RADIO'S LIVEST MAGAZINE

A GERNSBACK PUBLICATION

Radio-Craft

39

April

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HUGO GERNSBACK Editor

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MORT VROOMAN

RADIO SET PRINTS NEWSPAPER

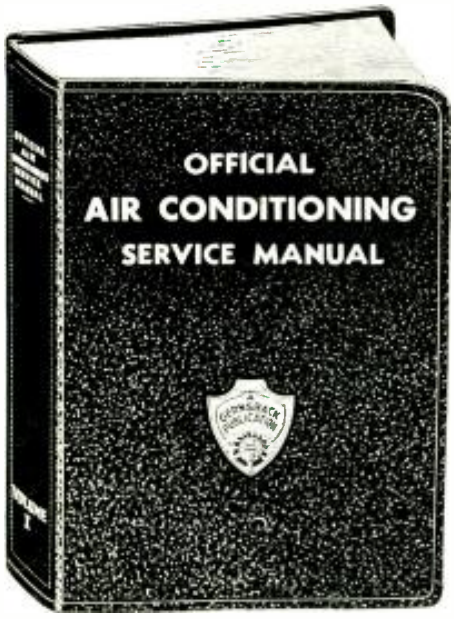
See Page 590

20 Ways to Improve Your Set—Auto-Radio Noise—Headphones Coming Back?
Radio-Controlled Battleships—A Knockabout Tester—Aligning Radio Sets

ANNOUNCING

A GOLDEN OPPORTUNITY FOR ALERT RADIO MEN IN

THE NEXT GREAT INDUSTRY



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THE idea of electricians, radio service men and other mechanically inclined men, servicing Air Conditioning and Refrigeration Units is self-evident and the thought has occurred to some untold thousands ever since air conditioning equipment has been installed in public auditoriums, theatres, studios, department stores, office buildings and manufacturing plants. The tremendously broad possibilities in this new industry are bound to give employment and success to men far-sighted enough to see its advancement and development. We quote an excerpt from Mr. Hugo Gernsback's editorial which appeared in the September, 1933 issue of Everyday Science and Mechanics:

> *"I advise young and progressive men to go into the air-conditioning business during the next few years; because, this, without a doubt, is the coming industry in this country. Thousands of small firms will spring up, undertaking to air-condition private houses, small business offices, factories, etc. We are not going to tear down every building in the United States immediately. It will be a gradual growth; yet small installation firms will air-condition small houses, and even single offices in small buildings."*

This is only partial proof of the certain success of this new field. Further assurance is that engineering schools have already added many important courses on air conditioning to their regular curriculum. Architects and building contractors are giving considerable thought to installation of this equipment in structures which are now being planned and built. The beginning of this business will probably be similar to the auto and radio industry, but in a few short years it will surpass these two great fields.

Official Air Conditioning Service Manual

352 Pages
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The OFFICIAL AIR CONDITIONING SERVICE MANUAL is being edited by L. K. Wright, who is an expert and a leading authority on air conditioning and refrigeration. He is a member of the American Society of Refrigerating Engineers, American Society of Mechanical Engineers, National Association of Practical Refrigerating Engineers; also author of the OFFICIAL REFRIGERATION SERVICE MANUAL and other volumes.

In this Air Conditioning Service Manual nearly every page will be illustrated; every modern installation and individual part carefully explained; diagrams furnished of all known equipment; special care given to the servicing and installation end. The tools needed will be illustrated and explained; there will be plenty of charts and page after page of service data.

Remember there is a big opportunity in this new field and plenty of money to be made in the servicing end. There are thousands of firms selling installations and parts every day and this equipment must be cared for frequently. Eventually air conditioning systems will be as common as radios and refrigerators in homes, offices and industrial plants. Why not start now—increase your earnings with a full- or spare-time service business.

You have the opportunity to get your copy of the OFFICIAL AIR CONDITIONING SERVICE MANUAL today—at a saving of ONE DOLLAR. When the book comes off press, which will be March 15th, the price will be $5.00 a copy. YOUR ORDER TODAY BRINGS YOU A COPY FOR $4.00, POSTAGE PREPAID. This is our usual courtesy, pre-publication offer which enables us to determine the approximate print order for the first press run. Send us the coupon today, together with a deposit of $2.00. When the book reaches you, you pay the other $2.00.

Here are some of the chapter heads of the AIR CONDITIONING SERVICE MANUAL:

Contents in Brief

History of Air Conditioning; Fundamental Laws; Methods of Refrigeration; Ejector System of Refrigeration; Compression System of Refrigeration; Refrigerants; Lubricating Oils; Liquid Throttle Devices; Servicing Expansion and Float Valves; Servicing Refrigerating Systems; Control Devces; Thermodynamics of Air Conditioning; Weather in the United States; The Field of Air Conditioning; Insulating Materials· Heat Transmission Through Walls; Complete Air Conditioning Systems; Estimating Requirements for the Home, Small Store, Restaurant; Layout of Duct Systems; Starting Up a System; Operating and Servicing Air Conditioning Systems; Air Filtration, Ventilating and Noise Eliminating Devices; Portable Electric Humidifiers and Room Coolers; Automatic Humidifiers; Air Conditioning Units for Radiator Systems and Warm Air Systems; Central Conditioning Units, etc.

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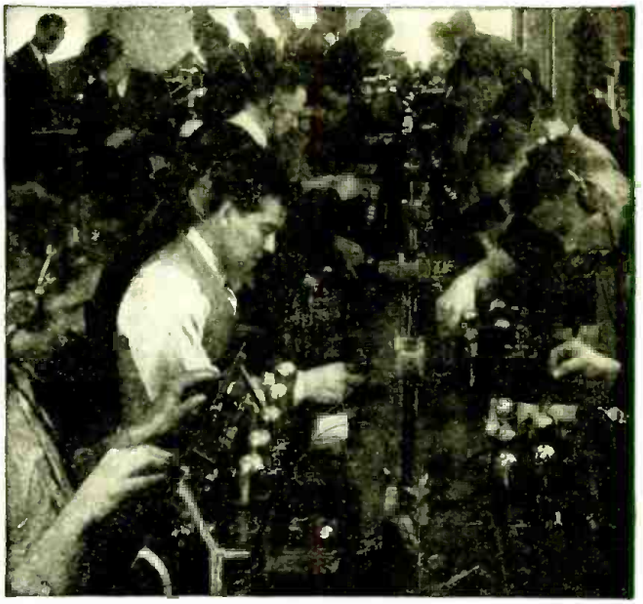

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Radio-Craft
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CONTENTS OF THE APRIL, 1934, ISSUE

VOLUME V Number 10

IN OUR NEXT FEW ISSUES:

CHOOSING YOUR RADIO SET. Now that the depression is past and people are looking about for something to spend money on, radio sets are receiving their share of attention. In this article, a careful analysis of the latest "gadgets" found in radio receivers is supplied. From this analysis, you will gain all the information needed to profit by the latest improvements.

MUSIC IN THIRD DIMENSION. The radio fan and P.A. worker who thinks that the present day receivers and P.A. installations supply the ultimate in fidelity have a shock awaiting them when they first hear the latest in sound reproduction. With the advancements made in "auditory perspective," present day theatre equipment is almost compared to the tin-horn phonograph of 1920.

POLYTONE—A NEW ELECTRONIC ORGAN. Here is a new electronic instrument which can imitate the effects produced on large pipe organs—and it does not have a single pipe in its makeup. Electronic instruments are attracting much attention both in music and radio circles. This one will no doubt achieve considerable fame.

RADIO-CRAFT is published monthly, on the fifth of the month preceding that of date; its subscription price is $2.50 per year. (In Canada and foreign countries, $3.00 a year to cover additional postage.) Entered at the post office at Mt. Morris, Ill., as second-class matter under the act of March 3, 1879.

HUGO GERNSBACK, President I. S. MANHEIMER, Secretary

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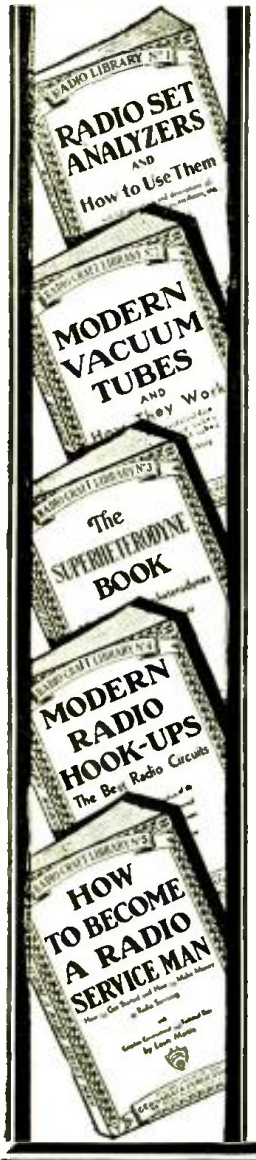

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By LOUIS MARTIN

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Book No. 6

Bringing Electric Sets Up to Date

With Pentodes, Multi-Mus, Dynamic Speakers—Complete Information How to Modernize A. C., D. C. and Battery Operated Receivers

By CLIFFORD E. DENTON

In this country there are over ten million electrically operated receivers that could be modernized—by placing in them new type tubes, new speaker equipment and other modern improvements. This business of improving old sets can go to the experimenters and Service Men if they will quickly jump into action.

Book No. 7

Radio Kinks and Wrinkles

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A Complete Compendium on the Latest Radio Short-Cuts and Money-Savers

By C. W. PALMER

It often becomes necessary for experimenters and Service Men to call upon their memory for some short cut or radio wrinkle that will solve a problem quickly. In business, "short cuts" mean time and money saved, and to the Service Man "time saved" means money earned.

Book No. 8

Radio Questions and Answers

A Selection of the Most Important of 5,000 Questions Submitted by Radio Men During the Course of One Year

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By GEORGE J. SALIBA

If there is one subject that is fascinating to every radio man, it is that of Home Recording. Of course, this volume is not all on "Home" recording, but the information contained therein is important to commercial radio men, studio operators, engineers and others interested in this phase of radio.

The art of recording and reproducing broadcast selections is becoming more important every day to radio men, experimenters and Service Men. Equipping dance halls, auditoriums, churches, restaurants and homes with public address systems and amplifiers brings many extra dollars and often an excellent income.

Book No. 11

Point-to-Point Resistance Measurements

The Modern Method of Servicing Radio Receivers

By CLIFFORD E. DENTON

Of the difficult problems which Service Men face today when repairing receivers, the greatest is that of replacing proper resistance values in sets. This task becomes even more difficult when the values of resistors are unknown; and manufacturers of many standard sets do not pass this information on to Service Men. In this new book radio men will find the information needed to quickly place a receiver in normal operating condition. This book cuts in half the time usually required to adjust the average set. Sufficient space has been devoted to the elementary problems and the theory of electricity as it is applied to resistance measurements so that the Service Man will have a comprehensive idea as to how to overcome this problem.

Below you will find a partial list of the contents which will appear in this new book:

INTRODUCTION. Advantages of Resistance Measurement Method of Servicing for Radio Work; Basic Principles; Methods of Resistance Measurement; Resistors in Radio Receivers and Amplifiers; Point-to-Point Resistance-Measurements in Typical Radio Set using Ohmmeter; Resistance Measurements using Modern Tester; Routine Testing where Circuit Diagram is Available and where Resistances are Known; Routine Testing where Circuit Diagram is Not Available and where Resistances are Unknown; the Relation of Voltage Testing Methods to Resistance Measurement. APPENDIX. Resistance Charts etc.

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Radio-Craft
FOR THE SERVICE MAN · DEALER · RADIOTRICIAN
"Takes the Resistance Out of Radio"

Editorial Offices: 96-98 Park Place, New York, N. Y. HUGO GERNSBACK, Editor Vol. V., No. 10, April, 1934

THE RADIO POWER WAR

An Editorial by HUGO GERNSBACK

WHEN RADIO broadcasting first got under way in 1921, practically all stations started with about 100 to 500 watts power, and for many years, this was standard. And this 500-watt maximum rating meant, of course, not 500 watts in the antenna, but merely the so-called "output" of the transmitter. Since the efficiency of broadcast stations was less at that time, the broadcast energy, therefore, was rather small—not much more than that of a good-sized electric incandescent lamp. Yet, with this little power, it was possible for us to rig up a one-tube regenerative set and listen to stations from all over the country. But soon all this started to change. Stations cropped up with 1,000 watts, and pretty soon we had especially "powerful" stations that used 5,000 watts. Then about 1928, we began to use so-called "super-power," of 50,000 watts or 50 kilowatts. Such stations as KDKA, WGY, WJZ, WEAF, etc., were the first to use a power which, in those days, was considered colossal.

Let us stop for a second, at this point, and see why there was a demand for such power. In the first place, as stations became larger, as broadcasting became "big business," it was necessary to give the stations vast "coverage," of numbers of steady listeners. The engineer's idea, backed by the business management, was that anyone within a radius of 500 miles who had any kind of a radio set, of one tube or upwards, should be able to listen to these large stations. No one was to be left out, and every owner of any radio set must be able to listen to the program within a certain radius. Expensive advertising programs were put on the air, so naturally advertisers demanded "coverage"; and the broadcasters were there to fill the demand.

By and by, when it appeared that radio was a profitable business, many broadcasters wanted to use powerful stations. However, most of the applications were denied by the Federal Radio Commission because it feared chaos would result, and those stations which obviously did not give adequate public service were denied applications for super-power.

It was then found that you could circumvent such an edict of the Federal Radio Commission by moving out of the country. This is, indeed, what happened when a certain Texas broadcaster took his station and moved it across the border into Mexico, where he set up a transmitter with an output of 150,000 watts (150 kilowatts), which is now readily heard in many parts of the United States; and this in defiance of the Federal Radio Commission, which has no jurisdiction over Mexico.

As radio broadcasting advanced, and as more powerful equipment came to be designed, the broadcasters took another look into the future and said to themselves, "Why stop at 50,000 watts; why not 500,000 watts?" So thought Powel Crosley, Jr., owner of Station WLW in Cincinnati, favorably located almost in the center of population of the U. S. He applied for a license for 500,000 watts, that is, 500 kilowatts, and got permission to erect the station and broadcast with this power. At the present time it is experimental only, broadcasting during the night hours. Soon, the station will be broadcasting during the daytime and, with the present power, it will be possible to lay down a signal that may be heard consistently over a radius of several thousand miles from Cincinnati.

In Europe, the situation is similar. The Soviet Government, which wishes to outshout and outdo all other broadcasters, now owns several stations which broadcast with a power of 100 kilowatts, and one of 500 kilowatts.

Little Luxembourg, with an area of about the same size as Rhode Island, helped itself to a choice wavelength and started a radio barrage across continental Europe with a "wattage" of 100,000—to the great discomfiture of the rest of the European nations, which are helpless to do anything because Luxembourg happens to be a sovereign state and is not much concerned with any radio laws promulgated at Berne.

From this, we see the trend of the times; and if anyone thinks that 500,000-watt power is as high as we can go, he does not reckon with either progress or with big business. That we will soon have 750,000 and even 3 million watts, no one today doubts. Rapidly, during the past ten years, the world has become radio-conscious. Boundaries and distances mean nothing. The world's population will listen to those stations which come in best, those which give the best programs, best music, and those which take the trouble to speak in the language of the people to whom the broadcast is addressed. Indeed, the Hitler government of Germany is making use of almost daily propaganda in English for North American consumption, and in Spanish for South American consumption.

Soon, our own broadcasters in America, as soon as their stations have stepped up to really great power, will find it necessary to send out programs in different languages, at different times of the day. At first, they will probably be in English, Spanish and Portuguese only; later on, our stations will cover Europe and Asia as well, and other languages must be added.

It is realized today that the use of radio broadcasting is not only for big business, but it is also political. During the past few years America has lagged in super-power, but soon we will be at the fore again, and it is to be hoped we will stay there in the battle of radio supremacy over the world. If our radio stations are directed properly, much good can be done—not only from the cultural angle, but in impressing other countries with American ideas and with American progress.

THE RADIO MONTH

Photo by Bachrach

DR. J. H. MORECROFT
Whose untimely demise is mourned by radio fans and engineers the world over.

DR. MORECROFT SUCCUMBS AT PASADENA

A SAD outcome of the "game of the year" between Columbia and Stamford Universities on the first of January has become known during the past month. Dr. John Harold Morecroft, much admired and followed professor of electrical engineering at Columbia University and an internationally known figure for his research work in radio communication succumbed on Friday, January 26, 1934. Dr. Morecroft contracted pneumonia while watching the football game on New Year's Day.

Dr. Morecroft was born in England and was graduated from Syracuse University in 1904 and in 1906 he returned to Syracuse as instructor. In 1907 he became instructor at Pratt Institute and in 1909 he joined the Columbia faculty. During the war Dr. Morecroft was employed by the Navy Department to perfect a sound detector as a defense against submarines. He is known the world over for his engineering books on radio communication and recently has spent much time on development work in connection with vacuum tubes.

Dr. Morecroft had a pessimistic attitude toward television and was quoted as saying that few steps had been made in the past fifteen years. He said that he could construct a set in his laboratory in a few hours that would give as good results as any now made, but that those results would not be worth the trouble and expense.

The demise of so famous and clever a man as Prof. J. H. Morecroft will be grieved by everyone acquainted with radio communication and electrical engineering.

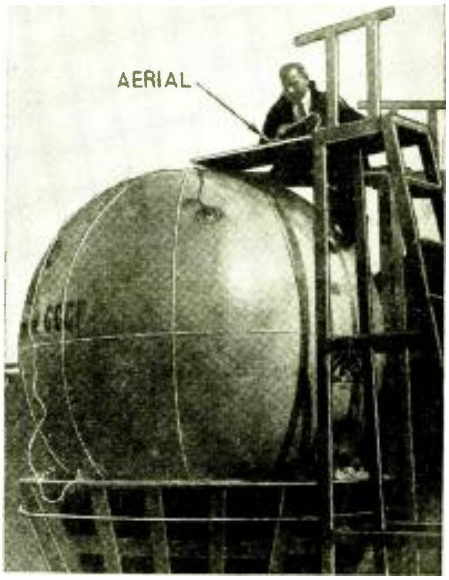


Photo by Soy Uzphoto

THE STRATOSPHERE FLIGHT THAT FAILED
This view shows an engineer installing the Soviet stratosphere balloon's aerial.

STRATOSPHERE FLIERS' DEATH NO FAULT OF RADIO EQUIPMENT

THE tragic death of the three Soviet airmen who flew higher than man has ever before achieved brought to an end a long heralded flight from Moscow recently.

The balloon was built with the greatest possible precision and was fully equipped with radio transmitting and receiving equipment. The radio installation worked perfectly throughout the flight, and even a few minutes before the crash; 150 miles from Moscow, listeners heard that "all was well."

The three men who lost their lives were Paul Fedeseemko, the commander of the balloon, who was a well-known civilian pilot; Ilya Oususkin of the Institute of Physical Science—the vice commander, and Andrey Vasenko, the constructor of the balloon.

Despite the unfortunate ending of this flight, the usefulness of radio for such uses is evident. Without radio, it would not have even been known how high the fliers went, or where they were before they crashed. Not that the latter could have possibly forestalled the unfortunate accident, but at least it helped locate them immediately afterward.

AMATEUR RESCUES FLIERS LOST IN CANADA

ONCE more we must take our hats off to amateur transmitters as a reliable rescue force. The many thrilling acts of amateurs in the past are known to everyone. The many floods, earthquakes and other calamities at which they have served are too numerous to mention.

The latest addition to the "honor" roll is Arthur Ozvath of White Plains, New York, who picked up a message which resulted in the location of four fliers forced down in Northern Canada, and from whom no word had been received for almost a month.

The message received was as follows: "We are down safely in Port Harrison. Send word to Canadian Airways." It was signed Dick Bibby.

Arthur, who operates amateur station W2CSM succeeded in making contact with the Canadian Airways and a plane was sent to the men. The four men were found safe and unhurt.

THANKS TO W2CSM
Four fliers who were forced down in northern Canada were found safe and unhurt.

IN REVIEW

Radio is now such a vast and diversified art it becomes necessary to make a general survey of important monthly developments. RADIO-CRAFT analyzes these developments and presents a review of those items which interest all.

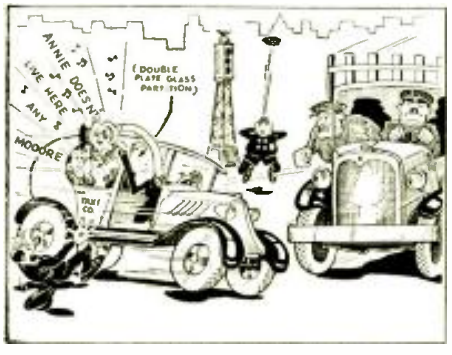
RADIO TAXIS BANNED—THEN PERMITTED

SINCE our first mention of the influx of radio-equipped taxicabs in New York City, a very interesting controversy has been going on. First, former Police Commissioner Bolan apparently regretted his decision to permit the use of radio receiving sets in cabs. After the first few thousand "radio" taxis had been placed on the streets, and a wide interest was shown by the public, as mentioned in RADIO-CRAFT, February 1934, page 455, friend Bolan retracted his ruling. The date of the ban was delayed, to give General O'Ryan, the newly appointed Police Commissioner, a chance to pass on the matter.

Commissioner O'Ryan said: "I believe the Commissioner's duty under the law is limited to the effect of the use of radios upon the safety of operation of the vehicles in which they are installed and particularly whether the inclusion of a radio set as part of the equipment of a licensed taxi renders such a vehicle unfit or unsuited for public patronage."

It is interesting to note that news has also been received that taxi companies are now experimenting with a switch arrangement in conjunction with the rear seat cushion. When the passenger sits down, he automatically closes the switch, disconnection being made when he rises again.

With reference to Commissioner O'Ryan's decision, we wonder if the taxi drivers' attention will be concentrated on driving when an interesting or amusing program is being received by the passenger!



NEW YORK'S RADIO TAXIS
Will the drivers give their attention to driving under the conditions shown in this sketch?

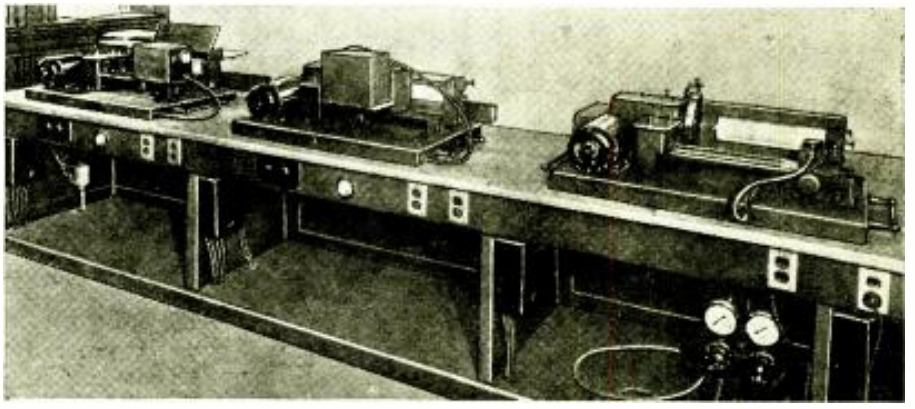


Photo by RCA.

ULTRA-SHORT-WAVE FACSIMILE TRANSMISSION
While the units shown are used in transatlantic communication, similar units will be used for ultra-short-wave facsimile transmission between New York and Philadelphia.

ULTRA-SHORT-WAVE PHOTOGRAM SERVICE

RADIO Corporation of America has just announced that they are preparing to supply a service of radio picture transmission on ultra-short waves between the large cities of the United States, by a method similar to the transatlantic facsimile transmission pointed out by Hugo Gernsback—"Radio Set Delivers Newspaper"—in this issue.

In fact, they are actually in the process of constructing the first of a chain of such transmitters which will provide service between New York and Philadelphia.

While facsimile transmission is not entirely new, being in commercial use for transatlantic service at this time, this is the first indication of the use of ultra-short waves and shows to what extent these wavelengths will be in demand in the near future, for short-distance communication of all types.

The system under construction will utilize two automatic relay stations at New Brunswick and Trenton, New Jersey. These relay stations will boost the strength of signals so that constant service can be guaranteed.

In commenting about the new system, David Sarnoff, President of RCA said: "Over this new circuit, when completed, it is confidently expected that photograms will be transmitted at higher speed and at lower tariffs than is possible with the dot and dash system of the morse code. Tariffs on this circuit will not be based upon so much per word but upon so much per square inch, or perhaps so much per standard size letterhead."

THE HYPNOTONE — A NEW RADIO INVENTION

ARE you troubled by lack of sleep at night? Does the baby keep you awake? Well, *then* here's news that will interest you!

It is a new device developed by Hugo Gernsback and fully described in the April, 1934, issue of EVERYDAY SCIENCE AND MECHANICS, which induces sleep even when other methods fail.

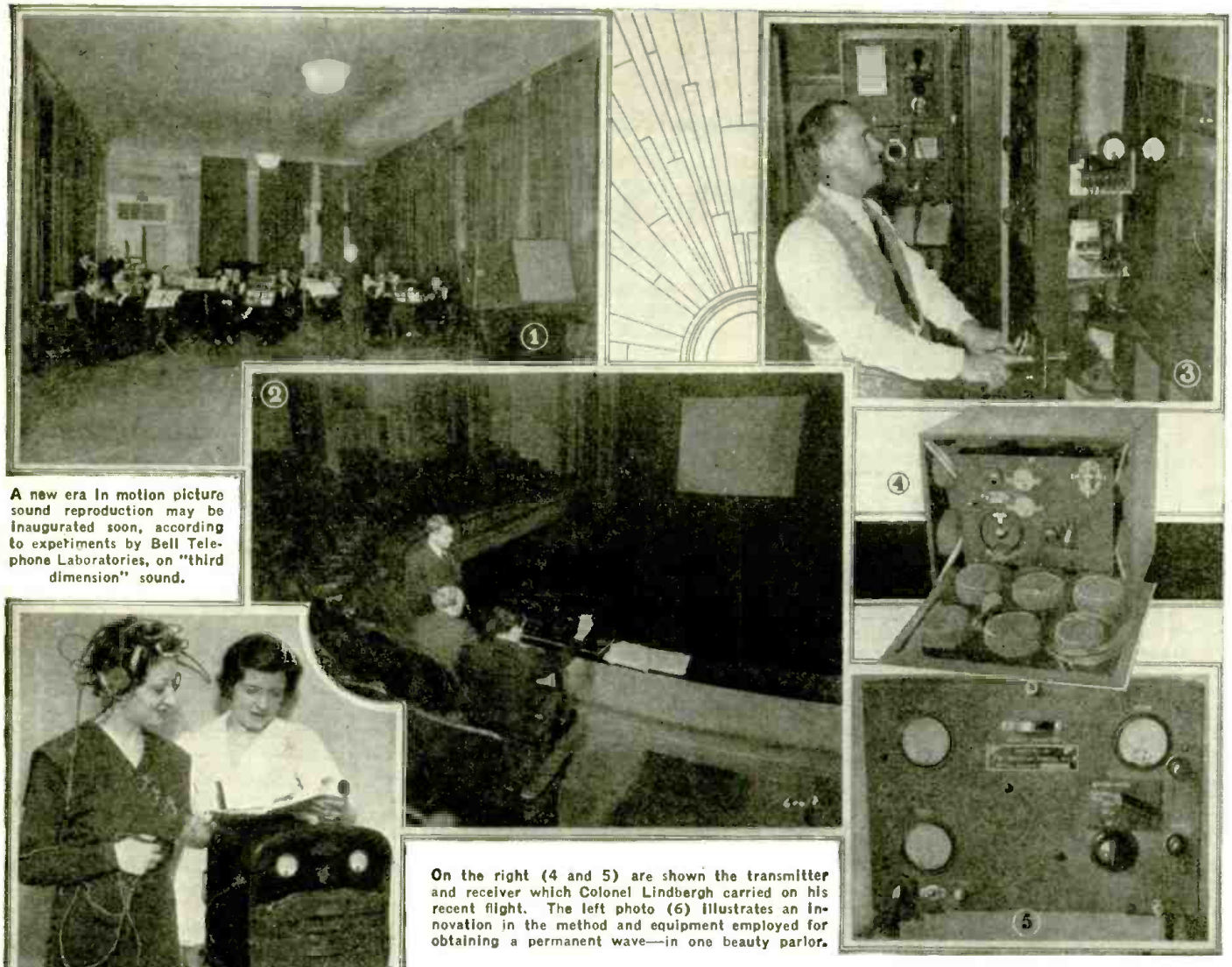
Insomniacs may eventually disappear—their malady entirely cured.

How does it work? Well, that's easily

(*Continued on page* 619)

THE HYPNOTONE
Does the baby keep you awake at night? Here is just the device that you need, then.

RADIO PICTORIAL



A new era in motion picture sound reproduction may be inaugurated soon, according to experiments by Bell Telephone Laboratories, on "third dimension" sound.

On the right (4 and 5) are shown the transmitter and receiver which Colonel Lindbergh carried on his recent flight. The left photo (6) illustrates an innovation in the method and equipment employed for obtaining a permanent wave—in one beauty parlor.

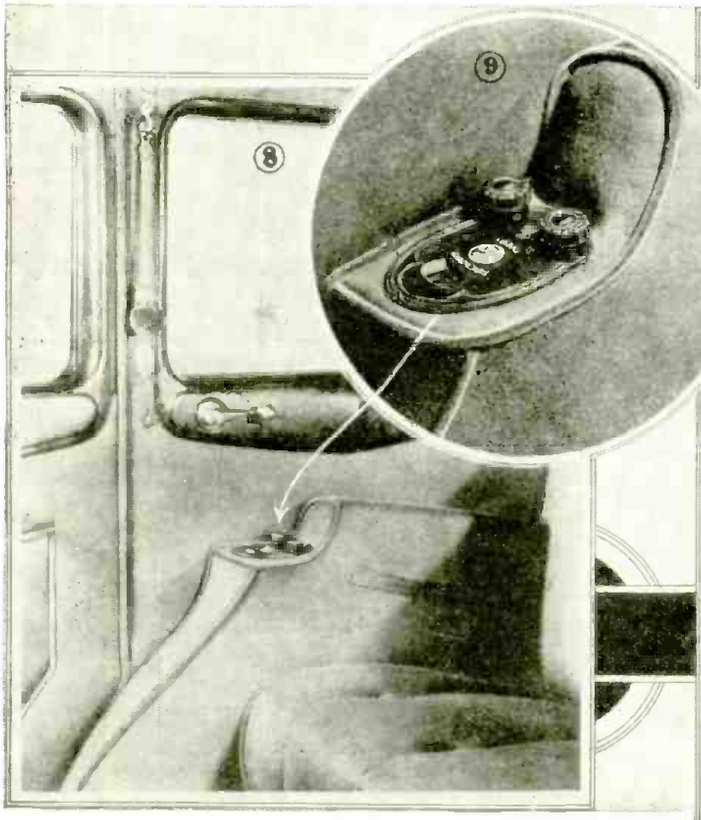
AN inkling of the music of the near future, and incidentally, the introduction of "realism" in the sound reproduction of motion pictures, was given in a demonstration at the Engineering Societies' Building, New York City, by the Bell Telephone Laboratories. A small orchestra of thirty pieces (shown at 1) was amplified to sound like 5,000 musicians, and an ordinary buzzer was made to sound like a thousand boiler factories. Airplanes flew from the stage and over the heads of the audience—that is, the sound effects were so realistic that the impression of the audience was that the planes were flying above them. A revolver shot could be heard whistling across the stage, and then to climax the amazement of the audience, the shot was made to reverse itself and return to the place it started from. In the second photo are shown the controls for obtaining these weird effects, in addition to the signalling booth, amplifier room, etc., etc., so as to maintain the proper coordination necessary for these effects. Separate microphones, as shown in the first illustration, connect to individual amplifiers, and, in turn, connect to their respective loudspeakers on the stage.

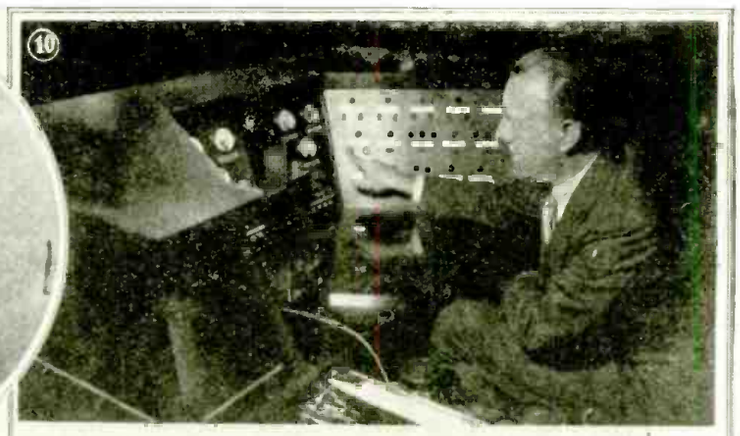
A new ultra-short-wave radio for controlling airway beacons is shown in the third photograph. The remote control transmitter shown operates on a wavelength of about five meters, and in operation the radioman simply dials a series of pre-determined characters, like making a telephone call, and the short-wave impulses operate the radio beacon without the guidance of a human hand.

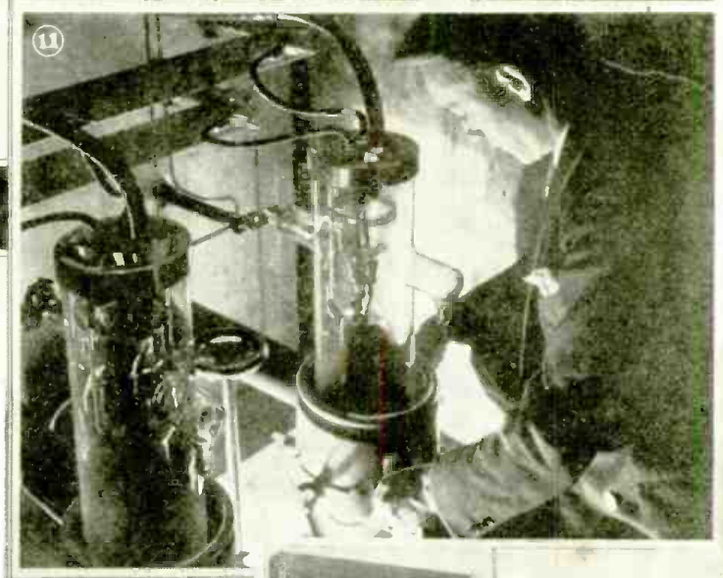
When Colonel and Mrs. Lindbergh made their recent 30,000 mile flight around the Atlantic, the radio flashes sent by Mrs. Lindbergh, who performed the services of radio operator, aroused considerable newspaper comment concerning her proficiency in this direction. The transmitter and receiver employed, and pictured in 4 and 5, were built in a water-tight case to survive a crash, submersion, arctic cold or equatorial heat.

It may soon be possible to obtain a "permanent" via radio—(this to the ladies) and the mechanism which suggests this possibility is shown in the sixth illustration. Because of this arrangement it may be soon found that the housewife can go about her tasks, get her permanent, and listen to her favorite program, all at the same time.

(Continued on page 632)





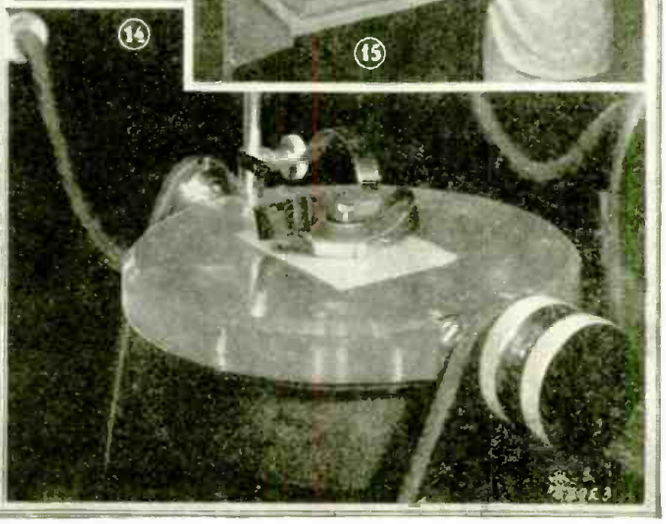


HERE'S the radio control that tunes the set in the auto of the President of the United States. And, if we may be permitted to say so, it sure is a neat and convenient installation. Judging from the photagraphs (numbers 8 and 9), if the same amount of attention was given to other installation details, the reception should be very satisfactory to the President.

And here we have the new giant 500-KW going on the air for the first time (10), the gentleman pressing the button, in this illustration, being none other than Mr. Powel Crosley, Jr., the owner of the station. At 11 we see just a few of the 20 giant water cooled tubes used in this new 500,000 W. station.

Did you ever have trouble in making yourself heard over the telephone? Well, the Bell Telephone Labaratories which performs all sorts of telephone research has perfected an "artificial mouth" (12 and 13) to conduct tests to indicate the causes of such trouble.

The ticking of small watches are often very hard to detect. And because, many times, the watchmaker can only tell by this sound if the watch is operating correctly or not, a correct analysis of watch ailments is sometimes impossible. Only recently, the Bell Telephone Laboratories have developed a method whereby such feeble impulses may be amplified and thus facilitate repair. Photographs 14 and 15 show the mechanism and amplifier employed. The metal case of the watch is made to act as one plate of a condenser. The plates of this condenser are charged by a battery placed across them and through a high resistance. Also, the two plates are connected to the input terminals of an amplifier, and thus the resulting fluctuations are magnified by the amplifier which is of high-gain type.



THE LATEST RADIO EQUIPMENT

"Best-selling" bypass condensers. (No. 422)

"REPLACEMENT" CONDENSER KIT

IN line with the present "replacement" idea, which is to furnish components of identical characteristics but independent manufacture, and the "kit" idea, of supplying units of assorted values, there has been marketed the kit of replacement condensers illustrated above. These 50 condensers, of "midget" type, are "outside foil grounded." Capacity values are from 250 mmf. to .5-mf. (600 to 400 V., working).

NEW "FLOOR"-TYPE MICROPHONE

A NEW design in microphones is illustrated in the figure below. This "piezoelectric" microphone is designed to set directly on the floor (as, for instance, in a theatre stage); excellent for producing "binaural" effects (by using several of these units).

The output is to be fed into a standard 2 stage pre-amplifier. The floor acts as a baffle, enhancing the low-frequency response; wide-range pickup is obtained.

This microphone establishes a new standard for units of this type, first described in the July, 1932, issue of RADIO-CRAFT, in, "The Rochelle-Salt Crystal Reproducer."

All-wave service oscillator. (No. 424)

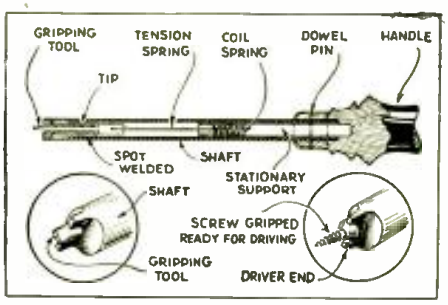
"ALL-WAVE" SERVICE OSCILLATOR

IN the figures above and below are illustrated a service oscillator that was designed to meet the need for an instrument to cover a frequency range of 150 to 25,000 kc. (2,000 to 12 meters, approx., respectively).

The device requires two type 30 tubes, a 4.5 V. "A" battery, and a 22.5 V. "B" unit. These are contained inside the aluminum shield case, which measures 9¾ x 4⅛ x 8½ ins. high; the weight, with batteries, is 3½ lbs. The light weight is a welcome feature.

A 7 point switch controls the frequency ranges, which are as follows: 150-330 kc.; 330-720; 720-1,460; 1,460-3,505; 3,505-7,400; 7,400-14,300; 14,300-25,000. The vernier tuning ratio may be varied from 6-to-1 to 20-to-1 by adjustment of the position of the small arm above the tuning knob; the position for maximum vernier action is very useful where tuning is critical.

One tube is the R.F. oscillator; the other, its 400 cycle modulator.



A Service Man's screwdriver. (No. 425)

A RADIO SCREWDRIVER

FOR a long time radio men have needed a few special tools. It is of interest, therefore, to note that one manufacturer is now offering a chrome vanadium steel screwdriver, illustrated above, that fulfills some of the demands of Service Men. The unit is made of high-grade materials, and should give good service.

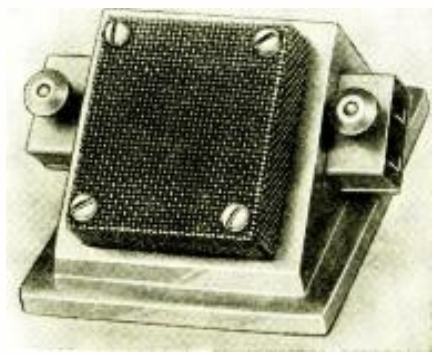
This tool is available in lengths of 3 to 10 ins. Its feature is a central, rotating section of the blade: this section presses firmly against the screw slot and holds the screw until its thread has a chance to catch hold.

A NEW CAR RADIO SET

A 6 tube set of modern design is illustrated below. It incorporates two type 78 tubes, a 75, a 6A7, a 41 output tube and, in the "B" unit, a type 84 rectifier.

This set is entirely self-contained. Note that the new "airplane"-type dial is used in the remote control unit. The field coil of the dynamic reproducer obtains field current from the storage battery of the car.

(*Continued on page* 619)



"Don't tread on me," says "mike," for, this "low down" microphone mounts on the floor. (No. 423)

Above, rear view of all-wave oscillator. Right, a 1934 car radio set. The left-hand control knob is entirely removable. (No. 426)

Name of manufacturer of any device will be sent on receipt of a self-addressed, stamped envelope. Kindly give number in description under picture.

Shielded fuse retainer. (No. 427)

AUTO-RADIO FUSE RETAINER

ALTHOUGH the device illustrated above was designed especially for use as a fuse retainer, it also may be used as a connector unit—especially, for connecting the flexible lead from the antenna connection of the car radio set, to the antenna lead-in. Previous types of "retainers" were unshielded.

