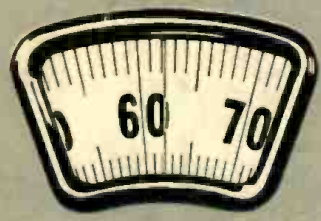
Popular Radio

25¢

★ OCTOBER 1926



¶ —*In this Issue*—

HOW TO BUILD THE *NEW* LC-27 BROADCAST RECEIVER

up to 135 volts ....from your lighting socket

Now you can get a full 135 volts for the "B" circuit of your radio set from any 110 volt, 50 to 60 cycle A. C. lighting source! The RCA Duo-Rectron has taps for 22½ volts, 45, 90 and 135 *volts*. Whether you have a one tube set or a ten tube set, you get the current it needs—no more—no less.

It stands a heavy current drain and gives correct, full voltages all the way up to 50 milliamperes. It is the one unfailing, unfluctuating source of energy for the new high power amplifier Radiotrons UX-120 and UX-112, which take 135 volts on the plate. And it makes the operation of high power sets inexpensive.

Add to this, current filtered and smoothed out so that it is free from all hum. Voltage automatically maintained at a constant value by a special regulating glow-lamp. A long life rectifier tube. And you know that the Duo-Rectron marks the end of all "B" battery troubles.

RCA Duo-Rectron, complete, $65

RCA Uni-Rectron is a power amplifier for loudspeakers. Connect it with the first audio stage of any set and get super-power amplification from an A. C. socket. Price complete, . . $105

RCA

Authorized Dealer RCA

Buy with confidence where you see this sign.

RCA "B" BATTERY ELIMINATOR

[DUO-RECTRON]

RADIO · CORPORATION · OF · AMERICA · NEW YORK · CHICAGO · SAN FRANCISCO

"They last twice as long as the smaller Batteries of equal voltage"

"THAT'S a pretty broad statement, Tom. Won't you have to make it conditional on the number of tubes in the set or the use of the new power tubes?"

"No, sir! Under the same operating conditions—whether you use four, five tubes or more, whether you use a power tube that uses up to 135 volts, the Eveready Heavy-Duty No. 770 or the even longer-lived Eveready Layerbilt No. 486 will last twice as long as the smaller sized 45-volt batteries."

"Well, they ought to, they cost more."

"Yes, about a third more—but lasting twice as long, they cost much less."

"Your arithmetic is good, Tom, but if that's so, when I bought my set why did the dealer equip it with the smaller Eveready 772's? Why didn't he put in the Eveready Heavy-Duty Batteries?"

"He probably thought he was doing you a favor—making your first investment cost you a little less. That little difference looks like a lot to a good many folks who are buying their first set, equipped with tubes, loud speaker, 'A' and 'B' batteries and everything."

Heavy-Duty batteries last twice as long as the smaller batteries of equal voltage. Eveready Heavy-Duty Batteries are the great contribution that the world's foremost electro-chemical laboratories has made in "B" battery economy, dependability and satisfaction.

Dry "B" batteries give a noiseless current, pure D. C. (direct current), the kind that is essential if you prize pure tone.

Send for booklet, "Choosing and Using the Right Radio Batteries," which we will be glad to send you upon request. This booklet also tells about the proper battery equipment for use with the new power tubes. There's an Eveready dealer nearby.

Manufactured and guaranteed by

NATIONAL CARBON CO., INC.
New York San Francisco

Canadian National Carbon Co., Limited
Toronto, Ontario

NOTE: A "C" battery gives a quality of reception unobtainable without it and greatly increases the life of your "B" batteries.

LEFT - *Eveready Layerbilt No. 486.*

RIGHT - *Eveready Dry Cell Radio "A" Battery, 1½ volts.*

EVEREADY
Radio Batteries
-they last longer

Tuesday night means Eveready Hour—9 P. M., Eastern Standard Time, through stations:

WEAF–*New York*	WSAI–*Cincinnati*
WJAR–*Providence*	WTAM–*Cleveland*
WEEI–*Boston*	WWJ–*Detroit*
WTAG–*Worcester*	WGN–*Chicago*
WFI–*Philadelphia*	WOC–*Davenport*
WGR–*Buffalo*	WCCO–*Minneapolis, St. Paul*
WCAE–*Pittsburgh*	
KSD–*St. Louis*	WRC–*Washington*

