman.

by Morton Scheraga
Allen B. DuMont Labs.

A NOTABLE change in the new television receivers is the shifting of the sound and video IF carrier frequencies from their prewar values. The sound IF has been changed from 8.25 mc to its present frequency of 21.9 mc; the video IF has been changed from 12.75 mc to 26.4 mc. The lower frequencies were subject to many interference effects. Image frequencies, FM stations, the amateur and aviation channels, and local oscillator radiation were all found to create spurious signals in prewar receivers. The new IF frequencies are chosen to give good operation with the least interference from other services. Fig. 1 shows the relative position of the picture and sound carriers for channels 2, 3, and 4. The sound and picture carriers are separated by 4.5 mc in each channel. A station transmitting video modulation frequencies of up to 4 mc on channel 3 has side band frequencies up to 65.25 mc, with the lower side bands being suppressed at the transmitter.

Most manufacturers operate the receiver RF oscillator at a higher frequency than the received channel so that the IF frequency relation of picture to sound carrier is reversed as shown in Fig. 2. The IF carrier frequencies indicated in the diagram are 21.25 mc for the sound, and 25.75 for the video. These are the frequencies employed by RCA in their model 630TS and are shown here because this circuit will be described below. It will be found that different manufacturers do not use the same IF carrier frequencies. For example, Philco receivers are designed with

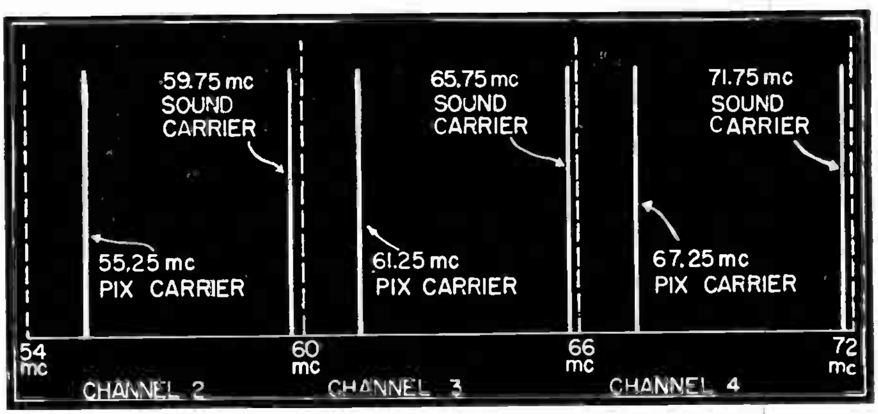


Fig. 1 Location of sound and picture carriers for television channels 2, 3, and 4.

IF carrier frequencies of 22.1 mc and video IF carriers of 26.6 mc. G.E. and DuMont employ 21.9 and 26.4 sound and video IFs, respectively.

Basic IF Circuits

Two basic circuits are now common to the design of television IF amplifiers. The more conventional type is the over-coupled band pass amplifier, using double tuned transformers. The second type is the stagger-tuned amplifier which was perfected during the war and is now becoming popular in television receiver circuits because it offers improved economy, simplicity, and ease of adjustment. Stagger-tuned amplifiers can now be made to have as good selectivity and phase characteristics as double-tuned or multiple-tuned coupled circuits.

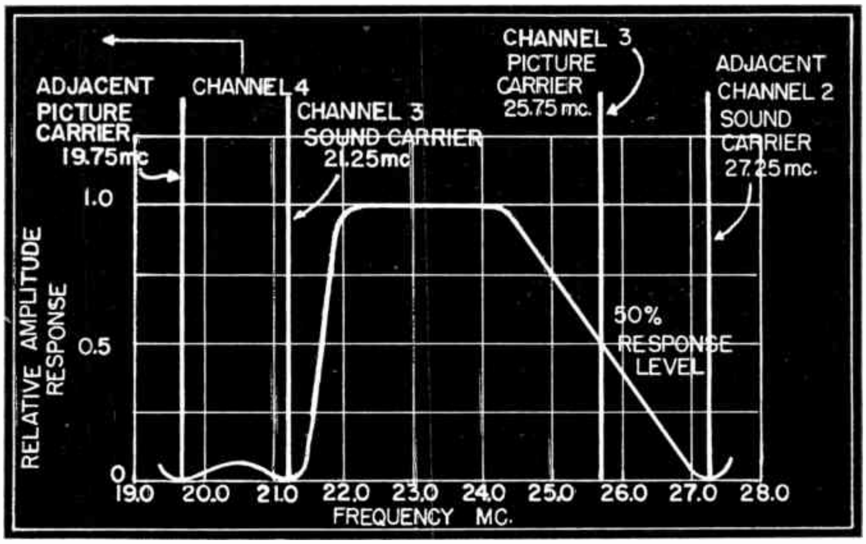


Fig. 2 Ideal picture intermediate frequency response.

The G.E. Model 801 television receiver uses the over-coupled amplifier design. See Fig. 3. Three 6AC7 tubes are used in the three-stage video IF amplifier. The transformers T1 and T2 are overcoupled and then loaded with resistance R1 to obtain the approximate 4 mc band-pass frequency characteristic. These stages have the response curve shown in Fig. 4. With such a band-pass characteristic, not enough attenuation of the sound carriers on the same and adjacent channels is obtained. Sound traps are therefore used to shape the response curve. A third winding is added to each video transformer and tuned to trap out the audio carrier and its sidebands. The trap on T1 is tuned to 27.9 mc to reject the adjacent channel audio IF. The traps at T2, T3, and T4 are tuned to 21.9 mc to reject the same channel audio IF. The combination of sound traps and overcoupled trans-

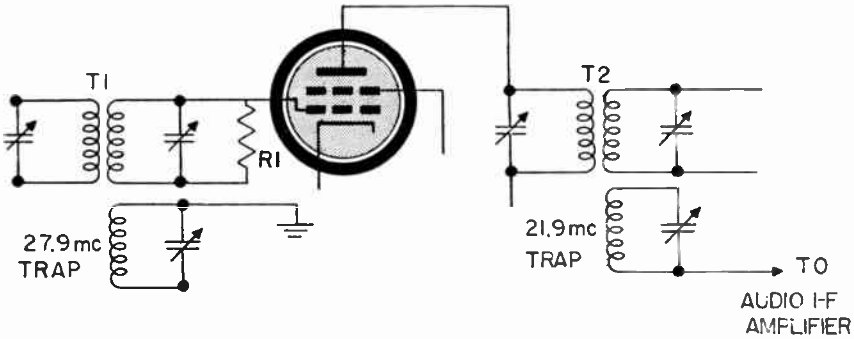


Fig. 3 Single stage of the video IF amplifier in the G.E. Model 801 receiver.

Fig. 4 Video IF response curve of circuit in Fig. 3, without effect of sound traps.

Fig. 5 Effect of sound traps on video IF response curve for G.E. Model 801 circuit.

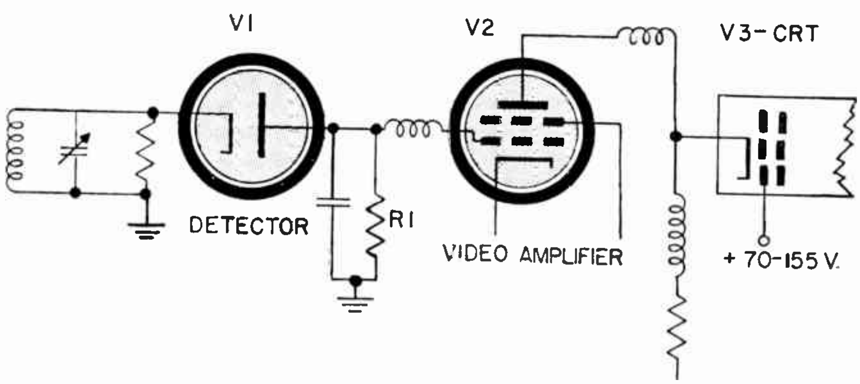


Fig. 6 Direct coupling of video amplifier to cathode of picture tube, eliminating need for DC restorer.

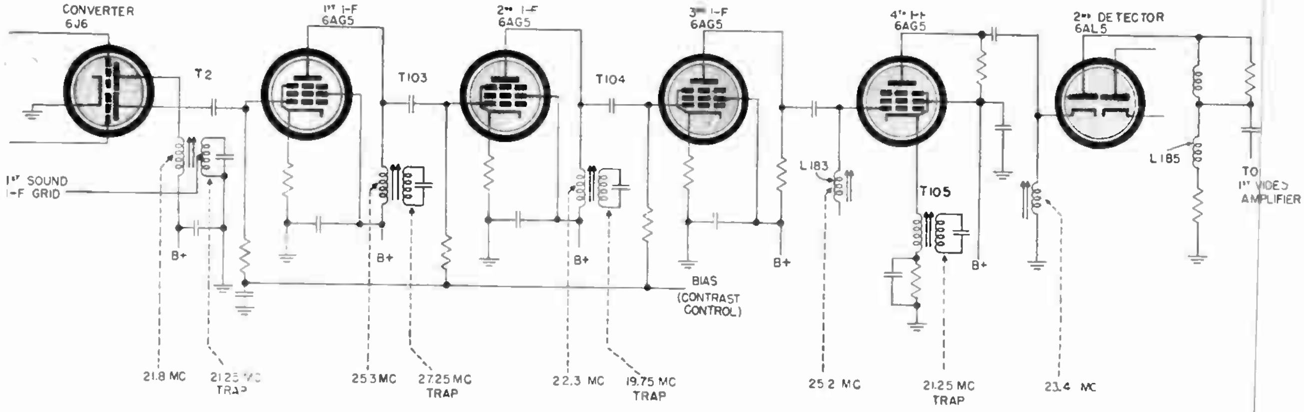


Fig. 7 Schematic of video IF stagger-tuned amplifiers.

formers then results in the response curves shown in Fig. 5.

Separation of the audio IF frequency from the video IF frequency is achieved by taking the 21.9 mc signal developed across the trap on T2 and feeding it to the grid of the first audio IF amplifier tube. See Fig. 3. There is no automatic gain control in this receiver.

An interesting feature of the G.E. video circuit is that DC restoration at the picture tube is not necessary. Fig. 6 shows the video detector, amplifier, and picture tube. The video IF amplifier output is applied to a diode rectifier, V1, and the diode load, R1, is connected to develop a negative video signal at this point. The signal is amplified by tube V2 and then applied directly to the cathode of the picture tube, V3. The DC level of the video signal is preserved and no DC re-insertion is necessary. Since the cathode of the cathode-ray tube is directly coupled into the plate circuit of the video amplifier, V2, a variable positive voltage must be applied to the control grid of the picture tube to change the grid bias and provide a brightness control.

