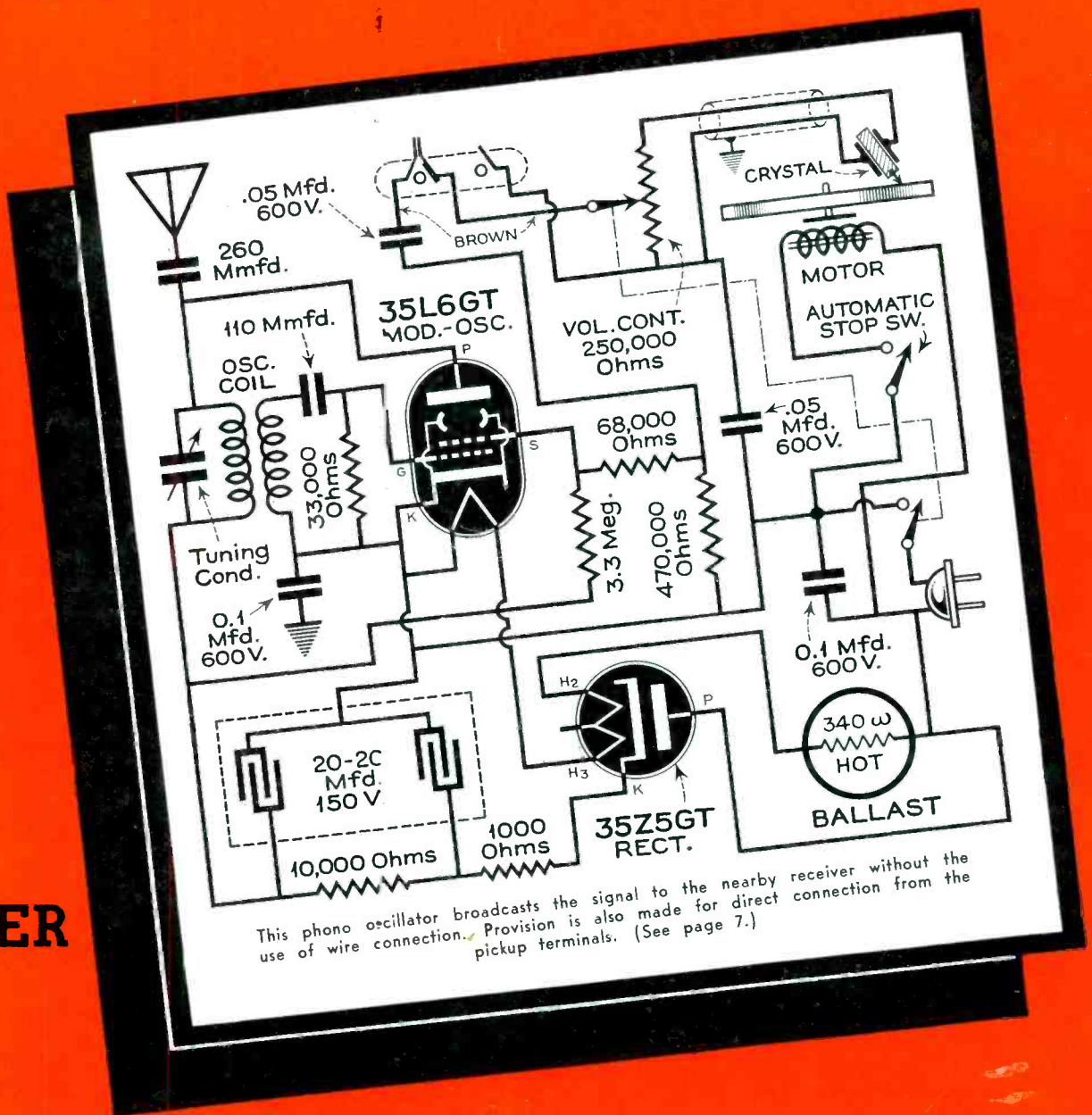


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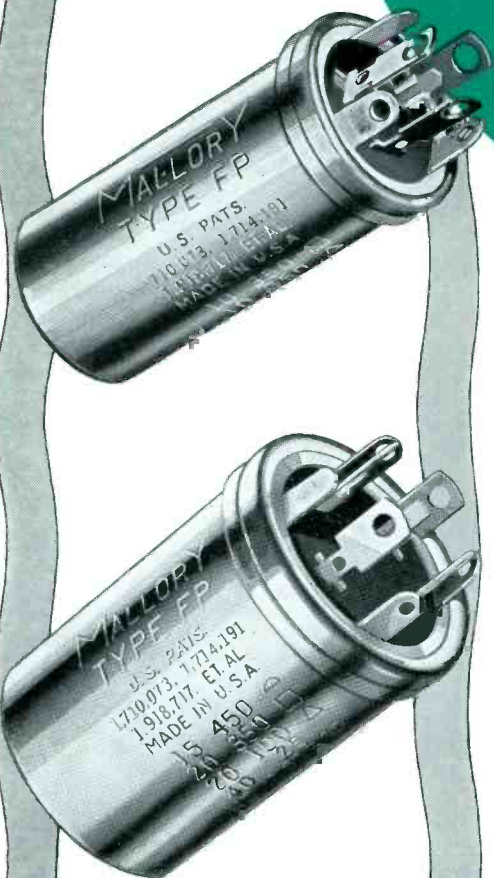
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A Monthly Digest of Radio and Allied Maintenance

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Page

LEADERS of the radio industry have already announced that the entire industry is geared and operating for national defense. Many large orders have been placed by the Army and Navy, and plans are under way to coordinate the industry.

A Defense Communications Board has been created "to coordinate the relationships of all branches of communications to the national defense." The Board has had several meetings, and has appointed committees to assist them.

It is obvious that the entire radio industry will be called upon to contribute its share towards our defense program—from the suppliers of raw materials and parts manufacturers to the manufacturing organizations who will assemble the parts into the finished radio products and even to the Service Man in the field. They will also call upon the broadcasting stations as well, especially to create hemisphere solidarity.

Yet the potential value of radio in national defense has barely been scratched. The present war in Europe, as everyone knows, is not being fought on the battlefields but along the assembly line. There are present indications that our future safety and security will lie, not in the hands of the soldiers, but in the hands of the design engineer.

New radio direction finders, radio altimeters, sound detectors, radio-controlled sea drome lights, radio-controlled bombs and torpedoes, not to mention the use of facsimile for sending drawings, maps, etc.—in spite of the censorship we realize what a vital part these are playing in the defense of the British Empire.

The possibilities suggested by the above staggers the imagination. Already, we can detect the approach of submarines in a huge radius. It remains only to perfect a system whereby we can determine which are ours and which are enemy's.

Our country must be defended by land, by sea and by air, but radio is the medium by which all these are controlled, and may, in the very near future, become the argus-eyed watchman of our hemisphere.

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President

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Chicago Office:
608 S. Dearborn Street
C. O. Stimpson, Mgr.
Telephone: Wabash 1903

Published Monthly by the
**Bryan Davis
Publishing Co.**
Inc.

19 East 47th Street
New York City
Telephone: Plaza 3-0483



PAUL S. WEIL
Advertising Manager

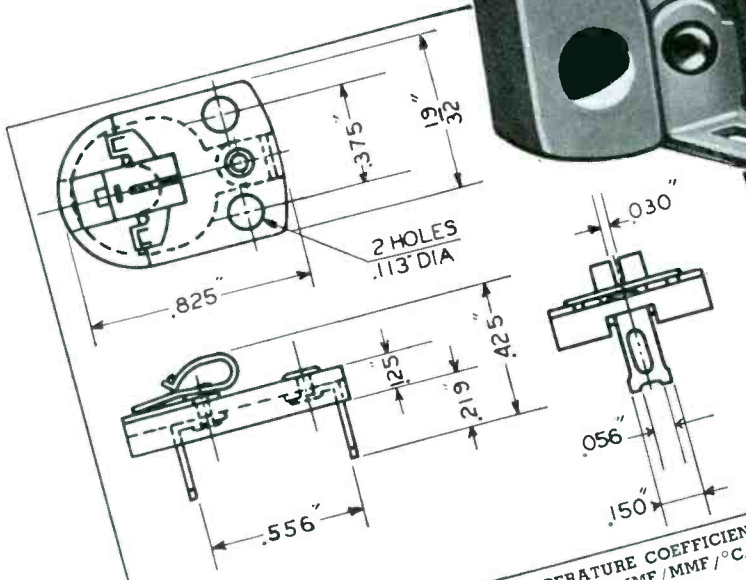
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Wellington, New Zealand:
Tearo Book Depot

Melbourne, Australia:
McGill's Agency

Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price: \$2.00 per year in the United States of America and Canada; 25 cents per copy. \$3.00 per year in foreign countries; 35 cents per copy.

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FREQUENCY MODULATION

By JACK AVINS

UNTIL recently frequency modulation has been of limited interest because of the relatively few f-m stations which were transmitting regular programs. However, by the first of the year there will be more than 100 f-m stations with indications pointing toward a rapid increase. All the evidence shows that f-m will eventually supplant a-m, at least on the ultra-high frequencies. Although it will probably be several years before f-m broadcasting will assume the importance of the present broadcast band—regardless of your location—you can no longer afford to neglect f-m. Despite the controversy over the relative merits of f-m and a-m which has raged in the past, the consensus of opinion is that frequency modulation is here to stay and to expand.

What F-M Is

According to the Federal Communications Commission, "The term 'frequency modulation' means a system of modulation of a radio signal in which the frequency of the carrier wave is varied in accordance with the signal to be transmitted while the amplitude of the carrier remains constant."

This definition uses the phrase "system of modulation" which may require some clarification. In any system of modulation we do something to a high-frequency carrier wave so that it will carry or convey our message to a distant point. When the modulated carrier reaches the receiving point, we amplify it by a suitable amount, and then demodulate or detect the wave. Since the carrier has performed its function of carrying the modulation we remove the intelligence (modulation), and throw away the carrier. Regardless of the system of modulation used, the same general process of modulation, transmission, and demodulation

WE WELCOME the growth of frequency modulation. We feel that it will perform a needed service and will make the listening public quality conscious, thus raising the standard of acceptable radio broadcasting. Frequency modulation promises to create a new branch of broadcasting with all that this implies: New jobs for those who make receivers and transmitters, for those who operate broadcasting stations, for program artists, etc. Not the least important, what Service Man needs to be told of the advantage of selling a quality receiver—one that has a unit price sufficiently high to enable a profit on the initial sale and a profit on later service jobs. Yes, frequency modulation has much to offer both to the public and to the radio industry, as has been amply demonstrated by the experience with f-m as far as it has already developed.

(detection) is always present.

There are of course many different ways of modulating a carrier. In a-m,

is positive, the amplitude of the carrier is increased, and when the amplitude of the audio signal is negative, the amplitude of the modulated carrier is decreased. There is no change in the carrier when the amplitude of the audio signal is zero.

In frequency modulation we have a somewhat similar set-up, except that in this case it is the *frequency* of the carrier which follows the audio signal. As Fig. 1 shows, when the amplitude of the audio signal is positive, the frequency of the carrier is increased. On the other hand, when the amplitude of the audio signal is negative, the frequency of the carrier is decreased. When the amplitude of the audio signal is zero, there is no change in the carrier frequency which is then at its center or rest value.

In both these systems of modulation you will observe that the change produced in the carrier by the modulation follows exactly the changes which take place in the audio or modulating signal. The essential difference between a-m and f-m is simply that in a-m it is the carrier *amplitude* which follows the modulation while the carrier *frequency* remains constant; in f-m it is the carrier *frequency* which follows the changes in the audio signal while the carrier *amplitude* remains constant.

Although there is this similarity between f-m and a-m, the similarity is only in the general mechanics of modulation. Beyond this point, especially in the ability of the two types of modulation to distinguish between noise and interference, the similarity vanishes.

As we should expect from this elementary comparison, an f-m receiver is essentially the same in all respects as an a-m receiver with the im-

portant exception that the f-m detector stage (discriminator) is different from the a-m detector. In addition, the f-m receiver incorporates an additional stage

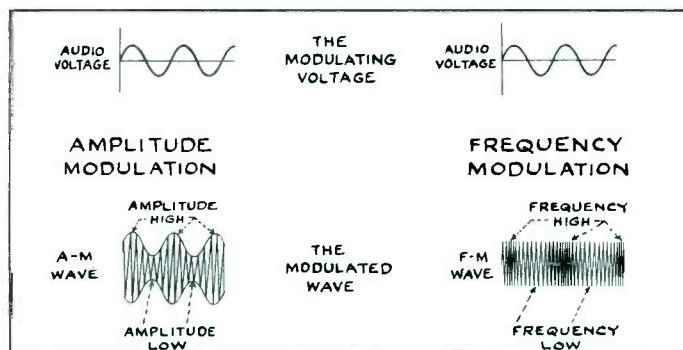


Fig. 1. In frequency modulation transmission the frequency of the carrier follows the amplitude changes in the modulating voltage. The carrier amplitude remains constant throughout the process.

as Fig. 1 shows, the amplitude of the carrier wave is varied in accordance with the audio signal to be transmitted. Thus when the amplitude of the signal

known as the limiter. (See Fig. 2.) The function of this limiter stage, which precedes the discriminator or detector, is to remove any changes in the amplitude (amplitude modulation) of the f-m signal which may have been introduced during transmission of the signal because of noise or other interference.

In Fig. 3 we show simplified diagrams of an a-m and f-m detector. In the a-m detector, the circuit is designed so that the output voltage is proportional to the amplitude of the modulated signal applied to the diode plate. Because of this characteristic the amplitude variations of the carrier are converted into the original audio signal which modulated the carrier at the transmitter.

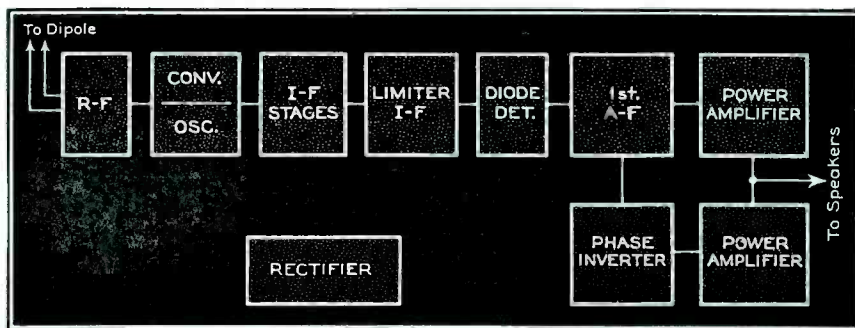
In an f-m detector, or discriminator, as it is commonly called (see Fig. 3) the circuit elements are so arranged that the output is proportional to the amount by which the carrier frequency is shifted from the center or rest frequency. When the carrier frequency is exactly at the rest frequency (equal to the i-f of the receiver) the output is zero. As the frequency of the carrier increases more and more from the center frequency, the output of the detector increases in a positive direction, while as the frequency decreases from the center frequency, the voltage output of the detector becomes more negative. This type of detector, in which the output is proportioned to the amount by which the carrier frequency is shifted from the center frequency, does exactly the same for the f-m signal that the conventional a-m detector does for the f-m signal.

Research to Reduce Noise

It is generally agreed that more research and effort has been spent in attempts to reduce static and interference, since the very beginnings of radio, than has been spent on any other single phase.

As the years have gone by the noise problem has become more and more acute because r-f amplifiers have been developed to the point where a sensitivity of a few microvolts is commonplace. To make matters still worse, interference from electrical equipment of

Fig. 2. An f-m receiver is essentially the same as an a-m receiver, except for the detector and for an additional stage, called a limiter.



all kinds, including machinery, auto ignition systems, appliances, etc., has multiplied many times over.

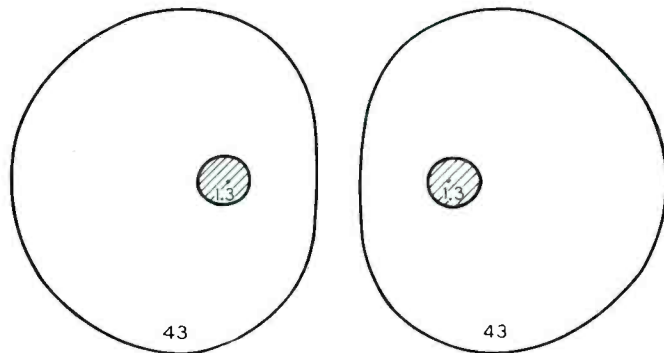
During this long period of research it is only natural that all sorts of schemes should have been proposed. But promising as some of these have seemed to be under laboratory conditions, the development of frequency modulation by Major Armstrong, announced in 1935, is the first practical solution to this hitherto baffling problem.

Primary Advantage of F-M

Frequency modulation has successfully demonstrated a number of important advantages over amplitude modulation. Almost without exception, all of these advantages are a result of its ability to discriminate against interference. Whether this interference takes the form of another weaker undesired signal, of man-made noise, or of natural static, is of no consequence. F-m is equally powerful against all forms of interference.

We might use some numbers here to indicate the overwhelming advantage of f-m over a-m in the matter of interference reduction. Using amplitude modulation, an interfering signal which has a strength of only 1/100 of the desired signal will cause a noticeable amount of

Fig. 5. These two dots represent two equally powered stations fifteen miles apart. The shaded areas represent the areas within which good reception is obtained using a-m signals. The coverage using f-m is approximately 33 times as great.



interference. However, with frequency modulation, there will be no interference provided only that the desired signal is at least twice as strong as the interfering signal. Thus with f-m, noise or other interference may be as strong as 50% of the desired signal without causing any interference with the desired signal!

Enables Greater Volume Range

The large reduction in noise which

results through the use of f-m has a number of important consequences. One of these is that it becomes immediately possible to broadcast programs with a greater volume range than is possible when using a-m. When f-m is used, the full volume range can be transmitted, from the weakest whisper to the full volume of a symphony orchestra. On the other hand, with amplitude modulation, the minimum modulation or sound level must be sufficiently great to override the background noise. Since the maximum sound output is definitely limited, it is clear that f-m makes possible more natural and faithful reproduction by extending the volume range. In this connection it is of interest to mention that f-m is effective in reducing not only interference and noise outside the receiver, but that it also reduces the noise level of the receiver itself by reducing the effects of the hiss produced in the input circuits of the receiver. With f-m, volume compression at the transmitter and volume expansion at the receiver are not required to obtain the greater realism and fidelity that go with a full volume range of reproduction.

Harmonic Distortion Reduced

An additional factor which is respon-

sible for the greater fidelity possible with f-m is the inherently low harmonic distortion of the f-m system. This property of low-harmonic distortion is not related to noise reduction, as are the other factors, but is a result of the fact that the f-m detector is not affected by non-linear tube distortion, either in the transmitter or in the receiver. More strictly, the f-m detector does respond to amplitude changes, but since these are eliminated by the limiter stage, we are justified in the statement that amplitude changes (including non-linear or harmonic distortion) will not affect the detector output.