Popular Radio

EDITED *by* KENDALL BANNING

FOUNDED 1911

VOLUME X | October, 1926 | NUMBER 6

CONTENTS

(Cover design by Frank B. Masters)

DEPARTMENTS

VOLUME X | OCTOBER, 1926 | NUMBER 6

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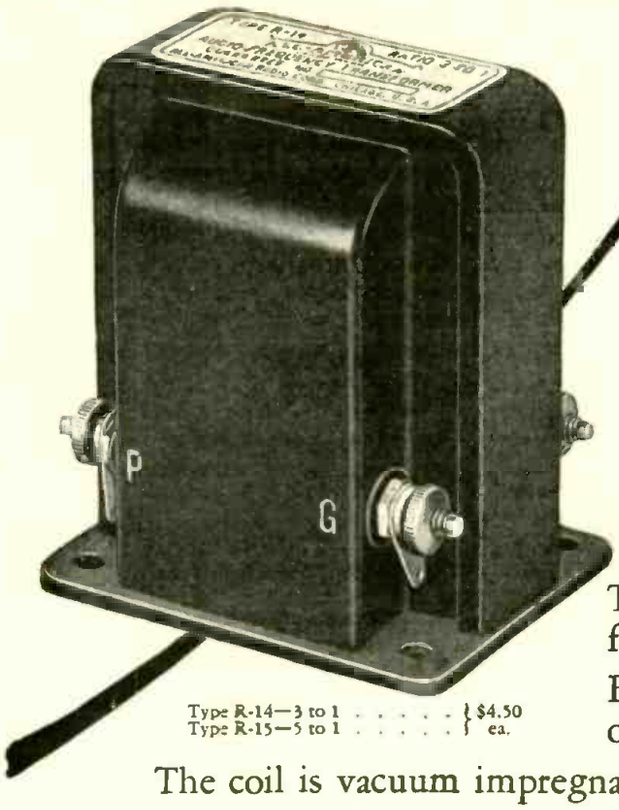
E. E. FREE, Ph.D., *Contributing Editor* LAURENCE M. COCKADAY, *Technical Editor* JOHN V. L. HOGAN, *Contributing Editor*



Type R-14—3 to 1 . . . . . } $4.50
Type R-15—5 to 1 . . . . . } ea.

New!

ALL-AMERICAN
TRADE MARK
AUDIO TRANSFORMER

This latest development meets the new demands for compact wiring and longer life—

Binding Posts are conveniently located for straight or sub-panel wiring—

The coil is vacuum impregnated—

After assembly the shell is filled with special compound and the complete unit hermetically sealed. *A transformer that sets a new standard.*

Tone Quality Is the Keynote

No standards of quality can be higher than those we set for our own products; no inspection is more rigid; no tests more severe.

Each of these All-American Transformers plays its part in determining the quality of radio reception. Each is designed and made with the same care that goes into the finest receiving sets.

These products have helped to create All-American leadership.

UNIVERSAL COUPLER highly efficient both as antenna coupler and tuned R. F. Transformer

New 1927 Radio Key Book

Everybody who enjoys radio should read it—an interesting 48-page analysis of radio in terms anybody can understand; with complete constructional details of the leading types of circuits. Send 10c in coin or stamps for your copy.

All-American Radio Corporation

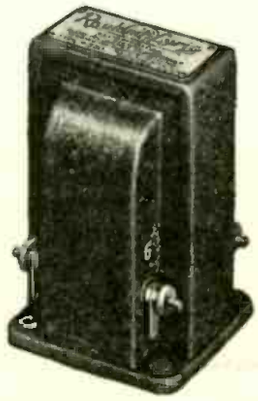
4207 Belmont Avenue CHICAGO

SELF TUNED R. F. TRANSFORMER effectively amplifies all frequencies. Designed to match tube characteristics

RAULAND-TRIO

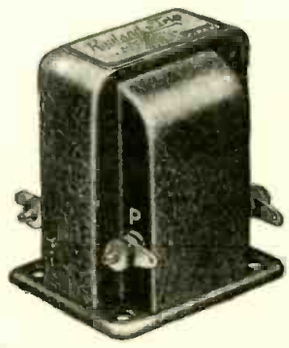
An inductance, a resistance and a capacity perfectly balanced in one shell—a compact factory-built unit for impedance coupled amplification

