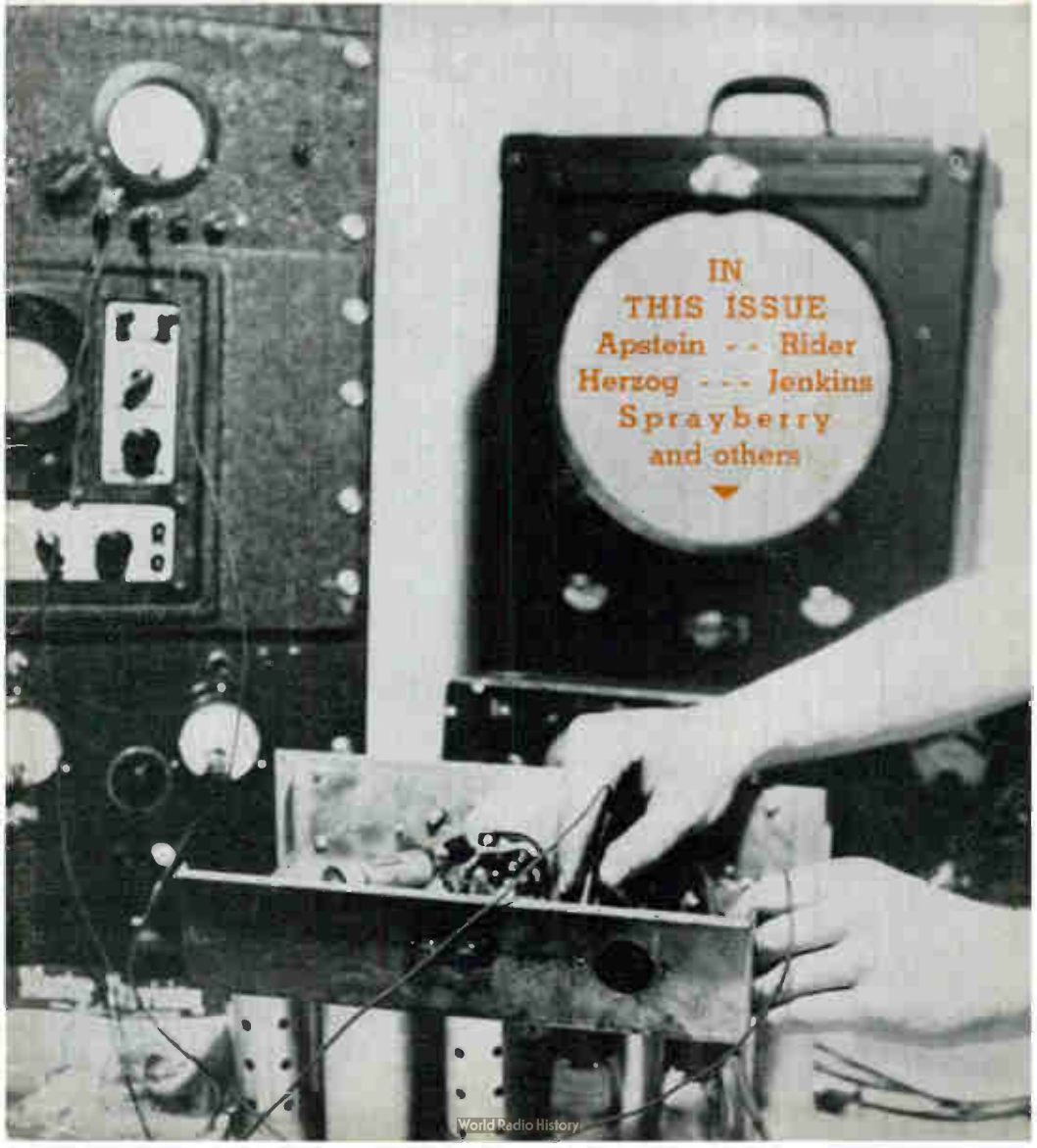
# Master Servicing

Edited by Glad Henderson

for 24,359 servicemen who do 82.6% of all radio service

MARCH 1938



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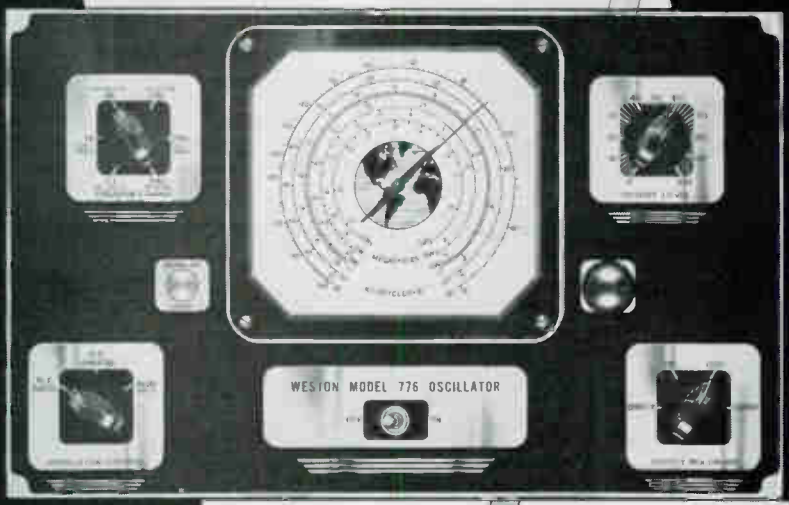


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# carrier-current signaling (wired wireless) explained in simple terms

MAURICE APSTEIN
Consulting Engineer

MOST servicemen have only the vaguest ideas about the principles governing carrier-current signaling, or as it was known in its early stages, "wired wireless." Actually the fundamentals involved and the form in which these fundamentals are applied in practice, differ very little from those which are entirely familiar to every serviceman who understands the basis of superheterodyne operation. With the advent of carrier-current telephones for interoffice communication purposes, and more recently, the announcement of a new type remote control based on these principles, every alert serviceman should make it his business to study the basic principles and many uses to which carrier currents may be put. He will then be able to capitalize upon that knowledge when called upon to service carrier-current equipment.

The purpose of this paper is to outline the underlying theory and basic mode of operation of carrier-current circuits. No schematic circuits will be analyzed since they differ somewhat for various applications. Block diagrams instead, will suffice to illustrate how closely the action and purpose of a carrier-current system coincides with the corresponding functions in a superheterodyne receiver. The serviceman should then be able to analyze the action of a carrier-current schematic in the light of his experience with various types of superhets.

## SUPERHETERODYNE RECEIVER

Fig. 1 shows a block diagram of a simplified superhet receiver. The signal enters at the left, either directly from the antenna or from one or more preselector stages. In the plate circuit of the detector (or in a mixer tube) it is mixed with the signal from the local oscillator, causing a beat frequency equal to the frequency to which the i-f amplifier is tuned. The primary reason for a relatively low i-f in a superhet receiver is because very efficient amplification can thus be obtained in the i-f amplifier. Also, since the i-f stages always operate at one frequency in a receiver, a high degree of selectivity is possible. The output of the i-f amplifier is then demodulated by the second detector and fed into an audio system which terminates in a

**PROBABLY the latest innovation in carrier-current control systems and one with which the serviceman is destined to become painfully familiar in the near future, is the new push-button remote control recently announced by the RCA License Laboratory. This unit allows complete remote control of a radio set from any point in the house, by the transmission of carrier impulses over the power line. By a very ingenious application of cold cathode discharge tubes, the receiver does not draw power until it is turned on from the remote point. In other words the receiving end of the carrier current control system draws no power from the line even though it is always ready for reception of the starting impulse which turns on the broadcast receiver. Additional signals are then transmitted which tune the radio to the desired station by actuating the familiar tuning motor.**

**This system will be described in an early issue of MASTER SERVICING.**

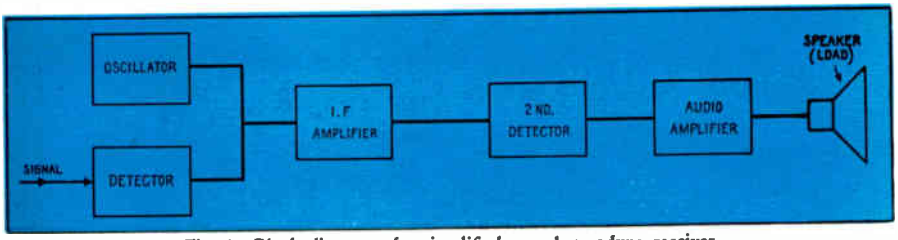



Fig. 1. Block diagram of a simplified superheterodyne receiver.

loudspeaker. All this is merely reviewed here for clarity.

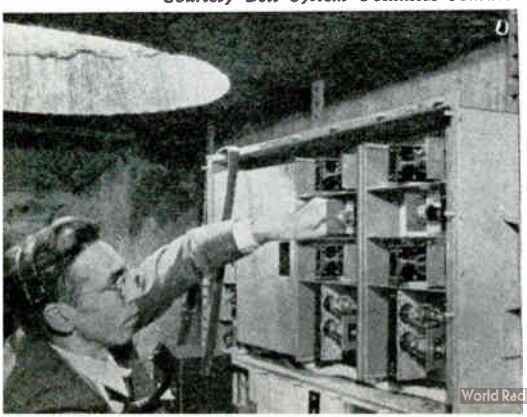
Fig. 2 shows a similar diagram for a carrier-current communication system. This is a generalized form which is the basis for practically all carrier-current transmission, used for signaling, telephony, remote switching, centralized radio system, etc. A simple inspection shows that it consists of the essentials of a superhet receiver split up into two parts and connected by a dotted line which represents a transmission line or link. The signal to be transmitted is mixed with the oscillator and emerges as a modulated intermediate frequency which is amplified by the I-f amplifier at the transmitting end. This i-f amplifier is coupled to almost any kind of path that will serve as an r-f transmission system, at the far end of which the receiver is connected. Here the signal is further amplified if necessary, detected, or rectified, and fed into a control device or speaker which acts as a load.

In the superhet circuit the primary reasons for frequency conversion were extreme efficiency of amplification and selectivity. In the case of carrier-current equipment there is also a definite but quite different reason. Relatively low radio frequencies (those falling in the lower part of the so-called i-f range, approximately 50 to 250 kc) can be transmitted along a comparatively poor transmission line with much less loss than the higher radio frequencies used for ordinary radio transmission. Also there is much less tendency for direct radiation from the transmission line at these frequencies. Consequently, almost anything metallic can be used as a link between transmitter and receiver. Probably the most important advantage of the use of these frequencies is that they are usually widely separated from any other service for which the interconnecting line may already serve. For instance, one of the most widely used transmission lines is the regular 115 volt a-c or d-c lighting or power line system. Because the tuned receiver will reject any energy except that at the i-f or carrier frequency, these lines can be used to transmit signals and power simultaneously without interference of any kind between services. Since both receiver and transmitter are connected to the power line anyway, no additional link is required between them for transmission of intelligence. In practice, the selective properties of receiver and transmitter are utilized even more fully by transmitting several signals at the same time but at different frequencies, all however, in the low i-f range. The receiver may then be tuned to pick up whichever of these signals is desired in much the same way that a broadcast receiver tunes in only the desired station without interference from other stations operating at the same time on different

*(Continued on page 80)*

Checking a telephone amplifier installed in a manhole. The system, off when not in use, is automatically turned on from a remote point when needed thru the use of carrier currents. Carrier currents permit 240 simultaneous conversations on a single pair of wires.

*—Courtesy Bell System Technical Journal*



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JOHN F. RIDER
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# hours for sale

ONE of the serviceman's greatest problems, and at the same time one of the most confusing, is what to charge per hour for service rendered or labor performed. This subject has been discussed by and large and it seems strange to find so few references made to the actual key to the problem . . . I refer to the number of hours available for sale which, when sold, must produce the revenue needed to cover expenses, salaries, profits, etc.

