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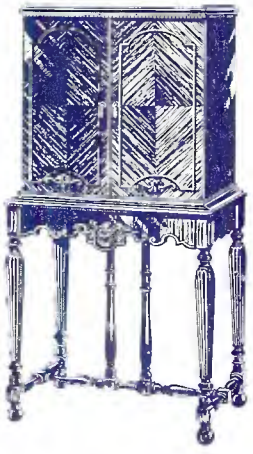
Radio Call Book Magazine

and Scientific Digest

RADIO · TELEVISION · MECHANICS

HOWARD
RADIO

Tone Beyond Compare!



The Green Diamond Console Model—beautiful cabinet of matched walnut, rich subdued finish. Magnavox Dynamic Speaker built in. Complete, less tubes.

$245

The 1929 Howard
Green Diamond Eight
(9 Tubes including Rectifier)
DYNAMIC SPEAKER

Selective to a degree almost unbelievable—a distance getter.

Howard Receivers always have been quality products. To really know the difference between a Howard Green Diamond Eight and an ordinary radio set, ask your dealer to lift the condenser shield of a Green Diamond. You'll marvel at the workmanship and watch-like perfection.

It is this excellence of construction, coupled with years of experience in radio engineering that insures Howard superiority. Any radio authority will tell you "if it's a Howard it's correctly designed and built."

Other Howard Models to $2500.
Ask for Illustrated Booklet.

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1949 North Crawford Avenue
CHICAGO
Phone—Independence 1122

for—

110 Volt Direct Current

A new 6-Tube Howard Table Model electrically operated receiver attaching to any light socket which supplies 110 volt Direct Current. (No batteries needed.) Price, less tubes,

$135

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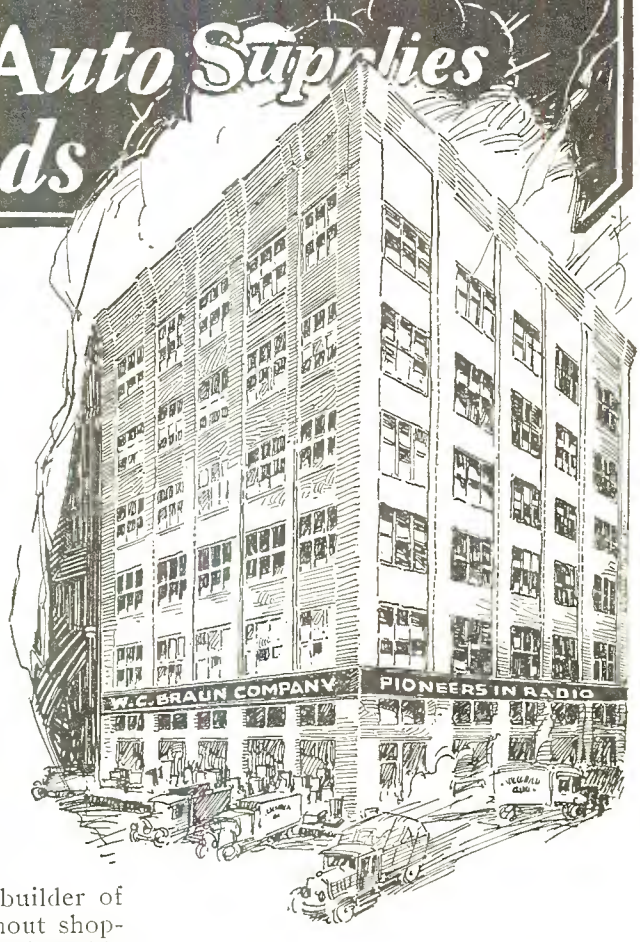

New Developments in Radio

No industry in the world's history has attracted so many inventors and experimenters as the radio industry. Something new is always on tap. Contrast the old wireless days with the modern electrically operated talking radio. Think of what is still to come when perfected television, telephony, short wave control, etc., are fully realized.

In keeping with the policies of *Wholesale Radio Headquarters* (W. C. Braun Company), our service lies in testing out and determining which of these newest marvels are practical, salable and usable for the greatest number. Our task is to study the multitude of new merchandise, select those items that are thoroughly proved and reliable, and make it easy for the public to secure these while they are still new.

A huge and varied line of standard radio merchandise is carried in stock for quick shipment to all parts of the country. This service assures the dealer and set builder of *everything he needs,* all obtainable from one house, without shopping around at dozens of different sources. It saves considerable time, trouble and money. For example, when you want a complete radio set or parts for a circuit, you also will want a cabinet, loud speaker, tubes and other supplies and accessories. You know that at Braun's you can get everything complete in one order, and thus save days and weeks of valuable time, besides a considerable saving in money.

New Lines for Spring and Summer

Here, all under one roof, is carried the world's largest stocks of radio sets, kits, parts, furniture, speakers and accessories for the radio season, portable radios and phonographs for summer trade and a complete line of auto tires, tubes and supplies, electrical and wiring material, camping and outing equipment, tents, golf goods, sporting goods; in fact, a complete merchandise line to keep business humming every day, every week and every month in the year.

Do You Get Our Catalog?

If you don't receive our catalog, by all means send us a request on your letterhead to insure getting each new edition as promptly as it comes out. Braun's Big Buyers' Guide is crammed full of bargains and money-making opportunities that you cannot afford to pass up.

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ILLINOIS

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New Super-Powerful Super Outperforms Set that Shattered All DX Records

New AC Shield Grid Super Outclasses Receiver that Spanned 10,000 Mile Gap between San Diego and Iceland

Recent tests of a new and very remarkable Receiver disclose a unique radio instrument that surpasses anything and everything on the market for consistent long distance reception with full loud speaker volume, including the world famous Magnaformer 9-8 DC battery operated Super, which Receiver, until the present time, has held the record in this country for DX reception. Consistent loud speaker reception on this Receiver of many broadcasting stations located in many countries from 6,000 to 10,000 miles distant, including 2LO London; VPS3 Hong Kong, China; 1YA Auckland, New Zealand; 2BL Sydney, Australia; 5CL Adelaide, Australia; JOAK Tokio, Japan; JOIK Sapporo, Japan; JOCK Nagoya, Japan; Danziger Rundfunk Station, Danzig, Germany (9,000 miles); 2RN Dublin, Ireland and G2SH Akureyri, Iceland—have been officially reported and verified.

The greatest verified long distance broadcast reception ever reported was achieved by Mr. William MacDonald on a Magnaformer Receiver located in his home near San Diego, California, when he brought in station GS2H Akureyri, Iceland—over 10,000 miles distant from San Diego. But this new super-powerful "Super" Receiver easily outperforms the Magnaformer that smashed all existing DX records.

New Coil Does the Trick

Ever since developing and perfecting the original Magnaformer Receiver the Engineers of the Radiart Laboratories have been endeavoring to develop a still better Receiver. During the first week of December they suddenly succeeded beyond their most sanguine expectations through the development and perfecting of a new Magnaformer Long Wave Intermediate Radio Frequency Transformer that successfully harnesses the broad tuning tendencies of the AC Shield Grid Tubes and makes them tune as sharply as the AC No. 227 tubes, retaining the tremendous amplification factor and extreme sensitivity of these Tubes.

Unique and Exclusive Features

This new job is 100% shielded. The radio frequency tubes and coils are in a separate shielded section by themselves and each stage containing a tube and coil is additionally and separately shielded from the other coils and tubes inside of the large shield. The audio frequency end is shielded by itself and is entirely separated from the other parts of the set. Then there is another large shield that is entirely separated from the other two that shields the tuning condensers and the oscillator coil.

Another advantageous feature of this new set is the plug-in oscillator coil scheme. This permits the set to be operated on the low wave stations as well as the broadcast waves. Two coils are provided for this purpose and all that it is necessary to do is to take out one coil and plug in the other whenever you want to change from one wave band to the other.

As stated before a new Magnaformer Intermediate Long Wave Radio Frequency Transformer has been perfected for the AC Shield Grid tube stages. This new transformer is known as RF No. 51. The original Magnaformer Intermediate Coil known as RF No. 61 is retained in the AC No. 227 R. F. stages.

This new Magnaformer Receiver known as the Magnaformer AC-29 is a 10 tube All Electric AC job containing 2 of the New High Amplification AC Shield Grid Tubes, 5 Heater Type No. 227 AC Tubes, 2 No. 281 Rectifier Tubes and 1 No. 250—450 volt Output Power Tube.

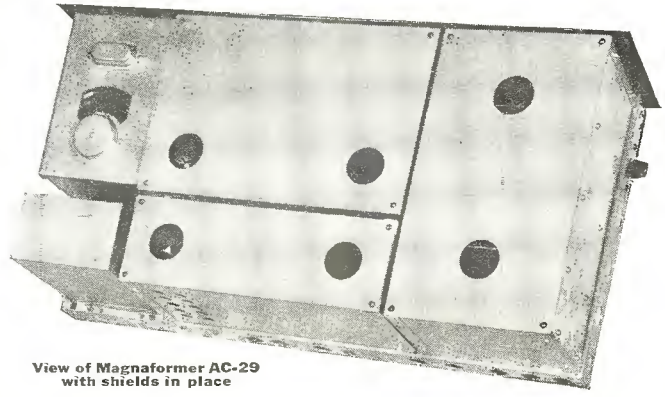
The job is controlled with a single dial and has a self-contained A, B & C Power supply including a large filter condenser which delivers all of the current for all of the A, B & C voltages for all of the tubes in the set.

Excels On These Points of Performance

The original Magnaformer is a prime favorite with high class custom set builders who cater to the most particular and exacting, well-to-do customers who want only the very best and are willing to pay for it. It is an outstanding and superior Receiver from several viewpoints:

1st—Its extreme Sensitivity, which enables it to bring in stations from 6,000 to 10,000 miles distant on the loud speaker at night and from 1,000 to 1,500 miles daylight reception.

2nd—Its truly marvelous Tone Quality, which is pronounced by expert musicians to be far superior to the tone quality of



View of Magnaformer AC-29 with shields in place

any other receiver at any price whether factory built or custom built.

3rd—Its tremendous Volume, developed by reason of the perfection of design and construction of the Long Wave Intermediate Transformers.

4th—Its extreme Selectivity, enabling it to cut through the most powerful local stations with 10 kilocycle separation with a dead spot in between.

5th—Its remarkable Quietness of Operation on DX — no sound other than the music or voice is heard (no roaring, hissing nor scratching sounds usually present in other receivers) also resulting from the perfection and efficiency of the Intermediate Transformers.

6th—Its Ease of Tuning, permitting the tuning-in of distant stations by those inexperienced in DX reception.

7th—Beauty of individual parts and their arrangement in the receiver and the attractiveness of the set as a whole. And

8th—The simplicity and ease of wiring and the short time required to do the job.

Ultra-Modern Design—1931 Style

The new Super-Powerful Magnaformer has been designed to retain and improve upon every one of the good qualities of the original Magnaformer 9-8 — and to eliminate the few features which prevent the old job from being strictly modern, such as battery or eliminator operation, employment of DC tubes, two-dial control and harmonic repeats on powerful local stations—and no provision for reception of short waves.

The new job is ultra-modern — 1931 style. It delivers a brilliancy of reception that is unique. It has greater sensitivity on account of the employment of the powerful and super-sensitive AC Shield Grid Tubes, permitting it to bring in low powered 10 to 100 watt stations 500 to 3,000 miles distant, and to bring in high powered stations from 6,000 to 10,000 miles distant with much more volume and greater ease—and to bring in far greater distance and many more stations during the daylight hours.

The marvelous Magnaformer Tone Quality has been retained and improved upon from the standpoint of the quality of tone on DX reception. On the new job stations 3,000 miles distant come in on the loud speaker with the same true tone quality as local stations.

On account of the employment of a 250 Power Tube in the last audio stage far distant stations can now be received with much greater volume than ever.

The Selectivity is greater on account of the elimination of harmonic repeats which were somewhat bothersome when the old set was located near a powerful broadcasting station that transmitted over a broad band; the new job having no harmonic repeats and still retaining the inherent selectivity of the old job, is much preferable.

The new job, on account of the perfect Intermediate Coils, retains the same remarkable Quietness of Operation on DX as the old job.

From a standpoint of Ease of Tuning the new job has quite an advantage over the old job on account of being controlled with a single dial. This feature makes the new job much more desirable on the part of the women folks who do not like to handle two dials, and is the only super we know of that is of single dial control.

The 100% shielding feature of the new job protects and hides the component parts. The shielded compartments are designed with the idea of attractiveness in view, the job being very compact and extremely business-like and aristocratic looking. The sub-panel including the complete A, B & C Power Supply and Filter Condenser measures only 11⅞ x 23 inches.

On account of the incorporation of the A, B & C Power Supply and Filter Condenser on the sub-panel with the set itself the wiring requires a slightly longer time than the old job but because of the simplicity of the arrangement of parts the wiring of the set is a considerably easier job than on the original Magnaformer. This is quite an achievement since the wiring of the original Magnaformer is acknowledged by all professional set builders to be the simplest of any Super set ever designed.

The Story of Magnaformer Coils

The advanced electrical design and absolute mechanical precision of Magnaformer Long Wave Radio Frequency Transformers account for the marvelously true tone quality of the New Magnaformer AC-29 Receiver. These R. F. Transformers are strictly a laboratory product—the result of a great many experiments and tests extending over a long period of time. The object of these tests and experiments was to develop and perfect a very superior precision instrument that could be duplicated by the thousands—each and every duplicate having EXACTLY the same characteristics as the master coil itself.

All Magnaformer Coils are Precisely Alike — Uniform and Unalterable—Nothing Can Change Them

These tests and experiments have proved highly SUCCESSFUL. Each Magnaformer is to all intents and purposes EXACTLY like every other Magnaformer. Only by the employment of elaborate laboratory apparatus can even the expert technician discover the slightest difference. It is this EXACT matching of Magnaformers—and building them so carefully and mechanically perfect that they stay EXACTLY MATCHED under all sorts of conditions that insures the exclusive degree of True Tone Quality and extremely high amplification that the New Magnaformer AC-29 possesses.

Every Magnaformer Coil is peaked exactly to a certain definite wave length, 69.73 kilocycles (4300 meters). This peaking is all done in the laboratory by thoroughly trained experts. Each and every Magnaformer Coil can pass ONLY the same identical length of wave. Therefore the full and complete wave-band with 100% of its vital, quality-producing, harmonic-carrying side-bands is positively and easily passed through all of the Radio Frequency amplifying stages and reaches the detector in perfect form—all side-bands intact. This extraordinary performance of Magnaformer Coils naturally results in as nearly perfect tone quality as it is possible to achieve. And in no other manner can True Tone Quality be achieved.

Has Self-Contained Power Supply

Everyone who has seen and heard this new Magnaformer Super-Powerful Receiver seems immediately to decide that it is an innovation—a very long stride in advance of the field. Comments by the engineers examining and testing the set indicate that to their belief it is five years ahead in design and that it will be a long, long time before another set will be developed, even by the Radiart Laboratories, that will surpass this job.

There recently has been a feeling of the need of a set that will operate perfectly with the new and popular Dynamic Speakers. This AC Shield Grid Magnaformer is the answer.

All other custom built Super Receivers have all or at least part of the power equipment located outside of the set itself. Professional custom set builders, and especially those who buy custom-built receivers, indicate a keen desire to have everything incorporated inside the set itself and nothing outside of the set except a wire that connects the set to the electric light plug. This new job meets all of these desires in what appears to be a perfect manner. It is the only custom-built Super having a 100% self-contained humless and noiseless A, B & C Power Supply.

At the present time the set is being heralded by radio experts of the leading technical magazines. They seem to realize that this very up-to-date job is a tremendous step forward in modern "Super" construction. From talking with the engineers who have designed this new job it was learned that many months have been spent in developing the humless and noiseless power supply and that the Power Units made for use with this set are subjected to very severe tests before leaving the laboratories in order to insure that there will be none of the trouble that is usually experienced with other units after they have been in operation some time.

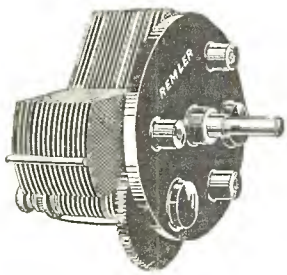
Free Wiring Diagrams Available

Custom Set Builders, Owners of Custom Built Receiver Service Stations and all those wishing to secure the delightful thrill of extreme DX reception coupled with remarkable tone quality are urged to send a request to Mr. Frank A. Ryder, 1022 Association Bldg., Chicago, Illinois, for complimentary copies of the schematic and part-to-part wiring diagrams and complete detailed, easy-to-follow wiring instructions for building the Magnaformer AC-29 in a very short time; also the name and address of the nearest jobber or dealer carrying complete parts for this receiver in stock for immediate delivery. The price of the complete parts for this wonderful receiver is very low indeed considering their high quality and the extraordinary results they achieve.

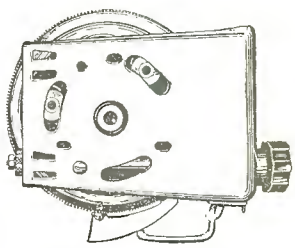
Citizens Radio Call Book Magazine and Scientific Digest, January, 1929. Published 4 times yearly, January 1, March 1, September 1, November 1. Volume X, No. 1. Published at Chicago, Ill. Subscription price, $1.75 yearly. Entered as second-class matter March 17, 1927, at the Post Office at Chicago, Ill., under the Act of March 3, 1879. Citizens Radio Service Bureau, Inc., Publishers, 508 So. Dearborn St., Chicago.

Exclusively Specified *for the* NEW Super-Powerful Magnaformer AC-29

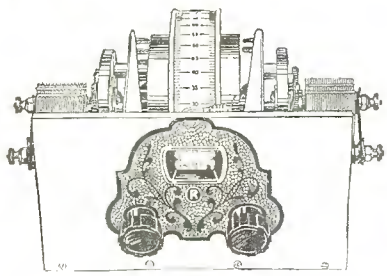
REMLER



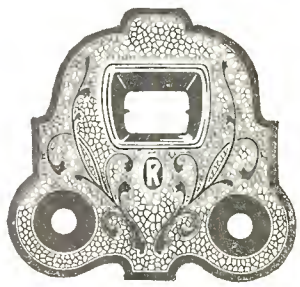
2 No. 639 Condensers



1 No. 112 Single Control Equalizer



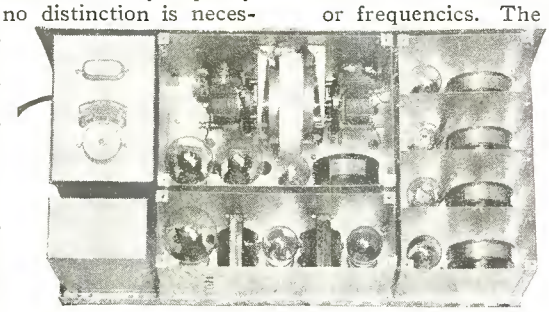
1 No. 110 Single Drum Dial



1 No. 1103 Escutcheon Plate

WITH the Remler Twin Rotor Condenser body capacity effects are entirely absent and no distinction is necessary as between stator and rotor. Both sets of plates rotate and are insulated from the dial and dial shaft. The dial rotates through 360 degrees and therefore gives unusually great dial separation of stations at all wavelengths.

The Remler Drum Dial permits a quiet, velvet smooth, vernier control. It is mounted back of the panel. Only an attractive, etched bronze escutcheon plate and the bakelite control knob are on front of panel. The drum is divided into 200 divisions—two for each broadcast channel. There is ample room to write in wavelengths or frequencies. The calibration strips are of heavy white cardboard printed in black; held rigidly in place yet readily removable and renewable. A 6-volt lamp with bracket is supplied for illumination.



Rear View of the NEW Magnaformer AC-29 with Tops of Shielded Sections Removed Showing Specified Ferranti & Remler Parts

The Remler Single Control Equalizer is used in conjunction with the Remler No. 110 Universal Drum Dial. It provides for the separate vernier adjustment of the capacity of one of the condensers over a capacity range represented by twenty divisions on the dial. For further information address Remler, 260 1st St., San Francisco, Calif.

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AUDIO FREQUENCY TRANSFORMERS AND RADIO PRODUCTS

receive preference by engineers who know

Real audio transformers with flat curves. Special output transformers for all speakers and tubes. High grade iron core chokes for "B" Eliminators. Three range portable meters. 1,000 ohms per volt. 10/50/250 scale. Three range portable meters. 200 ohms per volt. 150/7½ volt and 15 Mill. scale with switch. By-pass Condensers—2MF—400 volt and 200 volt. Circulars sent on request.

2 Ferranti AF4 Audio Frequency Transformers are specified for

the NEW Magnaformer AC-29

Write for details of the new Ferranti Push-Pull Licensed Power Amplifiers for 171, 210 and 250 tubes

Send 15c in coin for copy of 1929 Ferranti Year Book

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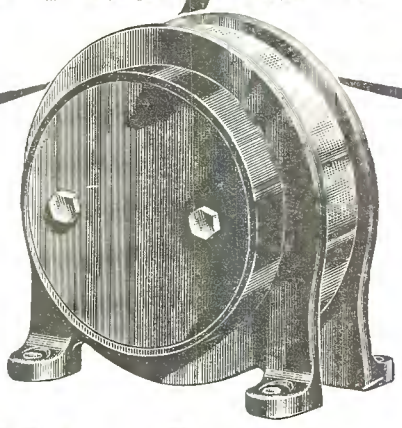
Always First with the Latest!

Magnaformer



Magna—The dictionary definition of "magna" (Latin) is "great"; the definition of "former" is "creator". Thus, we have the Great Creator, truly a name emblematic of the astonishing accomplishments of the Magnaformer.

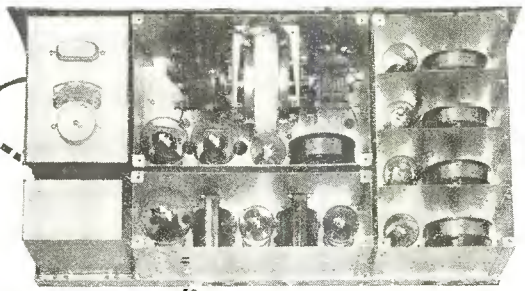
Get Your Kits from W. C. BRAUN CO.

Official Wholesale Distributors

Complete parts for this remarkable new receiver are already in our stocks! To give our Dealer and Set Builder friends instant service, we take this means of offering these kits direct from this page. No delay! Quick shipment! Gives you opportunity to get behind this fine receiver at once.

Make this your wholesale headquarters. Everything in sets, kits, parts, accessories. Make the best of 1929 with Braun service to back you up!

If you do not have a copy of our 1929 Catalog, request it now!



Showing Receiver with Shields Removed

MAIL

W. C. BRAUN CO.
589 W. Randolph Street
CHICAGO

Dear Sirs:

☐ Enclosed is remittance to cover my order for complete new Magnaformer A.C. 29 kit of parts as specified in Citizens Radio Call Book article in January, 1929, issue.
(NOTE: Enclose remittance based upon list price, less usual setbuilders' and dealers' discounts.)
☐ Send above kit C.O.D., less discount.
☐ If Long and Short Wave Antenna and Short Wave loop is desired, put "x" in this square.
☐ If complete wired chassis at $25.00 net price is desired, mark "x" in this square.
☐ Send new 1929 Catalog.

NAME.....

ST. AND NO.....

CITY.....STATE.....

YOUR ORDER NOW!

LIST OF PARTS

2	Magnaformer Intermediate Shield Grid R. F. Transformers	$12.00
2	Magnaformer Intermediate R. F. Transformers	12.00
1	Long Wave Unicoupler Oscillator	5.00
1	Radiart Drilled Sub-Panel with 10 Mounted Sockets	12.00
1	Radiart Drilled Metal Front Panel, 7x24 in.	6.00
1	Radiart 250 Power Unit	45.00
1	Radiart 5 Panel Audio Unit Shield	4.00
1	Radiart 8 Panel R. F. Unit Shield	5.50
1	Radiart 5 Panel Control Unit Shield	5.50
1	Radiart Bakelite Tip Jack Panel	.25
1	Radiart Bakelite Condenser Panel	.25
1	Radiart Bakelite Plug-in Oscillator Panel	.50
1	Radiart Bakelite Plug-in Oscillator Bottom Panel	.50
2	Shield Grid Clips Cable Leads	.50
	Bolts, Screws, Nuts, Bushings, Solder Lugs (Radiart)	1.25
	Cables and Hook-Up Wire (Radiart)	.50
1	Yaxley 20 ohm Center Tapped Resistance	.30
1	Yaxley 1,000 ohm Resistance	.35
7	Yaxley Insulated Tip Jacks	.85
1	.000045 Midget Regenerative Condenser with Bracket	1.75
2	Ferranti A.F. 4. Audio Transformers	17.00
2	Remler 639, Universal S.L.W. .0005 mfd. Variable Condensers	10.00
1	Remler 110, Single Control Universal Drum Dial	4.50
1	Remler 112, Single Control Equalizer	5.50
2	Remler 1104 BR. Knobs	.40
1	Remler 750-12 Knob	.20
1	Remler 1103, Escutcheon Plate	1.75
1	Frost, 200,000 ohm Variable High Resistance	2.00
1	Frost Special 500,000 ohm Tapered Variable High Resistance Unit with Switch	3.00
1	Samson 125, R. F. Choke	2.25
6	General Radio 274-J, Jacks for Plug-in Oscillator Panel	.60
6	General Radio 274-P Plugs for L. W. Unicoupler	.60
1	Aerovox Special 12 mfd. Filter Condenser	18.00
2	Aerovox 1 mfd. By-Pass Condensers	1.80
2	Aerovox .00025 Fixed Grid Condensers, with Mount	.80
1	Aerovox .001 Fixed Condenser	.40
2	Aerovox, 2 megohm Grid Leaks	.30
1	Electrad, 1250 ohms Fixed Resistance	.85

Complete Kit of Parts, List Price **$183.95**

Extra Equipment for Long and Short Wave Antenna and Short Wave Loop	$ 19.10
Completely Wired Chassis, extra, net	25.00

W. C. BRAUN COMPANY
Pioneers in Radio
589 West Randolph Street
CHICAGO
ILLINOIS

Citizens Radio Call Book Magazine

AND SCIENTIFIC DIGEST

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C. B. BENSON, Advertising Manager
M. R. HARRIS, Circulation Manager

JANUARY, 1929 | Published January, March, September, November | Vol. 10, No. 1

CONTENTS THIS ISSUE

In This Issue

THAT variety is the spice of life applies just as well in the radio business as in anything else. This statement is quite well borne out by a reference to the contents of this issue, where any radio man, regardless of his desires, is sure to find something of real interest to him. There are amplifier combinations for those who wish power amplifiers or dealer's demonstration amplifiers. There are a. c. superheterodynes for those who wish that type. There are short wave converters for those who wish to broaden the usefulness of their present receiver.

Added to the regular list of articles in this issue, there are three departments that are crammed full of helpful hints and suggestions, these being the one for the professional set builder, the department on practical television and th ABC of Radio, the latter department having been established last issue and now going in full swing, with considerable interest being manifest in this department by the younger generation and also the newcomer in radio, regardless of his age.

We are very hopeful that by this time the frenzied changing of wavelengths and call letters has come to an end. Latest advices from our Washington correspondent state that only very few changes may be anticipated in the future. The broadcast list printed in this issue is corrected up to within three days of going to press and we have every assurance that there will be very, very few changes and these only of a minor nature. In this present broadcast list, there is a cross reference idea employed for stations having two call letters. For example: KYW operates under another call known as KFKX. In the list KYW carries all of the pertinent data relating to the station, whereas under the heading of KFKX there is a note referring the reader to KYW for further information.

Interest in television is still running at a high pitch, being particularly aroused now with the announcement of the formation of a company to take over the Jenkins patents and to put the Jenkins scanner on the market. In addition to that, the company is rushing the completion of a 5000 watt transmitter, which should insure a very strong signal to all parts of the country, so that television enthusiasts should have no trouble in the future in getting excellent images from this station.

The Editor.

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Citizens Radio Call Book Magazine is for sale on all newsstands in the United States and Canada; also Department Stores and Book Stores; also can be purchased in most radio stores. Paris, France, Brentanos, Ave de L'Opera. England, R. A. Rothermel, Ltd., 24-26 Maddox St., Regent St., London, and W. H. Smith & Sons, London. Australia, McGills Agency, 179 Elizabeth St., Melbourne.

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Reap Big Dividends from this Investment in Tone Quality

A Thordarson Power Amplifier (Home Constructed) Will Transform Your Radio Into a Real Musical Instrument

WITH the insistent demand for quality reproduction, power amplification has become a vital radio necessity. Today, it is hard to find a radio set manufacturer who does not employ one or more power tubes in the output stage of his receiver.

There is no need, however, for you to discard your present radio instrument in spite of the fact that it is outclassed by newer models with power amplification. You can build a Thordarson Power Amplifier which, attached to your receiver, will provide a fullness and richness of reproduction that will equal or surpass the finest offerings of the present season.

Thordarson Power Amplifiers are exceedingly easy to assemble, even for the man with no previous radio experience. Only the simplest tools are used. Specific instructions with clear-cut photographs, layouts and diagrams insure success in home construction.

Whether your present receiver is factory made or custom built one of these amplifiers may be attached with equal ease. In fact, most Thordarson Amplifiers require absolutely no changes in the wiring of the receiver itself, attachment being made by means of a special plug which fits the last audio socket of the receiver.

Thordarson Power Amplifiers for the home constructor and professional set builder range from the simple plate supply unit up to the heavy-duty three stage units employing the 250 type power tube in push-pull arrangement. These power amplifiers cover the requirements for every purpose and every pocket-book. They may be used with any type of horn, cone or dynamic speaker.

With a background of over thirty-three years manufacturing quality transformers, it is only natural that so many manufacturers of receiving sets of undisputed superiority have turned to Thordarson as the logical source of their audio and power supply transformers. The discriminating home constructor will do well to follow the lead of these manufacturers when buying his power amplifier.

Write to the factory today, enclosing 25c for the new "Power Amplifier Manual"—just off the press.

New!

No Amateur or Professional Set Builder Should Be Without This Book—

"POWER AMPLIFIER MANUAL"

A simple, yet complete, treatise on the subject of audio and power amplification, including full information on building, servicing, and testing power amplifiers in general. Also contains detailed specific construction data on twelve individual power units, with clear-cut layouts and diagrams of each.

25c

Send 25c in Cash or Stamps for This New Book—
Just Off the Press!

THORDARSON
RADIO TRANSFORMERS

SUPREME IN MUSICAL PERFORMANCE

MAIL THIS COUPON TO-DAY!

THORDARSON ELECTRIC MANUFACTURING CO.
500 West Huron Street, Chicago, Illinois

Gentlemen: Please send me your new "Power Amplifier Manual" for which I am enclosing 25c. ☐

Please send me free of charge your instruction sheet on the amplifier I have checked below:

171 Single ☐. 171 Push-Pull ☐. 210 Single ☐. 210 Push-Pull (1 Stage) ☐. 210 Push-Pull (2 Stage) ☐. 250 Single (1 Stage) ☐. 250 Single (2 Stage) ☐. 250 Push-Pull (3 Stage) ☐. 210 Phonograph Amplifier ☐.

Name.....

Street and No.....

Town.....State.....

3586 A

American Broadcasting Stations

Station assignments shown in the following pages became effective November 11th, allocations having been made by the Federal Radio Commission. This list is revised from issue to issue in accordance with such reallocations as the Commission may make.

Initials such as E, C, M, and P denote Eastern, Central, Mountain and Pacific time. No wavelength is given in this list, but frequency is stated, which is the new method of designation recommended by the Federal Radio Commission.

KDKA
980 kc, East Pittsburgh, Pa., Westinghouse E. & M. Co., 50,000 w. E.

KDLR
1210 kc, Devils Lake, N. D., Radio Electric Co., 100 w.

KDYL
1290 kc, Salt Lake City, Utah, Intermountain Broadcasting Corp., 1000 w, M, "On the Air, Goes Everywhere. Shared.

KEJK
1250 kc, Beverly Hills, Calif., R. C. MacMillan, 500 w, P. Shared.

KELW
780 kc, Burbank, Calif., Earl L. White, 500 w, P, "The White Spot of the San Fernando Valley." Shared.

KEX
1180 kc, Portland, Ore., Western Broadcasting Co., 5000 w, P, "A Public Service Necessity." Shared.

KFAB
770 kc, Lincoln, Neb., Nebraska Buick Automobile Co., 5000 w, C, "Home, Sweet Home." Shared.

KFAD
620 kc, Phoenix, Ariz., Electric Equipment Co., 500 w, M, "Phoenix, Where Winter Never Comes."

KFBB
1360 kc, Havre, Mont., F. A. Buttrey Co., 250 w, M.

KFBK
1310 kc, Sacramento, Calif., Kimball-Upson Co., 100 w, P.

KFBL
1370 kc, Everett, Wash., Leese Bros., 50 w, P, "The Voice of Puget Sound." Shared.

KFBU
600 kc, Laramie, Wyo., Bishop N. S. Thomas, 500 w, M, "The Top of the World."

KFCB
1310 kc, Phoenix, Ariz., Nielsen Radio Supply Co., 100 w, M, "Kind Friends Come Back."

KFCR
1500 kc, Santa Barbara, Calif., Santa Barbara Broadcasting Co., 100 w, P.

KFDM
560 kc, Beaumont, Tex., Magnolia Petroleum Co., 500 w, C, "Kall for Dependable Magnolene." Shared.

KFDX
1210 kc, Shreveport, Pa., First Baptist Church, 100 w, C. Shared.

KFDY
550 kc, Brookings, S. D., State College, 500 w, C. Shared.

KFEC
1370 kc, Portland, Ore., Meier & Frank Co., 100 w, P, "Known for Every Courtesy." Shared.

KFEL
940 kc, Denver, Col., Eugene P. O'Fallon, Inc., 250 w, M, "The Argonaut Station." Shared.

KFEQ
560 kc, St. Joseph, Mo., Scroggin & Co., 2500 w, C. Shared.

KFEY
1210 kc, Kellogg, Idaho, Union High School, 10 w, P, "The Voice of the Coeur d'Alenes."

KFGQ
1310 kc, Boone, Iowa, Boone Biblical College. 10 w, C.

KFH
1300 kc, Wichita, Kan., Hotel Lassen, 1000 w, C, "Kansas' Finest Hotel, in the Very Heart of God's Country." Shared.

KFHA
1200 kc, Gunnison, Colo., Western St. College of Colorado, 50 w.

KFI
640 kc, Los Angeles, Calif., Earl C. Anthony, Inc., 5000 w, P, "National Institution."

KFIF
1420 kc, Portland, Ore., Benson Polytechnic School, 50 w, P.

KFIO
1230 kc. Spokane, Wash., North Central High School, 100 w day, P.

KFIU
1310 kc, Juneau, Alaska, Alaska Electric Light & Power Co., 10 w, "A Voice From the Far North."

KFIW
940 kc, Hopkinsville, Ky., The Acme Mills, Inc., 1000 w, C.

KFIZ
1420 kc, Fond du Lac, Wisc., Fond du Lac Commonwealth Reporter, 100 w, C.

KFJB
1200 kc, Marshalltown, Iowa, Marshall Electric Co., 100 w, C, "Marshalltown, the Heart of Iowa."

KFJF
1470 kc, Oklahoma City, Okla., National Radio Mfg. Co., 5000 w, C, "Radio Headquarters of Oklahoma. Shared.

KFJI
1370 kc, Astoria, Ore., Geo. Kincaid, 50 w, P. Shared.

KFJM
550 kc, Grand Forks, N. D., University of North Dakota, 500 w, C. Shared.

KFJR
1300 kc, Portland, Ore., Ashley C. Dixon & Son, 500 w, P. Shared.

KFJY
1310 kc, Ft. Dodge, Iowa, C. S. Tunwal, 100 w, C. Shared.

KFJZ
1370 kc, Ft. Worth, Texas, Henry Clay Allison, 100 w, C.

KFKA
880 kc, Greeley, Colo., Colorado State Teachers College, 500 w, M. Shared.

KFKB
1130 kc, Milford, Kan., KFKB Broadcasting Ass'n, 5000 w, C, "The Sunshine Station in the Heart of the Nation."

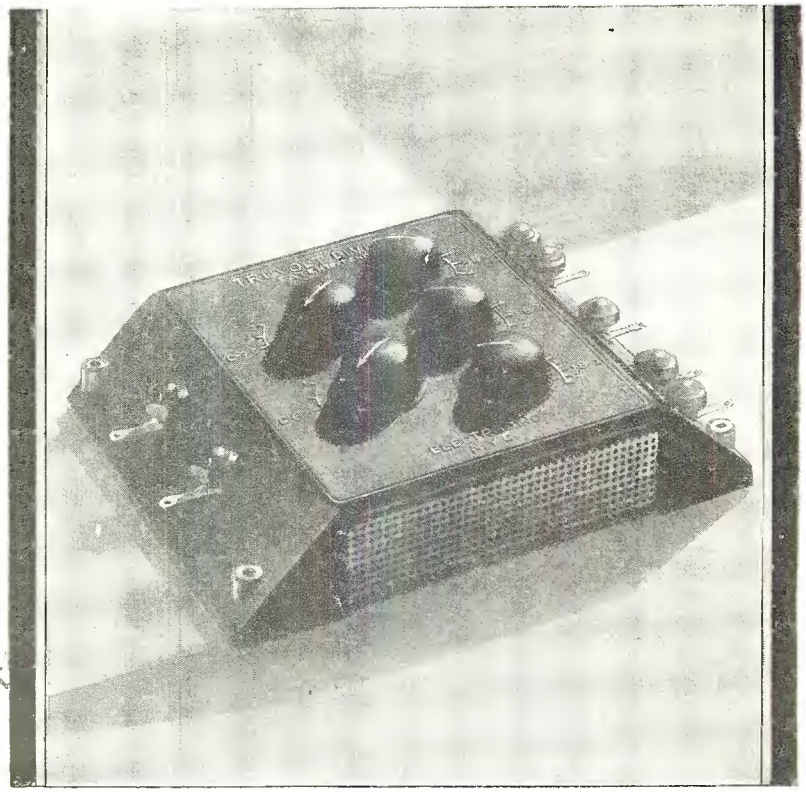
KFKU
1220 kc. Lawrence, Kan., University of Kansas, 1000 w, C, "Up at Lawrence on the Kaw." Shared.

KFKX
See under KYW.

KFKZ
1200 kc, Kirksville, Mo., Northeast Missouri State Teachers College, 50 w, C, 'Kirksville, the Home of Osteopathy."

KFLV
1410 kc, Rockford, Ill., A. T. Frykman, 500 w, C.

KFLX
1370 kc, Galveston, Texas, Geo. Roy Clough, 100 w, C.

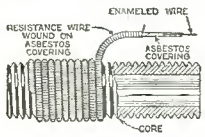


TRUVOLT DIVIDER *Correct Voltage*

A NOTABLE advance in the control of filtered voltage — the new Electrad TRUVOLT Divider combines in one compact unit, variable, wire-wound resistances with handy knobs that regulate desired voltage for any receiver using up to twelve tubes.

Think of the trouble it saves! No guessing—no complicated mathematical calculations—no voltage-regulating tubes—no fixed resistances of uncertain value—no superfluous wiring.

The knob settings have been calibrated in the Electrad laboratories to give *exact* voltage wanted from *any* type battery eliminator — plus a smooth, *graduated* control for any *in-between* value.



Electrad Wire-wound Resistances are superior in principle and workmanship. They last longer, give more accurate voltages and smoother operation.

WHERE you want it *WHEN* you want it *HOW* you want it!

A handsome molded Bakelight, ventilated case that can be mounted on the base or sub-panel, or used as the front panel of your eliminator. Easily accessible input and output terminals. Three "B" voltage regulator-knobs and two for "C" bias. Price $12.50 at your Dealers.

Mail the coupon for TRUVOLT DIVIDER Manual and other Power Pack information.

ELECTRAD

ELECTRAD, Inc., *Dept. EA-1*, 175 Variek Street, New York

Send me free copy of TRUVOLT DIVIDER MANUAL and other Electrad Voltage-Control Data

Name_____

Street_____

City_____ State_____

KFMX
1250 kc, Northfield, Minn., Carleton College, 1000 w, C. Shared.

KFNF
890 kc, Shenandoah, Iowa, Henry Field Seed Co. 500 w, C, "Known for Neighborly Folks." Shared.

KFON
1250 kc, Long Beach, Calif., Nichols & Warriner, Inc., 1000 w, P, "Where Your Ship Comes In." Shared.

KFOR
1210 kc, Lincoln, Neb., Howard A. Shuman, 100 w, C.

KFPL
1310 kc, Dublin, Texas, C. C. Baxter, 15 w, C, "Baxter's Place."

KFPM
1310 kc, Greenville, Texas, The New Furniture Co., 15 w, C, "Biggest Little Ten Watts on the Air."

KFPW
1340 kc, Siloan Springs, Ark., Rev. Lannie W. Stewart, 50 w.

KFPY
1390 kc, Spokane, Wash., Symons Investment Co., 500 w, P.

KFQA
See under KMOX.

KFQB
1240 kc, Ft. Worth, Texas. W. B. Fishburn, Inc., 1000 w, C. Shared.

KFQD
1230 kc, Anchorage, Alaska, Anchorage Radio Club. 100 w. Shared.

KFQU
1420 kc, Holy City, Calif., W. E. Riker, 100 w, P. Shared.

KFQW
1420 kc, Seattle, Wash., KFQW, Inc., 100 w, P. "Gateway to Alaska and the Orient." Shared.

KFQZ
850 kc, Hollywood, Calif., Taft Radio & Broadcasting Co., Inc., 1000 w, P.

KFRC
610 kc, San Francisco, Calif., Don Lee, Inc., 1000 w, P.

KFRU
630 kc, Columbia, Mo., Stephens College, 500 w. C, "Where Friendliness is Broadcast Daily." Shared.

KFSD
600 kc, San Diego, Calif., Airfan Radio Corp., 500 w, P.

KFSG
1120 kc, Los Angeles, Calif., Echo Park Evan. Assn., 500 w, P, "The Church of the Air."

KFUL
1290 kc, Galveston, Texas, W. H. Ford, 500 w, C, "The City of Perpetual Sunshine."

KFUM
1270 kc, Colorado Springs, Colo., W. D. Corley, 1000 w, M, "Known for Unsurpassed Mountain Scenery." Shared.

KFUO
550 kc, St. Louis, Mo., Concordia Theological Seminary, 500 w, C, "The Gospel Voice." Shared.

KFUP
1310 kc, Denver, Colo., Fitzsimmons General Hospital, 100 w, M.

KFUR
1370 kc, Ogden, Utah, Peery Building Co., 50 w, M.

KFVD
700 kc, Culver City, Calif., W. J. McWhinnie, 250 w, P.

KFVS
1210 kc, Cape Girardeau, Mo., Hirsch Battery & Radio Co., 100 w, C, "The City of Opportunity." Shared.

KFWB
950 kc, Los Angeles, Calif., Warner Bros. Broadcasting, 1000 w, P. Shared.

KFWC
1200 kc, Ontario, Calif., J. R. Fouche, 100 w, P, "The Voice of the Orange Empire." Shared.

KFWF
1200 kc, St. Louis, Mo., St. Louis Truth Center, Inc., 100 w. Shared.

KFWI
930 kc, San Francisco, Calif., Radio Entertainments, Inc., 500 w, P. Shared.

KFWM
930 kc, Oakland, Calif., Oakland Educational Society, 500 w, P, "The Most Good to the Most People." Shared.

KFXD
1420 kc, Jerome, Idaho, Service Radio Co., 50 w, M.

KFXF
940 kc, Denver, Colo., Pikes Peak Broadcasting Co., 250 w, M. "The Voice of Denver." Shared.

KFXJ
1310 kc, Edgewater, Colo., R. G. Howell, 50 w, M, "America's Scenic Center." Shared.

KFXR
1310 kc, Oklahoma City, Okla., Exchange Avenue Baptist Church, 100 w, C.

KFXY
1420 kc, Flagstaff, Ariz., Mary M. Costigan, 100 w, M.

KFYO
1420 kc, Breckenridge, Texas, Kirksey Bros. Battery & Elec. Co., 100 w, C, "Breckenridge, the Dynamo of West Texas."

KFYR
550 kc, Bismarck, N. D., Hoskins-Meyer, 500 w, C. Shared.

KGA
1470 kc, Spokane, Wash., Northwest Radio Service Co., 5000 w, P.

KGAR
1370 kc, Tucson, Ariz., Citizen's Publishing Co., 100 w, M. "Way Out on the Desert."

KGB
1360 kc, San Diego, Calif., Pickwick Broadcasting Corp., 250 w, P, "Music for the Sick."

KGBU
900 kc, Ketchikan, Alaska, Alaska Radio & Service Co., 500 w. Shared.

KGBX
1370 kc, St. Joseph, Mo., Foster-Hall Tire Co., 100 w.

KGBZ
930 kc, York, Nebr., Geo. R. Miller. 500 w. C. "The Swine and Poultry Station." Shared.

KGCA
1270 kc, Decorah, Iowa, Chas. W. Greenley, 50 w, C. Shared.

KGCB
1370 kc, Enid, Okla., Wallace Radio Inst., 100 w, C.

KGCI
1370 kc, San Antonio, Texas, Liberto Radio Sales, 100 w, C, "Radio Sam at San Antonio."

KGCN
1420 kc, Concordia, Kan., Concordia Broadcasting Co., 50 w.

KGCR
1210 kc, Brookings, S. D., Cutler's Radio Broadcasting Service, Inc., 100 w.

KGCU
1200 kc, Mandan, N. D., Mandan Radio Association, 100 w. M, "The Voice of the West."

KGCX
1420 kc, Vida, Mont., First State Bank of Vida. 10 w, M.

KGDA
1370 kc, Dell Rapids, S. D., Home Auto Co., 15 w.

KGDE
1200 kc. Barrett, Minn., Jaren Drug Co., 50 w. C.

KGDM
1150 kc, Stockton, Calif., E. F. Peffer, 50 w.

KGDP
1210 kc, Pueblo, Colo., Boy Scouts of America, 10 w, M.

KGDR
1500 kc, San Antonio, Texas, Joe B. McChane, 100 w, C.

KGDY
1200 kc, Oldham, S. Dak., J. Albert Loesch, 15 w, C.

KGEF
1300 kc, Los Angeles, Calif., Trinity Methodist Church, 1000 w, P. Shared.

KGEK
1200 kc, Yuma, Colo., Beehler Elec. Equip. Co., 50 w, M. Shared.

KGER
1370 kc, Long Beach, Calif., C. Marwin Dobyns. 100 w, P, "The Service Club of the Air."

Clear Silver Tones

straight from the microphone to you!

On The Air 52

sparkling, tuneful, wonderfully entertaining broadcast programs, featuring the music you like to hear played the way you like to hear it.

Over WOR and the Columbia Broadcast Chain of 20 stations every Monday evening at 8:30 Eastern Time; 7:30 Central Time.

THERE is a quality in CeCo Tubes that is rarely encountered in any other tube —a clearness, roundness, naturalness of tone that gives any type of radio reception a new beauty.

Only the finest materials, painstakingly employed by skillful craftsmen—the ablest direction of trained laboratory experts, could make such performance possible.

And yet CeCo Tubes (and there is one for every radio need) cost no more and last longer.

Ask for our booklet "Getting the most out of your Radio"

CeCo MFG. CO., Inc. - - Providence, R. I.

KGEW
1200 kc, Ft. Morgan, Colo., City of Ft. Morgan, 100 w, P. Shared.

KGEZ
1310 kc, Kalispell, Mont., Flathead Broadcasting Association, 100 w, M. "Located in the Switzerland of America—The Beautiful Flathead Valley."

KGFF
1420 kc, Alva, Okla., Earl E. Hampshire, 100 w, C.

KGFG
1370 kc, Oklahoma City, Okla., Faith Tabernacle Assn., 100 w, C, "The Whole Gospel to the Whole World."

KGFH
1000 kc, Glendale, Calif., Frederick Robinson, 250 w, P.

KGFI
1310 kc, San Angelo, Texas, San Angelo Broadcasting Co., 100 w, C, "The Voice of West Texas."

KGFJ
1420 kc, Los Angeles, Calif., Ben S. McGlashan, 100 w, P, "Keeps Good Folks Joyful"

KGFK
1200 kc, Hallock, Minn., Kittson County Enterprise, 50 w, C.

KGFL
1370 kc, Raton, N. Mex., L. A. Hubbard, 50 w, M.

KGFW
1420 kc, Ravenna, Neb., Otto F. Sothman, 50 w.

KGFX
580 kc, Pierre, S. D., Dana McNeil, 200 w daytime, C.

KGGF
1010 kc, Picher, Okla., D. L. Counell, M.D., 500 w, Shared.

KGGH
1310 kc, Cedar Grove, La., Bates Radio & Electric Co., 50 w, C.

KGGM
1370 kc, Albuquerque, N. Mex., Jay Peters, 100 w.

KGHA
1200 kc, Pueblo, Colo., Geo. H. Sweeney, 50 w, M.

KGHB
1320 kc, Honolulu, Hawaii, Radio Sales, 250 w.

KGHD
1420 kc, Missoula, Mont., Elmore-Nash Broadcasting Co., 50 w, M.

KGHF
1320 kc, Pueblo, Colo., Ritchie & Finch, 250 w, M.

KGHG
1310 kc, McGehee, Ark., Chas. W. McCollum, 50 w.

KGHI
1500 kc, Little Rock, Ark., Berean Bible Class, 100 w.

KGHL
950 kc, Billings, Mont., Northwestern Auto Supply Co., 500 w, M.

KGHX
1500 kc, Richmond, Tex., Ft. Bend County School Board, 50 w, C.

KGIO
1320 kc, Idaho Falls, Ida., Jack W. Duckworth, Jr., 250 w, M. Shared.

KGIQ
1320 kc, Twin Falls, Ida., Stanley M. Soule, 250 w, M. Shared.

KGIR
1360 kc, Butte, Mont., Symons Broadcasting Co., 250 w, M. Shared.

KGIW
1420 kc, Trinidad, Colo., Trinidad Creamery Co., 100 w, M.

KGJF
890 kc, Little Rock, Ark., First Church of the Nazarene, 250 w.

KGKB
1500 kc, Goldthwaite, Tex., Eagle Publ. Co., 100 w, C.

KGKL
1370 kc, Georgetown, Tex., M. L. Cates, 100 w, C.

KGKO
570 kc, Wichita Falls, Tex., Wichita Falls Broadcasting Co., 250 w, C.

KGO
790 kc, Oakland, Calif., General Electric Co., 10,000 w, P.

KGRC
1370 kc, San Antonio, Texas, Gene Roth & Co., 100 w, C.

KGRS
1410 kc, Amarillo, Texas, Gish Radio Service, 1000 w, C. Shared.

KGTT
1420 kc, San Francisco, Calif., Glad Tidings Temple, 50 w, P, "Voice of Glad Tidings." Shared.

KGU
940 kc, Honolulu, Hawaii, Marion Mulrony, 500 w. "In the Land of Sunshine, the Future Playground of America."

KGW
620 kc, Portland, Ore., Oregonian Pub. Co., 1000 w, P, "Keep Growing Wiser."

KGXX
1420 kc, Sandpoint, Idaho, C. E. Twiss, 15 w, P.

KGY
1200 kc, Lacey, Wash., St. Martins College, 10 w, P, "Out Where the Cedars Meet the Sea." Shared.

KHJ
900 kc, Los Angeles, Calif., Don Lee, Inc., 1000 w, P, "Kindness, Happiness, Joy."

KHQ
590 kc, Spokane, Wash., Louis Wasmer, Inc., 1000 w, P, "In the Friendly City."

KICK
1420 kc, Red Oak, Iowa, Atlantic Automobile Co., 100 w daytime. Shared.

KIDO
1250 kc, Boise, Idaho, F. L. Hill & C. G. Phillips, 1000 w, P.

KJBS
1100 kc, San Francisco, Calif., Julius Brunton & Sons Co., 100 w, P. "The Voice of the Storage Battery." Shared.

KJR
970 kc, Seattle, Wash., Northwest Radio Service Co., 5000 w, P.

KKP
1370 kc, Seattle, Wash., City of Seattle, 15 w, P. Shared.

KLCN
1290 kc, Blytheville, Ark., Daily Courier-News, 50 w, C.

KLDS
See under KMBC.

KLRA
1390 kc, Little Rock, Ark., Arkansas Broadcasting Co., 1000 w. Shared.

KLS
1440 kc, Oakland, Calif., Warner Bros., 250 w, P, "The City of Golden Opportunity." Shared.

KLX
880 kc, Oakland, Calif., Tribune Pub. Co., 500 w, P, "Where Rail and Water Meet." Shared.

KLZ
560 kc, Dupont, Colo., Reynolds Radio Co., Inc., 1000 w, M, "The Pioneer Station of the West."

KMA
930 kc, Shenandoah, Iowa, May Seed & Nursery Co., 500 w, C, "Keeps Millions Advised." Shared.

KMBC
950 kc, Independence, Mo., Midland Broadcasting Co., 500 w, C, "The Station Dedicated to Knowledge, Liberty, Divinity and Service." Shared.

KMED
1420 kc, Medford, Ore., W. J. Virgin, 50 w, P, "See Crater Lake."

KMIC
1120 kc, Inglewood, Calif., James R. Fouch, 500 w, P.

KMJ
1200 kc, Fresno, Calif., The Fresno Bee, 100 w, P.

KMMJ
740 kc, Clay Center, Neb., The M. M. Johnson Co., 1000 w daytime, C, "The Old Trusty Station."

KMO
1340 kc, Tacoma, Wash., KMO, Inc., 500 w, P. Shared.

KMOX
1090 kc, Kirkwood, Mo., Voice of St. Louis, Inc., 5000 w, C.

KMTR
570 kc, Hollywood, Calif., KMTR Radio Corp., 1000 w, P, "Your Friend in Hollywood." Shared.

KNX
1050 kc, Hollywood, Calif., Western Broadcast Co., 5000 w, P, "The Voice of Hollywood."

Startling Price Reductions

On Everything In RADIO

Buy Now!

Allied has cut prices to the bone—your big profits in radio can now be bigger—no need to wait any longer. This new low level of prices places before you the season's outstanding values.

Brand New Catalog for 1929

A pre-inventory sale that is featuring some of the most drastic price reductions known to radio. Everything in our tremendous stock is offered in this sale—and this large new catalog has been prepared to bring before you this tremendous array of radio values.

Every branch of the radio industry is represented—appealing to set builders interested in parts and kits—to dealers interested in the new sets and modern accessories—as well as agents who are interested in tieing up with one of the season's most successful lines of A.C. and D.C. receivers.

Wholesale Prices

Selling as we do on an exclusively wholesale basis, the prices we now offer you are establishing new standards in radio values—new A.C. sets as low as $32.95—attractively designed consoles for as low as $16.25. Corresponding values are offered in kits, parts and accessories in nationally-advertised, quality merchandise—the products of the country's foremost radio manufacturers.

The Catalog is Free
Send for Your Copy Now

Knight Receivers for A.C. and D.C. operation have established an enviable record for performance. See them in this new large catalog.

Allied Radio
CORPORATION
711 W. LAKE ST. Dept. C-2 CHICAGO

KOA
830 kc, Denver, Colo., General Electric Co., 12,500 w, M.

KOAC
560 kc, Corvallis, Ore., Oregon State Agricultural College, 1000 w, P, "Science for Service." Shared.

KOB
1180 kc, State College, N. M., N. M. College of Agri. & Mech. Arts, 10,000 w, M, "The Sunshine State of America." Shared.

KOCW
1420 kc, Chickasha, Okla., Chickasha Broadcasting Co., 100 w, C.

KOH
1370 kc, Reno, Nevada, Jay Peters, Inc., 100 w.

KOIL
1260 kc, Council Bluffs, Iowa, Mona Motor Oil Co., 1000 w, C, "The Hilltop Studio."

KOIN
940 kc, Portland, Ore., KOIN, Inc., 1000 w, P, "The Station of the Hour."

KOL
1270 kc, Seattle, Wash., Rhodes Department Store, 1000 w, P. Shared.

KOMO
920 kc, Seattle, Wash., Fisher's Blend Station, Inc., 1000 w, P.

KOOS
1370 kc, Marshfield, Ore., H. H. Hanseth, 50 w, P.

KORE
1420 kc, Eugene, Ore., Eugene Broadcast Station, 100 w, P.

KOW
1390 kc, Denver, Colo., Associated Industries, Inc., 500 w, M, "The KOW Station Away Out West." Shared.

KPCB
1210 kc, Seattle, Wash., Pacific Coast Biscuit Co., 100 w, P. Shared.

KPJM
1500 kc, Prescott, Ariz., Frank Wilburn, 100 w, M.

KPLA
570 kc, Los Angeles, Calif., Pacific Development Radio Co., 1000 w, P. Shared.

KPO
680 kc, San Francisco, Calif., Hale Bros. & The Chronicle, 5000 w, P, "The City of the Golden Gate."

KPOF
880 kc, Denver, Colo., Pillar of Fire, Inc., 500 w, M. Shared.

KPPC
1200 kc, Pasadena, Calif., Pasadena Presbyterian Church, 50 w, P. Shared.

KPQ
1210 kc, Seattle, Wash., Archie Taft & Louis Wasmer, 100 w, P.

KPRC
920 kc, Houston, Texas, Houston Printing Co., 1000 w, C, "Kotton Port Rail Center." Shared.

KPSN
950 kc, Pasadena, Calif., Pasadena Star-News, 1000 w, P. Shared.

KQV
1380 kc, Pittsburgh, Pa., Doubleday-Hill Elec. Co., 500 w, E, "The Smoky City Station." Shared.

KQW
1010 kc, San Jose, Calif., First Baptist Church, 500 w, P, "For God and Country."

KRE
1370 kc, Berkeley, Calif., First Congregational Church, 100 w, P. Shared.

KRGV
1260 kc, Harlingen, Texas, Harlingen Music Co., 500 w. Shared.

KRLD
1040 kc, Dallas, Texas, KRLD, Inc., 10,000 w, C, "Down Where the Blue Bonnets Grow." Shared.

KRMD
1310 kc, Shreveport, La., Robert M. Dean, 50 w, shared, C.

KRSC
1120 kc, Seattle, Wash., Radio Sales Corp., 50 w daytime, P.

KSAC
580 kc, Manhattan, Kan., Kansas State Agricultural College, 500 w, C. Shared.

KSBA
1450 kc, Shreveport, La., W. G. Patterson, 1000 w, C, "Keep Shreveport Before America."

KSCJ
1330 kc, Sioux City, Iowa, Perkins Bros. Co., 1000 w, C. Shared.

KSD
550 kc, St. Louis, Mo., Pulitzer Pub. Co., 500 w, C. Shared.

KSEI
900 kc, Pocatello, Idaho, KSEI Broadcasting Assn., 250 w, M, "Kummunity Southeast Idaho."

KSL
1130 kc, Salt Lake City, Utah, Radio Service Corp., 5000 w, M, "The Voice of the Intermountain Empire."

KSMR
1200 kc, Santa Maria, Calif., Santa Maria Valley R. R. Co., 100 w, P, "The Valley of Gardens."

KSO
1380 kc, Clarinda, Iowa, Berry Seed Co., 1000 w, C, "Keep Serving Others."

KSOO
1110 kc, Sioux Falls, S. D., Sioux Falls Broadcasting Assn., 1000 w daytime, C.

KSTP
1460 kc, Westcott, Minn., National Battery Broadcasting Co., 10,000 w, C.

KTAB
550 kc, Oakland, Calif., Associated Broadcasters, 500 w, P, "Knowledge, Truth and Beauty." Shared.

KTAP
1420 kc, San Antonio, Texas, Robert B. Bridge, 100 w, C, "The World's Biggest Little Station."

KTBI
1300 kc, Los Angeles, Calif., Bible Institute of Los Angeles, 1000 w, P. Shared.

KTBR
1300 kc, Portland, Ore., M. E. Brown, 500 w, P. Shared.

KTHS
800 kc, Hot Springs, Ark., Chamber of Commerce, 5000 w, C, "Kum to Hot Springs." Shared.

KTM
780 kc, Santa Monica, Calif., Pickwick Broadcasting Corp., 500 w, P, "The Station with a Smile." Shared.

KTNT
1170 kc, Muscatine, Iowa, Norman Baker, 5000 w, C, "The Voice of the Iowa Farmers' Union." Shared.

KTSA
1290 kc, San Antonio, Texas, Lone Star Broadcast Co., 1000 w, C.

KTUE
1420 kc, Houston, Texas, Uhalt Electric, 5 w, C.

KTW
1270 kc, Seattle, Wash., First Presbyterian Church, 1000 w, P. Shared.

KUJ
1500 kc, Longview, Wash., F. W. Lovejoy & R. W. Kerfoot, 10 w, P. Shared.

KUOA
1390 kc, Fayetteville, Ark., University of Arkansas, 1000 w, C. Shared.

KUOM
570 kc, Missoula, Mont., State University of Montana, 500 w, M.

KUSD
890 kc, Vermilion, S. Dak., University of South Dakota, 500 w, C. Shared.

KUT
1120 kc, Austin, Texas, University of Texas, 500 w, C, "Come to University of Texas." Shared.

KVI
1340 kc, Tacoma, Wash., Puget Sound Radio Broadcasting Co., 1000 w, P, "Puget Sound Station." Shared.

KVL
1370 kc, Seattle, Wash., Arthur C. Bailey, 100 w. Shared.

KVOO
1140 kc, Tulsa, Okla., Southwestern Sales Corp., 5000 w, C, "The Voice of Oklahoma." Shared.

KVOS
1200 kc, Bellingham, Wash., L. Kessler, 100 w, M. Shared.

KWBS
1500 kc, Portland, Ore., Schaeffer Radio Co., 15 w, P.

KWCR
1310 kc, Cedar Rapids, Iowa, Harry F. Paar, 100 w. Shared.

KWEA
1210 kc, Shreveport, La., William E. Antony, 100 w, C. Shared.

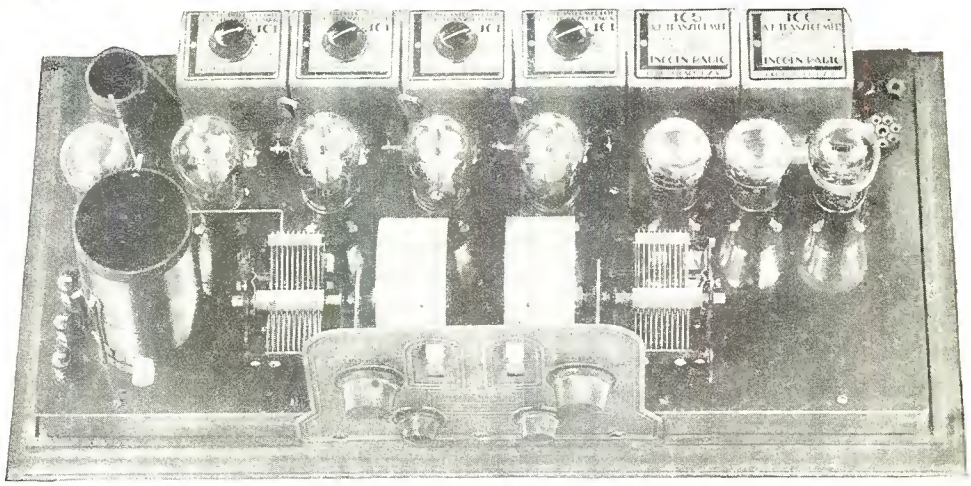
KWG
1200 kc, Stockton, Calif., Portable Wireless Tel. Co., 100 w, P. Shared.

KWJJ
P. "The Voice from Broadway."
1060 kc, Portland, Ore., Wilbur Jerman, 500 w,

KFI

IN A STEEL BANK BUILDING ON A 10 FT. ANTENNA WITH TREMENDOUS VOLUME!

LINCOLN 8-80 ONE-SPOT SUPER



That's the Performance of the Lincoln 8-80 in the Heart of Chicago

Set Builders report: Telegram, Nov. 28th—"JAPANESE STATIONS RECEIVED ON LINCOLN SUPER JOAK, JOIK, JOBK." TOKYO, JAPAN; SAPPORO, JAPAN; OSAKA, JAPAN; BROUGHT IN THROUGH THE MANY STATIONS AROUND 300 METERS.

"SIX PACIFIC COAST STATIONS WITHOUT ANTENNA OR GROUND."—*From Illinois*

"Being an ardent DX fan and having constructed and used practically all of the standard supers and tuned radio frequency outfits and having personally constructed and experimented with intermediate super transformers and equipment, I find the Lincoln 8-80 the best answer to all DX requirements. Only an experienced set builder can fully appreciate what it means to have solved for him such problems as having a proper means of matching an intermediate transformer to any tube's individual characteristics. Tone quality, simplicity of operation, the ease with which outside stations can be brought in and the fact that the price is within the range of all, make this the first set that I feel I could conscientiously recommend to everybody."

* * * * * * *

"75 stations logged before the new allocation of stations from a Chicago hotel, where 75 other receivers could not get out."

* * * * * * *

PRACTICALLY EVERY LINCOLN 8-80 OWNER REPORTS THIS WONDERFUL PERFORMANCE

* * * * * * * *

NOT A SINGLE BUILDER HAS ASKED FOR HIS MONEY BACK OR WISHED TO RETURN HIS LINCOLN 8-80

A WORD TO THE CUSTOM SET BUILDERS

You can out-demonstrate, out-perform any competitive equipment in your territory. You can pull in station after station in every degree of the dial with perfect tone quality of your local station. All this without a squeal, and only using a small part of your available power, and at a price without competition. You can convince your customer in one short demonstration.

The price of complete kit for the Lincoln 8-80 is $92.65.

Due to the new principles involved, every 8-80 works exactly alike, and you can get the same results as our finest laboratory model.

If you want an evening full of straight-from-the-shoulder superheterodyne dope written by an engineer who has played with every super going in the last few years, send 25 cents for William H. Hollister's "Secret of the Super," using the coupon below.

LINCOLN ENGINEERING SERVICE ON STANDARD KITS

Order today for immediate shipment any of the following Lincoln-Guaranteed complete kits:

Sargent-Rayment Seven (S-M 710) kit	$120.00	Tyrman 80—super	$199.50
S-M 720 Screen Grid Six	72.50	Tyrman 72 receiver kit	98.50
S-M 720 Screen Grid Six—factory wired	102.00	Tyrman 72 AC, with power pack	133.50
1929 Laboratory Superheterodyne	95.70	H. F. L. Isotone 10-tube super	195.00

LINCOLN RADIO CORPORATION

329 SOUTH WOOD ST. — CHICAGO - ILLINOIS.

Authorized Distributors for Lincoln 8-80
WESTERN RADIO MFG. CO.
128 W. Lake St., Chicago
WALTER RDWAN CO.
833 Washington St., Chicago
ELECTRIC & RADIO SUPPLY
22 N. Franklin St., Chicago
W. C. BRAUN CO.
563 W. Randolph St., Chicago
CHICAGO RADIO APPARATUS CO.
415 S. Dearborn St., Chicago

LINCOLN RADIO CORP. (Dept. C)
329 South Wood St., Chicago, Ill.

.....Send me your catalog, listing a complete line of 1929 kits for custom building.

.....Enclosed find 25c, for which send me William H. Hollister's new book "The Secret of the Super."

Name.....

Address.....

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Authorized Distributors for Lincoln 8-80
RADIO SUPPLY COMPANY
912 Broadway, Los Angeles
WHOLESALE RADIO SERVICE
6 Church St., New York City
HORACE HILLS
200 Davis St., San Francisco
KLADAG RADIO LABORATORIES
Kline Bldg., Kent, Ohio
HENRY L. WALKER CO.
27 E. Jefferson St., Detroit, Mich.

KWK
1350 kc, St. Louis, Mo., Greater St. Louis Broadcasting Corp., 1000 w, C. Shared.

KWKC
1370 kc, Kansas City, Mo., Wilson Duncan Broadcasting Co., 100 w.

KWKH
850 kc, Kennonwood, La., W. K. Henderson, 20,000 w, C. Shared.

KWLC
1270 kc, Decorah, Iowa, Luther College, 50 w, C. Shared.

KWSC
1390 kc, Pullman, Wash., State College of Washington, 500 w, P, "The Voice of the Cougars." Shared.

KWTC
1500 kc, Santa Ana, Calif., Pacific Broadcasting Fed., 100 w, P, "Kum West to California." Shared.

KWWG
1260 kc, Brownsville, Texas, Chamber of Commerce, 500 w, C, "Good Night, World." Shared.

KXA
570 kc, Seattle, Wash., American Radio Tel. Co., 500 w, P. Shared.

KXL
1250 kc, Portland, Ore., KXL Broadcasters, Inc., 500 w, P, "The Voice of Portland." Shared.

KXO
1200 kc, El Centro, Calif., Irey & Bowles, 100 w, P.

KXRO
1420 kc, Aberdeen, Wash., KXRO, Inc., 75 w.

KYA
1230 kc, San Francisco, Calif., Pacific Broadcasting Corp., 1000 w, P.

KYW
1020 kc, Chicago, Ill., Westinghouse E. & M. Co., 5000 w, C.

KZM
1370 kc, Hayward, Calif., Leon P. Tenney, 100 w, P. Shared.

NAA
690 kc, 434.5 m, United States Navy Department, Washington, D. C., 1000 w, "Where the Time Signals Originate," E.

WAAD
1420 kc, Cincinnati, Ohio, Ohio Mechanic Institute, 25 w, E.

WAAF
920 kc, Chicago, Ill., Drovers Journal Pub. Co., 500 w daytime, C.

WAAM
1250 kc, Newark, N. J., WAAM, Inc., 500 w, E, "Sunshine Station."

WAAT
1070 kc, Jersey City, N. J., Bremer Broadcasting Corp., 300 w. Shared.

WAAW
660 kc, Omaha, Neb., Omaha Grain Exchange, 500 w daytime, C, "Pioneer Market Station of the West."

WABC
860 kc, New York City, N. Y., Atlantic Broadcasting Corp., 5000 w, E.

WABF
1440 kc, Kingston, Pa., Markle Broadcasting Corp., 250 w, E, "The Voice of Wyoming Valley." Shared.

WABI
1200 kc, Bangor, Maine, First Universalist Church, 100 w, E, "The Pine Tree Wave."

WABO
See under WHEC.

WABY
1310 kc, Philadelphia, Pa. J. Magaldi, Jr., 50 w.

WABZ
1200 kc, New Orleans, La., Coliseum Place Baptist Church, 100 w, C.

WADC
1320 kc, Akron, Ohio, Allen T. Simmons, 1000 w E, shared, "Watch Akron Develop Commercially."

WAFD
1500 kc, Detroit, Mich., Albert B. Parfet Co., 100 w, E.

WAGM
1310 kc, Royal Oak, Mich., Robert L. Miller, 50 w, E.

WAIU
640 kc, Columbus, Ohio, American Insurance Union, 5000 w, E, shared, "The Radio Voice of the American Insurance Union."

WALK
1500 kc, Willow Grove, Pa., Albert A. Walker, 50 w, E.

WAPI
1140 kc, Auburn, Ala., Alabama Polytechnic Institute, 5000 w, C. Shared.

WASH
1270 kc, Grand Rapids, Mich., Baxter Laundries, Inc., 250 w, C. Shared.

WBAA
1400 kc, Lafayette, Ind., Purdue University, 500 w, C. Shared.

WBAK
1430 kc, Harrisburg, Pa., Pennsylvania State Police, 500 f, daytime, E, "The Voice of Pennsylvania."

WBAL
1060 kc, Baltimore, Md., Consolidated Gas, Elec. Co., 5000 w, E, shared, "The Station of Good Music."

WBAP
800 kc, Ft. Worth, Tex., Carter Publications, Inc., 50,000 w, C. Shared.

WBAW
1490 kc, Nashville, Tenn., Waldrum Drug Co., 5000 w, C. Shared.

WBAX
1210 kc, Wilkes-Barre, Pa., John H. Stenger, Jr., 100 w, E, "In Wyoming Valley, Home of the Anthracite."

WBBC
1400 kc, Brooklyn, N. Y., Brooklyn Broadcasting Corp., 250 w. Shared.

WBBL
1370 kc, Richmond, Va., Grace Covenant Presbyterian Church, 100 w, E, "Richmond, the Gateway North and South."

WBBM
770 kc, Chicago, Ill., Atlas Investment Co., 25,000 w, C.

WBBR
1300 kc, Rossville, N. Y., People's Pulpit Association, 1000 w, E, shared, "Watch Tower."

WBBW
1200 kc, Norfolk, Va., Ruffner Junior High School, 100 w, E.

WBBY
1200 kc, Charleston, S. C., Washington Light Infantry, 75 w, E, "The Seaport of the Southeast."

WBBZ
1200 kc, Ponca City, Okla., C. L. Carrell, 100 w, C.

WBCN
See under WENR.

WBET
1360 kc, Medford, Mass., Boston Transcript Co., 500 w, E. Shared.

WBIS
See under WNAC.

WBMH
1310 kc, Detroit, Mich., Braun's Music House, 100 w, E.

WBMJ
1500 kc, Wilkinsburg, Pa., Rev. J. W. Sproul, 100, E.

WBMS
1450 kc, Union City, N. J., WBMS Broadcasting Corp., 250 w.

WBNY
1350 kc, New York, N. Y., Baruchrome Corp., 250 w, E, shared, "The Voice of the Heart of New York."

WBOQ
See under WABC.

WBOW
1310 kc, Terre Haute, Ind., Banks of Wabash Broadcasting Assn., 100 w, C. "On the Banks of the Wabash."

WBRC
930 kc, Birmingham, Ala., Birmingham Broadcasting Co., 500 w, C, "The Biggest Little Station in the World."

WBRE
1310 kc, Wilkes-Barre, Pa., Louis G. Baltimore, 100 w, E.

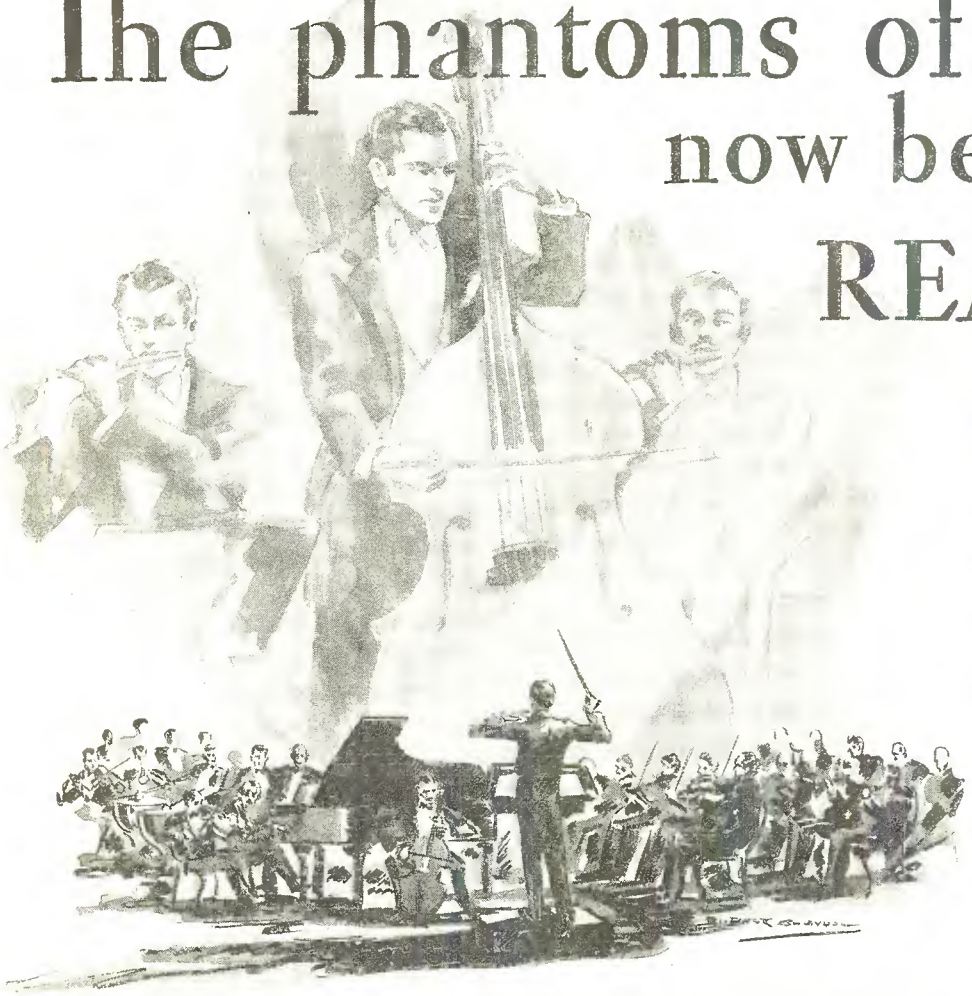
WBRL
1430 kc, Tilton, N. H., Booth Radio Laboratories, 500 w, E. Shared.

WBSO
780 kc, Wellesley Hills, Mass., Babson's Statistical Org., Inc., 100 w, daytime, E.

WBT
1080 kc, Charlotte, N. C., C. C. Coddington, 10,000 w, E, shared, "The Queen City of the South."

WBZ
990 kc, East Springfield, Mass., Westinghouse E. & M. Co., 15,000 w, E, shared, "The Broadcasting Station of New England."

The phantoms of music now become REALITY!



INSTRUMENTS—golden notes—formerly lost to radio now come through the broadcast receiver in full tonal beauty. No longer does the bass viol come in thinly on overtones alone—no more do the shrill notes of the piccolo at top register die away in a shrill, reedy absurdity. The modern radio has TONE!

Better broadcasting—better tubes—better speakers—but it has remained for Sangamo to build transformers to match these improvements. And particular attention is called to Sangamo Push-pull transformers! The Sangamo Push-pull Input Transformer has an extremely high primary inductance to secure faithful amplification of low notes and an accurately divided secondary insures practically identical frequency characteristics. There are Sangamo Push-pull Output Transformers to match the impedance of the various type power tubes and special Output Transformers for dynamic speakers.

In the Sangamo line there are transformers which permit set builders and manufacturers to produce the real tone fidelity. Are you ready for us to send you the data?

Sangamo Condensers

Molded in Bakelite—unchanging value under all conditions of service.

Tone!

"X" Line Transformers

Type AX straight audio amplification, list price.....**$6.00**

Type BX Push-pull Input unit, list price.....**$6.50**

Type CX-171 Push-pull Output transformer, for 171 or 250 power output tubes for cone speaker, list price..**$6.50**

Type DX, same as CX except for 210 and 112 power tubes, list price.....**$6.50**

Type HX Push-pull Output for 171 or 250 Power output tubes to match the impedance of moving coil of Dynamic loud speakers, list price.....**$6.50**

Type GX, same as HX except for 210 and 112 power tubes, list price.....**$6.50**

Type E output choke to match impedance of the various type power tubes, list.....**$5.00**

"A" Line Transformers

(Similar to "X" line but with special core metal to give slightly better curve)

Type A straight audio amplification, list price.....**$10.00**

Type B Push-pull Input transformer for all tubes, list price.....**$12.00**

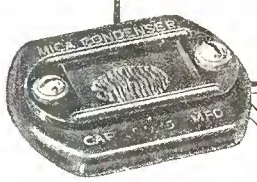
Type C-171 Push-pull Output, for 171 or 250 type power tubes with cone speaker.....**$12.00**

Type D-210, same as C except for 210 and 112 power tubes.....**$12.00**

Type H-171, Push-pull Output for 171 or 250 power tubes for Dynamic speaker.....**$12.00**

Type G-210, same as type H except for 210 and 112 tubes, list price.....**$12.00**

Type F Plate Impedance for use as a choke to prevent oscillation and for impedance coupled amplifiers, list.....**$5.00**



SANGAMO
ELECTRIC COMPANY

Springfield, Illinois

For 29 years preeminent manufacturers of electrical precision instruments

WBZA
990 kc, Boston, Mass., Westinghouse E. & M. Co., 500 w, E. Shared.

WCAC
1330 kc, Storrs, Conn., Connecticut Agricultural College, 500 w, E, shared, "Voice From the Nutmeg State."

WCAD
1220 kc, Canton, N. Y., St. Lawrence University, 500 w, daytime, E, "The Voice of the North Country."

WCAE
1220 kc, Pittsburgh, Pa., Kaufman & Baer Co. 500 w, E, "Where Prosperity Begins."

WCAH
1430 kc, Columbus, Ohio, Commercial Radio Service Co., 250 w, E. Shared.

WCAJ
590 kc, Lincoln, Neb., Nebraska Wesleyan University, 500 w, C. Shared.

WCAL
1250 kc, Northfield, Minn., St. Olaf College, 1000 w, C, shared, "The College on the Hill."

WCAM
1280 kc, Camden, N. J., City of Camden, 500 w, E. Shared.

WCAO
600 kc, Baltimore, Md., Monumental Radio, Inc., 250 w, E, "The Gateway of the South."

WCAP
1280 kc, Asbury Park, N. J., Radio Industries Broadcast Co., 500 w, E. Shared.

WCAT
1200 kc, Rapid City, S. D., South Dakota State School of Mines, 100 w, M.

WCAU
1170 kc, Philadelphia, Pa., Universal Broadcasting Co., 5000 w, E, "Where Cheer Awaits U."

WCAX
1200 kc, Burlington, Vt., University of Vermont, 100 w, E, shared, "The Voice of the Green Mountains."

WCAZ
1070 kc, Carthage, Ill., Carthage College, 100 w, daytime.

WCBA
1500 kc, Allentown, Pa., Musselman & B. Bryan, 100 w, E. Shared.

WCBD
1080 kc, Zion, Ill., Wilbur Glen Voliva, 5000 w, C. Shared.

WCBM
1370 kc, Baltimore, Md., Hotel Chateau, 100 w, E.

WCBS
1210 kc, Springfield, Ill., Dewing & Meester, 100 w,

WCCO
810 kc, Anoka, Minn., Washburn-Crosby Co., 15,000 w, C, "Service to the Northwest."

WCDA
1350 kc, New York City, N. Y., Italian Educational Broadcasting Co., 250 w, E. Shared.

WCFL
970 kc, Chicago, Ill., Chicago Federation of Labor. 50,000 w, C, shared, "The Voice of Labor."

WCGU
1400 kc, Coney Island, N. Y., U. S. Broadcasting Corp, 500 w, E. Shared.

WCLB
1500 kc, Long Beach, Long Island, N. Y., Arthur Faske, 100 w, E, shared, "The Voice of Community Service."

WCLO
1200 kc, Kenosha, Wis., C. Whitmore, 100 w, C. Shared.

WCLS
1310 kc, Jolict, Ill., WCLS, Inc., 100 w, C. Shared.

WCMA
1400 kc, Culver, Ind., Culver Military Academy, 500 w, C, shared, "The Voice of Culver."

WCOA
1120 kc, Pensacola, Fla., City of Pensacola, 500 w, E, "Wonderful City of Advantages."

WCOC
880 kc, Columbus, Miss., Crystal Oil Co., 500 w, C.

WCOH
1210 kc, Greenville, N. Y., Westchester Broadcasting Corp., 100 w, E. Shared.

WCRW
1210 kc, Chicago, Ill., Clinton R. White, 100 w, C. Shared.

WCSH
940 kc. Portland, Me., Congress Square Hotel Co., 500 w, E, "The Voice From Sunrise Land."

WCSO
1380 kc, Springfield, Ohio, Wittenberg College, 500 w, E. Shared.

WCWK
1230 kc, Ft. Wayne, Ind., Chester W. Keen, 500 w, C, daytime.

WCX
See under WJR.

WDAE
620 kc, Tampa, Fla., Tampa Publishing Co., 1000 w, E, "WDAE, the Voice of the Times at Tampa."

WDAF
610 kc, Kansas City, Mo., Kansas City Star Co., 1000 w, C, shared, "Enemies of Sleep."

WDAG
1410 kc, Amarillo, Texas, J. Lawrence Martin, 1000 w, C, shared, "Where Dollars Always Grow."

WDAH
1310 kc, El Paso, Texas, Trinity Methodist Church, 100 w, M.

WDAY
1280 kc, Fargo, N. D., WDAY, Inc., 1000 w, C. Shared.

WDBJ
930 kc, Roanoke, Va., Richardson-Wayland Elec. Corp., 250 w, E, shared, "The Magic City."

WDBO
620 kc, Orlando, Fla., Rollins College, Inc., 1000 w, E, shared. "Down Where the Oranges Grow."

WDEL
1410 kc, Wilmington, Del., WDEL, Inc., 500 w, E, shared, "First City of the First State."

WDGY
1390 kc, Minneapolis, Minn., Dr. Geo. W. Young. 500 w, C. Shared.

WDOD
1280 kc, Chattanooga, Tenn., Chattanooga Radio Co., Inc., 1000 w, C.

WDRC
1330 kc, New Haven, Conn., Doolittle Radio Corp., 500 w, E. Shared.

WDSU
1270 kc, New Orleans, La., Jos. H. Uhalt, 1000 w, C.

WDWF
1210 kc, Cranston, R. I., Dutee W. Flint, 100 w, E. Shared.

WDZ
1070 kc, Tuscola, Ill., James L. Bush, 100 w, daytime. Shared.

WEAF
660 kc, Bellmore, N. Y., National Broadcasting Co., Inc., 50,000, w, E.

WEAI
1270 kc, Ithaca, N. Y., Cornell Univ., 500 w, E.

WEAM
1370 kc, Plainfield, N. J., W. J. Buttfield, 100 w, E. Shared.

WEAN
550 kc, Providence, R. I., The Shepard Co., 250 w, E, "We Entertain a Nation."

WEAO
550 kc, Columbus, Ohio, Ohio State University. 750 w, E. Shared.

WEAR
1070 kc, Cleveland, Ohio, WTAM and WEAR, Inc., 1000 w, E. Shared.

WEBC
1280 kc, Superior, Wis., Head of The Lakes Broadcasting Co., 1000 w, C. Shared.

WEBE
1210 kc, Cambridge, Ohio, Roy W. Waller, 100 w, E.

WEBQ
1210 kc, Harrisburg, Ill., Tate Radio Co., 50 w, C. Shared.

WEBR
1310 kc, Buffalo, N. Y., H. H. Howell, 100 w, E, "We Extend Buffalo's Regards."

WEBW
600 kc, Beloit, Wis., Beloit College, 350 w, C, daytime.

WEDC
1210 kc, Chicago, Ill., Emil Denemark, Inc., 100 w. Shared.

WEDH
1420 kc, Erie, Pa., Erie Dispatch-Herald, 30 w, E.

"Almost as Good as a Victoreen"—

The Greatest Compliment That Can Be Paid Any Receiver

YOU can still build better than you can buy. This is a proven fact. There are features in a Victoreen Super, either "A.C." or "D.C." which cannot be had in any factory built set. The selectivity, sensitivity, tone quality and reliability of a Victoreen is positively unequalled by any "production" receiver on the market.

Victoreen Parts are the standard of quality

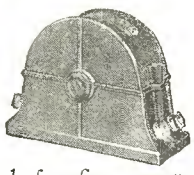
There is no real substitute for them, and for what they do. Victoreen developments are continually in advance of the times, yet they never are offered to the public until the most exhaustive tests have proven their merit.

Build with genuine Victoreen Parts and you will have a receiver that knows no superior

The Victoreen "A.C." Super

Compact in assembly, and free from frills, this 1929 Victoreen "A.C." Circuit knows no superior. Its results will meet the requirements of the most exacting critic. The essential parts are all Victoreen built. The heart of this circuit is the

New 172 R.F. Transformer



The finest obtainable for radio frequency amplification. It represents a marked improvement over the previous type 170—which for five years has been known as the standard of comparison. Each transformer is tuned and matched to a precision of less than 1/3 of one per cent. **$8.00.**

The new 152 Coupling Unit.....**$6.00**
The new 162 Antenna Coupler.. **4.00**

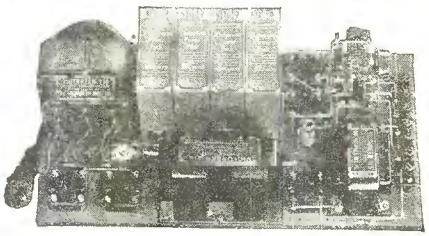
"216" Choke

Intended for use in the Victoreen Power Supply. A product of standard Victoreen quality, designed for 110 volt A.C. 60 cycle. No. 216 A is 110 volt, 25 cycle. Same case as the 112 Audio Transformer. Price **$15.00.**

Victoreen "C" Power Supply

The Victoreen 516 "C" Supply serves to eliminate the use of C batteries. It furnishes four voltages at one time, 45 and 90 volts fixed and two variable, 0 to 45 volts and 45 to 90 volts. The Victoreen 516 "C" Supply will be found more than advantageous as it supplies a voltage which may be varied to suit the detector requirements of the receiver.

Victoreen "B" Power Supply



The New Victoreen power supply is designed to furnish 45, 90, 180 and 450 volts and is intended for use with a UX 250 power tube in the last stage. It is not intended for loads greater than 100 mils DC. This power supply contains two voltage regulator tubes so that the 90, 180 volt taps are supplied with a constant potential.

"112" Audio Transformer

Outstanding in performance for Audio amplification. Contains both the first and second stages in the one case. Famous for its splendid tonal quality and freedom from distortion. Uses two "112" tubes and up to 450 volts of "B." Price **$22.00.**

"327" Filament Transformer

Contains two separate 2½ volt windings, and one 5 volt winding. Will supply five UY 227 tubes from each 2½ volt winding, and two UX 112A's or one UX 210 tube from the five volt taps. Also has leads for lighting dial light. Same case as 112 Audio Unit. Price **$22.00.**

BLUE PRINTS SENT FREE— USE THE COUPON

The New Victoreen 1929 A. C. Circuit, the new Universal D. C., the Victoreen "B" Power Supply and the Victoreen "C" Supply. Check the ones you wish.

Please send, without charge, the following Victoreen Blue Prints.

☐ **Victoreen A.C. Circuit**
☐ **Victoreen D.C. Circuit**
☐ **Victoreen "B" Power Supply**

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Street No.....
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THE GEORGE W. WALKER COMPANY
Merchandisers of Victoreen Radio Products
2825 Chester Ave., Cleveland, Ohio

Victoreen

STANDARDIZED RADIO PARTS

WEEI
590 kc, Boston, Mass., Edison Elec. Illum. Co., 500 w, E, "The Friendly Voice."

WEHS
1310 kc, Evanston, Ill., Victor C. Carlson, 100 w, C. Shared.

WELK
1370 kc, Philadelphia, Pa.. Howard R. Miller, 100, E.

WEMC
590 kc, Berrien Springs, Mich., Emmanuel Missionary College, 1000 w, C, "The Radio Lighthouse."

WENR
870 kc, Chicago, Ill., Great Lakes Radio Broadcasting Co., 5000 w, C, "Voice of Service."

WEPS
1200 kc, Gloucester. Mass., Matheson Radio Co., Inc., 100 w, E. Shared.

WEVD
1300 kc, Woodhaven, N. Y., Debs Memorial Radio Fund, 500 w, E. Shared.

WEW
760 kc, St. Louis, Mo., St. Louis University, 1000 w, daytime, C.

WFAA
1040 kc, Dallas. Texas, Dallas Morning News, 5000 w, C, "Working for All Alike." Shared.

WFAN
610 kc, Philadelphia, Pa., Keystone Broadcasting Co., Inc., 500 w, E.

WFBC
1200 kc, Knoxville, Tenn., First Baptist Church, 50 w, E.

WFBE
1200 kc, Cincinnati, Ohio, Park View Hotel, 100 w, E.

WFBG
1310 kc, Altoona, Pa., William F. Gable Co., 100 w, E, "The Original Gateway to the West and We Wish You All the Very Best."

WFBJ
1370 kc, Collegeville, Minn., St. Johns University, 100 w, C, "In the Heart of the Landscape Paradise."

WFBL
900 kc, Syracuse, N. Y., The Onondaga Co., Inc., 750 w, E, "When Feeling Blue, Listen." Shared.

WFBM
1050 kc, Indianapolis, Ind., Indianapolis Power & Light Co., 25,000 w, C.

WFBR
1270 kc, Baltimore, Md., Baltimore Radio Show. Inc., 250 w, E, "Home of the Star Spangled Banner."

WFDF
1310 kc, Flint, Mich., Frank D. Fallain, 100 w, E.

WFI
560 kc, Philadelphia, Pa., Strawbridge & Clothier, 500 w, E. Shared.

WFJC
1450 kc, Akron, Ohio, W. F. Jones Broadcasting, Inc., 500 w, E. Shared.

WFKD
1310 kc, Frankford, Pa., Foulkrod Radio Eng. Co., 50 w, E.

WFLA
900 kc, Clearwater. Fla., Clearwater Chamber of Commerce, 1000 w, E, "Inviting the World to the Springtime City." Shared.

WGAL
1310 kc, Lancaster, Pa., Lancaster Elec. Sup. & Const. Co., 15 w, E, "World's Gardens at Lancaster."

WGBB
1210 kc, Freeport, N. Y., Harry H. Carman, 100 w, E, "The Voice of the Sunrise Trail." Shared.

WGBC
1430 kc, Memphis, Tenn., First Baptist Church, 500 w, C. Shared (Sunday only).

WGBF
630 kc, Evansville, Ind., Evansville on Air, 500 w, E, "Gateway to the South."

WGBI
880 kc, Scranton, Pa., Scranton Broadcasters, Inc., 250 w, E. Shared.

WGBS
1180 kc, Astoria, L. I., N. Y., Gimbel Bros., Inc., 500 w, E.

WGCM
1210 kc, Gulfport, Miss., Gulf Coast Music Co., Inc., 100 w, C.

WGCP
1250 kc, Newark, N. J., May Radio Broadcast Corp., 250 w. Shared.

WGES
1360 kc, Chicago, Ill., Oak Leaves Broadcasting Corp., 500 w, C, "World's Greatest Entertainment Service." Shared.

WGH
1310 kc, Newport News, Va., Virginia Broadcasting Co., Inc., 100 w, E.

WGHP
1240 kc, Fraser, Mich., George Harrison Phelps, Inc., 750 w, E.

WGMS
See under WLB.

WGN
720 kc, Chicago, Ill., Tribune Co., 25,000 w, C.

WGR
550 kc, Buffalo, N. Y., Federal Radio Corp., 1000 w, E, "Key City of Industry." Shared.

WGST
890 kc, Atlanta, Ga., Georgia School of Technology, 250 w, E, "The Southern School with the National Reputation." Shared.

WGY
790 kc, South Schenectady, N. Y., General Electric Co., 50,000 w, E.

WHA
570 kc, Madison, Wis., University of Wisconsin, 750 w, C. Shared.

WHAD
1120 kc, Milwaukee, Wis., Marquette University 250 w, C. Shared.

WHAM
1150 kc, Rochester, N. Y., Stromberg-Carlson Tel. Mfg. Co., 5000 w, E.

WHAP
1300 kc, New York, N. Y., Defenders of Truth Society, Inc., 1000 w, E. Shared.

WHAS
820 kc, Louisville, Ky., The Courier Journal Co. & Louisville Times Co., 10,000 w, C.

WHAZ
1300 kc, Troy, N. Y., Rensselaer Polytechnic Institute, 500 w, E. Shared.

WHB
950 kc, Kansas City, Mo., Sweeney Automobile School Co., 1000 w, C, "Kansas City, Mo., the Heart of America." Shared.

WHBC
1200 kc. Canton, Ohio, St. John's Catholic Church, 10 w, E.

WHBD
1370 kc, Bellefontaine, Ohio, First Presbyterian Church, 100 w, E, "Ohio's Highest Point."

WHBF
1210 kc, Rock Island, Ill., Beardsley Specialty Co., 100 w, C.

WHBL
1410 kc, Sheboygan, Wis., Press Pub. Co., 500 w, C. Shared.

WHBP
1310 kc, Johnstown, Pa., Johnstown Automobile Co., 100 w, E, "The Voice of the Friendly City."

WHBQ
1370 kc, Memphis, Tenn., Broadcasting Station WHBQ, Inc., 100 w, C.

WHBU
1210 kc, Anderson, Ind., Citizens Bank, 100 w, C, "First Hoosier Bank on the Air."