Used as a fuse retainer, it takes the standard type 3-AG automotive fuse. The retainer hangs directly in the "hot" side of the "A" line, leading to the car radio set. The retainer takes auto cable up to 5/32-in. in dia.; the shielding, where necessary, can be attached to the retainer. Fuse renewals are made by turning a small bayonet lock.

When used as an antenna connection, the fuse is omitted, and the contact buttons are placed directly together instead of at the fuse ends. Contact is maintained by a strong spring.

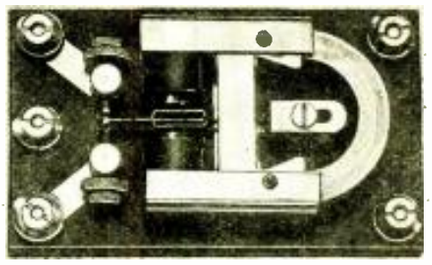
Tube-Gripping Shield. (No. 428)

SNUG-FITTING TUBE SHIELDS

SERVICE MEN should find the tube shield illustrated above a profitable item to carry as a "side" line. This tube shield design differs from previous types in that it has a series of vertical depressions that, on the inside of the shield, form ridges which grip the tube tightly. This design serves two purposes.

First, it prevents the glass bulb from vibrating, and thus reduces the tendency to cause microphonic noises. Secondly, it prevents injury to the tube, and prevents it from loosening in the socket.

These shields are available in sizes to fit standard tube types.



High-Resistance Relay. (No. 429)

6,000 OHM POLARIZED RELAY

ABOVE is illustrated a new relay designed to break 2 A. at 110 V., A.C., or 0.25-A. at 115 V., D.C., non-inductive load. An auxiliary relay will not be required in most cases.

These relays can be furnished with total coil resistance up to 6,000 ohms (approx.), and satisfactory operation can be secured with power consumption as low as .01-W., D.C.

The parts are mounted on an insulating base which measures 5 x 3 x ½-in. thick; the overall depth is 2½ ins., including the base.

This relay is designed for operation where the D.C. in the operating coils must be kept as low as possible, and where reversal of the current in them brings about a reversal in the contact arrangement, but where no contact is made when the coils are de-energized.

DON'T "FIGHT," BUT SHAKE HANDS WITH

YOUR SERVICE OSCILLATOR

KENDALL CLOUGH*

THERE exists among Service Men widespread ignorance of the capabilities of the common, or "garden" variety of service oscillator—and even more regarding the newer, and vastly more efficient models that have made their appearance within the last year.

An outstanding example of the newest in service oscillators is illustrated in actual operation, in Fig. A. Strange it may be, but nevertheless true that the average Service Man would seldom attempt to use this instrument in the manner shown in the view, that is, to check the A.V.C. action in a receiver under suspicion. Perhaps if we point out the case and speed with which many tests in radio receiver circuits may be made, the technician will be less inclined to "fight" his best tool—and will, instead, endeavor to master its many functions.

Included among the accomplishments of the latest design in service oscillators are the following:

(1) Aligning R.F. circuits;
(2) Aligning I.F. circuits for either "flat top" or "peak" resonance;
(3) Aligning oscillator circuits;
(4) Trimming oscillator padding condensers;
(5) Checking tube efficiency;
(6) Determining overall receiver gain;
(7) Testing A.V.C. circuit operation;
(8) Making stage analyses;
(9) Checking overall receiver selectivity;
(10) Neutralizing receivers incorporating any type of neutralization circuit;

(*Continued on page* 632)

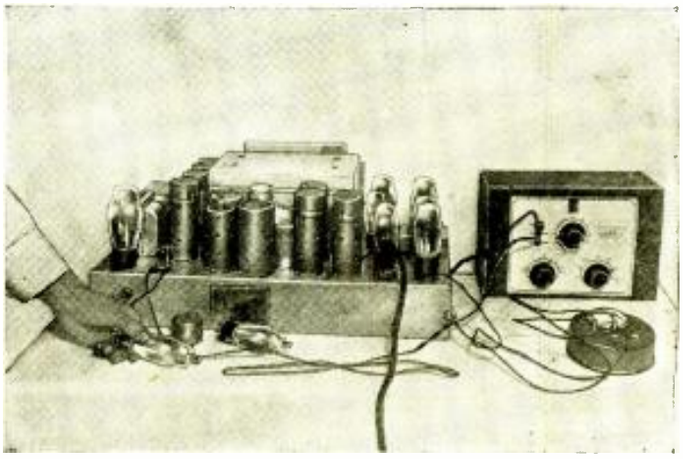


Fig. A
Meet Mr. Service Oscillator, "on the job."

* Chief Engineer, The Clough-Brengle Co.

INTERNATIONAL RADIO REVIEW

AUTO RECEIVER FROM ENGLAND

IN RECENT issues of the various English radio magazines, much interest has been displayed concerning the automobile receivers which have made their appearance. While these sets follow the general appearance and construction of American sets, there are certain fundamental differences imposed by the broadcasting conditions in Europe.

The set shown in Fig A, is a typical set which was described recently in WIRELESS WORLD. The first thing of interest about this set that is noticeably different from American sets is that it consists of two units—the receiver and the speaker. Thus, it resembles the sets shown in this country a year or more ago. Also, an examination of the description in WIRELESS WORLD reveals the fact that the set is completely battery operated, the filament supply being taken from the car battery, while the "B" supply is taken from "B" batteries which are housed in a third box mounted under the floor of the car. In these respects, the set is behind the present designs of auto sets manufactured in the U. S.

However, in other respects it is quite modern. It has a T.R.F. circuit, using variable mu tubes, diode detection, A.V.C. and class B A.F. amplification. As we have pointed out several times, the latter A.F. method is exceptionally popular in England, at this time.

The set covers not only the regular broadcast band, but also the long-wave bands used by European broadcasters. The shifting from one band to the other is accomplished in the remote control unit, by the use of a relay actuated by the on-off switch. Two tuning scales appear at the dial window, illuminated in different colors for the two bands. Iron core R.F. tuning coils are used in the set (these coils have been discussed in this department in recent issues).

HERE is what the radio experimenter has been wanting for a long time—a semi-technical review of the thousands of new ideas which are continually appearing in overseas publications. Each month there are received at the offices of RADIO-CRAFT hundreds of daily, weekly and monthly magazines originating from every point on the face of the globe.

SINCE the cost of subscribing to each of these would be prohibitive for most radio men, we have arranged with technical translators to prepare for our readers reviews of all the really important, new developments illustrated and described each month in these international radio periodicals.

NOTE that the only available information is that which is published; the experimenter must adapt the ideas to whatever equipment he has on hand.

GLOW-TUBE VOLTAGE DIVIDER

IN THE ordinary type of "B" power unit found in A.C. sets, the voltage supplied to the various tube elements varies according to the current taken by the amplifier tubes. As the load increases the voltages on the plates and screen-grids drop off. This effect occurs, even when a transformer with good regulation is used, because of the increased potential drop through the rectifier and filter.

To obviate this difficulty, the system shown in Fig. 1 has been developed. This unit was described in THE BROADCASTER AND WIRELESS RETAILER.

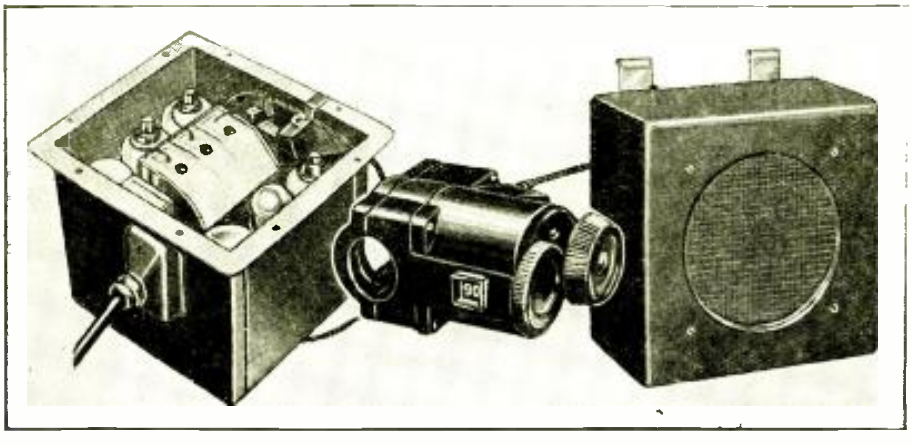
It consists of a gas-filled tube having constant voltage characteristics—that is to say, instead of following Ohm's law it can take an increase in current without producing any change in the applied voltage. This is caused by the varying resistance characteristic of the glow-tube used. This tube is a development of the Marconi Company.

SHORT-WAVE IRON CORE COIL

IN RECENT issues of RADIO-CRAFT, we have pointed out that radio experimenters in Europe are becoming interested in R.F. tuning coils having various types of iron cores. It is claimed that the iron core increases the effective "Q" of the coil (the "Q" of a coil is the term applied by engineers to denote the efficiency; it is the ratio of the reactance to R.F. resistance of the coil.—*Assoc. Editor*) and at the same time limits the external field, so that interstage coupling is not a serious consideration even with high-gain tubes.

Up to this time, however, these coils have been limited to the broadcast band and the long waves used in Europe for broadcasting purposes. The coil shown in Fig. B is made in several different types, one of which covers the wave band from 13.8 to 78 meters (in two sections). This is an innovation, as it permits experimentation with these new coils on the higher frequencies which should produce fine results if the claims for these coils are correct. The knob of the coil shown is a switch to permit changing from one band to the other.

We are awaiting with interest the results of several rumors to the effect that American coil manufacturers are working on variations of the iron core R.F. and I.F. coupling coils. Experimenters will, no doubt, be anxious to try these new coils which are making such a hit abroad.



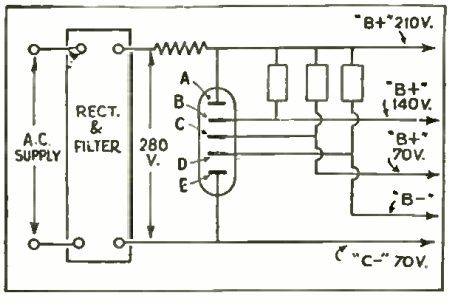


Fig. A, left
The appearance of the English auto set.

Fig. 1, above
A glow-tube voltage divider or bleeder.

VOLUME CONTROL FOR BATTERY SETS

THE rejuvenation of interest in battery sets using the 2V. series of tubes with constant-potential primary batteries, opens up another field of experimentation for the radio set constructor and Service Man.

In a recent issue of WIRELESS WORLD, a novel system of obtaining volume control in battery sets using variable mu tubes was shown. The circuit is shown in Fig. 2. As you can see, it consists of a combination of "C" bias control and aerial-shunt volume control. This system has been used to advantage in A.C. sets in which the bias is obtained from a cathode resistor. However, this method is not very satisfactory for battery operation and it is usual practice to employ separate "C" batteries.

In order that the sensitivity may not be affected noticeably at the maximum position of the volume control, an R.F. choke must be inserted as shown, and also the grid decoupling resistor R1 must be of high value—about 50,000 ohms, in place of the more usual 5,000 ohms. Also, to prevent short-circuiting the "C" battery in the minimum position of the volume control, a fixed condenser C1, must be inserted in the aerial lead, .001-mf. will be satisfactory.

ADJUSTABLE SPEAKER IMPEDANCE

THE difficulty of matching a speaker to the various output tube impedances has been met very satisfactorily in Europe by the speaker shown in Fig. C. This speaker is a permanent magnet dynamic unit in which the output transformer is equipped with a tapping scheme, thus permitting taps to be taken at the correct points to match the various tubes in use. The manufacturer shows how 17 different output impedance arrangements can be obtained with the double switch, and in addition four ratios are available for push-pull circuits.

A slightly different speaker to the one shown is advertised especially for extension or remote speaker use. This speaker is equipped with a separate volume control and an on-off switch so that it may be completely controlled from the remote point.

While there may be some loss in the unused portions of the matching transformer, this system is particularly useful for the experimenter and the loss should not be sufficient to be noticeable in the quality or volume of output.

A NOVEL TUNING METER

THE FRENCH radio magazine, RADIO REVUE, recently contained details of the construction of an unusual type of tuning meter that the home set builder can make. As shown in Fig. 3, it consists of a milliammeter connected in the cathode circuit of one of the R.F. tubes of the set. The indicating needle is equipped with a light shutter and a small pilot light is focused onto the flat plane of the shutter. When the set is turned on, the indicating needle of the meter moves to the maximum position showing maximum plate current flowing. Then as a signal is tuned in, the plate current falls off somewhat and the shutter blocks out less of the light of the pilot lamp.

A ground glass or translucent celluloid screen on the panel of the set, placed in the plane of the lamp and shutter will indicate to the operator the point of exact resonance by the width of the dark shadow on the screen.

The screen can be mounted over the dial of the receiver so that the tuning meter is in a convenient position. By adjusting the sensitivity of the meter by the use of shunts, the indicating needle can be made to move over the desired arc.

AUTOMATIC RECORD PLAYER

RADIO and phonograph enthusiasts in England can now enjoy phonograph music without the nuisance of setting the record, turning on the motor and dropping the pickup in the correct groove of the record. By the use of the device shown in Fig. D, playing a record becomes as simple as dropping a letter in the mail box.

Records of any size are inserted in the "letterbox" slot. This switches on the current and sets the pickup. When finished playing, the current is switched off and the record automatically returned. These units are available for various voltages and frequencies of A.C. The unit consumes about 20 W. of power.

RECORDING SOUND HEAD

THE unit pictured in Fig. E is a device available to the home-recording enthusiast in Austria. It appeared in RADIO-AMATEUR magazine.

It is a device for simplifying the task of cutting records at home. As you can see it consists of a cutting head, mounted on a horizontal frame, the end of which is connected by a flexible coupling to the central pin of the record turntable. By the use of this device, the motion of the cutting head across the record blank is caused by the motion of the flexible drive which is actuated by the actual movement of the turntable. This eliminates the need for synchronizing the speed of the record with the mechanism moving the cutting head.

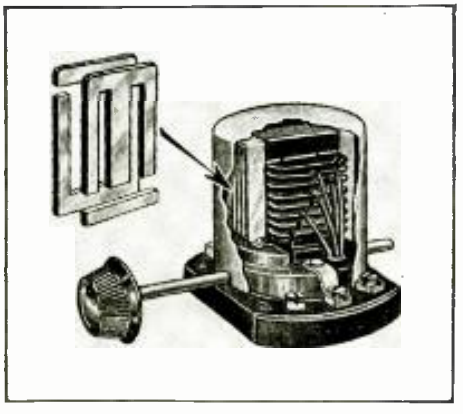


Fig. B
The iron core coil for short waves.

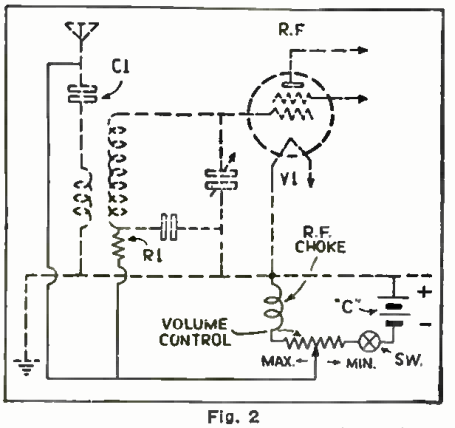


Fig. 2
A volume control method for battery sets.

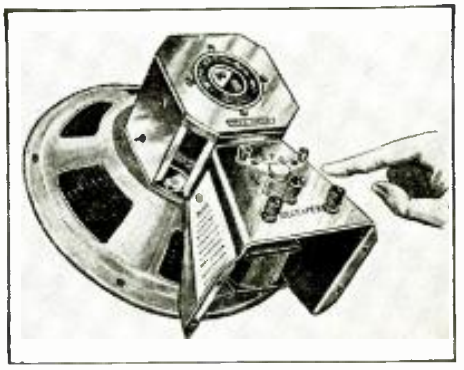


Fig. C
This speaker can be matched to tube impedance.

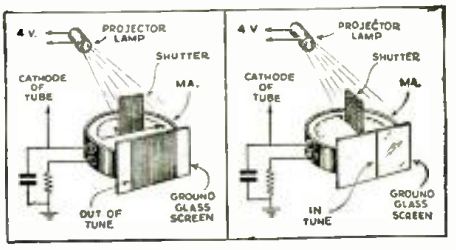


Fig. 3
A tuning meter kink for the experimenter.

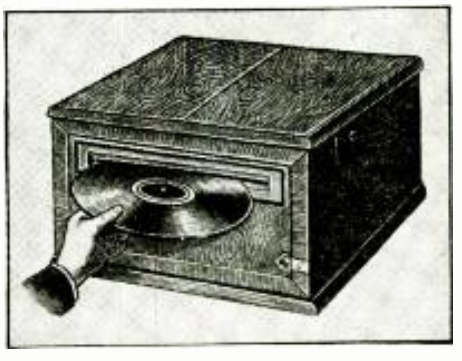
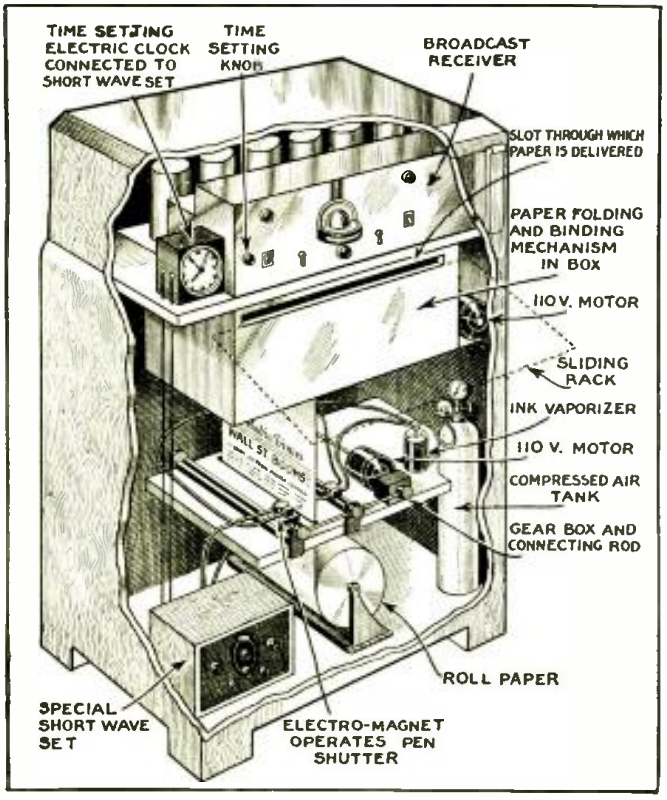


Fig. D
A completely automatic phono. record player.

Fig. E
An Austrian cutting head for home recording.



RADIO SET

There can be no question that the future of radio holds forth the best and most promising inventions — and, amongst those that will probably be seen in the not too far off future—will be a complete newspaper received and printed by the radio receiver, with illustrations, text, and probably advertising. It is even possible to construct such a set now, since equipment in present use for facsimile picture transmission may be readily adapted for a "radio newspaper" unit. These methods and associated equipment and their adaptation are described in this article.

AS I have frequently observed—the *great* radio inventions are still to come. So far, the proverbial surface has not been scratched. As the radio technique advances, and we obtain better instrumentalities, it becomes possible to do a lot of things which have not even been dreamt of before.

The radio set of the future has been envisioned many times, but not even the most audacious thinkers, who have projected themselves into the future, have imagined the final radio set—if indeed there is to be such a thing as a *final* radio set in the dim and distant future.

There has been, ever since the advent of radio, a feud between radio broadcasters and the newspapers. Originally, newspapers gave radio a tremendous amount of publicity; but, of late, the newspapers have felt that radio has become their greatest competitor. Consequently, they have cut down a good deal on the space allotted to programs until in many cities, particularly in the Middle West, no *free* programs are printed at all in the newspapers. These newspapers argue that this is free publicity and, if you wish to have your program printed, the station must pay for it. Indeed, in some of the Middle Western and Southwestern states, this system is now in vogue and the radio stations are indeed paying for their programs.

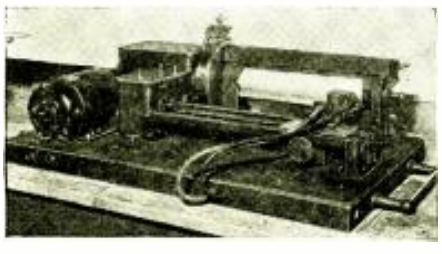
Recently, a new step was undertaken by the Columbia Broadcasting network to checkmate the newspapers; and Columbia now has its own newsgathering service which extends nationwide and abroad. Every night, a news service is put on the air; the information is, frankly, only "spot" or early, incomplete news; and the network is careful always to have a "by-line" which is as follows: "See tomorrow's paper for complete news." It is believed that in the future the rift between newspapers and radio broadcasters will widen.

The idea of using your radio set in your own home, to print a complete tabloid newspaper and deliver it to you, is not original with me. The idea has been mentioned by many well-known radio engineers ever since 1925, and perhaps even before that. There is, therefore, nothing novel in the idea itself; but the project so far, has not been translated into actuality. From the technical standpoint, it is perfectly possible to build, today, a radio set, for use in your own home, which will deliver to you, early in the morning, a small newspaper, and do this regularly, every day in the week. So far, the only drawback has been, in my estimation, the price. Such a set is expensive to build, and somewhat complicated and costly. If, however, the country wants a *Radio-Newspaper Receiving Set*, the radio industry is, no doubt, in a position to furnish such a set on short order. Indeed, I will be considerably surprised if such sets are not on the market within the next five years.

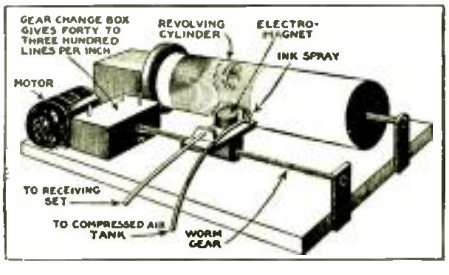
While none of these sets have, as yet, been built, I have outlined in these pages the technical details of bringing it about; and, though the system which I show here may not be the only practical one, I have selected it because a similar method is now in use by the Radio Corporation of America in their picture-transmitting devices which are in operation twenty-four hours a day throughout the week.

Let us now see what the future radio newspaper set will look like:

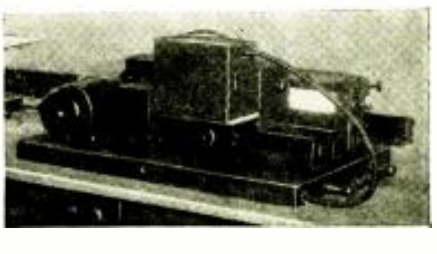
As our cover illustration shows, it seems very much like any other radio set, but with certain attachments. These are, chiefly, a panel which pulls out, and



A recorder employed by RCA Communications for picture facsimile reception.



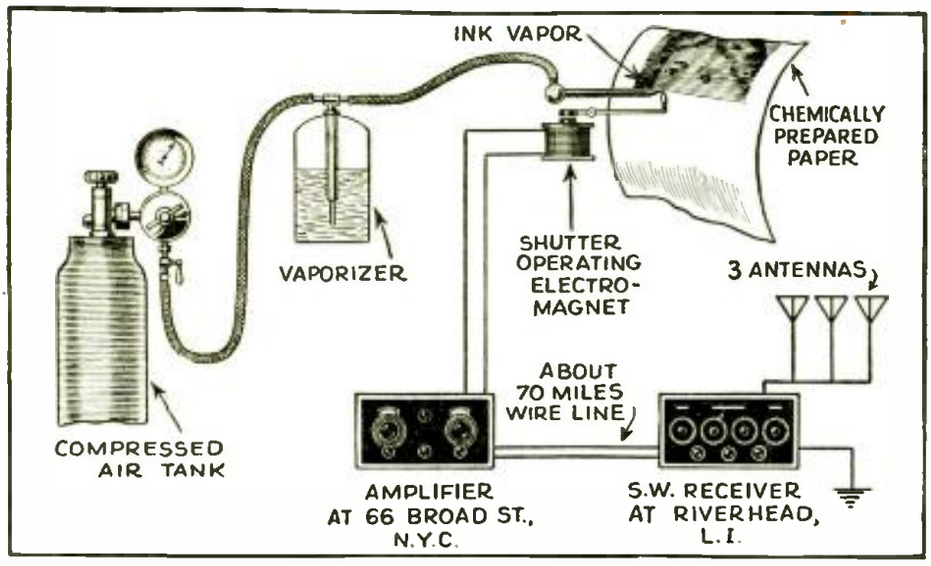
The same unit as shown on the left, but in schematic form with explanations of operation.



A scanning unit used in the transmission of photographs, by RCA.

PRINTS NEWSPAPER

HUGO GERNSBACK



An ink-pen arrangement that was employed some time ago, but discarded in favor of improved methods.

upon which, in the rack provided, you will find a newspaper ready and printed in the morning. Remember, too, this will not be a bulky 64-page newspaper! it will be, probably, a 4- or 8-page tabloid, giving you condensed news and pictures of the important events, similar to that shown in the cover illustration.

The cabinet contains the usual broadcast and short-wave set, as we have them today. In addition to this, there is a *separate* special short-wave set, to take care of the reception of the news, and which will be described later. The set also contains a clock which is set for, let us say, 2 A.M. At this time, the clock disconnects the broadcast set from its aerial and ground and in its stead, switches on the special short-wave set; and, at the same moment, the electric motor (which has to do most of the work in printing the newspaper) is also placed into the circuit. A few seconds later the radio signal impulses begin to come over the special short-wave set, and the newspaper is now being "printed."

In the particular method which is shown here, for the first time, there is no "printing" being done as we know "letterpress" printing today; it is all done by a special method, *both sides of the paper being acted upon at the same time*. I will explain details further on.

The electric motor, which feeds the newspaper roll, advances the roll little by little until, in an hour or less, the entire newspaper is printed. When it is finished, the paper is folded by an automatic folding attachment, and the newspaper, still moist, drops into the holder out of the set. No matter how early you rise in the morning, you will find your newspaper ready and waiting for you. The expense of the newspaper, it may be stated, is very slight. The paper, chemicals and the electricity consumed in manufacturing the newspaper only amount to a few cents—much less than it costs to produce a standard newspaper today.

The question arises immediately, why should the broadcasters set in motion all their transmitting machinery, as well as their news-gathering agency, the collecting of "spot" photographs of current events, etc.? The answer is that it will pay them to do so. They will probably accept a limited amount of advertisements and, if they obtain a sufficient amount of these, the enterprise can be made to pay for itself. Remember that,

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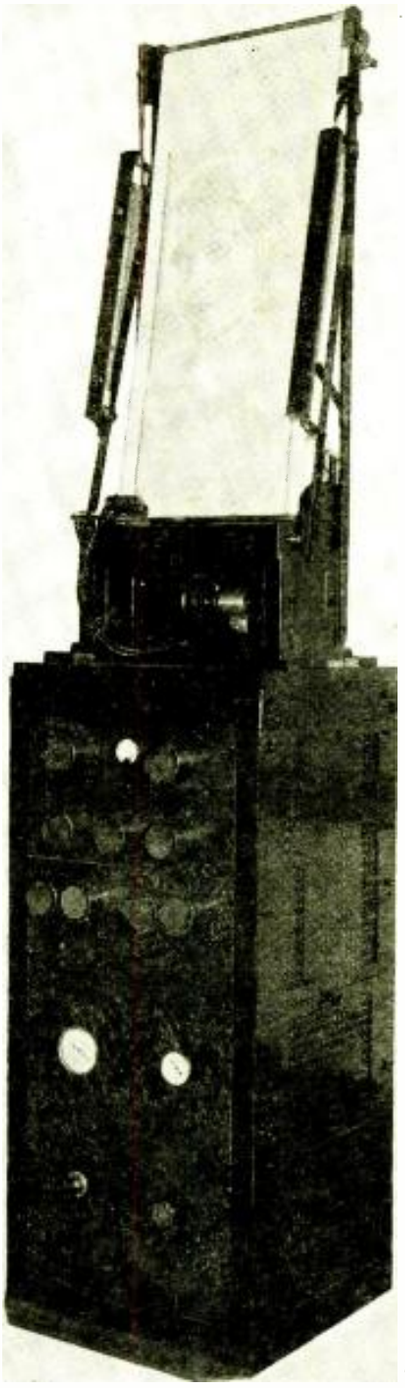
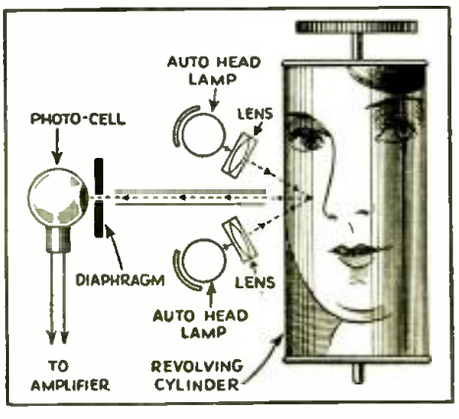
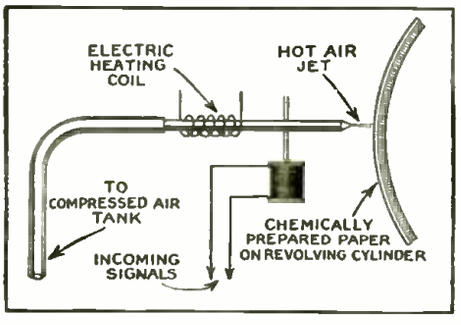


A complete RCA facsimile receiver used at the Chicago World's Fair in 1933.



A photo is mounted on a rotating cylinder and scanned, impulses amplified and transmitted.



An obsolete method of recording, a solenoid controlled shutter modulates a hot air stream.

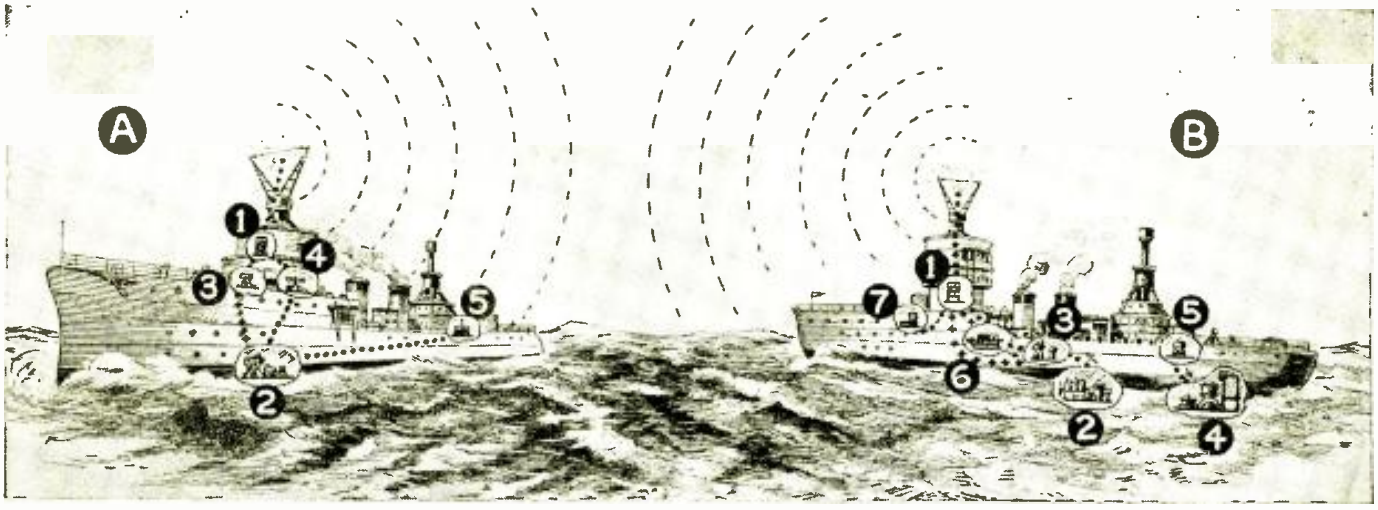


Fig. 1
In the control ship shown at A are (1) the transmitter, (2) main gyro-compass, (3) auxiliary gyro-compass, (4) gun control, (5) receiving apparatus. In the crewless ship are (1) receiver, (2) generator, (3) steering control-indicator with gyro-compass, (4) steering gear with mechanically operated rudder, (5) auxiliary gyroscope for the guns, (6) mechanism for gun control, (7) control transmitter.

RADIO CONTROLS BATTLESHIPS

LATEST METHODS PERFECTED BY THE BRITISH NAVY FOR STEERING SHIPS, FIRING GUNS, DISCHARGING TORPEDOES, FROM A DISTANCE BY "WIRELESS."

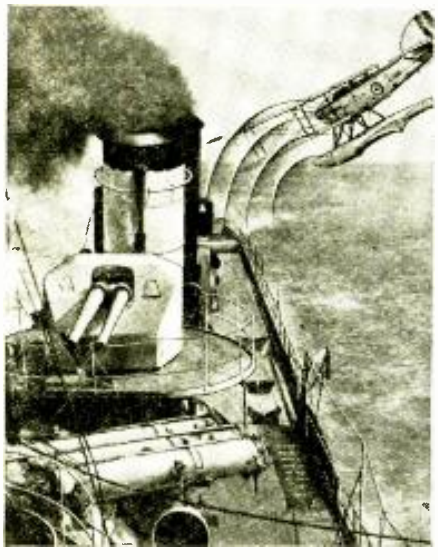


Fig. 2
A seaplane directing the firing of guns aboard the radio-controlled ship.

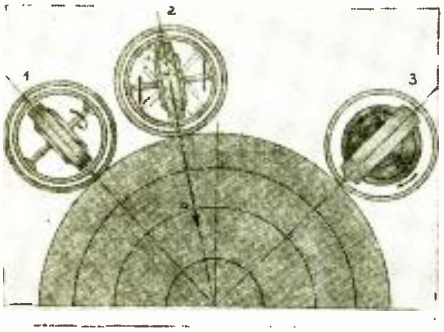


Fig. 3
Gyroscope action in radio-controlled ship. See text for explanation.

BEFORE the ink on the peace treaty was dry the European nations began preparing for another conflict. These war preparations are no longer a secret. The question now remains, who is better prepared?

The continental nations, like France, Italy, Germany, Russia, etc., are concentrating in fortifying their land and air forces. However, the problem with Great Britain is different. British existance, since Napoleonic wars depends on her great navy. British naval supremacy must be kept up for reasons that are well known to everyone. In order to perpetuate this supremacy she must adopt new means for protecting it.

British naval experts, since 1925, have been experimenting continuously to perfect the idea of steering air- land- and seacrafts from a distance by means of radio transmitted control waves, which was originated before the World's War. Their dream has been realized. Now, it is not only possible to steer her mighty ships without having a single man aboard, but also what is still more im-

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Fig. 4
Receiving apparatus shown on right, steering gyroscope in center.

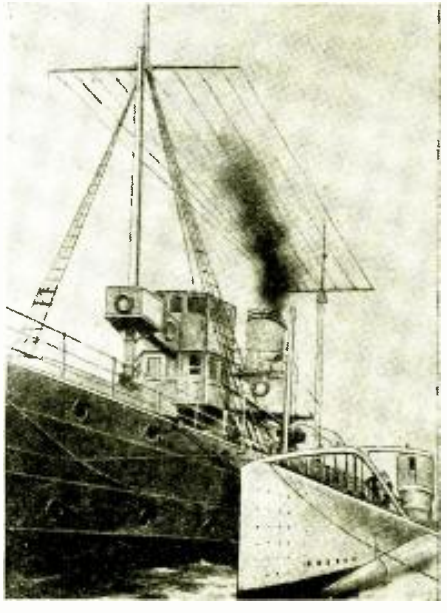
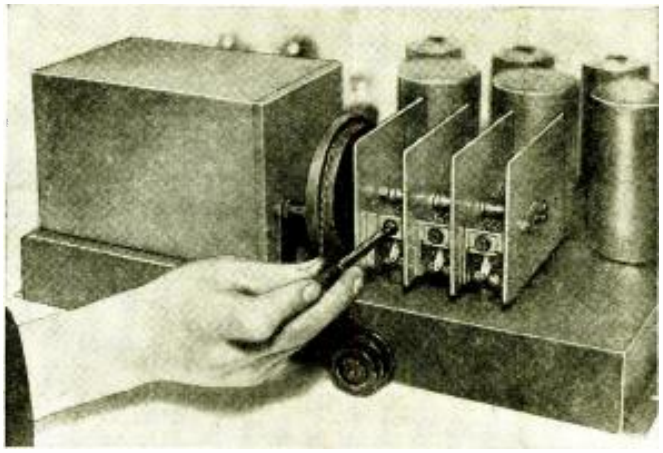


Fig. 5
A crewless submarine lying alongside of its control ship before a trial.

HIGH-FREQUENCY ADJUSTMENTS IN RECEIVERS



A description, in complete form, for realigning and stabilizing all types of receivers.

H. K. BRADFORD*

WHILE radio servicing definitely includes two classes of work, the Service Man really makes this distinction. These classes are: adjustment of the receiver and correction of definite trouble due to a breakdown of one or more parts in the receiver. The two problems are so intimately related in the Service Man's routine that there need be no definite division. On the other hand, one type of fault or trouble may fall in one classification whereas the Service Man may act on the other.

There is no substitute for the knowledge gained through experience with receiver troubles in distinguishing between poor adjustment and defective material. In many cases, much time is wasted attempting to "track down" some assumed defective part when the trouble may have its origin in poor adjustment. Hours spent in adjustment will prove ineffective if a defective part will not permit correct adjustment or correct operation, after the adjustment has been completed.

Without due consideration of the trouble with the necessary tests there is no absolute method of making the above mentioned distinction. A rather good rule in servicing is to make all adjustments as soon as it is possible to get a signal through the entire system. This

*Chief Eng'r. Capitol Radio Research Labs.

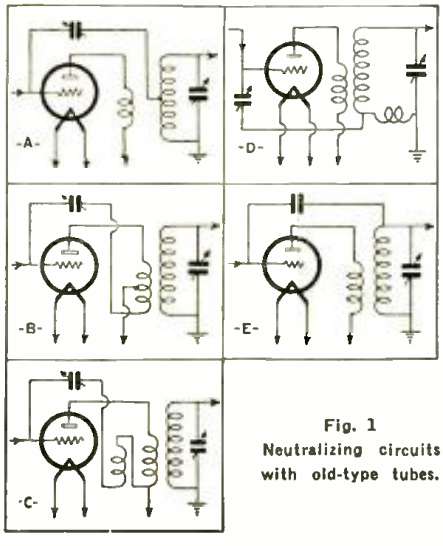


Fig. 1
Neutralizing circuits with old-type tubes.

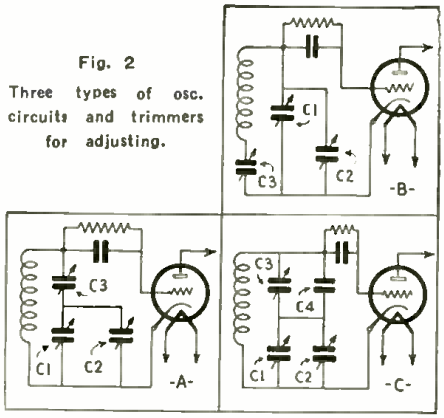


Fig. 2
Three types of osc. circuits and trimmers for adjusting.

cannot be followed strictly as in some cases conditions will not permit such procedure. In addition, it would be unwise to make a complete alignment—neutralization and other adjustments—when a circuit correction may have the effect of undoing this work.

All possible R.F. adjustments applying to practically all receiver circuits are completely explained in the manner of a definite procedure. The order of the major adjustments and of the individual items of each major adjustment will follow.

The order in which the major adjustments should be made will depend on the type of receiver, that is, T.R.F., superheterodyne, etc., and in cases where more than one major adjustment is necessary in one receiver type, they should be done in the order specified.

For T.R.F. receivers requiring neutralization, this should be done first. The only other adjustment in the high frequency portion of this type of receiver is alignment of the tuned stages. For superheterodynes the I.F. amplifier should be first neutralized if necessary and then aligned. We next proceed with neutralization of the R.F. stages where necessary, then adjustment for synchronizing the tuned stages, finally to the tracking problem.

Neutralization

The only other adjustment in the high- or I.F. amplifiers and provided with no means of suppression of self-oscillation must be neutralized: 01A, 01B, 01C, 30, 99, 26, 27, 37, 56, 215A, 40, WD11, WX12. These are the tubes commonly found in the earlier-model receivers. In Fig. 1, several neutralizing circuits are shown, and of course, there are others. For a given class of receivers, that is, A.C., D.C., battery, etc., the neutralizing procedure will be essentially the same regardless of the system of neutralization used by the manufacturer.

When we have a D.C. receiver to deal with in neutralization we must realize that the filaments of such a receiver are wired in series and that the above procedure will not be suitable because we must not prevent the system from carrying signals in the process of neutralization. There are several ways to get around breaking the filament circuit—one is to break the plate circuit at the "B" supply for each individual tube as it is neutralized, making sure that the plate bypass condenser is not disturbed. Another is to apply sufficient bias on the grid of the tube being neutralized to cut off all plate current of that tube. The third, which is the most practical for the busy Service Man, is to secure a double socket adapter whereby another tube identical to the one being neutralized is used to supply filament continuity only. A fixed resistor having the same value of resistance as the tube filament will do the trick also.

For battery operated receivers and

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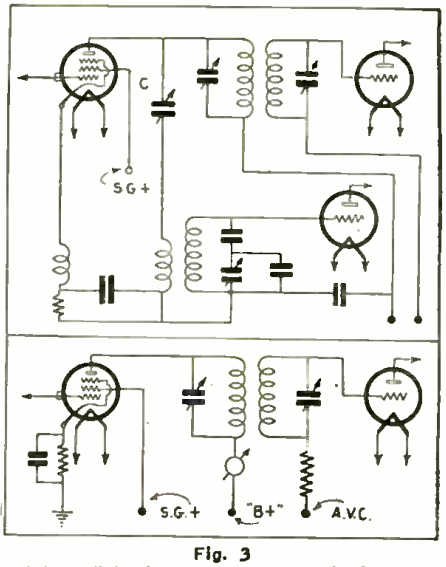


Fig. 3
Intermediate frequency trimmer adjustments.