In connection with harmonic distortion, comparative transmitter specifications show that the harmonic distortion of f-m transmitters is appreciably lower than that of a-m transmitters. This is because it is easier to design linear circuits which will shift the frequency of the carrier in the low-level stages of

the transmitter, than it is to design linear power amplifiers and modulators in a-m transmitters. It is worth mentioning here that carrier hum, due to imperfect filtering of the plate supply and the use of a-c voltage supply for the filaments, does not appear in the output of an f-m receiver, although it would be readily noticeable with an a-m receiver.

Transmitter Cost Lower

In addition to the important advantage that an f-m transmitter requires only a small fraction of the power output of an a-m transmitter to obtain the same coverage and fidelity, f-m transmitters are basically cheaper to build and more economical to operate than a-m transmitters of the same power output. This is a result of the simpler modulating equipment, and the greater efficiency resulting from the operation at constant carrier amplitude. Since harmonic distortion is not reproduced by an f-m receiver, it is possible to obtain the maximum output from power tubes, whereas in an a-m transmitter

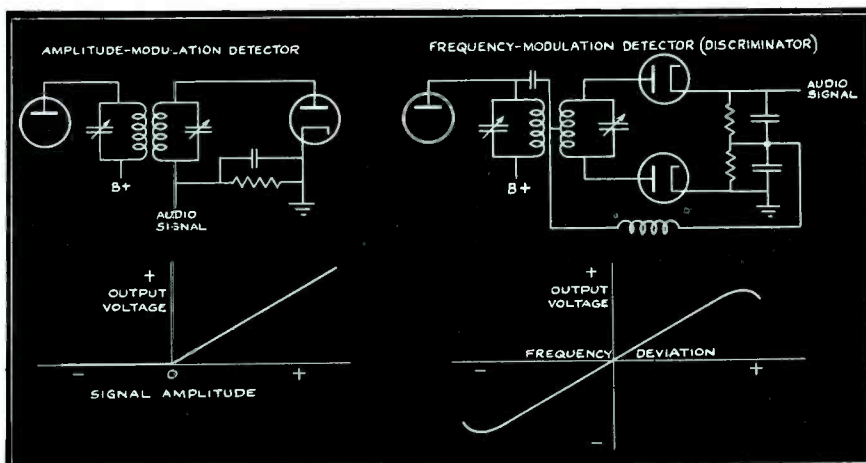


Fig. 3. The output of a-m detector is proportional to the amplitude of the modulated signal applied to its input. In the f-m discriminator the output is proportional to the amount by which the carrier frequency is shifted.

a total of only twenty-five tubes.

Effect of F-M on Present Set-Up

Will f-m replace present-day broadcasting in the band from 540 to 1600 kc? So far as this question can be answered at the present time, it seems that there will be no major change for several

our present relatively low standard, any more than it would go back to the performance of the Model T Ford. Even though the desire for high quality may be a latent one waiting to be aroused everyone concerned stands to profit from the expansion of f-m.

Why F-M Suppresses Noise

Actually, the noise suppression characteristics of f-m are the result of a number of different factors, each of which produces its own contribution to the overall signal-noise-ratio gain of f-m. The basic reason is that the amount of noise produced by any r-f noise component is proportional to the frequency difference between that noise component and the carrier. Another way of stating this is to say that noise components close to the carrier produce practically no change in the carrier frequency, while those noise components further away from the carrier produce a proportionately larger change in the carrier frequency. This results in a so-called triangular noise spectrum for f-m, this designation being only a way of expressing the fact that the noise produced by interfering frequencies is proportionately greater the greater these frequencies are separated from the carrier.

This explanation may seem somewhat involved. However, a satisfactory picture can be had by looking upon an f-m system as discriminating against noise because those noise components near the carrier are not effective in changing the carrier frequency—they change only the carrier amplitude—and hence they do not cause any audible sound in the output of the f-m detector.

On the other hand, in an a-m system, this advantage is not present. Those noise components which are close in frequency to the carrier produce just as

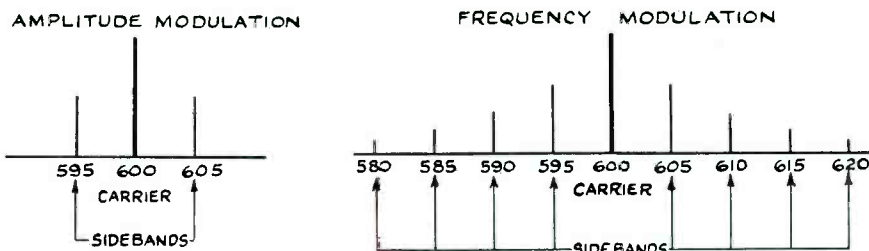


Fig. 4. The wave radiated from the transmitting antenna consists, not just of one frequency, but of a carrier and a set of both upper and lower side bands.

the operating point and the swing must be chosen so as to limit harmonic distortion to a satisfactorily low value. Because of the latter limitation, considerably greater power output can be obtained from an f-m transmitter which has approximately the same tube complement and voltage supply as an a-m transmitter. As previously mentioned, filtering requirements are much more severe in the case of an a-m transmitter than in the case of an f-m transmitter.

F-M Equipment Complexity Superficial

Frequency modulation equipment, including the receiver as well as the transmitter, may tend to seem complicated because of its very newness and unfamiliarity. However, this should be discounted. If anything, the very newness of f-m equipment is in reality evidence that it will be further simplified within a very short time. The truth of this statement is at once evident by considering that the f-m transmitter of 1935 used more than 150 tubes, whereas a comparable modern f-m transmitter of improved performance and stability uses

years in the conventional a-m system of broadcasting now in use. There are a number of reasons why f-m will not be used in the present broadcast band. In the first place there is insufficient space for wide-band f-m, and even if there were enough channels, it would still be impractical and uneconomical to obsolete the 54 million a-m receivers now in use. The fact that the f-m receivers being sold now are almost entirely combination f-m and a-m receivers supports the conclusion that f-m broadcasting service on the ultra-high frequency band from 4 to 50 mc (this is the band recently assigned by the FCC) will be a service which supplements rather than replaces our present broadcasting services. Thus those desiring to listen to the high-fidelity noise-free programs available on the ultra-high frequency channels can enjoy these programs in addition to those on the regular broadcast band.

It has been argued by some that the public is not interested in high-fidelity reception of radio programs. By and large this argument does not seem to hold water. The facts bear out the contention that once the public becomes accustomed to faithful noise-free reproduction it will not readily go back to

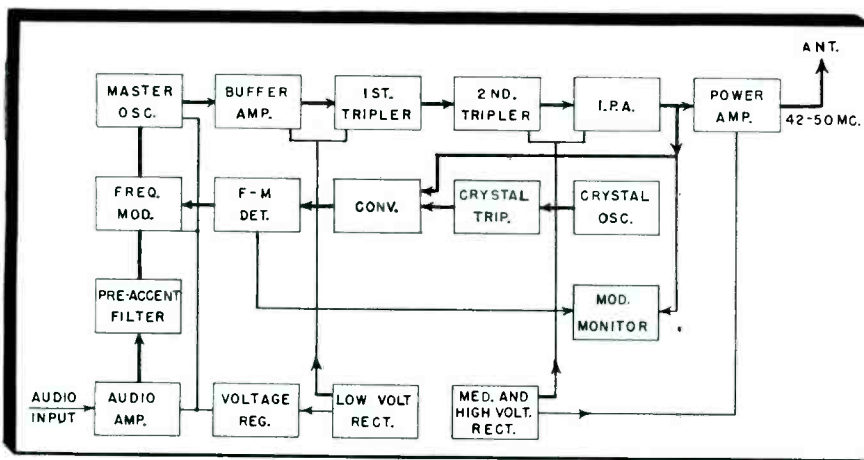


Fig. 6. Although the f-m transmitter seems complicated, this complication is superficial. Actually the transmitter is less expensive to construct and to operate.

much change in amplitude of the carrier, as those components which are farther removed from the carrier. Thus the total noise produced in an a-m system is greater than that produced in an f-m system.

The preceding discussion applies qualitatively regardless of what the bandwidth of the f-m signal may be. However, if a large frequency swing (band width) is used, there is an additional noise reduction. Roughly speaking, the reason for the further reduction of noise with wide band f-m, is the fact that the use of a large frequency swing results in a greater amount of desired signal without a corresponding increase in the amount of noise. Reference to the demodulator characteristic in Fig. 3 will show how a wider frequency swing results in greater audio or signal output.

Percent Modulation

The present regulations of the Federal Communications Commission call for a band width of 200 kc for each channel. For 100% modulation, the frequency swing on either side of the center frequency is 75 kc. Thus a swing of ± 25 kc corresponds to a percentage modulation of $25/75$ or $33 \frac{1}{3}\%$.

With a frequency swing of ± 75 kc, it should be noted that the noise present over the entire 150 kc does not reach the receiver output. This is a consequence of the fact that the response of the audio system is limited to 15,000 cycles so that noise components between 15,000 cycles and 75,000 cycles are inaudible. Clearly, then, the use of wide band f-m enables a greater signal output to be obtained by utilizing the full 150-kc band for signal transmission, whereas relatively small noise contributions are received from the 30-kc band adjacent to the carrier. It should be remembered that noise components in this latter band produce relatively little shift in the carrier frequency, and

therefore produce relatively little noise. This was explained in a preceding paragraph.

Preemphasis and Deemphasis

According to regulations established by the FCC, it is present practice to accentuate or emphasize the higher audio frequencies when the carrier is modulated at the transmitter. To restore the normal high-frequency response at the receiver, a filter is used in the receiver audio amplifier to attenuate the higher audio frequencies. The overall result of this high-frequency preemphasis at the transmitter and corresponding deemphasis at the receiver, is to raise the signal-noise ratio while at the same time maintaining uniform audio response.

The mathematical analysis of this action is somewhat involved, but it is not difficult to see qualitatively why preemphasis and deemphasis should raise the signal-noise ratio. Preemphasizing the upper audio frequencies at the transmitter enables a corresponding attenuation or deemphasis of these same frequencies to be made at the receiver. But when the upper audio frequencies at the receiver are attenuated, whatever high-frequency noise components are present are also attenuated. Thus these noise components are reduced in intensity without any overall reduction in the desired signal.

You might very logically say that this same process could be used to reduce high-frequency noise in an amplitude-modulation system. This is very true. However, there is this important distinction: In a-m the noise is distributed uniformly over the entire band (this is true for fluctuation noise, tube hiss), while in f-m the greater part of the total noise is present at the upper audio frequencies. Thus the application of deemphasis to an f-m system produces a greater reduction of noise than the application of the same degree of deemphasis to an a-m system.

Summary

As we have seen in the preceding paragraphs, the noise reduction charac-

teristic of f-m is a result of three separate factors: (1) the small shift in carrier frequency caused by noise components near the carrier, (2) the added signal-noise ratio contributed by using wide band transmission, and (3) the further reduction in noise resulting from preemphasis and deemphasis of the higher audio frequencies. For wide band f-m with a frequency deviation of ± 75 kc these three factors contribute a signal-noise ratio which is more than 100 times as great for an f-m signal as for an a-m signal of the same power.

What About Narrow Band F-M?

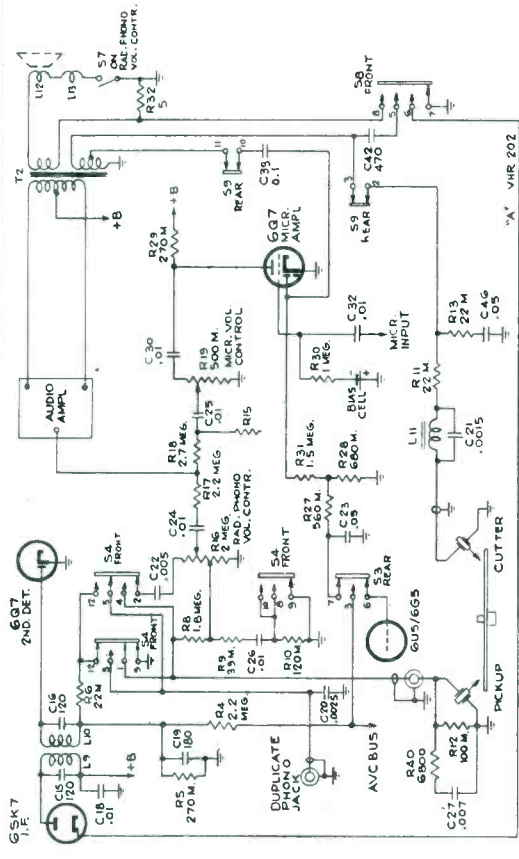
From what has been said, it would appear that narrow band f-m has no advantage over wide band f-m. Actually this needs to be qualified. In certain cases, where fidelity is not important and where intelligibility is the principal consideration, narrow band f-m is superior to wide band f-m. This is especially true where the interference is of the same order as the signal strength. The reason for the superiority of narrow band f-m under these conditions is that the smaller band cuts down the amount of noise interference which beats with the signal and thus enables the f-m detector action to discriminate against the noise. If for this borderline condition a wider band were to be used, the amount of noise admitted would tend to be larger than the signal itself, with the result that the f-m noise reduction action would tend to eliminate the desired signal in favor of the undesired noise!

We mention this effect to point out why in certain police radio installations, for example, narrow band f-m is being used rather than wide band f-m. We repeat: the reason is that here fidelity is not so important as it is that the signal be intelligible even where the signal is extremely weak.

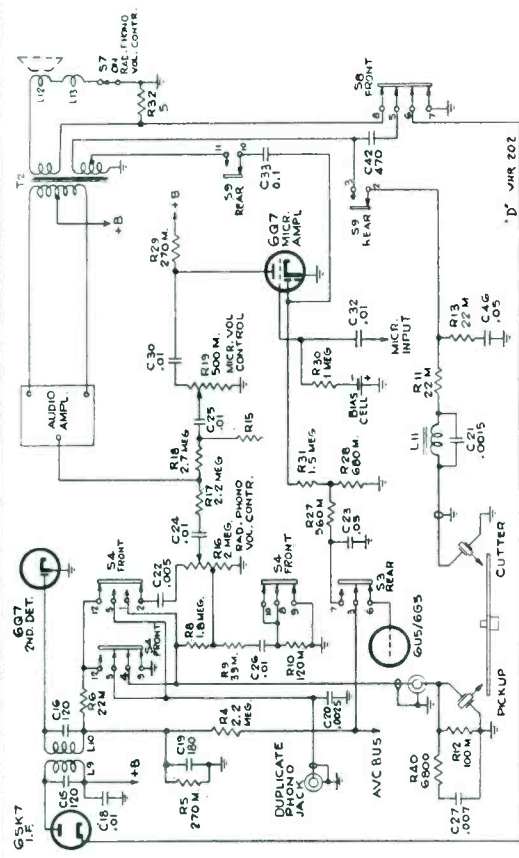
It is appropriate to mention here that marvelous as f-m is, it will not function properly unless the signal strength is approximately twice as strong as the interfering signal or noise. Thus it is important to install an antenna that will provide adequate signal pickup. In this connection, everything that we have said about the noise-suppression action of f-m presupposes that the limiter stage in the receiver is functioning to remove all amplitude variations in the signal. Thus it follows that the signal pickup must be sufficient to operate the limiter. The amount of signal required to accomplish this, of course, depends upon the sensitivity of the receiver.

F-M Signal-Sideband

In our previous description of an f-m signal we looked upon it as a wave the
(Continued on page 23)



1—"Recording"



4—"Radio"

RECORDING:
 1. CUTTING RECORDS OF VOICE THROUGH MICROPHONE.
 2. CUTTING RECORDS OF RADIO SELECTIONS USING AUXILIARY TURNABLE RECORDS OF PHONOGRAPH MIXED WITH VOICE OR MUSIC "MIXED IN" THROUGH MICROPHONE.

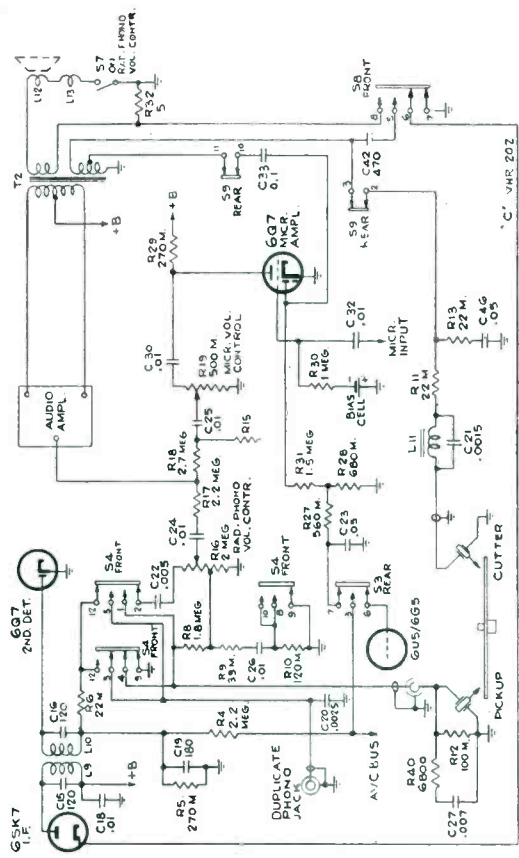
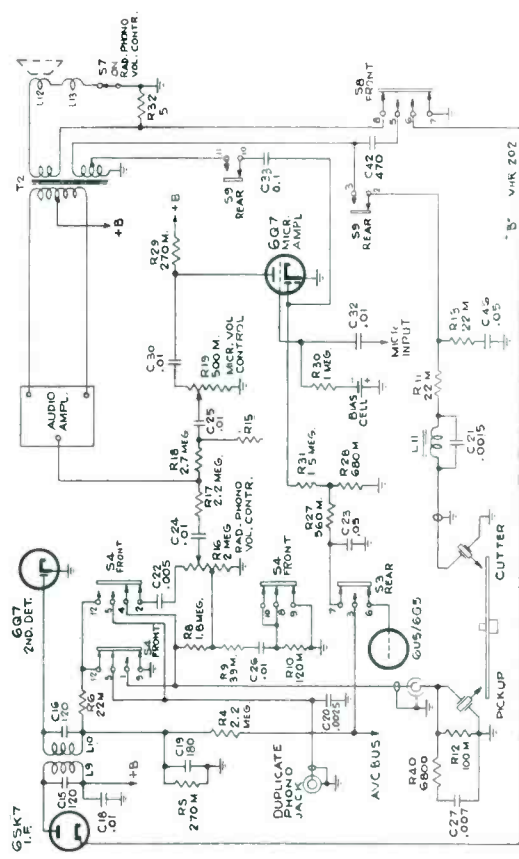
RADIO:
 1. RADIO PROGRAMS.
 2. RADIO PROGRAMS MIXED WITH VOICE OR MUSIC BY MICROPHONE.

VICTROLA:
 1. PHONOGRAPH RECORD SELECTIONS.
 2. CUTTING RECORDS OF RADIO SELECTIONS MIXED WITH VOICE OR MUSIC BY MICROPHONE.
 3. MICROPHONE ONLY (PA).

RADIO RECORDING:
 1. CUTTING RECORDS OF RADIO PROGRAMS.
 2. CUTTING RECORDS OF RADIO MIXED WITH VOICE OR MUSIC "MIXED IN" THROUGH MICROPHONE.