WHBW
1500 kc, Philadelphia, Pa., D. R. Kienzle, 100 w, E.

WHBY
1200 kc, West De Pere, Wis., St. Norbert's College, 100 w, C.

WHDF
1370 kc, Calumet, Mich., C. C. MacLeod, 100 w, C.

WHDI
1390 kc, Minneapolis, Minn., Wm. Hood Dunwoody Ind. Inst., 500 w, C.

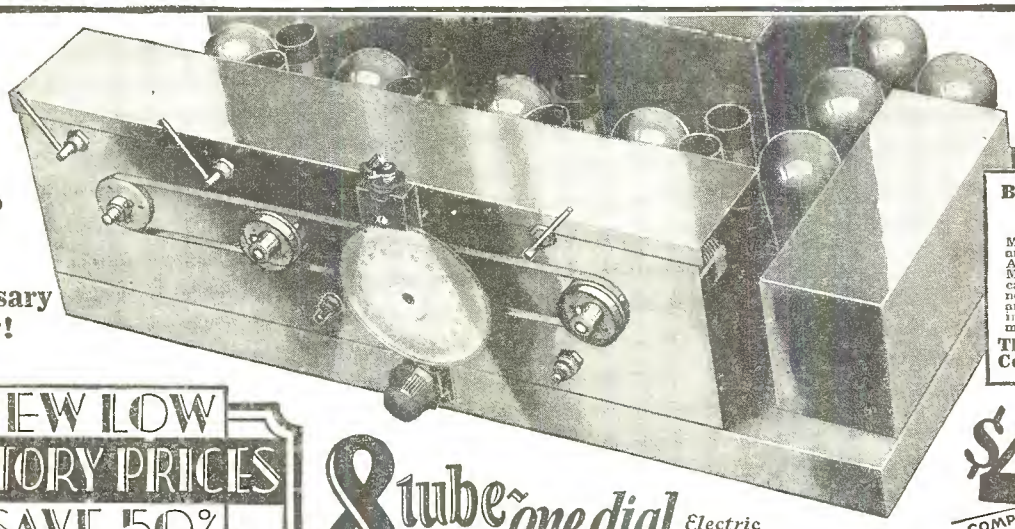
WHEC
1440 kc, Rochester, N. Y., Hickson Electric Co., Inc., 500 w, E. Shared.

WHFC
1310 kc, Cicero, Ill., Goodson & Wilson, Inc, 100 w, C. Shared.

WHK
1390 kc, Cleveland, Ohio, Radio Air Service Corp., 1000 w, E, "Cleveland's Pioneer Station." Shared.

FACTORY TO YOU—SAVE 50%—COMPARE WITH COSTLIEST OUTFITS BEFORE YOU BUY

Enjoy a powerful new Miraco AC Electric or Battery set or complete outfit 30 DAYS FREE



Get Our Send No Money 9th Anniversary Offer!

3 Year Guarantee

Built like, Looks like, Performs like a $200 set

Marvelous new 3-year guaranteed, lighted 1-dial control, All metal Super Shielded Miraco set, removed from cabinet. Front switch, phonograph pick-up connection and all latest features. Built in power section on AC models.

The Latest, Finest and Costliest Construction

$49.88 COMPLETELY ASSEMBLED

8 tube one dial Electric Lighted MIRACO

TRADE MARK REGISTERED

CATHEDRAL TONED, SUPER SELECTIVE, POWERFUL DISTANCE GETTERS

Celebrating its 9th successful year, America's big, old, reliable Radio Corporation springs a genuine sensation in high-grade sets. With its latest, Super-powered, 1-dial Miracos—the All Electric wholly self-contained, hum-free, AC-8 and AC-9, using AC tubes or the new 8-tube models for batteries or Eliminators—you are guaranteed values and savings unsurpassed in the fine set field.

Compare a Miraco with highest-priced radios, for 30 days in your home. Surprise and entertain your friends—get *their* opinions. Unless 100% delighted, *don't buy it!* Return everything—*the complete outfit*—at our expense. Your decision is final—absolutely!

Only exceptionally fine radios, of the very latest approved type, at rock-bottom prices, could possibly back up so liberally unconditional a guarantee. Send coupon now for *Amazing Special Factory Offer!*

Don't Confuse with Cheap Radios

With its rich, clear Cathedral tone, hum-free operation, tremendous "kick" on distant stations and razor-edge selectivity—with its costly sturdy construction, latest features, including phonograph pick-up connection, ease of tuning, beauty, and economy—a Miraco will make you the envy of many whose radios cost 2 to 3 times as much!

BIG DISCOUNTS
Exclusive Territory to User-Agents on
BATTERY OR AC ELECTRIC OUTFITS

Many thousands of Miracos—bought after 30 day home comparisons—are cutting through locals and getting coast to coast with the tone and power of costly sets, their delighted users report. Miracos are laboratory-built with finest parts, and embody 9 years' actual experience in constructing fine sets. Approved by Radio's highest authorities.

Deal Direct with Big Factory

Everything reaches you splendidly packed and rigidly tested to insure your instant enthusiasm. Enjoy the outfit 30 days—then decide. Liberal 3-year guarantee on each set. Play safe, save lots of money, and insure satisfaction by dealing direct with Radio's old, reliable builders of fine sets—9th successful year.

AC-8—$71.50

Unbeatable value in a 3-year guaranteed Super Shielded Metal Chassis.

Also New, More Powerful Battery Sets

The newest and latest in battery operated sets, designed with same advanced features used in electric sets! Same wide choice of cabinets. Highest quality, amazingly low priced!

Miraco Outperforms 'em All In Chicago

On the Miraco Unitune, to start with, will say: I got to date 61 stations outside of Chicago, from the Pacific Ocean to the Atlantic Ocean, and from Anchorage, Alaska, to the Gulf of Mexico, and I tried the set with 3 different antennas. That is an outside aerial 152 feet, an inside aerial 20 feet, and light socket. I want to say that your set does outperform the other sets I have. I put it up against a World Record Super 9 and beat that one. Then I put it up against a (names expensive make), and beat that one. Next I put it up against a Neutrodyne and beat that one. HARRY KOPP, 6555 South Peoria Street, Chicago, Illinois.

MIDWEST RADIO CORPORATION, 531-RJ Miraco Building, Cincinnati, Ohio

BEAUTIFULLY ILLUSTRATED CATALOG, AMAZING SPECIAL FACTORY OFFER, TESTIMONY OF NEARBY USERS—All the proof you want—of our honesty, fairness, size, financial integrity, radio experience and the performance of our sets—including Amazing Factory Offer—sent with catalog.

Dealers Write! **Free!**

MIDWEST RADIO CORPORATION
Pioneer Builders of Sets—9th Successful Year
531-RJ Miraco Bldg., Cincinnati, Ohio

THIS COUPON IS NOT AN ORDER

WITHOUT OBLIGATION, send free catalog, Amazing Special Factory Offer, testimony of nearby users, etc. ☐ User ☐ Agent ☐ Dealer

☐ **Check here if interested in an EXCLUSIVE TERRITORY PROPOSITION**

NAME ADDRESS

NEW LOW FACTORY PRICES SAVE 50%

Wide Selection of Beautiful Cabinets AC or Battery Sets

30 DAYS HOME TRIAL

Richly designed, genuine walnut console of finest type. Electro-dynamic or magnetic power cone, or long air column speaker. Marvelous value.

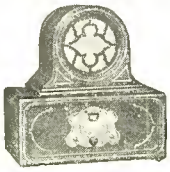
A popular walnut Hi-Boy Console, with drop-leaf desk. Beautiful two-tone finish. Rare bargain!

Beautifully graceful Spinet console, genuine two-tone walnut. Choice of speakers. Also comes in Electric Phonograph-Radio Combination.

A new-type arm-chair console. Genuine walnut. Very pretty. Low priced. Electro-Dynamic or Magnetic-Power Speakers.

At right, a Lo-Boy console, walnut finish, that costs little. A gem!

Above, popular inexpensive combination. Set on Table Speaker (sold separately).



Metal or wood compact style cabinets. Wood cabinets in walnut or new shaded silver-chrome finishes. Cathedral Electro-Dynamic or Magnetic-Power Speaker to match!

WHN
1010 kc, New York, N. Y., George Schubel, 250 w, E, "Voice of the Great White Way." Shared.

WHO
1000 kc, Des Moines, Iowa, Bankers Life Co. 5000 w. C. "W-H-O, Who? Banker's Life, Des Moines." Shared.

WHOH
830 kc, Gloucester, Mass., Matheson Radio Co., Inc., 1000 w, E.

WHPP
1420 kc, New York, N. Y., Bronx Broadcasting Co., 10 w, E. Shared.

WHT
1480 kc, Deerfield, Ill., Radiophone Broadcasting Corp., 5000 w, C. Shared.

WIAD
1370 kc, Philadelphia, Pa., Howard R. Miller, 100 w, E.

WIAS
1420 kc, Ottumwa, Iowa, Poling Electric Co., 100 w. daytime, C. Shared.

WIBA
1210 kc, Madison, Wis., Capital Times-Strand Theater Station, 100 w, C.

WIBG
930 kc, Elkins Park, Pa., St. Paul's P. E. Church, 50 w, daytime, E.

WIBM
1370 kc, Jackson, Mich., C. L. Carrell, 100 w.

WIBO
570 kc, Desplaines, Ill., Nelson Bros, Bond & Mortgage Co., 1000 w, C. Shared.

WIBR
1420 kc, Steubenville, Ohio, Thurman A. Owings, 50 w, E, "Where Investments Bring Results."

WIBS
1450 kc, Elizabeth, N. J., New Jersey Broadcasting Co., 250 w, E.

WIBU
1310 kc, Poynette, Wis., W. C. Forrest, 100 w, C.

WIBW
1300 kc, Topeka, Kan., C. L. Carrell, 1000 w, C, "Topeka—Where Investment Brings Wealth." Shared.

WIBX
1200 kc, Utica, N. Y., WIBX, Inc., 100 w, E.

WIBZ
1500 kc, Montgomery, Ala., Alexander D. Trum, 15 w, C, "We Interest Business Zeal."

WICC
1190 kc, Easton, Conn., Bridgeport Broadcasting Station, Inc., 500 w, E, "The Industrial Capital of Connecticut." Shared.

WIL
1420 kc, St. Louis, Mo., Missouri Broadcasting Co., 1000 w, C. "A Wave Length Ahead." Shared.

WILL
890 kc, Urbana, Ill., University of Illinois, 250 w, C. Shared.

WINR
1210 kc, Bayshore, N. Y., Radiotel Mfg. Co., 100 w, E, shared, "The Garden Spot of Long Island."

WIOD
1240 kc, Miami Beach, Fla., Isle of Dreams Broadcasting Co., 1000 w, E, "Wonderful Isle of Dreams." Shared.

WIP
610 kc, Philadelphia, Pa., Gimbel Bros., Inc., 500 w, E, "Watch Its Progress."

WISN
1120 kc, Milwaukee, Wis., Evening Wisconsin Co., 250 w, C.

WJAD
1240 kc, Waco, Texas, Frank P. Jackson, 1000 w, C, shared, "Waco, Texas, All Around It."

WJAG
1060 kc, Norfolk, Neb., Norfolk Daily News, 1000 w, C, shared, "Home of the Printer's Devil."

WJAK
1310 kc, Kokomo, Ind., J. A. Kautz, 50 w. Shared.

WJAR
890 kc, Providence, R. I., The Outlet Co., 250 w, E, "The Southern Gateway of New England."

WJAS
1290 kc, Pittsburgh, Pa., Pittsburgh Radio Supply House, 1000 w, E.

WJAX
1260 kc, Jacksonville, Fla., City of Jacksonville 1000 w, E, shared, "WJAX—W for Wonderful, JAX for Jacksonville."

WJAY
1450 kc, Cleveland, Ohio, Cleveland Radio Broadcasting Corp., 500 w, E. Shared.

WJAZ
1480 kc, Mt. Prospect, Ill., Zenith Radio Corp., 5000 w, C. Shared.

WJBB
1010 kc, Sarasota, Fla., Sarasota Chamber of Commerce, 250 w, E, "The Pioneer Semi-Tropical Business Journal."

WJBC
1200 kc, LaSalle, Ill., Hummer Furniture Co., 100 w, C. Shared.

WJBI
1210 kc, Red Bank, N. J., Robt. S. Johnson, 100 w, E. Shared.

WJBK
1370 kc, Ypsilanti, Mich., Ernest F. Goodwin, 50 w, C.

WJBL
1200 kc, Decatur, Ill., Wm. Gushard Dry Goods Co., 100 w, C. Shared.

WJBO
1370 kc, New Orleans, La., Valdemar Jensen, 100 w, C.

WJBT
See under WBBM.

WJBU
1210 kc, Lewisburg, Pa., Bucknell University, 100 w, E, shared, "In the Heart of the Keystone State."

WJBW
1200 kc, New Orleans, La., C. Carlsen, Jr., 30 w, C, shared, "The Serve You Broadcasting Station at New Orleans."

WJBY
1210 kc, Gadsden, Ala., Electric Cons. Co., 50 w, C.

WJJD
1180 kc, Mooseheart, Ill., Loyal Order of Moose, 20,000 w, C, shared, "Every Child Is Entitled to a High School Education and a Trade." Shared.

WJKS
1360 kc, Gary, Ind., Johnson-Kennedy Radio Corp., 500 w, C. Shared.

WJR
750 kc, PoPntiac, Mich., WJR, Inc., 5000 w, E.

WJSV
1460 kc, Mt. Vernon Hills, Va., Independent Pub. Co., 10,000 w.

WJZ
760 kc, New York City, N. Y., Radio Corporation of America, 30,000 w, E.

WKAQ
580 kc, San Juan, Porto Rico, Radio Corp. of Porto Rico, 500 w, E, "Porto Rico, The Island of Enchantment in the Caribbean Sea."

WKAR
1040 kc, East Lansing, Mich., Michigan State College, 500 w, daytime, E.

WKAV
1310 kc, Laconia, N. H., Laconia Radio Club, 100 w, E, "The Voice of the Winnepesaukee Lake Region."

WKBB
1310 kc, Joliet, Ill., Sanders Bros., 100 k, C. Shared.

WKBC
1310 kc, Birmingham, Ala., H. L. Ansley, 10 w, C.

WKBE
1200 kc, Webster, Mass., K. & B. Electric Co., 100 w, E. Shared.

WKBF
1400 kc, Indianapolis, Ind., Noble Butler Watson, 500 w, C, shared, "We Keep Building Friendships."

WKBH
1380 kc, LaCrosse, Wis., Callaway Music Co., 1000 w, C. Shared.

WKBI
1310 kc, Chicago, Ill., Fred L. Schoenwolf, 50 w. C. Shared.

WKBN
570 kc, Youngstown, Ohio, W. P. Williamson, Jr., 500 w, E. Shared.

WKBO
1450 kc, Jersey City, N. J., Camith Corp., 250 w. E. Shared.

WKBP
1420 kc, Battle Creek, Mich., Enquirer-News Co., 50 w, E.

WKBQ
1350 kc, New York, N. Y., Standard Cahill Co., Inc., 250 w, E. Shared.

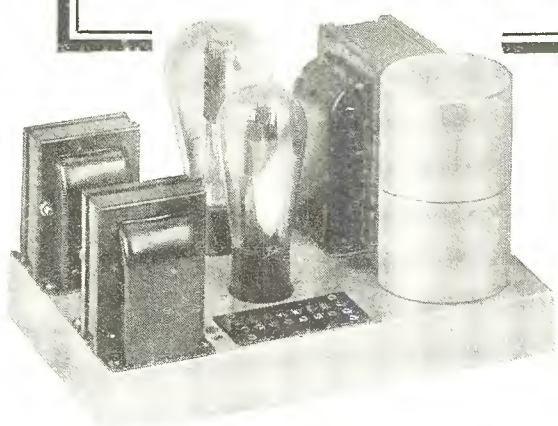
WKBS
1310 kc, Galesburg, Ill., Permil N. Nelson, 100 w. C. Shared.

WKBT
1420 kc, New Orleans, La., First Baptist Church, 50 w, C.

Blast your way through . . .

with the super powered

HFL SPECIAL NINE*



GUARANTEED to out perform any radio set on earth. Priced at $55.86. A set builder's money making plan that's a knockout. There's the story of the H F L Special Nine.

Radio's latest and greatest super is the chance of a life time for custom set builders. Four screen grid tubes. One dial and one spot. 250 tube power amplifier. A C heater or D C tube operation. No wonder they're selling them like wild fire.

You've never heard anything like the H F L Special Nine. Full loud speaker volume on 3,000 mile signals. Perfect selectivity that let's you get right alongside of the big boys. Tone quality that's a revelation. Absolutely no oscillation.

This H F L job is built like a Mack truck. Nothing to go wrong. When you sell one, it will stay sold. It's a five year set, allowing short wave operation and excellent reproduction of television signals. The Special Nine is years ahead of everything else in the radio field. And it's priced right, too—

	List Price	Net, less 40 & 2%
D C Chassis—9 tube . . .	$ 95.00	$55.86
A C Chassis—8 tube (250 external)	105.00	61.74
Set builder's wiring charge for either set	30.00	17.64
250 Power Amplifier and B supply, factory wired . . .	77.00	45.28

Prices are without tubes. The A C set requires the 250 power amplifier and B supply for operation. The power amplifier will also operate with and furnish plate voltages to the D C Special Nine.

Wide awake set builders! Attach coupon to your business stationery and send for our new plan showing how to sell at low prices and make large profits. Mail the coupon *today*. Grasp this golden opportunity *now!*

If you have mailed a previous coupon to the High Frequency Laboratories, please do not mail this one, as you will automatically receive complete information.

HIGH FREQUENCY LABORATORIES

Office: 6-28 N. Sheldon St. Chicago, Illinois

HIGH FREQUENCY LABORATORIES
Office 6, 28 N. Sheldon St., Chicago, Ill.
Gentlemen:
Without obligation please send literature describing the H F L Special Nine, also the new 250 Power Amplifier and B Supply. I have never mailed a coupon to you before.

*Name*_____

*Address*_____

*City*_____ *State*_____

(Please print plainly)

HFL

★ *Not a kit of loose parts, but a factory assembled chassis ready for wiring. Screen grid amplifier wired and tested.*

WKBV
1500 kc, Brookville, Ind.. Knox Battery & Electric Co., 100 w, C.

WKBW
1470 kc, Buffalo, N. Y., Buffalo Broadcasting Co.. 5000 w, E, shared.

WKBZ
1500 kc, Ludington, Mich., K. L. Ashbacker, 50 w.

WKEN
1040 kc, Buffalo, N. Y., WKEN, Inc., 1000 w, E. Shared.

WKJC
1200 kc, Lancaster, Pa., Kirk Johnson & Co., 100 w, E.

WKRC
550 kc, Cincinnati, Ohio, Kodel Radio Corp., 750 w, E, "WKRC, K—Kodel, R—Radio, C—Corporation."

WKY
900 kc, Oklahoma City, Okla., WKY Radiophone Co., 1000 w, C.

WLAC
1490 kc, Nashville, Tenn., Life & Casualty Ins. Co., 5000 w, C, shared, "The Thrift Station."

WLAP
1200 kc, Okalona, Ky., American Broadcasting Corp. of Kentucky, 30 w, C.

WLB
1250 kc, Minneapolis, Minn., University of Minnesota, 1000 w, C. Shared.

WLBC
1310 kc, Muncie, Ind., Donald A. Burton, 50 w. Shared.

WLBF
1420 kc, Kansas City, Mo., Everett L. Dillard, 100 w, C, "Where Listeners Become Friends."

WLBG
1200 kc, Petersburg, Va., Robert Allen Gamble, 100 w, E.

WLBH
1420 kc, Farmingdale, N. Y., Joseph J. Lombardi, 30 w. Shared.

WLBL
900 kc, Stevens Point, Wis.. Wisconsin Department of Markets, 2000 w, daytime, C, "Wisconsin, Land of Beautiful Lakes."

WLBO
1310 kc, Galesburg, Ill., Fred Trebbe, Jr., 100 w, C. Shared.

WLBV
1210 kc, Mansfield, Ohio, Mansfield Broadcasting Association, 100 w, E.

WLBW
1260 kc, Oil City, Pa., Petroleum Telephone Co., 500 w, E.

WLBX
1500 kc, Long Island City, N. Y., John N. Brahy, 100 w. Shared.

WLBZ
620 kc, Dover-Foxcroft, Me., Thompson L. Guernsey, 250 w, E.

WLCI
1210 kc, Ithaca, N. Y., Lutheran Assn. of Ithaca, 50 w, E.

WLEX
1420 kc, Lexington, Mass., Lexington Air Station, 100 w, E. Shared.

WLIB
See under WGN.

WLIT
560 kc, Philadelphia, Pa., Lit Brothers, 500 w, E, shared, "The Quaker City Siren."

WLOE
1500 kc, Chelsea, Mass., William S. Pote, 100 w. Shared.

WLS
870 kc, Crete, Ill., Agricultural Broadcasting Co., 5000 w, C, shared.

WLSI
See under WDWF.

WLTH
1400 kc, Brooklyn, N. Y., Voice of Brooklyn, Inc., 500 w, E. Shared.

WLW
700 kc, Mason, Ohio, Crosley Radio Corp., 50,000 w, E. Shared.

WLWL
1100 kc, New York, N. Y., Missionary Society of St. Paul, 5000 w, 6-8 pm, E. Shared.

WMAC
570 kc, Casenovia, N. Y., Clive B. Meredith, 250 w, E, shared, "Voice of Central New York."

WMAF
1360 kc, Dartmouth, Mass., Round Hills Radio Corp., 500 w, E. Shared.

WMAK
900 kc, Martinsville, N. Y., WMAK Broadcasting System, Inc., 750 w, E. Shared.

WMAL
630 kc, Washington, D. C., M. A. Leese Co., 250 w, E. Shared.

WMAN
1210 kc, Columbus, Ohio, W. E. Heskitt, 50 w, E.

WMAQ
670 kc, Chicago, Ill., Chicago Daily News, Inc., 5000 w, C.

WMAY
1200 kc, St. Louis, Mo., Kingshighway Presbyterian Church, 100 w.

WMAZ
890 kc, Macon, Ga., Mercer University, 250 w, E, shared, "Watch Mercer Attain Zenith." Shared.

WMBA
1500 kc, Newport, R. I., LeRoy Joseph Beebe, 100 w, E.

WMBC
1420 kc, Detroit, Mich., Michigan Broadcasting Co., Inc., 100 w, E.

WMBD
1440 kc, Peoria Heights, Ill., Peoria Heights Radio Laboratory, 500 w. Shared.

WMBF
560 kc, Miami Beach, Fla., Fleetwood Hotel Corp., 500 w, E, shared, "Wonderful Miami Beach Fleetwood."

WMBL
1310 kc, Lakeland, Fla., Benford's Radio Studios, 100 w, E, "Lakeland—The City of Heart's Desire."

WMBM
1500 kc, Memphis, Tenn., Seventh Day Adventist Church, 10 w, C.

WMBO
1370 kc, Auburn, N. Y., Radio Service Laboratories, 100 w, E.

WMBQ
1500 kc, Brooklyn, N. Y., Paul J. Gollhofer, 100 w. Shared.

WMBR
1210 kc, Tampa, Fla., F. J. Reynolds, 100 w, E, "WMBR, Everything for Radio at Tampa, Fla."

WMBS
1430 kc, Lemoyne, Pa., Mack's Battery Co., 500 w, E. Shared.

WMC
780 kc, Memphis, Tenn., Memphis Commercial Appeal, Inc., 500 w, C, "WMC, Memphis, Down in Dixie."

WMCA
570 kc, Hoboken, N. J., Greeley Square Hotel Co., 500 w, E, shared, "Where the White Way Begins."

WMES
1500 kc, Boston, Mass., Massachusetts Educational Society, 50 w. Shared.

WMMN
890 kc, Fairmont, W. Va., Holt Rome Novelty Co., 250 w, E.

WMPC
1500 kc, Lapeer, Mich., First Methodist Protestant Church, 30 w, E, "Where Many Preach Christ."

WMRJ
1420 kc, Jamaica, N. Y., Peter J. Prinz, 10 w, E, shared, "The Gateway of the Sunrise Trail."

WMSG
1350 kc, New York, N. Y., Madison Square Garden Broadcast Co., 250 w, E. Shared.

WMT
1200 kc, Waterloo, Iowa, Waterloo Broadcasting Co., 100 w, C. Shared.

WNAC
1230 kc, Boston, Mass., The Shepard Stores, 500 w, E.

WNAD
1010 kc, Norman, Okla., University of Oklahoma 500 w, C, shared, "The Voice of Soonerland."

WNAT
1310 kc, Philadelphia, Pa., Lenning Brothers Co., 100 w, E.

WNAX
570 kc, Yankton, S. Dak., Gurney Seed & Nursey Co., Dakota Radio Apparatus Co., 500 w, C. Shared.

WNBF
1500 kc, Endicott, N. Y., Howitt-Wood Radio Co., 50 w, E, "The Voice of the Triple Cities."

WNBH
1310 kc, New Bedford, Mass., New Bedford Broadcasting Co., 100 w, E. shared, "The Gateway to Cape Cod."

WMBH
1420 kc, Joplin, Mo., Edwin Dudley Aber, 100 w, C, "Where Memories Bring Happiness."

WMBI
1080 kc, Chicago, Ill., Moody Bible Institute, 5000 w, C, shared, "The West Point of Christian Service."

WMBG
1210 kc, Richmond, Va., Havens & Martin, Inc., 100 w, E, "The Daytime Station."

WNBJ
1310 kc, Knoxville, Tenn., Lonsdale Baptist Church, 50 w, C.

WNBO
1200 kc, Washington, Pa., John Brownlee Spriggs, 15 w, E, "The Voice of Washington, Pa."

WNBQ
1500 kc, Rochester, N. Y., Gordon P. Brown, 15 w, E.

WNBR
1430 kc, Memphis, Tenn., John Ulrich, 500 w, C. Shared.

WNBW
1200 kc, Carbondale, Pa., Home Cut Glass & China Co., 5 w, E.

WNBX
1200 kc, Springfield, Vt., First Congregational Church, Inc., 10 w, E. Shared.

WNBZ
1290 kc, Saranac Lake, N. Y., Smith & Mace, 10 w, daytime, E.

WNJ
1450 kc, Newark, N. J., Radio Investment Co., 250 w, E, shared. "The Voice of Newark."

WNOX
560 kc, Knoxville, Tenn., Sterckl Bros., 1000 w, C, shared, "Smoky Mountain Station."

WNRC
1440 kc, Greensboro, N. C., Wayne M. Nelson, 500 w, E.

WNYC
570 kc, New York, N. Y., Department of Plant & Structures, 500 w, E, shared, "Municipal Broadcasting Station of the City of New York."

WOAI
1190 kc, San Antonio, Texas, Southern Equipment Co., 5000 w, C, shared, "The Winter Playground of America."

WOAN
600 kc, Lawrenceburg, Tenn., Church of the Nazarene & Vaughan School of Music, 500 w, C, shared, "Watch Our Annual Normal."

WOAX
1280 kc, Trenton, N. J., Franklyn J. Wolff, 500 w, E, shared, "Trenton Makes, the World Takes."

WOBT
1310 kc, Union City, Tenn., Titsworth's Radio & Music Shop, 15 w, C.

WOBU
580 kc, Charleston, W. Va., Charleston Radio Broadcasting Co., 250 w, E. Shared.

WOC
1000 kc, Davenport, Iowa, Palmer School of Chiropractic, 5000 w, C. Shared.

WOCL
1210 kc, Jamestown, N.Y., A. E. Newton, 25 w, E.

WODA
1250 kc, Paterson, N. J., Richard E. O'Dea, 1000 w, E, "The Voice of the Silk City."

WOI
560 kc, Ames, Iowa, Iowa State College, 3500 w, C. Shared.

WOKO
1440 kc, Mt. Beacon, N. Y., Harold E. Smith, 500 w, E. Shared.

WOL
1310 kc, Washington, D. C., American Broadcasting Co., 150 w, daytime, E.

WOMT
1210 kc, Manitowoc, Wis., Mikado Theater, 100 w.

WOO
1500 kc, Philadelphia, Pa., John Wanamaker, 100 w, E.

WOOD
1270 kc, Grand Rapids, Mich., Walter B. Stiles, Inc., 500 w, C, shared, "The Voice of the Whispering Pines."

WOQ
610 kc, Kansas City, Mo., Unity School of Christianity, 1000 w, C. Shared.

WOR
710 kc, Newark, N. J., L. Bamberger & Co., 5000 w, E.

WORD
1480 kc, Batavia, Ill., People's Pulpit Association, 5000 w, C, shared, "The Watch Tower—Radio WORD."

WOS
630 kc, Jefferson City, Mo., State Marketing Bureau, 500 w, C, shared, "Watch Our State."

WOV
1130 kc, New York, N. Y., International Broadcasting Corp., 1000 w, E.

WOW
590 kc, Omaha, Neb., Woodmen of the World, 1000 w, C. shared, "The Omaha Station."

WOWO
1160 kc, Ft. Wayne, Ind., Main Auto Supply Co., 10,000 w, C. Shared.

WPAP
See under WQAO.

WPAW
1210 kc, Pawtucket, R. I., Frank Crook, Inc., 100 w, E, "The City of Diversified Industries." Shared.

WPCC
570 kc, Chicago, Ill., North Shore Congregational Church, 500 w, C. Shared.

WPCH
810 kc, New York, N. Y., Concourse Radio Corp., 500 w.

WPG
1100 kc, Atlantic City, N. J., Municipality of Atlantic City, 5000 w, E. Shared.

WPOR
See under WTAR.

WPRC
1200 kc, Harrisburg, Pa., Wilson Printing & Radio Co., 100 w, E.

WPSC
1230 kc, State College, Pa., Pennsylvania State College, 500 w, day, E, "The Voice of the Nittany Lion."

WPSW
1500 kc, Philadelphia, Pa., Philadelphia School of Wireless Telegraphy, 50 w, E, "First Wireless School in America."

WPTF
680 kc, Raleigh, N. C., Durham Life Insurance Co., 10,000 w, E. Shared.

WQAM
1240 kc, Miami, Fla., Electrical Equipment Co., 750 w, E. Shared.

WQAN
880 kc, Scranton, Pa., Scranton Times, 250 w, E. Shared.

WQAO
1010 kc, New York, N. Y., Calvary Baptist Church, 250 w, E.

WQBC
1360 kc, Utica, Miss., Utica Chamber of Commerce, 300 w, C.

WQBJ
1200 kc, Clarksburg, W. Va., John Raikes, 65 w,E.

WQBZ
1420 kc, Vierton, W. Va., J. H. Thompson, 60 w, E.

WRAF
1200 kc, La Porte, Ind., The Radio Club, Inc., 100 w. Shared.

WRAK
1370 kc, Erie, Pa., C. R. Cummins, 50 w, E.

WRAW
1310 kc, Reading, Pa., Avenue Radio & Electric Shop, 100 w, E, "The Schuylkill Valley Echo."

WRAX
1440 kc, Philadelphia, Pa., Berachah Church, Inc., 250 w, E.

WRBC
1240 kc, Valparaiso, Ind., Immanuel Lutheran Church, 500 w, C, "World Redeemed by Christ."

WRBI
1310 kc, Tifton, Ga., Kent's Furniture & Music Store, 20 w, E. Shared.

WRBJ
1500 kc, Hattiesburg, Miss., Woodruff Furniture Co., 10 w, C.

WRBL
1200 kc, Columbus, Ga., Roy E. Martin, 50 w. E.

A-C Operation

A-C Shielded Grid Tubes

Power Phonograph

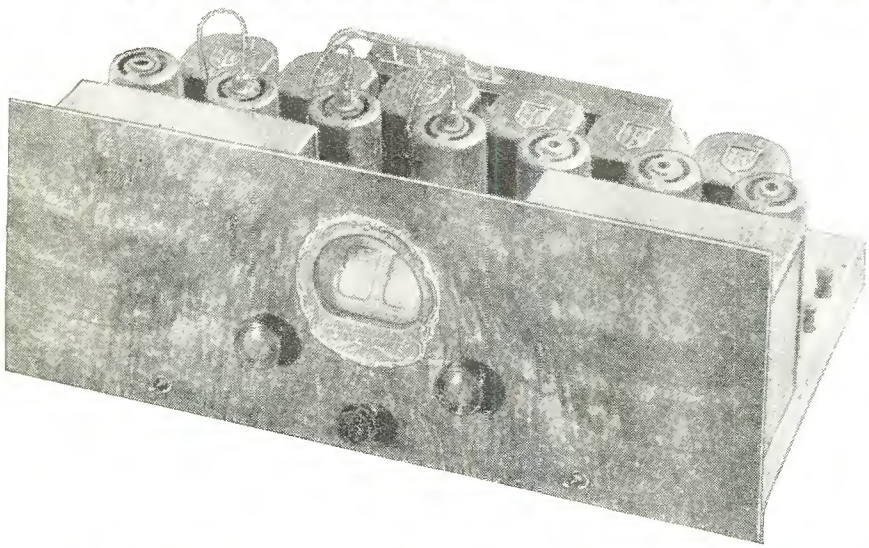
Tyrman "80"

Dynamic Speaker

UX350 OR 310 Amplifier Tube

Short Wave Plug-in Coils

Instant Success!!



Tyrman Imperial "80"

Custom-Bilt Shielded Grid

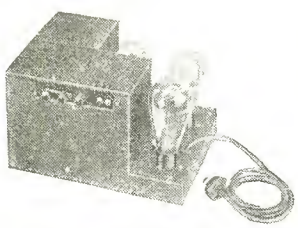
Complete A-C Socket Operation using A-C Shielded Grid Tubes—Improved Circuit Design incorporating many advanced features and refinements—350 or 310 Power Amplifier—Permanent Phonograph Connection—Plug-in coils for Short Wave Reception—Dynamic Speaker operation direct from Power Supply—10 K. C. Selectivity, One Spot—Unequaled Sensitivity and Stability. Brings in Distance with tremendous volume. Marvelous Tone Quality.

Beautiful, Rich Appearance

Front Panel solid walnut on steel. Illuminated Drum Dials of special design.

Easily and Quickly Assembled

All essential parts made of finest quality materials with special tools and dies to assure duplication of laboratory model. Wiring automatically insulated and grounded.



Tyrman "80" Power Supply
A powerful Power Supply designed solely for the Tyrman "80". Phone tips provided for any type speaker. Directly energizes field of dynamic speaker. Compact, completely wired. No adjustments.

Parts Complete—No Extras

Parts, including wired Power Supply, set of long and short wave plug-in coils, etc., complete, less tubes—List $19.50

Completely assembled and tested, $20.00 additional.

TYRMAN ELECTRIC CORPORATION
319 W. Superior Street, Chicago, Illinois

Amid all the fanfare of Custom Built Radio, there is one outstanding fact and that is Dealers and Set Builders are turning to Tyrman. There is no greater proof of success than repeat sales. That's the acid test!

Thank You

We want to take this opportunity to assure our thousands of friends that we appreciate your support. Such wonderful response to Tyrman products obligates us to continuous progress, offering only the finest products and to anticipate your demand in performance, design and value.

Is It Any Wonder Tyrman Leads?

Tyrman Engineers were the first to introduce the Shielded Grid principle. Now, a year later, other manufacturers adopt it as a feature. With a knowledge and experience unsurpassed in Shielded Grid, it was only natural that Tyrman should be the first to successfully employ A-C Shielded Grid Tubes in a completely A-C operated receiver. Again Tyrman introduces the "Year Ahead" radio.

You Can Easily Prove It

No need to take our word for it. Send for diagrams and descriptions. You will quickly recognize that the Tyrman "80" is not just another circuit of assembled parts. You will agree with thousands of others that it is a truly engineered receiver, every part designed to co-ordinate and interlock with each other, creating in the final assembly an A-C Receiver unrivalled for Sensitivity, Selectivity, Distance, Power and Tone.

FREE *Send coupon for book of diagrams and descriptions and see for yourself why Dealers and Set Builders are so enthusiastic in their praise of Tyrman.*

TYRMAN ELECTRIC CORPORATION
319 W. Superior Street, Chicago, Ill.
Send me free literature describing Tyrman "80" A-C Shielded Grid Receiver.

Name .....

Address .....

WRBQ
1210 kc, Greenville, Miss., J. Pat Scully, 100 w, C.

WRBT
1370 kc, Wilmington, N. C., Wilmington Radio Association, 50 w, E.

WRBU
1210 kc, Gastonia, N. C., A. J. Kirby Music Co., 100 w, E.

WRBW
1310 kc, Columbia, S. C., Paul S. Pearce, 100 w, E.

WRC
950 kc, Washington, D. C., Radio Corporation of America, 500 w, E, "The Voice of the Capital."

WREC
600 kc, Whitehaven, Tenn., WREC, Inc., 500 w. Shared.

WREN
1220 kc, Lawrence, Kan., Jenny Wren Co., 1000 w, C. Shared.

WRHM
1250 kc, Fridley, Minn., Rosedale Hospital Co. Inc., 1000 w, C, shared, "Welcome Rosedale Hospital, Minneapolis."

WRJN
1370 kc, Racine, Wis., Racine Broadcasting Corp., 100 w, C. Shared.

WRK
1310 kc, Hamilton, Ohio, S. W. Doron & John C. Slade, 100 w, E, "The Voice of Hamilton."

WRNY
1010 kc, New York, N. Y., Experimenter Pub. Co., 250 w, E. Shared.

WRR
1280 kc, Dallas, Texas, City of Dallas, 500 w, C. Shared.

WRUF
1470 kc, Gainesville, Fla., University Radio Service Co., 5000 w, E. Shared.

WRVA
1110 kc, Richmond, Va., Larus Bros. & Co., Inc., 5000 w, E, "Carry Me Back to Old Virginny."

WSAI
800 kc, Mason, Ohio, Crosley Radio Corp., 5000 w, E, shared, "The Gateway to Dixie."

WSAJ
1310 kc, Grove City, Pa., Grove City College, 100 w, E.

WSAN
1500 kc, Allentown, Pa., Allentown Call Pub. Co., 100 w, E, shared, "We Serve Allentown Nationality."

WSAR
1450 kc, Fall River, Mass., Doughty & Welch Electrical Co., Inc., 250 w, E. Shared.

WSAZ
580 kc, Huntington, W. Va., McKellar Electric Co., 250 w, E. Shared.

WSB
740 kc, Atlanta, Ga., Atlanta Journal Co., 10,000 w, E, "The Voice of the South."

WSBC
1210 kc, Chicago, Ill., World Battery Co., Inc., 100 w. Shared.

WSBT
1230 kc, South Bend, Ind., South Bend Tribune, 500 w, C. Shared.

WSDA
See under WSGH.

WSEA
780 kc, Portsmouth, Va., Virginia Broadcasting Co., Inc., 500 w, E, shared, "The Voice of Tidewater Virginny."

WSGH
1400 kc, Brooklyn, N. Y., Amateur Radio Specialty Co., 500 w. Shared.

WSIX
1210 kc, Springfield, Tenn., 638 Tire & Vulcanizing Co., 100 w, C.

WSKC
1410 kc, Bay City, Mich., James E. Davidson, 500 w, E, "Where the Summer Trail Begins."

WSM
650 kc, Nashville, Tenn., National Life & Accident Ins. Co., 5000 w, C, "We Shield Millions."

WSMB
1320 kc, New Orleans, La., Saenger Theaters, Inc., & Maison Blanche Co., 750 w, C, "America's Most Interesting City."

WSMD
1310 kc, Salisbury, Md., Tom F. Little, 100 w, E.

WSMK
570 kc, Dayton, Ohio, Stanley M. Krohn, Jr., 200 w, C, "The Home of Aviation."

WSPD
1340 kc, Toledo, Ohio, Toledo Broadcasting Co., 500 w, E. Shared.

WSRO
1420 kc, Middletown, Ohio, Harry W. Fahrlander, 100 w, C, "We Sell Radio Only."

WSSH
1420 kc, Boston, Mass., Tremont Temple Baptist Church, 100 w, E, shared, "Stranger's Sunday Home."

WSUI
580 kc, Iowa City, Iowa, State Univ. of Iowa, 500 w, C, shared, "The Old Gold Studio."

WSUN
See under WFLA.

WSVS
1370 kc, Buffalo, N. Y., Seneca Vocational School, 50 w, E, "Watch Seneca Vocational School."

WSYR
570 kc, Syracuse, N. Y., Clive B. Merewith, 250 w, E. Shared.

WTAD
1440 kc, Quincy, Ill., Illinois Stock Medicine Broadcasting Corp., 500 w. Shared.

WTAG
580 kc, Worcester, Mass., Worcester Telegram Pub. Co., Inc., 250 w, E, "The Voice From the Heart of the Commonwealth."

WTAM
1070 kc, Cleveland, Ohio, WTAM & WEAR, Inc., 3500 w, E, shared, "The Voice From the Storage Battery."

WTAQ
1330 kc, Eau Claire, Wis., Clyde S. Van Gordon, 1000 w, C. Shared.

WTAR
780 kc, Norfolk, Va., Reliance Electric Co., Inc., 500 w, E. Shared.

WTAW
1120 kc, College Station, Texas, Agri. & Mech. College of Texas, 500 w, C. Shared.

WTAX
1210 kc, Streator, Ill., Williams Hardware Co., 50 w. Shared.

WTAZ
1210 kc, Richmond, Va., W. Reynolds, Jr., and T. J. McGuire, 15 w.

WTBO
1420 kc, Cumberland, Md., Cumberland Electric Co., 50 w, E.

WTBQ
1500 kc, Wilmington, Del., E. Brandt Boylan, 100 w, E.

WTFI
1450 kc, Toccoa, Ga., Toccoa Falls Institute, 500 w, E.

WTHS
1310 kc, Atlanta, Ga., Atlanta Technological High School, 100 w, C. Shared.

WTIC
600 kc, Hartford, Conn., Travelers Insurance Co., 250 w, E, shared, "The Insurance City."

WTMJ
620 kc, Brookfield, Wis., Milwaukee Journal, 1000 w, C. Shared.

WWAE
1200 kc, Hammond, Ind., Dr. Geo. F. Courier, 100 w.

WWJ
920 kc, Detroit, Mich., The Detroit News, 1000 w, E.

WWL
850 kc, New Orleans, La., Loyola University, 5000 w, C. Shared.

WWNC
570 kc, Asheville, N. C., Chamber of Commerce, 1000 w, E.

WWRL
1500 kc, Woodside, N. Y., Wm. H. Rouman, 100 w. Shared.

WWVA
1160 kc, Wheeling, W. Va., John C. Stroebel, Jr., 5000 w, E. Shared.

Insist on the Original

for Better Results in Shielded Grid Circuits

SHIELDPLATE Shielded Grid Tubes

for Battery and A-C Operation

Improved Design
Means Tone
Power and
Efficient Performance

Rugged Construction
Assures Long Life

Shieldplate SP 122 A-C Tube
Note rugged construction

Shieldplate Tube Corporation
Dept. 119—4049 Diversey Avenue
CHICAGO, ILLINOIS

Marvelous Results

with SHIELDPLATE A-C Shielded Grid Tubes

Months of Actual Performance Prove Stability and Long Life

The wonderful performance and efficiency of D-C Shielded Grid Tubes, first introduced by Shieldplate, is again duplicated—Yes, even surpassed in SHIELDPLATE *A-C* Shielded Grid tubes.

Shortly after the introduction of the D-C Shielded Grid Tubes, Shieldplate Engineers, foreseeing the trend to A-C operation, began the development of the A-C Shielded Grid Tube. Now after months of actual performance, SHIELDPLATE *A-C* Shielded Grid Tubes have proved dependable, efficient and long lived when employed in circuits especially designed for their use.

Send for Free Descriptive Literature

See for yourself why SHIELDPLATE *A-C* Shielded Grid Tubes are outstanding in performance, long lived, and how they can be used in various ways for radio and television.

ALSO
"Diatrons"
Radio Tubes for Every Purpose

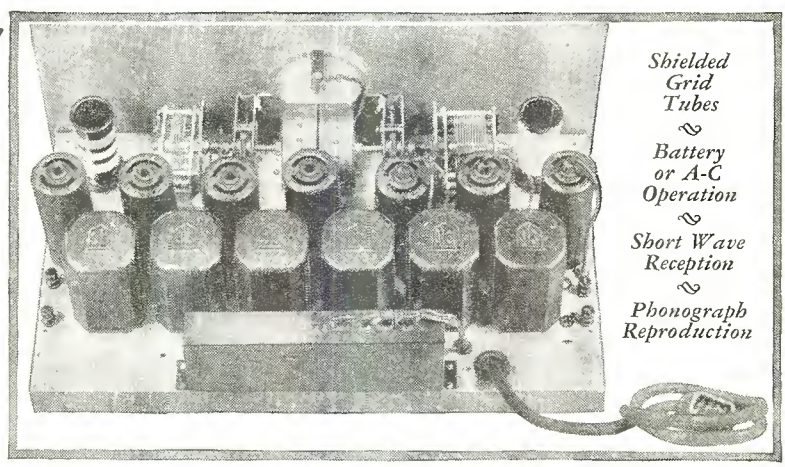
SHIELDPLATE TUBE CORPORATION
Dept. 119, 4049 Diversey Ave., Chicago, Ill.
Send me descriptive literature of Shieldplate tubes. I am particularly interested in ____A-C ____D-C.
Name _____
Address _____
_____
My Jobber _____

Tyrman "72"

Custom-Bilt Shielded Grid

for
- **Battery Operation** using D-C Shielded Grid Tubes
- *or*
- **Complete A-C Operation** using A-C Shielded Grid Tubes

A unique circuit design that provides an advanced Shielded Grid receiver for those who prefer battery operation or who are in a locality where A-C Power is not available. Even if assembled for Battery Operation the "72" can be converted to complete A-C Socket Operation by making a few simple changes. Sensitivity, Selectivity, Distance, Tone Quality comparable only to the Tyrman "80." Send for free descriptive literature and diagrams showing both A-C and D-C circuits.



Shielded Grid Tubes
Battery or A-C Operation
Short Wave Reception
Phonograph Reproduction

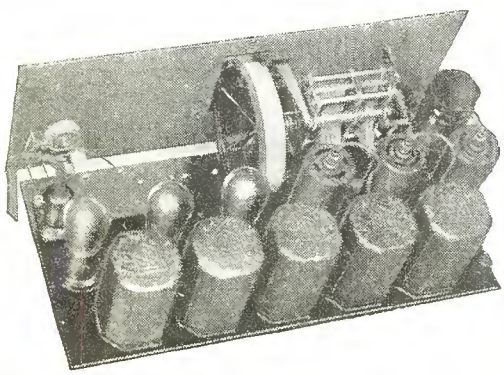
This shows the symmetrical layout of the Tyrman "72." Easily and quickly assembled.

In appearance the "72" resembles the "80". Front Panel is metal with walnut finish. Equipped with the New Tyrman Illuminated Double Drum Dial. 110 A-C switch and phonograph jack on front panel. Plug-in coils can be used for short wave reception. Like the "80" all parts for the "72" are specially built to insure uniformity. Parts complete including wire, lugs, etc. ready to assemble, less tubes. **$98.50** List Price

"72" Power Supply for A-C Socket operation . . . . . $55.00 List

Complete set of short wave coils $10.00 List.

TYRMAN ELECTRIC CORPORATION
322 W. Superior St., Chicago, Ill.
Send me free descriptive literature and diagrams of the (___"72" A-C) (___"72" D-C) (___"60" D-C) Tyrman Custom Built Receivers.
Name _____
Address _____
_____



Tyrman "60"

Custom-Bilt Shielded Grid

A QUALITY RECIEVER
At a Low Price

The Tyrman "60" is a six tube receiver designed for battery or eliminator operation. Uses three Type 22 Shielded Grid tubes. Combines many features of the famous "70." For Appearance, Tone, Selectivity and Distance the Tyrman "60" sets a new standard in a quality receiver at a low price. Parts packed complete, ready to assemble **$69.50**

TYRMAN ELECTRIC CORPORATION, CHICAGO, ILL.

U. S. Broadcasting Stations Listed by States

ALABAMA

Auburn, WAPI
Birmingham, WBRO, WKBC
Gadsden, WJBY
Montgomery, WIBZ

ALASKA

Anchorage, KFQD
Juneau, KFIU
Ketchikan, KGBU

ARIZONA

Flagstaff, KFXY
Phoenix, KFAD, KFCB
Prescott, KPJM
Tuscon, KGAR

ARKANSAS

Blytheville, KLCN
Fayetteville, KUOA
Hot Springs, KTHS
Little Rock, KLRA, KGHI, KGJF
McGehee, KGHG
Siloam Springs, KFPW

CALIFORNIA

Berkeley, KRE
Beverley Hills, KEJK
Burbank, KELW
Culver City, KFVD
El Centro, KXO
Fresno, KMJ
Glendale, KGFH
Hayward, KZM
Hollywood, KFQZ, KMTR, KNX
Holy City, KFQU
Inglewood, KMIC
Long Beach, KFON, KGER
Los Angeles, KEJK, KFI, KFSG, KGEF, KFWB, KGFJ, KHJ, KPLA, KTBI
Oakland, KFWM, KGO, KLS, KLX, KTAB
Ontario, KFWC
Pasadena, KPPC, KPSN
Sacramento, KFBK
San Diego, KFSD, KGB
San Francisco, KFRC, KFWI, KGTT, KJBS, KPO, KYA
San Jose, KQW
Santa Ana, KWTC
Santa Barbara, KECR
Santa Maria, KSMR
Santa Monica, KTM
Stockton, KGDM, KWG

COLORADO

Colorado Springs, KFUM
Denver, KFEL, KFUP, KFXF, KOA, KOW, KPOF
Dupont, KLZ
Edgewater, KFXJ
Fort Morgan, KGEW
Greeley, KFKA
Gunnison, KFHA
Pueblo, KGDP, KGHF, KGHA
Trinidad, KGIW
Yuma, KGEK

CONNECTICUT

Easton, WICC
Hartford, WTIC
New Haven, WDRC
Storrs, WCAC

DELAWARE

Wilmington, WDEL, WTBQ

DISTRICT OF COLUMBIA

Washington, NAA, WMAL, WRC, WRHF

FLORIDA

Clearwater, WFLA
Gainesville, WRUF
Jacksonville, WJAX
Lakeland, WMBL
Miami Beach, WIOD, WMBF, WQAM
Orlando, WDBO
Pensacola, WCOA
Sarasota, WJBB
Tampa, WDAE, WMBR,

GEORGIA

Atlanta, WGST, WSB, WTHS
Columbus, WRBL
Macon, WMAZ
Tifton, WRBI
Toccoa, WTFI

HAWAII

Honolulu, KGHB, KGU

IDAHO

Boise, KFAU
Idaho Falls, KGIO
Jerome, KFXD
Kellogg, KFEY
Pocatello, KSEI
Sandpoint, KGXX
Twin Falls, KGIQ

ILLINOIS

Batavia, WORD
Carthage, WCAZ
Chicago, KYW, WAAF, WCFL, WCRW, WEDC, WENR, WGES, WKBI, WPCC, WSBC, WGN, WMAQ, WMBI, WBBM
Cicero, WHFC
Crete, WLS
Decatur, WJBL
Deerfield, WHT
Desplaines, WIBO
Evanston, WEHS
Galesburg, WLBO, WKBS
Harrisburg, WEBQ
Joliet, WCLS, WKBB
La Salle, WJBC
Mooseheart, WJJD
Mt. Prospect, WJAZ
Peoria Heights, WMBD
Quincy, WTAD
Rockford, KFLV
Rock Island, WHBF
Springfield, WCBS
Streator, WTAX,
Tuscola, WDZ
Urbana, WILL
Zion, WCBD

INDIANA

Anderson, WHBU,
Brookville, WKBV
Crown Point, WLBT
Culver, WCMA
Evansville, WGBF
Fort Wayne, WCWK, WOWO
Gary, WJKS
Hammond, WWAE
Indianapolis, WFBM, WKBF
Kokomo, WJAK
La Porte, WRAF
Muncie, WLBC
South Bend, WSBT
Terre Haute, WBOW
Valparaiso, WRBC
Lafayette, WBAA

IOWA

Ames, WOI
Boone, KFGQ
Cedar Rapids, KWCR
Clarinda, KSO,
Council Bluffs, KOIL
Davenport, WOC
Decorah, KGCA, KWLO
Des Moines, WHO,
Ft. Dodge, KFJY
Iowa City, WSUI
Marshalltown, KFJB
Muscatine, KTNT
Ottumwa, WIAS
Red Oak, KICK
Shenandoah, KFNF, KMA
Sioux City, KSCJ
Waterloo, WMT

KANSAS

Concordia, KGCN
Lawrence, KFKU, WREN
Manhattan, KSAC
Milford, KFKB
Topeka, WIBW
Wichita, KFH

KENTUCKY

Hopkinsville, KFIW
Louisville, WHAS
Okalona, WLAP

LOUISIANA

Cedar Grove, KGGH
Kennonwood, KWKH
New Orleans, WABZ, WCBE, WJBO, WJBW, WKBT, WSMB, WWL, WDSU
Shreveport, KFDX, KSBA, KWEA, KRMD

MAINE

Bangor, WABI
Dover-Foxcraft, WLBZ
Portland, WCSH

MARYLAND

Baltimore, WCAO, WCBM, WBAL, WFBR
Cumberland, WTBO
Glen Morris, WBAL
Salisbury, WSMD

MASSACHUSETTS

Boston, WBZA, WEEI, WNAC, WSSH, WMES
Chelsea, WLOE
Dartmouth, WMAF
East Springfield, WBZ
Fall River, WSAR
Gloucester, WEPS, WHOH
Lexington, WLEX
Medford, WBET
New Bedford, WNBH
Webster, WKBE
Wellesley Hills, WBSO
Worcester, WTAG

MICHIGAN

Battle Creek, WKBP
Bay City, WSKC
Berrien Springs, WEMC
Calumet, WHDF
Detroit, WAFD, WBMH, WMBC, WWJ
East Lansing, WKAR
Flint, WFDF
Fraser, WGHP
Grand Rapids, WASH, WOOD
Jackson, WIBM
Lapeer, WMPC
Ludington, WKBZ
Pontiac, WJR
Royal Oak, WAGM
Ypsilanti, WJBK

MINNESOTA

Anoka, WCCO
Barrett, KGDE
Collegeville, WFBJ
Fridley, WRHM
Hallock, KGFK
Minneapolis, WDGY, WHDI, WLB
Northfield, KFMX, WCAL
Westcott, KSTP

MISSISSIPPI

Columbus, WCOC
Greenville, WRBQ
Gulfport, WGCM
Hattiesburg, WRBJ
Utica, WQBC

MISSOURI

Cape Girardeau, KFVS
Columbia, KFRU
Independence, KMBC
Jefferson City, WOS
Joplin, WMBH
Kansas City, KWKC, WDAF, WHB, WLBF, WOQ
Kirksville, KFKZ
St. Joseph, KGBX, KFEQ
St. Louis, KFWF, KSD, KWK, WEW, WIL, WMAY, KMOX, KFUO

MONTANA

Billings, KGHL
Butte, KGIR
Havre, KFBB
Kalispell, KGEZ
Missoula, KUOM, KGHD
Vida, KGCX

NEBRASKA

Clay Center, KMMJ
Lincoln, KFAB, KFOR, WCAJ
Norfolk, WJAG
Omaha, WAAW, WOW
Ravenna, KGEW
York, KGBZ

NEVADA

Reno, KOH

NEW HAMPSHIRE

Laconia, WKAV
Tilton, WBRL

NEW JERSEY

Asbury Park, WCAP
Atlantic City, WPG
Camden, WCAM
Elizabeth, WIBS
Hoboken, WMCA, WPCH
Jersey City, WAAT, WKBO
Newark, WAAM, WGCP, WNJ, WOR
Paterson, WODA
Plainfield, WEAM
Red Bank, WJBI
Secaucus, WOV
Union City, WBMS
Trenton, WOAX

NEW MEXICO

Albuquerque, KGGM
Raton, KGFL
State College, KOB

NEW YORK

Astoria, WGBS
Auburn, WMBO
Bay Shore, WINR
Bellmore, WEAF
Bronx, WHPP
Brooklyn, WBBC, WLTH, WMBQ, WSGH
Buffalo, WEBR, WGR, WKBW, WKEN, WSVS
Canton, WCAD
Cazenovia, WMAC
Coney Island, WCGU
Endicott, WNBF
Farmingdale, WLBH
Freeport, WGBB
Greenville, WCOH
Ithaca, WLCI, WEAI
Jamaica, WMRJ
Jamestown, WOCL
Long Beach, WCLB
Long Island City, WLBX
Martinsville, WMAK
Mt. Beacon, WOKO
New York, WBNY, WHN, WJZ, WKBQ, WMCA, WMSG, WNYC, WPCH, WRNY, WABC, WOV, WCDA, WQAO, WHAP, WLWL
Rochester, WHAM, WHEC, WNBQ
Rossville, WBBR
Saranac Lake, WNBZ
Schenectady, WGY
Syracuse, WFBL, WSYR
Troy, WHAZ
Utica, WIBX
Woodhaven, WEVD
Woodside, WWRL

NORTH CAROLINA

Asheville, WWNC
Charlotte, WBT
Gastonia, WRBU
Grecnsboro, WNRC
Raleigh, WPTF
Wilmington, WRBT

NORTH DAKOTA

Bismarck, KFYR
Devils Lake, KDLR
Fargo, WDAY
Grand Forks, KFJM
Mandan, KGCU

OHIO

Akron, WADC, WFJC
Bellefontaine, WHBD
Canton, WIBC
Cambridge, WEBE
Cincinnati, WAAD, WFBE, WKRC
Cleveland, WEAR, WHK, WJAY, WTAM
Columbus, WAIU, WCAH, WEAO, WMAN
Dayton, WSMK
Hamilton, WRK
Mansfield, WLBV
Mason, WSAI, WLW
Middleton, WSRO
Springfield, WCSO
Steubenville, WIBR
Toledo, WSPD
Youngstown, WKBN

OKLAHOMA

Alva, KGFF
Chickasha, KOCW
Enid, KGCB
Norman, WNAD
Oklahoma City, KFJF, KFXR, KGCB, KGFG, WKY
Picher, KGGF
Ponca City, WBBZ
Tulsa, KVOO

OREGON

Astoria, KEJI
Corvallis, KOAC
Eugene, KORE
Marshfield, KOOS
Medford, KMED
Portland, KEX, KOIN, KFEC, KFIF, KFIR, KGW, KTBR, KWBS, KWJJ, KXL

PENNSYLVANIA

Allentown, WCBA, WSAN
Altoona, WFBG
Carbondale, WNBW
East Pittsburgh, KDKA
Elkins Park, WIBG
Erie, WEDH, WRAK
Frankford, WFKD
Grove City, WSAJ
Harrisburg, WRAK, WPRC
Johnstown, WHBP
Kingstown, WABF
Lancaster, WGAL, WKJC
Le Moyne, WMBS
Lewisburg, WJBU
Oil City, WLBW
Philadelphia, WABY, WCAU, WFI, WHBW, WIAD, WIP, WLIT, WNAT, WOO, WRAX, WPSW, WFAN, WELK
Pittsburgh, KQV, WCAE, WJAS
Reading, WRAW
Scranton, WGBI, WQAN,
State College, WPSC
Wilkes-Barre, WBAX, WBRE
Wilkensburg, WBMJ
Willow Grove, WALK
Washington, WNBO

PORTO RICO

San Juan, WKAQ

RHODE ISLAND

Cranston, WDWF
Newport, WMBA
Pawtucket, WPAW
Providence, WEAN, WJAR

SOUTH CAROLINA

Charleston, WBBY
Columbia, WRBW

SOUTH DAKOTA

Brookings, KFDY, KGOR
Dell Rapids, KGDA
Oldham, KGDY
Pierre, KGFX
Rapid City, WCAT
Sioux Falls, KSOO
Vermillion, KUSD
Yankton, WNAX

TENNESSEE

Chattanooga, WDOD
Knoxville, WFBC, WNBJ, WNOX
Lawrenceburg, WOAN
Memphis, WGBC, WHBQ, WMBM, WMC
Nashville, WBAW, WLAC, WSM
Springfield, WSIX
Union City, WOBT
White Haven, WREC

TEXAS

Amarillo, KGRS, WDAG
Austin, KUT
Beaumont, KFDM
Breckenridge, KFYO
Brownsville, KWWG
College Station, WTAW
Dallas, KRLD, WFAA, WRR
Dublin, KFPL
El Paso, WDAH
Forth Worth, KFJZ, KFQB WBAP
Galveston, KFLX, KFUL
Georgetown, KGKL
Goldwaitbe, KGKB
Greenville, KFPM
Harlingen, KRGV
Houston, KPRC, KTUE
Richmond, KGHX
San Angelo, KGFI
San Antonio, KGCI, KGDR, KGRC, KTAP, KTSA, WOAI
Waco, WJAD
Wichita Falls, KGKO

UTAH

Odgen, KFUR
Salt Lake City, KDYL, KSL

VERMONT

Burlington, WCAX
Springfield, WNBX

VIRGINIA

Arlington, NAA
Chesterfield Hills, WTAZ
Mt. Vernon Hills, WJSV
Newport News, WGH
Norfolk, WBBW, WTAR
Petersburg, WLBG
Portsmouth, WSEA
Richmond, WBBL, WMBG, WRVA, WTAZ
Roanoke, WDBJ, WRBX

WASHINGTON

Aberdeen, KXRO
Bellingham, KVOS
Everett, KFBL
Lacey, KGY
Longview, KUJ
Pullman, KWSC
Seattle, KOL, KFQW, KPQ, KJR, KKP, KOMO, KPCB, KRSC, KTW, KVL, KXA
Spokane, KFIO, KFPY, KGA, KHQ
Tacoma, KMO, KVI

WEST VIRGINIA

Clarksburg, WQBJ
Charleston, WOBU
Fairmont, WMMN
Huntington, WSAZ
Vierton, WQBZ
Wheeling, WWVA

WISCONSIN

Appleton, WAIZ
Beloit, WEBW
Brookfield, WTMJ
Eau Claire, WTAQ
Fond Du Lac, KFIZ
Kenosha, WCLO
La Crosse, WKBH
Madison, WHA, WIBA
Manitowac, WOMT
Milwaukee, WGWB, WHAD, WISN
Poynette, WIBU
Racine, WRJN
Sheboygan, WHBL
Stevens Point, WLBL
Superior, WEBC
West De Pere, WHBY

WYOMING

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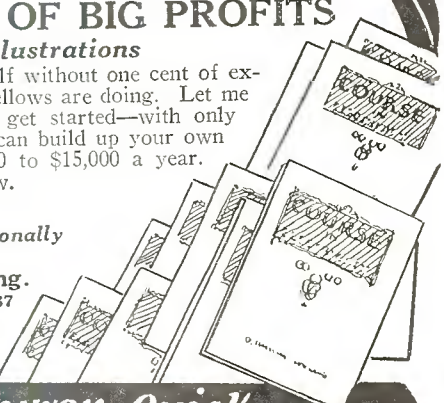

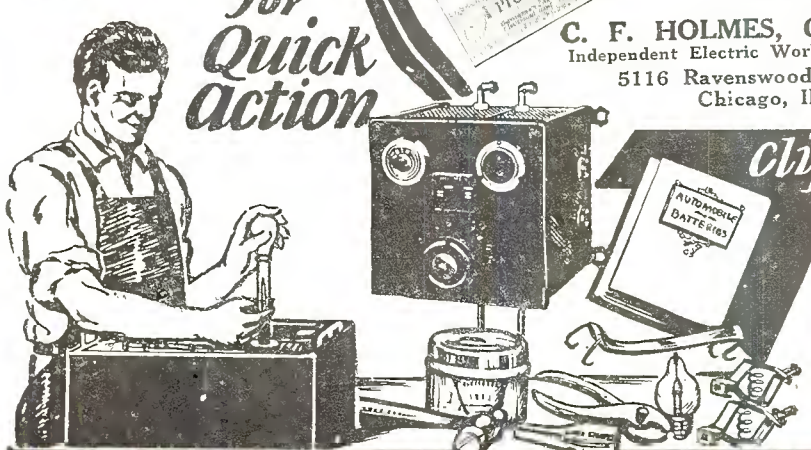

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560 Kilocycles, 535.4 Meters.
WLIT, WFI, KFDM, WMBF, WNOX, WOI, KFEQ, KOAC, KLZ

570 Kilocycles, 526.0 Meters:
WNYC, WMCA, WSYR, WMAC, WSMK, WKBN, WWNC, KGKO, WHA, WNAX, WPCC, WIBO, KUOM, KXA, KMTR, KPLA

580 Kilocycles, 516.9 Meters—Canadian Shared:
WTAG, WKAQ, WOBU, WSAZ, KGFX, KSAC, WSUI

590 Kilocycles, 508.2 Meters:
WEEI, WEMC, WCAJ, WOW, KHQ

600 Kilocycles, 499.7 Meters—Canadian Shared:
WTIC, WCAO, WREC, WOAN, WEBW, KFSD, KFBU

610 Kilocycles, 491.5 Meters:
WFAN, WIP, WDAF, WOQ, KFRC

620 Kilocycles, 483.6 Meters:
WLBZ, WDBO, WDAE, WTMJ, KGW, KFAD

630 Kilocycles, 475.9 Meters—Canadian Shared:
WMAL, WOS, KFRU, WGBF

640 Kilocycles, 468.5 Meters:
WAIU, KFI

650 Kilocycles, 461.3 Meters:
WSM

660 Kilocycles, 454.3 Meters:
WEAF, WAAW

670 Kilocycles, 447.5 Meters:
WMAQ

680 Kilocycles, 440.9 Meters:
WPTF, KPO

690 Kilocycles, 434.5 Meters—Canadian Wave:

700 Kilocycles, 428.3 Meters:
WLW, KFVD

710 Kilocycles, 422.3 Meters:
WOR

720 Kilocycles, 416.4 Meters:
WGN, WLIB

730 Kilocycles, 410.7 Meters—Canadian Wave:

740 Kilocycles, 405.2 Meters:
WSB, KMMJ

750 Kilocycles, 399.8 Meters:
WJR, WCX

760 Kilocycles, 394.5 Meters:
WJZ, WEW

770 Kilocycles, 389.4 Meters:
KFAB, WBBM, WJBT

780 Kilocycles, 384.4 Meters—Canadian Shared:
WBSO, WSEA, WTAR, WPOR, WMC, KELW, KTM

790 Kilocycles, 379.5 Meters:
WGY, KGO

800 Kilocycles, 374.8 Meters:
WSAI, WBAP, KTHS

810 Kilocycles, 370.2 Meters:
WPCH, WCCO

820 Kilocycles, 365.6 Meters:
WHAS

830 Kilocycles, 361.2 Meters:
KOA, WHOH

840 Kilocycles, 356.9 Meters—Canadian Wave:

850 Kilocycles, 352.7 Meters:
KWKH, WWL, KFQZ

860 Kilocycles, 348.6 Meters:
WBOQ, WABC

870 Kilocycles, 344.6 Meters:
WLS, WENR, WBCN

880 Kilocycles, 340.7 Meters—Canadian Shared:
WQAN, WGBI, WCOC, KLX, KPOF, KFKA

890 Kilocycles, 336.9 Meters—Canadian Shared:
WJAR, WMMN, WMAZ, WGST, KGJF, WILL, KUSD, KFNF

900 Kilocycles, 331.1 Meters:
WFBL, WMAK, WKY, WFLA, WSUN, WLBL, KHJ, KSEI, KGBU

910 Kilocycles, 329.5 Meters—Canadian Wave:

920 Kilocycles, 325.9 Meters:
WWJ, KPRC, WAAF, KOMO

930 Kilocycles, 322.4 Meters—Canadian Shared:
WIBG, WDBJ, WBRC, KGBZ, KMA, KFWM, KFWI

940 Kilocycles, 319 Meters:
WCSH, KFIW, KOIN, KGU, KFEL, KFXF

950 Kilocycles, 315.6 Meters:
WRC, KMBC, KLDS, WHB, KFWB, KPSN, KGHL

960 Kilocycles, 312.3 Meters—Canadian Wave:

970 Kilocycles, 309.1 Meters:
WCFL, KJR

980 Kilocycles, 305.9 Meters:
KDKA

990 Kilocycles, 302.8 Meters:
WBZ, WBZA

1000 Kilocycles, 299.8 Meters:
WHO, WOC, KGFH

1010 Kilocycles, 296.9 Meters—Canadian Shared:
WQAO, WPAF, WHN, WRNY, KGGF, WNAD, WJBB, KQW

1020 Kilocycles, 293.9 Meters:
KYW, KFKX

1030 Kilocycles, 291.1 Meters—Canadian Wave:

1040 Kilocycles, 288.3 Meters:
WKEN, WKAR, WFAA, KRLD

1050 Kilocycles, 285.5 Meters:
WFBM, KNX

1060 Kilocycles, 282.8 Meters:
WBAL, WJAG, KWJJ

1070 Kilocycles, 280.2 Meters:
WAAT, WTAM, WEAR, WCAZ, WDZ

1080 Kilocycles, 277.6 Meters:
WBT, WCBD, WMBI

1090 Kilocycles, 275.1 Meters:
KMOX, KFQA

1100 Kilocycles, 272.6 Meters:
WPG, WLWL, KJBS

1110 Kilocycles, 270.1 Meters:
WRVA, KSOO

1120 Kilocycles, 267.7 Meters—Canadian Shared:
WCOA, WTAW, KUT, WISN, WHAD, KFSG, KMIC, KRSC

1130 Kilocycles, 265.3 Meters:
WOV, KFKB, KSL

1140 Kilocycles, 263.0 Meters:
WAPI, KVOO

1150 Kilocycles, 260.7 Meters:
WHAM, KGDM

1160 Kilocycles, 258.5 Meters:
WWVA, WOWO

1170 Kilocycles, 256.3 Meters:
WCAU, KTNT

1180 Kilocycles, 254.1 Meters:
WGBS, WJJD, KEX, KOB

1190 Kilocycles, 252.0 Meters:
WICC, WOAI

1200 Kilocycles, 249.9 Meters: Canadian Shared:
WABI, WCAX, WNBX, WEPS, WKBE, WIBX, WBBW, WFBE, WHBC, WLAP, WLBG, WNBQ, WPRC, WKJC, WNBW, WQBJ, WABZ, WJBW, WBBY, WBBZ, WFBC, WRBL, KGCU, WJBC, WJBL, WWAE, WRAF, WMT, KFJB, WCAT, KGDY, WMAY, KFWF, KFKZ, KGDE, KGFK, WCLO, WHBY, KFWC, KPPC, KXO, KMJ, KSMR, KWG, KGEK, KGEW, KFHA, KVOS, KGY

1210 Kilocycles, 247.8 Meters—Canadian Shared:
WJBI, WGBB, WINR, WCOH, WOCL, WLCI, WPAW, WDWF, WLSI, WMAN, WLBW, WEBE, WBAX, WJBU, WTAZ, WMBG, WSIX, WRBU, WJBY, WMBR, WRBQ, WGCM, KFDX, KWEA, KDLR, KGGR, KFOR, WHBU, KFVS, WEBQ, WSBC, WCRW, WEDC, WCBS, WTAX, WHBF, WIBA, WOMT, KGDP, KFEY, KPQ, KPCB

1220 Kilocycles, 245.6 Meters:
WCAD, WCAE, WREN, KFKU

1230 Kilocycles, 243.8 Meters:
WNAC, WBIS, WPSC, WSBT, WCWK, WFBM, KYA, KFIO, KFQD

1240 Kilocycles, 241.8 Meters:
WGHP, KFQB, WJAD, WQAM, WIOD, WRBC

1250 Kilocycles, 239.9 Meters:
WGCP, WODA, WAAM, WLB, WGMS, WRHM, KFMX, WCAL, KFON, KEJK, KXL, KIDO

1260 Kilocycles, 238.0 Meters:
WLBW, WJAX, KWWG, KRGV, KOIL

1270 Kilocycles, 236.1 Meters:
WEAI, WASH, WOOD WDSU, KWLC, KGCA, KTW, KOL, KFUM, WFBR

1280 Kilocycles, 234.2 Meters:
WCAM, WCAP, WOAX, WDOD, WRR, WDAY, WEBC

1290 Kilocycles, 232.4 Meters:
WNBZ, WJAS, KTSA, KFUL, KLCN, KDYL

1300 Kilocycles, 230.6 Meters:
WBBR, WHAP, WEVD, WHAZ, KFH, WIBW, KGEF, KTBI, KFJR, KTBR

1310 Kilocycles, 228.9 Meters:
WKAV, WEBR, WSMD, WNBH, WOL, WGH, WRK, WAGM, WMBH, WFDF, WNAT, WABY, WFKD, WHBP, WFBG, WRAW, WGAL, WSAJ, WBRE, WMBL, WKBC, WRBW, KGHG, WTHS, WRBI, WOBT, WNBJ, KRMD, KGGH, KFPM, WDAH, KGFI, KFPL, KFXR, WKBS, WLBO, WEHS, WCLS, WKBB, WKBI, WHFC, KWCR, KFJY, KFGQ, WBOW, WJAK, WLBC, WIBU, KFBK, KFCB, KFIU, KGEZ, KFUP, KFXJ

1320 Kilocycles, 227.1 Meters:
WADC, WSMB, KGIO, KGIQ, KGHF, KGHB

1330 Kilocycles, 225.4 Meters:
WDRC, WCAC, WTAQ, KSCJ

1340 Kilocycles, 223.7 Meters:
WSPD, KFPW, KMO, KVI

1350 Kilocycles, 222.1 Meters:
WBNY, WMSG, WCDA, WKBQ, KWK

1360 Kilocycles, 220.4 Meters:
WBET, WMAF, WQBC, WJKS, WGES, KFBB, KGIR, KGB

1370 Kilocycles, 218.8 Meters:
WMBO, WSVS, WCBM, WEAM, WBBL, WHBD, WJBK, WIBM, WRAK, WELK, WJBO, WHBQ, WRBT, KGFG, KGCB, KGCI, KGRC, KFJZ, KGKL, KFLX, WFBJ, KGDA, KZM, KRE, KGER, KFBL, KKP, KFEC, KWKC, KGBX, WRJN, KGAR, KFUR, KOH, KVL, KFJI, KGFL, KGGM, WHDF, KOOS

1380 Kilocycles, 217.3 Meters:
WCSO, KQV, KSO, WKBH

1390 Kilocycles, 215.7 Meters:
WHK, KLRA, KUOA, KOW, KWSC, KFPY, WDGY, WHDI

1400 Kilocycles, 214.2 Meters:
WCGU, WSGH, WSDA, WLTH, WBBC, WBAA, WCMA, WKBF

1410 Kilocycles, 212.6 Meters:
WDEL, WSKC, KGRS, WDAG, KFLV, WHBL

1420 Kilocycles, 211.1 Meters:
WLBH, WHPP, WMRJ, WLEX, WTBO, WSSH, WSRO, WIBR, WAAD, WEDH, WMBC, WKBP, WQBZ, KGFF, KOCW, WKBT, KTAP, KTUE, KFYO, KICK, WIAS, KGCN, WLBF, WMBH, KGFW, KFIZ, KFXY, KGFJ, KFQU, KGTT, KFXD, KGHD, KGCX, KFIF, KMED, KORE, KFQW, KXRO, WIL, KGIW, KGXX

1430 Kilocycles, 209.7 Meters:
WBRL, WMBS, WCAH, WGBC, WNBR, WBAK

1440 Kilocycles, 208.2 Meters:
WHEC, WABO, WOKO, WABF, WRAX, WNRC, WTAD, WMBD, KLS

1450 Kilocycles, 206.8 Meters:
WBMS, WNJ, WIBS, WKBO, WSAR, WJAY, WFJC, KSBA, WTFI

1460 Kilocycles, 205.4 Meters:
WJSV, KSTP

1470 Kilocycles, 204.0 Meters:
WKBW, KFJF, WRUF, KGA

1480 Kilocycles, 202.6 Meters:
WJAZ, WHT, WORD

1490 Kilocycles, 201.6 Meters:
WBAW, WLAC, WFBL

1500 Kilocycles, 199.9 Meters:
WMBA, WLOE, WMES, WNBQ, WNBF, WMBQ, WLBX, WCLB, WTBQ, WWRL, WAFD, WKBZ, WMPC, WMBJ, WCBA, WSAN, WALK, WOO, WHBW, WPSW, WIBZ, KFHI, WRBJ, WMBM, KGKB, KGDR, KGHX, WKBV, KPJM, KWBS, KWTC, KFCR, KUJ

CANADIAN STATIONS

Call		Wave	Power
PRINCE EDWARD ISLAND			
CFCY	Island Radio Co., Charlottetown	312.3	100
CHCK	W. E. Burke, Charlottetown	312.3	30
CHGS	R. T. Holman, Ltd., Summerside	267.7	25
QUEBEC			
CFCF	Canadian Marconi Co., Montreal	410.7	650
CHRC	E. Fontaine, Quebec	340.7	5
CHYC	Northern Electric Co., Ltd., Montreal	410.7	750
CKAC	La Presse Publishing Co., Montreal	410.7	1200
CKCI	Le "Soleil," Ltd., Quebec	340.7	22½
CKCV	G. A. Vandry, Quebec	340.7	50
CKSH	City of St. Hyacinthe, St. Hyacinthe	296.9	50
CNRM	Canadian National Railways, Montreal	410.7	1650
CNRQ	Canadian National Railways, Quebec	340.7	50
SASKATCHEWAN			
CFQC	The Electric Shop, Saskatoon	329.5	500
CHWC	R. H. Williams & Sons, Regina	312.3	15
CJBR	Saskatchewan Co-op. Wheat Producers, Ltd., Regina	312.3	500
CJGX	Winnipeg Grain Exchange, Yorkton	475.9	500
CJHS	Radio Service, Ltd., Saskatoon	329.5	250
CJRM	James Richardson & Sons, Ltd., Moose Jaw	296.9	500
CJRW	James Richardson & Sons, Ltd., Fleming	296.9	500
CNRR	Canadian National Railways, Regina	312.3	500
CKCK	Leader Publishing Co., Ltd., Regina	312.3	500
CNRS	Canadian National Railways, Saskatoon	329.5	500
ALBERTA			
CFAC	Calgary Herald, Calgary	434.5	500
CKCN	W. W. Grant, Ltd., Calgary	434.5	1800
CHCA	Albertan Publishing Co., Calgary	434.5	250
CJCJ	Radio Service & Repair Shop, Calgary	434.5	250
CHCT	G. F. Tull & Arden, Ltd., Red Deer	356.9	1000
CKLC	Alberta Pacific Grain Co., Red Deer	356.9	1000
CHMA	Christian & Missionary Alliance, Edmonton	516.9	250
CJCA	Edmonton Journal, Ltd., Edmonton	516.9	500
CJOC	J. E. Palmer, Lethbridge	267.7	50
CKUA	University of Alberta, Edmonton	516.9	500
CNRC	Canadian National Railways, Calgary	434.5	500
CNRE	Canadian National Railways, Edmonton	516.9	500
BRITISH COLUMBIA			
CFCT	Victoria Broadcasting Assn., Victoria	475.9	500
CFJC	N. S. Dalgleish & Sons, Kamloops	267.7	15
CHLS	W. G. Hassell, Vancouver	410.7	50
CKCD	Daily Province, Vancouver	410.7	50
CHWK	Chilliwack Broadcast Co., Chilliwack	247.8	5
CJOR	G. C. Chandler, Sea Island	291.1	50
CKFC	United Church of Canada, Vancouver	410.7	50
CKMO	Sprott-Shaw Radio, Vancouver	410.7	50
CKWX	A. Holstead & Wm. Hanlon, Vancouver	410.7	100
CNRV	Canadian National Railways, Vancouver	291.1	500
MANITOBA			
CKY	Manitoba Telephone System, Winnipeg	384.4	500
CNRW	Canadian National Railways, Winnipeg	384.4	500
NEW BRUNSWICK			
CFBO	C. A. Munro, Ltd., St. John	336.9	50
CFNB	James S. Neill & Sons, Ltd., Fredericton	247.8	100
CNRA	Canadian National Railways, Moncton	475.9	500
NOVA SCOTIA			
CHNS	Northern Electric Co., Ltd., Halifax	322.4	100
CHNS	Halifax Herald, Halifax	322.4	500
ONTARIO			
CFCA	Star Publishing & Printing Co., Toronto	356.9	500
CFCH	Abitibi Power & Paper Co., Ltd., Iroquois Falls	499.7	250
CFLC	Radio Association of Prescott, Prescott	296.9	50
CFMC	Monarch Battery Co., Kingston	267.7	20
CFRB	Standard Radio Mfg. Corp., Ltd., King	312.3	1000
CFRC	Queens University, Kingston	267.7	500
CHCS	Hamilton Spectator, Hamilton	340.7	10
CHML	Maple Leaf Radio Co., Ltd., Mt. Hamilton	340.7	50
CHNC	Toronto Radio Research Society, Toronto	516.9	500
CKNC	Canadian National Carbon Co., Toronto	516.9	500
CJBC	Jarvis Street Baptist Church, Toronto	516.9	500
CJGC	Free Press Printing Co., Ltd., London	329.5	500
CJSC	Evening Telegram, Toronto	516.9	500
CKCL	Dominion Battery Co., Toronto	516.9	500
CKCO	Ottawa Radio Assn., Ottawa	434.5	100
CKCR	John Patterson, Brantford	296.9	50
CKGW	Gooderham & Worts, Bowmanville	312.3	5000
CKMC	R. L. MacAdam, Cobault	247.8	15
CKOC	Wentworth Radio & Auto Supply Co., Ltd., Hamilton	340.7	100
CKOW	Nestle's Food Co. of Canada, Toronto	356.9	500
CKPC	Wallace Russ, Preston	247.8	25
CKPR	E. O. Swam, Midland	267.7	50
CNRO	Canadian National Railways, Ottawa	434.5	500
CNRT	Canadian National Railways, Toronto	356.9	500

SHORT WAVE PHONE AND TELEGRAPH STATIONS

109.0	2XK, Schenectady, N. Y.	42.95	KDKA, East Pittsburgh, Pa.	26.0	KDKA, East Pittsburgh, Pa.
107.1	KIL, Gnadalupe, Calif.	40.0	6XBR-KFWB, Los Angeles, Calif.	22.8	WOWO, Ft. Wayne, Ind. (phone).
106.0	2XE, Richmond Hill, N. Y.	37.24	WCFL, Chicago, Ill.	22.1	2XE-WABC, Richmond Hill, N. Y.
105.0	6XBR-KFWB, Los Angeles, Calif.	35.0	WGY, Schenectady, N. Y.	22.02	2XAD-WGY, Schenectady, N. Y.
100.0	2XI, Schenectady, N. Y.	35.0	2XI, Schenectady, N. Y.	21.96	2XAD, Schenectady, N. Y.
65.4	2XAO-WOR, Newark, N. J.	32.77	2XAF-WGY, Schenectady, N. Y.	20.0	2XAW, Schenectady, N. Y.
63.66	KDKA, East Pittsburgh, Pa.	30.91	2XAL-WRNY, Coyotesville, N. J.	18.3	WBQ, Schenectady, N. Y.
58.75	KDKA, East Pittsburgh, Pa.	30.0	2XI, Schenectady, N. Y.	15.0	2XAW, Schenectady, N. Y.
52.02	8XAL-WLW, Harrison, Ohio.	26.78	KDKA, East Pittsburgh, Penn.		

SHORT WAVE TELEVISION STATIONS

Call	K. C.	Meters	Owner	Apertures
4XA	2400-2500	125-200	WREC, Inc., Memphis, Tenn.	....
2XBV	4500-4600	66.67-65.22	R. C. A., New York City, N. Y.	....
6XC	4500-4600	66.67-65.22	Robert B. Parrish, Los Angeles, Calif.	....
2XBS	4600-4700	65.22-63.83	R. C. A., New York City, N. Y.	....
8XAV	4700-4800	63.83-62.50	Westinghouse Elec. Co., Pittsburgh, Pa.	....
2XBU	4800-4900	62.50-61.22	H. E. Smith, Beacon, N. Y.	....
1XAY	4800-4900	62.50-61.22	J. S. Dodge, Lexington, Mass.	48

Call	K. C.	Meters	Owner	Apertures
WCFL	4847-4959	61.9-60.50	Chicago Federation of Labor, Chicago.	48
3XK	4900-5000	61.22-60.00	C. Francis Jenkins, Washington, D. C.	48
3XK	6420	46.72	C. Francis Jenkins, Washington, D. C.	48
2XAL	9710	30.91	Radio News, New York City, N. Y.	48
2XAD	13.660	21.96	General Electric Co., Schenectady, N.Y.	....
2XBW	15100-15200	19.87-19.74	R. C. A., New York City, N. Y.	....
8XAV	15100-15200	19.87-19.74	Westinghouse Elec. Co., Pittsburgh, Pa.	....

FOREIGN BROADCAST STATIONS

(Much of the data here shown is supplied by the Bureau of Foreign and Domestic Commerce Division of the Department of Commerce)

Call		Wave
ARGENTINA		
LOZ	Buenos Aires	330
LOS	Buenos Aires	291.2
LON	Buenos Aires	210
LOR	Buenos Aires	344.8
LOV	Buenos Aires	361
LOY	Buenos Aires	315.8
LOX	Buenos Aires	380
LOQ	Buenos Aires	261
LOO	Buenos Aires	252
LOJ	Buenos Aires	270
LOW	Buenos Aires	303
LOT	Buenos Aires	400
LOL	Buenos Aires	236
D3	Buenos Aires	253.3
B2	Buenos Aires	275
H5	Cordova	275
H6	Cordova	250
LOP	La Plata	425
LOU	Mendoza	380
M6	Mendoza	348
F2	Rosaria	270
F1	Santa Fe	279
AUSTRALIA		
5CL	Adelaide	395
5DN	Adelaide	313
4QG	Brisbane	385
4CM	Brisbane	278
4MB	Brisbane	337
7ZL	Hobart	525
3AR	Melbourne	484
3LO	Melbourne	32
3LO	Melbourne	371
3UZ	Melbourne	319
3WR	Melbourne	303
3EO	Mildura	286
2HD	Newcastle	288
2UW	Northbridge	263
6WF	Perth	1250
6AG	Perth	32.9
4NM	Rockhampton	323
2FC	Sydney	28.5
2KY	Sydney	280
2FC	Sydney	442
2BL	Sydney	353
2BL	Sydney	32.5
2ME	Sydney	28.5
2BE	Sydney	326
2GB	Sydney	326
2UE	Sydney	297
2WA	Sydney	462
4GR	Toowoomba	294
AUSTRIA		
	Graz	365.8
	Innsbruck	294.1
	Klagenfurt	272.7
	Linz	254.2
	Vienna	577
ORV	Vienna	517.2
	Vienna	22.2
OHK2	Vienna	70
EATH	Vienna	37
AFRICA (NORTH AND EAST)		
SDB	Algiers	310
SRE	Cairo	255
TNV	Carthage	1850
CNO	Casablanca	250
AIN	Casablanca	51
8KR	Constantine	42.8
	Narobi	90
	Rabat	416
TUA	Tunis	1450
AFRICA (SOUTH)		
	Capetown	372
	Durban	398
JB	Johannesburg	443.5
JB	Johannesburg	32
	Pretoria	323
BELGIUM		
	Antwerp	265.5
BAV	Brussels	508.5
	Ghent	275
	Liege	205
	Liege	294.1
LOAA	Luxembourg	217.4
BOLIVIA		
	La Paz	175
	La Paz	300
BRAZIL		
SQAD	Bahia	445
SQAF	Curytiba	340
SQAY	Juiz de Fora	380
	Pernambuco	310
SQAK	Ribeirao Preto	350
SQAB	Rio de Janeiro	320
SQAJ	Rio de Janeiro	260
SQAA	Rio de Janeiro	400
SQAI	Santos	280
SQBO	Sao Paulo	225.4
SQAG	Sao Paulo	360
	Sorocaba	425

Call		Wave
CHILE		
CMAI	Concepcion	345
CMAC	Sanitago	360
CMAD	Santiago	320
CMAE	Santiago	280
CMAT	Tacna	550
CMAK	Temuco	245
CHINA		
COHB	Harbin	435
COMK	Mukden	425
KRC	Shanghai	338
COTN	Tientsin	480
GEC	Tientsin	280
VPS3	Victoria	800
CUBA		
6EV	Caibarien	250
7AZ	Camaguey	225
7EV	Camaguey	190
7GT	Camaguey	195
7LO	Camaguey	230
6YR	Camajuani	200
8KP	Caney	180
8LC	Caney	300
7BY	Ciego de Avila	235
7FU	Ciego de Avila	200
7HF	Ciego de Avila	192
7IR	Ciego de Avila	193
6BY	Cienfuegos	260
6JQ	Cienfuegos	275
6KC	Cienfuegos	240
5EV	Colon	360
7SR	Elia	350
1AZ	Guanajoy	275
2LC	Havana	303
PWX	Havana	400
2AB	Havana	200
2BB	Havana	250
2CC	Havana	350
2CT	Havana	200
2GF	Havana	192
2MA	Havana	215
2MG	Havana	284
2MU	Havana	265
2OK	Havana	350
2OL	Havana	257
2RK	Havana	315
2TW	Havana	270
2UF	Havana	275
2XX	Havana	225
6RG	Havana	200
2FG	Hershey	200

Call		Wave
2JF	Mariana	245
2JL	Mariana	294
5DW	Matanzas	270
6HS	Sagua la Grande	200
6KP	Saneti Spiritus	195
8HS	Santiago	200
8DY	Santiago	250
8FU	Santiago	225
8IR	Santiago	190
8IQ	Santiago	130
6XJ	Tuinneu	278
6KW	Tuinneu	340

CZECHOSLOVAKIA

OKR	Bratislava	300
OKB	Brunn	441.2
	Kosice	263
	Kosice	1870
OKP	Prague	384.9

DENMARK

D7RL	Copenhagen	84.25
D7MK	Copenhagen	32.05
	Copenhagen	337.4
	Kalmudborg	1535
	Ryvang	1150
	Soro	1153.8

ESTONIA

	Tallinn	408
	Tallinn	1200

FINLAND

	Bjorneborg	254.2
	Helsingfors	500
	Helsingfors	31.5
	Helsingfors	240
	Jacobstad	275.2
	Jyvaskyla	297
	Lahtis	1515
	Lahtis	318
	Mikeli	566
	Tammerfors	400
	Uleaborg	250
	Viborg	240

FRANCE

2BD	Agen	297
	Agen	30.75
	Beziers	180
	Bordeaux	419
	Fecamp	200
	Grenoble	416
	Juan les Pins	246
	Limoges	285
	Lille	267.3
	Lyons	291
YR	Lyons	46.2
YN	Lyons	480
	Marseilles	300
	Monte de Marzan	390
	Montpelier	238
	Nancy	15.5
	Nimes	240
FSAV	Nogent sur Seine	80
	Paris	1750
	Paris	308
FL	Paris	2650
CFR	Paris	17.65
FPTT	Paris	458
	Paris	350
	Paris	340.9
FL	Paris	32
FSGC	Paris	61
	Paris	37
	Rennes	294
	Strasbourg	222.2
MRD	Toulousse	260
	Toulousse	389.6

GERMANY

	Aix-la-Chapelle	400
	Augsburg	566
	Berlin	566
AFT	Berlin	1250
	Berlin	438.9
	Breslau	329.6
	Bremen	272.7
	Cologne	283
	Danzig	272.7
AFK	Doberitz	67.65
AFK	Doberitz	37.65
	Dortmund	283
	Dresden	275.2
	Elberfield	268.8
	Freiburg	577
	Frankfurt	428.6
	Gleiwitz	320.7
	Hanover	297
HA	Hamburg	394.7
	Kaiserlautern	204.1
	Kassel	252.1
	Kiel	254.2
	Konigsberg	303
	Langenberg	468.8
	Leipzig	365.8
	Munchen	535.7
	Munich	235.7
	Munster	241.9
AGJ	Nauen	56.7
AGC	Nauen	17.2
	Norddeich	1829
	Nurenberg	241.9
	Scharbeek	230
	Stettin	236.2
	Stuttgart	379.7
AFB	Zeesen	4000
AFP	Zeesen	2900
	Zeesen	1250

GREAT BRITAIN

2BD	Aberdeen	500
2BE	Belfast	306.1
5IT	Birmingham	326.1
6BM	Bournemouth	491.8
2LS	Bradford	252.1
5WA	Cardiff	353
2NM	Caterham	32.5
6SW	Chelmsford	24
5GB	Daventry	491.8
5XX	Daventry	1604.3
2DE	Dundee	294.1
2EH	Edinburgh	288.5
5SC	Glasgow	405.4
6KH	Hull	294.1
2LS	Leeds-Bradford	277.8
6LV	Liverpool	297
2LO	London	361.4
2ZY	Manchester	384.6
5NO	Newcastle	312.5
5NG	Nottingham	275.2
5PY	Plymouth	400
6FL	Sheffield	272.7
6ST	Stoke-on-Trent	294.1
5SX	Swansea	294.1

HAITI

HHK	Port au Prince	361.2

HOLLAND

	Bloemendaal	566
PCJJ	Eindhoven	31.4
PCFF	De Bilt	1100
HDO	Hilversum	1060
	Huisen	340.9
	Huisen	1950
PCLL	Kootwij	18.4
	Scheveningen	1950

HUNGARY

MTI	Budapest	555.6
MT2	Budapest	1050

ICELAND

32SH	Akureyri	192
	Reykjavik	333.3

INDIA AND CEYLON

7BY	Bombay	357.1
2AX	Bombay	320
2FV	Bombay	387
7CA	Calcutta	370.4
VPB	Colombo	800
2GR	Madras	400
2HZ	Rangoon	350

IRISH FREE STATE

6CK	Cork	400
2RN	Dublin	319.1

ITALY

1MI	Milan	315.8
1NA	Naples	333.3
1RO	Rome	449
HAX	Rome	45

JAPAN

JHBB	Hirasio	37.5
JOFK	Hiroshima	353
JODK	Keijo	357
JOGK	Kumamoto	380
JOCK	Nagoya	360
JOBK	Osaka	385
JFAR	Taipah	39.5
JOAK	Tokyo	375
JOIK	Sapporo	361
JOHK	Sandai	390

JAVA

JFC	Batavia	220
ANH	Malabar	17
	Surabaya	140
ANE	Vandoeng	31.86
ANE	Vandoeng	15.93
	Vandoeng	310

JUGOSLAVIA

	Zagreb	275.2

CHOSEN

JODK	Seoul	357

KWANTUNG

JQAK	Dairen	395

LATVIA

KCX	Riga	526.3

LITHUANIA

	Kaunas	2000

MEXICO

CZF	Chihuahua	325
CYS	Ciudad Lerdo	250
CYA	Guadalajara	250
CZC	Jalapa	475
CYY	Merida	548.6
CYX	Mexico City	325
XFX	Mexico City	357
XEN	Mexico City	410
CYR	Mexico City	450
XFG	Mexico City	470
CZI	Mexico City	507
CZA	Mexico City	600-500
XEH	Monterey	311
XEI	Morelia	300
CYF	Oaxaca	265
XEE	Puebla	312

NEW ZEALAND

1YA	Auckland	420
3AC	Christchurch	400
3YA	Christchurch	306
4YA	Dunedin	463
22F	Palmerston	280
2YA	Wellington	420
2YK	Wellington	295

NORWAY

	Aalesund	511
	Bergen	31.25
LGN	Bergen	30
	Bergen	370.4
	Fredriksstad	434.8
	Notodden	412
	Oslo	370.4
	Porsgrund	405
	Rjuken	447.8
	Stavanger	277.6
	Tromso	500
	Trondhjem	243.9

PERU

OAX	Lima	360

PHILIPPINES

KZIB	Manila	260
KZKZ	Manila	270.1
KZRM	Manila	413

POLAND

	Cracow	422
	Kattowitz	422
	Posen	270.3
AXO	Warsaw	1111
	Wilna	435

PORTUGAL

PIAA	Lisbon	305

SPAIN

EAJ18	Almeria	320
EAJ13	Barcelona	462
EAJ1	Barcelona	344.8
EAJ13	Barcelona	277
EAJ9	Bilbao	434.8
EAJ3	Cadiz	400
EAJ16	Cartagena	330
EAR5	Las Palmas (Canary Islands)	250
EAR5	Las Palmas (Canary Islands)	350
EAM	Madrid	30.7
EAJ7	Madrid	375
EAJ2	Madrid	420
EAJ25	Malaga	250
EAJ19	Oviedo	280.4
EAJ27	Salamanca	500
EAJ8	San Sebastian	297
EAJ17	Seville	434.8

STRAITS SETTLEMENTS

1SE	Singapore	330

SWEDEN

SASE	Boden	1190
SMYB	Boras	230.8
SMXF	Gavle	204.1
SASB	Goteborg	416.7
SMZK	Falun	315.8
SMTC	Eskilstuna	250
SMSB	Halmstad	215.8
SMYE	Halsingborg	229
	Hamar	555.8
SMSL	Hudiksvall	272.7
SMZD	Jonkoping	201.3
SMSW	Kalmer	254.2
	Karlsborg	52.2
SMSM	Karlskrona	196
SMXG	Karlstadt	220.6
SMTG	Kirnna	238.1
SMTJ	Kristinehamm	202.7
SMUW	Linkoping	500
SMXO	Malmberget	400
SASC	Malmo	260.9
SASG	Motala	1380
SMVV	Norrkoping	275.2
SMTI	Orebro	236.2
SMZA	Ornskoldsvik	187.5
SASF	Ostersund	720
SMTS	Saffle	252.1
SASA	Stockholm	454.5
SASD	Sundsvall	545.6
SMXQ	Trollhattan	277.8
SMZP	Tidevalla	294.1
SMSN	Umea	229
SMRN	Uppsla	500
SMSO	Varborg	297

SWITZERLAND

HD3	Basle	1000
H9OC	Berne	32
HBA	Berne	411
HB1	Geneva	760
HB2	Lansanne	850
H9XD	Zurich	85
H9XD	Zurich	32
HBZ	Zurich	500

TURKEY

	Angora	1806
	Stamboul	1200

UNION OF SOVIET SOCIALIST REPUBLICS

RA47	Armavir	720
RA56	Artemovsk	790
RA26	Astrakhan	700
RA45	Baku	750
RA8	Bogorodsk	750
RA30	Dneipropetrovsk	525
RA49	Erivan	1050
RA39	Gomel	925
RA57	Irkutsk	1100
RA7	Ivanovo-Vosnesensk	800
RA43	Kharkov	475
RA45	Kiev	775
RA34	Koursk	575
RA38	Krasnodar	513
RA42	Lepingrad	1000
RA59	Leningrad	150
RA18	Minsk	860
RA1	Moscow	1450
RA2	Moscow	450
RA4	Moscow	450
RDW	Moscow	1450
RA67	Nalchik	1075
RA13	Nizlni-Novgorod	840
RA32	Novorossisk	1117
RA40	Odessa	975
RA25	Orenburg	640
RA64	Petropavlovsk	350
RA46	Petrozavodsk	765
RA14	Rostov-on-Don	820
RA22	Samara	900
RA32	Saratov	420
RA9	Sevastopol	800
RA68	Smolensk	330
RA72	Smolensk	150
RA77	Stalino	730
RA20	Stavropol	550
RA15	Sverdlovsk	1050
RA27	Tashkent	715
RA11	Tiflis	870
RA21	Tomsk	300
RA44	Tver	690
RA51	Ulyanovsk	500
RA16	Vel Ustjuk	650
RA17	Vladivostok	480
RA41	Vologda	875
RA12	Vorenezh	950

URUGUAY

CWOA	Montevideo	428.4
CWOF	Montevideo	300
CWOG	Montevideo	280
CWOH	Montevideo	300
CWOK	Montevideo	260
CWOL	Montevideo	272
CWOH	Montevideo	265.5
CWON	Montevideo	256.5
CWOO	Montevideo	294
CWOR	Montevideo	350
CWOS	Montevideo	380
CWOI	Salta	272
CWOJ	Salta	250

VENEZUELA

AYRE	Caracas	375

SALVADOR

AQM	Salvador	482

KC	Meters	STATIONS	DIALS 1	2
1500	199.9			
1490	201.2			
1480	202.6			
1470	204.0			
1460	205.4			
1450	206.8			
1440	208.2			
1430	209.7			
1420	211.1			
1410	212.6			
1400	214.2			
1390	215.7			
1380	217.3			
1370	218.8			
1360	220.4			
1350	222.1			
1340	223.7			
1330	225.4			
1320	227.1			
1310	228.9			
1300	230.6			
1290	232.4			
1280	234.2			
1270	236.1			
1260	238.0			
1250	239.9			
1240	241.8			
1230	243.8			
1220	245.8			
1210	247.8			
1200	249.9			
1190	252.0			
1180	254.1			
1170	256.3			
1160	258.5			
1150	260.7			
1140	263.0			
1130	265.3			
1120	267.7			
1110	270.1			
1100	272.6			
1090	275.1			
1080	277.6			
1070	280.2			
1060	282.8			
1050	285.5			
1040	288.3			
1030	291.1			

KC	Meters	STATIONS	DIALS 1	2
1020	293.9			
1010	296.9			
1000	299.8			
990	302.8			
980	305.9			
970	309.1			
960	312.3			
950	315.6			
940	319.0			
930	322.4			
920	325.9			
910	329.5			
900	333.1			
890	336.9			
880	340.7			
870	344.6			
860	348.6			
850	352.7			
840	356.9			
830	361.2			
820	365.6			
810	370.2			
800	374.8			
790	379.5			
780	384.4			
770	389.4			
760	394.5			
750	399.8			
740	405.2			
730	410.7			
720	416.4			
710	422.3			
700	428.3			
690	434.5			
680	440.9			
670	447.5			
660	454.3			
650	461.3			
640	468.5			
630	475.9			
620	483.6			
610	491.5			
600	499.7			
590	508.2			
580	516.9			
570	526.0			
560	535.4			
550	545.1			

A whispering campaign . . . . . .

will ruin the popularity of any set owner

if the set has "ADENOIDS"!