Servicemen have established devious methods of charging and have called them by various names, but every method resolves itself into a certain charge per hour. The flat rate method, which to all appearances is the farthest removed from the hourly basis, is, none the less, exactly the same. The flat rate method is based upon a given operation and the charge made for that operation in turn reflects the amount of time entailed to complete the operation. The charge, therefore, is really made upon the time basis.

## TOO MANY SHOPS OPERATE IN THE RED

Let us for the moment assume that a serviceman is familiar with his fixed expenses and that he has the ability to secure the needed sales. He cannot, however, establish a normal and profitable operating basis unless he determines his capacity, or the number of hours which can be sold.

We say without fear of contradiction that a great number of service stations are operating on an unprofitable basis because the owner has never decided upon his correct capacity. We know this because we have spoken to the men and they had absolutely no knowledge of why it was necessary to determine their productive hours. . . . This has never meant anything to the owner-operator type of shop because the owner felt that his time was his own and he could work as many hours as there were in the day or as he saw fit. It is because of this thought that present day service charges are so low as to be unprofitable.

The average serviceman feels that he is privileged to work 12, 14 and even 16 hours a day. . . . Some say that they must work such long hours in order to make a living, if we call it that. . . . Did you ever analyze such statements? There are several possible reasons that make it necessary for a man to work 12, 14 or 16 hours a day. First he must have sufficient work to keep him busy and he may work so many hours because the return per job is not sufficient. . . . Second, he may not be competent and therefore cannot complete the job in proper and profitable time. . . . The latter type of man we must forget, because he does not belong in the business. We are only concerned with the man who says that the return per job is not sufficient.

The primary reason why the majority of servicemen cannot secure satisfactory return on their work is because the majority started off on the wrong foot by not charging enough and are continuing to operate on a losing basis. If the industry awakens and elevates itself to a business level, so that the majority ask the proper fee, the public will soon learn to pay.

## WORKING HOURS

Getting back to working hours, the American radio serviceman works longer hours than any other group of maintenance men, other than those called upon in case of emergency. If we may say so, without maligning those servicemen who place themselves in the professional class and refuse to see

commercialism in the service field, automobile repair shops open at a certain hour and close at a certain hour; electricians with shops who cater to the users of electrical equipment open at a certain hour and close at a certain hour; plumbers open their shops at a certain hour and close them at a certain hour. . . .

The majority of owner-worker shops, other than those classified as retail stores, have fixed working hours. . . . But not so the serviceman. He is a privileged citizen who should work far into the night. . . . Is not ten hours of work per day sufficient? It seems so for the customers of the service shop. . . . Mr. Brown, Mr. Jones, Mr. Smith or Mr. American public who is working has fixed hours. . . . The receiver finds its most consistent use at night, be-


**Free tests day or night . . . repairs on the instalment plan . . . 50c repairs . . . free this, free that! Do the landlord, the butcher or the baker give free rent, steaks, bread? If a serviceman could work 24 hours a day he still can't make a living on free this and free that.**

cause Mr. and Mrs. America are at home at night . . . But not so Mr. American Serviceman. . . . He is in his shop working. . . . This working at night may not be so bad in itself. . . . What is bad is that the remuneration is too low. . . . That is what hurts. . . .

The major fault of interest to us at this time is that John Serviceman, in business for himself, does not have the courage to say that he is willing to work a reasonable number of hours and that the public must pay him for work done. . . . This is not radical talk, but a statement of fact. The average serviceman feels that if he is willing to work ten hours a day, he must establish a service charge based upon working 10 hours a day. As a matter of fact some men are even more liberal. They are willing to work 12, 14 and 16 hours. That may be fine, but to establish a service charge to the public based upon working between 10 and 16 hours a day most certainly is not good business. . . . Therein lies the fault. . . . The average service charge all over the United States is based upon too many working hours.

## TWO EXAMPLES

Mind you, we are not attempting particularly to reduce working hours. . . . We are concerned with the establishment of the service charge upon a reasonable number of working or productive hours in accordance with sound business principles. What we mean can best be illustrated by two living examples, both of whom we know intimately. We will not identify them, but for illustrative purpose we will call them Murphy and Kelly. . . . Both are located in the same town and have shops with a similar number of customers.

Murphy figures that he can operate on a basis of $1.00 per hour. He is in business for himself, so that the responsibility is his own. He is willing to work 10 hours a day. Exclusive of Sundays and legal holidays there are about 300 working days. That means that he has 3,000 hours available for productive effort. Murphy also figures that his expenses plus his salary approximate $2500. per year with about $1300. of that amount as salary. Deduct $2500. from $3,000. (the sale of 10 hours per day at $1.00 per hour for 300 days) and he has a net profit from the sale of his time of $500. per year. Add to this the 66-percent mark-up on cost of replacement parts, which he sells at list and he has more profit. . . . As a matter of fact a handsome business. (The 66-percent profit is the 40-percent discount off list.) . . . A really lovely picture that does not exist in practical life, as Murphy found out after years of struggle.

Now let us examine Kelly's arrangement and what is behind it, so that we can see what is wrong with Murphy's set-up. Kelly realizes that while 3,000 hours are available, he would be wrong to establish a service charge-per-hour based upon the sale of 3,000 hours. If he sold 3,000 hours of his time, it would be the equivalent of operating at 100 percent capacity. . . . Kelly realizes that

*(Continued on page 73)*

# more about unique circuits in receivers and amplifiers

IN the January issue of MASTER SERVICING a number of unique circuits and parts of circuits, found in current receivers and amplifiers, were discussed. Additional circuits are given below.

## ELECTRONIC TONE CORRECTOR

The Bogen Model CX 70 amplifier incorporates a system, for individual control of high and low frequency response, called the electronic tone corrector (see Fig. 9).

At one point in the amplifier circuit two networks, designed to control the bass and treble response separately, are coupled. A 6F5, with a suitable variable input control, is connected to each of these networks for amplification. The plates of the two 6F5s are coupled together. By separately controlling the inputs to these stages any amount of bass or treble response can be injected into the output without otherwise affecting the overall response characteristic of the amplifier.

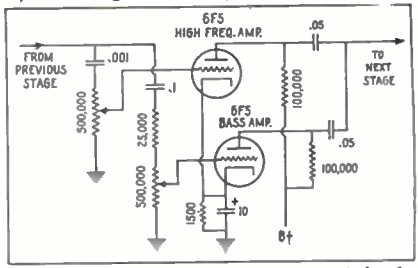


Fig. 9. Electronic tone corrector used in the Bogen Model CX 70 public-address amplifier.

## SENTINEL-ERLA 32-VOLT SET

The Sentinel-Erla Model 93-L (Fig. 10) is designed for operation from 32-volt d-c battery plants without the use of additional voltage for the plate and screen supply to the various tubes used in the receiver.

Three separate filament circuits are

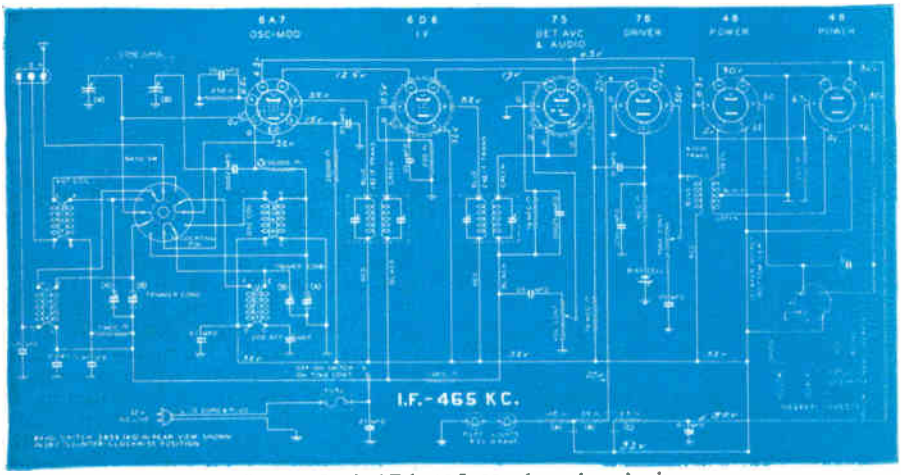


Fig. 10. Sentinel-Erla 93-L 32-volt receiver circuit.

used. The two 48 filaments are connected in parallel and then in series with a 2.5-ohm resistor across the 32-volt line. The remaining 4 tubes in the circuit are connected in series with a 25-ohm resistor and the line. A tap is taken off this filament line at 6.3 volts and is connected to the cathode of the 48 output tubes; a 200-ohm resistor, connected from the 48 cathodes to the ground, thus shunts the filament of the 75 tube. However, since the plate current of the 48s is added at this point the connection merely has a stabilizing effect on the bias. The third filament line is used for the two No. 40 pilot lites.

Since the maximum B voltage supplied to the receiver is only 32 volts, the actual voltage measured between the plate and cathode of the 48 output tubes is less than 24 volts. In spite of this a power output of about ¼ of a watt is available for the speaker.

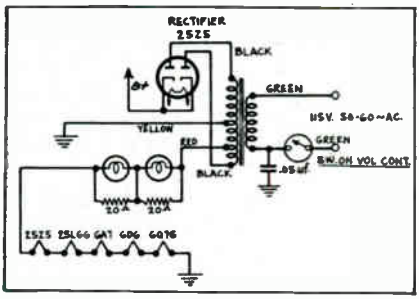


Fig. 11. Fada filament circuit

## FADA FILAMENT CIRCUITS

In the average a-c receiver the tube filaments are wired in parallel and connected to a low voltage winding of the power transformer. In the Fada Models 351, 353, 354 and 355 a-c receivers, however, the filaments (and pilot lites) are connected in series (see Fig. 11). The power transformer has but two windings—primary and secondary. The series connected filaments receive their power from a suitable tap on the high voltage secondary. A 25Z5 tube is used as rectifier.

This unique connection of filaments simplifies the underchassis wiring and, since the total filament current is only 0.3 amperes, heavy filament wires are not essential.

## HI-FIDELITY I-FS

There are a variety of i-f circuit arrangements used in modern hi-fidelity receivers to approach the ideal selectivity curve which gives a flat top over a 10-kc range on either side of the peak and drops sharply on both sides. Practical conditions dictate, however, that hi-fidelity i-f circuits provide adjustable selectivity under control of the listener. This enables him to obtain broad selectivity for hi-fidelity reception where possible or sharp selectivity where needed to cope with interference on crowded channels.

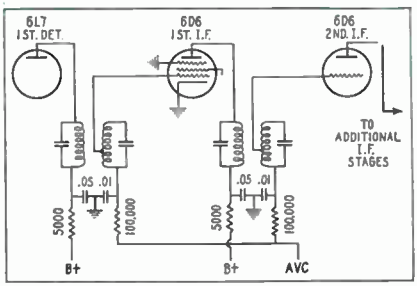


Fig. 12. Hammarlund i-f circuit.

## HAMMARLUND'S VARIABLE I-FS

The Hammarlund variable i-f transformers are designed to permit continuous variation of the mutual inductance between primary and secondary throughout a wide range of values without otherwise affecting circuit constants.

The 1938 Hammarlund Super-Pro receiver uses three variable-coupling i-f transformers which constitute the input circuits of the 6D6 I-f amplifier tubes. A fourth transformer couples

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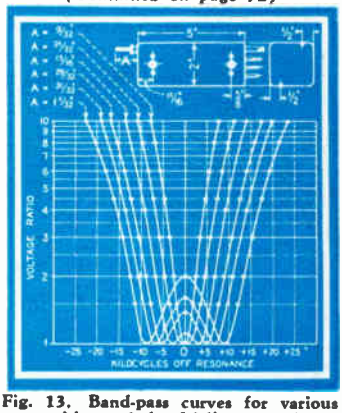


Fig. 13. Band-pass curves for various positions of the fidelity control.

