

THE

Radio Masters

MONTHLY

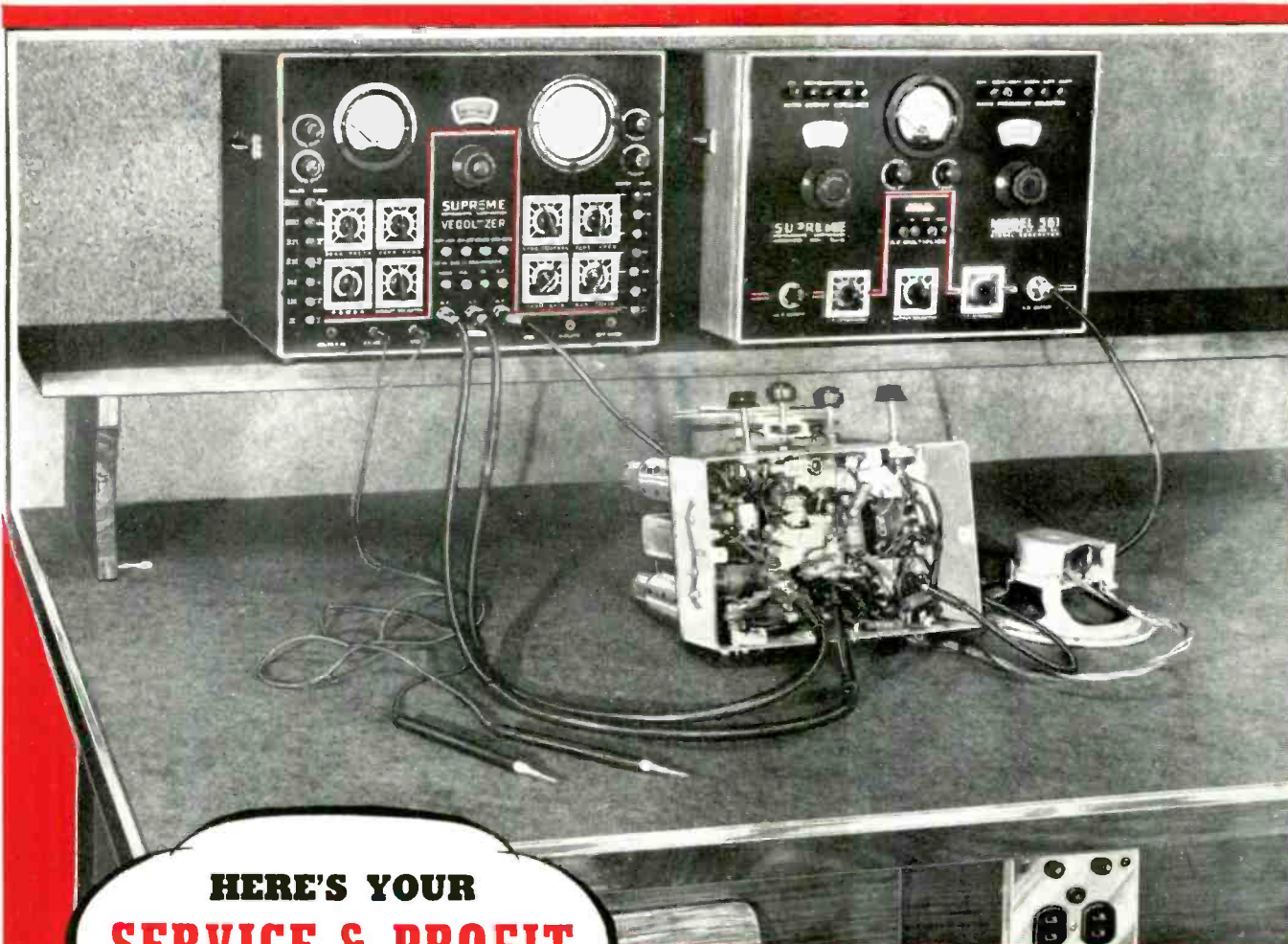
DEVOTED EXCLUSIVELY TO THE

INTERESTS OF THE RADIO SERVICEMAN

MARCH

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1940

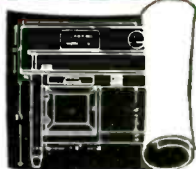


**HERE'S YOUR
SERVICE & PROFIT
SET-UP**

The test bench illustrated above is not an elaborate affair. It was built for, about, \$10.00 by a serviceman eight years ago and is still doing duty!

We like this test bench not only for the fine instruments shown, but because it's an ideal service set-up to get out the most work in the shortest and most convenient manner. It's neat, it's efficient, it's business-like and it's attractive—it's not a junk shop nor is it a store window mannequin. That's why it is a real work bench.

Please note that your instruments are solidly placed on a shelf about 9" above the table surface. As compared to a deck and panel or built-in job, this alone means that on only a 5" bench you have saved over 1000 square inches of working space, because the instruments require no working space at all. Add to this—the instrument probes come out at a natural "reach for" position—over your work, not behind it. And the instrument panels too—all indicators and controls in full view. No squat—no stoop—no squint. Give yourself a rest.



**GET YOUR TEST
BENCH PLANS FREE!**

We do not make or offer for sale any panels or test benches. But it is a definite part of our policy to help all service men. Therefore,

we have prepared a large 4-page booklet in which we discuss service benches in general, give valuable cost data, actual designs with detailed instructions for building, and our suggestions for necessary accessories. Sent free.

Do a better job, too, by using the modern and improved instruments now available. For the most complete and modern service shop imaginable only three instruments are required. On the left a Model 560 Vedolyzer is illustrated

(a SEI Amplifier could be substituted); on the right is one of the new SEI R. F. and A. F. Signal Generators. Open on the work bench or on the shelf above, or tucked away in the compartment below the bench (as shown there should be a 504 Sol and Tube Tester instantly available for bench work or an urgent outside service call. This is the only instrument which need be portable. You could spend over a thousand dollars and still not have as complete an equipment set-up as these three instruments will give you. In only three instruments you have:

1. C. M. oscilloscope, 3" tube, standard controls, all on front panel.
2. Three stage vertical amplifier, wide range video.
3. Vacuum tube voltmeter, 23 ranges A. C., D. C., R. F. volt and resistance.
4. Wave meter, 3 band.
5. Multi-input R. F., I. F., and A. F.
6. A. F. oscillator, 15 to 15,000 cycles.
7. R. F. oscillator, variable amplitude or frequency modulated.
8. Carrier meter, vacuum tube.
9. Modulator assembly with vacuum tube voltmeter circuit.
10. Frequency modulator, double image, positive self-synchronizing.
11. Tube Tester, patented circuit which tests all present or future tubes regardless of tube base terminations or filaments.
12. Leakage tester, tests 2-way for quality "hot" or super-sensitive leakage, etc.
13. Condenser meter, tests all electrostatic condensers for leak up to 50 megohms.
14. Electrolytic tester, accuracy less than all.
15. Settings on tube roller, check and tested on "English Reading" scale.
16. Complete push button Multimeter, 31 necessary ranges of A. C. and D. C. volts, micro-ampere and ampere, ohm pull ranges, ohms and megohms.

All this and more in only three instruments, more additional ranges and functions than we can describe here. Write now for your free Test Bench booklet and get your perfect Service and Profit Set-up.

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THE Radio Masters MONTHLY



DEVOTED EXCLUSIVELY TO THE INTERESTS OF THE RADIO SERVICEMAN



VOLUME 1 March, 1940 NUMBER 1

<i>News and Views</i>	4
<i>Service Highlights</i>	6
<i>Stepping Up Those Sales</i>	8
<i>Case Histories</i>	10
<i>All In A Day's Work</i>	12
<i>New Equipment and Material</i>	16
<i>Your Page of Knowledge</i>	17
<i>Current Information</i>	19
<i>Amateur Radio</i>	20

The frequency discriminator basks in the spotlight of Frequency Modulation fame. (Page 6)

Rising phonograph sales brings boom era to servicemen, says William Carduner. (Page 8)

Radio serviceman ingenuity saves hundreds in mine cave-in. (Page 12)

Studying the whys and wherefores of Test Equipment in a new simple way, developed by Max Spitalny. (Page 18)

Amateur radio and the serviceman become fast friends. (Page 20).

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ISSUE

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news and views

IN this, the first issue of **THE RADIO MASTERS MONTHLY**, we present a review of the many interesting topics that have been presented during our radio programs, during the past weeks. In addition, will be found, for the first time, many new and unusual features prepared especially for the interests of the serviceman.

To simplify reading and study, special sections have been set aside for the many phases of the service business. The case histories, for instance, appear on specially designed pages, that permit their insertion in loose leaf binders, or tip file cards.

The "Page of Knowledge", written by two of the country's outstanding authorities on radio education, offers the beginner and advanced man, too, an opportunity to become better acquainted with the many varied links of this interesting business.

In the pages devoted to "Service Highlights", appears data on an assortment of topics of importance to every serviceman. In our next issue, this section will be enlarged to include a host of data on other branches of radio

servicing, that we believe are valuable and potent to every serviceman.

DURING the broadcasts, we heard from many leading authorities in radio, whose topics of discussion were of such an important editorial nature, that we are presenting them herewith.

One of the discussions that was most interesting, covered the important question . . . How Much Is A Service Man Worth? **FRED HORMAN**, instructor in charge of radio and television servicing at the RCA Institutes, answered the question, most aptly. He said:

"The serviceman is not just an unclassified workman, following routine instruction. Instead he is a trained specialist, who can solve complex difficulties, because he is so expertly schooled. Now when he is called to service a radio receiver, and informs the customer that there will be a charge, of let us say, \$5.00, that may sound excessive; because first, the customer may not realize that not only is it necessary to replace quite a few parts, but that expert installation will be required . . . an installation that may

take quite a bit of time. Time is valuable. Now were the serviceman not capable and well trained . . . a training that by the way, was costly, the serviceman might have consumed more time . . . not arrived at the proper diagnosis . . . installed the wrong parts . . . and accordingly perhaps charged less . . . a feature that on the surface might attract a customer . . . but would be more costly later on. It is thus necessary to reward the serviceman suitably for his expert knowledge, and ability to solve a problem as quickly and accurately as is possible, under the circumstances."