2—"Victrola"

3—"Radio Recording"





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PROMISE November 1939... Wilderness and confusion in the tube industry—the unregulated evil of “too many tube types.” For the first time, a manufacturer points a way out. RCA leadership and experience—and months of study—permit the announcement: “Just 36 Preferred Type Tubes cover virtually every requirement in the design of radio receivers—for finest performance at lowest overall cost!”

PERFORMANCE June 1940... In six short months, the RCA Preferred Type Tubes Program has been endorsed and adapted to production by 18 leading manufacturers of radio receivers. Results—? Better, more uniform tubes. Faster deliveries—from stock. Lower inventory and warehousing costs. The entire industry has benefited!

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RCA goes farther even than that! From the experience and proof-of-performance of the past year, RCA now makes the still more sensational statement: “Only 31 Preferred Types will cover virtually every requirement for modern radio receivers.” Another great step!

Increasingly, this Program moves *forward*—to the betterment of manufacturer, distributor, dealer, serviceman and public alike.

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- ★ GILFILLAN ★ HALLICRAFTERS ★ PACKARD-BELL
- ★ PILOT ★ RCA VICTOR ★ SENTINEL
- ★ SONORA ★ STEOMBERG-CARLSON ★ WURLITZER



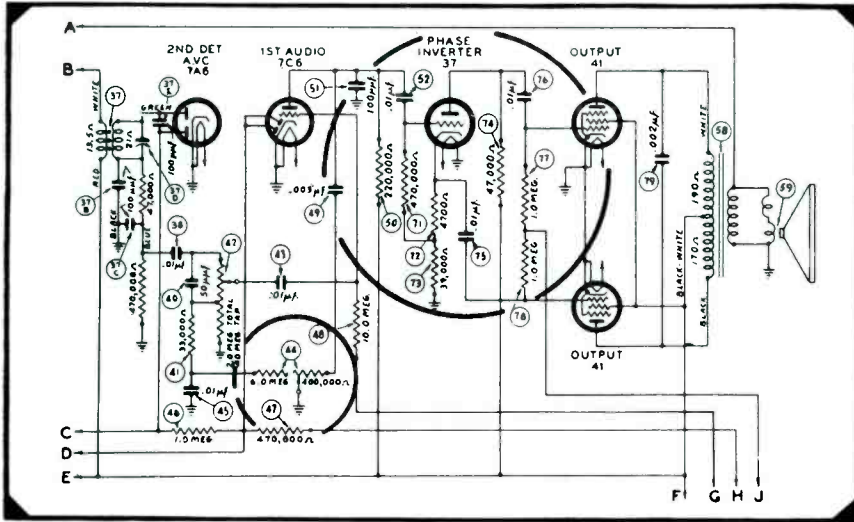


Fig. 8. Philco 41-290.

enjoyable due to the development of an ingenious sound trap called a tone guard. (See Fig. 1). An RCA Victrola feature, it makes possible the reproduction of records faithfully at low volume free from objectional mechanical noises due to motor rumble and pick-up squawking or needle scratch. Two grooved wells, one considerably larger than the other, act as acoustic filters which capture sound above 1,000 cycles where the noises are most objectionable. A sound proof covering prevents motor noises from leaking out below. A new speaker has been developed which has a very sharp cut-off at the high end. RCA claims a substantial reduction of needle scratch due to this characteristic.

Stewart-Warner 11-2A Wireless Record Player

This record player has novel tube types, using a 35Z5 rectifier and 35L6 oscillator-modulator with 150-ma heaters. Operating from 540 to 750 kc it features a resistance capacity filter, screen grid modulation and a tuned plate tank stable oscillator circuit. (See front cover.)

Motorola RW1

Although crystal cutters are very popular, some home recorders are using magnetic types with an impedance equal to that of the voice coil. This permits easy switching and eliminates the need for an additional winding on the output transformer. Two neon lamps are used in the Motorola RW1 recorder for indicating the proper recording level. (See Fig. 3.) The first lamp is to be continuously glowing while the second, or overload lamp, is to remain dark. This system was used some years ago before the present advent of popular priced recorders.

RCA VHR202, VHR207, VHR407
RCA recorder/Victrola Models VHR-

202, VHR207, VHR407 have provision for blending the microphone with radio or phonograph positions. The service selector switch has four positions: (1) Re-recording, providing for copying phonograph selections through the use of an auxiliary turntable mixed with microphone if desired; (2) Victrola, providing standard record play-

er mixed with mike if you must, or standard p-a system with mike only; (3) Radio, plus mike; (4) Recording radio, mike or both. (See Fig. 4.) The 12K7GT microphone amplifier derives its heater supply from the 5U4G rectifier output thereby minimizing any chance of introducing hum at this point.

Only about 11 volts need be supplied for this light duty. All other tubes in the set are the usual 6-volt heaters supplied in the usual manner.

Other Models

The Firestone Air Chief Model S-7404-5 has a 25-volt filament winding for the 25L6G output tube with a tap at 12 volts for all the other tubes which are of the 12 volt series. (See Fig. 5.) Gamble Model 797 has a 2 stage 6SQ7 mike amplifier delivering audio directly to the output stage, skipping the usual detector-first-audio tube. (See Fig. 6.) Note the combined phono-tone switch of the Stewart-Warner 11-5V in Fig. 7. It has four positions: radio, radio-tone, phono and phono-tone. Philco's Model 41-290 has a

(Continued on page 15)

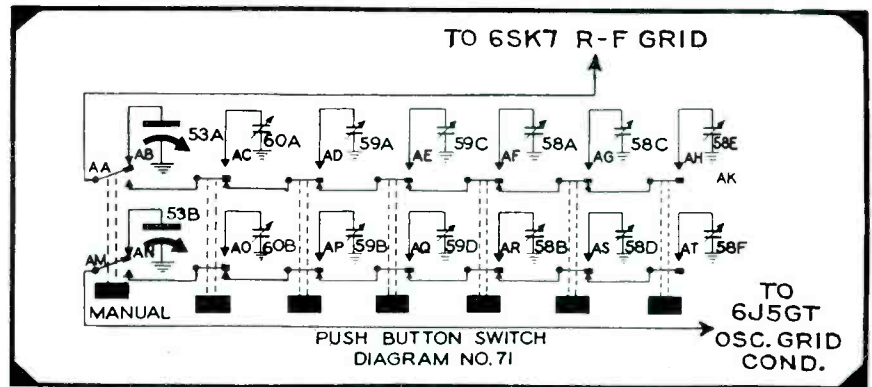
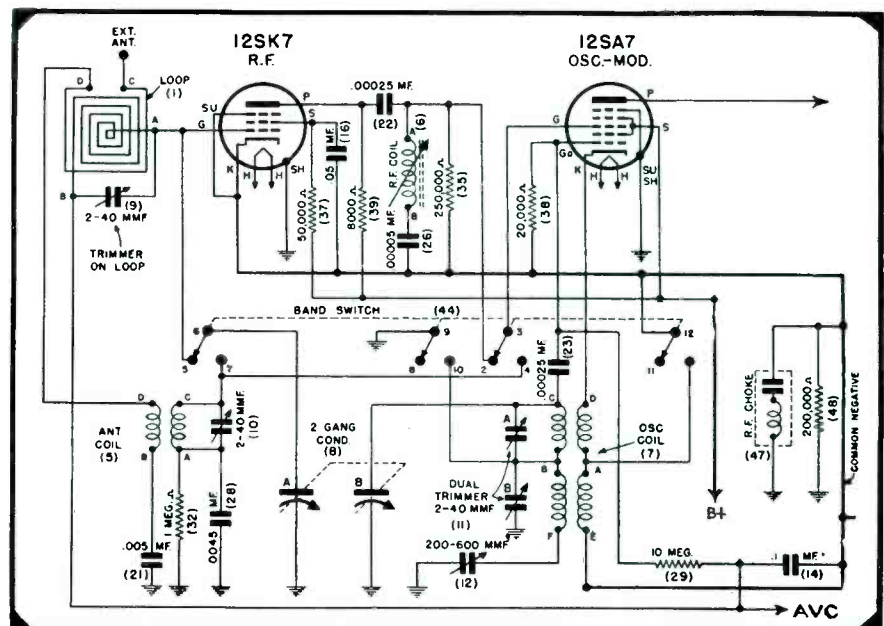


Fig. 10. (Above) Stewart-Warner 11-9B and 119BZ Chassis.

Fig. 13. Sentinel 6 tube a-c, d-c. (Below)



SOUND IDEAS

By JAY ALLEN

LUNCH rooms, restaurants, grills and the like have long presented a profitable market for the sale of intercommunicating systems. It seems justifiable, therefore, that the manufacturers of such equipment should favor these clients with a system designed specifically to their needs.

Typical System

Webster Electric has recently introduced their Teletalk, a complete, compact system for lunch counters that facilitates customer service, saves steps and time. (See Figs. 1 and 2.)

Basically, the Teletalk system consists of microphone, amplifier, and speaker—providing one-way communication from counter to kitchen. The system may be enlarged if required; up to six microphones and four speakers may be used on one amplifier.

The microphone has a push button at the top and two pilot lights—one red, one green. The push button is used to close the circuit, and permit communication to the speaker. When the button is pushed on one microphone the red pilot lights glows on all microphones, indicating that the system is in use, thus preventing speech and noise from being transmitted from other microphones. The green light on the microphone is operated from a push button located at the speaker, to indicate a request that the instructions be repeated.

The microphone unit, finished in satin chromium consists of a dynamic micro-

Figs. 1 and 2. A typical lunch room presents a simple installation problem for an intercommunication system. As indicated below, any number of microphone positions can be connected to the input circuit of a single amplifier. Speakers can be spotted around the kitchen and pantry. The system shown also provides for return signaling.

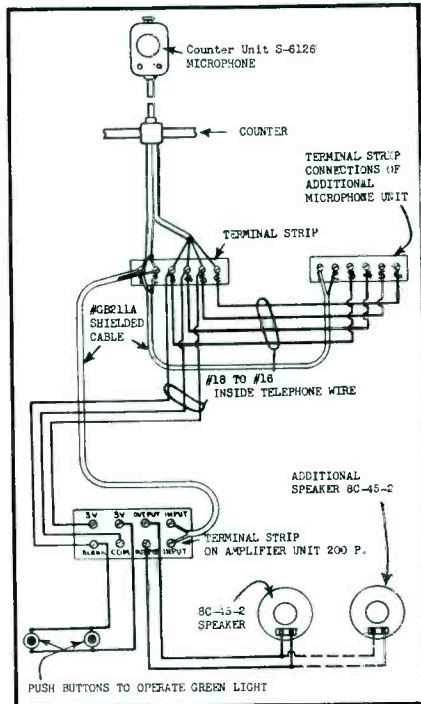


Fig. 3. Inter-room communicators present unlimited sales possibilities in the home as well as in business.



phone mounted on an 8½-in. stand, with a clamp for mounting to the edge of a counter.

The amplifier unit is housed in a metal case which may be side mounted on a wall or placed on a shelf in any out-of-the-way spot. An on-and-off switch, pilot light and volume control are provided; volume may be adjusted as required. The speaker unit consists of a moisture and steamproof dynamic speaker housed in a metal case. A bracket is provided for ceiling or wall mounting.

As sound emanates from the rear as well as the front of the speaker, the speaker should be mounted to take advantage of this fact. Ordinary push buttons may be installed at convenient locations near the speaker. These operate the green lights that signify to the calling operator that the call be repeated. (See Fig. 2.)

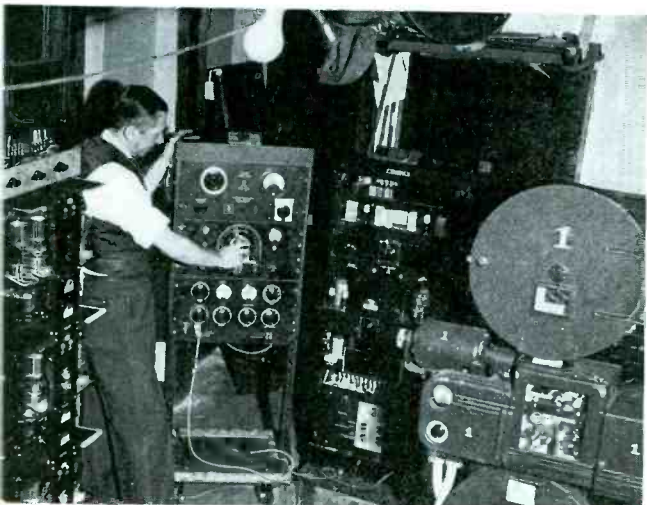
Inter-Room Communicators

Intercommunicating systems of some form or other have always been in demand. It would indeed be superfluous to mention the many uses for these systems in factories, offices, stores, restaurants, etc. We can say without exaggeration that intercommunication systems could be put to use in every type of business with great advantage and added economy. In larger homes, as well, such systems can save time and steps, "upstairs, downstairs, in my lady's chamber."

Even in the simple household they can be useful for communicating with the



Figs. 4 and 5. Walt Disney's newest picture, "Fantasia," employs a sensationally new type of sound called "Fantasound," which requires an entirely new sound system in each theatre in which it is featured.



basement, garage, etc. A unit placed near the crib will transmit the infant's awakening cry to the busy mother's anxious ear at some distant point.

The sales possibilities inherent in this field have barely been scratched, to say nothing of the hundreds of installations of such equipment in need of expansion, repairs or complete replacement. Low price equipment, such as the Philco-phone, Fig. 3, is readily available and can be easily demonstrated.

The master station (Fig. 3) is enclosed in a compact attractive plastic cabinet, is equipped with five push-button controls so that four additional remote stations may be connected to the master station.

The remote stations are housed in a small metal casing similar in appearance to a modern microphone.

In addition to the five remote-control

buttons the master control has a sixth push button marked "quiet." In normal operation the master control is left on with the volume turned up and the "quiet" button depressed.

In this position no sound can be heard from any of the remote stations until the person operating one of these stations pushes the "talk" button on the remote-control receiver. The user of the master control can then push the button for that particular station. The remote station operator then does not have to use the "talk-listen" button.

Unique Theatre Sound

The first public showing of Walt Disney's "Fantasia," in the Broadway Theatre, New York City, unveiled an entirely new type of motion picture sound recording and reproduction called "Fantasound," which projects a third-dimensional effect of sound and music. It is expected that within a few years leading theatres, in order to show this new type of screen entertainment, will have to be equipped with this new type of sound equipment.

Fantasound causes sound actually to move with all action on the screen. This realism in sound is accomplished by the use of a number of loudspeakers placed at different points behind the motion picture screen. If a bee buzzes into the scene, for instances, to circle around the screen and off again, loudspeakers are automatically cut on and off to follow its progress. This drone can also be heard traveling all around the theatre.

Fantasound plays an enormous part in "Fantasia." The music of the 103-piece Philadelphia Orchestra under the baton of Leopold Stokowski is the chief and sometimes the only actor. But to achieve the unusual orchestral effects required a staggering amount of work.

For every group of loudspeakers used in the theatre, there has to be a separate source of sound synchronized with the picture. So when Mickey Mouse appears on the right, a control mechan-

ism switches on the loudspeaker directly behind him and veers the sound to another speaker when he moves. The music had to be divided up in such a way that later it could be blended at will and reproduced through the required loudspeaker—wherever Disney wanted it.

To do this, the orchestra was divided into five sections—strings, basses, woodwinds, brasses and percussions. Each section was covered by three microphones, and recorded on a separate track. Also, there were three additional straight recordings, two on film, one on records, and a beat track giving the beat, entrance cues, etc., which the cartoonists used to synchronize the action to the music. Each of these tracks could be blended in any way with any other track or combination of tracks, so that actually any single instrument, section or the whole orchestra could be heard coming from any one point of the screen.

Fantasound succeeds in taking music and sound out of its customary accessory or incidental role in the theatre, and elevates it to the position of an important tool in the hands of the dramatist.

The results can best be described as surprisingly delightful. The Disney experts who produced the picture had difficulty in believing their own ears when they first beheld their handiwork. They heard screen sounds come forth with flexibility for the first time. They followed the music with their ears and eyes all over the screen. In addition, they heard it coming from all around them in certain of the more exciting or dramatic parts.

Fantasound should prove an important step forward for the motion picture art. At present limited to "Fantasia" because of the elaborate sound reproducing system required for the theatre, it is expected nevertheless to form the basis for further research and development in the realm of sound on film, from which eventually will come new sound equipment which the average theatre can afford to install.

Fig. 6. Ranging among the largest of similar structures, Jensen's new soundroom is nearing completion. According to Hugh S. Knowles, vice-president and chief engineer, the new soundroom will permit a more accurate determination of the response and directional characteristics of loudspeakers at low frequencies and will greatly facilitate precision acoustical measurements. Rigging is also provided for outdoor measurements as shown in the photograph where the performance of one of the new Jensen 60-cell type "K" Horns, equipped with 2 type X permanent magnet driver units, is being determined.