TWENTY WAYS TO IMPROVE

There are, unquestionably, countless readers of this magazine who have receivers that are operating satisfactorily, and yet which do not come up to the standard that is set by present day sets. Perhaps, for the longest time they have contemplated modernizing their set, but have held off because of lack of information on this subject. If so here is all the necessary detail, which should be welcome to not only the above mentioned, but to the Service Man as well. Here are the facts—go to it boys!

(Courtesy R.C.A.)

A modern radio set. Note improved design and control arrangement.

THERE are many thousands of radio receivers in use today that have become obsolete simply because later developments in receiver design have been made. These sets are not worthless; on the contrary they are giving their owners good service. But there is no reason why they cannot be brought up to date so that the results will rival even the most recent commercial sets. The fact that most people are more careful about spending money on such luxuries as a new radio set only makes the subject of modernizing receivers more lucrative, at this time.

To begin with, it must be understood that to cover such a general subject, it is not possible to supply actual circuits of all the available receivers. There are so many variations of the fundamental circuits in use that this would require an entire volume. Therefore, we must limit this discussion to types of circuits instead of specific examples.

In this way the man with a more or less general knowledge of set construction—the average experimenter, set builder or Service Man—can easily adapt the facts supplied to a particular receiver.

New Tubes

One of the widest advances in the past year has been the development of new tubes. Those sets which use the early screen-grid tubes, such as the 24 can be greatly improved by certain simple circuit changes. The 24 type tube has a rated voltage amplification factor of 650 when a plate voltage of 250 is used. The 58, on the other hand is rated at 1,280, almost twice as much. Thus, if we can change the 24 type tubes in a set for the later 58's, we can increase the sensitivity of a set considerably.

The 58 tube is an R.F. pentode and has one more element than the 24. For this reason, the sockets must be changed from the 5 prong to the 6 prong type. This is easily accomplished, since most receivers use the wafer type sockets. The extra prong of the 6 prong socket is connected to the cathode, as shown in Fig. 1B. The cathode resistor must also be changed, to suit the new tube. Instead of the previous value (about 1,500 ohms usually), a resistor of 300 ohms is needed for each tube, where individual bias resistors are used for each stage.

Some sets use a single bias resistor for several R.F. or I.F. stages. In this case, a correspondingly lower value of resistance is required, depending on the number of tubes.

The same circuit changes can be applied to changing from the type 35, and 24A to the 58; the 32 can be changed to the 34; and the 36 to the 78.

The increase in the amplification of the newer tubes may possibly cause a little difficulty with oscillation. If this is encountered, it may be necessary to increase the size of the bias resistor or lower the voltage supplied to the screen-grid in order to lower the gain sufficiently to stop the trouble. Generally, where complete tube shielding is employed, no trouble in this direction need be anticipated. However, even with a slight reduction of the amplification per stage, there are still advantages in the use of the new tubes. The variable mu characteristic eliminates many cases of interference between stations (those which are caused by cross-modulation), and also the R.F. pentode can carry much stronger signals without overloading because the suppressor-grid removes the secondary emission so prominent in some sets using the ordinary screen-grid tubes.

The amount of reduction in gain necessary to permit stable operation is not ordinarily very great, so that the actual gain-per-stage is greater than with the previous tubes. Improvements in shielding will permit even greater amplification.

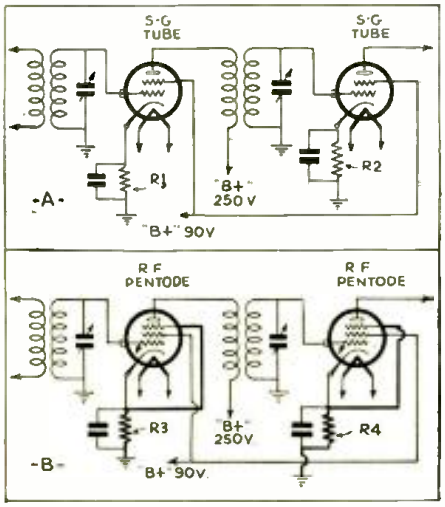


Fig. 1

A—R.F. circuit of old receiver using 24's.
B—Circuit for employing higher-gain tubes.

Fig. A

A high-frequency horn for obtaining wide-range frequency response.

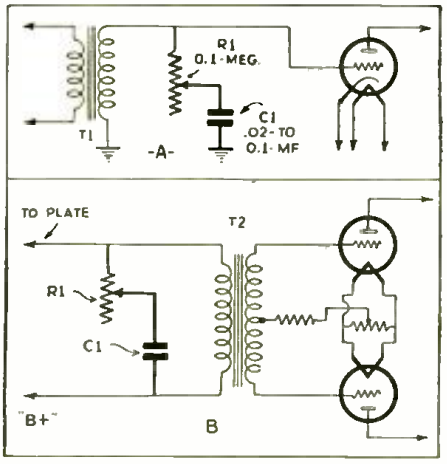
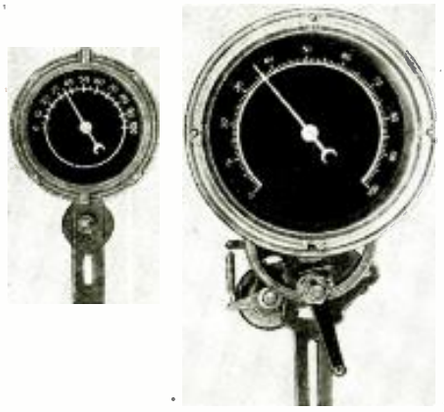


Fig. 2

A.—Regulating tone in a single power stage.
B.—Regulating tone in push-pull power stage.

YOUR RADIO SET — C. W. PALMER



Courtesy Crowe Name Plate & Mfg. Co.

Fig. B
Two sizes of airplane type tuning controls.

Wide Frequency Response

The dynamic speaker under normal conditions in radio receivers is not capable of projecting sounds over the entire audible spectrum. In fact, the usual dynamic speaker does not even pass the band of frequencies transmitted by the broadcast station (about 30 to 5,000 cycles). In order to overcome this, some manufacturers have incorporated two or more speakers in their console cabinets, each speaker being especially designed to cover one part of the audible band so that the very high and very low frequencies are not lost.

The average single speaker set has a predominance of the low frequencies; sometimes cutting off as low as 3,000 cycles. In order to improve a set under these conditions, an additional speaker can be added. There are several special high-frequency speakers, such as that shown in Fig. A, available now, and it is not a difficult task to incorporate one in a console. The particular speaker shown is a dynamic which must be matched to the output impedance of the set to which it is to be added. Under some conditions, it may be connected either in series or parallel with the voice coil of the original speaker, without an additional matching transformer. However, to effect a correct match, the former method is preferable. With this speaker, too, a source of power is necessary to actuate the field coil. However, the experimenter can easily construct such a unit, or one can be purchased.

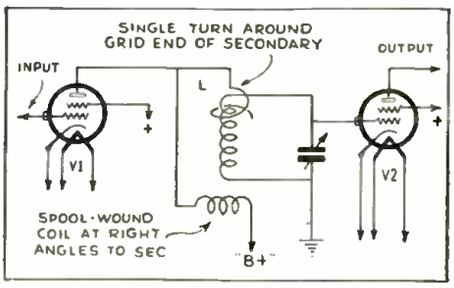


Fig. 3
Circuit employed for a high-gain R.F. coil.

The other type of high-frequency speaker available is a piezo-electric speaker, using a rochelle salt unit which drives a diaphragm similar to the dynamic unit. This type of speaker is easier to install than the dynamic type, as it does not have a field coil to actuate, and it may be connected directly across the voice coil circuit of the dynamic unit in the set. As the piezo unit has a capacitative reactance, and the voice coil circuit of the dynamic speaker is inductive, the two tend to balance, thus dividing the available power uniformly. The division of power also improves the power factor of the output circuit.

Baffle and Cabinet Improvements

In addition to improvements that can be made by the addition of a second speaker, the actual frequency characteristic of the baffle and cabinet in which the speaker is mounted can be improved.

The first way to accomplish this is to remove the speaker from the cabinet, mount the unit on a sheet of acousticelotex or other similar material of the dimensions of the inside of the speaker compartment and then replace the mounted reproducer in the cabinet. A hole the size of the reproducer cone is cut in the celotex. This will prevent to

(*Continued on page* 616)

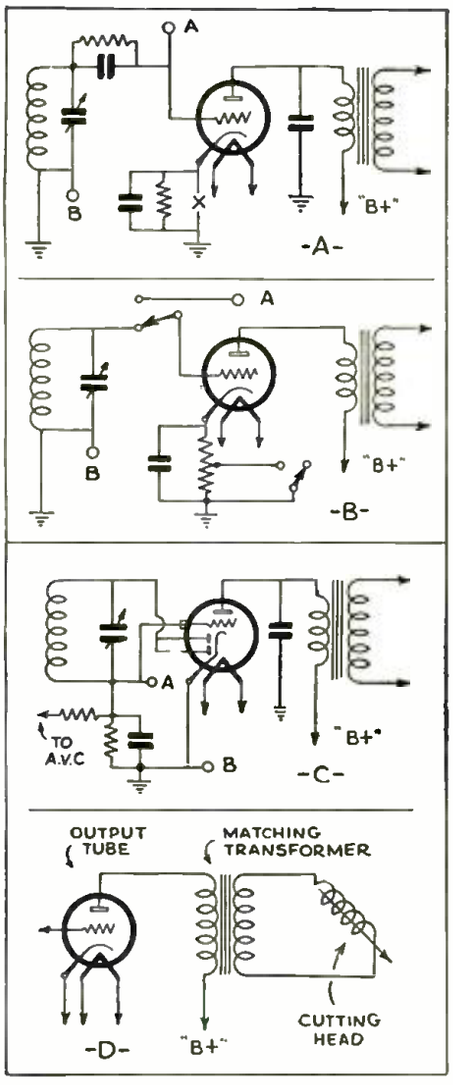


Fig. 5
A.—Phonograph connections in "grid-detector."
B.—Phonograph in plate-detection circuit.
C.—Connections made to grid and chassis here.
D.—Connecting a recording cutting head to set.

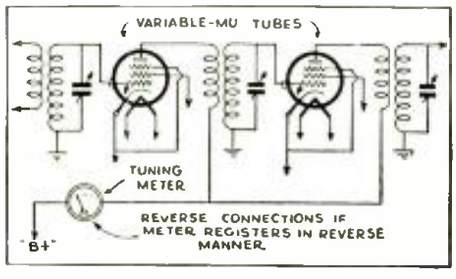


Fig. 4
Illustrating how a visual tuning meter may be wired in a receiver.

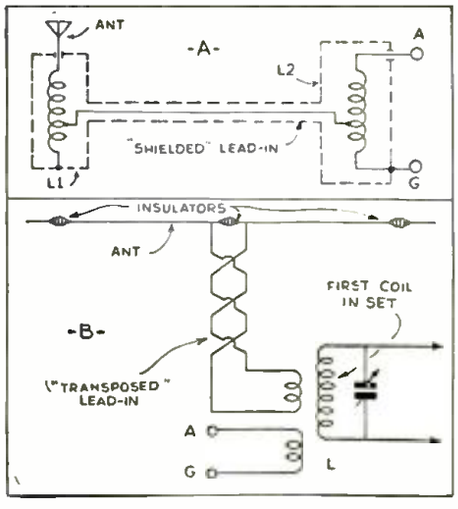


Fig. 6
A.—Method of reducing outside interference.
B.—Reducing noise with a transposed lead-in.

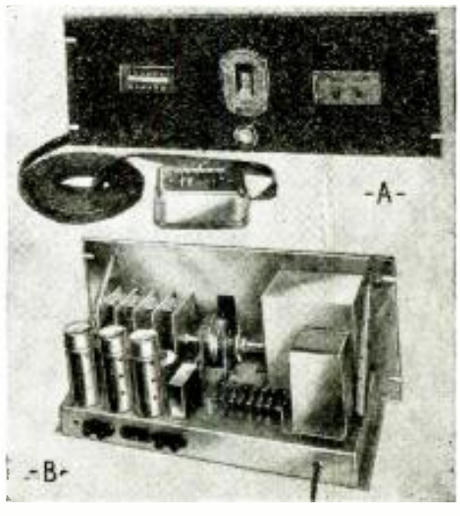


Fig. C
Service Men are augmenting their incomes by installing remote control tuning devices.

SHORT-CUTS IN RADIO

Hints, "kinks," ideas and suggestions that enable the amateur and professional to save time and money.

Fig. A
The parts of the latch-lock adapter.

A "LATCH-LOCK" ADAPTER

Paul A. Miller

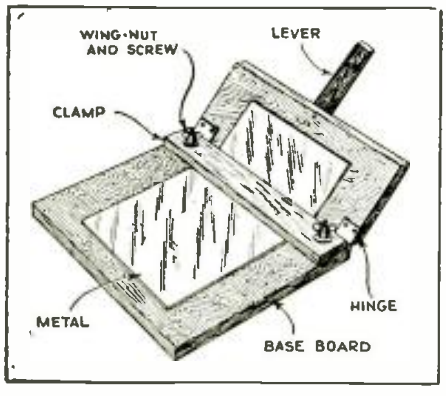
THIS is a short-cut in radio service, for those Service Men who still use Readrite analyzers. Take the plug, unsolder the 5 wire cable, unscrew the 5 prong plug from the handle, and drill a hole down through the top edgewise. Tap to hold a machine screw and cap for the grid wire of the new 8 wire cable (Fig. A).

Next cut a slot into the side of the handle about 3/16 of an inch from the bottom for the latch. Take a small 7-prong plug that screws into the handle and drill or punch a hole through the center; then take a regular tip jack and file the end of it off so that a phone tip will pass all the way through. Take a nut from an insulated-type phone tip and cut the point off as shown. Get a piece of brass and drill and bend to fit the nut; put a piece of a valve spring in between to keep the slide closed. Next take a brass rod the size of the phone tip jack and slot it as shown. Get a small 7-prong socket and make your own adapters as illustrated.

A CHASSIS BENDER

From "Amateur Wireless"

A VERY simple device made of odd pieces of wood which is very satisfactory for obtaining neat angles. The drawing, Fig. 1, is very simple and is self explanatory.



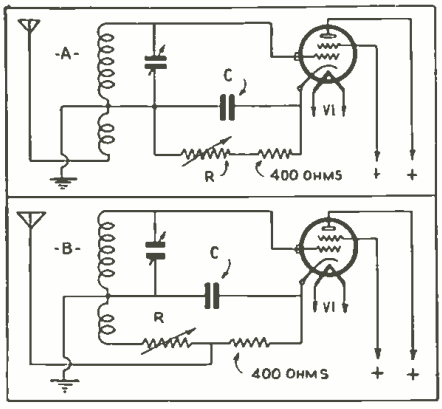


Fig. 2
A volume control method that is effective.

VOLUME CONTROL REPAIR

H. D. Hatch

I REPAIRED a set in which the volume control was a variable resistor in the cathode circuit, as shown in Fig. 2A. The value of the resistor was 10,000 ohms and the only substitute available was a 4,000 ohm unit and when installed did not cut the volume enough on loud locals. After some thought, I changed the wiring to that of Fig. 2B. Now R and the 400 ohm resistor make a potentiometer which is more effective.

A SENSITIVITY CONTROL

E. W. Little

AT the present time manufacturers of radio sets produce receivers that have even sensitivity at all points of the band. Some times a customer desires more sensitivity on the lower wavelengths. This is solved by the connection of a small condenser as shown in Fig. 3, and then re-alignment of the first tuning condenser.

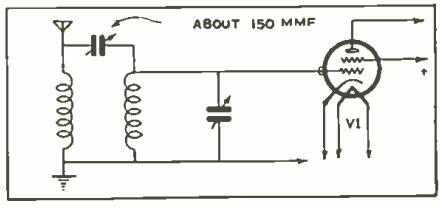


Fig. 1, left
A simple chassis bender made at home.

Fig. 3, above
A device for increasing H.F. sensitivity.

Fig. 5, right
A gas engine power unit for "the sticks." Use a standard "voltage divider" resistor.

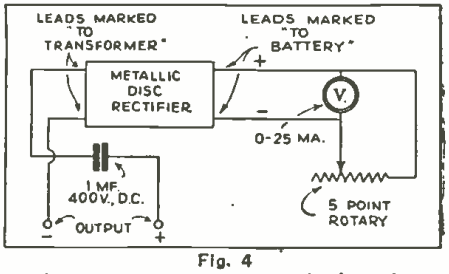


Fig. 4
An output meter made from simple parts.

A SIMPLE OUTPUT METER

Frank Hehre

QUITE a few Service Men have been looking for a suitable output meter for use with practically all sets. This is the one I use. The metallic disc rectifiers used some years ago for charging storage batteries along with a 0-25 ma. meter make up this unit. A Kuprox 110A unit is used.

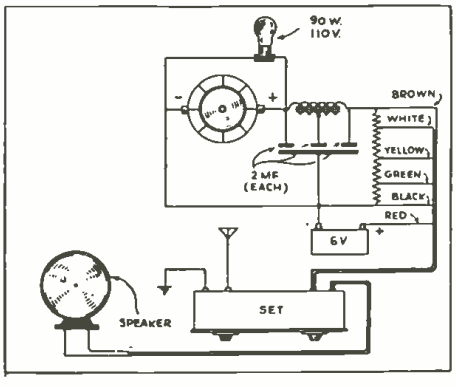
The shunts are made to give four ranges; by doubling, tripling and quadrupling the original scale. See Fig. 4.

A BACK-WOODS POWER UNIT

Marine Schell

WE needed a radio at our scout cabin in the woods; city power was not available and because we use it but once a week I thought that batteries would be too expensive.

So I decided to build a gas engine power plant. Luckily I had a 220 V. D.C. motor which gives about 300 V. D.C. turning at 2,200 r.p.m. I belted the engine to the generator with a V belt and a 4 in. pulley on the engine, and a 2 in. pulley on the generator. I used an old Maytag washing machine engine. The filter consists of a 30 hy. choke and three 2 mf. condensers. See Fig. 5.



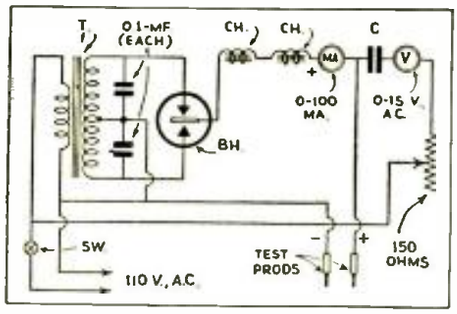


Fig. 6
A test unit for electrolytic condensers.

ELECTROLYTIC CONDENSER TESTER

E. A. Redmon

THIS tester will measure the capacity of a condenser and at the same time measure its leakage. To measure the capacity we must use alternating current and as we cannot use A.C. alone on an electrolytic condenser a rectifier is employed (a "B" eliminator will do as a substitute) as shown in Fig. 6. The voltmeter measures the capacity by calibrating the scale against known condensers and the leakage should not be more than 1. ma. per mf.

A UNIQUE VOLUME CONTROL

Milton S. Solberg

IN experimenting with a variety of hook-ups using R.F. amplification, I use a type of volume control shown in Fig. 7. It consists simply of a modified form of tone control, the difference being that a larger condenser is used. A 50,000 ohm resistor in series with a 1 mf. condenser gives good results connected as shown.

A TEST PROD IMPROVEMENT

M. C. Clapp

IF you use phone tip prods but occasionally have use for a sharp point, a bayonet can be made as shown in Fig. 8.

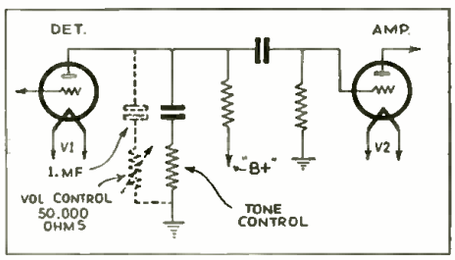


Fig. 7
An unique experimenter's volume control idea.

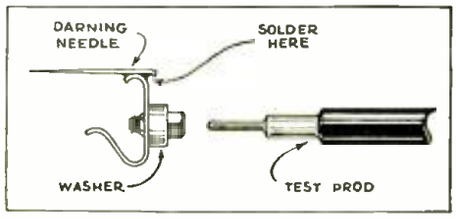


Fig. 8
Test prods from phone tips and jacks.

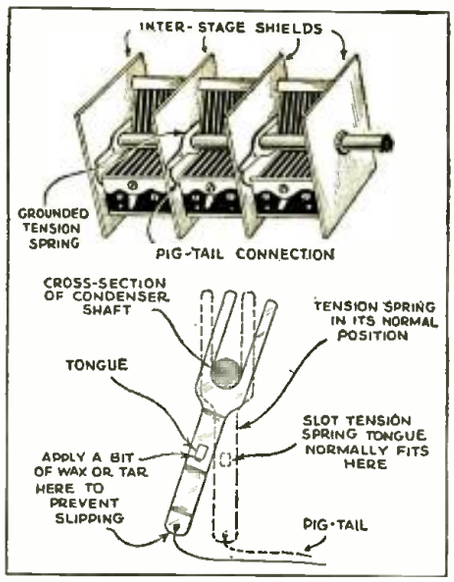


Fig. 9
A way to fix noisy tuning condensers.

NOISE IN TUNING CONDENSERS

Boris S. Naimark

MANY modern receivers employ grounding tension plates between the rotors of the condenser sections and the inter-section shield plates. When these lose their tension the receiver becomes noisy. In some cases, they can be cleaned, but it is usually better to replace them with short pigtail connections. See Fig. 9.

A TUBE-NOISE INDICATOR

H. W. Malmstrom

IT is easy to sell a customer a new tube to replace a noisy one that tests good otherwise, if you can duplicate the noise that the customer hears in his set. Here is a simple but effective noise indicator that can be easily added to any tube tester that measures the plate current in the tube. It will give an audible demonstration of noisy tubes due to defects of a mechanical nature. A tube that has loose elements, erratic opens or shorts will cause variation in plate current when it is tapped. If a speaker is connected in series with the plate lead of the noisy tube being tested (in the analyzer) it will produce static that will convince the most skeptical customer that the tube is defective. (Fig. 10.)

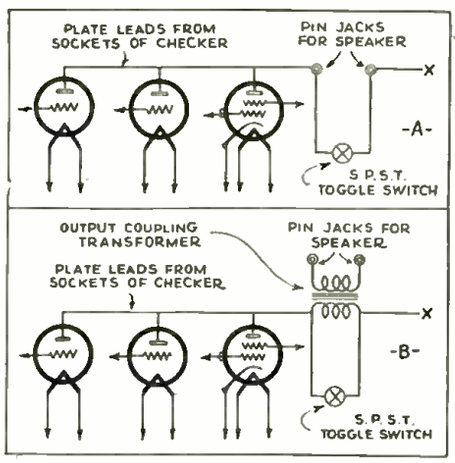


Fig. 10, above
A noise indicator for the tube tester.

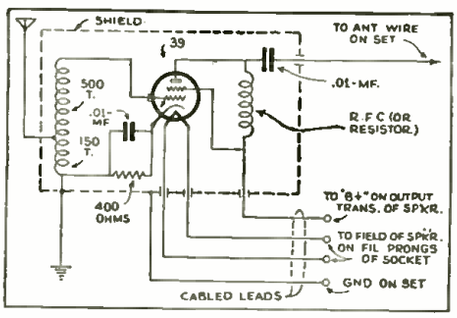


Fig. 11
An untuned R.F. stage for the auto set.

A SENSITIZER FOR THE AUTO SET

Malcolm Mackay

IN WORKING with automobile receivers, especially those designed a year or two ago, I have found that many of them did not have sufficient sensitivity for use in this part of the country. Unless the car is traveling within a comparatively few miles of a station, it cannot be heard.

With this in mind, we built an untuned R.F. stage consisting of a 39 tube inclosed in a metal box just large enough for the tube and a few R.F. chokes, etc. Referring to the circuit diagram, a coil is made by winding 650 turns of No. 33 wire on a small machine screw. Choke R.F.C. is a standard type of R.F. choke designed for S.G. tubes.

The remainder of the parts used in the unit are evident from the circuit. The bias resistor has a value of 400 ohms, bypassed by a .01-mf. condenser. Another .01-mf. condenser is used to couple the untuned amplifier to the receiver.

AN OLD TUBE TESTER—UP TO DATE

Iver Paulsen

THE Sterling R-409 AC, is an old timer made to test and reactivate 01A and 199's, which makes it practically useless to-day, but with a few minor

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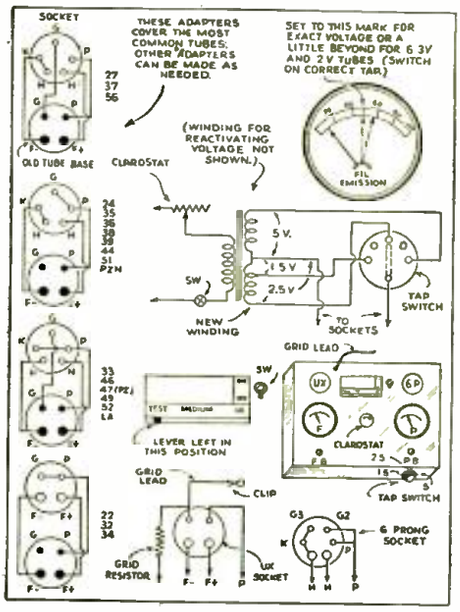

Fig. 12, right
Methods for renovating a tube tester. It may be unnecessary to discard "old reliable."

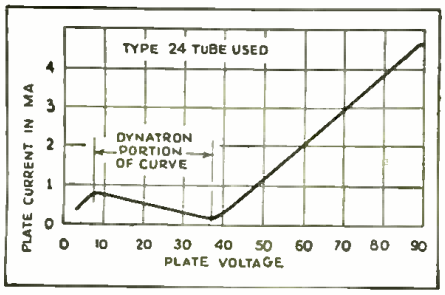

Fig. 6
Dynatron portion of curve for 24 tube.

FACTS ABOUT DYNATRON OPERATION

PART II

C. M. DELANO

The first chapter dealt with theory in a non-technical style; in this closing chapter circuits are described.

INASMUCH as the next tube to be considered is of the screen-grid type, it follows that one more element is available than was the case with the 3 element tube previously considered. It is practical to take advantage of this fact and put the extra element to good use in our circuit. Using the hook-up shown in Fig. 5, we can plot a graph along the lines indicated in connection with the discussion of the 3 element tube. Such a graph as the one already considered is representative of the usual type, with one exception; not all tubes will exhibit dynatron characteristics which indicate a reversal of direction when the graph crosses the base line. Many tubes indicating the dynatron characteristics operate in such manner that the downward slope of the characteristic dynatron curve ceases and the curve shoots upward before the base line of the graph is reached. (Notwithstanding what has been said in regard to screen-grid tubes being better for dynatron circuit purposes than the usual 3 element tubes, it is interesting to note that the curve already shown applied to a type 26, 3 element tube.) Figure 6 shows a graph plotted for a type 24 tube; in general it is found with plate voltages between 0 and 90, that the dynatron portion of the characteristic curve is found between plate voltage limits of about 8 and 38. Curves may also be plotted with plate voltages supplied by a single 45 V. battery but the general shape of the curve will change but slightly; different values of screen-grid current, too, will slightly alter the curve.

Uses of the Dynatron

The question as to what practical use may be made of the dynatron, or, as it is properly termed, the "pliodynatron" when a 4 element tube is used, will now be considered.

The dynatron circuit is exceedingly useful as an oscillator generating R.F. currents, and in this connection the Service Man and experimenter will find it both practical and simple to construct and also very stable when frequency variation is considered. Some writers who have expressed themselves on this subject have gone so far as to say that the dynatron oscillator compares favorably with temperature-controlled crystal oscillators, although the writer has no data to support this contention. A hook-up which the writer has found very satisfactory for signal generation in connection with aligning both T.R.F. and superheterodyne receivers is shown in Fig. 7. The writer claims no credit for thic circuit as it is a combination of circuits originally published in another magazine. Other methods of coupling the oscillator to the receiver may be employed, however, the writer does not recommend them to the beginner in this kind of experimentation and they will not be discussed at this time. Someone has referred to the dynatron as being a feeble oscillator. Under certain conditions this is true, but in general the writer has found that under identical oscillator tuned circuit voltage conditicns there is no difference in signal strength between the dynatron oscillator and the more common types. Certain people, at times, in experimenting with the dynatron oscillator circuit, have come to the conclusion that a given dynatron hookup would oscillate better at some point in the spectrum than at others within the limits of the tuning system employed, and only through a narrow band at that. The writer has found that the old-time "honeycomb" or duolateral type of coil tuned with a straight line frequency condenser, when used in the dynatron hookup, makes a very satisfactory and easily changed tuning inductance (in this connection it is proper to note that the October, 1933 edition of RADIO-CRAFT, page 230, contained some very complete and timely data on the choice of proper coils and condenser values as this pertains to the use of duolateral inductances). In addition to the fact that the dynatron circuit lends itself readily to the use of simple types of tuning inductances which may be easily interchanged, it is also true that the dynatron oscillator can emit many harmonics and it is possible to do a lot of practical and useful work with this circuit by making use of different harmonics. The problem of identifying harmonics is one that is very interesting but inasmuch as it has been discussed in detail in past issues of RADIO-CRAFT and in several other publications it will not be dwelt upon in this article. (Anyone desiring information on this should refer to the July and August, 1932 issues of RADIO-CRAFT for detailed information). The R.F. oscillator is invaluable in service work. If

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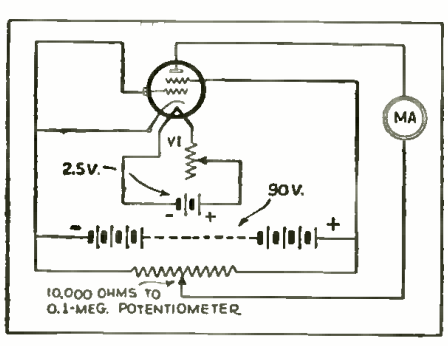

Fig. 5
For checking dynatron characteristics.

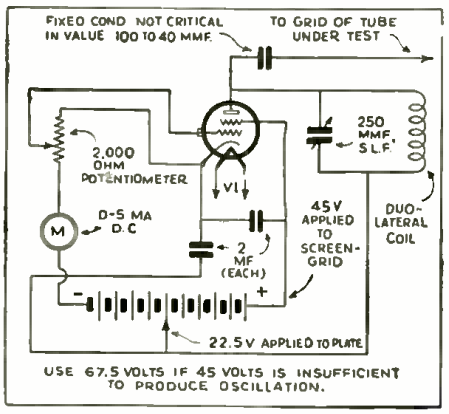

Fig. 7
Dynatron oscillator circuit for 24 tube.

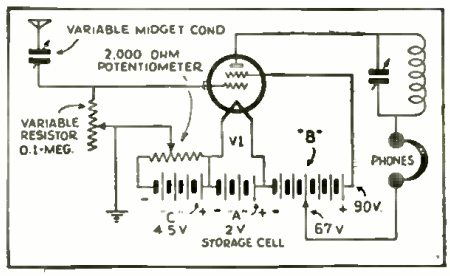

Fig. 8
Dynatron biased detector—32 tube.

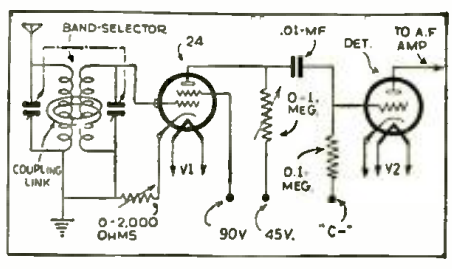

Fig. 9
Dynatron radio frequency circuit.

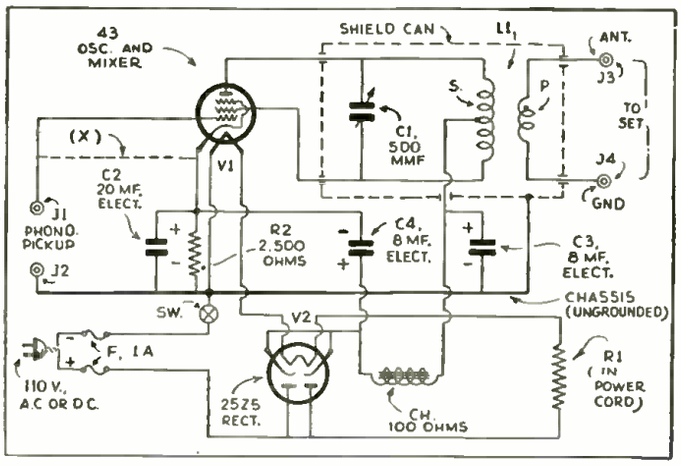

Fig. 1, left
Completely lettered diagram of the R.F. phonograph attachment.

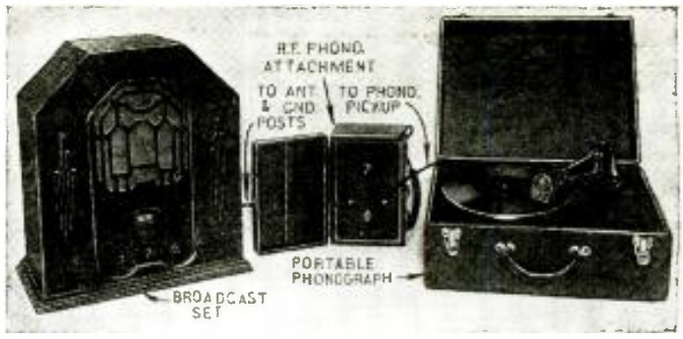

Fig. A, above
The pickup "feeds" the "Ant." and "Gnd." posts of the radio set.

HOW TO MAKE A NOVEL, PORTABLE, A.C.-D.C.

R. F. PHONOGRAPH ATTACHMENT

R. D. WASHBURNE
and N. H. LESSEM

FEATURES

(1) Operates on either A.C. or D.C.
(2) Attaches to any radio receiver, without recourse to adapters.
(3) Wires to "Ant." and "Gnd." posts.
(4) Uses any high-impedance pickup.
(5) Utilizes R.F. amplifier of set.
(6) Requires only 2 vacuum tubes.
(7) Compact and inexpensive.
(8) Resistor in power cord prevents high heat dissipation inside unit.
(9) Easy to build and operate.
(10) Portable—weighs only 4 pounds.
(11) Versatile—may also be used with a double-button microphone, and matching transformer, as a public address unit for addressing small gatherings, via any conveniently available radio set.

WHILE radio is a very wonderful invention, it would be even more wonderful if, by merely throwing a switch, we could select the very music or programs which we desire to hear at any particular time. *This is exactly what this "R.F. phonograph attachment" will do when connected to the* antenna and ground posts *of any radio set.* Have you ever had the experience (or shall we call it embarrassment) of not being able to furnish, let us say, dance music at a social gathering, simply because there was none to be had over the air?

With this little device you can, in a moment, take any phonograph record and reproduce it *electrically* through your regular radio receiver—*without touching the interior of the set, or using any type of "adapters."* In this manner you can choose your own programs for particular occasions and not be dependent entirely upon radio stations!

In the first place, a phonograph pickup cannot be conveniently or efficiently added to a surprisingly large number of radio sets. In many instances, the removal of an "overall" shield will unstabilize the receiver; in others, the removal of an individual tube shield produces the same result. Some sets do not have sufficient clearance to permit an adapter to be used; others go into circuit oscillation if a lead is brought out of the detector tube socket; anyway, still other adapters would be needed to adapt the attachment to the various types of detector tube sockets and circuits in the sets encountered. Also, when a pickup is connected into a tube circuit it is seldom that exactly the correct matching of values can be obtained; this results in a loss of fidelity. Finally, even if the set is equipped with phono. pickup connections, only the amplification of the A.F. section of the radio set is available, whereas, the use of the "R.F. phonograph attachment" permits the amplification of the R.F. section *also* to be utilized.

This device, a "radio frequency phonograph attachment," is illustrated in Figs. A and B; as the schematic circuit, Fig. 1, indicates, the connections are extremely simple.

First of all, note the simplicity of the design; there are only two tubes, two resistors (one of which is built into the power cord), one coil, one small-space variable condenser, one small filter choke and three fixed condensers, as major components.

How to Use It

To use the portable R.F. phonograph attachment, first remove the antenna wire from its binding post on the broadcast set, and permit the wire to lie unused. Next, connect a wire from "ANT" of the attachment to the antenna post of the broadcast set; and another wire from the "GND" post of the attachment to the ground post of the set (the latter, in addition to the regular ground wire,

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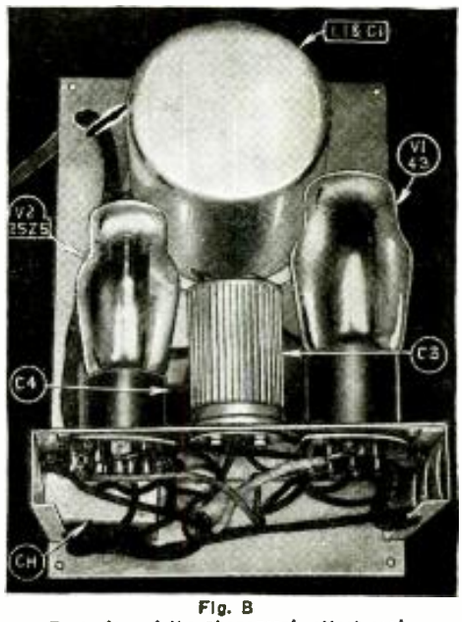

Fig. B
Rear view of the phonograph attachment.

A NEW METHOD FOR AUTO NOISE ELIMINATION

Aircraft radio installers get good results by the simple method of complete shielding. In this article, the author tells how the auto-radio man may duplicate that method.

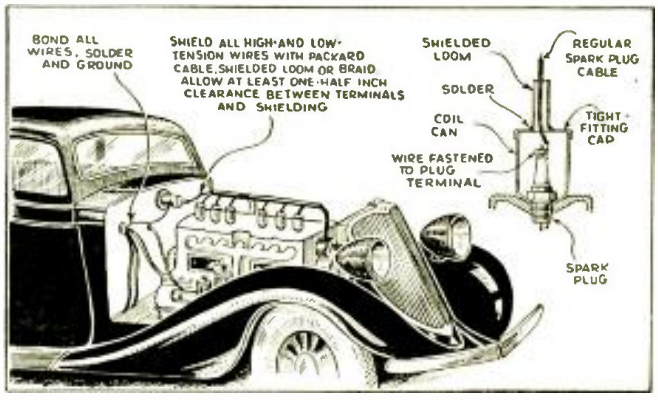

Fig. B
Illustrating how to shield spark plugs with coil cans.

J. T. BERNSLEY

TO those in the auto-radio installation and service profession who have encountered all sorts of trouble in eliminating ignition noises after a radio has been installed in a car, or who have had complaints from the car owner that the installation of the set seemed to affect the efficiency of the car, the contents of this article may prove a godsend. It is an established fact that the elimination of noise is easier in some cars than in others. In the case of the Buick automobile, for example, the procedure is very simple and excellent results are obtained; primarily due to the fact that the motor is of the "valve-in-head" type and hence all spark plugs are completely shielded. Also, due to this feature, no suppressors are necessary except one to the high-tension lead (center contact) of the distributor. As a result of the elimination of suppressors in this type of car installation, practically no decrease in the motor efficiency is experienced after the installation is made.

To some, the statement that suppressors materially affect the motor performance may be news, yet it is an absolute fact that the decrease in efficiency, in some cases, is as high as 20 per cent. The author has gone into detail, on this subject, with a number of master mechanics, besides having made personal tests, and has had this fact verified. The insertion of a resistance, generally about 25,000 ohms at the spark plug end of the high tension lead and again in the high tension lead at the distributor, produces a total resistance in this circuit of 50,000 ohms. Although the current here is small and the resultant voltage drop of a low order, the effect of heat on the value of these resistors is tremendous, particularly on certain types of suppressors.

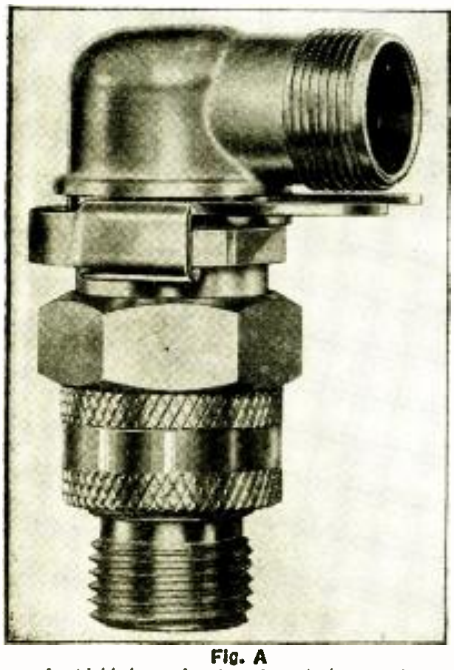

Fig. A
A shielded spark plug for airplane motors. Name of manufacturer supplied upon request.

In most cases, the resistance value of the suppressor decreases, especially when it is of the carbon type, which serves to reduce the efficiency of the unit as a noise eliminating device. Then again, the resistor after a few months of use will become damaged or defective, due to the constant dissipation of energy that takes place when current flows through it, which generally results in a "missing plug" and consequent loss of power. However, the following explanation is probably the real reason for the decrease in motor efficiency after the suppressors are connected to the spark plugs.

The amount of energy that is supplied to the primary (during the interruption of the breaker points) and transferred to the secondary winding remains constant for that short period. Now if we assume that the complete circuit of battery, breaker points, primary and secondary windings of the spark coil, and up to the contact points of the plug as equivalent to a resistance "R," and the spark gap resistance as "Rx," then the energy dissipated in "R" we know to be useless, whereas the energy dissipated in "Rx" is useful, since it is expended in creating the spark discharge for igniting the gas mixture. (See Fig. 1.) It is therefore logical that any added resistance (in the form of suppressors) introduced in that circuit existing outside of the plug points would only dissipate additional energy uselessly. The net result, when this addition is made, is that an inferior spark is obtained and consequently the performance of the car is affected. Unfortunately, no actual data is available concerning the resistance at the plug gap, during the discharge, which incidentally is a variable factor, and which would permit us to calculate the actual effect of the added suppressor in the form of additional dissipated energy.