POWER (PUSH-PULL) AMPLIFYING TRANSFORMER, gives power amplification without distortion where excessive volume is demanded



RAULAND-LYRIC

An audio Transformer, famous for its perfect tone reproduction—an outstanding product. Made with painstaking thoroughness without regard to cost



A Page With The Editor

In the next issue of Popular Radio—for November—will appear the first of the follow-up articles on the LC-27 Receiver; it will tell how to build the new LC-Senior Power-pack, and it will give not only the complete constructional details but also full instructions for the installation and operation of the LC-27 without batteries. The November number will be on the newsstands October 20th.

* *

During one of the hottest of July nights the Editor sat in on one of the many tests of the new LC-27 receiver (described on page 511 of this issue). Merely as a matter of record, the following list of stations were logged between 10 and 11 P. M., when the set was used without an aerial:

WEAF	WJZ	WJAZ	WORD
WOO	WIP	WHAM	WRCA
WOR	WGY	WGHP	WOK
WHN	WGBS	WBCN	KYW
WMCA	WAAM	WFBL	WMAF
WMSG	WFI	WSBC	WSAI
WCBA	WRNY	WIBM	WEEI
WLW	WNJ	WSWS	WJAX
WSB	WNYC	WEBH	WODA
WLS	WCAU	WHT	WBZ
WFBH	WPG	WGN	CKAC
WLIT	KDKA	WQJ	WTAM

* *

"I have been a reader of your magazine for the past four years; and, although I have had the urge a good many times, I have never patted you on the back for the type of magazine you are turning out. I read it from cover to cover every month and then file it away for future reference. As a man who has been interested in radio since nineteen hundred and eleven, I wish to say that you put out the best radio publication going!"

—Tom Murray, *Norwich, N. Y.*

* *

Mr. J. O. Perrine, the author of the article, "What the Change in 'Frequencies' means to the Broadcast Listener," which appears on page 534 of this issue, served during the war as a Captain in the Signal Corps, and during 1918-19 he was in charge of the technical instruction in the Signal Officer's Training School. Upon leaving the army he became assistant professor of radio engineering at Yale and he is now engaged in experimental and research work in the laboratories of the American Telephone and Telegraph Company in New York.

* *

"Congratulations on your magazine. I classed it as the best a year ago but it gets better every issue."

—Fred C. Merrill, *Cobourg, Ontario, Canada.*

* *

The steady progress made by Popular Radio during the four summer months of May, June, July and August is eloquently expressed not alone in circulation figures but in advertising figures as well.

During this period a year ago, for example, Popular Radio stood second in advertising carried by the radio magazines. The exact figures for 1925, as recorded by *Printer's Ink*, are as follows:

Nearest Competitor. . . . .93,147 lines
Popular Radio. . . . . .51,632 lines
Difference in favor of *Nearest Competitor*, 41,515 lines.

* *

During this same period of *this* year—1926—however, the record printed in *Printer's Ink* is as follows:

Popular Radio. . . . . .54,912 lines
Nearest Competitor. . . . .49,703 lines
Difference in favor of Popular Radio, 5,209 lines.

* *

If it is true that advertisers patronize the best magazine in each field, here is gratifying as well as convincing evidence that Popular Radio leads the field—with a net gain of 46,724 lines of advertising over *Nearest Competitor* during the four-months period just passed.

* *

The author of the article, "Sets that Earn Incomes," (on page 525 of this number), Mr. H. R. Kibler, is the Secretary of the National Farm Radio Council, which has recently completed a survey of the use of radio on farms. The author has based his contribution not upon theories or opinions, but upon actual figures that were compiled as the results of months of effort.

* *

Mr. Kibler's article furnishes further evidence of the establishment of the radio receiver not merely as a luxury but as an instrument of practical, everyday value that is bringing about progressive changes among important groups in our civilization.

* *

Readers who want to construct the Improved Browning-Drake receiver (described in the August issue of Popular Radio) from actual-size blue print diagrams may now obtain them for $1.00 a set from the Popular Radio Service Bureau.

* *

Each set consists of two blue prints—one containing the circuit diagram and the other the baseboard, panel and wiring diagram.