"PROBABLY one of the most important links in phonograph high fidelity reproduction is our tiny friend, the needle, who until recently has been sadly overlooked," said Stephen Nestor of Recoton, during one of the broadcasts. "No record is any better than the needle, that is used in conjunction with it, because it is the needle that is the bridge that affords he reproduction we want.

"The frequencies that are recorded must be transmitted to the radio or phonograph truthfully, and with the

least amount of surface noise . . . and to the sturdy little needle falls that big job.

"In the needles today, we find not only special structural designs, but special chemical applications. For instance, unusually high quality steel alloy is used today. The new design includes a specific angle of operation . . . an angle that permits a tailor-made fit into the groove of the record to afford the perfect coupling necessary for quality reproduction. The special shape of the needle also acts as a mechanical filter, assisting in the elimination of surface noises.

"Instead of just punching out bits of steel, as was the custom, today we turn them out carefully on a special lathe. And then we polish the tips with the utmost of precision. This polished surface extends the life of the record, and permits a remarkably smooth operation and consistency of rotation. Needles that don't have these polished tips, have to depend on the abrasive action of the record for groove fitting. This of course, means surface noise.

"A quality needle, today can be used on anywhere from 10 to 1000 records, depending on the steel, design of the tip and precision of production."

SINCE the early days of radio, microphones have been one of the most important links. In his talk over the air, Andres Barbieri, chief engineer of Amperite, pointed out that the microphone of today is quite an intriguing device, capable of delivering reproduction, quite uncanny in its faithfulness.

"Good frequency response and little harmonic distortion are two of the most important requisites of a good microphone today," said Mr. Barbieri. "As we all know, sound is the air vibrating back and forth, a number of times per second. When this number varies between 16 and 21,000, the human ear can detect it. Therefore we call this the audible range. The number of vibrations per second is also

known as frequencies. It is necessary for a microphone to follow these vibrations within this range, for an inability in doing so, will eliminate certain tones from that reproduced sound. It is also necessary that the response of the microphone should be proportional to the intensity of sound energy that excites it.

"Now, due to the mechanical construction of microphones, particularly those possessing a diaphragm, they have resonant frequencies of their own, which are mainly due to the weight and stiffness of the moving element. Whenever sound possessing this frequency of resonance strikes the microphone, the generated current will be many times higher than it is for the non-resonant frequencies. Therefore a particular tone will predominate, making the reproduction unnatural and tiring. Another disadvantage introduced by the resonant frequencies is that of a higher feedback point.

"As we know, feedback is caused by the sound emitted by the loud speaker, being picked up by the microphone, amplifier, and re-emitted again by the speaker, and keeping on so, in such a vicious cycle, that we hear a continu-

ous howl. We can see then that if the microphone happens to be too efficient at one particular frequency, the whole system is apt to feedback very easily.

"Now harmonic distortion, involves sound and its nature. All tones have pitch and timbre. Pitch is the number of times that the air vibrates in a second, while timbre means additional vibrations or multiples of the pitch that are present in a greater or lesser degree in all sounds. That is why, when the same note is struck on two different instruments such as middle A on a piano, and on a violin, although possessing the same pitch, they seem to sound entirely different, as far as timbre is concerned. If a microphone does not reproduce all these harmonics exactly as in the original, the sound will change in nature. That is known as harmonic distortion".

ELECTRONIC musical instruments have grown to be quite an important factor to the radio service man, according to Clyde Doerr, the celebrated saxophonist, who has turned inventor, and produced one of the most unusual electronic instruments ever seen. In his chat during a RADIO MASTER program, he said, "The radio service man is now as important to this new business as the artist himself, who must play the instrument.

"With these new instruments that depend so much on the performance of actual radio apparatus, it is imperative that we work quite closely with the radio man. For only with his assistance, can we hope to maintain the quality of performance that is so essential for good listening.

"The radio serviceman can capitalize on this new market, by keeping a close watch on the routes of every orchestra. Practically every orchestra in the country now uses an electronic instrument of some sort or other. Some are simple, and some are elaborate, but they all require the guidance of an expert, like the radio service man."

Listen In

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OF
THE RADIO MASTERS

Every Sunday

9:15 to 9:45 P.M.

on
STATION W B N X
1 3 5 0 K . C .

service highlights

A Resume of Important Electrical and Mechanical Developments

FREQUENCY MODULATION

THE backbone of the frequency modulation receiver, the receiver that is the current talk of the town, is the frequency discriminator. A typical discriminator circuit is shown in Fig. 1. T is an output type intermediate frequency transformer, with the diode plates of a 6H6 tube connected to the ends of a secondary winding. The cathode 2 is grounded, but cathode 1 is not. Also some voltage from the primary winding is coupled capacitively to the center tap of the secondary, from which separate but equal load resistors go to each cathode.

To escape confusion, let us analyze the operation of the discriminator in several conditions. In condition A, a signal at the resonance frequency of the IF transformer is considered. Voltages 1 and 2 are equal and opposite as they must always be with a center tapped

secondary. Voltage C is the voltage coupled by the capacity C1, from the primary. This voltage is the same for both diodes, since it is brought in at the center tap. Now, at resonance, the voltage C, must be exactly 90 degrees from the inductively coupled voltage. The result is that both diodes will develop DC voltages proportional to the equal resultants R1 and R2. There will be no voltage from the audio around RL1 and RL2 to ground, since the equal and opposite voltages add up to zero.

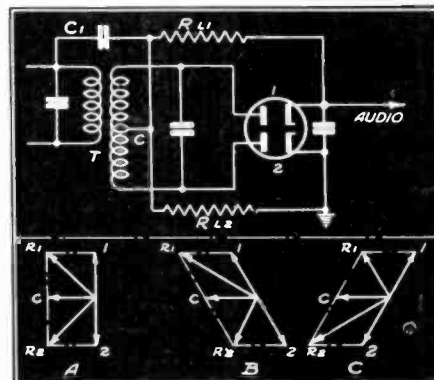


FIG. 1

In condition B, we have the signal off resonance in one direction. In C, we have it off resonance in the other direction. As can be seen, the 90 degree angle relation is gone and different voltages are generated in each diode. In case B, diode 1 develops the larger voltage, so that audio is positive with respect to ground. In case C, audio is negative, with respect to ground.

Thus we see that the discriminator will develop a voltage or an audio signal, depending on the variation of a carrier from a central frequency. Therefore it constitutes, and is a detector for frequency modulated signals.

—Stanley Rich

COMMUNICATION RADIO RECEIVERS

MOST communication receivers now employ an automatic noise limiter. The limiter used, a shunt type, is found to give excellent results on

such types of noise as ignition, bell-buzzer disturbances and other high-peak, short duration types of interference. The performance gained through the use of a good simple limiter warrants the small trouble of adding one to any good superheterodyne, having a diode second detector. Servicemen will find many customers for such an installation, particularly among the short wave fans.

Fig. 2 is a simplified workable shunt type of limiter, with an automatic "threshold". No adjustment of this circuit is necessary after it is installed. The diode used will automatically cut off all peaks of greater amplitude than twice the carrier level. That is, it will admit 100% modulated signals and cut off everything above this value.

In the circuit, the diode load is made up of two half-megohm resistors. The AVC voltage is taken from the filter, made up of the two megohm resistor and the .05 mfd. condenser. Audio voltage is taken half way up the diode load, or at point A. Between point A and point C, or the AVC voltage source, a diode is connected; cathode to A, plate to C. This diode may be the second half of the 6H6 detector used in the receiver, or an auxiliary 6H6 added to the set.

The limiter operates as follows. Because of filter action in the two megohm resistor, and the .05 mfd. condenser, the AVC voltage is always one half of the carrier maximum voltage at 100% modulation. This voltage is not changed by the presence of noise of short duration. The audio voltage at point A, because it is half way up, can never exceed one half of the total car-

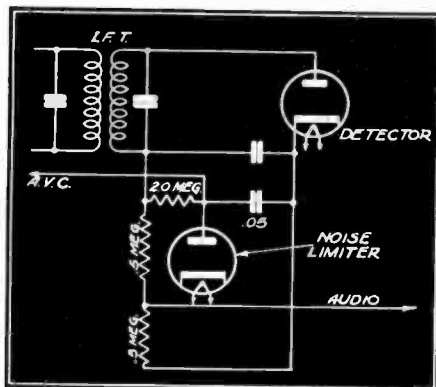


FIG. 2

rier voltage at 100% modulation. Therefore, for ordinary signals, the noise diode will not conduct. However any noise pulse will cause the diode to function and shunt this noise peak to ground, through the low reactance .05 mfd. condenser. Noises will cease crashing and will be reduced to pinpoints of sound in the background.

As for a practical installation, the writer has found that soldering short heavy leads directly to the 6H6 tube prongs is very effective. In this way, the necessary short leads are guaranteed and the tube can be hung like a pigtailed resistor exactly where it is most needed.

—Stanley Rich

TELEVISION

TO fully understand the mechanics of Television, it is quite important for every serviceman to acquaint themselves with the standards that have been set up by the RMA. The 441 lines per frame, for instance, were selected because it is an economic compromise of a number of factors. The maximum detail required for good pictures was determined by test, and a comparison of television pictures with a different number of scanning lines. Because of the acceptance by the public of home movies, it was felt unnecessary for television to exceed home movie detail. Another factor was the bandwidth required, since increased picture detail meant fewer television channels available. Increased bandwidth also enlarged the transmitter and receiver difficulties.