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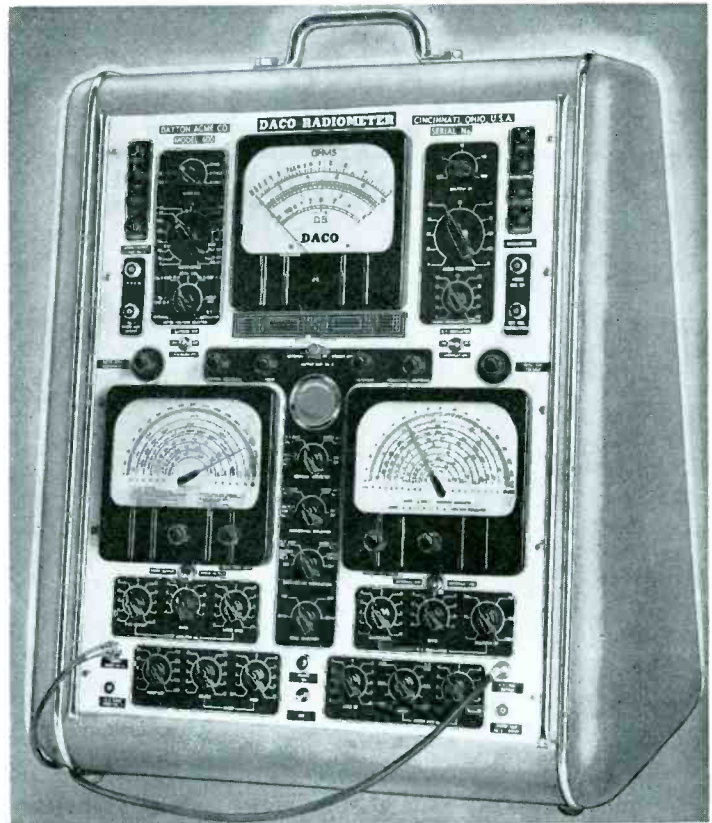
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• LOCK-IN TYPE TUBES •

LOCK-IN TYPE	FILAMENT CURRENT IN AMPERES	APPLICATION	TYPICAL PLATE VOLTAGE	REMARKS	TYPES FOR EQUIVALENT SERVICE
1LA4	0.050	POWER AMPLIFIER	85-90	OUTPUT 115 Mw.	1A5G, 1A5GT
1LA6	0.050	FREQUENCY CONVERTER	85-90	—	1A7G, 1A7GT
1LB4	0.050	POWER AMPLIFIER	45-90	OUTPUT 200 Mw.	(1T5GT)
1LC5	0.050	R-F - I-F AMPLIFIER	45-90	GM 775	(1T4)
1LC6	0.050	FREQUENCY CONVERTER	45-90	—	(1LA6)
1LD5	0.050	DETECTOR-AUDIO	45-90	VOLT GAIN 60 TO 100	(1S5)
1LE3	0.050	AMPLIFIER	85-90	MU 14	1E4G
1LH4	0.050	DETECTOR-AMPLIFIER	85-90	MU 65	1H5G, 1H5GT
1LN5	0.050	R-F - I-F AMPLIFIER	85-90	GM 800	1N5G, 1N5GT
3LE4	0.050	POWER AMPLIFIER	45-90	OUTPUT 300 Mw.	(1S4)
7A4	0.32	AMPLIFIER	90-250	MU 200	6J5, 6J5G, 6J5GT
7A5	0.75	POWER AMPLIFIER	110-125	OUTPUT 2.2 WATTS	(25L6), (25L6G), (25L6GT)
7A5	0.160	DETECTOR-A.V.C.	—	—	6H6, 6H6G
7A7	0.32	R-F - I-F AMPLIFIER	100-250	GM 2000	6SK7, 6SK7GT
7A8	0.160	FREQUENCY CONVERTER	100-250	—	6D8G, (6A8G)
7B4	0.32	AMPLIFIER	100-250	—	6F5, 6F5G, 6F5GT
7B5	0.430	POWER AMPLIFIER	100-315	OUTPUT 4.5 WATTS	6K6G, (41)
7B6	0.32	DETECTOR AMPLIFIER	100-250	MU 100	6SQ7, 6SQ7G, 6SQ7GT, (75)
7B7	0.160	R-F - I-F AMPLIFIER	100-250	GM 1750	6S7G, (6SK7), (6SK7GT)
7B8	0.32	FREQUENCY CONVERTER	100-250	—	6A8, 6A8G, 6A8GT
7C5	0.48	POWER AMPLIFIER	180-315	OUTPUT 5.5 WATTS	6V6, 6V6G, 6V6GT
7C6	0.160	DETECTOR-AMPLIFIER	100-250	MU 100	(6T7G), (6SQ7), (75)
7C7	0.160	DETECTOR-AMPLIFIER	100-250	GM 1300	6W7G, (6SJ7)
7E6	0.32	DETECTOR-AMPLIFIER	250	MU 16	6R7, 6R7G
7E7	0.32	DETECTOR-AMPLIFIER	250	GM 1300	6B8, 6B8G, 6B8GT
7F7	0.32	AMPLIFIER-INVERTER	250	MU 70	(6C8), (6C8G)
7G7/1232	0.48	R-F - I-F AMPLIFIER	250	GM 4500	(6AC7/1852)
7H7	0.32	R-F - I-F AMPLIFIER	100-250	GM 3600	(6AB7/1853)
7J7	0.32	FREQUENCY CONVERTER	100-250	LOW FREQUENCY DRIFT	6J8G
7L7	0.32	R-F - I-F AMPLIFIER	100-250	GM 3100	(6AC7/1852)
7N7	0.64	AMPLIFIER-INVERTER	90-250	MU 20	6F8, 6F8G
7Q7	0.32	FREQUENCY CONVERTER	100-250	—	6SA7, 6SA7GT
7Y4	0.53	FULL OR HALF-WAVE RECTIFIER	325-450	DC OUTPUT 60 MA.	6X5G, (84)
14A7/12B7	0.160	R-F - I-F AMPLIFIER	100-250	GM 2350	12SK7, 12SK7GT
14A4	0.160	DETECTOR-AMPLIFIER	90-250	MU 20	12J5GT
14A5	0.160	POWER AMPLIFIER	250	OUTPUT 2.5 WATTS	(6V6), (6V6G)
14B6	0.160	DETECTOR-AMPLIFIER	100-250	MU 100	12SQ7, 12SQ7GT
14B8	0.160	FREQUENCY CONVERTER	—	—	12A8GT
14C5	0.240	POWER AMPLIFIER	180-315	OUTPUT 5.5 WATTS	(6V6), (6V6G)
14C7	0.160	DETECTOR-AMPLIFIER	100-250	GM 2275	(12SJ7)
14F7	0.160	AMPLIFIER-INVERTER	90-250	MU 70	(12C8)
14H7	0.160	R-F - I-F AMPLIFIER	100-250	GM 3800	(6AC7/1852)
14J7	0.160	FREQUENCY CONVERTER	100-250	LOW FREQUENCY DRIFT	(6J8G)
14N7	0.320	AMPLIFIER INVERTER	90-250	MU 20	(6F8)
14Q7	0.160	FREQUENCY CONVERTER	100-250	—	12SA7, 12SA7G, 12SA7GT
14Y4	0.320	FULL OR HALF-WAVE RECTIFIER	325	DC OUTPUT 70 MA	(6X5G)
35A5	0.160	POWER AMPLIFIER	90-110	OUTPUT 1.5 WATTS	35L6G, 35L6GT
35Y4	0.150	HALF-WAVE RECTIFIER	110-235	DC OUTPUT 100 MA	35Z5GT
35Z3	0.160	HALF-WAVE RECTIFIER	110-235	DC OUTPUT 100 MA	35Z4GT
50A5	0.150	POWER AMPLIFIER	90-200	OUTPUT 2.2 TO 4.7 WATTS	50L6GT

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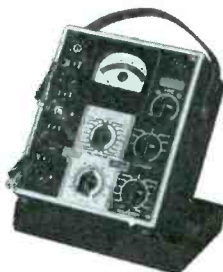


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ohm resistor to ground—in Fig. 11. Admiral uses a tuning eye amplifier operating from the avc bus; a 6SK7 feeding a 6AF6 eye in Fig. 12. Sen-

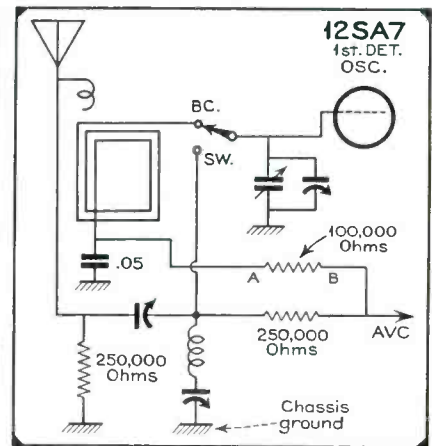


Fig. 14. Admiral J6, XJ6.

tinell's 6-tube loop set has an iron core wave trap between the r-f and converter stage. The r-f stage is cut out for short-wave reception. (See Fig. 13.) Admiral Model J6 cuts out the loop for short waves and capacity couples the antenna. Note also that the detector

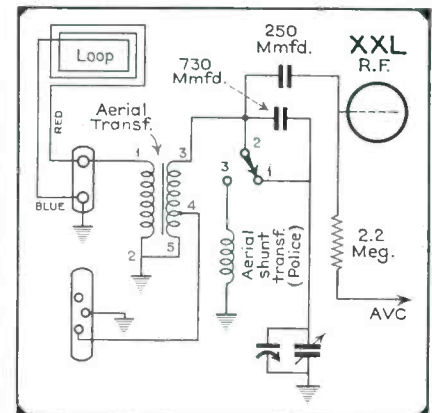


Fig. 15. Philco 41-230, 41-235, Code 121.

coil is padded—Fig. 14. In Philco's 41-230 the loop feeds the primary of an antenna transformer, the secondary of which is tuned by the gang condenser. (Fig. 15.)

PHILCO 1940 PORTABLES

Aerial jacks: These portables have a series aerial jack in the side of the case. In some of the early sets the glue used in the assembly of the cabinet runs down over the jack and causes dirty contacts. Trouble will not show up until the jack has been used with an external aerial and the position of the contact has been disturbed.

There is a slight variation in the inside dimensions of the portable cases, with the possibility that in some cases the aerial jack may be bumped and damaged when installing the battery. This may cause an open contact. A fish-paper shield should be added over the jack to prevent damaging the jack when the battery is installed in the portable. This has already been done in later models.

Philco RMS Service Note

PROGRESS

By T. D. GIBBS

THIS is not a story of phenomenal success but relates to progress and results that have been most gratifying, back of which are simple principles of conduct and of cause and effect. There have been no outstanding engineering feats nor any clever, expensive advertising plans. The process is comparatively slow but definitely a sure one.

Results

The results of this procedure in our case, are such that within a year's time since we began diligently to follow it, we are no longer looking for business. It seems to come miraculously, if you please, and for better than a year and a half our only problem has been to take care of the business we have had in the most practical and advantageous manner.

Extra Service

One of the things that has proved most valuable would come under the heading of extra service. This does not mean cutting prices. Our prices are above the average, but we make it a point to do everything and anything that is within common sense to please our customers. A set may come in for any one or more of the common radio troubles. Our service does not end with the mere replacement or adjustment of parts. First, everything about the receiver, cabinet and all, is cleaned thoroughly. Every mechanical detail is inspected and oiled with a special oil. Nicks, bruises, etc., on cabinets are repaired. When a radio leaves our shop it seldom has any squeaks or slipping in dialing apparatus; the volume control works as it was intended; the band switch (if any) changes without noise; the chassis sets straight in the cabinet and many other minor details we could mention.

Our service does not stop here, however. In the home, wires and cords are arranged neatly. If they are badly worn or frayed they are replaced.

Time Well Spent

Time? Sure this takes time but we get paid for it and good pay besides. These details just mentioned are things the customer can see and appreciate. We can replace all the condensers and resistors in a dead radio and this action will bring little enthusiasm from the

(Continued on page 20)

Here's the one you have been waiting for!



This "different" Meissner Portable

PHONO-RECORDER

can bring YOU extra profits!

Whether you are a Jobber, Dealer-Serviceman or Sound Technician, this new Meissner Portable Phono-Recorder should be the means of putting extra money in your pocket!

Its outstanding high quality, professional appearance and operation, fidelity of recording and reproduction, facility and flexibility in handling all sizes of records up to 12"—plus its additional features including its use as an auxiliary P-A System for small groups, make its demonstration and sale almost a matter of form in many widely variant fields.

Housed in an attractive airplane-luggage case, only 16" x 17" x 7", this instrument is readily handled on any kind of job. Contains built-in, high-quality audio amplifier, complete with tubes; space for crystal mike and power cord inside case; record storage space conveniently placed inside demountable cover. Operates directly from any 110-volt, 60-cycle power line. Sturdy 6" dynamic speaker furnishes full volume output on reproduction or P-A use, without distortion.

Fully equipped with complete control equipment for making high-grade recordings—Volume Control, Tone Control, Selector Switch for Recording, P-A and Reproduction, Normal and Overload Indicators; provided with first quality magnetic cutting head and wide-range crystal pick-up. Furnished with combination hand-and-stand crystal microphone.

Nothing has been overlooked to make this unit the real leader of the field in quality performance! And yet the price has been held to an encouragingly low level—only \$59.50 list, subject to usual Jobber and Dealer discounts!

Write for Your Free Copy of the New Meissner General Catalog!

ADDRESS DEPT. S-11


**MT. CARMEL
ILLINOIS**
"PRECISION-BUILT PRODUCTS"

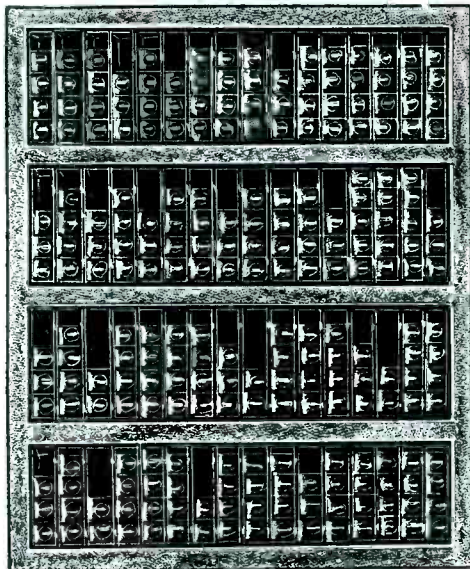
BETTER tube STOCK and SALES control the N.U. WAY

Six ways to tube

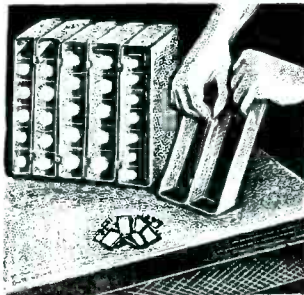
STOCK CONTROL

With the large number of types of tubes used in radio sets today, the stock problem of the Service Dealer is very complicated. First of all the dealer must have the necessary type of tube on hand when it is called for. Secondly any system that he uses for stock control should be simple and precise.

Consider the N. U. Way. Each tube carton has an inventory tab showing the type number sealed to the carton when you receive it . . . Tube Stacking Racks are provided for easy dressing and rotation of tube stock . . . All fast moving tube types are identified by a line under the type number on the carton all of which help you to **MAKE MORE MONEY WITH NATIONAL UNION**



The well dressed tube stock is easiest sold. N. U. Stacking Racks put new joy in tube handling. Tubes dress on a line with the front of cabinet, can't fall over, easy to rotate.



N. U. Stacking Racks come in five sizes for the different size cartons, sizes of cartons for each type tube is shown on price card. Assembled with clips furnished, front edges on a line, each rack clipped to the next. Racks have different depths, thus when the right type is placed inside all dress to the same front level.

© 1940 N.U.R. CORP.



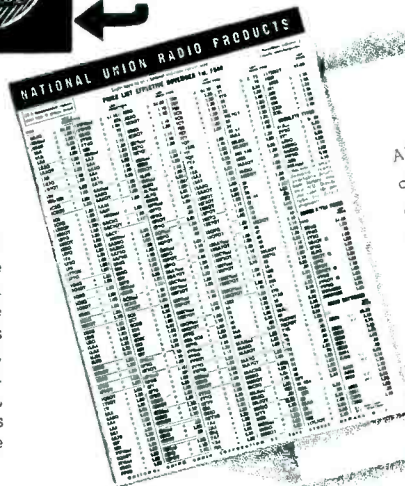
Carton receptacle with slot. Note slot for receiving inventory tab after it has been removed from the carton. End comes off for quick removal of tabs when getting ready to count and order.



Inventory tab as it appears on carton. Has double end—one for jobber inventory use and one for dealer use. Should be torn off and put in container when tube is sold.



Note line under tube type. Only the fast moving types are so designated by N. U.—all other have no line under type. 80% of your business is done with the fast moving 60 some types.



All N U price cards show after each tube type the letter a, b, c, d or e designating carton size for use in ordering stacking racks

FOR THE BEST EQUIPPED SHOP IN TOWN

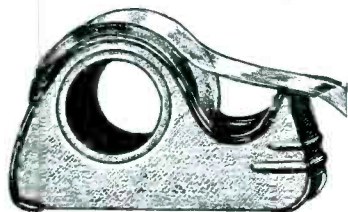
to simplify sales!

SALES CONTROL

National Union's stock and sales plan is the envy of the entire tube industry. For the busy service dealer without an elaborate office organization, it offers quick dependable control as far ahead of old methods as the typewriter over longhand.

Study the operation of your business. Compare your present procedure with what National Union offers. Don't be satisfied to stay in a rut. National Union is constantly doing things to help the service dealer and you in turn can definitely **MAKE MORE MONEY WITH NATIONAL UNION.**

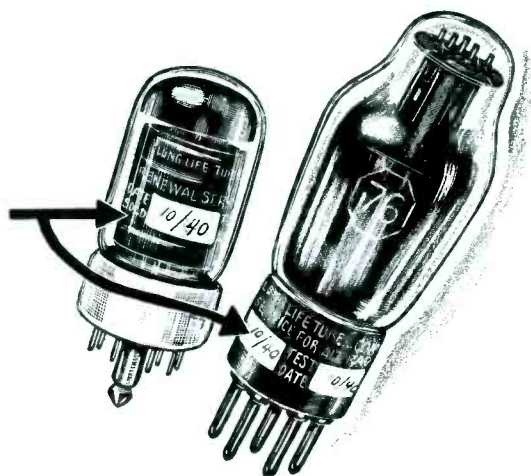
SCOTCH TAPE DISPENSER



Available at all stationery stores. A roll of scotch tape is sold attached in place on dispenser.

Every N. U. Tube sold for replacement has a space in the brand for dating the sale. This can be put on easily with an ordinary pencil and it will stay on unless rubbed off.

To prevent rubbing off, we suggest covering the date marks with scotch tape. This will adhere readily to glass or bakelite and the date marks will show through clearly.



Six Reasons for going the N. U. Way

1. NU quality is Supreme — All types available.
2. Price is Maintained.
3. All Prices Strictly Competitive.
4. Exclusive Appeal to Service Dealers.
5. Exclusive Equipment Program.
6. Over 50,000 Completed NU Deals with Service Dealers.



E. J. MAGINOT, Boston, Mass. In my opinion, and in the opinion of many other service engineers with whom I am associated, N. U. enjoys a prestige which needs no apology. Modern radio sets demand modern testing equipment. N. U. supplies it the easy way.

FOR THE MOST EFFICIENT SHOP IN TOWN

**it's a tube tester's job
to SELL tubes as well
as TEST them...**



A TUBE tester can be just that—or it can be a "silent salesman" helping to pay its way through increased tube sales. The professional appearance of the RCP Model 312, its clearly marked 9-inch meter, and its workmanlike operation all help to establish the confidence of customers in its measurement of the quality of their tubes. Its decision "Bad" means "Buy" to them.

And even "behind the scenes" in the shop this RCP instrument continues to be a money-maker. Its ability to detect tube defects which other testers overlook is a mighty factor in getting at the root of set servicing headaches. With an RCP tester you don't find the tubes in a balky set test good, then check every part in detail only to find by a process of elimination that the trouble was in the tubes after all. Herbert E. Hall of the Barnes Radio Service, Odessa, Texas, found this out. He writes: "I had a difficult set for service which several other men had worked on without finding the trouble. My

new RCP tester found it to be in defective tubes which other higher priced tube testers had passed as 'Good'."

Because RCP equipment is so economically priced, it doesn't take many extra tube sales, or much time saved in diagnosing set ailments, to pay its cost. The RCP Model 312 "Dependable" Tube Tester, for instance, is priced at only \$29.95 for the counter types (horizontal or vertical). Yet all types boast a jumbo 9-inch meter, the famous dynoptimum test circuit, built-in Rolindex charts, sockets for all old and new tubes with spares for future tube types, line-voltage regulator with meter indication, double fuse protection, separate tests for shorts, hum, noise and intermittents, and a multitude of other features.

What's true of RCP tube testers is true of every item in its line of "Dependable" test equipment which includes over 40 profit-making, time-saving models ranging from tiny pocket type multimeters to all-purpose combination instruments.