The fact that this method of eliminating noise from radio reception in a car never was completely satisfactory is in itself sufficient reason to condemn it. Installation men who are constantly installing radio sets in cars, are well aware of the fact that generally there is considerable additional work to do to eliminate the ignition noise, even after the suppressors are installed. In most cases the noise, at that point, is generally found to be due to the antenna pick-up of the spark discharges as they occur at the various plugs. This in itself is proof of the inadequacy of the suppressor, since, if this device was efficient in accomplishing its purpose, no radiations would occur.

What then should be done to successfully eliminate ignition noises when a radio is to be installed in a car—and yet maintain the motor efficiency that was existent prior to the installation? In seeking a better method we would do well to first ascertain the methods employed by aircraft radio engineers when installing receiving equipment in planes. Naturally, we would find in this instance the efficiency of the plane and motor considered uppermost since the safety of the plane, passengers, and pilot depend upon this factor. Devices that would in any way tend to diminish this

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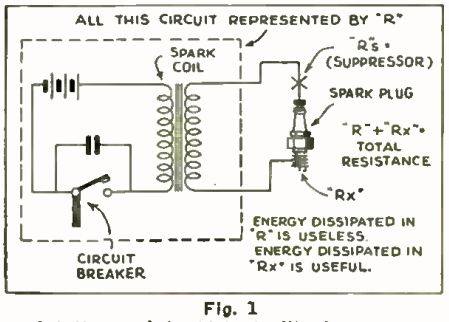


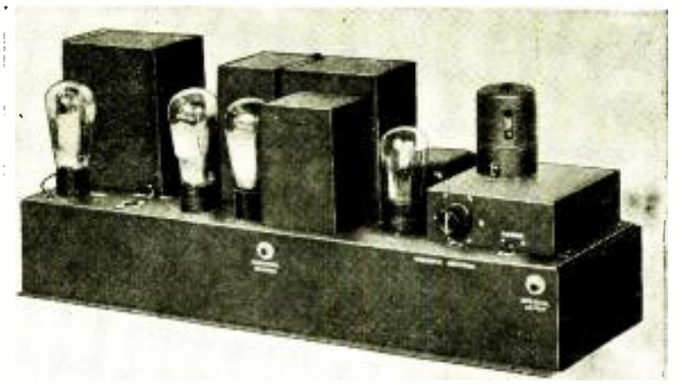
Fig. 1
A better spark is obtained without suppressor.

SERVICING THE "TALKIES"

In this article the author deals with the manager's problems and the best method for approaching him. Some very valuable suggestions are made in this connection.

PART VI.

AARON NADELL



A typical small-theater amplifier, incorporating volume control, fader switch, and monitor jack.

IN most theatres, the man who has power to place orders—and sign checks in payment—is the manager.

Consequently, before we are ready to consider definite and concrete ways in which theatre and Service Man can be of use to each other we must first determine the considerations that are most likely to pursuade him to say "yes" instead of "no."

Show Business and Managers

The manager is a showman (that is his profession) selling his public psychological intangibles. Therefore, it is very necessary to catch his attention and capture his imagination. Talk about occluded gas in vacuum tubes, or molybdenum plates in vacuum tubes means very little to the manager himself; and if molybdenum is something Mae West hasn't got, his customers won't be interested. Therefore, you must first talk about what you can do for his show—and his budget.

Although there are many concrete ways in which the radio man can be of use to the theatre with good profit to himself, not a few will revolve, directly or indirectly, around the manager's problems of advertising and ballyhoo; those that center directly upon exploitation will be of the greatest *initial* use to the radio man in selling his services to the manager.

Advertising—Ballyhoo—Tie-Up

Like the radio store, the theatre sells a luxury. Unlike the radio store, it has to sell the same luxury over again to the same people, two or three times a week. Most folks that do not have a radio—want one; most folks that have poor "radios" want a better one. But no one wants to go to the movies every night. The manager's problem is to make as many persons as possible desire to go to the movies as many nights per week as possible. To do that he advertises, but—what has he got to advertise? All he sells is time—two hours, more or less, in a more or less comfortable seat. He advertises glamour, romance, adventure, commodities he cannot weigh out for his patrons, or tie up for them to carry away. At least, he tries to advertise those things, but in themselves they are too difficult, too intangible, to solve his problem wholly. Therefore, he relies on other methods when he can get them. He has two chief resources, ballyhoo and the tie-up.

Essentially, ballyhoo is anything that will attract attention. It is likely to be mighty expensive and therefore occupies a large percentage of the manager's thoughts. This will partly explain why any radio man is likely to encounter a degree of disinterest if he walks in cold to offer to save the manager some part of his battery costs. The manager will probably be too busy wondering whether he can afford to send a truck-load of singing harpooners through the streets to advertise "Moby Dick," or obtain prizes that may prove awards of interest to every member of the family, or a thousand-and-one other ideas. He is a business man, not a technician, and although a breakdown in the show is very important to him—and he will do almost anything to avoid it, even listen to a lot of engineering talk, if necessary—his most important thoughts are naturally and quite properly centered elsewhere, and must be recalled before he is in a mood to listen to a talk on electricity.

The tie-up is a means used by theatres to keep their advertising and ballyhoo costs within reasonable limits. The essence of the tie-up (here again the Service Man enters the picture) is to obtain advertising or ballyhoo by a swap of some kind rather than a cash payment.

Those prizes, for example. They may be bought by the theatre; but they are quite as likely to be donated by a local store, which in return will receive all the advertising the theatre can give, from the stage, in the lobby, perhaps in part of the newspaper space paid for by the theatre.

But this is only one of almost innumerable forms of tie-up. For example, that truck-load of harpooners to publicize "Moby Dick." A P.A. amplifier on the truck would be very helpful; the theatre may be willing to rent one from the Service Man, and pay for the rental in cash; but he is more likely to try to offer payment in the form of an exhibition of radio receivers in its lobby, together with the card of the radio merchant or Service Man.

The average theatre manager will spend a good deal of time working out new methods of tie-up; he is always willing to listen to any new suggestion along *those* lines.

But ballyhoo, advertising, and tie-ups are very far from being the only concerns of the manager. In order to understand just what part sound equipment and servicing play in the thoughts of this autocrat of the theatre it will be well to glance briefly at a list of *some* of the typical exhibitor's other responsibilities.

Responsibilities of the Manager

There is *booking of the show;* selecting the pictures to be shown and the most suitable dates on which to run them. Then there is *arranging the show;* the order in which feature, news reel and shorts are to appear; it is sometimes thought poor showmanship to run a slap-stick comedy directly after a serious drama—a newsreel, at least, should intervene. Also, the *timing of the show* is important: the second show of the evening should begin in time to catch the greatest crowd, and much the same idea applies to holiday showings.

Then the manager is in charge of "maintenance," under which heading sound equipment is included. He has the roof fixed, and the plumbing seen to; he buys carpets, chairs, painting, electric light bulbs in all colors; he must keep the theatre well cleaned at the smallest cost; he is responsible for any safety hazard (such as loose carpet on a stair case, or even chewing gum on a seat) that may injure patrons or their clothes. He buys all projection room parts, supplies and repairs, and all equipment needed back-stage, if there is a stage. As an employer of labor he hires and supervises projection operators and stage-hands, porters and cashiers, ushers and advertising writers, not to mention the harpooners-for-a-day who ride about town on the ballyhoo truck. (But in a very small theatre the manager may run the projection himself, his wife sell tickets, both of them sweep up

(*Continued on page* 612)

SAVE YOUR OLD TUBE TESTER

For those who desire to rewire and convert their old but expensive tube testers, here's a complete article with all data, that will permit them to make this change with little expense or trouble. To get an idea of how simple, efficient, and up to date this unit is, just glance at the following features.

1. Brings obsolete testers up to date.
2. Economical, may be built for less than $6.00.
3. Supplies all new filament voltages, all instructions engraved on panel.
4. All new tubes listed on panel.
5. Simple to operate.
6. Provides for future changes.

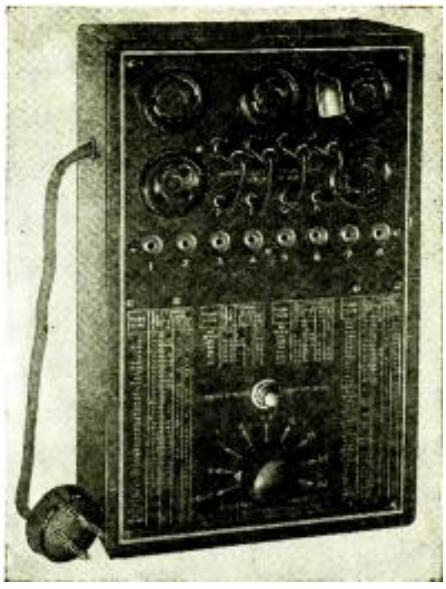


Fig. A
Front view. Instructions engraved on panel.

MILTON REINER*

ONLY a small percentage of the total number of tube testers, which are owned by Service Men, dealers and distributors are up-to-date. In most instances the owner of a tube checker cannot test many of the new tubes that are in frequent use in receivers today and this predicament presents an embarrassing problem which often results in the loss of confidence by the customer.

The serious deficiencies of the obsolete testers may be classified as follows: (1) Lack of new sockets to accommodate the new tube bases; (2) Lack of proper filament supply to operate the tubes; (3) Lack of circuits to apply required test voltages to various elements and to provide inter-connection of different tube elements.

Although an up-to-date and economical tube tester was described by the writer in the August, 1933, issue of RADIO-CRAFT, and many testimonial letters acclaim its value, there are many owners of testers who do not feel justified in scrapping an expensive, well-made instrument, which they have, because it is obsolete; and getting a new one that is not as pretentious, nor as costly. For this group of radio mechanics and dealers, the author has designed a comprehensive adapter that will bring their obsolete testers entirely up to date, at a very nominal cost.

This device is designed to overcome the deficiencies mentioned above. The instrument is designed to test tubes as triodes, *which is the fundamental circuit of almost all the "obsolete" equipment* on the market; also, this "super-multidapter" is extremely simple to use. (The 4 prong plug of the super-multidapter cable is inserted in the 01A socket of the old tester and from then on it is an easy matter to test a 25Z5, 6F7, 12Z5, 48, or any other type tube).

Figure A illustrates the complete unit.

(*Continued on page* 634)

* Chief Engineer, Radio City Products Co.

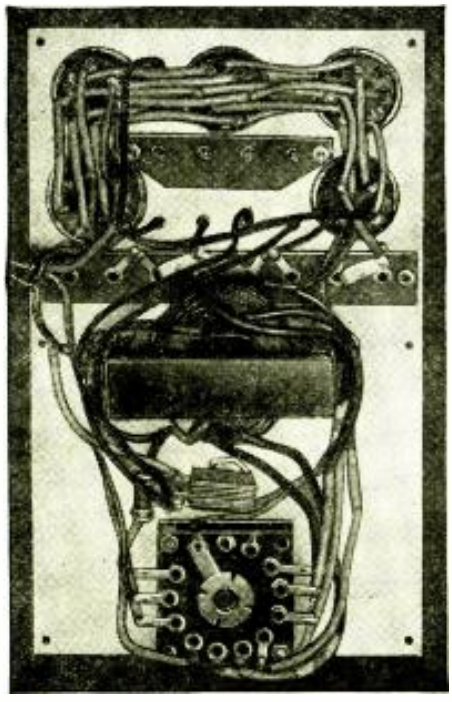


Fig. B
Back view, showing location of parts.

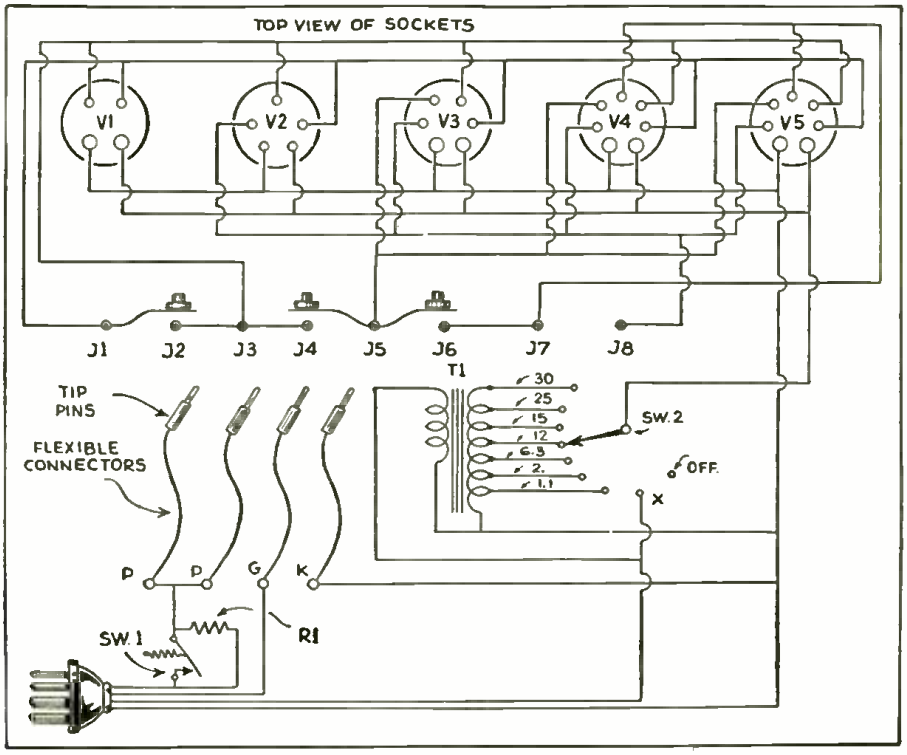


Fig. 1
Wiring diagram of a "super-multidapter," the transformer supplies all requisite voltages.

BEGINNER'S 3 TUBE ALL-WAVE SET

F. R. HARRIS

Here is a more advanced, yet simple and easily constructed, set for the newcomer to the radio field. It will receive both short-wave and broadcast-band stations, and although headphones are recommended loudspeaker results can be obtained.

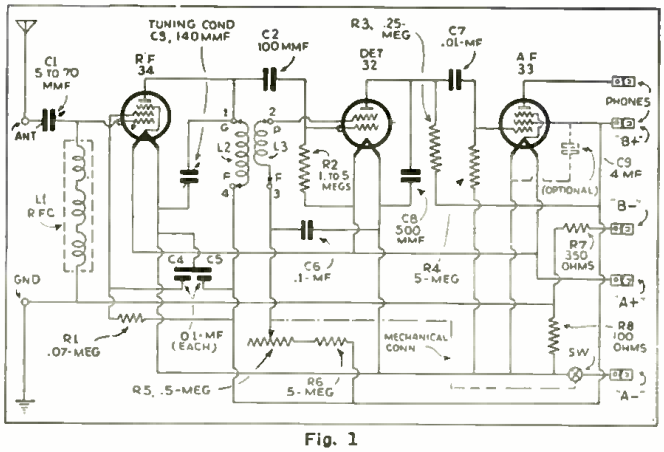


Fig. 1
Schematic diagram of the 3 tube beginner's set.

IN THE February Beginner's Department we described a simple, 1 tube, all-wave set designed to serve as an introduction to the short-wave field. At that time the prediction was made that, having once gotten into short-wave work, you would not be satisfied until you built a more elaborate outfit. There has been plenty of time since then for you to get thoroughly acquainted with the possibilities—and limitations—of your 1 tube job; hence, we present this time a 3 tube set that should reach out and bring in those elusive stations that you just almost got on the smaller set, and will bring in the stronger ones on the loudspeaker.

The Circuit

Ordinarily, a 3 tube circuit would involve considerable complication but in this particular layout the main consideration has been simplicity, which of course involves some sacrifice of other factors, but, on the whole you will find that the performance of the finished product will amply repay the time and effort spent upon it. It makes use of an untuned antenna input to the control-grid of a type 34 tube. The plate coil of this tube constitutes the only tuned circuit in the set, and the only coil that must be changed in going from one band to another. (See schematic diagram Fig. 1.) The signal is fed to the type 32 tube, operating as a grid detector, through the condenser, C2, serving the dual purpose of acting as grid condenser and isolating the plate voltage from the grid of the detector tube. The leak, R2, serves to keep the grid from "floating" and to give it the slight positive bias, (due to its being returned to the positive leg of the filament), which makes for greatest sensitivity for this type of detection. The signal, which is now of audio frequency, is then fed to the grid of the type 33 tube through coupling condenser, C7, and thence to the phones or speaker. Regeneration, necessary for sensitivity, selectivity and to permit code reception, is obtained by feeding the screen-grid of the detector tube through the tickler on the tuned coil form and is controlled by varying the voltage on the screen-grid by means of the potentiometer, R5.

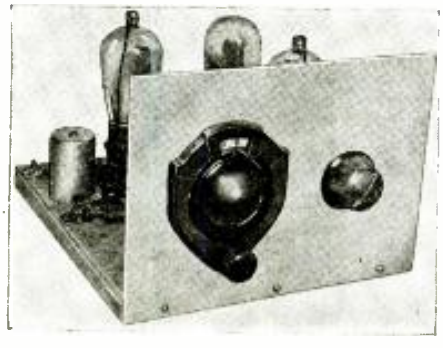


Fig. A
Front view illustrating panel layout.

The set has been laid out to be constructed on the same panel and baseboard as the previous one—although this time the batteries will have to be put elsewhere as the set occupies the entire baseboard. The first thing to do, therefor, if you have built the previous set, is to clean everything off the baseboard, unsoldering all wires and cleaning out all connection lugs.

For those of you who are starting "from scratch" of course the first thing to do is to cut the panel and base to size, drill the panel with mounting holes along the bottom and for the tuning condenser and potentiometer, then mount it on the baseboard, after which the condenser and potentiometer can be put in place.

Next, screw all parts down to the baseboard. The locations are very clearly shown in the back view (see Fig. B). On the extreme right is the input choke, next to this the type 34 R.F. tube, on the left the type 33 output tube. Next to the panel the socket to the right is for the coils and to the left for the type 32 detector tube. Mount the seven fahnestock clips as shown—two on the right for antenna and ground, three across the back for "B" battery and phones, and two near the panel on the left for the "A" battery.

Wire up the filament circuit, being sure to include the switch which is an integral part of the potentiometer specified in the circuit—and don't forget a wire connecting the rotor lug of the tuning condenser to the negative filament line. Then, starting with the R.F. tube, wire up the remainder of the circuits going to each socket in turn—*completely*—before proceeding to the next; in other words, wire up the circuit in the same sequence as a signal proceeds through it, and the chances of making a mistake or leaving something out are then greatly minimized. Be sure, also, that the shield can of the R.F. choke, L1, is grounded.

Keep all leads as short and direct as possible and be sure to make good soldered joints. Perhaps some of you who have followed this series grow tired of this constant repetition of the advice to make good soldered joints and the insistence on a definite plan and sequence in construction; but rest assured that no single factor makes for smooth and consistent performance of radio equipment more than solidity, and no single factor helps to prevent mistakes more than systematic methods of doing things.

Operation

After you are sure that every wire is in its place, and its correct place, plug in the tubes and attach the "A" battery;

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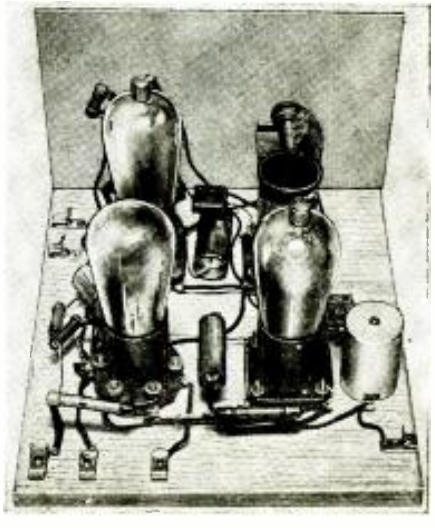
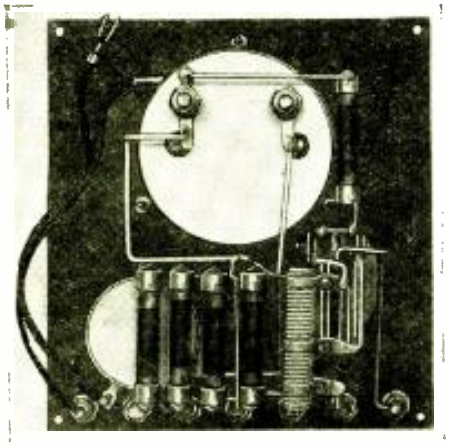


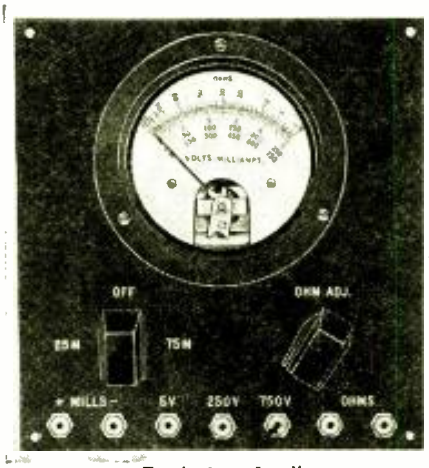
Fig. B
Rear view showing location of parts.

THE KNOCKABOUT TESTER

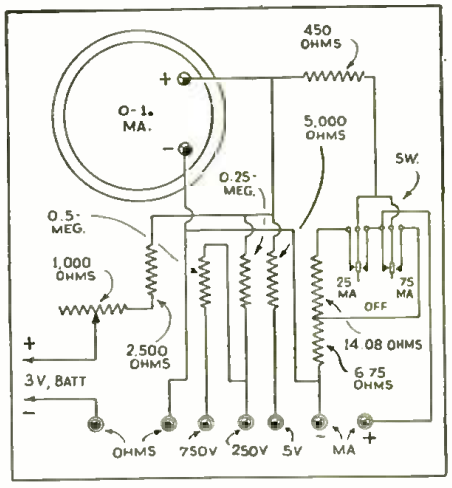
JACK GRAND*



Rear view—showing assembly



Front view of unit



Schematic circuit of the tester

THERE ARE occasions when a Service Man or an experimenter would like to use a compact and inexpensive volt-ohm-milliammeter in place of his regular tester. Many reasons can be advanced for this desire; such as a lack of space, or that the test does not require extreme accuracy, or the fact that one or two tests are to be made in a hurry.

The knockabout tester was designed to meet these demands, and supplies the following ranges:

D.C. V. ..... 0-5, 250 and 750
D.C. Ma. .....0-25 and 75
D.C. Resistance ...0-200,000 ohms

* Chief Engineer, Sun Radio Co.

It is fortunate that lately, some manufacturers have released inexpensive 1 ma. meters. These meters are guaranteed by the manufacturers to have an accuracy of 2 per cent, incorporating various voltage ranges at 1000 ohms per volt.

The meter selected was a Beede 1 ma., 3¼ in. meter, having an internal resistance of 50 ohms and is furnished with a scale that allows for the ranges described.

The resistors used as multipliers are of the metallized type that the average Service Man has in quantities. If the resistors are purchased from good manufacturers, some can be selected that may be within 2 per cent accuracy, and will maintain this accuracy for a reasonable period of time.

For current readings, an Electrad 10 W. wire-wound resistor with an extra clip was used. To make calibrations easier, a resistance of 450 ohms was placed in series with the meter. Therefore, the shunt resistance for the 25 ma.

(*Continued on page* 626)

A COMBINED P. A. AMPLIFIER AND BROADCAST TUNER

PART II

LEON J. LITTMANN*

UP TO THE present time it has been practically impossible to place the phono.-microphone matching transformer on the same chassis as the power amplifier and power pack proper, without introducing an objectionable hum into the loudspeaker. This was invariably the case, due to the impracticability of shielding the input tranformer well enough from the strong magnetic fields of the power transformer. However, *this unit does not use a power transformer.*

The universal input transformer, T1, has not only a winding for a double-button or two single-button microphones, but also has a high-impedance phono. winding, BP4, 5, 6 and 7, of 3,000 ohms, tapped at 500 and 200 ohms, to permit the use of practically any phono. pickup or line. In other words, any phono. pickup may be connected directly to this universal input transformer. The various input impedances permit any phono. pickup to be correctly matched, enhancing thereby the possibility of distortion-free and life-like reproduction with maximum gain. Similarly, a double-button microphone, or two single-button microphones may be correctly matched when connected to the corresponding binding posts BP1, 2, 3, after a 3 or 4½

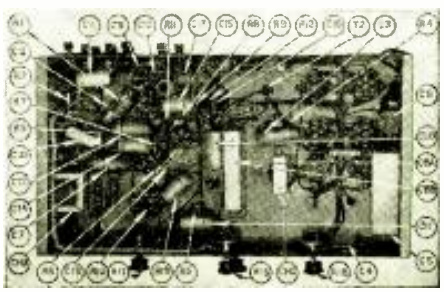


Fig. 2
Internal wiring and layout

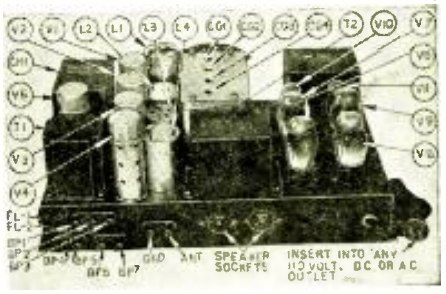


Fig. 3
View showing layout of equipment

V. "C" battery is connected to the two flexible extension leads FL1, FL2. No precaution in respect to polarity needs to be taken. The input signals to the phono.-microphone amplifier are fed from the universal input transformer through a .5-meg. tapered attenuator, R16, directly into the grid of the first triode section of the 79 tube. Its plate, P1, is resistance-capacity coupled to the second triode (contained within the same glass envelope) of the 79 twin audio tube. As these two triodes have a common cathode and cathode resistor, the bypass condenser across it, C6, should be a 50 mf. 25 V. electrolytic condenser to prevent the 79 tube from breaking into oscillation. Switch Sw.1 and R16 are ganged, and when snapped on the switch

(*Continued on page* 630)

* Chief Engineer, Coast-to-Coast Radio Corp.

READERS' DEPARTMENT

A department in which the reader may exchange thoughts and ideas with other readers.

NOISE FROM THE BRAKES?

Editor, RADIO-CRAFT:

I read RADIO-CRAFT regularly, especially the Operating Notes section and have copies on file since the first copy that I found on sale at a newsstand which was in September, 1930.

We specialize in installing and servicing automobile radio equipment and having seen two articles in RADIO-CRAFT regarding a noise in some cars even with the motor shut off, but coasting. I since have found this same trouble in three different cars and stopped it by adjusting the foot brakes until there was very little clearance, so that by just touching the brake pedal the brakes start to take hold.

I hope that this hint may help some other Service Men who have this trouble.

M. E. GREEN,
1017 *E. Cache la Pandre,*
Colorado Springs, Colo.

This condition has been reported by several readers, besides Mr. Green. The only explanation we can offer at the moment is that there is probably a static charge built up in the brake drums, and that readjustment of the tension permits this charge to be grounded in the metal parts of the chassis of the car which has considerable capacity to ground.

CHINA ON THE BROADCAST BAND!

Editor, RADIO-CRAFT:

I have just recently started reading your magazine. I am a DX fan and would like to submit my list of stations.

I have logged a total of 372 stations on my 5 tube mantel radio. I have heard from at least one station in every state (except one) in the U. S. A. The exception is Florida. Also, I have heard from all but 2 provinces in Canada. The exceptions here are New Brunswick and Prince Edward Island. I have heard quite a lot of 100 W. stations from all over the U. S. and Canada. Among my best Canadians are CHLP, Montreal, 100 W.; CHRC, Quebec, 100 W.; VAS, Halifax, 2,000 W.; 10AB, Moose Jaw, 25 W.

I also have many foreign stations. These included eight from Australia. They are: 2CO Corowa; 3AR, Melbourne; 5CK, Crystal Brook; 5CL, Adelaide; 4QG, Brisbane; 3LO, Melbourne; 4RK, Rockhampton; and 2BG, Brisbane.

Also, I have 10 from Japan: JOTK, Matsui; JOJK, Kanazawa; JOHK, Sendai; JODK, Keijyo; JOFK, Hiroshima; JFAK, Tahoiku; JOBK, Osuka; JOGK, Kumamanto; JOIK, Supporo; JOAK, Tokyo.

The mixed stations I have received are: CMW, Havana, Cuba; CMK, Havana; COMB, Harbin, China; COMK, Mukden, China; YV1BC, Caracas, Venzuelo; HRB, Tegucigalpa, Honduras; RUS, San Salvador; ZL2YA, Wellington, New Zealand; WOWR, St. Johns, Newfoundland: WKAQ, San Juan, Porto Rico; KGU, Honolulu; KGMB, Honolulu; KFQD, Anchorage, Alaska; KGBU, Ketchikan, Alaska; KZ1B, Manila.

I have also received 18 Mexican stations. I tuned in on Australia from 12:00—1:45 A.M. Japan comes in best from 1:30 — 3:30 A.M. China was received at 4:15 A.M. Alaska comes in at midnight to 1 A.M.

The Japanese and Chinese do not have English call letters except on special occasions. I logged most of my call letters by referring to log books.

ALDEN FRANCESCINI,
Cumberland, B.C.,
Canada.

DO YOU AGREE?

Editor, RADIO-CRAFT:

I have been a reader of RADIO-CRAFT for quite a while and I have a couple of suggestions which might interest you.

I think it would be an idea to use the back of the service Data Sheets for some of the full page ads so we can cut them out without ruining the rest of the articles.

Why not keep the articles together instead of starting them in the front of the book and just as we get interested making us go hunting in the back for the rest of it. Why not continue them on the next page? If they do not fill the page, it would be a simple matter to fill it with ads. This would save a lot of temper, Hi! Also, it would give the advertisers a break as their ads would be spread through the book instead of being all crowded in the back.

I would like to see in the RADIO-CRAFT library a book devoted entirely to formulas for measuring or figuring inductance, capacity, resistance, impedance, transconductance, Ohm's Law, etc. I think such a book would be very popular with the experimenter and Service Man. Such a book should contain coil-winding data for short, long and intermediate waves. If it will do any good, I will send you the formulas I have collected.

FRANK T. LAMB,
305*A Madison Ave.,*
Atlantic City, N. J.

RIGHT FROM THE SHOULDER

Editor, RADIO-CRAFT:

I am sending a copy of a short talk given by me at a recent meeting of the local chapter of a Service Men's association to which I belong. If you see fit to publish this item I will welcome comments on it.

All technicians charge a fee commensurate with the initial and current investment in their knowledge and ability. Text books, instruments with which to work on the ever changing circuits and tube types, technical magazines with which to keep posted on new developments, transportation, education, etc., these are all taken into consideration by the medical technician and what is a first class radio man if not a technician?

A radio technician is as much entitled to a fair return on his investment as is the medical, surgical, dental and law technician. Therefore I believe that the radio technician should adopt a code of ethics and price standards whereby he is assured a fair and proportionate return on his investment to which he is rightfully entitled.

There will always be the "shyster" and "quack" to contend with and the "cut-rate" tube changer and tin-smith who calls himself a technician just as there are quacks and shysters among the other professions. Drastic measures should be taken at once to eliminate this scourge. Some such method as outlined in the proposed ordinance which

(*Continued on page* 634)

A DIRECT-COUPLED P. A. SYSTEM

A complete and efficient rental or demonstration portable 10 W. push-pull set-up.

HUBERT SHORTT*

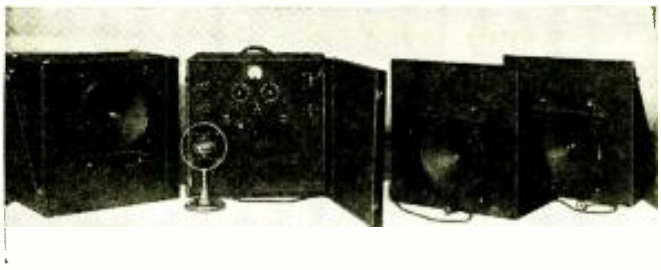


Fig. A
The complete equipment of the portable P.A. system

WITHIN the past few years, the demand for portable systems has increased tremendously. Many radio Service Men have taken advantage of this situation, increasing their profits to a point where they were able to specialize in this particular field and leave the less profitable types of work to slow-moving competitors.

Right now, the market is still wide open and there is no excuse for delay in getting started. Portable P.A. systems are required by lecturers, vaudeville acts, political speakers, fraternal orders, for demonstrations of all kinds, etc. Once a demonstration of a P.A. system has been made, a sale is readily assured. No special knowledge is required.

Modern P.A. systems are fool-proof and are exceedingly easy to operate. The particular system described here has been designed especially for use wherever a compact and portable P.A. outfit is required. Due to its compactness and light weight, it may be moved quite easily from place to place. Its output of 10 W. permits it to be used in theatres, dance halls, and for outdoor gatherings up to 3,000 people.

The complete system is built into two handy cases, one of which contains the amplifier and mixing panel, and the other two dynamic speakers to assure adequate sound distribution.

The mixing panel incorporates a master switch with pilot light, a mike current control, a Weston mike current meter, two jacks for breaking into either button line for measuring button current, a master gain control, a tone control and a phono-mike changeover switch. All connections—microphone, phono. pickup and speakers—are made from the front of the panel. In this way, complete control is available di-

(*Continued on page* 614)

* Chief Eng'r, Wholesale Radio Service.

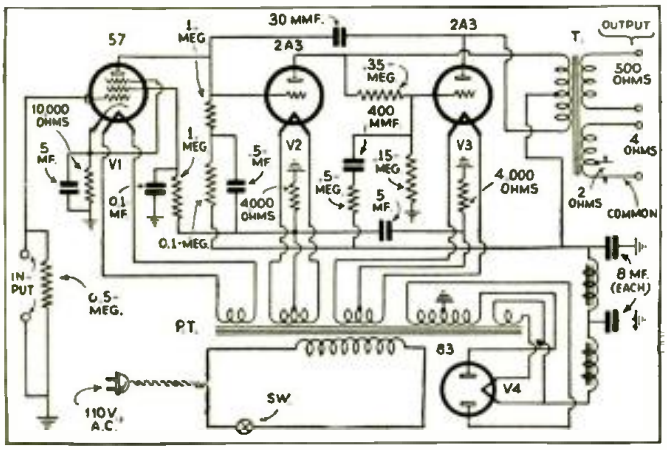


Fig. 1
The schematic wiring diagram of the amplifier

ARE HEADPHONES COMING BACK AGAIN?

IT seems that radio fads or fancies are cyclic in that Mr. John Radio Public is bringing back into use receiver instruments that have gone out of popularity some time ago—at least where headphones are concerned. And the reason for the present resumed popularity of these ear clamping devices is obvious when we consider the renewed activity of DX fans. The possibility of obtaining remote stations by means of short-wave reception, the improved efficiency and increased power of present day broadcast stations, more sensitive and improved receivers, are all the potential reasons for the reincarnation of the "distance getter" and consequently the motivating force behind the increase in sales of headphones.

This adapter, while slightly larger than the average, incorporates added features.

Distance can best be received in the early hours of the morning, even on short waves. This is due to the time difference that exists where stations are remotely located from the receiver, and also due to the "signing off" of local stations (most of them, anyway) around midnight, which removes station congestion all over the receiver dial, and as a result permits going after out-of-town reception. However, there's the wife, baby, or rest of the family to consider, whichever the case might be, and so phones must be used unless an anesthesia is administered to those who retire early so that they might not be disturbed later. Then again, some signals will be received very feebly, necessitating the use of phones if the program or the station call letters is to be heard clearly.

Not all sets have provision for this item, due to the waning popularity of phones in the past few years, up until this time. While there are many who have a sufficient knowledge of radio circuits and are therefore able to make the necessary circuit changes and additions, there are still a considerable number

who are not equipped with this knowledge, or still another class who would hesitate to make any alterations on their receiver for fear that the changes might in some way diminish the efficiency of the set. While there is no real ground for fears of this nature—providing the slight changes necessary are done properly, nevertheless there is no need for all this work since there are many devices or "adapters," now on the market.

One of these units that is very much different from the conventional type and

(*Continued on page* 626)

THE ANALYSIS OF RADIO RECEIVER SYMPTOMS

OPERATING NOTES

WHAT THIS DEPARTMENT IS FOR

It is conducted especially for the professional Service Man. In it will be found the most unusual troubles encountered in radio service work, written in a practical manner, by Service Men for you.

Have you, as a professional man, encountered any unusual or interesting Service Kinks that may help your fellow workers? If so, let us have them. They will be paid for, upon publication, at regular space rates.

CROSLEY 124

A CROSLEY model 124 presented the greatest number of ills heretofore encountered in any one particular radio set. The most prominent ailments appeared to be lack of volume, persistent fading, and a rasping reproduction of sound with frequent low-frequency howls.

A voltage analysis disclosed abnormal plate and screen-grid voltages on the R.F. and I.F. tubes. This trouble was traced to an erratic 15,000 ohm resistor feeding this section.

The fading was then traced to the condenser block containing four .1-mf. bypass condensers. Replacing one section at a time, the entire unit in this case had to be replaced before the fading subsided.

And so, by the process of elimination, all that remained to be remedied was the faulty reproduction and accompanying howl. Since this was obviously caused by the dynamic speaker, this member was put into operation in a dark room for observation. (Examination of the voice coil had previously disclosed the cause of the rasping sound to have been a "rubbing voice coil," but eliminating this defect failed to cure the howl, therefore the "dark-room" experiment. Even though the voice coil appeared to be perfectly centered, a series of tiny sparks were seen each time a howl occurred. This same kind of howl could be simulated by allowing one of the bare voice-coil leads to intermittently touch the speaker chassis, thereby creating a low-frequency buzzer action. A more careful examination of this voice coil revealed the cause of the entire difficulty to be in a distorted coil. The innermost end of the coil-form proved to be larger in diameter than elsewhere along its length. During the coil's outward excursion, when reproducing a tone of low-frequency, the above mentioned buzzer action would take place with its resultant howl. A new cone replacement overcame this difficulty and made the set perform normally.

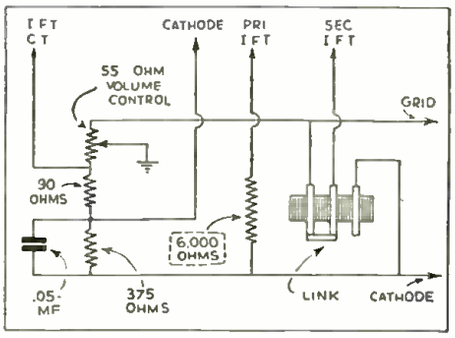


Fig. 2
Overcoming low volume in Radiola 66.

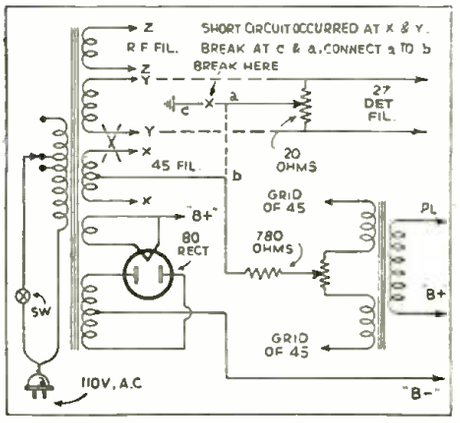


Fig. 3
Removing hum and distortion in Edison R4-R5.

PHILCO 30

SINCE the bakelite encased condensers manufactured and used by Philco in their battery and electric models appear to be such persistent offenders, it naturally follows that an initial check-up of these units is not amiss, usually resulting in the discovery of the offender.

The battery model Philco 30 is no exception to this rule. When radio signals do the disappearing act in this model, i.e., fade out regularly, the trouble can nearly always be traced to one or more of the .05-mf. blocking condensers in the R.F. stages, most often the first as indicated in the accompanying schematic part-circuit diagram, Fig. 1. The offending unit can usually be made to "act-up" by exerting a slight pressure on one or the other of its connector lugs with the set in operation. A proper replacement obviously effects the cure.

RADIOLA 66

A LACK of volume in the Radiola 66 superhet. can often be traced to the red and yellow bleeder resistor connected (as indicated in Fig. 2) to the primary of one of the I.F. transformers

(*Continued on page 622*)

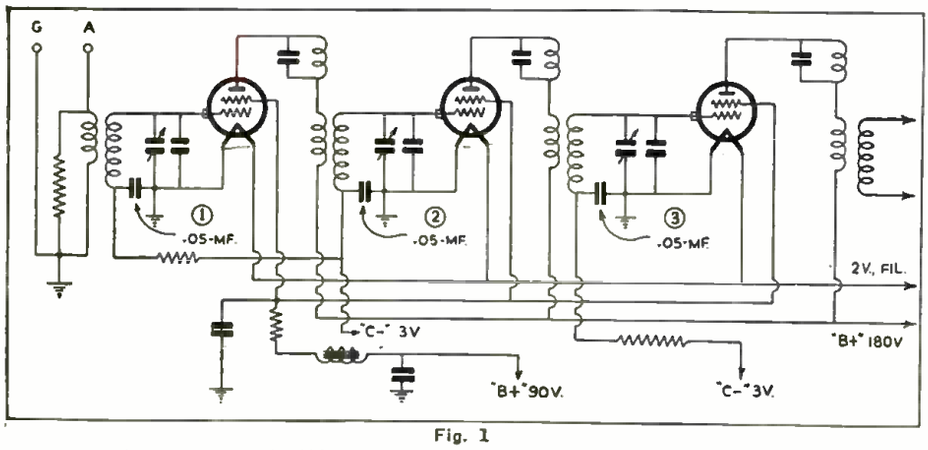


Fig. 1
Intermittent reception in Philco 30's is sometimes caused by defective bypass condensers.

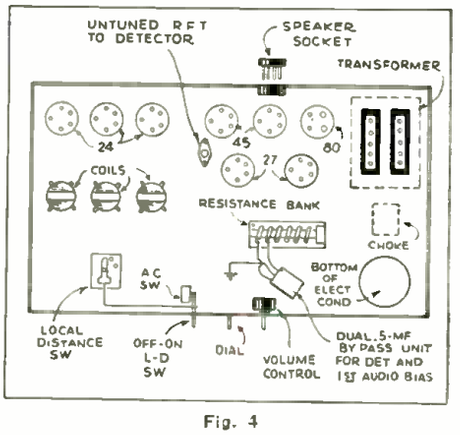


Fig. 4
Crosley 42's, dual bypass unit causes grief.