Alignment of overcoupled amplifiers was previously described in Radio Maintenance. (*Television Receivers—The Video Channel*, by Morton Scheraga, Jan. 1947, p. 4.)

Stagger Tuning

The stagger-tuned video IF amplifier used in the RCA Model 630TS receiver differs considerably from the conventional overcoupled amplifier. In a stagger-tuned system, each stage is peaked to a particular frequency, and the overall response curve is the result of the combination of peaked stages. In the RCA circuit, four stages of IF amplification are employed to obtain the necessary wide band characteristic with adequate gain. The converter plate and the successive IF transformers use only one tuned circuit and each is tuned to a different frequency. These stages are shown in Fig. 7. Fig. 8 shows the relative gain and selectivity of each coil. The overall response curve which results from these combined curves is shown dotted.

In order to obtain this band pass characteristic, the picture IF transformers are tuned as follows:

Converter transformer,
21.8 mc (T2 primary)
First pix IF transformer,
25.3 mc (T103 primary)
Second pix IF transformer,
22.3 mc (T104 primary)
Third pix IF coil,
25.2 mc (L183)
Fourth pix IF coil,
23.4 mc (L185)

Traps

Attenuation of unwanted sound and picture IF carriers is accomplished by four traps. The first three are absorption circuits which are tuned as follows: The first trap (T2 secondary) is tuned to the sound IF frequency of 21.25 mc; the second trap (T103 secondary) is tuned to the adjacent channel sound IF frequency of 27.25 mc; the third trap (T104 secondary) is tuned to the adjacent channel picture IF carrier frequency of 19.75 mc. The reader should refer to Fig. 2 to see the relative effects of these traps on the IF response curve. The fourth trap (T105 secondary) is in the cathode circuit of the

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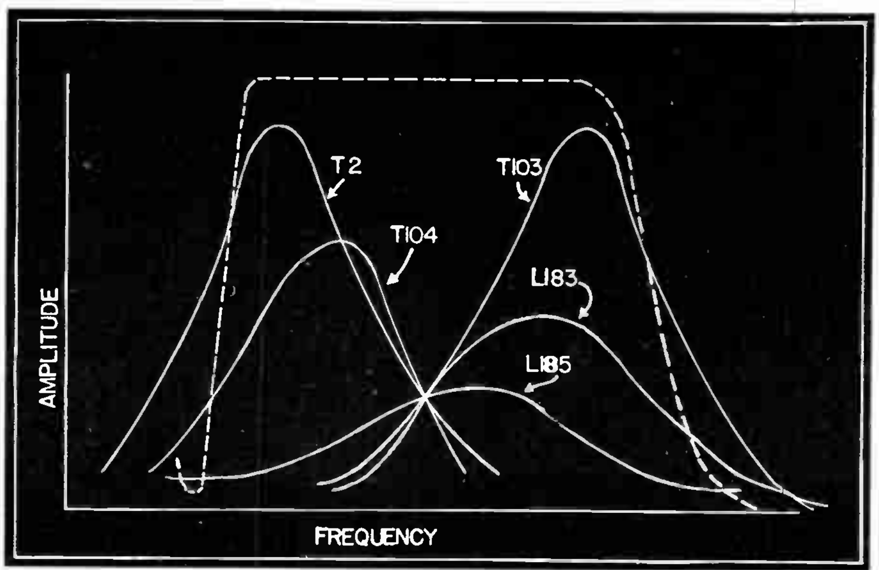
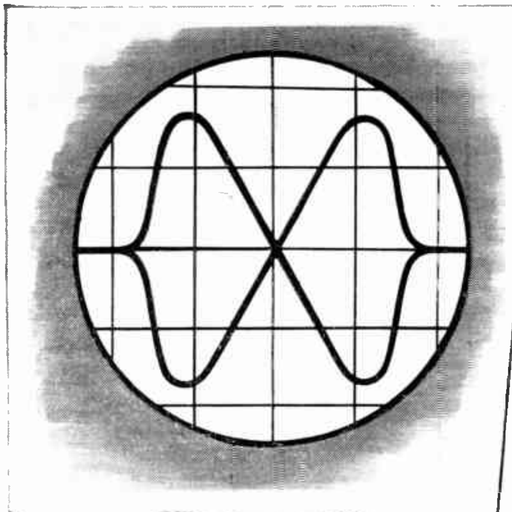


Fig. 8 Relative gain and selectivity of each coil in staggered video IF amplifier in RCA 630-TS receiver. Resulting overall response curve is shown dotted in background.



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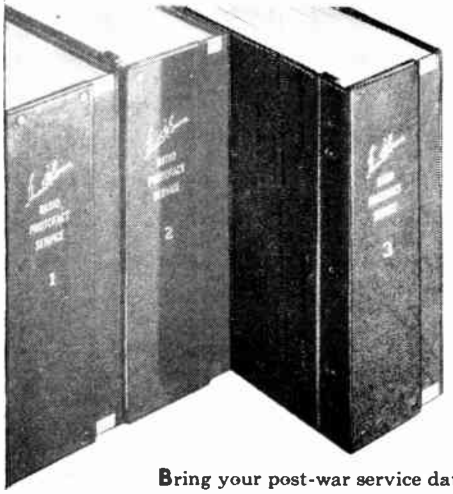

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Starting at Hartford, Connecticut, in September, the caravan stopped at Boston, New York, Pittsburgh, Cleveland, Columbus, Detroit and Chicago. It then continued through Denver and the West Coast, Texas and Southern cities before returning early in December.

A three-hour program for radio service technicians was divided into three parts as follows:

1. Description of the characteristics of frequency modulation reception compared to those of ordinary amplitude modulation reception.

2. Technical discussions of servicing operations.

3. Demonstration of actual test procedure. An FM receiver which was first put out of alignment was used as a model.

The program was prompted by the realization that FM receiver servicing has reached a large volume and requires the latest in skills and techniques.

A few weeks from now in Philadelphia hundreds of servicemen will attend a three-day Town Meeting of Electronic Technicians. While primarily of interest only to the radio technicians of the Philadelphia area, it is also of great im-

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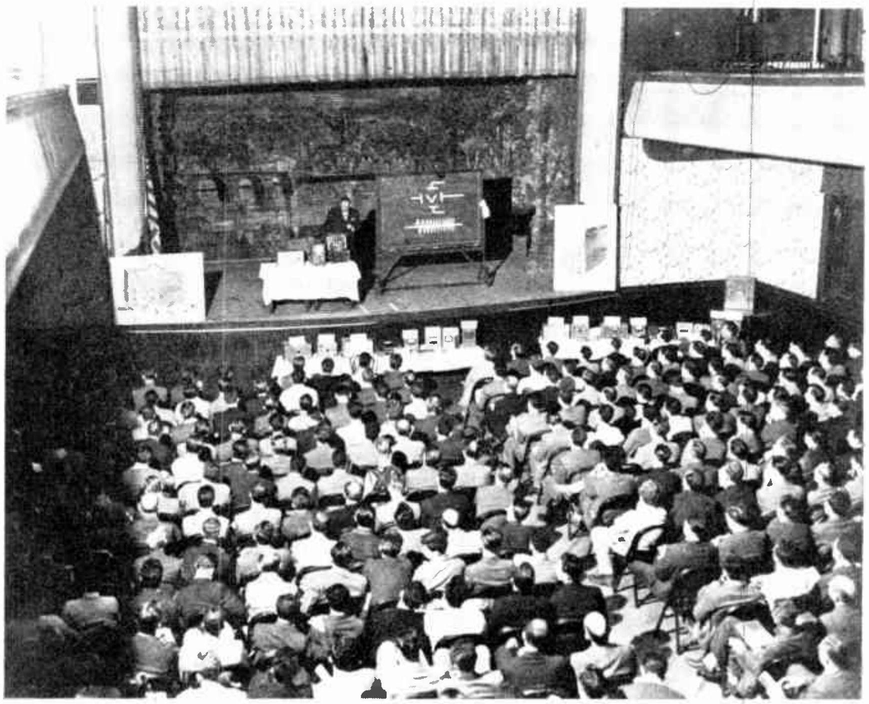

A. The New York City meeting of the G-E FM caravan. Servicemen were given information on theory and practical demonstrations of the use of test equipment.

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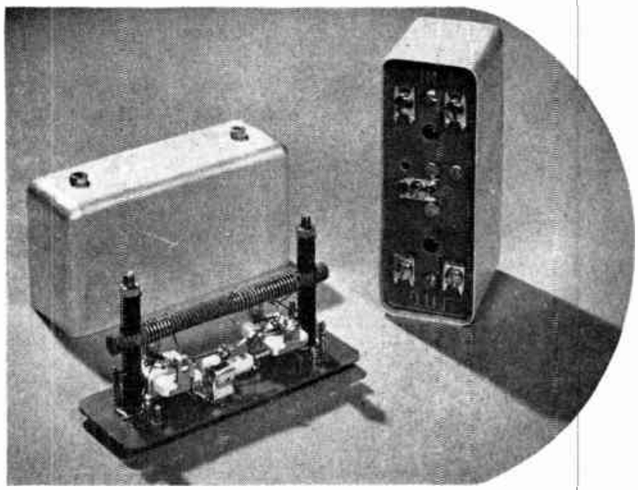


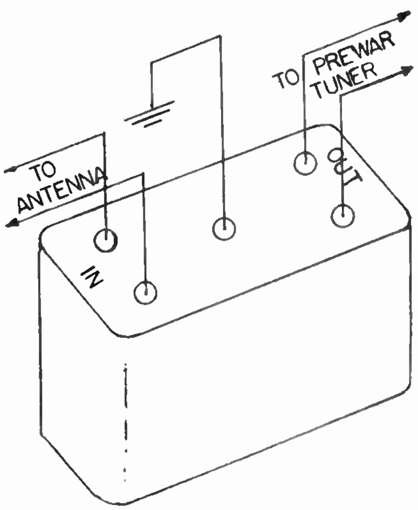


FIG. 1

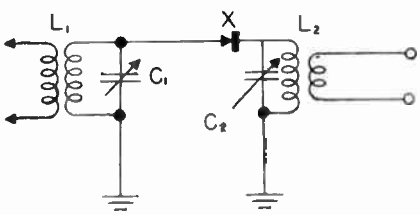


FIG. 2

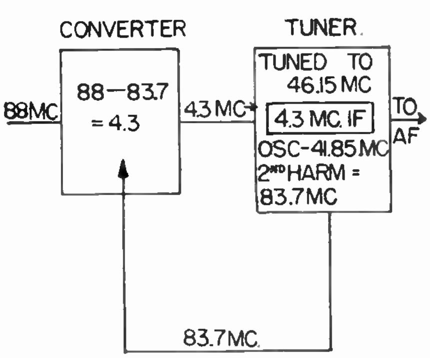


FIG. 3

A LARGE number of pre-war FM tuners and receivers are still in operation in many areas. When the FM band was changed from 42-50 mc to the new range of 88-108 mc, a demand for some simple method of conversion for the older tuners arose. Without such a converter, the pre-war receivers are rendered useless except for the few low band stations now operating, and which will soon go off the air.