The scanning process by which alternate even numbered lines are scanned first, with the trace returning first to the start and scanning the remaining odd numbered lines, is called interlaced scanning, that is in use today. This scanning method gives a general idea of the whole picture in one-half frame, filling in the detail on the interlacing. On the other hand, progressive scanning would show full detail as it advanced, but the picture is only complete, after the full frame has been completely scanned. Therefore interlaced scanning, is twice as fast as pro-

gressive scanning, reducing the possibility of flicker, and also reducing the circuit difficulties, and cost, as the minimum video frequency requirement is doubled.

Motion pictures are shown at the rate of 24 frames per second, yet television pictures are shown at the rate of 30 per second. Now this brings up an interesting point, since this particular procedure makes it more difficult to televise motion picture films. However this is done since the frame frequency must be a multiple or a submultiple of the power supply frequency to avoid bad picture distortions caused by hum. Hum bends or waves the scanning lines unless the frame frequency is integrally related to the power frequency. Incidentally you may like to know how regular motion picture film is televised. The difference in the rate of movies and television cannot be corrected by merely speeding up the film through the television projector, since this would give a whizing effect to the pictures. The method used to televise motion picture film is to run the film at 30 frames per second and with a special mechanism, jerk the film past every third frame, omitting to scan it.

—Henry R. Hesse

(To Be Continued)

STANDARD BROADCAST

A STRIKING driver-amplifier circuit is used in the Zenith Chassis Number 5810 in which we have a 6F5G amplifier employed as a driver feeding directly via cathode to the grid of 25AC5G driver. The advantage is the gain equivalent to resistance coupling without the losses, and of course, minus transformer distortion. (Fig. 3)

—Leonard Charles

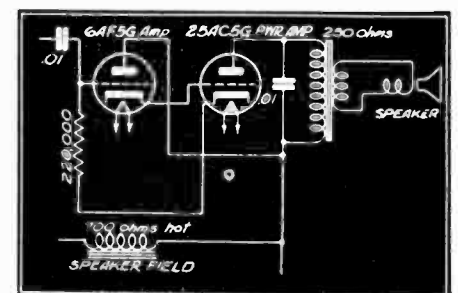


FIG. 3

stepping up those sales

Five Specialists Reveal New Methods of Increasing Sales

THE problem of free tube testing has been quite a thorn in the progress of the service man. It's a delicate matter that demands care and diplomacy in following through. But there are ways of overcoming these pitfalls, according to Arthur E. Rhine.

"In the plan I have developed," says Mr. Rhine, "I make a small charge of five cents for every tube tested that proves to be unsatisfactory; and that is not purchased or replaced by a new one from our laboratory. I explain this practice to our customers, in advance, so that they will be fully aware of this policy. I tell them, too, that if all the tubes are all right, there will, of course, be no charge; and that if defective tubes are present, and they are replaced in our shop, there is no charge for this test.

"Now, this charge does not annoy the customer, as might be the general

thought. For the customer realizes that tube testing instruments are a costly investment, and their operation and maintenance are costly too. Thus, it is only fair that this expert service be paid for, as a separate charge, or by the purchase of the replacement tube.

"Although it is the concensus that everyone who has a tube tested, and finds it to be bad, proceeds to buy a new one, I have found that ever so many do not buy a new one, and thus pay my five cent charge. Many persons feel that as long as the tube lights, there is some performance left in it. This of course is a bad practice, for as a result, not only does the performance of the set suffer, but the life of the various components in the receiver suffer too."

SINCE the outbreak of the war in Europe last Fall, there has been a great and continuing increase in the

use of communications receivers, in the home of the radio listening public. For with these receivers satisfactory results from the world over is quite assured. Thus Mr. and Mrs. Public have been able to listen to foreign short wave stations and pick up flash news, not only before it appears in the papers, but that may be omitted from the papers entirely. With this new efficiency available, the fascination of listening to the world becomes intense.

"This wave of popularity has thus swung the service man into a new market," says Robert Finlay, field engineer for the Hallicrafters.

"In undertaking this new responsibility, the serviceman will find himself called upon not only to use the best equipment, in coping with many of the specialized features that are characteristic of communications receivers; but to become conversant with the latest

developments in the art, for these usually appear in communications receivers first. Yet, there are many features that will make his task easier and more enjoyable. The interior of the communications receiver is more accessible. The design and construction is well thought out for radio efficiency, rather than for compactness, or to fit a particular style of cabinet. Being built along fundamental lines, the construction is usually much more open, and the wiring is neatly placed for easy checking. In addition, because of the very extreme nature of the work for which communications are designed, the components used in them are so carefully calculated and pre-tested, that the occasional failures, when they do occur, are of a minor nature, and easily located. The owner of a communications receiver is usually an exacting and particular person to please. Yet this is an intriguing and relishing part of the job, for it yields plenty of personal satisfaction when the work has been well done. And there is no bigger booster or advertiser for any serviceman, than a customer, who has had restored to him, this means to his enjoyment, of one of the most thrilling of all hobbies . . . a hobby that is incidentally also being enjoyed by some 70,000 amateurs throughout the world."

TOO many servicemen keep themselves in a bit of a shell, forgetting that it is wise to advertise themselves, once in a while, according to Herman Lederhaus of the Long Island Radio Dealers Association.

"There are many forms of advertising that will prove quite profitable to every serviceman," says Mr. Lederhaus.

"One is the direct mail form. It is true that is quite costly, but its quality affect is more than worth the cost. Church publication advertising has also been found to be quite successful.

"The loaning of power amplifiers to local organizations, has proven to be a very effective means of advertising services.

"The small business card with a station log has helped to stir up sales too.

Many a time, I have walked into a customer's home to repair a radio and have found this little card and log, sitting on the radio.

"Newspaper advertising with a specific message, other than the low cost message is quite helpful. By specific message, I mean the featuring of some specific service that can be rendered by your shop; such as elimination of noise, improving quality, getting more distance, eliminating interference, and so on. You can dress up your advertisement with an illustration of a radio star, or a motion picture celebrity who may be a guest star the day that you are advertising. Such advertising will not only be read, but will be remembered and bring results.

"In addition to the above forms of advertising, there is one form, that is quite an able associate. This is your work! A thorough, guaranteed repair job will go a long way to keep a customer. Standardization of prices are also most helpful. The following of strict code of ethics at all times, will prove most effective in winning the confidence of everyone, and will help to build your business. So advertise your services and render the quality service you advertise."

THE development of automatic record changers, making it possible to use them with any existing radio, has opened up wide avenues of revenue for the serviceman.

"The wide-awake serviceman will find a new constant source of income in the installation and servicing of these automatic devices," says William Carduner of Garrard.

"I daresay that one out of every two homes will accept a record changer, if the serviceman will acquaint the customer with all facts. In fact, I would like to go a step further and predict that in the very near future, there won't be a radio made, that will not be a radio-phonograph combination. What's more, they will have automatic record changers, and they will be good record

changers. After all, you know the greatest pains are taken to insure genuine fidelity in recordings. Isn't it a little foolish to pay for faithful recordings and then destroy the whole thing by playing the records on an unit, that simply hasn't the ability to give high fidelity reproduction? I am sure that the public will recognize this before very long. And here again the local serviceman can play his important role . . . by passing on information like this to his customers . . . and a grateful customer will think of him, when next a serviceman is required."

AS difficult as it may be, door to door canvassing is worth all the trouble in the world, according to Wesley Polmon.

"I don't deny that it's quite a job to keep knocking on doors, all day," says Mr. Polmon, "but it's knocking on doors that will bring in the business. if, and here's a big IF, the knocking has been preceded by some promotional plan.

"In other words, if the serviceman will map out a complete plan, that may involve leaflets, newspaper advertising, local spot advertising, or a series of letters; and then follow this up at least once a month, with a door rapping campaign, not only will results be available, but the results will be surprising. I know, for I have been following this method for years and it works like a charm. I know that it requires a great deal of hard work, but it's worth it. You certainly can't get much business by sitting in your shop and just waiting. And neither can you expect customers by just calling on folks every now and then. You have got to keep on reminding your prospective customers that you're still around. And the more often you do this, the more business you will get . . . and you'll get it!"

CASE histories

Compiled by ARTHUR E. RHINE

R C A MODEL U-107

PROBLEM

Records unintelligible on convertor operated synchronous phono motor. Constant speed 78 rpm by stroboscope.

SOLUTION

Either the phono motor is not the correct motor for alternating current supplied by convertor, or the convertor is supplying wrong (cycle) current for correct motor. Stroboscope viewed under light source supplied by convertor will not divulge convertor trouble. Insert business card under record. Count revolutions for 60 seconds. If count is from 5 to 10 rpm or more from normal, convertor is not 60 cycle type.

Submitted by A. E. Rhine, Jr.

ADMIRAL MODEL 399-6M

PROBLEM

No plate voltage. Tubes light up and test O.K.

SOLUTION

Look for high potential short to coil shield of 2d IF transformer. Unsolder high voltage lead. Dress insulation, allowing 1/8" bare for soldering. Clearance between lug and shield will then be sufficient. It is important that all resistors in high potential circuits be tested for value alteration; due to extreme heat to which some have been subjected. Realign after dressing IF leads.

Submitted by Jack Frost

RCA MODEL 140

PROBLEM

Uncontrollable oscillation.

SOLUTION

By-pass high power factor electrolytics or those which filter RF-IF circuits directly, with paper or mica condensers, as shown at A and B. Use 200 to 1000 mmfd. condensers. Although this problem is anent to the RCA 140, it is also common to all makes using electrolytics for pre-amplifier filtering.