RCA VICTOR MODEL 261, 555 TO 107 METER, DUAL-RANGE, 10 TUBE SUPER.

(Incorporates tone-compensated volume control; A.V.C.; interstation noise suppression; push-pull A.F.; electrostatically-shielded power transformer; and individual treble and bass tone controls.)

A frequency-range switch is the top control. Turn it clockwise for the 540 to 1,500 kc. broadcast band; using the range numerals, the dial scale reads directly in kc. for this band. Turn clockwise for the 1,400 to 2,800 kc. bands (services 1, 2 and 3, below); using the small numerals at the bottom of the dial, add 2 ciphers to obtain the kc. reading. The three services mentioned above are as follows: (1) police calls—1,574 to 1,712 kc., and 2,400 to 2,500 kc.; (2) amateur phone—1,800 to 2,000 kc.; (3) aviation phone—2,500 to 2,800 kc. (Strong local stations in the broadcast band may be sometimes heard at more than one point on the dial, when the frequency-range switch is set for the 1,400 to 2,800 kc. band.)

At the lower left of the panel is the silent-tuning control; next, right, the bass and treble tone controls; and, extreme right, the combined off-on and volume control.

With the silent-tuning control set in the extreme counter-clockwise position tune to a point at which no station is heard within several scale divisions, then turn the silent-tuning control *clockwise* until the background noise just disappears. This adjusts the inter-station noise suppression circuit.

Next, without touching the silent-tuning control accurately tune the receiver to a desirable program and adjust the volume control to a fairly low value. Then, tune the receiver accurately to a position midway between the points on the dial at which the program becomes unintelligible or disappears. Finally, re-adjust the volume control for the desired sound level and vary the two tone controls to obtain the desired tone shading.

To reduce the high-frequency (treble) response, or to decrease the background noise interference *on station settings*, turn the right-hand or treble-control knob counter-clockwise. To reduce the low-frequency (bass) response, or to decrease low-pitched hum present on the signals of some stations, turn the left-hand bass-control knob clockwise.

All resistance values, including those of coils, are shown in parentheses.

Tube operating voltages are as follows. The voltages are read with the volume control at minimum, no signal being received, and a line potential of 120 V.

Tube Type	C.-G. Volts	S.-G. Volts	Plate Volts	Plate Ma.
V1	3	100	230	7
V2	8	95	220	2½
V3	—	—	105	6
V4	7½	100	225	2½
V5	7½	100	225	2½
V6	20	—	0	—
V7	17	—	250	1.2
V8	18	255	245	33
V9	18	255	245	33

The recommended outdoor antenna length for this receiver is from 25 to 75 feet, including lead-in and ground wire.

The power consumption of this set is 120 W. The undistorted power output is 4 W.

Four adjustable condensers are provided for aligning the R.F. and oscillator circuits. Lack of alignment may result in poor tone quality, insensitivity, poor A.V.C. action, and possible inoperation of the receiver. To align the R.F. circuits use a service oscillator having A.F. modulated signals of 600, 1,400, and 2,440 kc. The output meter may be a current-squared galvanometer connected to the secondary of T2 instead of the voice coil; a 0.5-ma. meter connected in the plate supply circuit of V7; or, a low-range A.C. voltmeter connected across the reproducer voice coil. Plug a dummy, type 56 tube (a "good" 56 from which one heater prong has been removed) in place of V6.

First check the chassis and carefully ascertain that the dial pointer reads exactly at the first line on the scale when the rotor plates of the tuning condenser unit are fully meshed. Then, couple the 1,400 kc. output of the service oscillator to the antenna connection, turning the range switch counter-clockwise and setting the dial exactly at 1,400. With the output meter connected to the set, place the volume control and suppressor control, if noise level will permit, at its maximum position and adjust the oscillator input for a moderate output meter reading. Adjust the circuits of V3, V2 and V1, in this order, for maximum deflection of the output meter.

To align the high-frequency band, adjust the service oscillator to 2,440 kc., set the dial at 1,200, and turn the range switch to the clockwise position; align the condensers on the selector switch for maximum output meter reading.

Now, set the service oscillator at 600 kc. and align C9 for maximum deflection of the output meter while rocking the tuning condenser gang back and forth.

A similar series of procedures is to be followed with the service oscillator adjusted to 1,400 kc., to complete the alignment of the R.F. circuits. Note that I.F.T.2 is untuned. The tuned I.F. transformers are broadly peaked.

Still using an output meter, and a dummy type 56 tube, couple the 175 kc. output of the service oscillator to the control-grid of V2 and to ground, after having removed V3 from its socket. The chassis should be connected to a good ground. Adjust the oscillator output for maximum output meter deflection, with the receiver volume control at maximum. Adjust the I.F. trimmers in the following order: C22, C21, C15 and C14; repeat this series of procedure until maximum deflection of the output meter is obtained.

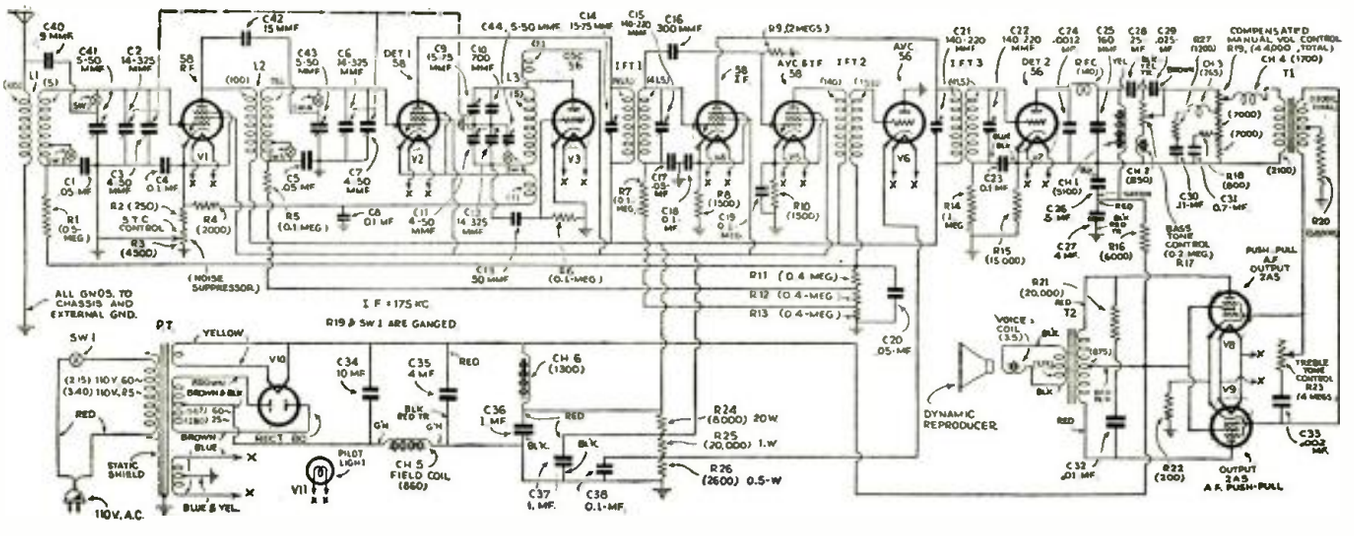
Due to the inter-locking of adjustments it is good practice to follow the I.F. adjustments with the R.F. and oscillator adjustments.

Do not apply power to this receiver until all the tubes are in place. Make certain that all the tube shields are rigidly in place. Also, check the spring connectors of the short, flexible (control-grid) leads and make sure that they are securely attached to the dome terminals of the correct tubes; it is important that the adjacent green and black leads be connected correctly—that is, not reversed. The shield-can lids must be securely in place.

The resistors on the resistor board are placed on this board in the following order: R25, R26, R11, R12, R13, R7, R2, R4.

Note that the tuned secondary of L3 is permitted to "float" without connection to any other part of the circuit, and results in extreme frequency stability.

The audio system of this receiver merits special consideration. If it becomes necessary to replace any of the components, extreme care should be taken to use high-quality replacement components of exactly the specified values.



EMERSON MODEL 678 "AUTO-DYNAMIC" 5 TUBE SUPERHETERODYNE

(Incorporates delayed A.V.C.; push-pull A.F. amplification; full-wave, tubeless "B" supply; tone control; automatic tone-compensated volume control; interstation noise suppression.)

Recommended as a self-contained automobile and motorboat superheterodyne receiver, this set has a sensitivity of less than 1 microvolt-per-meter; the battery drain is only 4.8 A. The maximum output is 4 W. Following are the voltage readings for this receiver, all voltages being measured to ground:

Tube Type	Cath. Volts	S.-G. Volts	Plate Volts
V1	3.25	80	205
V2	3.25	80	205
V3	4	80	205
V4	16	205	195
V5	16	205	195

Use a high-resistance voltmeter. The figures given are average values taken with a fully-charged storage battery and with no signal being received. The field coil has a resistance of 6 ohms; the potential across the coil is 6 volts.

If the positive terminal of the storage battery is grounded no changes are necessary in the receiver when making the initial installation. If the negative terminal of the battery is grounded a slight change in the receiver connections is necessary. Remove the top screw and loosen the bottom screw holding the serial number plate to the right side of the receiver cabinet. Tip the plate down and reverse the red-and-black-marked spade lugs so that the black-marked lug will be on the top, and the red-marked lug will become the lower one. Test for battery polarity by using a low-reading D.C. voltmeter. When connecting the twin-conductor, shielded cable to the battery the black wire always connects to the grounded terminal of the battery, and the yellow wire to the "hot" terminal, regardless of battery polarity. Ground the cable as often as possible along its entire length, and run the cable as far as possible from the engine compartment and all wires which might act as interference carriers.

Noise suppression resistor R1 is adjusted at the factory for minimum suppression. If the interstation noise is considered too high (this may be determined best by tuning in an average station at a setting of average volume, then detuning the dial slightly, without touching the volume control setting, so that no signal is received), adjust R1 clockwise sufficiently for best interstation noise suppression. Adjustment beyond this point may de-sensitize the receiver to weak stations although not affecting strong ones.

Tone control R2 is adjusted at the factory, for full-register reproduction, to the best setting recommended for reception of local programs in closed cars; turning the control clockwise brings up the low tones and is recommended for the reception of musical programs in open cars (incidentally, the position recommended for the reduction of static, and other high-frequency interference).

Do not adjust R2 clockwise more than necessary as definition of speech may be lost due to the attenuation of the higher frequencies caused by the acoustic characteristics of the interior of the car. To align the I.F. circuits connect the oscillator output to the control-grid cap of V1 and the chassis; connect a rectifier-type output meter across the voice coil of the speaker or the primary of T1. Then, ground the antenna lead, and turn the tuning dial so that the only signal received, with the volume control at maximum, is that of the service oscillator. Align for maximum output, using a non-metallic screwdriver.

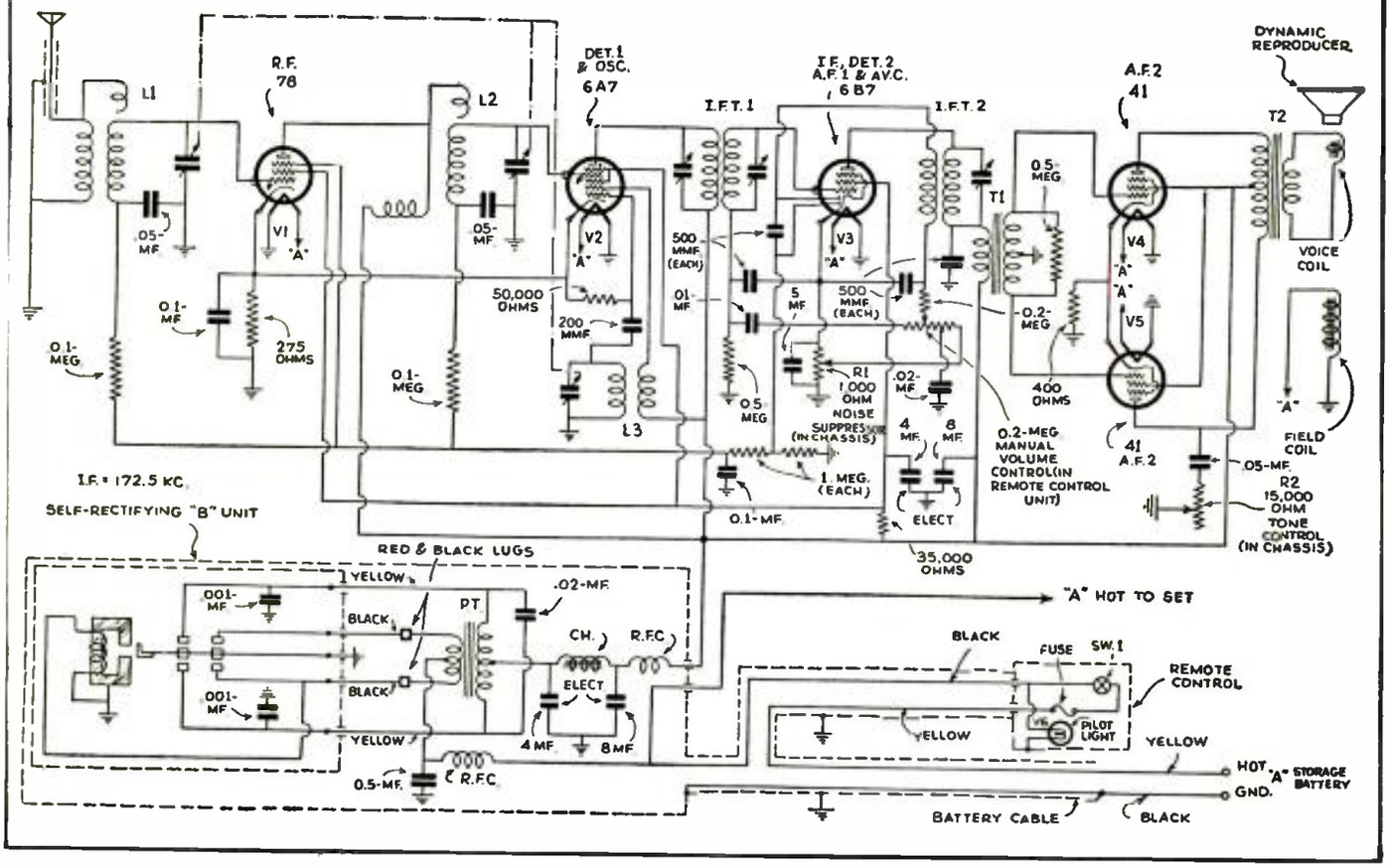
To align the R.F. section couple the oscillator to the antenna lead and chassis. Align for maximum output, using a weak signal of about 1,400 kc.; re-align the trimmers once or twice.

A slight buzz or vibration of the "B" unit when in operation is normal; lack of this characteristic may indicate a fault in the unit (in which case the output voltage should be checked).

The fuse in the remote control unit is a 10 A. unit. If it burns out, determine the cause before replacing it.

In previous DATA SHEETS and elsewhere in past issues of RADIO-CRAFT, the suppression of car radio noise has been given detailed consideration. The following data supplements this information. Interference may be generally classed as (1) body noise; (2) brake static; (3) hash. Body noise may be checked by permitting the car to coast with the motor shut off. Eliminate the fault by tightening all body bolts and bonding metal parts which are not thoroughly grounded. Brake static is a peculiar noise developed in the brakes and can be eliminated by cleaning and adjusting the brakes, and bonding all metal parts which are not thoroughly grounded. Hash is a term applied to interference caused by vibrator-type "B" units. It may be picked up by either the antenna of the set, or the set cables. Complete shielding and frequent bonding of the antenna lead-in will eliminate this type of interference.

Coils L3 and I.F.T.1 are a composite unit. The condenser furnished with the noise suppression kit is a 5 mf. unit.



RADIO-CRAFT'S INFORMATION BUREAU

SPECIAL NOTICE TO CORRESPONDENTS: Ask as many questions as you like, but please observe these rules:

Furnish sufficient information, and draw a careful diagram when needed, to explain your meaning; use only one side of the paper. List each question. Be SURE to sign your name AND address.

Those questions which are found to represent the greatest general interest will be published here, to the extent that space permits. At least five weeks must elapse between the receipt of a question and the appearance of its answer here.

Replies, magazines, etc., cannot be sent C. O. D.

Inquiries can be answered by mail only when accompanied by 25 cents (stamps) for each separate question; answers are subject to subsequent publication, if considered of exceptional interest.

Other inquiries must be marked "For Publication."

"TREASURE LOCATOR"

(249) Mr. L. C. Wright, Springfield, Ohio.

(Q.) Although I have carefully built up the "treasure locator" described in the July, 1933 issue of RADIO-CRAFT, and checked over the instrument as per the additional information in the Information Bureau of the November, 1933 issue, the device seems to lack sensitivity. Can you make any further suggestions?

(A.) We are fortunate in being able to print below the following interesting letter received from Mr. Iven Gill of Pueblo, Colo. Although the directions published in the July and November issues of RADIO-CRAFT have been given official sanction by Mr. Sarver, the following reference data may prove useful in checking the operation of balky models.

"Having built the metal locator described in the July, 1933 issue of RADIO-CRAFT and not being successful in getting my apparatus to function in the floating oscillator circuit shown, I rewired the circuit slightly as shown in Fig. Q. 249. When completed, using this Hoffman balanced Colpitts circuit, the outfit worked satisfactorily on first trial, "detecting" metal at a distance of 6 feet in the open air and in the ground at a distance of about 3 feet! The general construction and mounting of parts remains the same as in the original article; I have not tried the later circuit given in the November, 1933 issue."

"THE 'PHONOSONE' "

(250) Mr. J. A. Parrisch, Baton Rouge, Louisiana.

(Q.) Is the Osophone a practical device for use as a deaf aid? (This instrument is designed to be gripped by the teeth of a person who is hard of hearing, its vibrations being "heard" through the teeth.)

(A.) Although the Osophone as originally designed functioned very satisfactorily it was inconvenient to use it and for that reason the "Phonosone" has been designed; a description of this later unit has been published in the March, 1934 issue of RADIO-CRAFT. For those who may be interested in experimenting with this idea there are given in Fig. Q.250, two improved circuits for connecting the Phonosone to the radio set.

At A are indicated the connections for a single output tube; and at B, the diagram to be followed if the output tubes are in push-pull. When the switch is in position *a*, only the "unit" is being used; at *b*, only the regular dynamic reproducer in the set is used; in neutral position *c*, both units are inoperative. The switch is of the 12 leaf, 3 position, anti-capacity type.

REVAMPING OLD SETS

(251) Hawley Fleming, San Francisco, Calif.

(Q.) As I would like to rebuild a Sparton model 40 automobile radio set for greater sensitivity and volume, kindly furnish all information regarding the necessary resistors, condensers, and applied voltage values to use the following tubes. In place of the original type 26 tubes, I would like to use the type 39, and two type 89 tubes in push-pull in place of the 38.

(A.) To successfully incorporate the tubes mentioned it would be necessary for you to obtain an entirely new set of coils, tuning condensers, resistors and fixed condensers. The cash outlay and labor involved would outweigh the improvements that might be secured.

TYPE 58 TUBE

(252) Mr. Louis Giordana, Arlington, New Jersey.

(Q.) Isn't there some mistake in the connection of the type 58 tubes in the diagram of the "Ultra-Modern Super" shown in the October, 1932 issue of RADIO-CRAFT? A schematic shows the suppressor-grid connected to the cathode *internally*, whereas, the tube data in the July, 1933 issue shows the connection to be *external*. I have made a continuity test between cathode and suppressor-grid and there is no connection.

(A.) The suppressor-grid connection of the type 58 tube should have been shown as being made *external* to the tube, as indicated in the RADIO-CRAFT Tube Chart to which you refer.

SUBSTITUTING TUBES

(253) Mr. Arturo E. Govin, Habana, Cuba.

(Q.) I beg to refer to your editorial published in the January, 1934 issue of RADIO-CRAFT, suggesting the substitution of the type 27 tubes by the new 56; and, the type 24 tubes by the new 57 or 58 tubes, and others.

In the first place, I hardly see how a tube of higher plate voltage can be used instead of one of lower plate voltage as is the case with the new 57 tube and the old 24 tube. The same applies to the new 56 tube in connection with the old 27 tube. Consequently, I do not think such substitution could be done in a receiver using three type 24 R.F. tubes and one 27 as detector, as we would have available only 180 V. and 90 V. plate voltage, respectively, and if we would like to use three 57's as R.F. and one 56 as detector, we would need to have available 250 V. plate voltage in both cases.

Furthermore, in using the new 57 instead of the old 24 there is an additional connection to be made—the S.G. prong of the 57, which you do not indicate in said article. I presume that this additional connection of the 57 (S.G.) should be made to the cathode of the tube or to chassis, for I understand that leaving open this lead the new tube would be inoperative.

I would highly appreciate your suggestions in connection with the points above referred to.

(A.) In the first place, the editorial was not intended as a technical presentation but merely as a suggestion as to what can be done. The types 56, 57 and 58 tubes are rated at 250 V. on the plate. This does not necessarily mean that you cannot apply less than this amount. If you have 180 V. available this may be applied with excellent success, even though the label on the tube says "Plate Voltage, 250."

In using the 57 instead of the 24, the additional grid should be tied directly to the cathode of the tube, remaining connections being the same.

In connecting these new tubes, of course, you must be familiar with their ordinary usage and arrange your circuit so that it can be accomodated.

"MEGADYNE 'N' "

(254) Mr. G. T. Her, Fanwood, N. J.

(Q.) I have noticed with keen interest the circuit and description of the Megadyne "N" receiver described in the April, 1933 issue of RADIO-CRAFT. I notice that the tickler coil you state is connected in the screen-grid circuit, while the circuit shows it connected in the control-grid circuit. Which is correct?

(A.) The correct connections of the Megadyne circuit are as they appear in the schematic diagram. *(Continued on page 620)*

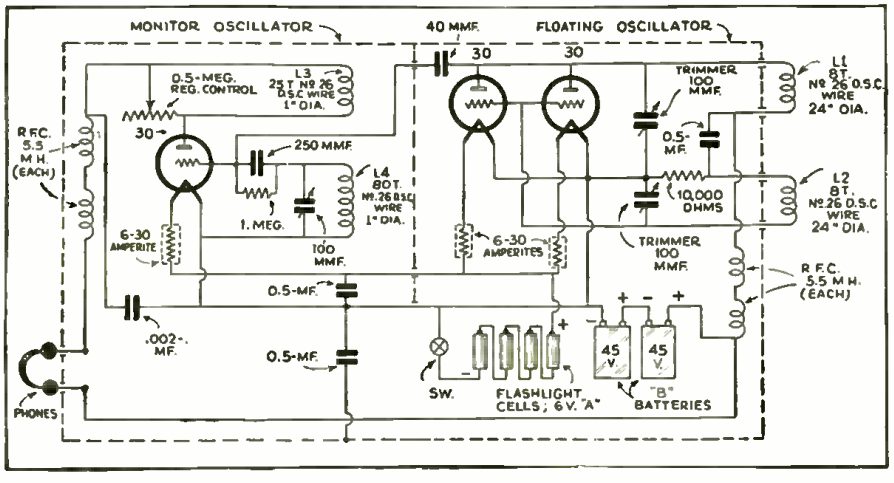


Fig. Q.249
On the left, an improved floating oscillator for "Treasure Locator," to increase sensitivity.

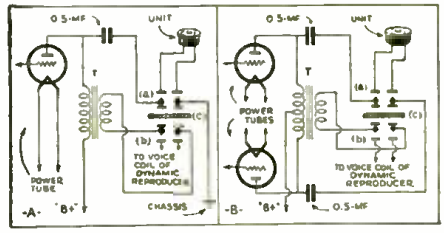
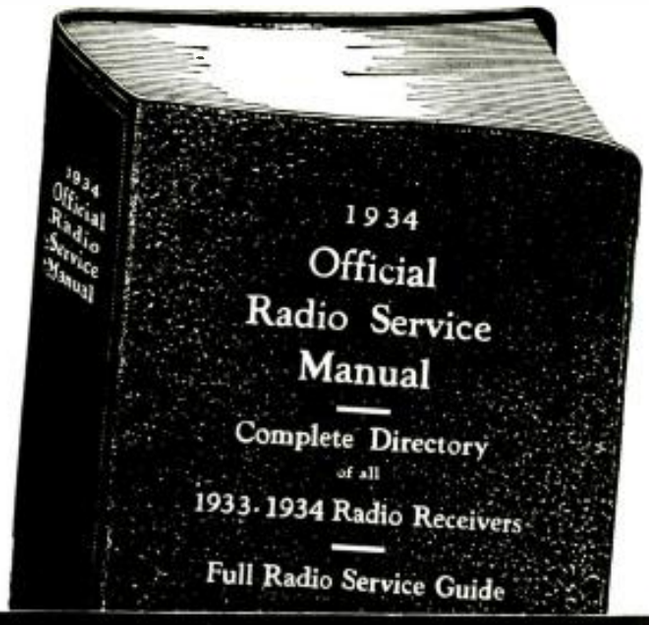


Fig. Q.250
Above, improved circuits for connecting the Phonosone to sets using 1 or 2 output tubes.



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H. F. ADJUSTMENTS

(*Continued from page 593*)

A.C. receivers with filament circuits operated in parallel or separated, the following procedure is recommended:

1. Turn on the receiver for regular operation and tune the set to a station somewhere above 1000 kc. Select a station giving low or minimum volume and adjust the volume control so that the signal will not be entirely eliminated by removing the 1st R.F. tube. If you can find no station with which to attain the adjustment, secure a modulated oscillator, connect its low-output terminal to the antenna post of the receiver, its ground post to the ground of the receiver and adjust the attenuator until the above conditions are realized; that is, the oscillator and receiver are tuned so that the set picks up its signal somewhere above 1000 kc.

2. Remove the 1st R.F. tube from its socket, place a small section of a drinking straw over one filament terminal (these are the larger terminals) and replace it in its socket. Some Service Men use a "dummy" tube having one filament prong detached or one having a burned out filament. Since such a tube may not have the exact internal capacity of the one which must be used in the circuit the first method is preferred.

3. Adjust the neutralizing condenser for the 1st stage, first one way then the other, carefully noting the signal volume as it will come through the tube capacity or the neutralizing capacity if the latter is not correctly adjusted. There will be one point in the adjustment of this condenser where the signal will entirely disappear, if there is no extraneous pick up from the circuit, and this is the correct neutralizing setting. Turn the adjusting screw one way until the signal can just be heard, then in the opposite direction, into the "null" zone until it can just be heard again. Finally adjusting to the exact half-way position between the two points.

4. Follow exactly the same procedure for every R.F. and I.F. stage in the receiver and neutralization will have been attained. To avoid extraneous pick up a distant station is usually tuned in, when fair volume is possible. The volume may be set at any convenient value.

Alignment or Synchronization of Circuits

This information is equally applicable to T.R.F. and superheterodyne circuits and to all of the tuning condensers. To establish the theory and technique of this work clearly in mind we will consider the T.R.F. circuit first.

Each main tuning condenser whether there are 2, 3, 4 or 5 of them in the receiver will usually be provided with a small adjustable condenser in shunt with it and having about ⅛ to 1/10 its capacity value. In many cases one condenser of the gang will not be so provided as the other values will be adjusted to this one thus making it unnecessary.

Adjustments of these "trimmers" as they are called are made as follows:

1. Tune the set to a station near 600 kc., and if no station can be tuned from the lower tuning limit (maximum capacity) to about 1000 kc. setting, use a modulated oscillator tuned to 600 kc. or thereabouts. Ordinarily an oscillator will not be necessary for the average adjustment.

2. Turn the adjustment screw or nut on each condenser in any order for maximum signal output, reducing volume as desired, and noted by ear, as you go.

3. On sets having one trimmer for each tuning condenser—if one or more trimmers show a continuous increase in signal output up to maximum value beyond which the condenser cannot be adjusted—tune the main dial to a slightly lower frequency so that the signal volume is somewhat reduced (about ¼ normal in your judgment) and reset all trimmers for maximum response once again. On models having one less trimmer than tuning condensers this procedure cannot be followed.

4. Now set the tuning dial to some station around 1000 kc. or if necessary use an oscillator as before and repeat adjustment of all trimmers. Little or no re-adjustment should be necessary.

SERVICING "TALKIES"

(*Continued from page 601*)

after the show, and fix up next day's advertising copy together at home before they go to bed.)

It is thus a gentleman of very varied interests who must approve the plan of buying his sound supplies and service from the Service Man, instead of through whatever agency has been providing them in the past.

The Manager of a Chain Theatre

Perhaps the majority of American theatres at the present time are operated as members of small chains comprising, roughly, from three to twenty or thirty theatres, all under one ownership or management. The extremely large chains, including hundreds of theatres, which were the rule a few years ago, have now broken down into these smaller units. Obviously it is far more profitable for the Service Man to deal with a chain, rather than a single theatre, if he can.

There are two ways to interest a chain of theatres; one is to visit its central office. The other is to secure the interest and approval of the manager of the local theatre of that chain.

The writer would suggest that the Service Man first approach his local manager and do business with him directly so far as he can. In this way the Service Man will soon learn, without asking, whether or not the theatre is a member of any chain, and, if so, to what extent the local manager is free to exercise his own judgment in matters of sound service and purchasing. The Service Man can then, if occasion requires, visit the chain's home office with the background of having served one of its theatres satisfactorily in some matters, as a sufficient justification for suggesting other services.

Personnel of a Theatre Chain Office

The Service Man who has occasion to contact the district manager, or executive personnel of a theatre chain, can safely act on the assumption that the psychology of any of those men—with one exception—is that of any manager of an individual theatre.

But, there may be one exception. A chain may have a chief projectionist, or a purchasing official, or some other employee or partner who specializes in maintenance and *is not a showman.* Such a man can be recognized at once by the direct and well-informed interest he will take in the merchandise, prices and services the radio man has to offer. He will call tubes by their code numbers; he will not have to refer to his books to find out what he has been paying for them. There will be no necessity for employing any round-about methods of evoking his interest.

What the Service Man Has to Sell

Everything that has been said so far in this series of articles constitutes no more than an unfortunately necessary preliminary to the meat of the matter: *what the Service Man has to sell.* Without such introduction some of the most valuable of the commodities he has to offer might not be understood by a radio man who happened to be unfamiliar with theatre practices. The list of the services the radio man can sell the manager includes the following:

(1) Help in his advertising;
(2) Help in his ballyhoo;
(3) Equipment and parts of equipment, which the theatre now buys, very often at prices far below what the theatre is accustomed to paying, with a good margin of profit to the Service Man;
(4) Equipment and parts of equipment, which the theatre now does not buy (tube testers, for example) for lack of a technician accustomed by daily habit to the use of such equipment;
(5) Equipment and parts of equipment, which the theatre does not now buy (battery-replacement rectifiers, for example) for lack of a local technician willing to guarantee their installation and servicing;
(6) Insurance against breakdown in the show;
(7) Insurance against prolonged interruption of the show, if a breakdown does occur.

Sell the theatre one item of the above, please the manager and the projectionists, and you will probably be able to sell them the whole list.

RADIO CONTROLS BATTLESHIP

(*Continued from page* 592)

portant in the case of actual battle, to operate guns, discharge torpedoes and operate the smoke screening apparatus.

The principle of distant control steering is simple enough. From a transmitting station, in the same way as in the ordinary wireless telegraphy system, signals of a definite wavelength and order of succession are sent off and taken up by the receiving apparatus of a radio-controlled ship. The weak impulses, when taken up by this receiver, actuate various relays, each of which will respond to only one signal. When the relay in question closes the electrical circuit, it automatically releases the rudder or other required motions.

Great difficulties, however, were encountered in carrying these principles into effect. Moreover, it was only possible to achieve this by combining them with additional means, namely gyroscopic motion. In course of development the gyroscope became the most important part of the intricate transmitting apparatus. Just as an auxiliary compass can be actuated by a gyroscope, so can an automatic ship-steering gear. This possibility has been recognized for years, the best known of such devices being manufactured by Vickers in England and for automatic control of hydraulic installations, in Germany.

In this automatic steering device the helmsman is replaced by a small electric motor. All that is required is that the navigating officer shall set the required course on the steering compass by means of a small wheel, the rest being effected by a small steering compass in conjunction with an electric motor. The latter revolves the formerly hand-operated steering wheel by chain transmission, the ship rudder being adjusted in the usual manner, either hydraulically or by telemotors.

Having evolved the automatic steering gear, the next step was to navigate from a distance. This, at present is done as follows: at the transmitter, the officer sets the required course which the radio controlled ship is to follow. Any momentum of the lever of the transmitting steering mechanism simultaneously changes the electrical contacts and, by this means, the various circuits which in their turn produce the special Morse signals. These signals are taken up by the receiver of the controlled ship, and they operate corresponding relays. The circuits thus closed, set the course indicator on the steering compass which then automatically performs its work. The machinery driving the ship is controlled in the same order of operation on the same principle.

After the steering of the unmanned ships had been mastered, great difficulty was encountered in manning their guns from a distance. Apart from the difficulties of automatic loading, the main problem was sighting and laying the guns (this problem in itself would have been solved had there been in existence any practicable and fool-proof television devices). However, after long experimentation the naval technicians developed a practical gun sighting and laying device which is comparatively simple in operation. In the fuselage of an aeroplane two transparent discs and other sighting arrangements are fitted. These two transparent and circular discs are marked with divisions each of which is numbered. An identical quadrant scale with similar divisions and numbers is fitted in the wireless-controlled ship. From an aeroplane an observer looks through the discs at the target below. The ship to be fired at comes within vision in one of the quadrants, say for instance in No. 4.

The observer sends off signal "4" to the controlling ship in which an officer adjusts the guns in the controlled ship by wireless to quadrant No. 4. The first shell is fired and simultaneously the observer watches (always through the discs) the drop of the shell.

If the shell drops close to the target, the splash would naturally appear in another quadrant of the disc—say in No. 5. He then signals "5" to the ship. The gun is adjusted by wireless to the correct range. Since, however, the aeroplane, the controlled ship, and the target are constantly changing their rela-

tive positions, this aiming operation would be impossible unless the mechanics of the sighting and laying devices eliminated their relative movements. When the radio controlled steering gear is operated directly from the aeroplane, the complicated arrangement of signalling to the controlled ship is done away with, and the range of action of the controlled ship is considerably increased.

The ultimate aim of British naval scientists is now centered in the control of an entire fleet of warships by a single small and fast ship. The experiments to achieve this purpose are carried out with television devices. There is no doubt that in the near future some important announcements will be given regarding these experiments. It then will be possible to send out a fleet of unmanned fighting machines, either a fleet of warships or a fleet of aeroplanes in a surprise attack on the enemy, at whatever distance they may be.

●

DIRECT-COUPLED P.A. SYSTEM

(Continued from page 606)

rectly at the panel. For example, tone and volume can be varied, mike and phono. pickup can be changed, etc.

The case which houses the two speakers serves the purpose of providing bases for the speakers and also serves as a very practical compact carrying case. Special 12 in. cone dynamic speakers are used. These are provided with accurate matching transformers, assuring best performance regardless of the distance from the amplifier. Each speaker is provided with a 50 ft. cable and plug. A special snap-on cover provides adequate protection against damage for each speaker cone during transportation.

If desired an additional pair of speakers may be added to the system and may be obtained in a case to match the others. These speakers are equipped with their own field supply since the amplifier will supply field current for only two speakers.

The amplifier, which is the "heart" of the P.A. system, is the result of a number of years of intensive research. It employs an improved circuit consisting of a 57 tube directly coupled to a pair of 2A3's in push-pull arrangement. The exceptionally high gain of 80 db. eliminates the need for a pre-amplifier stage, for average microphone usage. The high-frequency response of this amplifier is very good, due to the use of a unique method of neutralization. An 83 rectifier provides ample plate current with excellent regulation.

Although the amplifier is rated at 10 W., it will maintain good tone quality at the peak output of 12 W. Rugged, oversize parts are used throughout to provide high safety factors, but nevertheless the entire amplifier unit measures only 12 x 7 x 7½ ins. high. Figure 1 shows the schematic diagram of the amplifier.

Details of the mixing panel can be seen in Fig. A. It will be noted that there are three controls on this panel, two of which are located near the top. The tone control provides a means for compensating for the variation in the voice of the announcer. Thus, if he has a shrill voice, it may be toned down and made deeper or if he has a particularly deep voice, it may be raised to a higher pitch. The tone control may also be used to reduce needle scratch in phonograph reproduction or static in radio reproduction.

The gain control at the right regulates the volume obtainable from the amplifier when used on microphone, phonograph or radio. The design is such that tone quality is not changed regardless of the position of the gain control.

The microphone button-current control regulates the amount of current flowing through the microphone buttons. The meter at the top of the panel is equipped with a plug and cord that may be plugged into either of the two jacks mounted on each side of the current control. This automatically breaks the circuit of each button, permitting a reading of the current flowing through either button. Of the three switches provided, one is for the A.C. supply. A pilot light directly above this indicates whether the current is "on" or "off." A second switch is for the microphone button current. This also is provided with a pilot light. The center switch is a change-over switch to permit the operator to change from microphone pickup to phono. pickup or vice-versa, quickly and easily.

At the right of the panel, a group of three terminals are provided for connecting the two-button microphone. Directly underneath, connections are provided for a high-impedance pickup or a radio tuner output. The radio tuner may be connected directly, without using an A.F. transformer. The two 4 prong sockets at the left are for the speaker connections. The large holes are for the 4,000 ohm fields and the smaller are for two 250 ohm lines in series.

The output impedance of the amplifier is 500 ohms. If desired they may be used as far away as 1000 ft. without frequency discrimination or loss of volume. This is possible because of the low impedance speaker matching used in this particular system.

●

ALL-WAVE 3 TUBE SET

(Continued from page 603)

the tubes should light up with a dull red glow when the switch is turned to the "on" position. Now connect the headphones in place, plug in one of the coils, connect the negative side of the "B" battery and remove all the tubes but the type 33 from their sockets. Flip the positive "B" wire quickly across its post—nothing in particular should happen except a loud click in the headphones. If this is the case, plug in the other two tubes, attach antenna and ground and you are ready for the first test.

The first adjustment that it may be necessary to make will be in regards to feed-back, or regeneration. This makes itself known by a rushing sound in the phones and a whistle whenever a station carrier is passed in turning the tuning condenser. It should be possible to cause this whistle to appear or disappear by turning the potentiometer arm one way or the other with any coil in the socket. If it is impossible to make it disappear then increase the value of the fixed resistor, R6; any value up to several megs, may be necessary here, depending on the tube. If it is impossible to obtain regeneration with any coil the first thing to do is to reverse the connections to the tickler coil, L3. If this doesn't work it may be necessary to decrease R6, although this is hardly likely, the fault probably being in a poor tube.

If, after patiently trying, it is impossible to get satisfactory control on all coils with the potentiometer alone then it will be necessary to add or subtract turns from the tickler winding of the offending coil until it is possible to control it smoothly.

One more value is of a variable nature and determined only by experiment and that is the antenna coupling condenser, C1. It is dependent on the antenna you are using and may be larger or smaller than given, and may not even be necessary at all in some cases. Experience in tuning in all bands and a large number of stations will enable you to set this at its best value.

The 4 mf. condenser marked "optional" in the circuit diagram is helpful in obtaining smooth operation in all cases but is absolutely necessary if the batteries used are old, otherwise the circuit will oscillate violently at audio frequencies.

Tuning for short waves requires patience and experience to produce outstanding results. The main factor is to tune very slowly across the band meanwhile keeping the oscillation control just inside the point of regeneration; you will soon learn to recognize the hiss that indicates this condition—when you hear the whistle that indicates the presence of a carrier you have a nibble and its up to you to fish until you bring it in. And when you do pull in a real "DX" station note carefully the time and the program and send for a verification card, giving this information and not forgetting to enclose return postage. Then when you tell your friends about it you will have the proof at hand to squelch any accusation of stretching the truth.

Theory

For those of you who are interested, a short statement of the reasons for the particular design presented is given. The main

consideration was simplicity, both of construction and operation, hence an untuned input stage was chosen to eliminate another tuning control and the necessity of changing two coils each time a shift was made from one band to another.

Now there is nothing particularly new in an untuned R.F. stage in a short-wave set, it has been done before but due to the lack of a choke which was really efficient over the wide band of frequencies involved it has never been very successful. However, with the choke specified, shown on the wiring diagram as, L1, and which is, in reality, as indicated in Fig. 1, three small chokes wound on the same form and each covering its particular band of frequencies effectively, this objection has been overcome.

Another point is that more than one stage of tuned R.F., especially at the higher frequencies, is rather hard to manage even for an experienced constructor, and hence out of the question for the beginner.

Grid detection was used for two reasons; It is somewhat more sensitive than plate detection and the grid leak made the use of another choke, bad practice for a number of reasons, unnecessary. The A.F. stage was added to get further gain and allow of the use of a loudspeaker on local reception.

Grid bias for the first stage and the power stage is secured from the drop across the two resistors, R7-R8, in the negative "B" line. A type 34 tube was used in the first stage, even though no use is made of its variable mu feature for volume control purposes, because such a tube is less liable to the effect known as "cross modulation" or the riding through of a strong signal on the back, as it were, of a weaker one. Due to the absence of tuning in the input stage this effect is particularly liable to be present.

The necessary parts to construct the set are specified below. Where particular trade names are given it is suggested that they be used, as the units have characteristics making them specially desirable for the particular use to which they are put.

It is suggested that the coils be bought ready wound but for those who would like to try "rolling their own," the data is given.

Coil	Length L2	Space	Length L3	Turns L2	Turns L3	Wave-length
A	1/2"	1/4"	1/2"	5	7	16-30
B	1/2"	1/4"	1/2"	10	10	29-54
C	1/2"	3/8"	1/4"	20	15	54-110
D	3/4"	1/4"	3/4"	52	25	103-252
E	1/2"	1/4"	5/8"	140	57	200-585

All forms are 1¼" dia. x 2" long.