Several simple devices were developed to solve the problem. One of the simplest and most compact is the crystal converter shown in the photograph. This converter is manufactured by the Crystal Devices Company of New York City. Using a crystal detector as a mixer, it requires no power of any kind except the signal from the antenna and oscillator voltage coupled from the tuner or receiver.

The service technician is likely to find opportunities to install and service these devices. The job is simple and easy if the operation is thoroughly understood. This operation is as follows:

1. The antenna is connected to the converter input; the converter output is connected to the pre-war tuner antenna posts. (See Fig. 1.)

2. Input tuned circuit L1-C1 resonates broadly in the new FM band and passes the signal along to crystal detector X (Fig. 2).

3. RF voltage at the second harmonic frequency of the tuner oscillator is fed back to the input circuit of the converter.

4. When the tuner dial is adjusted properly, this oscillator second harmonic frequency differs just 4.3 mc from frequency of the incoming signal.

5. The oscillator harmonic and the received signal mix and produce a 4.3 mc signal, which is picked up and amplified by the tuner IF section.

A block diagram illustrating these operations is given in Fig. 3. An 88 mc received signal is used as an example, with a tuner using the standard 4.3 mc IF (pre-war). The tuner oscillator frequency is 4.3 mc lower than the tuner mixer circuit resonant frequency, which puts it at 41.85 mc when the tuner is adjusted to 46.15 mc.

Installation

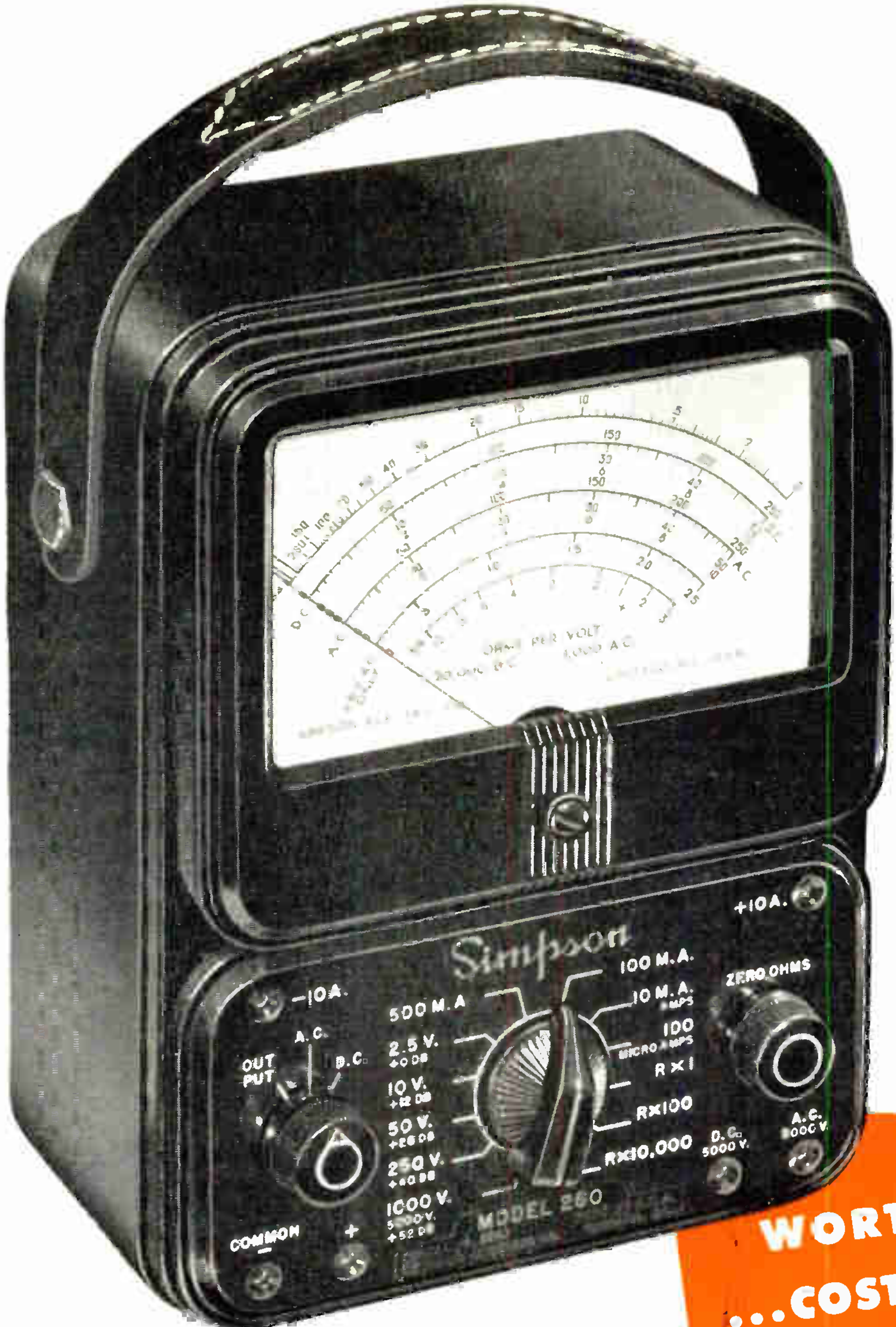
Before making the installation, we should determine the intermediate frequency of the tuner to be converted. Although 4.3 mc was the standard FM IF before the war, some FM tuners and receivers used other frequencies.

After conversion, tuning is still done with the old tuner. The dial setting of the tuner will depend on the IF it uses. Tuner dial coverage for 88-108 mc is as follows:

3.0 mc IF—45.5 mc to 55.5 mc
4.3 mc IF—46.15 mc to 56.15 mc
5.0 mc IF—46.5 mc to 56.5 mc

These values can be checked and new ones calculated from the information given above.

Oscillator voltage is coupled from the tuner into the converter through the converter output leads. Better coupling is obtained by running a lead from one antenna connection to the tuner, where it is formed into a loop which couples to the oscillator. ✓ ✓ ✓



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What's New In Video Amplifiers?

→ From Page 14

fourth picture IF amplifier and is tuned to the accompanying sound carrier IF frequency. Fig. 9 shows the response curves of each stage in the stagger-tuned system and the effects of the various traps.

Alignment of the IF section consists of peaking the transformers to the specified frequencies with a signal generator. The overall response is then observed by use of a sweep generator and cathode-ray oscillograph. Because of slight deviations from standard circuit Q, the overall response may have to be adjusted a bit by shifting the transformer center frequencies slightly.

An oscillograph is not necessary to peak each stage. Instead, a vacuum tube voltmeter is connected across the picture sound detector load resistor. If you know the RF stage is correctly aligned, connect an accurately calibrated signal generator to the receiver antenna terminals. If you are not sure of the RF alignment, the signal generator may be applied directly to the converter grid through a small capacitor.

Set the IF bias voltage at the value prescribed by the manufacturer for alignment (—3 volts in this case). The signal generator is successively set at the frequency of each trap, and the trap coil is adjusted for minimum indication on the vacuum tube voltmeter. The signal generator is then set at the frequencies required to peak IF coils for *maximum* indication on the vacuum tube voltmeter. ✔ ✔ ✔

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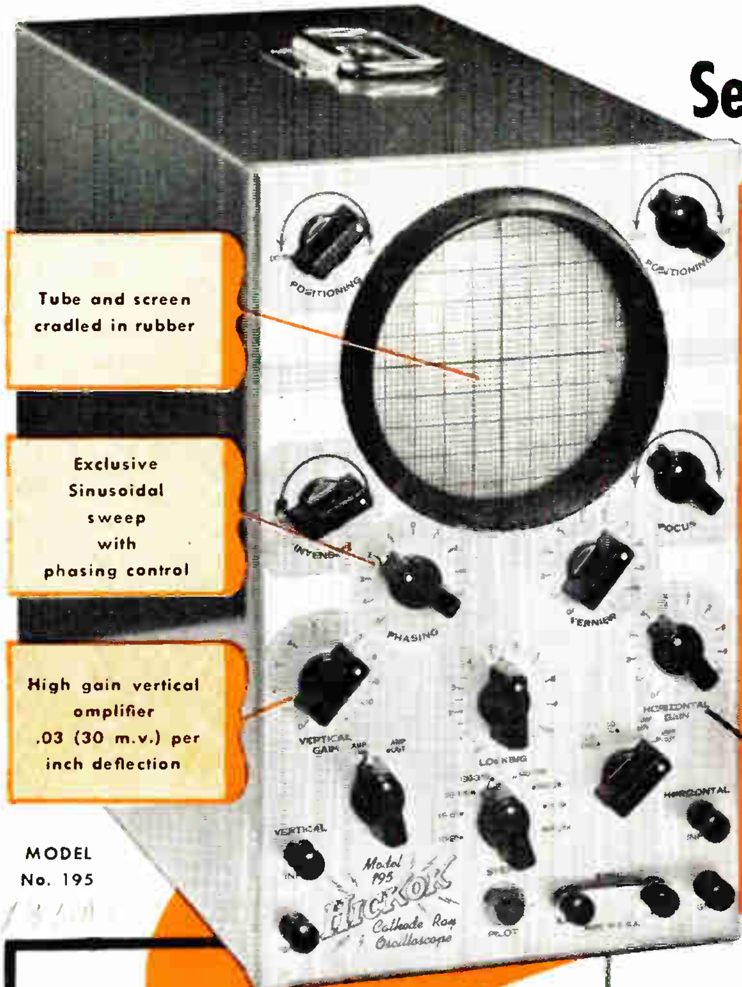

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   c. Horizontal—.15 Volts (rms) per inch
   d. Horizontal, Direct—20 Volts (rms) per inch
4. Input Impedance:
   a. Vertical—1 meg, 25 mmf
   b. Vertical, Direct—2.2 meg
   c. Horizontal—4 meg, 35 mmf
   d. Horizontal, Direct—2.2 meg
5. Frequency Range:
   Amplifier, Vertical—30 cycles to 50 kc
   Amplifier, Horizontal—10 cycles to 50 kc
6. Tube Complement:

Tube	Function
1	6SJ7—Horizontal Amplifier
1	884—Sweep Circuit Oscillator
1	6AC7—Vertical Amplifier
1	6X5—Low Voltage Rectifier
1	5Y3—High Voltage Rectifier
1	5UP1—Cathode Ray Tube

7. Size: 8 5/16" wide x 18½" deep x 13" high
8. Weight: Approximately 25 lbs.

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4. Determine unknown frequencies.
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How To Improve Your Signal Tracing Technique

→ From Page 7

No hum and no signal mean a short. Very low hum and no signal would be observed if no station were on the air, and the primary were in good condition. If the coil is good and the stations are transmitting, signals will be heard. At the secondary, a gain of 3 to 10 in home receivers is usual while in auto sets it may be from 10 to 50.