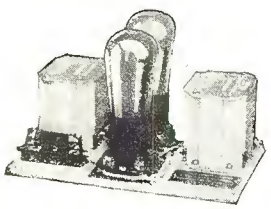
REMEMBER it isn't what they say to your face about your set—it's what they say behind your back. And how those hammers do get busy when they get a set with "adenoids" to talk about.

Preserve the good opinion of your friends—and get the enjoyment you deserve—perform that adenoid operation today—take out the inferior transformers and in their place put AmerTran tone-true radio products.

You can use AmerTran DeLuxe audio transformers—or push-pull for 171 tubes—or better yet the completely built Power Amplifier for two 210 type tubes and the AmerTran Hi-Power Box.

No matter what the change—if you switch to AmerTran you will improve the quality of your set.

Perform that adenoid operation today—turn the sneers to cheers! AmerTran Radio Products will do the job for you.

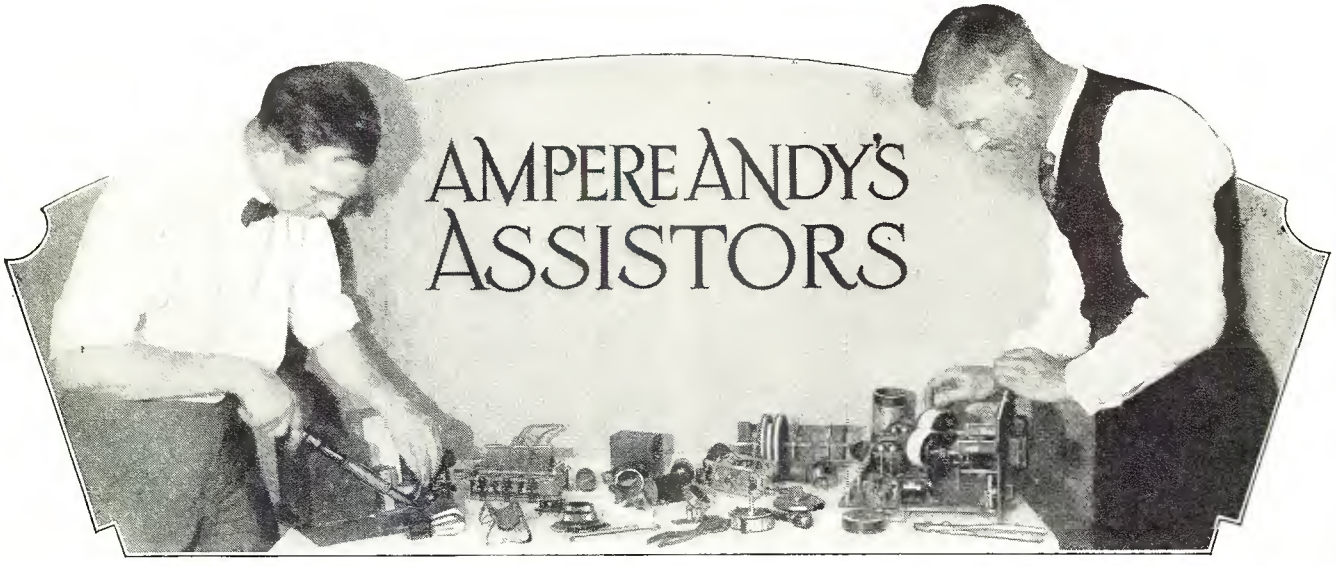


AmerTran Push-Pull Power Stage (illustrated here)—completely wired with input transformer and a choice of 4 output transformers depending on speaker and power tubes. Adaptable to 171 or 210 tubes, cones or dynamic type speakers. Price, East of Rockies—less tubes—$36.00.

AMERTRAN

AMERICAN TRANSFORMER COMPANY, 95 Emmet St., Newark, N. J.

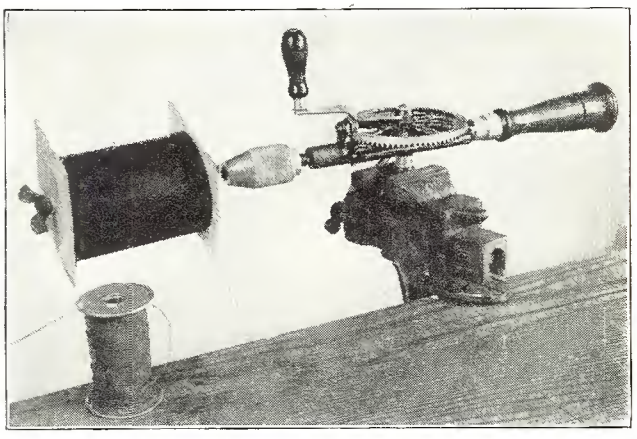
Transformer Manufacturers For More Than 29 Years



Pepping Up a Loop

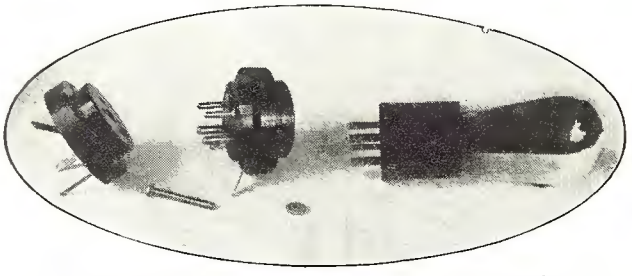
Frequently superheterodyne owners complain that they do not secure a strong signal from their loop operated sets. One of the simplest and most economical methods of feeding greater signal voltage to the loop is by means of wrapping two or three turns of antenna lead-in around the loop and then either grounding or leaving ungrounded the free end. This procedure results in an inductive feed from the antenna to the loop and will give a much stronger signal, although if too many turns are put on there is a possibility of the loop dial being rather broad. As in everything else there is a happy medium which experimentation will disclose.

Home Made Coil Winder



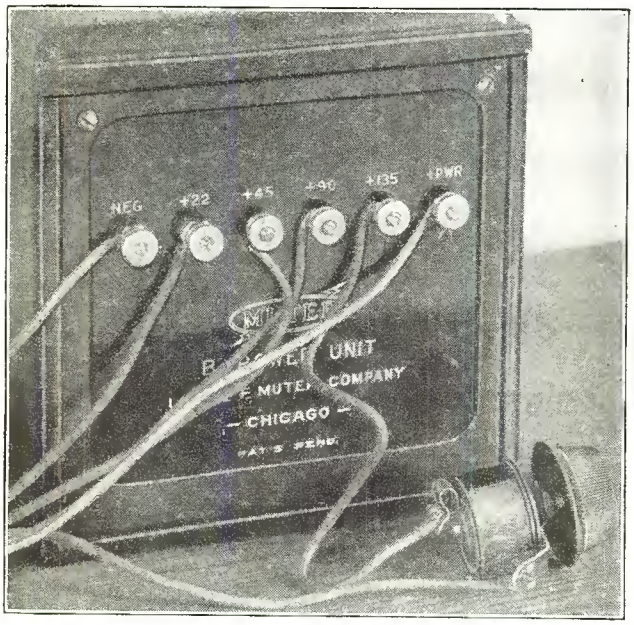
Lack of a lathe should not prevent a builder from winding any simple coil he desires, when the expedient illustrated in the photograph is possible. A twist drill is placed in the vise in the manner shown and a quarter-inch threaded rod put in the chuck. The coil is held between two end pieces on the threaded rod and a wing nut used at the extreme end to compress the two end forms tightly together. When the coil has been properly centered so that it does not wabble on rotation, the wire may be wound on the coil, using the left hand to maintain a slight tension on the wire and the right to turn the crank of the twist drill.

Novel AC Adapter



A simple home-made adapter may be readily constructed for converting a set now using d. c. tubes into one using the a. c. tubes. An old tube base is cut off and placed on the under side of a Tyrman socket. These two parts should be held together by means of a bolt and nut. The grid and plate prongs of the socket shown in the center photograph are bent over to touch the grid and plate prongs of the tube base and soldered thereto. The two filament prongs on the tube base are left unconnected.. The two terminals of the Tyrman socket representing the filament leads are bent outward and to these are connected the two wires from the filament transformer. The adapter is plugged into the regular four-prong socket in the receiver and the a. c. tube plugged in at the top of the adapter. This permits conversion of a d. c. set to an a. c. set without very much difficulty, and should one be dissatisfied he can always return to the old style operation.

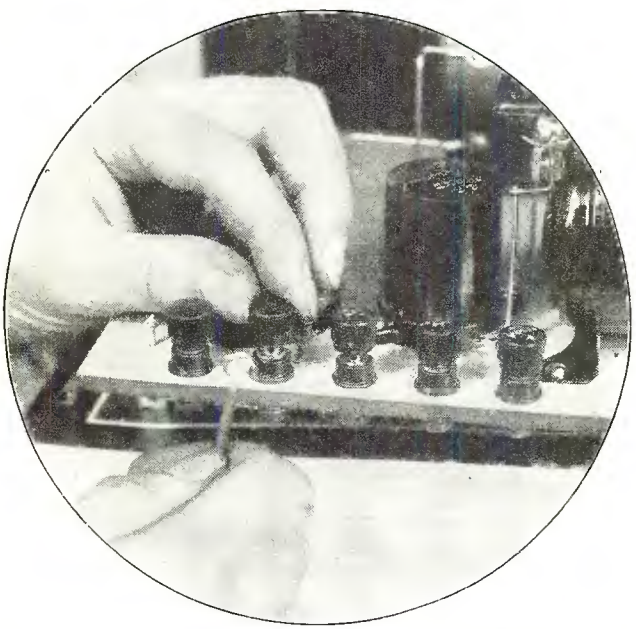
Securing Odd Voltages



In many instances where the fan has a standard eliminator, he may desire to have a voltage value other than the one provided on his eliminator. Intermediate values of voltages over a moderate range may be secured by placing a Clarostat or other heavy duty variable resistance in series with the positive 135 volt terminal on the eliminator.

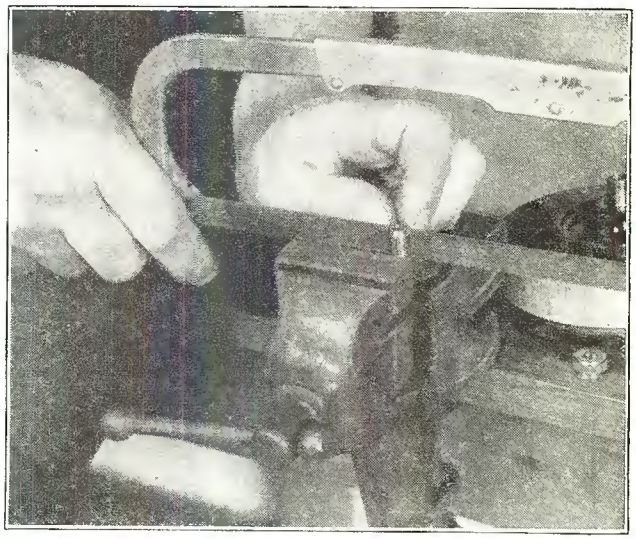
~ ~ ~

Making Correct Loop



Despite all that has been written for years on the subject of how to make a loop go under a binding post, repair shops still find evidences that many builders do not know the proper way of making a wire loop go under any binding post. Since the rotation of the binding post knob is towards the right, it naturally follows that the curl of the loop should be in the same direction, so that maximum holding is secured. If the loop is run in the opposite direction, it is very difficult to secure a tight hold and there is always a possibility of the connection becoming loosened.

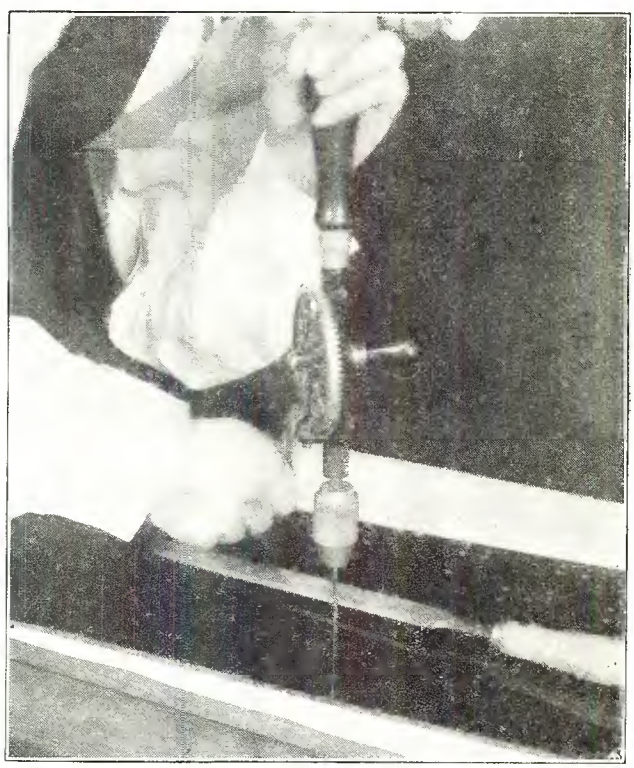
Getting Tighter Grip



When tightening up the compression bushing on some types of drum dials, occasion may arise where there is not sufficient grip in the bushing to hold the dial tightly to the shaft. To remedy this, the bushing may be taken out and placed in a vise and a hack-saw run through the slot so as to clear it and possibly widen the slot. When the bushing is again put back into position, it will be found that with the nut it will be possible to get a tight grip on the shaft.

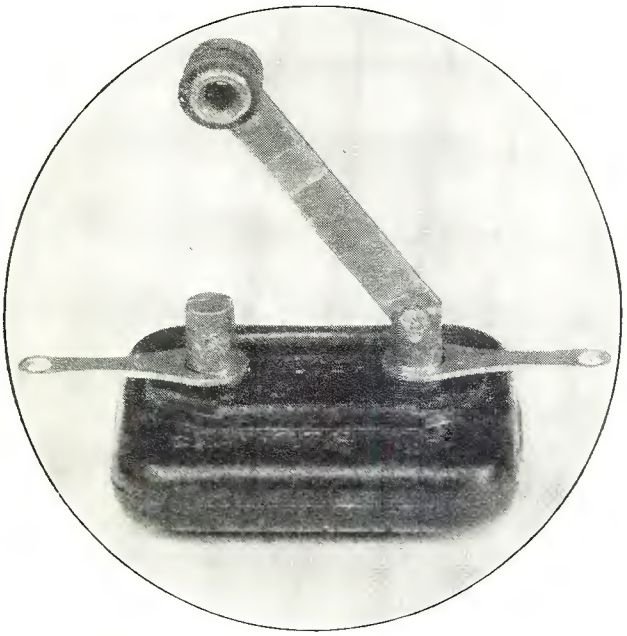
~ ~ ~

Square Cutouts Easy



Many embryo set builders have been puzzled when confronted with the necessity of making a square cut-out in a sub-panel. Of course, if a hack saw is available the job is very easy, but not every builder has such apparatus. Therefore, the simplest method is to bore a line of holes along the marking for the cut-out, spacing these holes quite close together so that when all holes have been drilled it will be possible to use a file or a hack saw blade to cut through between hole-walls. A file may be used to smooth off the edges after the section has been knocked out.

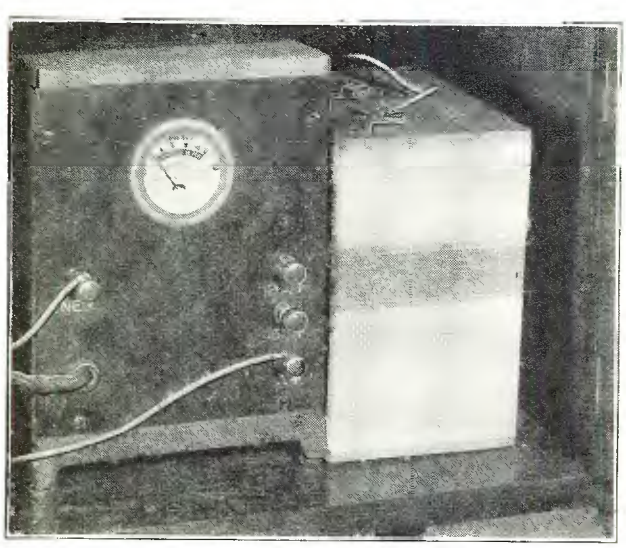
Simple Antenna Switch



A very novel method of securing the equivalent of a long or short antenna is illustrated in the photograph herewith. The method consists simply of a shorting switch located across the terminals of the condenser shown in the photograph. The antenna wire is attached to the lug at the left, while the lug at the right goes to one end of the antenna coil. Thus when the switch is open, as shown herein, the condenser is in series with the antenna, giving the effect of an electrically shortened antenna. When the switch is closed, the electrical length of the antenna is greatest and naturally strongest signals ensue.

~ ~ ~

Keep Away from Heat



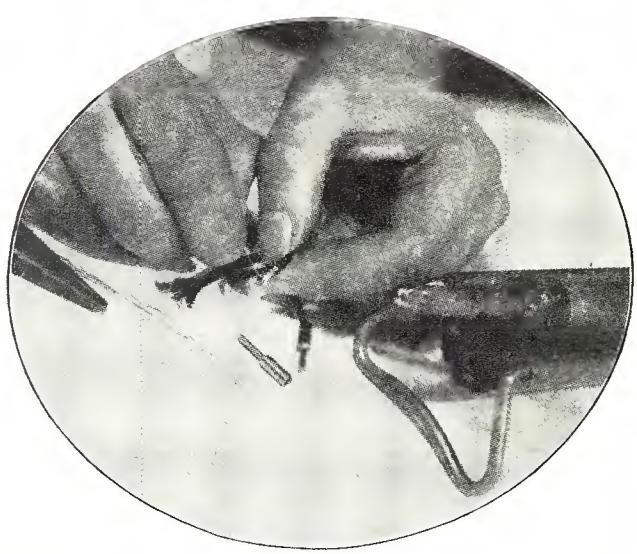
All manufacturers of dry cell batteries state in their literature and on the battery cartons the cells should be kept in a cool, dry place. In the photograph above a battery is shown next to a 5 ampere charger, which generates considerable heat and which heats up the battery. This is not a good plan and wherever possible the dry cell and any given heat producer should be separated by several inches.

Reducing Tube Voltage

If you find your rheostat will not dim your tube sufficiently, a further drop in voltage may be secured by the simple expedient of placing a fixed resistance in series with the rheostat as shown in the accompanying photograph.

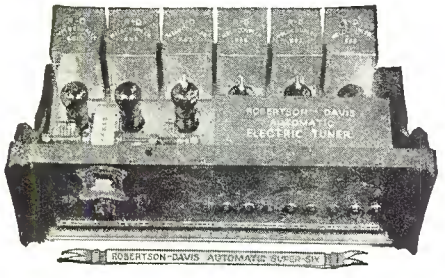
~ ~ ~

Soldering Tinsel Wire



We have been taught for years that there is no such word as "can't" in the vocabulary of an ambitious individual. However, in the case of the radio art, we believe there are several, one of the most noteworthy being the fact that you can't solder tinsel wire directly. The simplest way of achieving the result is by wrapping the tinsel wire closely with a single strand of small copper wire for a distance of about ½ inch or so, then quickly tinning the wrap. Then if tips are to be soldered on, the tip should be filled about one-half full of solder and held against an iron until the solder is hot, when the tinsel end with its protective covering is deftly plunged into the opening in the tip. The photograph shows the operator in the act of winding a single strand of flexible wire around the tinsel to prevent its burning through the application of the heat.

We will make You Our Exclusive R-D Set-Builder



THE ROBERTSON-DAVIS AUTOMATIC SUPER-SIX RECEIVER

WHETHER you are building for your own amusement, or to sell for profit, you can't go wrong with the new Robertson-Davis Automatic Super-Six Receiver. All of the best features of the world's best and most expensive receivers are combined and provided to you in one, at the same price as that of an ordinary receiver. It is the design of the world's leading radio engineers, built and serviced by the world's leading custom set-builders. It is the receiver that has everything everybody wants in a radio set. Entirely A.C. operated—and 3 Stages A.C. Shield Grid Amplification.

No other custom-built set has the automatic feature. Supplied with or without the Automatic Electric Tuner, as desired. You have the automatic tuner, and a single illuminated drum-dial for tuning in stations of the greatest distance—they all come in at one spot on the dial or on one automatic tuner button. So here you have all that is new in radio because of the automatic feature, and all that is new in old-fashioned tuning because of the single drum-dial.

GOES TOGETHER IN 18 MINUTES

You get the receiver ready to assemble in a few minutes—it fits together like a set of toy building blocks. All instruments are fitted and housed in the sub-panel except the trimmer, condensers and volume control, which are mounted directly on the panel. No soldering or tinkering—all you need is a screwdriver. The entire receiver comes in a factory packed kit of wired, laboratory-tested parts complete. A complete set of Blue Prints and Instructions furnished with everything marked. You lose no time.

Due to the improved circuit and shielding throughout, static is at a minimum. There is no more hum with this receiver, though entirely A.C. operated, than with a receiver eliminator—operated on D.C. current. The unique shielding, specially constructed transformers, and peculiar way in which the R-D Automatic Super-Six circuit is arranged, all give it a selectivity that surpasses anything known in radio. Gives 10 K.C. separation, one spot reception, and perfect tone and volume on local or coast-to-coast stations through all forms of interference.

All of these points are proven nightly for the public in our Receiving Studios, which are located in the heart of the highly congested districts of Chicago. The public is invited. You can see for yourself!

How Would You Like To Be the Only Representative of Custom-Built Automatic Radio Receivers?

There isn't another custom-built receiver in the world that has all the features of the R-D Automatic Super-Six. There isn't another automatically tuned receiver in the world that you can build and sell. No other set-builder in your district can offer the same service, if you take advantage of this opportunity. No other manufacturer can offer you the same profitable proposition.

Showing the R-D Automatic Super-Six in one of our exclusive consoles

WE SUPPLY EVERYTHING DIRECT TO OUR LICENSED SET-BUILDERS

Through our exclusive Franchised Set-Builders, we provide every part and accessory complete—everything guaranteed to give satisfaction;

R-D Super-Six Receiver	A.C. Tubes for Set and
Automatic Electric Tuner	Pack
All-Electric Power Pack	Cabinets and Furniture
Dynamic Speakers	Phonograph Pick-Ups
Phonograph Pick-Ups	and Turntables
Television Coils, Etc.	Short-Wave Coils, Etc.

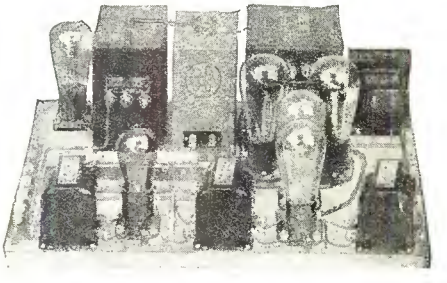
All of this equipment is internationally known to be of the highest standard and best quality. It is only a question of following the simple instructions that come with the kits to secure the finest and most satisfying results you have ever obtained with a radio receiver.

YOU WILL BE ABSOLUTELY PROTECTED

You can make yourself our Exclusive Franchised and Licensed Set-Builder for your community, if you are now engaged in or wish to enter this profitable, fascinating field of work. We are looking for one good set-builder in each district, and we fully protect him! You will not find the Robertson-Davis Automatic Super-Six Receiver sold over the counter by so-called dealers who sell to the public at wholesale prices. No other dealer or set-builder can come in and supply the receiver after you promote the sale. You have no competition.

A FRANCHISE TO ALL WHO QUALIFY

We sell direct to you, wholesale. While you are starting, we give you all the help we can, and an option on your district. After your third set is built and sold, you are given the Exclusive Franchise for your district, authenticated by a large Certificate for framing and an authorization card. Circulars, Broadsides for mailing (imprinted with your name), Window Trims and other advertising and selling helps are supplied free to help you sell.



THE R-D AUDIO & A-B-C ALL-ELECTRIC POWER PACK

This is a special 210 Push-Pull Unit with voltage divider, for use with any type of speaker, horn or cone—magnetic or dynamic. Equipped to be used with phonograph pick-up, if desired. Takes care of all audio and power requirements for the R-D Automatic Super-Six Receiver when operated from 60 cycle A.C. 110 volt electric lighting socket.

The Only Custom-Built Radio Receiver Automatically Tuned

Press a button and your favorite station plays. Even a child of 3 can play it—the Automatic Electric Tuner does all the work. Any six stations can be selected for automatic playing, and these can be changed at will. Depressing any button automatically cuts out all the rest, and brings in only the station desired from those on the Automatic Tuner, or any other you wish to tune in with the drum-dial on the receiver. This is the receiver you will want to own, and the receiver you will want to build. Fill in and mail the coupon, and we will tell you all about it!

The World at your finger-tips

with

ROBERTSON-DAVIS
Automatic Radio

SET BUILDERS: MAKE REAL MONEY WITH THIS QUICKLY ASSEMBLED, FOOL-PROOF RECEIVER. WRITE FOR BUILDER'S DEAL.
RADIO FANS: GET DX OR LOCAL WITH INCOMPARABLE TONE AND VOLUME. SEND COUPON FOR FREE LITERATURE.

29
RCB-1

Robertson-Davis Company, Inc.
361 W. Superior St.
Chicago, U. S. A.

Gentlemen:

Please send, without charge or obligation, complete literature on the R-D Automatic Super-Six Receiver, Automatic Electric Tuner, All-Electric Power Pack, and Guaranteed Accessories to use with them. (Set-Builder's Offer will be included, if indicated.)

ARE YOU NOW A SET-BUILDER? [If You Are, Enclose Card or Letterhead] YES☐ NO☐

Name.....

Address.....

Town.....

Addition of 250 Power Tube Makes S-M 720 Even More Powerful

Screen Grid Six Now Arranged for Increased Output for Use at Lodge Halls and Dances

SINCE the appearance in the September issue of the Citizens Radio Call Book Magazine of an article describing the S-M 720 Screen Grid Six, a number of letters have come to our notice, describing feats of distance reception through local interference, using this extremely high gain receiver. Listeners in New York City report no difficulty in loud speaker reception of stations like KRLD, Dallas, Texas; KOIL, Council Bluffs, Iowa, and CHNS, Halifax, Nova Scotia. In Cincinnati a listener reports daytime reception of stations all over the Mississippi Valley and Great Lakes region, with good preservation of the excellent tone quality produced by the new Clough system audio transformers, which has made so many friends for this hook-up.

Want 250 Tube

Numerous requests have been received, however, for information as to how a set of this type may be equipped with a high power output tube such as the 250, and thus make it effective in lodge halls, church assembly rooms and other meeting places, as well as for use in the home when unusual volume is desired for some occasion such as a dancing party. Provision was made by the designer of the 720 so that the super-power tube can very easily be installed, with a minimum change, in the set as wired for lower voltage power tubes—in fact, without any change whatev if so desired, in routing and wiring of existing parts. For readers who have not yet built the 720 Screen Grid Six, the description here given, of the set as it may be built originally with the 250 type tube, may result in adding one more interesting feature to a design already very attractive to the set builder.

Phonograph Amplification

Many owners of high grade radio receivers are now finding it very advantageous to provide wiring, through a jack, from the audio amplifier input to a magnetic phonograph pickup, so that the high quality amplifier built into the radio receiver can be used

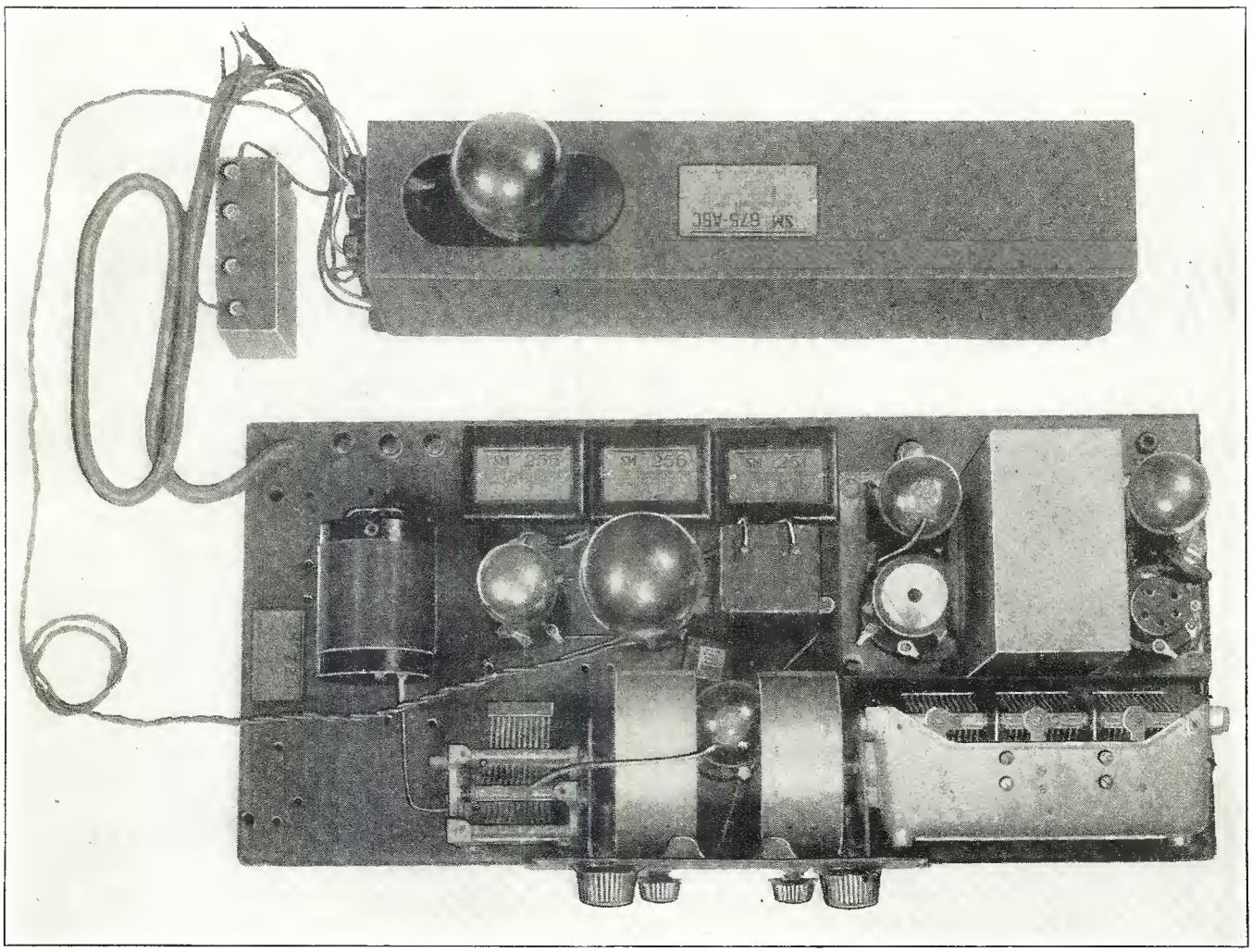


Fig. 1. This photograph shows the new arrangement of the Screen Grid Six used in conjunction with a 675 ABC power supply as described in the accompanying article

(This receiver tested and all illustrations made in our laboratory)

when playing phonograph records. This use of the radio set becomes still more attractive when the last audio stage is equipped with a 250 tube, for in this way a very inexpensive phonograph—or a simple turntable with electric motor mounted in the cabinet—can be made to deliver to the dynamic speaker volume usually equal to or even greater than that of the original studio performance, even in the case of a large band or orchestra; and with such an extremely high grade audio system as found in the Screen Grid Six, this sound reproduction may be expected to show a quality equal to the best that can be had from high priced electrical phonographs.

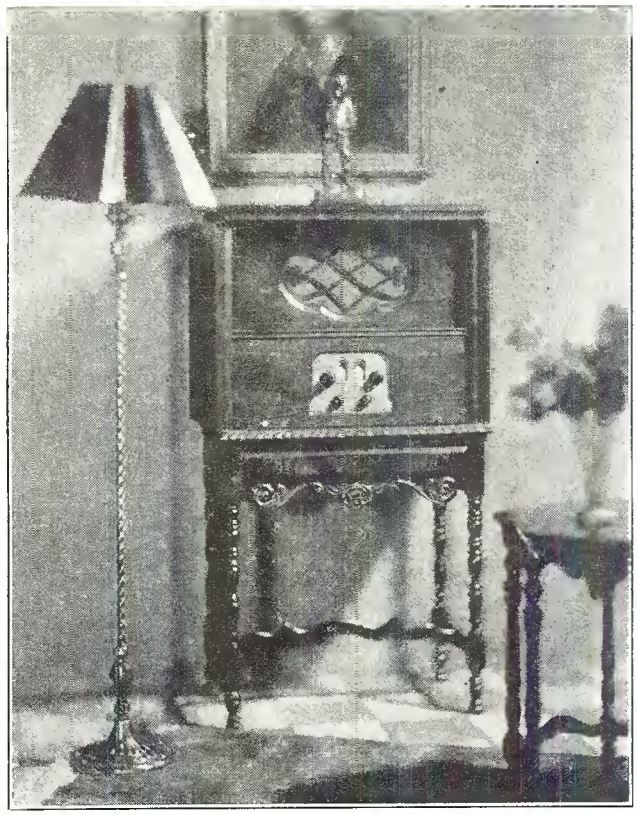


Fig. 2. The completed receiver is here shown in an exquisite furniture setting

Power Needed on Low Notes

The great advantage in using high powered tubes like the 250 is more readily seen when it is remembered that the amount of energy necessary to produce a given effect upon the ear is several million times as much for a note of 50 cycles pitch as for a note at 1000 cycles. When using transformers of the type commonly found on ordinary ready made radio sets, it is not so necessary to have this additional power in the tube, because very little of the energy passing the detector at frequencies around 50 cycles can get through the audio system—these low bass notes being thus almost completely lost as far as any actual reproduction in the speaker is concerned (the ear often imagines them to be present even when they are not, so that even a cheap audio amplifier does not usually sound quite as bad as laboratory tests would indicate. But with audio coupling such as provided by the two Clough system transformers in the S-M 720, which actually do pass at practically their full natural strength, currents of frequencies as low as 50 cycles (a note just below the lowest one on a common E-flat bass tuba) it becomes very important, in order to utilize this broad range in the amplifier, to have a tube powerful enough to supply the required energy.

Use Output Filter

Owing to the high plate voltage which is necessary with the 250 type tube if its full power is to be secured, it is never safe to let the plate current flow directly through the loud speaker. That is, some kind of output transformer or other coupling device is always necessary. On the chassis of the Screen Grid Six, a suitable space has been left for mounting, beside the second stage audio transformer, an S-M 251 output transformer—this being an instrument of the same general type as the 255 and 256 Clough system audio transformers. The 251 transformer has four terminal lugs, but only two or three are used in any circuit—the selection of the proper terminals to be used, depending, however, on the type of power tube out of which the 251 transformer is to work. In this way, due allowance is made for differences in the impedance of common power tubes, so that none of the high quality of output possible with the 250 tube need be sacrificed on account of the output transformer having been designed to work optionally out of smaller power tubes.

How to Mount New Parts

Having mounted the 251 transformer as shown in the photograph, it should be connected as follows if the 250 tube is to be used: terminal 1 to the 450 volt post of the power supply, terminal 2 to the plate (P terminal on the socket) of the last audio tube. The insulated tip jack formerly connected to this P terminal on the tube socket should now be connected to the extra 1 mfd. condenser which is to be mounted as in the photograph directly in front of the output transformer. The other side of this high voltage condenser then goes to terminal 2.

The 250 type tube requires filament current at 7½ volts. Since this voltage is not available from storage batteries in common use, and since raw a. c. is not objectionable in the filament of the last tube "A" current for the 250 tube will be taken from a filament voltage coil on the power supply. If the adapter is used, so that filament wiring to the last audio socket need not be disturbed, the two leads from the adapter are simply run to the 7½ volt terminal on the power supply. A somewhat neater method, however, and one which is very easily carried out if all the leads present in the power cable to the set have been retained, is to utilize the yellow and yellow-white leads to carry filament current to the 250 tube. If this is to be done, the two wires, connecting the filament terminals of the power tube socket on the 720 chassis to the "A" power supply for the other tubes, are

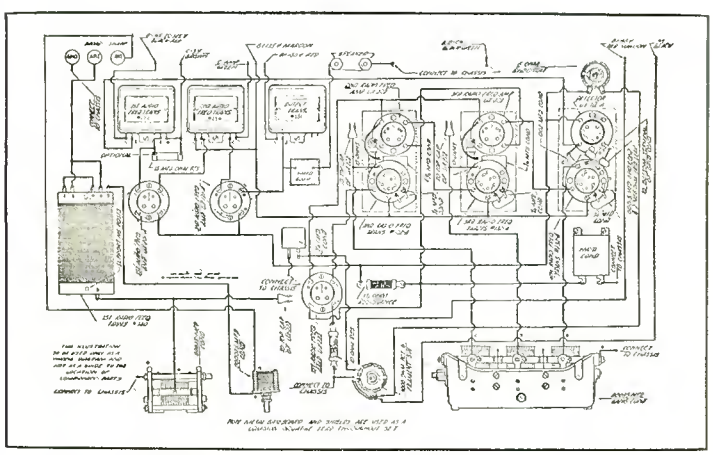


Fig. 3. This drawing represents the graphic method of making connections in wiring up the receiver

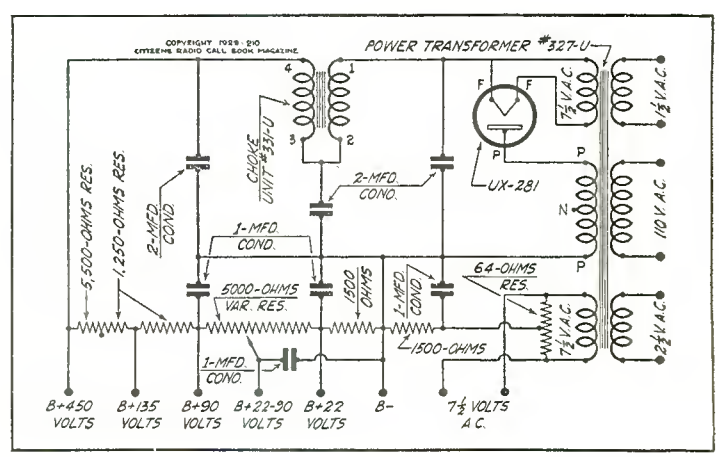


Fig. 4. The schematic circuit involved in the ABC supply is illustrated above

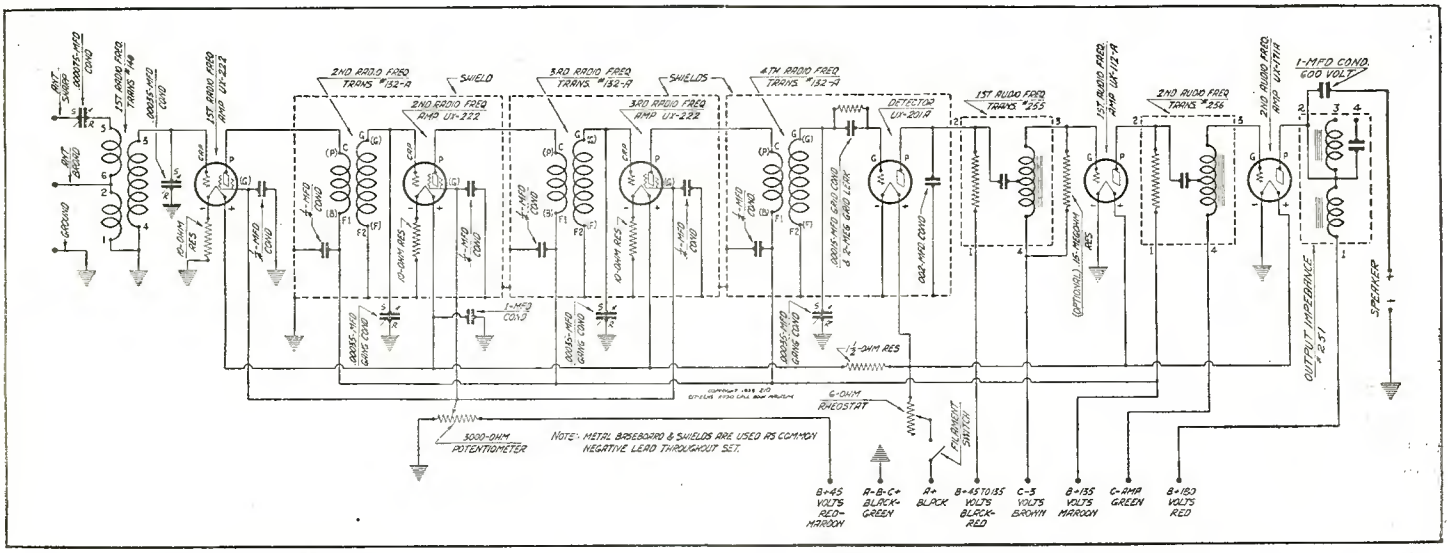


Fig. 5. This schematic diagram gives all of the electrical connections involved in the Screen Grid Six described in this article

disconnected from this last socket, and the yellow and yellow-white wires substituted. The outer ends of these wires are then connected to the 7½ volt posts on the power supply, and the adapter is not used at all. This makes the installation no less neat and compact than where a smaller power tube is used.

Used with Power Supply

An S-M 675ABC power supply is ideal for furnishing to the super-power 720 the high B voltage required for the 250 tube, as well as the 7½ volt "A" current required for its filament. Moreover, the internal connections of the 675ABC are such that the necessary C bias is furnished to the power tube without altering the connections of the receiver in any way for this purpose. This is accomplished by connecting the "C— power amplifier" lead from the receiver to the "B—" post on the 675ABC power supply, and connecting the other power leads just as is done on ordinary B supplies ,or on the S-M 670 (which is recommended for the 720 set when used with 171A powe rtube). The 40 volt "C" battery commonly used with the 171A type of power tube is then not required, and a small 3 or 4½ volt "C" battery, as shown in the photograph, is all that is required.

Hence, the super-power 720 Screen Grid Six is very nearly equal in simplicity of installation to the same set when used with power tubes of ordinary type, and the considerable improvement in tone quality and tremendously greater volume capacity amply justify the small added expense.

The schematic diagram shown in Fig. 5 will give all of the electrical details involved in the screen grid Six. The antenna stage has two input connections, one for sharp tuning and one for broad tuning. The grid of the input stage is tuned by the .00035 mfd condenser across the secondary section of the first radio frequency transformer 140. The second r. f. transformer, 132-A, which is of the plug-in type, and its associated 222 tubes are contained within one shield, while the third r. f. transformer 132-A and the third r. f. amplifier are contained in a second stage shield. The detector tube and its associated transformer are located in the third shield. The screen grids of the first, second and third tubes are connected together and potential applied to them through a 3000 ohm potentiometer located across the B-45 volt terminal and ground. This enables the operator to shift the potential applied to the screen grid and is used as volume control. A separate bias is applied to the grid of each shield grid tube by the drop across the 10 ohm resistance located between the negative filament of the tube and ground. The detector circuit has a 6 ohm rheostat in series with that filament, which is common with the positive line of the screen grid tubes, the latter through a 1½ ohm fixed resistance. This 6 ohm rheostat also controls the first and second audio tubes. Each screen grid circuit, the positive filament circuit, and the B terminal of each r. f. transformer are bypassed to ground through the shield. The plate circuit of the detector is also bypassed with a .002 mfd condenser from plate to negative filament, which is common with the shield. all of which contributes materially to the stability of the receiver.

Official Parts List

Parts for the complete receiver as here described are:

1 Silver-Marshall 701 Universal chassis
1 Silver-Marshall 809 dual control escutcheon
1 Silver-Marshall 806-L vernier drum dial
1 Silver-Marshall 806-R vernier drum dial
1 Silver-Marshall 320-R .00035 mfd Universal condenser
1 Silver-Marshall 323 .00035 mfd 3-gang condenser
1 Silver-Marshall 342-B .000075 mfd midget condenser
3 Silver-Marshall 638 copper stage shields
1 Silver-Marshall 140 antenna coil
3 Silver-Marshall 132-A plug-in r. f. transformers
3 Silver-Marshall 512 5-prong sockets
5 Silver-Marshall 511 tube sockets
1 Silver-Marshall 255 first stage audio transformer
1 Silver-Marshall 256 second stage audio transformer
1 Silver-Marshall 708, 10 lead, 5 foot connection cable
1 Package Silver-Marshall 818 hook-up wire
1 Yaxley 3000 ohm junior potentiometer, No. 53000-P
1 Yaxley 500 switch attachment
1 Yaxley 420 insulated tip jacks
3 Carter RU-10 resistances
1 Carter AP-6 sub-base rheostat
1 Carter H-1½ resistor
1 Potter No. 1 mfd bypass condenser
6 Sprague or Polymet ¼ mfd midget bypass condensers
1 Polymet .00015 grid condenser with clips
1 Polymet .002 mfd bypass condenser
1 Polymet 2 megohm grid leak
1 Durham .15 megohm resistor with leads
1 Naald 581XS cushion tube socket
3 Moulded binding posts
1 Set hardware consisting of studs, screws, nuts, washers
3 222 type r. f. amplifier tubes
1 201-A type, or preferably 112-A type, detector tube
1 112-A type first stage a. f. amplifier tube
1 171-A type power output tube (if 250 not used)

Extra Parts Required If 250 Tube Is Used

1 Silver-Marshall 251 output transformer
1 Silver-Marshall 1 mfd condenser, 600 volts
1 Silver-Marshall 675ABC high voltage power supply

Remler A. C. Power Amplifier Using 250 Tube for High Quality

Output Circuit of Amplifier Has Tapped Coil for Use of Either Dynamic or Magnetic Speaker

DESCRIBED in this article is a new addition to the Remler line of radio apparatus designed for use in connection with Remler receivers, as well as receivers of other makes. Its output circuit is so constructed that either magnetic or dynamic speaker may be used, depending on the method of connection made in the output coil winding. The entire amplifier is designed for quality amplification throughout and will be welcomed by Remler enthusiasts who wish to increase their possibilities of quality reproduction.

Built on Chassis

Examination of the schematic circuit shown in Figure2 will give an idea of the constituent parts and related circuits. The Remler power compact No. 950 is enclosed in a metal housing and is that portion of the set represented at the right rear in the photograph, Fig. 1. It comprises an alternating current primary with three taps, one for 105 volts, the second for 115 volts and the third for 125 volts. By this means some compensation may be allowed for a variation in line voltages at the location where the amplifier is being operated. The secondary of the power transformer has a high voltage winding, the extremities of which go to the plates of the two 281 rectifier tubes, while the center tap of this winding becomes the negative line of the amplifier. Across the 7½ volt winding, which supplies the filaments of the two rectifiers, is placed a 64 ohm center tapped resistance, the center of which becomes the high voltage line and leads to the input of the double filter choke system, this filter being bypassed at the input, the center and the output by 2 mfd condenser blocks. The filament circuit of the first audio amplifier, which uses a 227 tube, is energized by a 2½ volt winding from the power transformer, a 64-ohm center-tapped resistance being placed across the heater terminals, the center of which goes to the common negative of the system. Grid bias for this first stage is supplied through the drop across a 2000 ohm variable resistance between the cathode of the 227 and the common negative line.

In the last power stage, where a 250 tube is employed, the bias for that grid circuit is obtained through the drop across a variable 2000 ohm resistance between the common negative and the center tap of the 64 ohm center-tapped resistance across the 7½ volt filament winding. The plate circuit of the 250 tube takes the maximum high voltage.

Magnetic or Dynamic Speaker

When the power amplifier is to be operated in conjunction with a magnetic speaker, the terminals at the point marked "see note A" are bridged with a 2000 ohm resistance to make up for the lower value of the resistance network when the magnetic speaker is used. When the dynamic speaker is used, the resistance of the

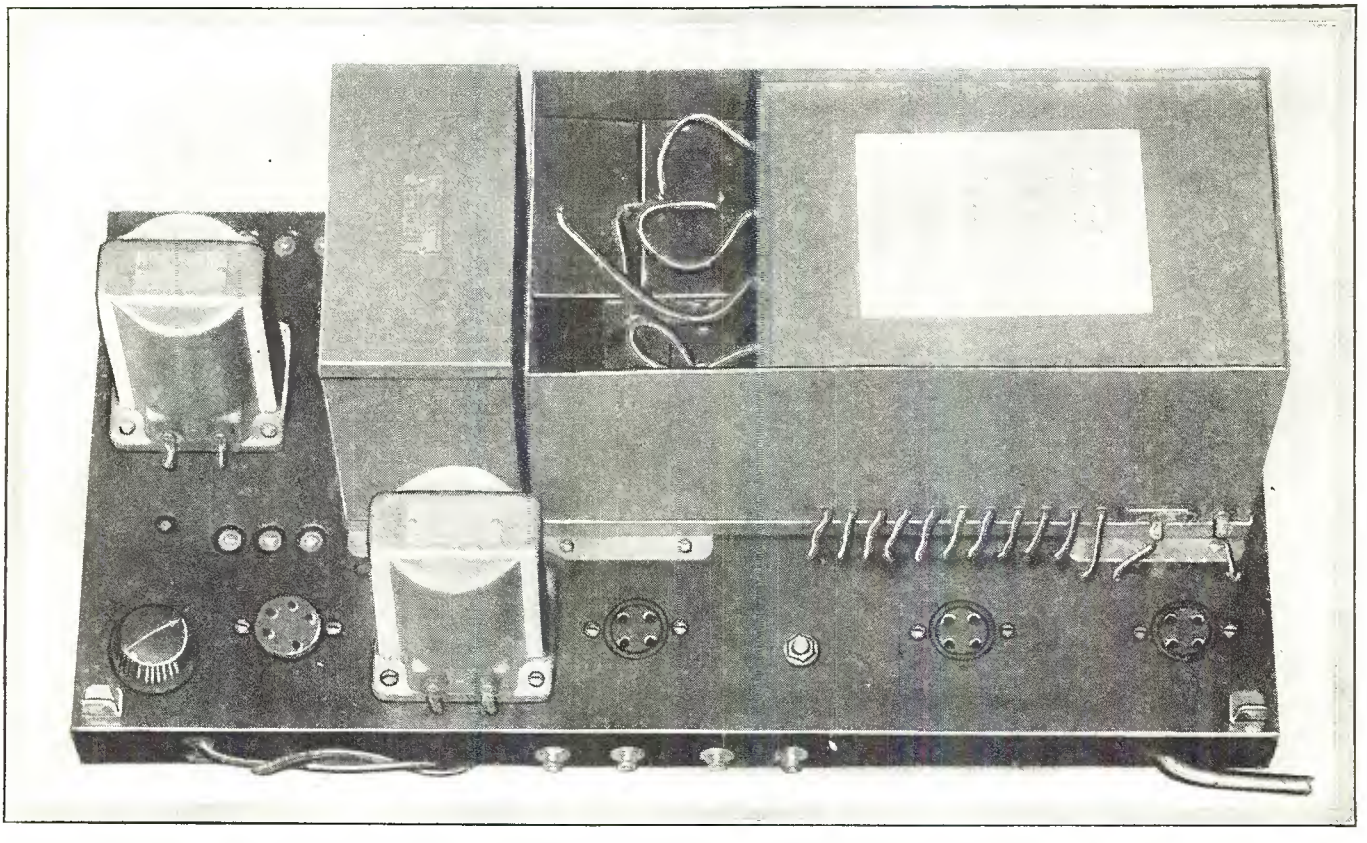


Fig. 1. This photograph shows the completed Remler power amplifier after all of the wiring has been put in. The power compact shown at the right rear has been almost fully wired, there only being two or three wires to run to the various condensers. The chassis upon which the amplifier rests is already pierced for the necessary units

(This amplifier tested and all illustrations made in our laboratory)

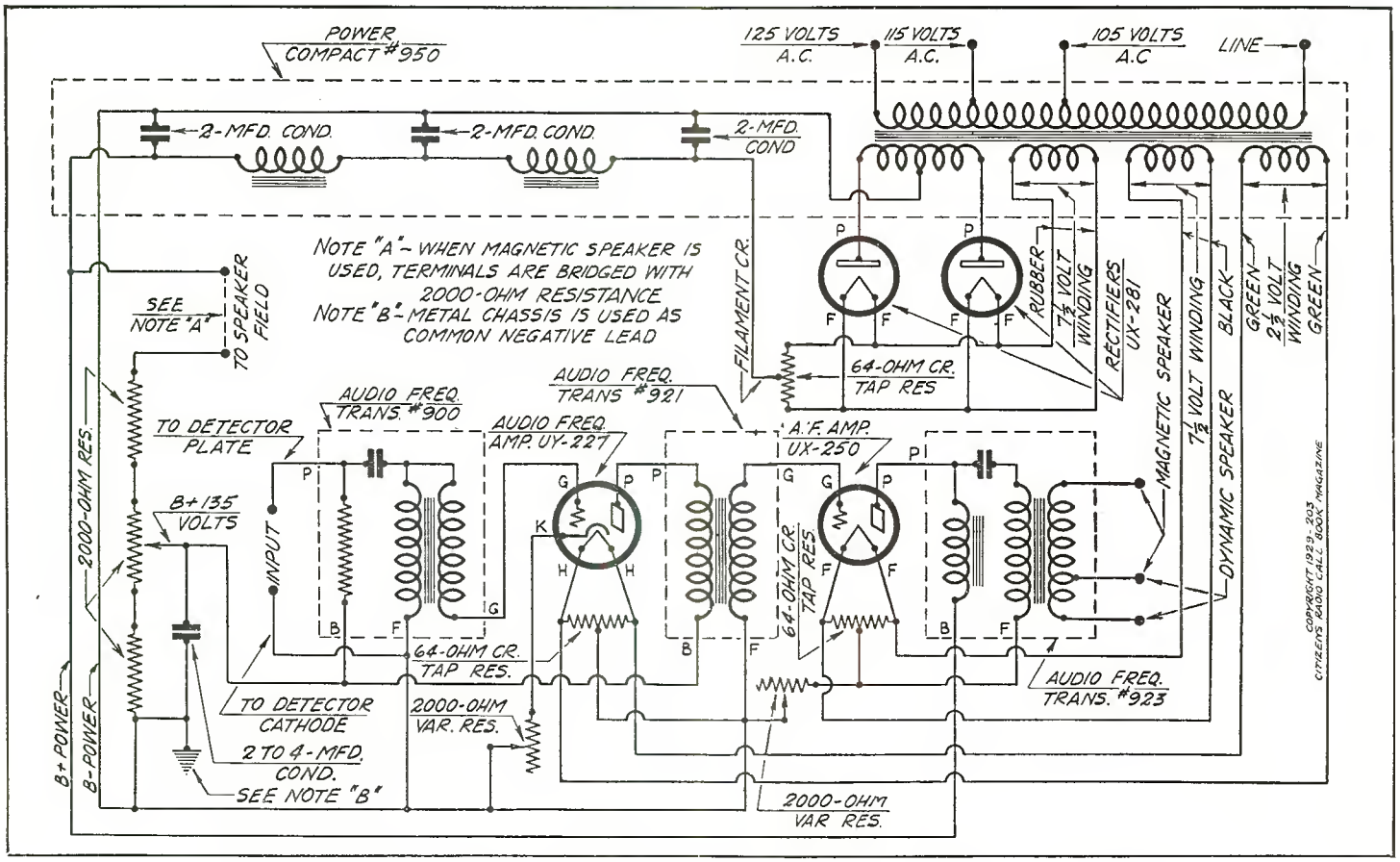


Fig. 2. The schematic circuit involved in the Remler power amplifier is shown above

field winding is 2000 ohms and as a consequence only the field winding goes across the speaker field terminals without any additional change.

Input to the amplifier is across the P and F terminals of the No. 900 audio frequency transformer. This transformer is of the resonated primary type previously described in this magazine in connection with the "29" Remler receiver. The second audio is of the conventional two-winding type. A plate voltage of 135 volts is applied to the B terminal of the first audio unit, as well as the B terminal of the second, although the fixed resistance in

(*Continued on page* 140)

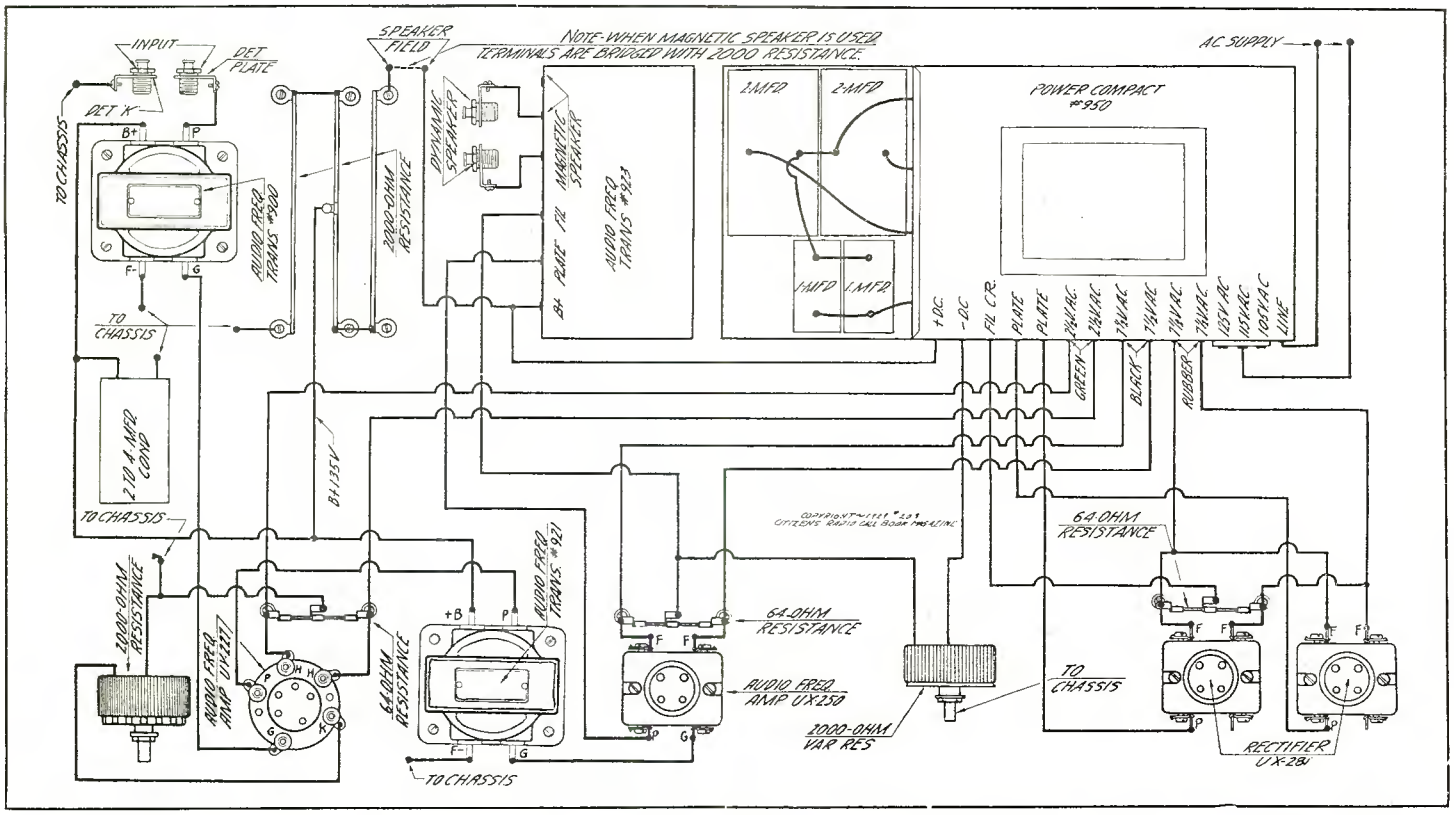


Fig. 3. This graphic diagram represents the manner in which connections should be made for wiring up the amplifier

Aero 21 Chronophase Has Its Own A, B and C Supplies in Set

Completely Alternating Current Operated This Model Uses Four 227 and One 171-A Tubes

PRODUCED by Aero to meet the demand of the public and professional set builders for a custom-built receiver which will compete in price and exceed in performance the factory receivers, the Chronophase 21 a. c. is described in the accompanying article.

This is one of the several models designed and merchandised this season by the Aero Products in order to give their customers and the public a wide line of receivers and parts from which to make selections.

Full A. C. Operated

Completely alternating current operated, the Aero 21 Chronophase contains a Radiart power unit, which supplies A, B and C voltages for the receiver. Four of the heater type tubes are used, the filament energy being derived from the low voltage secondary on the Radiart unit. The 5 volt secondary supplies filament current for the 171-A, which is used as a power tube, while the high voltage section of the unit is used in connection with a 280 rectifier tube and supplies plate voltages for all tubes as well as the C bias.

Construction of the receiver is considerably simplified by the fact the sub-panel and the front panel are already pierced, and in the case of the sub-panel the sockets are attached thereto. Holes are also punched for the audio transformers, coil sockets, etc., so that very little time need be expended in placing the parts on the sub-panel and front panel. The wiring itself is also quite simple if the builder follows the diagram shown in the graphic illustration in Fig. 2, or if he is more experienced this wiring may be accomplished by consulting the schematic circuit in Fig. 5. In wiring up the power supply, Figs. 4, 6 and 7 should be consulted.

In the design of the Chronophase receiver, consideration was given to the most bothersome type of station interference which appeared to be that strong local station's signals had a tendency to spread as much as 100 kilocycles on each side of the transmitting frequency. Inasmuch as the Chronophase was being planned to secure distance, even though there was strong local interference, this particular condition was not allowable and it was decided that a signal strength of 1 per cent of the full value was permitted 50 kilocycles on each side of the normal frequency. With further experimental set-ups, entirely unshielded and with the coils separated by a distance of about 8 inches, it was found that this condition was secured by the use of two stages of radio frequency. These tests were performed at the Aero laboratories during actual reception conditions using a 100-foot aerial approximately 50 feet high. A general idea as to the placement of the coils, that is, the final placement, is shown in the photograph in Fig. 1.

Next came the question of audio frequency amplification. A transformer has been recently made available of the type hitherto

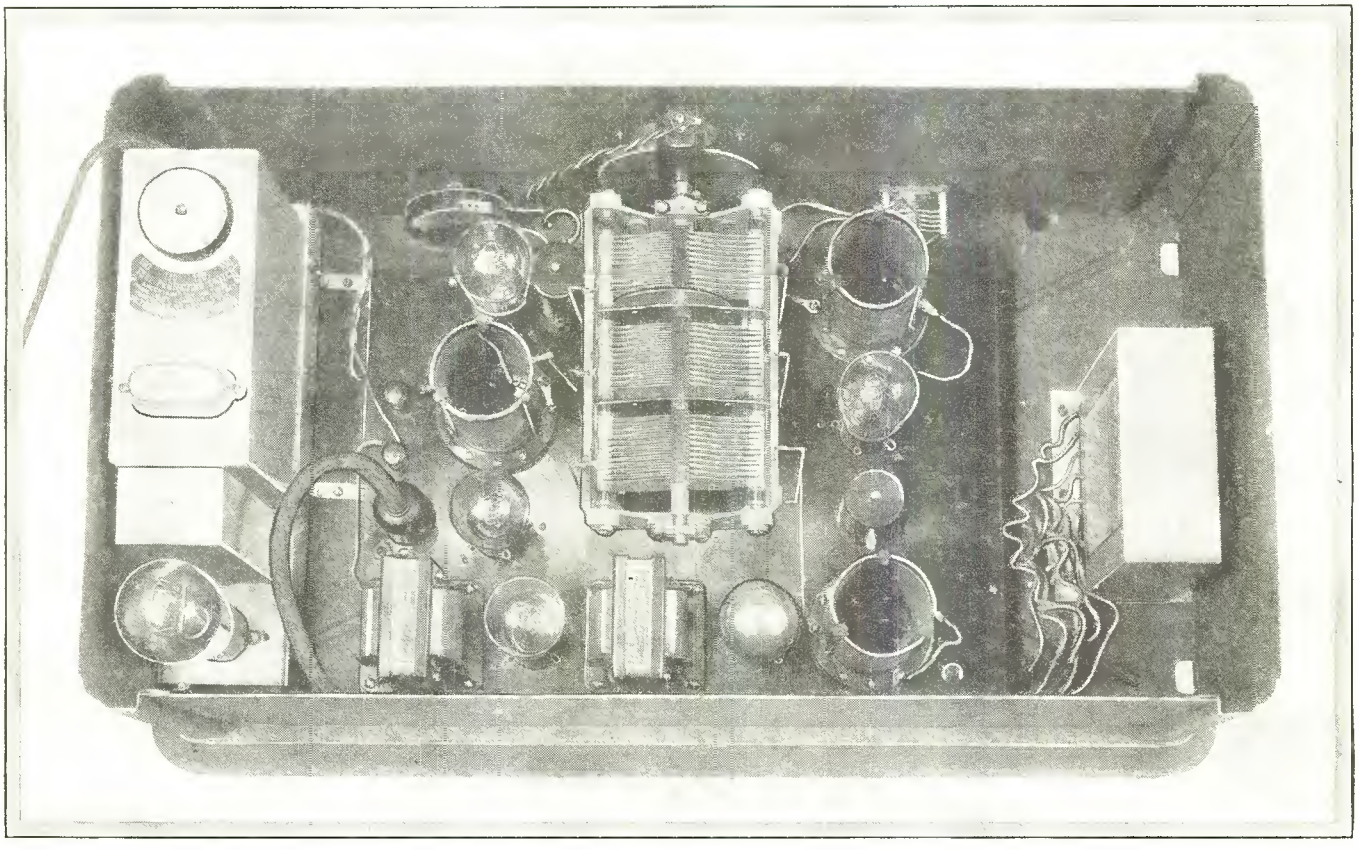


Fig. 1. This photograph shows the Chronophase 21 fully wired together with its A, B and C power supply, which is shown at the left of the photograph

(This receiver tested and all illustrations made in our laboratory)

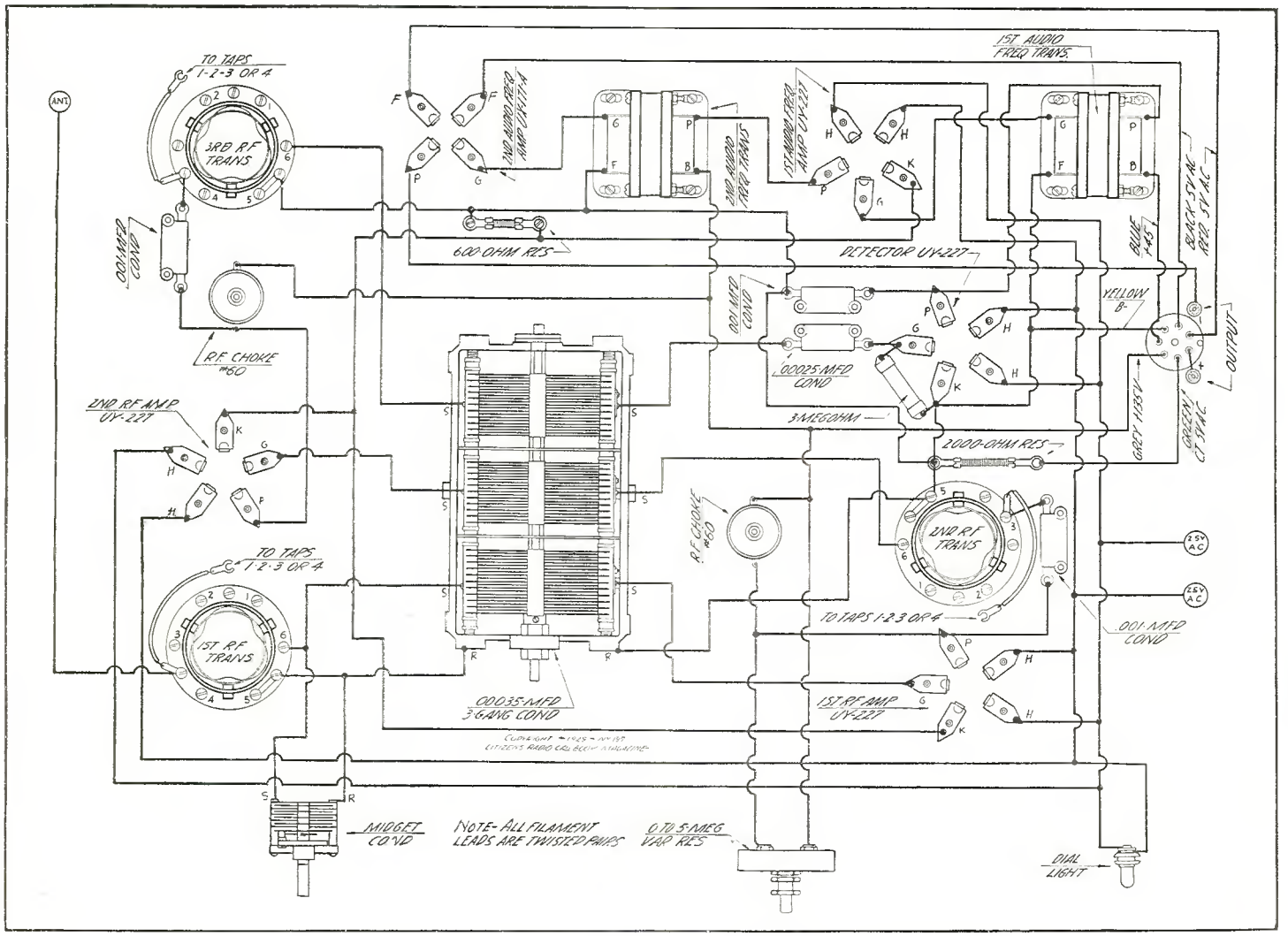


Fig. 2. For those who wish to save time in wiring, the graphic diagram shown above may be followed

used only in especially constructed amplifiers which are placed in telephone lines used in transmitting broadcast programs for long distances over wire. To the average man who has trouble building a three stage audio amplifier without getting violent distortion, it would seem almost inconceivable that some of the chain programs may pass through many times that number of amplifier stages before being transformed in a radio frequency carrier and put on the air. The fact that no quality can be lost through this long chain of amplifiers is indicative of their need for almost perfect characteristics in the transformer and a special type is developed for that purpose, with much flatter curve over the audible range than is ordinarily obtainable and continues the flat portion of this curve out beyond the audible range so that there will be no loss of overtones and harmonics, which although themselves inaudible will produce a decided effect upon the ear.

With these audio transformers available, both the audio and the radio frequency ends of the receiver are taken care of.

Short Leads Important

Next in importance comes the design or layout of the receiver in such a way that no serious losses would result from troubles in the layout construction. Assuming that the coils and condensers of the radio frequency amplifier are of the best quality obtainable, one of the most prolific sources of difficulty has been found to be in superfluous lengths of leads, particularly in the grid circuit where a maximum energy is desired and the impulses are most readily vulnerable. The plate leads are next in sensitivity to external influences. In order to keep both these leads as short as possible, the arrangement of parts indicated in the photograph in Fig. 1 was employed. It will be noticed that the stators of the condensers which must be in the grid circuit anyway are used as grid leads, allowing the placing of each tube very close to the subsequent radio frequency transformer and permitting extremely short leads in both instances. A triple condenser with arrangements for compensating any slight differences in capacity is used to tune the r. f. stages. The means provided for synchronizing sections of the condenser proved to be insufficient to properly compensate for antenna variation, and since with some antennas adjustment will be required between the high and low frequency ends of the broadcast band, it was deemed advisable to put a midget condenser, used as a vernier for the first stage, on the front panel.

An inspection of the illustration accompanying this article will show there are practically no connections on the top of the subpanel other than those running from the stators of the variable condensers to the No. 6 terminals of the coils. The coils are mounted by three machine screws and the .001 condenser between the plates of the tubes and the taps on the coils are connected to the mounting screws between terminals 3 and 4 on the underside of the panel. A piece of flexible wire is attached to the top of the same screw, the other end of which can then be connected to whichever terminal of the coil gives the desired results, as will be explained later.

Heavy Filament Leads

In constructing this a. c. model, it should be borne in mind that the filament leads to the heaters of the 227 tubes should be twisted and made of fairly heavy wire. Examination of the photograph shown in Fig. 1 will disclose that the power supply shown at the left is quite close to the Yaxley cable plug, so that these filament leads are very short. The Radiart power unit No. 55 has been designed both mechanically and electrically to fit the

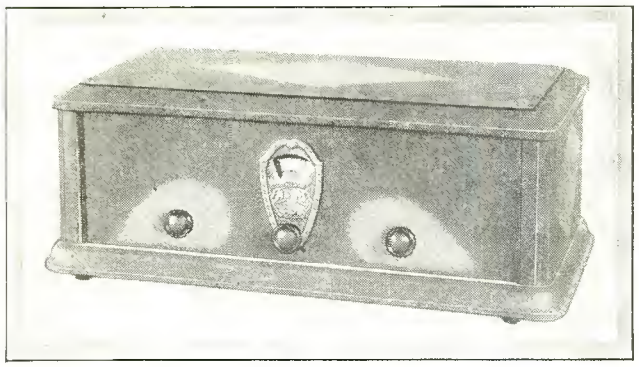


Fig. 3. An attractive metal cabinet is made by Aero in which their receivers may be placed

Chronophase 21 a. c. receiver only and may not be used with other receivers. It is a very compact unit consisting of a power transformer, choke coils, a container for the transformer, choke coils, resistance unit, sockets for the 280 rectifier tubes, a tube protecting voltage control switch, a protecting fuse, a detachable bakelite terminal board and a base for mounting the unit in the Aero metal cabinet. The overall size is 3 in. wide, 11 in. long and 7 in. high. Choke coils are designed to pass 60 milliamperes with less than ¼ of 1 per cent ripple. On account of the type of transformers used in the Aero receiver, it is necessary that the power supply be perfectly filtered, which it is. A tube protecting voltage control switch is mounted on the top of the unit, which operates in connection with the tapped primary of the power transformer. This switch regulates the A, B and C voltages, insuring highly efficient regulation. There is a pointer on top by which changes may be made from 100, 110, 120 and 130 volts to take care of any line variations. The owner of the receiver must ascertain the exact voltage of the electric light line in his own home. He can do this either with the aid of a proper voltmeter, or he can ascertain the voltage from the electric light company supplying the power. The pointer should be set at the voltage obtainable on his line. A 1 ampere fuse covered in the specifications of the Underwriters laboratory is located on top of the power unit and connected to the primary circuit of the power transformer. In this position it is readily accessible. This fuse will blow and open the primary circuit of the high tension winding, should it become short circuited. It will also blow in case of any other short circuit effecting the power unit. The resistance network in the power supply is a unit mounted at one end and outside of the container of the transformer and choke coils. It is wound and tapped to supply the exact B voltages for the Aero 21 Chronophase. In the cord supplied with the unit is incorporated a cut-out switch, for turning the a. c. current on and off. This automatically stops and starts the entire receiver. All of the leads from the power transformer choke coils are brought out from the bottom of the power unit container directly to a permanently mounted terminal board. By reason of this design there are only two solder joints which are not in plain view but easily accessible. This is a very desirable feature.

Connections Are Simple

With each power unit there is supplied an auxiliary removable bakelite terminal board which fits over the permanently mounted terminal board. On this auxiliary terminal board are mounted soldering lugs to which the leads from the receiver itself and

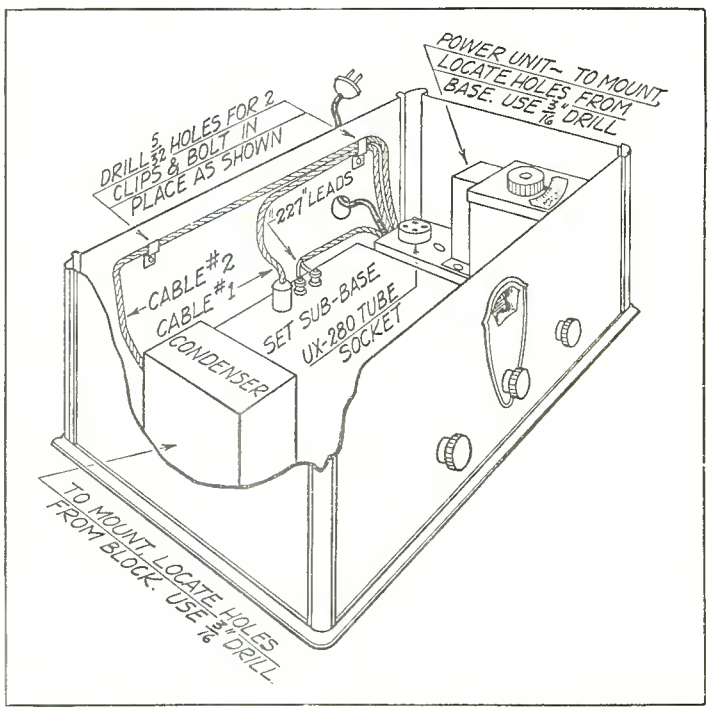


Fig. 4. The sketch shown above shows the relation of the power supply and the filter condenser block as placed in the receiver itself

from the condenser block and from the rectifier tube socket and from the resistance unit are soldered. The only additional apparatus side from the receiver and the power supply is the Aerovox BC-280 filter condenser block having a total capacity of 11 mfd. This filter block is shown at the right side of the photograph in Fig. 1.

Most of the connections to the power supply and to the condenser are made from two short cables, these being made by cut-

(*Continued on page* 134)

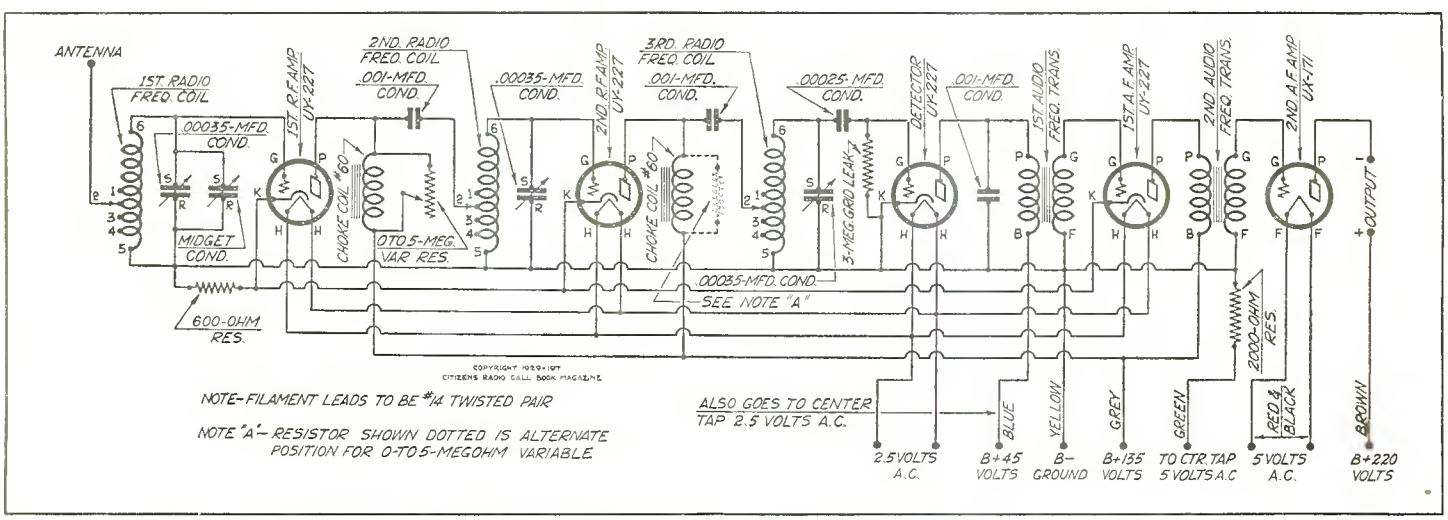


Fig. 5. The schematic circuit involved in the Aero 21 Chronophase is shown in the above diagram

Laboratory Amplifier Made for the Professional Set Builder

Sangamo Transformers Used in Push-Pull 171-A Design for Testing Radio-Phonograph Sets

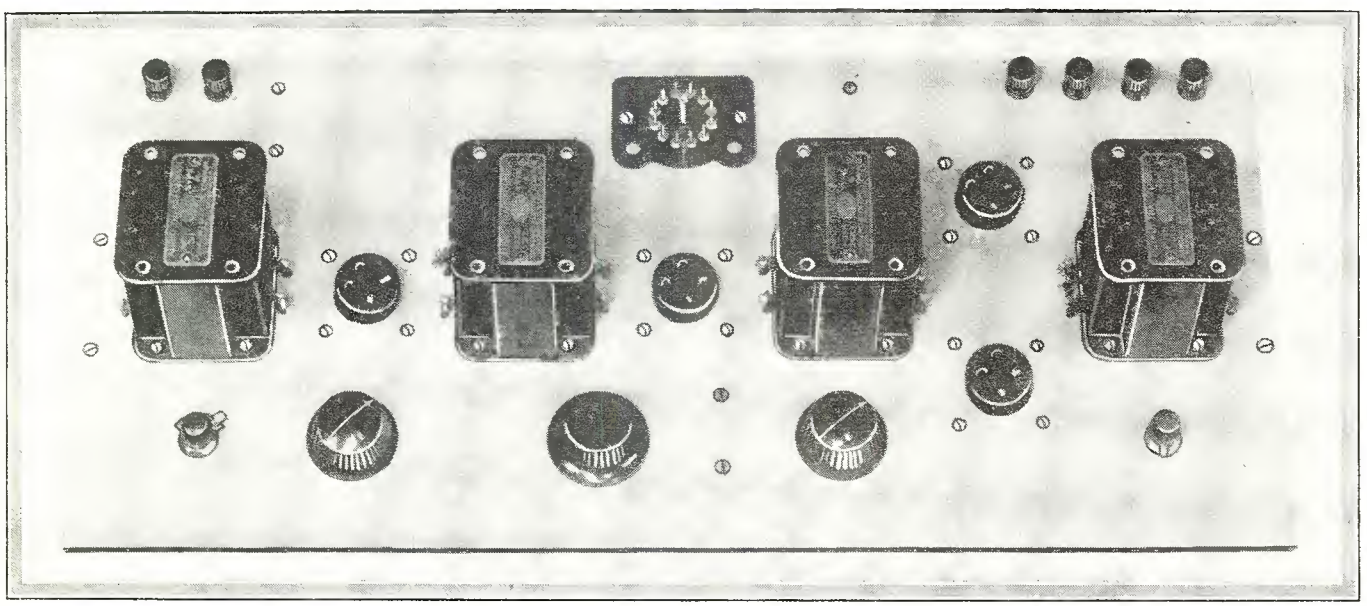


Fig. 1. The completed laboratory amplifier using Sangamo parts is shown in the photograph above

FREQUENTLY our technical department is called upon to provide a sketch or diagram of an amplifier using transformers of various makes now on the market. One of the recent requests was for a laboratory type amplifier which could be employed by professional set builders in their workshop as a means of testing the r. f. end of a receiver or using it in connection with a phonograph pick-up unit.

The design described in the accompanying article was developed in order to give as much flexibility as possible for operation of the amplifier and at the same time hold down its cost. Since a number of the set builders and other experimenters desired an amplifier which could be operated from storage batteries, if necessary, or with a small B eliminator, it was felt that the 201-A, 112-A or 171-A tube combination would probably be the most satisfactory.

Sangamo Transformers

As shown in the schematic diagram in Fig. 2, it will be seen that the amplifier consists of a Sangamo type A input transformer for use in connection either with a phonograph pick-up or with the detector circuit of a receiver. While at the time it might appear that two stages of transformer coupling followed by push-pull would give entirely too much volume, nevertheless it was felt that when the unit is used in connection with a phonograph pick-up it might be necessary to have the added stage and when required the volume could be cut down by means of the 200,000 ohm variable resistance placed across the secondary of the second audio transformer. If the set is to be operated with a radio receiver, then the volume control is turned to the "off" position so its presence in the circuit does not matter. Then the volume is controlled by the receiver itself.

In the schematic diagram, previously referred to, the input tube is a 201-A with a 20 ohm rheostat in series with the negative terminal of that socket as well as the negative terminal of the socket for the 112-A, which is the second audio tube. By placing a rheostat in this position it is possible for the professional set builder or experimenter to use almost any type of tube in these two positions that he desires. A 20 ohm rheostat is also included in the negative filament circuit of the two 171-A tubes, so that there is some flexibility in this particular circuit as well.

Push-pull Circuit

The output of the 112-A stage is fed into the primary of the transformer type B, which is a push-pull input. Its secondary is of the center-tapped type, the center leading to a negative bias voltage of 40½ volts. The two extremities of the secondary go to the grid of the two 171-A's arranged in push-pull. Under certain conditions it might be advisable to use a .00025 mfd fixed condenser from the F terminal to one G terminal of the push-pull input circuit, although this may not be required in each installation. The plates of the 171-A tubes go to the P terminals of the Sangamo output transformer type C-171, while the center of this winding goes to the 180 volt terminal of the eliminator or battery. By means of a single pole double throw switch located at the extreme right in the schematic circuit, it is possible to switch the output of the amplifier from one speaker to another. This was designed in order to allow the operator or experimenter an opportunity of determining for himself the difference between two speakers of the magnetic type. While this arrangement is perfectly satisfactory for the magnetic type of speaker, nevertheless when it is used in connection with the dynamic kind, results will not be so satisfactory because the output of this amplifier is then feeding into another input transformer, or a step-down transformer, in the dynamic speaker itself. However, if just for test purposes, that is, for determining the difference between two dynamic speakers, the arrangement shown above might be considered satisfactory.

(This amplifier designed, tested and all illustrations made in our laboratory)

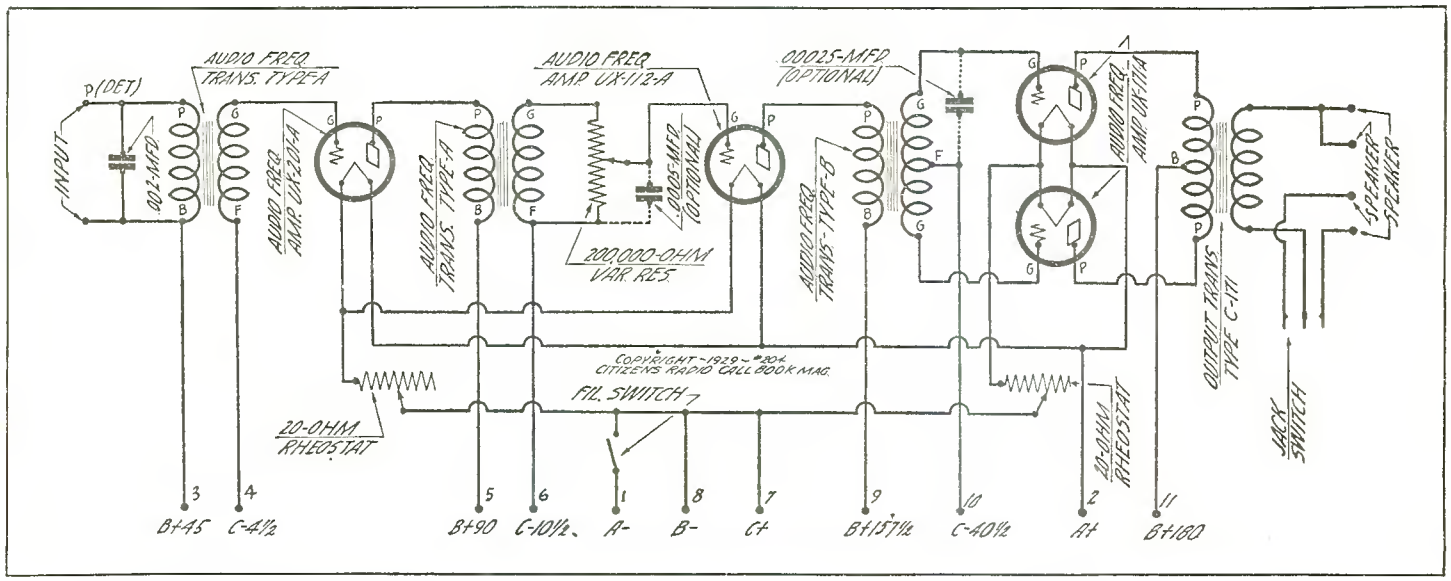


Fig. 2. This diagram represents the schematic circuit involved in the phonograph or radio amplifier used by the professional set builder for test purposes

If the amplifier is to be used as a permanent job on the operation of dynamic speakers, then the output transformer shown as C-171 should be removed and the H-171 substituted therefor, because the latter is designed for an impedance working into the dynamic speaker, whereas the C-171 is so designed to match the impedance of a cone type speaker. Since it is more likely that the set builder and experimenter will be testing the cone type of speaker, the C-171 will be found in more general use. If it is desired to use a dynamic speaker permanently with amplifier and the owner already has a C-171 output transformer in the amplifier, he may take the dynamic input terminals across the two extremities of the primary in the C-171 transformer. Of course, this will not permit shifting from one dynamic to another, but at least, if the job is to be a permanent one, it can be so arranged.

Sub-panel Mounting

The sub-panel on which the apparatus is mounted is a piece of ivory Formica 9x20x$\frac{3}{16}$ in. It is supported by means of two Silver-Marshall 540 brackets. Looking at the photograph in the 20 ohm rheostat next to it is the filament control for the 201-A and 112-A tubes, the center know of the three is the 200,000 ohm variable resistance for a volume control, while the right knob is the 20 ohm filament rheostat in series with the negative terminal of the two 171-A tubes in push-pull. At the extreme right is a single pole double throw Carter jack switch for shifting from one cone speaker to another.

At the left in the rear are the two binding posts represented as the input terminals, while at the right rear are the four binding posts, two of these going to one cone speaker and two going to another cone speaker, if two speakers are to be tested. The Yaxley 12-contact cable plug is shown at the center in the rear. Looking at the photograph in Fig. 1, at the extreme left, is the Sangamo type A transformer, then another type A transformer, these two being the first and second stages, then comes the type BX push-pull input and finally the type C-171 output transformer. Four Benjamin UX sockets of the floating type were employed.

By consulting the photograph shown in Fig. 3, the builder will acquaint himself with the manner in which the wiring is accomplished. This wiring may be done with flexible wire and after all leads have been run in properly, the entire job may be cabled with string or tape. The cabled lead idea results in much stabler operation of the amplifier, because the various leads do not have an opportunity for picking up any energy from high potential neighbors.