List of Parts

One Hammarlund Star tuning condenser, 140 mmf., C3;
One Hammarlund 5 to 70 mmf. balancing condenser, C1;
One 100 mmf. mica grid condenser, C2;
One 500 mmf. mica bypass condenser, C8;
One double .1-mf. paper bypass condenser, 200 V., C4-C5; must be non-inductive;
One .1-mf. paper bypass condenser, 200 V., C6, must be non-inductive;
One .01-mf. paper condenser, 600 V., C7;
One 4 mf. paper bypass condenser, 200 V. (optional), C9;
One special, "all-wave" R.F. choke coil, L1;
One set, five plug-in coils for 140 mmf. tuner, L2-L3;
One Lynch resistor, .07-meg., ½-W., R1;
Two Lynch resistors, .5-meg., ½-W., R4-R6;
One Lynch resistor, 1 to 5 megs. (preferably latter), ½-W., R2;
One Lynch resistor, .25-meg., ½-W., R3;
One .5-meg. potentiometer with switch attached, R5;
One Electrad resistor, 350 ohms, 1 W., R7;
One Electrad resistor, 100 ohms, 1 W., R8;
One solid 4 prong socket for coils;
Two spring mounted 4 prong sockets;
One spring mounted 5 prong socket;
Seven terminal clips;
One wood baseboard, 8¼ x 9 x ⅝-in.;
One aluminum panel, 8¼ x 6 x 1/16-in.;
One RCA Radiotron, Sylvania or National Union type 33 tube;
One RCA Radiotron, Sylvania or National Union type 32 tube;
One RCA Radiotron, Sylvania or National Union type 34 tube;
One pair sensitive headphones (Baldwin);
One roll push-back wire;
Three 45 V. "B" batteries;
One 2 V. storage cell;
One vernier dial.

TWENTY WAYS TO IMPROVE SETS

(*Continued from page 595*)

some extent the effects of cabinet resonance that produce "boomy" sounds when any bass note is struck.

To increase the effectiveness of this "resonance muffler" the other interior walls of the reproducer compartment can also be lined with sound absorbing material, or another method described recently in RADIO-CRAFT may be used (January, 1934, page 397). The last two methods can be resorted to in severe cases, when the bass output is quite noticeably distorted.

Control of Tone

It has been generally admitted that tone control devices do produce some improvement in the tonal quality of the set, under certain conditions. This is particularly true when DX stations are being received, as the background noise can be reduced by cutting out some of the higher frequencies.

For those who desire to add a tone control to sets not so equipped, the circuits of Fig. 2A and B are given. It will be noticed that in both cases the control device consists of a .1-meg. variable resistor in series with a fixed condenser. The value of the condenser determines the sharpness with which the cut off of high frequencies takes place. Usually a condenser of about .02-mf. is correct although different values can be tried to suit individual conditions. Then by varying the value of resistance, the amount of bass depth can be chosen.

Another use for tone control devices will be covered later.

Improving Selectivity and Gain

Radio receivers made several years ago were troubled to some extent by the fact that the amplification was not equal on different parts of the band. In other words, the amplification at the higher frequencies was less than that at the lower frequency end of the dial, with the result that the low wavelength stations did not come in nearly as loud as those on longer wavelengths.

To overcome this, modern sets usually employ coils of the type shown schematically in Fig. 3. In this type of coil the primary is in the form of a lattice or universal-wound coil placed at right angles to the secondary at the grounded end of the latter. This coil is wound with a large number of turns and in the case of the aerial coil, it is actually tuned to a wavelength that is longer than the highest one to be received. In addition to this change in construction, a single turn of wire is wrapped around the grid end of the secondary and is connected to the plate or aerial end of the primary. The latter turn provides some capacitative coupling to the secondary that further increases the high-frequency gain.

These coils are available from most mail order houses and some radio stores and the experimenter will find that by their use a set can be materially improved. By the addition of such coils and the use of higher gain tubes, as previously described a set can be made to rival the latest type receivers in both selectivity and sensitivity.

To still further improve it, in the important point of appearance, there has just been placed on the market an airplane type dial that can be used to replace the present dial on many sets. If the set you are modernizing uses a full-vision dial of practically any type (not the drum type) it can be replaced by this new type of dial. Two types of these dials are shown in Fig. B.

Visual Tuning Meter

If your set is a superheterodyne, or if automatic volume control is used, a visual tuning meter of one type or another is really an essential to correct operation. If the signals are not tuned in correctly with either of the above sets, the quality is liable to be very poor.

There are several types of visual tuning meters available that can be added to existing sets, providing there is space on the control panel to mount them. As you probably know, the visual tuning meter is simply a sensitive galvanometer (similar to a milliammeter) which is placed in the plate circuit of one or more R.F. tubes. Then, when no signal is tuned in, the meter registers the normal plate current of the tube or tubes. However, when a signal is tuned in, the plate current changes and the greatest change shows when the signal is correctly in tune.

As the movement of the tuning meter is similar in design to a D.C. milliammeter it must be connected correctly in the circuit, or it will read in reverse. See Fig. 4.

Adding Automatic Volume Control

Many of the sets made before 1932 were not equipped with A.V.C. and as this convenience in radio reception is almost universally included in modern sets some experimenters may desire to add a separate unit to permit A.V.C.

The usual method of using one plate of a duo-diode triode tube for A.V.C. is not very satisfactory for existing sets, as this type of tube is too recent to be included in the sets to be modernized. As a result, some of the older methods are preferable and as they have been explained in past issues of RADIO-CRAFT, we will not repeat them, but simply refer to the correct issues. These references are—RADIO-CRAFT, November, 1930, page 287; December, 1930, page 334; May, 1932, page 667.

While on the subject of A.V.C., it might be well to point out that A.V.C. is not satisfactory in sets that do not use variable mu tubes—they will not work satisfactorily. However, if these tubes are inserted as explained previously in this article, the A.V.C. unit can also be added.

Phono.-Radio Connections

The subject of home phonograph recording and record playing, in conjunction with the amplifier of the radio receiver is one that has attracted many radio experimenters. That good results can be obtained by simple circuit changes has been pointed out many times. Many radio fans hesitate to try the interesting experiments possible with records and recordings, however, because they are frightened off by the changes necessary in the receiver.

The changes are quite simple, though and will not affect the operation of the set in any way. In Fig. 5 are shown the methods required for different types of tubes. At A, B

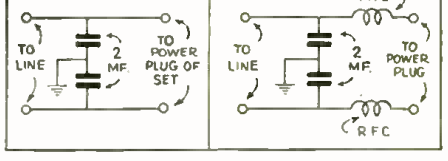

Fig. 7
Adding a "line-noise eliminator."

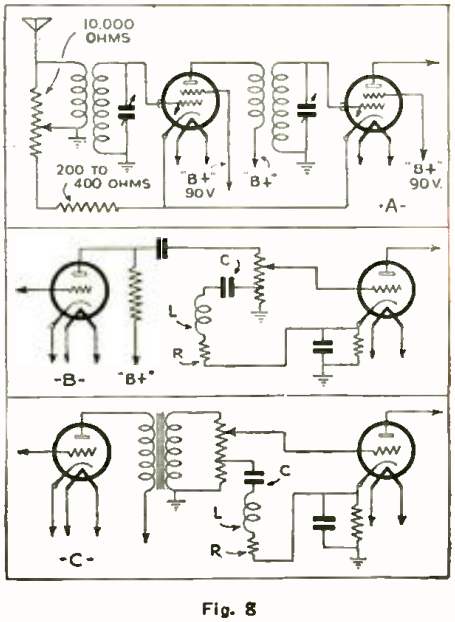

Fig. 8
Improved volume and tone controls.

and C are shown three methods of using the audio amplifier in conjunction with a phono. pickup to amplify recordings. At A is shown the detector circuit of many sets of the vintage of 1926 to 1929. This is the grid leak type of detector. In this type, a resistor and a condenser are connected in parallel and inserted in the cathode lead which is ordinarily connected to chassis or ground. The phonograph pickup is then inserted between the grid of the tube and the chassis. A switch can be included in the set to short-circuit the resistor and condenser when the radio is to be used. At B is the more common plate detection circuit, and here again the pickup is connected between the grid and chassis. However, in this case, the grid circuit must be opened so that the pickup will not be shorted. Another switch is included to short-circuit part of the bias resistor so that the correct bias can be obtained for utilizing the detector as a straight A.F. amplifier. The value of bias resistance required in circuit A and the tap in the bias A tube table can be used to determine the value of this resistor.

At Fig. C is shown a more modern circuit using a diode-triode tube. The pickup is connected directly to the grid of the triode section—no circuit changes or switches are needed.

At D is shown the method ordinarily used to connect the output of an amplifier to a record cutting head. In some cases it is possible to use a phono. pickup as a cutting head, by placing a weight on the arm supporting the pickup.

Whether a pickup unit or a special cutting head is employed, a coupling transformer is required to couple the power tube to the cutting device. The ratio of this transformer depends on the type of tube and the impedance of the cutting head. Most manufacturers of the latter units can also supply coupling transformers.

Noise Reduction in Aerials

The improvements in sensitivity and quality mentioned earlier in this article may introduce another difficulty that is being encountered in all modern high-gain receivers; that is, excessive noise pick up in the aerial. Naturally the more sensitive the set is made, the more annoying will be the pick up of local disturbances. It has been proven that in most shielded receivers, the pick up of noise is mostly in the aerial and lead-in. In many cases, the aerial can be so placed that it does not pick up much interference, but the effects are ruined by the fact that the lead-in runs close to the electric light, telephone and other wires in the house.

By the use of either a shielded lead-in or a transposition lead-in arrangement, as shown in Fig. 6A and B, this pick up can be avoided. The device at A consists of a coupling arrangement in which the impedance of the circuit carrying the signals to the receiver is reduced, so that the loss in the transfer is kept at a minimum.

The device at B consists of a T type aerial, each side of which is brought down to the set individually, the two lead-in wires being changed in position every few feet as shown. This transposition of the lead-in wires prevents any pick up in a manner similar to that used in twisted wires (such as those for A.C. filaments and the A.C. power leads).

The other source of noise pick up common in radio receivers is through the power supply lines. This can be reduced by one of the methods shown in Fig. 7. This consists of condensers, connected across the power lines feeding to the set or at the interfering electrical device, which effectively bypass the interference to ground. The condensers should be not less than 2 mf. and in the case of B the coils can be wound with about 100 turns of bell wire on a form 1 in. in diameter.

Remote Control

Another field that is receiving considerable interest in the past few months is the remote operation of radio receivers, several manufacturers having introduced sets of this type.

There are several remote control devices available that can be added to existing sets, such as the one shown in Fig. C, to effect

the same results as these new sets. However, since the details for installing these devices vary so widely, no details are given here. Suffice to say that it is not difficult to install them and the manufacturers supply full details for this purpose.

Volume Control

The methods of controlling the volume in radio receivers has changed somewhat in recent models. Some time ago, it was common practice to control the volume by shifting the screen-grid voltage. However, with the advent of the variable mu tube, this became inadvisable as it changed the characteristics of the tube and defeated to some extent the advantages gained by the new type of tube. For this reason the use of some method of controlling the grid bias, by adjusting the cathode resistance has become almost universal. In order to further increase the effectiveness of the volume control in sensitive sets, the method shown at A in Fig. 8 is often used. This can be easily inserted in existing sets.

The methods shown in Fig. 8B and C represent a compensated volume control arrangement which eliminates the loss of low notes on low volume levels. In other words, it is a tone control circuit that acts only on very low volume, so that the same high quality can be obtained at any desired signal strength.

The unit is designed for sets using a volume control in the A.F. amplifier. The values of the parts in Fig. 8B are: C, .1-mf.; L, .3-hy. choke; R, 3,000 ohms. In Fig. 8C for transformer coupling, the values are: C, .02-mf.; L, 1.5 hy. choke; R, 15,000 ohms. The values mentioned above are only approximate, as the actual values depend upon other circuits of the set. However, they give actual values worked out for one receiver and will give the experimenter comparative figures to work from.

In conclusion, it might be pointed out that it is not always possible or desirable to incorporate all the above suggestions in a set. For example, there are some experimenters who do not approve of tone control devices or other suggested improvements. These, of course, can be omitted. In preparing this article, an attempt was made to cover many of the recent developments in set design. As mentioned before, though, it is not possible to give so many actual circuits of receivers and therefore only fundamental circuits and average values are given here.

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SHORT-CUTS IN RADIO

(*Continued from page* 597)

changes it can be made to test any tube in common use.

First thing to do, is to take out the large socket, and put a UX sub-panel socket in its place. A hole is then drilled in the case, at the right of this socket, to pass the grid lead. Then the transformer is taken out and the additional filament winding put on over the coil as it is. Each lead is carefully marked before unsoldering, so no mistake will be made when the transformer is put back, as several of the leads have the same color. The winding consists of 22 turns tapped at the 14th, to give 2½ and 1½ V. This gives us 3 voltages which is enough, because the automotive series can be tested on the 5 volt tap, and the 2 volt series on the 1½ tap, by increasing the voltage (adjusting the Clarostat in the primary circuit) so the needle goes beyond the arrow on the filament meter. (See diagram.) A 5 point tap switch is then mounted on the side, with the shaft insulated from the case. Alternate points are used so no two of the taps will be shorted. This switch is used to give the proper voltage to the sockets.

Then the 199 socket is taken out (or it may be left in and used as originally intended, but 99's are just about extinct around here, so the socket and series resistor were removed, and another type of socket put in its place, making one less adapter required), and the hole reamed out enough to pass a regular tube base, and a 6 prong socket put in, and wired up to test 89, 57 and 58 tubes.

All UX triodes are tested in the UX socket on the panel, and other tubes by use of simple adapters, easily and inexpensively made up. All multi-grid tubes have their adapters wired so total emission is recorded. Examples: a 24 tested in the 27 adapter showed—filament emission—40, plate button up—0 plate button down 3. But tested in its own socket it read—fil.—60, and plate b. up—1—p.b. down—8. And a 47 in the 27 socket read—fil. 40, p.b. up—0, p.b. down—4, but in its own socket it read—fil. 80—p.b. up 4 p.b. down—12.

This tester was changed over about a year ago and has proven most satisfactory. As new tubes came along adapters were made up to fit them. However, the new Alden universal adapter, recently put on the market, will save making up so many adapters (in which case the 6 prong socket on the panel can be changed to some other combination).

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RADIO SET PRINTS NEWSPAPER

(*Continued from page* 591)

of course, we are speaking of the future when, we premise, there will be several millions of these sets in use. The advertising revenue from such a large circulation will be quite heavy, and the broadcasters will, no doubt, be able to get a sufficient amount to make it worth their while.

As to technical details, let me first state that, whatever I have said here, comes strictly within present-day radio technique. The apparatus which I illustrate is simply an adaptation of that now in use by RCA, and open to public traffic at the present. The original apparatus now used was devised by Capt. R. H. Ranger, formerly research engineer with RCA. The receiver, or picture reproducer, during the past few years, has gone through a number of changes. At one time an ink-pen arrangement was used with a special waxed paper. Later on, a jet of hot air was used, the force of the jet being modulated or varied in accordance with the light and dark parts of the picture, all by means of an electromagnetically operated valve, built into the air jet. The chemically-prepared paper, on which the image was reproduced, was wrapped around a cylinder, driven by a specially synchronized motor rotated in perfect step or synchronization with a similar cylinder containing the original picture at the transmitting station. The hot jet air apparatus has been abandoned in favor of the present ink-vapor jet, which is now being used; since it gives better details than the former hot-air jet. We recently saw pictures, measuring 8½ x 12 ins., being recorded on a 21 meter wavelength transmitted over 2,500 miles (from San Francisco). The same apparatus is used to handle commercial orders for pictures, received from Europe, on short waves day or night; the day wavelength being about 21 meters and that for night 30 meters or more, depending upon atmospheric conditions.

At the transmitting end, the photograph is rotated on a cylinder which is kept in perfect synchronization by special synchronizing means, including a temperature controlled tuning fork and a powerful concentrated pencil of light; the latter scans the photograph, line by line, as the cylinder on which it is mounted rotates in front of a pair of concentrated-filament headlight bulbs and a pair of lenses. The light reflected from the photograph being scanned passes through a small black tube and a diaphragm, into a photoelectric cell connected in a special bridge circuit. Before the photoelectric cell's impulses are sent over the line or by radio waves to the receiver there is imposed on the "image signal" a special accurately-timed interruption signal which has the effect of breaking up the dots constituting the image at the receiver, and serves to produce the well-known halftone effect.

In some picture-facsimile systems the *width* of the line is modulated; but in the RCA system the *length* of the dots is changed in accordance with the highlights and shadows of the image being transmitted, and as previously mentioned, the dots are furthermore split up into fractional dots so as to get a better halftone effect, as has been found to be the case in practice.

LATEST IN RADIO
NEW CAR SET

(*Continued from page 586*)

Another feature of this set is its "key knob." This knob is located on the lower left-hand side of the remote control unit and operates the volume control and off-on switch; further, the set may be made inoperative, so that unauthorized persons cannot operate it, by pulling the knob outward, when the knob, and a key that forms part of it, may be removed.

The I.F. transformers are peaked at 175 kc. Automatic volume control and first-detector operation are obtained in the diode section of the type 75 tube; its triode section operates as an A.F. amplifier.

In the 6A7 are combined the operations of first-detector and oscillator.

A suppressor kit, including a distributor suppressor and a generator bypass condenser, and all necessary hardware for mounting the set, are included.

The remote control tuning dial is calibrated directly in kc. When aligning the R.F. circuits, the tuning control must first be attached to the tuning condenser shaft with the pointer set at 530 and the tuning condenser plates entirely meshed. To align the circuits, tune in a weak signal near 1,400, and at its correct dial reading, and adjust the first and second trimmers on the variable condenser gang (from front of chassis), for loudest signal. If the signal is not received at its correct dial setting, carefully adjust the rear trimmer on the condenser gang to shift the signal to its correct location, and then readjust the first and second trimmers. After re-installing the set in the car, slightly re-adjust the first trimmer.

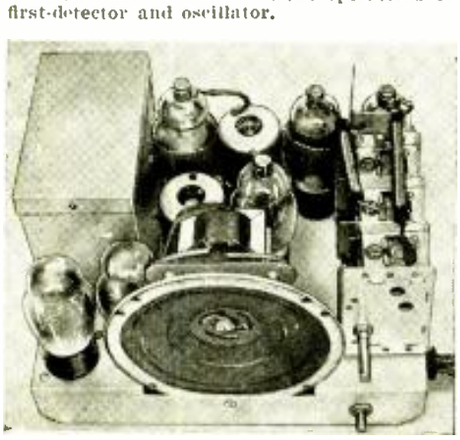
THE RADIO MONTH IN REVIEW

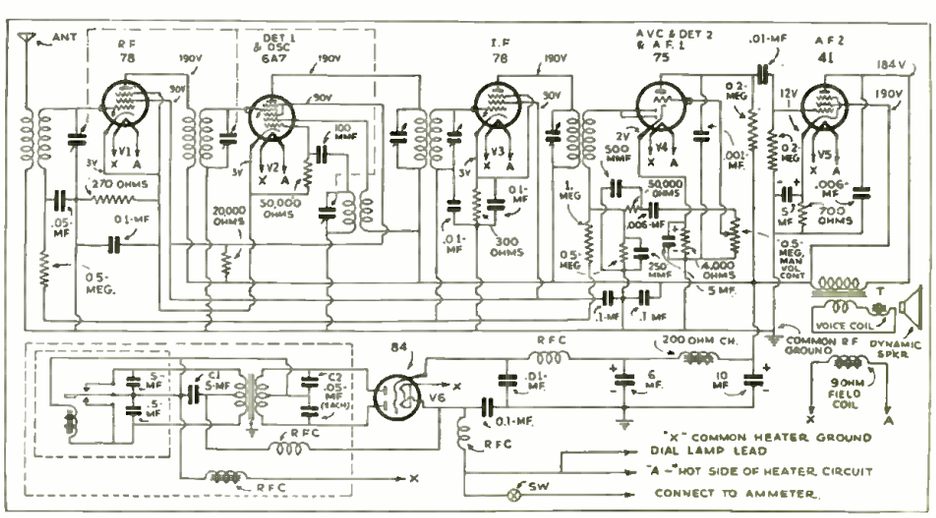
(*Continued from page 583*)

explained. You know how sleepy you get when you ride for a long time in a car or a train. The continuous repetition of (monotonous) sounds such as the click of a train over the tracks or the drone of the car motor is what does the trick.

The Hypnotone, as the new device is called, is a device that acts in a manner very much like the train or auto—it is an audio frequency oscillator; a device known to all radio men—that sends out a tone of just the right volume and pitch to put you or the baby to sleep in the shortest possible time.

It is necessary to provide individual control of both the volume and pitch, since not everyone hears sound the same way.





Above, chassis view of the new radio set. Right, schematic circuit of the receiver. Late tube types, including an 84, are used in an efficient circuit.

INFORMATION BUREAU

(*Continued from page* 610)

NEW RADIO DISTRICTS

(255) Mr. Abraham Levin, Joplin, Mo.

(Q.) The writer has been advised that the listing of radio districts as published in the Information Bureau of the May, 1930 issue of RADIO-CRAFT has been superceded by a new classification. Please furnish whatever information you may have available in this connection.

(A.) Your informant is correct. The reorganized radio districts are discussed as follows in a recent release by the Federal Radio Commission:

The field service of the Federal Radio Commission has been reorganized into twenty districts, each in charge of an officer whose title is "Inspector in Charge."

The reorganization was accomplished by making the nine large radio districts, established under the Radio Division of the Department of Commerce, since transferred to the Commission, into smaller districts.

The list of districts, showing the territory embraced and the location of the headquarters office is as follows:

Radio District No. 1: Headquarters, Customhouse, Boston, Mass. *Territory*: Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island.

Radio District No. 2: Headquarters, Federal Bldg., 641 Washington St., New York, N. Y. *Territory*: City of Greater New York and the Counties of Suffolk, Nassau, Westchester, Rockland, Putnam, Orange, Dutchess, Ulster, Sullivan, Delaware, Greene, Columbia, Albany and Rensselaer of the State of New York, and the Counties of Bergen, Hudson, Passaic, Sussex, Warren, Morris, Essex, Union, Somerset, Middlesex, Monmouth, Mercer, Hunterdon of the State of New Jersey.

Radio District No. 3: Headquarters, Gimbel Building, 32 Ninth St., Philadelphia, Pa. *Territory*: City of Philadelphia and the Counties of Bucks, Montgomery, Philadelphia, Delaware, Chester, Lancaster, York, Adams, Cumberland, Perry, Dauphin, Lebanon, Berks, Schuylkill, Lehigh, Northampton, Carbon and Monroe of the State of Pennsylvania, and the Counties of Ocean, Burlington, Atlantic, Cape May, Cumberland, Salem, Gloucester and Camden of the State of New Jersey; State of Delaware.

Radio District No. 4: Headquarters, Fort McHenry, Baltimore, Maryland. *Territory*: State of Maryland, the District of Columbia, and the Counties of Arlington, Loudoun, Fairfax, Prince William, Fauquier, Rappahannock, Page, Warren, Shenandoah, Frederick and Clark, of the State of Virginia.

Radio District No. 5: Headquarters, Customhouse, Norfolk, Virginia. *Territory*: State of Virginia, except the Counties of Arlington, Loudoun, Fairfax, Prince William, Fauquier, Rappahannock, Page, Warren, Shenandoah, Frederick and Clark, and the State of North Carolina, except the Counties of Ashe, Watauga, Caldwell, Avery, Burke, McDowell, Yancey, Mitchell, Madison, Buncombe, Haywood, Swain, Graham, Cherokee, Clay, Macon, Jackson, Transylvania, Henderson, Polk, Rutherford and Cleveland.

Radio District No. 6: Headquarters, 528 Postoffice Building, Atlanta, Georgia. *Territory*: States of Alabama, Georgia, South Carolina, Tennessee, and the Counties of Ashe, Watauga, Caldwell, Avery, Burke, McDowell, Yancey, Mitchell, Madison, Buncombe, Haywood, Swain, Graham, Cherokee, Clay, Macon, Jackson, Transylvania, Henderson, Polk, Rutherford, and Cleveland of the State of North Carolina.

Radio District No. 7: Headquarters, 1424 Dade County Building, Miami, Florida. *Territory*: The State of Florida.

Radio District No. 8: Headquarters, Customhouse, New Orleans, La. *Territory*: The States of Louisiana, Mississippi and Arkansas.

Radio District No. 9: Headquarters, Chamber of Commerce Building, Galveston, Texas. *Territory*: Counties of Jefferson, Chambers, Harris, Galveston, Fort Bend, Brazoria, Wharton, Matagorda, Jackson, Victoria, Calhoun, Goliad, Refugio, Aransas, San Patricio, Mueces, Jim Wells, Kleberg, Brooks, Kenedy, Willacy, Hidalgo, and Cameron of the State of Texas.

Radio District No. 10: Headquarters, 464 Federal Building, Dallas, Texas. *Territory*: State of Texas, except the Counties of Jefferson, Chambers, Harris, Galveston, Fort Bend, Brazoria, Wharton, Matagorda, Jackson, Victoria, Calhoun, Goliad, Refugio, Aransas, San Patricio, Mueces, Jim Wells, Kleberg, Brooks, Kenedy, Willacy, Hidalgo and Cameron, and the States of Oklahoma and New Mexico.

Radio District No. 11: Headquarters, 1105 Rives-Strong Building, Los Angeles, Cal. *Territory*: Counties of Monterey, Kings, Tulare, San Luis, Obispo, Kern, Santa Barbara, Ventura, Los Angeles, Orange, San Diego, Imperial, Riverside, and San Bernardino of the State of California; the County of Clarke of the State of Nevada, and the State of Arizona.

Radio District No. 12: Headquarters, Customhouse, San Francisco, Cal. *Territory*: State of California, except the Counties of Monterey, Kings, Tulare, San Luis, Obispo, Kern, Santa Barbara, Ventura, Los Angeles, Orange, San Diego, Imperial, Riverside and San Bernardino, and the State of Nevada, except the County of Clark.

Radio District No. 13: Headquarters, 227 Postoffice Building, Portland, Oregon. *Territory*: State of Oregon and the State of Idaho, except the Counties of Boundary, Bonner, Kootenai, Shoshone, Benewah, Latah, Clearwater, Nez Perce, Lewis and Idaho.

Radio District No. 14: Headquarters, 1012 Exchange Building, Seattle, Wash. *Territory*: State of Washington, the Counties of Boundary, Bonner, Kootenai, Shoshone, Benewah, Latah, Clearwater, Nez Perce, Lewis and Idaho of the State of Idaho; and the counties of Lincoln, Flathead, Glacier, Toole, Pondera, Teton, Lake, Sanders, Mineral, Missoula, Powell, Lewis and Clarke, Cascade, Meagher,

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PHONO. ATTACHMENT

(*Continued from page* 599)

which is permitted to remain on the ground post of the radio set).

Finally, connect a phonograph pickup (or a microphone transformer, if a microphone is to be used) to the attachment terminals marked PICKUP; start the motor of the phonograph with which the pickup is to be used; and then tune the broadcast set until the phonograph program is heard.

If there is available only a phonograph not equipped with a phonograph pickup, this unit must be provided. By selecting a slightly larger carrying case a phonograph pickup could be carried along with the "attachment," and used as necessary.

Description of Circuit

The reader will not be bored with a lengthy description of *why* the circuit works. Instead, only a short, general description will be given.

Although the ways in which circuit oscillation may be obtained are legion, the circuit utilized in our R.F. phonograph attachment is one of the most simple and, for our purpose, efficient. In this instrument the plate of the oscillator-mixer pentode, tube V1, is connected to one end of an R.F. circuit comprising variable condenser C1, and center-tapped secondary S, of coil L1; the screen-grid of V1 is connected to the other end of this circuit (which is resonant in the broadcast band). The center-tap on L1 is connected to the maximum available voltage supply. Upon grounding the control-grid of V1, as shown (only for the purpose of this discussion) dotted, at X, circuit oscillation is obtained; the R.F. output may be taken off by means of a pick-up coil (primary P, of L1), and fed to the antenna and ground connections of any radio set, producing a whistle when the set is tuned to a broadcast station within the operating range of the attachment.

A "Home" Broadcast Station

However, unless the broadcast set is tuned to a broadcast station, neither the whistle or anything else can be heard. It now remains to merely "modulate" this R.F. output, in some manner, at audio frequency, and our R.F. phonograph attachment will be complete and functioning as a miniature home broadcast station.

Audio modulation is conveniently accomplished by breaking the control-grid lead of the 43 and inserting a phonograph pickup into the circuit, at connections J1 and J2. The plate and screen-grid currents must pass through resistor R2 and in so doing establish across its terminals a voltage which becomes the "C" bias for the tube. Condenser C2 bypasses the R.F. and A.F. around the grid bias resistor unit R2, thus eliminating its tendency to reduce the A. F. modulated R.F. output of the tube; C3 acts as both a power supply filter condenser, and power supply R.F. bypass; C4 eliminates hum when the attachment is operated on A.C. power lines. We now have a miniature radio transmitter functioning full-blast—it only remains to utilize the signal.

A convenient manner of utilizing the "signal" is to run leads from the primary winding P., located at the center of the secondary of L1, to the antenna and ground posts of any radio set. As most broadcast receivers are more sensitive at the lower end of the wavelength range, this attachment was designed to be operated within approximately the first one-third section of the tuning range. Just tune the broadcast set to a "dead" point on the scale, within this range, at which a broadcast station cannot be heard, and then adjust the setting of C1 on the R.F. phonograph attachment until the phonograph program can be heard. Finally, adjust the volume control on the phonograph pickup for optimum volume and maximum tone quality, and the volume control on the radio set for the desired output volume.

A direct ground connection to the chassis must not be made since, in the reversed position of the line plug, the power line would be shorted, on D.C. power circuits.

The Power Supply

To secure operation on A.C. power lines a rectifier is required to furnish the necessary D.C. for the plate and screen-grid of V1. A type 25Z5 tube, V2, was selected for several reasons. First, it has a 25 V. filament and, in conjunction with V1, a tube that has a 30 V. filament, accounts for 55 V., which requires the filament limiting resistor R1 to "absorb" only 60 V., thus the power cord heats to the minimum degree. Second, although this tube is of the high-vacuum type, it has a very low internal resistance and therefore will deliver to the 43 much more current than would other type tubes.

A special filter choke, designed for A.C.-D.C. sets and having a resistance of only 100 ohms, is used as "Ch." in order to obtain maximum voltage on D.C. power supplies.

If the chassis of the attachment is grounded accidentally in the reversed position of the line plug, fuses F, inside the line plug, will act as safety devices.

Almost any center-tapped R.F. broadcast coil having a centrally-located primary may be used. The authors' coil was made by winding 100 T., center-tapped, of No. 28 wire on a tube 2½ x 1½ ins. in dia., for the secondary; the primary was made by winding 25 T. of No. 32 wire over a layer of empire cloth at the center of the secondary.

Although numerous refinements are possible for those who wish to build a more elaborate unit, there is no need to put such features in a unit that is intended, as was this one, for portable operation. Under the heading of possible refinements would be included, for example, a switch for automatically disconnecting and connecting the antenna to the broadcast set (in portable use such a switch would introduce long leads, in many instances); a built-in electric phonograph motor and turntable (in portable operation, practically impossible due to power supplies often being of several types—in New York, for instance, where the attachment was designed to be used, both A.C. and D.C. power supplies will be found, and sometimes both in the same dwelling; another objection is the weight of electric phonograph motors); and, mixing and volume controls for selecting either, or both phonograph pickup and microphone—the latter for making introductory remarks regarding the phonograph program, or comments of a witty nature—(this idea is not so practical for a portable design, since it would call for more equipment, including the controls and a microphone).

The authors will be glad to assist anyone who encounters any difficulty in building this little A.C.-D.C. R.F. phonograph attachment.

List of Parts

One specially-wound antenna coil (see text), **L1**;
One variodenser, 500 mmf., C1;
One Tobe Deutschmann electrolytic condenser, 20 mf., 35 V., C2;
One Concourse high-temperature electrolytic condenser, 8 mf. (or two 4 mf. units, to save space), 500 V., C3;
One Concourse electrolytic condenser, 8 mf., 500 V., C4;
One General Transformer Corp. special A.C.-D.C. choke, 100 ohms, Ch.;
One Blan power cord (to drop 60 V.), R1;
One I.R.C. resistor, 2,500 ohms, 2 W., R2;
One RCA Radiotron, Sylvania or National Union pentode, type 43, V1;
One RCA Radiotron, Sylvania or National Union rectifier, type 25Z5, V2;
Two Na-Ald 6 prong sockets, for V1, V2;
One Blan power switch, Sw.;
One fused power plug;
Two fuses, 1. A., F;
Four insulated tip jacks, J1 to J4;
One Blan aluminum panel, 5½ x 8½ x 1/16-in. thick;
One Blan aluminum base, 4 x 5½ x 1/16-in. thick;
One Blan aluminum shield can (for coil);
One pair sub-panel brackets, cut to fit;
One Radio Trading Co. carrying case, 5½ x 8½ x 5½ ins. deep (inside dimensions);
One phonograph pickup, high-impedance type, with volume control;
Miscellaneous supplies (wire, solder, coil-mounting bracket, knob for C1 to fit a short length of ¼-in. rod, the other end of which is tapped to fit in place of the adjusting screw furnished with C1).

INFORMATION BUREAU

(*Continued from page* 620)

Broadwater, Jefferson, Granite, Ravalli, Deerlodge, Silver Bow, Beaverhead, Madison, Gallatin of the State of Montana, and Territory of Alaska.

Radio District No. 15: Headquarters, 538 Customhouse, Denver, Colo. *Territory*: States of Colorado, Utah, Wyoming, and Montana, except the Counties of Lincoln, Flathead, Glacier, Toole, Pondera, Teton, Lake, Sanders, Mineral, Missoula, Powell, Lewcis and Clarke, Cascade, Meagher, Broadwater, Jefferson, Granite, Ravalli, Deerlodge, Silver Bow, Beaverhead, Madison and Gallatin.

Radio District No. 16: Headquarters, 513 Federal Building, St. Paul, Minn. *Territory*: States of South Dakota, North Dakota, Minnesota, the northern peninsular of Michigan, and the State of Wisconsin, except the Counties of Crawford, Richland, Sauk, Columbia, Dodge, Washington, Ozaukee, Maukesha, Jefferson, Dane, Iowa, Grant, Lafayette, Green Rock, Walworth, Racino and Kenosha.

Radio District No. 17: Headquarters, 231 Federal Building, Kansas City, Missouri. *Territory*: States of Nebraska, Kansas, Missouri and Iowa, except the Counties of Winneshiek, Allamakee, Fayette, Clayton, Buchanan, Delaware, Dubuque, Linn, Jones, Jackson, Clinton, Cedar, Johnson, Washington, Muscatine, Scott, Louisa, Des Moines, Henry and Lee.

Radio District No. 18: Headquarters, 2022 Engineering Building, Chicago, Ill. *Territory*: States of Indiana, Illinois and the Counties of Winneshiek, Allamakee, Fayette, Clayton, Buchanan, Delaware, Dubuque, Linn, Jones, Jackson, Clinton, Cedar, Johnson, Washington, Muscatine, Scott, Louisa, Des Moines, Henry and Lee of the State of Iowa; and the Counties of Crawford, Richland, Sauk, Columbia, Dodge, Washington, Ozaukee, Milwaukee, Waukesha, Jefferson, Dane, Iowa, Grant, Lafayette, Green Rock, Walworth, Racine and Kenosha of the State of Wisconsin.

Radio District No. 19: Headquarters, 2900 David Stott Building, Detroit, Mich. *Territory*: State of Michigan, except the northern peninsula and the States of Ohio, Kentucky and West Virginia.

Radio District No. 20: Headquarters, 514 Federal Building, Buffalo, N. Y. *Territory*: State of New York, except the City of Greater New York and the Counties of Suffolk, Nassau, Westchester, Rockland, Putnam, Orange, Dutchess, Ulster, Sullivan, Delaware, Greene, Columbia, Albany, and Rensselaer; the State of Pennsylvania, except the City of Philadelphia, and the Counties of Bucks, Montgomery, Philadelphia, Chester, Delaware, Lancaster, York, Adams, Cumberland, Perry, Dauphin, Lebanon, Berks, Schuylkill, Lehigh, Northampton, Carbon and Monroe.

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OPERATING NOTES

(*Continued from page* 607)

and to the flat black wire-wound bias and bleeder resistor. This resistor has, in some cases, been found to vary from 6,000 ohms (the correct value) to as low as 2,000 ohms with a consequent variation of plate voltages on the I.F., R.F., 1st-Det., and Osc. tubes. The usual voltage on these tubes is about 90 V. Replacing the defective unit with one of correct value brings gratifying results.

EDISON R-4, R-5

AN UNUSUAL problem was encountered in servicing an Edison R-4. The complaint of a bad hum and distortion immediately led me to condemn the biasing resistor in the grid circuit of the push-pull A.F. stage. However, a more thorough check-up proved that the trouble was in the power transformer. By referring to the schematic diagram, Fig. 3, one finds that this model has three 2.5 V. windings (filament) namely, R.F. and 1st-A.F.; Det.; and the P.P. A.F. filament supply. The center-tap of the detector filament winding is normally grounded while the adjoining 45 A.F. filament winding is in turn grounded through a series of resistors. In this particular case, these two filament windings became shorted to one another, thereby depriving the 45's of their biasing voltage, due, of course, to the normally grounded center-tap of the former. Since replacement of the power transformer was out of the question, the following remedy was tried. The detector filament winding center-tap connection was transposed, from its direct ground, to the center-tap of the 45 filament winding, thus restoring the bias voltage to the 45's without increasing the hum level. The radio now resumed normal operation much to the financial satisfaction of the customer.

JOHN LEEBL.,
Spillville, Iowa.

CROSLEY 42-S

A CROSLEY 42-S came into shop marked "Poor tone, repair speaker." At volume equal to a whisper the set sounded O.K., but when loud enough to reproduce low notes distinctly distortion was present. The speaker was inspected for cone rattle, contact between core and voice coil, then tried on another set, and found O.K. I figured the trouble to be in the A.F. amplifier. After replacing the .5-meg. 1st A.F. grid resistor (which didn't help the tone any) the voltage on the A.F. tube was normal. The voltage chart of set showed normal detector voltage 11 to 17 on grid, and 70 to 85 on plate (due to resistance 1st audio). An analyzer test showed 4 V. bias. Ah! a bias resistor "out." No, it tested between 50,000 and 55,000 ohms (55,000 normal), which was not making all the difference. I checked through the resistor bank, and all were within reasonable limits (all are carbon resistors). I tried substituting some resistors that I knew were accurate. I finally obtained proper bias with a 20,000 ohm resistor, which should have made the voltage way too low for good detection in that particular set. By chance as I was "prettying up" the underside, shortening resistor pigtails and touching up solder joints, double-checking for "cold" ones, the lead to the detector bias bypass broke, and the voltage went haywire again. By this time I was ready to throw a baby sledge at that set, but when I checked the dual .5-mf. unit bypassing both detector bias and 1st A.F. bias, I found a leakage *between sections* that was causing all the grief. Replacing the dual bypass condenser (Fig. 4) and the original detector bias resistor restored the tone quality. Two weeks later the screen-grid voltage bypass "went west" but the customer finally realized, after a half-hour discussion, that it was in no way caused by the previous trouble.

G.E. J-100 AND J-125 RECEIVERS

ON SEVERAL new G.E. J-100 series and J-125 sets, I was driven frantic by a flood of trouble calls with cathode shorts in 56's and 58's causing bad hum on all stations similar to station hum, and only noticeable when a station was tuned in. I found out that the section of town where calls were originating has very high line voltage (up to 126) in afternoon and early evening, which caused something to "give" too much inside the tubes. The power transformers in these sets are wound to 112 V. primary, and there was 2.7 V. on the heaters. I purchased several line voltage regulators and installed them on the offending sets, and their owners are not riding my neck as often as they used to.

C. J. HUTCHESON, JR.,
1027 *Blackford Ave.*,
Evansville, Ind.

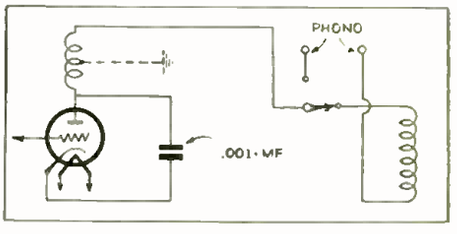

Fig. 5
Grounded R. F. choke in Edison 7-R set.

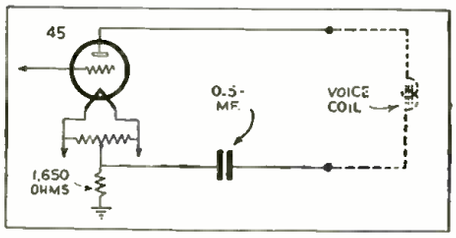

Fig. 6
A shorted 0.5-mf. condenser in Crosley 53 (or 54) causes trouble.

EDISON MODEL 7-R

I RECENTLY serviced an Edison 7-R receiver that was not functioning properly. The complaint was that signals would come in faintly and then burst through strong and clear. The chassis was checked and everything was found to be O.K., except the detector plate voltage which was nil. It was found that by tapping the R.F. choke the signals would come in with usual strength. This unit is encased (shielded) and grounded in this model. When this unit was replaced with a new one, reception became normal again. The R.F. choke was grounded, thus short-circuiting the plate supply of the detector to the ground. See Fig. 5.

CROSLEY MODEL 53 (or 54)

AGAIN, a Crosley 53 was serviced. This chassis was checked and the grid biasing resistor (1,650 ohms) of the 45 was found to be smoking. The 45 circuit was checked, and the .5-mf. condenser inserted between the voice coil of the speaker and a terminal of the grid biasing resistor was found to be defective. It was replaced with a new one and the set began to function again. See Fig. 6.

JAMES L. HOARD,
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Providence, R. I.