Measuring Gain

Because of the wide range of frequencies to be covered, it is impossible to calibrate tracers accurately for gain measurements. However, all of them provide an attenuator control which regulates the gain of one of the amplifiers. An approximate indication of gain

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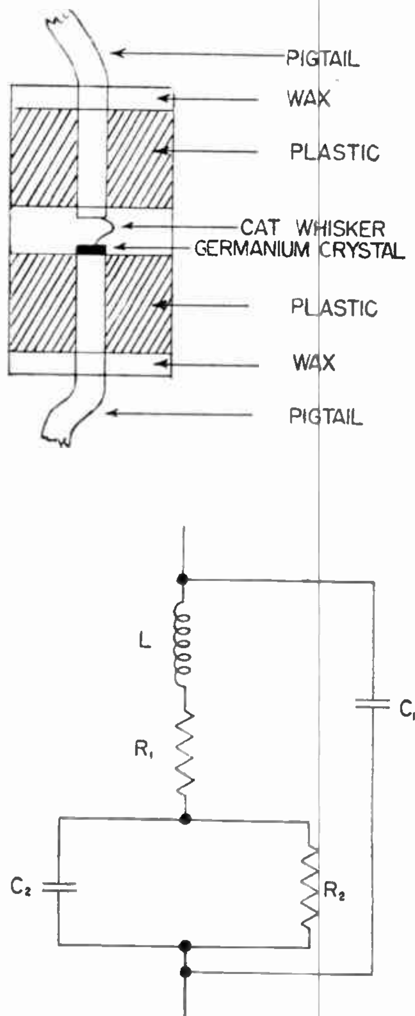
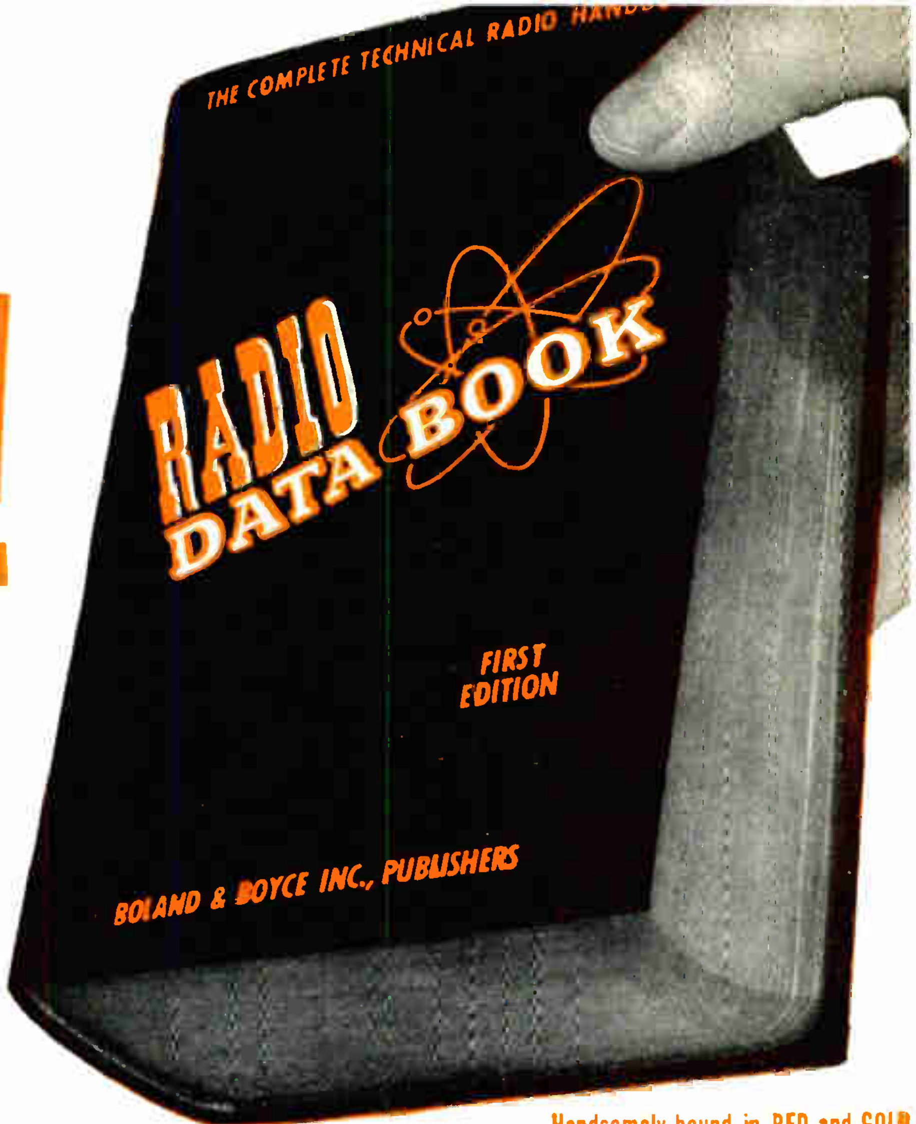


Fig. 9 The germanium crystal—its construction and equivalent circuit.



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How To Improve Your Signal Tracing Technique

→ From Page 22

is then possible. The gain of the tracer should have to be reduced, step by step, as the tracer is moved from the antenna to the speaker. For such measurements, set the gain control of the tracer to give a convenient meter reading or to close the "eye" tube shadow when the tracer probe is at the grid of the stage being tested. Then, move the probe to the plate. Reset the gain control of the tracer to get the same meter indication or to close the "eye." The ratio of the two settings of the gain control is the gain of the stage. Some sample gains are helpful in tracing:

Antenna coils (home receivers)	5
Antenna coils (auto receivers)	30
RF amplifiers (broadcast)	30
RF amplifiers (shortwave)	15
Mixer grid to 1st IF grid	50
IF amplifiers	120
IF amplifier to diode	100
1st AF amplifier (medium mu)	20
1st AF amplifier (high mu)	50
Pentode output tube	15
Triode output tube	3
Output transformer, a loss of 30	

Considerable variation from these values will be found.

Indicators

The choice of an indicator to be used in a tracer is important. Some use the "eye" tube since only the relative strength is to be determined. It can be located at any point in the tracer such as directly after the detector or at the output of the amplifiers depending on the signal strength. Also, without the detector, it can be used to indicate relative DC potentials without using additional test equipment.

A milliammeter is a less flexible indicator since it can be used only in a vacuum tube voltmeter requiring additional circuits to permit the same versatility as the "eye" tube. It can be used as a VTVM in combination with the probe but this limits the sensitivity.

All tracers should provide aural indicators, either a speaker, headphones or both. This is necessary to determine whether the signal being traced is actually a signal and not a hum or noise voltage. Also, when the complaint is distortion, the signal must be heard to find at what stage the distortion is originating.

The instruction books given with signal tracers will supply a long list of uses as, for example, if when the probe is placed at the screen grid of any stage in a receiver, a

→ To Page 28

Compare "Hi-Kaps"

See why Centralab's ceramic by-pass and coupling capacitors are your best buy for QUALITY!

"HI-KAP" FEATURES	DESCRIPTION	ADVANTAGES
1. Impervious to moisture	Ceramic-X is non-hygroscopic. Moisture absorption is .007% or less.	No deterioration, no shorting. Longer life even under the most adverse conditions.
2. Low mass weight 3. Small size 4. High capacity	Av. Wt. / Dimensions / Values: .029 oz. / D—.315″ L—.540″ / .00005—.00025 mfd. .044 oz. / D—.315″ L—.830″ / .0005 mfd. .050 oz. / D—.340″ L—1″ / .000750—.005 mfd. .082 oz. / D—.400″ L—1.305″ / .01 mfd. Rating: 600 WVDC — 1000 VDC flash test.	For unit size and weight, Centralab BC "Hi-Kaps", made with Ceramic-X, are the only capacitors on the market which provide these voltage ratings.
5. Special insulation	Wax impregnated, lacquered, dipped in special phenolic resin, cured and wax impregnated.	Prevents any possibility of shorting to adjacent leads, chassis or components.
6. Convenient side leads	Heavy #22 gauge tinned copper.	Permit rapid, close-coupled connections. No tricky bending or fitting required.
7. Low power factor	Initial — .6%. After 100 hours, 95% humidity test — 3.0%.	More efficient circuit operation, fewer failures.
8. High leakage resistance	Initial — 5000 megohms. After humidity —500 megohms.	Long life, more efficient performance.
9. Maximum dependability	One-piece construction. Leads soldered directly to electrodes.	Will not short or become intermittent.
10. Factory tested	For your protection, all units 100% factory tested before packaging and shipping.	Your guarantee to your customers of reliable service and performance.

See why Centralab's ceramic by-pass and coupling capacitors are your best buy for PRICE!

NEVER BEFORE has the dependability, permanence and convenience of *ceramic* by-pass and coupling capacitors been offered to Radio Service Dealers at a favorable price! As more and more manufacturers turn to BC "Hi-Kaps" for longer life and better set performance, Centralab now offers you this opportunity to give yourself and your service customers the newest and finest in capacitor components! Made with high dielectric constant Ceramic-X, BC "Hi-Kaps" are rated at 600 WVDC — 1000 V. flash tested. Values from .000050 to .010000 mfd., list priced from $1.25 to $1.50 per envelope of five.