Official Parts List

Parts used in the construction of the radio phonograph amplifier using Sangamo transformers are shown below:

1 Sangamo .00025 mfd. fixed condenser
2 Sangamo .002 mfd. bypass condensers.
2 AF Sangamo 3-1 audio frequency transformers
1 BX Sangamo push-pull input transformer
1 C-171 Sangamo push-pull output transformer
1 1892 Frost 200,000 ohm 3-point variable resistance
2 1920 Frost 20 ohm rheostats
1 Formica ivory sub-panel 9x20x3/16 in.
1 Yaxley 12 contact cable plug
6 Eby binding posts
4 9044 Benjamin UX sockets
1 10 Yaxley line switch
1 D-22 Carter jack switch
2 540 Silver-Marshall brackets
1 CeCo or Sonatron 201-A tube
1 CeCo or Sonatron 112-A tube
2 CeCo or Sonatron 171-A tube
1 Pkg. Corwico Braidite hook-up wire

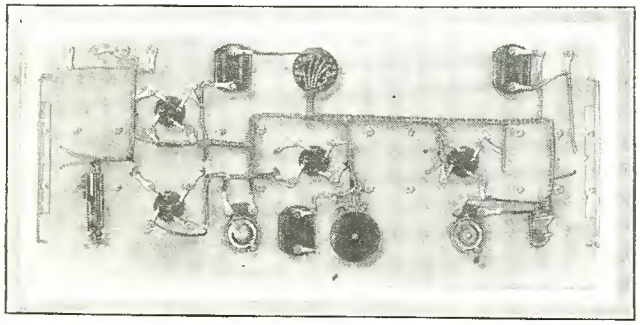


Fig. 3. All of the wiring on the bottom of the amplifier is run together in a cabled form, which gives it a neat appearance

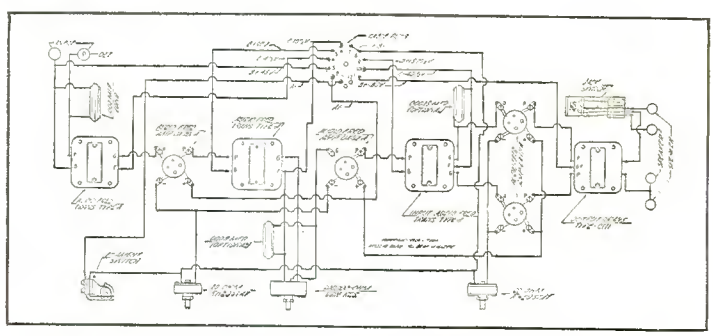


Fig. 4. The amplifier referred to in this article may be wired by following the above graphic diagram, although professional set builders will probably wire their jobs from the schematic shown in Fig. 2

Tyrman 72 Now Designed as Battery or Alternating Current Set

Production Change Made So All Models Fit in Standard Cabinet; Power Supply Separate

SECOND in the line of receivers manufactured by the Tyrman Electric Corporation is the model 72 described in this article, which is a seven tube superheterodyne using screen tubes, and arranged either for alternating current operation or battery operation, as desired by the builder.

When assembled for alternating current operation, the receiver is a complete a. c. receiver in every sense, using a. c. shield grid tubes and the 227 type of detectors. Even if the model is assembled as a battery or eliminator operated model, it is a comparatively simple matter to convert it to socket operation by changing a few parts and the sockets for a. c. tubes and following a different wiring scheme.

In the model described in this issue, the wiring is shown as an alternating current operated superheterodyne. A power pack especially designed for the 72 is provided, which is plugged into the receiver by means of a connector cable. Where in the original model, it was desired to include the power supply on the rear of the sub-panel, nevertheless it was found in merchandising that this involved securing a cabinet of other than standard dimensions. As a consequence, in order to meet the demand of set builders, who wish to use the receiver in a standard cabinet, the power supply was taken from the chassis and is now supplied in a separate unit, which is connected to the receiver itself by means of a cable. Thus the power supply may be on a lower shelf in a console.

Volume for Home

The power supply uses a 280-tube as a rectifier for the high voltage current and has a very high grade filter system, which filters the pulstating current so that it is the equivalent of battery operation. The power stage in this receiver is a 171-A, which gives ample volume for home purposes.

Looking at the schematic circuit shown in Fig. 3, it will be observed that the first detector is a 222 tube of the a. c. type, this being located at the extreme left in the diagram. The oscillator for the circuit is at the extreme right of the diagram, where a 227 heater type tube is employed. Mixing is accomplished by the pick-up in the oscillator coil feeding into the lower portion of the antenna coil, the tuning being across the two extremities of this inductance. Rectification in the first detector is by means of the .0001 mfd condenser and 3 megohm grid leak shown in the diagram. A 3000 ohm fixed resistance spanned by a ¼ mfd fixed condenser between the cathode of the a. c. 222 and the ground furnishes the necessary drop in that circuit.

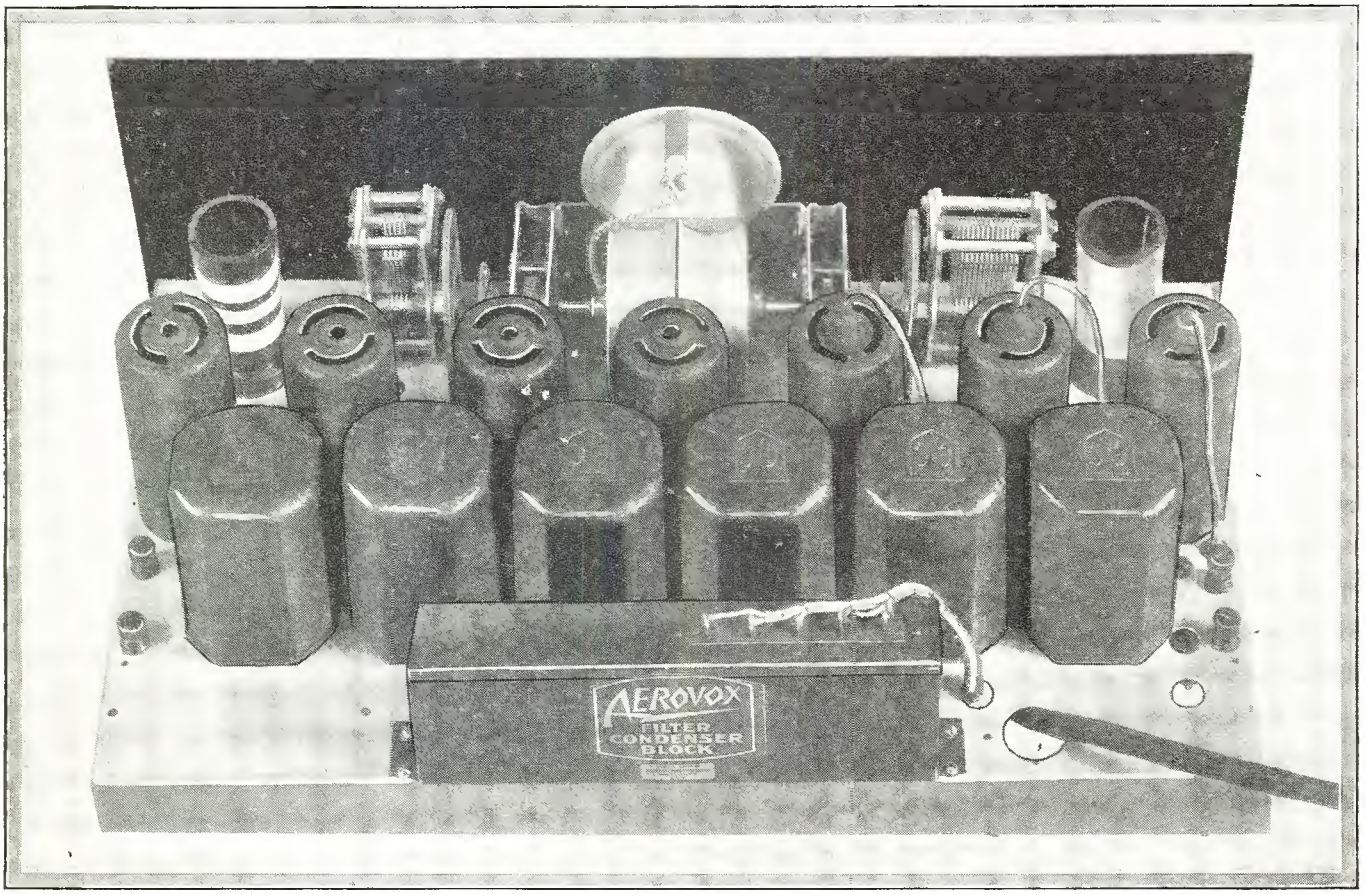


Fig. 1. This photograph shows a rear view of the Tyrman 72 for battery or a. c. operation. The power supply used in conjunction with the receiver is illustrated in the photograph shown in Fig. 4

(This receiver tested and all illustrations made in our laboratory)

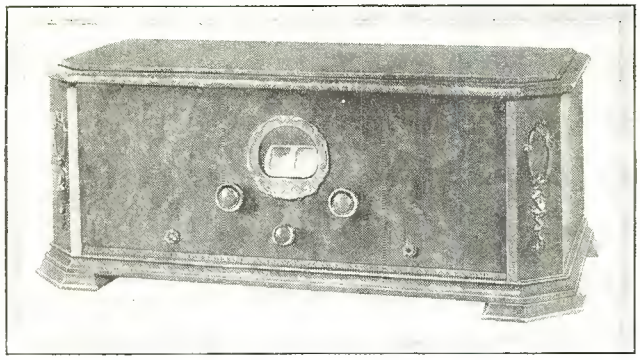


Fig. 2. This photograph illustrates the manner in which the Tyrman 72 is placed in a table size cabinet. It may also be used in a console if desired

Three stages of screen grid intermediate frequency amplification are provided, the 222 tubes being used and feeding into a second detector using a 227 tube. In the second detector, rectification is by means of the bias afforded the grid through the drop across the 3000 ohm fixed resistor between the cathode of the tube and ground. A 75,000 ohm variable resistance common with the two cathodes of the first and second intermediate tubes and the ground afford a control of bias on the grids of these two tubes. This variable resistance is used as the volume control in the receiver. Shield grid voltages of a value of 50 volts are supplied to all of the type 222 a. c. tubes.

Phono Pickup Jacks

Located in the plate circuit of the second detector is the phonograph pick-up jack, by means of which energy from a phonograph pick-up unit can be applied directly across the plate side of the first audio unit and then obtains its amplification through the succeeding amplifiers and be reproduced through the loud speaker units used with the Tyrman 72. This phonograph pick-up jack is brought to the front panel and is shown at the right in the photograph, Fig. 2. The switch at the left in Fig. 2 is the 110 volt switch controlling the power supply, while the center knob is the variable resistor or the volume control. The left dial in this photograph controls the condenser across the antenna inductance, while the right dial governs the condensers across the oscillator inductance.

Plub In Coils

The antenna tuning coil is of the plug-in variety, which is also true of the oscillator coil. This makes for convenient changing when short wave reception is desired. Suitable coils can be obtained for short wave opration.

The condenser tuning the oscillator coil has a maximum capacity of .00015 and a semi-fixed variable plate which should always be adjusted so that the minimum capacity is obtained. This is necessary in order that the oscillator condenser just covers the broadcast band without overlapping. All of the terminals of the various units which are to be grounded are automatically grounded because of the construction of the chassis and the insulating sub-panel.

In outward appearance, the 72 is a duplication of the model 80, which appeared in the last issue of this magazine. The front panel is metal with a burl walnut finish. It is equipped with a new Tyrman double drum drive which concave translucent window reflector permitting indirect illumination of the drum dial. The operation of the receiver is concentrated control with three knobs. Two are for selecting stations and one for volume. Subpanel platform is of heavy gauge steel cadmium plated, formed and pierced to automatically accommodate the parts to be mounted on it.

All parts for the model are merchandised by Tyrman in a complete container.

Power Pack Separate

The power pack supplied with the Tyrman 72 is a very compact one and foolproof in operation, since there are no variable controls which the operator can work. Examination of the sche-

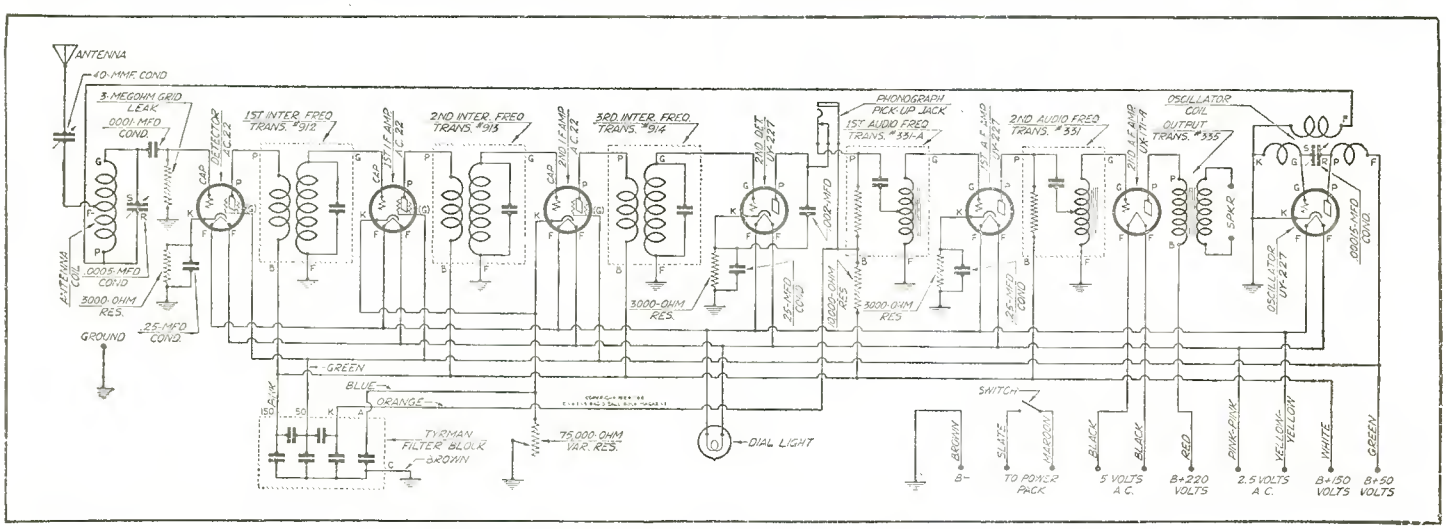


Fig. 3. The schematic circuit involved in the Tyrman 72 is illustrated above

Fig. 4. This photograph shows the power supply which is used separately with the Tyrman 72

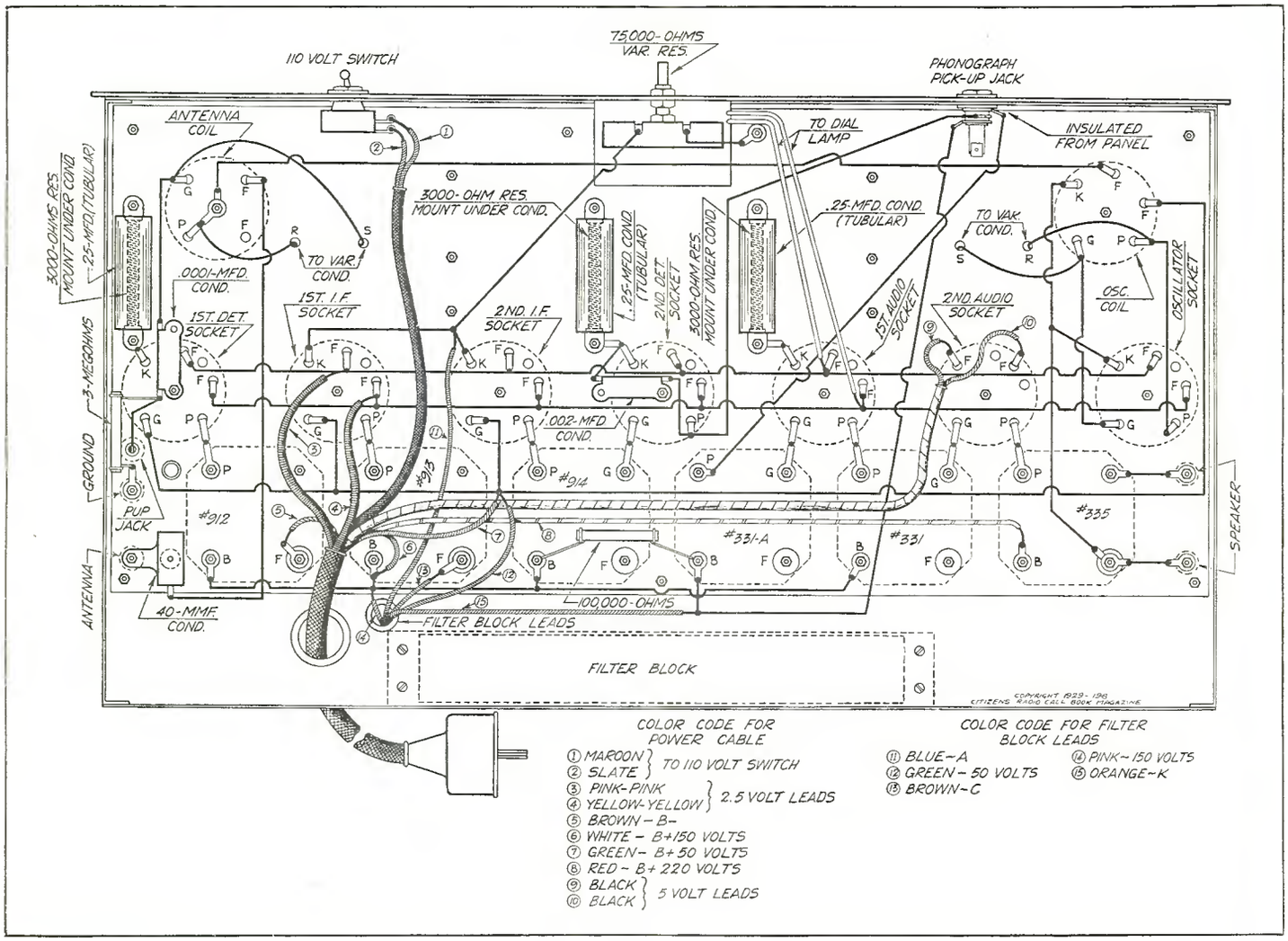


Fig. 5. Above is a drawing of the under side of the chassis, this graphic diagram being suitable for wiring up the receiver

matic in Fig. 6 will show that the power transformer consists of a 110 volt a. c. winding, with a switch in the primary for high or low voltage, this being placed there to compensate for a drop in the line at the home of the operator. By the same token, it can be used as a compensator in the event that the line voltage is high.

The high voltage winding which is one of the secondary goes to the two plates in the UX-280 rectifier, the center tap of this winding becoming the negative line of the system. The filament secondary which supplies current for the filament of the 280 is center tapped and this center tap becomes the positive high voltage, which is carried through the double choke unit, properly bypassed with its required capacity. A 5 volt secondary is supplied for energizing the filaments of the 171-A tube, the center tap of this winding having a fixed resistance and a capacity across it leading to the common ground, this resistance furnishing the required C bias for that tube. The 2½ volt a. c. current for the filaments of the 22 tubes is supplied by a 2½ volt winding. The resistor protects the winding against shorts.

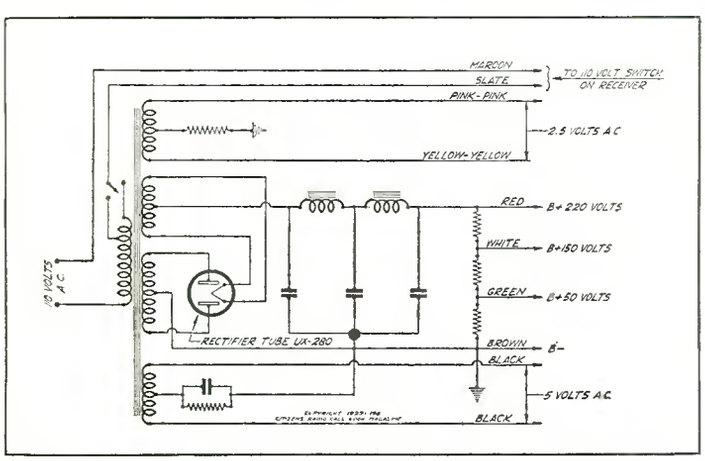


Fig. 6. The schematic of the power supply is illustrated above

Maximum voltage obtained from the power unit will be 220 volts and the resistance network is made up so as to give additional voltages of 150, and 50. These values are fixed and may not be changed by the builder.

Examination of the photograph shown in Fig. 4 will disclose that connection is made to the receiver by means of a flexible cable having a plug head, this plug fitting into the receptacle shown at the top o fthe power supply in Fig. 4.

A 40 mmf condenser is located in series with the antenna lead and to the center tap of the antenna inductance. This condenser may be shifted around within its limits so as to increase or decrease the amount of pick-up being secured from the energy collecting system. This condenser is also helpful in cutting down the amount of energy picked up from local stations when the receiver was being operated adjacent to a broadcast station.

Parts contained in the Tyrman 72 A. C. kit, merchandised by the Tyrman Electric Corp, are as follows:

1 Front panel
1 Steel chassis
12 No. 14 bus bar wire
1 Cable
1 Intermediate kit

(*Continued on page* 132)

Amertran Parts in a High Quality Radio Phonograph Amplifier

Push-Pull Arrangement of 210 Tubes Suggested Because of Their Greater Undistorted Output

THE above caption, in a nutshell, expresses the desired specification of a unit required by a radio enthusiast. What sort of a circuit should it be? How many stages; and what are the resulting frequency and gain characteristics?

Such questions are of paramount importance, and must be answered before going ahead with this type of radio job. Assuming one has a good radio frequency amplifier developing ample selectivity, without undue cutting of the audio frequency side-bands, and with long distance signal reception of little or no importance it may be reasoned, therefore, all apparatus up to and including the detector should be used.

The latter remarks are generally overlooked, because the average set owner seems to invariably reach the decision that only a new set will fill his needs, whereas, in many cases installation of a highly audio amplifier alone generally develops tonal quality excelling that of most of the so-called mass production factory built sets.

Reasons for the Circuit

Analysis of the requirements revealed that the amplifier must be of the dual type, that is to say, it should be suitable for use with both the radio frequency circuits, or in conjunction with a high grade phonograph pick-up.

And if quality reproduction is of principal consideration, then certainly a push-pull stage becomes necessary since this stage must be capable of handling signals of large amplitude without fear from overloading, and it should be relatively free from frequency or signal shape distortion. It also appeared desirable to limit the plate voltage to a maximum of 180—such as would be developed by a power device incorporating a 280 type rectifier tube.

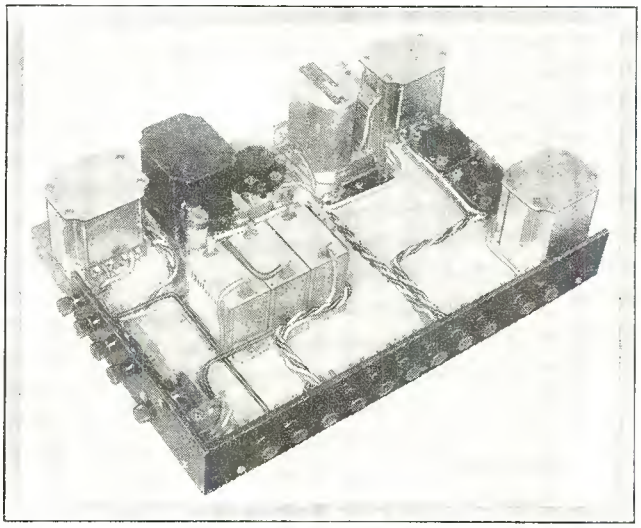


Fig. 1. This photograph shows the completed combination of radio and phonograph amplifier constructed with the AmerTran parts

Such an output power stage unit would of course call for a push-pull stage using 171-A type tubes. But further analysis of the problem showed that the maximum instantaneous values of tube load current was such as to cause a relatively large drop in effective plate voltage that it was doubtful whether a push-pull 171 stage should be considered.

Another important feature generally overlooked where low-mu power tubes are resorted to is the fact that the lower a power tube amplification factor the smaller will be its sensitivity to weak (or distant) signals.

In view of these facts it was felt that since there is but a rather slight difference in building costs between a 171 and a 210 push-pull power amplifier, it was decided to construct the 210 type because undistorted power output is fully 100 per cent greater than for 171 types, plate voltage could be more easily maintained for best all around operation and a better response would be realized when dealing with distant or low amplitude signals.

Some may say, "Well, if one is so critical, then why not go to a 250 push-pull stage?" And the answer, briefly, is that such an output is seldom made necessary for the average home; nor should one forget its low sensitivity, as previously pointed out.

Since the amplifier must also give quality reproduction from a phonograph pick-up it was thought best to make a little study as to proper means for coupling the pick-up to the first audio tube. Such devices are of relatively low impedance, and are not suitable for either direct connection across a tube input or if placed in series modern transformer primary windings.

However, the Amertran people were found to have developed an impedance balancing transformer or network which functions as an adjustable primary impedance for obtaining the best match for the pick-up proper; while its secondary windings possess correct impedance characteristics for working into standard audio frequency transformers. With such an efficient combination it only becomes necessary to use a simple little Yaxley jack switch for setting the amplifier input circuits so these may be connected to either the radio set or phone pick-up.

While ample loudspeaker volume was a requirement, still it was felt that a properly designed two stage amplifier should prove every bit as good as the average attempt at three stage types.

And for the latter reasons it was decided to use high quality audio transformers. The Amertran models adopted possess high primary winding inductance and impedance values. This feature, of course, is realized by use of high permeability alloy core materials. But through its use, like with Permalloy, one must be careful to keep the d. c. plate current circulating through this winding down to fairly low values (approximately 3 ma.) or preferably it should be eliminated altogether.

It was therefore decided to design the amplifier so that only the first or input Amertran unit would carry the d. c. plate circuit component of the detector tube, whereas plate current would be kept out entirely from the primary winding of the push-pull input transformer.

The latter scheme was accomplished by means of a type 103 Amerchoke—another apparently new device now available in the interest of high quality reproductin. Analysis of the circuit shows that in this stage the parallel feed plate supply system was adopted; in this way only the a. c. signal component circulates through the transformer primary winding.

A Few Other "Trieks"

Any capable engineer appreciates that one must be careful when

(This amplifier tested and all illustrations made in our laboratory)

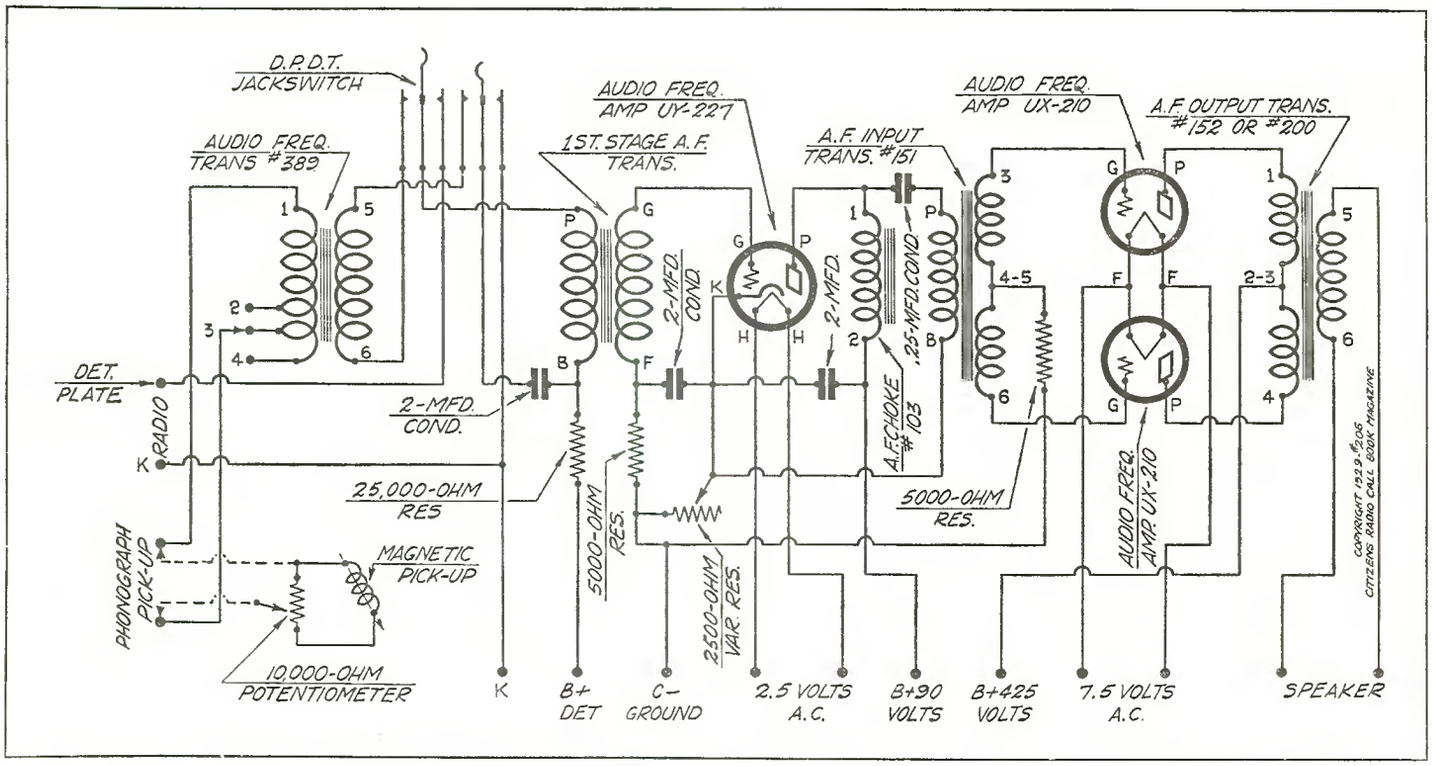


Fig. 2. In the above schematic diagram may be seen the electrical details of the combined amplifier. Parts required for the construction of the unit are shown in the list of parts accompanying this article

using high quality amplifier systems in conjunction with high voltage rectifier methods. Otherwise the common impedance path offered by the power unit may be of such order as to cause audio frequency oscillation or "motorboating," which, of course, will completely change the amplifier characteristics.

It will ordinarily be found that the detector stage proves a principal offender. And in the circuits under discussion the designer adopted a "trap circuit" scheme, as originally developed by R. Wise, whereby a simple resistance and shunt condenser is placed in series with the primary winding of the first audio.

Because the plate current of a 227 a. c. detector tube is somewhat high this resistor, of course, brings about a fairly large voltage drop. However, since a high voltage power unit was employed with the amplifier, this drop could be compensated for by using a detector "B" voltage of either 90 or 135. But in the event one may care to employ another method free from such voltage loss then it is apparent that a type 103 Amerchoke may be used in place of the resistor.

It also is important to use a suitable number of high quality long life by-pass condensers at certain points of the circuit. It is good practice to note that the leakage resistance be a minimum for the coupling condenser placed between the parallel feed choke and the 151 input push-pull transformer.

In order that the several circuits would operate with complete stability, metalized grid-leak resistors were placed in the grid circuits of both stages; perhaps the use of wire-wound resistors of the Superdavohm type should prove an even better scheme.

The photograph reveals that practically all wiring (three colors used is of the twisted pair type. This method proves quite helpful to eliminate stray inductive pick-up of hum and background noises. All a. c. filament wiring going to either the 227 heater type tube or the 210's were kept rather well isolated from the other circuits, and this in a measure accounts for the somewhat open type of construction.

Now just a word with reference to the phone pick-up or equalizer transformer. This unit is equipped with a tapped primary so that this circuit can readily be adjusted for the best load impedance ratio for working out of any high grade magnetic pick-up such as the Stromberg-Carlson, Bosch, Phonovox, Victor, General Electric, etc. It will be necessary to make a simple test for determining best operation.

The foregoing reveals the engineering data developed by the designer—it tells the whole "why and wherefore" of the design. And should one be interested in a high quality combination radio and phonograph power amplifier, certainly it should meet with his approval.

The entire device was assembled on a small 10 by 14 inches drafting board. The photograph shows just where and how each part should be placed; if these designs are carried out, then perfect results may be assured, though, of course, certain changes depending upon individual requirements may suggest itself—for example, one may rather use a d. c. instead of an a. c. tube in the first audio stage.

At this point may be remarked that the power amplifier as built was constructed so that the output push-pull transformer should feed into some high grade electro-magnetic type loudspeaker; in this case a model No. 152 Amertran transformer was employed. However, should the builder desire the amplifier to operate into a dynamic type speaker, then it becomes necessary to use a type No. 200 Amertran output transformer.

Official Parts List

Parts used in the construction of the amplifier here described are:

1 AmerTran type 389 equalizer transformer
1 AmerTran DeLuxe first stage audio transformer
1 AmerTran 151 input transformer
1 AmerTran type 152 or 200 output transformer
1 AmerChoke type 103
1 Dubilier 907¼ mfd condenser
3 Dubilier 907 2 mfd condensers
1 Electrad type B 25,000 ohm wire wound resistor
1 Electrad type B 2,500 ohm wire wound resistor
1 Electrad Royalty potentiometer 10,000 ohms
2 Daven 5,000 ohm Super Davohm or Glastor resistors
1 Yaxley double pole double throw jack switch
1 Benjamin UY socket
2 Benjamin UX sockets
15 Eby binding posts
1 Ceco or Sonatron 227 tube
2 Ceco or Sonatron 210 tubes
1 Package Belden hook-up wire

Receiver and ABC Supply Combined in "Hi-Q" 29 A. C. Junior

Three Stages of Resistance Coupled Audio Amplification Using Arcturus Heater Tubes

DIFFERING only a trifle in circuit arrangement and the number of tubes from the Master model described in the November issue of this magazine, the Hammarlund-Roberts Hi-Q 29 Junior a.c. model is presented in the article following for the benefit of those who wish a smaller set, yet one operating on the same principle as the bigger receiver.

The a. c. and battery operated Junior models were designed by Hammarlund particularly for those who want a good all-around receiver built at a moderate price. It is a true single control six tube set, using a screen grid antenna coupling tube, a screen grid tuned radio frequency stage, a detector and three stages of high quality audio amplification.

Resistance Amplification

Where in the Master model audio amplification is by means of transformer coupling, in the Junior model, to cut down expense for the builder, resistance coupled audio amplification is employed, with an output circuit using a 171-A power tube.

The screen grid coupling tube is used to isolate the antenna from the first tuned circuit, making possible satisfactory simultaneous control of both the detector and the tuned radio frequency stages, without necessitating any separate means for compensating for different types of antennas.

Coupling Tube Amplifies

The 201-A type of coupling tube as used in most factory-made, single control sets is satisfactory for isolation purposes, although it provides but little amplification. In the Junior, however, a screen grid tube is used as a coupling tube and high amplification obtained from this tube results in considerable increase in signal strength.

The radio frequency stage also uses a screen grid tube, resulting in a very high degree of amplification in this tuned stage. The coil used in the radio frequency amplifier incorporates primaries especially designed for screen grid use, being unusually small in diameter and consisting of a great number of turns of very fine wire. This design tends to equalize the amplification over the broadcast frequency range. The interstage radio frequency transformers have the further advantage of tapped primaries, making it possible to vary the operating characteristics

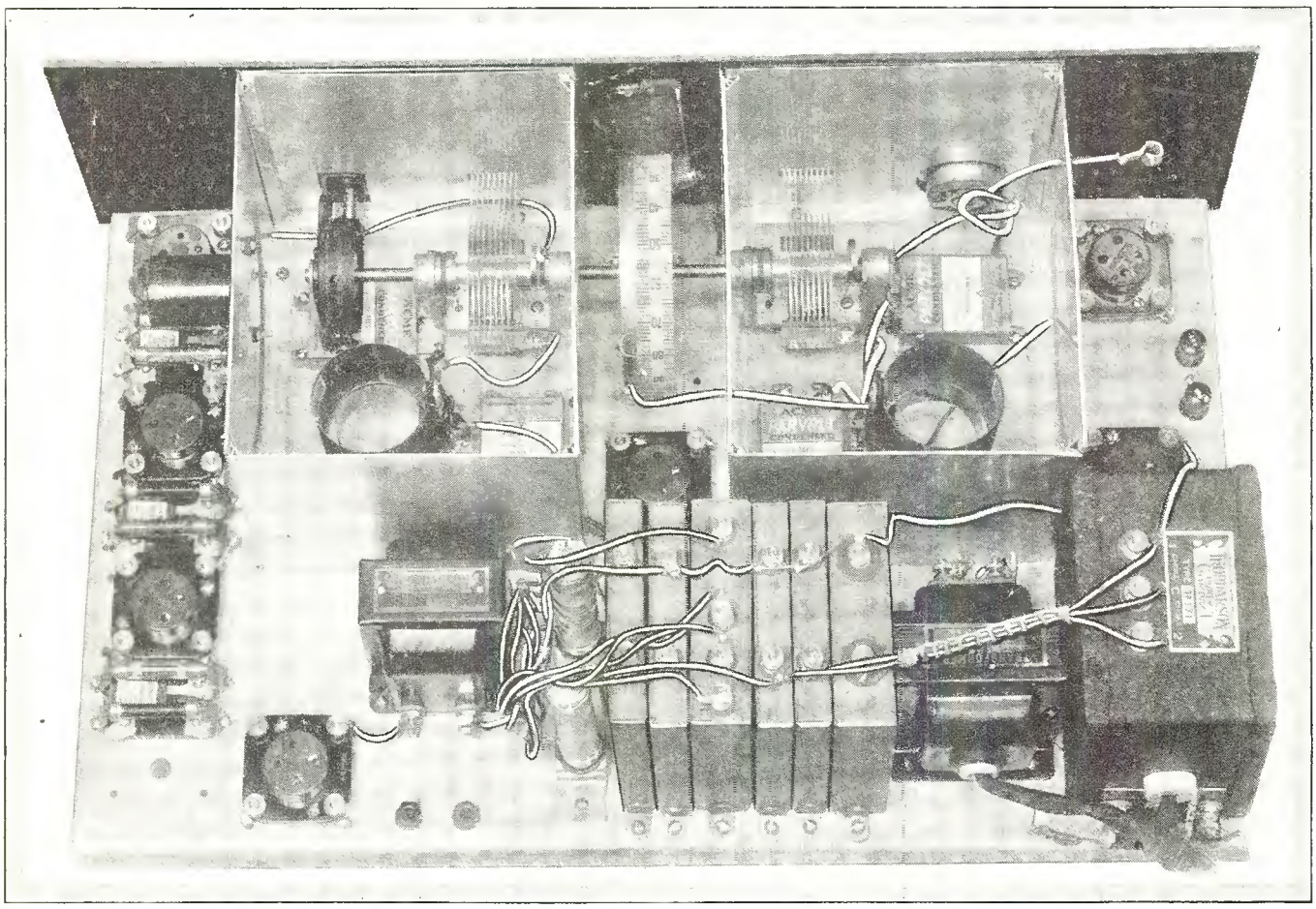


Fig. 1. This photograph shows a rear view of the completed receiver, the power supply is being located at the rear of the sub-panel

(This receiver tested and all illustrations made in our laboratory)

of the receiver to suit broadcasting conditions and their requirements for different classes of service.

Plate Rectifieation

The detector circuit is arranged for plate rectification, providing a high quality output for the audio frequency amplifier, which consists of three stages, resistance coupled. Technical advantages of resistance coupling are too well known to require further comment, and in addition the mechanical layout is especially suited to the requirements of Junior model. A Hi-mu tube is used in the first stage of the amplifier, another in the second and a 171-A in the output stage to furnish the amount of power required by the better class of speakers. In the a.c. model described in this article, the Arcturus tubes are employed, these being operated from a 15 volt transformer.

The tuning circuits are completely shielded in aluminum shields of special design to prevent electrostatie and inductive coupling between them. If the screen grid tubes are to be used at maximum efficiency any feed-back must be prevented. Separate stage shielding accomplishes the major part of this necessary isolation and in addition the shield grid terminals of the tubes are bypassed to prevent coupling between them. Also separate filters are used in the plate circuit of both shield grid tubes, these filters consisting of 5000 ohm resistors and .5 mfd bypass condensers.

Short Grid-Plate Leads

Shielding of the screen grid tubes has been handled in an unusual manner. Placing these tubes in the shield cans of the coils and tuning condenser would necessitate individual tube shields to isolate the tube element from the other apparatus. To avoid the use of these additional shields, the tubes are placed between the stage shields in such a position that the control grid and plate leads are very short and all coupling of the tube element to other parts of the circuit is prevented.

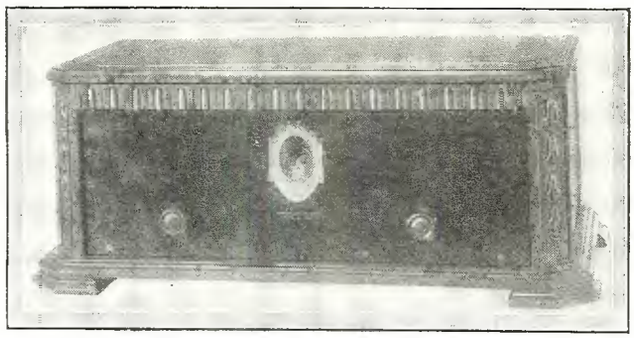


Fig. 2. In this photograph is shown the completed a. c. Junior mounted in a suitable cabinet

Control of volume is accomplished by the use of a 3000 ohm specially tapered potentiometer connected between the antenna and ground. The slider of this instrument is connected to the grid of the antenna coupling tube, thus allowing any desired part of the signal voltage to be passed on to the grid. This results in a smooth, continuous control of volume from a whisper to the full power output of the set. The special tapering of the resistance unit prevents criticalness at the lower volume setting.

In the complete a. c. operated model, described in this issue, the A, B and C power apparatus is mounted directly on the steel chassis, making the receiver an entirely self-contained unit ready to plug into the light socket. Arcturus unipotential cathode heater type a. c. tubes are used because of the favorable characteristics of d. c. tubes and are reliable in long life due to the excellent mechanical features incorporated in their construction.

Uses Carbon Heater

Briefly, the Arcturus a. c. tube is an alternating current tube of the indirectly heated cathode type, employing a carbon heater, mounted in a standard four-prong base fitting the present sockets without additional wiring of any kind. A heater type of tube is a tube in which the filament is used to heat the cathode or electron emitter without emitting itself. In other words, that part of the tube which carries the hum producing alternating current forms no part of the receiving circuit, resulting in a reduction of hum to an infinitesimal minimum. Arcturus tubes are of the heater type, which aside from a highly desirable hum insurance, results in several mechanical conveniences which were taken into consideration by the designers of the receiver. These tubes, due to the similarity of heater design, operate from the same heater potential, drawing the same filament current, thereby necessitating only one secondary winding on the filament lighting transformer. Also the filament wiring to all tubes is identical, greatly

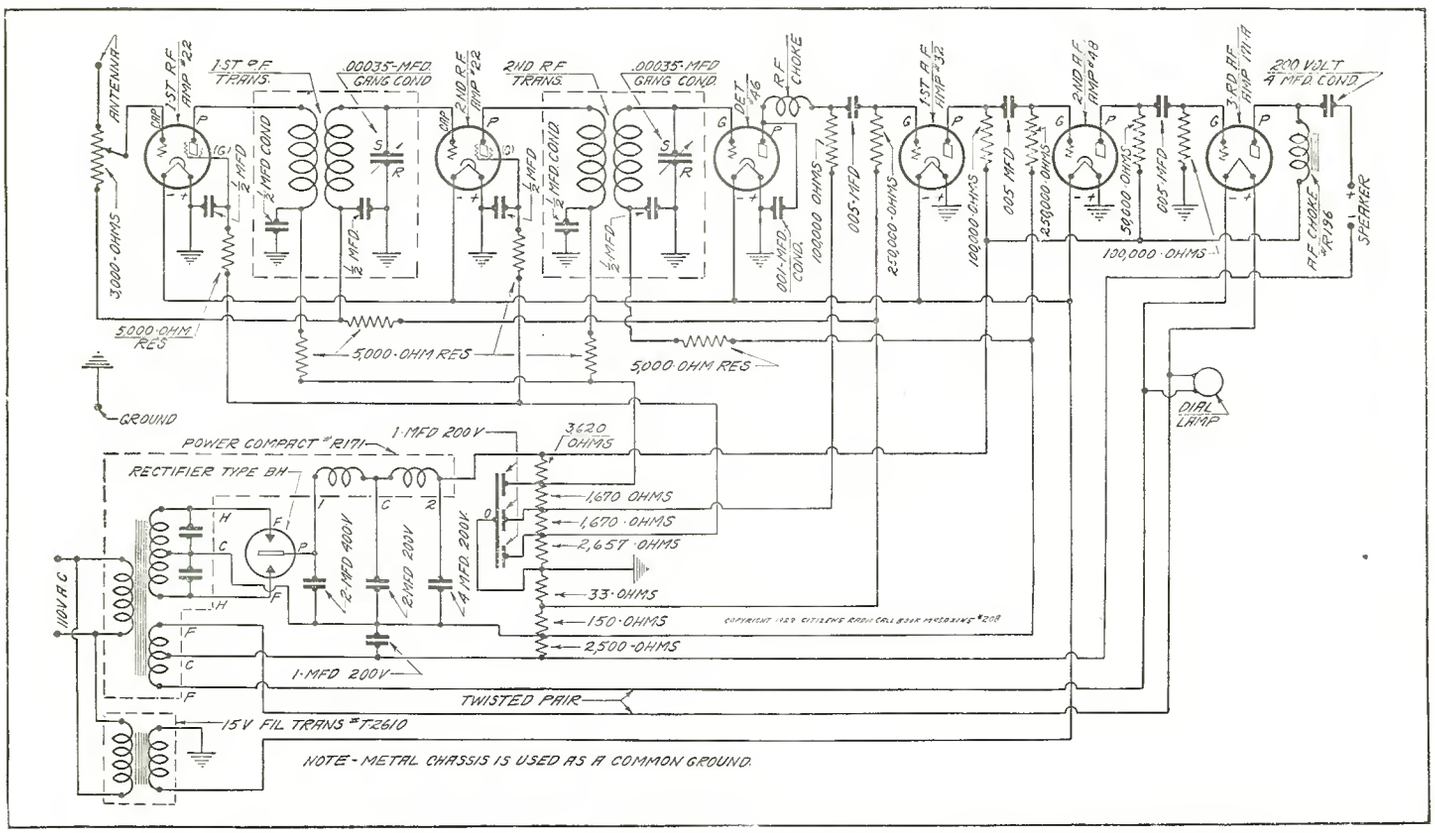


Fig. 3. The schematic of the combined receiver and power supply is shown in the above diagram

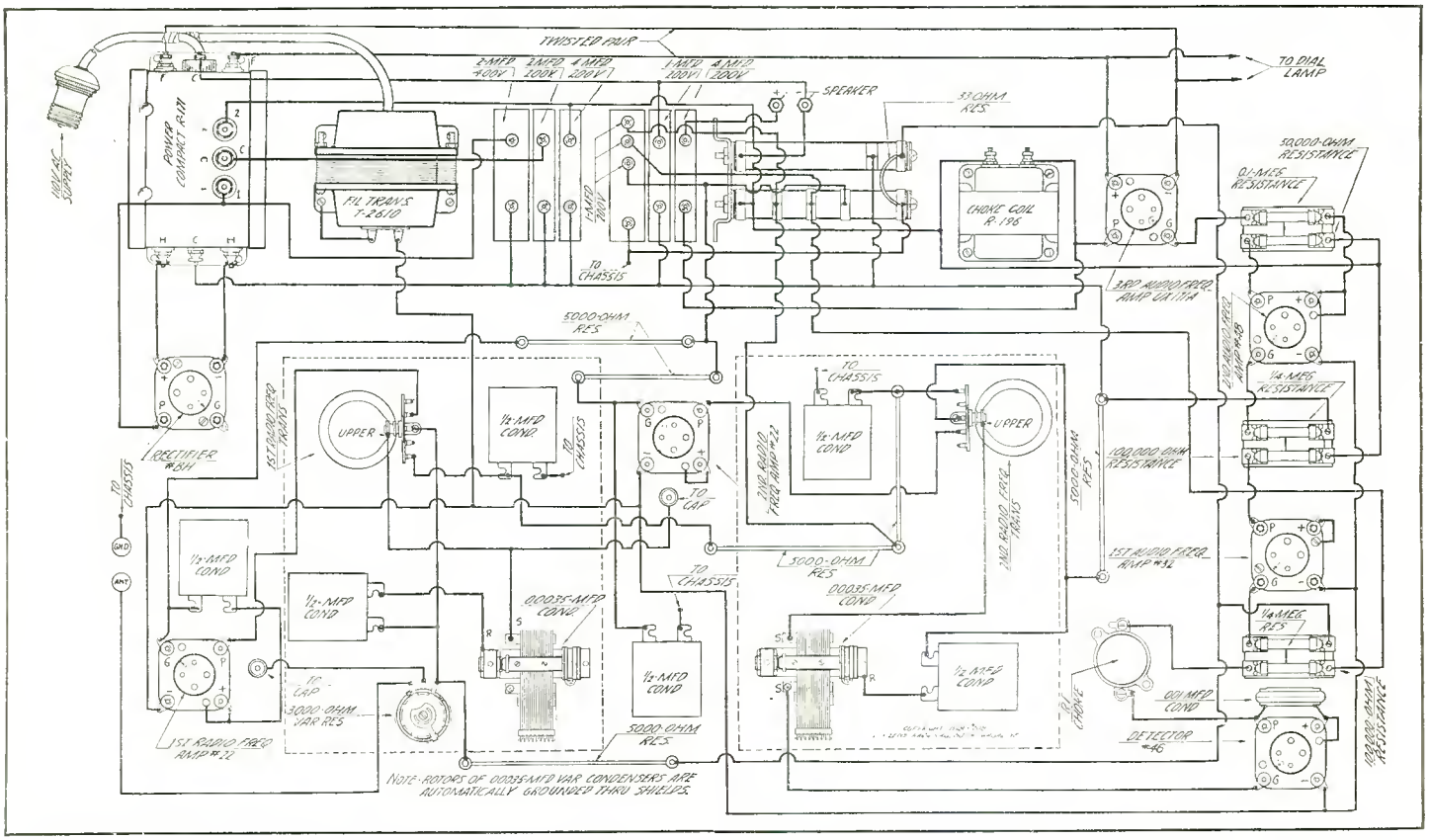


Fig. 4. Those not having a great deal of experience may wire up the receiver from the graphic illustration shown above

facilitating wiring. These tubes operate from the filament or heater potential at 15 volts and consume a current of .35 amperes. Due to this low heater current, these tubes are operated in multiple exactly as d. c. tubes are, and can be wired with the conventional hook-up wire. Extra heavy bus leads are not necessary.

In this model, there are two Arcturus No. 22 shield grid tubes, one No. 46 detector tube, one No. 32 Hi-mu amplifier tube, one No. 48 amplifier tube and a conventional 171-A power tube.

Testing the Set

When assembly and wiring are finished, a systematic course of testing should be followed by the builder to make sure that no errors have been made in the job. Checking may be done by referring either to the schematic or the graphic diagrams contained in this article.

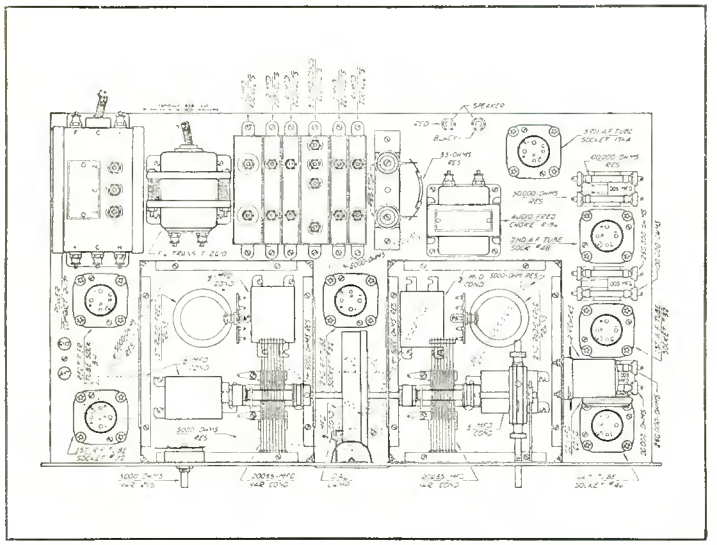


Fig. 5. Although the sub-panel for this receiver is already pierced, the parts should be laid out in accordance with the general idea shown above

The tubular bronze springs furnished in the foundation unit of the Junior model are in reality small padding or compensating condensers to equalize the tube capacities of the various stages. The design of these springs is such that when the specified lengths are slipped over the proper grid lead, compensation is effected under average conditions. Of course, vacuum tubes vary slightly in their characteristics. Also there will be slight variations in wiring. Therefore, where exact circuit-alignment is desired, a Hammarlund equalizer code No. EC35 may be substituted. This equalizer may be mounted directly on a tuning condenser by removing the unused stator soldering lug and using its screw to secure the equalized to the stator clamping bar. The bronze spring of the equalizer may be then connected to the lug on the condenser frame by a short wire. The equalizer may be adjusted with a screw-driver until precise alignment is obtained.

Features of Circuit

By referring to the schematic circuit shown in Fig. 3, good many details of the receiver's operation may be learned. In the antenna stage, the input stage is aperiodic, while the plate circuit is not tuned, this particular tube only acting as a buffer against the antenna. However, in the first radio frequency stage, the input circuit is tuned by one of the variable condensers, while the input circuit of the detector is tuned by another. These two condensers are joined together with a shaft connecting them to the drum dial located at the front of the receiver. On account of the first tube being a buffer one, it is possible to line up the r. f. and detector tuning condensers without reference to any changes in the constants of the antenna being operated. Thus, these two condensers should permit their circuit to be in exact resonance from the bottom to the top of the dial.

It will be noted that the screen grid of each 22 tube is bypassed directly to ground with a proper condenser and also that a fixed resistance is placed in series with each of the screen grids. There are also resistors in the plate circuit of the first and second screen grid tubes.

With reference to the photograph in Fig. 1, which gives a rear view of the receiver, it will disclose the fact that the set is

(*Continued on page* 126)

Victoreen Duplex Power Amplifier Is All-Electric Operated

Two Voltage Regulator Tubes Are Used and Separate C Bias Supply Is Provided in New Design

CONSISTING of two power amplifiers so arranged as to give the equivalent of push-pull amplification with fidelity, regardless of the input voltage, the Victoreen duplex amplifier is described in this article. It has been designed by the makers for the benefit of the professionel set builder, dealer or any one interested in an amplifier that will take care of almost any condition of power handling.

Standard Victoreen Parts

Built up from standard parts, the duplex amplifier is alternating current operated throughout by the use of the heater type 227 tube and the larger power tubes, the 250 type. An inspection of the schematic circuit shown in Fig. 4 will give a general idea as to the electrical characteristics of the amplifier. It will be seen that the unit contains two audio amplifiers, each one consisting of three tubes, an input, first and second audio. Each stage employs straight transformer coupling. The impressed signal enters each amplifier system, in the same manner, but 180 degrees out of phase. The output of each of the two audio systems is in series. Because of the 180 degree phase relation between the two systems, they be said to be in push-pull to each other.

It will be noted that the amplifier employs two 874 voltage regulator tubes. The purpose of these tubes is to hold the plate voltage constant on the input and first audio tubes. In this manner an overload in the output stages cannot react throughout the audio system. By this method the useful undistorted output is thereby increased over the value normally obtained from a 250 tube.

Separate C Supply

In previous power amplifier systems, a resistor in the negative B circuit has been employed to obtain a voltage drop for the C bias. Under those conditions, the C bias is dependent upon the plate current drawn by the amplifier. In the new design of amplifier made by Victoreen, a separate grid voltage supply is provided, the C voltage for the power tube being definitely determined regardless of change in plate current. Changes in line voltage are thus automatically corrected as the C supply primary and the power transformer primary both operate from the same line.

The power amplifier described in this article has been primarily designed for phonograph reproduction, in which a magnetic phonograph pick-up is used. The volume is either controlled by means of the volume control furnished with the pick-up or by a variable resistor placed across the pick-up. With some pick-ups fixed condensers are placed across the input to the amplifier, in order to prevent needle scratch. This is particularly true with pick-ups having a greater efficiency at the higher frequencies. With high grade pick-ups a very small value is needed, otherwise as high as .02 mfd may be required. This value is solely determined by opinion, as some individuals prefer more low notes than others. The exact method of connecting the magnetic pick-up to the input is shown in Fig. 2.

Voice Amplifier

In the event that the unit is to be used as a voice amplifier and a microphone provided for voice or music, it should be connected as shown in Fig. 3. The resistor resistance should be about the same as that of the microphone unit. In general a value of 25,000 ohms will suffice. The potentiometer is used as volume control. The microphone shown in the diagram is a single button type, which will serve for general purposes.

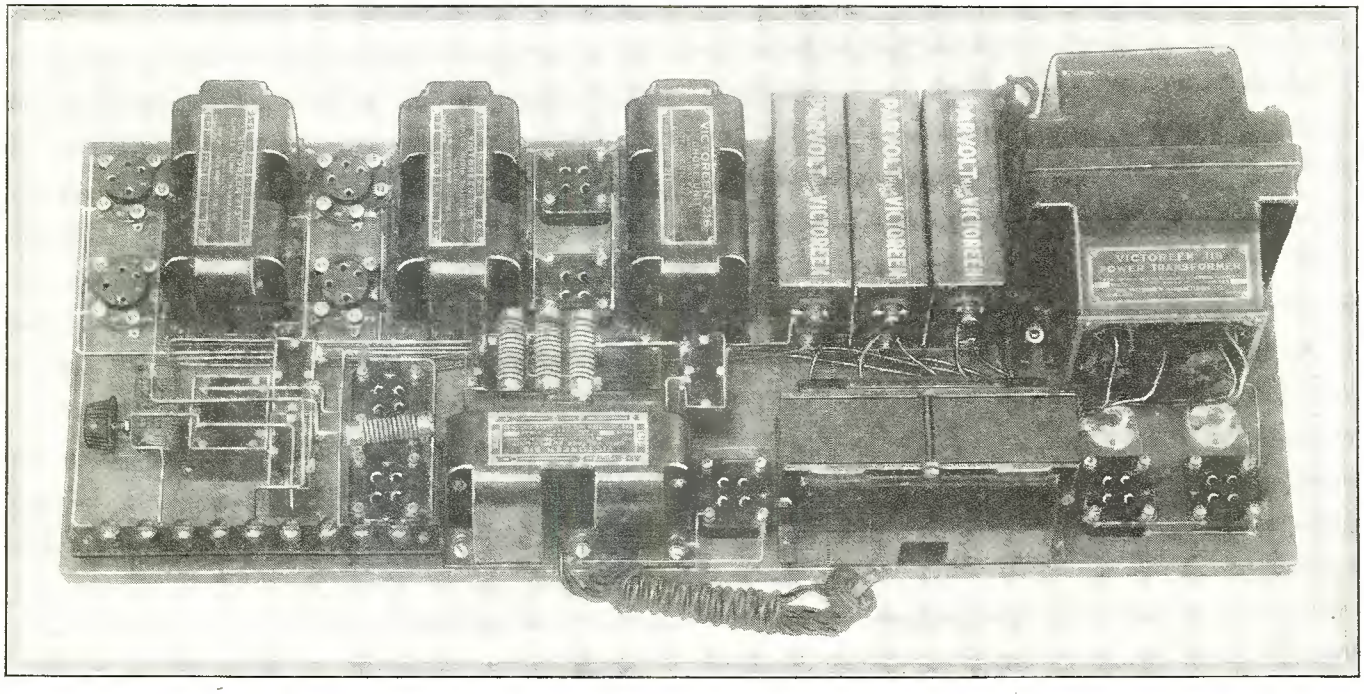


Fig. 1. In the photograph shown above may be seen the duplex power amplifier recently announced by Victoreen

(This amplifier tested and all illustrations made in our laboratory)

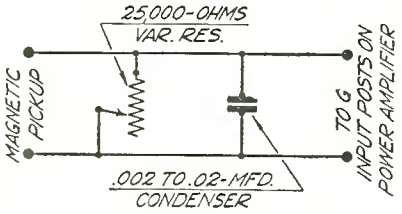
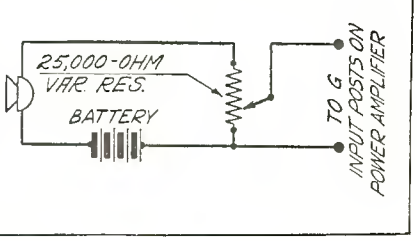


Fig. 2. This simple schematic shows the method of fixing up a volume control on a magnetic pick-up, the pick-up being shown at the left and the output at the right

Fig. 3. When it is desired to use the amplifier with a microphone pick-up, the circuit shown above should be followed. For ordinary, purposes the single button microphone will suffice



The duplex power amplifier will supply 45 and 90 volts to the radio frequency stages of almost any radio set. However, the detector system must be changed. Two detector tubes are placed in a receiver and their grids connected together. The reason for connecting the two detectors in parallel is to give a greater power output from the detector. The diagrams shown in Fig. 5 and Fig. 6 represent the methods of hooking up the power detector. While this method of connection is not especially desirable for distant reception, nevertheless when the amplifier is used for maximum power output on any given station, extremely satisfactory results are secured. In the event that the amplifier unit is to be used on 25 cycle current, a special 118 power transformer only is required. A separate C battery must be used, because the 516 unit cannot be furnished for 25 cycles.

In the diagram shown in Fig. 4, it will be observed that the filaments of the 227 tubes are left unconnected. This is not an oversight, but rather was done in order to eliminate a large number of lines necessary for connecting this tube to the 2½ volt secondary of No. 118 power transformers. The same thing applies to the filament connections of the 250 tube.

Safety Lamps Used

It will also be noted that two small 6 volt flashlight lamps are used in the plate circuit of the rectifier. These lamps are used as a protective measure in the event that one of the high voltage condensers should become shorted. In operation, should these lamps light up brilliantly and the signal cease, it is an indication that one of the condensers has probably blown. In normal practice, these lamps should operate at about one-half of their rated brilliancy. Our loud signals, should the lamps flicker or momentarily increase in brilliancy, it indicates that the amplifier is being forced beyond the rated ability of the 250 tube. Both tubes should operate at the same brilliancy. If not, the bulbs should be interchanged with each other. Should the brighter bulb now be dimmer, it indicated that the 281 rectifier tube, used with the dim bulb, is low in emission and should be replaced.

If trouble should develop, it will usually be found to be in either the tubes, resistances or condensers. A set tester will generally locate faulty tubes. Any tube which turns blue must not be used, this being particularly true of the 250. One of the main difficulties encountered with a 250 is its tendency to draw reverse grid current, even when slightly overheated, and thus drop in C voltage. This generally shows up after the amplifier has been in operation for several minutes, when the volume will begin to decrease and distortion occurs. At the same time the flash bulbs will gradually increase in brilliancy.

Another possible source of trouble may be the resistors. These should be handled with care before assembling and because of the extremely small wire with which they are wound, should be assembled very carefully. Should the 5000 ohm resistor become opened, the voltage regulator tube will not glow. Should either of the three resistors in the C supply become opened, the amplifier will have a tendency to motor-boat. This may be tested by short circuiting each of the three resistors separately. When the open resistor is shorted, the motor-boating will cease. It is important to connect the C supply primary and the power supply primary permanently together in order to be able tore that grid voltage is always available.

More Than One Speaker

A large number of speakers may be operated in parallel or in series, depending upon their type and number, and the 216 choke unit is so designed that no direct current flows through the speaker. Where complete insulation is required from the high voltage, a 4 mfd 600 volt d. c. condenser should be placed in each

(*Continued on page* 146)

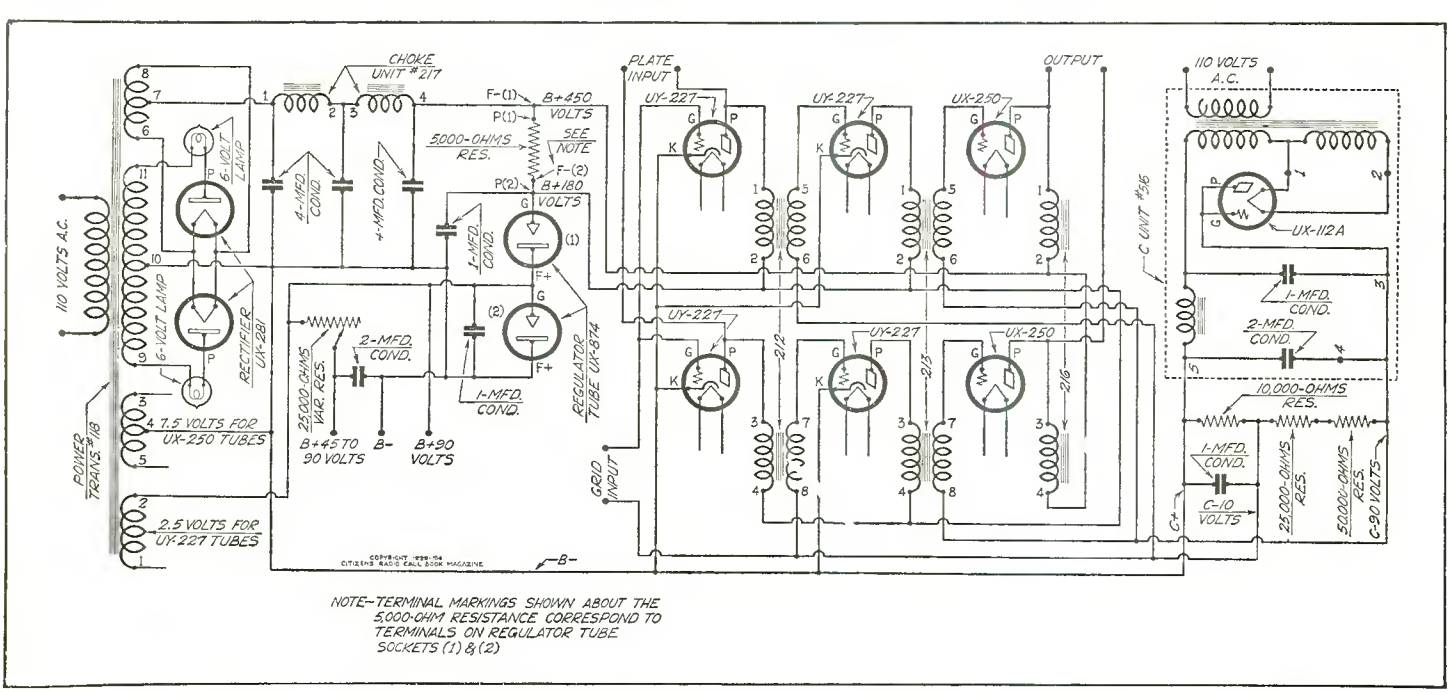


Fig. 4. The schematic circuit of the power amplifier itself and the separate C bias rectifier is shown herewith

Aero Low Wave Adapter for Custom or Factory A. C. Receiver

Radio Owners May Secure Full Enjoyment on Increased Broadcast Range of Their Own Set

THERE is hardly a day that passes in the technical department of this magazine but that some one of our readers possessing an alternating current operated set, either of the custom built type or of the factory built, has asked whether or not a short wave converter is available for use in connection with an alternating current set. While it is true that we have published many short wave converters, or adapters, nevertheless these previous articles have only dealt with the direct current operated sets.

Answering the demand for a converter which could be utilized with alternating current sets, regardless of whether of the custom built variety or factory made, the Aero Products organization has recently designed and announced a short wave converter employing a 227 a. c. tube. While this short wave converter was originally designed to fill out the Aero line, which includes a number of tuned radio frequency receivers for both d. c. and a. c. operation, nevertheless the converter may be used with any receiver regardless by whom made.

Increased Tuning Range

With the announcement of this alternating current operated short wave converter, professional set builders and listeners are now enabled to take full advantage of an increased broadcast range on their a. c. operated sets. While undoubtedly the d. c. type had a considerable vogue, with the extreme interest shown this year by the public in alternating current operated sets, the converter being described in this article should meet a hearty response.

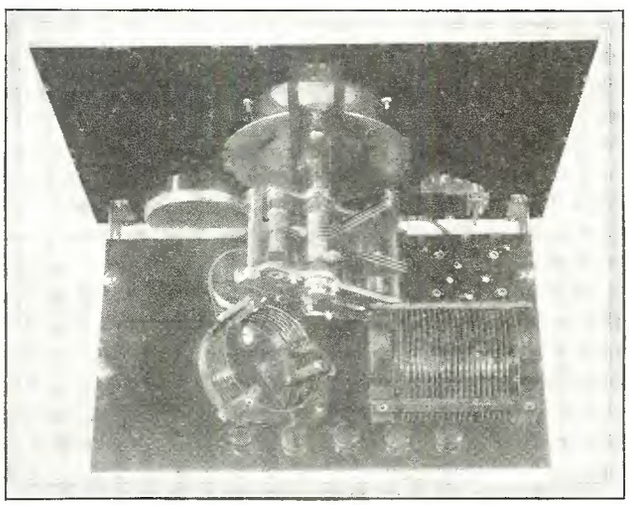


Fig. 1. Neat and compact is the new Aero a. c. short wave converter described in the accompanying article

An examination of the photograph shown in Fig. 1 will disclose the general layout of the parts involved. The coil shown at the back of the sub-panel is of the plug-in type and consists of a secondary and regenerative winding on the big form, and the primary on the small form, which is variable in inductive relation with respect to the secondary. This coil is known as the LWT-10 kit. The antenna coil portion remains in the circuit for all time after it is once plugged in, the secondary, however, being of different value for the various wavelength bands that are covered.

As shown in the schematic diagram, Fig. 4, wavelength tuning is across the secondary by means of the .00014 mfd variable condenser. Regeneration control is through a combination of fixed capacity and variable resistance, this control being located between the junction of the plate coil and the choke coil and the negative return of the circuit. This is but one of the numerous methods by means of which regeneration and oscillation can be controlled and was adopted because it involved a very small amount of additional apparatus and simplicity of control is thereby gained, together with economy. The choke coil No. 60 placed in the B positive lead to the plate coil insures smooth operation regeneratively over the broadcast band covered.

Uses 227 Tube

Detection is by means of the .00015 mfd grid condenser spanned by a 10 megohm grid leak, the latter going from the grid of the tube to the cathode of the 227 tube. The cathode line, the bottom of the variable resistor, the rotor of the variable condenser and the filament terminal of the secondary inductance are all common and go to negative B line, which is carried to one of the prongs of a five-prong tube base. A sketch of the five-prong tube base is shown in the lower right section of Fig. 4 diagram, the view being taken from the top. This tube base is the one that is inserted in the detector socket of a receiver, when it is desired to operate the short wave converter in conjunction with a standard wavelength receiving set. The antenna coil is of the conventional type, one end going to the antenna and the other to the common cathode lead. The inductive relationship of the antenna coil may be varied from minimum to maximum in order to increase or decrease the amount of pick-up from the aerial. The inductive relation of this coil with respect to the secondary has, to some extent, an effect upon the regeneration and oscillation qualities of the receiver. The set will oscillate easiest when the coil is practically at right angles to the secondary, and will oscillate with increasing difficulty as the coil is brought up to closest possible coupling.

Subpanel Is Punched

One of the features of the short wave converter, which will be appreciated by the average builder, is the fact that the subpanel is already punched and the necessary coil socket holes, socket holes and other position for apparatus are punched at the factory, with the result that the amount of wiring required on the part of the builder is reduced to a minimum. The idea of punching the subpanel also contributes materially to preventing wrong connections being made by the builder.

In effect, the short wave converter is nothing more or less than a single tube short wave receiver with plate and filament leads brought out through a cable, which terminates in an ordinary tube base and can be inserted in either the first r. f. socket or the detector socket of the broadcast receiver. In the a. c. model of this converter, the 227 detector tube removed from the set may be used in the short wave converter. When using the converter with a superheterodyne, the converter plug should be inserted in the second detector socket.

(This converter tested and all illustrations made in our laboratory)

The wavelength range covered by the three coils included in the LWT-10 kit is as follows: The first coil has a range from 16.5 to 32 meters. The second coil has a range from 26.2 to 48.7 meters. The third coil runs from 46.7 to 89.5 meters. These three broadcast bands are sufficient to receive almost any of the short wave broadcast work being done now in the United States and abroad. Information covering short waves may be gained by referring to the broadcast list published in each issue of this magazine.

A little data on the putting together of the receiver might not be amiss at this point. When the unit is unpacked by the builder, he will find one unit completely wired containing the tube socket, binding posts, coil primary, interchangeable coil sockets, radio frequency choke, grid condenser, grid leak and plate blocking condenser. Packed loose in the box will be the switch, regeneration control resistance, tuning condenser and dial parts, as well as the front panel. First the dial should be mounted on the front panel, attaching the tuning condenser and then followed by mounting the switch and regeneration control. The front panel is now mounted on the subpanel. The necessary wires are then put in in accordance with the graphic diagram shown in Fig. 3, or the diagram accompanying the kit. A very convenient plug may be made by utilizing the base of a burned-out vacuum tube. Break the glass away from the base and remove the plate and grid structures, taking care to see that the wires running to the plate and filament contact on the bottom of the base are not broken off too short. The connecting cable should be soldered to these wires, making sure to connect the filament and plate leads to the appropriate wires in the base. The filament pins on the plug which is to be inserted in the receiver are those prongs of the larger diameter. To determine which is the plate terminal, the simplest way is to place the tube base in the socket and notice which pin goes in the hole marked P on the socket. A small sketch of the tube base is shown in Fig. 4 and it may be readily wired by referring to that particular drawing. After the wires have been properly attached to the tube base, the base may be filled in with melted sealing wax.

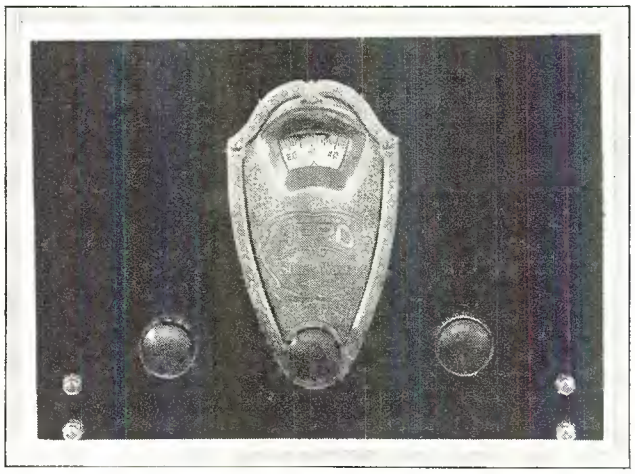


Fig. 2. A top view of the short wave converter may be seen above. The left-hand control is for the 110 volt off and on switch and the right-hand control is for regeneration

Operating the Converter

To operate the converter, first remove the detector tube from its socket in the broadcast receiver. In the case of the alternating current operated set, this is a 227 tube. This tube should then be inserted in the socket of the converter. Next insert the plug carrying the cable into the detector socket of the receiver. The aerial to be used should be connected to the binding post provided. The tubes of the radio frequency end of the broadcast receiver may be either turned off or removed, according to the facilities provided, as they serve no useful purpose when used with the converter.

There have been occasions when better reception is secured when the converter plug is put into the first radio frequency socket of the broadcast set. In this connection it acts as an autodyne receiver and oscillator. The incoming signal is heterodyned to the wavelength on which the broadcast receiver is set and then amplifies those frequencies passing through the detector and audio frequency amplifier in the usual manner. Controls on the broadcast set need not be changed. Regeneration is controlled by means of the variable resistance in the converter, while control of tuning is accomplished by varying the .00014 mfd variable condenser. This converter is tuned in identically the same manner as an ordinary three-circuit broadcast receiver.

These a.c. converters are designed to operate with a B voltage of 22½ to 45 volts applied to the plate of the detector tube. Some set manufacturers, however, apply 67 volts and sometimes more to the plate of this tube and where this is done, it is necessary to reduce this voltage by a variable resistor of 0 to 50,000 ohms, such

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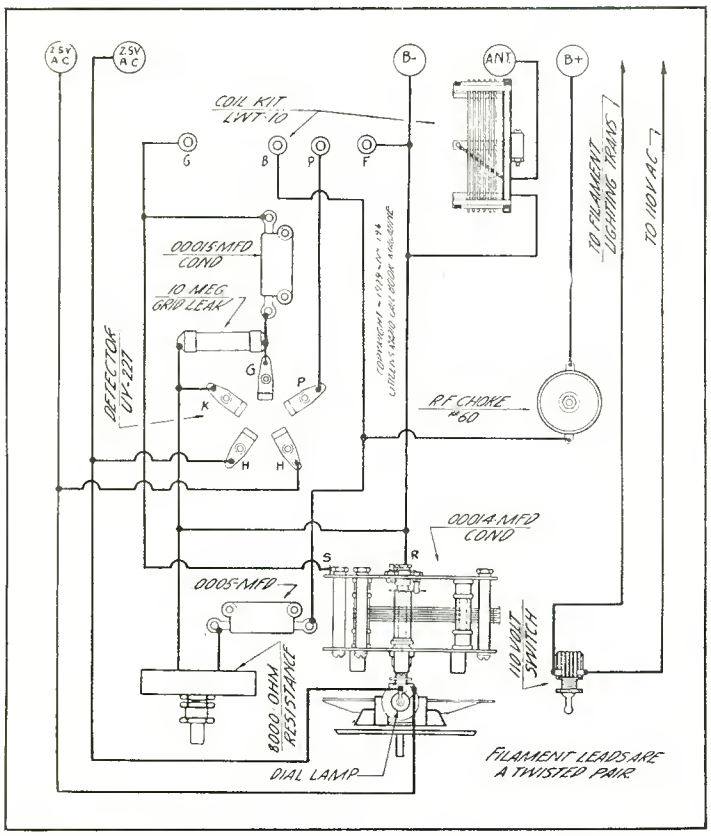


Fig. 3. Considerable speed may be made in wiring up the short wave converter by means of the graphic diagram shown in the illustration above

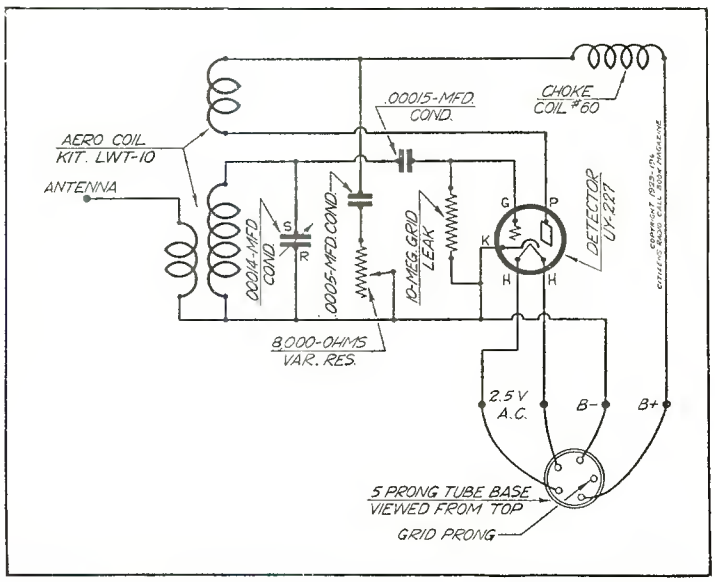


Fig. 4. After all there is not very much to the electrical circuit of the short wave converter, as will be shown by an inspection of the above schematic

One Dial Tuning and A. C. Screen Grid Tubes in H. F. L. Special 9

New Models for Alternating Current Operation with 250 Tube, or D.C. Model with 171-A

AVAILABLE in two models, the new H. F. L. Special Nine just announced for the 1929 season has many interesting features which should appeal strongly to the professional set builder.

It is available in two forms, a straight d. c. operated model using a 171 A output tube and a straight a. c. model using heater type tubes throughout with a 250 as the power output tube. Both receivers have four screen grid intermediate frequency stages.

Inasmuch as both receivers are constructed on the same chassis, and since both operate in substantially the same fashion, we will describe the a. c. set, as space does not permit a description of both of them.

Complete In Kit

In line with the merchandising policy of H. F. L. both kits come complete, i.e., all of the parts are riveted down to the chassis and the intermediate frequency eatacomb is completely assembled, wired and tested. It is, therefore, impossible for the purchaser of an a. c. kit to confuse his parts with those of a d. e. kit and vice versa.

Attention is directed to the fact the intermediate amplifier catacombs are of different construction in each case. The problems of amplifier design for a. c. and d. c. screen grid tubes vary greatly with the different kinds of tubes. An entirely different kind of amplifier is necessary in each case.

This amplifier is responsible for the selectivity and sensitivity of the H. F. L. Special Nine. It has one tuned intermediate frequency stage more than the well known Isotone. The appreciation in selcctivity and sensitivity is considerable.

This catacomb fits along the back edge of the receiver chassis. Thc chassis itself measures 20½ inches long by 4¾ inches deep. When the amplifier catacomb is bolted on to the rear of the chassis thc depth of the entire receives beeomes 7½ inches. The front panel protrudes ¼ inch beyond the chassis face at each end and measures 21 inches long by 7 inches high.

Wiring is accomplished by simply running jumpers from the catacomb terminal strips to the proper positions on the tube sockets and so forth. Practically all of the by-pass condensers are wired right into the catacomb, so the actual wiring of the H. F. L. Special Nine is a very simple job, requiring not more than an hour at the most.

The catacomb is divided into seven compartments, one for each radio frequency circuit and its associate equipment. This method of construction allows an extremely high ratio frequency gain, and also permits the screen grid tubes to be operated without shielding. This is a highly desirable consideration in a. c. operation where the tubes become quite hot, and it also permits a substantial saving in the manufacturing cost of the receiver which is passed on to the purchaser.

One Spot Tuning

The intermediate frequency amplifier operates at a frequency which allows absolute onc spot tuning, and each transformer in the amplifier can be peaked for exact resonance by adjusting the small condenser which is shunted across the secondary circuit. These small adjusting nuts can be seen betwcen the tubes in the illustration.

It will be noted that each grid bias resistor is by-passed, and it may be well to state that these resistors are not of the standard recommended values, but of a special value which permits a very much larger gain per stage throughout the instrument. Thc first detector tube has a high bias which increases the selectivity of

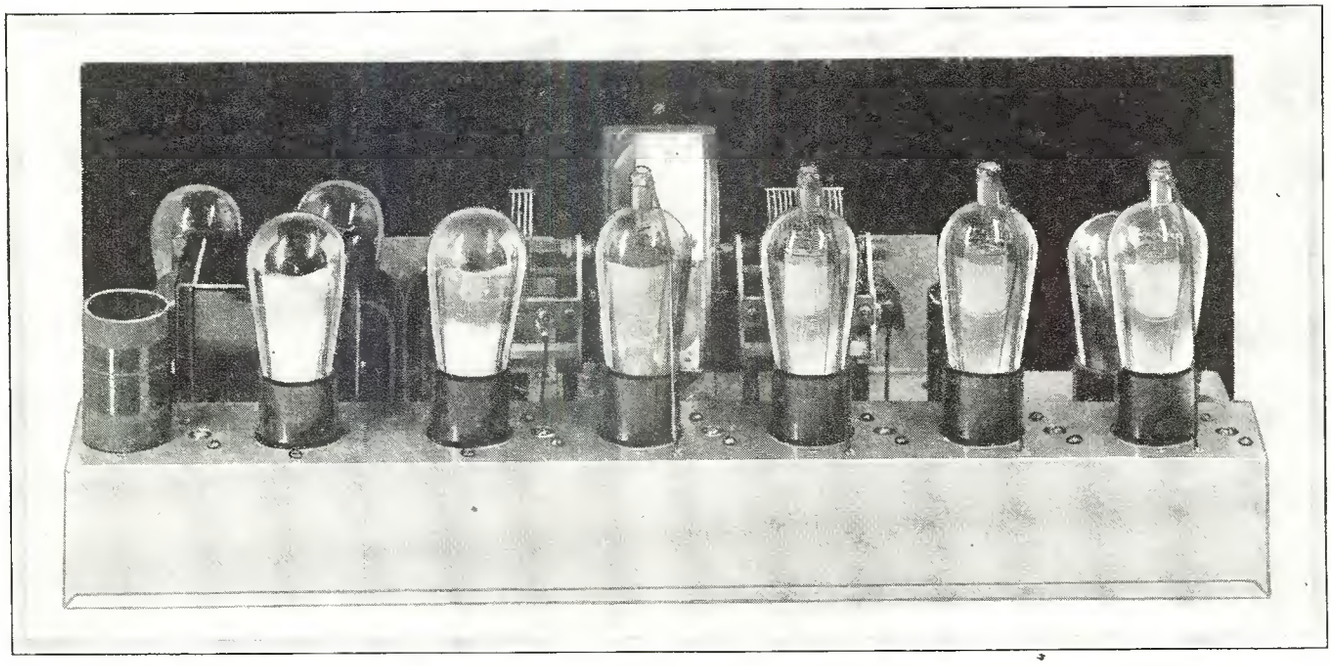


Fig. 1. In this photograph is shown the new HFL Special 9 described in the accompanying article

(This receiver tested and all illustrations made in our laboratory)

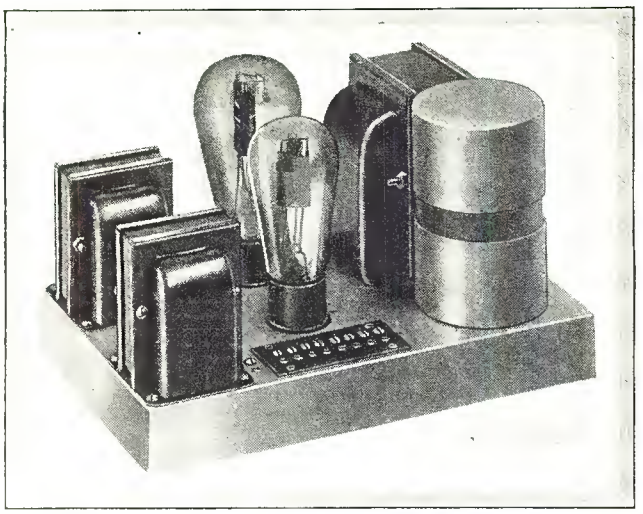


Fig. 2. Above is a photograph of the power supply for operating the alternating current model of the HFL Special 9

the antenna circuit, and the oscillator is also biased in order to do away with any tendency toward harmonics.

Inasmuch as the gain of the intermediate frequency amplifier is considerably more than could ever be utilized under the operating conditions, the tubes are operated at low heater temperature. The standard filament voltage for a tube of this type is 2.25 volts. The tubes in the H. F. L. Special Nine never receive more than 2.1 volts. This drops the current from the standard value of 1.75 amperes to 1.60 amperes. A. C. tubes cost money, and the set builder generally considers economical operation a factor.

The H. F. H. Special Nine is a one dial super. There are only three controls, the main tuning dial, a small compensating condenser for the antenna circuit (the left hand knob) and a volume control and switch which are attached to the right hand knob. In actual operation, it is easily possible to hear twenty consecutive stations without adjusting the antenna compensator, and for local reception the entire broadcast band may be covered with the main tuning control alone. Thus, the set is a true one dial receiver of the highest type. Plug in coils are being designed for the short wave broadcast bands, and these coils will be constructed with the one dial method in view.

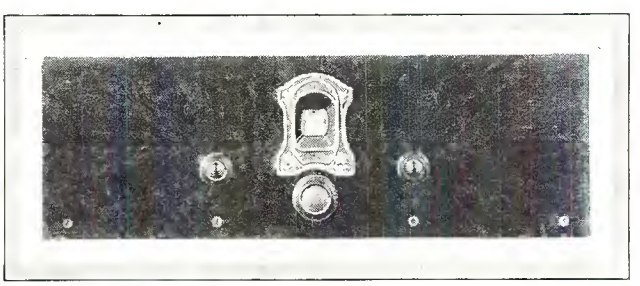


Fig. 3. In this photograph is seen a front view of the new receiver with its single control tuning dial at the center

The kit comes entirely assembled, including the front panel, which is of metal, having a very fine burled walnut finish. Custom set builders will welcome the news that H. F. L. has decided not to put their trade mark on this receiver, except in the form of a small decalcomania, which may be readily washed off with a little alcohol.

The A. C. Special Nine operates from an excellent 250 power amplifier. This compact unit measures 11 inches long, 7 inches deep and 7½ inches high with the 250 tube in the socket. It furnishes all B, C and heater voltages to the Special Nine. Attention is called to the fact that in the a. c. set the ninth tube or 250 operates in the power amplifier circuit, and that there are only eight tubes in use on the receiver chassis.

This efficient power amplifier will no doubt be welcomed by custom set builders, for it can be operated with any kind of a receiver, and it is designed so that it will furnish plenty of plate current with extra voltages up to 150 volts. Fourteen amperes of heater current at 2.25 volts can be taken from the unit, and it is wired so that one single 110 volt switch (on the receiver chassis) handles the power amplifier and its associate dynamic loud speaker, if one is used.

The power amplifier operates with a single 280 rectifier tube, and, of course, the 250. A 210 may be used as the amplifier tube in place of the 250, inasmuch as the circuit is self balancing. Variable resistors are employed so that the set builder can move the clips and thus obtain whatever voltages he may require; 37 microfarads of condenser are employed in the filter circuit.

Inside or Outside Aerial

The H. F. L. Special Nine is designed so that it will operate with practically any outside or inside antenna. In addition to the variable compensating condenser which tunes the first grid circuit, there is a variable condenser of low capacity in series with the antenna circuit which allows the adjustment for any length of antenna. In an actual laboratory test, the Special Nine reproduced signals from station KWKH at Shreveport, La., with full loud speaker volume using a 30 inch length of bus bar for an antenna.

Loud speaker signals from station CZE at Mexico City were obtained at 9:30 p. m. Thursday, November 22, using a 20-foot inside antenna. Several interested parties witnessed this demonstration at that time when twenty-eight local stations were in operation in the district around Chicago, where the test was made. Station PWX at Havana, Cuba, which operates right behind station KWKH at Shreveport, La., was heard on several evenings whenever a lapse of a few seconds at KWKH permitted them to come through.

The audio transformers are specially designed for the receiver, and the impedances are figured for the partieular jobs which they have to do. Low note reproduction is entirely dependent upon the size of the dynamic baffle board.

The output filter is an impedance and condenser arrangement which has been carefully figured so that it will match the general run of dynamic loud speakers with the minimum loss of power.

When the H. F. L. Special Nine is operated with a dynamic loud speaker which derives its field supply from a tube of the 280 type (such as the new one designed by Muter), the tone quality is well nigh perfect.

Phonograph operation is the one test which brings out the perfection of a good audio amplifier. Attaching a pick-up to the Special Nine is a simple matter when a phono adapter such as the Pacent is used. This adapter simply slips over the pins of the second detector tube and the tube is replaced in its socket. The pick-up cord tips are then plugged into the two little tip jacks on the phono adapter, and the amplifier is ready for phonograph operation. The pick-up, of course, should be disconnected when the instrument is again used as a radio receiver.

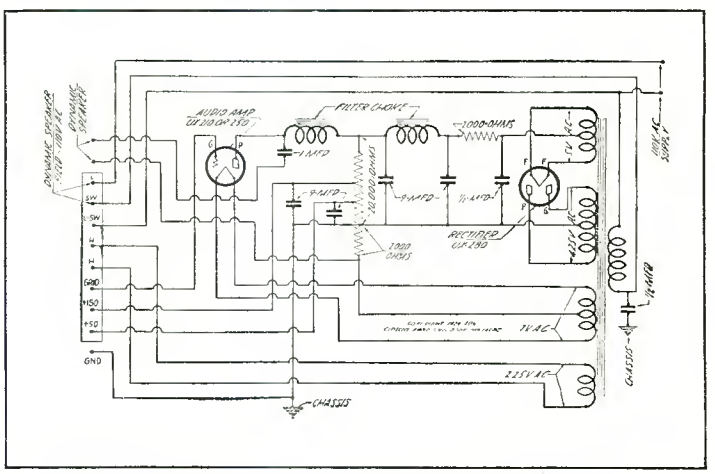


Fig. 4. The electrical connections in the power supply are shown in the schematic illustrated here

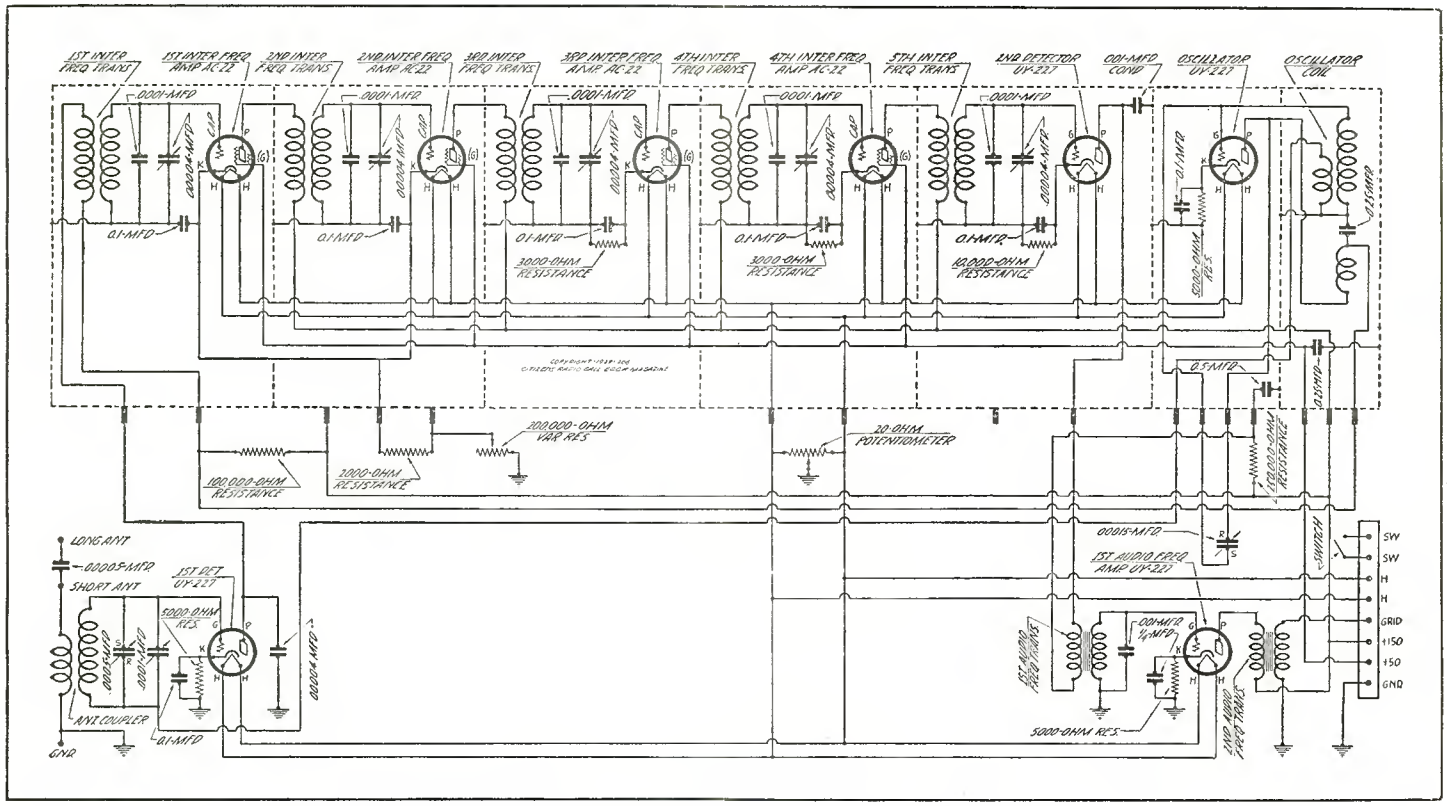


Fig. 5. All electrical details of the circuit employed in the new receiver are depicted in the above schematic

The photograph shown in Fig. 2 gives an idea as to the appearance of the power supply designed for operation with the HFL Special Nine. This unit comprises the two chokes shown at the left in the photograph, the 280 rectifier tube in the foreground with the 250 power amplifier tube in the rear. The high voltage transformer with its low voltage secondaries is at the right rear, while the tubular unit at the right front is the special bypass condenser. Resistors and other small parts are located underneath the chassis of the power supply.