Submitted by A. E. Rhine

ANY MAKE ANY MODEL

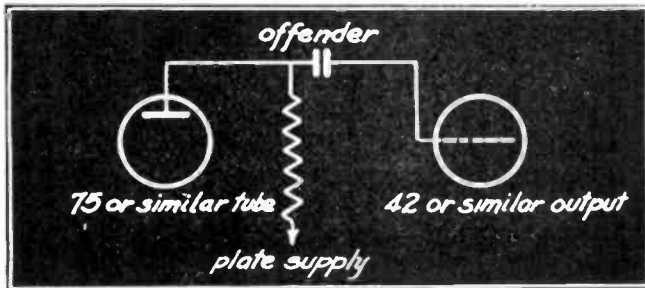
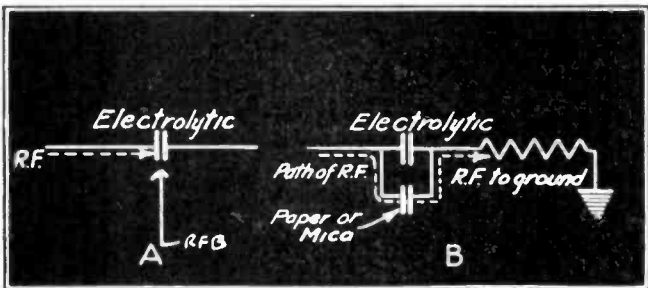
PROBLEM

Insufficient gain . . . garbled or mushy reception.

SOLUTION

Replace bad coupling condenser with new condenser of 600 volt rating. These condensers are of widely different capacities and ratings in different receivers. Don't be fooled by usual capacity-leakage test of original condenser, since resistance as high as 5 to 10 megohms may be sufficient to impair reception.

Submitted by Walter Horner



EMERSON MODEL V4 (420) TRF

PROBLEM

Lack of sensitivity on low frequencies.

SOLUTION

Attach an output meter. Tune in high frequency station having same signal strength as lowest frequency desired. Note output reading. Tune to low frequency. Move antenna primary until reading approximates high frequency reading. Hold coil position with tape. Return to high frequency. Note lower reading. Subtract difference in high frequency readings. Divide remainder by two; add quotient to low reading or subtract from high reading. Readjust primary until milliammeter reaches this pre-determined point. Cement antenna primary permanently. Recalibrate dial . . . reneutralize. Don't disturb volume control during operations, except when ready to neutralize.

Submitted by Jack Krauel

ANY MAKE

ANY MODEL

PROBLEM

Fading, when fading cannot be traced to usual causes.

SOLUTION

Check oscillator padder. High output causes corona effect in poor quality mica condensers. The corona effect changes characteristics of the oscillator tank circuit, thereby resulting in inconstant resonance. Moisture or excessive dampness is a common cause of oscillator padder trouble. Replace mica dielectric with good plate of Indian Ruby mica . . . after carefully cleaning all condenser parts with alcohol only. Avoid use of all patented cleaning fluids.

Submitted by Werner Mueller

STROMBERG CARLSON MODEL 82

PROBLEM

Howling on strong locals.

SOLUTION

Note that oscillator coils here are rigidly mounted. A and C band coil assembly will be found next to 76 oscillator. The B and D band oscillator coil assembly will be found in back of condenser No. C-28 (1350 mmfd. aligner). Demount these two coils. Insert rubber washers tightly fitted around each coil. Replace coils and shields. Excessive vibration previously causing howl will now be absent. (In the chassis, P-22732 is actually next to 76.)

Submitted by Dave Strong

GRUNOW MODEL 871 . . . CHASSIS 8E and similar
push-pull Grunows.

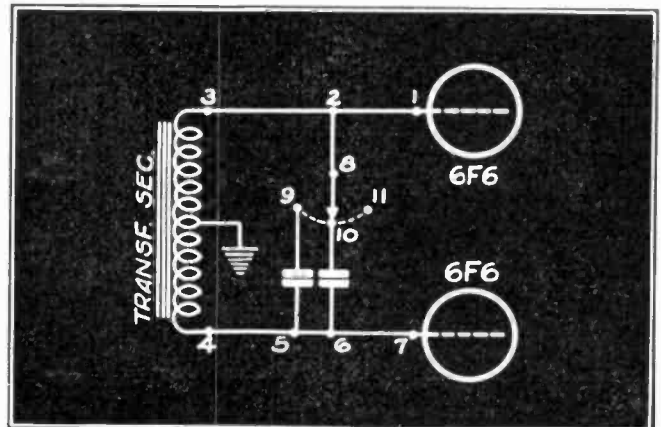
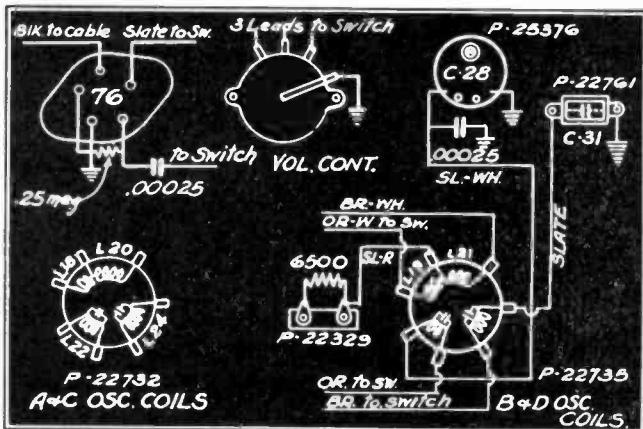
PROBLEM

Audio oscillation, resembling microphonic tube howl.

SOLUTION

Microphonic solder connections are common causes of audio oscillation, especially in tone control, when placed in output grid circuit. Use rosin core solder and re-flow every connection in the sockets, transformer secondary connections, switch arm and condensers. The dots in the diagram represent all possible connections to be re-soldered. Unbalanced transformer secondary conditions must be bypassed to ground.

Submitted by Thomas Rowal



all in a days work

Unusual True Stories of The Radio Service Man

IN the following true story, **WERNER MUELLER**, tells about an intriguing device, that saved the lives of a whole family.

"A number of years ago, I was a rather active business man, on the alert particularly for new electrical devices to sell. I took a special interest in automatic time controls, and sold any number of installations. Out my way, people like the idea of not having to get out of bed and turn the radio on or off. One of these installations took place in one of the homes that uses hot air furnaces, where individual pipes lead to the various rooms in the house and heat them thusly.

Well, during one night in this home, while everyone was asleep, something went wrong with the furnace. Coal gas seeped into the heater ducts and spread throughout the rooms of the house. Our friends were asleep, and their slumber settled deeper and deeper. No

one detected these dangerous fumes that were lulling them into a sleep of death.

"Then suddenly at the stroke of six, the silent timer snapped on a switch, and turned on the radio. The announcer spoke, and still no one heard the message. Then music . . . hardy music . . . began filling the rooms. One of the younger members of the family stirred. He moved slowly. His head felt heavy, and he could hardly move his eyelids. But he heard the music. It was time to rise, and yet no one else was up. That's strange, he thought. Everyone seems to be so sound asleep. The music played on and on, and his senses began to awaken slowly. His sense of smell began to adjust itself. He sniffed a bit . . . a bit more. He wondered what that funny odor could be. He seemed to recall that he had smelled something of this pungency before. Then suddenly, he realized that it was coal gas, that he was smelling.

"'Coal gas,' he shouted. 'So that's why everyone is so sound asleep.'

"He pulled himself out of bed and dragged himself over to his brother's bed, and shook and shook him. But, no matter how hard he shook, his brother did not answer. He became panicky, for he realized the danger of this gas. Rushing to the windows, he opened them up wide, and shouted at the top of his lungs. A passerby heard the yells, came running in, and saw at once that medical attention was imperative.

"In a few moments, the doctors had come. And they had come just in time . . . just in time to prevent real tragedy . . . thanks to the timer and the radio that awakened the little boy!"

FROM the files of **JOHN H. WALTERS**, comes our next true story.

"Some months ago, a bank in a

(Concluded on page 14)

PHILCO

ALL MODELS TO 1936

PROBLEM

Fading and intermittent reception.

SOLUTION

Replace all old original type block condensers. These were originally constructed by bringing enclosed condenser and resistor leads straight to the lugs on casing. Stretched tightly, the leads become rigid, and finally snap off, or loosen sufficiently to cause fading, noise and intermittent reception, all due to the warping of casings. Since 1936 this condition has been rectified by assembly with slightly pigtailed leads to compensate for stretch. And so, it is advisable to change all original types of condensers.

Submitted by Harold Wilson

PHILCO

MODEL 16, CODE 122

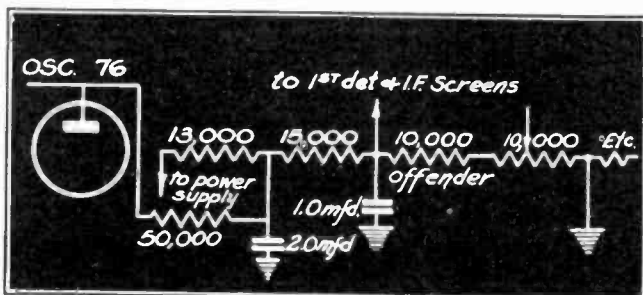
PROBLEM

Bass distortion . . . treble harsh . . . has detuned sound.

SOLUTION

Make voltage tests while set is hot. You will note that 1st detector 77, and the two IF 78 screens are operating at voltages greatly in excess . . . although the test during first 30 minutes will check O.K. Oscillator plate voltage will also be excessive. Philco resistor No. 83, 10,000 ohms, in network between noise-potentiometer and Philco No. 91, 15,000 ohm resistor will be found to test as low as 1000 ohms during this 'hot' condition. Replace with wire wound 20 watt resistor. Realign receiver.

Submitted by Sam Kuzyk



ANY MAKE

ANY MODEL

PROBLEM

If any model receiver becomes inoperative due to failure of 42 output tube, what substitute can be made, if new 42 is not available?