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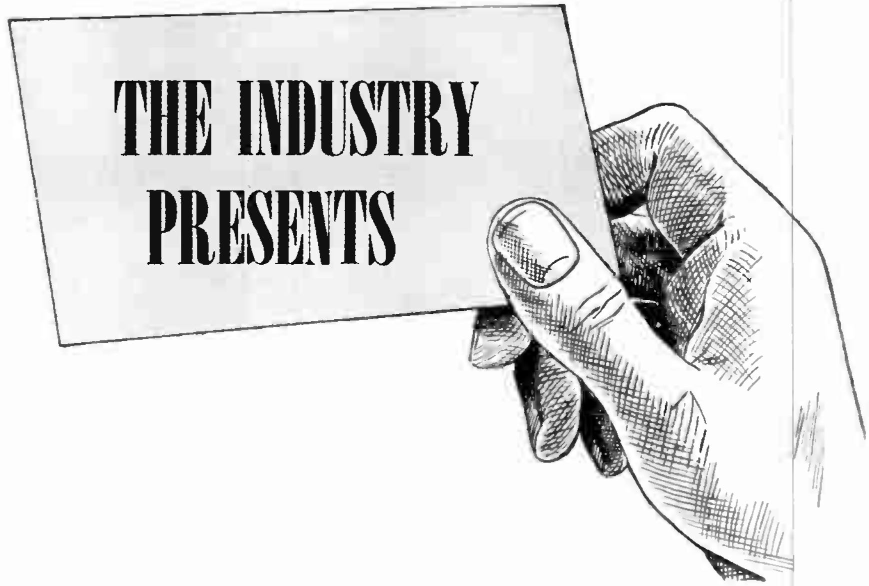
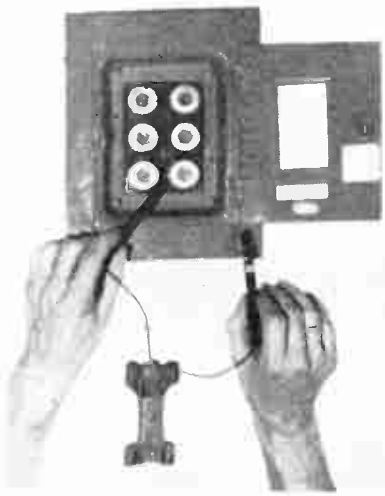
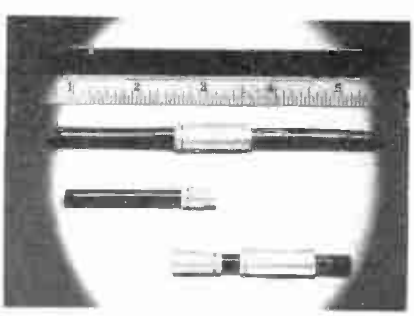




CONTINUITY TESTER

The new Star Suretest Universal Tester is a vest pocket continuity checker which operates directly from any 110 volt receptacle. It is also adapted to line testing for voltages from 75 to 600 volts. A neon lamp is used as the indicator and is located in one of the two test prods, which have 100,000 ohm protective resistors in them. For further details, write to the Star Fuse Corp., 235 Canal St., New York, N. Y.



COAXIAL CONNECTOR

H. H. Buggie & Company manufacture a miniature connector designed for either RG 58/U or RG 59/U cable. It has an overall diameter of 23/64 inches and a length of 1¼ inches when mated. It is small in size and light in weight and has a voltage rating of 500 volts peak with a low loss. It is solderless and requires minimum cable preparation. No special tools are required for assembly. The separation force of the quick disconnect lock more than satisfies normal requirements. A panel mounting plate is optional. For further information, write to H. H. Buggie and Company, 2145 Madison Ave., Toledo 1, Ohio.

PORTABLE AMPLIFIER

A portable amplifier designed for recorded music is announced by the Webster-Chicago Corp. This unit, known as Model 66, contains three tubes and rectifier. It is

suitable for use with Model 65 portable record changer or Model 80 wire recorder. Separate tone and volume controls are provided, and the control panel is recessed to keep the knobs flush with the case. Dimensions are 15¾" x 9½" x 9¼", and the weight 18 pounds. Operation is on 105-125 V 50 or 60 cycles. For further information, write to Webster-Chicago Corp., 5610 Bloomingdale Ave., Chicago 39, Ill.

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SPRAGUE TRADING POST

SWAP—BUY OR SELL

FOR SALE—Precision E-200C signal generator, 88 cycles to 120 mc and Precision 912MCP tube tester. Both instruments new and unused. Generator $60 tube tester $55. James S. Kirk, 623, 15th St., Bedford, Ind.

FOR SALE — Engineering Electronics, Fink; Radio Engineering, Terman; Radio Engineering Measurements, Terman; Television Simplified; Kiver; Principles of Television Engineering, Fink; Radio Mathematics, Cooke; Micro-Wave Transmission, Slater; Time Bases, Puckle; Calculus Book, Grandville, $25 for lot; also Triplett tube tester 2413 like new $40. J. Herzon, 3142 W. 16th St., Chicago 23, Ill.

FOR SALE—New 7" and 12" transvision television sets, expertly wired in a-1 operating condition, less cabinets, 7", $185; 12", $325. Wiener Lab., 1818 Bryant Ave., Bronx, N.Y.C.

FOR SALE—R.C.P. model 802N tube and set tester, tube tester takes them all, new condition 7 months old, $50, with Rallindex tube chart. Rudolph Hardy, Sea View Hospital, Staten Island 10, N. Y.

FOR SALE—NC-46 receiver and matching speaker, rebuilt for a-c operation only; equipped with tuning eye and phono jack. Uses 6K8, 2-6SG7, 6H6, 6SF7, 6J5, 6SN7, 2-6V6, 5U4G and 6U5G; tuning range 540 KC to 30 mc in 4 bands, $125 plus shipping charges. Theodore R. Faulk, 1728 Ohio St., Owensboro, Ky.

FOR SALE—Dial scales for G-E GD-60 Midgets; ten sheets $1 with 2 complete sets including push buttons on each sheet. I. Susman, 1052 Blake Ave., Brooklyn 8, N. Y.

WANTED—Rider's manuals complete set or separate volumes. Thomas Lamb, 17 Clinton Ave., Kingston, N. Y.

WILL TRADE — New 200-CM variac trans. volts from 0-135. Want 450 used Superior tube tester. Jack's Radio Service. 7237 Marjorie St., Detroit 13, Mich.

FOR SALE—Television receiver 5" improved Vision Research. 20 tubes — FM sound. 7" tube may be used with no changes, $100 with all tubes but less cabinet. I. Pickell, 714 Newton Place, N.W., Washington 10, D.C.

SELL OR TRADE—Instructograph code machine slightly used; complete with tapes. Want voltohmeter or radio manuals. Frank Reaves, 402 West St., Halstead, Kans.

FOR SALE—Stewart-Warner auto radio, R-131, $20; Superior signal generator OSC-12, $35; NRI radio course, 1928, $15; Sprayberry 3, 4 & 5 (16 magazines), $5; Gernsbeck's manuals 2, 3 & 4 also Encyclopedia, $10. Massett's Radio Service, 552 Clinton Hts. Ave., Columbus 2, Ohio.

FOR SALE—1936 Ford, Philco receiver, $25, C.O.D. in perfect condition. Grant LaMaye, 548 E. 6th St., Erie, Pa.

FOR SALE—Turner contact microphone for string instruments 10"x10"x6", speaker cabinet black crackle finished with 6" P.M. speaker; also 4 tubes 6SL7-GT, 25Z6GT/G, 25L6-GT/G and 78, $13 postpaid. Bennie Farmer, Good Hope, Ga.

FOR SALE—6 months old Webster 56 deluxe record changer in cabinet with 5 tube amplifier and Alnico V speaker. Cost $60 to construct, will sell $45. A. Ginsberg, 3245 Perry Ave., Bronx 67, New York.

URGENTLY NEEDED—Two 6v storage batteries or one 12v or reasonable substitute used or new to power Mark II transceiver. Joseph A. Repko, 349 Success Ave., Bridgeport, Conn.

SELL OR TRADE—National NC100Xa with crystal filter, 11 tubes, matching speaker in best condition. Want wire recorder or $90. R. R. Day, Solon, Ohio.

FOR SALE—RCA Rider chanalyst used only 2 weeks with all cords and instructions. Cost $162.50 will sell $100. Charles H. Dietrich Alanson, Mich.

FOR SALE—Complete 45 watt Concord add-a-unit pa system A-1 condition with four speakers. Harry Zink Jr., 444 E. Market St., Marietta, Pa.

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FOR SALE—Good radio and appliance service station; top merchandise and old established service. Baileys Radio Sales & Service, 176 West 2nd St., Weston, W. Va.

FOR SALE—Speco signal tracer used only 2 months, $20. Hopper's Radio Shop, 301 Hollis St., Framingham, Mass.

WILL TRADE — Radio tubes, meter tested, new cartons. Want radio receivers, test equipment. Best Radio Shop, 3349 Fulton St., Cleveland 9, Ohio.

FOR SALE — UTC high fidelity input transformer, multiple line to grids, single or pushpull $5 and 8" Jensen high fidelity PM-8CT pm design, $6. Herbert Jacobowitz, 1412 Franklin Ave., Bronx, 56, N. Y.

FOR SALE—Turner crystal microphone with high quality desk stand (chrome and black crackle finish), cable, and connector, $8; Kelton watch, $10 with guarantee; used radio and old type tubes for sale. Peter Bedrosian, 2 Unicorn St., Newburyport, Mass.

FOR SALE—Complete N.R.I. course in radio and television also back issues of Radio News. Gerald Spector, 158 Chestnut St., Lakewood, N. J.

FOR SALE — UTC S-9 Driver transformer, new pp plates to class B grids, $3.50 postpaid. Leland Gerber, Box #505, Findlay, Ohio.

WILL TRADE — Two 814 tubes and 1 807 tube, $10 or what have you. Jim Pierce, 402 N. Mulberry, Elizabethtown, Ky.

FOR SALE—Precision E 200 signal generator, range 88kc to 120 mc never used; also Radio City Products multimeter, 20,000 ohms per volt 461AP, $100. Albert Mraz, 301 Third St., Glassport, Pa.

FOR SALE — GRL signal tracers as featured in December 1947 issue of Popular Science, $14.25 ea. Also radio tubes, guaranteed new. J. T. Cataldo, 222 St. Marks Ave., Brooklyn 17, N. Y.

SELL OR TRADE — DeForest training course, covers Radio and Television also includes questions and answers in good condition. Want multitester. John Saul, 111 Pollock Ave., New Castle, Pa.

WANTED — Position as radioman's helper in radio service shop. Benjamin Reyes, General Delivery, McFarland, Calif.

FOR SALE—Silver 900 Vomax; Solar CE-1-60 condenser checker, RCA 155C 3" oscilloscope and army BC-612 oscilloscope. All instruments in A-1 like new condition with leads and instruction manuals. Porter Davis, 5859 Calumet Ave., Chicago 37, Ill.

FOR SALE — Webster wire recorder $150. M. Metzarek, Chicago & Vine, Arlington Heights, Ill.

SELL OR TRADE—Fishing rods and reels. Want electronic V.O.M. or Rider's 7, 8, 9, 10, 11, 12. Fred M. Merrill, Box 92, Callicoon, N. Y.

FOR SALE—RME 9D receiver in good condition, $25. Robert Rosenbohm, 370 22nd Place, Clinton Iowa.

FOR SALE—BC454 receiver in perfect condition with 24v dynamotor, $4.95. Has 6 tubes and operates on 80 meters. Mike Freeman, 1210 S. 13½ St., Fargo, N. Dak.