First, it satisfies the customer as to our reliability and willingness to make adjustments when necessary, and that we are taking a personal interest in their behalf. Secondly, it assures us that we and not someone else will be called if something does go wrong. Thirdly, in case of credit business it goes a long way to eliminate non-payment on the excuse the set "did no work right," because, as you can see, they were invited to let us know in such cases. Last, but not least, many customers have said to us, "We regret having to call you after having received your nice letter." What a difference this attitude is compared to the average comeback. Also, in many cases people refrain out of respect and courtesy from calling us on the dozens of unavoidable radio conditions that are peculiar to location, weather, etc., that ordinarily kept us running in the past.

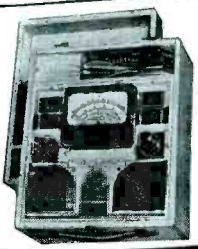
Another Phase

Another phase of importance is appreciation. Our best business, and we think anyone's, comes from personal recommendations. The proper appreciation in such cases is most gratifying to those who recommend us, and to these people promptly goes a letter that we write expressing our gratitude and at the same time assuring them that their friend or friends will be so treated that they will not regret the favor extended to us.

Other phases of our program are promptness, fulfilling promises, neatness, ordinary and uneffected courtesy, sincerity, etc.

Portable AC-DC DeLuxe Multitester Model 414P

Easy to use—easy to read—accurate. With fused, wide-scale meter and a new rectifier system replacing the usual copper-oxide type, the 414 makes AC voltages as easy to read as DC; in fact the same scales are used for both! Sensitivity—2000 ohms per volt. Ranges: Voltage—5/50/250/2500/5000, both DC and AC. Milliampere—10/50/250/1000. Amperes—1/5/25. Capacity—.03/3/30/300 mfd. Resistance—0 to 100/15,000/150,000/1.5 meg./15 meg. Inductance—.25 to 100/1,000/10,000 henries.



Complete in finely finished hardwood case **\$24.50**



LEARN MORE about the job that these instruments can do for you. Write today for the RCP's brand new catalog, No. 124.



RADIO CITY PRODUCTS CO., INC.
88 PARK PLACE • NEW YORK CITY

STUDEBAKER & PACKARD ROTARY ANTENNAE

Stripping of antenna knob: Unless the knob is firmly placed on the shaft so that the serrations are properly lined up, there is a danger that in the process of pressing the knob on the shaft, some of the serrations may have been damaged.

Should it be necessary to replace the knobs due to this stripping condition, it is absolutely necessary that the knob is placed on the shaft squarely and is gently tapped on with a hammer to the full length of the serrations. On all recent production aerials, the aerial shafts have been given a slightly greater bevel to help in the installation of the knob.

Tube removal holes: One-quarter inch (1/4-in.) holes will be found in the side of the housing opposite the tubes and vibrator on the 1941 Studebaker-Philco Auto Radios. The purpose of these holes is to facilitate the removal of the tubes and vibrators for test. In order to remove a tube, insert the end of a small screw driver through the hole in the housing and between the subbase and the base of the tube. Then push down on the screw driver and the tube can easily be removed.

Holes are provided in the housing for removal of the 7A7 i-f tube, 7B6 tube, 7Y4 tube, 7C5 tube and the vibrator. All other tubes will have to be rocked in the direction of the rivets.

PROGRESS

(Continued from page 17)

customer, but you should hear their expression of gratitude at seeing a clean dial they couldn't get into to clean themselves.

Post Card

After the radio is set up in the home, we are still not through. Whether the job is paid for or not, the next day the following letter or postal card is off to the customer:

"It was our pleasure recently to

service your radio and we wish to express our appreciation of your patronage.

Inasmuch as we endeavor to maintain a guarantee that really means something to you, we urge you to report any condition which you think may need further attention.

Trusting we may have the pleasure in the future to serve you again, we are,

Gratefully yours."

The effect of this letter is far more fetching than many might realize.

Bulletins, etc. . . .

Copies of the catalogs and bulletins discussed below may be obtained directly from the respective manufacturers mentioned. Write for them today!

* * * * Catalog No. 41 of the Alpha Wire Corp., 50 Howard St., New York City, gives 12 pages of illustrative and descriptive information on stock items of wire, wire products and aerial accessories for the Service Man.

* * * * American Microphone Co., Inc., 1915 S. Western Ave., Los Angeles, Calif., have issued an 8-page two-color catalog (No. 37) which illustrates their line of dynamic, crystal, and carbon microphones and accessories.

* * * * Ideal Commutator Dresser Co., 1266 Park Ave., Sycamore, Ill., have issued a series of illustrated data sheets which describe various items in their line. Among the bulletins is one covering their line of "Quick Heat" soldering tools and electric etchers; another describing Ideal storage cell for flashlights and similar applications, and a third picturing a group of handy aids for electrical workers.

* * * * A data sheet issued by Jensen Radio Mfg. Co., 6601 S. Laramie Ave., Chicago, describes and illustrates their Type J extended-range high-fidelity dual speakers and 8- and 12-in. single speakers.

* * * * Bulletin 500, issued by Howard B. Jones, 2300 Wabansia Ave., Chicago, illustrates and describes their Series 500 polarized power plugs and sockets for 2, 4, 6, 8, 10 and 12 contacts designed for 5,000 volts and 25 amperes.

* * * * A new catalog with details and replacement recommendations for a-c motor starting capacitors is available from P. R. Mallory & Co., Inc., Indianapolis, Ind.

* * * * The 1941 edition of the RCA radio and television test equipment catalog includes data on new radio and television test equipment and phonograph modernization assemblies. 28 pages in 2 colors. RCA Mfg. Co., Inc., Camden, N. J.

* * * * A new 16-page two-color catalog covering the 1941 line of "Dependable" test equipment for the Service Man has been released by Radio City Products Co., 88 Park Place, New York City.

* * * * Snapshots in sound is a two-color brochure issued by the RecorDisc Corp., 395 Broadway, New York City, manufacturers of recording blanks. Lists discs and accessories.

* * * * The latest Koolohm resistor catalog issued by Sprague Products Co., N. Adams, Mass., is designed specifically for industrial users and illustrates economies and design opportunities made possible by this resistor type.

* * * * Stancor's entire line of transformers for amateurs, Service Men or industrial users, as well as transmitter kits and a line of packs are all condensed in their 24-page, complete catalog No. 140B. Copies from Standard Transformer Corp., 1500 N. Halsted St., Chicago.

FEATHERWEIGHT PRESSURE LIGHTENS THE BURDEN OF SELLING

RECORDS LAST A LIFETIME

Astatic Low Pressure Crystal Pickups exert only one-ounce stylus pressure on the record, scarcely more than one-third the conventional weight. Records retain newness indefinitely.

ASTATIC
Model FP-18
Low Pressure
Crystal Pickup
List Price \$16.50



ELIMINATES NEEDLE CHANGING

Astatic Low Pressure Crystal Pickups are supplied with permanent, built-in, sapphire styli, maintaining their highly polished and accurate contour indefinitely.

Single hole
mounting and
simple hookup
assure easy in-
stallation.

THERE'S A BIG MARKET FOR ASTATIC *Low Pressure* PICKUPS

All radio and electrical shops, department and chain stores, music houses and other places where phonograph records are demonstrated and sold, furnish a fertile market for Astatic's new Low Pressure Pickups. Here is a pickup arm with permanent sapphire stylus that not only eliminates the buying and changing of needles, but provides greater fidelity of reproduction without surface noise and distortion. Stock records under conventional needle pressure become "used records" with a single playing. By reducing wear, stock records remain like new regardless of the number of times they may be demonstrated. Stop for a moment and think what an advantage and convenience this will be to these retail dealers in your territory, who demonstrate and sell records, and the sales opportunities it offers you today. This is new business. Get it.

Literature and displays are available.
Tell us your needs.

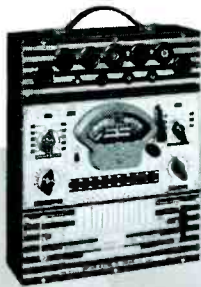
ASTATIC
ASTATIC MICROPHONE
IN CANADA: CANADIAN
ASTATIC Ltd., TORONTO, ONT.
YOUNGSTOWN
OHIO
Laboratory Inc.
ASTATIC CRYSTAL PRODUCTS LICENSED UNDER BRUSH DEVELOPMENT CO. PATENTS

If you recognize the finer things in instruments-

THE word "quality", is used more in advertisements than any other . . . and yet we all know that the place to look for it is not in advertisements, but in PRODUCTS!

You who have used testing instruments for a number of years recognize quality—or the absence of it—the moment you get your eyes and hands on testing instruments. Indeed Simpson Testers owe their meteoric rise to the fact that so many service men DO recognize the FINER THINGS in instruments.

If you know testing equipment you owe it to yourself to inspect Simpson instruments like those briefly described here. That is all we ask. The rest we leave to the instruments!



MODEL 400—Never before have so many features been combined in a tester. "Unit design" guards against obsolescence; visual guide lies in speed-roll chart with switches; three-way switching broadens scope. Your name engraved free on panel. Dealers \$36.00 net price.



MODEL 240—A remarkable value in a pocket size (5 1/4 x 2 7/8 x 1 3/4") 3,000 volt, self-contained tester. Four A.C. and five D.C. voltage ranges at 1,000 ohms per volt; 0-15-150-750-milliamperes; 0-3000-300,000 ohms. Dealers \$14.75 net price.

A handsome new catalog covers the advanced Simpson line. Ask for your copy.

SIMPSON ELECTRIC CO.
5216-18 Kinzie St., Chicago, Ill.



MODEL 300—A handsome, precision tube tester at a remarkable price. Filament voltages of 5 to 120 V. Tests locals, single ended tubes, bantams, midjets, miniatures, ballast tubes, gaseous rectifiers, Christmas tree bulbs, etc. Has neon short check; "good" and "bad" markings; percentage scale; tube charts in cover. Dealers \$26.50 net price.



MODEL 260—The outstanding value in a high sensitivity set tester for television and general servicing. Ranges to 5000 volts—both A.C. and D.C. at 20,000 ohms per volt D.C. and 1000 ohms per volt A.C. Resistance readings from 10 megohms down to 1/2 ohm and five Decibel ranges from -10 to +52 D.B. Dealers \$27.50 net price.



MODEL 320—Giant tester with 9-inch illuminated meter. Has 50 ranges . . . nine A.C. and nine D.C. voltage ranges; six milliamperage ranges; five resistance ranges; four capacity ranges; seven decibel ranges. Entirely A.C. operated. All voltage ranges have resistance of 1,000 ohms per volt. Test leads included. Rack mountings available. Dealers \$37.50 net price.

SIMPSON INSTRUMENTS THAT Stay ACCURATE



22 • SERVICE, NOVEMBER, 1940

Displays . . .

Counter display picturing Dorothy Claire and the new Electro-Voice polydirectional dynamic microphone. From Electro-Voice Mfg. Co., 1239 South Bend Ave., South Bend, Ind.

8-color display for winter windows illustrates the TWA airliner cockpit in the shape of a Sylvania tube. Miss America Aviation, a pert white attired stewardess, is also featured. From Hygrade Sylvania Corp., 500 Fifth Ave., New York City.

Metal counter display featuring a demonstration model of Worner Fotoelectric announcer. From Worner Products Corp., 1019 W. Lake St., Chicago.

Personnel . . .

Louis Alexander has just finished 15 years as sales engineer for the Aerovox Corp.

I. J. (Jim) Youngblood is now sales engineer in the Indiana territory for Clarostat Mfg. Co., Inc. He operates from 1002 W. 5 St., Marion, Ind.

M. M. Brisbin has been transferred to the Advertising Department at the Camden headquarters of RCA to handle test equipment advertising and sales promotion. He will also edit the RCA Service News.

C. L. (Chet) Walker has been appointed assistant chief engineer of the Utah Radio Products Co.

O. P. (Opie) Smith has been appointed sales representative for Earl Webber Co., in Chicago, Northern Illinois and Southern Wisconsin.

CRYSTAL CARTRIDGES

CRYSTALS used in phonograph pickups and recorder heads are permanently damaged if they are subject to temperatures above 130° F even for a very short interval of time. This makes it essential to use extreme care when soldering leads to crystal cartridges, so that they are not over-heated and ruined. The following precautions must be observed to do a good soldering job.

1. Use a hot iron. If the iron is not hot enough, it will be necessary to hold it against the soldering lug for a relatively long time before the solder will flow. This long contact will permit heat to flow to the crystal, raising its temperature beyond the safe limit.

2. Be sure the connecting wires are thoroughly clean. If the connecting wires are old or dirty, the solder won't take immediately. The continued heating and application of solder may easily ruin the crystal. It is always a good idea to clean and tin the wire first so you will be sure the solder will take properly.

3. Be sure your soldering iron tip is clean. A heavily corroded soldering iron won't melt and flow solder properly.

4. Work quickly. If the iron is hot and clean, and the terminal wire properly tinned, all you need for a good job of soldering is a quick touch of iron and solder to the connection. Take the iron away just as soon as you see the solder flow.

5. Never solder a lead to the case of the crystal cartridge to serve as a ground. This will invariably raise the cartridge temperature above the safe limit.

STEWART-WARNER CORP.

FREQUENCY MODULATION

(Continued from page 6)

frequency of which swung back and forth about a center frequency in accordance with the modulating audio signal. This much is shown in Fig. 1. From this interpretation it would seem that at any instant, the wave being radiated from the transmitting antenna consists of but a single frequency which is varying in accordance with the modulation. Actually, however, there is more than one frequency being radiated. In fact, the signal being radiated consists not of just one frequency, but of a carrier frequency plus a set of both upper and lower sidebands. This is shown diagrammatically in Fig. 4 for the case of a 600-kc wave which is being frequency modulated by a 500-cycle audio note. Although only four sidebands are shown, it should be understood that there are in reality a much larger number. However, because the amplitude of outer sidebands decreases very rapidly, only those close to the carrier are important.

The exact number of sidebands depends upon the maximum frequency swing and the audio frequency. A good first approximation is the statement that all the important sidebands are contained in the space between the maximum frequency swing on each side of the center frequency. Thus the band width of the r-f and i-f sections of an f-m receiver must be approximately equal to twice the maximum frequency deviation, or 150 kc for the present standards.

For the sake of comparison, the corresponding case for a-m is also shown in Fig. 4. Here there are only two sidebands which differ from the carrier frequency by an amount equal to the audio frequency.

It may seem that there is a contradiction between the viewpoints that (1) an f-m wave consists of a carrier plus a large number of sidebands, and (2) at any instant the f-m wave has a single frequency depending on the modulating voltage. Actually there is no contradiction here, if you bear in mind that the carrier plus the sidebands shown in Fig. 4 combine to form a single wave the frequency of which varies from maximum and minimum at the rate of 5000 times a second. This is analagous to the a-m case. Here the carrier and the two sidebands combine to form a single wave the amplitude of which varies from maximum to minimum at the rate of 5000 times a second.

Thus in the f-m case, varying the frequency of the carrier introduces a large number of sideband frequencies, whereas in a-m varying the amplitude of the carrier introduces a single set of



Economy Plus Performance

sums up the story of

New RCA Standard 50-Watt Amplifier

1 High Gain Single Unit. **2** Four "High" and "Low" Inputs. **3** Automatic Compensation for Phonograph. **4** Bass and Treble Controls.

This new RCA Standard 50-watt amplifier is a single unit, high power amplifier for all-around use.

Look at these features! 50 full watts of high quality power... four high and low impedance input positions for microphone and phonograph... electric mixing... inverse feed-back... beam power output tubes... no interaction between inputs... full frequency response... pilot light... externally fused power transformer. Remember—RCA can supply with *low priced* equipment your amplifier requirement.

Any sound system sounds better equipped with RCA Radio Tubes



COMMERCIAL SOUND

RCA Manufacturing Co., Inc., Camden, N. J. • A Service of the Radio Corporation of America

RCA Standard 50-watt Amplifier MI-12214

- RCA 6-watt Amplifier MI-12209 operates from high impedance microphones and high or low impedance phonograph inputs. High gain—excellent frequency response. An outstanding value at a low price.

- RCA 15-watt Amplifier MI-12202-B. This medium power, high gain amplifier has two individually controlled input positions for microphone and phonograph. Continuously variable tone control and other features. 15 to 20 watts output—Intra-Tube Mixing, two high impedance inputs, phonograph input jack. Excellent for moderate power installations.

- RCA 25-watt Amplifier MI-12205 has most modern circuit design, is extremely flexible, can be used for four input positions for microphone and phonographs; Remote Electric Mixing, bass and treble controls, provision for extra inputs, automatic phonograph compensation, and other features.

sidebands. In both f-m and a-m there is a complete set of sidebands for each of the audio frequencies present in the modulating signal.

It might seem at first thought that wide band f-m would require more space in the u-h-f spectrum than would be required by a-m. It turns out, however, that f-m is more economical of space than a-m because of the interference-reducing property of f-m.

This is well illustrated by a series of tests which were made recently of the relative merits of f-m and a-m in reducing interference between stations operating on the same frequency. Fig. 5 shows the results of one of these tests.

The two dots represent two equally-powered stations fifteen miles apart. The shaded areas within the small circles represent the areas within which good reception is obtained using a-m signals. The large circles represent the areas within which good reception is obtained with f-m signals. The coverage using f-m is approximately 33 times as great as with a-m.

Obviously the advantage resulting from the ability of f-m to discriminate against interfering signals (which are 50% or less of the desired signal) is that the same frequency can be assigned for use by transmitters serving areas which are relatively close.



**Look
for those
NEW ITEMS**

YES SIR, Aerovox now "flags" those new items so you won't miss them on your jobber's shelves. Each new-item carton carries a bright red label on front and sides (see above). A glance over the Aerovox stock tells you what's new and worthy of your special attention.



Practical radio men themselves, constantly in touch with latest radio developments and current servicing requirements, Aerovox engineers bring out one new type or value after another for your convenience and profit. And lest such contributions to better servicing be overlooked, the new red-label carton now "flags" your attention.



So look over that Aerovox stock on your jobber's shelves. See what's new. Take advantage of this most complete line of condensers. Catalog on request—from jobber or from us direct.



SOUND NEWS

KNIGHT RECORDER

The Knight-Bruno recorder includes, in addition to the Bruno BR12 recorder, a 20-watt recording and p-a system. Recorder cuts from outside-in at both 33 $\frac{1}{3}$ and at 78 rpm. Housed in Fabrikoid cases. Allied Radio Corp., 833 W. Jackson Blvd., Chicago.

ELECTRO-VOICE CARDAK

The Electro-Voice Cardak Model 725 has an adjustable sound pick-up pattern which enables the operator to select one suitable for the particular installation. A control screw allows the microphone to



function as a cardioid or as a bi-directional microphone. Response, 30 to 10,000 cycles; average level, —52 db from 1 volt/bar. Finish: Butler chrome. Electro-Voice Mfg. Co., Inc., 1239 South Bend Ave., South Bend, Ind.

WEBSTER-CHICAGO P-A

Economy, performance and portability are three features claimed for Webster-Chicago's new line of portable p-a systems. Three sizes are available, each including two 12-in. speakers, microphone and connecting cable and the amplifier all mounted in a single carrying case. Webster-Chicago Corp., 5622 Bloomingdale Ave., Chicago.