SOLUTION

Reception can be restored in this emergency by the substitution of a 78 or 6D6, providing it is done as a temporary expedient only. Distortion, effecting tone, will result. Top grid cap must be ignored. The suppressor grid will function automatically as the 42 grid does, because of socket location. Construction and position of the suppressor and several other characteristics do not warrant its use, except in such an emergency.

Submitted by Herman Lederhaus

PHILCO

MODEL 16X

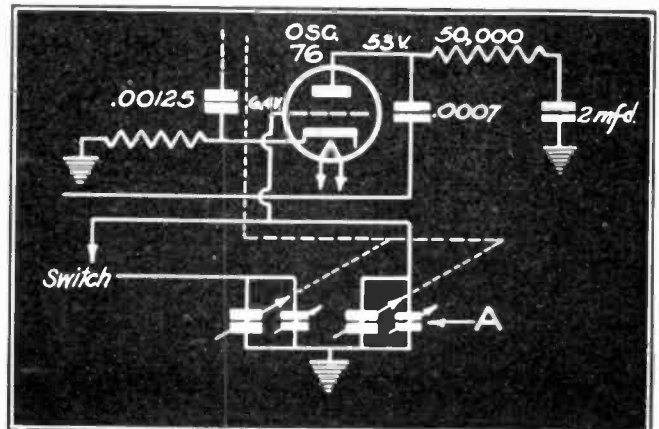
PROBLEM

Frequency drift.

SOLUTION

To avoid being fooled by apparent fading, tune receiver five or ten kc. plus or minus. If restoration of signal normally results, your trouble is not fading. Inspect stator of oscillator tuning condenser. Slight looseness of screws and rivets will cause the drift or signal frequency fade. Remove the bank, (A in diagram) tighten all rivets and screws. Reassemble and be sure to re-align the receiver.

Submitted by Arthur E. Rbine



metropolitan city had an inter-communication system installed. Connections were made between the bank office and the local police station, using the electric vault clock line as the transmission line. The system was kept on during the night in a constant transmitting position. And thus any noises that would originate within the bank, could thus be picked up easily and relayed to the police station.

"Well, one fine night in July, a few thieves forced their way into the bank, and went about their professional work of forcing the safe door leading to the vaults. They couldn't imagine why they shouldn't discuss their intricate job with each other, and so as they drilled every hole, removed every nut, and slid off every connecting bar, they described, with pride, each of these operations.

"Some miles away, a police officer listened in with surprise, as this colorful description came floating in, by way of his radio. At first stunned by the brashness of these crooks, it wasn't long, before the officer realized just what was happening in the bank. And so to the detective's quarters he raced, to tell them what he had just heard. Needless to say, it wasn't long before the officers were at the bank, herding the 'commentating' safecrackers into a patrol wagon.

"When the crooks heard what was responsible for their capture, they were truly non-plussed. For that was the last thing in the earth that they would ever think of, they said.

"To think, that all that valuable information, on how to break 'em open, we were telling the cops, without them askin. Can you imagine that!" they chorused, as they were being led to their cells.

"Undoubtedly from now on, they'll say little to anyone, without first putting a coating of cement over them!"

INTO the pit of a coal mine went **FRANKLYN T. CRANE**, a short

time ago to install a wired radio communication system. He installed the system successfully, but not without running into some of the most breathless moments that ever cross the path of anyone.

Writes Mr. Crane . . . "My company was engaged in installing wired radio communication in the West Virginia coal mines. We used transceivers having about ten watts of radio frequency output, with two way communication being carried out over the power lines, by super-imposing an RF carrier. Our work carried us deep into the mountains, from which part we had to establish contact with the dispatcher's office at the entrance to the mine. Well, this fatal day, everyone put on their composition helmets, as usual, with the small flashlights, entered the mine car and began the trip into the gloomy depths of the mine. As we went down, test signals were sent out. These were received quite well.

"Finally the driver of the car, announced that we were at the bottom of the pit . . . some seven miles from the starting point. The section was new, with the road gang working on supports. The equipment was hooked up, and the routine signalling was run through, with perfect reception being reported.

"Then suddenly, a low rumble was heard . . . then a few more rumbles echoed through the mine. The ominous sounds grew more and more vicious every moment. Everyone paled . . . not a soul spoke. Everyone knew that the slate deposits, of which there were many in this region, probably had begun to slide. Although these miners always anticipated such an event, they somehow always steeled themselves sufficiently, just to forget about . . . until . . . until . . . they saw it coming their way. In the flash of seconds, a pounding, smashing pelt of slate had begun to crash down. Bodies were glued to the side of the shaft, to avoid these pieces of death.

"As quickly and suddenly as the thunder had started, it stopped. And soon, all was still again . . . but too still . . . too quiet. It was a tomb-like silence, that chilled everyone. For the moment, everyone was too paralyzed with fear to speak, but the typical courage of the miners soon made itself evident. After looking over the mess, it was found that the road back to the opening had been sealed with falling slate. Back to the transceiver I rushed. But one look at that instrument, and my heart sank, for a huge slice of slate had crashed through the microphone and damaged the wire too. However the powerline was still alive. Somehow, it hadn't been cut by the avalanche of slate. Quickly, I turned to inspect the other part of the equipment, and found that it hadn't been damaged. But with no mike, I was in a dilemma as how to call for help.

"'Why not use the head set . . . that should make a good mike,' I said to the boys.

"So snap went the oscillator plate circuit, and in series went the phones.

"Slowly, I spoke these words over this makeshift hookup . . . words that we prayed would reach the outside world . . . "Cave in . . . shaft 27 . . . new wing . . . no casualties . . . but unable to get out . . . road covered with debris . . . microphone broken . . . using headphone as microphone . . . before answering back give three minutes to connect phones . . . go ahead!"

"We changed back to listen . . . hoping that the message had not been a message in vain. Then suddenly, I heard . . . "Received you . . . received you O.K. . . rescue gang on the way . . . stand-by!"

"'Stand-by . . . boy, will we stand by,' we chorused!

"And then bedlam broke loose . . . with waves of rousing cheers for that faithful radio that had averted a sickening tragedy!"

ANY MAKE AC/DC ANY MODEL

PROBLEM

No sensitivity at lower frequencies.

SOLUTION

Performance at low frequency end can be improved by shunting an RF coil between antenna mounting lug and chassis. Still better results may be possible if one end of added RF coil is connected to outside ground, instead of chassis. No condenser in series with ground is necessary. Avoid direct ground lead contact with chassis. Any ground to chassis connections in AC/DC receivers must be made through a series condenser. Use of a heavily wound RF choke, will prove as efficient as an RF coil, and will take less space.

Submitted by Paul Klarerns

ANY MAKE ANY MODEL

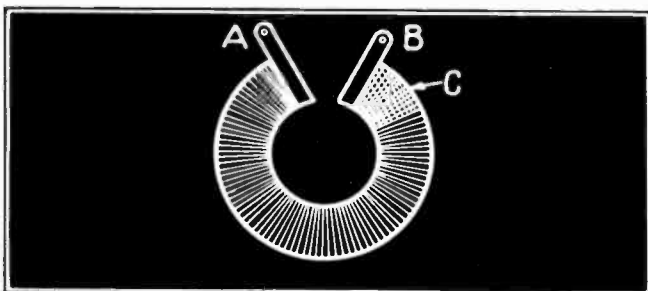
PROBLEM

Rumbling or growl at low volume.

SOLUTION

Often, volume controls that apparently test perfect, prove to be defective, for several degrees at the low starting end. A slight alteration of the characteristics of the element at this point, has fooled many. Substitution of an exact match control, will put you right. A to B in diagram, indicates overall apparent OK test. B indicates poor or loose terminal to watch out for, and C shows disintegration, of element.

Submitted by Frank Chaffers



RCA MODEL U 130

PROBLEM

Intermittent jamming of phono mechanism.

SOLUTION

In this model and other models using automatic phono, the trouble is caused by a bent or sprung main lever. This makes the roller on the end of the main lever, jump off the cam groove, and pass under the nose of the cam, where it sticks. This action will occur occasionally when vibration is in time with the main lever. This trouble will affect the change cycle only.

Submitted by E. H. Gilchrist

PHILCO MODEL 116

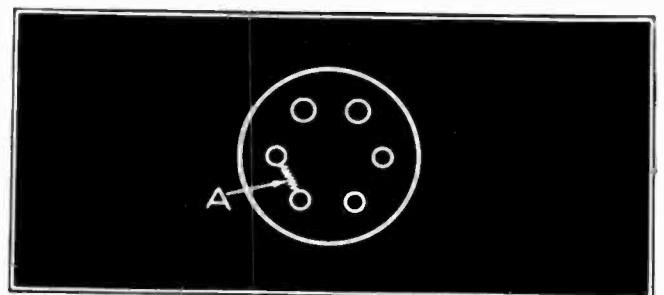
PROBLEM

Drift, after entire chassis is fully heated.

SOLUTION

Inter-terminal socket leakage caused by heat, prompts this trouble. These leakage paths, though of high resistant characteristics, form stray paths for transient currents, as illustrated in the diagram, at point A. Resulting high potential variance affects values of associated constants, including resistors. Bypaths become low resistant, and will function as portion of the resistor network. Offending socket may be found by isolating connections and testing with ohmmeter, capable of measurement of a fraction of an ohm.

Submitted by Arthur E. Rhine



REPLACEMENT CAPACITORS —

Known as the type EZ, this Cornell-Dubilier Condenser affords dual economy features of low cost and quick replacement. In addition, it is universal in its application, serving for replacement of vertical can, spade lug and strap mounted originals.

Single, dual, triple and quadruple units are included, with a choice of common negative leads or separate sections. In all there are 38 different varieties and combinations ranging from single 8, 12, 16 and 24 mfd. capacitors with ratings of 250, 350 and 450 volts, to multiple units.