# As We See Radio Servicing

THANKS for all those good letters on service problems. We appreciate your taking time out to aid us with your comments, and some of them are mighty valuable. In a quick conclusion, we believe that there are too many servicemen who are scared of their value. We don't know why, but we find men in towns where others say that business is poor, who are doing a good business at good profits.

Take a jobber in a town of 100,000, who has sold sets for, say 10 years. Perhaps he has sold 7 different lines, aggregating 12,000 sets. He has a service department, for most dealers rely on him to do their servicing, as so many dealers neglect this important feature of their business. Even the servicemen come to him for aid when they get a problem which they can't solve. He does the servicing and charges plenty—and they pay it.

Proving that when a man doesn't care, he can get the work and get his price. Reports show that this type of jobber gets from $5 to $8 for jobs that servicemen take at $2 to $4. Perhaps it is the jobber's prestige that does it, or he may have brown eyes, but whatever it is, he is getting the business at profitable prices.

How many servicemen are there in Albany, N. Y., or in Harrisburg, Pa., or in Peoria, Ill.? Walter Braun tells me that there are 3,000 in the Chicago area, alone, and he sells most of them. But over half of them work from their homes because they haven't yet discovered the art of doing business. Braun didn't comment on this, but we do.

A WHOLESALER recently in our office refers to the average serviceman as a "tube juggler." He says all they know is how to test a tube, and there is only one man in a town of 77,000 population that he regards as efficient. This isn't right, I'm sure, but the reputation and the sets that come to the jobber's office indicate that the boys are stumped at the slightest thing out of the

ordinary. Here is an indictment that we don't think is deserved for all of the servicemen of that city, but he thinks so because of experience with perhaps 14 men.

He thinks that many servicemen are chiselers; they try to buy a part for 11 cents which ought to cost 29 cents, and then feel proud that they "put it over" on the customer. Many servicemen take pride in their work, and would automatically buy the 29 cent part, because gyp parts are a waste of energy at the best. Any serviceman who doesn't use standard tubes is likewise short-changing not only the customer, but also himself. What he makes money on is his time, and if he is one of those nickel coffee birds, he thinks in terms of doughnuts and not of giving a good job and getting paid for it. So few servicemen have earned a reputation for service by diligently adhering to the proper standards that the field is wide open to a man who wants the good will of customers.

If I went into the radio service business tomorrow, my first customer would radiate enthusiasm at my work; he or she would give me leads for two more calls; I'd then get three or four more and before long, I'd be known as "the best serviceman in town." I'd make friends of my clients, who in turn would regard me as a friend, and it is only the friends who can be relied upon to "go to bat." Make friends of your clients, and there need be no worry on your future—unless, of course, that you don't know your stuff and that you do nothing but stall around with a know-it-all attitude.

In the past, when new set sales were low, the servicemen had no trouble doing a fine business. 1938 ought to be the best year for "service" since 1930.


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HENDERSON PUBLICATIONS, INC.
1270 Sixth Avenue New York City

# Jenkins

# do we need sounder standards of test oscillator accuracy?

V. E. JENKINS
Weston Electrical
Instrument Corp.

FOR conventional instruments such as voltmeters or ammeters, the basis for accuracy ratings is now well established and commonly understood. According to the AIEE standards: "In specifying the accuracy of an indicating instrument, the limits of error at any point on the scale shall be expressed as a percentage of full scale reading." Although the manufacturer of test instruments obviously cannot guarantee that accuracy will remain within the rated limits in the face of electrical injury or abuse in handling, it is generally understood that the values given will be retained throughout years of service under the conditions which are normally encountered in the proper use of the particular instrument.

## OSCILLATOR NOT AN INSTRUMENT

When we come to the test oscillator, however, we find a fundamentally different situation. Actually, of course, the test oscillator is not an instrument at all in the indicating sense and customary definitions of indicating instrument accuracy cannot apply. As the source of a controlled signal output, an oscillator must be judged both by the facilities for control it offers, and by the fidelity with which it generates the particular signal for which the controls are set. An accurate oscillator can only be one in which all the characteristics of the output signal are accurately known, including attenuation, wave-form and modulation characteristics as well as frequency, and these under actual service conditions.

As the basic function of the test oscillator is to furnish a signal at the definite frequency which the user requires at the moment, the first significant rating is one which expresses the maximum percentage of error in the output frequency which may exist at any desired point. In oscillators of the all-wave type, it is particularly necessary to know that the controls can be set at any point on any wave band with the expectation that the frequency of the signal generated will correspond to the value shown on the dial or calibration curve within a known percentage of error.

## MANY PRESENT RATINGS VAGUE

The majority of test oscillators on the market appear to be rated as "accurate within 1 or 2 percent," but many of the statements to this effect are decidedly vague as to percentage of what. If this refers to a percentage of the highest frequency available on

Calibrating a Weston test oscillator dial scale to match the individual oscillator circuit.

any particular wave band, the accuracy may be much less at the frequency for which the controls are set. A truly useful accuracy rating can only mean that at every point on every wave band, the generated frequency is within 1 or 2 percent of the dial settings: 1 kilocycle at 100 kilocycles, 10 kilocycles at 1,000, and so on.

Even more important perhaps is some understanding as to how long and under what conditions the rated accuracy may be expected to be maintained. Will the frequency be "accurate within 1 percent" for example, after a few weeks in a hot, damp shop, or after being taken out of a cold automobile into a warm room?

After all, as every serviceman must know from his own experience no piece of high-frequency equipment of this kind can be stamped out and wired up so that calibration is merely a matter of tightening a set screw on a dial. Either the dial or scale plate for each instrument must be individually calibrated to match the oscillator circuit, or the oscillator circuit must be adjusted to match the fixed divisions on the scale plate. The latter practice saves time and expense, but it inevitably introduces into the critical circuit the use of "trimmers" or other means of adjustment.

## ATTENUATION

So far we have been discussing oscillator accuracy in terms of frequency alone. However, the matter of attenuation control is basically an accuracy question, too, though here regulation to within 20 or 25 percent of rated output level (in microvolts) meets normal servicing needs. If the attenuation is to be given any accuracy rating at all, provision must be made to furnish a definite output level at every position of the attenuator knob, regardless of the frequency setting, and regardless of fluctuations in supply voltage. Output level must remain at 2 microvolts, for example, even when frequency is shifted from one band to another. If attenuation is to be accurate within 25 percent, some automatic means must be employed to hold this output voltage constant. Otherwise the oscillator fails in its function to supply a fully controlled output signal.

When you consider that attenuation

*(Continued on page 81)*

Ruttenberg

SAM RUTTENBERG
President
Amperite Co.

# interesting characteristics of velocity microphones

MADE of one of the lightest of metals (an aluminum alloy) and only two ten-thousandths of an inch thick, the ribbon in the velocity microphone has a natural period of 10 cycles-per-second. This is the reason for its freedom from peaks. Strange as it seems the lightness and thinness of the ribbon is also the reason for the ruggedness of the velocity microphone. Should the microphone be accidentally dropped or subjected to severe mechanical shocks the ribbon is not permanently distorted. It merely flutters a little, then returns to normal position. A heavier mass subjected to shocks would tend to distort permanently.

It is the free vibration of the extremely light ribbon in a constant magnetic field, that accounts for a probably more important although less known property of the velocity microphone—zero harmonic distortion. There is no air compression, stiffness of diaphragm or acoustic cavity placed near the vibrating element.

## LOW-FREQUENCY ATTENUATION

Without introducing any peaks the velocity can be designed with the low frequencies slightly attenuated, which is sometimes desirable for p-a work. When a crooner insists on getting right into the microphone, slight attenuation of the lower frequencies will give better reproduction. This can be accomplished in the design of the transformer or by an acoustic compensator (see Fig. 1). As the name implies the compensation is made acoustically rather than electrically. Compensating electrically with filters, etc., may introduce undesirable effects which are not experienced with the acoustic compensator. The acoustic compensation is accomplished by a sliding panel that gradually closes the back of the microphone, changing it from velocity to pressure operated. Closing the back of the velocity makes it higher pitched.

Fig. 1. A sliding panel that gradually closes the back of the microphone changes it from velocity to pressure operated. Closing the back of the velocity makes it higher pitched.

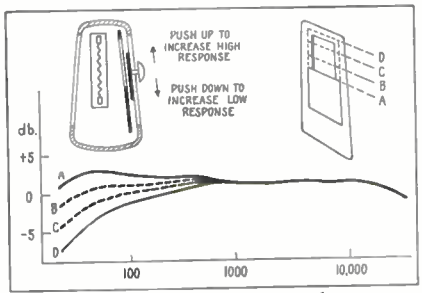



Fig. 2. Curves showing changes in the response characteristic for various positions of the acoustic compensator shown in Fig. 1.

It permits adjustment for best operation under different conditions. For example if the performer is close to the microphone (6 in. or less) it is desirable to attenuate the low frequencies slightly. This can be accomplished by merely pushing the com-

pensator knob up the desired amount. The higher it is pushed up the higher the pitch. When picking up an entire orchestra or a performer at a distance from the microphone, it is desirable to have a microphone with the best low-frequency response possible. A high-pitched microphone will give thin reproduction. The compensator slide should, therefore, be pushed all the way down whenever the source is more than 6 inches from the microphone.

## RUGGEDNESS

A velocity microphone experienced an unusual and interesting test in the recent 1937 flood. Portsmouth, Ohio,

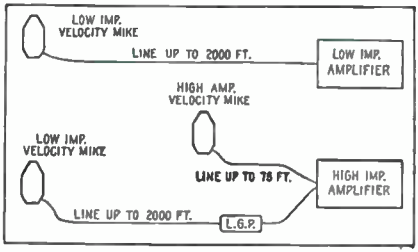



**Fig. 4. The combination of a low-impedance velocity and a cable type transformer permits using the microphone into high-or-low impedance.**

the home of station WPAY, was one of the most severely flooded areas. The station was practically washed away; much equipment was lost. However, a velocity microphone under water for a period of about ten days (Fig. 3) worked after the mud was cleaned off the outside. It is thus evident that moisture does not affect the velocity microphone. Temperature and altitude, likewise, have no ill effects upon the output or response characteristics of the microphone.

The magnetic flux will not change enough to cause a 2 db change in output, and its frequency response can only be changed by altering the microphone construction. Even a forty mile gale will not in any way damage the ribbon.

## CABLE LENGTH

Cable length and extraneous field pickup are the governing factors in determining the selection of output impedance. High impedances have the advantage of eliminating the input transformer—but have the disadvantage of not allowing a long cable. Of course the higher the impedance the shorter the permissible cable and the more trouble with hum pickup. The high-impedance velocity has an impedance of approximately 2,000 ohms and therefore should not be confused with other high-impedance microphones which run up around 500,000 ohms. The comparatively low impedance of the high-impedance microphone permits cable lengths up to 75 feet and does not introduce any hum problems in ordinary installations. Since 80 percent of the installations require cable lengths of 50 feet or less, the high-impedance velocity is the simplest and least expensive installation because it feeds directly into the high-impedance input of present high-gain amplifiers.

However, for the p-a man who might be called in on any type of installation, 200 to 2,000 feet of cable lengths are not uncommon.

The problem of matching low-impedance microphones into high gain amplifiers with grid input is solved by the cable type input transformer (see Fig. 4). The cable type input transformer is placed approximately two feet from the amplifier and is so constructed to eliminate hum pickup.

As shown in Fig. 4, the combination of a low-impedance velocity and a cable type transformer permits using the microphone into high- or low-impedance input—and in either case cable lengths up to 2,000 feet can be used.

**Fig. 3. A velocity microphone under water in the Ohio flood for ten days was found to be in good operating condition when recovered.**

Sprayberry

# common variations in receiver oscillator circuits

FRANK L. SPRAYBERRY
Academy of Radio

A FEW of the more common variations in receiver oscillator circuits are given in the accompanying diagrams to assist the serviceman in identifying the various parts.

In Fig. 1 the primary of the i-f transformer appears to be untuned. The condenser $C_t$, however, serves this function along with its action to feedback energy from the plate to the cathode for producing oscillation. It is adjusted with the other i-f trimmers.