SELL OR TRADE—Few each European tubes, EC13, ECF1, CY2, DCH11, DF11, DL11, DDD25, DC25, DF25, DCH25, DAC25, UY11, UY21, UBL21, UCH21, 12A8 and 955; have base diagrams for these and other tubes as well as RF Xtals. E. F. Smiley, Radio & Sound, 15510 Eldamere Ave., Cleveland, Ohio.

FOR SALE—Precision 910 dynamic electrometer tube tester, perfect, $40 or will trade for Volt-ohm millampmeter. Harold W. Dalton, RFD 1, Box 168-A, Blacksburg, Va.

SELL OR TRADE—Complete radio control unit, xmitter, receiver, escapement, power supply Electronic Lab 2606 6v input, 300v @ 100ma. output, receiver operates on dry batteries; has tubes and all connecting cables, not surplus, $50. J. G. Thomas, 1047 Hammond, San Antonio, Texas.

FOR SALE—Battery eliminator to change 110v a-c to 90v d-c and 1½v.a.; used less than month, $7. Peter L. Anderson, P. O. Box 688, Beloit, Wisc.

FOR SALE—RCA New Rider chanalyst, $120. Paul H. Schissler, Box 541, Westminster, Colo.

SELL OR TRADE—Nearly new outside neon sign 3' x 1½' with Radio in 6" neon on two sides $60 or will trade for late RCA voltohmist, Jr. or what have you? Herbert J. Hanson, 5007 26th Ave S.W., Seattle 6, Wash.

FOR SALE—Rider manuals 6 to 15, $80, volumes 1 and 2 $5 ea. Frank Kedl, Box 122, Sheridan, Wyo.

FOR SALE—Gears for converting Presto-K-8 recorders to cut 96 lines per inch, can be pressed on turntable shaft by any machinist. Willoughby W. Moyer Jr., Box 71, Creamery, Pa.

FOR SALE—Browning RJ-12 FM-AM tuner chassis with PF-12 matched power supply, perfect, $95. Edward Brzezinski, Krakow, Wisc.

TRADE OR SELL—Zenith record demonstrator with cobra pickup, special tone circuit, 5 tube 15 watt amplifier, phono table and motor and 8" speaker in case and original carton. Want BC-348 revamp, surplus transmitter, scopes or what have you? Bill Rex, Box 488, Odebolt, Iowa.

FOR SALE—Two BC-222 walkie talkies, 28 to 52 mc complete less batteries, $40 ea or $75 for two. Alvin E. Allen, 1069 West 105th St., Los Angeles 44, Calif.

FOR SALE—Complete radio service shop in downtown section doing good business. Will sell all or part. R. W. Nickson, Radio Service, 109 S. Edgewood Ave., Somerset, Pa.

SELL OR TRADE—Triumph signal generator perfect, $38 or 30-30 or 303; also Savage rifle in good condition. Roberts Radio Service, Wheeler, Mich.

WANTED — Zenith chassis 5905, less tubes, need not be in playing condition. Speaker not wanted. Kearns Radio Service, 7510 Memphis Ave., Cleveland 9, Ohio.

FOR SALE—G-E UM-3 set tester new condition, $23; Hickok T-53 tube tester, modernized to test 11T28, loctal, 1R5, etc. was factory reconditioned 2 months ago, $35; new St. Clair vacuum tube voltmeter, $30; new Hudson car radio DB-40 complete, but less speaker, $20. Will sell lot for $100. Don J. Arata, 944 E. 41st St., Chicago 15, Ill.

WANTED — Riders manual #2; state price and condition. Rex Radio Service, 2813 Forest, Great Bend, Kans.

FOR SALE—Precision 920 P tube and radio analyzer in original carton, also Precision EC signal generator. John T. Levine, 15-17 Kelley Square, Worcester 4, Mass.

WILL TRADE—R.M.E. receiver 45; 1 year old with speaker like new for metal lathe with 9" swing or better. Jos. Lang, 309 Evergreen Ave., Millvale 9, Pa.

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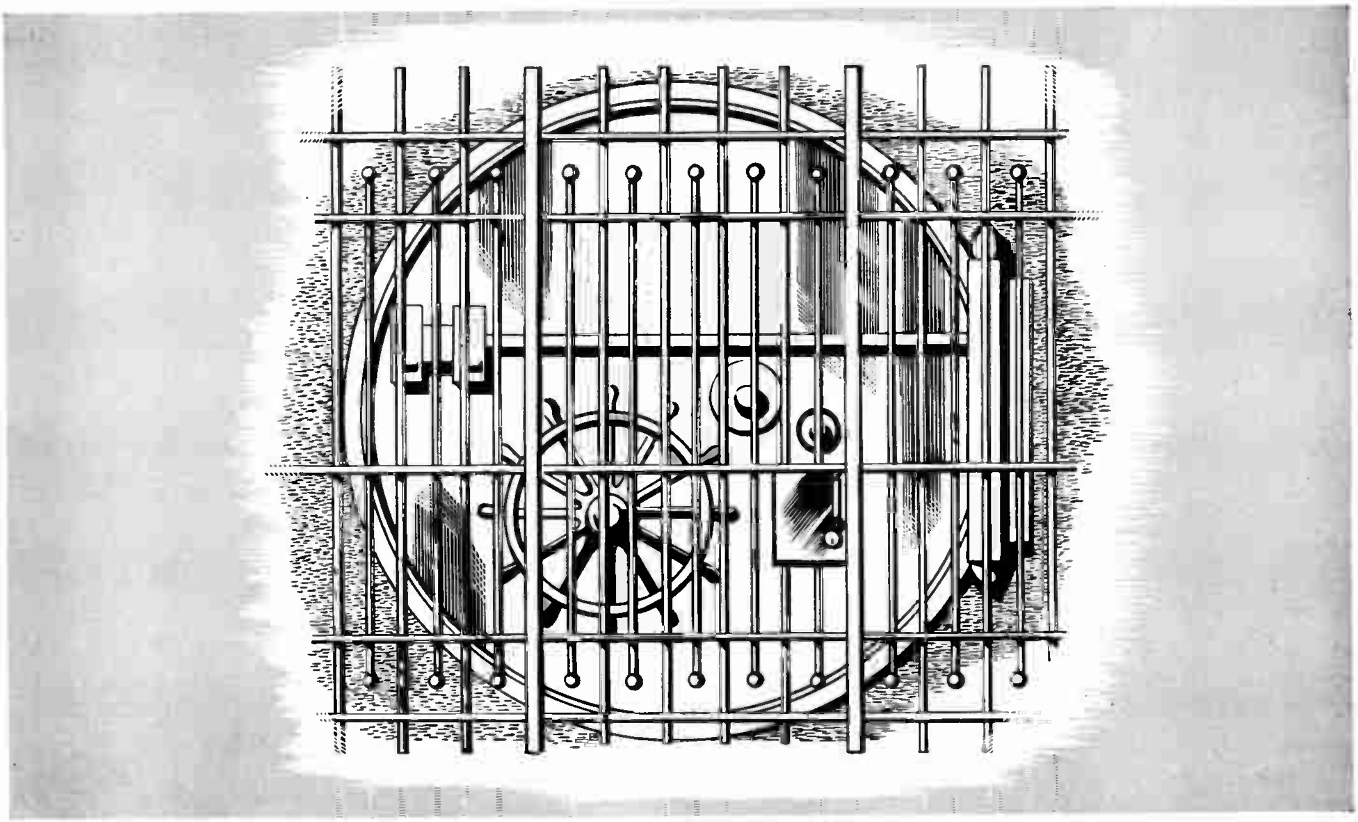
How To Improve Your Signal Tracing Technique

→ From Page 24

signal or hum is heard. It indicates insufficient bypassing. Likewise, the efficiency of the power supply filter can be tested by listening to the ripple at various points in the filter circuit.

The greatest usefulness of the signal tracer is in locating faults in intermittent receivers. Connecting the instrument to one stage at a time and waiting for the receiver to "stop," the defective stage can be found in a minimum of time. Static measurements usually unbalance circuits enough to prevent as rapid troubleshooting of such a receiver.

It is hoped that the information in this article will help the serviceman to get the most out of the signal tracing system of servicing and assist him in selecting signal tracing equipment ✔ ✔ ✔

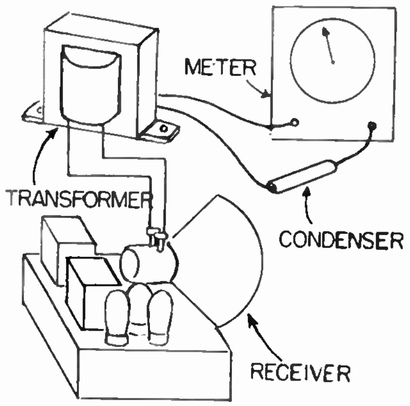


Patching Ribbon Line

More and more use is being made of twin lead, ribbon type feed line. The insulation becomes soft when you make a soldered connection. This is because the heat of your iron melts the insulating material. Joints and connections may be mended and weather-proofed by insulating material from another piece of the same type of line. Just melt the material and let it drip onto your joint. It burns while it drips, so be sure you choose a safe spot and guard against fire.

M. A. Tuksal
Detroit 2, Mich.

Each month the reader sending in the best suggestion receives a crisp ten dollar bill. For all others published, RADIO MAINTENANCE will pay five dollars. Let's hear from you.



Output Meter Readings

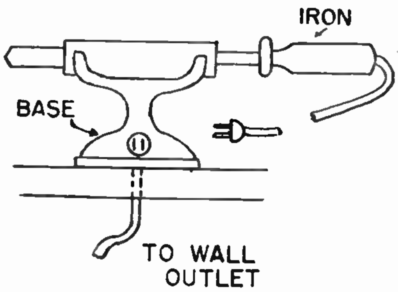
IT IS desirable to make output meter readings across the voice coil leads of the output transformer. This is an accessible spot and there is no B plus around. However, because this is a low impedance circuit, there is often not enough voltage to give a good reading.

This problem can be solved by feeding the output from the voice coil leads through another output transformer as shown. Connect the voice coil leads from the receiver to the voice coil leads on the extra transformer. The plate side of this transformer will then give a stepped-up voltage and a good reading on your AC meter.

R. N. Knowland
Knowland Radio Service
East Alton, Illinois

Soldering Iron Rest

An old telephone base of the French type makes a good soldering iron rest. It can be used plain or an AC female plug can be mounted where the dial assembly has been removed. An AC cord is then connected inside the base to



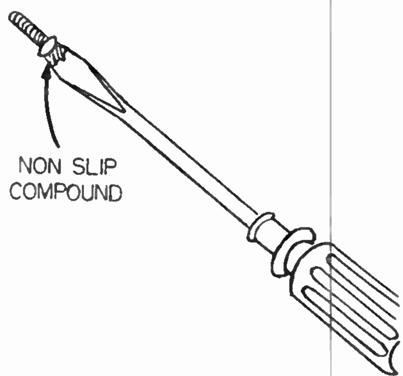
the female plug, and the other end fitted with a plug which is placed in a convenient wall socket. The plug from the iron cord is then in a convenient position.