An examination of the schematic diagram shown in Fig. 4 discloses a 2000 ohm fixed resistor, which is a departure from other power supply methods. This 2000 ohm resistor forms a portion of the input circuit to the filter and eliminates the necessity for having a double filter choke in that particular position. The resistance network across the output of the filter has a total of 20,000 ohms with voltages of 50 and 150 properly bypassed. The bias resistor has a value of 2000 ohms and is located between the center tap of the high voltage winding and the center tap of the 7½ volt secondary for operating the 250 or 210 power tube. The unit is self-balancing in that either a 250 or 210 may be used and the proper voltage may be assured for the grid bias. All of the voltage terminals and those for the dynamic speaker are brought out to a connection block, which is shown in the forefront of the photograph in Fig. 2.

Tubes required for operation are:

A. C. Operation

4 Ceco or Sonatron a. c. 22
4 Ceco or Sonatron 227
1 Ceco or Sonatron 250 (or 210)
1 Ceco or Sonatron 280 (rectifier)

D. C. Operation

4 Ceco or Sonatron 222
4 Ceco or Sonatron 201 A tubes
1 Seco or Sonatron 171 A

Parts in Kit

Although the H. F. L. sets come to the consumer entirely assembled, the a. c. parts list is being given for general information. The d. c. parts list is substantially the same with a few changes in the resistor and condenser values.

1 H. F. L. special copper amplifier housing
1 H. F. L. special copper amplifier top
1 H. F. L. special copper amplifier bottom.
9 Special UY type sockets
1 Special UX type sockets
5 H. F. L. special r. f. transformers
7 Micamold .00003 mfd trimmer condensers
5 Micamold .0001 mfd fixed condensers
7 Sprague .1 mfd bypass condensers
3 Sprague .25 mfd bypass condensers
10 Love plastic resistors—various values
1 H. F. L. special No. 3 terminal strip
1 H. F. L. special No. 4 terminal strip
2 Muter .001 mfd fixed condensers
4 Carter screen grid clips
1 Special .5 mfd bypass condenser
1 Special 2-stage audio transformer unit
1 Frost special 200,000 ohm volume control and switch
1 Pilot .0001 mfd variable condenser
1 USL .00015 mfd variable condenser
1 USL .0005 mfd variable condenser
1 Special cord driven drum dial
1 H. F. L. special steel chassis, cadmium plated
1 H. F. L. special 7x21-inch steel front panel
3 Kurz-Kasch 1¾-inch bakelite knob
1 Yaxley 20 ohm hum balancer
2 H. F. L. special steel control supports, cadmium plated
1 H. F. L. special 110 volt supply cable
1 H. F. L. special plate supply cable
8 H. F. L. special condenser mounting studs
3 Eby bakelite binding posts
1 Westinghouse 2½ volt dial light
2 H. F. L. special steel chassis supports, cadmium plated
1 H. F. L. special No. 5 terminal strip
1 H. F. L. special plug-in antenna coil
1 H. F. L. special plug-in oscillator coil
1 H. F. L. special bakelite condenser drive shaft
1 Muter .0005 mfd fixed condenser
Miscellaneous equipment consisting of eyelets, washers, lugs, nuts, bolts, wire, instructions, etc.

"Round the World Four" Uses Screen Grid for Distant Signals

Silver-Marshall Model May Be Made Up Either as Four Tube Set or as Two Tube Adapter

COINCIDENT with publication in the November issue of an article covering the construction of the 731 "Round the World" Adapter, as made by Silver-Marshall, our blue print department has been literally swamped with requests for the four tube version of this same circuit, which in deference to our readers is being presented in the accompanying article.

Made in Two Models

When constructed as a four tube receiver, the unit is given the number of 730, whereas when built as a short wave adapter it bears the code number 731. The latter is the unit which was described in the November issue on pages 86 and 87. That particular model was used for some time by our technical staff in intercepting the short wave television signals from station 3XK, the Jenkins laboratories at Washington, D. C.

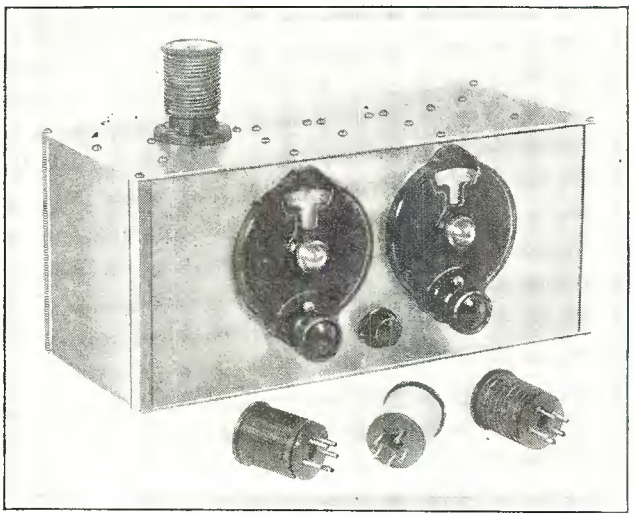


Fig. 1. In the photograph shown above is the completed four tube job, together with the four coils required for covering the short wave broadcast band

Basically there is very little difference between the two models, with the exception that the 730 has two audio transformers and the extra sockets, binding post, bypass condensers, etc., which the 731 does not have. However, the aluminum stage shield is punched for the four tube job, and when the adapter is built only the required number of units are located in it.

"The "Round the World Four" is illustrated photographically in Fig. 1, with another view of the inside of the unit being given in Fig. 2. The schematic circuit is in Fig. 3, while the graphic circuit shown in Fig. 4 is for the benefit of those who are fairly experienced at set construction.

Referring to the schematic diagram shown in Fig. 3, it will be observed that a screen grid tube is used as the first r. f. stage. The input circuit of the screen grid is aperiodically tuned by means of an r. f. choke, so that it is responsive to waves over quite a wide band. The plate circuit of the screen grid tube contains the seconary of the regenerative inductance and it is tuned by means of a .00014 mfd variable condenser connected through the .005 fixed condenser and located across the G and F-2 terminals of this inductance. An r. f. choke coil, type 275, is located between the F-2 terminal and the B-90 voltage terminal to prevent r. f. stray current from getting into the battery circuit. The detector uses either a 201-A or a 112-A tube, depending on the wishes of the operator. However, when using a 112-A tube, it will be found that the coils will not tune down as low as if the 201-A is employed. Detection is by means of a .00015 fixed condenser, with a 5 to 10 megohm grid leak, running from the grid to the negative filament of that tube. It will probably be necessary to try several values of grid leak to secure the one which gives best operation from all standpoints. It is also quite likely that a different grid leak will be required when used for short wave telegraph signals than when it is used on short wave phone broadcasts. Regeneration in the detector stage is accomplished by means of the .00035 mfd variable condenser between the junction of the plate coil and the r. f. choke and the negative filament line. The regenerative coil is that part of the winding shown at F-1 and P in the schematic circuit, Fig. 3. When the unit is used as a short wave adapter, the head phones are placed between the bottom terminal of the plate choke 277 and the 45 or higher plate voltage terminal. However, in this model the first audio transformer, which is a type 255, is located in this position. This transformer is of the Clough type, having a resonated primary as shown in the schematic. The secondary goes to the grid of the 112-A first audio tube. A 60,000 ohm fixed resistance is shown as an optional across the grid terminal of the 112-A and terminal 4 of the first audio transformer, this being the C 4½ bias connection.

Coupling of the first audio to the second audio is also by means of the Clough system, in this case a type 256 transformer being used. The output tube in this design is also a 112-A tube, with the speaker terminals being located between the plate of the last tube and the 135 volt terminal.

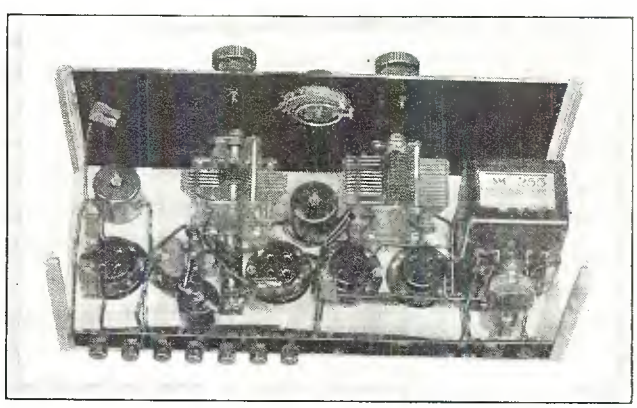


Fig. 2. This photograph shows the inside of the aluminum shield with all parts in place and properly wired. The photograph is taken upside down, with the bottom, back and two side shields removed

Filament control in the first and second audios is by means of a 2 ohm fixed resistance located in the positive leg of the tubes' filament. Filament control of the detector circuit is by means of a 20 ohm variable rheostat, which, if desired, may be used as a volume control, although the regenerative condenser will probably serve better in that capacity. The filament circuit of the 222 screen grid tube is fixed by means of the two 10 ohm resistances in each side of the filament circuit. Bias for the grid of the 222 tube is obtained by the drop across the 10 ohm resistance in the negative side of

(This receiver tested and all illustrations made in our laboratory)

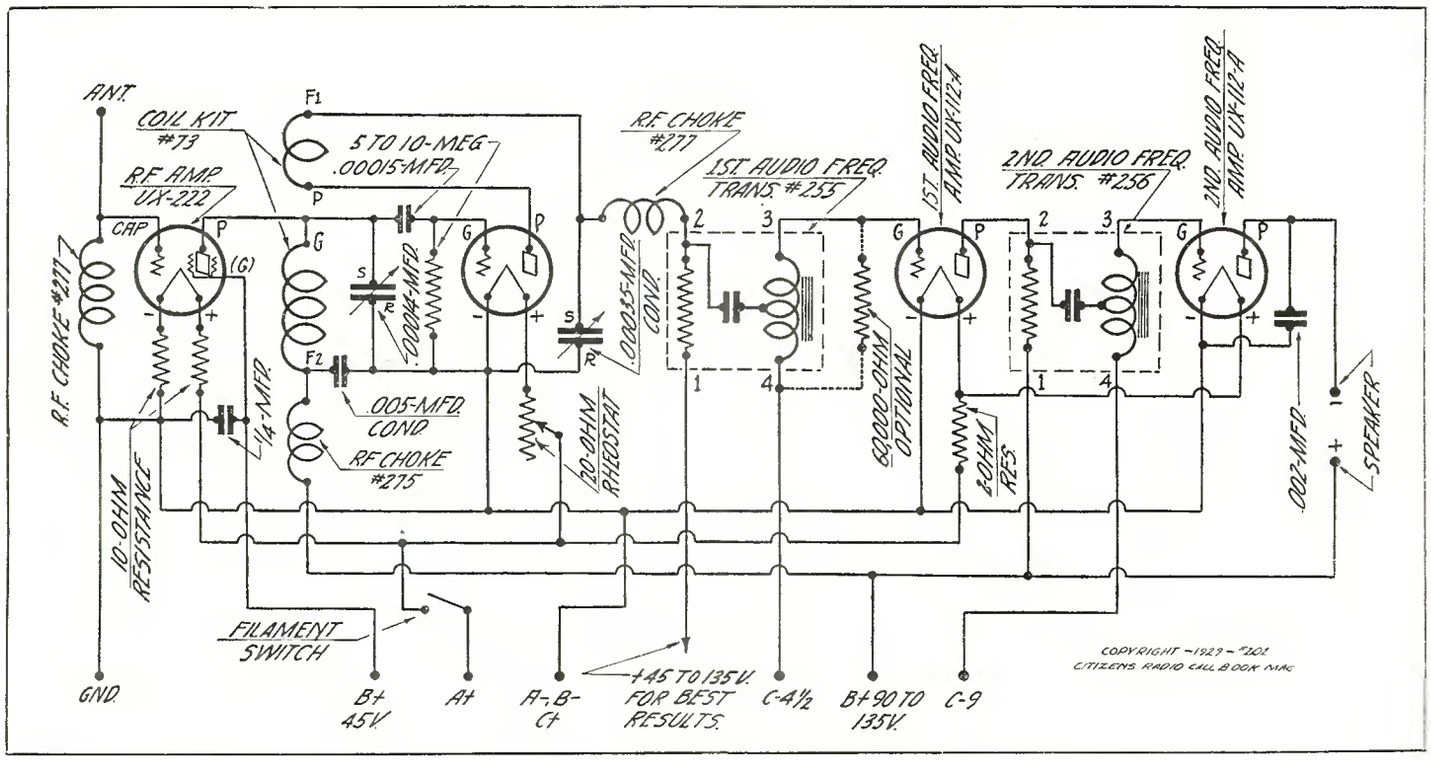


Fig. 3. The schematic circuit involved in the "Round the World Four" is shown in the diagram above

that circuit.

Operation Easy

In operation of the receiver, after all the batteries and other connections have been made, insert the 131-V coil, this being the one with the greatest number of enameled wire turns, turn the rheostat knob so that the arrow points straight up. If operated during the evening, station KDKA on 64 meters will be found somewhere between 20 and 25 degrees on the left dial. Turn the right dial, which is the regenerative one, up from zero until a dull plunk is heard in the speaker and then rotate the left dial about its setting until a sharp squeal is heard. Then adjust both the left and right dials until the squeal becomes music. The adjustment of both dials for best signal strength will be found quite critical and to facilitate tuning the dial reduction ratios may be increased by turning to the right the small nickel button just over each tuning dial knob, which will give the indicator dials a slow movement. Volume may be reduced by tuning down the right dial. A tuning chart which accompanies the 730 and 731 kits, will give an approximate idea of where the receiver is tuned at any dial setting. However, it is probably best for the operator to make up his own tuning chart in accordance with his own particular set.

Blank Forms Available

In addition to the ready made coils available, these being known as the type 131 P. U. V, W, X and Y, Silver-Marshall also are in position to furnish plain moulded bakelite forms, which may be used by the operator in winding his own coils. Each grid coil is started at the top of the form with the end connected to the pin G. Turns are wound in the smooth winding space and the winding ended at the bottom in pin F-2. The tickler or regenerative winding is wound in the slot starting at pin F-1 and ending at pin C. Both coils must be wound in the same direction for regenerative effect. If the regenerative coil is reserved, signals will hardly be heard.

The fifth prong on these coils is not used.

The wavelength range of the coils is as follows:

131-T 17.4 to 32 meters
131-U 31 to 58 meters
131-V 56 to 110 meters
131-W 105 to 204 meters
131-X 190 to 358 meters
131-Y 344 to 647 meters

Official Parts List

Parts required for the construction of the 730 "Round the World Four" are shown in the list below.

1 Silver-Marshall 732 "Round the World" Essential kit
1 Silver-Marshall 734 aluminum shielding cabinet with terminal strip
1 Silver-Marshall 255 first stage a. f. transformer
1 Sliver-Marshall 256 second stage a.f. transformer
3 Silver-Marshall 511 tube sockets
1 Yaxley 20-ohm midget rheostat
1 Yaxley 500 switch attachment
2 Yaxley insulated tip jacks
1 Na-ald 481XS spring socket for detector
1 Polymet .00015 condenser
1 Polymet .002 condenser
1 Polymet .005 condenser

(*Continued on page* 134)

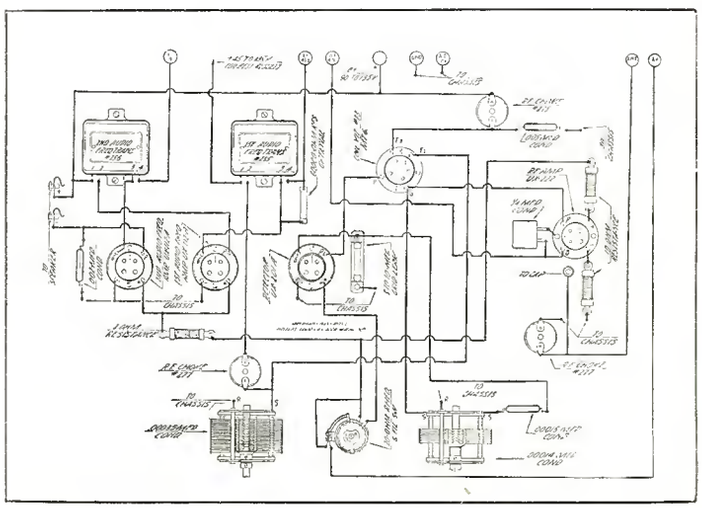


Fig. 4. Those who are not experienced set builders may readily construct the four tube receiver by means of the graphic diagram shown in this sketch

Vee Products Has Six Tube Receiver for Medium Priced Market

Recent Design Using A. C. 22 Tubes Has A, B and C Power Supply on Rear of Receiver Chassis

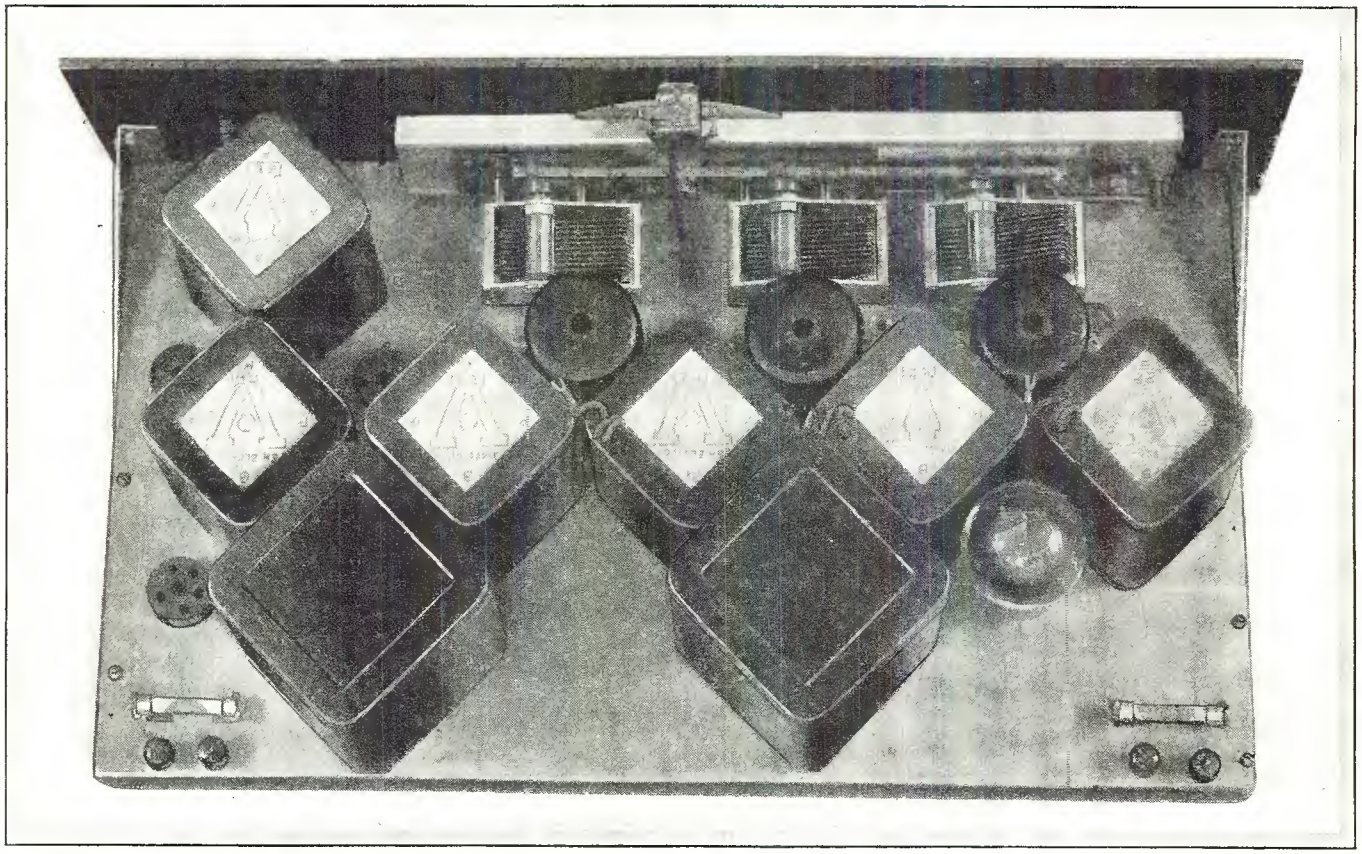


Fig. 1. In above photograph may be seen the rear view of the recently designed Vee Products six tube a. c. screen grid receiver. The five square copper containers in the center of the set are the radio frequency stages and the first audio. The two larger containers at the rear of the sub-panel contain the high voltage power supply and the filter condensers and choke

LOOP OPERATED, using three a. c. screen grid tubes, 227 detector and first audio and the last stage a 171, the receiver shown photographically in Fig. 1 is a recent design of C. J. Victorteen and is being merchandised for the medium priced set market by the Vee Products of Chicago.

Operates From Loop

Heretofore practically the only receivers in which a loop was recommended for operation were the superheterodyne type, but in this instance the designers feel that quite satisfactory results may be secured by the employment of a loop in connection with this six tube receiver. Then again the presence of the loop in the circuit would permit taking advantage of some of the directional properties of a coil antenna, which might not be the case if the receiver were operated from a short length of aerial. This feature should be of some assistance to those who are so located that interference is caused by nearby stations.

Wiring Is Concealed

All of the wiring in the receiver is concealed, which contributes materially to the simplicity in wiring. A new type of rectifying tube, which automatically protects the power pack condenser from overload while the heaters are warming up, is provided in this new design, the tube being supplied with the kit. Single control in the receiver is achieved by means of the patented Vee compensated control unit, which has a rack and pinion arrangement for governing two or more variable condensers from a single knob.

Units Sealed in Cans

Many of the details of the circuit will be apparent on an inspection of the schematic circuit shown in Fig. 3. The Vee loop recommended by the designer goes across the P and B terminals of the first radio frequency unit, 1-L. The inductance shown in the schematic inside of the dotted lines of the first r. f. unit acts as loading inductance and makes possible "center tapped" regeneration with only two wires, also the use of .00035 tuning condenser with .0005 loop. Tuning for this particular circuit is by means of a .00035 mfd variable condenser from the cap of the first tube to the other loop terminal. This stage may be made regenerative by manipulation of the .000035 mfd midget condenser from one of the loop terminals to the plate of the first r. f. stage. The second radio frequency unit known as the 1 r. f. coil is of a special type, the upper inductance being in the plate circuit, with a bypass condenser from its lower extremity to the common ground. The lower section of the

(This receiver tested and all illustrations made in our laboratory)

inductance acts somewhat as an r. f. choke. The plate circuit of the first radio frequency stage feeds capacitatively into the cap of the second r. f. amplifier, with a fixed resistance being placed from the cap terminal down to the common ground. The two inductances, the two condensers and the fixed resistance are contained within the can of the second unit. This particular stage is not tuned in this receiver. The sueceeding stage, which is the third r. f. amplifier, is tuned by the second .00035 mfd condenser, which is ganged together with two others on the rack and pinion Vee control. The primary of the third r. f. unit, called 2 r. f., is the same as the preceding one, although the secondary is different, as will be shown by an examination of that section of the schematic. In series with the cap lead of the secondary, is a fixed resistance, for stabilizing purposes. The fourth r. f. unit, called 3 r. f., is also of a special type and its secondary is tuned by the third .00035 mfd variable eondenser. In this stage a 227 detector is employed, and the detector is made regenerative by means of the .000035 mfd midget condenser between the F terminal of the 3 r. f. unit and the P terminal of the 227 tube. The first and second audio units are of special design, whose characteristics may be learned by referring to that portion of the schematie circuit.

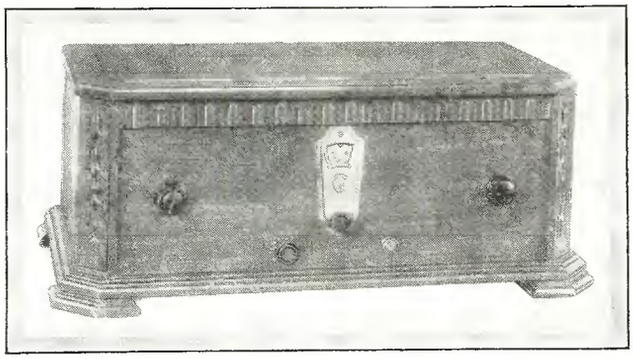


Fig. 2. This photograph shows the front view of the Vee Products receiver, which is a single control job, using a rack and pinion movement in the rear of the center dial in order to turn the three variable condensers across the first and second radio frequency and the detector stages

Set Doubly Regenerative

It will, therefore, be seen that the receiver is doubly regenerative, in that the first r. f. amplifier may be made regenerative and the detector may be regenerative, both of these controls being in the form of midget condensers, one of which is brought out to the front panel, this being the detector regeneration.

The volume control employed in this receiver is a 400 ohm variable resistance between the common cathode terminals of the first and second r. f. and detector and the ground, this control serving to increase or decrease the bias placed on the caps of the three a. c. screen grid tubes. There are only two filament voltages, these being the two .5 volt windings for the filaments of the a. e. 22 and the 227 tubes, and another winding of 5 volts a. c. for the filament of the 171 power tube in the last stage. A special 7.5 volt secondary is provided for the filament of the speeial rectifier shown at the lower portion of the schematic in Fig. 3.

Special Rectifier Tube

A, B and C voltages are supplied by the special rectifier circuit, which is made a part of the chassis, the high voltage transformer, choke and filter condensers being located in the two larger copper containers at the rear of the sub-panel in Fig. 1. The tube at the right rear is the rectifier which is plugged in the socket. The socket at the extreme left is the 227 first audio stage, while the power stage is at the left and nearest the panel.

Only One Voltage

The power unit will be seen to consist of a 110 volt a. c. primary, with a switch in one lead for turning the set on and off, a 2.5 volt winding for the a. c. screen grids and the 227, and a 5 volt winding for the 171 tube. Bias for the 171 grid is secured by the drop aeross the 1500 ohm fixed resistance between the 5 volt center tap and ground. One side of the 2.5 volt seeondary is grounded. The high voltage secondary has one terminal going to the P terminal on the rectifier socket, while the other one goes to the mid-point between two fixed condensers, one condenser then leading to the G terminal of the rectifier and through the choke to the 200 volt line supply, while the other condenser leads through to ground, where it is joined by the main filter condenser between the 200 volt line and the ground. The cathode of the special rectifier tube is common with ground, while the filaments are energized from the 7½ volt secondary previously mentioned. Thus, the rectifier supplies only one main

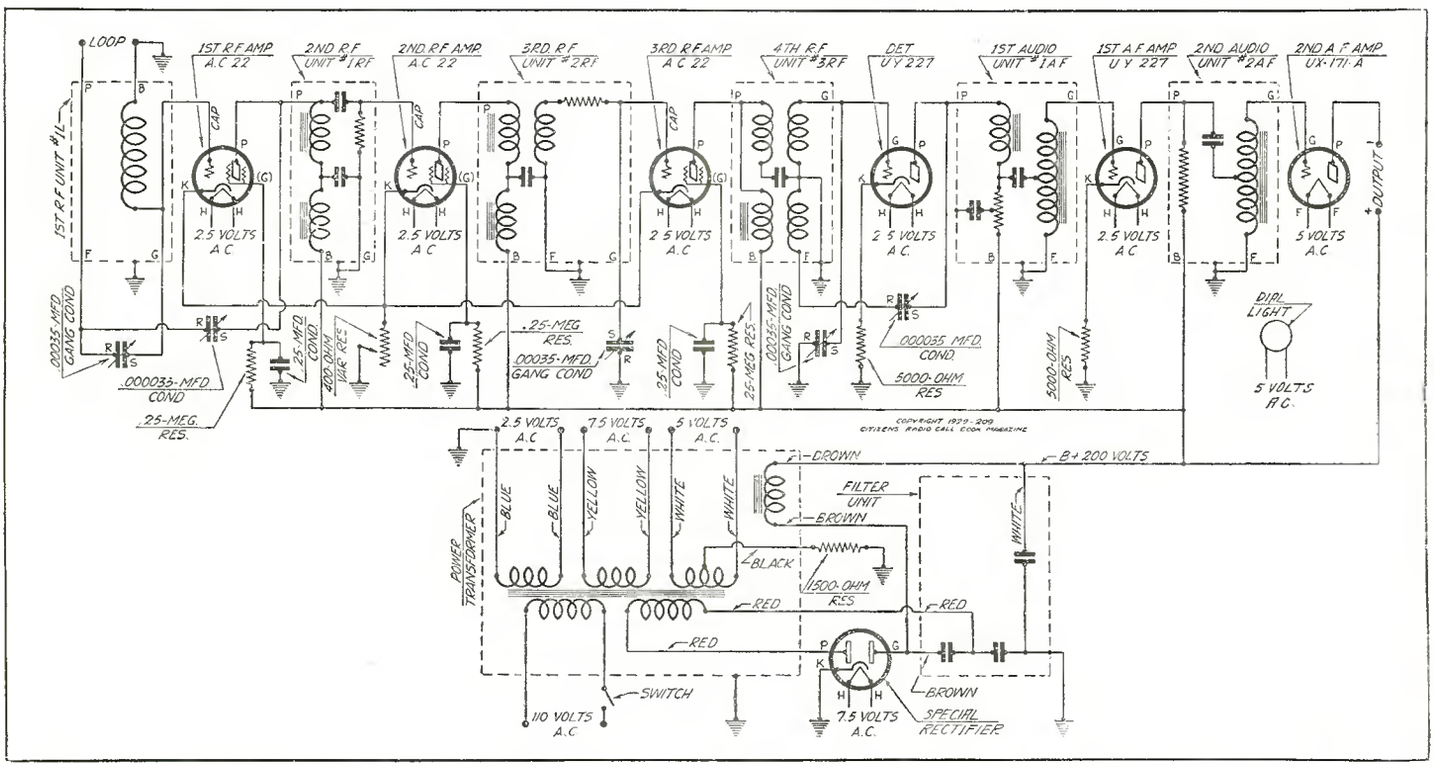


Fig. 3. In the schematic circuit above are shown the electrical details of the receiver described in the accompanying article, together with the diagram of the power supply, which is included on the chassis of the receiver

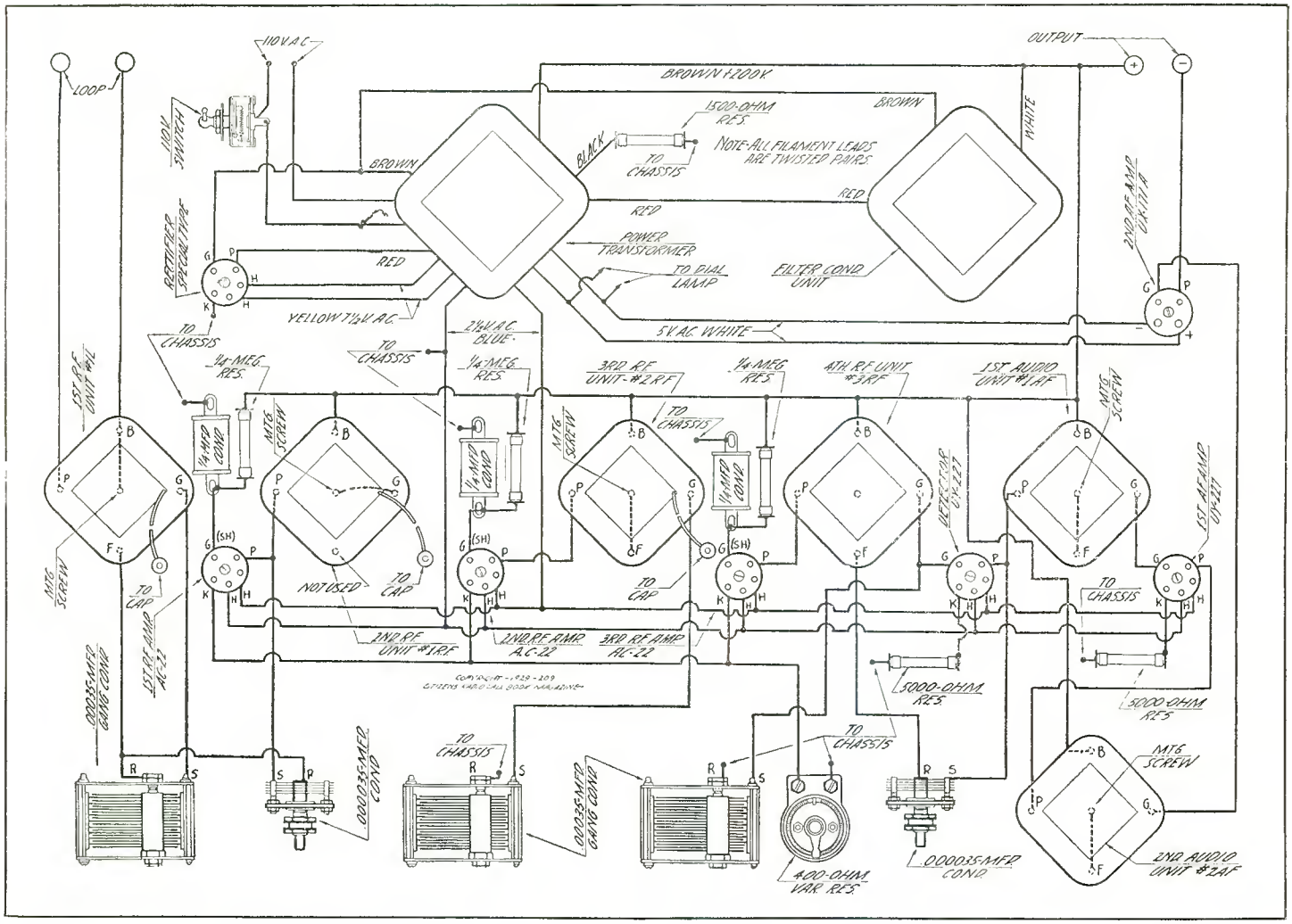


Fig. 4. In wiring up the receiver described in this article, this graphic diagram should be employed by the builder, since it will save him some time in making connections. If there is any doubt as to a connection, it would be a good idea to refer to the schematic circuit shown in Fig. 3 to check up

voltage, which is 200 volts, which potential is applied to all tubes through proper resistances in the first and second audio. A ¼ megohm fixed resistance, properly bypassed to ground with its respective condenser, is placed in each of the screen grid leads of the three a. c. 122 tubes, so as to drop this voltage to the proper value for the operation of the screen grid.

The absence of a resistor network and other items required in a power unit supplying several voltages thus permits production economy, which is seen in the price of the completed job. The dial light is operated from 5 volts a. c., which is the same voltage used on the filament of the 171-A power tube. This power stage gives ample volume for home purposes, and a very nice tone quality.

Everything required for the construction of the receiver is included in the kit, the parts of which are shown in the succeeding paragraphs.

Official Parts List

Parts required for the construction of the receiver described in the above paragraph are shown in the accompanying list, and are supplied by the designer of the receiver:

1 Vee shield coil type 1-L
1 Vee shield coil type 1-RF
1 Vee shield coil type 2-RF
1 Vee shield coil type 3-RF
1 Vee shield coil type 1-AF
1 Vee shield coil type 2-AF
The above units are individually tested and adjusted at the factory.
1 Vee power unit
1 Vee special rectifying tube
1 Vee tuner unit
2 Midget variable condensers
2 R.F. chokes
1 Vee control unit
1 High resistance variable
3 Bypass condensers
6 UY sockets
1 UX socket
3 Tube shields
5 Fixed resistances, cartridge
5 Mountings
1 Metal sub-panel
1 Front panel
4 Binding posts
1 Roll special hook-up wire
1 Rosin core solder
1 Vee coil antenna

Power Supply Parts

Parts required for the power supply and amplifier when used with other circuits, as shown below:

1 Vee power unit
1 Vee special rectifier tube
1 Vee filter unit
2 2 mfd condensers
1 UY socket
1 UX socket
1 Resistance unit
1 Sub-panel
6 Binding posts
Hook-up wire and solder

S-M Double Push-Pull Public Address Amplifier for Theatre Work

Used with Two Electric Turntables and a Dual "Fading" Device It Permits "Cueing" Pictures

PROFESSIONAL set builders in the smaller towns of the country may at times find it profitable to install in the small theaters a means of entertainment to take the place of an existing form of entertainment which may be unsatisfactory.

Record Reproduction

In the accompanying article, we are describing briefly the dual push-pull auditorium amplifier made by Silver-Marshall, which may be used in conjunction with a double electric turntable for providing record reproduction during the course of a picture and for fading out one record and fading in another where it is desired to do any cue work.

Uses Double Turntable

Perhaps the simplest way of mounting up the two turntables is by the method shown in the photograph at the head of this article. A stand is built on the top of which are located the two electric turntables, with the balancer or fading device located between the two. Two electric pick-ups are employed, one for each turntable. The amplifier is located in the bottom portion of the stand and the speakers are energized from the output of the dual push-pull amplifier. As many as four small dynamic speakers may be used, or one or two large auditorium dynamic speakers, if preferred. All speakers must, in every case, be connected to the same pair of lugs on the output choke (see Fig. 4); the question of which of the three pairs to use depends on the speakers themselves and must be settled by trial, the inner pair (5 & 3) being, in general, more likely to accentuate bass notes than the outer pairs. The speakers should be set in a cluster, at the best position found by test on the part of the professional set builder and the representative of the theater.

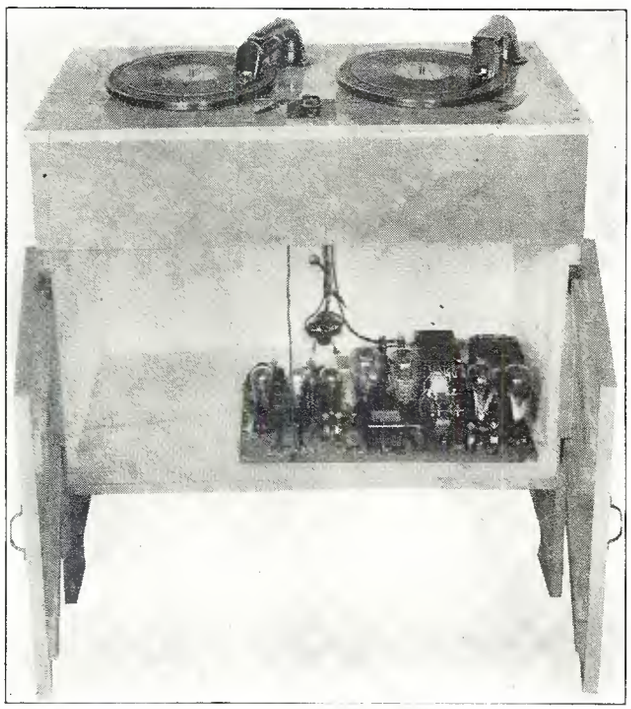


Fig. 1. This photograph shows the rear view of a stand on which has been mounted two electric phonograph turntables. The amplifier is located in the bottom of the stand. By means of the fading device shown at the center between the two tables, it is possible to shift from one record to another without any lapse in the program

Has ABC Supply

The dual push-pull amplifier, whose schematic circuit is shown in Fig. 4, is complete in that it supplies A, B and C voltages for all tubes. Any professional set builder who has any radio experience at all can proceed with this work without encountering any difficulty. This is just another one of the means whereby set builders may be able to produce business that will prove profitable to them.

Official Parts List

Parts required for the construction of the dual push-pull amplifier described in the article above are shown in the list below:

1 Silver-Marshall 328 power transformer
1 Silver-Marshall 247 filament transformer
2 Silver-Marshall 255 first stage transformers
1 Silver-Marshall 257 push-pull input transformer
1 Silver-Marshall 227 push-pull interstage transformer
1 Silver-Marshall 248 Universal output choke (or type 228, if encased model is desired)
6 Silver-Marshall 511 tube sockets
1 Silver-Marshall 512 tube socket
2 Silver-Marshall 659 resistors
1 Potter 673 condenser bank
2 Ohmite 750 ohm resistors
1 Yaxley 2000 ohm grid resistor
2 Frost FT64 center tapped resistors
1 Carter AP15 balancing potentiometer
1 5 foot cord and plug
1 Silver-Marshall 818 hook-up wire (25 feet)
5 Fahnestock clips
1 Silver-Marshall wood chassis, $21\frac{7}{16}$x$9\frac{15}{16}$x$\frac{1}{2}$ inch
1 Set hardware as below
4 8/32 threaded brass rods $3\frac{3}{8}$ inches long
2 8/32x5 inch threaded brass rods
12 8/32 nuts
1 Steel strap 5x$\frac{1}{16}$x3 inch
38 ½ inch No. 6 RH wood screws
4 1 inch No. 6 RH wood screws

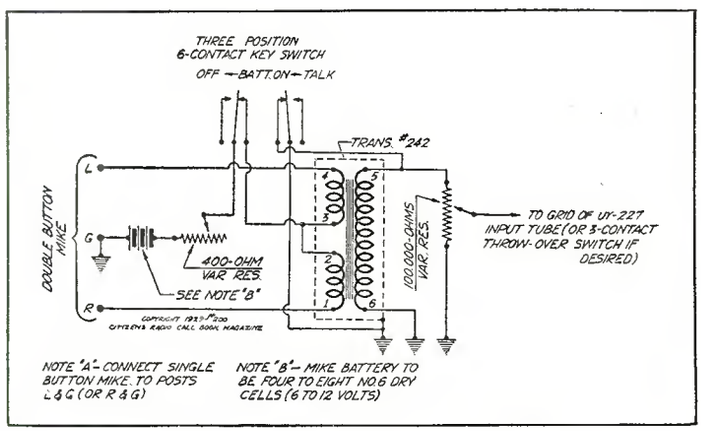


Fig. 2. The schematic circuit shown here shows the method of hooking in a double button microphone if this amplifier is to be used for voice work

(This amplifier tested and all illustrations made in our laboratory)

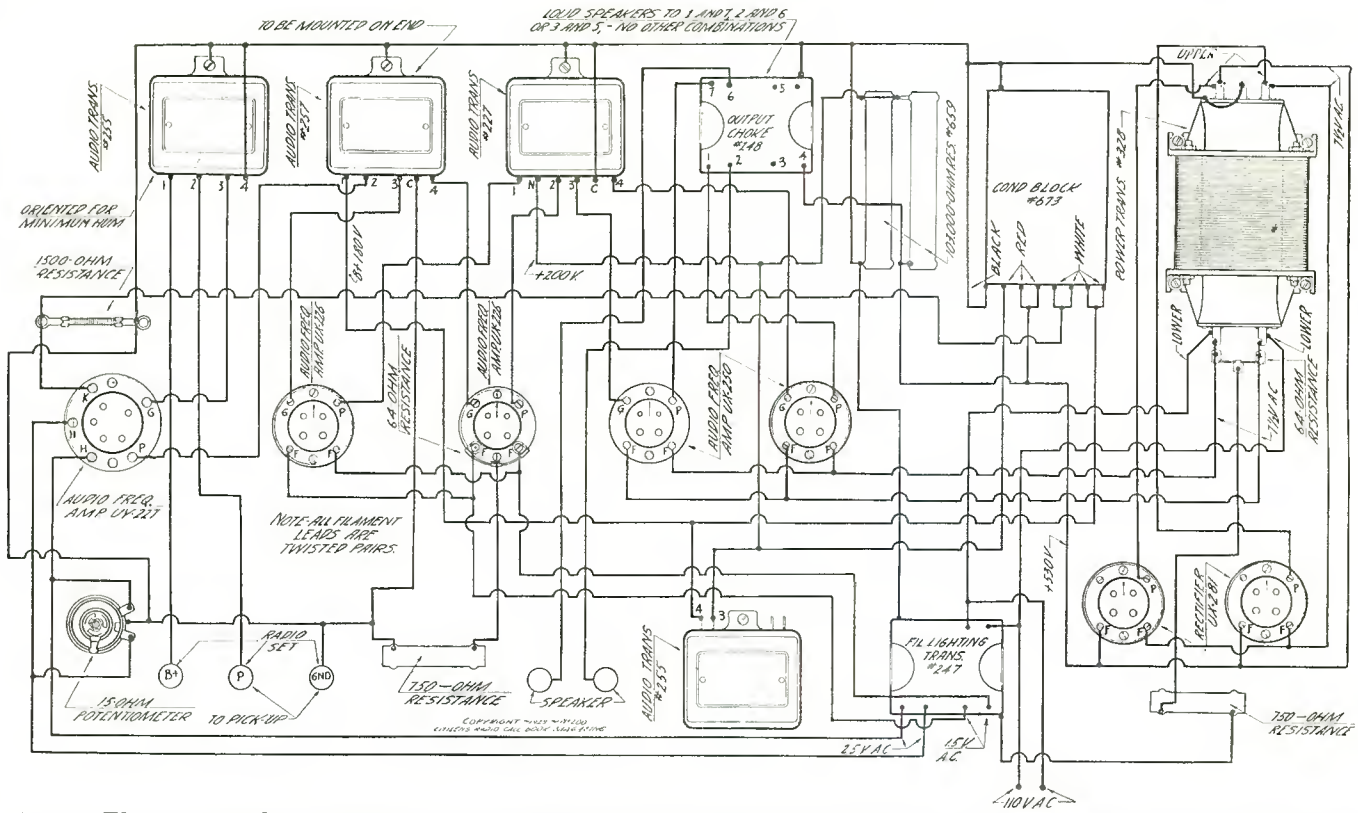


Fig. 3. This is a graphic illustration of a method by which connections may be made in wiring up the dual push-pull amplifier described in this article

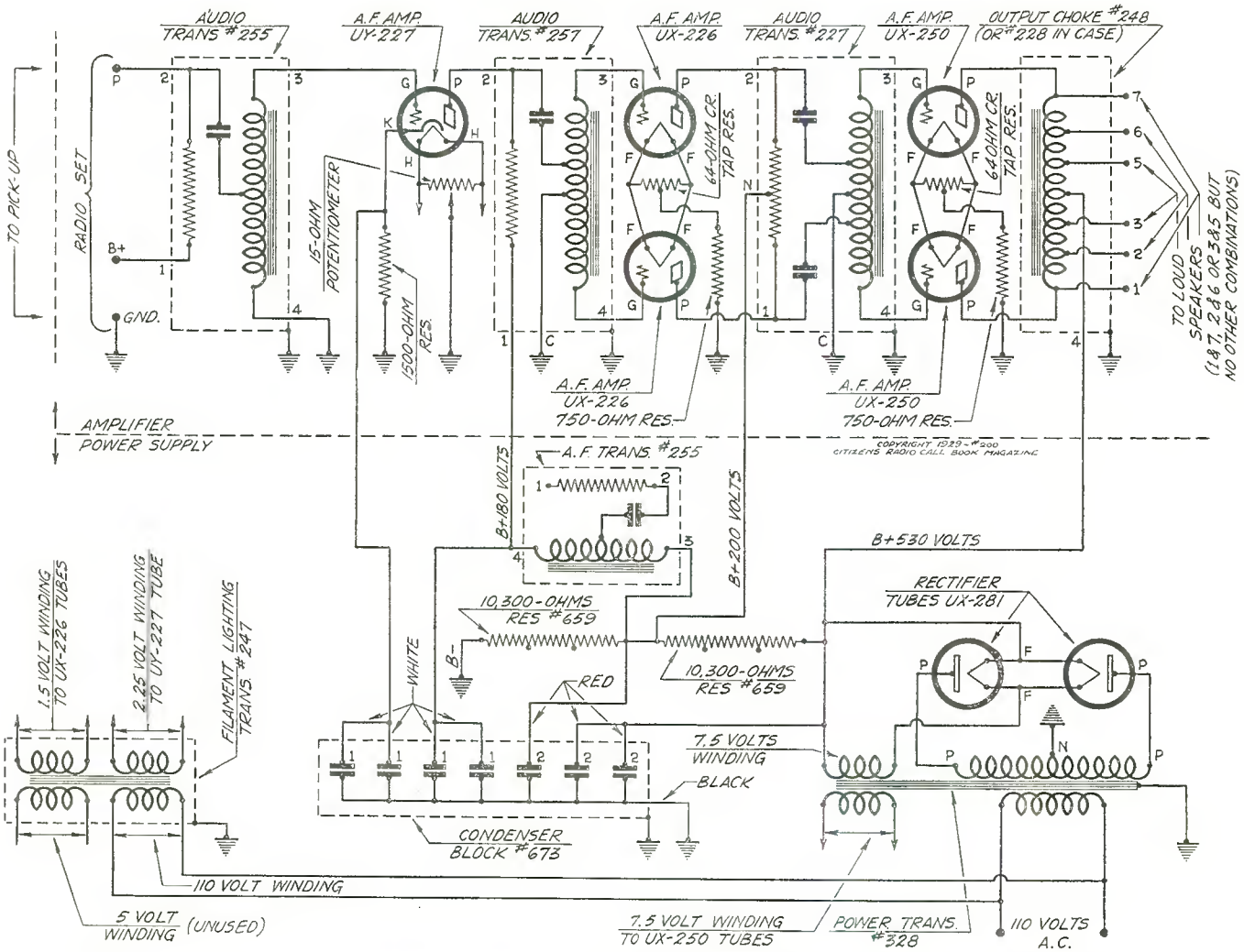


Fig. 4. This schematic diagram represents all of the connections in the dual push-pull amplifier

(Continued on page 120)

A. C. Shield Grid Magnaformer Design Announced for 1929 Season

Popular Super Is Now Made Completely Light Line Operated in Answer to Fan Demand

THE new all-electric Magnaformer 29 a. c. shield grid receiver is the 1929 offering of the Radiart Laboratories and is the successor of the Magnaformer 9-8 described in previous issues of this magazine.

This new receiver is the result of eight months of effort to build a set superior to the Magnaformer 9-8. The new job is 100 per cent shielded and has a complete built-in power unit that is a part of the set itself. The entire set, including power unit and filter condenser, occupies a sub-panel measurement of 11⅝x23 inches.

Two a. c. shield grid 22, five a. c. 227, two 281 rectifiers and one 250 power tube are used. Volume on distant stations is tremendous and the tone quality is practilly the same beautiful result as that from local stations. Power is very simply controlled from the faintest whisper to extreme volume.

The new receiver is controlled from a single dial and has no harmonic repeats. A new Magnaformer coil developed by engineers of the Radiart Laboratories makes the screen grid tubes tune as sharply as the 227's and still retain the amplification factor and sensitivity peculiar to the shield grid tube.

Another feature of the new receiver is the plug-in oscillator coils, one for the long waves and one for short waves. All that is necessary to do to change from one band is to remove one coil and plug in another. The set is designed for loop operation on account of the directional factor of the loop, but if one wants a short aerial, two antenna couplers are available, one for long waves and one for short waves. The set is particularly designed to operate with the new dynamic speakers.

Construction of the receiver is not difficult, because the entire layout has been so arranged that with the punched sub-panel and front panel, there is relatively little work to be done in assembly and mounting the various units in their respective positions. The photograph shown in Fig. 1 gives an idea as to the general layout of the receiver, while the schematic diagram shown in Fig. 2 gives the electrical circuit involved. The graphic diagram shown in Fig. 3 is not so much as a means of wiring but as a means of showing how simple the actual wiring is. However, for better results, it is suggested that the large sized graphic which accompanies the kit be employed, since it is much easier to read than the one shown in Fig. 3.

As shown in the schematic circuit in Fig. 2, it will be seen by readers that the circuit is designed for use with a loop. The reason it is desired to operate the set with a loop is because the input stage tuning may then be kept at a definite value, so that the single control idea may be carried out very successfully. Therefore a center tapped loop is used, the .0005 mfd Remler con-

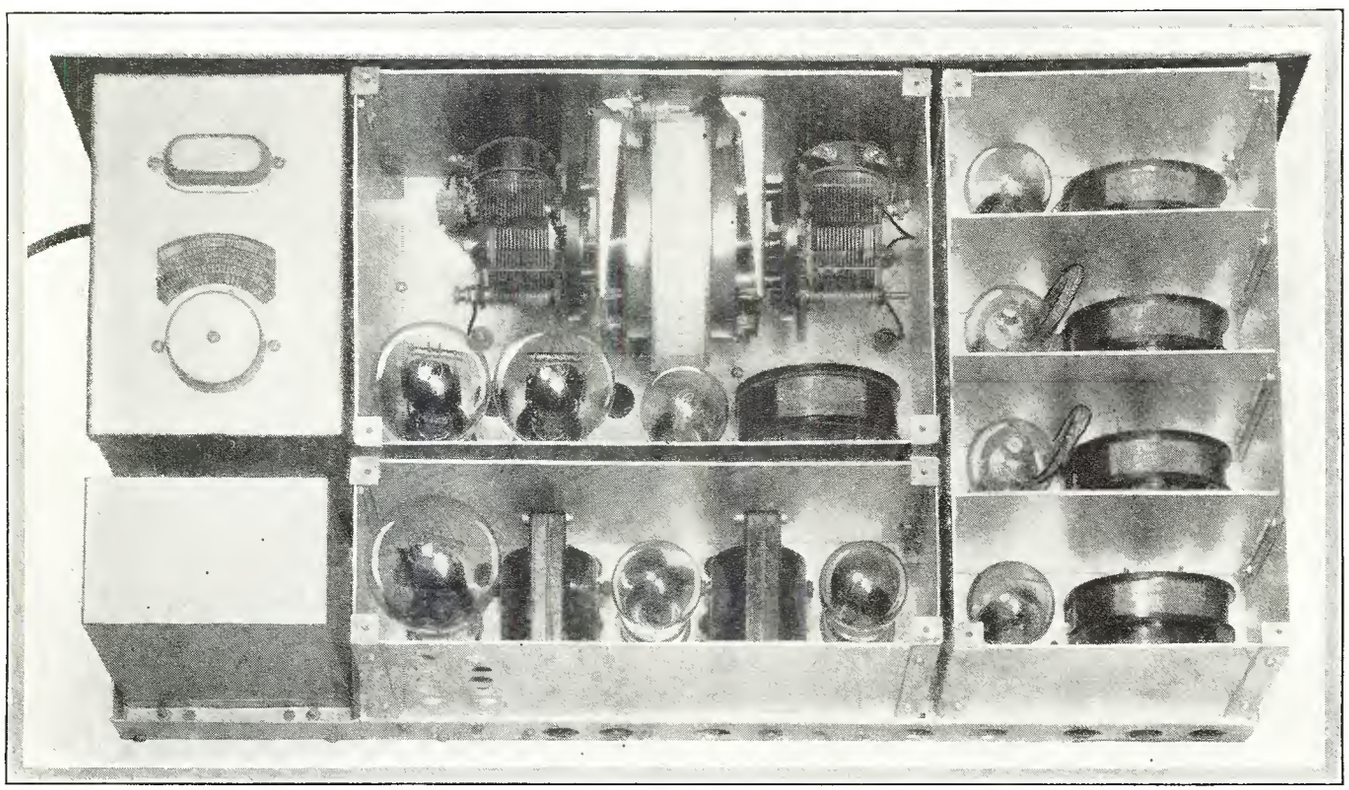


Fig. 1. This photograph shows the top and rear view of the a. c. shield grid Magnaformer as recently designed in answer to the demand of the fans. The A, B and C power supply is that portion of the set at the extreme left. The audio portion is in the center rear section, while the intermediate frequency stages are shown at the right. The receiver is a single control affair, with a balancing arrangement on the input end, so that the set may be tuned to absolute resonance, when desired

(This receiver tested and all illustrations made in our laboratory)

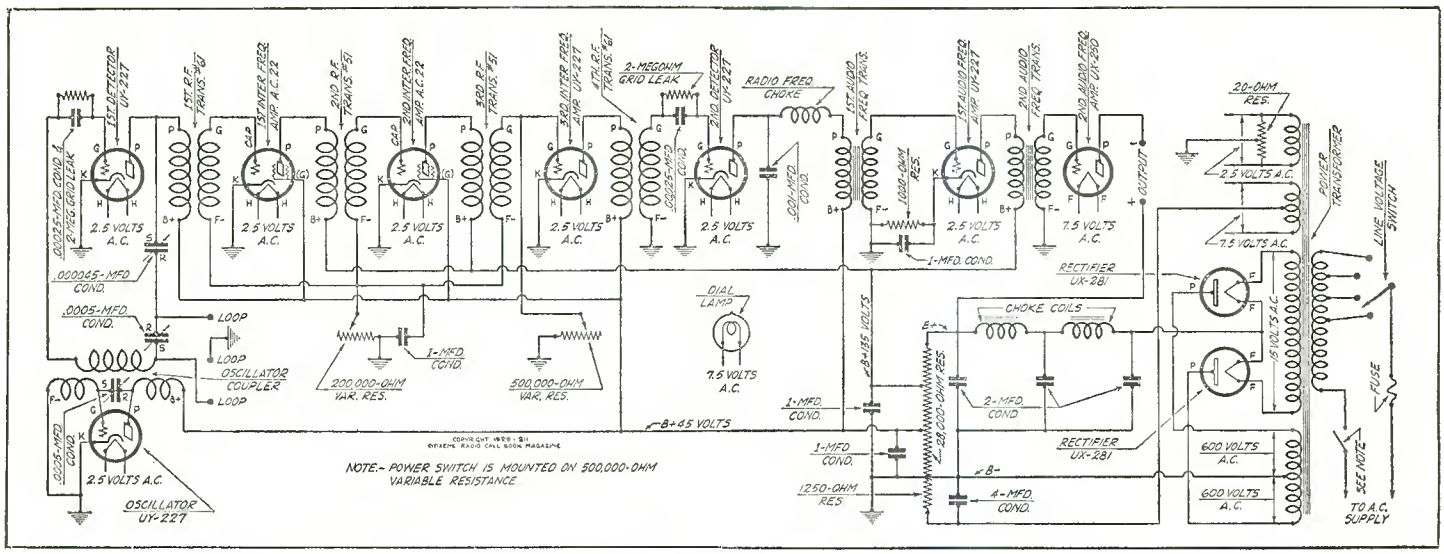


Fig. 2. The schematic circuit of the combined receiver and power amplifier is shown in the diagram above

denser being placed across the extremities of the loop, with a regeneration control of the first detector made possible by the employment of a .000045 mfd midget condenser between one loop terminal and the plate of the first detector, which is a 227 tube. Rectification in the first detector is by means of the .00025 mfd condenser and 2 megohm grid leak. The cathode of the 227 first detector is common with ground. By means of the .000045 mfd regenerative condenser, it is possible to make the first detector circuit quite sensitive to weak signals, although the condenser should not be turned too far, or instability will result due to a semi-regenerative first detector. On account of the location of this particular condenser, it will not be used as a tuning control, but will merely set at a definite value for best results and then left alone.

No Body Capacity

The oscillator in this new design uses a 227 tube, with its cathode common to ground. Tuning is across the grid and plate of the oscillator tube and because of the type of condenser used (Remler) no body capacity may be encountered. Plate voltage for the oscillator circuit is 45, which is also the value placed on the plates of the first detector, first intermediate screen grid, second intermediate screen grid, and the plate circuit of the third intermediate frequency amplifier. The second detector also operates with 45 volts on the plate of the 227. The plate of the first intermediate amplifier, the second intermediate amplifier and the plate of the first audio frequency transformer are supplied a potential of 135 volts, while the 250 tube used in the last stage is given 450 volts, which is the maximum output of the power supply included in the receiver chassis.

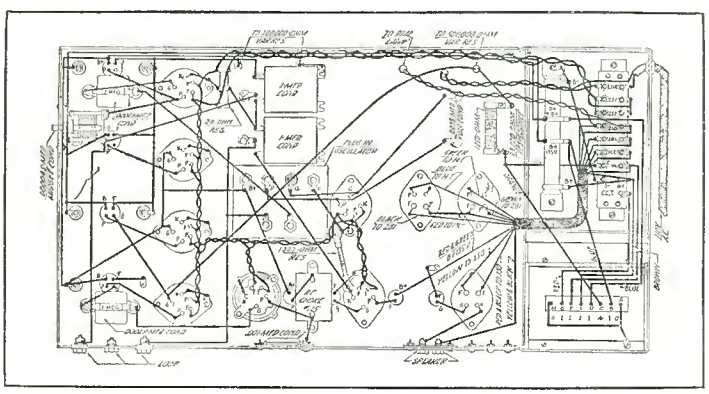


Fig. 3. This graphic diagram is merely shown to give an idea as to the simplicity of the wiring in the receiver itself. In actual wiring it would perhaps be better to follow the full sized graphic which accompanies the kit, since it is much easier to read a diagram of larger dimensions than the present one

Sensitivity and Volume Control

There are two high resistance controls located on the front panel, one being a 200,000 ohm variable in series with the grid return of first, second and third intermediate frequency amplifier stages, where two a. c. 22 tubes and one 227 are used. This variable resistance is located between the grid return and the ground and is bypassed to a 1 mfd condenser. This control governs the input impedance of the two a. c. 22 tubes and the 227 and is used exclusively on distant stations. This control is located at the left of the receiver when facing the front panel. The control at the right is the one shown in the schematic diagram, Fig. 2, as being a special tapered 500,000 ohm variable resistance located directly from the grid of the third intermediate frequency tube, which is a 227, and ground.

Grid Biases Automatic

In the second detector, another .00025 mfd grid condenser and 2 megohm grid leak are used for rectification. The cathode of this 227 tube also goes to ground. A radio frequency choke in series with the plate circuit of the second detector and bypassed by a .001 mfd condenser to ground serves to prevent passage of any stray r. f. current into the primary of the first audio transformer. In the first audio amplifier, a 1000 ohm fixed resistance bypassed with a 1 mfd condenser is located between the F minus terminal of the transformer on the cathode of the tube and there serves as a means of placing the proper bias on the grid of that stage. The bias for the 250 power tube used in the last stage is obtained by the drop across a 1250 ohm fixed resistance, bypassed with a 4 mfd condenser between the common B negative line and the center tap of the 7½ volt a. c. winding for the filaments of the 250 tube.

By examining the schematic circuit shown in Fig. 2, it will also be possible to see the details of the power supply, which is included in the receiver. The primary of the power supply has a tapped arrangement whereby various voltages may be selected from which to operate the unit. For example: if the line voltage is 115, the power supply may be set for that value, or it may be set for any other value of line voltage within the limits of the unit itself. For that reason it is advisable to find out beforehand from the electric light company the exact voltage at the location where the receiver is to be operated, so that the power supply may be set for that value. A break is made in the 110 volt a. c. supply, so as to be controlled from the 500,000 ohm variable resistance, which has a switch contact arranged on it. Thus, when the 500,000 ohm variable resistance is turned all the way to the left, the set is cut off, while to turn on the set, the knob is turned to the right and volume controlled from that point to the extreme right hand travel of the knob. This eliminates the necessity for

(*Continued on Page* 122)

Junior Radio Builder May Get Fun in Making This Simple Set

Many Young Fellows Might Like to Have Their Own Radio Receiver; Here's How It Is Built

AMERICAN boys are representative of the spirit of the times in that they keep abreast of improvements in any of the arts. The telephone, electric light, telegraph, automobile, radio and other factors which accelerate transportation or communication are being constantly seized upon by the younger generation as a means of better keeping in touch with progress in the world.

Boys' Personal Receiver

There is so much entertaining or instructive material broadcast by radio stations at the present time that many boys, who in the past might have been satisfied with some other form of entertainment, are now turning to radio as a means of appeasing their healthy appetites for the brighter things in life. In families where one radio set, generally a large one, is used in the living room for the entertainment of the elders, the boy or young man of the family might wish to have a private set of his own which could be operated in his room with a pair of head phones and by means of which he might seek out the program of his choice, rather than having to listen to those that the family desires. Then, too, there are many families in which the elders are not interested in radio, but the boy of the family because of training received during school hours is more than interested in the learning of the fundamentals of the radio art and perhaps learning to build small receivers, by means of which he can gain experience in set construction.

With the present efficient state of the art, when apparatus has been developed to a high degree of perfection and when prices of material have been brought down to a point where they are now within the reach of almost every individual, it is a simple enough matter to build a small receiver for personal entertainment purposes that will yield a maximum in entertainment or instruction, and at the same time not be a severe drain upon the pocketbook of the builder.

Built In Two Parts

In designing this small receiver shown in this article, it was the intention of the technicians in our laboratory to create a small set which might be started as a single stage of tuned radio frequency and a regenerative detector, and then later by the addition of two stages of audio, the receiver could be brought up to a point where it would entertain more than one individual. Thus, the receiver might be called a two-step affair. The first step is illustrated and described in this article, and the second step, which consists of the addition of the audio frequency amplifier stages, will be shown in the forthcoming issue of this magazine. For that reason, the baseboard shown in the photograph, Fig. 1, has been purposely made large, so that the parts for the entire receiver may be easily laid out on this baseboard, but in the present case only the first and second tubes are placed thereon. In the forthcoming issue, there will be two more tubes and two audio transformers on the baseboard. The radio frequency and

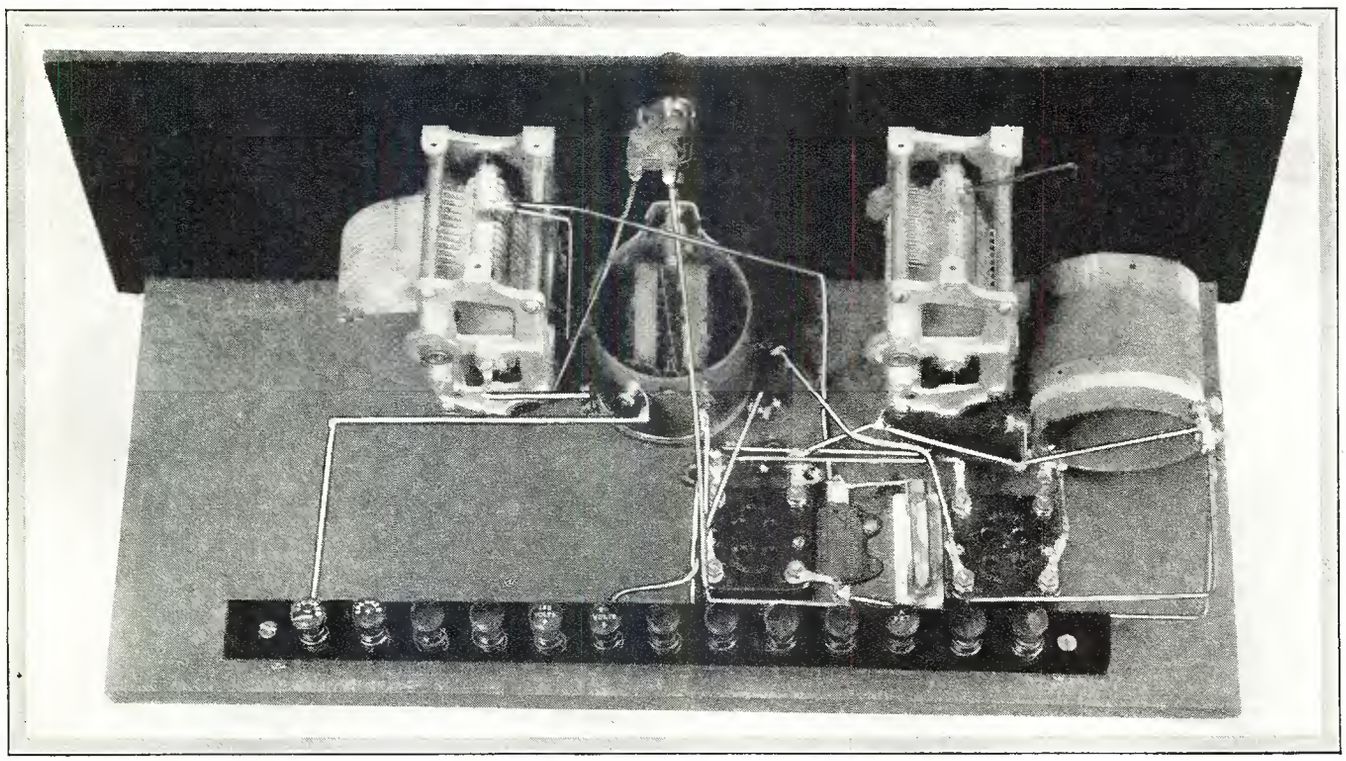


Fig. 1. The photograph above shows the simplicity of the small receiver containing one stage of radio and a regenerative detector. The baseboard is made large on purpose for the two stages of audio which are to follow in the next number of this magazine

(This receiver designed, tested and all illustrations made in our laboratory)

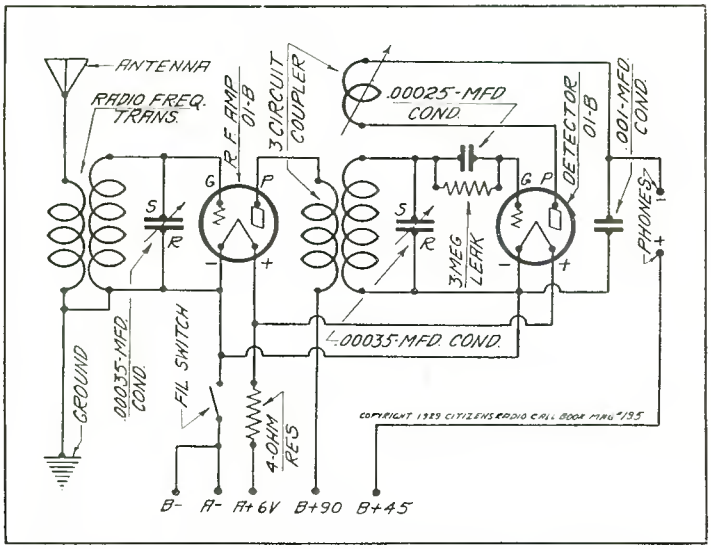


Fig. 2. The schematic circuit involved in the simple receiver is shown above and may be followed in wiring work by those who are accustomed to this type of a diagram. Inexperienced builders should construct their receiver from the graphic illustration shown in Fig. 4

detector stages will not be changed in the succeeding article, since this portion of the receiver is standard.

Therefore, in securing a front panel, for the receiver, a panel size is utilized which will cover both the first and second steps in the construction of the set without any necessity for throwing away any portion of it. The same thing applies to the binding post strip which is shown in the photograph, Fig. 1. All of the binding posts on this strip are not used in the present receiver, although when the second step is illustrated in the forthcoming issue, each one of the binding posts will terminate at a definite position and all be used.

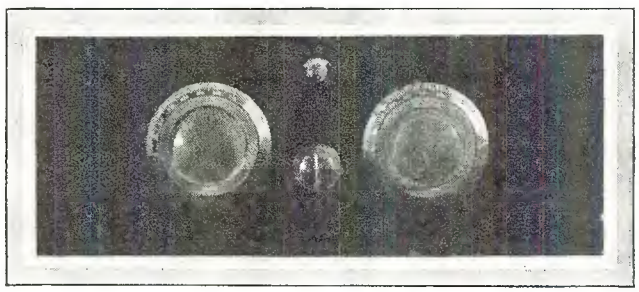


Fig. 3. There are two major controls and one refining control shown in the front of the simple receiver described herein. The left-hand dial governs the wavelength of the r. f. circuit, while the right dial covers the wavelength of the detector circuit. Regeneration is accomplished by rotating the variable plate coil, the knob of which is located at the center of the panel. The filament switch is placed at the top and in the center

As shown in the list of parts, which appears at the end of this article, the front panel will be seen to be a Formica 7x18x3/16 inch black panel. The baseboard is a wooden one 7x17x⅝ inch. By referring to the photograph shown in Fig. 3, it will be seen that the two condensers are placed on the front panel so as to be more or less centrally located, with the mounting of the regenerative coupler being located at the exact center. The filament switch is also located at the middle of the panel, but at the top. A better idea of this may be secured by looking at the photograph shown in Fig. 1. The only holes in the front panel beside the condenser, inductance and switch holes are for three holding screws, which go between the lower part of the front panel and the baseboard. These screws serve to hold the front panel and the baseboard together.

After the condensers, inductance and switch have been located, the front panel may be affixed to the baseboard and then the binding post strip should be constructed. This binding post strip is a piece of Formica 1x13x3/16 inch and has thirteen holes made in it for the same number of X-L binding posts. These are the bakelite top push post type. Soldering lugs should be placed under each binding post at the bottom of the strip before the screw is run up. Because of this, all of the binding posts may be affixed to the strip at one time and then the strip itself screwed down to the baseboard. When connections are made to the binding post strip, the connection itself is made to the soldering lug without having to disturb the post itself. The two sockets are screwed down to the baseboard. When doing this part of the work, it would be well to follow somewhat the idea shown in the graphic diagram, No. 4. The grid condenser and the mounting for the leak are located between the two sockets. These should be preferably placed as close to the grid of the second socket as possible. The .001 mfd bypass condenser, which in the schematic is shown as being across the bottom end of the regenerative winding and the negative filament, may be located on the baseboard in almost any position as long as it does not appear to the left of the socket located at the center in the photograph, Fig. 1. If by chance the condenser is put in that position, then when the two stages of audio are added, it is likely that the bypass condenser would be in the way.

How to Wire It

After all of the parts have been laid out on the baseboard and the builder is ready to wire, the graphic diagram shown in Fig. 4 should be very carefully studied. It will be noted that between the antenna binding post and one terminal of the radio frequency transformer a wire is run. Then another wire goes from the ground binding post to the second terminal of the radio frequency terminal of the radio frequency transformer and to the grid return of the secondary, the rotor of the tuning condenser at the left in Fig. 4, to one side of the .001 mfd to the negative terminal of both of the tube sockets, to the rotor of the second condenser shown at the right in Fig. 4, to one terminal of the middle inductance, which is the grid return of the secondary and then through the filament switch to the two binding posts represented as being B negative and A negative, these two binding posts being tied together with a jumper.

The grid terminal of the first tube goes to the last terminal of the radio frequency transformer and to the stator of the left-hand condenser shown in Fig. 4. Be sure to connect the stator of this condenser to the grid of the first tube because otherwise body capacity might result. The plate circuit of the first tube socket is connected to one of the terminals of the middle inductance, the other one being connected to the B plus 90 binding post on the strip. The grid circuit of the second tube is connected with a piece of wire

(*Continued on Page* 124)

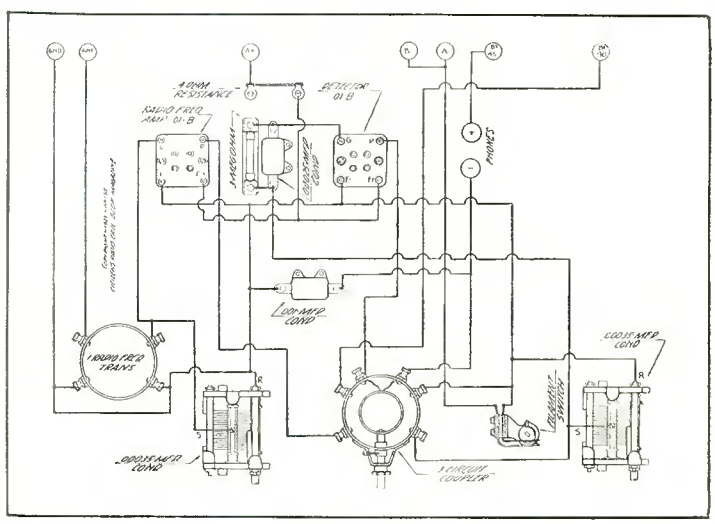
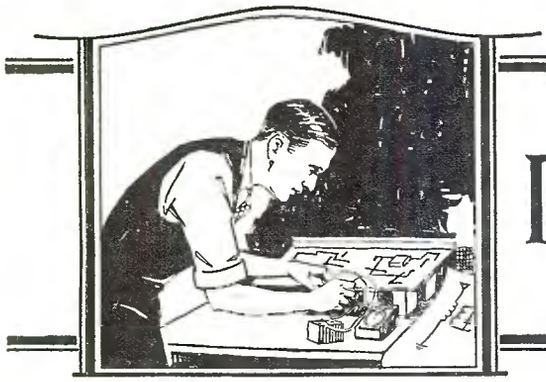


Fig. 4. Even a beginner in radio may wire up the small receiver described in this article, by following the simple directions shown in this graphic diagram. By consulting this diagram and the photograph shown in Fig. 1, it is easy to see how the set may be put together and wired. The forthcoming issue of this magazine will contain an article describing how the two stages of audio are placed in the receiver



With the PROFESSIONAL SET BUILDER

SINCE the publication in the September issue of this magazine, page 83, of an article concerning the construction of an ohmeter, we have had several requests from our readers as to whether the range of this meter could be increased to include megohms.

This could not be done without considerable alteration and an extremely expensive operation at that. It was originally our desire to run another article covering construction of a megohmeter for those who might have use for such an instrument. However, going over the subject with the technicians in the laboratory, it was discovered that one of the chief drawbacks of such instrument is the extreme cost of meter for use in such a circuit. This meter would cost around $25.00 and the question occurred to the Editorial Department as to whether our set builders would care to go to that expense in building up such a test device.

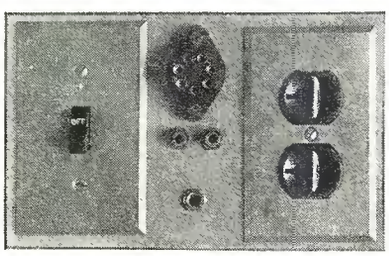
We shall be glad to hear from our set builders as to whether they would be interested enough in building up such a device, if we give them the constructional data. Frankly, the use of such a device is quite limited in that it may be only used for the measurement of circuits involving a resistance of a million ohms or more. The ohmeter shown in the September issue, however, has quite a number of uses in power supply work, audio transformers, resistances of most all types, and for general, all-around purposes, whereas the megohmeter would have but limited use. However, if a sufficient number of professional set builders desire that we construct the apparatus, we shall be glad to do so in a forthcoming number, provided these set builders will give us their opinions on the subject.

Dynamic Input Transformers

INPUT transformers used for dynamic speakers are not the same as the type used for other speakers. Any of the magnetic type speakers used on a dynamic input speaker will sound distorted. While it is usually customary for the input transformers for dynamics to be included in the speaker housing, nevertheless there are cases where these input transformers are available on the open market and these should always be used only with a dynamic speaker.

Handy Work Bench Unit

IN our November issue, in this department, was described a handy unit for the work-bench suggested by O. H. Schmidt. At the time we were not able to secure a photograph of the unit in question, but in this section of this issue we are showing the general idea photographically in the picture reproduced herewith.



Shifting Antenna Load

WHEN using double or triple section condensers and one section is across the grid circuit of the antenna stage, it is generally considered good practice to remove about five turns of wire from the grid coil and employ a .000025 mfd midget condenser on the front panel to bring the antenna stage in resonance with the succeeding one or two tuned stages.

This procedure is usually considered necessary in order to allow the operator to shift the antenna load to compensate for varying aerial lengths. Of course, when the antenna stage is tuned by a single condenser and the succeeding stages are tuned by a gang condenser, the method referred to previously is not required, since the single antenna stage will allow placing of that stage in exact resonance with succeeding ones.

Home Made Portable Tester

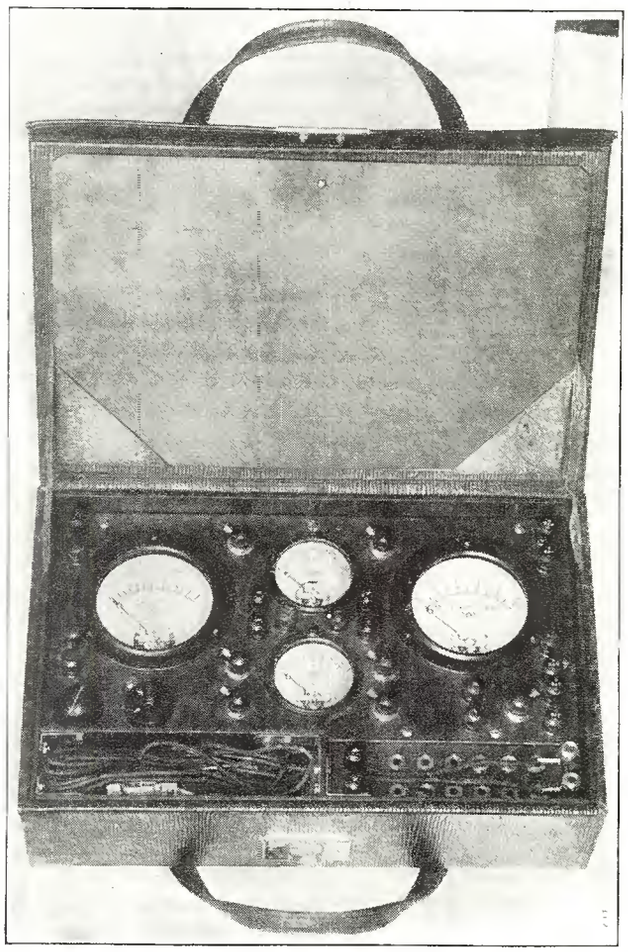


Fig. 3. An enterprising Chicago set builder named Lynn Sherk, 5901 Race Ave., finding the need for a portable set tester constructed one as shown in the photograph above. The vanity case in which the tester is housed was secured at a department store at a nominal cost

D. C. "A" Eliminator

THERE are many occasions where individuals residing in districts supplied with direct current may have been hard put to find an eliminator from which the filaments of their radio sets might be operated. This is particularly true since they do not desire to use a storage battery. In the accompanying

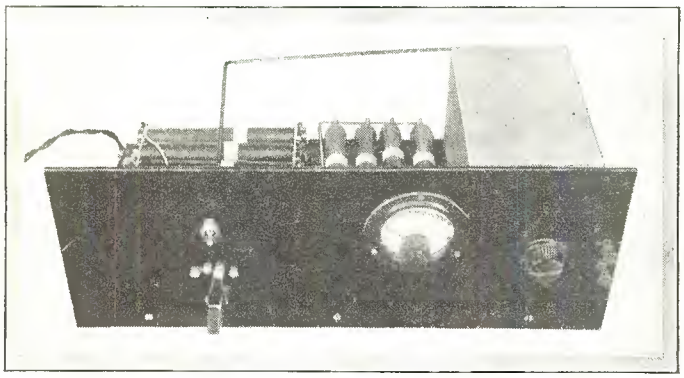


Fig. 1. This photograph shows the front and top views of the 110 volt line A eliminator recently designed in our laboratory for those who live in direct current districts. This switch on the front panel cuts in or out resistance sections for increasing or decreasing the current available. A voltmeter is supplied on the front panel in order to keep the operator advised of the voltage obtained at the time

article is described a simple A eliminator for 110 volt d. c. circuits. It is shown pictorially in Fig. 1 and schematically in Fig. 2.

The eliminator consists of a Tobe A filter, a Weston O-10 d. c. voltmeter, 16 fixed resistances made by Ohmite, a switch and four switch points, a power switch, and a three or six ohm rheostat which will handle 20 watts at 6 volts without heating.

In the resistance network there are 16 fixed resistances, each of these being 70 ohms apiece. They are in sets of four in parallel, and each four sets in turn are in series. Looking at the schematic circuit shown in Fig. 2, resistors R-4, 5, 12 and 13 should handle 100 watts. Resistors R-3, 6, 11 and 14 should also be able to handle 100 watts. Resistors R-2, 7, 10 and 15 should handle 75 watts, while resistors R-1, 8, 9 and 16 should be of the 50 watt capacity. In the original model which was built up in our laboratory, 25, 50 and 75 watts was the rating of the resistors, but on test it was determined that they got too warm and as a consequence the higher power rating was required.

On account of the heating, it is suggested that the entire unit

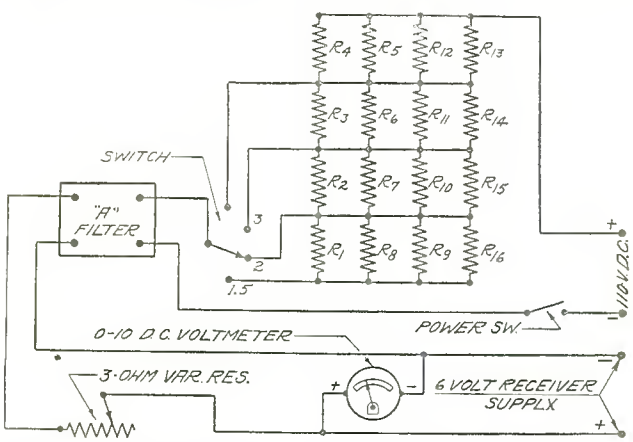


Fig. 2. The schematic circuit used in the d. c. A eliminator is shown in the above diagram. Resistance values from R-1 to R-16 are given in the text accompanying this description

be mounted on transite board, so as to lessen the fire danger. While a 3 ohm rheostat is shown in the schematic circuit, nevertheless it would probably be better to use a 6 ohm provided one can be found which will pass 20 watts at 6 volts without any difficulty. With such an arrangement each of the four taps would overlap each other, which would give a control from 1½ to 3 amperes without any spaces between. The schematic shows that on the first tap 1.5 amperes is available, the second tap 2 amperes and the third tap 3 amperes. The d. c. voltmeter must be placed across the output of the filter after it has gone through the variable resistance, so that it gives an indication of what is actually being supplied the receiver. As a precautionary measure the power switch is the one which should be used to break the circuit, rather than the switch on the receiver because if the receiver switch is turned off the load disappears and the voltage across the meter will be high enough to burn out the meter. For that reason the power switch has been provided in this design.

Above all be certain that the ground binding post of the receiver does not go directly to ground but through a ½ or 1 mfd, as one side of the 110 volt line is grounded and the receiver being grounded too would cause a short circuit.

While the unit works quite satisfactorily in handling any special receiver, nevertheless it operates better when used for one definite value of current rather than a variable device. It is not as good a testing medium for receivers as a battery, due to the presence of commutator ripple which might be bothersome when actually testing receivers, and which at the same time might not be noticed on broadcast reception in the home.

Term TU Defined

WITH the frequent appearance of the word "transmission unit" in literature covering radio subjects, many of our professional set builders have been a little curious as to the exact meaning of the term transmission unit. Accordingly we are giving a brief statement as to the definition of the term and also the means by which it is derived.

A transmission unit (t u) is an expression symbolizing the power ratio of a circuit.

Used originally by the wire communication companies, the term t. u. is now universally used in the radio industry to denote gain or degree of amplification in amplifiers, the loss in any type transmission circuit, or for comparing the strength of two signals.

The input and output circuits of any circuit bear a definite relation to each other, this being known as the power ratio. This power ratio is expressed in transmission units by making use of the following relation:

$$N = 10 \log \frac{P2}{P1}$$

N is the number of transmission units, which is equal to ten times the logarithm (to the base ten) of the power ratio. In this relation, P2 is the output measured in milliwatts and P1 is the input measured in milliwatts.

In measuring any circuit where the output exceeds the input, the gain is shown as a gain in transmission unit, or where the input exceeds the output, the loss is represented as a loss in transmission units.

The use of the word "transmission unit" is particularly applicable to description of the gain to be secured from a public address system and it will be noted in a recent article covering Silver-Marshall's public address system what the word "transmission unit" is used quite frequently.

Novel Mounting Wrinkle

MOUNTING midget condensers in a tight place, or on a sub-panel, where there is very little room afforded, is quite a problem. One of our set builders observes that the Hammarlund midget is threaded at one end of the condenser stator post, so as to permit the condenser being mounted vertically on top of the sub-panel, if not sufficient room is afforded beneath. While it is not often that one must depend on this style of mounting, nevertheless it is well to know that this method of placing the condenser may be resorted to in a pinch.

Causes of Oscillation

MANY professional set builders have on occasions been called upon to service a tuned radio frequency receiver in which one of the radio frequency stages is oscillating. Quite frequently the location of the cause of oscillation in a tuned radio frequency set may not be as easy as it appears, although if a little thought is given to the subject and considerable patience is expended, the cause will eventually be found and the remedy applied.

In the ensuing paragraph we are going to attempt to give as large a number of causes for oscillation as it is possible to mention briefly. There are four principal causes of oscillation in any r. f. amplifier circuit. These causes are:

1. Magnetic field coupling
2. Conductive coupling
3. Capacitative coupling
4. Magnetic loop

Under the classification of magnetic field coupling, there are three possible causes of trouble. The first is that the radio frequency inductances may be placed too close too each other. The second is that unshielded audio frequency transformers and the r. f. inductances may be too close to each other. The third is that the radio frequency coils may be located in an incorrect inductive relation or position.

Conductive coupling may give rise to two possible causes, the first of which is that in a. c. receivers the r. f. and a. f. filament supply is secured from the same filament secondary instead of an individual secondary being provided for the r. f. and another for the a. f. supply. The second possible cause is that insufficient bypass capacity is placed across the grid biasing resistance in an a. c. set.

In considering capacitative coupling, there are three possible causes of trouble, the first two of which are closely related. For example: the condenser and coil may be too close together, giving rise to an electrostatic coupling condition, which is after all a capacitative coupling. The same applies in the second case, where condensers may be located too close together. The third possible cause under capacitative coupling is that the grid and plate leads may be located too close to each other. As a rule a distance of 1½ inches or 2 inches between these leads will prevent trouble, or at least the difference between them should be the distance that the grid and plate occupy on a socket. This is around 2 inches.

Under the heading of magnetic loop there are a number of possible sources of trouble. For example, the grid wires may be located in a field set up by the A negative and B positive wires. Or the grid wires may be located in a field set up by the A negative and A positive wires. Also plate wires in the field of A and B positive, or A negative and A positive will give trouble. Another possible cause of trouble is that coils may be located between the loops mentioned in the foregoing paragraph, or that condensers are likewise located between the loops previously mentioned.

In addition to the four general causes noted in the preceding paragraphs, there are a number of related causes which usually indicate that one of the four conditions mentioned above exists. However, it is a rather difficult task to draw a fine line of distinction between direct causes and indirect causes, so in the following list the causes given are related regardless of whether they are direct or indirect. These secondary causes are as follows:

A. Too high plate voltage
B. Too many turns in plate coils
C. Filament voltage too high
D. Insufficient antenna load
E. Insufficient bypass condenser across the battery end of a plate coil
F. Too low grid bias on tubes
G. Poorly evacuated tubes
H. Unbalanced section of gang condenser
I. Unmatched coils used in tuning circuit
J. Screen grid voltage too low
K. Coupling between primary and secondary too close
L. In neutralized sets, the neutralization of the set may be out, or unbalanced
M. Poor or leaky shielding
N. Shielding not grounded
O. Poor or no ground connection

As previously stated, one of the prime requisites in searching for trouble in any circuit is patience. Even in the absence of a great degree of understanding of the circuit, nevertheless if the service man will persist in his search for the trouble, and make such search in an orderly manner, he will eventually locate the cause by a process of elimination. Usually it is best to start out with A, B, C circuits, then the coils, then the tubes, then the wiring, etc. Before all possibilities have been exhausted, the cause will undoubtedly be found.

Ask Us an Easy One

ASKING a question is the easiest thing in the world and the hardest thing in the world is to answer it, especially when the question is: "Which is the best set you have ever tried?"

Quite frequently our readers will write us seeking an answer to the question noted above. They are undoubtedly sincere in their desire to know which is the best set that has ever been tested in our laboratory. However, such a question is impossible to answer, simply because there is no definite standard of what constitutes the best. There is no best radio set any more than there is a best coffee, best chewing gum, best automobile or any other object. No two engineers or even individuals will agree on a single radio receiver. Obviously if everybody agreed on one thing, there would be only one set, but the very fact that there are hundreds is evidence that likes and dislikes are different with each individual.

Another question which is frequently asked is: "How does set A compare with set B?" This is another poser. No comparative test would be worth the paper it is written on unless the two receivers were tested within a second of each other under duplicate conditions regarding A, B and C supplies, tubes, antenna and ground, wavelengths of the station being listened to, duplicate speakers and all conditions of the test being exactly alike. Even assuming that such a test were made with receivers A and B and it was determined that receiver B was the best of the two, there is no indication that this receiver would, on actual working conditions with the purchaser, merit its selection as the best of the two.

It is, therefore, easy to see why no comparative test between two receivers could be made. The personal experience of every experimenter or set builder with a particular receiver is the best guide as to which set should receive his continued patronage.

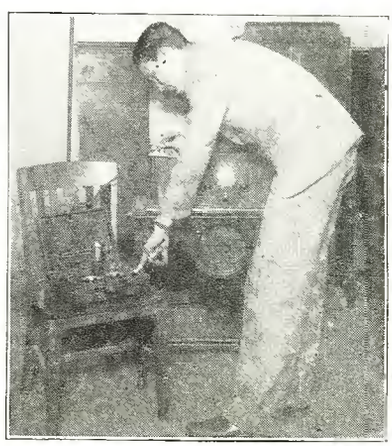
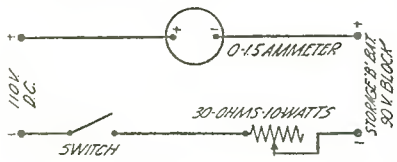


Fig. 4. Here we see a service man diagnosing trouble in a radio set by means of a test outfit of the portable type, aptly called a little "box of tricks." The set tester illustrated in this photograph is one of the kind made by the Jewell Electrical Instrument Co. of Chicago

IN the simple schematic circuit shown herewith is a method whereby a 90 volt storage B battery may be charged from a 110 volt direct current source. All that is required is a 30 ohm rheostat with a rating of 10 watts, a switch and a 0-1.5 ammeter. These parts are arranged as shown in the schematic. Before the B battery is placed on charge, make sure that all of the resistance in the rheostat is in so that charging will be at a minimum rate.



The method shown will enable one to charge B battery units from a 110 volt d. c. source. If it is desired to charge other than 90 volt blocks, that is, for example, a 45 volt block of wet battery, it is necessary to double the resistance value shown in the schematic. Thus for 90 volt blocks the value is 30 ohms and for 45 volt blocks the value would be 60 ohms. Charging current will be greatest at the time that the battery is started on its charge and will be least at the time when the charge is completed. The charging rate at all times may be read directly from the ammeter, which is always in the circuit.

Status of Set Builder

ONE or two professional set builders have written in to this department to determine their legal status as regards the construction and sale of kit receivers.

Judging from conditions in the past and viewing the matter from the standpoint of the professional set builder, it does not appear that the custom builder of radio sets will ever be bothered, principally because of the fact that such a step would involve thousands of individual suits, each one of them expensive, and scattered all over the country. Then again there is the attitude taken that the manufacturer of the kit must bear the burden for their merchandising and sale.

So far we have not heard of any one ever being molested and until such an occasion does arise, it is probably the best policy to keep on working and not worry about the future.

UNDOUBTEDLY many of our readers have frequently come upon handy shop hints or kinks during the course of their experimentation. The columns of this department are always open to ideas and suggestions from our professional set builder readers who wish to give their fellow-craftsmen the benefit of such suggestions. We shall be glad to print such novel stunts, hints or ideas as our readers send in from time to time. After all this department is established for the benefit of the professional set builders and anything they do to improve their own work will help to improve that of the other professional set builders. Don't be bashful about sending in your suggestions and we will be glad to print as many as space and timeliness will allow.

Magic in Modern Servicing

OWNERS of radio receiving sets no doubt often wonder at the ease and apparently unerring manner in which radio service men can get at the exact seat of trouble or can tell just the right adjustment to make to put a balky receiving set back in tip top operating shape. Knowing of the multitude of ills which may overtake a radio set this thought certainly gives one reason for wonder and speculation.

A loose screw, an unsoldered connection, a bad condenser, a defective tube, a poor tube contact—these and a thousand other easily corrected faults hard to find, can easily be the cause of complete failure of the receiver, and still the modern service man locates the exact trouble in a few minutes after arriving on the scene. Of course the average service man is more or less technical but for the most part his success can be traced to the "litfle box of tricks" that he carries with him.