In Fig. 2 the high-frequency trimmer $C_t$ is in shunt with the oscillator gang tuning section $C_g$ while the (low-frequency) padder $C_p$ is in series with the coil to ground. An unusual feedback means is used, but this does not change the principle or procedure of alignment.

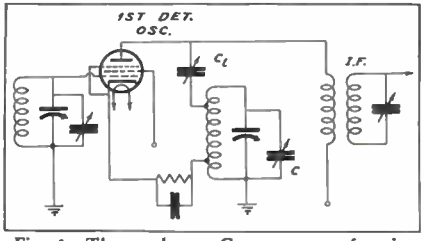



Fig. 1. The condenser $C_t$ serves two functions in this circuit.

The padder is sometimes connected to a tap on the oscillator grid coil as $C_p$ in Fig. 3. Once this is recognized as the low-frequency padding condenser, it is adjusted as usual.

In the circuit of Fig. 4, the high-frequency oscillator trimmer has been shifted over to the afc coupled circuit and still tunes the oscillator grid coil $L_1$ by induction. The condensers are marked as usual.

## OSCILLATOR ALIGNMENT

In aligning a superheterodyne the adjustment of the oscillator circuits usually follows the i-f alignment. For this purpose the signal generator output is shifted to the antenna-ground posts of the receiver. The low or attenuator connection of the generator is used so that the signal may be lowered as desired. The proper dummy antenna specified by the receiver manufacturer must be used in series with the generator output. Although the actual values specified by the different manufacturers vary somewhat, a 200-mfd condenser is usualy satisfactory for general alignment work on the broadcast band. On the short-wave bands a 400-ohm carbon resistor (1/2 watt or larger) should be used.

Except for making provisions for stopping avc action or working below the avc threshold level the receiver should be restored to normal operation. The output meter should be left in place. Turn the afc control to the off position; tune the fidelity control to the sharp or lowest-fidelity position and set the signal generator attenuator to the lowest position consistent with a readable output. The receiver volume control should be at or near maximum.

In the conventional oscillator there

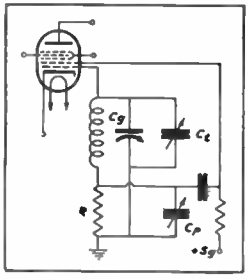



Fig. 2. The low-frequency padder is in series with the coil to ground.

are but two adjustments to be made for each band. The usual procedure is to start with the broadcast band.

A typical oscillator circuit for a multiband receiver (showing connections for only one band) is given in Fig. 5. The variable condenser $C_g$ is the oscillator section of the gang tuning condenser. $C_t$ is shunted across the gang section $C_g$ on this band and $C_p$ is in series with the oscillator grid coil. The latter is shunted by C so that the total capacity may be quite large and yet the variable part of the capacity $C_p$ still is effective. As condenser $C_g$ is reduced in capacity, $C_t$ becomes more and more important as the tuning agent of the circuit and its adjustment becomes more critical. Therefore, set the signal generator to 1,400 kc; tune the set dial to exactly 1,400 kc and adjust trimmer ($C_t$) for maximum output.

In many receivers, especially those using i-f values below 200 kc, there will be two possible adjustments at 1,400 kc which will produce a maximum output. One will be where the trimmer is nearly closed (adjustment screw near maximum turned to the right) and the other will be obtained with the condenser a good bit more open (adjustment screw turned out or to the left). It is this left-hand or out setting which must be chosen invariably. Therefore, turn the adjusting screw all the way out (counter clockwise) and adjust by turning it back to the right (clockwise) until the first optimum setting is reached. In this manner the wrong setting will be avoided.

At this point the r-f trimmers are adjusted for maximum reading on the output meter.

Next, tune the signal generator to

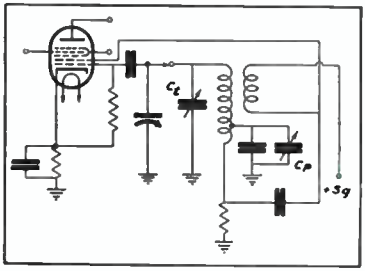



Fig. 3. The padder is sometimes connected to a tap on the oscillator grid coil.

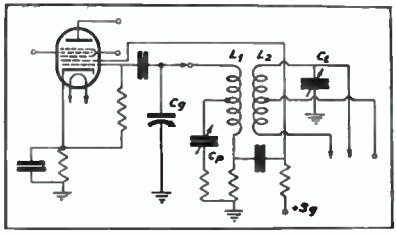



Fig. 4. The oscillator trimmer ($C_t$) still tunes the grid coil ($L_1$) by induction.

600 kc and tune the receiver to the signal disregarding the dial setting at which the signal is received. (Although some set manufacturers may advise some other frequency at the low-frequency end of the dial, where no advice is available use 600 kc for this work.) At this setting of the generator the oscillator padding condenser is adjusted while rocking the receiver or generator dial. After the

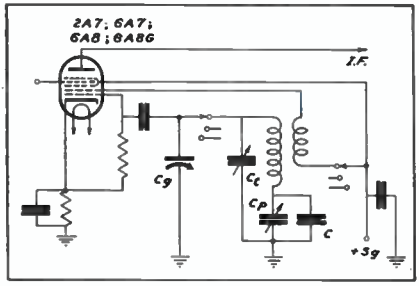



Fig. 5. A typical oscillator circuit in a multiband receiver.

padding condenser is adjusted for maximum output, the 1,400-kc adjustments must be repeated.

Switch to the next band and repeat the same process where both trimmers and padders are provided. In many bands the padders will be omitted as the oscillator grid coils are wound with less inductance and will track well enough with adjustment. Where the manufacturer's figures are available for the frequencies at which adjustments should be made, they should be used. If they are not available, it will be safe to select frequencies about 10 or 15 percent from either end of the dial for each band.

It may rarely be found that the dial scale is too long or too short for the

*(Continued on page 81)*

Superfacts

# exclusive data solves alignment puzzles on current supers

IN the January issue of MASTER SERVICING, circuit diagrams and brief alignment notes for several current receivers were given. On page 22 of that issue much of the general procedure common to the alignment of every receiver was also given. By way of review some of this procedure will be repeated. It is assumed, however, that the average serviceman is completely familiar with the routine alignment of a superheterodyne.

The alignment procedure which accompanies each circuit, gives, in chart form, the order in which the alignment operations must be taken; the point on the receiver to which the signal generator is to be connected; the resistor or condenser to be used in series (dummy antenna); the settings of the various generator and receiver controls and the trimmers to be peaked.

Before attempting to realign a given receiver the condition of the existing alignment should be determined thru the use of a tuning wand or similar instrument. In no case should the trimmers be readjusted until all other possible defects have been checked for and corrected.

Both the receiver and the signal generator should be allowed at least 15 minutes to warm up before any adjustments are attempted.

The signal fed to the receiver should be continually reduced, by means of the attenuator provided on the signal generator, as the stages are brought into alignment so that the output meter deflection is just readable. The signal in the speaker should be audible but not loud. The receiver volume control should be on full throughout the entire procedure.

In aligning i-f circuits it is desirable to begin with the secondary trimmer on the last i-f stage and work towards the primary trimmer on the first i-f stage. The i-f alignment should be repeated before the r-f adjustments are made. For more accurate results the entire alignment should be repeated several times.

While making oscillator padder adjustments the tuning condenser rotor (or the signal generator dial) should be rocked to and fro thru the signal. The maximum output meter reading resulting from the combined operations is the correct setting for the padder.

Wave-trap trimmers should always be adjusted for a minimum reading on the output meter. It may be necessary to increase the generator signal to obtain a suitable adjustment.

In some of the circuit diagrams which follow the various voltages encountered on the tube socket prongs are lettered on the diagrams. In these cases the voltages were measured with a 1000-ohm-per-volt voltmeter. The receivers were in operating condition with no signal input. The volume control was on full while the measurements were made. Average values are indicated with a power supply voltage of approximately 115 volts. Measurements taken in the field may differ as much as ±15% from those given.

While making the high frequency oscillator adjustment on each short-wave band it is advisable to check for the image, to determine whether the proper setting of the trimmer has been chosen.

## g. e. f-40

This model is a four-tube compact designed for operation from the 50-60-cycle, 110-125-volt power lines. The average power consumption is 60

## GENERAL ELECTRIC F-40 ALIGNMENT DATA

| Connect Generator to | Dummy Antenna | Generator Frequency | Dial Setting | Peak Trimmer |
|---|---|---|---|---|
| 6A7 Grid | 0.05 mfd | 455 kc | 540 kc | 1, 2, 3, 4 |
| Antenna | 400 ohm and 250 mmfd | 455 kc | 540 kc | 5 |
| Antenna | 400 ohm and 250 mmfd | 1830 kc | 1830 kc | 6 |
| Antenna | 400 ohm and 250 mmfd | 1500 kc | 1500 kc* | 7 |

* Tune to signal

watts. The single band covers the frequency range from 540 to 1800 kc.

A 6½-inch speaker is used with a voice-coil impedance of 5.5 ohms at 400 cycles. An undistorted output of 1.5 watts is available with a maximum of 3.0 watts.

The complete circuit diagram is shown in Fig. 1. Fig. 2 shows tube and trimmer locations. The accompanying chart gives the alignment operations. The resistor and condenser indicated under dumy antenna should be connected in series.

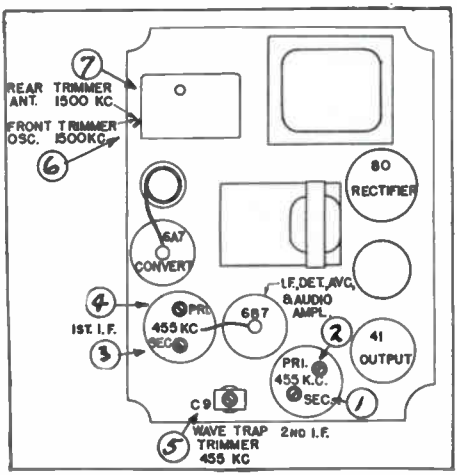



Fig. 2. G. E. F-40 chassis view showing parts layout and trimmer locations.

## hudson-rca sa 38

This auto-radio receiver employs a six-tube, single unit superheterodyne chassis with a frequency range from 542 to 1610 kc. The receiver in operation consumes 6.0 amps at 6.3 volts. A permanent-magnet dynamic is used,

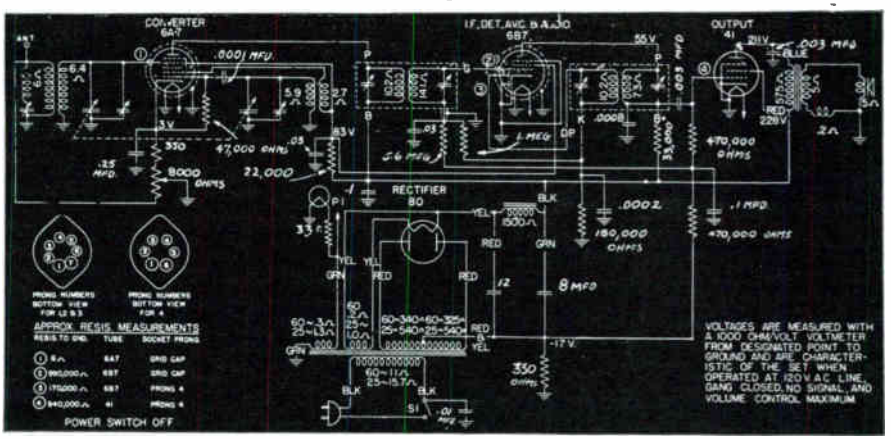



Fig. 1. G. E. F-40 circuit diagram.