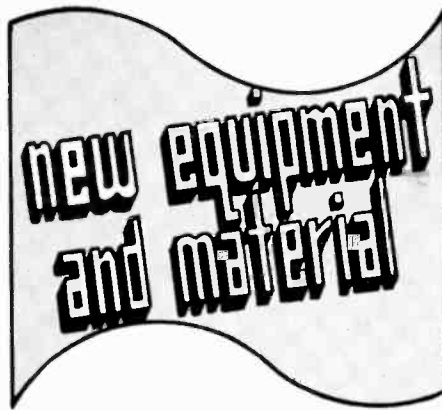
Enclosed in cylindrical cardboard container, and all leads are insulated and color coded.

* * *

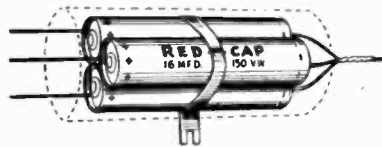
MULTITESTERS — A series of instruments by Radio City Products affording an unusually wide range of voltage, current and resistance measurements, with five direct-reading capacity ranges permitting readings from .0001 to 300 mfd. Other important features include: 4 1/2, 7 and 9-inch meters in the different series; styles for bench, counter and rack mounting; ohmmeter shorting button which eliminates need for shorting test prods in balancing ohmmeter; built-in battery and line-power supply for resistance measurements; low-ohms range in which first ten divisions read 0.05 ohm each with 2.0-ohm midscale, etc.

* * *

SOLDERING IRON — An "instant heat" compact soldering iron that heats instantly, upon touching wire or terminal to be soldered, developed by Ideal Commutator Dresser Co. Iron is no larger than lead pencil. Extremely safe to use. Current only in use when in actual contact with work.

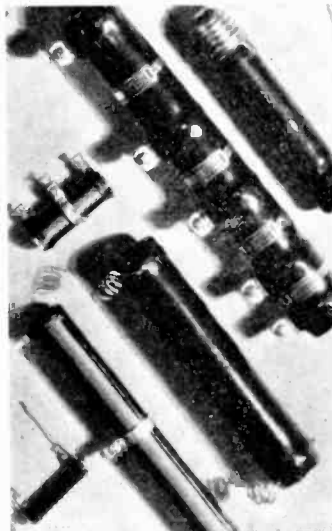


ELECTROLYTICS — Sealed in metal tubes, and rated to withstand extreme surges, yet so small that several units can be strapped together to occupy no more space than original filters, these new Red-Caps by Solar, fit a definite niche in the serviceman's shop. Twelve ratings cover a majority of filter block repair requirements.



* * *

RESISTOR — A new vitreous enameled wire wound resistor developed by Ward Leonard, as a result of 10 years of intensive research and development work on refractories, wire processing and enamels. This new resistor has an enamel structure that withstands humidity, moisture and immersion.



RELAYS — For antenna change-over, switching of band, crystal or tank circuits, Allied Control has developed the type H relay, etc. All parts plated. "Lucite" insulation with wide spacing is used throughout. The double pole, double throw contacts are of fine silver. Layer wound, impregnated coils are standard. The relay dimensions are 3" x 2 1/2" x 1 1/2". Made in 6, 12 & 125V D.C. or 60 cycle A.C.

* * *

TRANSCRIPTION NEEDLE — Newly developed needle by Recoton with highly polished point, made by famous turning process in Swiss factory. Each needle, made of special steel alloy, plays at least 10 records. Gives a smoother and flatter response within 500 cycles better on the high end, during comparison test.

* * *

SPADE BOLT CONDENSERS — Designed to serve as universal replacements for the many condensers of this type now used in many popular radio receivers, these units by Sprague are equipped with spade bolt mounting and are of the standard Sprague cardboard dry electrolytic sealed type construction. They include an 8-8 mfd. 450 working volts unit capable of withstanding a surge of 525 volts; an 8-16 mfd. 450 unit with a surge of 525 volts, and a 12-16 unit of 200 working volts and handling a surge voltage of 225 volts.

* * *

REPLACEMENT VIBRATORS — For farm and auto radios, made by ATR, and featuring 3/16" diameter tungsten contacts, with full wiping action, perforated reed of highest quality Swedish spring steel, mica and metal stack spacers with 2 bolt construction, extra flexible leads with tinned clamp supports.



Your page of knowledge

FUNDAMENTALS IN RADIO

By ADOLPH SUCHY

Part I

THERE are many elements that must be covered in a study of the fundamentals in radio that do not seem to bear directly on the subject, but are of a scientific nature, and come under the head of physics. These elements though sometimes difficult for the serviceman to grasp must be thoroughly understood before a man can call himself a qualified service man. The writer does not mean to imply that the serviceman take on the role of a college professor while servicing a radio set; but a thorough elementary understanding of the everyday terms, with which he deals and in which he thinks, must be his, in order for him to fully know his business. As a matter of fact, without the understanding of these rudiments of physics, radio service itself, loses much of its flavor, and becomes a mere mechanical manipulation of soldering irons, condensers, resistors, coils and so on. To those of us, who have made a living at this business, it holds more of a fascination, than mere mechanical work itself, would imply.

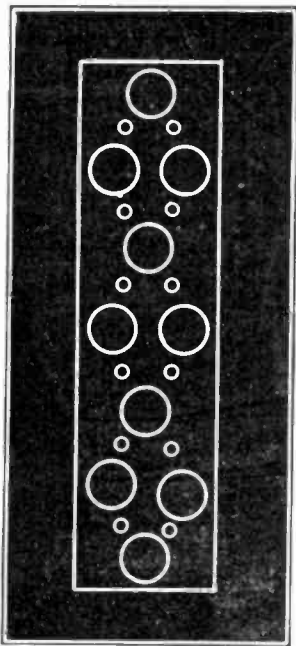


FIG. 1

The large circles are atoms, and the smaller ones are electrons.

The writer has reviewed several text books, before writing this article, and he feels that a detailed discussion of atoms, molecules and electrons, with which the average study in radio, invariably starts, is so adequately covered that to repeat such a complete discussion would be of a little value. Suffice it to say here, however, that electrons which are the smallest divisions of the smallest divisions of matter are able to pass through organized matter with ease, and an electric current is composed entirely of such particles bumping along from atom to atom, or from molecule to molecule. An idea of this 'bumping' of electrons from atom to atom may be illustrated by a greatly enlarged piece of copper wire, Fig. 1. This, of course, is a very crude

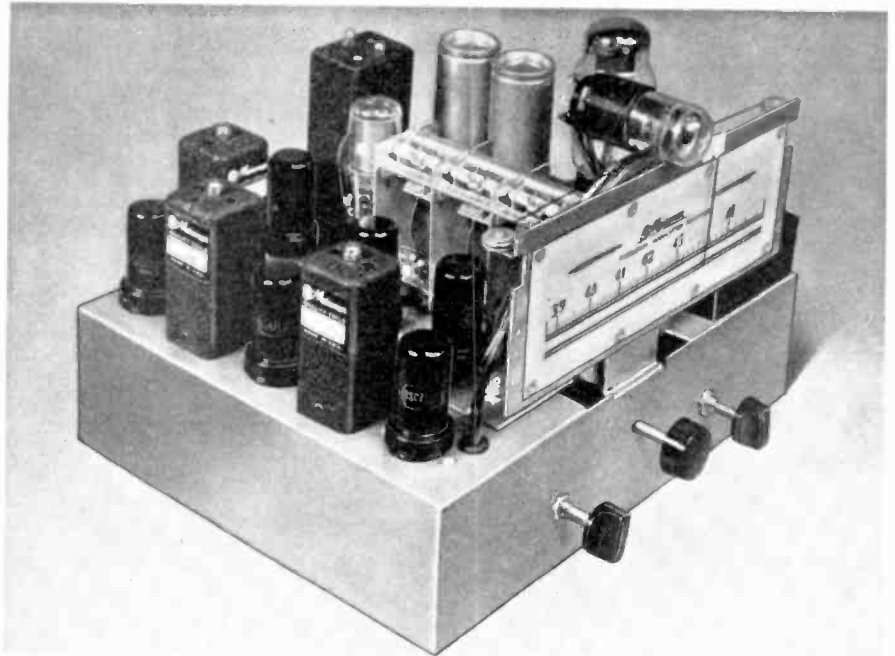
picture, but serves to portray the idea. We realize, however that the atoms are much further apart in a piece of copper wire, than we picture them. This movement of electrons from atom to atom, is by no means lethargic. The movement is faster than we can possibly imagine. Sometimes the speed is as great as 35,000 or 40,000 miles per second.

The electrons we have thus pictured are no different from any other electrons in nature. They are torn loose from their natural orbits, by means of generating devices and raced on to the next atom, with the amazing speed, which we have just mentioned.

To return to our crude picture of the electron crowding through the copper wire.

(Continued on Page 18)

FREQUENCY MODULATION



DEMANDS IMMEDIATE ACTION!

Not since the first introduction of radio as an entertainment medium has public interest been so thoroughly aroused as it is now — over Frequency Modulation.

This remarkable new system has taken hold — new transmitters are going up steadily — several in your own vicinity — it's here to stay! And what a market this opens up for you!

Your customers will be demanding receivers capable of providing the high-quality reproduction which features this new system. You can supply that demand NOW with the Meissner F-M Receptor!

The F-M Receptor is a complete, ten-tube "tuner", everything but the audio. Its output is easily connected to the audio sys-

tem of any radio receiver or to any good amplifier system.

Not a kit! This unit is completely wired, aligned and ready to operate. Don't delay — take immediate advantage of the unusual possibilities for fast, profitable sales. Demonstrate the Receptor in your customer's home — with his present receiver.

Write today for complete details, circuit, prices, etc.