SHURE MICROPHONE

Shure Brothers, 225 W. Huron St., Chicago, announce their Model 708A Stratoliner crystal microphone. The unit employs a moisture sealed, Bimorph crystal



mechanically isolated in an iridescent grey die cast case for semi-directional or non-directional operation. Output level 49.7 db below 1 volt per bar.

LAFAYETTE AMPLIFIER

Lafayette Model 462T has been designed to meet requirements of the sound man who specializes in rentals. Carrying cases have been eliminated in favor of two decorative handles on the amplifier proper. Output is 30 watts for either line or 6-



volt operation. Two high and two low gain channels. Overall gain 130 watts. Multiple output impedances. Phono top. Lafayette Radio Corp., 100 Sixth Ave., New York City.

CLARION AUTOMATIC RECORD PLAYER

Clarion Model C182 is a complete automatic record player combination with built-in amplifier and speaker or phonograph oscillator. Housed in a portable Pyrotweed leatherette case, the device will play twelve 10 or 12 in. records without attention, intermixing them as desired. A changeover switch provides choice of internal amplifier or oscillator. Transformer Corp. of America, 69 Wooster St., New York City.

WALSCO STAPLES

Walter L. Schott Co., 5264 W. Pico Blvd., Los Angeles, Cal., have introduced a new type of staple to be used with the Walasco Staple drivers. The new staple is so hard that it can be driven into brick, mortar, and even into some types of concrete, it is said. Samples upon request.

**A "LAB" to
fit your pocket**

**Readrite
RANGER**

**MODEL
739**

\$9.90
Dealer Net Price

**A.C.D.C.
VOLT-OHM-MILLIAMMETER**

Pocket Volt - Ohm - Milliammeter with Selector Switch. Molded Case. . . . Precision 3-Inch Meter with 2 Genuine Sapphire Jewel Bearings. AC and DC Volts 0-15-150-750-1500; DC MA. 0-1.5-15-150; High and Low Ohms Scales. . . . Dealer Net Price, including all accessories, \$9.90

WRITE FOR CATALOG

SECTION 1117 COLLEGE AVENUE

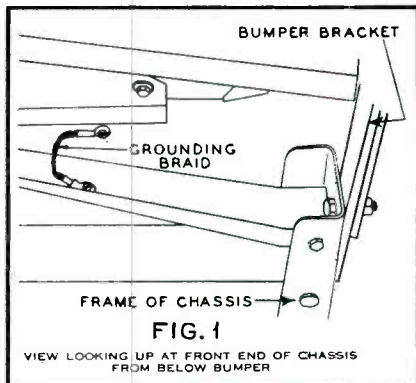
READRITE METER WORKS, Bluffton, Ohio

STUDEBAKER 1941 IGNITION NOISE

THE following operations should be performed on the 1941 Studebaker cars in which the ignition interference has not been reduced to a satisfactory level, after standard suppression work has been done.

Radiator Ground Strap

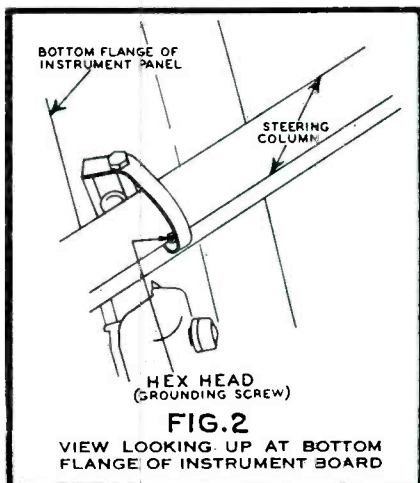
There is some interference radiation from the radiator core and the front end of some



Studebaker cars. A ground strap, similar to the one used on the steering column and on the gear shift lever column should be connected between the front frame cross member and the radiator frame, as shown in Fig. 1. It will be necessary to drill both the frame and the stud bar with a 1/8-in. drill and fasten the ground strap with self tapping screws.

Steering Column

An additional ground on the steering column must be provided between the steering column and the steering column-instrument board bracket. This grounding



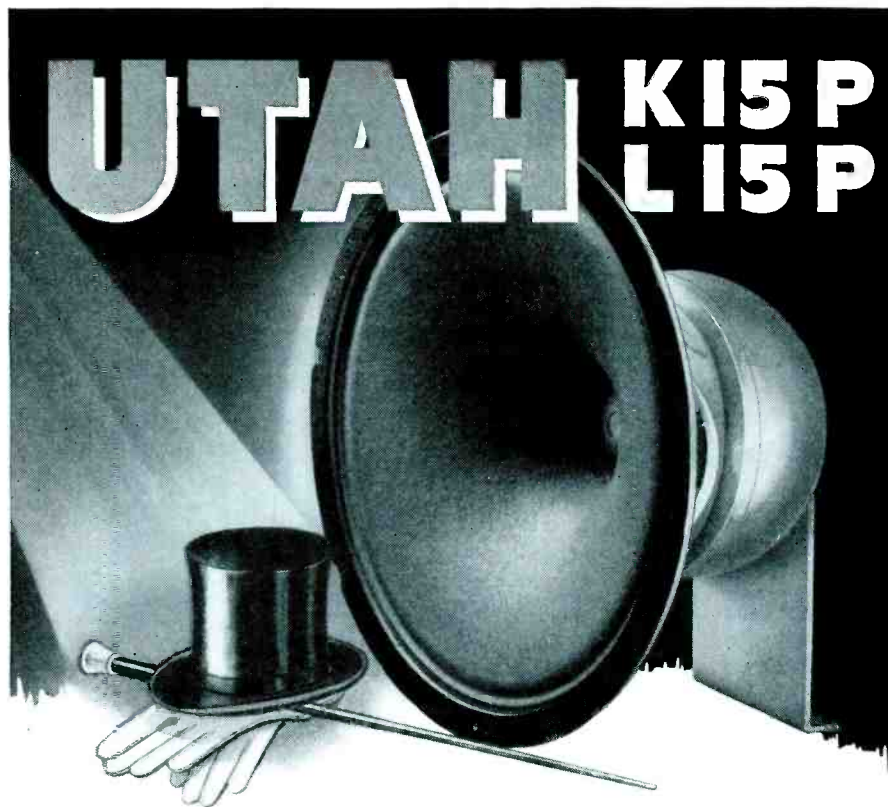
can be done by drilling a 1/8-in. hole in the column, next to the bracket and screwing in a 1/8-in. hex head self tapping screw, not over 1/4-in. long. The head of the screw must rub against the edge of the bracket and make a good contact between the steering column tubing and the instrument board bracket.

Overdrive Control Harness

On some of the earlier cars the overdrive control wiring harness was located below the frame of the car at a point where it crosses to the transmission unit. This wiring harness should be so located that it is above the frame at all points in order to help reduce the interference field radiating from it.

Hot Water Hose

In all 1941 Studebaker cars it is important that the hot water hose be kept as



TOPS for auditoriums or theatres

For absolute "tops" in sound reproduction with cone type speakers, use the Utah K15P or L15P. They are unsurpassed for speech and music in public address applications.

These outstanding representatives of the well-known Utah speaker line have extremely high power handling capacity. They have an efficiency of 4 DB above any other Utah speaker ever produced. Owing to their high efficiency, they're ideal for "woofer" applications in two-channel systems.

Check these features: Specially treated for atmospheric conditions—2 inch 8 ohm

voice coil over 1/2-inch deep—spider of exclusive Utah design and material permits release of back pressure found in ordinary construction—greatly improved bass response—exceptional brilliance in the voice range—magnet weight 15 lb. and 23 lb. List price \$79.50 and \$104.50 (subject to standard trade discounts.)

Write for full details about the complete line of Utah speakers. UTAH RADIO PRODUCTS COMPANY, 816 Orleans Street, Chicago, Illinois. Canadian Office: 560 King Street, West, Toronto. In the Argentine: Ucoa Radio Products Company, S. R. L. Buenos Aires. Cable Address: Utaradio, Chicago.



SPEAKERS

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close to the floor boards as possible so that the ignition radiation from this hose will be restricted as much as possible.

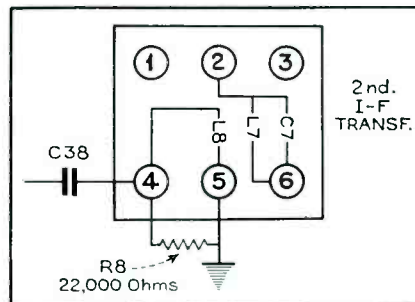
Bolt Heads

It has been found beneficial in stubborn cases to carefully loosen all the mounting bolts on the hood hinges and side panels and remove the paint underneath the brackets and bolt heads so that a good electrical connection will be made here.

STROMBERG CARLSON 505, 515

Weak or no signal on the f-m band: Low sensitivity or no signal on either of these receivers manufactured prior to October 1, 1940, may be caused by the 22,000-ohm resistor (R8), connected between ground and the second i-f transformer, heating up and changing in value. In most cases, this condition can be rectified by simply removing this resistor from the circuit.

If regeneration or oscillation does occur after this resistor has been removed, connect a different 22,000-ohm resistor be-



tween ground and the secondary of the second i-f transformer (terminals 4 and 5) as shown in the accompanying diagram.

new*

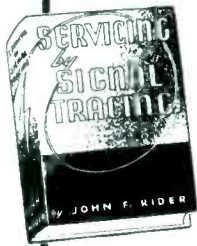
* Webster defines "new" as: "Lately made. Lately discovered. Renewed. Different." All of these descriptions apply to the Rider Books listed below. They have all been recently published. They all bear on lately discovered developments or currently revived subjects—and they are *all different*—in approach, handling and even in physical make-up. Order the ones you need—**TODAY.**



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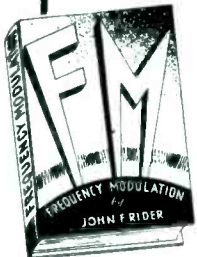
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Servicing by Signal Tracing is being used by an ever increasing number of professional radio servicemen for locating troubles in every conceivable type of radio communication system. It is the most fundamental method—free from every limiting factor heretofore encountered.

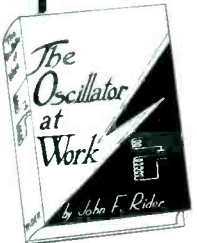
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Read RIDER BOOKS

26 • SERVICE, NOVEMBER, 1940

New Test Equipment

PRECISION TESTER

The Precision Model 954, combination tube tester and 37 range a-c, d-c multi-range set tester is a complete service laboratory in one compact unit, it is said. 20,000 ohms-per-volt, including ranges of 6,000 volts a-c, d-c; 60 microamperes; 12 amperes and 60 megohms. Available in 4 models, complete with batteries and high



voltage test leads (954MCP, an open type portable in metal case; 954C, counter type in metal cabinet; 954PM, in standard panel for rack mounting, and the 954P in walnut finish, hardwood, portable type carrying case with removable cover and tool compartment). Literature available from Precision Apparatus Co., 647 Kent Ave., Brooklyn, New York.

WEBBER TUBE TESTER

The Earl Webber Model 200MM tube tester features a 4½-inch square type meter and has an illuminated roll chart. The tube is said to show the effect of mutual conductance, power output and emission on the same scale. A descriptive and illustra-



tive bulletin on this and other Earl Webber test equipment for the Service Man is available from Earl Webber Co., 4348 W. Roosevelt Rd., Chicago.

New Parts, Etc.

MALLORY A-C CAPACITORS

A new line of a-c motor starting capacitors has been announced by P. R. Mallory & Co., Inc., Indianapolis, Ind. Less weight, smaller size and lower cost are the features of these new units, it is said. Complete hardware for mounting is included with each condenser.

QUIETONE FILTERS

Types IF24 and IF25 Quietone filters are designed for application to fluorescent lamps and similar appliances to eliminate radio interference. Features are adapted to convenience in installation, it is said. Cornell Dubilier Electric Corp., South Plainfield, N. J.

DEWALD COMPANIONETTE

DeWald Radio Mfg. Corp., 436 Lafayette St., New York City, have introduced their Model 410, a miniature personal 4-tube



superhetrodyne called the companionette. Weighs 4 lbs. Simulated cowhide case. 540 to 1,700 kc.

RCA TUBE PRICES REVISED

A general revision in the prices of RCA receiving tubes to bring them into line with current manufacturing costs has been announced by L. W. Teegarden, manager of the tube and equipment division of the RCA Manufacturing Co. Net prices of some types have been increased slightly, while others have been reduced.

The new prices concentrate approximately 40% of the renewal tube business in the 90c and \$1 list price brackets. Slightly less than 28% of the renewal business is now in the 60-cent to 80-cent bracket, while the balance of 32% is in the \$1.20 to \$2.75 category.

SOLAR PLUG-IN ELECTROLYTICS

Solar Manufacturing Corp., Bayonne, N. J., announces a series of plug-in dry electrolytics in cans. These units, called



Type DO, fit standard octal type sockets. Straps are also available for use under conditions of vibration. Available in usual single and multiple ratings.



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150 VARICK STREET EXPORT DIVISION: 100 VARICK STREET NEW YORK, N. Y. CABLES: "ARLAB"

RCA JUNIOR VOLTOHMYST



Fig. 3. The VoltOhmyst is an electronic voltohmmeter that has provisions for a-c measurements and other multimeter functions.

THE RCA Junior VoltOhmyst is designed to measure d-c and a-c voltages and resistances over an extremely wide range. The features of the instrument are its high input resistance; d-c voltmeter which is automatically protected against burn-out; ohmmeter which is also protected against burn-out even if a high voltage is present across the resistance being measured; zero adjustment and ohms adjustment that do not have to be reset when changing ranges; and its signal tracing type of test probe which permits dynamic voltage measurements in signal carrying circuits without interfering with the action of the circuit. As a d-c or a-c voltage measuring device its range of operation is from 0.05 volts to 1,000 volts. Its input resistance (11,000,000 ohms) is constant on all d-c ranges. Thus the sensitivity on the 3-volt d-c scale is 3,666,666 ohms per volt.

The Junior VoltOhmyst will measure d-c voltages which are positive or negative with respect to ground without switching leads. It will not interfere with the operation of any circuit or element across which

it may be connected. It is not necessary to reset the zero adjustment when changing voltage ranges and all voltage measurements, regardless of polarity, can be made with the common lead connected to the chassis or ground simply by turning the polarity reversing switch.

During a-c voltage measurements, with the selector in a-c position the instrument is completely isolated from the line, and all a-c voltages up to 1,000 volts can be measured. To secure complete isolation from the line, a copper oxide rectifier unit is used. The sensitivity for a-c measurements is 1,000-ohms-per-volt. The instrument need not be plugged into the line for a-c measurements. The input circuit to the a-c voltmeter is polarized so that the meter is protected should d-c voltage be accidentally measured with the a-c probe while the selector switch is in the a-c volts position and the common lead connected to chassis ground.

The ohmmeter covers ranges from 0.1 ohm to 1,000 megohms and does not require resetting of the zero adjustment when changing ranges. The ohmmeter test voltage, applied across the resistance being tested, varies from 0.03 volts across 0.1 ohms to a maximum of 3 volts across 1,000 megohms.

Circuit Description

The Junior VoltOhmyst uses a push-pull d-c electronic vacuum-tube voltmeter of new design. Its schematic circuit is given in Fig. 1. This circuit is very similar to the circuit used in the RCA Rider VoltOhmyst which has had very wide acceptance in many fields. Unlike the conventional balanced voltmeter, the two type 6K6GT tubes are linked by means of a common high resistance R27. Because of this coupling any change in the input voltage to the grid of V1 changes the cathode bias of V2 and as a result the change in the plate current of V1 is accompanied by a simultaneous change in the plate current of V2 in the opposite direction. The differential voltage thus developed across the load resistors R19 and R20 is applied to the meter which is calibrated in terms of the voltage applied to the grid of V1, and in terms of resistance when the instrument is being used as an ohmmeter.

In addition to the push-pull action, a high degree of self regulation is obtained as a direct result of the high value of coupling resistance R27. This is due to the regulating effect secured through the use of self bias, but because R27 is approximately 100 times as large as the value of cathode resistance which it is possible to use in conventional circuits, the self regulating action is correspondingly increased. At the same time the excessive loss of sensitivity normally experienced when using such a high cathode resistance is eliminated in the VoltOhmyst because of the balanced nature of the circuit. A controlled amount of inverse feedback to obtain independence of tube characteristics is secured by means of the two resistors R25 and R26.

A principal factor limiting the maximum input resistance of a-c vacuum tube voltmeters has been the problem of reducing grid current and the so-called contact potential error to a low value. In the Junior VoltOhmyst, this problem has been

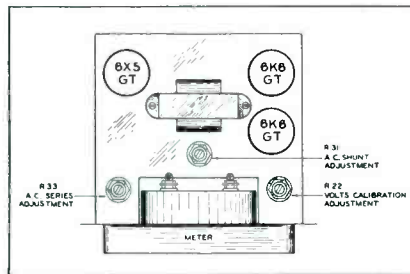
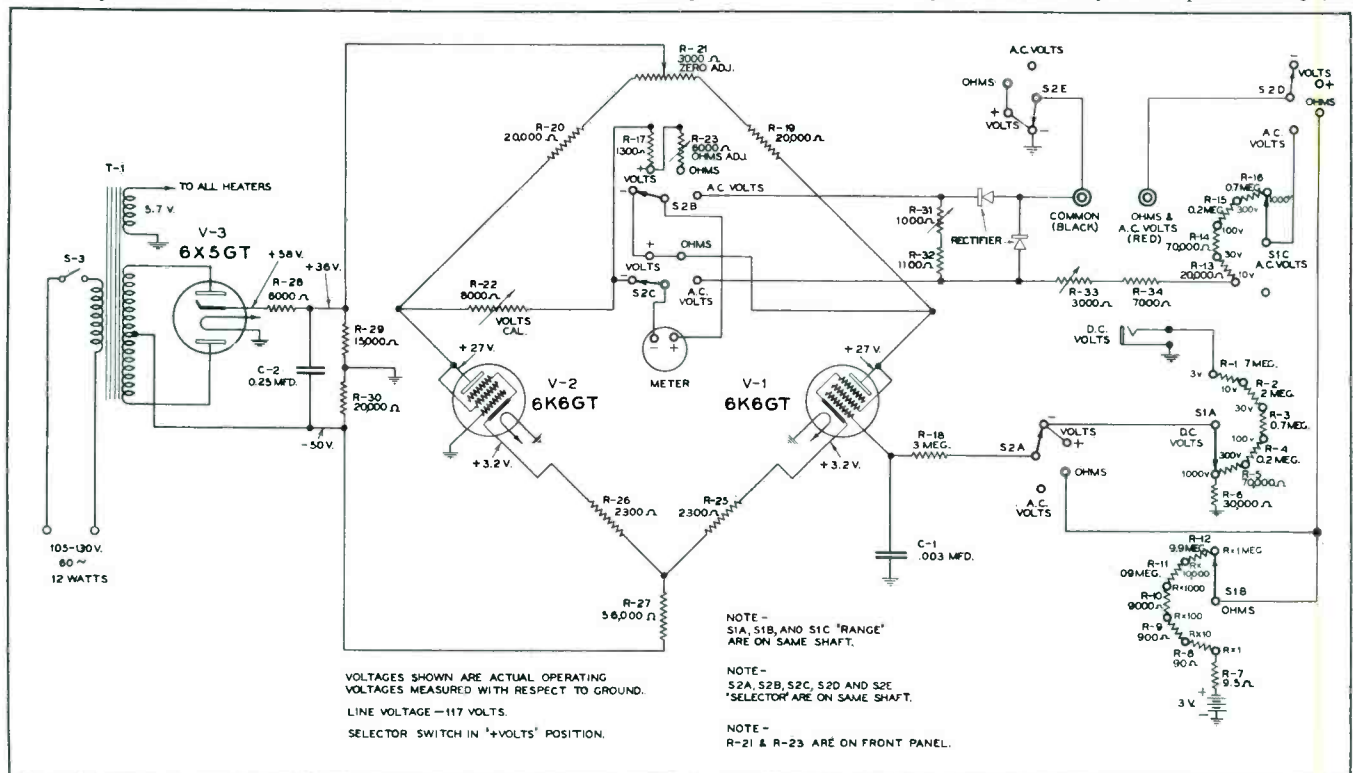


Fig. 1 (Below) and 2 (Above). The VoltOhmyst uses a bridge type circuit of novel design.



solved successfully by the choice of a suitable tube type, the use of a very high cathode resistance, and by operation at a low plate voltage.