## HUDSON-RCA SA 38 ALIGNMENT DATA

| Connect Generator to | Dummy Antenna | Generator Frequency | Dial Setting | Peak Trimmer |
|---|---|---|---|---|
| 6K7G I-F Grid | 0.25 mfd | 260 kc | 542 kc | L8, L9 |
| 6A8G Det Grid | 0.25 mfd | 260 kc | 542 kc | L4, L5 |
| Antenna Plug | 100 mmfd | 1400 kc | 1400 kc | C10, C5, C3 |
| Antenna Plug | 100 mmfd | 600 kc | 600 kc* | C11 |
| Antenna Plug | 100 mmfd | 1400 kc | 1400 kc | C10, C5, C3 |

* Tune receiver to signal. Rock dial while adjusting.

with a voice coil impedance of 3 ohms at 400 cycles. An undistorted output of 3 watts is available with a maximum of 4 watts.

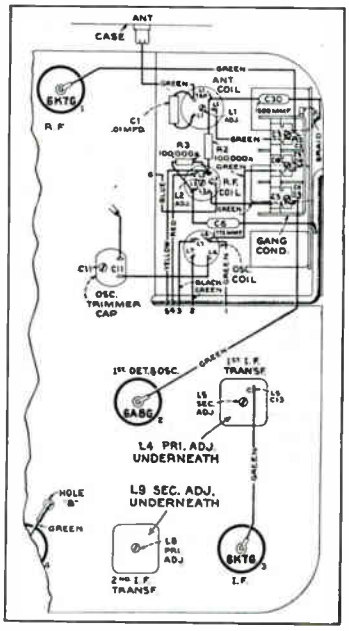



Fig. 2. Hudson-RCA SA 38 trimmer locations.

A complete circuit diagram is given in Fig. 1. The alignment operations are given in the accompanying chart. Fig. 2 shows the locations of the various aligning adjustments.

## RCA R-93 RECORD PLAYERS

### HUM AND VIBRATION

This is often caused by an armature ring that is not exactly centered with reference to the spindle. To realign, use a centering tool. This can be made of a piece of tin or iron about 2½-inches long, and ½-inch wide. Drill a ⅜-inch hole with its center exactly 2 inches from one end. This tool is placed over the turntable spindle, the three set screws losened a bit, and the ring centered by turning the tool until it contacts all points on the inner surface of the ring with equal pressure. If the bearing is lost, any 3/16-inch ball bearing may be substituted. See your nearest auto mechanic for a supply of bearings.

*E. M. Prentke*

## RCA RAE 26, RAE 29, RAE 79 AUTOMATIC RECORD CHANGER

### RECORD MAGAZINE TOO LOW

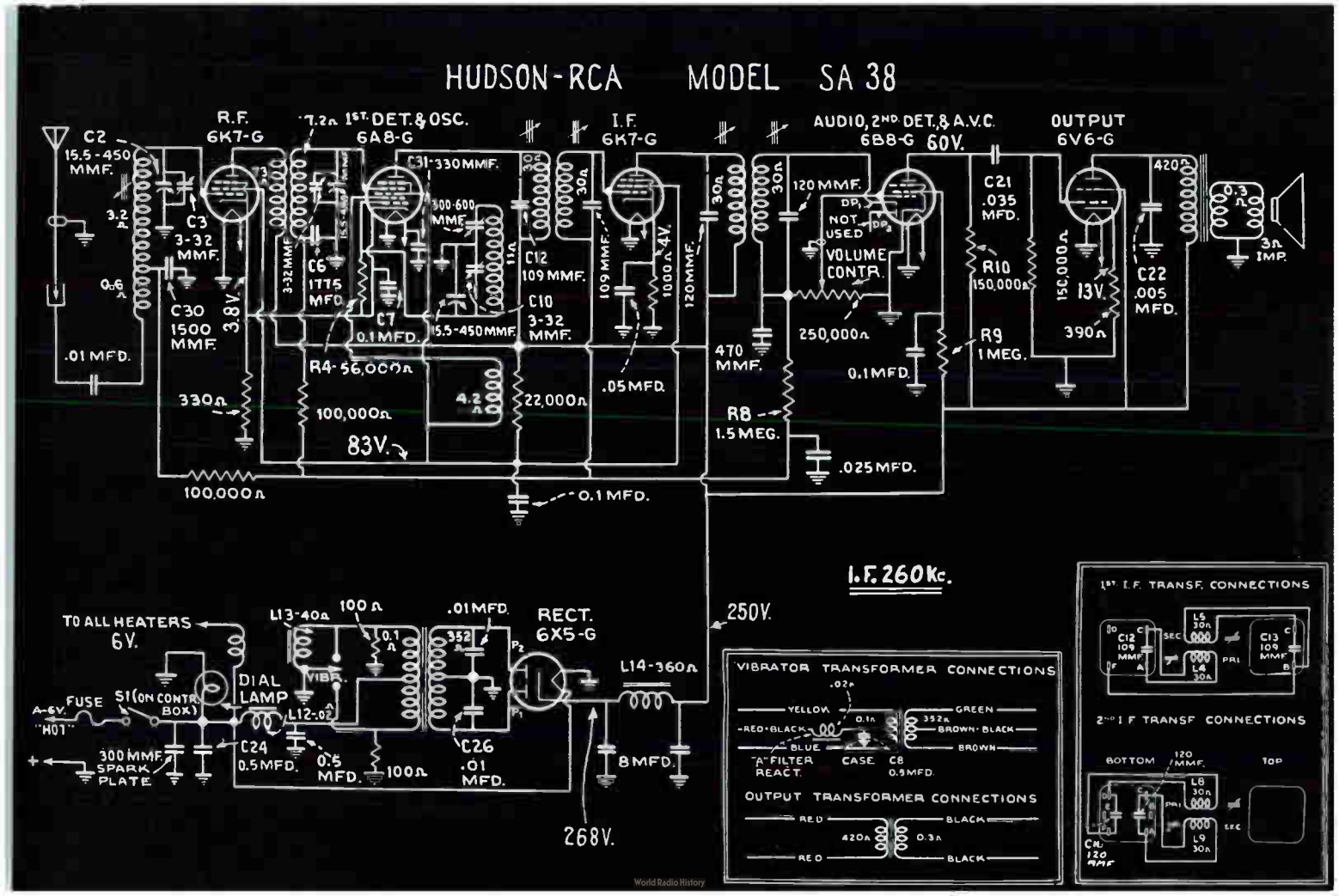
In some of these models the record magazine may be too low, when loaded with records, to clear the record transfer lever even with proper adjustment of the latter. Evidently the bearing has worn, or the arm has bent down. To take up this wear loosen the two hexagon head screws that hold the collar of the record magazine to its shaft and lift the magazine out of the panel. Select a brass or fiber washer of a thickness not exceeding 1/16 inch that can be slipped over the shaft between the bearing and the shoulder. Reassemble, and adjust the magazine so that when it is out of its changing cycle, its outer surface nearest the turntable spindle measures exactly 5/32 inch to the nearest side of the spindle. Readjust the height of the magazine roller so it will just contact the magazine when empty. Readjust record transfer lever.

### NOISY REPRODUCTION

Intermittent or noisy record reproduction may often be the result of a worn shielded lead through the tone arm. Replace the entire lead.

*E. M. Prentke*

# HUDSON-RCA MODEL SA 38



## HERZOG continued

*(See page 58 )*

the output of the third i-f tube to the control grid of the 6B7 second detector. A small coupling coil closely coupled to its plate or primary coil serves as pickup.

Since the pentode section of the 6B7 second detector amplifies at inter-

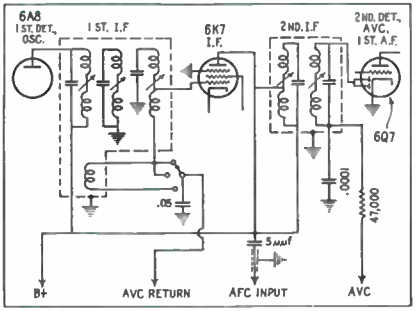



Fig. 14. Westinghouse WR-334, 336 i-f circuits.

mediate frequency, it really constitutes a fourth i-f stage. Its plate circuit is coupled back to the diode plates by means of a fifth single-tuned transformer.

Altogether, the i-f amplifier has nine tuned circuits; four pairs and one single. Three of the pairs may have their coupling continuously varied by a panel control while the coupling of the remaining pair is fixed. A portion of the i-f circuit is shown in Fig. 12.

The width of the band passed by the i-f amplifier is continuously variable by means of a calibrated mechanical control on the front panel. This control simultaneously varies the coupling between the primaries and secondaries of the i-f transformers. Since both primary and secondary of each transformer are tuned this variation of coupling changes the response characteristic from a single sharp peak in the minimum coupling position to a wide double-humped curve in the position of maximum coupling (see Fig. 13). The total range of coupling provided by the panel control is from approximately one-third optimum in the narrow position, to about three times optimum in the wide position. Since the control is continuously variable, any intermediate value between these two extremes is readily obtainable. A wide change in coupling also results in a wide variation in gain (except when operating on avc).

### WESTINGHOUSE SELECTIVITY CONTROL

The 1938 Westinghouse receivers (the arrangement and parts values shown in Fig. 14 are for the Models WR 334 and WR336) provide two degrees of selectivity. The first i-f transformer is of the three winding type, in which a tertiary tuned circuit is interposed between the primary and secondary windings. A more desirable i-f selectivity curve is obtained than is possible without the winding. As shown in Fig. 14 an auxiliary winding closely coupled to the primary is connected in series with the secondary, in the hi-fidelity position of the switch, and effectively increases the net coupling between the two main windings.

### HOWARD PUSH-BUTTON CONVERTER

The Howard Model 211 converter unit (Fig. 15) is designed to convert any receiver into a push-button model without any changes in the chassis. It can also be used as a remote control—provided other means are used to turn the receiver on and off at the remote point.

The unit is essentially a superneterodyne converter similar to those recently employed to make older receivers tune the short-wave stations. It is self-powered from the 110 volt a-c line. Two tubes, a 6A7 and a 1V,

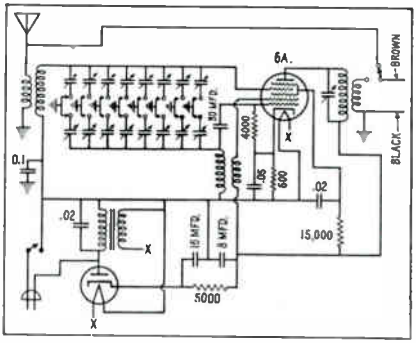



Fig. 15. Howard push-button converter circuit.

are used. Nine push-buttons provide presetting for eight stations and an off button.

A similar unit, the model 210, is available for installation directly into a console.

RIDER continued
*(See page 56)*

if a shop is open 10 hours a day, you cannot really work productively every minute of the day.

Since Kelly is the owner and operator, there are certain duties he must perform. . . . Trivial as the following may seem, they nevertheless are true. . . . Radio jobber catalogs must be examined so that purchases can be made. . . . Mail must be read and bills sent out. . . . Receivers must be delivered and called for and if these charges are not to be too high, they must be charged for at a rate less than the normal working rate. This means that the income for every hour spent in pickup and delivery is less than the amount secured from work in the shop. While it is difficult to accurately apportion this time, we are tempted to say that 10 percent of the total time available in the year would not be too much to set aside as being non-productive because of time lost during pickup and delivery.

Every serviceman who reads these pages knows that it is necessary to refer to service notes, no matter where you secure these service notes. Sometimes it may be necessary to spend as much as 15 to 20 minutes examining the wiring diagram of a complicated receiver before service work actually starts.

Supplementary to the above, we have the visit to the jobber's shop for supplies or if the jobber has a salesman traveling, a certain amount of time is spent conversing with the man. All of which Kelly realized. He finally decided that he would establish a service charge based not upon 3,000 hours sold, but about 1500 hours sold.

Kelly went beyond his own calculations. He checked into other commercial enterprises and he discovered that many organizations selling time, based their charges upon an operating capacity of from 40 to 60 percent of the total available time. Kelly, estimating 50 percent of his time as productive, realized that a charge of $1.00 per hour was not sufficient; he would have to charge $2.00 per hour.