Fred Stolze
Flushing, N. Y.

Loop Antenna

One way to pep up a small radio on weak stations is as follows. Wind about 15 or 20 turns of small cotton covered wire in random fashion around the loop antenna. Weak station pickup will be much better, especially if this wire is externally grounded on one end. The other end can be left loose.

R. J. Oja
Bob's Radio Electric Shop
Laurium, Mich.



Screw Holder

When trying to hold screws that are to be put in out-of-the-way places, touch the tip of the screw driver in the non-slip compound used for dial cords, allowing some of it to stick to the tip of the screw driver. When the screw driver is placed in the screw head, it will stick to the screw well enough to hold it there. This trick works with both Philip's head and single slot screw heads.

Alva H. Clark
Tarboro, N. C.

Antenna Wire Anchor

Many receivers have an antenna wire coming from the back of the cabinet. This wire connects to the antenna coil. You seldom find any mechanical protection to prevent the wire from pulling loose. A small piece of string will give this protection. First tie a knot in the antenna wire. Then tie your string to

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The Notebook

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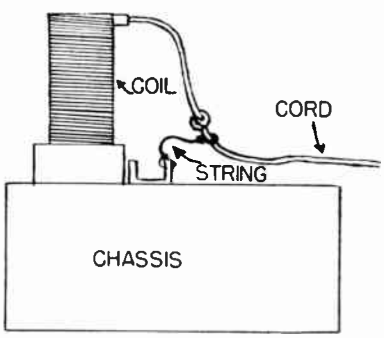

the far side of the wire. Anchor the other end of the string to the chassis.

Junichi Takahashi
Stockton, Calif.

Have You A Useful Suggestion?

Send it to The

NOTEBOOK

(see page 30)

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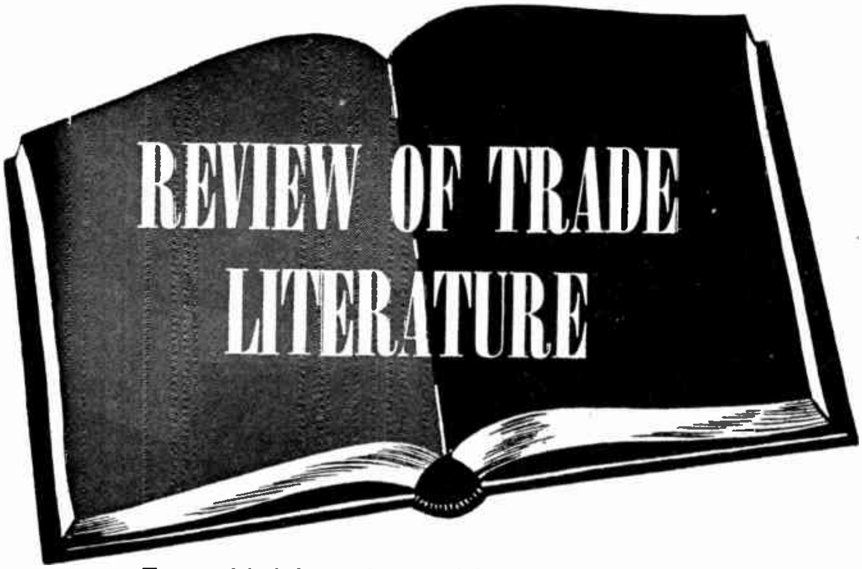

To avoid delay when writing to the manufacturer give issue and page number.

HOWARD W. Sams & Co., publishers of "Photofact Folders" have recently published two new books. The Sams "Automatic Record Changer Service Manual" features servicing information about 42 different makes and models. For each model there are parts list, general information, the change cycle, adjustments, troubles, lubrication and two full pages of exploded views labeled and keyed to the parts list. In addition there are several photographs of each model. Data on wire and tape recorders are included. The manual is bound in a smooth, hard cover and contains 400 pages. It is priced at $4.95.

The other new Sams publication is the "Dial Cord Stringing Guide." This booklet contains information on dial cord arrangements for all regular types of receivers available. A separate diagram of each dial and pulley design is given, with 552 of these diagrams included. Each diagram is numbered. The various models of receivers are listed in the front of the book with the numbers of the dial cord arrangements used. The introduction includes servicing information about causes of slipping, properties of dial cord, selection of proper size, etc. The Dial Cord Stringing Guide sells for 75 cents.

A continuous service on new receiver schematics is now being offered to servicemen by John F. Rider, publisher of the Rider "Perpetual Troubleshooter's Manuals." Starting on November 30 photostatic copies of schematics and service data were made available by mail to take care of new material which has not yet appeared in the Rider Manuals. This is an in-between-manuals-service for diagrams and service data and follows adoption of the policy of three Rider Manuals each year instead of an annual publication.

The photostats of diagrams available will sell for 10 cents for two pages consisting of schematic, alignment and voltage data, parts list (if available) and whatever else can be included in these two pages. There will be a charge of 5 cents for any additional pages up to seven pages, and 3 cents for any additional pages above seven. The photostats will be 8½ x 11 inches, with the double-page (17 x 11 inches) schematic spreads being counted as two pages. Photostats will be mailed on the day the order is received and by postpaid first-class mail. Servicemen desiring this service are asked to send twenty cents with each order, either in stamps, coins or postal note. The difference in cost, if less, will be returned with the photostats. If the cost is higher—depending upon the number of pages necessary — this information will be given in the letter bearing the photostats. Printed copies of schematics and servicing data that have already appeared in Rider Manuals will also be available under the above

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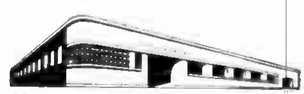

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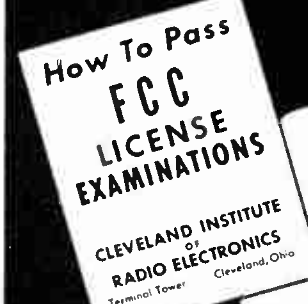

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OVER THE BENCH

by John T. Frye

THE fellow had asked me to come down and look at some radio parts that he thought I might be interested in buying. I had gone, not with the idea of buying anything, but more out of curiosity. The fellow worked on the railroad, and I could not understand what he would be doing with a stock of "new radio parts still in their original boxes," as he put it.

As I sat there in the garage and looked at the stock of parts, I had a hard time smothering a grin. He had not misled me for the parts were still in their original cartons; but what parts! There were about five huge cone-type speakers with paper cones that measured nearly three feet across. A neat stack of tubes had "71A," "01A," "112A," and even "200A" written across the ends. Another group of boxes were labelled "New Straight-Line-Frequency Tuning Condensers." There was even a servicing instrument, a compact Readrite Tester housed in an elliptical-shaped metal case and having a metal cover. There were three meters: a milliammeter, a voltmeter, and an AC voltmeter.

"I used to be in the radio service business," the man explained. "Did quite a lot of it, too. Built several sets. But when battery sets began to go out and the new AC sets came in, I gave up. That AC stuff is too complicated for me. At first, I figured on studying up and staying in the game. That is why I bought that tester with the AC meter. But I just couldn't seem to get the hang of it, so I quit the whole deal."

I explained as gently as I could that I would have practically no use for the parts, with the possible exception of the cone speakers. I knew by experience that the flat driving units of the speakers could easily be converted into surprisingly satisfactory pillow speakers. We came to terms on those, and I started home with my purchase.

As I drove along, a quotation kept going through my head. It was spoken by Governor Bradford as he watched a wretched criminal being led to his execution.

"There, but for the grace of God, go I," said the wise executive.

As I thought about this ex-serviceman, shunted off into a stagnant pocket by the hurrying current of radio progress, left hopelessly behind simply because he made too little effort to keep abreast of developments, the words of the good governor took on a sharp, almost a warning significance.

Right now, I mused, radio is taking another leap forward that is even greater than the change from battery to AC power for sets. On the one hand, we were changing the very method of impressing modulation upon the carrier, and this was accompanied by a corollary change in the method of reception. A change still more abrupt, though, is in the actual nature of the intelligence being transmitted. In addition to the aural intelligence that we have come to think of as being the basis of radio transmission, there is now added the transmission of visual intelligence! Your radio receiver not only allows you to hear but also to see!

What a small step-up was the change from batteries to alternating current when compared with these sweeping changes in the radio art! Yet that small advance was sufficient a barrier to terminate the radio service career of the man I had just left. How many more servicemen, now active, would allow these new developments to leave

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Over the Bench

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them behind in the dust, I wondered.

It is nothing to be complacent about. The changes, abrupt as they are in theory, take place so gradually and smoothly in the servicing field that a fellow scarcely knows what is going on until he wakes up some fine morning and discovers that his equipment, his technique, and even his fund of knowledge, are obsolete. If he does decide to do something about it and makes a really sincere effort to catch up, he can do so; but it requires tremendous and unremitting effort to overtake those who have gone right along with the progress of their art *and are still going*. Anyone who has attempted to catch up with his class in school after missing a few weeks will know exactly what I mean when I say it is infinitely harder to *catch up* than it is to *keep up*.

As I turned the problem over in my mind, I decided that there is one bright aspect: Servicemen now have more aids to help them in keeping up with the swift pace of radio advancement than they had when this battery-serviceman was left in the lurch. Every radio magazine you pick up these days is filled with articles on FM and Television. An attempt is made to acquaint the serviceman with every phase of these advancements. You find articles on theory, on construction, and on actual service of these new receivers. Analogies are used to impart this information as painlessly as possible, and every attempt is made to relate the new techniques to those the serviceman already possesses.

Yes, the serviceman who subscribes to a service magazine—and surely that includes every radio repairman who makes the least pretence of being up to date—has at hand wonderful help in marching right along with radio's swift movement; but he still has to take advantage of this proffered aid; he still has to read and to understand the articles. Let him not keep putting off this study on the grounds that he has little call for service on FM and Television sets yet. The time to prepare for such service is *before* the sets start coming in—and they will be coming in sooner than many of you imagine.

Start studying *now*, lest one of these days you hear yourself saying, "Yes, I used to be a radio serviceman. Did a lot of it, too; but when FM and Television started coming in, I gave up. That stuff was too hard for me to get into my head, or at least I thought so at the time. I've always been sorry I didn't keep up with servicing." ✓✓✓

Review of Trade Literature

→ From Page 33

cost schedule, also effective November 30. To obtain this service, write to John F. Rider Inc., 404 Fourth Ave., New York 16, N. Y.