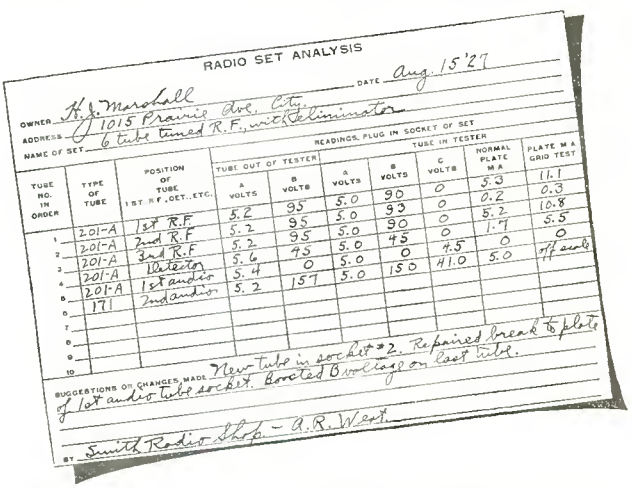
In the earlier days of radio it was different. The successful service man not only had to be a good guesser but also had to know how to best take advantage of his guessing. A pair of pliers, a srew driver, a soldering iron and solder, a pair of phones, a voltmeter, a small flashlight battery and a dozen or more sundry articles were used by him to pry or entice the trouble to the surface. And even then it sometimes required several return calls before a set was completely serviced. But now it is different. One call not only serves to correct the trouble but brings to light impending failure of tubes or other weaknesses which may be developing. And again its the "little box of tricks" that does it.

Diagnosing Set Ills

The radio industry has often been likened to the automobile industry especially as to the methods of distribution and program of service after sale, but in the servicing of automobiles there never was a device available which could look into its vitals, and point out the trouble so definitely as is now available for servicing radio receivers.

We refer directly to the modern up to date radio servicing device or devices as the "little box of tricks" for in practically all cases that is the general appearance created by the equipment usually carried by the up-to-date, enterprising service man.

Of the several complete service sets on the market the more


RADIO SET ANALYSIS

DATE Aug. 15'27

OWNER H. E. Marshall

ADDRESS 1015 Prairie Ave. City

NAME OF SET 6 tube tuned R.F., with Eliminator

READINGS, PLUG IN SOCKET OF SET

TUBE NO. IN ORDER	TYPE OF TUBE	POSITION OF TUBE 1ST. R.F., DET., ETC.	TUBE OUT OF TESTER A VOLTS	TUBE OUT OF TESTER B VOLTS	TUBE IN TESTER A VOLTS	TUBE IN TESTER B VOLTS	TUBE IN TESTER C VOLTS	NORMAL PLATE M.A.	PLATE M.A. GRID TEST
1	201-A	1st R.F.	5.2	95	5.0	90	0	5.3	11.1
2	201-A	2nd R.F.	5.2	95	5.0	93	0	0.2	0.3
3	201-A	3rd R.F.	5.2	95	5.0	90	0	5.2	10.8
4	201-A	Detector	5.4	45	5.0	45	0	1.7	5.5
5	201-A	1st audio	5.4	0	5.0	0	4.5	0	0
6	201-A	2nd audio	5.2	157	5.0	150	41.0	5.0	off scale
7	171								
8									
9									
10									

SUGGESTIONS OR CHANGES MADE New tube in socket #2. Repaired break to plate of 1st audio tube socket. Rewired B voltage on last tube.

BY Smith Radio Shop - A. R. West

In the photograph above is shown a sample of a typical chart furnished by the Jewell organization with each of the set testers. The charts are ordinarily provided in pad form. The form above, one of the many possible combinations, is the one given the set owner by the service man. It serves as a receipt for work done and tells what was corrected, as well as showing the time of last inspection

efficient are housed in a handy portable case of attractive appearance generally designed to add a professional atmosphere to the appearance of the service man. For the sake of brevity we will confine ourselves to a discussion of one of the testing sets which seems to be highly representative of these outfits, made by the Jewell Electrical Instrument Co. of Chicago.

The "little box of tricks" in question lends itself very effectively to the picture. It is of a size handy for carrying. The case is covered with a good grade of black leather and all in all its appearance lends dignity to the work for which it is used. Lifting the cover we find a panel generously covered with a multitude of parts including two instruments, a number of binding posts, and several switches in the form of simple push buttons. This combination, innocent enough in appearance, is still a wonder in efficiency, and performance. Every test requirement likely to be encountered in a radio set is provided for.

Buttons Tell Secrets

Starting with a plug and cord leading into the interior of the test set—this plug fits directly into a socket of the radio set under test and because of its construction leads thus directly to all the major circuits in any of which the trouble being sought may be located. For servicing a radio receiver this plug is inserted, in turn, into each of the tube sockets in the receiver and the tube

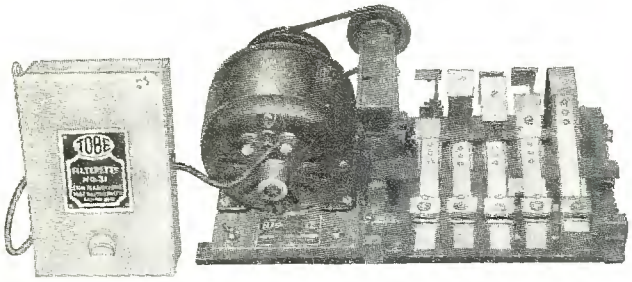


Fig. 6. In the bigger cities one of the greatest causes of interference, especially to those in the immediat neighborhood, is the electric sign flasher, which is illustrated in the photograph above. However, intereference of this nature can be curbed by the proper use of the filter condenser circuit, such as the one made by Tobe and shown in the illustration

from the socket placed in the socket which is provided on the panel of the tester. And now for the tricks.

The innocent looking push buttons placed along each side of the tester are brought into play and because they are plainly marked as to their function cannot be readily overlooked unless intentional. They also serve as a hint to the service man as to the tests to bc made, and if followed in their order will tell him exactly where to find the trouble. Now you are asking "What do they do?" They tell you facts as fast as the individual buttons ean be pressed, which is faster than the instruments ean be read. Actually they seleet a definite part of the radio rceeiving circuit to test and connect that circuit through one of the ranges in either of the two instruments. This of eourse is aecomplished by the plug and cord which is inserted into one of the several sockets in a set. If the receiver under test is a. c. operated there are push buttons which when pressed tell at once the voltage received at the filament of the tube. As this voltage may normally range from one to fifteen volts three push buttons are needed to eover the three ranges, any one of which may be involved for this test, depending upon the voltage requirements of the tube filament. Another button tests for cathode voltage, strictly an a. e. test.

Should the radio be operated from batteries, filament voltage is obtained on another push button switch. In both types of sets a. c. or d. c. plate and grid voltages and plate milliamperes are obtained by push buttons common to both. In addition to tests for these factors a reliable tube test is ineorporated in the form of a grid shift button and a small dry eell clipped into the case giving a uniform voltage for grid shift.

All these tests require multi-range instruments if only two are used as in this tester. A glance shows the direct current instrument as having six readings—7.5—75—300—and 600 volts all of high resistance, and 15 and 150 milliamperes. The a. c. instrument has four ranges—4—8 16 and 160 volts. The ranges of these two instruments are seen to be suffieient to eover all requirements of input and output of either a. e. or d.c. operated receiving sets. To make the serviee set even more useful all ranges are available at binding posts and test leads ineluding a special pair of line voltage testing at the outlet are ineluded. Four and five prong tube adapter for use in making the right eonnection in a tube socket in a set with the plug and cord and also for inserting the tube in the soeket of the tester are also provided.

Briefly summarized this tester provides testing either a. c. or d. e. operated sets for filament, grid and plate voltages, line voltage, plates milliamperes, total B-eliminator, output in milliamperes, charging and diseharge rates, tube conditions (a speeial grid shifting test being included) eontinuity tests of eondensers, transformers or other circuits. In addition a special eathode test gives information of this important a. c. tube funetion. Has anything been overlooked? Is it any wonder that the serviee man using one of these test sets can put his fingers on the fault in a receiving set in short order?

Substantially Built

The internal eonstruction and quality of workmanship in this test set need no special comments further than to suggest that a single device covering so many functions so closely related to eaeh other as found in this tester must need be of substantial eharacter to avoid failure of inter-related parts.

Maybe servicing in the future will be automatic and all that is required to test a defeetive radio receiver will be to connect it to the decendant of one of these test sets, pull a lever and a printed card bearing thc trade name, model number, quantity and year manufaetured together with the exact location and nature of the trouble in the radio set will be ejeeted to a eontainer at the lower left hand eorner—then it surely will be—"a little box of tricks."

Filter Development

IN the onward sweep of radio the entire industry has been fighting to keep its production keyed up to a point where the market eould be satisfactorily taken care of. Time for the careful consideration of many accompanying problems has been lacking.

Radio ean be likened to the automobile, only it is a method of transporting mental objeets by sound in the form of music and words. Like the automobile industry, the production of cars for years required everyone's attention. The roads were pretty bad in the earliest days; in fact, have only been good in the last few years. Good roads followed the demand for them eaused by a huge riding market.

Man Made Statie

Today we see radio sets in sueh numbers that the demand for better radio "roads" is starting to assume tremendous proportions. The ether is the radio road. The new allocations are the result of this demand for better radio "roads." But still there are millions of imperfections on these new roads which must be ironed out before smooth, satisfying radio transportation can be aehieved. These imperfections may be entitled "interference" or "man-made static."

Regular static offers its problems but is being overcome to a great degree by cleared channels and increased power. Local interference or man-made statie is, however, a horse of another color and its overcoming has for the most part been totally neglected.

With five million receivers in operation the listening public, well over its first thrill of just hearing musie, has suddenly realized that many undesired noises are spoiling reception. Practically all of these are caused by local electrieal maehinery; such as, motors, vacuum eleaners, washing maehines, refrigerators, oil burners, hair dryers, fans, sign flashers, and all other eleetrical apparatus.

It has been the privilege of the Tobe Deutchmann Company

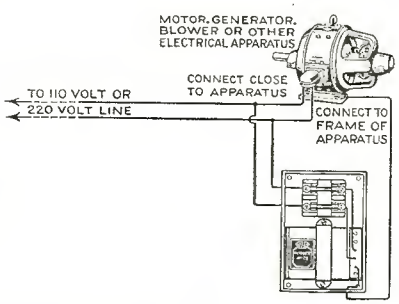


Fig. 7. Here's a method of stopping man-made static at its source. It is known as the Tobe Filterette No. 22, designed for all types of motors, generators, blowers or other electrical apparatus using 110 or 220 volts, regardless of horse power

of Canton, Mass., to have foreseen the need of attaeking this opponent of good radio reception and to have spent the last few years in preparing for this problem, at a time when no one though it would amount to anything at all.

Coping with Interference

The result is that they are completely equipped to meet problems of radio interferenee with several perfeeted pieces of apparatus, known as "Filterettes," and an engineering staff capable of running down the causes and designing special apparatus for unusual situations.

No one who has not lived with this problem night and day for a while can appreciate the tremendous field of opportunity it

offers. Every power and light company is eagerly seeking co-operation as they want to sell electric current, and interfering machinery brings them constant complaints. Real estate operators cannot have satisfied tenants when the radio reception is spoiled by noises from oil burners, ieeless refrigerators, ventilators and elevators.

As an important step in this new field of radio endeavor, the Tobe Deutschmann Company is starting a little paper, "The Filterette," dedicated to the annihilation of man-made static. It is planned as a help to every radio listener, retailer, real estate operator, service man, power company, and all others whom man-made static effects. They are offering a free advisory service on interference problems and will be glad to hear from any of our readers.

A Useful Panel Switch

WE are grateful for a recent contribution to the set builder's department from M. D. Vail, treasurer of the Vail-Ballou Press, Inc., Binghamton, New York, who writes: "Several of my friends who are set builders and radio experimenters have shown so much interest in my panel switching device and wiring arrangement that I feel that these might be of interest to others."

We feel sure that our professional set builders will be glad to have the ideas of Mr. Vail and will undoubtedly put them into practice in some of their own jobs. It is contributions of this nature which we most welcome, since it represents an actual interest on the part of the set builder in the department which this magazine has established for the individual. The article accompanying Mr. Vail's drawings is printed below:

MOST experimenters and set-builders have accumulated several extra rheostats. Certain kinds may be utilized for the construction of useful panel switches. Knobs to match the tuning and volume controls can be attached, and, if properly wired, these switches are a great convenience. Fig. 8 shows one of the common variety, of bakelite construction. First detach the connector strip F from C and move it to B. Then mount a third post at B. Solder a small piece of wire from H to C. We now have a potentiometer. With a file cut the wires at two convenient points such as E and D. With a pair of pliers remove the

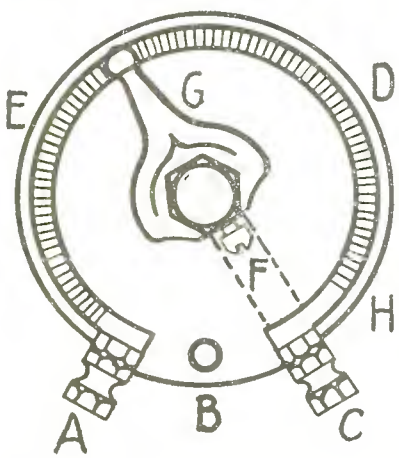


Fig. 8. This sketch shows the manner in which a useful panel switch may be made by means of a rheostat that may be laying around the workshop. This sketch and the idea shown in Fig. 9 on this page are furnished through the courtesy of M. D. Vail, Binghamton, New York

short loose pieces of wire. The two gaps at E and D should not be more than $\frac{1}{16}$ to $\frac{1}{8}$ inches wide so that the slider G can pass between two consecutive sections without completely losing contract with both. The potentiometer has now become a form of single-pole, double-throw switch.

Controlling Two Speakers

Connect the output from the set to A and C. Attach one speaker to the posts A and B and another to posts B and C. When the slider G is at any point between E and D both speakers are in series and in operation at the same time. When the slider is moved to either side, one of the speakers is short- circuited. Thus we can have either or both of the speakers on by merely operating the knob.

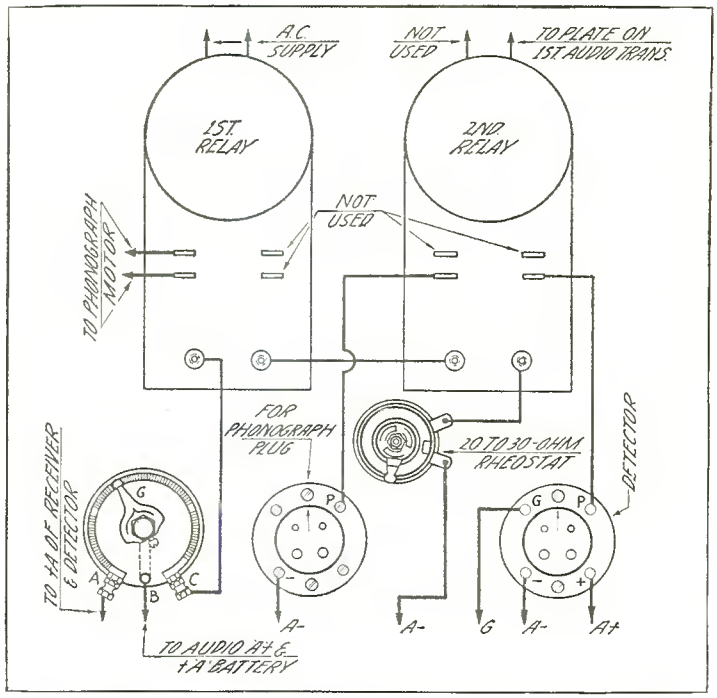


Fig. 9. In the above diagram is shown the method of shifting to and from the phonograph in connection with a radio set. The two relays shown in the diagram are of the type known as the Yaxley automatic power control. A full description of the method of operation is contained in this department

Shifting to and from Phonograph

Construct another switch like that described above. It is best to run a light coating of solder between points E and A also D and C. The ordinary phonograph magnetic pickup has, besides the unit holding the needle, a plug which must be placed in the socket of the detector. One must also remove all the tubes from the stages preceding the detector. By means of one of these switches and two relay switches like the Yaxley automatic power controls, one can shift from radio to phonograph or back again by merely operating the knob on the panel. When the slider G is in the center position both instruments are shut off. First mount an extra socket at any point convenient to the detector.

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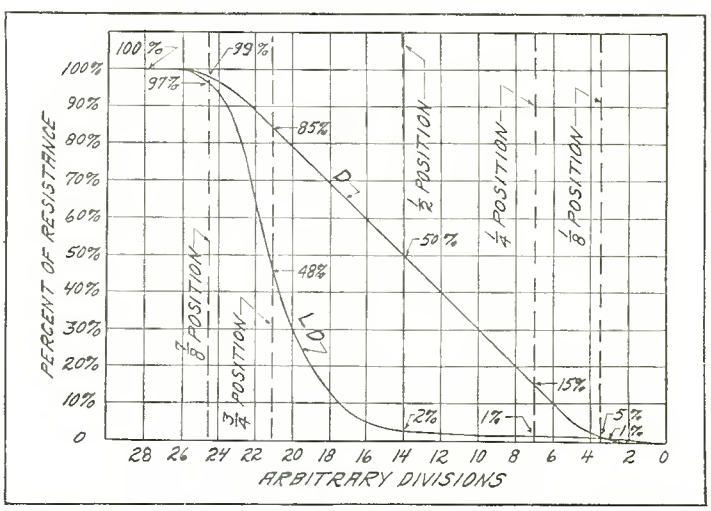


Fig. 10. In the graph shown above are two types of resistance controls, of the variable high resistance type. One is the D type and the other the LD type, and these refer to curve obtained on variable resistances of the type mentioned, made by Frost. Each one of the curves representing a type of resistance has a specific purpose as is explained in the text accompanying the diagram

Radio-Phonograph Lab. Amplifier

SERVING a dual purpose, in that it may be used for amplification of either radio or phonograph, the amplifier described in this article, which was recently designed in our laboratories, should be of benefit to any professional set builder or other experimenter who desires a standard amplifier into which may be fed the output of any receiver or phonograph pick-up unit.

Single or Double Audio

The output stage of the amplifier is arranged for push-pull amplification, using 171-A tubes, and by a switching arrangement either one stage of audio or two stages of audio preceding the push-pull section may be used. The transfer from a single to a double stage amplifier is accomplished by means of a four pole double throw switch shown in the schematic, Fig. 3. A double pole double throw switch is also provided for the use of a single speaker if desired, or if a comparative test of three speakers is to be made, throw the switch in one position and permit this sort of comparative test. This is also illustrated in the schematic circuit previously mentioned.

Another feature of the amplifier which makes it of interest to the professional set builder is the 0-25 milliammeter placed on a plug which may be inserted into the first, second or third jack on the panel and will give you the milliampere reading of each stage of amplification. In the case of the jack No. 3, which is in series with the plate circuit of the push-pull stage, a 50 milliampere shunt is provided across the jack so that when the reading is taken the current shown should be multiplied by two. In the case of jack No. 1 and jack No. 2, the current readings are exactly as shown on the meter. Another possibility that is of interest in connection with jacks Nos. 1, 2 and 3 is the fact that instead of plugging in the milliammeter the experimenter or professional set builder can plug in a pair of headphones on each individual stage and adjust his C bias for maximum results according to the dictates of his ear.

The amplifier panel is designed so that a shallow box may be built, onto which the panel is placed. It was felt that this form of construction would be more logical than to have the panel setting up on edge, since the experimenter or builder is more than likely to have the amplifier on a work bench, in which event the panel lies flat and is more accessible for connecting A, B and C supplies and speaker terminal. Also the tubes would then be in an upright position, whereas if the panel were placed in an upright position the tubes would be placed horizontally, which is not quite so desirable on account of the possibility of sagging of filament or other elements.

A 6 ohm rheostat on the negative filament of the two straight audio stages is provided for volume control in that portion of the circuit, while a second 6 ohm rheostat in series with the filaments of the two 171 stages is also provided for altering the current on the filaments of the push-pulls.

In the event that the amplifier, when using two stages, should exhibit any tendency towards squealing or howling with a high pitched squeal, this may be curbed by placing a .005 mfd fixed condenser across terminals P and G of the second audio transformer. This method of connection gives a semi-impedance coupling, or furnishes a sufficient phase shift to prevent the stage from howling.

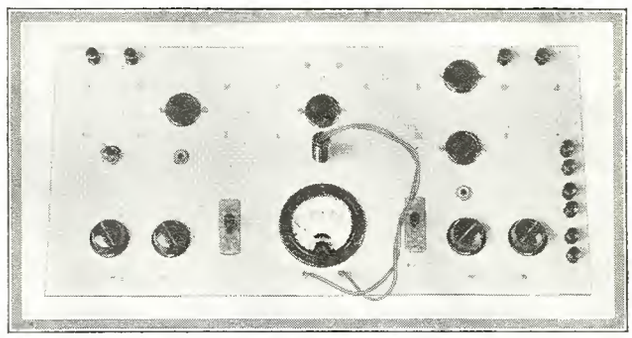


Fig. 2. Top view of the radio-phonograph combination is shown in the above picture

Official Parts List

Parts used in the construction of the laboratory amplifier are:

2 Carter .001 mfd fixed condensers
1 Carter .005 mfd fixed condenser
2 Thordarson R-300 audio transformers
1 Thordarson 2408 push-pull input transformer
1 Thordarson 2420 push-pull output transformer
1 Frost 895 500,000 ohm variable resistor
2 Frost 1906 6 ohm rheostats
1 Formica 10x21x$\frac{3}{16}$ inch Ivory panel
1 Frost 10-contact cable plug
10 Eby binding posts
4 Eby UX sockets
1 Yaxley No. 10 line switch
2 Federal 1427-W jack switches
2 Yaxley pin jacks
1 Carter inductance switch
1 Weston 302 0-25 milliammeter

Granting that electrical and physical characteristics are identical, the following items made by the respectively named manufacturers may be used in the construction of an amplifier similar to the one described above.
Condensers, fixed: Acme, Aerovox, Dubilier, Muter, Potter, Sangamo, Tobe;
Transformers, audio: AmerTran, Dongan, Jefferson, Sangamo, Silver-Marshall;
Panels: Celeron;
Binding Posts: X-L;
Sockets: Benjamin, Frost;
Switches and Jacks: Carter, Frost, Yaxley;
Meters: Jewell;
Tubes: Ceco, Sonatron;
Resistances, variable: Carter, Centralab, Clarostat, Electrad, Yaxley;
Cable Plugs: Yaxley.

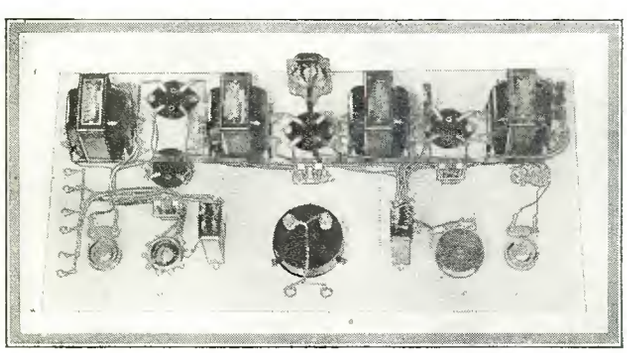


Fig. 1. This photograph shows a bottom view of the completed amplifier

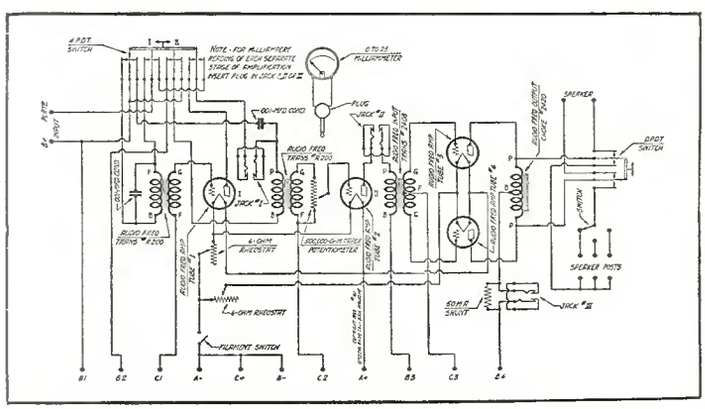


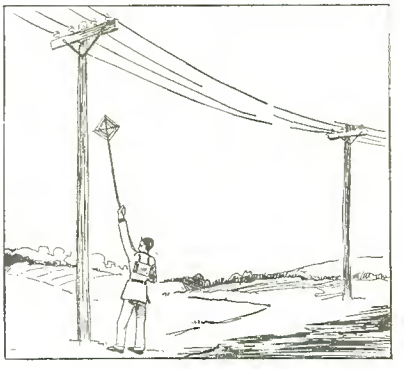
Fig. 3. The schematic circuit which may be followed by professional set builders in wiring up the amplifier is given above

(This amplifier designed, tested and all illustrations made in our laboratory)

Citizens Interference Locater for Finding Power Line Leaks

Self-Contained A and B Supply for Detector and One Stage Receiver; May Be Slung Over Shoulder

SO many requests have come in from professional set builders for a portable set by means of which power leaks may be located that the technical department has recently designed the interference locater described in the following article as a means of giving these professional set builders some unit which could be put to a practical use in the location of interference.



Many Power Leaks

Judging from the multitude of correspondence that passes over the editorial desk in connection with the location of interference, it would appear that most of this interference is confined to the rural sections and is of the power leak kind. Power leaks may be caused by several factors, the most common one being either a leaking or a defective insulator, or a broken insulator where the wire has fallen away from the pin on the cross arm and in the wind will swing back and forth against or near the metal brace holding up the wood cross arm. Then again there is the type of interference that is caused when tree limbs or branches or leaves are too close to a high power line. This type of interference is especially prevalent immediately following a storm or during the winter time when sleet gets on the branches and pulls them down close to a line.

When such leaks occur on a line, it is quite likely that the interference will be heard over a fairly wide area. There have been occasions when a leak of that sort will be heard over a fair sized town and it was only located after intensive search on the part of three or four individuals using portable sets and patrolling the line until they reached the position where the sound was the loudest in the head phones.

Then again there is the type of interference encountered in the fairly large towns, where there are street railways, this interference being apparently caused by the street railway, but in fact probably being caused by defective transformers, defective insulators, defective oil switches and other devices, as well as perhaps

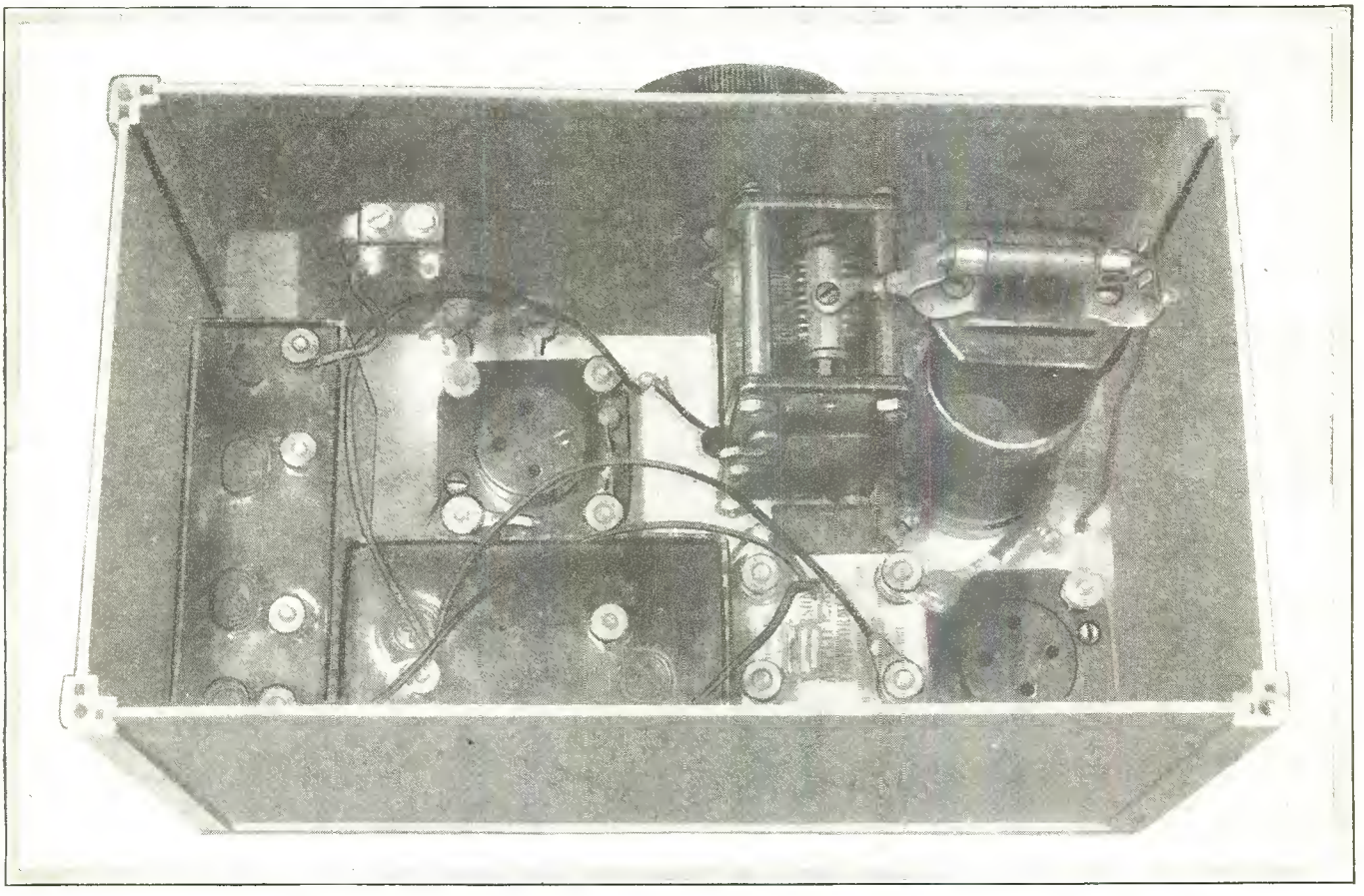


Fig. 1. This photograph discloses the compactness of the interference locater, which has its own A and B supply contained within the aluminum shield. Both the coil and the condenser are of small dimensions, so as to permit being placed inside. A high ratio audio transformer is employed to give good amplification without regard to quality

(This interference locater designed, tested and all illustrations made in our laboratory)

poor ground. While the interference locater described in this article is not intended to locate all types of interference, nevertheless the most pernicious type may be found by a judicious use of the interference locater.

As shown in the little pen and ink sketch at the heading of this article, the unit is small enough to be carried on the back or swung over the shoulder of the man who is patrolling a power line. By means of a short pole and a small spider web loop, the operator is able to probe in the vicinity of insulators and on account of the loop being connected to the grid circuit of the receiver itself, he can get quite a signal when in the proximity of the disturbing interference. In this connection, it might not be a bad idea to call attention of the users of such a device that in patrolling a line or probing for interference, they must not get too near to the line itself with the loop because if by some chance they happen to hit the line, disastrous consequences would undoubtedly result. For that reason, in the sketch, the human figure is shown holding a loop which does not reach up near the wires or the insulators.

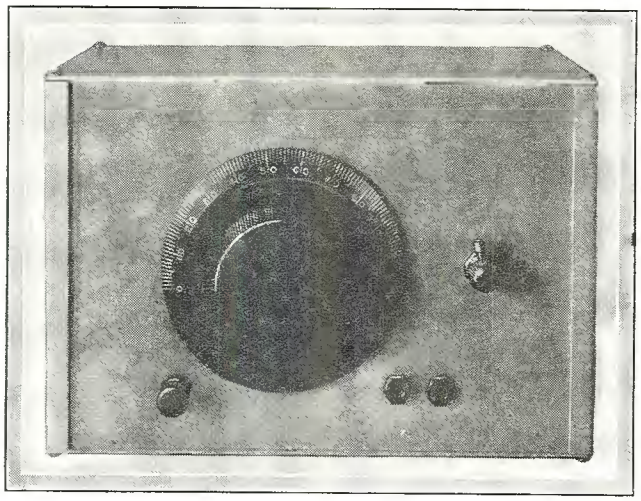


Fig. 2. In this photograph may be seen the front of the interference locater. The dial is for tuning. The switch is at the right. The binding at the left bottom is the grid terminal of the set and to which is attached the wire for probing, the phones going to the tip jacks at right lower part of the panel

On Broadcast Band

In the design of the interference locater, it was felt that since most of the interference which causes universal trouble is on the broadcast band, it would be best to confine the tuning range of the receiver to that particular band. However, it would be possible if one desired to use a plug-in coil and cover a number of wavelengths, but in this particular instance it was found that interference on other frequencies was not sufficiently bothersome to warrant using a plug-in coil and for that reason a single coil of a definite band coverage was employed.

In order to make the set portable, it was deemed expedient to include the A and B battery inside of the receiver can. A 4½ volt C battery lights the filaments of the two 199 tubes and will give them sufficient current for operation over a period of between five and six hours.

Fits Carrying Case

This is practically the only expense involved in shooting trouble, but the possible expense is overbalanced by the portability of the unit and its lightness. If desired, a small carrying case may be made for the unit and it can be dropped over the operator's shoulder or swung over his back. Those desiring information as to the maker of a carrying case may secure such information by writing the editor of this magazine.

By a special arrangement with our technical department, the Vee Products of Chicago have arranged to make up, on order, a small spider web loop suitable as a probe for connecting to the grid circuit of the interference locater and to be employed somewhat after the fashion shown in the sketch at the beginning of this article.

Referring to the schematic circuit shown in Fig. 4, it will be seen that the receiver itself consists of a non-regenerative detector, followed by one stage of audio amplification, the turn ratio in the audio transformer being high in order to give quite an amplification value without regard to distortion. There are cases when this would be necessary, since the operator must wear the head phones and must have at least a readable signal upon which to work.

Because the grid of the detector tube is the most sensitive part of the circuit, it is only logical that the antenna coil, or the probe, should be connected to the grid. Tuning is accomplished across the broadcast band by means of the .00035 mfd variable condenser. It will be found that the condenser will be set at a value where the interference is loudest and it need not be touchd as long as that particular form of interference is being encountered. In some cases the interference will be found on the lower wave-

(*Continued on page* 142)

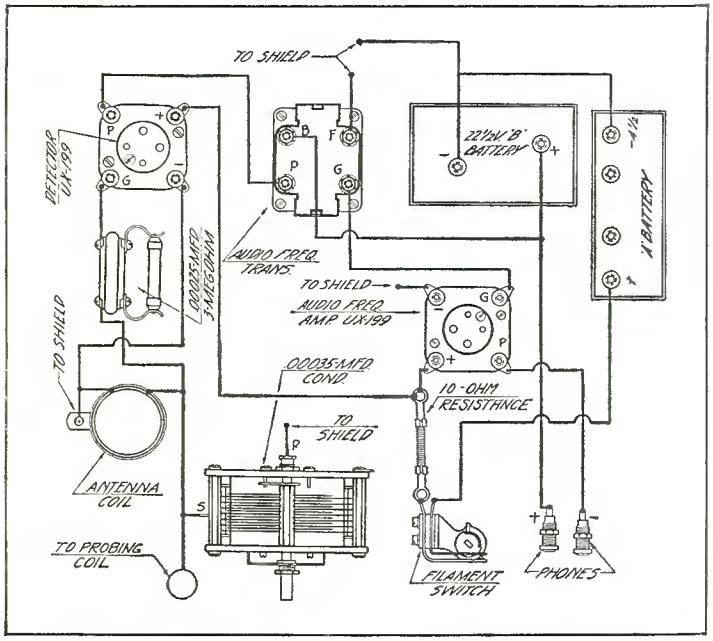


Fig. 3. All parts for the receiver may be laid out in accordance with the graphic diagram shown in the above illustration

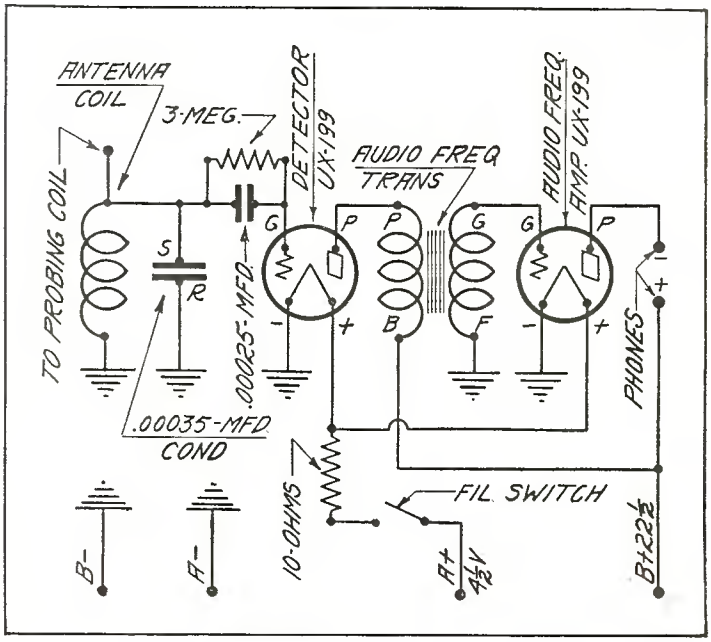
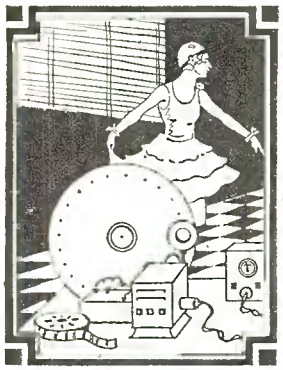


Fig. 4. Electrical details of the circuit may be learned by consulting the schematic printed above

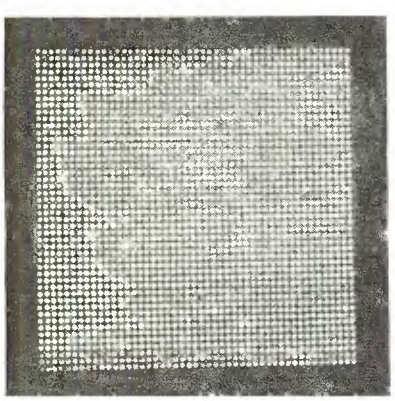


PRACTICAL TELEVISION

BEFORE the end of next summer baseball games will be broadcast by television and will be seen as they happen, according to the latest prediction made by C. Francis Jenkins, pioneer experimenter in television and radio movies. He is now constructing a new form of receiver that will give many times as much light as those now in use, and which, using proper lenses, will permit the image to actually be projected on a screen.

In the new receiver, tiny incandescent lamps take the place of the neon light used at present. The usual telemovie method is to rotate rapidly a disc containing a spiral row of tiny holes in front of the glowing neon tube. The entire disc rotates fifteen times a second. As used in the old Jenkins apparatus there are 48 of these holes, and as the picture is square, it consists of 48 times 48, or 2304, separate units. It may be compared with a newspaper halftone picture, which is made up of small dots about the same size.

Unlike the halftone, however, in the radio movie receiver only one dot is seen at a time. On account of persistence of vision in the eye, one impression lasts until the same spot appears again a fifteenth of a second later, so that the observer seems to see a continuous area of light as a background against which the dark figures appear.



This photograph shows a radio movie receiver surface divided into 48 times 48 elementary areas, the phenomena being a substitution of persistence of elementary area light for persistence of vision. This receiver light source is projected on to a theater screen, giving ample illumination for theater radio movies

The substitution of light sensitive elements for the lamps of the receiver makes an excellent transmitter by which outdoor scenes and sports may be broadcast directly from the field

Mr. Jenkins' latest idea is to get away from the persistence of vision in the eye, and to provide a light that will continue to glow for the full fifteenth of a second between successive pictures. This is accomplished by employing a bank of 2304 small incandescent lamps, like those used in flashlights. These are controlled by the radio receiving set. A revolving switch, or commutator, connects the lamps successively to the set. But unlike the neon light, the filament of the lamp continues to glow for an instant after the current is turned off, until it is again connected. Thus the background does not merely appear to be bright the whole time; it actually is bright. However, there is enough contrast between a lamp that has just been connected, and one that was connected a fifteenth of a second earlier, on a previous turn of the commutator, to give sufficient contrast between the subject and background, even in the case of a rapidly moving object. With the light advantage thus gained, and with the greater intrinsic brightness of the incandescent lamps, the image will be many thousands of times as bright as with any form of neon tube. It will be so bright that a projection lens can be placed in front of it, and an enlarged picture projected upon a screen.

Mr. Jenkins also plans a transmitter upon the same principle. In this, a bank of small light-sensitive cells, which give off electric current when light shines on them, will be used in the same position as the incandescent lamps. A large camera lens will form an image of the subject upon them. Each cell will be connected to a condenser, so that electricity will be stored up in it, and every fifteenth of a second a commutator will come around and discharge it, thus controlling the radio transmitter.

Overloading Kino-Lamps

IN the desire to secure greater illumination not so much in television reception as in general experimentation, there is always danger of overloading the neon or kino-lamp. In the case of the standard or Raytheon kino-lamp, the current should be limited to 25 milliamperes for long life, which is obtained by operating on 235 volts with a 50,000 ohm adjustable current-limiting resistor in series.

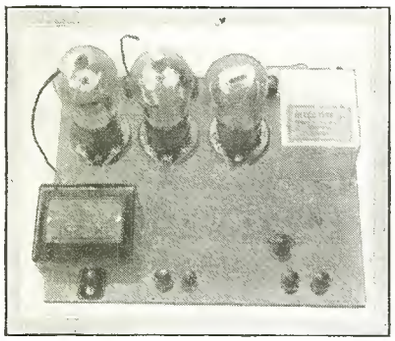
Just what happens when a kino-lamp is overloaded? Answering this question, D. E. Replogle of the Raytheon engineering staff, states:

"Of course the illumination from an overloaded kino-lamp is enormously increased, but the life is correspondingly decreased. The neon gas is rapidly cleaned up or exhausted, as the result of overload, and other gases present in the metal and glass parts, are driven into the diminishing neon content, causing a change in color of the glow from the rich pink to a sickly lavender. The kino-lamp should be operated at 25 milliamperes or less. The life is cut in half if the current flow is raised 50 per cent, with still more rapid decrease of life beyond that overload.

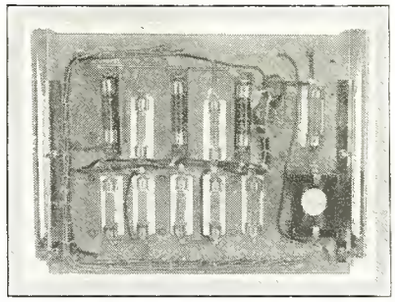
"An overloaded kino-lamp soon loses its unform glow, and the illumination on the plates becomes spotty. This is due to the boiling out of gases deeply imbedded in the plates, which would not be boiled out under normal operating conditions. Excessive overloading causes the plates to buckle from the heat generated. The glass beads may be cracked by the heat, causing leakage of current. Voltage breakdown takes place between closely spaced wires, due to the presence of other gases and water vapor.

"A kino-lamp that has been seriously overloaded is, of course, more or less permanently ruined and should be replaced by a new kino-lamp for any precision work such as television reception. Nevertheless, due to the care with which such a device is made in the first place, it is possible to restore the damaged lamp to some extent, at least for experimental application. The damaged kino-lamp should be operated at a current drain of 20 milliamperes for hours, following the same practice of the original aging of the tube at the factory. This procedure should restore a more or less uniform glow over the plates, although of reduced intensity and changed color. If alternating current is applied, both plates will be treated simultaneously. If direct current is applied, such as from a B-eliminator, only one plate will be treated at a time. A re-aged kino-lamp will usually be good enough for ordinary experimental use, so that it need not be a total loss.

"Nevertheless, an ounce of prevention is worth a ton of cure, when it comes to the operation of kino-lamps."



This photograph shows a top view of the resistance coupled amplifier described schematically in part in Fig. 4 on the succeeding page. An input transformer is shown in the photograph and was used in operation because it was felt that when using the amplifier with a regenerative set, better results might be expected than if the input network to the amplifier were a resistance affair. It will be noted in the schematic in Fig. 4 that the input circuit is left blank, so that any type of input may be used as desired



In this photograph is shown a bottom view of the resistance amplifier unit, the resistors and their mountings being located underneath the sub-panel because of the fact that fairly high voltages are dealt with and it was not considered advisable to have these clipped on the top of the sub-panel, where they might become short circuited or might give the operator a shock. If the proper values are placed in the clips at the beginning of the experiment, it is not likely that it will be necessary to change resistance values. However, if it should be necessary to change these values, the whole unit may be tipped up at one end and the resistance cartridges changed. In doing so it would be a good plan to break the high voltage line so that there is no possibility of a shock when changing resistors

RESISTANCE coupled amplifiers in common use today, have two inherent disadvantages. In the first place, they require altogether too many B and C batteries; in the second place, they are unstable. It is true that reasonably stable amplifiers have been built, amplifiers with a maximum gain of 70 t. u. and a variation if less than 10 t. u. over a range extending from 30 to 6000 cycles. There are, however, many instances where an amplifier capable of handling direct and audio frequency voltages up to 10,000 and even 30,000 cycles is highly desirable.

According to a recent release of the International Resistance Co. such an amplifier has been designed in England and after much experimentation, its basic principles have been successfully applied to standard American vacuum tubes. Here in America have been developed two remarkably stable amplifiers. The first is capable of giving an excellent gain on direct voltages and audio frequency voltages up to 10,000 cycles, while the second gives the same result up to 30,000 cycles. The latter amplifier is being described in this article and is shown schematically in Fig. 1. In both amplifiers, the uniformity throughout the frequency ranges leaves little to be desired. In one model having three stages, the overall gain is approximately 60 t. u., with less than 10 t. u. variation between zero and 3000 cycles and 60 t. u. between 3000 and 6000 cycles. For use in a broadcast receiver, an amplifier of this type will provide excellent results for moderate power output, since the frequency band necessary for excellent reception extends from 30 to 6000 cycles. It has the added advantages of simplicity and low cost, but its particular field of application is found wherever it is necessary to amplify direct voltages or very low frequency alternating voltages.

Television Amplifier

The amplifier shown in Fig. 1 is not primarily intended for broadcast reception, although it may be employed for that purpose. It has a gain frequency characteristic, which is flat from below 30 cycles to above 15,000 cycles, decreasing only 7 t. u. at 30,000 cycles. This amplifier is especially well adapted to television experiments and to any purpose requiring amplification over the entire audio frequency band. The overall gain of this particular model is 54 t. u.

The circuit shown in Fig. 1 is quite novel. For one thing, it will be observed that no coupling condensers are used to link one stage to the next. This coupling is accomplished by means of resistors. The first two stages employ a standard screen grid tube, while the last stage calls for Western Electric type 101-D tube, although any power tube may be employed in the last stage with slight alteration. In the diagram shown herewith a 171 or 171-A tube has been employed. It will be noticed that the first two tubes are connected according to the screen grid or shield grid method. This decreases the effect of grid-plate capacity with its resultant drooping of the gain frequency characteristic at the higher frequencies. However, for its still flatter characteristic, the equalizor, shown in the output circuit of the last tube, has been inserted. This equalizor, consisting of a series circuit containing an inductance of approximately 750 MH and a resistance of 3500 ohms, is connected across the load. It acts as a high pass filter. The value of the resistance governs the amount of signal loss at the low frequencies.

The values of the Durham resistors used in the amplifier are given in the schematic circuit. Battery voltages, A, B and C, are likewise noted in the drawing.

In this amplifier the plate and grid bias voltages are somewhat critical. Shielding of the amplifier, however, is entirely unnecessary. Although this amplifier requires a high voltage and is somewhat critical in its initial adjustment, its performance is so good that the International Resistance Co. staff has found no other to take its place where high and uniform amplification over the entire audio frequency band is required. Needless to say the resistors used in the construction of this amplifier must be the best obtainable. If the resistors are not accurate in resistance value, not stable or again incapable of carrying the necessary currents without deterioration, the amplifier cannot be expected to perform satisfactorily. Although the amplifier is essentially a precision device for radio enthusiasts and experimenters seeking precision amplification, nevertheless it is essentially inexpensive. This particular would be very good for television work where a wide response of frequency is desired.

The amplifier illustrated photographically on this page has recently been built in the laboratory of this magazine, incorporating the schematic circuit shown in Fig. 4 on the succeeding page.

The unit is made quite compact and simplified as much in construction as was possible considering the amount of parts involved in the unit. The amplifier is mounted on a Formica 7 in. x 10 in. x $\frac{3}{16}$ in. Ivory sub-panel and is elevated by means of two Benjamin brackets located at either side. The transformer used is one made by Silver-Marshall and known as their type 240, details of which transformer will be covered further along in this article. Three of the Silver-Marshall 511 UX sockets were employed for holding the two screen grid tubes and the 171-A.

These resistors are mounted in eight Amsco grid leak mountings, and are the type made by Durham, there being two of the powerohm type and the remainder of the grid leak type. The powerohm type are called upon to handle a heavier current and for that reason the grid leak resistor type would not be suitable. Filament control is by means of the 1-A Amperite for the 171 tube and two 622 Amperites for the screen grid tubes. The Samson 500 MH choke is employed instead of the 750 MH shown in the schematic. In actual practice, the 500 gives almost the same results as the 750, and the former is a standard size, whereas the 750 would have to be made up especially. The condenser shown in hte output circuit of the schematic is a type 711 made by Tobe and is of 4 mfd capacity.

In using the receiver ahead of this amplifier on television signals, and employing C bias for detection in the detector stage, it was found that utilizing the Silver-Marshall 240 transformer, a fairly wide frequency response could be secured because with a C bias detector the plate circuit would have a very high impedance when no signal is being received but when a signal is being received, the impedance would drop to a low enough value to cause the transformer to function over a much wider range of frequencies. For experimental purposes, this transformer serves

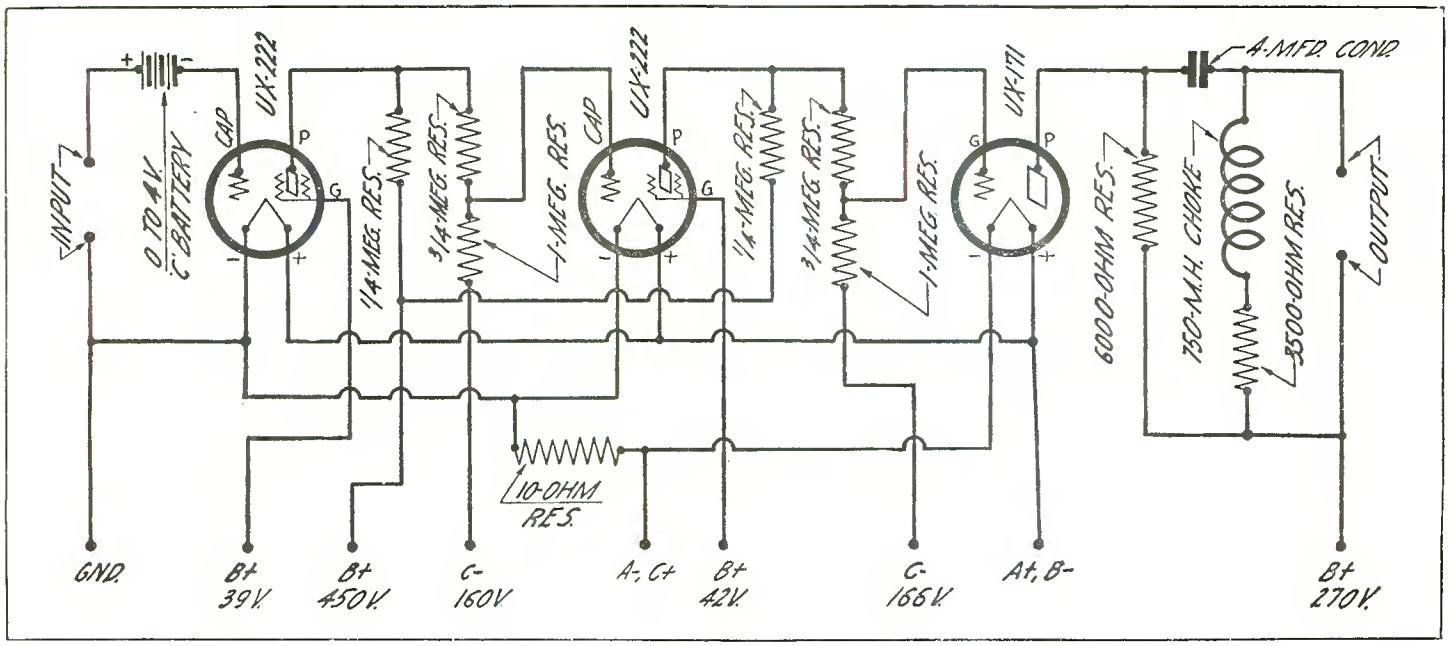


Figure 4

quite satisfactorily and with the present state of the art it is quite possible to secure very good television images through this particular transformer.

In the operation of the detector stage by the method referred to previously, it is quite likely that a bias voltage on the grid will have to run as high as 22 volts and that the plate voltage applied to the detector tube should be in the neighborhood of 180 volts. With this high C bias and high plate voltage on the detector, the impedance of the plate circuit is quite high when no signal is received and when a signal is coming through the impedance of the plate circuit is quite high when no signal is received and when a signal is coming through the impedance drops accordingly.

Parts required for the construction of this experimental television amplifier are shown below:

1 711 Tobe 4 mfd fixed condenser
1 240 Silver-Marshall audio transformer
1 500 Samson 500 MH choke
1 1-A Amperite
2 622 Amperite
1 Formica 7x10x$\frac{3}{16}$ in. sub-panel, Ivory
16 Eby binding posts
3 511 Silver-Marshall sockets
1 10 Yaxley line switch
2 Benjamin brackets
1 Durham 3500 ohm power ohm
1 Durham 6000 ohm power ohm
2 Durham 1 megohm grid leak
2 Durham .75 megohm grid leaks
2 Durham .25 megohm grid leaks
8 Amsco grid leak mountings
1 Pkg. Corwico Braidite hook-up wire
1 Ceco or Sonatron 171-A tube
2 Ceco or Sonatron 222 screen grid tubes

Television Reception Progressing

WHERE in the beginning only a few hundred individuals were listening in on television broadcasts, we are now informed by Mr. Jenkins that several thousand are listening in nightly to the 3XK broadcast. The majority of these listeners are securing excellent results, although there are sporadic cases where on account of skip distance or undue fading, the receivers are not able to maintain good detail. Just prior to the presidential election, the station 3XK was closed down about a week or ten days in order to permit reception of pre-election and election bulletins. However, right after the election the station started up transmitting again and is still continuing.

With the recent announcement of the incorporation of the Jenkins Television Corp., with James W. Garside, president of DeForest, as president of the new organization, and Mr. Jenkins himself as vice president in charge of research, it is anticipated that much more interest will be aroused on the part of television experimenters.

We are now advised that work will start immediately on the completion of the 5000 watt transmitter for use on the wavelength authorized by the Federal Radio Commission for the Jenkins radio movies. With such a transmitter, this should insure that television experimenters scattered all over the country, should be able to maintain an exceptionally good signal strength from that station in Washington. With an ideal signal, something which every experimenter desires, it is only natural that more indi-

Photo by Wide World

The above photograph shows Philo T. Farnsworth, the inventor of a new type of television transmitter and receiver, which is said to do away with the usual scanning disc which is in use with other types of television apparatus. The image size is as large as the largest square which will fit in the white circle to which Farnsworth is pointing

viduals can be convinced of the interest that exists in the reception of radio movies from the Jenkins transmitter.

It is also understood that the new Jenkins organization contemplate going on the market with the Jenkins drum scanner, described in previous departments, and that the price is to be brought down to a value where almost any individual can afford such a device. As previously explained, the drum scanner does away with the necessity for a 18 or 24 in. scanning disc. By means of a magnifying glass, the image is brought up to a size of approximately 6 in. x 6 in. While this does not necessarily spell the death knell of the scanning disc, nevertheless for those who wish to play with television in the home and at the same time have a fairly civilized looking outfit, the new Jenkins scanner will undoubtedly have considerable appeal. On the other hand, there are many thousand experimenters who already have the regular scanning disc and who will continue to operate it as long as programs are sent utilizing that particular number of holes.

By this time the 48 hole scanning disc, or scanning method, regardless of whether it is a disc or not, is almost universally accepted. Some of this is due to the pioneer work done by the television committee of the R. M. A., who got together and decided that the R. M.A. should suggest a definite standard of aperatures and 48 holes seems to be the most logical figure.

Increased Cell Sensitivity

WITH the newly created interest in television, as well as sound-reproducing films and other developments calling for the translation of light intensities into corresponding electrical intensities, the photo-electric cell has become an object of considerable interest. The former selenium cell, once considered ideal for the purpose, has not even been considered, because of its sluggist response and other handicaps. The older types of photo-electric cells have had to make way for far more efficient cells developed during the past year. And now, as another step in the development of light-sensitive devices, the sensitivity of the best of cells has been multiplied by three or four times through the efforts of a young genius.

A young engineer, working in the Raytheon Research Laboratories at Cambridge, Mass., has startled the radio and electrical world by increasing the sensitivity of the usual photo-electric cells by a factor of three or four. His new cells are more sensitive than any light-sensitive devices ever produced before, and even more sensitive than those employed for daylight pick-up of the television image in recent experiments.

It appears that this young engineer, whose modesty prevents the use of his name, in the course of his laboratory work hit upon a new combination of rare elements placed on the cathode of the photo-electric cell, causing a much greater electrical response. With every chemical known at his disposal, together with machinists ready to turn out any desirable metal parts, skilled glass-blowers ready to shape any kind of tube or stem, as well as various gases, vacuum pumps, bombardment equipment, sealing machinery and other facilities, this research worker has tried many combinations of chemicals, shapes, dimensions, mechanical combinations and so on. Many of his essays have been duds. A few have been good. One of his combinations, however, has proved so far superior to the best photo-electric cells heretofore known to the art, as to open up new possibilities for this new technique.

The new photo-electric cell developed by the Raytheon staff does not have the disadvantages of the potassium hydrid cells, since it can withstand ionization without any detrimental effects. In the case of the small sized foto-cell, the cathode lead comes out through the top of the tube as in the usual screen-grid vacuum

(*Continued on page* 128)

Alexanderson's 48-Hole Disc

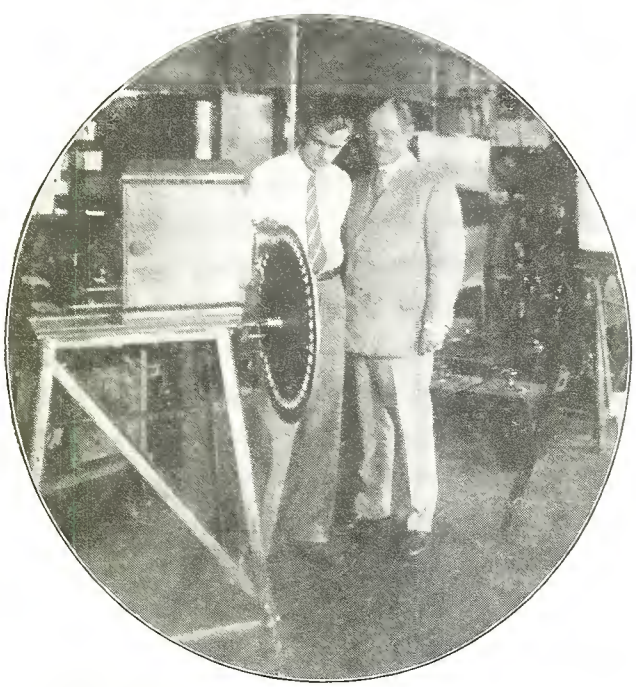


Photo Wide World

Dr. Ernest F. W. Alexanderson, of the General Electric Co. research laboratories, recently demonstrated his latest discovery in the television field, that of projecting the image on the screen. The television projector includes a disc with 48 lens and the picture or image is projected through a ground glass screen. The photograph shows Dr. Alexanderson and his assistant, R. D. Kell, in the laboratory of the General Electric Company at Schenectady, experimenting with the television screen.

Looking into Televisor

Photo Wide World

The radio televisor, still in its experimental stage, designed by two Chicagoans, M. L. Hayes and U. A. Sanabria, was exhibited to the public for the first time at the Second Annual Radio Trade Show at the Hotel Stevens in Chicago. The transmission of the pictures is done by converting light into electrical energy and back into light at the receiving point. This conversion is done with photo-electric cells, filled with inert gas and actuated by electric current. The photograph shows M. L. Hayes, television engineer, sitting in front of the televisor transmitter during its demonstration. The photo-electric cells act as part of the projector

The A B C of Radio

ONE of the first steps a novice should take in learning the fundamentals of radio is to become acquainted with the generally accepted symbols for the various apparatus. A clear understanding of all of the symbols will go a long ways toward helping the beginner to master the rudiments of the art.

In sketch A are shown eleven figures, each representing a different piece of apparatus. In this particular sketch tubes of various sorts and types are shown symbolically. In Fig. 1 is given the symbol for an ordinary receiving or amplifying tube with direct current filament. The tube consists of three elements, the grid shown at G, a plate shown at P and the filament shown at F and F. This tube might be a 199, 201-A, 112-A, 171-A. It might also be a 210 or a 250. In the event it is a power tube operated from alternating current on the filament, the leads to the tube would be shown as twisted pair or at least marked a. c. 5 or 7½ volts. In all drawings appearing in this publication, the type of tube is specified alongside of the symbols so as to make it perfectly clear to the builder which particular tube is to be employed.

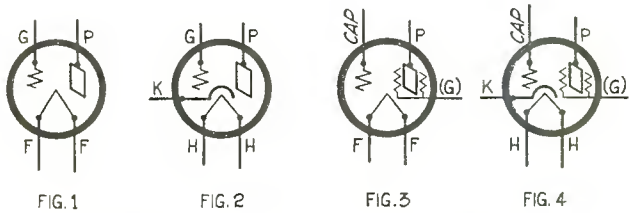


FIG. 1 FIG. 2 FIG. 3 FIG. 4

FIG. 5 FIG. 6 FIG. 7

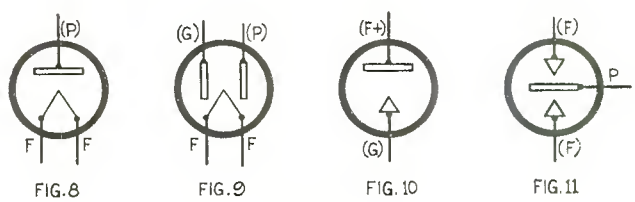


FIG. 8 FIG. 9 FIG. 10 FIG. 11

Sketch A

In Fig. 2 is shown a tube having heater elements for operation from an alternating current source. The heater elements are shown at H and H, while the terminal K is known as the cathode and is the termination of the grid return of the tube. The grid and plate elements are identical in this figure, the only departure from the previous figure being that the tube is operated by means of a heater energized from an alternating current source.

Fig. 3 shows the new screen grid, or shield grid tube. It is operated from direct current. It consists of the cap of the tube, which is the ordinary grid of tubes similar to Fig. 1 or Fig. 2. The normal G marking on the socket is not the grid, but instead is the screen grid upon which a positive potential is applied. The plate and the filament of this tube is the same as the preceding figures. The cap on the tube is a small metal one and this corresponds to the grid in the other types of tubes.

In Fig. 4 may be seen a screen grid tube using a. c. on the filament by means of the heater. This tube also has a cathode at K, similar to the cathode in Fig. 2. Cathodes are provided in this type of tube to permit a point of no potential to which a grid return from the tube may be made.

The symbol for a television lamp, or neon tube, is shown in Fig. 5. The two terminals of a four-prong socket which are used are the P and F minus terminals. These go to the plates of the television lamp.

Fig. 6 shows symbolically a dial light, which is quite simple. Fig. 7 shows the symbol used for a photo-electric cell, this device being used in television transmission.

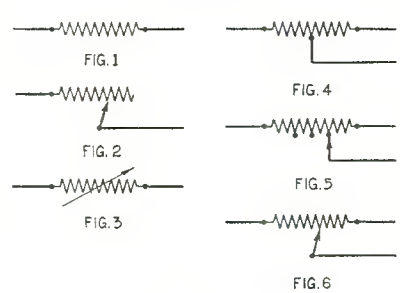
A half wave rectifier is shown symbolically in Fig. 8. This would correspond to the 216-B type of rectifier tube which is now practically obsolete, its place having been taken by the 281. Three of the four terminals on a four-prong socket are utilized by this tube, these being the P terminals and the two F terminals. In the case of a full wave rectifier, such as the 280 shown in Fig. 9, all of the terminals on the socket are utilized, G and P representing the two plates of the rectifier, while the F and F represent the filament. A voltage regulator, or glow tube, similar to the 874, is shown symbolically in Fig. 10. The voltage regulator tube also only uses two of the terminals in a four-prong socket.

Where the full wave rectifier shown in Fig. 9 is of the type using a filament, the full wave rectifier shown in Fig. 11 is of the gaseous type such as the Raytheon BH and BA type. In those the two plates are represented by terminals F and F and the negative of the system represented by the terminal P.

The symbols referred to in sketch A comprise practically all of those required in the radio art at the present time as far as the home builder or professional set builder is concerned. The oldest of the symbols is that in Fig. 1, while the newest one is shown in Fig. 7, since a special symbol had to be made for a television photo-electric cell.

Resistance Symbols

Another series of symbols which also will be understood by the layman is shown in sketch B, which represents the resistance symbols. Fig. 1 is a simple fixed resistance. Fig. 2 is a variable resistance, such as a rheostat. At times it is necessary to show a variable resistance by the symbol shown in Fig. 3. Fig. 4 is a center tapped resistance which cannot be moved. Fig. 5 is resistance with a center tap and a number of other taps, which are movable. In Fig. 6 is shown the symbol of a potentiometer, this unit having three binding posts.

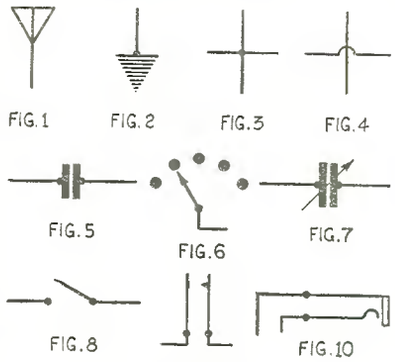


Sketch B

In the sketch shown as sketch C are many of the ordinary symbols used in radio work, which will also be of interest to the novice.

The antenna is represented in Fig. 1, while the ground symbol is shown in Fig. 2. Fig. 3 shows where one wire passes over the other without any connection being made.

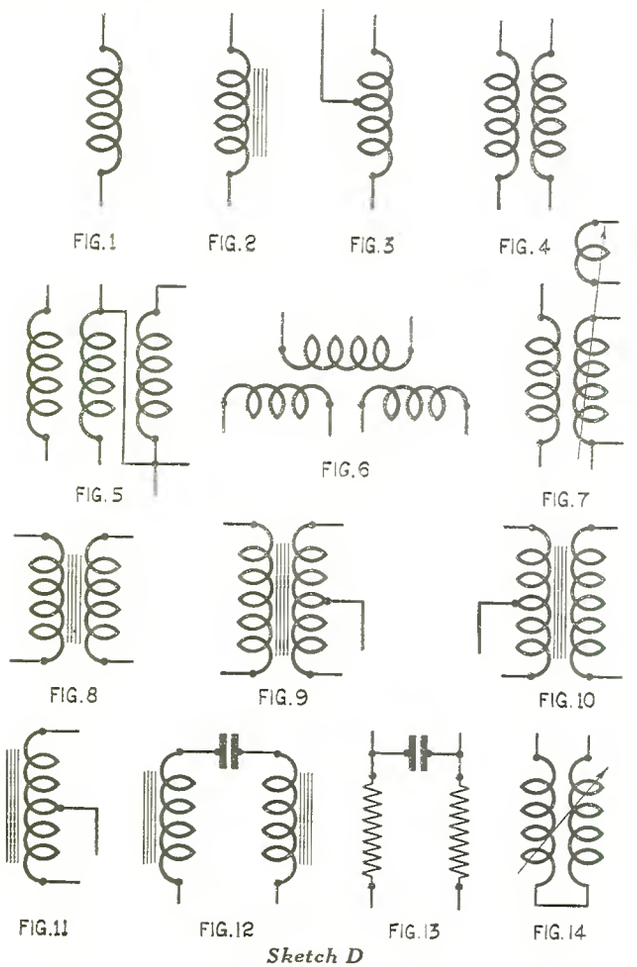
Fig. 5 represents a fixed condenser of any kind regardless of whether it is in the grid circuit of a detector, across a transformer or as a bypass in a power supply. Fig. 6 is a switching arrangement with five switch points and a movable arm. Fig. 7 shows a variable condenser regardless of whether it is continuously variable, as in a tuning condenser, or semi-variable, as in a neutralizing condenser. Fig. 8 represents a switch. Switches are generally used in the filament circuit of d. c. operated receivers or in the 110 volt line of alternating current operated receivers.



Sketch C

Fig. 9 represents a jack switch and is somewhat the same as that shown in Fig. 8, although different in construction. However, its uses are the same. Fig. 10 represents a phone jack, or any open circuit jack. There are many types of jacks, but in the present day there is generally only one type, which is used in the receivers found during this period.

Another series of symbols which are quite interesting to the novice may be found in sketch D. In Fig. 1 is shown a simple single winding coil. It may either be a plate coil, an r. f. choke, or any coil having only one winding and no iron located within its core. In the following figure, which is 2, is a single winding coil but having an iron core. This may be used as an audio frequency choke or as a radio frequency choke, but with a wide response band on account of the presence of the iron in the core. Fig. 3 is r. f. coil, similar to the kind used in an antenna circuit, where the top winding goes to the grid, the bottom to the filament and the off-center tap going to the antenna.



Sketch D

In Fig. 4 we have an r. f. transformer. It consists of two windings, a primary and a secondary. In most cases the primary has the smallest number turns of wire and the secondary the largest. It may be wound on any type of insulating material or it may be air spaced and self-supporting, due to the method of winding and impregnating the winding. It may also be an intermediate transformer in a superheterodyne. Regardless of the frequency at which the intermediate is peaked, it would be represented in the fashion shown in Fig. 4.

The coils shown in Fig. 5 comprise a primary and a secondary with a neutralizing winding. In years past this particular type of coil was quite popular, although since the introduction of the screen grid tube the necessity for neutralizing has been done away with and as a consequence most of the tuning coils are of the type shown in Fig. 4. In the case of the coils shown in Fig. 5, the one at the left is the primary, the one at the right is the secondary and the one in the center is the neutralizing coil. This neutralizing coil generally consists of a small number of turns wound in an opposite direction from those on the secondary.

Those who are interested in superheterodynes will recognize the oscillator coil from the one shown in Fig. 6. The top coil is the pick-up winding, the left-hand section of the coil is the grid circuit and the right-hand section is the plate circuit. Regardless of the form of connection used in the circuit, the oscillator coil will be represented in the form shown in Fig. 6.

Regenerative coils are always shown by one symbol and that is the one shown in Fig. 7. The coil at the left is the primary, the one immediately next to it at the right is the secondary, while the small winding at the top is the plate coil or regenerative winding. The long arrow going through the secondary and the plate coil indicates that the plate coil is movable or variable against the secondary, and allows regeneration control by means of varying the inductive relation of the plate coil to the secondary.

In Fig. 8 is a radio frequency or audio frequency coil. If used in a super, it is a broad response intermediate. If used in an audio stage, it is an audio transformer. When used in a super in the intermediate stages, this coil may be tuned either at the primary, left, or secondary, right, sides. Or it may be left untuned. The coil shown in Fig. 9 is a push-pull input audio transformer. The winding at the left is the primary, while the one at the right is the secondary. The two extremities of the coil go to the grids of the two tubes in push-pull and the center tap goes to the bias terminal.

While the coil in Fig. 9 might also be a push-pull input for an intermediate stage, nevertheless no manufacturer is making this type of coil. The mate to this circuit is shown in Fig. 10, which is a push-pull output coil. The winding at the left has at its two extremities the plate of the two tubes used in push-pull, while the center tap goes to the B battery terminal. The output circuit is the coil at the right and goes to the speaker, in the event that one is used in this position. This type of coil might also be used in intermediate frequency work, but so far no manufacturer is doing this type of winding. Hence, it can be considered as strictly an audio frequency output transformer of the push-pull type.

In Fig. 11 is shown an audio frequency choke having a center tap. The top end of this coil goes to the plate of the power tube and to one side of the speaker, while the bottom end of the coil goes to the other side of the speaker and the center tap goes to the B battery potential.

In the circuit shown in Fig. 12 may be found an impedance coupled form of audio amplification. The coil at the left is the plate circuit, the upper extremity going to the plate and the lower going to the B battery. The coil at the right has its upper extremity going to the grid and the bottom terminal going to the C bias or filament. Coupling from one circuit to the other is by means of the fixed condenser placed between the top of each of the coils.

Another form of audio frequency amplification is shown in Fig. 13, which is a resistance coupled job. Here the resistance shown at the left and the right takes the place of the impedances at the left and right shown in Fig. 12 and the coupling method between the plate of one tube and the grid of the next is the

same, that is, by means of the fixed condenser. In addition to this there are combinations of resistance and impedance, where the plate circuit of the unit will be a resistance and the grid circuit will be an impedance. While resistance coupling may be used in the intermediates, nevertheless it has not been found very satisfactory to date.

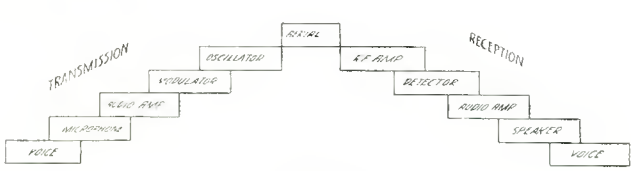
In Fig. 14, which is the last one of this particular series, is shown a variometer. This form of winding is quite old and is seldom seen except in laboratory apparatus or occasionally where a portion of a secondary will be wound in variometer form to allow for compensation, without the use of a variable capacity for trimming.

The symbols shown in four sketches, A, B, C and D, comprise practically all that is required for a clear understanding of set building. However, as new ones occur, we will include them in this department.

Transmission and Reception

SINCE the opening of this department we have had a number of requests from non-technical radio fans for a complete description of all that transpires in the transmission and reception of the voice or music. While this is necessarily a lengthy subject, nevertheless we feel that perhaps it may be summarized within a reasonable length, if not too much attention is paid to the technique, but mostly to the actual steps in the process of transmitting and receiving voice waves.

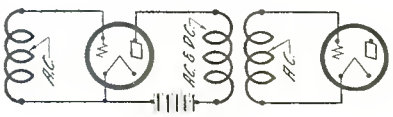
Perhaps the easiest way for the layman to get an idea of the necessary steps in this transmission phenomena is to consult the diagram shown in sketch G. Here it will be seen that transmission consists of six orderly steps and that reception consists of the same number of orderly steps but in the reverse direction. For example: the first step in transmission is the actual voice of the performer or the sound of the music. The next is the microphone, then the audio amplifier, then the modulator, then the oscillator and finally the aerial. In reception, the process is reversed. We start at the aerial, then follow the radio frequency, then the detector, then the audio amplifier, then the speaker and finally the voice heard. It will be noted by careful examination of the diagram that many of the functions are similar, but reversed in process. For example: the voice in transmission is the same as the voice in reception. The microphone in transmission is the same as the speaker in reception, but reversed. Audio amplification in both transmission and reception is the same. Modulation in transmission and detection in reception are like processes except opposite in function. In the case of the oscillator, it and the r. f. are similar except that they, too, are reversed in function. The aerial, of course, is used for both transmission and reception, and is the same.



Sketch G

Sound Waves Start

We will now take the first step in the transmission and attempt to give as simple an explanation of it as possible. A performer in a broadcasting studio is giving a talk. The sound of the performer's voice on striking the air in the studio sets up a train of sound waves varying in amplitude in accordance with the range and intensity of the voice. These sound waves of their own accord could not be impressed on a transmitter without auxiliary or interpreting devices and here is where the microphone steps in. The microphone, similar to the one on your house telephone, but infinitely more satisfactory and more sensitive, consists of a diaphragm located equi-distant between two sets of carbon granules. The carbon granules and the diaphragm are connected together in a battery, or energizing source. When the sound waves set up by the performer strike the diaphragm of the microphone, the diaphragm is set into vibration at the same frequency as the voice of the performer. This physical vibration compresses and decompresses the carbon granules in the microphone and alternately increases or decreases the resistance of the microphone circuit. This increase and decrease of the electrical resistance of the circuit is at the amplitude of the voice uttered by the performer. We have now changed from a physical condition into an electrical one. Where in the case of the human voice, the sound waves are considered a mechanical or physical function before they reach the microphone, after they have hit the microphone an electrical condition is created. This electrical condition, in the microphone circuit, sets up in the secondary of the microphone transformer an alternating current at audio frequency, or at the same frequency as the spoken voice. These alternating currents are not of themselves sufficiently strong to be impressed on the transmitter and as a result they must be passed through an audio amplifier to strengthen them.



Sketch H

By consulting the sketch shown in Figure H, it is seen that the grid circuit of any tube has present in it alternating current, while the plate circuit has two types of current present. The first the direct current resulting from the plate battery, and the second the alternating current component similar to but immensely stronger in amplitude than the comparatively weak current in the grid circuit. In passing to the next stage, the only thing that goes through is the alternating current component, which, when it reaches the grid circuit of the succeeding tube, is pure alternating current. Then when the process is carried further, the succeeding plate circuit contains both direct current and the alternating current component. In the case of the audio amplifier, the alternating voice currents are stepped up in intensity until they can be delivered to the modulator circuit, this last stage being the one where we lose sight of the audio frequency voice currents because they are being impressed onto the radio frequency carrier created by the oscillator. The voice currents are directly audible in the modulator, but after getting into the oscillator they are lost entirely because they are occurring at a frequency too great for the human ear to appreciate. The radio frequency or inaudible current (because it is beyond the range of human audibility) is now fed into the antenna, where by its frequency of polarity reversal it sets up in the surrounding atmosphere a train of electro-magnetic waves. This train of electric-magnetic waves travels in each and every direction of the compass. Some of these waves, traveling at a speed of 186,000 miles per second, strike a distant antenna and there the process of reception begins.

Mechanical to Electrical Change

In the transmitting end, we have seen that the voice started as a physical sound, was changed to an electrical one by the microphone, amplified by the audio amplifier, impressed into the radio frequency carrier by means of the modulator and forced out into the air by means of the oscillator and the antenna. In such a condition these waves are inaudible and it is now necessary to bring them back into audibility. At the receiving end the electro-magnetic waves strike the antenna and induce in the grid circuit of the radio frequency amplifier minute electrical currents, which are amplified by this stage. This electrical energy is then passed on to the detector stage, where rectification or demodulation takes place. Where in the transmitter the modulator is the one that impressed the audio frequency currents onto the oscillator, in the reception it is the detector which takes out of the radio frequency amplifier the audio frequency tones desired. A homely simile for the detector would be that of an automatic pea

sheller, which takes the peas out of the pod and throws away the pod. In this case, the peas are the audio frequency currents and the pod is the radio frequency current. After the detector has demodulated or converted the radio frequency energy into audio frequency energy, this alternating current component, at a relatively low frequency is now led into the audio amplifier where it is stepped up in strength in the same fashion that it was done in the transmission end from the microphone to the modulator. In the reception end, the same process holds true as far as the tube circuit is concerned, as was previously explained under the sketch H, where the grid circuit of the tube contains alternating current and where the plate circuit contains direct current and an alternating current component. The radio frequency currents having been thrown out of the detector circuit by means of the bypass condenser used for that purpose, the only thing that now goes into the audio stage is alternating current at the frequency of voice transmission. In this case, the a. c. voice current is strengthened and built up so that it may be impressed upon a sound producing device, the latter being the speaker. A speaker is in effect the reverse of a microphone, because where in a microphone the sound wave strikes the diaphragm and cause electrical energy, in the speaker elcctrical energy travels through the windings of the speaker and sets up a field around the diaphragm, causing the diaphragm to produce sound waves which are audible to the ear.

The foregoing briefly gives an idea as to the two processes in connection with transmission and reception. It will, therefore, be seen that the voice is the same at the receiving end as at the transmitting end because of fidelity of transmission processes. It will be further seen that the microphone and the speaker are similar devices with opposite purposes. The audio amplifier in either case performs the same function, while the modulator and the detector are like devices but with opposite functions. In the case of the oscillator, this device is a producer of radio frequency current, whereas in the r. f. amplifier at the receiving end this device is a receiver of modulated and unmodulated radio frequency current. In the case of the antenna in the transmitting scheme, it causes fluctuation in the surrounding atmosphere, thereby setting up electro-magnetic waves. The aerial at the receiving end, being located in the atmosphere, is acted upon by these electro-magnetic waves and thereby sets up an alternating current in the grid of the receiving tube.

Resonance

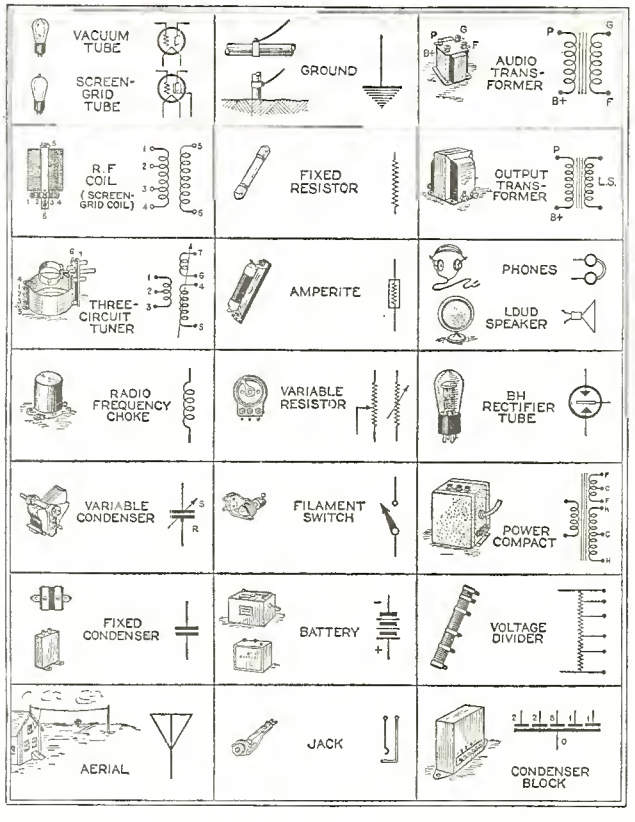
In order for the transmitted energy to be received, it is necessary that the receiving antenna be tuned to the same wavelength or frequency as the transmitting antenna. This is necessary because the transmitter is emitting its waves at a definite frequency and unless the receiver is tuned to exactly the same frequency, nothing occurs in the receiver. A simple analogy whereby this condition may be appreciated is the consideration of two G strings separated by a distance of about three or four inches. If one G string is plucked hard enough, it will set into vibration the neighboring G string. This will only occur providing both strings are tuned to the same pitch. In the event one of the strings is off pitch, or out of resonance with its neighbor, it will not vibrate when plucked. Thus the two G strings correspond to the antenna at the transmitter and that at the receiver.

Alternating Current Defined

SOME of our readers have stated that they do not understand how alternating current is obtained to actuate the speaker windings of a dynamic when pulsating current is found in the plate circuits of the amplifier stages.

This can best be understood by stating that alternating current may be produced by two methods. One is a reversal of polarity, and the second is amplitude of current change. The latter method is the one that explains how alternating current can be produced in a speaker winding when a plate circuit contains pulsating current. If alternating current were only produced by the first method, the dynamic, head phone, detector or other radio appliance would not be possible.

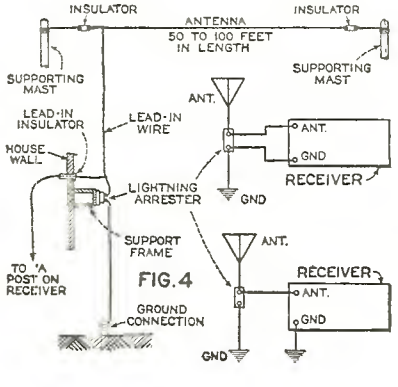
AN interesting series of symbols for the different parts for radio sets is shown in the diagram below and is taken from one of the lesson sheets of the Junior Radio Guild, about which our readers were advised in our last issue. In addition to showing the technical representation of the item itself, there is also given a graphic view of the unit so that even if the builder was not acquainted with the technical name or symbol of the unit, he would recognize it by its physical characteristics. This is quite desirable when the embryo builder has not reached the point where he is able to read a simple schematic circuit.



Therefore, there is no reason for any young boy or young man to refrain from building a set simply because he cannot read the schematic. If he will follow the graphic diagram shown, he will have no difficulty in recognizing the different units by their physical characteristics.

One of the interesting diagrams shown in the first lesson of the Junior Radio Guild is that illustrated in Fig. 4.

Quoting from the lesson sheet in particular, we find there are just a few pointers on the antenna ground system. "At the broadcasting station, the purpose of the antenna is to radiate the waves

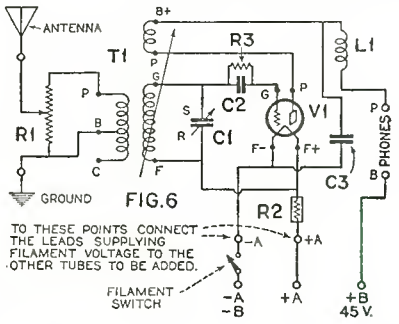


into space. At the receiving station, it is the job of the antenna to absorb a portion of this radiated energy and pass it along to the receiver coil and another tuning apparatus, so that of all the waves absorbed the desired one may be selected.

There are a number of considerations which must be given to

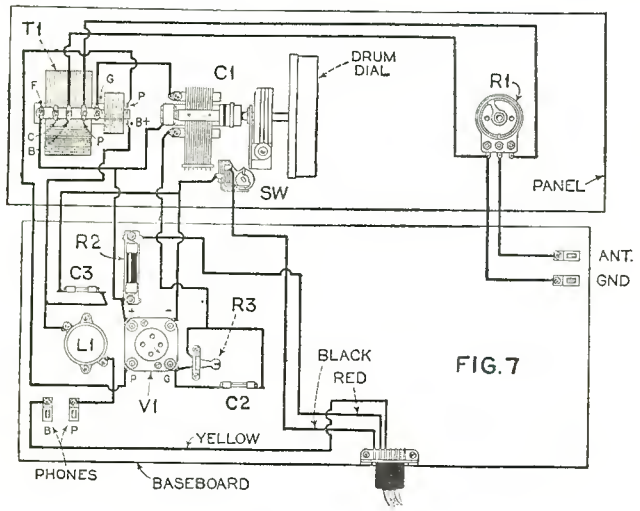
the construction and erection of the antenna if it is to be really efficient, that is, if it is to absorb a maximum of energy. First it should be erected as high as possible. The wire used for the antenna should be strong enough to be pulled tight, so that there will be no slack after it is put up. Antenna wire usually consists of seven strands of eopper or bronze wire. Second, it should be located in an unobstructed place.

If it is placed close to other large metallic objects, such as a tin or copper roof, the received signals will be seriously weakened. Third, it should be erected in such a manner that it is free from



contact with other objects. At no point along the length of the antenna or its lead-in wire should it come in contact with cornices, supporting masts, sides of the house or any grounded object. If such contact does take place, not only the efficiency of the antenna receiving qualities will be reduced, but also a disturbing, scratchy noice will be heard in the receiver due to the constant making and breaking of the contact between the antenna and the other object.

The down-lead, otherwise termed the lead-in, should comply with fire underwriters' rules in that it should be connected to a lightning arrester at the where the lead is brought into the house. All of these points are made clear by referring to the sketch showing antenna construction and erection in Fig. 4. Several methods of connecting the lightning arrester are also shown.



In the second lesson in the Junior Radio Guild course, from which we are excerpting certain portions, is a description of the construction of a single detector stage illustrated in Fig. 6 shown above. This is the simple schematic diagram of the receiver. In Fig. 7 is shown a graphic idea of how the receiver should be wired. The diagram in Fig. 7 indicates the back view of the front panel and the top view of the baseboard. The upper portion of the sketch represents the back of the front panel, while the lower portion represents the sub-panel. Thus, the operator is looking at the rear of the receiver.

This receiver is so designed that as a detector it will give excellent results on head phone operation for the builder and later on, if he so desires, it may be converted into a larger set. After the first portion of the receiver has been built, there will be no changes in that end of the circuit and the only addition will be the employment of sufficient audio amplification to make signals audible on a speaker instead of having to listen in on a pair of head phones. However, for the beginner, the simple detector circuit is quitc economical and later on he can add to the set as his purse and desires warrant.

Inasmuch as the panel of the receiver is already drilled, much of the work is reduced in the preparation of the receiver. The wiring may be accomplished by following the diagram shown in Fig. 7.

Parts required for the detector stage are shown in the list below.

1 Hammarlund Midline condenser .0005 mfd
1 Hammarlund TCT-23 coil
1 Hammarlund r. f. choke 85
1 Hammarlund drum dial type SDB-1
1 Electrad Tonatrol type A variable resistance
1 Electrad bypass condenser .001 mfd
1 Electrad grid condenser .00025 mfd
1 Durham grid leak 5 megohm
1 Benjamin Ux socket
1 Durham single resistor mounting
1 Amperite type 1-A
1 Yaxley midget battery switch No. 10
1 Yaxley cable connector, cable and plug type 660
1 Drilled front panel 7x21-in.

After the receiver has been completely wired, operation may be secured by following the procedure outlined below:

Insert the 5 megohm grid leak in the clips of the grid leak mounting. Connect the antenna and ground to the respective clips. Connect the phones to their clips. Connect the batteries to their respective wires. Only the A battery and the first 45 volt section of the B battery are used with the detector unit. If, when the condenser plates are entirely closed or meshed with each other, the dial does not read 100, then loosen the dial set screws and make the correction. Next turn on the filament switch, turn the regenration control partly to the right and then slowly rotate the dial knob. At first the station will manifest itself by a shrill whistle. After the whistle has been tuned in to its loudest point, then slowly retard the regeneration control until the undistorted signal of the station is heard. At this point, it may be found necessary to slightly retune the setting of the dial to bring in the station with maximum loudness. Other stations may be tuned in in a like manner.

The editorial department of this magazine will be interested in hearing from readers as to their reactions on the type of material contained in the Junior Radio Guild and whether the readers find this material of service to them. If this material does prove of benefit to them, we will be glad to continue making excerpts from the lesson sheets, although, of eourse, the best idea is for the ones interested to take the course themselves.

Listeners' Commandments

NOW that DX or long-distance reception is becoming possible again with the clearing of the broadcast atmosphere by the Federal Radio Commission, it is well to formulate Ten Commandments for the DX fan. And here they are, as formulated by the Clarostat engineering staff:

1. Good reception begins with the interception of ample signal strength. Therefore, make sure of a good antenna and ground connection. Joints should be soldered, or at least taped. A suitable socket antenna plug will often prove more efficient than an antenna, particularly in poor radio localities. It may be employed as a "booster," in addition to the usual antenna.

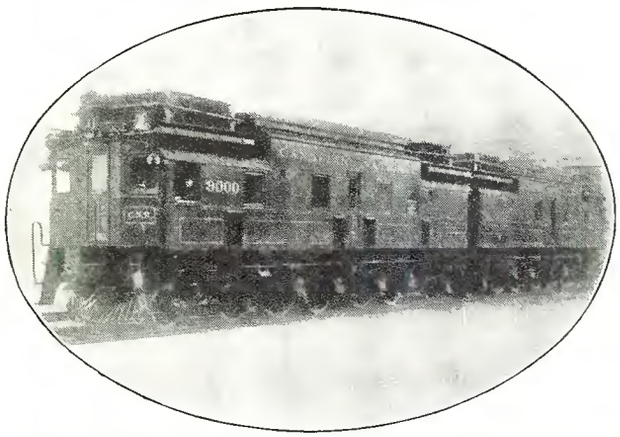
2. Reception can do no better than the tubes employed. Tubes, contrary to general opinion, do not last forever. Even if they light, that is no indication of their goodness. When tubes have been in use more than a year, they should be replaeed with fresh tubes. Only tubes of a reliable brand should be used. Cheap tubes are most expensive in the end.

3. Proper A, B and C voltages should be applied. In the case of batteries, this may be done by voltage taps. In the ease of

(*Continued on page* 138)

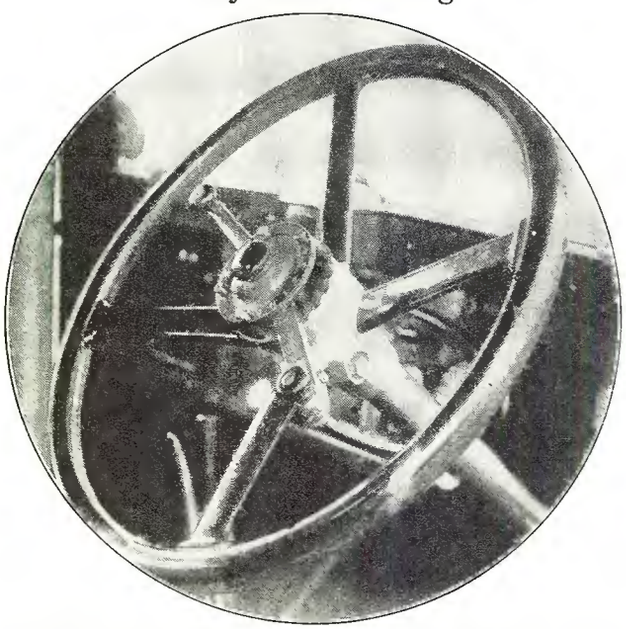
Digest of Science

Oil-Electric Locomotive



The brains of three countries, Canada, the United States and Britain, have been working to produce this Canadian National Railway oil-electric locomotive which, by utilizing an oil motor to generate electrical energy, develops speed and power at costs far below those of coal fired steam driven engines. The new locomotive, which has developed from the oil-electric car, originated by the Canadian National, is being placed in service on the main line between the Northern type now in use over the National system. The promise of its wide use in the hauling of heavy passenger and freight trains, in which it will effect an outstanding economy, is predicted by railroad engineers as certain to bring about a revolutionary change in transportation on the North American continent

Easy Gear Shifting

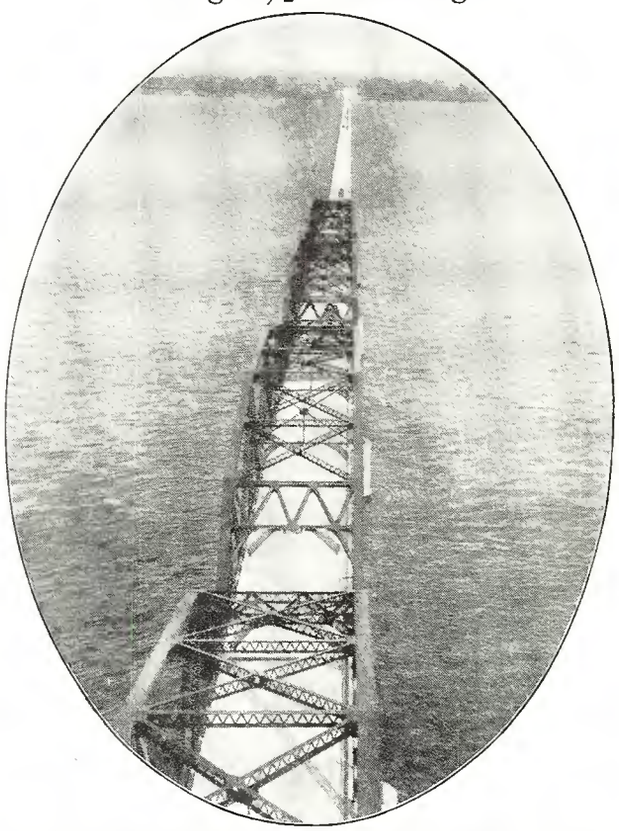


Motorists will welcome the self-changing, automatic gear shift which has been adopted by Armstrong-Sydney Motors, Ltd., of London. This innovation is simplicity itself in operation. Gear positions are clearly indicated on a quadrant on the steering wheel. These positions are reverse, neutral, low, medium, normal and high. When the driver wishes to start he turns the steering wheel pointer to low and presses the foot pedal and the car glides away. When going up a hill, the car automatically shifts from high to normal.