Our friend Kelly was not concerned with what would happen if he got busy and worked into the night because he could not finish all of his work in the daytime. Operating at better than 50 percent was fine, but he knew that if he did operate at 50-percent capacity or sold 1500 hours of time he would make a profit.

## ESTABLISH PRODUCTIVE BASIS

Kelly had the good business sense to know that no successful service business could predicate its service charges upon 100-percent capacity. That is what the majority of servicemen must realize. The sooner they do, the sooner will there be a general increase in returns from service work all over the country.

The figures of $1.00 and $2.00 as quoted herein are purely illustrative. The exact amounts depend upon what it costs to run each individual establishment. However, there is such a great similarity between service shop operations in different parts of the country that an annual expense of between $2500. and $3000. for a one man shop is typical. To this the owner can add whatever profit he desires, but he at least can establish the basic rate so that he knows how much business he must do to break even. . . . That is extremely important, because this figure represents the basic figure to which is added the profit.

The number of productive hours which must be sold at a certain price is also of importance in connection with the very existence of the business. . . . Maybe the location of the shop is such that there are not enough receivers in the trading area to permit the sale of 1500 hours at a certain price, based upon expenses. Then it becomes necessary to determine if the expenses can be cut or if a new location must be found.

There are any number of factors of importance with respect to the operation of a service shop, but one of the most important is that which we have stated, the establishment of the number of productive hours which can be sold and which will provide the required income. We are not concerned with the exact dollars and cents charged per hour. That is up to each serviceman . . . The important item is the method of establishing what the basic charge should be. Based upon statistics compiled from various sources our belief is that the average service station operator should figure that 1500 hours or less should furnish the basic income to offset the cost of running the business.

# PRODUCTION CH

## PILOT X-114, X-115

A dummy antenna should be employed when aligning either of these models. The schematic will be found on Pilot page 6-15 in Rider's Volume VI and the alignment instructions on the following page.

In the paragraph on Pilot page 6-16 headed "I-F Alignment" in the lower left hand column, change the 0.002-mfd condenser used as dummy, to 0.01 mfd. When aligning band 2 the dummy should be a 400-ohm non-inductive resistor. For the long-wave alignment a 0.002-mfd condenser should be used.

Changes have been made in the i-f transformers. The plates of the 6A7 and 6D6 tubes should connect to one side of the primary of their respective transformers instead of to the mid-point. The control grids of the two 6D6 i-f tubes should be connected to the midpoint of the secondary instead of to one side. Condensers C32 and C33 should be eliminated and the switch S3 should short only the 250-mmfd condenser C34.

A 0.01-mfd condenser should be connected from each side of the power-transformer primary to the chassis.

• • •

## RCA 85T2

This is an upright table model employing a chassis similar to the model 85T. The data for this receiver will be found on RCA pages 8-109 to 8-111 inclusive in Rider's Volume VIII. Either of two loudspeakers may be used and can be identified by the numbers 84128-1 or 84128-2. The speaker cable connects to the chassis as follows: The brown lead (L11) to the F terminal of the rectifier tube to which the red lead from the condenser pack is connected; the black-brown lead (L11-T2) to the SG terminal of the 41 output tube and the black lead (T2) to the plate terminal of the 41 tube.

The resistances of the various speaker and output transformer coils, in ohms, are given below:

| Coil | No. 84128-1 | No. 84128-2 |
|---|---|---|
| Field Coil (L11) | 1300 | 1300 |
| Voice Coil (L9) | 2.3 | 4.2 |
| Hum Neut Coil (L10) | 0.15 | 0.23 |
| Output Trans (T2) Pri | 470 | 610 |
| Output Trans (T2) Sec | 0.35 | 0.5 |
| Voice Coil Impedance | 2.6* | 5* |

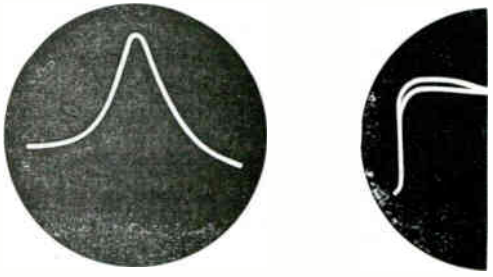
*Taken at 400 cycles.

All service data which appears on the above mentioned pages for 85T are applicable to these receivers except the d-c socket voltages, which, in general, are approximately 5 percent higher; the speaker data given above and the parts numbers for these speakers and their component parts.

• • •

## SILVERTONE 4601

In some cases chassis pick-up may occur even after all the installation instructions and suggestions have been faithfully followed. Chassis pick-up can be told from antenna pick-up because it will be heard when the antenna plug is removed from its socket in the case. This interference can be eliminated by connecting a 0.1-mfd, 200-volt condenser across the 6-volt heater supply leads, i.e., connect one side of the condenser to the heater of the 6U7G i-f tube and the other side to a grounding terminal mounted under the i-f shield mounting nut. The condenser is located between the resistors R7 and R8 (see the under chassis view on Sears page 8-76 in Rider's Volume VIII.) Keep



Response curves for the various positions of the fidelity control on Stromberg-Carlson hi-fidelity receivers. From left to right:

the leads to the condenser as short as possible.

This condenser has been added at the factory when the indentification number reads 101,463 B or a subsequent letter.

It sometimes happens that the volume of one of these sets drops to a low value when the volume control is decreased, but then increases again as the control is turned still lower. This can be corrected by removing the chassis from the case and disconnecting the leads to the two outside terminals of the volume control. Then connect a 22½-volt B battery between the center terminal and the case of the control. Rotate the control two or three times throughout its range. This should correct the trouble, after which the leads should be soldered to the outside terminals again.

*Note:* Do not connect the B battery between the center terminal and any of the other terminals of the control, as this will damage the unit.

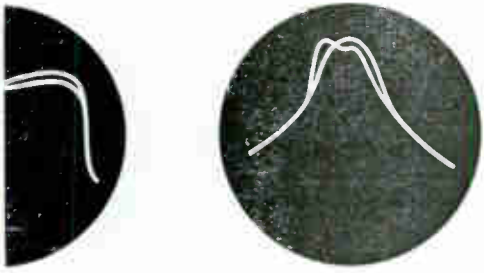
• • •

## STROMBERG-CARLSON HI-FIDELITY SETS

Alignment adjustments on all Stromberg-Carlson receivers are accurately made at the factory and, ordinarily, no readjustments are necessary. However, should it become necessary to make any readjustments, the alignment procedure given in the Engineering Data Sheet and in Rider's Manuals for the particular receiver should be carefully followed. For service shops equipped with an oscillograph, the following information is presented to supplement that given.

After alignment, all Stromberg-Carlson hi-fidelity receivers, when considered in items of the band spread of the i-f system, will show oscillograph curves similar to those shown below. A calibrated oscillograph, such as is used in research laboratories, would enable band-spread measurements to be made.

The curves on different model receivers will vary somewhat. However, the curves on all receivers follow the same general shape as shown below.



with the control in the normal position; control full on and with the control in the middle position.

• • •

## WELLS-GARDNER CAR ANTENNA

In early Wells-Gardner models using a tapped antenna coil, high-capacity antenna meant 1500 mmfd and low-capacity meant 200 mmfd. In later models, however, HC means 200 mmfd and LC, 70 mmfd.

The following Wells-Gardner models released in 1936 had HC equal to 1500 mmfd and LC equal to 200 mmfd:

| Model | Page | Rider's Volume |
|---|---|---|
| 6K | W-G 7-20 | VII |
| 6L | W-G 7-22 | VII |
| 6N | W-G 7-24 | VII |

The model 6C1 (1937) has an HC of 200 mmfd and an LC of 70 mmfd. Data on this set will be found on Wells-Gardner page 8-17 in Rider's Volume VIII.

The following list shows the average capacities of different auto antenna and their shielded lead:

Metal roof antenna used in the 1936 Chrysler, Dodge and DeSoto cars 1500 mmfd. Running board antenna or roof antenna for non-metallic top cars, 200 mmfd. Fishpole antenna, 70 mmfd. Over-the-top antenna, 95 mmfd.

If a 1937 set is used in a 1936 Chrysler, Dodge or DeSota, it will be necessary to use a running board or fishpole antenna. The latter type, however, cannot be used with a 1936 set, as the antenna coil is not adapted to this capacity.


## "hew close to the line, let the 'gyps' fall where they may"

★ **MEET OUR NEWEST EDITORIAL STAFF** member, Frederick L. Horman, Jr. Freddie won't take up his editorial duties for about twenty one years — he was only born on January 30, 1938. It has been a source of much good natured "ribbing" on the part of the proud father's associates that the family consisted of FIVE GIRLS. Had the latest addition been a girl-doll, Fred was going to try and wrest Eddie Cantors laurels from him, on accounta Cantors greatest fame came from the fact that he had five dotters. But the arrival of "Junior" put the kibosh on any broadcasting ambitions, and Fred will continue his duties at the RCA Institutes and as Contributing Editor to MASTER SERVICING, meanwhile breaking "Junior" in to be a top flight radio engineer. When "Chips" visited the new arrival at St. Ann's Hospital in N'Yawk, he was impressed with the possibilities of making a sound engineer of him. We should estimate that his intensity would be somewhere in the neighborhood of 73 db. Pretty good eh?

★ **SOME OF THE COMMENTS** about the first issue of MASTER SERVICING are good enough to warm the cockles of a publisher's heart . . . Hal Richmond of General Radio sez: "It is a fine little magazine for the serviceman" . . . Herschel Dillman of Kresges, Columbus, Ohio, sez he was "favorably impressed" . . . Austin (Ad-man) Lescarboura writes: " . . . I believe you have a real publication in the making. I like the size, I like the fact that it is human, which is something sadly lacking in some of the other technical publications in the same field" . . . Norman Andreotta, Servicer, of Somerville, N. J. writes: "There is . . . a definite need for a publication in the servicing field that is written by men who, through experience and contacts, know some of the problems that confront the radio servicer and your 'baby' with its staff . . . seems to be the answer" . . . John Thompson of Canandaigua, N. Y. tells us: "My best answer to your setup is the enclosed check for a subscription . . . hang on to Rider, "Chips" and some of the other authors and you will be assured a successful publication" (Aside to J. T.; Gosh, ya got me blushing!) . . . Auto Electric Shop of Worcester, Mass. sends in a subscription with the comment; "I find MASTER SERVICING a very interesting magazine" . . . Monroe Freedman of New York comments: "Your magazine is O. K." . . . "Sid" (Weston) Cassey opines: "Mister, you've GOT something there" . . . practically every subscription was accompanied by a few words of praise . . . interesting fact: Seven out of ten of the subscribers to MASTER SERVICING have checking accounts—who said servicers couldn't write? . . . another interesting fact: The average number of Rider Manuals owned by our subscribers is SEVEN . . . the front cover illustration of the first issue created a lotta talk . . . opinion pro and con was equally divided. The photo was not posed—it was a real action picture—and a prizewinner . . . quite a demand for some business administration articles —"Bob" Herzog tells this corner that he has some good ones in the works . . . don't miss a single issue from now on—to make sure of getting every one —mail in a check with blank printed elsewhere in this book (free "ad" for the Circulation Dep't.—Mgr. Lyons owes me a drink).