SEND FOR FREE CATALOG

Mail a post-card at once to the address below for your copy of the big 48-page Meissner catalog. Contains full descriptions, illustrations and prices on the complete line of Meissner kits and other radio products.

ADDRESS DEPT. M-3

Meissner MT. CARMEL ILLINOIS

"A FAMOUS NAME FOR TWO DECADES"

(Continued from Page 17)

They do not move through all matter with the same speed. For instance, they do not go so fast through a piece of iron, as through a piece of copper, for some reasons which are not clearly understood at the present. On the other hand, a wire made up of silver, allows electrons to pass more freely than one of copper. Thus we could arrange metals in a table according to the passage of electrons through the wire. This, of course, is the resistance of the metal. Substances which allow a fairly good passage of electrons, have low resistance. Those through which the electrons do not flow so readily, have a high resistance. Gold offers little resistance to the passage of electricity, whereas nichrome offers high resistance.

A substance which offers the free passage of electrons is known as a conductor. There is no substance in the world that is a complete non-conductor of electrons, although there are many which are extremely poor conductors of electrons.

(To Be Continued)

(Following are a group of questions, based on the study of electrons, as discussed in the above article. We suggest that you study these questions carefully, and see if you can answer them accurately. In the event corrections of your answers are desirable, THE RADIO MASTERS MONTHLY will be glad to lend a hand through their special answer department. Simply send your answers to "Page of Knowledge" department, and include a self addressed stamped envelope plus ten cents in stamps or coin to cover cost of handling. Mark your request . . . for Part I . . . Fundamentals of Radio.)

1. What is the speed of electrons?
2. What substances offer little resistance to electrons?
3. What are electrons?

4. What is a conductor?
5. What is an electric current composed of?
6. Through what will electrons go faster?
7. Is physics important to the serviceman? Why?
8. What is the size of an electron?
9. What power has an electron?
10. Can electrons be seen?

RADIO TEST EQUIPMENT

By MAX SPITALNY

Part I

MODERN radio servicing requires the use of sensitive indicating devices.

Whether we are using a milliammeter, voltmeter, ohmmeter, vacuum tube voltmeter, oscilloscope, or any other indicator, we need to know just what is being tested and what the indicator of the test instrument means.

I recently heard a story, told by Alfred McCosker, president of WOR, which illustrates the point aptly. A lawyer named Al Strange was making his will. On his tombstone he wanted inscribed the words . . . "Here lies an honest lawyer".

"But," said his partner, "how will people know, whose tombstone it is?"

"That is easy," said Al, "why anybody looking at that stone will stop and say . . . 'that's strange'!"

In looking at the indication of our test instruments, we do not want to say 'that's strange', but we do want to know what it means.

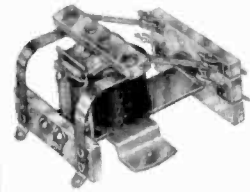
In this discussion, we will explain the types of test equipment normally in use, how they work, and how they can be used.

Modern signal tracing using such sensitive devices as the vacuum tube voltmeter and

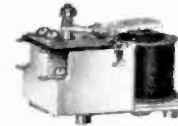
(Concluded on Page 22)

ALLIED RELAYS

for



TYPE H



TYPE D



TYPE PC

- Motor starting
- Signalling
- Light Control
- Timers
- AC/DC Radios
- Antenna change-Over
- Band switching
- Dynamotor starting
- Filament control
- Overload Protection
- Plate Circuit
- Photo cell
- Alarm Systems
- And many other applications

Other models are made, such as the new type K which is available with contact arrangements up to 6-P.D.T., and type E, a latch relay with electrical release.

Allied relays have the most advantageous fulcrums possible and large size coils to insure complete dependability of operation. Coils are layer wound and impregnated; high grade electrical iron is used throughout; cadmium or nickel plating; fine silver contacts. Special contacts available.

Stocks are carried by the leading jobbers throughout the country. Contact them or write us directly for information.

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It's that extra measure of service that makes HARVEY'S so popular with radio men

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However, we do definitely state that we are ready at all times to go to extremes to please our customers . . . There's darn little in the way of SERVICE that you can't get at HARVEY'S.

In fact, we've gone so far as to install a complete camera department for those of our radio customers who have become photography fans . . . and we're even working out trade-in deals of radio equipment for camera gadgets . . . or camera for radio . . .

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Radio Company of New York

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Current Information

(For Copies of the Following,
Use the Special Mailing Card)

1—CRYSTAL OSCILLATOR — A circuit and list of parts for a crystal controlled oscillator, with fundamentals of 100 and 1000 kilocycles, has been prepared by the Bliley Electric Co. The unit permits the serviceman to obtain multiples of the above ranges so that he can align his receiver, in conjunction with his service oscillator, to an unusual degree of accuracy.

* * *

2—PROFITABLE SERVICING — How to gauge costs of servicing, depreciation of equipment, selling of tubes and other hints are contained in a new Weston Electrical Instrument pamphlet. In addition, there are data on the newest Weston servicing instruments.

* * *

3—MANUAL — The new Cornell-Dubilier capacitor manual contains 240 pages of data on replacements, indexed to circuits in Rider's manuals. Forthcoming supplements will be published in the C-D Capacitor.

* * *

4—ENCYCLOPAEDIA — A new 352-E replacement transformer encyclopaedia and service guide, has just been issued by Thordarson. This guide replaces the service guide 243, and also guide 342.

5—FREQUENCY MODULATION—A completely wired up frequency modulation tuner, ready to be hooked up to any amplifier or radio is described in a Meissner booklet. All frequency drift in the tuner is minimized by the use of ceramic sockets, coil forms, etc.

* * *

6—TUBES — How to multiply tube profits is explained by the Hytron Corp. in their latest broadsides. Complete lists of the selected tubes necessary for most of the standard uses are shown in neat, tabulated form.

* * *

7—MICROPHONES — True cardioid uni-directional microphones are explained by Shure Bros. in their new booklet, called . . . Goodby Feedback. Sales and technical data offered, are most complete and useful.

* * *

8—REMOTE CONTROLS — For automobiles, and aircraft, flexible shafts are a very effective piece of apparatus. Their design and use are described in engineering bulletins prepared by the S. S. White Dental Mfg. Co.

* * *

9—COMMUNICATION RECEIVERS — For professional and amateur use, Hallicrafters have designed many receivers. How to use them and operate them are described in a number of attractive folders.

* * *

10—RECORDING — Discussions of recording equipment, particularly the home recording style appears in the Wilcox-Gay bulletins. In addition, service information on these instruments is presented, in complete form.

* * *

11—BATTERIES — Flashlights, lanterns, flashlight batteries, hearing aid batteries, ignition and telephone batteries, radio batteries, mazda lamps and special purpose batteries are all effectively described in a new Burgess Battery Company catalog.

THE BRONX'

OLDEST RADIO SUPPLY HOUSE

"Freed Transformers"

"Cornell Dubilier"

Condensers

"Ray-O-Vac" Batteries

Test Instruments

*Amplifiers, Micro-
phones, Pick-ups,*

Vibrators, Auto Heads,

Hard To Get Parts

etc., etc., etc.



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amateur radio

By STANLEY RICH, W2DIW

AMATEUR radio is being "discovered" by the serviceman. Often enough to draw conclusions, a serviceman friend will report that he has just repaired a commercially constructed amateur receiver; that some ham came in for advice and bought a tube; that his transmitting rig in the show window attracts radio-minded people. In other words, we conclude that amateur radio, more popular today than ever before, is not only a fine recreation, but a logical and profitable field for progressive servicemen.

The serviceman and his technical ability are regarded highly when he is associated with amateur radio. He is elevated to a more respected position in the community, and his sales and services receipts multiply, correspondingly. They multiply, not only in the sale of broadcast equipment and service, but, if he, himself, becomes a licensed amateur, they multiply the sale of amateur equipment and service. For with such a license, he is more fully equipped to sell communication type receivers. He is able to erect antennas for amateurs. He is able to advise and shoot trouble more effectively. And if he is enterprising, he may even conduct technical classes for would-be hams, and thus benefit again.

The serviceman, who is an amateur as well, has an additional factor in his favor. He is familiar with high frequency apparatus, and what it will do. This information

E -	A	T -	B	A -	C
I -		M -		W -	
S -		O -		J -	
N -	D	A -	E	N -	F
D -		U -		G -	
B -		V -			
R -	G	K -	H	Q -	I
L -		C -		Y -	
F -					
P -	J	1 -	K	6 -	L
X -		2 -		7 -	
Z -		3 -		8 -	
		4 -		9 -	
		5 -		0 -	

THE INTERNATIONAL CODE

FIG. 1

will be of great value with the spread of frequency modulation and television, where 40 megacycles and higher, are the operating frequencies. In these new devices, special circuits, tubes and antennas, familiar to the ham, are used.

It is evident that the serviceman can really dig in, if he is an amateur. Thus it is the purpose of this column of THE RADIO MASTERS MONTHLY to help the serviceman along this path. To follow through with this thought, amateur radio, in study form, will be the topic of discussion. First will be presented . . . code . . . and how to master it, with the least effort. Then, theory and construction of simple receivers for all bands, will be presented. Later on, transmitters and antennas will be analyzed. And, in conjunction with all this material, we will also help servicemen and amateurs, with their particular problems . . . such as noise and how to combat it; operation from apartments in crowded locations and the difficulties presented here, etc.

The first step in becoming an amateur, is to learn the code . . . and with the proper systematic approach, it presents no problem at all. In fact, learning the code should prove both entertaining and educational. In learning the code, three necessary factors are involved. First, it is necessary to choose a system for remembering the dots and dashes. Second, it is necessary to secure a code oscillator, so that it will be possible to receive and send . . . and thus develop an ear for listening and a flexible 'fist' for sending. The third requisite is a simple receiver, in order to gain actual experience in copying amateur signals.