CROSLEY 40S—41S—42S—82S

WHEN SERVICING these machines, it is often necessary to move the chassis to the shop and as the speaker is fastened in the cabinet with screws it is desirable to avoid taking it out. To test a machine of this type under operating conditions, the method outlined below is the best that I have found. This method is to use a dummy field coil, output transformer and a magnetic speaker. Any good filter choke will do in place of the field coil. Any convenient output transformer, primary having fair matching characteristics (the secondary is not used) may be used in the output circuit. This testing assembly is wired as shown in Fig. 7 and is mounted in a small box with a jack for the speaker and two sets of leads; one set terminates in a tube base, the other has phone tips soldered to the ends of the wires.

The latter set of leads are used on the early models having the conventional Crosley speaker connections; that is, pin jacks marked BROWN, N and P. The circuit is as follows: the choke is connected across the brown pin jacks, while the ends of the output transformer are connected to the N and P pin jacks. A lead connects one side of the choke to the center-tap of the transformer. The speaker is connected from the center-tap to either side of the primary winding.

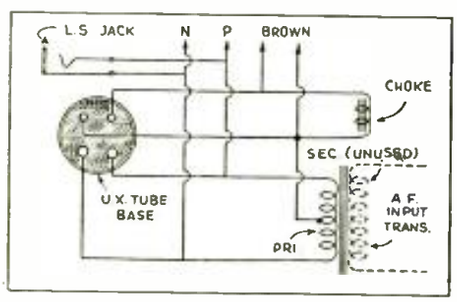

Fig. 7
An inexpensive and convenient "gadget" for testing reproducers without removing them from the chasses.

The later type sets use a 4-prong UX-plug speaker connector. The choke is connected across the grid and plate prongs of an old tube base, as shown in Fig. 7, while the transformer is connected across the filament prongs. The center-tap in this instance is connected to the grid-prong lead where it joins the choke. The speaker is connected as described in the paragraph above.

In these Crosley receivers the most common source of trouble is the volume control. The type used is an old Centralab design using a leather washer under the depressor arm; this washer either wears out or turns over. To repair this unit cut a new washer from a thick piece of leather with a harness punch and trim one end to fit the hole in the arm. Loosen both nuts on the unit so that the arm can be pushed far enough out to put the new slider washer in place.

Another common place to look for trouble in these machines is in the bath-tub type tuning condenser. When the rotor gets stuck or tight the owner generally oils it; the result is low volume or none at all. To remedy this condition solder a pig-tail from the end of the shaft to the frame. I find that it is good practice to do this on every set that comes in, as it ordinarily eliminates noises and increases the volume.

NELSON E. GRUBBS,
Eutaw, Alabama.

FLASH!

Make your own "talking light beam" transmitter and receiver, as described in detail in the forthcoming issue of RADIO-CRAFT. The author describes an inexpensive and ingenious system that may be built up in a short time by anyone.

We reproduce aboxe one Service Man's answer to the "50c per call" racket. Fair prices on his card do the trick for Mr. Harris.

RADIO SET PRINTS NEWSPAPER

(*Continued from page* 618)

The average number of lines used at present is 100 per inch but, with the present machines, the number can be increased up to 300; this maximum number of lines is practically never used, as there is at present no call for such fine-quality reproduction.

This is simply mentioned to show how far this art has already advanced, and what has actually been accomplished.

A recent announcement by RCA states that it is now prepared to send *telegrams in facsimile* all over the country. In other words, you write in longhand a telegram in which you can incorporate sketches if you wish, and RCA will transmit such telegrams, handwriting, sketches and all, at a low rate. RCA, however, stresses the point that, so far as its service is concerned, this ultra-short wave high-speed facsimile apparatus is to be a purely point-to-point proposition, open for public use in the transmission of pictures, messages, bank statements, etc.

In my present project, the only new thing which I show is the use of a *double system* of ink-vapor jets which operate simultaneously, one on each side of the paper sheet. Use is made of a doubly-modulated wave, similar to what was used two years ago by the Columbia Broadcasting System to broadcast both sound and sight on one wavelength. This method would seem perfectly feasible in connection with the ink-vapor jet arrangement; but some further experimenting must be done to get down to the fine points. No great technical difficulties, however, are foreseen in solving this particular point.

As far as the owner of the set is concerned, the action of the printing device is wholly automatic; all that he need do is to renew the roll of paper once in a while, get a new air-pressure charge in the tank, and a fresh ink bottle. The air-pressure tank can be taken to the nearest garage, where compressed air can be furnished; or, more likely, Service Men of the future will call once a month and take care of the renewals of paper, ink and air bottle. Some little cleaning of the air-brushes (for ink) and other details will be taken care of by the Service Men who, for a small fee, will give a monthly routine inspection to the set.

The different illustrations which I present are self-explanatory, and they show all the necessary details for the interpretation of this new art. Several photographs of the RCA machine which is now in use have also been added.

RAISING THE OHMMETER RANGE

T. B. Taylor

HAVING a "direct reading" ohmmeter, we reasoned that if we could establish the amount of current flowing in the ohmmeter circuit at its various "ohm readings," we could use a voltage-multiplying resistor, external to the meter, and thereby obtain a two-purpose meter.

Our first move toward this, was to observe the "ohm reading" marked at CENTER of the scale. In our particular instrument, powered by one 1.5 V. battery, the "ohm reading" is 5,000 ohms. From the above we can determine the full-scale current of the meter by dividing the voltage, 1.5, by "ohm reading" 5,000 and obtain .0003. So far, this information tells us that our instrument is entirely satisfactory for use as a "high-resistance-per-volt" meter. The computed resistance-per-volt (5,000 ohms divided by 1.5 V.) is 3,333 1/3 ohms.

Now, to establish the meter current values at the various "ohm readings." We will select as example, an "ohm reading" of 10,000. To this figure ADD 5,000 ohms, the value of the resister which is placed between the meter and the voltage supply to limit the circuit current to full-scale current reading or "zero" ohm reading; the total then is 15,000 ohms. By dividing voltage, (1.5) by ohms, (15,000) the quotient is .0001-A. (The dial "ohm reading" of 10,000 thus indicates the .0001-A.)

For voltmeter operation, we wished the full-scale range of our voltmeter to be 450. The necessary external voltage multiplying resistor value was computed as 1,500,000 ohms, obtained by dividing desired voltage range (450) by FULL SCALE current of the meter, (.0003-A.).

The watts rating of the voltage-multiplying resistor is obtained by squaring the full-scale current (.0003 times .0003) the product being .00000009. This being multiplied by the value of the voltage-multiplying resistor (1,500,000) gives .135 as the watts rating for the resistor. A 1,500,000 ohm resistor of 0.5-W. rating or higher, would be satisfactory.

We now want to know the voltage being read when the meter indicates "ohm reading" 10,000 when the meter current is computed as .0001-A. The voltage being read is 150, obtained by multiplying circuit resistance (1,500,000 ohms) by circuit current (.0001-A.).

Each "ohm reading" of the meter scale may be calibrated as to meter current; or, if only one voltage range is desired, the "ohm readings" may be calibrated as voltage readings.

You will note in the circuit of the ohmmeter, one test prod is directly connected to meter terminal, say "negative," and this prod may be used as "negative" of voltmeter. One end of the voltage multiplying resistor is connected directly to opposite terminal of meter, which would then be "positive." The positive test prod of the voltmeter connects to opposite end of the resistor.

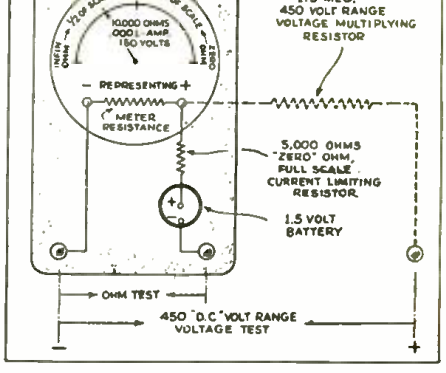

Fig. 1
Details for revamping the ohmmeter.

FACTS ABOUT DYNATRON OPERATION

(*Continued from page* 598)

one has an output meter, the R.F. oscillator circuit described already can be used "as is." If a modulated signal is desired, the reader is respectfully referred to an article on page 464 of the February, 1931 edition of RADIO-CRAFT for details. The writer has a beat-frequency oscillator which primarily consists of a dynatron oscillator functioning at a fixed frequency and a second dynatron oscillator which has a variable tuning adjustment operating through a narrow band of frequencies. By varying the tuning condenser the two oscillators are caused to produce "beat" notes which are passed on to a detector, and through an A.F. amplifier system to a phono. pickup. This device can produce audio frequencies from something like 30 cycles on up to about 10 kc, and is an application of the dynatron circuit to the measurement of audio-frequency apparatus. One use in particular to which this apparatus can be put—and one which is not frequently given a thought by the Service Man—is the subject of loudspeaker resonance (this can be determined with the beat-frequency oscillator mentioned).

Another example of the utility of the dynatron oscillator lies in its application to the study of code telegraphy; a circuit for this purpose was shown in RADIO-CRAFT in November, 1932, page 279. For the benefit of any who may be interested in the use of the dynatron as a frequency changer in the superheterodyne circuit the reader is referred to the circuit shown on page 676 of the May, 1931 edition of RADIO-CRAFT. As already mentioned, *there are* limitations to the application of the dynatron principle in vacuum tube operation and this is the reason for its not having been put to more general use, commercially. In order to function as a good dynatron, a tube must have elements that are clean and bright, as the secondary emission is ordinarily at a maximum under such conditions, however, with the attendant heating of the elements. Therefore, a tube which may be an excellent dynatron tube, when new, may not be at all satisfactory for this purpose after it has been in use for a time. The thinking and farsighted engineer engaged in designing apparatus for sale to the public has not "taken up" with the dynatron. One application of the dynatron, however, as an oscillator, is in the case of one of the ultradyne circuits which were developed by the late Robt. E. Lacault and in which the dynatron was used as a superheterodyne oscillator.

Owing to the fact that it was something of a problem, in the course of tube operation in general, to control secondary emission, tube manufacturers have endeavored to get away from the difficulty, as far as reasonably convenient, by spraying their tube elements with carbon. For this reason, not many of the tubes made today are very good when used in dynatron circuits, except as they may be picked, one at a time, in the shop or laboratory, and tested for their individual adaptability for use in circuits of the type being considered. (Any who desire some information pertaining to the spraying of tube elements with carbon are referred to the September, 1932 edition of RADIO-CRAFT.) The individual Service Man or experimenter should have little difficulty in picking out an occasional tube for such use, considering the number of tubes that pass through his hands from time to time. (Incidentally, it is proper to note that the dynatron property of tube operation which gives rise to a decrease in plate current with an increase of plate voltage is sometimes termed "negative resistance." That portion of the characteristic curve already studied which reflects this feature of tube operation is sometimes referred to as the "negative resistance" portion of the curve. When a tube is operating under such conditions it is referred to as functioning in the "dynatron region," and when making a laboratory set-up for the use of a tube as a dynatron it is desirable to adjust the applied voltages so that the tube is operating somewhere near the middle of the "dynatron region").

The Dynatron as a Detector

As a detector the dynatron has possibilities, although this is something more or less in the experimental stage at the present time. Studies of this subject made thus far, indicate that good reception is possible with a dynatron detector circuit and for those who may desire to try it out, the circuit diagram shown in Fig. 8 is offered.

The grid leak type of detection does not satisfactorily apply to dynatron detector application, rather a bias is best used in the circuit between the grid and the cathode or filament, as the case may be. Commonly this grid bias will be found to be some value within the resistance range from about 75,000 ohms to .75-megohm, however it varies more or less from tube to tube and no one value can be definitely assigned, offhand. It is pertinent to emphasize the fact that this biasing resistance value, for any given tube, is decidedly critical. As a means of determining the value for a chosen tube (after having run a test on the tube in order to determine definitely as to whether or not it is adaptable to dynatron circuit requirements) it is suggested that a variable resistance be used in determining the critical value of the bias and when this has been determined by experiment—measure the resistance value and then substitute an accurate fixed resistance for the variable resistor.

Tuning of a dynatron detector circuit is largely a matter of tuning the midget variable condenser in the aerial circuit, although it is important to have an inductance in the plate circuit which is of a value corresponding to the frequency range to be received by the detector. Otherwise the experimenter may find himself listening to several stations at one time. The dynatron as a detector seems to possess considerable possibilities when applied to the reception of short waves, and the writer suggests this as a subject for experiment by those who may be interested. It should be kept in mind that the sensitivity of this circuit depends largely upon the careful manipulation of the biasing resistor, for it acts as a control on regeneration.

The Dynatron as an R.F. Amplifier

Most of what has been published regarding the dynatron circuit heretofore has pertained to its application as an oscillator, although limited references have been made to its use in detecting and amplifying circuits. The writer has been interested for years in practical, workable, and at the same time simple, R.F. amplifiers. Therefore it was quite in keeping with dynatron circuit investigation to experiment with the thought in mind of determining its utility as an R.F. amplifier. The circuit employed is that of the ordinary resistance-coupled amplifier with a lower voltage impressed upon the plate than that which is applied to the screen-grid. It should be kept in mind at all times that the circuit has a tendency to oscillate, and resistor and voltage values which will permit the circuit to function without introducing objectionable oscillation must be used. The circuit arrangement of a one-stage amplifier is shown in Fig. 9.

An interesting experiment has been conducted by connecting the oscillator whose circuit is indicated in Fig. 7 to the input of a receiver of the T.R.F. type, precisely as if the tuning condensers were to be lined up. By adjusting the oscillator condenser so as to beat with the receiver when the latter is tuned to a given station and at the same time controlling oscillation by the potentiometer, it has been found that in certain instances the receiver output volume has been at least doubled. With such an arrangement, too, it has been noted that broadcast stations were heard which could not be heard at all without the oscillator; or at least if they were heard, it was not possible to separate them. This applies particularly to stations in the "graveyard" division of the wavelength allocation. Thoughtful consideration of this application of the circuit being considered will make it plain that provided oscillations are properly controlled, we have in such a circuit an application of the tuned-plate, capacity-coupled amplifier. While it may be regarded as unstable, it has been found that it can be made to work under certain conditions, and that very naturally helps to satisfy aroused curiosity.

(*Continued on page* 627)

HEADPHONES COMING BACK

(Continued from page 606)

includes some really new and distinct features is shown in the accompanying photograph. A toggle switch for selecting either phone or loudspeaker reception is included. Two tip jacks are mounted in the side of this adapter and into these the phone cord connects. This unit can be employed in either the first audio or power stage (where single tube power stage is employed) depending upon the amount of volume the listener desires or can stand. It replaces the tube in either of the aforementioned tube sockets, and the tube itself is then plugged into the top of the adapter where a conventional socket is mounted. A few words of precaution are necessary at this point. When selecting the adapter, the type of tube it is to replace must be considered since the number of prongs on this unit must conform to the number on the tube.

There are, of course, other types of devices which will permit headphone use—most of them being built along the lines of wafer sockets which fit over the tube prongs, connections being made by eyelets through which the prongs pass. This type will also be found satisfactory although the innovations described for the first adapter are not included.

Incidentally, if any intensive listening-in with headphones is going to be done, the listener would do well to obtain and use a pair of lightweight phones. Unless one happens to be a commercial or amateur operator and accustomed to wearing phones for a considerable period of time, it is surprising how quickly the ears become fatigued.

●

A KNOCKABOUT TESTER

(Continued from page 604)

range is 20,83 ohms. For the 75 ma. range, 6.75 ohms is required.

To make this shunt correctly, the following is the procedure: secure a 25 ohm resistor and place the extra clip at approximately one-fourth the distance from one end, and adjust to 6.75 ohms. Then adjust the other end so that the resistance is 20.83 ohms from one end to the other. Do not calibrate the 20,83 ohm section first. The double-pole double-throw switch used must have an off position.

In the ohmmeter circuit (see diagram) the 2,500 resistor is only used as a limiting device and need not be accurate. The variable resistor compensates for high or low batteries from the discarding point of 2½ V. to 3½ V. The panel was designed to fit an easily obtained card file box. The inside dimensions of this box are 5⅛ x 5⅜ x 3½ ins. high, although the height is not important and may vary with different file-card boxes.

The diagram is very simple, and the parts easily obtained. There is no reason why this kit of parts, including the meter and a drilled and engraved panel should cost over $10.00.

List of Parts

One Beede 1 ma. meter with combination scale;
One drilled and engraved bakelite panel: 5⅛ x 5⅜ x ⅛-in.;
One Lynch 450 ohm resistor, 2% accuracy;
One Lynch 5,000 ohm resistor, 2% accuracy;
One Lynch .25-meg. resistor, 2% accuracy;
One Lynch .5-meg. resistor, 2% accuracy;
One Lynch 2,500 ohm resistor;
One Electrad 1000 ohm variable resistor;
One Electrad 25 ohm resistor with extra clip, 10 W. type;
One type 762 D.P.D.T. switch;
Seven tip jacks.

DYNATRON OPERATION

(*Continued from page 625*)

Dynatron A.F. Amplification

The dynatron circuit, resistance-coupled, will function as an A.F. amplifier with very satisfactory results. Such a circuit was shown on page 560 of the March, 1931 edition of RADIO-CRAFT, in an article by Mr. C. H. W. Nason. The writer has used a similar amplifier for some time past, with a type 47 tube connected as a triode, instead of the 45 output tube suggested by Mr. Nason. The hook-up employed, using the 47 output tube, is shown in Fig. 10. (The substitution of one type of tube for another offers thought for much very interesting study, particularly in the matter of substituting new types of tubes for older ones. For a discussion pertaining to the application of the pentode as a triode see RADIO-CRAFT, July, 1932, page 42).

Other Uses of the Dynatron Circuit

In addition to the applications of the type of circuit under consideration in this article there are others that are in more or less common use. Of these uses perhaps one of the best known, and least used, is the use of the dynatron circuit in the various applications of the vacuum tube voltmeter. Such a circuit has been considered in the following issues of RADIO-CRAFT: April, 1932, p. 614; November, 1932, p. 285; and March, 1933, p. 545. Another application of the circuit is possible in the case of a radiophone transmitter, although this application has never received very much favorable consideration on the part of those, particularly amateurs, who might be the ones to profit by it in the way of gaining experience and practice in its applications.

The writer has constructed an experimental substitute for the common doorbell by arranging an oscillator so that when the push-button is depressed a musical note is emitted by a single headphone connected in series with the plate inductance. This coil by the way, is tuned with a fixed condenser and the audible output is somewhat musical in tone. The circuit is essentially the same as that shown in Mr. Pollack's article, in Fig. 1, on page 464 of the February, 1931 issue of RADIO-CRAFT, with the addition of the push-button which is in series with the filament-heating battery.

The use of the dynatron circuit in frequency meter construction has not been directly referred to heretofore in this article. However, such an application of the circuit is possible and convenient. The construction of such a device is very similar to that involved in making an oscillator for laboratory or service work. In fact the same device may be used for either purpose with but slight changes. In one case, the instrument emits a signal at a pre-determined frequency, while in the other it is used to determine the frequency of a signal generated by some other source.

Conclusions

From what is known of the dynatron circuit at the present time, it may be said that the principle involved is one that is readily workable and requires a minimum of apparatus. As pointed out, the subject of secondary emission is one for study and owing to the difficulty involved in controlling such emission the tube manufacturers have been treating their tube elements with carbon for some time past, as it has been found by most manufacturers of tubes to their regret, that the negative "shielding" effect resulting from the use of bright tube elements caused more or less difficulty in the functioning of tubes in the usual run of receiver circuits. From this it may be inferred that the dynatron circuit is not likely to find much application in commercial receivers for some time to come. This, however, need not deter the student and experimentally inclined Service Man from investigating the merits of so simple, useful and practical a circuit. There need be little hesitancy on the part of the experimenter as to the availability of an occasional tube with which to conduct such an investigation. Most of the type 15, 22, 24, 32, 35, 51 and 865 (the latter being a low power, screen-grid transmitting tube of 12½ W. rating), and some 2A3 tubes, will function in dynatron circuits very satisfactorily. It must be kept in mind that tubes employed in dynatron circuits, because of the varying conditions surrounding the subject of secondary emission, will not act uniformly when one is compared with another of similar type. Neither will a given tube necessarily function under a given set of conditions throughout its normal life. This, however, should have little bearing on such uses as the amateur, experimenter, student or Service Man is likely to subject the tube to. That the dynatron circuit is possessed of much merit is without question. That it has its limitations is also true. However, the man who makes a study of it need not feel that his time is being wasted and it should be remembered that he may find himself well rewarded through the acquisition of useful information.

An investigation of the properties of the dynatron circuit should not be regarded as complete without reference to some good works pertaining to the subject of tubes in general, together with their applications.

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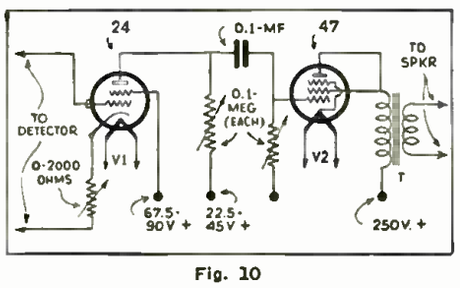

Fig. 10
A dynatron A. F. amplifier.

BATTERY SET OF HIGH SENSITIVITY

In the forthcoming May issue of RADIO-CRAFT will appear complete construction details of a battery set of extreme sensitivity. You have been waiting a long time for a good set design, using the new battery tubes—now, here it is!

A NEW METHOD FOR AUTO-NOISE ELIMINATION

(*Continued from page* 600)

factor would certainly never be used. And, here we find the "proof of the pudding" since, surprising as it may seem to a great many, no form of suppressor device is ever employed for eliminating ignition noise from aircraft radio reception. Instead the simple method of complete shielding of all high- and low-tension cables and shielded spark plugs is employed. And also, strange as it may seem to auto-radio installers, this procedure works out quite satisfactorily and is all that is necessary to eliminate the interference. Again the installer is referred to the Buick type of installation where no (spark plug) suppressors are necessary due to the complete seclusion and shielding of the plugs by a metal plate that encloses them, as proof that this procedure will work out just as well in auto radio practice.

Airplane System

In airplane work a shielded plug such as that shown in Fig. A is generally employed. There are, of course, some variations in the design of this unit as made by various manufacturers, but substantially the principle of completely enclosing or shielding the plug and cable leading to it is incorporated in all of them. In airplane work the shielded ignition cables are made up complete for the various types of motors that are generally employed for plane use. However, the Packard Electric Corp. makes up a form of woven metal shielding that slips over the cables of non-standard installations. Unfortunately, there are no automotive equipment manufacturers that supply a shielded plug for automobile use. This is probably due to the fact that while plug sizes are pretty well standardized in airplane motors to a very few types, in automobiles there are well over fifty types and sizes. However, when, and if there is ever a demand for an auto plug of this type, it is safe to assume that the manufacturers will respond by bringing such units on the market.

A New Idea

Meanwhile a suggested substitute, in the form of a wrinkle, is shown in Fig. B. A coil or tube shield of the required height is adaptable for this purpose. If a coil can is used, the bottom should have a hole drilled equal in size to the diameter of the threaded portion of the plug. The plug is then inserted into the shield with the threaded area protruding through the opening that was drilled for it. It can then be inserted into its respective cylinder and by means of a spark plug socket wrench screwed down tightly so that the shoulder of the plug locks the shield against the cylinder head and automatically grounds it. It would, of course, be good policy to first scrape the metal area against which the shield would contact to insure a good ground connection. The cover of this can must also be drilled to permit the cable leading to the plug to go through it. The shielded loom or braid that fits over the spark plug cable must be soldered to this cover and should cover the cable to the point where it reaches the tubing or housing above the cylinder head. At this point all shielded cable should be bonded and grounded. Where the wires leave the housing and go to the distributor head, the procedure of shielding each individual cable should be continued. A clearance of approximately ½-in. must exist between the distributor head terminals and the shielded loom or braid, otherwise there will be a flashover discharge caused by the high voltage from the terminal to shield (which is equivalent to ground), and which would prevent the motor from functioning properly. Similarly, the high-tension lead from the spark coil to the center terminal of the distributor must be shielded with the same precautions, as mentioned previously, in mind.

The regular procedure of bonding and grounding all cables, oil or gas line pipes, or any other metal tubing which may come through the "fireboard" (that is the wall which separates the motor compartment from the instrument-board space) should be performed or else there might be some interference radiated by these lines due to stray R.F. currents that the shielding does not take care of.

Additional Shielding

Low-tension wires in the motor compartment, particularly the one leading to the breaker points, should also be shielded if completely satisfactory results are desired. Remember to ground all shielding, preferably to a heavy metal braid that is bolted to some portion of the girder construction supporting the body of the car and which is brought up to the motor and secured there. This is to insure a better motor ground, especially desired where the motor is mounted on rubber blocks to minimize vibration. Even though the motor will be found to be grounded in a case of this sort because of the bolts which hold it down, it should be considered that the motor will rock when it is running or when it is suddenly accelerated, causing an imperfect ground contact due to the fact that the bolts are not "taken up" tightly so that this rocking or vibration could be taken care of by the rubber blocks.

●

A NEW "LIGHT METER"

A "RIGHT LIGHT" METER for measuring light intensities and making illumination surveys is announced by the Westinghouse Electric and Manufacturing Company. Only a few seconds are needed to check lighting conditions at any point, since the dial is marked in foot-candles with zones denoting the minimum amount of light needed for specific types of work.

The following are among useful applications of the "right light" meter:

(1) Checking intensities on dull days when natural light fails;

(2) Checking the efficiency of artificial lighting installations;

(3) Indicating when higher candle power lamps are required or when fixtures need cleaning;

(4) Surveying the condition of walls and ceilings which may prevent proper reflection of light;

(5) Determining the efficiency of lamps which may be of old design or worn out and in need of replacement;

The new foot-candle meter embodies many unusual features. It uses the new Westinghouse Photox cell, a recently developed copper-oxide photo-voltaic cell, which changes light directly to electric current without any auxiliary electrical supply.

HIGH-FREQUENCY ADJUSTMENTS IN RADIO RECEIVERS

(*Continued from page* 612)

5. Set the receiver to around 1,400 kc. using a station or oscillator signal as before and completely readjust all trimmers just as for items 3 and 4 above.

If no readjustment is required at either 1000 or 1,400 kc. no further attention need be given the set as far as alignment of the tuned stages is concerned. If considerable, or even appreciable adjustment is necessary, on either 1000 or 1,400 kc. further work must be done as it naturally follows that readjustment at one dial setting will mean maladjustment at another. Nothing can be done about this condition unless the condenser is provided with "alignment leaves." These are formed by slotting the outer rotor plates on one or both ends of each condenser in several places to form fan shaped segments. This arrangement provides a means of changing the capacity over one particular band (usually 100 kc.) without disturbing it at any other band. In some receivers thumb screws are provided to bend these leaves toward or away from the outside stator plate. In others they must be bent either way by pressure of the finger or by use of an insulating rod.

The following is the correct procedure for bending these leaves:

1. When you find that the trimmers must be readjusted at 1000 and 1,500 kc, set the main dial to around 1000 kc, and adjust the trimmers as accurately as possible for peak response as before.

2. Now reset the dial to 600 kc, and readjust for maximum response by bending the leaves toward or away from the stators as necessary. At 600 kc, the plates will be almost fully in mesh and those leaves which will come out first (the largest ones) when the condensers are rotated should be adjusted first to a maximum amount. If bending one is insufficient, start the next smallest one, and so on until peak response is attained.

3. Set the tuning dial now to 1,400 kc, and bend leaves (those still in mesh only) until correct maximum response and correct alignment are attained.

Tracking Adjustment for Superheterodyne Receivers

In a superheterodyne, the oscillator frequency is set above the signal frequency and must stay as nearly as possible the same number of kilocycles above the signal frequency for every setting of the tuning dial. The difference between the oscillator and signal frequencies, of course, is the intermediate frequency and, for example, if the dial is set to 1000 kc, for a receiver having an I.F. of 175 kc, the oscillator controlled by the same dial must be adjusted to function at 1,175 kc. (1000 plus 175 kc.). If the dial is set to 1,400 kc, subsequently the oscillator must function at 1,400 plus 175 or 1,575 kc, for proper reception.

When the other sections of the receiver are correctly adjusted, all tracking adjustments are made in the oscillator grid circuit. For this purpose there are three applications of a single basic circuit shown in Figs. 2A, 2B and 2C.

Carefully note that in the oscillator grid circuits shown, the main "gang" tuning condenser is C1 having a shunt "gang" tuning condenser C2 of 1/5 to 1/8 its value and an adjustable condenser C3 in series with the combination, having a value usually somewhat greater than that of C1. This value must be so large—the amount of its variation need be so small—that often it is split into a fixed section C4 and a variable section C3 as in Fig. 2C.

Adjustment of C2 and C3 may be done correctly as follows:

1. Set receiver dial at 1,400 kc, and feed an oscillator signal or a station signal in the input (antenna and ground posts) and adjust condensers C2 for maximum output signal. This way be done with an output meter. The manner of connecting this device will vary with the particular receiver make and model.

2. Now set receiver dial to 600 kc, and adjust C3 for maximum. Condenser C2 should *not* be readjusted at 600 kc, because it will

have practically no effect. The same may be said for readjustment of C_3 at 1,400 kc.

3. If you do not obtain the correct response between 600 and 1,400 kc. the trimming adjustment must be repeated.

Oscillator Feed-Back Adjustment

In Fig. 2, condenser C is for the purpose of regulating the oscillator. In some cases the oscillator tube will grow less and less efficient with use, finally stopping oscillation. When a new tube is replaced adjustment must be made according to its particular sensitivity. To adjust this condenser proceed as follows:

1. Tune the receiver dial to a station around 600 kc. and turn set screw of C counter-clockwise until the set goes "dead." Turn in a clockwise direction until station again comes in and add one or two additional turns. If the set operates for any setting of this capacity it should be adjusted at a minimum position. The volume control of the receiver should be full-on during adjustment.

I.F. Stage Alignment

Each intermediate stage in a superheterodyne having tuning facilities must be adjusted for a definite frequency response. This is the intermediate frequency. From 2 to 8 adjustments may be necessary depending on the design. Procedure for correct adjustment follows:

1. Connect the output of an oscillator to the plate terminal of the 1st-detector socket (the tube being removed) and to ground. If the oscillator output has no series capacity, one should be used to avoid D.C. If the oscillator is modulated either an output meter or the speaker may be used for indicating response but if the oscillator is unmodulated a 2nd-detector plate meter is advised. A tuning meter provided where A.V.C. is used is suitable also, and if A.V.C. is used with no tuning indicator, a plate milliammeter should be used and tuned for minimum plate current.

2. Starting with the grid circuit of the 2nd-detector, turn the adjusting screw for maximum response, and proceed toward the 1st-detector. Both plate and grid circuit are usually tuned and require adjustment.

COMBINATION AMPLIFIER-TUNER

(*Continued from page* 604)

connects the plate P2 of the second triode to the special push-pull input class A prime transformer, T2.

As the tuner volume control, R17, is provided with its own on-off switch, the phono.-microphone preamplifier and the tuner may be operated simultaneously or independently from each other, permitting mixing and fading from one type of program to another, or permitting a radio program for instance to be used as a musical background for the microphone program.

A tone and microphone feed-back control, R18, is placed across the power amplifier and is therefore effective on both the radio and the phono.-microphone amplifier. It is equipped with a master "ON" and "OFF" power switch. The three controls and switches thus constitute a very simple but complete and efficient P.A. control board.

The Power Amplifier and Power Pack

The power amplifier consists of four 43 tubes grouped in push-pull parallel fashion. The relatively large bias voltage is obtained partially from the cathode resistor, R4, and partially from the speaker field current, which has to flow through the same resistor in order to complete its circuit. At this higher bias the tubes are operated in class A prime circuit, and it becomes imperative to employ a large bypass condenser (10 mf, 35 volts, C7) in order to obtain the maximum undistorted audio output power of 7½ W. The resultant tone and quality has seldom been attained before in A.C.-D.C. receivers, and is only equalled in performance by the very best console type.

The speaker field employed has a resistance of 4,000 ohms. This assures a minimum power consumption, as the current drawn is only 20 ma. Provision is made to handle two such speaker fields, as the rectifier tubes are being taxed only up to a part of their combined current handling capacity of 200 ma., D.C. or A.C. This permits the use of low-frequency and high-frequency type loudspeakers to obtain realistic performance.

If A.C. or magnetic type speakers are employed, no provision is required to close up the fields, the receiver remaining in an electrically balanced condition with a slight reduction of undistorted A.F. output power, a corresponding smaller load being consequently imposed upon the rectifier tubes.

The matching output transformer should have an output impedance from plate to plate of 2,000—2,000 ohms, or if two speakers are employed with their individual transformers the plate to plate impedance of each should be 4,000—4,000 ohms.

As the two 25Z5 rectifier tubes are of the slow-heater type, no strain is imposed upon the large capacity filter condensers C9, C10, which assures absolutely hum-free performance, although only half-wave rectification is employed on A.C. (such filtering would have been absolutely prohibitive at the high voltages commonly encountered in A.C. receivers of same power output). When operated on D.C., this filtering action entirely eliminates all line noises from the receiver and amplifier. As the power transformer and line voltage surges have been done away with in this system, the resulting danger of breakdown has been completely eliminated. The filter chokes Ch.1, Ch.2, should have 500 ohms resistance or less to prevent a voltage drop that would lower the voltages for the remaining tubes.

It might be well to mention here that successful home recordings may be made with this system not only of radio programs, but also of singing, speeches, or all other sounds fed through a microphone, due to the inherent high gain of the 3 stage A.F. amplifier.

List of Parts

One Coast-to-Coast drilled chassis, 10 x 18 x 3 ins.;
One 4 gang condenser, superheterodyne type, 350 mmf., C1, C2, C3, C4;
One Remington filter choke, 200 ohms, 50 ma., 30 hy.;
Two Remington filter chokes, 500 ohms, 30 ma., 30 hy., Ch.2, Ch.3;
One Remington universal phono.-microphone input transformer, type D-2329, T1;
One Remington class A prime push-pull input transformer, type E-683, T2;
Two Clarostat .5-meg. tapered potentiometers, R16, R18;
One Clarostat 10,000 ohm tapered potentiometer with 1000 ohms minimum resistance, R17;
One Lynch resistor, 10,000 ohms, 1 W., R1;
One Lynch resistor, .1-meg., 1½ W., R2;
Two Lynch resistors, 25,000 ohms, 1 W., R3, R10;
One resistor, 200 ohms, 5 W., R4;
One Lynch resistor, 1. meg., 1 W., R5;
One Lynch resistor, 250 ohms, 1 W., R6;
One Lynch resistor, 10,000 ohms, ½-W., R7;
One Lynch resistor, .25-meg., 1 W., R8;
Two Lynch resistors, .5-meg., 1 W., R9, R12;
One Lynch resistor, 3,000 ohms, 1 W., R11;
One resistor, 110 ohms, 10 W., R15;
One resistor, 30 ohms, 3 W., R13;
One resistor, 10 ohms, 1 W., R14;
One band-pass antenna coil and shield, L1;
One even-gain interstage R.F. coil, L2;
One 175 kc. I.F. transformer and oscillator coil composite unit, with shield, IFT1;
One 175 kc. I.F. transformer, closely coupled, IFT2;
One R.F. choke, 8.8 mhy., L5;
Four Coast-to-Coast cartridge condensers, ½-mf., 200 V., C5, C16, C18, C23;
One Polymet dry electrolytic condenser, 50 mf., 25 V., C6;
One Polymet dry electrolytic condenser, 10 mf., 35 V., C7;
Three Polymet mica condensers, .006 mf., C8, C13, C14;
One Polymet dry electrolytic, 50 mf., 150 V., C9;
One Polymet dry electrolytic, 2 x 16 mf., 175 V., C10a, C10b;
One Polymet dry electrolytic, 4 mf., 175 V., C11;
Two Coast-to-Coast cartridge condensers, ½-mf., 200 V., C12, C22;
Four Coast-to-Coast cartridge condensers, 1/10-mf., 200 V., C15, C19, C17, C4;
One Polymet mica condenser, 300 mmf., C20;
One Polymet mica condenser, .002-mf., C21;
One triple-post connector post for microphone; BP1-3;
Two twin-post connector posts for phones, BP4-7;
One frequency-calibrated tuning dial and pilot bulb;
Miscellaneous hardware, sockets, knobs, wire, cable, 1 amp. fuse and fuse block, etc.

RADIO PICTORIAL

(*Continued from page 584*)

In number seven is shown a portable amateur station owned and operated by Mr. L. A. Morrow, Springfield, Ohio, and which can be on the air within fifteen minutes after reaching a location. Mr. Morrow plans to take this portable station to Florida and other states to make tests, but, with apologies to Joe Penner, *we didn't know that* this was permissible according to amateur rules and regulations.

●

YOUR SERVICE OSCILLATOR

(*Continued from page 587*)

(11) Aligning short-wave receivers;

(12) Checking A.F. circuits and apparatus;

We will discuss each of these functions, under "average" conditions, in their numerical order, with reference to the service oscillator circuit shown in Fig. 1.

(1) To Align R.F. Circuits. (See "How to Align Radio Sets," in this issue.)

If the tuned circuits are badly out of alignment it may be necessary to use relatively high service oscillator output. The minimum output of this service oscillator is about 2 microvolts, but the maximum, across the attenuator, is 50,000 microvolts. If the latter figure is insufficient for initial alignment procedure, connection may be made to binding posts which provide an output of about 0.5-V. Crystal-calibrated frequencies of 600, 1000 and 1,400 kc. are provided.

(2) To Align I.F. Circuits for either "Flat Top" or "Peak" Resonance. The A.F. modulated I.F. output of the service oscillator is fed to the input of the I.F. amplifier section of the receiver (usually, the control-grid of the first-detector). For "flat top" resonance the service oscillator must first be set for one of the several crystal-calibrated frequencies of 130, 175, 262, and 456 kc. Then, set a "10 kc." dial provided on the service oscillator off-resonance a few kc., depending upon the number of tuned I.F. circuits and the desired degree of "flat top." After aligning one I.F. circuit at this frequency, the calibrated "10 kc." dial is moved to the next required frequency and the *next* I.F. circuit resonated for maximum output on the output meter. And so-on until the required number of alignments have been made.

For "peak" resonance the operation is much more simple. Just align the I.F. circuits for maximum output meter reading for the exact I.F. output of the service oscillator as specified for the individual receiver. (See "How to Align Radio Sets.")

(3) To Align Oscillator Circuits. (See "How to Align Radio Sets.")

(4) To Trim Oscillator Padding Condensers. (See "How to Align Radio Sets.")

(5) To Check Tube Efficiency. Apply a service oscillator frequency to the antenna and ground posts of the set and tune in the signal for maximum deflection of the output meter. Now, by replacing any tube in the set with another of the same type, the relative efficiency of either tube will be noted by a change in the reading of the output meter. Be careful to allow for differences in characteristics—especially, between tubes of the same type but of different manufacture.

(6) To Determine Overall Receiver Gain. It is not necessary for the Service Man to use a calibrated output meter, if he is accustomed to use the same instrument in his work, to obtain a good idea of the relative sensitivity of various receivers. The calibrated attenuator readings for various receivers, for a given deflection of the output meter, are noted, and these readings used as a basis for checking the sensitivity of other sets of equivalent type.

(7) To Test A.V.C. Circuit Operation. Connect the service oscillator to the input terminals of the radio set, and adjust the output, with the receiver volume control set at maximum, for a meter deflection of about one-half the optimum value. Now, substitute for the

A.V.C. tube another of equivalent type. A reduction in the reading of the output meter indicates that the first tube was defective, and that the second tube is more suitable in the A.V.C. circuit.

(8) To Make Stage Analyses. By applying the output of the service oscillator to circuits preceding those of the output, and noting the response on the output meter, receiver faults may be readily localized. (RADIO-CRAFT, December, 1933, pg. 348.) Thus, open- and short-circuits in the wiring or apparatus may be located in minimum time.

(9) To Check Overall Receiver Selectivity. The "10 kc." dial makes it convenient to run a test of the overall selectivity of a given radio set. It is best to plot on graph paper the readings for various settings of the "10 kc." dial, on either side of resonance, with the service oscillator output feeding the antenna and ground posts of the set. Use the left-hand, vertical column for the meter readings, and the base line for "kc. off resonance."

(10) To Neutralize Receivers. (See "How to Align Radio Sets.")

(11) To Align Short-Wave Receivers. Frequencies other than the fundamental frequencies previously mentioned are available, as harmonics of these fundamentals, for aligning the circuits of modern short- and all-wave receivers. A sensitive receiver ordinarily is capable of receiving the 20th harmonic of the 1000 kc. fundamental of the service oscillator; the "10 kc." dial permits the fundamental to be shifted, in 1 kc. steps, 10 kc. either side of this value. The harmonics of the 1000 kc. frequency are conveniently 1 megacycle apart, so that it is handy to start testing and calibrating at, say, 2,000 kc., on the receiver. With this point located, the 3,000 kc. calibration is located from the 3d harmonic of the 1000 kc. test note. To confirm this point, the frequency-selector switch may be adjusted for 1,500 kc., to determine whether the 2nd harmonic of this note is heard at exactly the same point on the receiver dial. The frequency-selector switch is then re-set at 1000 kc., and the 4,000 and 5,000 kc. points on the receiver dial located. At 6,000 kc. the actual frequency can again be definitely established by using both the 1000 kc. and 1,500 kc. service oscillator frequencies to be certain of the actual harmonic that is being used. This seemingly long-winded, but actually simple procedure eliminates the possibility of mistaking "ghost" and other spurious frequencies for those of the calibrating instrument.

(12) To Check A.F. Circuits and Apparatus. Microphonic tubes, cabinet resonance, and other defects in the audio system of the radio receiver may be located by connecting the full output of the service oscillator to the control-grid of the audio tubes, whereupon the 400 cycle note of the service oscillator modulator tube will be heard in the reproducer.

Since many of the tests described above depend for their efficiency upon the accuracy of the service oscillator, it may be well to point out that the particular instrument illustrated has a frequency variation of less than 0.2-kc. for a change in line voltage of 90 to 120 V. Electron coupling of the oscillator circuits is used to insure further stability. The method of coupling the oscillator and modulator circuits eliminates "frequency modulation," which would cause broadness and instability in the output frequencies. The R.F. output is prevented by a system of choke coils from feeding via the light lines into the receiver under test.