★ **THE CUSTOMERS WRITE** and tell us what is on their minds. From

Herbert Snyder, president of the Binghamton Chapter of the R.S.A. comes a note which says: "It may do some good to comment on the fact that the servicer's chief problem is the distributor who sells at wholesale prices to every one regardless of whether they are in the radio business or not." Well, Herb, there's your comment, and I dunno how much good it's gonna do . . . the answer lies within the power of servicemen's organizations . . . most jobbers I've met draw the line rather finely . . . D. H. Thompson "The Radio Man" of Pecatonica, (sounds like a bottle of medicine) Ill., forwards a rather new (to us) wrinkle. Sezze: "Since June 1936, I have been charging customers for testing their tubes when no tubes are purchased at time test is made. I charge 10c for testing 1-8 tubes, 15c for 8-10 tubes and 25c for over 10 tubes. Not an exorbitant charge to which customers object, yet it is large enough to pay the upkeep on the tester and permit the purchase of a new tester about every two years, and best of all, the ones who are the 'Free Booters' are paying the upkeep." Looks to us like a good idea for the instrument makers to promote, but we wonderrrrr if it would be possible for a servicer in N'Yawk or Chicago or any other large town to "get away" with a testing charge. When the corner drug store, hardware stores, electrical stores, dry goods stores, lingerie shops (honest), and a dozen other types of unrelated businesses handle tubes as a side line, selling at cut prices (ads in the newspapers today carry a price of 8c—and it's an auto supply store), there is little chance of getting anything for testing tubes . . . but, "D. H."—it's nice work if you can get it. And when you get around to it, Podner, send "Chips" a PECK O' that TONICA, willya?? Charlie Heselton, one of the old timers in radio (uster be with Arcturus) writes from Skowhegan, Maine: ". . . someone did a good job on your mailing list to locate me way up here in the woods . . . from the make up of the first copy, I believe "You've got something there" . . . here's my dollar for a subscription." For the benefit of the old gang at Arcturus, Charlie, we'll run your address—145 Water St.—wanna bet you'll hear from some of them??

★ SEE YOU AT THE TRADE SHOW?

"Chips"

# SERVICEMEN'S O

## RADIO SERVICEMEN OF AMERICA, INC.

THE Radio Servicemen of America, Inc., grew out of a desire of servicemen throughout the country to have an association qualified to assume its rightful place in the industry and before the public.

The by-laws insure that the control of the policies and business affairs shall be vested in its qualified members. Any member is eligible for service on the board of directors.

A method of representation based on set population has been worked out whereby the country is divided into twenty districts. Before June of 1938, the members in each district will elect a director to represent them. The directors thus elected will constitute the governing body of RSA. Their term of office is two years.

Qualifications for membership are determined by the local chapters. Provision has been made that wherever a local affiliated chapter exists, an applicant must become a member of that local chapter and must be certified to the national office by the proper chapter officers before he can be accepted as a member of the national body; likewise, when a member at large moves into an existing chapter area, he must become a member of the local chapter. RSA feel that local problems can best be solved by a united local group acting in the best interests of the majority.

Upon acceptance of applications, a member will receive a certificate of membership and a pocket membership card. Regular mailings will be made of circuit diagrams which we are receiving by virtue of the cooperation of set manufacturers. A monthly house organ containing news and editorials will be mailed to members.

RSA are embarking upon a program desgined to educate the public to the need of reliable servicing and will use such media as newspapers, periodicals and local broadcasts in towns where local chapters already exist. Through the cooperation of publishers, manufacturers and trade journals, RSA offers to members technical information and advice. Thru these same contacts, a National Speakers Bureau will be established to provide speakers for local chapters. Education in actual service problems as well as technical theory is planned for the immediate future.

National dues have been set at $2.00. Please address correspondence to Radio Servicemen of Amercia, Inc., 304 S. Dearborn St., Chicago.

*Joe Marty, Executive Secretary*

## CHAPTER NEWS

The national office reports that the following chapters have affiliated as of January 1, 1938: Manchester, N. H.; Boston, Mass.; Newark, N. J.; Binghamton, N. Y.; Tri-County Chapter, Johnstown, Pa.; Cleveland, Ohio; Detroit, Pontiac, and Flint, Mich.; Chicago, Freeport, and Peoria, Ill.; Duluth and St. Paul, Minn.; Oklahoma City, Okla.; Waco, Abilene and Dallas, Texas; and the Interstate Chapter at Davenport, Ia. In the last sixty days requests for affiliation have been received from over 1800 individuals.

A general election will be held in the immediate future, when the members of the RSA will elect directors to represent them on the national board.

### BOSTON CHAPTER

Boson Chapter of RSA, a group of servicemen representing the old IRSM and the old RTG, held a consolidation meeting on January 10, 1938 and voted unanimously to amalgamate their organizations and affiliate with RSA.

The following officers were elected at the meeting: Al Wells, president; Mr. Staples, vice-president; Ingvar Paulsen, corresponding-secretary; Mr. Shirks, recording-secretary, Mr. Kemmes, treasurer.

### CHICAGO CHAPTER

Chicago Chapter of RSA held a receiver-chassis show recently. Fifteen set manufacturers displayed their latest push-button tuning sets. Service engineers connected with these various manufacturers explained the details of their sets.

# RGANIZATIONS

At the January 23 meeting of the Chicago Chapter Sandy Cowan of Service was the guest speaker. Following Mr. Cowan's address, the following officers were elected for 1938: Ray Manson, chairman; Lew Evans, vice-chariman; Robert Storey, secreary; S. A. Gazinski, treasurer.

### CLEVELAND CHAPTER

The annual election of officers of the Cleveland Chapter was held on January 3rd. L. F. Vangunten was elected chairman; Horace M. Ricks, vice-chairman; Joseph Repar, secretary; Rudolph Trammell, treasurer; and A. J. Theriault, as candidate for the national board of directors from Cleveland.

A chicken dinner was followed by several rounds of boxing. Neal Bear, in his capacity of "Official Photographer," took action pictures. SOHARSM with its bewildering display of robes and ceremony was in full swing following the adjournment of the general meeting. Prominent members of the Cleveland Chapter were initiated into this mystic society.

### DULUTH CHAPTER

The Associated Radio Servicemen of Duluth was among the first to affiliate with RSA. Under the leadership of M. O. Endresen, president; Eric N. Holmlund, vice-president; and Edward J. Durand, secretary-treasurer, a drive for membership is in full swing. In the near future the Duluth Chapter should have all of the qualified servicemen living in that area in their ranks.

### INTERSTATE CHAPTER

Interstate Chapter of RSA, Davenport, Iowa held an election of officers on February 1, 1938. This chapter has more than doubled its membership since it was organized on December 10, 1937.

### RADIO SERVICEMEN OF NEW JERSEY

The Radio Servicemen of New Jersey, Newark, is cooperating with local authorities towards the alleviation of the evils caused by misbranding of radio sets by unscrupulous manufacturers and dealers.

This newer chapter of RSA is under the direction of Carl Rauber, chairman; Norman L. Andreatta, treasurer and Albert Fasanello, secretary; elected last January.

## PRSMA

The PRSMA 1938 year opened in January with a rousing meeting from which everyone took home some stimulating ideas and data . . . and the next three months are already lined up with a "Hit Parade" of meetings to be conducted by America's leading radio men.

It seems as though all the boys are piling out attending the meetings again. Had to put out the "S. R. O." sign at the last meeting!

Who was the fellow whose heart almost stopped beating when asked if he ever overcharged a customer?

We wonder how the boys up in Frankford made out at the meeting in George's house. Keep in touch with us, George.

Stan Meyers (watch-dog of the Treasury) will be glad to welcome you for your 1938 dues. Don't forget to ask for your large membership card for your shop or car.

We missed Bill Hoos, Jr., at our last meeting. We're hoping he'll be with us at our next session. How about it, Bill?

*PRSMA News*

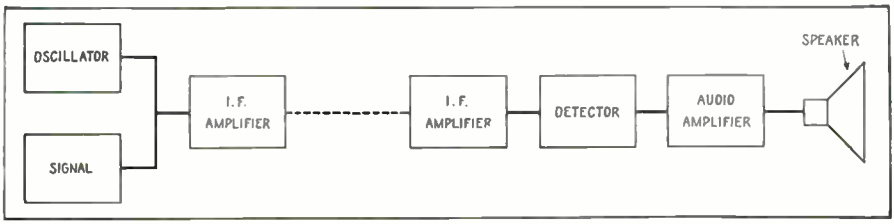



Fig. 3. An intercommunication system set up as indicated above could use as its transmission line the same power line that supplies both the transmitter and receiver with power. Similarly, by using several transmitters and several hundred carrier-current receivers distributed thruout a building a centralized radio system may be installed without any special wiring between the transmitters and receivers.

## APSTEIN continued

*(See page 52)*

channels. This is basically the underlying principle of selective carrier-current communication.

Thus an intercommunication system set up as in Fig. 3 could use as its transmission line the same power line that supplies both the transmitter and receiver with power. If a number of such units were set up and each transmitter emitted a different carrier frequency, by tuning the receivers, the signal of any one of the transmitters could be selected at any or all receivers at will. The reader will appreciate that there are a multitude of variations that can be applied to this general principle.

If, in Fig. 3, the output of a standard radio receiver is used for the signal source, a very simple type of carrier-current receiver will suffice to pick up the signal after it has been converted to the intermediate frequency and impressed on the transmission line. By using several transmitters, each modulated by separate broadcast receivers, and several hundred carrier-current receivers distributed throughout a large building or hotel, a complete multi-channel centralized radio system may be installed without any special wiring between transmitters and receivers.

Up until this point we have only treated of signaling in the sense of communication. However it can be seen that any of the foregoing circuits could be used to transmit impulses of any type so long as the receiver is capable of responding to them. Moreover, both impulses and other signals could be transmitted simultaneously over the same transmission line and received by separate receivers or separate tuned circuits in the same receiver.

In this way remote control by carrier-current is accomplished. Instead of an audio signal actuating a loudspeaker, various types of impulses are caused to actuate relays which in turn operate the remotely controlled device.

At least one large manufacturer has developed and marketed for some time, a complete school signaling system, which uses a single transmission line for operation of room clocks, room telephones, fire alarm system and centralized radio system thruout the building.

One form of marine emergency announcing system made by another manufacturer uses the hull of the ship as one leg of the transmission line and the power line as the other leg, obviating the necessity of extremely costly and complicated marine wiring.

Public utility companies have for a long time been extensive users of carrier-current signals for remote control of telephone repeaters and power substations. These highly complicated versions of the simplified setup explained, allow continuous monitoring of completely unattended telephone repeaters and power substations by means of carrier-current impulses automatically transmitted over the telephone or high tension power lines, as the case may be.

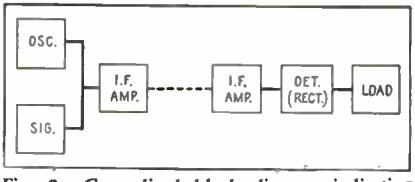



Fig. 2. Generalized block diagram indicating the basic form of all carrier-current operated devices.

## JENKINS continued

*(See page 62)*

from 0.1-volt output down to 1 microvolt provides an output range of 1 to 100,000, the critical nature of this control becomes clearer. The difficulty is to provide shielding sufficiently complete and efficient to prevent high-frequency leakage to the output at the terminals. Inadequately shielded oscillators often transmit a signal of high volume to a receiver several yards away before any connection is made—just by leakage. Obviously, there is very little chance to attenuate a unit of this type down to a level where avc operation will be ineffective.

### WAVE FORM

A final standard of a good oscillator is the wave form of the output signal. It should be modulated at least 30 percent and not more than 50 percent and should be similar over all wave bands. In alignment work on avc equipped receivers, particularly, broad tuning and incorrect alignment may result from the irregular wave forms generated without proper modulation.

The lack of accuracy standards in oscillators is not necessarily due to a lack of agreement on what the standards should be, or even to the general principles for achieving them. More often than not, it simply calls for more critical judgment on the part of servicemen in the selection of his oscillator to assure himself that reasonable design standards and satisfactory mechanical means for maintaining those standards are incorporated therein.

## SPRAYBERRY continued

*(See page 66)*

correct band coverage of the set in which case the instructions for padding and aligning the r-f system of the receiver as given in the manufacturers service notes must be followed. The correct frequency or electrical alignment, however, is much more important than the dial indications and in the great majority of cases it will come out very nearly correct if the adjustments are made as specified.

No special attention need be given to the oscillator circuit or tube except that the trimmers and padders be clearly identified.