A one-megohm resistor is built into the ungrounded but shielded d-c voltmeter probe which effectively makes it a signal tracing type of probe and makes possible dynamic voltage measurements in signal carrying circuits.

The ohmmeter circuit places the unknown resistance in series with a 3-volt battery and one of six standard multiplying resistors. The electronic d-c voltmeter is then used to measure the voltage drop across the unknown resistor. The standard resistors range in value from 10 ohms to 10 megohms, which provide multiplying factors from Rx1 to Rx1,000,000.

As is to be expected from a consideration of the circuit, the Junior VoltOhmyst is stable in operation, requires no readjustments of the zero adjusters when changing ranges, and is essentially independent of changes in line voltage and tube characteristics.

Resistors Over 1,000 Megs

The voltmeter section of the Junior VoltOhmyst can be used to measure resistances higher than those covered on the R times 1 meg range. This application is especially useful for the measurement of the leakage resistance of paper and mica condensers which, for the smaller capacities, should be well above 1,000 meg.

An external voltage supply, of from 250 to 500 volts, is required. The higher the voltage the higher the value of the resistance which it is possible to measure. The voltage source, the resistance and the Junior VoltOhmyst are connected in series. Note the value of the d-c voltage reading on the instrument scale. If the reading is small, increase the value of the external supply until it can be conveniently read.

The value of the resistance, in megohms, is equal to eleven times the difference between the voltage of the external supply and the reading on the meter scale (External Voltage minus Reading of Junior VoltOhmyst) divided by the reading of the Junior VoltOhmyst.

BOOK REVIEWS

RCA VICTOR SERVICE NOTES FOR 1939, prepared by the Service Division, RCA Manufacturing Co., Inc., Camden, N. J., 1940, 480 pages, 8½ by 11, price \$1.50.

The largest bound volume of service notes issued by RCA Victor covers all 1939 radio and radio-phonograph instruments and a number of 1940 models. The book, including more than 500 illustrations, is the eleventh in a series dating back to 1923.

More than 150 circuits are shown with schematic diagrams, or nearly double the number included in the 1938 edition. The volume also includes complete instruction books on new RCA test equipment, a new index for bound RCA Victor service notes, and a special supplementary data section for receiver and equipment models covered in the 1939 and preceding volumes.

All service information is presented in the original, unabridged form, including complete alignment data. The volume also includes television service notes on the latest type receivers. The test equipment instruction-service notes cover such instruments as the Signalyst, VoltOhmst, five-inch CRO, television sweep oscillator, Crystal Calibrator, and tube tester. In addition, a valuable inclusion in the bound



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In short, use IRC Type D Controls with Tap-in Shafts *universally*. Learn how a stock of only 18 of these controls equips you for prompt service on about two-thirds of all types of replacements. Study the construction of these sturdy little controls and see how amazingly superior Type D's are to ordinary midgets—fully equal in quality to the larger Type C Controls and with all the same features *plus* the added convenience of Tap-in Shafts which make them far more universal in use and much easier to install in a crowded receiver. Catalog free.



Tap-in Shafts Stay Put!
Don't pull loose.
Don't vibrate loose.

INTERNATIONAL RESISTANCE CO. 401 N. BROAD ST., PHILADELPHIA, PA.

volume is the 48-page new edition of the RCA Rider Chanalyst instruction book. These notes represent a storehouse of practical technical information on radio testing methods.

The volume is especially recommended in those territories and for those Service Men that are repeatedly called upon to service RCA and similar receivers. R. H.

TELEVISION BROADCASTING, by Lenox Lohr, published by McGraw-Hill Book Co., Inc., 330 W. 42d St., New York City, 1940, 269 pages, price \$3.00.

Television Broadcasting authoritatively reveals the many phases of television from its beginning over ten years ago. Mr. Lohr, formerly President of NBC, is well qualified to discuss the new social force in our daily lives.

The book has been written for the lay-

man as well as the technician, revealing the range of television from the initial research and planning through production economies and technique. It also attempts to clarify the part that radio, theatre, and advertising play in television—which has now entered the field of public service. This book is a valuable record of the history of television, the efforts and experiences, its development, operating technique, equipment, programs and technical problems and advertising possibilities. B. A.

CORRECTION

In the review of a book by G. N. Goldberger, on page 26 of the October issue of SERVICE, an incorrect title was given. This 119-page booklet is called "Servicing by Signal Substitution." It was recommended to "those who make their living from servicing radio receivers. . . ."

JACKSON 652 AUDIO OSCILLATOR

THE Model 652 is a portable audio frequency oscillator providing audio frequency voltages throughout the range of 20 to 20,000 cycles. The audio signal is generated at its fundamental frequency by a capacity-resistance tuned bridge circuit which provides improved operating characteristics. The full frequency range is covered in three logarithmic ranges. No calibration or zero adjustments are required in the operation of this instrument.

An output power of 500 milliwatts is available from the instrument. A selection of five load impedances in the output circuit provide matching facilities for various load conditions. The output control provides continuous adjustment of the output voltage from zero to maximum.

Output

The output circuit of the instrument consists of a transformer with four taps providing the proper output impedances for working into loads of 10, 250, 500 and 5,000 ohms. In addition a high impedance position on the load impedance switch preloads the 5,000-ohm tap for use on high impedance circuits. With the Output Control at maximum the following voltages are available at the Output posts: 10-ohm load = 2.23 volts; 250-ohm load = 11.2 volts;

500-ohm load = 15.8 volts; 5,000-ohm load = 50. volts; high-ohm load = 50. volts. The proper output-load tap should be used to match the impedance of the load circuit. It is necessary that a reasonably close impedance match be obtained between the audio oscillator output and the load to insure good wave form of the audio voltage.

One side of the output circuit is connected to chassis ground of the instrument. The "GND" binding post, which is mechanically insulated from the panel is con-

nected to ground by means of a short jumper from the binding post to a soldering lug on the chassis. If it is desired that the output circuit be operated above ground potential, this ground lead can be removed to provide an isolated output circuit. It is necessary to remove the instrument from the case to disconnect this lead.

General Circuit

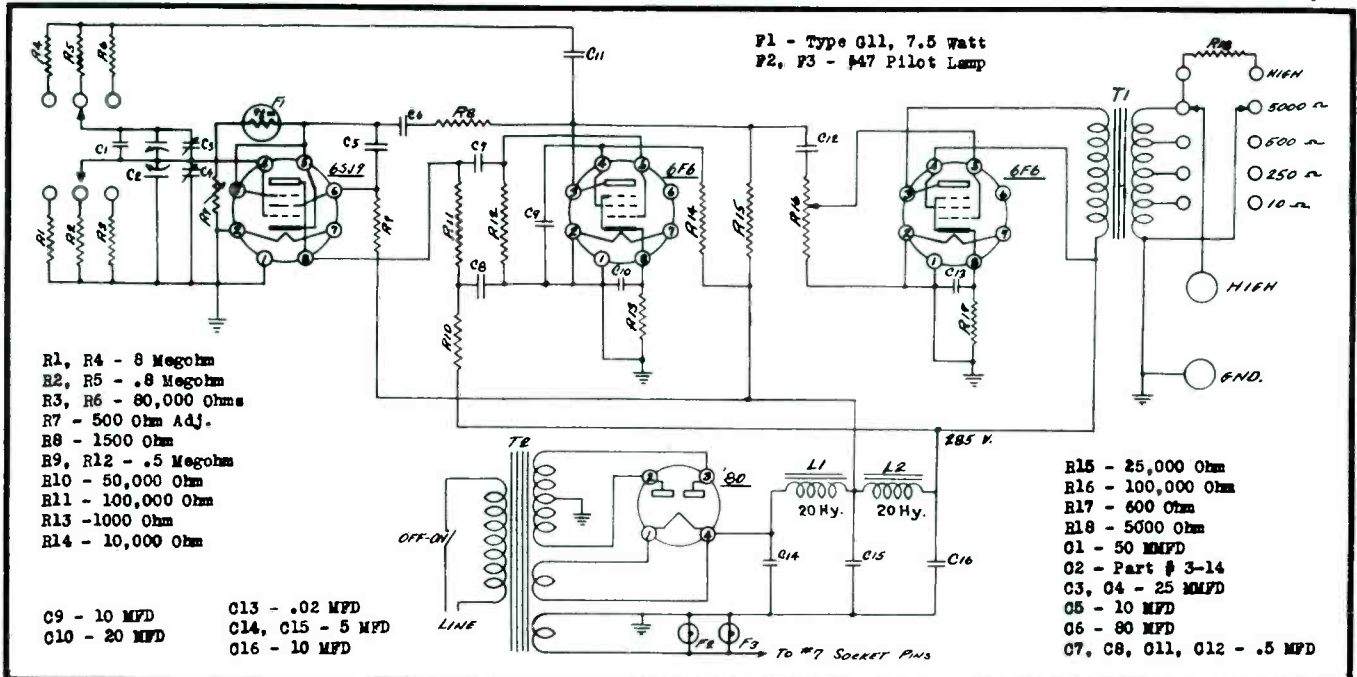
The Model 652 uses a Wien bridge resistance capacity tuned circuit to generate the audio signal at its fundamental frequency. A type 6SJ7 and 6F6 comprise the oscillating circuit. Positive feedback is introduced from the 6F6 plate circuit to the 6SJ7 grid circuit to maintain oscillations. Negative feedback is introduced into the cathode circuit of the 6SJ7 to provide waveform correction and amplitude control of the oscillations. A type 6F6 is used as an audio amplifier working into an output transformer providing various output load taps.

Due to the self-compensating nature of the circuit the output voltage remains practically constant throughout a wide range of input line voltage. The control action is provided by the ballast lamp "F1" (see circuit diagram) which controls the feedback factor. This also provides amplitude control of the generated signal throughout the audio range.

A small interval of time is necessary for



The 652 audio oscillator provides a range from 20 to 20,000 cycles. The signal is generated at its fundamental frequency.



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- Each subscriber should print his name and address clearly and state his occupation—whether a dealer, jobber, independent service man, service organization, etc.

Remember this Group Plan when Your Subscription Expires

this control action to take place. It will be noticed that when the line voltage is suddenly changed the output signal value drops but comes back to its normal value. Likewise when the frequency dial is rapidly turned the control action will be noted in restoring the signal to its normal level.

The instrument has been calibrated at the factory. No adjustments should be required to maintain its accuracy. When replacing tubes no adjustments are necessary. The circuit has been adjusted by means of the trimmer condensers C3 and C4 to provide a balanced circuit and the main variable condenser C2 adjusted to provide the calibration accuracy. The feedback control R7 (located beneath the chassis) has been adjusted to provide good wave form and the proper output voltage. It should require no adjustment throughout the life of the instrument.

The dial lamps may be replaced by removing the frequency control knob and the four screws holding the dial escutcheon.

Specifications

Line voltage..... 105 to 120 v, 50 to 60 c
 Input watts..... 50 watts
 Frequency range... 20 to 20,000 c
 Accuracy..... 3%
 Calibration curve.. Logarithmic
 Scale length..... 25 inches
 Output impedance. 10, 250, 500 5,000 ohms
 and high
 Output power..... 500 milliwatts
 Output control... Continuously variable
 Waveform..... Less than 5% distortion
 Frequency char- + or -1 db, 30. -15,-
 acteristic..... 000 c
 Hum level..... Down 60 db of max.
 output
 Tubes..... 1-80, 1-6SJ7, 2-6F6
 Dimensions..... 13" wide, 9½" high,
 9½" deep
 Weight..... 26 lbs.

SWITCH-CONTACT SERVICE KIT

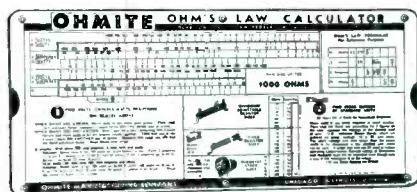
General Cement Mfg. Co., 919 Taylor Ave., Rockford, Ill., have announced a



kit of materials for cleaning noisy attenuators, tuners and switch contacts. Consists of contact cleaner and lubricant.

OHM'S LAW CALCULATOR

A convenient Ohm's law calculator has been designed by the Ohmite Manufacturing Co., 4835 Flournoy St., Chicago, for readers of SERVICE. It gives direct

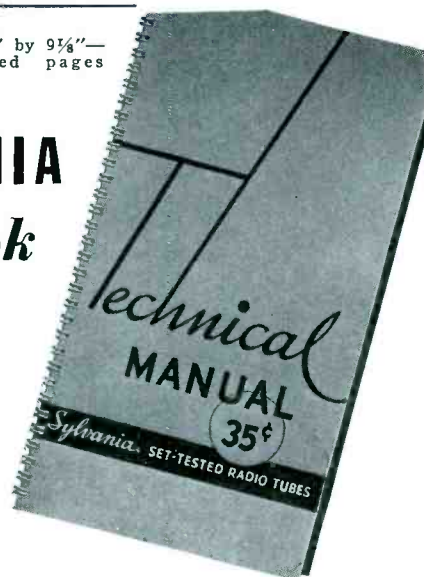


readings for problems in Ohm's law with a simple setting. Has scales on both sides to cover ranges commonly used in radio and allied work. May be obtained directly from Ohmite for 10c.

Actual size 4½" by 9½"—
272 fact-filled pages

GET YOUR COPY OF THE BIG SYLVANIA Tube Fact Book

272 Pages of Vital
Tube Information
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Operating Conditions
Tube Characteristics &
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374 Tube Types



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City..... State.....

Serviceman Experimenter
 Dealer Amateur

"HAVING A SWELL TIME," WRITES ABNER BUGLE, "WISH YOU WERE HERE"

Abner Bugle is the man who used to write the advertisements for Sprague Condensers.

Nobody could juggle adjectives more gracefully than Abner and, when it came to slapping on the superlatives, even Abner admitted he was just about tops in his profession. But Abner ran into a snag one day, and here is how it happened:

"Look, boss," he wailed to the president of the advertising agency for which he worked. "I'm in a helluva fix. There's nothing more to say about Sprague Atom midget dry electrolytic condensers."

"What!" roared the president, gnashing his teeth so hard he bit the stem off his Meerschbaum. "Don't be a fool, Bugle! Why, Atoms build up quicker. They stand higher surges. Their low leakage avoids overheating. They're smaller, and they've got more guts than —"

"I know all that," mourned Abner. "But every cheap condenser makes just about the same claims—whether they can live up to 'em or not. They may not be as good as Atoms in a radio set, but they look just as good in an ad. I don't know what to do."

"Jeepers Creepers, man!" the president's below shook the oil painting of the 50th million Sprague TC Tubular hanging on the wall. "An' you say you're an advertising expert! Of course Atoms are better. They're unconditionally guaranteed. There isn't a firecracker in a carload—not in a trainload—two trainloads—three trainloads —"

"I know that, boss," wailed Abner. "But you can't PROVE those things in print. No mat-



ter if he fills 'em with mush and wraps 'em in tissue paper, another manufacturer might CLAIM that his condensers are as good as Atoms."

The president did not reply. Grasping pad and pencil, he suddenly began to write. For two hours, Abner stood by, pale and wan and there was no other sound save the feverish scraping of the boss' gold pencil.

"Eureka!" shouted the president finally. "I've got it. Here's what we'll say in our next ad. Listen to this:

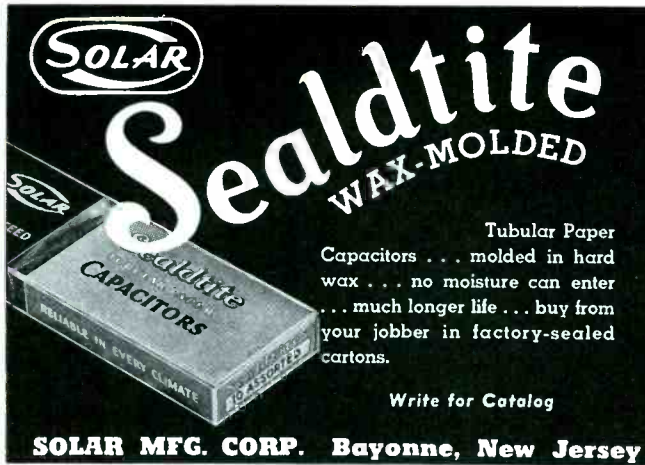
"We're glad most condensers are bought on the basis of hard-boiled engineering tests rather than mere advertising claims. When quality is allowed to speak for itself, there can be no mistaking what it says. That's why Spragues are today specified by leading users throughout the world."

"Splendid copy, boss—and it's all true," said Abner, breathing a deep sigh of relief.

"Splendid nothing!" snorted the president. "It's perfect. What's more, you're fired, Bugle. In the future, I'll write the Sprague ads myself."

SPRAGUE PRODUCTS COMPANY
North Adams, Mass.

P.S.—When last heard from, Abner Bugle had become a beachcomber in Tahiti. "Having a swell time—wish you were here," was what he wrote on the postcard, and added: "It's a great life. Beats advertising to a frazzle."



SOLAR
Sealtdite
WAX-MOLDED
Tubular Paper
Capacitors . . . molded in hard
wax . . . no moisture can enter
. . . much longer life . . . buy from
your jobber in factory-sealed
cartons.

Write for Catalog

SOLAR MFG. CORP. Bayonne, New Jersey



KEN-RAD
DEPENDABLE
RADIO TUBES

Ken-Rad Radio Tubes are dependable in service and dependable profit-makers for dealers. We invite inquiries from tube dealers and servicemen.

KEN-RAD TUBE & LAMP CORPORATION
Owensboro, Ky.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of SERVICE—A Monthly Digest of Radio and Allied Maintenance published monthly at New York, N. Y., for October 1, 1940.
County of New York, } ss.:
State of New York, }

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared B. S. Davis, who, having been duly sworn according to law, deposes and says that he is the Business Manager of SERVICE—A Monthly Digest of Radio and Allied Maintenance, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, Bryan Davis Publishing Co., Inc., 19 East 47th Street, New York, N. Y.; Editor, Robert G. Herzog, New York, N. Y.; Managing Editor, None; Business Manager, B. S. Davis, Ghent, N. Y.