Spanish Easy for Parrots

Parrots learn the Spanish language easier than English or German, dealers in birds and other pets in the Southwest declare. Species of parrots from the tropics that are brought here when young are said to acquire the habit of saying the soft words of the Spanish language quicker than the rather harsh words common to theTeutonic languages. In the bird house at the Dallas muncipal zoo a parrot speaks Spanish words picked up from countless Mexican visitors and has never spoken a word in English. In El Paso a parrot learned words in Spanish and in Chinese but seldom spoke English.

Bridge 5½ Miles Long



A view of the great Newport News-James River bridge leaping five and one-half miles across the James River, connecting the mainland with the Virginia peninsula, costing $7,000,000, which was formally opened recently when President Coolidge pressed a button in Washington, D. C.

Unmutilated Animal Grows New Foot

A triton, one of the lower vertebrates related to frogs and salamanders, has been induced to grow a new foot on an unmutilated leg already provided with a foot. At a recent meeting of the Russian Academy of Sciences, Dr. N. N. Nassenow described his experiments.

It is nothing new for a triton to grow a new foot, or even a

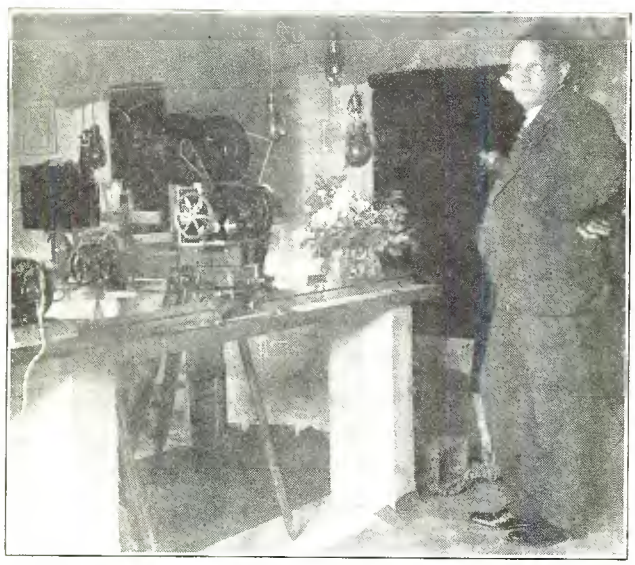
whole new leg. Tritons seem to be able to regenerate very considerable parts of their anatomy, even including such complex organs as eyes. But hitherto they have done so only when through accident or surgical operation something was cut or bitten away.

In Dr. Nassenow's experiment no cutting took place. He merely put a bandage around the creature's leg, tight enough to put pressure on the tissues but not tight enough to injure them severely. Some time thereafter, a swelling was noted on the triton's leg, which subsequently grew out into a normally formed foot, alongside the one already normally present.

Dengue Fever Is Mosquito-Borne

Dengue fever, which has been running riot in Athens, and in fact has swept over the whole of Greece, is no respecter of persons, having finally attacked Prime Minister Venizelos himself. The total number of cases in the present epidemic has reached 80,000, according to reports received by the U. S. Public Health Service at Washington. This is an unusually large number even for a warm country like Greece, where the disease occurs frequently.

X-Rays Blooming Rose



Arthur C. Pillsbury, California photo-botanist and x-ray motion picture expert, is shown in his laboratory with a machine he uses and the rose that he is now x-raying. This rose has been blooming four days and it is expected to take four more days before full bloom is reached. In addition to the study on roses, Mr. Pillsbury is x-raying and photographing the mending of a break in a rat's leg.

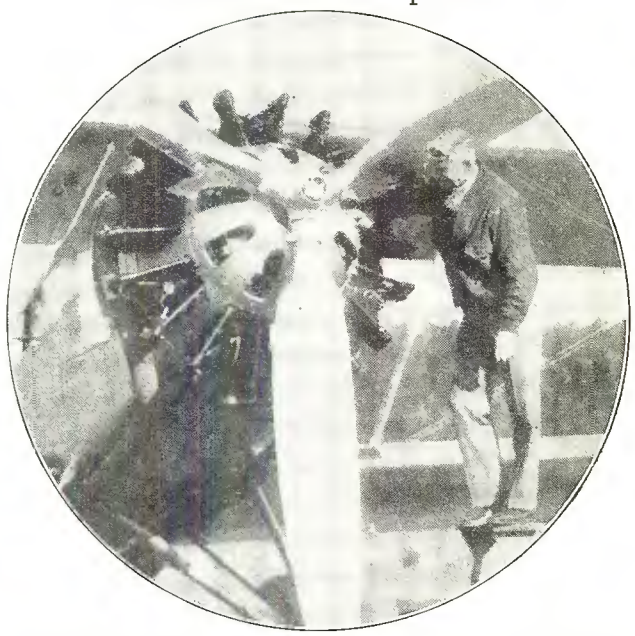
Dengue fever, like yellow fever and malaria, is one of the so-called tropical diseases and is spread by the mosquito. In former times it was considered a mild form of yellow fever, but more recently it was found to be a distinct disease. It has a sudden onset, and the course of the disease is acute and short, usually seven days. The death rate is very low, the patients almost always recovering. The severe pains which characterize this fever earned it the name of "break-bone" fever.

Hypnotism Used to Capture Lizards

The capturing of lizards used to be a difficult, almost impossible, matter for Edwin D. McKee, connected with the educational forces at the Grand Canyon National Park in Arizona. Now, however, he reports it surprisingly easy, since he has learned to hypnotize them before attempting to catch them. This method, he states, applies particularly to the blue-bellied lizard, which is a particularly long and slender member of the lizard family.

The method employed is to keep one's eyes squarely and steadily focused on those of the desired animal. At the same time the hand is gradually advanced to a commanding position within a foot or less of the intended victim. Then with a quick downward dart of the hand the lizard is pinned to the rock, from which he may be transferred with ease.

Three-Bladed Propeller



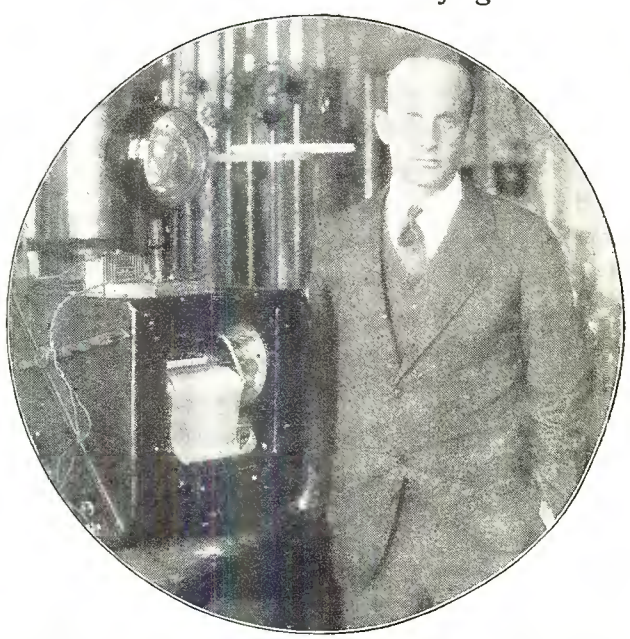
Erik Nelson, round the world flyer, now attached to the Boeing Air Plant of Seattle, is making experiments with a three-bladed propeller on the theory that the new arrangement will give the plane more lifting power and speed. Photo shows Nelson exhibiting the new propeller.

Undersea Camera Gets Tide Data

A unique motion picture camera, recording automatically the velocity and direction of currents beneath the surface of the water, was used to advantage this past summer by the U. S. Coast and Geodetic Survey during what is stated to be the most comprehensive survey of tide and current conditions in Chesapeake Bay ever attempted.

While the device is so new that it has not yet been perfected fully, it has shown results that indicate it will be used as a regular part of standard current testing equipment. The camera is

Measures Value of Daylight



Dr. L. R. Koller, of the Research Laboratory of the General Electric Co., with his daylight integrator, a device that records the amount of daylight received over any desired period of time. The equipment consists mainly of a giant photo-electric cell, several times larger than the usual cell and two hundred times as sensitive

Folding Kitchen

An extremely serviceable adjunct to the modern one-room apartment is this fourfold screen, with all the requirements of a miniature kitchen enclosed. When not in use, it may be folded up and placed discreetly in one corner of the room. This idea is quite popular in London

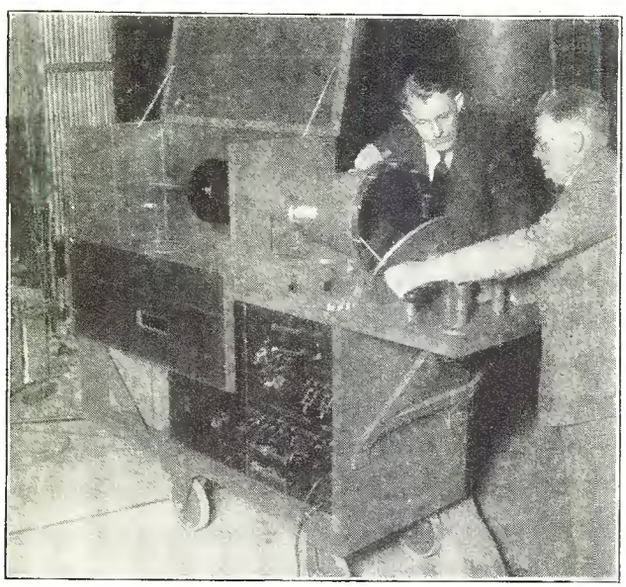
designed to take the place of a complete human observing unit composed of one boat, one officer and six men. It contains within it a compass and revolution dial of which pictures are made each half hour, and works continuously without attention for an entire week.

The purpose of the Survey's probe this summer was to bring aids to navigation, such as mariner's charts and current tables, absolutely up to date. From the data gathered this year and last, current tables will be published from which at any future time the direction and velocity of currents at any place in the Bay may be ascertained. The information likewise will be valuable in enabling engineers of surrounding cities to make proper disposal of their sewage. They must know at precisely what point the ebb of the tide will be able to convey the sewage farther out to sea than the flood current is able to bring it back.

Fishing interests will be aided by the data since certain fish are known to bite better at certain tidal stages than at others.

Htaded by Lieut. George L. Anderson, the Survey engineers, four all told, conducted their investigations from four 65-foot launches. A unique feature was that 24 college boys, selected from leading universities in the east and mid-west, acted as special observers, their purpose being to gain technical experience to add to their engineering knowledge.

High Speed Camera



A colossal photograph machine capable of recording electrical phenomena occurring in a 100,000,000th part of a second is purchased by the California Institute of Technology at Pasadena. It will be used in the Institute high tension laboratories. The big camera is called a cold cathode ray oscillograph and will be used to study and record the antics of the electrical activities. It is the first machine of its type to be placed in an institution of learning. Professor Royal W. Sorensen, head of the electrical engineering department, explains the operation of the powerful oscillograph to Professor Chas. E. Lauritsen (left) of the Institute faculty

Will-o'-the-Wisp Studied by Germans

Two close-up observations of the will-o'-the-wisp, those weird and elusive flames that appear over marshy ground, have recently been put on record by German observers.

H. H. Sven, a German scientist, observed one night in November, 1927, near an iron mine in Bohemia upon a swampy tract of land, four small bluish phosphorescent flames. They were of the height of the candle-flame and a diameter of about an inch and were constantly hopping up and down. Near them appeared a flame of about three feet in height of a yellowish green color and diameter of about a foot. Their light was sufficient to read the face of a watch and to make notes, but the fames had no heat when touched. After the phenomenon had lasted 15 minutes they went out.

In the vicinity are several springs with radio-active water. Upon returning to the place in the day time Mr. Sven could find no trace of the source of the flames. He learned, however, that while will-o'-the-wisps appear to be independent of air temperature they are dependent upon air pressure; the higher the pressure the less the light.

New Type Movie Film

Karl Wahl, (right) and Roehrich, two Berlin engineers, who have succeeded in manufacturing a film destined to revolutionize present day methods and to reduce cost of material to a fraction of its present price. The distinctive features of the product are: it burns only with difficulty, and is free of argentum. Besides it is 50 per cent more pervious to light, thus causing a saving in electric current when projecting

Robin Breaks Ice to Take Bath

During a recent cold spell at the Grand Canyon a robin discovered the bird bath outside the chief ranger's house to be covered with ice. Many humans would have been discouraged and postponed the daily bath until the sun had a chance to get its work in. Not this immaculate robin, however, Undaunted by the icy coating of the bath he first broke the ice with his feet and then plunged in.

"Ultra-Violetted" Cereal Now Offered on the Market

A cereal food treated with ultra-violet light to give it the beneficial action of vitamin D, preventive of rickets, has now appeared on the market. This is the first commercial application of the discovery of the famous University of Wisconsin professor, Harry Steenbock, that ordinary foods exposed to the action of ultra-violet rays, either from quartz lamps or from natural sunlight, will promote the formation of healthy bones and teeth in children and young animals, supplementing or sometimes even supplanting the cod liver oil which it is so hard to make children swallow.

Every Man His Own Cop

Pedestrians can now act as their own traffic officers with the invention of a new street crossing device by Ralph Dorsey, Los Angeles traffic signal engineer, which is now being tried out. Operated by a push-button, this work-it-yourself signal halts traffic with stop arm and red light for 15 seconds, giving the pedestrians time to cross the street, then it automatically reverts to the "clear" position. Twenty-five seconds must then elapse before another pedestrian can again halt traffic. Photo shows pupils from the Luther Burbank Junior High School in Los Angeles operating the new device.

New Aviation Test Duplicates Plane's Motion

A device that stimulates actual flying conditions and produces the psychological effect to the beginning airman of an airplane in motion has been developed at the Wright Field Experiment Flying Station at Dayton after almost a year's tests, it was revealed recently by Lieut. Albert I. Hegenberger.

As yet without a technical name but known temporarily as an "orientator" or apparatus designed to accustom the novice to the feel of the plane, the new invention is producing excellent results and when further perfected may entirely take the place of the "Ruggles" orientor, the standard device of the same general nature that is in wide use today.

As a casual glance the "orientator" looks very much like the Ruggles apparatus since it is about the same size and is used in a like frame. However, it has certain marked and revolutionary differences, Lieut. Hegenberger explains. Whereas the former device is able to simulate the control appartatus of a plane and contains the actual cockpit, it has neither propeller nor engine. But the new "orientator" has all these things and is tus able to give all the plane's basic movements, such as an up and down lift, a left and right stability, the roar of the engine plus the attendant strong blast of air, and precisely the same loops and turns as are made by an actual piane in the air. In addition the "orientator" is equipped with a regulation acron or moveable flat foil that serves the ship from wobbling from side to side. The apparatus is electrically controlled and the bulk of it is covered with a fabric very similar to that of a plane.

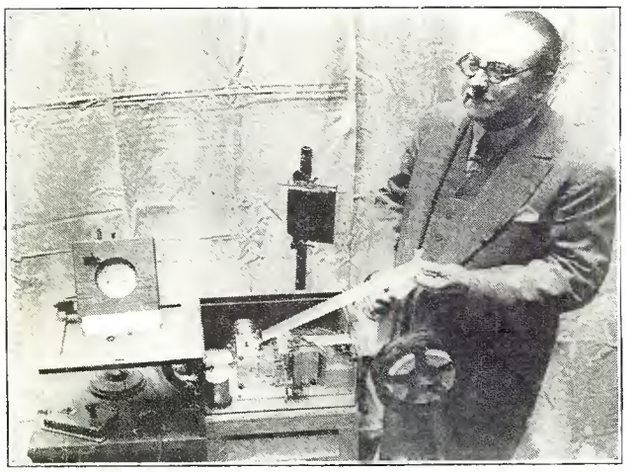
New Plate Invented

A new plate, taking the place of the mat and the electrotype, has made its appearance on the market, and all signs point to its revolutionizing the printing industry. The invention consists of a flexible plate, fabricated by a special process from a paper base so light that it can be whisked through the mails as first class matter, and yet withstand wear and tear and general knock-about handling to a degree that metal plates can not endure. The new paper plate is capable of being run off on either the flat bed or cylindrical presses, without mechanical make-ready. It is the invention of Fred C. Goldenbaum if New York. Photo shows three of the newly invented paper plates mounted on blocks ready for flat bed presses

Removes Metal from Body

Newest electrical marvels were exhibited at the recent annual electric show at the Grand Central Palace in New York. In this photograph Carmen Morales of the "Lucky Girl" cast is shown before the giant eye magnet which is capable of removing all sorts of metal from the human body. She is here demonstrating how a bit of metal is removed from the eye.

Measured Athletes' Speed at Olympics



Wide World Photo

F. L. Loebner, inventor, with his newly perfected time measuring apparatus which records the speed of athletes and picturizes the finish of a race at the same time. The new device was tried out at the Olympic games in Amsterdam

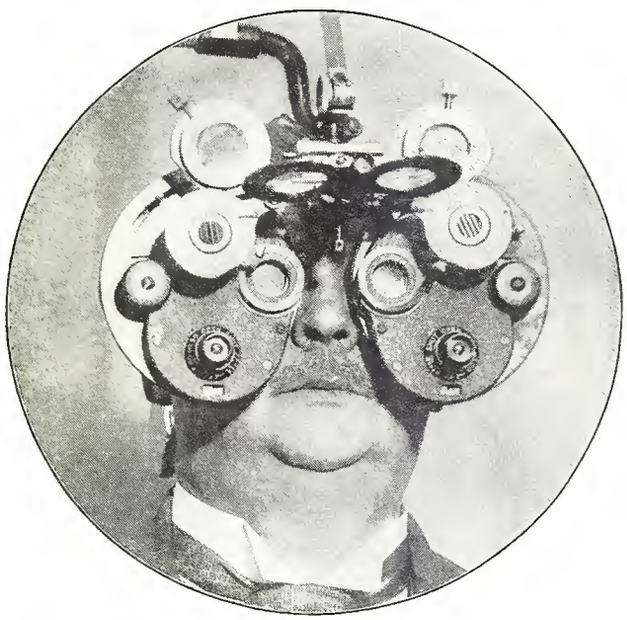
Radio "Echo" Tells Ship's Position

Methods of locating a ship's position by means of automatic radio signals sent out from shore stations upon the receipt of a sound signal through the water from the ship have now reached a high degree of perfection and dependability. This is the announcement made by Col. E. Lester Jones, director of the U. S. Coast and Geodetic Survey, in his annual report just made public.

Depth measurements are made by the survey's ships with the echo sounding device. A sound wave travels to the bottom, is reflected back and the time taken indicates the depth. In order properly to locate the position, however, it is necessary to know the position with respect to fixed points that can be identified on maps. With radio this can be done at night or in cloudy weather or at distances too far for the ordinary visual bearings.

"In radio acoustic sound ranging," said Col. Jones, "a sound is produced at the survey ship which travels through the water to two or more shore stations which automatically send wireless signals to the ship as soon as the sound arrives. This gives a measure of the distance of the ship from each tation. Knowing the location of the two stations from previous surveying, the three sides of a triangle are known from which the ship's position can be computed."

Tests Eyes Minutely



This remarkable instrument, which is in reality a battery of lenses no bigger than a cigar box, enables the optician to secure over one million combinations of lenses almost instantaneously. It is one of the various new instruments installed in the London Refraction Hospital which has been rebuilt at a cost of $50,000. This instrument will reveal the fact that patient's eye deviates by as little as a quarter of a degree from its normal outlook.

Helium Leaks Through Glass

Glass, which about fits the average man's idea of something absolutely leak-proof unless it is cracked, isn't so tight after all. It will permit a slow leak of the valuable gas helium, even when the high-quality pyrex variety is used, according to results of an experiment by Prof. G. P. Baxter, Dr. H. W. Starkweather and Dr. R. B. Ellestad of Havard University, which will be reported in the forthcoming issue of Science. The three experimenters sealed up 1044 milliliters—something over a quart—of helium in a pyrex glass globe and left it there for over a year, weighing it carefully at intervals. At the end of 366 days it had lost 10.7 milliliters, or over one per cent of its original content, by slow seepage through the glass.

Waves Operate Turbines

Photo Wide World

An entire city can be furnished with electricity by this wave turbine pier, according to George E. Faucher, its inventor, who has just completed and is exhibiting his first model in Los Angeles. Built like a pier, 1,000 feet long, the "V" of the machine points oceanward and as the waves roll in they are split and operate two series of turbines on both sides of it. The turbines are made of steel and encased in air and watertight tanks that float. The force of the waves is caught in air and wings that send the turbines spinning, according to the inventor. Constant storing of electric energy thus developed will require the largest storage battery ever built. The turbines will float so high that high and low tide present no handicap.

Pulleys, Not Hearts, Raise Sap in Trees

Sap does not rise in trees, it gets pulled up. There are no hearts or other pumps, and the mysterious "root pressure" that used to be talked about is little more than a myth. And water, though "as weak as water" in large masses, is as strong as wire when confined within the walls of the tiny tubes that make up the sap-wood of trees.

These are elements in the picture of the inside of a plant's water-distributing system, worked out by Dr. D. T. MacDougal of the Desert Laboratory, Tucson, Ariz., who lectured recently before the Carnegie Institution of Washington. One of Dr. MacDougal's most recent discoveries is that the air confined in the deal vessels of a tree trunk forms a single connected system, just a the sap does. By applying pressure instruments to different parts of the tree's anatomy, he discovered that changes of pressure in one part of the confined air were rapidly transmitted to all parts of the tree.

Test for Radium Poisoning

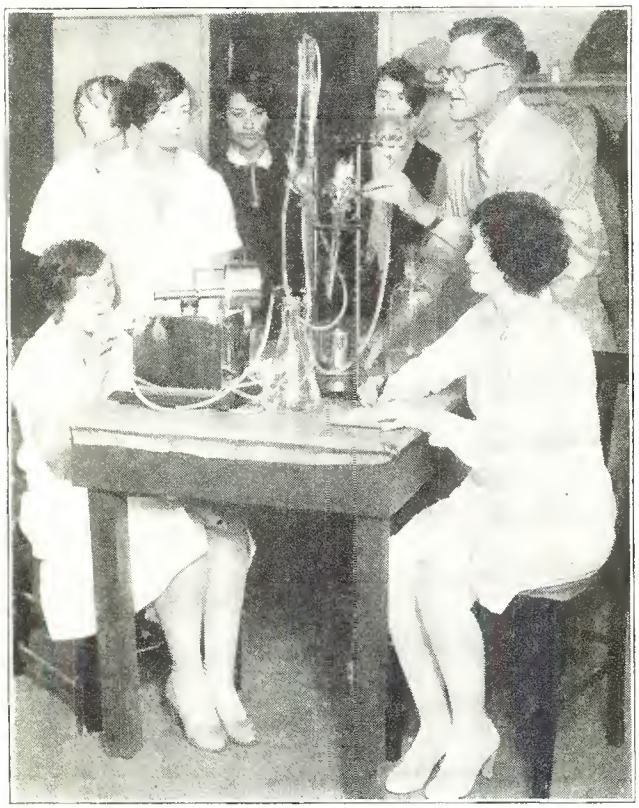


Photo Wide World

To prevent any repetition of the famous "radium poisoning" case in the East, employes of Los Angeles concerns making luminous dial-appliances are tested for any poisonous effects through the use of an ingenious apparatus devised by Capt. H. R. Zimmer, famous radium products technician. Capt. Zimmer is presiding in tests of all radium products employes which started recently at the Pacific Radium Appliance Company in Los Angeles. Miss Helen Pimmings is being tested while Bernice McGalliard makes notes. The new testing device is said to be the only apparatus in existence of its kind and operates by testing the radio-active reaction from a person's breath.

Electric Meter Keeps Tab on Planes' Gas

No longer will aviators have to guess at their fuel supply when the gasoline gauge freezes or breaks. A simple and strongly constructed electric meter, connected by wires to the bottom of the gas tank, may tell the gas supply in future planes. The new gauge is the invention of J. H. Payne, of the General Electric Company. By means of a diaphragm at the bottom of the tank with a pile of small pieces of carbon back of it the exact weight of the gasoline is measured. It will measure the amount of fuel in the tank to within an eighth of an inch, or about 1 per cent of the amount.

Measures Body Electricity

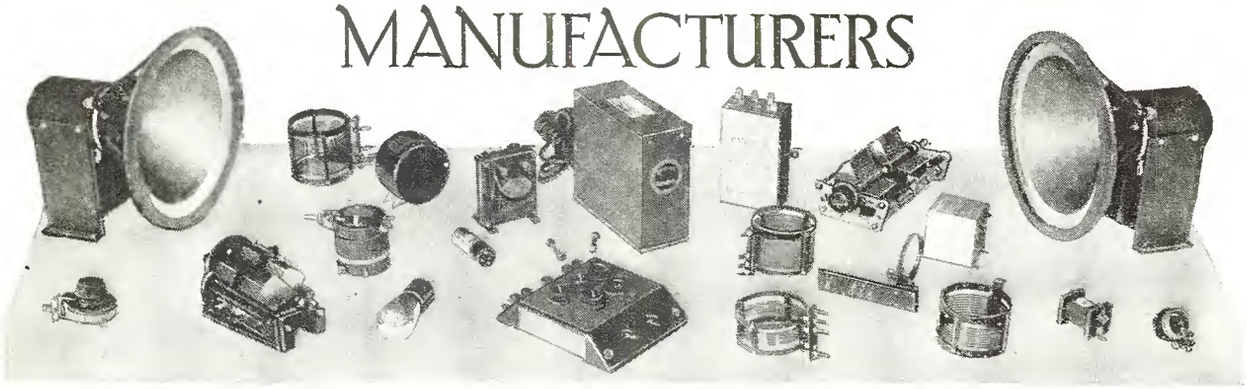
J. Vacher, a Berlin engineer, who has invented a device called "Jonisator," which he claims will show the amount of electricity in the human body. He proves this by fixing to one part of the body a zinc sheet, to another part of the body a copper sheet. Connecting the two to a sensitive galvanometer, the amount of electricity in the body may be determined

Mechanical Crew-Saving Lung

Photo Wide World

Lieutenant C. B. Momsen demonstrating the use of his new safety device, called "The Lung," which will enable the trapped crews of sunken submarines to leave the craft at will. Assisting him into the boat is Chief Gunner C. O. Tibbals of the Washington Navy Yard who assisted in developing "The Lung."

WITH THE ACCESSORY & PARTS MANUFACTURERS



Use Full Wave Rectifier Circuit As Exciter in Muter Dynamic

New Arrangement Permits Use of Proper Filter to Kill A.C. Hum; Simplifies Replacement

Muter Dynamic Rectifier Circuit

EMPLOYING a much more simpler and efficient rectifier circuit, the new Muter a. c. dynamic speaker announced for the 1929 season has been placed in production and by the time this magazine is on sale it will be available throughout the country. The Muter 1929 dynamic represents the last word in electrical reproducers, designed for universal use, and will give satisfactory results when used with either an ordinary radio set or a special power amplifier for phonograph work. It is entirely free from any inherent tone pitch and when used with a proper baffle, it will faithfully reproduce without distortion or alteration whatever sounds are fed into it through the amplifier system. A photograph of the new unit is shown in Fig. 1, while in Fig. 2 is a schematic and graphic combined sketch giving an idea as to the rectifier circuit together with the connections involved in the speaker.

Because of its mechanical and electrical construction, the Muter dynamic is able to reproduce to its full value low notes which would scarcely be audible on the reproducer of a magnetic type. However, this does not necessarily mean that the use of a Muter on any radio set will bring out bass notes with the desired volume. These notes must first come through the audio amplifier system with proper intensity. There are three different models of the 1929 Muter dynamic, varying in accordance with the method of exciting the electro-magnetic field. These three units are supplied in a handsome walnut cabinet, as well as in the manufacturer's model, which is the unit form. The three units are alike in every respect, except the method of exciting the field, and when properly used will be identical in performance from the standpoint of volume and tone quality. Type No. 4310 for 110 volt a. c. is designed for field excitation on any 105 to 125 volt alternating current source of supply. It is the model recommended for general use wherever an alternating current supply in the above voltage range, such as the ordinary house lighting supply, is available for excitation. When the field is properly excited, this model will perform equally well on either a. c. or d. c. radio sets.

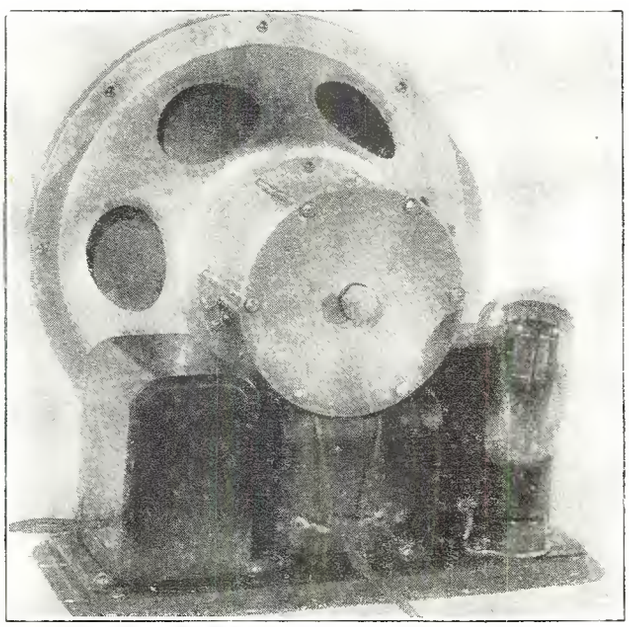


Fig. 1

Because direct current is required to excite the magnetic field, it is necessary to provide some means of rectifying the 110 volt alternating current. In the 4310 Muter, the dry rectifier has been replaced wtih a 280 vacuum tube rectifier. This has enabled Muter to incorporate a special filter circuit not possible with the dry rectifier, eliminating the 60 cycle hum which has been an annoying factor in the operation of any 110 volt a. c. dynamic speaker previously. The tube is also a much more practical rectifier, inasmuch as it can be quickly, easily and cheaply replaced. The sketch shown in Fig. 2 is a schematic diagram of the 4310 unit, with its rectifier and filter circuit. This model is supplied with a 6 foot cord for input connections and a 10 foot lamp cord and plug for the field connection. A switch is provided in the cord; when the speaker is not in use. care should be taken to turn this switch to the off position, to prevent undue wear on rectifier tube.

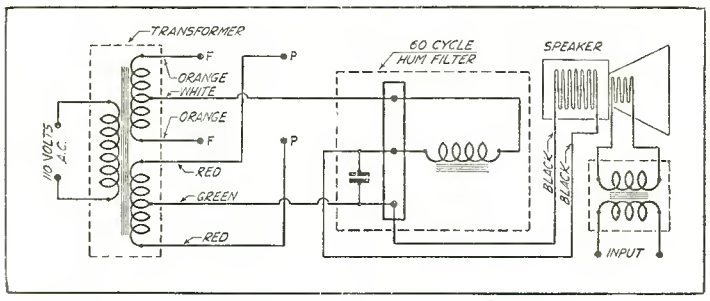


Fig. 2

When the speaker is used with an a. c. set, it is often possible to connect the field lead to the 110 volt line inside of the set in such a manner that the power switch on the set will control both set and speaker. If the user is not familiar with the proper method of accomplishing this, a competent service man or professional set builder should be consulted.

Another model of the Muter using the 280 rectifier tube is the 4410 unit, in this the back of the cabinet must be unscrewed in order to insert the tube in the place provided in the base of the unit. After the tube has been inserted and the speaker tested, the back should be replaced and care must be taken to insure that it is screwed down tight to prevent rattle. Rectifier tubes are not supplied with either the 4310 or 4410 models. Any 280 type full wave rectifier tube, such as the CX-380 or UX-280 may be used.

The direct current models are 4390 and 4490, the 4390 having a field resistance of 2300 ohms designed for excitation on 90 volts to 180 volts direct current. It may be used in cases where the lighting circuit is 110 volts d. c. and also in connection with radio sets and power or phonograph amplifiers that provide special field connections for dynamic type speakers. When used in connection with such devices, care must be taken to insure that the current passing through the speaker field is not less than 40 nor more than 80 milliamperes. The 4390 is especially adapted for use by amateurs and set builders in connection with power amplifiers, etc., where it is desired to excite the speaker field direct from the B supply system, thus avoiding the additional cost of a special rectifier for the speaker.

The 4490 dynamic consists of a 4390 unit in a handsome walnut cabinet. In this model a 6 foot phone cord is provided for input connections and two 8 foot wires for the field connection.

Battery operated types are the 4306 and the 4406, the 4306 unit being designed for field excitation on six or twelve volts d. c. The field may be excited either from a 6 volt battery or a 6 volt battery charger.

The 4306 unit is intended to be used in connection with battery operated sets in cases where the 110 volt house lighting current, either a. c. or d. c., is not available. The 4406 unit is a 4306 unit installed in a handsome walnut cabinet. This aso has 6 foot phone cords for input connections and two 8 foot leads for the field connection.

From the professional set builders' standpoint, as well as that of a manufacturer embodying dynamics in the cabinets or consoles of receivers, it is quite likely that the 4310 unit will be very well received. The replacement problem of a rectifier in that model is quite simple, as contrasted to the replacement of other forms of rectifiers. This point alone should be of interest to a professional set builder, who is called upon to do frequent servicing in his locality. Another important feature is the fact that by the use of this rectifier circuit, it is possible to eliminate more a. c. hum than by any other method, and this should go a long ways towards satisfying the critcial buyers of dynamic speakers, who wish to have something that is entirely free from extraneous noises.

New Weston Set Tester

THE Weston Model 537 a.c.-d.c. radio set tester is a complete outfit, most ingeniously designed and fully adaptable to the testing requirements of every set made, whether operated by direct current from batteries or battery substitutes, or by alternating current from socket power.

It will measure the various currents and voltages employed anywhere in the set, including those at the tube sockets. All tests can be made by using the regular voltages normally supplied to the set by its batteries or socket power without the necessity of changing connections. Nor is any auxiliary power required.

The set is provided with two instruments—an a. c. voltmeter and a d. c. volt-milliammeter. An ingenious system of switches and binding posts provides for automatically connecting the instruments to the circuits being tested. The a. c. voltmeter has three ranges—150-8-4 volts—the lower ranges being required for measuring the filament voltages of tubes, and the highest range is provided for measuring the line voltage. The d. c. volt-milliammeter has four voltage ranges—600, 300, 60 and 8 volts and two current ranges—150 and 30 milliamperes. All voltage ranges have a resistance of 1,000 ohms per volt. The set is furnished with the necessary socket adaptors and a complete instruction book.

It is made by Weston Electrical Instrument Corporation, Newark, N. J.

Webster Auto-Potentialator

AN interesting item being marketed this season by the Webster Company, 850 Blackhawk Street, Chicago, Ill., is known as their potentialator for a. c. voltage regulation.

The new Webster autopotentialator provides complete automatic regulation of a. c. current. It delivers to the a. c. set or the A and B eliminator absolutely even flow of alternating current of the exact voltage necessary for the most successful operation of any make of receiver. Entirely automatic, it contains no tubes or liquid, needs no complicated adjustment and affords protection from sudden line fluctuations that occur in a. c. lighting circuits.

It is sturdily built, small in size. It slips out of sight in the console or other place where the radio set is being operated. It measures 8¾x4½x5¼ inches.

Amperite Blue Book

BEGINNERS in radio and others who are not well versed in the art may find considerable information in the Amperite Blue Book of radio information, issued by the Radiall Co. of 52 Franklin Street, New York City. Matter that is especially interesting may be found on pages 8 and 9, where a current problem is described. Simple charts are shown to give an idea as to the operation of a tube with Amperites in the filament circuit.

There is also a chapter in the little booklet on voltage regulation for the a. c. tubes, wherein the new Amperite made for the 226 and 227 tubes is described and methods of installation are explained.

Interesting Magnavox Booklet

DESPITE the tremendous interest in the subject of dynamic speakers, and this year this type of speaker is proving even more popular than ever before, there is still a demand for a plainly written booklet covering the principle of the electrodynamic speaker.

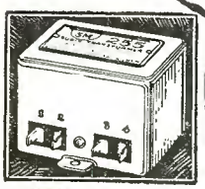
We believe the recent booklet issued by the Magnavox Co., 4250 Horton Street, Oakland, Calif., covers the subject very fully and should be of more than ordinary interest to those who have been wondering what actually goes in the dynamic speaker. There are some historical sketches which show the dynamic principle as pertaining to reproducer design, and also showing that this particular design was not new to the Magnavox interests as early as 1911, seventeen years ago. By careful perusal, even the layman can grasp the true meaning of the word dynamic. In this booklet there are a number of small sketches which give an idea as to the operation of a dynamic speaker.

Those interested in this subject may secure a copy of this interesting booklet by writing the Magnavox Co. at the address given above.

(*Continued on page* 114)

SM

The Synonym for Quality Audio Amplification—S-M



To the proven "finest audio transformers ever made" S-M now adds push-pull transformers of utterly unequalled performance!

The S-M 255 and 256 transformers at $6.00 each, and the 225 and 226 units at $9.00, each introduced the Clough audio system. Just how good they are is told by two things. Sold on the only "better or money-back" guarantee in the business, hardly a one has ever been returned, and more are sold today than any other supposedly high-quality transformers.

Now S-M offers push-pull transformers built on the Clough system—transformers unconditionally guaranteed finer than any and all competitive types. The Type 257 is a push-pull input type to operate between a magnetic record pickup or one 201A, 112A, 226 or 227 tube and two 112A, 226, 227, 171A, 210 or 250 power tubes. Its frequency characteristic is practically flat from 40 to 8,000 cycles in an A.C. or D.C. amplifier, yet its price is but $7.00 in the popular 255 type case. Type 227 is a dual push-pull transformer to operate out of two 201A, 112A, 226, 227, or 171 tubes into two power tubes such as 112A, 226, 227, 171, 210, or 250 types. Its characteristic is flat from 40 to 8,000 cycles in A.C. or D.C. amplifiers. Price in new 255 type case 3½" high, $9.00. (Both 257 and 227 transformers show a desirable—and exclusive—slight accentuation of bass notes between 40 and 150 cycles.)

Type 258 push-pull output choke is intended to operate out of two 171A or 210 power tubes into any standard magnetic or dynamic speakers, and is provided with taps for exact impedance matching. Its frequency characteristic is flat, its core will not saturate from 171 or 210 plate currents, and its price in a 255 type case is only $5.00.

Type 248 Universal output choke is for operation out of two 171 or 250 type tubes into any normal combination of standard magnetic or dynamic speakers. It is provided with impedance adjusting taps, and is designed to operate out of two 250 tubes with absolutely no danger of core saturation. It allows a flat frequency characteristic over the entire audio range, or bass note accentuation if desired. Upon the addition of a 1 mfd. condenser it may be operated with one 250 tube as an adjustable impedance tone filter. The 248 is the output device you have been waiting for, carefully designed to meet a demand filled by no other output device—yet its price is but $7.00, in 240 type open mounting (or $8.00 as type 248 in same size case as 227).

Look these new prices over—they tell you that nowhere else can you get the value in quality and price that S-M offers.

THE S-M reputation for high quality audio transformers is so well known that there isn't much to write about it. It is based on one basic fact—that S-M makes the finest audio transformers available, bar none. And not alone does S-M simply *say* this—S-M *proves* it by making public comparative tests against other standard transformers as no other manufacturer has ever dared to do. And no person has ever yet *heard* or *made* such a fair test and retained any other idea than that S-M makes the best a.f. transformers in America today.

Of course, you don't find S-M audio transformers in ready-made sets—and you don't find S-M tone quality in ready-made sets either. The reason is simple. Set manufacturers pay sixty cents, or maybe a dollar (for their several-hundred-dollar sets), for audio transformers, and no one, S-M included, can make *quality* audio transformers for sixty cents or a dollar. And then, again, S-M doesn't price a transformer to you at $6.00 or $8.00 and then turn around and sell it for a tiny fraction of that amount to some set manufacturer—no, a $6.00 S-M transformer costs a manufacturer *more* than competitive $8.00 and $10.00 types—simply because there is more actual quality in S-M.

But on the other hand it happens not infrequently that still another set manufacturer's engineers will say "Yes, our tests show you've got the best tone, but our buyer simply won't let us pay the price." Another well-known Chicago manufacturer of expensive sets said that a few days ago. And the head of the testing laboratory of one of the country's few really large and great manufacturers said, unofficially, recently "We ran curves on your 225 and 226 transformers. The curves looked better on paper than those of any transformers we make, so we substituted a pair of S-M's in one of our amplifiers. We couldn't help but notice the improvement." And so it goes.

But where price doesn't count—take theatrical sound reproduction and group address work for instance—S-M sells the largest makers of theatrical phonographs; the U. S. Shipping Board selected S-M Unipac amplifiers when it needed such equipment. Users of other audio equipment come to S-M every day. Their story is: "We want better quality—hang the price." And S-M gives it to them.

That's about the story—if you want the superior tone quality for which the S-M name is synonymous today, you can't find it in ready-made sets where price is the governing factor. But you *can* find it in custom-built sets. And just how good S-M audios are—how far S-M is ahead in engineering—is well illustrated by the fact that the Clough audio system introduced by S-M last June was copied by competitive parts manufacturers as soon as it was out! Imitation, they say, is sincere flattery.

If you build professionally, write us about the Service Station franchises. Or if you don't build, yet want your radio to be custom-made, S-M will gladly refer your inquiry to an Authorized Silver-Marshall Service Station near you.

Are you receiving "The Radiobuilder" regularly? Every issue describes new and interesting radio developments. To all Authorized S-M Service Stations, it comes free of charge; to others a nominal charge is made. Use the coupon.

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....No. 2. 685 Public Address Unipac
....No. 3. 730, 731, 732 "Round-the-World" Short Wave Sets
....No. 4. 223, 225, 226, 256, 251 Audio Transformers
....No. 5. 720 Screen Grid Six Receiver
....No. 6. 740 "Coast-to-Coast" Screen Grid Four
....No. 7. 675ABC High-Voltage Power Supply and 676 Dynamic Speaker Amplifier
....No. 8. Sargent-Rayment Seven
....No. 9. 678PD Phonograph Amplifier
.....Name
.....Address

With the Parts and Accessory Manufacturers

(*Continued from page* 105)

Thordarson-Electrad Resistance Kit

TRUVOLT resistors are now being included in the Thordarson specifications for the R-171, R-280 and R-480 power compacts, according to a recent announcement made to the trade.

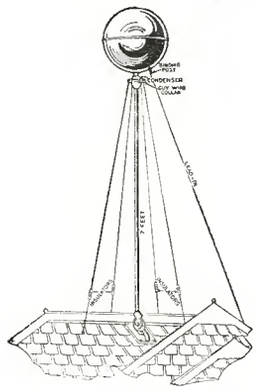
They are also being used in the Thordarson R-210 power amplifier kit, as well as the Thordarson 250 plug-in power amplifier and power supply, Thordarson 210 push-pull power amplifier No. 1, Thordarson 210 push-pull power amplifier No. 2, Thordarson 250 two-stage power amplifier and plate supply and the Thordarson heavy duty 250 power amplifier.

Truvolt resistor kit 1-T goes in the R-171, R-280 and R-480. Truvolt resistor kit 2-T goes in the R-210 power amplifier, while kit No. 3 goes in the five specified sets mentioned in the previous paragraph.

Electrad, Inc., 175 Varick St., New York City, now has a handy reference chart for manufacturers, representatives and dealers, giving the type numbers of the Electrad parts used and specified in the various popular power amplifier and power supply combinations. This chart also gives the various values of Truvolts, wire grid resistance, center tapped resistances, Royalty variables, Tonatrols and Electrad Rheostats and potentiometers. It also gives the different resistance values in the power supply systems specified by the various manufacturers.

Yahr-Lange Super Ball Antenna

RECENT changes in the design of the super ball antenna have been announced by Yahr-Lange, Inc. at Milwaukee, Wis. In the previous models, there were only three guy wires used, whereas in the new model there are four wires employed. These guy wires are 12 feet long. Another feature of the super ball antenna is the fact that a condenser has been located under the ball, as shown in the illustration accompanying this article. The manufacturers state that this condenser acts as a neutralizer for the entire antenna system and clarifies the tone.



The model illustrated is for use on any type of building, and has an adjustable ball and socket at the base, by means of which it may be mounted vertically regardless of the slope of the roof.

The super ball aerial is all-directional and has a conductive surface of 346 sq. in. The four 12 foot guy wires gives this aerial an additional vertical pick-up. The super ball aerial complies with the standard of the national electric code and rulings of the National Board of Fire Underwriters.

No More "Call Backs"

when you service with a

SUPREME

A Real Money Maker for Dealers and Service Men

The Model 400A SUPREME is not only the most thorough and complete testing apparatus available, but the instrument comes in a handsome brass bound traveling case especially designed for use by the practical service man. This case is most complete and convenient in its appointments, providing adequate and easily accessible compartments for all tools, accessories and supplies. It also contains a special swinging tube shelf providing absolute protection and instant accessibility to tubes. Complete set of tools and materials, from electric soldering iron to screw-driver, is furnished, each located in its proper place in the case. All of this is accomplished by ingenious design without making the case bulky or cumbersome—the exterior measurements of the case being only 18 in. x 10½ in. x 7 in., and the weight approximately 23 lbs. complete.

Instrument lifts out of traveling case for store or laboratory use.

THREE WESTON METERS

Mounted in Bakelite cases.
1 Voltmeter, three scales of 0/10/100/600, 1000 ohms per volt.
1 Milammeter, of 125 mils and 2½ amps.
1 A.C. Voltmeter, three large scales of 0/3/15/150.

Use the Supreme in making installations and repairs. Balance the radio frequency tubes. Test all tubes at time of sale. Assures your customer maximum results, saves time and increases profits for you and creates good will that builds business. With the Supreme one man does the work of three and does it more accurately and easily, because it substitutes scientific analysis for guess work.

PRICES AND TERMS

Under our time payment plan the Model 400A SUPREME can be bought for $38.50 cash and 10 trade acceptances (installment notes) for $10 each, due monthly. Cash price, if preferred, is $124.65. All prices are net and do not carry dealers' discounts.

Send No Money

The SUPREME must sell itself to you on sheer merit and performance. We are willing to place it in your hands for actual use in your service work, and allow you to be the sole judge of its value. Fill out and sign the following request for six-day trial.

Request for 6-Day Trial

Supreme Instruments Corporation
310 Supreme Building
Greenwood, Mississippi.

Date.....

Please ship me one Model 400A SUPREME.

Upon delivery of the instrument I will deposit with the express agent either the cash price of $124.65 OR $38.50 cash and 10 trade acceptances (installment notes) for $10.00 each, due monthly, at my option, subject to the following conditions:

It is agreed that the deposit made with the express agent shall be retained by him for six days. If, within that time, after testing the instrument I am not entirely satisfied, I have the privilege of returning the instrument to the express agent in good condition, with the seal unbroken (see note below) and all tools and parts intact. Upon such return and upon the prepayment of return express charges, the deposit I have made with the express agent will be promptly returned to me.

Signed.....

Firm Name.....

Address.....

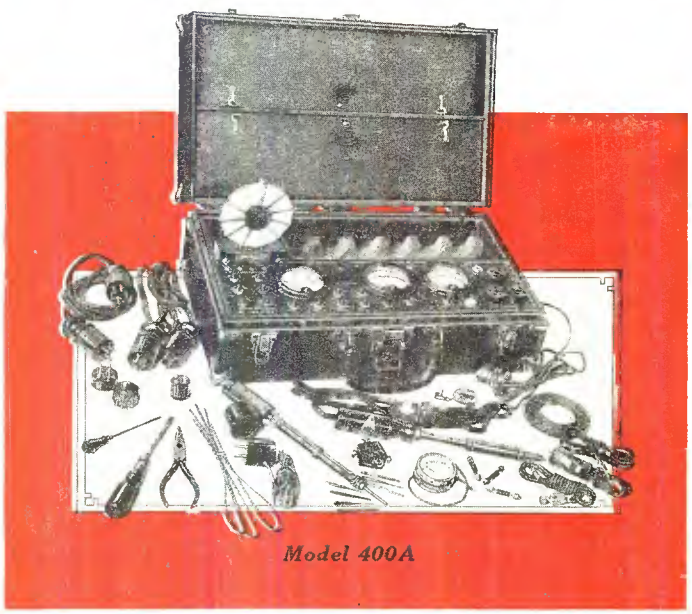
City.....State.....

Please send three or more trade references, including at least one bank, with this coupon.

NOTE: The seal on the panel of the instrument covers the master screw in the assembly. It is never necessary to disturb this, and it does not in any way prevent or restrict the use of the instrument. Factory guarantee ceases with disturbance of seal.

The Sign of Efficient Radio Service

Radio Owners: Look for this emblem in your radio shop or on the button worn or card carried by your service man. *It is your guarantee of dependable service.*



Model 400A

The Only Instrument on the Market That Will Make All These Tests

The SUPREME is the only service instrument that makes oscillation tests on all radio tubes—the true measure of the value of a tube.

The exact working conditions of any tube from 1½ to 15 volts, including screen grid, heater type, and rectifier tubes are shown by meter readings; the only instrument that shows output of rectifier tubes on meter.

The oscillation tests from alternating current are made possible by the exclusive self-contained SUPREME Power Plant. Every radio engineer and service man will appreciate this feature.

The SUPREME radiator sends out a modulated wave. Simply plug into A.C. line. No more wasting valuable time on broadcast stations; always at your service and finer adjustment assured. Condensers can be balanced or synchronized—not by the former tedious methods—but with both meter reading and audible click. Easy and much more accurate.

All continuity tests can be made from socket on either A.C. or D.C. sets, with independent cathode readings.

The SUPREME heavy duty rejuvenator provides scientific method of rejuvenation of any thoriated filament tube. Will reactivate up to 12 tubes at one time without removal from set. Push a plug—the SUPREME does the rest.

The SUPREME will give direct reading of amplifying power of tubes and will show actual working condition of all tubes. The SUPREME will play radios with open transformers and will give condenser, choke coil output and capacity output on radios not wired for that purpose.

Access is provided to all apparatus through pin-jacks. Will test condensers for breakdown. Contains various fixed condensers from .001 to 2 mfd., a 30 ohm rheostat, a 500,000 ohm variable resistance, and an audio transformer, for instant use and various combinations.

It will give plate and filament voltage readings with or without load; will test voltage and current of all radios, including those using tubes such as 210 and 250. It will give grid circuit readings up to 100 volts; will test output of trickle charges, or any output up to 2½ amps.

In fact, the SUPREME will give you everything that can be obtained with all other set testers and analyzers combined, and in addition will provide many other really important tests that cannot be obtained by any other means.

Hammarlund Short Wave Manual

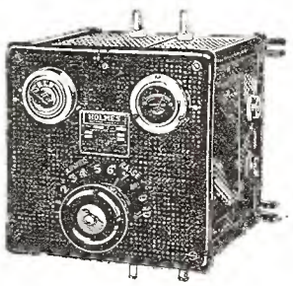
MUCH interesting information covering the subject of short waves is contained in the Hammarlund Short Wave Manual for 1929, which has recently been released and which is available at a nominal fee of 10c from the Hammarlund Mfg. Co., Inc., 424 W. 33rd St., New York City.

Many of the topics handled in this manual will be of more than ordinary interest to the short wave enthusiasts. For example: there is data on the reflection of short waves, exclusive field for short waves, short wave design trend, theory of the 222 tube, effect of grid plate capacity of the 222, limiting frequency for stable operation, tuned input circuits, standard antenna constants, single control for r. f. circuits, shielding the r. f. stage, common regeneration controls, dead spots due to poor chokes and many other interesting problems which the average set builder will encounter at some time in his work.

In addition there is material on television circuit requirements, a list of short wave call letters, a frequency wave length conversion chart, and many other interesting items of a real informative nature.

Holmes Battery Charger

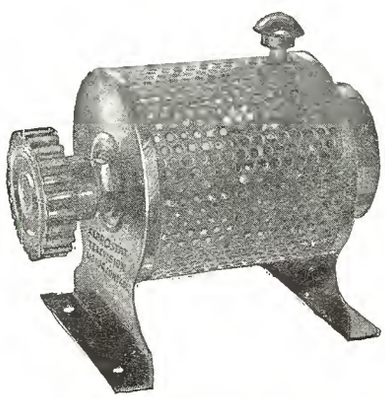
A CHICAGO inventor, C. F. Holmes, recently developed a new machine for charging batteries which promises amazing new fields of profit for operators. This new service station charger, according to the inventor handles 50% to 70% more batteries than similiar machines now on the



market, yet effects a saving in electric current equal to 40% to 60% due to special transformer construction and other original features of design. Readers interested in this branch of service should write to C. F. Holmes, 5116 Ravenswood Ave., Chicago, Ill. for a further description of his invention.

Clarostat Television Control

A NOVEL variable resistance which may be used in television control circuits has recently been announced by Clarostat Mfg. Co., Inc., 285 North 6th Street, Brooklyn, N. Y. The unit is illustrated below and is supplied with a ventilating housing.



In addition to this, a push button is provided at the top, which shorts the resistance and enables the operator to kick his motor ahead at a greater speed in order to maintain synchronism.

Now—Radio's Two Biggest Advances Combined—

Screen Grid and AC

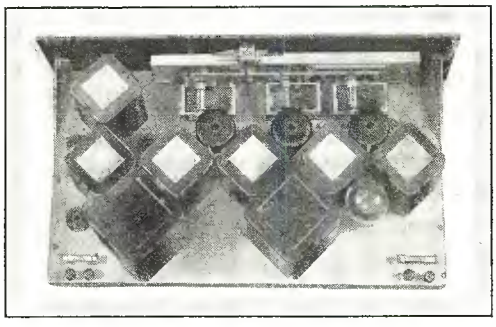
LAST year's two big contributions to better radio were in tube design. AC heater-type tubes advanced radio reception immeasurably. Screen grid tubes improved it in volume and clarity. Now in the Vee Screen Grid Kit using AC Screen Grid tubes, these two big advantages are combined —the great amplification factor and inherent stability of the screen grid tube with the high emission possible only with the heater type tube.

Here are transformers which are not an adaptation—they are designed only for Screen grid tubes enabling you to get all the value from them. The Power Pack is greatly simplified, giving A, B and C voltages with a minimum of parts, as voltage regulation is inside the transformer cases.

The Vee Screen Grid receiver is a real unit control, lamp socket set having great volume with a purity and faithfulness of reproduction heretofore unknown—all this with only six tubes.

The Vee Shield-Coil Kit Includes

Transformers, both RF and AF, condensers, patented Vee unit control, chokes, powerpack including special tube, resistances, sockets, wire, panel and subpanel, layout and wiring instructions. Everything is included excepting tubes, cabinet and loud speaker. Better results than have been obtainable with 8 to 10 tubes. Loop operated. The last word in receivers.



The Vee Safety Power Pack

The Vee Power Pack is furnished separately for use with other circuits, giving all B voltages and filament and grid voltage for last audio stage (171).

We believe this to be the most efficient practicable Power Pack yet designed. Compact — simple — automatically protected against overload of condensers. It is complete, including everything needed—rectifying tube, subpanel, resistance units, sockets, binding posts, wire and full directions.

If your dealer hasn't these new Vee Products, send orders direct. The coupon will bring you full data—send it today, checking the items in which you are interested.

The VEE Coil Antenna

THE improved Vee Coil Antenna has a greater pick-up, keener directional ability, and a lower distributed capacity. Not only for loop sets, but can be used with a slight change with any tuned R. F. set of five tubes or more. Complete instructions packed with the loop.

Remember the Vee Kit Is Complete Including Everything Needed— Rectifying Tube, Subpanel, Resistance Units, Sockets, Binding Posts, Wire and Full Directions

VEE PRODUCTS

Division of

Story & Clark Piano Co.

173 North Michigan Avenue
Chicago, Illinois

VEE PRODUCTS
Division of Story & Clark Piano Co.
173 No. Michigan Ave., Chicago, Ill.

I am interested in the items checked below. Send full details at once.

Name.....

Address.....

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

My dealer is.....

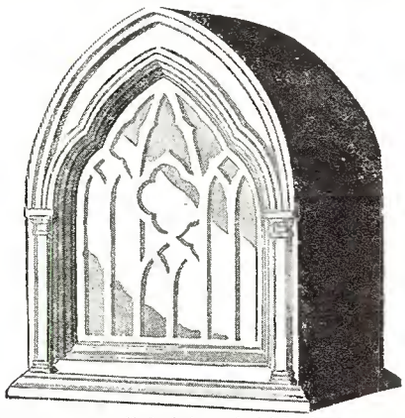
Address.....

☐ Screen Grid Kit ☐ Essentials ☐ Power Pack ☐ VEE Loop

Tell 'Em You Saw It in the Citizens Radio Call Book Magazine and Scientific Digest

Peerless Dynamic Speakers

IN the illustration herewith is shown the Peerless dynamic speaker manufactured by the United Radio Corp., Rochester, N. Y. The model 19-A is encased in a beautifu carved wanlut cabinet of classic Gothic design. This powerful, new 9 inch Peerless dynamic is in every essential the industry's standard of comparison for dynamic speakers. The 9 inch cone gives remarkable efficiency at all audible frequencies.



The model has an overall height of $16\frac{5}{16}$ inches, a depth of $10\frac{3}{16}$ inches and a width of 14½ inches. Models are available for battery or socket power operation, direct or alternating current and in either 25 or 60 cycles.

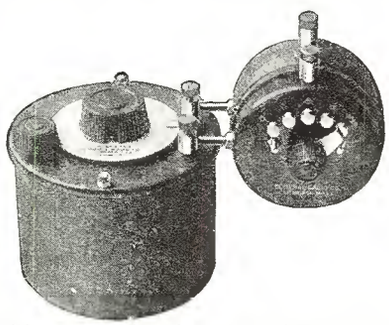
Another model built like the 19-A but in a cabinet of lesser cost and with a 7 inch instead of a 9 inch cone, is known as the Peerless 17-A with an overall height of 14½ inches, depth 9¼ inches and width 12½ inches. It is also equipped for battery or socket power operation, direct or alternating current, 25 or 60 cycle.

In addition to the dynamic speakers, Peerless also manufactures the model 7-A, which is a magnetic cone speaker and is available in a beautiful Gothic cabinet of mahogany. Its overall height is 12½ inches, depth 7 inches, width 11½ inches. It is equipped for battery operation.

General Radio Filter-Wavemeter

DESIGNED primarily to reduce interference when listening in on broad tuning receiving sets, the General Radio type 247-W filter illustrated below has a value when used in sharp tuning sets where it may be operated as a wavemeter.

The 247-W filter has two forms of connection. The series connection for the filter is termed a rejector circuit inasmuch as it will reject any particular station within the range of the filter.



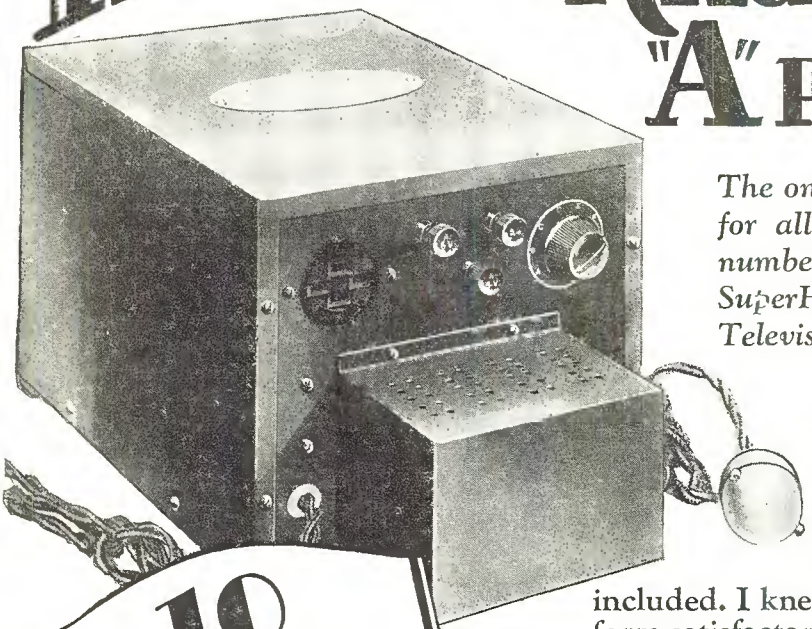
For example, this connection is used whenever an operator desires to eliminate a single interfering broadcasting stations.

When the filter is to be used as an acceptor, the parallel connection is employed and the unit will accept only one station within the filter range. In this condition it is used to reduce code interference or interference from a group of stations.

These filters are individually calibrated to a wavelength accuracy of 2%, and may also be used as a wavemeter for the measurement of a received signal or the measurment of the wavelength of the transmitter regardless of whether it is radiophone, continuous wave or spark.

The unit is manufactured by the General Radio Co. of Cambridge, Mass.

Now...4 or 6 Volts with the Improved Knapp "A" POWER



The only "A" Power suitable for all sets — irrespective of number of tubes — including SuperHets, Short Wave and Television receivers.

THE new Knapp "A" Power is designed for the most exacting service — super-hets, short wave and television receivers included. I knew that if it would perform satisfactorily with these receivers that there could be no question as to its efficiency on ordinary broadcast signals. The three Elkon dry condensers, the improved choke coils and the *special* Elkon dry rectifier make the difference between ordinary and Knapp performance.

10 Improvements

1. Two taps for 4 or 6 volt operation.
2. Larger filter system.
3. Three Elkon Dry Condensers instead of two.
4. Improved Choke Coils.
5. Pendent Switch Controlling "A" Power, "B" Eliminator and Set.
6. Dial for Regulating Voltage.
7. Celeron Front Panel.
8. Baked Finish.
9. Heavier Gague Metal Cover.
10. Die Cast Base Plate instead of wood.

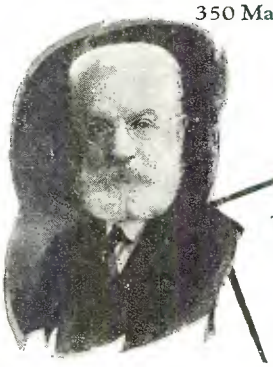
No Change in Price

Even with these wonderful and costly improvements, there has been no advance in price — due to the tremendous volume going thru my plant. Remember that the Knapp is the fastest selling "A" Power on the market.

KNAPP ELECTRIC, Inc.,
—Division of P. R. Mallory & Co., Inc.—
350 Madison Ave., New York City

See your dealer today

Go to your dealer today. Most of the good ones carry the Knapp in stock. Do not accept a substitute —because only in the Knapp will you get full satisfaction as typified by the famous Knapp "A" Power. If your dealer cannot supply you send the coupon.



Mr. David W. Knapp, Pres.,
Knapp Electric, Inc., Dept. K-16
350 Madison Ave., N. Y. C.

Send me complete information on the Knapp "A" Power.

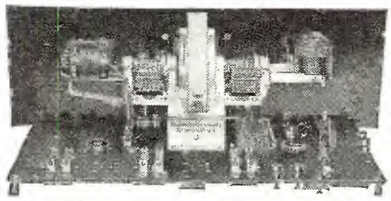
.....

.....

Browning-Drake A. C. Kit

STRICTLY modern in every particular is the new Browning-Drake kit available for a. c. shield grid operation. It is shown in the illustration herewith.

The receiver is a single control affair without trimmer con-



densers or antenna variometer. By the use of the a. c. shield grid tube, it is possible to operate the set from the electric light circuit in connection with a B eliminator or other power supply, although if desired it can be operated on B batteries as far as the plate circuit is concerned. The kit is made by the Browning-Drake Corp. at Cambridge, Mass.

Truvolt Voltage Divider

JUDGING from the comments of professional set builders, the Truvolt divider, announced sometime ago by Electrad, Inc., 175 Varick St., New York City, N. Y., is meeting with considerable success in its application in the construction of power amplifiers and power supplies, where it is desired to have the resistance network in small, compact units.

The Truvolt divider offers the radio engineer or builder of eliminators a compact wire wound resistance unit so arranged with five adjustable contacts that all required voltages may be obtained with any set or eliminator combination. The device removes the guess work and saves time and trouble in constructing an eliminator. By dividing the filter voltage into usable values, it eliminates the necessity of mathematical calculation. It does away with a great deal of wiring and the need of regulator tubes. The Truvolt divider is not only flexible to all receiver current conditions, but it is possible, because of its inherent design, to calibrate the adjustable contacts. By the use of tables or graphs, the divider may be adjusted to give desired voltages without using a high resistance voltmeter.

An interesting booklet giving information covering the divider may be secured on application to Electrad, Inc., whose address is given elsewhere in this article.

Silver-Marshall Public Address Amplifier for Theater Work

(*Continued from page* 75)

1 ½x6/32 machine screw
1 6/32 nut
1 Silver-Marshall 340 condenser bracket
13 Soldering lugs

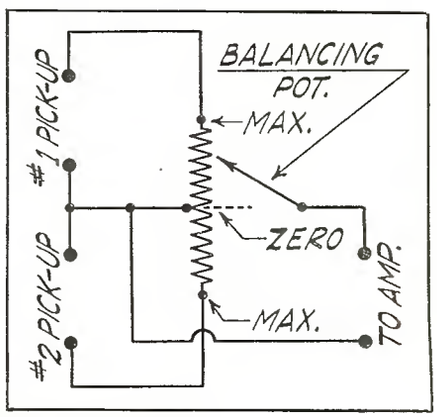


Fig. 5. In this schematic are shown the connections of the fading device used for shifting from one record to another

(*Continued on page* 150)

A. C. Shield Grid Magnaformer Design Announced for 1929 Season

(*Continued on Page 77*)

having a pendant switch on the 110 volt line to start and stop the set.

Rectifier Circuit

The high voltage secondary in this unit is carried to the plate of each of the 281 rectifier tubes and the center tap of this transformer, which has 600 volts each side of it, goes to the common B negative line and ground of the system. Instead of using a conventional 7½ volt winding for the filaments of rectifiers and placing these in parallel, the designers of the Magnaformer are using a 15 volt secondary with the two rectifier tubes in series across this winding. Then the center position between the filament circuit, as shown in the schematic, becomes the positive voltage line and goes in through the double choke coil, the input, center and output being bypassed by 2 mfd filter condensers as shown in the diagram. The value of the resistance network across the high and low voltage terminals of the rectifier is 28,000 ohms, there being a tap for 45 volts and another for 135.

The power supply of the whole is compact and rugged. It may be seen by referring to the left of the photograph shown in Fig. 1. Athough the maximum voltage of 450 may seem rather high to use on the present 250 tubes, nevertheless arrangements are now being made for that particular tube to be produced as an interchangeable one with the 210, so that the maximum voltage rating of 450 volts will be proper. However, in view of the fact that the undistorted output of the 250 in much greater than any other tube, it is only logical that this tube should be employed for best results.

Official Parts List

Parts required for the construction of the receiver described in the article above are as follows:

- 2 Magnaformer r. f. No. 51 intermediate shield grid r. f. transformers
- 2 Magnaformer r. f. No. 61 intermediate r. f. transformers
- 1 Long wave C. U. No. 71 unicoupler oscillator
- 1 Radiart completely drilled aluminum sub-panel, 11⅝x23 inch, with 10 mounted sockets
- 1 Radiart special finished and drilled metal front panel, 7x24 inch
- 1 Radiart No. 250 ABC power unit, including mounting base and resistant unit
- 1 Radiart 5 panel audit unit shield
- 1 Radiart 8 panel r. f. unit shield
- 1 Radiart 5 panel control unit shield
- 1 Radiart bakelite tip jack panel for speaker
- 1 Radiart bakelite regenerative .000045 condenser panel
- 1 Radiart bakelite plug-in oscillator panel
- 1 Radiart bakelite plug-in long wave oscillator C. U. No. 71 coil bottom panel

  Bolts, screws, bushings, solder lugs (Radiart), cables and hook-up wire (Radiart)
- 2 Shield grid clips and 2 shielded grid cable leads (Radiart)
- 1 Yaxley No. 820-C, 20 ohm center tapped resistance
- 1 Yaxley No. 71000, 1000 ohm resistance
- 7 Yaxley insulated tip jacks, 5 black No. 421 and 2 red No. 420
- 1 .000045 midget regenerative condenser with bracket
- 2 Ferranti a. f. No. 4 audio transformers
- 2 Remler No. 639, Universal S.L.W. .0005 variable condensers
- 1 Remler No. 110, single control Universal drum dial
- 1 Remler No. 112, single control equalizer
- 2 Remler No. 110-4BR knobs
- 1 Remler No. 750-12 knob
- 1 Remler No. 1103 escutcheon plate
- 1 Frost No. 1892, 200,000 ohm variable high resistance unit without switch

FREE!

YOU can enjoy the perfect reproduction and the unusual convenience of this Midget Cone Speaker ***absolutely free.*** Manufactured by one of the largest manufacturers in the country, this speaker has innumerable advantages in portability and perfect tone. Ideal for apartment use, or in different rooms of the house, the Midget Speaker is delighting thousands who are now using it.

One of these speakers may be yours absolutely free, by just filling in the coupon below for one year's subscription to the Citizens Radio Call Book Magazine. Because the supply is ***limited,*** do not delay in sending in the coupon.

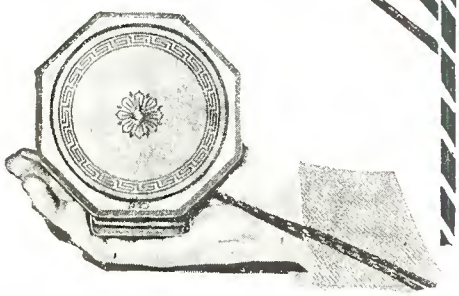
Mail It Today!

From Elizabeth, N. J.:

"I received the Midget speaker today. It's great and I am well pleased."

Richard Ogden.

From Ocean Breeze, Cal., W. P. McGuide writes: "I received your Midget Speaker and sure was surprised by its performance. I play all distant stations just as good as any speaker I've had, and it performs dandy." . . .



CITIZENS RADIO CALL BOOK MAGAZINE
508 So. Dearborn St., Chicago, Ill.

Here's my $1.75 (Foreign $2.00), for which please send me Citizens Radio Call Book Magazine for one year, beginning ☐ January ☐ March ☐ September ☐ November.

This subscription entitles me to a free Midget Loudspeaker.

NAME.....

ADDRESS.....

CITY..... STATE.....

1 Frost No. AC1885 Magnaformer Special 500,000 ohm tapered variable high resistance unit with approved a. c. snap switch and Remler No. 750-12 knob
1 Samson No. 125 r. f. choke
6 General Radio No. 274-J jacks for plug-in oscillator panel
6 General Radio No. 274-P plugs for L. W. unicoupler No. 71
1 Aerovox Special TH-862M, 12 mfd filter condenser
2 Aerovox No. 200-S, 1 mfd bypass condensers
2 Aerovox No. 1475, .00025 fixed grid condensers with mountings
1 Aerovox No. 1450, .001 fixed condenser
2 Aerovox No. 1082, 2 megohm grid leaks
1 Electrad B-12.5, 1250 ohm fixed resistance unit

Extra Equipment

1 Radiart short wave C. U. No. 72 unicoupler oscillator coil
1 Radiart bakelite plug-in S.W. oscillator No. 72 coil bottom panel
6 General Radio No. 274-P plugs for S.W. No. 72 unicoupler coil
1 Radiart long wave No. 82, antenna cupler
1 Radiart short wave No. 83, antenna coupler
1 Radiart bakelite plug-in antenna coupler panel
5 General Radio No. 274-J, jacks for plug-in antenna coupler panel
5 General Radio No. 274-P, plugs for long wave antenna coupler No. 82
5 General Radio No. 274-P, plugs for short wave antenna coupler No. 83
1 Radiart bakelite plug-in L.W. antenna coupler No. 82 bottom panel
1 Radiart bakelite plug-in S.W. antenna coupler No. 83 bottom panel

Junior Radio Builder May Get Fun in Making This Simple Set

(*Continued on Page* 79)

from the G terminal of the socket to a junction between the 3 megohm grid leak and the .00025 mfd condenser. This leak is in parallel to the condenser and after leaving this point the wire is carried to the stator of the second tuning condenser, which is at the right and to one terminal of the three-circuit coupler. The regenerative winding of the three-circuit coupler goes between the P terminal of the second socket and one side of the head phone binding post, the other side going to the B45 binding post on the terminal strip. In the second step of this receiver, the binding posts for the phones are eliminated and the primary of the first audio transformer takes this position, but this matter will not be discussed in the present article.

The radio frequency transformer is the one which has only two windings, a small number of turns being the primary and a large number being the secondary. In the case of the three-circuit coupler, there are three distinct windings, a small fixed winding being the primary, a large number of turns, fixed, being the secondary, and the small number of turns on a rotor being the regenerative coil. Reference to the schematic circuit shown in Fig. 2 will also help the builder in understanding some of the terms used in this description.

The receiver is designed to operate from the 01B type of tube. These tubes are the same, in effect, as the 201-A, except that the filament current is exactly half. Thus, the receiver might be operated as far as the filament circuit is concerned from four 1½ volt dry cells. The plate supply is obtained from two 45 volt blocks of B battery. These may be of the heavy duty type and will last a considerable length of time because the current drain of the set itself is rather small.

In the event that the builder is a little uncertain as to where the connections from the inductances go, we would suggest that he place the receiver before him in a position shown in Fig. 1. The inductance at the right is made fast to the baseboard by means of a small angle bracket. Looking at this inductance in the manner shown in the photograph, the first winding is a light colored one and has two terminals on it, these two terminals being located at the right in the picture, Fig. 1. One of these terminals, the lower one, goes to the antenna binding post on the strip, which is the first binding post at the extreme right. The second terminal of this primary winding, or the upper one, goes to the second binding post at the extreme right and has a jumper from the binding post on the coil down to the top binding post at the left of this coil when looking at it as shown in the photograph, Fig. 1. The bottom terminal on the left is the one that goes to the grid of the first tube and stator of the right-hand condenser, looking at the set as shown in Fig. 1.

Three Circuit Coupler

When looking at the set exactly as in Fig. 1, the second inductance, or the three-circuit coupler, may be easily figured out by the following method: The terminal at the bottom of the coil nearest the front panel at the right is the one that connects to the plate of the first tube socket. The next binding post on the right, the one nearest the builder, is the primary of the three-circuit coupler and goes to the B plus 90 binding post on the strip. At the left of the three-circuit coupler the terminal which is nearest the front panel is the one which goes to the stator of the condenser at the left and then to the grid condenser and grid leak in parallel and from there into the grid of the detector tube socket. The other binding post at this winding, which is at the left but towards the back of the set, connects with the negative terminal on the second soeket and with the rotor of the left-hand condenser. The regenerative winding is the orange colored one on the rotor and the right-hand terminal of this winding goes to the plate terminal of the detector socket. The head phones are located between the left terminal of this regenerative winding and the extreme left post on the terminal strip, and the B+45 volt binding post. These are the only connections that might cause any trouble and the foregoing description is given so as to simplify the wiring of the coils as much as possible.

(A special graphic illustration of this set is available from our Blueprint Department for 10 cents.)

Official Parts List

Parts required for the construction of the first step in this receiver are shown in the following list:

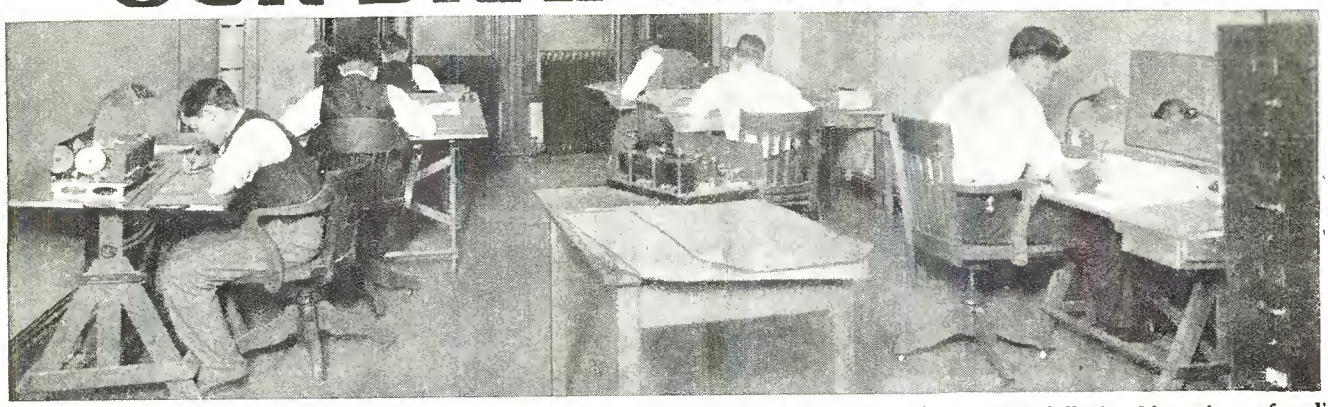
2 Amsco .00035 mfd variable condensers
1 Frost .00025 mfd fixed grid condenser
1 Yaxley 4 ohm fixed resistance
1 Durham 3 megohm grid leak
1 Formica 7x18x3/16 inch black front panel
1 Wood baseboard 7x17x⅝ inch
1 Formica 1x13x3/16 inch terminal strip
13 X-L bakelite push posts
2 530 Frost UX sockets
1 10 Yaxley jaek switeh
1 Amsco grid leak mounting
1 Frost .001 mfd fixed condenser
1 Birnbach r. f. transformer for .00035 condenser
1 Birnbach three-circuit coupler for .00035 condenser
2 Kurz-Kaseh 4 inch plain dials

Receiver and ABC Supply Combined in "Hi-Q" 29 A. C. Junior

(*Continued from page* 61)

quite compact and symmetrically laid iut. The a. e. leads to the 15 volt filament transformer and the 110 volt primary of the 171 eompact may be tied together and a cutout, or a pendant

OUR DRAFTING ROOM



This staff of highly trained draftsmen is continually preparing the most accurate and complete full size blueprints of radio receivers and power packs obtainable.
Blue prints are available on all circuits described in the CALL BOOK. Each set of prints is composed of all the necessary drawings prepared in such complete detail and accuracy as to enable an inexperienced builder to duplicate in every respect the receivers built in our laboratory, thus assuring positive success and the greatest satisfaction.

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No. 70	Improved Nine-in-Line (5 drawings)	1.50
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GRAPHIC WIRING DIAGRAMS

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No. 140	Citizens Radio Frequency Amplifier	.60
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No. 160	Thordarson 210 Power Compact	.60
No. 164	Thordarson 250 Amplifier	.60
No. 165	Citizens SG Booster Stage	.60
No. 166	Silver-Marshall SG Six (no output choke)	.60
No. 170	Silver-Marshall SG Super Nine	.60
No. 171	Thordarson Dealer's Amplifier	.60
No. 174	Sargent-Rayment Seven Receiver	.60
No. 178	Silver-Marshall 731 Short Wave Adapter	.60
No. 182	Halldorson A.C. 56—T. R. F.	.60
No. 183	National Short Wave Receiver	.60
No. 185	Silver-Marshall "Coast to Coast" Four	.60
No. 186	Aero 7-29 No. 32 S. G. Receiver	.60
No. 187	Citizens Special Short Wave Receiver	.60
*No. 195	Junior 2 Tube Receiver	.10
*No. 196	Aero A.C. Short Wave Converter	.60
*No. 197	Aero A.C. 21 Chronophase Receiver	.60
*No. 200	Silver-Marshall Phonograph Amplifier	.60
*No. 202	Silver-Marshall 730 Four Tube Receiver	.60
*No. 203	Remler A.C. Power Amplifier	.60
*No. 204	Sangamo Push-Pull Lab. Amplifier	.60
*No. 209	Vee Products A.C. Shield Grid Receiver	.60
*No. 210	Silver-Marshall 6 Tube Receiver (using output choke)	.60

SCHEMATIC WIRING DIAGRAMS

No. 160a	Thordarson 210 Power Compact	.50
No. 164a	Thordarson 250 Power Supply and Amplifier	.50
No. 165a	Citizens SG Booster Stage	.50
No. 166a	Silver-Marshall SG Six (no output choke)	.50
No. 168a	HFL Isotone	.50
No. 169a	Halldorson SG 5-6	.50
No. 170a	Silver-Marshall SG Super Nine	.50
No. 171a	Thordarson Dealer's Amplifier	.50
No. 174a	Sargent-Rayment Seven Receiver	.50
No. 178a	Silver-Marshall 731 Short Wave Adapter	.50
No. 182a	Halldorson A.C. 56—T. R. F.	.50
No. 183a	National Short Wave Receiver	.50
No. 185a	Silver-Marshall "Coast to Coast" Four	.50
No. 186a	Aero 7-29 No. 32 S.G. Receiver	.50
No. 187a	Citizens Special Short Wave Receiver	.50
No. 191a	Scott World's Record S. G. Nine "Battery Operated"	.50
*No. 194a	Victoreen Duplex Power Amplifier	.50
*No. 196a	Aero A.C. Short Wave Converter	.50
*No. 197a	Aero A.C. 21 Chronophase Receiver	.50
*No. 200a	Silver-Marshall Phonograph Amplifier	.50
*No. 202a	Silver-Marshall 730 Four Tube Receiver	.50
*No. 203a	Remler A.C. Power Amplifier	.50
*No. 204a	Sangamo Push-Pull Lab. Amplifier	.50
*No. 205a	AmerTran Power Amplifier	.50
*No. 206a	HFL Special Nine A.C. Super	.50
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*No. 210a	Silver-Marshall 6 Tube Receiver (using output choke)	.50
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*Circuits described in present issue.

Any of the above blue prints will be sent postpaid by return mail upon receipt of the proper amount or they can be obtained from any of the Radio jobbers advertising in this publication. C. O. D. orders not accepted.

CITIZENS RADIO SERVICE BUREAU

508 So. Dearborn Street **7th Floor** **Chicago, Illinois**

switch, may be inserted in the main 110 volt line so as to start and stop the receiver by that particular switch.

This particular model of the Hi-Q 29 a. c. Junior should be well received by the professional set builder who is frequently called upon to sell a custom built receiver in competition against some of the lower priced factory built sets. Since the receiver will fit the standard cabinets or consoles, it is possible to make up a furniture combination that will appeal to any set buyer.

Official Parts List

Parts required for the construction of the receiver described in the foregoing article are shown below:

1 Hammarlund Hi-Q 29 Junior foundation unit containing drilled and engraved panel, two complete aluminum shields, drilled steel chassis, shaft, coupling condenser, resistor mounts, binding post strip, fixed resistance unit, clips, wire, screws, nuts, washers, solder, all special hardware required to complete receiver.
1 Hammarlund ML-17 .00035 mfd Midline condenser
2 Hammlund SGT-17 shield grid r. f. transformers
1 Hammarlund RFC-85 radio frequency choke
1 Hammarlund SDW knob control drum dial, walnut
7 Benjamin Cle-Ra-Tone 9040 sockets
1 Sangamo .001 mfd fixed mica condenser
1 Carter PT3M tapered volume control 3000 ohm
6 Parvolt .5 mfd series 200 bypass condensers
1 Parvolt 3 mfd series 200 bypass block
1 Parvolt 1 mfd series 200 filter condenser
1 Parvolt 2 mfd series 200 filter condenser
2 Parvolt 4 mfd series 200 filter condenser
1 Parvolt 2 mfd series 400 mfd filter series
2 Durham metalized resistors ¼ megohm
1 Durham metalized resistor 1/10 megohm
2 Durham powerohms, 1 watt, 100,000 ohms
1 Durham powerohms, 1 watt, 50,000 ohms
1 Thordarson R-171 power compact
1 Thordarson R-196 choke coil
1 Thordarson T-2610 filament transformer, 15 volts
1 Electrad Truvolt Hi-Q 29 type resistor
1 Pr. Yaxley No. 422 insulated tip jacks
2 Eby engraved binding posts.

Practical Television

(*Continued from page* 92)

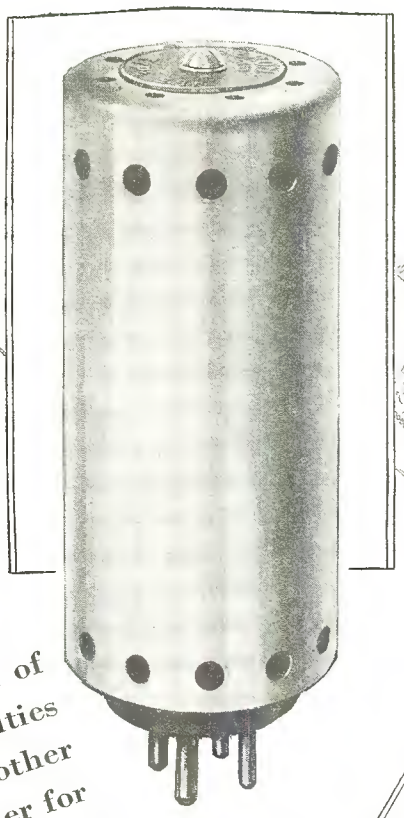
tube, in reducing leakage current or "dark current" to an absolute minimum in this super-sensitive device.

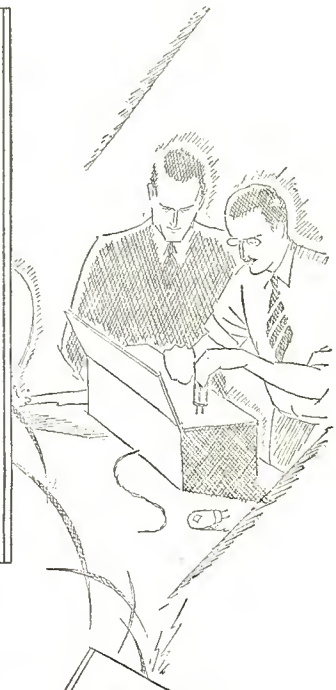
The increased sensitivity of the latest foto-cell paves the way for important developments in television technique. In fact, it becomes possible to pick up images in broad daylight, with the image scanned by a powerful arc light beam, since the new cells arranged in a bank, are sufficiently sensitive to differentiate between daylight illumination and the superimposed arc beam. These super-sensitive foto-cells may also have a marked bearing on the reproduction of sound tracks on motion picture film, as well as in other non-radio applications.

Interesting Bulletin

CONSIDERABLE information of a helpful nature on the subject of television audio amplifiers is contained in engineering bulletin No. 4 recently issued by the engineering department of the International Resistance Co. at Philadelphia, Pa. The bulletin covers the subject of precision audio resistance amplifiers for television and laboratory experimenters. It gives schematic circuits and frequency characteristics which are quite interesting. Copies of this bulletin may be secured upon writing the International Resistance Co., 2006 Chestnut St., Philadelphia, Pa.

THE NEW 5000 HOUR ELKON METALLIC RECTIFIER FOR "B" ELIMINATORS





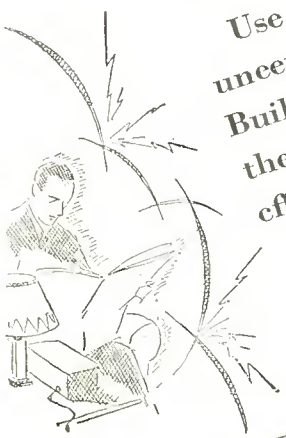
At last a dry high-voltage rectifier! All of the advantages of a tube—none of its frailties—much longer life—more efficient—smoother power—no noise—now as perfect a rectifier for the "B" end as the Elkon "A" Rectifier—standard with "A" Eliminator manufacturers. And the Elkon Rectifiers are Self-Healing—line surges or accidental overloads are automatically taken care of—no permanent injury is done.

The Elkon EBH replaces BH type tubes in "B" Eliminators. Simply take out the fragile 1000 hour tube and plug in the husky Elkon EBH 5000 hour Rectifier. Same characteristics, but what an improvement.

Use the Elkon EBH Rectifier! Eliminate all uncertainty of life, of successful operation. Build your own new "B" Eliminator or convert the one you have to up-to-the-minute radio efficiency.

ASK ABOUT THE OTHER ELKON RECTIFIERS. TOO

M-16 for "A" Eliminators and 3 ampere chargers.—V-4 for trickle chargers.—and the authorized Balkite Replacement Rectifiers BNK and BJ.



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Division of P. R. Mallory & Co., Inc.

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Name .....

Address .....

With the Professional Setbuilder

(*Continued from page* 85)

The two relay switches can be hung on the back or ends of cabinets on the inside. The plug that comes with the phonograph pickup is placed in the extra socket permanently. One of the Yaxley relay switches starts and stops your turn-table motor. The other shifts the plate connection of first audio transformer to either the radio detector socket or the phonograph plug. The panel switch operates these two relay switches and shuts off the filament current in the unused tubes when phonograph is on. After the wiring is completed as shown in Fig. 9, set the rheostat in —A return of second relay so that the maximum resistance is in. They turn the panel switch to post C. Neither of the relays should come on. Slowly turn the rheostat till you hear the click of both of them. Leave this rheostat permanently in that position. If this precaution is not taken, you are likely to burn out the actuating coils in the relays. Some testing is necessary to determine which one of the wires at the top of the second relay is unused. This is easily done by connecting the end of one wire in series with a battery, a meter and post P on phonograph plug socket. The wire that gives no meter reading should have tape wrapped around it and remain idle. If you are now using a relay to operate a B-Eliminator, it should be wired in series between your A Battery and the post B of panel switch.

Controlling A. C. Supply

Construct a third switch with solder coating between EA and DC. Insert one quarter-inch bakelite shaft in place of two metal

Does Everything but Think

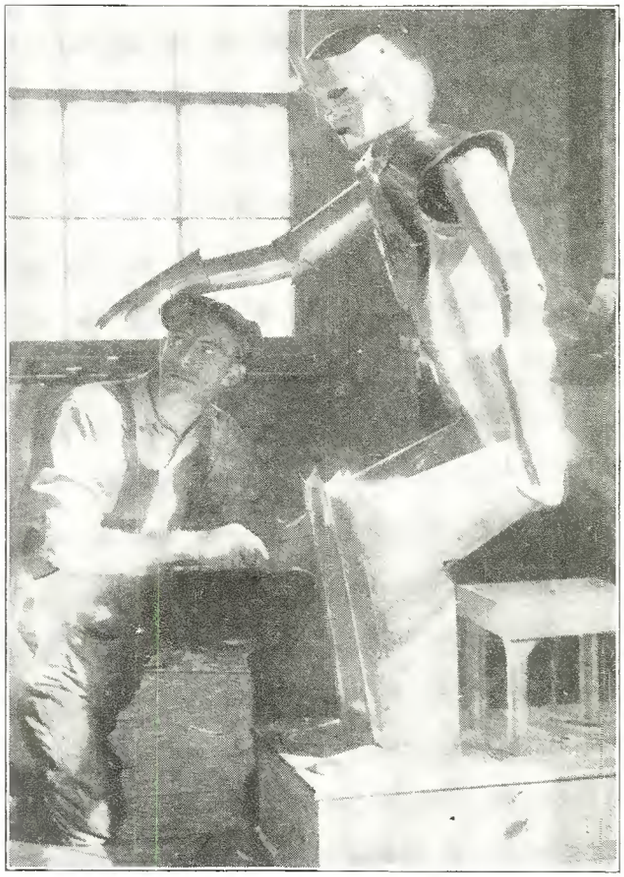
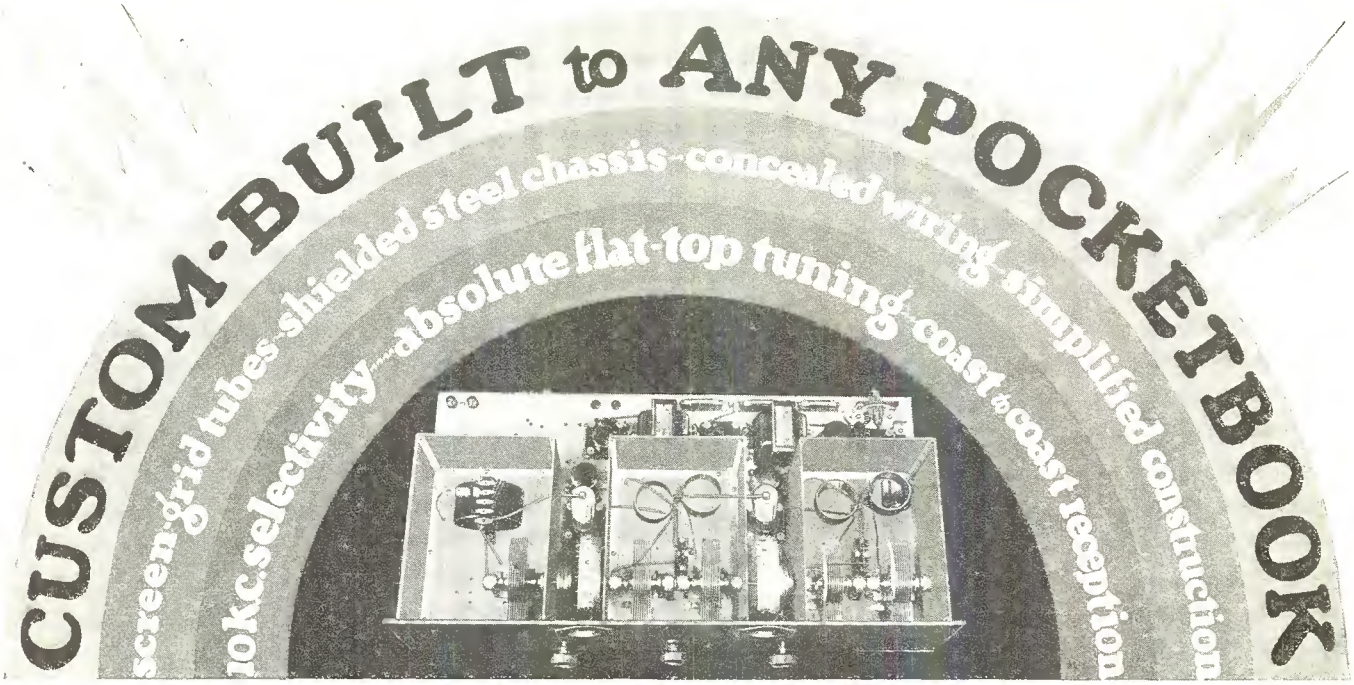


Photo Wide World

Capt. Richards, English inventor, is shown here working on his "Robot," which was later exhibited at the London Radio Show, causing much interest. The mechanical man is able to move his hands, sit down and stand up, and last but not least, to actually speak. There is really nothing but a radio loud speaker inside but the effect is uncanny, combined with the flashing of its eyes, which are electric light bulbs.



THE 4 GREATEST RECEIVERS IN Hi-Q HISTORY!

TO say that these four new Hi-Q Receivers are the greatest instruments ever produced in Hi-Q History is equivalent to saying that they are the most efficient, most selective, most sensitive and most beautifully toned radios in the world. A powerful, all-inclusive statement. But every professional RADIO-TRICIAN who has built one knows this statement is a fact.

For example, there is no receiver, to our knowledge, which employs the Band Pass Filter—an entirely new system used exclusively in the Master Hi-Q 29 models. This new development effects absolute flat-top *square cut-off* tuning for the first time in radio history. It assures positive 10 K. C. selectivity. Even in crowded areas it is impossible to tune in more than one program at a time. "Cross talk" cannot occur. Oscillation, buzzing, humming and background noises are totally eliminated. Stations don't simply "swish" in—they *snap* in, clear and positive. Tone is practically identical with the original broadcast at the microphone!

There are FOUR Hi-Q Receivers for 1929—the Junior Hi-Q 29 at $54.35; the Junior A.C. Hi-Q 29 at $101.50; the Master Hi-Q 29 at $99.50 and the Master A.C. Hi-Q 29 at $151.50—four wonderful receivers which meet practically every range of pocketbook. All these instruments are the joint creation of America's ten leading parts manufacturers. All are stage-shielded, built on steel chassis from the finest parts available in the industry.

FOUR MODELS
A. C. or D. C.
Have One Built by Your Local RADIO-TRICIAN

Anyone can build the Hi-Q Receiver, quickly, easily, successfully AND AT BIG SAVINGS over factory-made sets of anything like similar efficiency. If you prefer to have it built for you, write for address of your local Radio-Trician. Over 6,000 of these Hi-Q experts in the country. One is near you. He will be glad to demonstrate the Hi-Q Receiver and build one for you at a very moderate fee.

If You Want Real Radio Value, Write for Our New 80-Page Book

The new 80-page Construction Manual is the biggest and most complete book of its kind ever published. Tells how to build all 4 new Hi-Q Receivers. Photos and diagrams illustrate every detail. Covers power amplifiers, tube and battery combinations, antennae, installation, short-wave adapters, house wiring and a wealth of other data on custom-built radio. ✓ ✓ Price 25c.