# what's new with the manufacturers?

**MAGNAVOX monthly bulletins**

The Magnavox Co., Fort Wayne, Indiana, are distributing monthly service bulletins on speakers and capacitors. These may be obtained regularly by returning this notice, on the back of your business card or on your regular letterhead, directly to the manufacturer.

**TRAV-LER service charts**

Complete service charts and circuit diagrams on all new Trav-ler models may be obtained from Trav-ler Radio and Television Corp., 1036 W. Van Buren St., Chicago, by returning this notice.

**CLAROSTAT service manual**

Clarostat Manufacturing Co., Inc., 285 N. 6 Street, Brooklyn, N. Y., is prepared to reprint their 208 page service manual to assure every real serviceman a copy. These may be obtained by returning this notice, on the back of your business card or on your regular letterhead, directly to the manufacturer.

**WEBSTER-CHICAGO mobile p-a**

The police department of Miami, Fla., have recently installed a Webster-Chicago mobile p-a system in the safety car used by their Accident Prevention Bureau.

**MIDWEST APPLIANCE catalog**

Midwest Appliance Parts Co., 2722 W. Division St., Chicago, announces a new catalog of washing machine and vacuum cleaner parts. Copies may be obtained by returning this notice directly to Midwest.

**WESTON bulletin**

Weston Electrical Instrument Corp., Newark, N. J., have issued a bulletin describing multiranged test equipment. Copies may be obtained by returning this notice to the manufacturer.

**CONTINENTAL CARBON suppressors**

Continental Carbon, Inc., 13900


Lorain Ave., Cleveland, Ohio, have developed two suppressors designed to quiet the electrical ignition system of


oil burners. Complete information may be obtained directly from the manufacturer.

**CENTRALAB data book**

Centralab, 900 E. Keefe Ave., Milwaukee, Wis., have available an engineering data book on carbon composition fixed resistors. Write directly to Centralab and ask for form 647.

**AEROVOX vibrator condenser**

Aerovox Corp., 70 Washington St., Brooklyn, N. Y., have announced a new type replacement for the two-section condenser used in the Motorola and similar vibrators. Additional information may be obtained from the manufacturer.

*(Continued on page 84)*

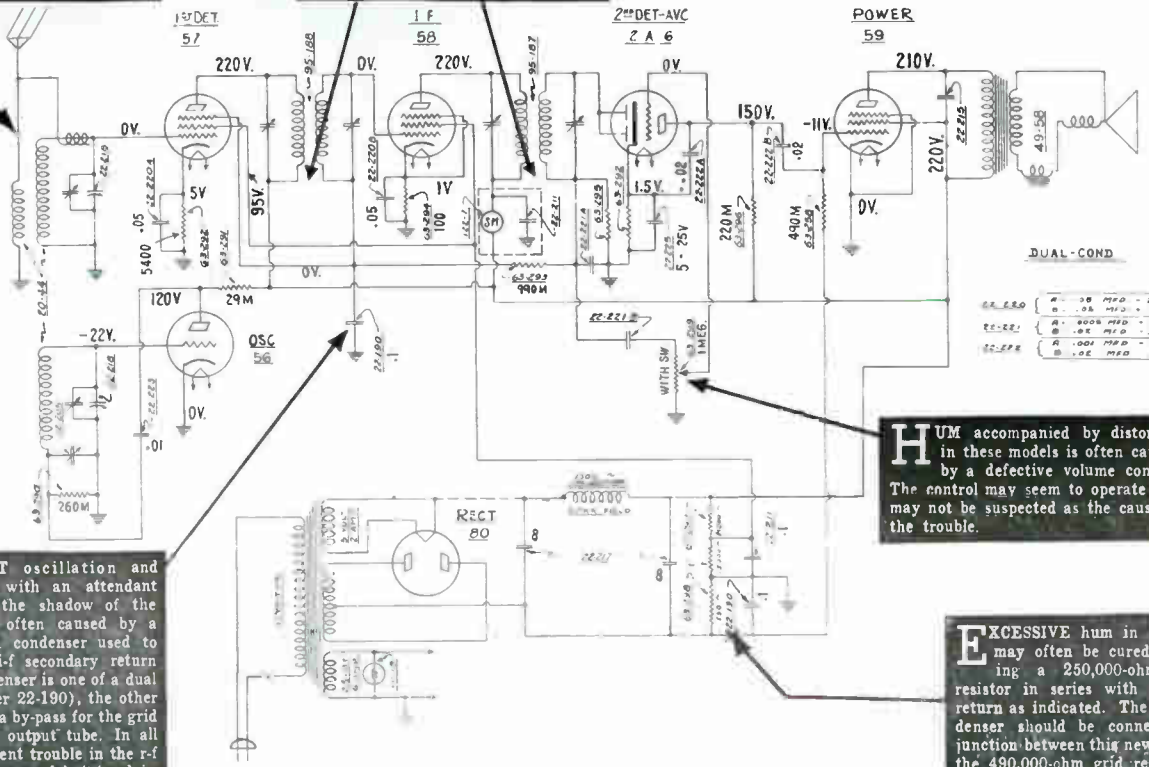
# ZENITH 705, 706, 707, 711, 712, 750 MASTER REPAIR RECORD

( CHASSIS No. 2052 )

**INTERFERENCE** from code stations over the entire tuning range can be cured by connecting a wave trap in the antenna circuit. Either the series or parallel type may be employed. The i-f peak for this receiver is 485 kc.

**AN** inoperative receiver with the grids of the 58 i-f tube glowing red can be caused by a short between the primary and secondary windings of the i-f transformer. The condition may be remedied by removing the shield and insulating the leads.

I.F. 485 KC.




**HUM** accompanied by distortion in these models is often caused by a defective volume control. The control may seem to operate and may not be suspected as the cause of the trouble.

**INTERMITTENT** oscillation and motorboating with an attendant widening of the shadow of the tuning meter is often caused by a defective 0.1-mfd condenser used to by-pass the 58 i-f secondary return circuit. The condenser is one of a dual unit (Part number 22-190), the other section is used as a by-pass for the grid return of the 59 output tube. In all cases of intermittent trouble in the r-f or i-f stages in these models it is advisable to change this condenser.

**EXCESSIVE** hum in these models may often be cured by connecting a 250,000-ohm. ½ watt resistor in series with the 59 grid return as indicated. The by-pass condenser should be connected to the junction between this new resistor and the 490,000-ohm grid resistor.

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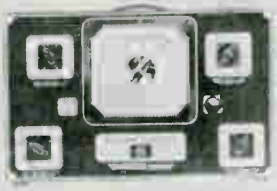

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### HYTRON "bantams"

The Hytron Corp., Salem, Mass., announce a complete series of "bantam" size tubes similar in electrical characteristics to the larger standard tubes. Additional information may be obtained directly from the manufacturer.

## NEW PRODUCTS

## (See Opposite Page)

1. Vocagraph Sound Systems, 925 Glengyle Pl., Chicago, have announced their Model 30-05 complete p-a system at a remarkably low price. Additional information may be obtained by returning this notice directly to the manufacturer.

2. Electro-Voice Mfg. Co., 332 E. Colfax Ave., South Bend, Ind., have introduced a modernistic high-sensitivity double-button microphone. Descriptive literature may be obtained directly from the manufacturer.

3. Cornell-Dubilier type BR reduced size electrolytics are available in single sections, in 4, 8, 12, 16, 20 and 40 mfd at 150 volts and up to 8 mfd 450 volts. Additional details may be obtained from Cornell-Dubilier Electric Corp., South Plainfield, N. J.

4. Specially designed dial plates are available, in various sizes, for Ohmite vitreous enameled rheostats. The dials are calibrated numerically and indicate the percentage of resistance in the circuit. Descriptive literature may be obtained from the manufacturer, Ohmite Mfg. Co., 1827 Flournoy St., Chicago.

5. Sprague Products Co., North Adams, Mass., have introduced a unit designed to reduce interference caused by electric razors, heating pads, hair dryers and similar fractional horsepower motor driven devices. Descriptive literature may be obtained by returning this notice directly to the manufacturer.

6. Weston Electrical Instrument Corp., Newark, N. J., have introduced an a-c operated test oscillator with an individually hand-calibrated dial. Trimmer condensers are completely avoided thru this procedure. A descriptive brochure may be obtained by returning this notice directly to Weston.

7. Raytheon's latest "Databook" is a pocket size volume containing 200 pages of information on tubes (from the oldest to the newest), ballasts and panel lamps.

The information on tubes give applications, maximum ratings, characteristics and operating curves. Definitions of the various tube characteristics and terms and explanations of how these quantities may be determined from the characteristics curves; simple circuit diagrams showing the essentials of the various sections of the modern receiver and charts for determining the proper values of certain tube constants and operating voltages are also included.

Copies of this "Databook" may be obtained directly from Raytheon Production Corp., 445 Lake Shore Drive, Chicago.

8. RCA Mfg. Co., Inc., Camden, N. J., have announced a simplified facsimile system designed to flash pictures, news bulletins and other text through the air and into the home.

9. RCA Victor Division, Camden, N. J., have announced a four-tube, push-button receiver for mantel and desk use. Six buttons are provided for as many stations. Descriptive literature may be obtained from the manufacturer.

10. All Jensen 8-10-12-15, Auditorium and 18-inch p-a speakers are offered complete with Bass-Reflex enclosures. A special descriptive folder may be obtained by returning this notice to Jensen Radio Mfg. Co., 6601 S. Laramie Ave., Chicago.

11 and 12. The Webster-Chicago Model JS-118 School sound system provides all-wave radio, master call and return and phonograph transcriptions for (up to) 16 rooms. The Model PA-714 portable sound system features a full length mike stand, tone control and two pm speakers stowed in a single leatherette carrying case. Descriptive literature on either system may be obtained directly from Webster-Chicago, 5622 Bloomingdale Avenue, Chicago.

13. David Bogen Co., Inc., 663 Broadway, New York City, have announced their Model C28 mobile p-a system. A power output of 35 watts (maximum) is available on either 6 volts d-c or 110 volts a-c. Both power supplies are enclosed in the single unit. Descriptive literature may be obtained directly from the manufacturer.

# Master Servicing

Vol. 1 No.2

MARCH 1938


## EDITORIAL



## ARTICLES



## FEATURES



*cd indicates that circuit diagrams accompany the text.*

# THE SWEETEST CONDENSER EVER DEVELOPED FOR THE SERVICEMAN!

CARRY A CARTON OF TEN TO TAKE CARE OF EVERY SERVICE *Requirement*



## THE C-D "Beaver"

## TYPE BR ETCHED FOIL ELECTROLYTICS

Type BR etched foil electrolytic capacitor is the smallest . . . and just about the "sweetest" . . . filter condenser ever developed. Study these features and see if you don't agree that the smart thing to do is to carry a stock of ten "Beavers" with you.

1. SMALL . . . one-fifth the size of corresponding types for similar capacity and voltage range. Will easily fit into most confined space.
2. A cinch to hook-up. No mounting brackets, no pal nuts, riveting or similar assembly operations. Just wire in . . . as you would a tubular condenser. Avoid headaches, delays, and eliminate exact duplicates.
3. Both terminals carefully insulated; protective cardboard sleeve supplied with unit. Polarity clearly indicated. Hermetic seal assures long life.
4. Available in single capacity units only. Capacities 4, 8, 12, 16, 20 and 40 mfd., 150 volts, D.C., and up to 8 mfd., at 450 volts, D.C.

Demand the condenser with the C-D emblem . . . hallmark of quality for twenty-eight years.

Ask your local C-D distributor to show you a handy carton of ten Beavers."

*Get set for maximum profits . . . Stock up with Type BR.*

*Cable Address:* "CORDU"

**CORNELL DUBILIER**

**ELECTRIC CORPORATION**

1010 Hamilton Blvd., So. Plainfield, N. J

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at www.ICGtesting.com
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720796LV00007B/134