2. That the owners are: Bryan Davis Publishing Co., Inc., 19 E. 47th St., New York, N. Y.; B. S. Davis, Ghent, N. Y.; J. C. Munn, Union City, Pa.; I. A. Walker, St. Albans, L. I., N. Y.; A. B. Goodenough, New Rochelle, N. Y.; P. S. Weil, Great Neck, L. I., N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances, and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock, and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) BRYAN S. DAVIS, Business Manager.

Sworn to and subscribed before me, this 4th day of October, 1940.
(Seal) J. A. WALKER, Notary Public.

Queens Co. Clk's No. 1991; Reg. No. 5650. New York Co. Clk's No. 199; Reg. No. 1-W-176. Commission expires March 30, 1941.

Mr. Radio Serviceman:

RSA MEANS BUSINESS!

New business promotion plans and new member-helps spell increased profits for RSA members at the start of the new season. Watch for the RSA Replacement Parts Guide—New Broadcast Promotions—New Member Helps! Don't be the last man in your neighborhood to join RSA. Send the coupon Today!

MAIL THIS COUPON NOW!

RADIO SERVICEMEN OF AMERICA, INC.
304 S. Dearborn St., Chicago, Ill.

I am interested in RSA Membership. Tell me about it.

Name

Address

City State

8-11-40

*Let's Grow Together
in 1940!*



**RADIO SERVICEMEN
OF AMERICA, Inc.**

Reliable Service Assured
JOE MARTY, JR., EXECUTIVE SECRETARY
304 S. DEARBORN STREET, CHICAGO, U.S.A.



**Radio Electric Service Co.
Philadelphia, Pa.**

In Philadelphia, Camden, Eastern Pennsylvania and Delaware radio circles the Radio Electric Service Co., Inc., is well known. From headquarters, at Seventh and Arch Sts., in Philadelphia, President John Stern and General Manager Gene Rothman direct the multitude of activities of this organization and its six branches located in Philadelphia, Camden, N. J., Wilmington, Del., Allentown and Easton, Pa.

Five outside salesmen cover the territory at regular intervals pushing the sale of the many lines of standard parts, accessories and sound equipment.

**Zimmerman Wholesalers
Hagerstown, Md.**

Down in the famed Blue Ridge Mountain country are three progressive radio parts distributing outlets. Operated by G. O. Zimmerman, Zimmerman Wholesalers with headquarters in Hagerstown, Md., also has branches in Uniontown, Pa., and in Cumberland, Md. The latter branch, recently opened, was necessitated by an ever increasing volume of sales on the many lines of standard products handled by this concern. Commenting on the steady growth of the organization, Mr. Zimmerman remarked recently "The patronage of our many customers has proven without a doubt that prompt service and high quality merchandise fully compensates our efforts."

Here's a picture of the Hagers-

town headquarters. You'll notice both Mr. and Mrs. G. O. Zimmerman behind the counter.



**Scranton Radio and Television
Scranton, Pa.**

Dahl Mack of Scranton Radio & Television Supply Co., Scranton, Pa.



He's the busy chap you will see at all radio conventions and meetings getting first hand information on

new products and developments to pass on to his hundreds of satisfied customers.

A go-getting group of salesmen cover seven counties in northeastern Pennsylvania and four in southern New York State for this progressive organization. Just about all standard lines of service parts, amateur necessities and sound equipment are carried in stock and it is the boast of Mr. Mack that for prompt delivery his concern ranks right at the top.

Dahl Mack was a licensed amateur way back in 1920. He was actively engaged as a Service Man until 1928 at which time he went into the parts jobbing business. Scranton moved into their new quarters, at 519 Mulberry St., in May of this year. It's said to be one of the most attractive showrooms in the state and contains more than five times the floor space required by the concern some few years back. That seems to be ample evidence of the close cooperation between Scranton and their innumerable loyal customers, both Service Men and amateurs. Yes, the handsome chap pictured here is Dahl W. Mack, the guiding spirit of this progressive concern.

In the interest of closer cooperation between Service Men and their local distributors, SERVICE will give its readers, from time to time, interesting and pertinent facts about radio parts wholesalers in various sections of the country.

**George D. Barbey Co.
Reading & Lancaster, Pa.**

If you were doing service work anywhere within the trading areas of Reading and Lancaster, Pa., chances are that you would be one of hundreds of Service Men who make the George D. Barbey Co. their headquarters. George, and his son and partner, Carl W. Barbey, have developed one of the most progressive distributing organizations in the country. Only nationally advertised lines are carried—service parts and accessories, amateur and sound equipment. Barbey blankets Pennsylvania "from the Maryland state line to Sunbury" with a group of hard-hitting able salesmen.

George started in business in 1917 as an automotive electrical service shop and four years later changed to radio, right at the start of this industry. Broadcast station WBBB, the first in central Pennsylvania, was built and operated by George Barbey. The organization now has an experienced personnel of 14.

A constantly growing business



necessitated the opening of the Lancaster branch in 1936.

**Radio Distributing Co.
Harrisburg, Pa.**



service parts are carried in stock as well as sound and amateur equipment, recorders and radio receiving sets. Modern office equipment of the highest type assures prompt and efficient handling of every transaction. Shown in the accompanying photograph are employees Helen Johnson, William Wolff, Karl Stock, William Clave, Bob Craeger and Manager R. M. Pepper.

**Eugene G. Wile
Philadelphia, Pa.**

Eugene G. Wile, located at 10 S. 10th St., Philadelphia, Pa., is one of the oldest houses in the East specializing in the sale of service parts and amateur equipment, it is said. A complete stock of all standard is known for its prompt courteous service.

**J. R. S. Distributors
York, Pa.**

Operating from York, Pa., and actively covering Adams, Carrol, Franklin, York and parts of Dalphin and Lancaster counties, Jim Strauss, proprietor of J. R. S. Distributors has developed a business of which he can well be proud. In 1926 Jim started in the service business and after consistent progress entered the parts distributing field just ten years ago.

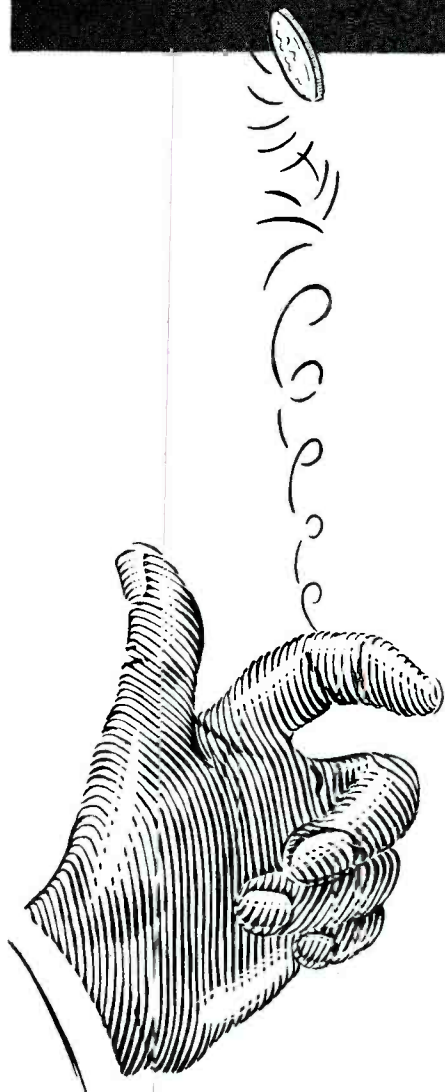
Seven well qualified employees now help Jim take care of his ever increasing business. All standard

lines are prominently displayed on his shelves for Service Men and the amateur trade. J. R. S. has a special department to serve the industrial field and make special equipment to order. The concern is also in a position to assist Service Men and dealers in servicing auto and home radio receivers.

In the accompanying photo of the J. R. S. display room you can see Don Hull, Jack McDonald, Jim Strauss and J. Warren Routzahn.



LET'S TAKE THE GAMBLE OUT OF THE RADIO PARTS BUSINESS



You have to hand it to the professional gambler on two counts anyway: He plays percentage and he always bets on a sure thing. It's no mystery that he wins!

You can take the gamble out of your business, too, by the simple expedient of buying from the Radio Parts Distributor who displays the NRPDA Emblem. This is your cue that that jobber is far sighted, co-operative and has subscribed to the code of ethics which motivates the NRPDA.

He sells only advertised brands of radio parts, he frowns upon destructive price competition and he has done his bit to help remove practices which have, in the past, taken from you profits which are legitimately yours.

When you place your money on NRPDA — you have "a sure thing,"—a return that pays you your percentage—regularly.

This advertisement is sponsored by the following members of the Eastern Pennsylvania and Maryland



chapter.

THE GEORGE D. BARBEY CO.
432 Walnut St., Reading, Pa.
29 E. Vine St., Lancaster, Pa.

J. R. S. DISTRIBUTORS
644 W. Market St., York, Pa.

RADIO DISTRIBUTING CO.
1124-26 Market St., Harrisburg, Pa.

RADIO ELECTRIC SERVICE CO., INC.
7th and Arch Sts., Philadelphia, Pa.
3145 N. Broad St., Philadelphia, Pa.
5133 Market St., Philadelphia, Pa.
811 Federal St., Camden, N. J.
1042 Hamilton St., Allentown, Pa.
219 W. 8th St., Wilmington, Del.
9 N. Second St., Easton, Pa.

SCRANTON RADIO AND
TELE. SUPPLY CO.
519 Mulberry St., Scranton, Pa.

EUGENE G. WILE
10 S. Tenth St., Philadelphia, Pa.


ZIMMERMAN WHOLESALERS
114 E. Washington St., Hagerstown, Md.
75 Morgantown St., Uniontown, Pa.
32 Bedford St., Cumberland, Md.

BUY NATIONALLY ADVERTISED PRODUCTS

SERVICE, NOVEMBER, 1940 • 35

R-O-TENNA
-RADIART'S ALL-
MECHANICAL WIND-UP
AERIAL-IS ACTUALLY
INSTALLED AND OP-
ERATING SATISFACTOR-
ILY IN THOUSANDS
OF CARS.

SEE your
RADIART
distributor



STANDARD OF COMPARISON
RADIART

WRITE FOR
BULLETIN 640

THE RADIART
CORPORATION
CLEVELAND, OHIO

XCELITE
QUALITY PRODUCTS

DON'T BUY
A QUALITY
HANDLE WITH A
CHEAP
BLADE!



XCELITE
 blades,
 made from
 S.A.E. 6150
 Chrome
 Vanadium
 Steel,
 have the
 same high
 quality as
 XCELITE
 guaranteed
 handles!

All Xcelite handles are guaran-
 teed against spitting, breaking or
 burring. Defective blades will be
 replaced if returned within one
 year from date of sale.

PARK METALWARE
COMPANY, INC.
ORCHARD PARK, NEW YORK

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Another Exclusive "First"!



MODEL VG-6

The Vacuum tube volt-meter that has revolutionized potential measurement for the design and service engineer.

Only One Search Prod!

Indicates DC with respect to ground, AC, AF, and even RF from 15 cps to 60 mc without frequency error. 0-3, 15, 30, 150, 300, 600 volts in 6 steps. Only one zero adjustment.

See this amazing instrument at your jobber or write for 1941 catalogue.

Obsoletes all current drain and capacitive load type instruments. **\$47**
 Guaranteed for one year

TELEVISO PRODUCTS, Inc.

2400 N. Sheffield Blvd., Chicago, Ill.

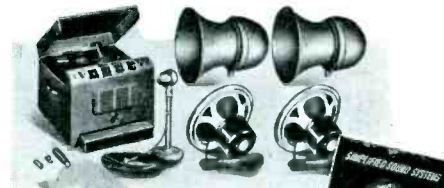
Sound System Men Praise Airline SOUND SYSTEM

You can depend upon the opinion of men who know sound systems! Here is what a few of them say about the Ward Airline: "Working perfectly . . . no repairs of any kind!" "Big volume . . . tone clear and natural!" "Customers pleased!" "Most natural tone I ever heard!" Remember, with Ward's direct selling plan, no other sound system could produce such results at anywhere near the price!

WRITE FOR CATALOG

The new Ward Sound System Catalog contains important facts about sound systems—what speakers, amplifiers and mikes to select, how everything plugs together for setting up and taking down. Mail coupon for FREE copy!

TIME PAYMENTS - 15-DAY TRIAL
 MONEY-BACK GUARANTEE



Montgomery Ward

9 GREAT MAIL ORDER HOUSES
 MORE THAN 600 RETAIL STORES

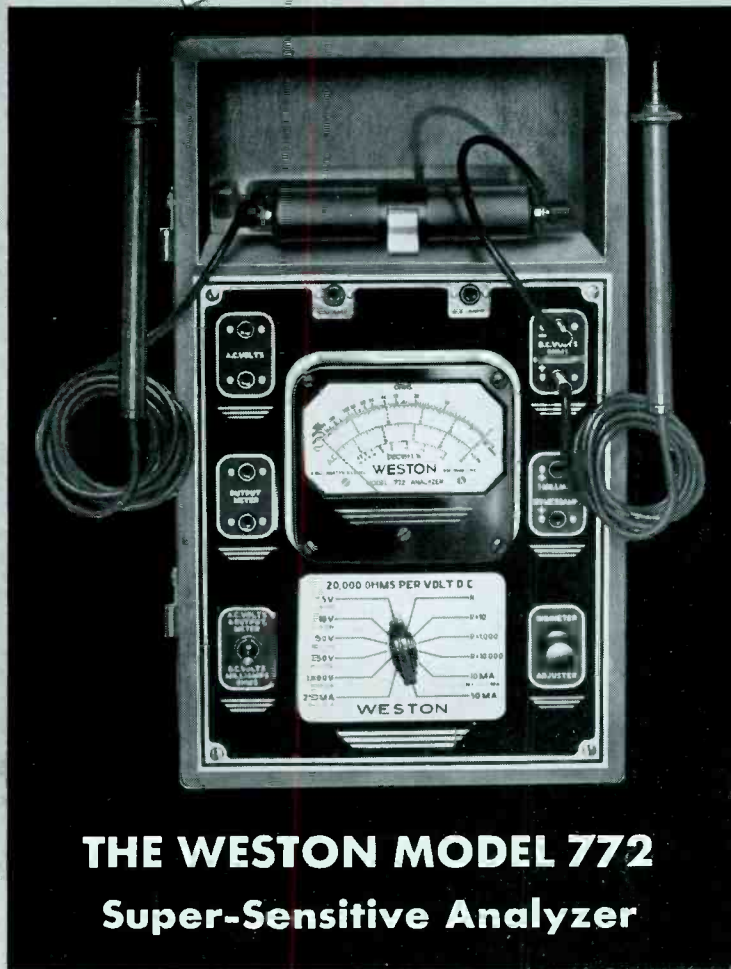
MONTGOMERY WARD & CO.
 Dept. AT-41, Chicago, Ill.
 Send your FREE Airline Catalog
 on Sound Systems.

Rush Coupon
 for FREE
 CATALOG

Name _____
 Address _____
 City _____ State _____

Stands Out

BECAUSE IT STANDS UP!



**THE WESTON MODEL 772
Super-Sensitive Analyzer**

Good service is a vital part of a strong industry. » » » The amazing growth of radio over twenty years reflects in no small part the essential job you do that keeps receiving sets tuned in on the networks of the globe.

To help you give this better service WESTON first introduced Model 772 in 1936. This same model is still tops! It stands out because it stands up—and you know how that helps your profit.

Model 772 is another of WESTON'S leading contributions to your important part in celebrating radio's twentieth anniversary. Once you team up with this foremost instrument you have a partner that will stick by you, always be a swell performer, and make good money for you for many years.

Consistently high quality in design and manufacture has maintained WESTON leadership for more than fifty years. All WESTON products stand out because they stand up! When you buy such dependable equipment you save and profit more. Make your next move with WESTON and you'll be right! Write for complete literature on Model 772 and other WESTON instruments for radio servicing. Weston Electrical Instrument Corporation, 597 Frelinghuysen Avenue, Newark, N. J.

RADIO'S 20th ANNIVERSARY

WESTON is proud to salute the Radio Industry on its twentieth anniversary. There is no finer contribution to the advancement of mankind than that of all of radio's forces uniting to achieve this wonder: *with the speed of light the voice and music of man reach even the remotest corners of the world.*

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters . . . Aircraft Instruments . . . Electric Tachometers . . . Dial Thermometers.

FOR OVER 52 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

LOOK HOW MUCH YOU GET!

...Look How Little You Pay!

NEW RCA JUNIOR VOLTOHMYST

D. C. Electronic
Push-Pull Volt-Ohmmeter
plus isolated A. C. Voltmeter!

ONLY
\$34.95
COMPLETE
Stock No. '65



No Other Instrument Gives You So Much for So Little!

11,000,000 ohms, constant input resistance for D. C. Volts . . . 6 D. C. Voltmeter Ranges: 0-3, 10, 30, 100, 300, 1,000 volts . . . 5 Ohmmeter Steps: 0.1 ohm to 1,000 megohms . . . Meter automatically protected against D. C. Volts overload . . . No Zero Reset when changing Ohmmeter Scales . . . 1,000 Ohms per volt Rectifier A. C. Voltmeter . . . Stable—no Grid Current—Independent of line voltage changes . . . Checks Insulation Resistance . . . Checks Bias Cells—A. V. C. and A. F. C. Voltages . . . Checks Voltages with signal present using Special Signal Tracing Type Probe . . . Famous Rider VoltOhmyst Circuit . . . A Perfect Output Meter.



More than 4,000 owners of RCA Rider Chanalysts—ask the man who owns one!

HAVE you been stymied on tough jobs because you couldn't measure voltages without loading the circuit? Now the kind of instrument you've always wanted—a D. C. Electronic Push-Pull Volt-Ohmmeter—is priced scarcely higher than an ordinary volt-ohmmeter!

Now you can check oscillator voltages at the grid of the tube, with the signal present . . . with the circuit functioning. Read AVC, AFC and FM discriminator voltages . . . check bias-cells without harmful drain . . . D. C. voltages in high-resistance photo-cell circuits . . . television circuits! See how much time you can save on both routine and special jobs, with a meter that offers a constant input resistance of 11,000,000 ohms—sensitivity as high as 3,566,656 ohms per volt!

And the Ohmmeter side of the Volt-Ohmyst story! 0.1 Ohms to 1,000 Megohms

Resistance-Readings! No leads to short—no zero-point resetting as you switch in five steps over the ranges that let you read accurately resistance from 0.1 to 1,000 megohms—a range of ten billion to one! Check coil resistances . . . or insulation and condenser leakages . . . accurately, easily, quickly!

Plus an A. C. Voltmeter! For extra convenience, an A. C. meter, too! Rugged copper-oxide rectifier type, 1,000 ohms per volt, reading up to 1,000 volts A. C. . . See the new RCA Junior VoltOhmyst at your RCA Distributor's—it's the test instrument you've been waiting for!



Test Equipment

RCA MANUFACTURING COMPANY, INC., CAMDEN, N. J.
A Service of the Radio Corporation of America