Now, in Figure 1, we see the code characters. They are arranged as groups for easy memorization. By experience, the writer has found that it is easier to remember groups of characters as easily as single letters. Thus the number of groups is ten, with some letters repeated; while as individuals, twenty-six characters actually must be learned.

Let us take a bit of an example to see how this grouping helps us to learn. In group "C", dit-dah is the letter A; dit-dah-dah is W; dit-dah-dah-dah is J. A, W and J are associated by the way the characters are developed. Therefore, they are placed in the same group. Whenever J is needed, even if it is not recalled at first, it is quickly derived by its association with . . . let's say . . . A, which is dit-dah. J or dit-dah-dah-dah, is just a few seconds thought from dit-dah, or A. Thus in each group learning is quite simplified. The numbers are self-explanatory.

(Continued on Page 21)

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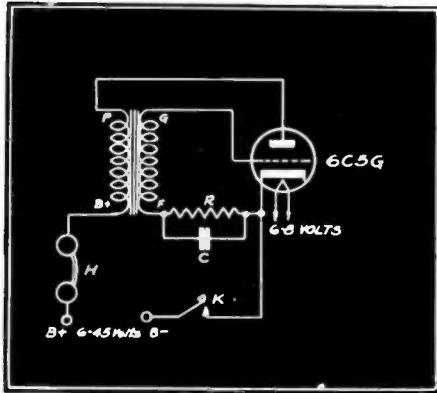


FIG. 2

(Continued from Page 20)

In order to master the code, some practice is absolutely necessary. Figure 2 shows a code oscillator, with connection for a key, headphones, and power supply or batteries. It is a very simple feed back oscillator, with provision for headphones and a sending key. The tube used is a 6C5G. This tube was chosen because it can be used in our simple receiver, that will appear in next month's issue. Any six to eight volt filament or heater source may be used, as shown, and it may be AC or DC. For plate supply, any DC plate battery or "B" supply may be used.

T is an audio transformer, such as Stancor A-53; Thordarson T-13-A-34 or U.T.C. R33. The oscillator coil serves as a feedback medium between the grid and plate and controls the audio frequency generated by the circuit. R1 is a one watt, 50,000 ohm resistor, used as a grid leak. C1 and C2 are .1 mfd. 200 volt by-pass condensers.

The code oscillator will give no trouble and should put out a clean, musical tone. There is but one fact to remember. This is . . . if the circuit does not work, with the tube plate connected to P and the headphones to B plus, then simply reverse these connections.

Next month, we will discuss a receiver, in addition to many other points of interest to the amateur. Code practice will also be announced. That is, amateurs associated with THE RADIO MASTERS MONTHLY, will transmit regular practice periods at announced sessions, and at starting speeds.

(To Be Continued)

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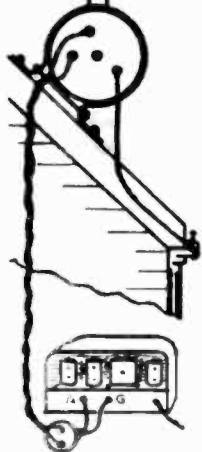
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Harvey Radio Co. of N. Y.	18
Hallicrafters, The.....	23
Meissner Mfg. Co.	17
Precision Apparatus Co.	24
Sun Radio Co.	21
Supreme Instrument Corp.	2
Terminal Radio Corp.	20

(Continued from Page 18)

oscilloscope, will be better understood, if we first study the basic test instrument . . . the milliammeter.

While there are a number of different types of current measuring instruments . . . the galvanometer, dynamometer, etc., the basic instrument in radio test work is the milliammeter, of the D'Arsonval or moveable coil type. This consists of a coil of fine wire, suspended in the magnetic field of a permanent magnet. To the coil is attached a pointer, which moves over a calibrated scale.

When current is sent through the coil, it produces a magnetic field around the coil, causing it to act like a magnet. The interaction of the two magnetic fields, will cause the coil to move against the restraining action of a small spring. The amount of movement is proportional to the amount of current passing through the coil. This is indicated on the calibrated scale by the pointer that is attached to the coil.

The resistance of the coil is low, and therefore, it must always be connected in series with a higher resistance in the circuit. When used as a voltmeter, this resistance is connected internally in the meter.

When used as an ammeter or a milliammeter, the meter must be connected in series with the circuit that is being measured. Because of its low resistance, if connected directly across the circuit, it would draw a considerable amount of current, and burn out. A sensitive meter requires very little current to produce a full scale reading . . . about one milliamper or less. When a larger current is being measured, it is necessary to connect a low resistance shunt across the terminals of the coil, so that a definite fraction of the total current will pass through the coil. Shunts can be constructed for any range of current desired.

A voltmeter is a device that is used to measure the voltage, or the electrical potential between two points in an electrical circuit. In order not to disturb the constants of a circuit, the voltmeter should draw as little current as possible, and must therefore, have a relatively high resistance. The range of a voltmeter may be increased by connecting multiplier resistances in series with the meter.

(To Be Continued)

(Following are a group of questions, based on the study of test equipment. We suggest that you study these questions carefully, too, and see if you can answer them correctly. In the event corrections of your answers are desirable, THE RADIO MASTERS MONTHLY will be glad to lend, through their special answer department. Simply send your answers to the "Page of Knowledge" department, and include a self addressed stamped envelope plus ten cents in stamps or coin to cover cost of handling. Mark your request . . . for Part I . . . Radio Test Equipment.

1. Name several types of current measuring devices.
2. Explain the action of the D'Arsonval type of milliammeter.
3. Why must a milliammeter be connected in series with the circuit being tested?
4. What precautions are necessary to protect the milliammeter?
5. What determines the sensitivity of a meter?
6. Explain the action of a shunt in a milliammeter.
7. Explain the action of a multiplier in a voltmeter.
8. In radio testing work, why is it important to know the resistance of your voltmeter?
9. Why must the resistance of the coil in a meter always be connected in series with a higher resistance in the circuit?
10. What is a voltmeter?



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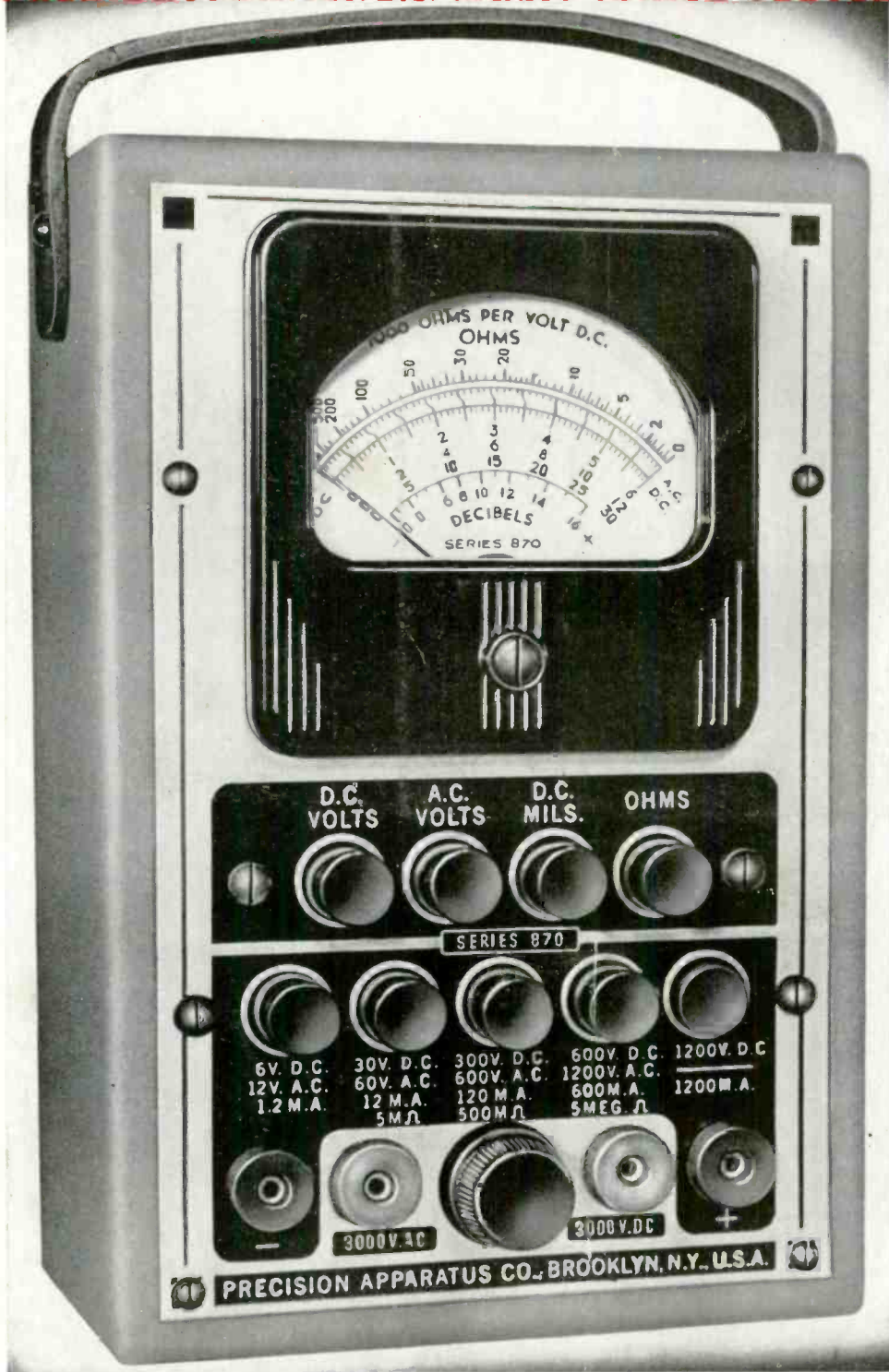


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