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shafts in original rheostats so that both a. c. and d. c. current can be controlled by one knob. Drill two small holes in bakelite shaft through which insert very small nails which can be soldered to the two sliders. The two switches can be attached to brackets which are mounted to radio base board. We now have a double-pole, double-throw switch, made of the two switches constructed last. Mount an ordinary a. c. porcelain base-socket to your radio base board. Connect one side of socket-plug to both posts A and C of a. c. switch and connect other side of plug to post B of switch. Thus the a. c. current will come on when knob is turned either way.

By means of the combined panel switches described above, it is possible for you to turn either or both speakers on either your radio or phonograph amplifier. Many other useful applications of panel switch will suggest themselves to the experienced experimenter and set-builder.

Resistance Curves

PROPER methods of employing variable high resistances in direct current and a. c. circuits are always interesting and we feel sure that professional set builders will be glad to see the resistance curves shown in Fig. 10, which is supplied us by courtesy of the H. H. Frost Co. The graph represents two types of curves. With the development of the D curve unit, these variable resistances become a universal unit for oscillation or tone and volume control. Since all units are equipped with three terminals, they may be used as a potentiometer type of control, or if desired, by connecting the center terminal and one of the outside terminals, the unit can be used as a two-terminal resistance. The direction of rotation of the kneb for increase or decrease of resistance would depend upon which outside terminal is connected. As will be seen in the graph accompanying the description, the D curve is practically a straight line, with the exception of the slight curve at either extremity of the line.

Thus, the D curve type of variable resistance may be used as an oscillation control in tuned r. f. circuits, where it is placed in series with the plate voltage to the radio frequency stages. It may also be used as a volume control in a transformer coupled audio circuit, where it is located across the secondary of the audio transformer, with the center arm going to the grid of the succeeding tube. It may also be used as a sensitivity control with the screen grid tubes, in this connection being located in series with the plate of the 222 tube.

In the LD curve which is shown in the accompanying graph, it will be observed that the resistance change from zero to fourteen arbitrary dial divisions is a very gradual one. Thus for 2 per cent of the range of the resistance unit, the curve is almost flat, then it mounts and increases fairly rapidly up to about 97 per cent of this range, then gradually up to the 100 per cent. This type of curve makes a unit extremely nice for use as a regeneration control in a regenerative circuit, where it is placed across the windings of the plate coil or tickler. By the same token, it is also quite useful as a volume control in an a. c. circuit, where it is placed between antenna and ground, with the center arm going to the grid of the first radio frequency stage.

A good deal of very interesting information contained in the recent Frost Radio 1928 catalog, which may be secured by writing H. H. Frost, Inc., at the main office, Elkhart, Indiana, or copies may be secured from this publication if the set builder will write us for them.

Tyrman 72 Now Designed as Battery or Alternating Current Set

(*Continued from page* 56)

1 Double drum
1 .00015 condenser
1 .0005 condenser
1 6 mfd filter block
6 5 prong socket and shields

Save $2.50

Get two radio magazines for the price of one!

"Citizens Radio Call Book" and "RADIO" (San Francisco)—a full year subscription to both magazines for the price of a subscription to "RADIO" alone —$2.50. This great money saving offer is repeated again by popular request. Radio fans in various parts of the world have taken advantage of this saving. The opportunity is yours once more—if you act quickly. Let us send both of these well known magazines to your address for an entire year. If you are already a subscriber you can extend your subscription for another year and save money. These magazines regularly cost you $5.00 if purchased from a news dealer over a period of a year. Save $2.50 by subscribing NOW! This is the most liberal magazine subscription offer available. Get in on it before it is withdrawn. Clip the coupon—attach your check, money order or stamps for $2.50—and get it in the mails today.

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1 4 prong socket and shield
1 Hardware
1 Volume control
1 Set coils
1 3-31 audio coupler
1 3-31A audio transformer
1 3-35 audio output coupler
3 Yaxley 3000 ohm resistors
1 Amsco 100,000 resistor
1 Globar 3 megohm grid leak
3 Brown & Caine ¼ mfd condensers
1 Eby antenna binding post, 1/32 in. extruded
1 Eby ground binding post, 1/32 in. extruded
2 Eby plain binding post, 1/32 in. extruded
1 2-A Jack, Carter with 2 insulating washers, 1 Br. washer, 1 hex. nut
1 Steinen, single pole, single throw Toggle switch
1 Aerovox .002 condenser, midget mica
1 Aerovox .001 condenser, midget mica
1 Shielded grid connector lead
1 Hammarlund equalizing condenser
1 Eby tip jack wtih two washers

"Round the World Four" Uses Screen Grid for Distant Signals

(*Continued from page* 70)

1 Polymet grid leak mounting
1 Polymet 5 megohm grid leak
1 Durham 60,000 ohm resistor
1 Sprague ¼ mfd condenser
2 Carter RU10, 10ohm resistors
1 Carter H2, 2 ohm resistor
8 binding posts consisting of 8/32 screw, nut and insulated top
2 National type B vernier dials
1 set hardware

Aero 21 Chronophase Has Its Own A, B and C Supplies in Set

(*Continued from page* 51)

ting in half the regular Yaxley cable. This 5 ft. Yaxley 7-strand connector cable and plug is supplied with the Aero kit. The cable is cut in two parts 20 in. from the base of the seven-point plug. Cable No. 1 is connected from the power supply to the set, while cable No. 2 goes from the power supply to the condenser. This is shown in the sketch illustrated in Fig. 6. Complete instructions for making the two cables are contained in the literature accompanying the Radiart power supply.

If it is desired to use the panel switch on the receiver, by means of which the receiver may be turned on and off instead of by the cut-out switch in the power supply cord, the two terminals on the bottom of the power supply shown connected together by means of a jumper should be opened and the panel switch should be connected to these two terminals. These terminals are shown in the diagram, Fig. 6, and are those which are indicated by the legend "see note." If the set is to be turned on and off by means of the cut-out switch in the power supply cord, then the jumper is left in the position shown in Fig. 6.

The designers state that using the particular receiver described in this article, on a 200-ft. antenna, sufficient selectivity was obtained to bring in WOC at Davenport, while WEBH and WBBM were both in full operation, although WEBH is located within about a mile where the set was tested. With the same adjustments exactly and during the same evening, the set brought in stations over 1,000 miles distant with loudspeaker volume. Over a short period of testing, stations on both coasts were received in the same location.

The need for careful adjustment of both taps and synchronizing studs on the multiple condenser cannot be too strongly empha-

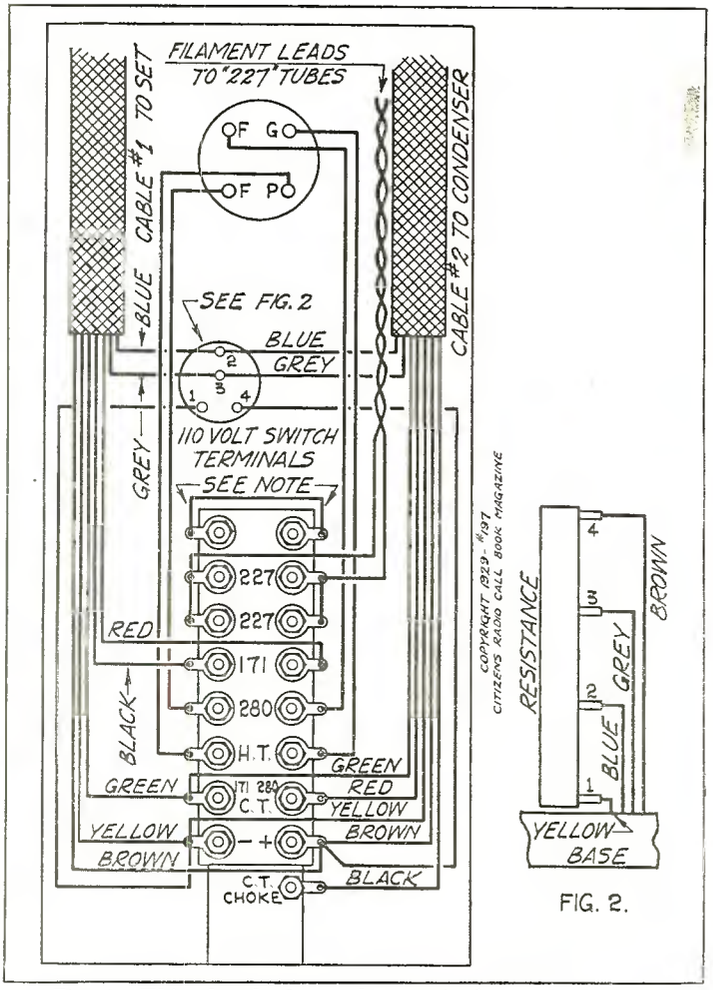

Fig. 6. This sketch shows the terminals on the bottom

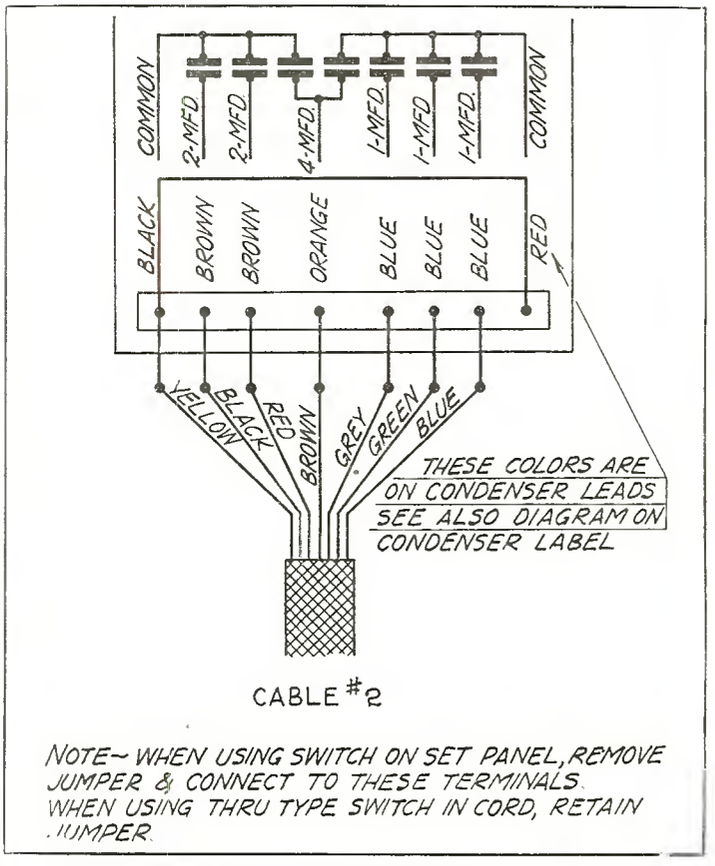

Fig. 7. This simple sketch shows proper connections

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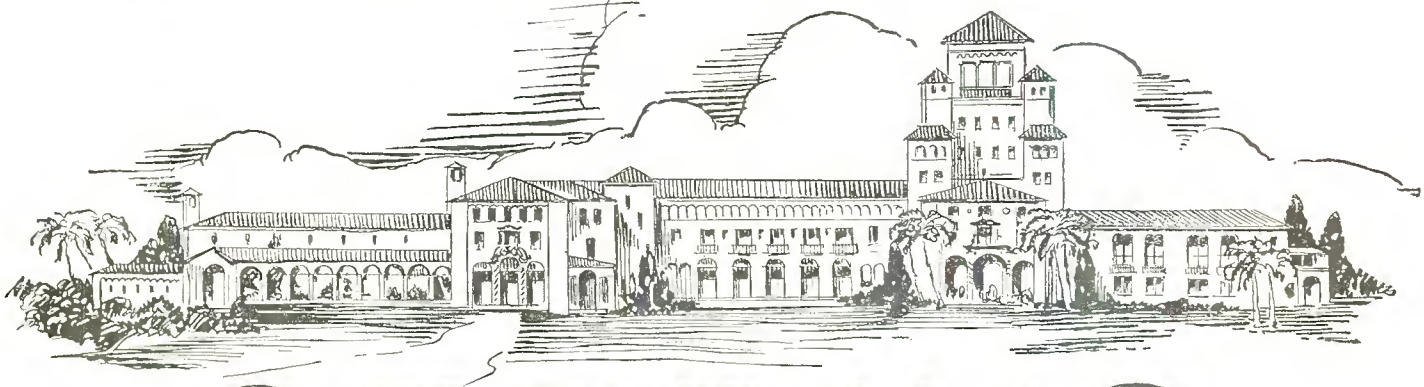


SEBRING
FLORIDA

WITH beautiful Lake Jackson at its front door, Harder Hall is adjacent to the attractive city of Sebring on the "ridge" of Florida and far to the north of Miami and Palm Beach. Forty thousand acres of Lakes, aided by an altitude of 300 feet and natural drainage, completely protects this section from destructive cold weather. The average winter temperature is 65 degrees, assuring the most delightful climatic conditions, with frost practically unknown.

The Seaboard Air Line and the Atlantic Coast Line provide direct Pullman trains from Jacksonville and the North, and similar service to Tampa, St. Petersburg, Miami and Palm Beach. And for the motorist, hard surface roads radiate from Sebring to every section of the State, with Tampa only a short three hours drive.

The location of Harder Hall was carefully selected, and the appeal of the Sebring climate, with its lack of humidity is irresistible. Comparative accessibility to the centers of population; the beautiful location on Lake Jackson, with its natural white sand beach, and eleven miles of fascinating shore line; the general beauty of the Scenic Highlands; the pure water and invigorating air—all combine to make Harder Hall an ideal spot for your winter vacation.

If GOLF is your passion you will be perfectly at home. The best 18 hole Golf Course in Florida is within a stone's throw of the front door. The views of lake and countryside are fascinating. The near-by Kenilworth course has been the scene of several championship tournaments, and a number of other excellent courses are within a short distance.

Lake Jackson is a bewitching body of water and affords motor boating, rowing, canoeing, and bathing at their best. Fishing is very popular. There is baseball, football, basketball, and tennis for the more strenuous. Horseback riding finds much favor, thanks to miles of fascinating roads and trails in every direction.

The illustration above conveys but a suggestion of the simple beauty of Harder Hall, which is 630 feet long, with a tower 108 feet high. The furnishings throughout are comfortable and restful, with quiet and harmonious color schemes.

The American Plan prevails, with rates that are surprisingly moderate for the type of accommodations. The season is from December 14th to late April, and the management will welcome your inquiry for a copy of the illustrated folder of Harder Hall.

HARDER HALL
SEBRING, FLORIDA

Charles N. Thompson, Managing Director
Roberta A. Hill, Associate Manager

sized. If either adjustment is not correct, there will be a pronounced lack of selectivity and the receiver will probably bring in nothing but local stations.

The matter of balancing up the set is not at all difficult, but will primarily require quite a bit of time. In most cases, regardless of the type of tubes used, the set will be found to operate to the best advantage with the antenna on tap No. 2, the first radio frequency coil connected at tap No. 3, and the second radio frequency coil at No. 1 or No. 2. For a comparatively short antenna, it may be desirable to put the tap on the antenna coil on No 3 or No. 4 and for maximum selectivity with a long antenna tap No. 1 should be used.

After connecting the tap, tune in a station which will give a fairly weak signal when the set is not oscillating. Turn up the stabilizer until the set oscillates. Then when the set is in oscillation adjust the stabilizer units on the two rear sections of the multiple until maximum volume is obtained, retuning to a weaker station if necessary, so that while adjusting the volume is always kept at a comparatively low value. When perfectly balanced, the set should go into oscillation with the stabilizer about one-third of the distance from minimum resistance and should go in and out of oscillation at the same point, that is, it should be unnecessary after the set breaks into oscillation to retard the control beyond the point where it went into oscillation.

Official Parts List

The following is the list of parts for the Aero 21 Chronophase a. c.:

1 Aero Chronophase foundation unit 21F for a. c.
1 Aero special 3-gang condenser .00035 mfd
1 Aero special Precise midget condenser
1 Aerovox moulded bakelite condenser .00025
3 Aerovox moulded condensers .001
1 No. 660 Yaxley cable connector
2 No. 422 Yaxley tip jacks
1 No. U-203 Aero coil kit
2 No. C-60 Aero Noskip choke coils
1 Type E National illuminated dial
3 Kurz-Kasch walnut knobs
2 Aero type AE-770 transformers
1 3 megohm Allen-Bradley grid leak
1 Aero special type AE-250 Centralab resistor
1 Aero bushing for dial shaft
1 Radiart No. 55 power unit
1 Aerovox BC-280 filter block

The ABC of Radio

(*Continued from page* 97)

radio power units, this may be done by employing efficient variable resistors, such as the clarostat, in obtaining precise voltages for all purposes.

4. The grid leak in the detector circuit should be adjusted for best results. While the 2 megohm value may be satisfactory for powerful local signals, this resistance value is too low for weak, DX signals. Either a collection of grid leaks of various values should be on hand, or a suitable variable grid leak such as the grid leak clarostat should be employed if you would enjoy DX results.

5. Regeneration is practically essential to real DX results. It can be secured in various ways, for practically every radio-frequency circuit has some form of stabilizer to prevent regeneration, and this can be altered when in search of DX, so as to permit of regeneration or approach to maximum sensitivity.

6. A sensitive loud-speaker should be employed, or, better still, a pair of head-phones, plugged into the first audio stage. Many loud-speakers today are relatively insensitive, because they are designed to operate on powerful local signals without blasting

7. It is well to change tubes around, so as to obtain the best tube for each function in the radio set. There is sufficient varia-

tion in most tubes to make some better for one purpose than for another.

8. If troubled by excessive background noises or microphonic interference, the cause is generally traced to the detector tube, which should be changed.

9. By-pass condensers of 1 or 2 mfd., connected between minus B and the various plus B terminals of the radio set, will improve sensitivity and tone quality of weak signals.

10. And in the final analysis, DX is largely a matter of patience and skill, for some fellows can hear Hong Kong on a crystal detector while others can't cover 500 miles with an eight-tuber.

Remler Power Amplifier Using 250 Tube

(*Continued from page* 48)

series with the primary of the first transformer is of such value as to cut down the voltage applied to the plate of the detector tube. In the output circuit of the power tube, the maximum voltage is applied, this output transformer being also of the resonated type. In the diagram, the speaker coil of this 923 audio

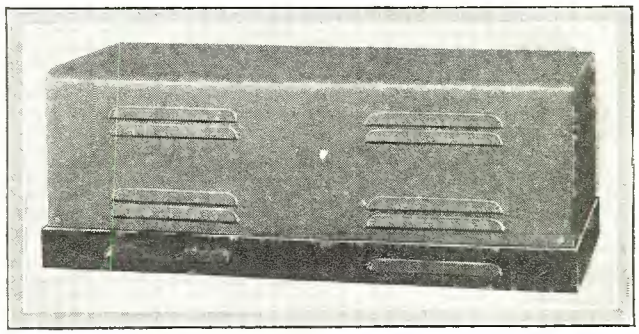


Fig. 4. In this photograph is shown the amplifier after the cover has been placed on it. The louvres shown in the front of the cover are for ventilation

frequency transformer has two taps, one set of taps being for the dynamic speaker input and another set being for the magnetic.

The metal chassis of the amplifier is used as a common negative lead throughout the set. Because of this fact, considerable of the wiring may be simplified and much time may be saved.

Official Parts List

This amplifier is merchandised in a kit built around Remler and Frost parts. In the list of parts shown may be found all of the necessary units required for the construction of this amplifier.

1 Remler 950 power transformer
1 Remler 900 first stage audio transformer
1 Remler 921 second stage audio transformer
1 Remler 923 output transformer
1 Remler 952 foundation kit
1 Frost 300 resistance kit
3 Frost 1405 2 mfd filter condensers
2 Frost 1104 1 mfd bypass condensers

Aero Low Wave Adapter for Custom or Factory A. C. Receiver

(*Continued from page* 65)

as a clarostat or adjustostat, and, if desired, the filament switch shown on the panel may be omitted and this resistor mounted in its place. If this is done, connect together the two leads that now are shown running to the filament switch, for the filament lighting can be controlled by the insertion and removal of the tube base plug, which is inserted in the detector socket of the broadcast receiver. To then connect up the variable resistor, run a lead from one side of it to the tube base prong marked B plug in the diagram, Fig. 4. Then run a lead from the other side of this resistor to one side of the choke coil No. 60, the opposite end of the choke being connected to the tickler coil as illustrated in Figs. 3 and 4

Parts required for the construction of this receiver are shown in the following list.

1 Aero base unit 12BW or 14BW
1 LWT-10 Aero coil kit
1 Type E National dial, illuminated
3 Black Kurz-Kasch knobs
5 Eby binding posts
1 Centralab type AE-8 variable resistor
1 Carter a. c. switch 110-A
1 F-1 split brass bushing.

Citizens Interference Eliminator for Finding Power Leaks

(*Continued from page* 88)

lengths and in other cases on the higher wavelengths. The coil is an ordinary Birnbach r. f. transformer made for use in connection with a .00035 mfd variable condenser. The audio transformer is one of the small Thordarson, with a ratio of six to one. On account of an aluminum shield being used, it is possible to make a good many of the circuit returns to the shield for a common ground and this saves considerable time in wiring. Connections for the head phones are brought out to two tip jacks on the panel. When the set is in operation, the operator will have the head phones on his head while patrolling from pole to pole in order to locate the interference, this process of location being assured by an increase or decrease in the strength of the signal as he walks nearer or away from the source of interference.

Electrically, the circuit is very simple and its construction is quite easy. Even the layman may build up the unit from the diagram shown in Fig. 3, while the experienced set builder will be immediately able to hook up the circuit from that shown in Fig. 4.

Types of Interference

In some of the larger cities, the power companies are equipped with a portable receiver located in a car which they use for chasing down power leaks or other sources of interference along their lines. However, there are many cases in which either the broadcast listener or the professional set builder in a neighborhood is called upon to convince the service company that interference exists. In all our experience with power companies, we have found that they have been quite co-operative, and always willing and desirous of locating any source of trouble on their own line, not only because of the fact that this helps the broadcast listeners in their own neighborhood, but also any form of interference which persists for any length of time will undoubtedly manifest itself in a break or a short and naturally it is to the advantage of the service company to know of these conditions in advance and thus prevent their occurring.

In one case in northern Ohio it was found that interference was being created over an area of a mile or so in each direction and one enterprising set builder finally tracked down the interference and found it to be caused by a pole transformer, which was defective. While it is true that the interference was carried over the particular area covered by that particular pole transformer, nevertheless the set builder found that greater signal was secured as he neared the transformer itself.

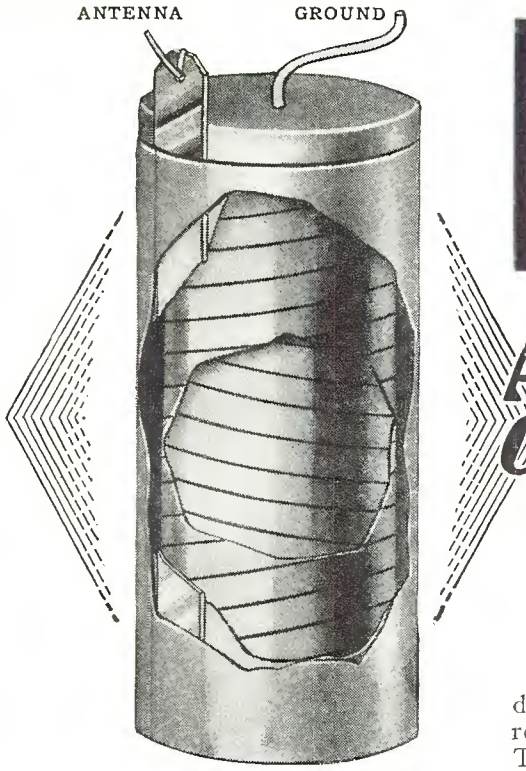
In another case under our observation a small town had an interference which blanketed practically all of the broadcast reception. Numerous tests were made at the power house and along the line to determine the cause of interference but no success was encountered. Finally one individual with a portable set located the trouble in one of the oil switches. This switch had been giving trouble recently, but repairs had been made and apparently the switch was not causing the trouble. However, two days after the source of trouble was located and before any definite action could be taken on it, the switch burned out.

Another interesting case of interference was that created by a wire which had broken off from one of the insulators on the cross arm and the wire swung in the wind to within about four

or five inches of a metal brace holding up the cross arm. When the wire reached a distance of four inches from this metal brace, there was a loud crackling noise heard, which was heard over practically the whole city. Then when the wire swung in the opposite direction, the noise ceased. However, with the wind, this interference was kept up for nights and days at a time, until finally it was located by patrolling the poles carrying one of the high tension lines. This particular form of interference was very difficult to find, because it was not continuous in nature but rather interrupted, and on days when there was no wind, no interference occurred. The interference only occurred on windy days and gave rise immediately to the idea that something must be swinging close to a power line. However, it was only by following the line with a portable set and wearing a pair of head pones that the inspector was able to find the cause of the trouble.

Service Companies Co-operate

It would seem the best policy on the part of professional set builders or others who have a need for such a device to take up with their local power company the question of locating interference and secure as much co-operation from them as possible. With the hundreds of types of interference that can be caused in the electrical circuits of the nation, it is only natural that the power companies must be fairly certain that the trouble is on their own lines before they will take any action. For example: if the violet ray machine is being operated in a house, it is hardly logical to expect the power company to eliminate a type of interference such as that. By the same token, if trouble arises in the street car rail bonding, it is not logical to go to the local power company and expect them to tear down lines and renew apparatus merely to eliminate an interference which they are not causing. For that reason, with the location of interference it is wise to be very sure of the source before any report is made. In many cases it is advisable to have the advice and help of some of the local power house people after the trouble has been found, in



NEW-

ANTENNA and GROUND

Combined in one convenient Unit

A wonderful thing has happened in radio! Convenience never before dreamed of! Clearer, sweeter-toned reception! Radio pleasure with less interruption! These things are brought to you by the amazing, tested, approved, EARTH-ANTENNA.

Many set owners have come to realize the importance of using a dependable antenna, also the value of perfect grounding in getting good reception. Now science has gone a step further; it says that the LOCATION of the antenna is an equally important factor in getting best results. Because the radio wave goes right into the earth—where obviously there is less atmospheric disturbance and interference—it is claimed the logical place for the antenna should be the EARTH, not the air. This important conclusion allowed Radio Engineers to work out the EARTHANTENNA.

REDUCES STATIC

Gets Clearer, Sweeter Tone

Have you ever listened to reception that almost took your breath away with its faultless reproduction, its pure melodious tone? And then gone home and compared its haunting beauty to YOUR receiver's often unsatisfactory, static-ridden performance? Probably nine out of ten set owners who formerly thought they were getting "pretty good" reception have had this experience.

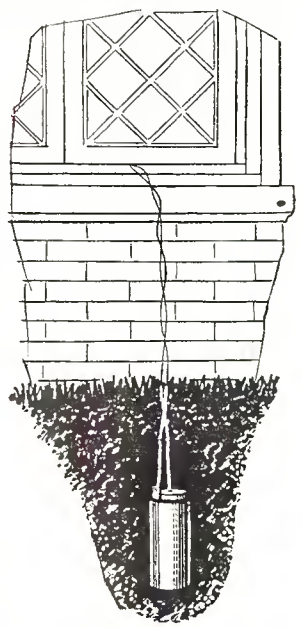
They accepted the shrieks, whistles, knocking and howls due to atmospheric conditions—the weak, faulty results of sagging, broken or soot-laden aerial wires—the interference of other aerials or power line noises—the fading often caused by corrosion or imperfect contact in an unscientific ground—all as necessary evils.

Progressive radio refused to stop there. The new Scientific successful EARTHANTENNA is designed to give you clearer, better, more dependable reception—and it costs no more than the old inefficient aerial—in fact less than many.

EARTHANTENNA is so easy to install that soon people will wonder how they ever put up with the old, dangerous, slow methods. You simply dig a small hole only two feet below the surface of the ground, drop the EARTHANTENNA into it and attach the lead-in wires to your set. Now you are ready to listen to earth-clarified, sweeter toned ground wave reception. You never need to touch the EARTH-ANTENNA again.

Shielded Antenna Gets Better Reception

The antenna is insulated or "shielded" against electro-static disturbances as are the most advanced, expensive receivers and their various parts. Science declares that the earth itself "shorts" the electro static capacity before it reaches the Antenna. This acts as another shield. The ground element is constructed of copper, undisputed as the most effective material for obtaining a perfect ground connection. This section of the unit is separated from the antenna by the insulation which shields the Antenna. So in the EARTHANTENNA you have a scientific ground and an antenna of modern shielded construction combined in one compact unit. You can test it yourself right now, at our risk. Hear the wonderful results!



Test EARTHANTENNA at OUR Risk

Let EARTHANTENNA prove its own value without your risking one cent. Don't remove your old aerial and ground until you've compared the old and modern methods and hear the vast improvement with the new. If possible pick a time when statie is bad. Then if you are not convinced that EARTHANTENNA is the greatest discovery you've ever found for your radio—if you are not enthused over the improvement—you don't pay us a cent. The thrilling details of this important development—illustrated—will be sent immediately on receipt of this coupon. Mail it NOW!

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Dept. 502-A.E., St. Clair Bldg., cor. St. Clair and Erie Sts.
CHICAGO, ILLINOIS

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COMBINED ANTENNA AND GROUND

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Chicago, Ill.

Rush literature on EARTHANTENNA and Free Trial Offer. No obligation.

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Address.....

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

order to make sure that that is the actual cause of the interference.

The small loop referred to previously and which Vee Products is prepared to make on order is in conformity with specifications drawn up by our laboratory and consists of two lengths of wood which are joined together either by a ferrule or by a screw, the top length carrying a small spider web loop. The loop is in effect merely a coil of wire and only one end of it is used, that being the end that goes down to the receiver itself. The two wood sticks are 5 feet in length and the loop is about 8 inches across. Thus, a man is able to reach up a distance of approximately 15 or 16 feet into the air, and still not high enough to touch any of the lines. Attention could again be called to the danger of touching any power lines with such a probing coil.

We shall be glad to hear from professional set builders and others who have occasion to use such a device and would like to know of the results they experience.

Official Parts List

Parts required for building the interference locater are:

1 518 Amsco .00035 mfd variable condenser
1 Sangamo .00025 mfd grid condenser and clips
1 Birnback r. f. transformer for .00035 mfd condenser
1 Thordarson audio transformer, 6-1 radito
1 810 Yaxley 10 ohm fixed resistance
1 Durham 3 megohm grid leak
1 Eby binding post
2 9040 Benjamin UX sockets
1 Kurz-Kash 4 inch knob
1 Yaxley No. 10 switch
2 422 Yaxley pin jacks
1 Aluminum Co. of America stage shield
1 Package Corwico Braidite hook-up wire
2 Ceco or Sonatron 199 type tubes
1 Vee Products special probing coil

Victoreen Duplex Power Amplifier Is All-Electric Operated

(*Continued from page 63*)

output lead. This may be done without impairing the quality.

Another point which might be observed by the service man or professional set builder is that if the amplifier exhibits a tendency to squeal as the volume control is opened, it indicates that a

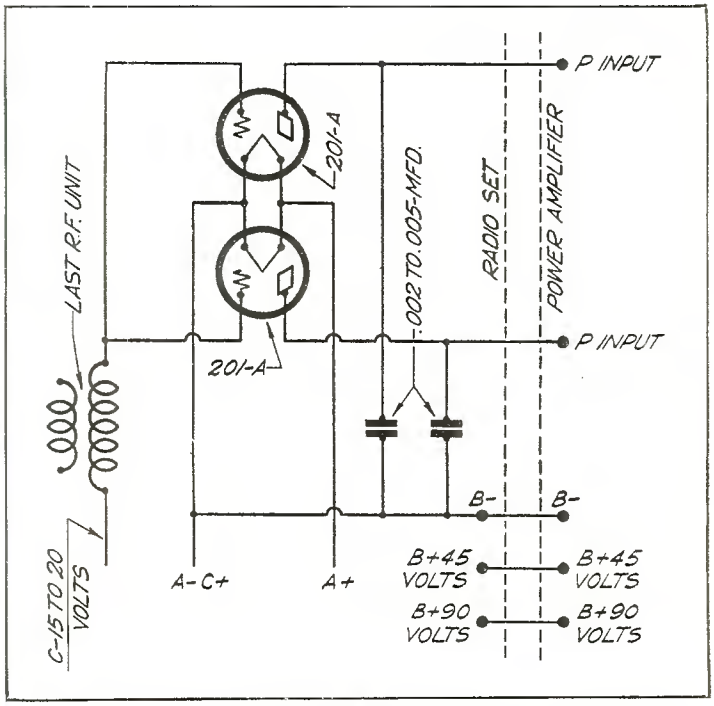


Fig. 5. In this schematic diagram is shown the method of securing power detection using direct current tubes

ground is required. Wherever possible, it is recommended that a ground connection be used from the B minus post to a waterpipe or other good ground.

In the operation of the amplifier from a phonograph pick-up, the pick-up leads from the phonograph itself should be no longer than necessary and the condenser across these leads should be located close to or in the power amplifier. A .02 mfd condenser will give less needle scratch and more low notes than a .002 mfd condenser, although the higher condenser may be detrimental in some cases.

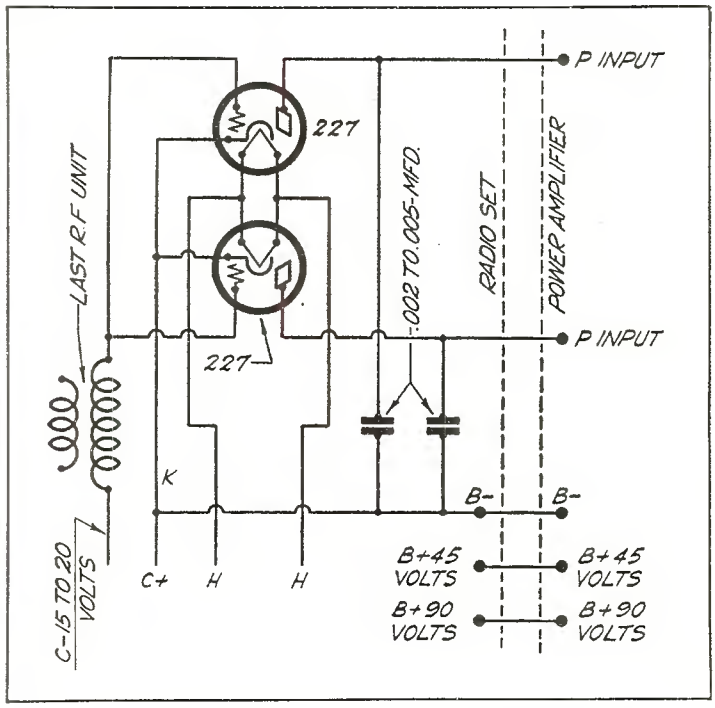


Fig. 6. In this diagram may be seen the duplex power detector system for alternating current tubes

In the wiring of the amplifier, it is suggested that all leads be covered with Empire tubing, spaghetti, to prevent short circuit, or if the job is done with flexible wire, it should be seen that a generous amount of rubber covering is available on the wire. In operation, the amplifier should have ventilation, if it enclosed, as otherwise there is a possiblity of damaging the condensers through their proximity to heat source.

Official Parts List

Parts required for the construction of the Victoreen duplex power amplifier are shown in the accompanying list.

1 118 Victoreen power transformer
1 212 Victoreen duplex audio transformer
1 213 Victoreen duplex audio transformer
1 216 Victoreen choke unit
1 217 Victoreen choke unit
1 516 Victoreen C unit
3 Parvolt 4 mfd 600 volt d. c. condensers
2 Parvolt 1 mfd bypass condensers
1 Parvolt 2 mfd bypass condenser
4 Benjamin 5-prong sockets
7 Benjamin 4-prong sockets
1 Truvolt 25,000 ohm variable resistor
1 Daven 5,000 ohm superohm
1 Daven 10,000 ohm superohm
1 Daven 25,000 ohm superohm
1 Daven 50,000 ohm superohm
2 5 Eby binding posts
2 Miniature sockets
1 Package Belden hookup wire
1 Wood baseboard 10x28x⅝-in.
1 Formica binding post strip ½x$\frac{3}{16}$x8½-in.

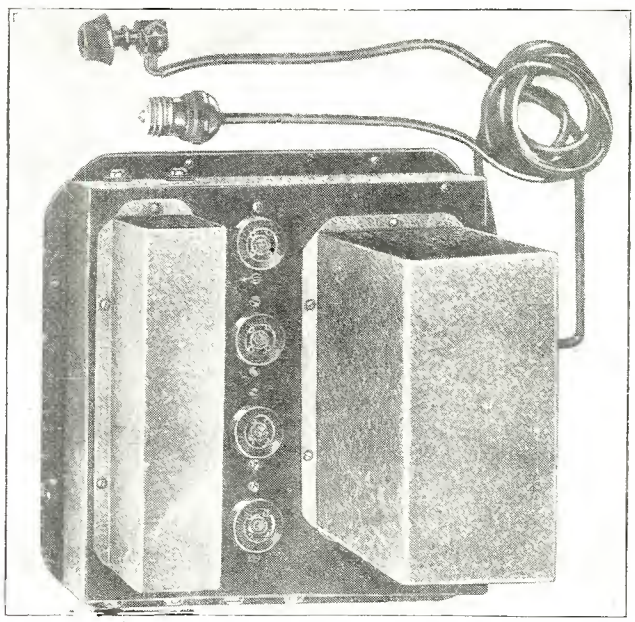
(*Continued from page* 120)

The New Eby 220 Power Amplifier

THE illustration shown herewith is that of the new number 220 power audio amplifier being manufactured by the H. H. Eby Mfg. Co., 4710 Stenton Ave., Philadelphia, Pa.

This power unit, operated from the 110 volt a. c. mains consists of two stages of transformer coupling, and utilizes a stage of perfectly balanced 226 and a stage of push-pull 171s. The power supply for the unit is obtained from a 280 full wave rectifier.

The unit has been designed along most modern lines and in



accordance with the transmitting characteristics of the majority of high calibre broadcasting stations. As such, it is possessed of a flat frequency operating characteristie between 60 and 5000 cycles. The eomplete unit has an undistorted power output of approximately 1500 milliwatts, the equivalent of 1.5 watts.

Particular care has been exercised to obtain correct filament balance and perfect filtering in the B eliminator. As a result, the 226 stage is perfectly balanced and the total hum is so small as to be inaudible 1 foot distant from the speaker connected to the power amplifier. The design of the audio coupling units differs from the conventional, and satisfactory response is obtained at 25 cycles.

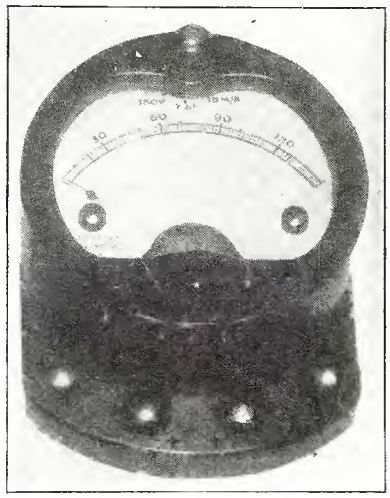
Ferranti Announces Meter Line

FERRANTI, Inc., wish to announce the introduction of a new line of radio meters now available for distribution. Three types are available, a portable of 1,000 ohms per volt with 3-scale ranges of 10/50/250 volts and a second 3-range 200 ohms per volt portable with voltage scales of 7.5/150 and milliampere scale of 15 mills.

The latter instrument is equipped with a switch for changing from one range to others, and a fuse which protects the meter from being burned out in case a high voltage lead is connected to the milliampere scale by mistake.

The third type consists of a flush pattern milliameter which is available in ranges of 100 and 200 milliamperes. All of these meters are of the D'Arsonvol moving coil type. The moving

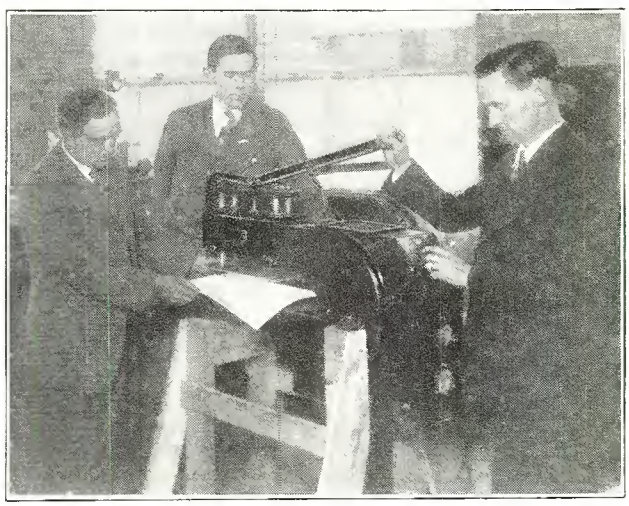
element has highly polished steel pivets running in sapphire bearings and girder type pointer of very light and strong construction with knife edge to facilitate accurate reading.



All of these instruments are of highest quality, accuracy and finish. Manufactured by Ferranti, Inc., 130 W. 42nd St., New York, N. Y.

Weighs Paper In Motion

RADIO by-products are increasing in number from day to day. The latest one brought to our attention is called the Verigraph, which is an instrument that accomplishes a difficult feat and a commercially important one, since it weighs moving webs of materials without touching them. It does this by electrical means reliably and with extreme and permanent accuracy. It adapts radio principles to an important industrial service that has never hitherto been performed, the continuous weighing of sheeted products during their manufacture. The principle is new and the working-out very ingenuous, but the



instrument is simple and robust and it can be used as an indicator, which can easily be read by the workman. Either the weight of the moving web or its deviation, up or down, from the standard sample, may be indicated on the large dial where ever it is wanted, or it may be reported on a chart, or both.

The inventor of the device is Albert Allen, who is shown in the photograph herewith. The unit is made by the Atlantic Precision Co., 80 Federal St., Boston, Mass., who also make a moisture control instrument embodying radio principles.

Makes Record Dive

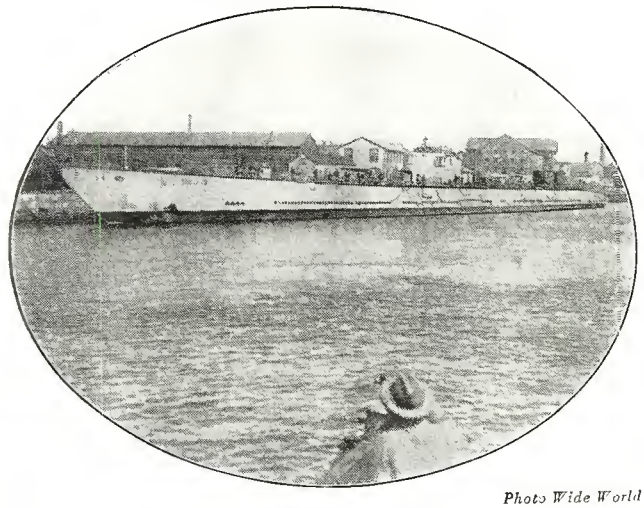


Photo Wide World

A view of the U. S. Submarine V-4, largest in the navy, which established what is believed to be a record for submarine diving in the United States when it reached a depth of 318 feet during a five-hour test off the Isles of Shoals

Measuring Atomic Layers Step to Better "Talkies"

Layers of metallic rubidium, only one atom deep, so thin that several million would be required to equal the thickness of the paper this is printed on, have been measured at the Bell Telephone Laboratories. Thin films of rubidium, a metal similar to the sodium of common salt, are important because of their use in photoelectric cells.

As the magic lamp of modern physics, the photoelectric cell, transmuter of light variations into sound, is the very heart of the revolutions in industry that have been plotted in the physics laboratories. Talking motion pictures, radiovision, television, telephoned photographs would all be impossible without the photoelectric cell.

In the course of researches on how to make the photoelectric cell most efficient, A. L. Johnsrud measured the thin films. When the thin film of metal inside the glass cell was very thin it operated better than when thicker. Rubidium can be made into thin films more easily than its relative metals, because at rather low temperatures and without loss of time it can be made to evaporate and the vapor deposited, in a vacuum, to form such a film.

A large photelectric cell was made and so arranged that rubidium could gradually be deposited on the glass, or else, after a thick deposit had been made, it could gradually be removed. While the film was thus getting thicker or thinner, the photoelectric response, the current given off when light fell on it, could be measured. Since the maximum response was obtained at the same point, whether the film was growing thicker or thinner, it was necessary exactly to record the film's depth.

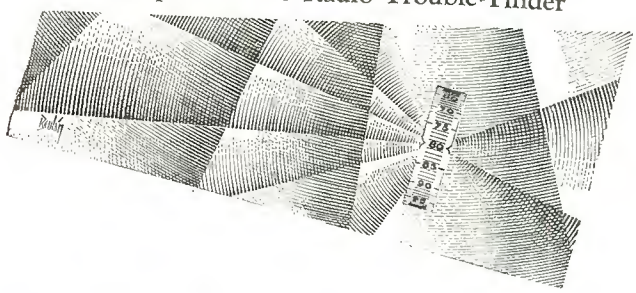
Ordinary measuring methods proved inadequate and polarized light was used. Polarized light differs from ordinary light because, by passage through a special kind of prism, it is made to vibrate in a single direction. Ordinary light waves vibrate up and down, right and left, and in every conceivable direction, but that of polarized light is confined to a single plane.

When polarized light passes through any film, such as the one of rubidium, the direction in which it vibrates is twisted. The thicker the film, the more it is twisted. By means of another prism similar to that which polarizes the light the extent of the twisting, and also the thickness of the film, is measured. The most current was obtained when the film was but one atom thick.

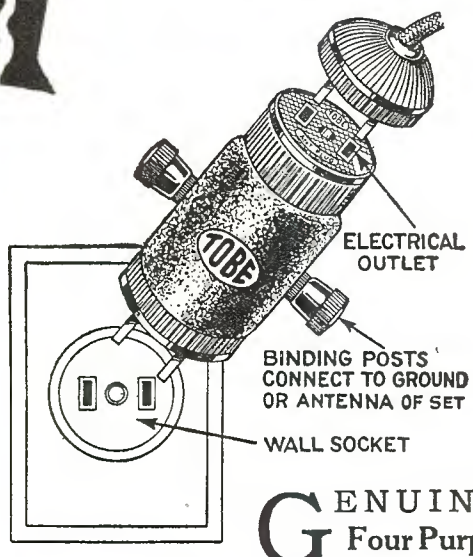
(*Continued on page* 158)

IN THIS ISSUE

Short Wave Superheterodyne
Radio Picture Reception
Overcoming Volume Control Difficulties
Helps For The Radio Trouble-Finder



FREE!



GENUINE Tobe Four Purpose Light Socket Aerial

FREE with one year's subscription to **Citizens Radio Call Book—Radio's Greatest Magazine.**

The Tobe Socket Aerial solves many aerial problems and does many things—just put plug in your electric light socket and hook your radio set to one side, your ground to the other and you still have your electric outlet.

Static minimized—construction of plug prevents excessive pickup of static—increased selectivity—improves tone quality. Tuning is sharpened—your set will tune much more sharply when you use a Tobe Aerial, than when you use an outside aerial. **Each aerial guaranteed for two years, unconditionally.** Full instructions showing many combinations accompany each aerial.

Send This Coupon Today!

CITIZENS RADIO CALL BOOK MAGAZINE
508 So. Dearborn Street, Chicago, Ill.

Here is my $1.75 (Foreign $2.00) for which please send me a Tobe Four Purpose Light Socket Aerial FREE and enter my subscription for the Citizens Radio Call Book Magazine for one year starting with the

☐ January ☐ March ☐ September ☐ November issue

Name.....

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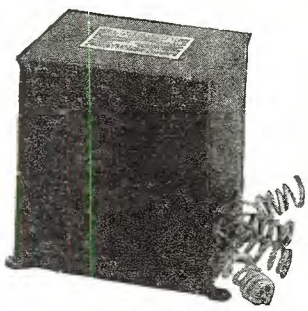
QUALITY DONGAN PRODUCTS

Build Your Power Amplifier Around UX 250 Tube and Dongan Transformers, Chokes and Condensers



No. 7568

Immediate delivery of all items listed. Send check or money order.

No. 7568 — Transformer for full wave rectification using 2 UX281 tubes to supply B and C power to receiver and power for 2 UX250 tubes $13.50

No. 8529—Transformer similar to No. 7568 with addition of 2 low voltage windings, one for 226 tubes and the other for 227 tubes so that you can build a power amplifier for either radio receiver or phonograph pick-up.....$16.50

No. 6551—Double Choke, for use with above transformers....$15.00

D-600—Power Amplifier Condenser Pack contains 2-2-4 Mfd. 1000 volt condenser units.....$16.50

D-307—A Condenser Pack, containing 4-2-1-1 Mfd. 400 volt condenser units, used in connection with D-600.....$10.00

No. 1177—Straight Power Amplifier Output Transformer.....$12.00

No. 1176—Same as No. 1177 but of Push Pull type.....$12.00

Dongan Electric Manufacturing Company
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At Last!

JEEMS SUPER TROUBLE SHOOTER

The Easy Method for Locating Trouble in Your Superheterodyne

THIS handy chart, comprising 16 symptoms, 130 possible causes, is highly recommended by professional set builders as a valuable asset in the work shop.

Accurate, Sure, Complete, Practical

By Mail, 50c

Roberts Radio Service

Caxton Building **Chicago, Illinois**

(*Continued on page* 154)

Cathode Rays Promised As Laboratory Tool

The wonder-working cathode rays, first obtained in large quantities in the open air two years ago by Dr. W. D. Coolidge, of the General Electric Company's research laboratory, are now at the disposal of any well equipped research institution. The effects of the rays on all sorts of living and mineral matter can now be studied.

This is possible with a new form of the tube, simpler than an X-ray tube, and hardly more complicated than an electric light bulb, which has been perfected by Dr. C. M. Slack, of the Research Department of the Westinghouse Lamp Company.

Cathode rays were first studied as they were produced inside glass tubes made by the English scientist, Sir William Crookes. Then, in 1894, a German, Prof. P. Lenard, first succeeded in getting them in feeble quantities in the air. Dr. Coolidge, in 1926, invented a tube in which they were obtained in large quantities in the open air.

The rays consist of speeding electrons, the "atoms" of an electric current, and of which the atoms of matter are supposed to be built. In the Coolidge cathode ray tube they are produced by a glowing electric light filament, and given their great velocity by the application of an electric potential of several hundred thousand volts. This is sufficient to drive them through a thin nickel window at the end of the tube, where they cause the air to glow, as well as other curious effects.

Dr. Slack's improved tube dispenses with the nickel window and uses a bubble of glass, but so strong is it that the pressure of the air on the outside is not sufficient to break it, and destroy the essential vacuum within. Some of these windows are only one-five thousandth of an inch thick and an inch in diameter.

They are made by drawing in a bubble of molten glass on the end of the glass tube, and then allowing it to freeze. Thus it automatically assumes the shape so that the air pressure afterwards is the same as that during its formation, and it will stand surprisingly high pressures. The glass is so thin, that the electrons, or cathode rays, can sneak through the spaces between the glass atoms, even though these spaces are not large enough for the air atoms to squeeze through.

Boat Jumps Through Loop

Photo Wide World

This remarkable scene of a spectacular jump made by Floyd Pierce in Commodore O. K. Hunsacker's "Oh Kay" outboard motorboat at Lake Elsinore, near Los Angeles, was snapped during the try-outs for the jumping contest that will be an added feature of the National Mid-winter Outboard Championship races held at the lake recently

Scientists Need X-Ray Protection

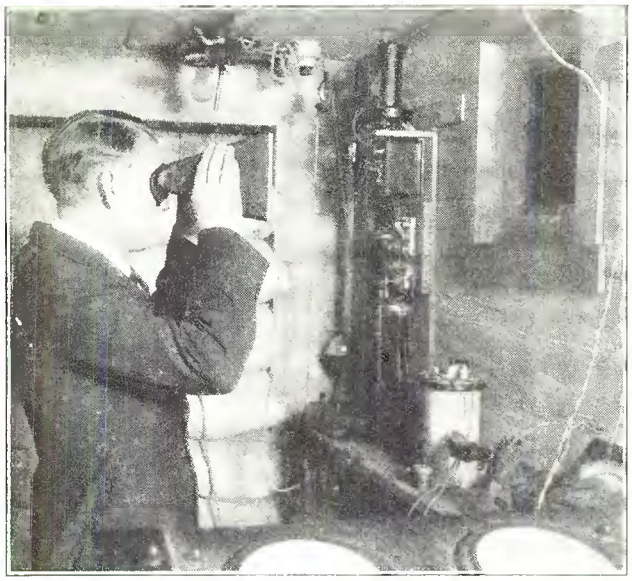


Photo Wide World

Wartime emplacements with a concrete wall and sandbags are built around the world's largest x-ray tube at the California Institute of Technology in Pasadena, Calif., to protect scientists from rays emanating from the fifteen foot tube. Operating under the impulse of 1,000,000 volts of electricity, the giant ray throws off stray rays that would be harmful to the operator and scientists during the experiments now being conducted with it. The wall and the sandbags are designed to absorb these

Two Magnets Contain Secret of Gravity Defier

Magnetic force is the defier of gravitation in the so-called gravity eliminator that London daily papers report has been invented by a young Englishman. This appears probable from the reports reaching here.

Making metal float in the air is a laboratory trick with a firm scientific basis. Upon the desk of R. L. Sanford, chief of the magnetic section of the U. S. Bureau of Standards in Washington there is a small metal bar that stays up in the air all the time. Similar demonstration devices were used recently by an electrical manufacturing company as souvenirs at a scientific meeting.

The law that every high school physics student learns, "Like poles of a magnet repel," makes this metal float in the air in apparent defiance to gravity. Below the floating steel bar there is another metal bar, a twin in size, shape and treatment. Each is made of a special magnet steel, containing about 35 per cent cobalt. The peculiar quality of this steel is that it can be more strongly magnetized than ordinary iron or steel.

When the bars of this steel with their magnetic ends pointing the same way are placed together, they are repelled with such force that they spring apart. Light vertical guides are necessary to prevent the upper magnet swinging around bringing together unlike poles, which attract each other. With this precaution, the steel will stay afloat for days. The lower magnet is hidden by the wood of the base so that the phenomenon seems mysterious.

Ordinary magnets can not be used to perform this trick as one of them will soon lose its strength under the influence of the other. Nor can electromagnets be used for the same reason.

The sphere of influence of a magnet is very limited, the force diminishing according to the square of the distance. There is therefore no possibility of this magnetic phenomenon being used on a large scale, as for instance to hold an airplane aloft. But electrical machines in daily use make magnetism serve man in a multitude of ways.

Interweaves Paper Margins

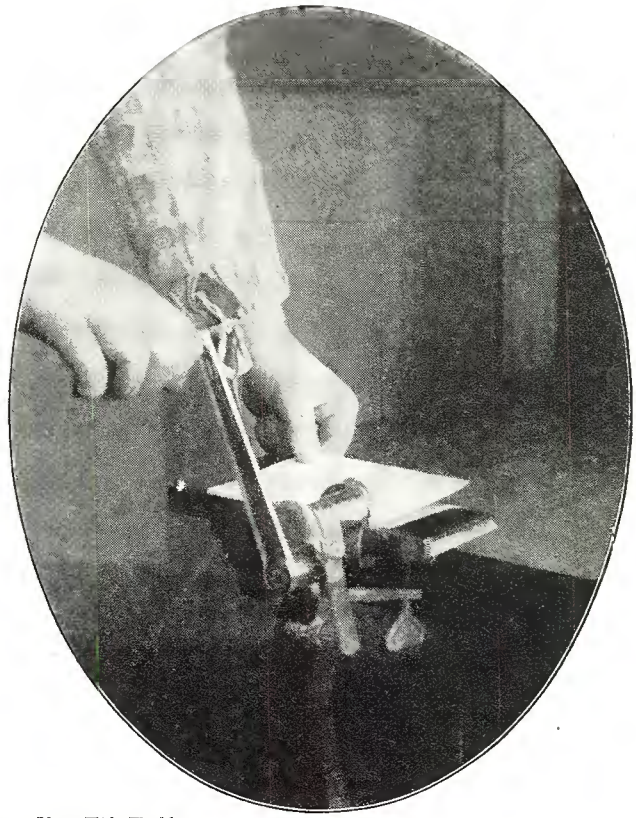


Photo Wide World

Everyone knows the awkwardness of trying to read a prospectus or other series of typewritten pages when attached with either a pin or ordinary paper clip. This little apparatus, the "Clusor," by a simple system of attaching the paper margins to each other and interweaving them, creates a book-like form, handy to read and quite securely fixed so that there will be no loss of papers from removing and mislaying them.

Bombs of Gas Fall Into Sun

Bombs of gas, traveling at great speed may fall into the sun, but not solid meteors. This is the surprising announcement made at the meeting of the National Academy of Sciences by Prof. Henry Norris Russell, astronomer of Princeton University.

Previously, astronomers assumed that solid meteorites could fall into the sun. Prof. Russell pointed out that the great heat of the sun would change them completely to gas as soon as they approached, unless they are more than two or three feet in diameter. However, the mass of gas would itself continue towards the sun with the same speed as if the meteor were solid.

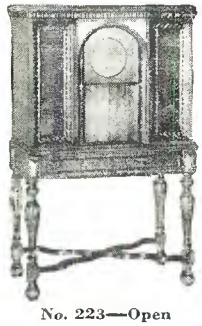
Dr. Harlow Shapley of Harvard, has estimated that 1,000,000,000 meters strike the earth daily, and the Dutch astronomer, J. C. Kapteyn, has computed the total quantity of matter in a given volume of the universe. This has allowed Prof. Russell to calculate that the average mass of a meteorite is about 2 milligrams, or about one-fourteen thousandth of an ounce, which would make them miscroscopic in size. He suggested that the meteors we observe from the earth may be members of the solar system, and that they might be larger, but he thinks that few of these would hit the sun.

Because this amount of meteoric matter is so small, not more than about 60 tons a second would fall into the sun, a very small amount, considering the sun's great size. On this account, he said, the gas generated by the meteors would not be enough to account for some of the strange dark bands observed in spectrum photographs of the stars, which are suns, like ours, but much farther away.

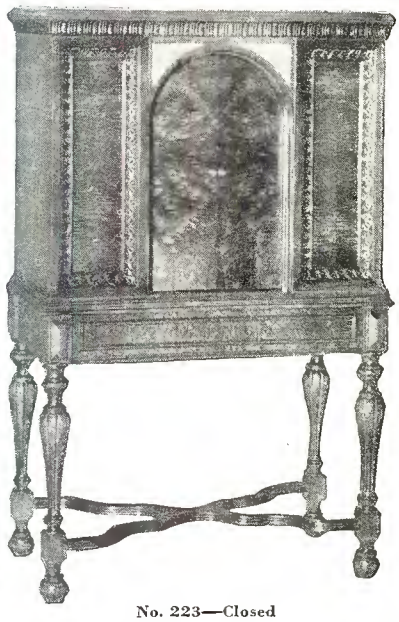
Distinctive Radio Cabinets by Aston

For those who are pleased with only the finest

THE name **Aston** is now recognized as the hall-mark of supreme excellence in cabinet craftsmanship. For in **Aston Cabinets** are combined a basic soundness of construction and a beauty of design that have inevitably brought the highest recognition. The cabinets here illustrated are a fitting piece to occupy the most handsomely appointed room. No. 223 and No. 218 are only two of the attractive cabinets you will find in our new catalog—write for it today.



No. 223—Open



No. 223—Closed

One of our latest Aston Radio Cabinets, of 100% Burl Walnut front, together with the Satinwood overlay topping the doors. As the doors are opened, they reveal the richness of the set panel 13" wide for dials and the French polychromed speaker grille with a dash of color.

No. 218—Closed

No. 218—Open

A staunchly built Aston Radio Cabinet, of select five ply Walnut. Doors of beautifully figured matched Walnut which fold back against the sides. Carved legs joined with a pleasingly designed stretcher.

DEALERS and SET-BUILDERS

Write for our new 1929 catalog. It will give you full details about these beautiful cabinets, as well as description of many other pleasing ASTON models. Our attractive discounts will interest you.

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Distinctive Originality in Design of High Grade Radio Cabinets

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If you are in this vicinity COME IN and see our new, complete display

Zeppelin's Commander Began As Psychologist

Dr. Hugo Eckener, commander of the Graf Zeppelin, obtained his doctor's degree in a field quite removed from aviation, it was recently revealed by Dr. Lightner Witmer, director of the Psychological Laboratory and Clinic at the University of Pennsylvania. Dr. Eckener was a student in psychology at the University of Leipzig, under the famous Prof. Wilhelm Wundt, at the same time as Dr. Witmer. In 1892 Dr. Eckener received his degree, but he remained at the university and when Dr. Witmer received his degree a year later, it was for a piece of research for which Dr. Eckener had acted as subject.

Failure in obtaining a position in psychology led Dr. Eckener into the work for which he is now internationally famous. No jobs were open, even though he wrote Dr. Witmer later to see if there was an opening in America. As an alternative, he got into newspaper work. In the early days of Count Zeppelin's experiments, he wrote a scathing article condemning the whole lighter-than-air proposition. Zeppelin protested that Eckener knew nothing about it, but invited him to visit his works and learn more. As the result of this visit the air-ship builder and the erstwhile psychologist became close friends, and eventually Eckener became Zeppelin's assistant.

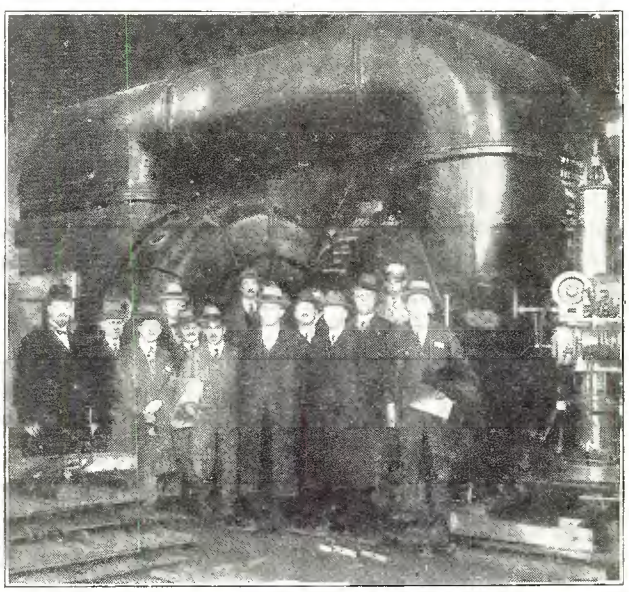

Photo Wide World

Members of the American Society of Mechanical Engineers, at their convention in New York recently, made a tour of inspection of the new 210,000 horsepower turbo-generators in the Hell Gate station of the United Electric Light & Power Company. They are among the largest in the world and will be placed in operation shortly. Photo shows engineers inspecting one of the new turbo-generators at the station. In the group are Professors Fessendin and Keller, of the University of Michigan

Big Tree Bark Resembles Asbestos

The bark of a California Big Tree is, on large specimens, as much as three feet thick and is almost as resistant to fire as asbestos. A sample of the bark twelve inches square was placed in a lumber mill furnace, surrounded with dry pine and fir wood and burned for eight hours. When taken from the furnace the Big Tree bark was merely charred on the outside.

This resistance to fire is one reason for the longevity of the California Big Tree, which is known to attain an age of four thousand years and may reach six thousand or more. A mature specimen, twenty feet or more in diameter, sustained scores of forest fires in the days before the national parks and forests were protected.

Other conifers of the western mountains, notably the sugar pine, yellow pine, red and white fir, also possess thick fire-resisting bark. But the **Sequoia gigantea** is the Shadrach, Meshac and Abednego of the forest world.

Radio Altitude Meters May Permit Plane Landing in Fog

Airplanes may soon be able to land safely in a fog without the pilot seeing the landing field at all. This is one of the possibilities of a radio altitude meter for airplanes developed by Dr. E. F. W. Alexenderson, of the General Electric Company, and described by him to the National Academy of Sciences.

The radio altitude gauge does the same thing for an airplane that the sonic depth finder does for a ship, he announced. With the aid of the latter, the captain can make a constant record of the depth of the water beneath him. He can not only avoid shallow water, but he can actually plot the contour of the ocean bottom and identify it with the contours given on his charts. It operates by sending a sound wave from an oscillator on the bottom of the ship. The wave travels to the bottom, is reflected upwards, and the difference between the time the sound is made and the time the echo returns permits an exact measurement of the depth.

Radio waves may be made to do the same thing for the airplane that the sound waves do for the ship, said Dr. Alexanderson, but since they travel at the speed of light and far faster than the sound waves through water, their use requires quite a different technique. The waves are sent out from a transmitter on the plane, part travel downwards to the ground, there they are reflected, and with the proper receiver they may be picked up again in the airplane. The time is too short to notice the difference, however, and indirect methods must be used.

Television "War Paint"

Photo Wide World

For the first time in history a complete drama was transmitted by television, picture and voice being simultaneously broadcast on separate radio channels from the laboratories of the General Electric Co. at Schenectady, N. Y. Dr. E. F. W. Alexanderson, consulting engineer of the company, staged the performance for the purpose of demonstrating the great strides made in this new science within the past few years. The photograph shows Izotta Jewel as she appeared before the television transmitter. Note the heavy make-up required for the performance.

Farm Industry Book Printed on Cornstalk Paper

Paper made from cornstalks will be used in the printing of a book on farm products in industry soon to be issued. The author, Dr. George M. Rommel, agricultural expert, investigated the problem of waste materials in agriculture. As a demonstration of the use of one of the most plentiful of farm by-products he conceived the idea of printing his book on a new paper made from cornstalks which are usually wasted.

Boys Study Television

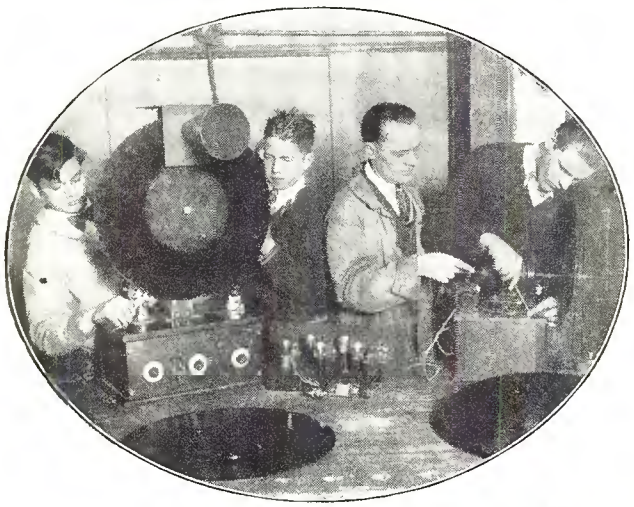

Photo Wide World

The radio class at Lane Technical High School of Chicago are studying the theory and building of television apparatus. Several television receivers are under construction and the students expect to produce great results with this latest radio innovation. Photo shows the Lane Technical High School students assembling a television set

Russians Have Native Source for Camphor

A native source for camphor, important in both medicine and manufacturing, has been discovered in a species of wormwood that grows on the sandy steppes of the government of Astrakhan. An oil extracted from this plant has been subjected to experiments at the Saratow experiment station and was found to yield a quality of camphor. The crystals differ in their physical properties from those of camphor obtained from camphor trees, but chemically they are identical with it.

Biggest American Built Steamer

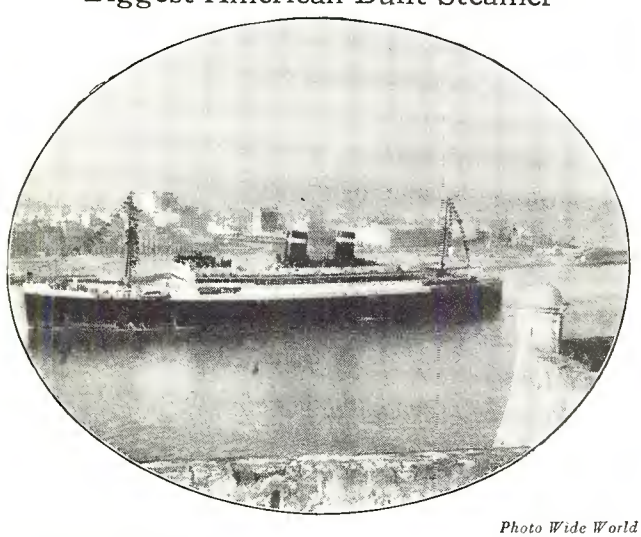

Photo Wide World

The S. S. Virginia, the largest American built steamer, passing historic Morro Castle at entrance to Havana, on her maiden voyage to Cuba.

ENGLAND every day
AUSTRALIA on Thursdays
HOLLAND on Fridays

"It may be of interest to you to know . . . that 5SW (Chelmsford, England) has been received every afternoon . . . since March 19th. . . . PCJJ at Eindhoven, Holland, comes in every Friday from 7 p. m. to 11 p. m. . . . 2NM at Caterham, England, on Sundays, Wednesdays and Fridays. . . . PCLL at Kootjwik, Holland, about three days a week. Listened to 2FC at Sydney, Australia, from 6:30 a. m. to 7 a. m. Thursday morning." . . .

—Extract from letter received

Aero Gets Everything in the Air

The above is an unsolicited letter received by us from a satisfied user of a short wave set built around Aero Coils. With two stages of audio, *loud speaker reception* was obtained about three days a week.

While such results as this cannot be expected from every receiver, it is a fact that with a given amount of power, a broadcasting station can be heard at far greater distances when transmitting on short waves than in the usual broadcast band, and this fact has been responsible for the tremendously increasing interest in short wave reception by radio fans. Static is much less objectionable on the short waves and their use has made possible, for the first time, summer reception in many parts of the country where the seasonable decrease in signal strength and increase in atmospheric disturbances has heretofore rendered the summer use of a radio receiver very unsatisfactory.

Most of the short wave receivers which have been made available to the public up to the present time have been designed primarily for the reception of continuous wave code signals, and have been more or less unsatisfactory for the reception of musical programs, and we believe that Aero short wave receivers are the first ever placed before the general public which have been designed primarily for the reception of *broadcast programs on short waves.* Aero International Kit shown above will give you real thrills. Price of Kit No. 8, complete, $55.30. For sale by jobbers and dealers.

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The Aero-5-tube Chronophase Receiver and all of the famous Aero Short-Wave and Broadcast Receiver and Transmitter Kits, parts and supplies are carried in stock at Wholesale Radio Headquarters, W. C. Braun Co., Chicago, Ill., who are official distributors for the complete Aero line.

Dealers and setbuilders are urged to send their orders here, where they will be carefully and promptly filled and shipped.

Nowhere in the country will you find such a huge assortment of everything needed by the radio setbuilder and dealer—including complete kits of all circuits, parts, supplies, accessories and complete factory-built sets, both A. C. and D. C.

If you have not received the big 264-page Braun's Big Radio Buyers' Guide, be sure to send for it today. Write on your letterhead and free copy will be mailed to you at once.

~~~

W. C. BRAUN CO.

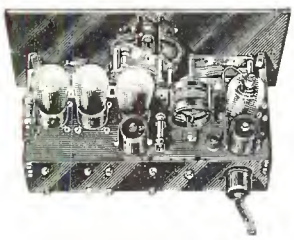
Pioneers in Radio

553 W. Randolph St.

CHICAGO

ILLINOIS

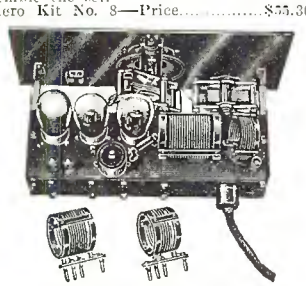
SHORT WAVE RECEIVERS



INTERNATIONAL
Short Wave Receiver

This is the first short wave receiver designed exclusively for the reception of broadcast on low waves. Broadcast reception on short waves is remarkably clear and free from static. Programs come in from greater distances with the utmost simplicity of control. Complete kit includes everything necessary to assemble the set.

Aero Kit No. 8—Price.....$55.30



STANDARD
Short Wave Receiver

This three-tube short wave receiver utilizes a circuit which has been proven by years of excellent results in the hands of amateur operators. The audio transformers are of the same type as are used in broadcasting stations, assuring excellent tone quality even when receiving programs from a great distance.

Aero Kit No. 10 for A. C. Tubes. Price.....$49.95

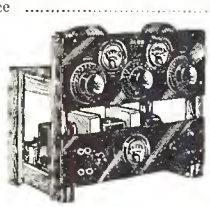
Aero Kit No. 11 for D. C. Tubes. Price.....$49.95

STANDARD
Short Wave Converter

You can receive short wave programs on your present set by utilizing this short wave converter. Kit is complete. The base panel has all parts entirely assembled on it, wired and tested. It is only necessary to connect four or five wires to use this converter.

Aero Kit No. 12 for D. C. Tubes. Price.....$32.00

Aero Kit No. 14 for A. C. Tubes. Price.....$32.00



Short Wave Transmitters

For either the man who wishes to build his first low-power transmitter or for the dyed-in-the-wool amateur who wants to purchase all the parts for a high-powered installation from one source. Aero Radiophone Transmitters are available in complete, easy-to-assemble kits. Prices on application.

BROADCAST RECEIVERS

AERO-SEVEN
TWENTY-NINE

The Aero "7-29" is a 7-tube set, employing three stages of "Chronophase" radio frequency amplification, and one semi-aperiodic stage. Extreme selectivity and great sensitivity assure the user of distance and "pep" while the improved audio amplifier gives truly surprising tone quality. A 71 power tube is employed in all models. In the A.C. Model, six 27 tubes are utilized, and in the D.C. type, six O1-A type tubes. The shield grid model uses four shield grid tubes, two O1-A's and one 171. All kits, $97.85 list with cabinet.

AERO-DYNE

The Aero-Dyne is a 6-tube receiver of supreme excellence. Three stages of "Chronophase" radio frequency amplification, will utilize any type of tube, whether it be shield grid, A.C., or D.C., to the maximum advantage. Uses the new special broadcasting line audio amplifier and is the most sensitive and selective receiver which can be built for anything like the money. Transcontinental reception can be properly expected from the Aero-Dyne under favorable conditions. This kit includes the large cabinet illustrated. A.C. set uses 5 227 tubes with 171 power amplifier. D.C. uses either shield grid or 201-A tubes and 171 power amplifier. All kits, $93.50 list with cabinet.

"METROPOLITAN"

The Aero "Metropolitan" is a four-tube receiver especially designed to secure the maximum possible gain from the already popular radio frequency regenerative circuit. Special coil kits allow the use of shield grid tubes or standard tubes with the inter-electrode capacity of the tube neutralized as in the popular Roberts and Chicago Daily News circuits. A novel and extremely efficient method of controlled regeneration is employed which also operates to stabilize the R. F. Amplifier automatically, compensating for any slight changes introduced by careless wiring and at the same time gives greater selectivity as the sensitivity of the receiver is increased. All kits, $58.00 list with cabinet.

"CHRONOPHASE"

The Aero "Chronophase" Receiver is a 5-tube set, embodying two stages of tuned radio frequency, utilizing the "Chronophase" circuit for either shield grid, A.C. or D.C. tubes. This receiver is recommended as the best low priced all purpose receiver on the market. Selectivity is sufficient to separate powerful locals without difficulty and reception reports of 2,000 miles are not unusual. We have seen no 7-tube set that can approach it. List price, all kits, $74.50 with cabinet.

"TRIO"

The Aero "Trio" is a simple three-circuit regenerative receiver of time-proven ability. It is recommended especially for use in locations one hundred miles or more distant from high-powered broadcasting stations where the selectivity given by "Chronophase" system is not required. Practically all the long distant reception records have been made on receivers of this type. All kits $42.00 list with cabinet.
~~~

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AERO KITS

24-HOUR SERVICE

"CHRONOPHASE"

5 TUBE KIT

For the man who wants to build a receiver that will separate locals almost regardless of how congested the ether may be and will at the same time have sufficient sensitivity to reach out for distant stations, we recommend the "CHRONOPHASE." This receiver contains two stages of tuned radio frequency, one detector and two stages of audio frequency using the new Aero audio system. The two radio frequency stages will utilize either shield grid, 227 or 201-A tubes to their maximum efficiency and the AC model will utilize either the 171, 210 or 250 power tubes, depending upon power supply available.

Prices are very low,—for example "CHRONOPHASE"5 tube kit complete without cabinet has a retail list of $68.55. Your Wholesale Price is $40.31. Kit for shield grid tubes is No. 2R-3685; for AC tubes is No. 2R-3686; and for DC tubes is No. 2R-3687. Your order for any of these models will be filled within 24 hours from the time it is received.

Aero Short Wave Converter

World wide reception on the short waves has aroused the interest of thousands of new Radio fans. Get started by using the simple Aero Standard Short Wave Converter which can be attached to any "broadcast" radio receiver. It can be assembled in a few minutes and can be plugged into the detector and sometimes the first R.F. socket utilizing the same tube which has been removed. Factory sealed kit, complete with instructions. Kit for DC tubes is No. 2R-3666 and for AC tubes is No. 2R-3667. The price is unusually low especially when you consider the thrill you'll get of listening in on foreign programs. The retail list is $32.00 and your special wholesale price is $18.82.

Free Wholesale Catalog

Our big wholesale catalog which is **FREE** to you contains 100 pages of selected values "boiled down" from the vast offerings of an enormous market. You will applaud our choice. Kits, parts, sets, accessories, cabinets, electrical appliances,—the best the market affords. Absolutely FREE. Send for your copy today.

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WE are California headquarters for the new **Aero 4-tube Metropolitan** and all other Aero parts and kits. Our complete stocks on this popular line, as well as all others of reputable manufacture enable us to make **same day shipment** on all mail orders. **For quick delivery,** send your orders to us. You will profit by our speedy service.

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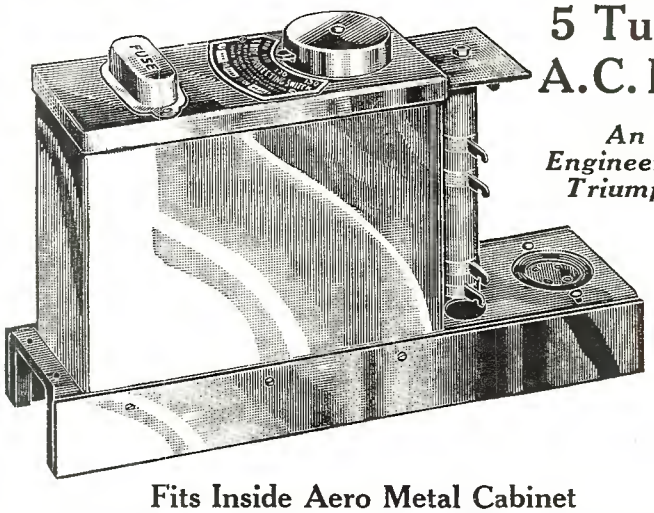
A, B and C Power Supply for Aero 5 Tube A.C. Kit

An Engineering Triumph



Fits Inside Aero Metal Cabinet

Size ONLY 3x7x11" **Price ONLY $34 Each**

EXACTLY supplies all filament voltages for the No. 280 Rectifier Tube, the No. 227 A.C. Tubes and the No. 171 Power Tube. Also supplies the absolutely correct B voltages for all of the tubes. Also EXACTLY supplies the very important C bias voltage for the No. 171 power tube, insuring the full power and truly beautiful tone quality of which this tube is capable when A, B and C voltages are all absolutely EXACTLY as specified by the tube manufacturers.

These Power Units are special jobs. They are built for the exact and specific requirements of the Aero 5 Tube No. 21 Chronophase A.C. Receiver Kit. They are the result of many months of the combined efforts of Aero Engineers working in co-operation with Radiart Laboratories Engineers.

Order Radiart Power Unit No. 55 for the 5 Tube Kit. Order Aero Metal Cabinet No. 250 for the 5 Tube Kit. Order Aerowox Filter Condenser Block No. BC-280 for the 5 Tube Kit.

Radiart Power Units for Aero A.C. Kits can be obtained from all distributors of Aero Kits. If your dealer is temporarily out of them they will be shipped direct on receipt of price. Address

RADIART LABORATORIES, 1002 Ass'n Bldg., Chicago, Ill.

Guaranteed

BY THE LARGEST AND MOST UP-

This highly efficient organization with trained service men, together with a completely equipped laboratory, is at your disposal for repairing, testing and advice on all types radio receivers, battery eliminators and power units. Our experience in this field has helped all our clients to enjoy better and continuous radio reception. All laboratory instruments used in testing and repairing are modern and up to date, insuring rapid and accurate location of trouble involved in your receiver.

Remember

the confidence of many leading manufacturers has been placed in this laboratory. The Radio Service Laboratories will give to you the same conscientious service that the manufacturer himself would give you.

Any receiver or power device repaired by us is positively guaranteed to perform in the manner claimed by the manufacturer.

Because the largest staff of trained service repairmen and engineers are at your service, you can be assured at all times of the most careful and competent work. This is proven by the large numbers of sets shipped to us for service from every state in the U. S., Canada, Alaska and Mexico.

We Specialize

on all receivers illustrated in the Citizens Radio Call Book. If you have constructed any of these receivers and are not obtaining satisfactory results, let us give an estimate for putting the set in first class condition. Each receiver repaired by us is given a thorough inspection of each individual part.

BEST operation of any receiver is only secured when all voltages are up to their rated value. Many a set giving poor results is due to lower plate voltages. Occasionally this may be caused by defective resistances or poor or leaky condensers.

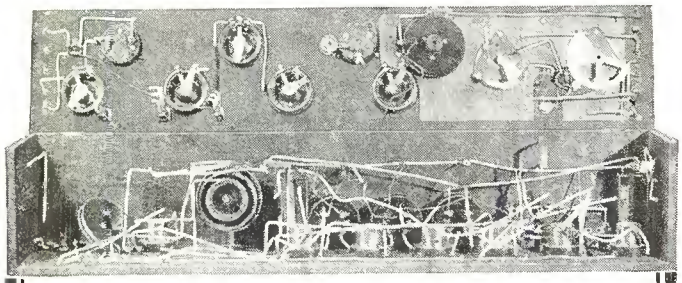
Our trained staff is fully equipped to service your power supply and restore it to its proper condition. Have your work done now so that you may obtain the maximum efficiency of your receiver. We are also prepared to construct any type of power device.

RADIO SERVICE

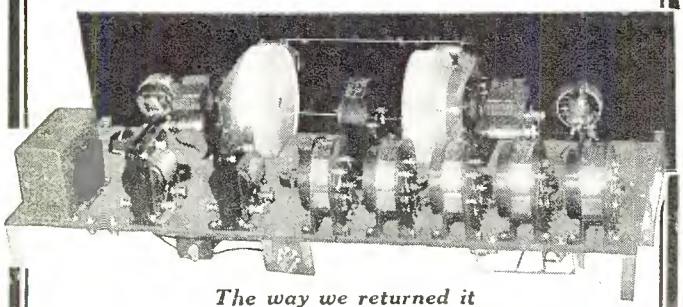
508 South Dearborn Street *Telephone*

Radio Service

TO-DATE SERVICE STATION IN AMERICA



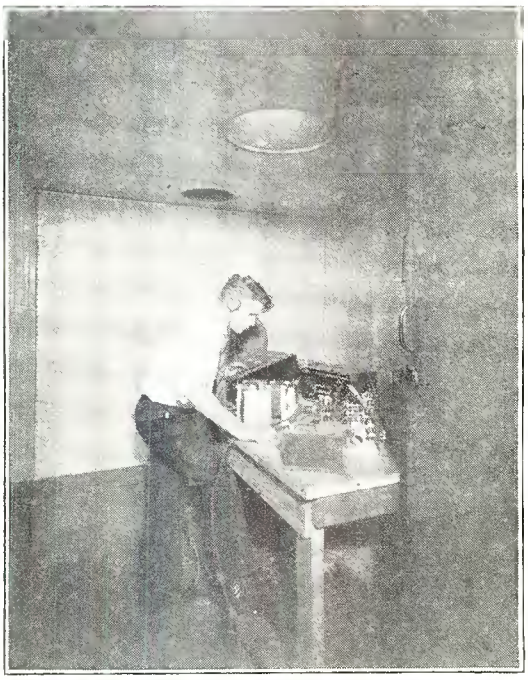
The way it came in



The way we returned it

WE will repair, test or design any type of receiver you may desire. Being specialists in this field we are in an excellent position to rebuild your present receiver and bring it up to date.

It is more practical and wise to bring your problems here than to some irresponsible radio man who is unfamiliar with the merchandise you wish serviced. This is an era of specialized effort and our charges are no more than you would pay for inferior workmanship.



(All receivers serviced in this laboratory are given a final test in a completely shielded room where the internal noises are absolutely eliminated.) This insures noise-free reception, which is necessary for satisfactory performance. In addition, complete equipment is available for properly testing all types of power units.

If you are unable to personally deliver the receiver or unit you wish to have repaired, securely pack it in a strong box with plenty of cushioning material such as excelsior, and ship it to us via American Railway Express, prepaid. It is not necessary to ship the cabinet or accessories.

In order that you may safely ship your receiver to us for repairs, we can supply you with a strong fabricated carton. including the required amount of packing, sealing tape, wrapping paper and rope at a cost of $1.00. This carton conforms to the construction requirements of Consolidated Freight Classification, a resistance of 200 pounds per square inch and a gross weight limit of 65 pounds.

LABORATORIES, Inc.

Harrison 2870 **Chicago, Illinois**

Index to Advertisers

Pierson Phono-Radio

ABOVE is illustrated, the GREATEST VALUE IN PHONO-RADIOS on the market. Think of it:—THE ORLEANS sells at List, with Magnetic Speaker, completely equipped for $185.00, or with Dynamic at $215.00. The equipment consists of A.C. Induction Type Electric Motor, Cobalt Magnet, Electric Pickup, Statuary Bronze Tone Arm, Two-Way H & H Phono-Radio Switch, Volume Control, Radio Adapter, etc.

THE ORLEANS will house such sets as Radiola 18, or 60—Graybar, Brunswick, Federal and in fact any set, with wonderful results.

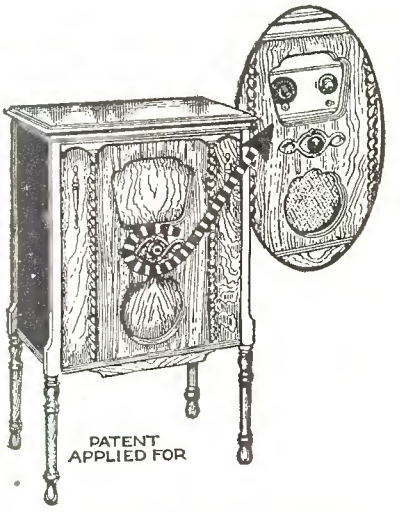
Special—

Atwater-Kent, Crosley, Steinite and sets having center Tuning Control, can use the **Miracle Phono-Radio,** listing at $156.00 complete, with Dynamic Speaker.

"Be First with Pierson"

THE PIERSON COMPANY
ROCKFORD, ILL.

The "MIRACLE" Radio Cabinet



"When You See the Revolving Door You'll Know— It's the MIRACLE"

DEALERS

Advance information is now available on the MIRACLE CABINET. WRITE FOR IT TODAY!

Custom-Radio Builders, ATTENTION

PIERSON protects your profits. You have a complete line to select from and no mail order house can sell your customers.

Write today for application for Dealer's Pass Card, which will admit you to any of our Wholesale Display Rooms.

THE PIERSON CO.
830 Cedar Street
Rockford Illinois

Barawik - the Old Reliable RADIO SERVICE

NEW WRINKLES FOR SPRING AND SUMMER

THE Barawik Radio Guide points the way to a new and unique service to radio fans. Plenty of profitable business and entertainment for the Spring and Summer months, with new portable radio sets, portable phonographs, short wave, television, camping and outing equipment, golfing supplies, tennis and other sporting goods. Hundreds of items of new merchandise—auto tires, tubes and accessories—and just the things you need most for everyday use in the home, office, shop, store and factory.

Get the ***Barawik Radio Guide*** if you already haven't one. It shows you have to save tremendous sums on everything you buy in these lines.

Amateur and Short Wave Equipment

BARAWIK is the pioneer in supplying kits and parts for short wave receivers and transmitters. We are headquarters for all the popular short wave circuits such as: Hammarlund, Aero, Karas, Cardwell, R.E.L., Thordarson, Acme, National, etc., as well as the individual parts used in the assembly of all makes of short wave receivers and transmitters.

Television

Television is still in its infancy and far from perfect, but we are keeping abreast of all events in this new field and will be able to supply fans with the various necessary parts to keep up experiments as new developments come out. During vacation many fans will want to experiment with television. Barawik will help you to get the most reliable merchandise for this purpose.

You Save More Money Here

Ask any of the quarter million Barawik customers why they trade here, and they'll tell you that, ***quality considered,*** our prices can't be beat. That's something to think about! Quality comes first—good, new, fresh, reliable merchandise, but the price always means a tremendous saving, nevertheless. Get our catalog and prove this to yourself. Don't spend a nickel until you see our offerings first.

Deal with a Reliable House

At Barawik's you can secure the proved, reliable merchandise of the world's leading radio manufacturers—everything from complete sets to the smallest individual parts so necessary to the set builder. You can depend upon the reliability of Barawik goods. You can depend upon Barawik's ability to deliver the kind of service that means time saved in waiting. You can depend upon Barawik's honesty, ability and willingness to serve you—and last, but far from least, you know that Barawik's big discounts assure you of the lowest prices always—prices that mean huge savings to you in everything you buy.

Send Coupon for Free Book

You need Barawik's Big Guide as you never needed it before. Just mail the coupon and the big, profusely illustrated Radio Catalog, Guide and Cyclopedia will be sent to you free. Be sure to write for this new big edition today.

BARAWIK CO., 31 Canal Sta., Chicago

Please send me the big free Barawik Radio Guide, Catalog and Radio Cyclopedia at once, showing the many new bargains you offer.

Your Name.....

Address.....

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

12-HOUR SERVICE

The Barawik Co.

31 Canal Station
CHICAGO, ILL., U. S. A.

We want IMMEDIATELY

Thorola TUBE

5000 Dealers

The demand for Thorola Tubes compels us to get wider distribution *immediately.* We must add at least 5000 dealers quickly! To get them—and to make the Thorola line everywhere available to the Thorola buying public—we make this *amazing* offer to dealers who will *act at once.*

WE OFFER FREE

With Each $100 (Net) Order of Thorola Tubes

THIS MARVELOUS TONED

Thorola DYNAMIC SPEAKER

The finest type of dynamic speaker available today—made by Thorola, for ten years nationally famous in the loud speaker field. This offer has no strings attached to it. We make it to get *immediate* wider distribution of the world's finest *one-year guaranteed* tubes—and to assure adequate representation of the complete Thorola line of tubes and loud speakers.

Take advantage of this offer, Mr. Dealer! Of necessity, it is limited as to time. Thorola offers you a generous 50% off list tube prices. In addition, you get absolutely FREE this nationally famous Thorola Dynamic. We ask you only to demonstrate to your trade the wonderful new reproduction afforded by this magnificent toned speaker.

The Thorola line offers a *guaranteed* tube for every requirement; also matched sets of AC tubes.

Thorola Tubes —the World's Finest *Guaranteed* Line

—50% off—

LIST PRICES
All Standard Types

No sliding scale discounts—50% from current list price is your discount on any quantity.

DC TUBES

Type	List
201-A	$1.50
V-199	2.25
X-199	2.25
X-11	2.50
X-12	2.50
X-120	2.50
X-222	6.50

AC TUBES

226	2.25
227	4.00
AC-171	4.00
280	4.25
222-AC	7.50

POWER TUBES

X-171	2.75
X-112	2.75
112-A	2.75
171-A	2.75
200-A	4.00
281	7.50
250	11.50
210	9.00

MATCHED SETS OF AC TUBES

No. 6 AC KIT
1—AC—227
1—AC—171 List Price
4—AC—226 $22.25
1—280 (Rectifier)

No. 7 AC KIT
1—AC—227
1—AC—171 List Price
5—AC—226 $24.50
1—280 (Rectifier)

No. 8 PUSH PULL KIT
1—AC—227
2—AC—171 List Price
4—AC—226 $26.25
1—280 (Rectifier)

For ten years Thorola has stood for the best in the field of *fine* radio. This name on radio tubes is absolute assurance of rigid quality standards, long life and dependable performance. Every Thorola Tube is scientifically engineered, laboratory tested and backed by a gilt-edged, full year's unconditional guarantee which is made good directly at the factory if any tube proves defective.

DEALERS! Order your requirements from list opposite—50% off list prices. ***Get your order in immediately!*** Upon receipt of your $100 (net) order for Thorola tubes, we will ship at once with your order a FREE demonstrator Solid Walnut Thorola Dynamic Speaker. Don't pass up this opportunity—***the season's most sensational dealer offer!*** We can afford to make it only because we must have immediate representation everywhere. ***Wire your order today.*** Or fill in the coupon below and mail at once. Act *immediately,* before the supply of Thorola Dynamic Speakers set aside for this special purpose is exhausted.

Jobbers, Dealers and Manufacturers' Representatives are invited to write or wire us immediately for full particulars regarding a very desirable proposition.

YOURS! This THOROLA DYNAMIC

This magnificent-toned Thorola Dynamic Speaker actually "breathes." Catches and reproduces with life-like realism every note from the highest violin treble to the lowest boom of the kettle drum. Ten inch cone, 25% larger than usual, gives greater volume and efficiency. Mounted in beautifully designed solid walnut cabinet, 15 inches wide, 13¾ inches high, 8½ inches deep. Furnished for both 110 volt AC (with built-in rectifier) or 6 volt DC. Specify type you want sent with order.

THOROLA RADIO PRODUCTS
General Offices: 110 East 21st St., Chicago

Thorola
Guaranteed TUBES

"World's Finest Tube Line"

THOROLA RADIO PRODUCTS
110 East 21st Street
Chicago, Illinois

Please ship at once my order for Thorola *Guaranteed* Tubes totaling $..... (less 50% discount). Find my itemized order attached. If my order amounts to $100 or more *NET,* I understand that I will receive absolutely FREE one Thorola Dynamic Speaker.

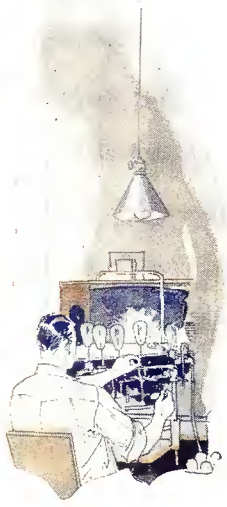
Name.....

Firm.....

Address.....

Bombarded with Energy

. . . . for longer life and super-performance! Sonatron radio tubes come to you brimming with energy . . . Life! Zest! Sparkling tone for your set! Many added hours of dependable service because of the Sonatron bombarding process. A vivid, colorful flash of light . . . and another Sonatron radio tube has been given that abundant energy which Sonatron standards demand.



Of the many interesting processes to which Sonatron tubes are subjected, none is more interesting or more important than "bombarding."

In this process, the elements of each Sonatron tube are literally "bombarded" with energy for the operation of the tube throughout its life. In Sonatron tubes, this process is, in part, the secret of the *longer life* and *super-performance* with which the Sonatron label has become associated.

The thoroughness of the "bombardment," the length of time in which this operation is performed—these have a vital bearing on the qualities of the tube. As in every operation in the Sonatron factory, there is no skimping here, no compromise with time or cost. Every Sonatron tube is a rich storehouse of energy and vitality for your receiver. Set owners who have equipped with Sonatrons are enthusiastic over their tone and performance throughout a longer life.

Go to your Sonatron dealer for your next set of tubes. ℂWrite us for a free copy of the 1929 edition of "How to take care of your Radio Tubes."

SONATRON

THE WORLD'S LARGEST RADIO TUBE LINE

SONATRON TUBE COMPANY

16 Hudson Street, *New York City* 108 West Lake Street, *Chicago, Ill.*
88 Eighth Avenue, *Newark, N. J.* *Cable Address:* SONATRON-NEWARK