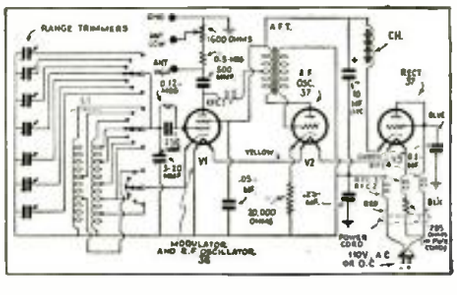

Fig. 1
Representative, modern service oscillator.

READER'S DEPARTMENT

(*Continued from page 605*)

was submitted at the last meeting should be adopted at once. The sooner the better, and when adopted it should be enforced rigidly. Quack physicians are soon ostracized from their profession; shyster attornies are likewise considered rabble. Therefore, I believe that the "soi disant" technician should be eliminated from the ranks of the professional technician until such a time as he has served his apprenticeship and proven to a board of examiners his technical qualifications beyond a doubt. By eliminating the radio quack and shyster we will, to my belief, eliminate the cut-price and cut-throat artist from our chosen profession.

Just as physicians, surgeons and attornies consult their superiors and colleagues when they encounter a puzzling diagnosis or legal matter the radio technician should also consult his superiors and go into a huddle on some perplexing technical problem.

One of the most important points in maintaining the professional attitude so important to the radio servicing is to dress like gentlemen, not grease monkeys, wearing dirty chambray shirts, smeared full of grease as seen at a recent meeting of radio technicians. No wonder the public is against paying $1.00 for the service call to Service Men of this type. Put on canvas gloves to avoid marking console cabinets, spread papers under the tool kit, brush out the chassis on additional paper, wipe dust off tubes, touch up scratches on cabinets, etc.

M. MICKELSON,
3336 16*th Ave., South,*
Minneapolis, Minn.

Mr. Mickelson is perfectly right. Too many Service Men neglect the important point of appearance when attending to their service calls. Radio servicing is, after all, selling just as every other occupation is a selling job. It does not make any difference whether you sell service, material or whether you sell your services to a "boss" or a group of customers—it is still selling. And every good salesman appreciates the importance of appearance. The point cannot be stressed too highly.

●

TUBE TESTER

(*Continued from page 602*)

On the panel are inscribed all the instructions for operation when testing only the current types of tubes.

Four flexible cords, P, P, G, K (see diagram, Fig. 1), with miniature plugs, permit every possible inter-connection required of the various tube elements. Connections are made by inserting these plugs into the jacks shown: J1, J2, J3, J4, J5, J6, J7, J8.

Transformer T1 has a 5 V. primary, which is energized by the 01A socket filament supply in the old tester. A rear view of the panel illustrating the mounting and wiring of the unit is shown in Fig. C. The supermultidapter may be quickly and easily constructed by using the material specified and by following the wiring diagram of Fig. 1. Resistor R1 is connected in the plate circuit by pressing switch Sw.1, and serves to reduce the plate current to a safe value. This is only done when the meter on the old tester goes off scale, when testing some of the new, high-plate-current tubes.

Calibration of the old tester for the new tubes can easily be accomplished by testing a good, new tube (one for each type) and marking down its reading for grid-shift test, or by noting the position of the compensator, rheostat, or potentiometer of other types.

For 2.5, 3.3, 5 and 7.5V., set Sw.2 at x and supply from tester, in testing the tubes shown in Table I. The asterisk (*) indicates special short-wave tubes.

• Index to Advertisers •

(While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.)

List of Parts

One 5½ x 9 in. super-multidapter panel, drilled and engraved, with mounted tip-jacks;
One leatherette-covered case, with hole and bushing;
One knob, with indicator;
One 4 prong 2 piece speaker plug;
One 4 wire cable, 18 Ins. long;
Five Na-Ald molded sockets (V1 to V5), 4, 5, 6, 7, 7 prong-large;
One molded control-grid cap and cord;
One Dependable transformer, T1;
One momentary S.P.S.T. switch, Sw.1;
One Dependable 9 point filament selector switch, Sw.2;
One I.R.C. resistor, 5,000 ohms, R1;
One Dependable jack-strip, 8 jacks, J1 to J8;
Four miniature plugs, P, P, G, K.

TABLE I

Tube Type	Filament Volts	Connect Plugs P to	G to	K to
1	6.3	1	–	3
5	6.3	1–8	3	–
•10	7.5	Cap	1	–
18	14.0	2	5	8
19	2.0	1–8	4	–
•20	2.5	2–5	–	8
•22	6.3	2–5	–	8
25	2.5	2	5	8
29	2.5	2–5	–	8
•30-8	2.0	Cap	1	–
33	2.0	1–8	3	–
41	6.3	2	5	8
42	6.3	2	5	8
43	25.0	2	5	8
46	2.5	1–8	3	–
47	2.5	1–8	3	–
48	30.0	2	5	8
49	2.0	1–8	3	–
52	6.3	1–8	3	–
53	2.5	1–8	3	5
55	2.5	2–5	–	8
57	2.5	2–5	–	8
58	2.5	2–5	–	8
59	2.5	2–5	7	8
68	6.3	2	5	8
69	6.3	2–5	–	8
70	6.3	2–5	–	8
75	6.3	2–5	–	8
77	6.3	2–5	–	8
78	6.3	2–5	–	8
79	6.3	1–8	3	5
80	5.0	1	–	–
2nd Plate		3	–	–
82	2.5	1	–	–
2nd Plate		3	–	–
83	5.0	1	–	–
2nd Plate		3	–	–
84	6.3	1	–	8
2nd Plate		3	–	3
85	6.3	2–5	–	8
89	6.3	2–5	–	8
90	2.5	1	5	8
92	6.3	1	5	8
96	10.0	1	–	3
98	6.3	1	–	8
2nd Plate		3	–	8
257	5.0	1–8	3	–
866	2.5	Cap	–	–
1A6	2.0	2–8	5	–
2A5	2.5	2	5	–
2A6	2.5	1	5	8
2A7	2.5	2	6	8
6A4	6.3	1–8	3	–
6A7	6.3	2	6	8
12A5	6.3	2	7	5
2B6	2.5	2	7	5
2B7	2.5	2	6	8
6B7	6.3	2	6	8
6C6	6.3	2–5	–	8
6D6	6.3	2–5	–	8
6D7	6.3	2	6	8
6E7	6.3	2	6	8
2F7	2.5	2–7	5	8
6F7	6.3	2–7	5	8
6Y5	6.3	3	–	5
2nd Plate		8	–	5
5Z3	5.0	1	–	–
2nd Plate		3	–	–
6Z3	6.3	1	–	3
6Z4	6.3	1	–	8
2nd Plate		3	–	8
6Z5	6.3	1	–	3
2nd Plate		5	–	3
12Z3	12.6	1	–	3
12Z5	12.6	1	–	4
2nd Plate		8	–	4
25Z3	25.0	1	–	3
25Z5	25.0	1	–	4
2nd Plate		8	–	4
AD	6.3	1	–	–
2nd Plate		3	–	–
AE	12.6	2	5	8
GA	5	1–8	3	–
LA	6.3	1–8	3	–
PA	6.3	2	5	8
PZ	2.5	1–8	3	–
PZH	2.5	2	5	8
HZ50	12.6	1	–	3
1V	8.3	1	–	3

Blank Cartridge Pistol

REVOLVER STYLE

.22 CAL.

MADE IN 3 SIZES

25c
50c
$1.00

Three new models now out **25c, 50c and $1.00.** Well made and effective. Modelled on pattern of latest type of Revolver. Appearance alone enough to scare a burglar. Takes 22 Cal. Blank Cartridges obtainable everywhere. Great protection against burglars, tramps, dogs. Have it lying around without the danger attached to other revolvers. Fine for 4th July, New Years, for stage work, starting pistol, etc. **SMALL SIZE 4 in. long 25c. MEDIUM SIZE 5 in. long 50c. LARGE SIZE 6in. long $1.00. BLANK CARTRIDGES 50c per 100. HOLSTER (Cowboy type) 50c. Shipped by Express only not prepaid.** *710 page catalog of other pistols, sporting goods, etc. 10c*

BOYS! THROW YOUR VOICE

Into a trunk, under the bed or anywhere. Lots of fun fooling teacher, policeman or friends.

THE VENTRILO

a little instrument, fits in the mouth out of sight, used with above for Bird Calls, etc. Anyone can use it. **Never fails. A 16-page course on Ventriloquism together with the Ventrilo. All for 10c postpaid.**

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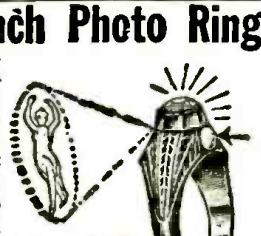
Fun, Magic and Mystery

We also publish a monthly magazine of FUN, MAGIC AND MYSTERY. Each issue contains a big collection of parlor magic, tricks with cards, fortune-telling, funny readings, amusing experiments, money-making secrets, jokes, riddles, conundrums, parlor amusements, puzzles, problems, science, mechanics, etc. In addition it will list all the latest novelties, tricks, puzzles, etc. Because it is really a magazine and catalog combined, we have fixed the subscription price at ONLY 10c per year, or 3 years for 25c. This as you readily see does not even cover our mailing expenses, let alone the cost of getting up the magazine. Try this magazine for one year.

Novelty French Photo Ring



Here is a very great novelty in Rings, that is selling in thousands. It is a nicely made ring, finished in imitation Platinum, and set with a large imitation diamond. It looks just like an ordinary ring, but in the shank of the ring is a small microscopic picture almost invisible to the naked eye, yet is magnified to an almost incredible degree and with astonishing clearness. There is quite an assortment of pictures that should suit all tastes. Some are pictures of bathing girl beauties, pretty French Actresses, etc., others are views of places of interest in France, Panama Canal and elsewhere; others show the Lord's Prayer in type, every word of which can be read by persons with normal eyesight. They are interesting without being in any way objectionable. **PRICE 25c. 3 for 65c. or $2.25 per doz. postpaid.** *710 page Catalog 10c.*

REAL LIVE PET TURTLES

25c

Sent by Mail for only 25 Cents

A FASCINATING AND INTERESTING PET

LIVE Delivery Guaranteed

If you want a fascinating and interesting little pet, just risk 25c and we will send you a real live PET TURTLE by mail postpaid. Thousands sold at ChicagoWorlds Fair. No trouble at all to keep. Just give it a little lettuce or cabbage or let it seek its own food. Extremely gentle, easily kept and live for years and years. Need less attention than any other pet. Get one or more. Study their habits. You will find them extremely interesting. Price 25c. SPECIAL TURTLE FOOD 10c pkg.

MAKE YOUR OWN RADIO RECEIVING SET

Enjoy the concerts, baseball games, market reports, latest news, etc. The copyrighted book "EFFICIENT RADIO SETS" shows how to make and operate Inexpensive Radio Sets; the materials for which can be purchased for a mere trifle. Also tells how to build a short-wave Receiver for bringing in foreign stations, police calls, ships at sea, etc. **ONLY 15c. postpaid.**

SILENT DEFENDER

Used by police officers, detectives, sheriffs, night watchmen and others as a means of self-protection. Very effective. Easily fits the hand, the fingers being grasped in the four holes. Very useful in an emergency. Made of aluminum they are very light, weighing less than 2 ounces. Handy pocket size always ready for instant use. **PRICE 25c each. 2 for 45c postpaid.**

BIG ENTERTAINER

180 Jokes and Riddles. 34 Magic Tricks. 54 Parlor Games. 73 Toasts. 15 Tricks with Cards. 50 Money-making Secrets. 10 Funny Readings. 3 Monologues. 21 Puzzles and Problems. 5 Comic Recitations. Cutouts for Checkers and Chess. Dominoes, Fox and Geese, 9 Men Morris, Spanish Prison Puzzle, Game of Anagrams, etc. **All for 15c postpaid.**

WONDERFUL X-RAY TUBE

A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your fingers; the lead in a lead pencil, the interior opening in a pipe stem, and many other similar illusions. **Price 10c, 3 for 25c.**

HOW TO WIN AT POKER

Written by a card sharper. Tells how to win at draw poker. Explains different varieties of poker such as Straight Poker, Stud Poker, Whiskey Poker, Mistigris, The Freeze-out, The Widow, Buck, Jack-Pots, etc. Exposes the methods used by card sharpers and professional gamblers, 19 Chapters. This book contains a vast amount of information and may save you from being fleeced by crooked players and gamblers. **PRICE 10c postpaid.** *710 page Novelty Catalog 10c*

THE FAN DANCE

Hit of the Chicago Worlds Fair

Who will forget the famous FAN DANCE episode of the Century of Progress Exposition in Chicago? Here it is humorously, cleanly, presented in vest pocket form.

You flip the pages and **HOTSY TOTSY** comes to life and whirls through her dance ... provoking not a sly smile, but a wholesome laugh from all. No end of fun and amusement. Spicy, piquant entertainment for all. Pocket size, 2 x 3 inches. **Price 10c ppd.** *710 page Novelty Catalog 10c*

Fortune Telling By Cards

Book shows how to tell fortunes with cards, dice, dominoes, crystal, etc. Tells the meaning and signification of every card. Several different methods explained and fully illustrated. Crammed full from cover to cover with complete information on fortune-telling. **PRICE 10c postpaid.** *Stamps accepted.*

GoodLuck RING

Very striking, quaint and uncommon. Oxidized gunmetal finish; skull and crossbones design; two brilliant flashing imitation rubies or emeralds sparkle out of the eyes. Said to bring good luck to the wearer. **PRICE 25c Postpaid**

HOW TO PITCH Pitch the Fade-a-way, Spitter, Knuckler, Smoke Ball, etc. Lessons by leading Big League Pitchers. Clearly illustrated and described with 56 pictures. **POSTPAID 25c**

JAPANESE ROSE BUSHES

The Wonder of the World

Japanese Rose Bushes **bloom all the year round.** Just think of it. Six weeks after planting the seed, the plants will be in **full bloom.** It may not seem possible, but we positively **guarantee it to be so.** They will **bloom every ten weeks.** Summer or Winter, and when three years old the bush will be a **mass of roses,** bearing from five hundred to a thousand roses on each bush. The flowers are in three shades —white, pink, and crimson. The plants will do well both in and out doors. We guarantee at least three bushes to grow from each packet of seed. **Price, 10c** packet, 3 pkts. for 25c postpaid.

10 Cts.

Chinese Fragrant Tree Fern

Just introduced; noted for its rapid growth. An exceptionally pretty ornamental plant. Foliage is rich dark green. Forms grand pyramidal bushes about 6 feet high. Branches very desirable for decorative purposes, wreaths, etc. **Seeds 15c pkt., 3 for 40c.**

Weather Plant

NATURE'S WEATHER PROPHET

By mysterious changes that take place, this remarkable plant accurately forecasts the weather many hours in advance. Will grow anywhere all the year around. An interesting house plant. Bears large, fragrant, pink, butterfly shape flowers. **Seeds, 15c packet. 3 for 40c. postpaid**

GROUND ALMONDS

Amazingly Prolific—Easily Grown From Seed

The Ground Almond has a flavor that is MOST EXCELLENT, resembling the cocoanut. The meat is snow white, covered with a shell or skin of brown color. It grows close to the surface and anything from 200 to 300 Almonds may be expected from a single nut. There is no trouble whatever in growing anywhere and in any kind of soil. May be planted any time, and in eight or ten weeks from time of planting you will have an ENORMOUS CROP of the MOST DELICIOUS ALMONDS YOU EVER TASTED. **Seeds 15c Pkt.**

Chinese Cabbage

Novelty from China and should be grown in every garden. Seems to be a cross between Celery and Coe Lettuce. Flavor is more mild than any other cabbage. **Can be served on the table** and eaten raw or cooked like cabbage, spinach or lettuce or made into salad. Grows very rapidly, easy to cultivate. You can create quite a sensation by cultivating this remarkable novelty. **Seeds, 15c packet, 3 pkts. for 40c.**

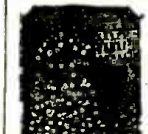
TREE OF HEAVEN

This splendid ornamental tree is a native of China and is called the Tree of Heaven, on account of its great beauty. Very hardy, thrives in any soil, no matter how poor, and grows from 6 to 10 feet high from seed the first summer. The leaves are from 5 to 6 feet in any length, giving it a grand appearance. Nothing outside the tropics can rival it for lawn decoration. Large panicles of bloom, followed in season by great clusters of colored seed pods, make the tree a continual thing of beauty. **Packet, 15c; 3 packets 40c**

THE REMARKABLE FIREFLY PLANT

A Vine that Blooms at Night

Fills the Atmosphere with Fragrant Aroma



One of the most rapid growing vines known. Under favorable conditions this vine has been known to grow OVER 25 FEET IN A SINGLE WEEK. In a very short space of time indeed the Vine has climbed to a great height, and is covered with IMMENSE FLOWERS, from 5 to 7 inches in diameter. It is, indeed, a great novelty for, unlike other plants, the flowers OPEN IN THE EVENING and remain open until about noon the following day. In dull weather they will remain open all day. It is a most INTERESTING SIGHT to watch the opening and closing of the flowers as the clouds appear and disperse. As the flowers open they give forth a DELIGHTFUL AROMA and the whole atmosphere around is full of scented fragrance. It is always the object of favorable comment, and much curiosity is aroused by people passing at night time as to the cause of the charming aroma, frequently stopping in an endeavor to satisfy their curiosity. **PRICE, 15 CENTS packet, two packets for 25 CENTS, POSTPAID.** JOHNSON SMITH & CO.

TheGreatWonderberry

A luscious berry that may be grown and ripened from seed in any soil or climate in 3 months. The flavor is fine and unsurpassed for eating raw, cooked, canned or preserved in any form. The fruit is blue-black in color, and tastes like a luscious, rich blueberry. One bush will produce an enormous amount of fruit, yielding great masses of rich fruit all Summer and Fall. **Packet, 10c, 3 pkts. for 25c, postpaid.**

Shoo Fly Plant

A very remarkable Botanical curiosity you should have. Though quite odorless it is said flies will not remain in a room where it is grown. Bears very pretty blossoms; blooms summer and winter. Grows rapidly from seed. **SEEDS 15c pkt. 3 for 40c. postpaid.**

Banana Musk Melon

Quite a curiosity. Looks and smells like a banana. Peculiar shape and its delicious flavor make it well worth your while cultivating. Flesh is deep and of exquisite flavor. Very high prices are obtained in the city markets, as high as a dollar sometimes being demanded for one single specimen. **Seeds 10c, 3 pkts. for 25c.**

The Great Japanese Umbrella Palm

A Graceful House or Conservatory Plant

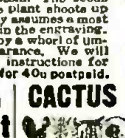
Easily Grown From Seed Winter or Summer

The Japanese Umbrella Palm is a semi-aquatic plant. It is easily grown from seed either in a bowl of water or in very damp soil. Probably the most usual, as well as the most interesting method, is to cultivate the plant in a bowl or jardiniere filled with water, with two or three inches of good garden soil at the bottom. The seeds soon commence to germinate, and the plant shoots up stems two to three feet high and rapidly assumes a most pretty palm-like appearance, as shown in the engraving. The tops of the stems are surmounted by a whorl of umbrella-shaped leaves, of a waxy appearance. We will send a package of this seed, with full instructions for culture, for only 15c or three packets for 40c postpaid.

Perfume Plant

Blooms only at night, giving forth the most delightful scented fragrance for quite a distance. Causes much comment. For house or garden. Also valuable because of rare perfume made from it. **SEEDS. 10c pkt., 3 for 25c.**

CACTUS FROM SEED



Very curious, odd looking, strange species of plants; will thrive anywhere with little or no care. Flowers are of exquisite beauty and delightfully fragrant. You will be astonished at the odd looks of the Cacti just sprouting. **Packet, 10 cents, three packets for 25 cents, postpaid.**

GIGANTIC NEW GUINEA BUTTER BEANS

THE NEW EDIBLE VEGETABLE WONDER

- Grows to an astonishing size, the Beans measuring from 3 to 6 feet long, and weighing anything from 10 to 16 lbs., and a row or two is sufficient for a family for several meals. Very palatable and rich in nutritious materials. The delicate Buttery Flavor is much appreciated. The Vines are easily grown, very prolific, and a most welcome and valuable adjunct to your garden. Try them; you will find them the most delicious vegetable you have ever tasted. Imported direct. Unobtainable elsewhere. Sample package of seeds with full directions for cultivating and cooking. **25c, postpaid.**

Kudzu Vine

Most rapid growing vine known. Will grow 20 feet in one week. Luxuriant foliage, lovely purple flowers, very fragrant. Nothing to equal it for shade purposes and quick growth. **Seeds 15c packet. 3 for 40c.**

Yard Long Bean

Produces enormous crop of long, slender, round pods, of excellent quality for snap beans. Pods grow from 3 to 5 feet in length. Very tender and fine flavor. The vines are rampant growers; an interesting curiosity. **Seeds, 15c pkt., 3 for 40c**

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Our complete Catalog sent on receipt of 10c., or the De Luxe Cloth Bound Edition for 25c. Bigger and better than ever. Only book of its kind in existence. Nearly 800 pages of all the latest tricks in magic, the newest novelties, puzzles, games, sporting goods, rubber stamps, unusual and interesting books, curiosities in seeds and plants, etc., unprocurable elsewhere. Remit by Coin, Money Order, Check or unused U. S., Canadian and Foreign Stamps for all articles listed above.

HERE IS A GROUP OF FINE QUALITY RADIO PARTS THAT "*Shouts*".. VALUE!

Mershon Triple 10 Mfd. Electrolytic Condenser

A genuine Mershon Electrolytic condenser at this low price for the first time.

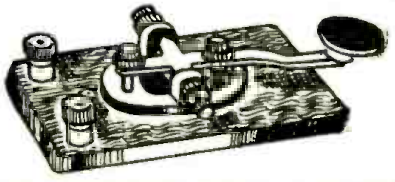
Contains three 10 mfd. condensers in one. Used as a replacement in many different receivers.

Proven design, puncture - proof, constant capacity —are the features which distinguish this condenser from others.

Positive terminal leads are brought out to bolts on top of the condenser. Negative is grounded to the container.

Price **$1.25**

POWERTONE SENDING KEY

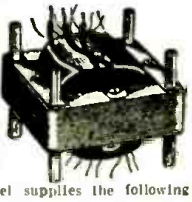


This popular design is widely used as a low power transmitting and code practice key.

Mounted on a mahogany finished base. The key is well-balanced and fully adjustable for clearance and tension. Contacts are designed for heavy service. A commercial key at the amateur's price. Base dimensions 5¾ inches long and 2⅝ inches wide.

Price **79c**

CROSLEY POWER TRANSFORMERS



Constructed of the finest materials. Large oversized construction insures freedom from heating. Massive core and oversized coil provides long trouble free life.

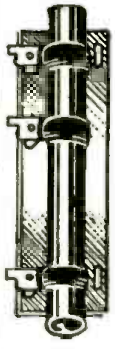
R. H. model supplies the following voltages:

1½ volts for 4-226; 2½ volts at 2 amps. for 1-227; 5 volts at ¼ amp. for 1-171A; Winding for Raytheon Type B.H. tube: 250-250 High voltage; Primary 110 volts A.C. 60 cycle. Price $1.00

Fast .06-.06 Condenser

A high grade by-pass condenser made by one of the foremost condenser manufacturers in the country. Contains two .06-condensers in one can. Separate terminals are brought out for the common connection and both positive. Can is not grounded.

Price **12c**



60,000 ohm Ward Leonard Vitrohn Resistor

A high grade well known heavy duty resistor. Will dissipate 25 watts continuously. Total resistance is 60,000 ohms tapped at 1500. Comes completely mounted on a bakelite strip to ease installation. Bakelite strip measures 4 inches in length and 1¼ inch wide.

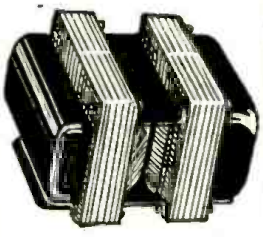
Price **19c**

4 Prong Bakelite Socket

We bought a great quantity of these sockets before the price rise. Here is your chance to stock up. They will go fast at this low price—send in your order now. Phosphor-bronze contacts assure permanent connection.

Price **5c**

CROSLEY DOUBLE CHOKE



A unit consisting of two chokes which can easily be separated. Each choke is rated at 30 henries at 60 mills. Sturdily constructed and will handle an overload of 15%. Fully shielded in an attractive black enameled can. Measurements 3¾ ins. long, 2¾ ins. high, and 2¾ inches wide. Each choke contains separate terminals.

Price **69c**

R.C.A. VICTOR HAND MIKE

Provides true toned reproduction of music and voice. Ideal for use in home recording systems, and as a home broadcasting mike. Widely used in amateur portable public address systems. dress systems. Neatly finished in brown gun metal enamel — complete with 5 foot cord.

Our Price **$1.25**

FARRAND INDUCTOR DYNAMIC SPEAKERS--9" MODEL

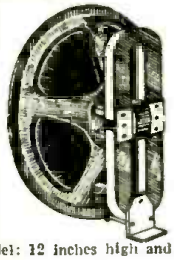
The ideal short wave receiver speaker; eliminates hum and line noise; draws less current; absolutely genuine Farrand; Compact in size; brings in the very weak short wave stations.

Do not confuse this model with the various similar types on the market posing as Farrands. This is the true Farrand Inductor Dynamic. Its adaption to Short Wave Radio Receivers has proven a popular step. The most inaudible stations are brought in with remarkable clearness without the customary noise and hum of regular dynamic speakers. Has two magnets parallel to each other with a bracket placed between them to facilitate mounting. Overall 9" model. Please state power tube when ordering.

Price **$3.95**

12" MODEL

The Genuine Farrand Inductor For The First Time At This Low Price



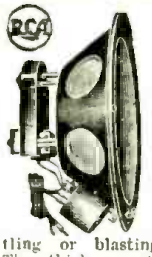
These models are not to be confused with the various types now on the market and labeled Farrand Inductors. These models are all factory built and not just put together haphazardly.

The 12 inch models have two magnets standing upright, with a bracket on the bottom to ease mounting. Dimensions of the 12 inch model: 12 inches high and 6½ inches deep.

(12" Model)

Our Price **$4.95**

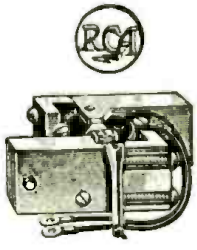
GENUINE R. C. A. MAGNETIC CHASSIS



This chassis is the identical one used in the R.C.A. 100A-100B Speakers which list for as high as $35.00. Note built-in output transformer which permits use of 450 volts without distortion, rattling or blasting. Generous oversized magnet. The thick armature is accurately centered, the sturdy metal frame is lined with a special self-baffling fabric, greatly improving acoustic properties of this sensational speaker. Note the corrugated surface of the cone, an exclusive feature—enhances perfectional reproduction qualities considerably; most compactly made; 9" outside diameter, 4½" deep overall.

Price **$2.50**

Replacement Unit

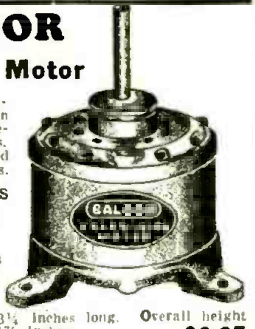


The genuine replacement unit mechanism for the R. C. A. 100A, 100B, and 103 speaker chassis. This unit is complete in every detail except that it is furnished **less the magnet.** Guaranteed to be in perfect condition. Can also be used for replacement purposes on any other type speaker.

Our Price **95c**

With Magnet **$1.25**

BALDOR Television Motor



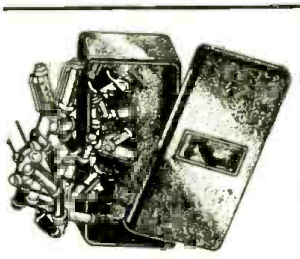
A silent synchronous motor used in the Jenkins Television receivers. All genuine brand new Baldor Motors.

SPECIFICATIONS

Type M 2 C R
H. P.—1/15
R. P. M.—1700
Volts—110 volts
A.C., 60 cycle
Amp.—1.0
Ph.—1

Standard shaft 3¼ inches long. Overall height 8 inches. Width 4¾ inches.

Price **$6.95**



Handy Kit of 50 R.M.A. Color Coded Resistors ½-1-2-Watt

A complete assortment of resistors which will prove invaluable to the service bench. Their long tinned leads and small size permit easy insertion or replacement. A compact kit and easy to carry. Odd values can be obtained by connecting two or more values in series or parallel. R.M.A. color coded for easy identification.

FREE—With each assortment of 50 resistors a beautiful bakelite case—a souvenir of the Chicago Century of Progress Exposition. Size of box: 6⅛ x 3¼ x 1⅜ inches.

Price **$2.95**

All orders are F. O. B. New York, and subject to prior sale. Terms: A deposit of 20% is required with every order. Balance may be paid on delivery. Deduct 2% if full amount is sent with order.

DO NOT SEND FOR CATALOG

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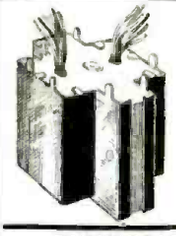
SALE OF ORIGINAL *Majestic* REPLACEMENT PARTS

All Parts Used in MAJESTIC Receivers Have Been Known to Be of the Highest Quality



FILAMENT AND PLATE TRANSFORMER
Model No. 25
Primary 115 volt 25 cycle
Secondary to anode center tapped
Secondary 5 volt 2 amp.
Secondary 2.5 volt 7 amp.
Secondary 2.5 volt 7 amp. center tapped
Weight 13 lbs.
Original Majestic Part No. 5883
$3.45 Each

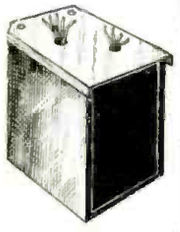
FILAMENT AND PLATE TRANSFORMER
Model No. 23A
Primary 115 Volt 60 Cycle
Secondary to anode center tapped
Secondary 5. Volt 2 Amp.
Secondary 2.5 Volt 7 Amp.
Secondary 2.5 Volt 3 Amp. center tapped
Weight 20 lbs.
Original Majestic Part No. 2156
$3.65 Each

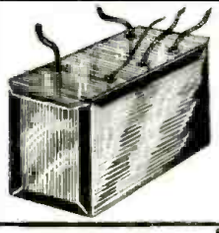
FILAMENT AND PLATE TRANSFORMER
Model No. 10 Converter
Primary 110 Volt 50-60 Cycle
Secondary to anode center tapped
Secondary 5. Volt 2 Amp.
Secondary 2.5 Volt 3½ Amp.
Weight 4 lbs.
Original Majestic Part No. 6414
$2.29 Each

UNIVERSAL POWER TRANSFORMER
Primary 110, 120, 150, 200, 220, 240 Volt
Cycle 25, 100
Secondary to anode center tapped, supplies 385 Volt D.C. at 140 M.A.
Secondary 2.5 Volt 3 Amp. for No. 82 rectifier
Secondary 2.4 Volt 7 Amp., center tapped
Secondary 2.4 Volt 4 Amp., center tapped
Weight 13 lbs.
Original Majestic Part No. 9529
$3.95 Each

UNIVERSAL POWER TRANSFORMER
Primary 110, 120, 150, 200, 220, 240 Volt
Cycle 25, 100
Secondary to anode center tapped, supplies 380 Volt D.C. at 120 M.A.
Secondary 2.5 Volt 3 Amp. for No. 82 rectifier
Secondary 2.4 Volt 13 Amp., center tapped
Weight 13 lbs.
Original Majestic Part No. 9478
$3.95 Each

FILAMENT AND PLATE TRANSFORMER
Model No. 130A—Chassis 131-132-133
Primary 115 Volt 60 Cycle
Secondary to anode center tapped
Secondary 5. Volt 2 Amp.
Secondary 2.5 Volt 7 Amp.
Secondary 2.5 Volt 3 Amp., center tapped
Weight 16½ lb.
Original Majestic Part No. 891
$3.45 Each





PICKUP TRANSFORMER
Model No. 155
Weight 3 lbs.
Original Majestic Part No. 5332
89c
Each

PICKUP INPUT TRANSFORMER
Model No. 155
Original Majestic Part No. 5578
89c
Each

PICKUP INPUT TRANSFORMER
Model No. 109
Weight 3 lbs.
Original Majestic Part No. 468
89c
Each

PUSH-PULL INPUT TRANSFORMER
Model No. 30
Weight 4½ lbs.
Original Majestic Part No. 3624
89c Each

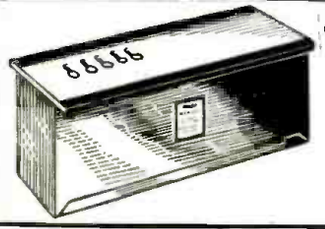
PUSH-PULL INPUT TRANSFORMER
Model No. 100B—90B
Weight 4½ lbs.
Original Majestic Part No. 1551
89c Each

PUSH-PULL OUTPUT TRANSFORMER
Model No. 30
Weight 3 lbs.
Original Majestic Part No. 3053
69c Each

CONDENSER BANK
For No. 100B and 90B
Original Majestic Part No. 1585
$1.79 Each

CONDENSER BANK
Contains 3—2 mfd.
Original Majestic Part No. 1258
$1.49 Each

BY-PASS CONDENSER ASSEMBLY
Model No. 35
Contains 4-1/10 mfd.
Weight 1 lb.
Original Majestic Part No. 5792
69c Each



CONDENSER BANK No. 7BP3
Weight 6½ lbs.
Original Majstic Part No. 716
$1.49 Each

CONDENSER BY-PASS ASSEMBLY
Model No. 390
Original Majestic Part No. 9167
69c
Each

BY-PASS CONDENSER AND TERMINAL STRIP ASSEMBLY
Model No. 200
Original Majestic Part No. 6208
69c
Each

CONDENSER ASSEMBLY
Model No. 340B
Original Majestic Part No. 9043
69c Each

CONDENSER ASSEMBLY
Model No. 25 and 25B
Weight 3¼ lbs.
Original Majestic Part No. 5607
69c Each

CHOKE ASSEMBLY
No. 7P3
Dual choke
Weight 5½ lbs.
Original Majestic Part No. 712
89c Each

FILTER CHOKE UNIT
Model No. 50
Weight 5 lbs.
Original Majestic Part No. 3051
89c Each

DOUBLE CHOKE FOR 90 SERIES
9P6 power pack
Weight 8 lbs.
Original Majestic Part No. 281
$1.19 Each

SINGLE CHOKE FOR 70 SERIES
7P3 power pack
Weight 5 lbs.
Original Majestic Part No. 640
89c Each

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COLONIAL REMOTE CONTROL ATTACHMENT

★ Complete . . Nothing Else to Buy

Imagine the convenience of just sitting back in an easy chair or lying in bed and merely by pressing a series of buttons, starting the radio located in a far off room or hidden away in the basement. Not only that, but selecting one of ten stations from a remote point. If this is the machine age, it is also the age of convenience. The remote control is a machine designed to tune your radio automatically. Why not take advantage of it, especially when it is priced more than 300% below its original list value.

This remote control outfit was used on one of the Colonial remote Control receivers which sold for more than $300.00; yet you or anyone at all handy with tools can attach it to your own radio. You can then hide the radio either in the closet, basement, or some other out-of-the-way place and extend wires to any number of speakers, strategically located in various parts of your apartment. Imagine the surprise of your friends or guests at dinner or at special gatherings, when, by merely pressing a button the room is gradually flooded with beautiful music or other entertaining programs, by the hidden speakers. Aside from being a novel idea it is also a very practical one.

RADIO SERVICE MAN and CUSTOM SET BUILDER—Here is Your Opportunity!

You need but mention the words "remote control" to your customer and immediately you command his entire interest and attention. You are able to do this because the idea to him, is new and because it immediately implies expensive equipment. However, when you inform him that you can construct or **ADAPT HIS RECEIVER FOR REMOTE CONTROL OPERATION** for only a few dollars more, his interest will most certainly materialize into an order. We need not give YOU any more talking points on this subject because you probably can muster up more than we.

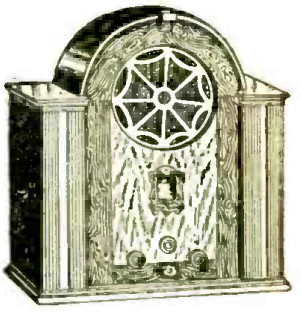
EXTREMELY SIMPLE TO OPERATE

The outfit comprises two small motors (one for turning the tuning condenser and the other for turning the volume control), a 10-position commutator switch for selecting 10 different stations, a step-down transformer for energizing the motors and a 13 button control board (10 buttons for the 10 stations, two buttons for increasing or decreasing the volume and one button for silent tuning). A pilot light in this control board indicates when the receiver is operating.

If the shafts of the tuning condenser and volume control of your present receiver can be extended so that the commutator switch section and one of the motor gears can be slipped over the tuning condenser shaft and the other motor gear on the volume control shaft then you can easily adapt this outfit to your receiver DIRECTLY without any further changes. With some sets it may be necessary to remove the volume control entirely from the chassis and mount it directly on the gear of the volume control motor. Custom set builders need have no headaches about this remote control, inasmuch as they can design the physical layouts of their sets to conform with this equipment. The illustration clearly shows all component parts of this complete remote control system. Shipping weight 18 lbs.

No. 1789 Colonial Complete Remote Control Outfit
YOUR PRICE. Only **5.96**

Greatest Buy in America? Pilot Six-Tube Two-Volt ★ Battery Receiver



COMPLETE, NOTHING ELSE TO BUY

There are ONLY 20 of these battery receivers available. ACT FAST if you desire to have one at this low price. Every one is familiar with the fine quality and performance of Pilot receivers. Their precise engineering and elaborate design has made them famous throughout the world. A fortunate buy permits us to sell these 6 tube 2-volt receivers at a price which is almost 300% below list.

This receiver may be operated from a storage battery as well, without any additional changes. Uses 2-30's, 2-31's and 2-32's. These tubes are arranged in a highly sensitive tuned radio frequency circuit which assures stability throughout the entire life of the set. Every component part, including the tuning condenser, are thoroughly shielded to prevent stray signals from entering the circuit. A large 8" magnetic speaker, specially designed to work from push pull tubes, reproduces the programs with a clarity which compares favorably with the original renditions. Both chassis and speaker are mounted in a two-toned cabinet of special columnaire design. The four controls on the front panel are respectively volume control, station selector, "on off" switch and tone control. The cabinet measures 18" high by 16" wide by 9" deep. Shipping weight 30 lbs.

No. P-200—Pilot 6 Tube 2-Volt Battery Receiver, Less Tubes.
YOUR PRICE **$13.52**
Complete set of tubes for this receiver **$4.82**

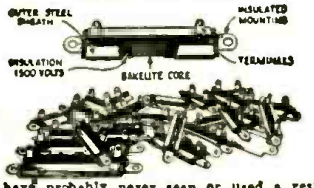
Don't Junk Your Old Tube Checker! Modernize it With This Multidapter

Contrary to popular belief the advent of the seven prong and other new tubes has not rendered your tube checker obsolete. Why throw away an expensive tube checker when it can be easily, without any internal changes, brought up to date? You merely plug this new Multidapter into the four prong socket of your present tube checker and you are all equipped to test every tube that was ever placed on the market. The legends of more than 60 of the new tubes are lithographed directly on the front panel of the Multidapter.

Furthermore, the unit is so flexibly constructed that the operator has access to every single element of any tube. In other words, aside from being able to make standard tests, every conceivable other test desired by any serviceman or experimenter can be readily made through the manipulation of four plugs and the series of plug jacks, symetrically arranged on the front panel. This feature makes the unit a perpetual instrument. Shipping weight 5 lbs.

No. 205—Multidapter
YOUR PRICE **$7.52**

Servicemen's Wire Wound Fixed Resistor Kit



You have probably never seen or used a resistor of this type. It is new, it is radically different from other resistors, both in construction, accuracy and maintenance of calibration. These resistors are "ARMORED" in the strictest sense of the word. A heavy steel covering around fine wire element protects it indefinitely and prolongs its life. A RESISTOR OF THIS TYPE MAY BE USED OVER AND OVER AGAIN, FROM SET TO SET, WITHOUT LOSING ITS CALIBRATION OR WEARING OUT.

The kit consists of 24 resistors, only 4 of which are duplicated. In other words there are more than 20 different values. If these units were bought individually they would cost more than $6.50. Manufacturers and custom set builders are rapidly becoming aware of the fact that these resistors defy adverse conditions. They will stand a considerable overload without breaking down. It is quality merchandise of this kind which builds up the business and reputation of a serviceman or custom set builder because "cheap things are expensive in the long run."

CONTENTS OF KIT

The kit contains one each of the following values: 20 ohms C.T., 40 C.T., 60 C.T., 50 ohms, 100, 150, 250, 300, 400, 600, 1250, 1500, 2000, 2500, and 3000; and two each of the following 200 ohms, 500, 750 and 1000. Shipping weight 3 lbs.

No. "MU-KIT"—Service Men's Wire Wound Fixed Resistor Kit.
YOUR PRICE ..... only **$2.24**

★ A REAL MICROPHONE at the Price of a Toy

Here is the largest value ever offered in a commercial type microphone! An unusually large two-button microphone, ruggedly constructed and designed especially for broadcast purposes. Frequency range 30 to over 5,000 cycles—adequate for all speech and music reproduction. **EXCELLENT FOR PUBLIC ADDRESS WORK.** Stretched cushioned diaphragm of duralium with pure gold center contacts on buttons and diaphragm. Standard 200 ohms per button. Finished in beautiful polished chrome. Net weight 1¾ lbs. Shipping weight 2½ lbs.

No. "F" 2 Button Mike.
YOUR PRICE **$4.96**

★ High Emission 201-A Tube

This tube may be called a "cross" between a 71-A and the 201-A. It has the M type filament of the former and the characteristics of the latter. In other words it is a 201-A tube, which, due to its "M" shape filament has a very high electronic emission. This means high plate current. These characteristics make it exceptionally suitable for use as an oscillator in transmitters or in receivers. May be used to advantage as oscillators in 5 and 10 meter transmitters. Filament voltage 5 volts, filament current —.25 amps. maximum plate voltage 157 volts. Shipping weight ¼ lb.

No. ZRF—High Emission 201-A Tube
YOUR PRICE ..... each **$0.22**

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