Articles for Radio Servicemen

RADIO MAINTENANCE is in the market for good articles for radio servicemen and will welcome new manuscripts for approval.

Articles on radio are plentiful, but RADIO MAINTENANCE magazine will continue its policy of publishing only material that is of direct value to the Radio Serviceman and his business. We are constantly searching for more and better material of this kind.

It has been our experience that the best men to write such articles are radio servicemen themselves and if you have something you feel will meet our requirements, or if you have an idea for an article, get in touch with the editor.

the Organizations

Reports from all over United States and Canada are making it clear that the Radio Service Technician is finding membership in an organization of great benefit. Radio Maintenance has kept you informed by starting this column many months ago, and we have watched group activity grow. If you are an organization member, let's hear from you about your group activities.

HERE'S that information we've been promising you about the Philadelphia convention in January. "The **Federation of Radio Servicemen's Associations of Pennsylvania** will hold its first annual convention of radio servicing technicians in Philadelphia simultaneously with the Town Meeting of Radio Technicians in the Bellevue-Stratford Hotel on January 11, 12 and 13, 1948. The Philadelphia Radio Servicemen's Association, local Federation group, will act as convention host.

"The **Town Meeting of Radio Technicians** is being held to discuss many of the fundamental technical advances which have taken place in the electronics industry as they apply to the technician's needs as well as the changing pattern for small businesses.

"The Federation urges all radio technicians and associations who are interested in furthering their welfare and that of their members to have representatives present at both the Convention and the Town Meeting sessions.

"New developments in the field of electronics and all types of modern test equipment will be demonstrated in their practical application to shop procedures.

"Well known authorities on technical developments, engineering, and merchandising will speak on subjects including FM, television, and various phases of business management. The Town Meeting is being programmed for its practical usefulness to the technician's earning power, and the convention is being planned to clear up many areas of confusion in the industry today. Efforts are currently under way, with top industry sponsorship, to obtain some of the latest available electronic exhibits for the Town Meeting, which will eliminate any exploitation by any factor in the radio industry.

"The Federation's Convention Committee would like to receive from all cooperating associations and individuals, including those who cannot attend the convention or Town Meeting, ideas concerning practical or technical problems confronting them, as radio servicing technicians, which they would like to have discussed at the Town Meeting. The Committee will either include them on the Convention's agenda or turn them over to the Town Meeting's program committee for discussion.

"Early applications for accommodations are requested in order that they may be handled properly. The hotel has been able to reserve for the Federation only a limited number of rooms. Address all communications to David Krantz, 2109

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man of the day. This round table meeting was a highlight of the year. Ordinarily not liking to talk when we have a guest speaker, many members had previously withheld good information that came out under Mr. Gregson's direction.

"Another meeting on October 22 was under the chairmanship of Past President P. N. Nibbelin who introduced the speaker of the evening, Mr. Ralph Seilers of Suess Young Brown Company, Zenith Distributor of Los Angeles. His topic was FM circuits and how to balance them. Inasmuch as Mr. Seilers is the head of Zenith Service, he really can pick up the questions and lay down the answers.

"Mr. Seilers introduced Art Kraft of S.Y.B. Company and Sales Representative George Guest of the same company. In order to bring out the points of radio circuits better and to give a more comprehensive explanation of FM problems, Mr. Seilers used a series of slides. This I believe covered the problems completely.

"President Wes Ferrill was in charge of the meeting."

Harry Ward,
Public Relations

"The **Whaling City Chapter** of the **Radio Technicians Guild** has just undergone a reorganization program. At the November meeting, the newly elected officers took over the running of meetings. Al Wobecky is now the new president.

"A lecture on the theory of radio tuned circuits, presented by Frederick S. Baker, electrical instructor at Vocational High School, was featured at the regular monthly meeting of the Radio Technicians Guild held at Carpenter's Hall in November. Albert Wobecky presided.

"John Santos, Harry Wood and Albert Gagnon were appointed as a committee to study the revision of the by-laws, John Santos acting as chairman. Arrangements were made to conduct a Christmas party at the next meeting and to prepare a food basket for donation to some needy family."

James L. Shepley,
Secretary

Electronically Speaking

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portance to all radio technicians in the United States. It marks the beginning of an organized industry-wide effort to help the serviceman sole the problem being thrust upon him by the advent of FM, television, and other new, expanding phases of the radio industry.

The meeting will be the result of joint effort on the part of the Radio Manufacturers' Association, the Sales Managers Club, the Philadelphia members of the National Electronic Distributors Association, the Mid-Lantic Chapter, The Representatives, the Federation of Radio Servicemen's Associations of Pennsylvania, the Philadelphia Radio Servicemen's Association and others.

The purpose of the Town Meeting is to provide the radio technicians of greater Philadelphia and all others who wish to attend with the latest technical information and expert advice on various phases of small business management.

H. W. Clough, chairman of the Radio Parts Industry Coordinating Committee, recently stated, "Success of the Philadelphia show will be watched by the entire industry, for too many years, we in the radio industry, preoccupied with the problems of building a new industry in a new and rapidly developing field, have neglected the needs of the radio technician.

"I consider the Philadelphia experiment a significant step forward in terms of industry relations. It is a sign of industrial maturity and a recognition of industrial responsibility."

While the immediate purpose of the Philadelphia meeting is to assist the radio technicians of the Philadelphia area, the program has another and perhaps more important long-range purpose. It is essentially an experiment. According to Harry A. Ehle, chairman of the Coordinating Committee's Subcommittee on the Town Meeting of radio technicians, success in Philadelphia will probably result in a continuing series of similar projects in all the major business centers of the country. According to Mr. Ehle, one of the most encouraging factors encountered during the planning and preparation of the meeting has been the excellent cooperation and total lack of special interest shown by the various groups participating. The program will de-emphasize brand names and all participating manufacturers have agreed to abstain from merchandising during the sessions.

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VECTOR ANALYSIS

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TELEVISION RECEIVER FUNDAMENTALS
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NOVEMBER 1946

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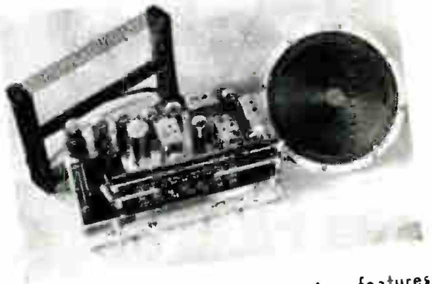

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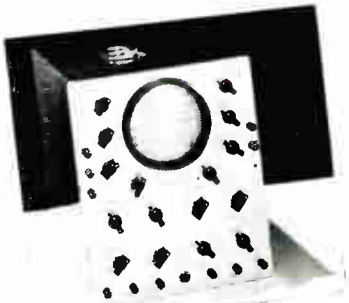

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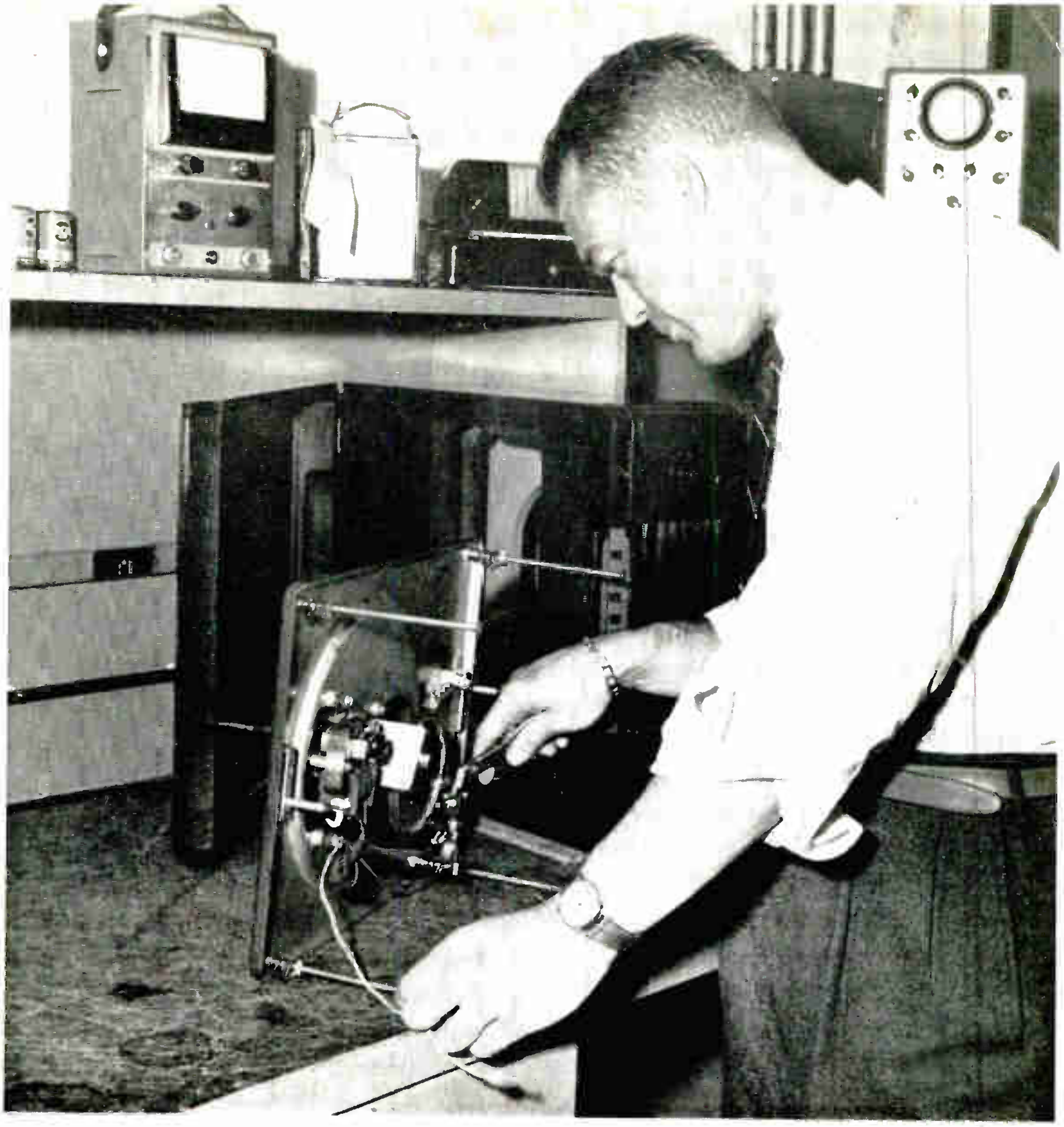

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