* *

Among the scientists who have made studies of the phenomena of fading—a phenomenon with which every set owner is familiar—is Prof. Charles C. Bidwell, of Cornell University. The results of his investigations are epitomized in his article on page 531 of this issue, which brings new support to the theory that fading is largely if not wholly due to the irregularities of the Heaviside layer.

August 9, 1926, marked another milestone in the history of radio. On that date the British Postmaster General (who has charge of radio matters in England) granted the first transmitting and receiving licenses to a company that actually operates a television apparatus invented by a Scotchman, John L. Baird.

* *

This official recognition of another system of "seeing by radio" enters still another aspirant in the international contest for honors in the field of television.

* *

The United States is represented by C. Francis Jenkins of Washington, D. C., whose television apparatus was first announced in Popular Radio for August, 1925.

* *

France is represented by M. Edouard Belin, who also contributed an article to Popular Radio on his invention for sending pictures by radio (August, 1924) from which has developed his television apparatus on which he is at present engaged.

* *

The Austrian representative is Denoys von Milhaly.

* *

The Baird invention, which operates on a different scientific principle from either of the other devices, will be described in Popular Radio for next month; it will be illustrated by special photographs and diagrams.

* *

Mr. Baird believes that television machines may soon be installed in the home at a cost of about $150 each and that television theatres will spring up, to be served by "central broadcasting stations" that will dispense both visual and aural entertainment.

* *

While Prof. L. A. Hazeltine, the creator of the Hazeltine circuit, was conducting his experiments, he took the precaution of keeping notes in his "laboratory note book."

* *

Upon one of these notes, as events proved, patent rights valued at $1,500,000 hung.

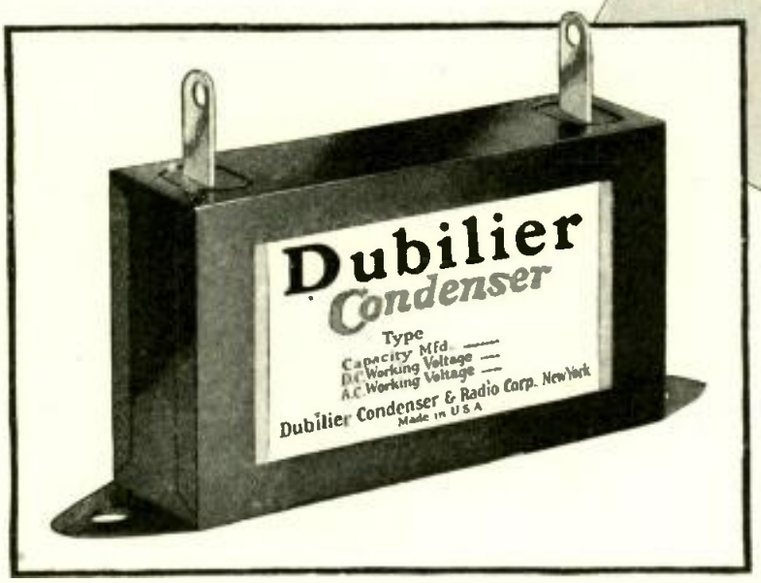
* *

The value to every radio experimenter of keeping laboratory notes is one of the points made in the article "How To Patent Your Radio Invention," which will appear in the next issue.

Kendall Banning

Editor, Popular Radio

The Passing of "By-Pass" condensers



Dubilier Condenser Type 907
Capacities 0.1 to 2.0 mfds.
Price $.60 to $1.75

"BY-PASS" was the name originally given to small paper condensers by Dubilier. This name described their functions—such as shunting radio frequency currents around high resistances, and their use in amplifier circuits.

But now the clumsy old "By-Pass" condenser is out of date. The high voltage used in radio today along with sub-panel construction, demand a condenser of higher electrical efficiency and more compact size.

"—used in the LC-27"

In the new Type 907, Dubilier has made a compact all-purpose condenser with a *working voltage** of 160 volts D.C. With improved soldering lug terminals and mounting feet, Type 907 will give more efficient service in smaller space for every purpose for which the old "By-Pass" type of condenser has been used.

For long life at high voltages insist on Dubilier Paper Condensers.

Dubilier
CONDENSER AND RADIO CORPORATION

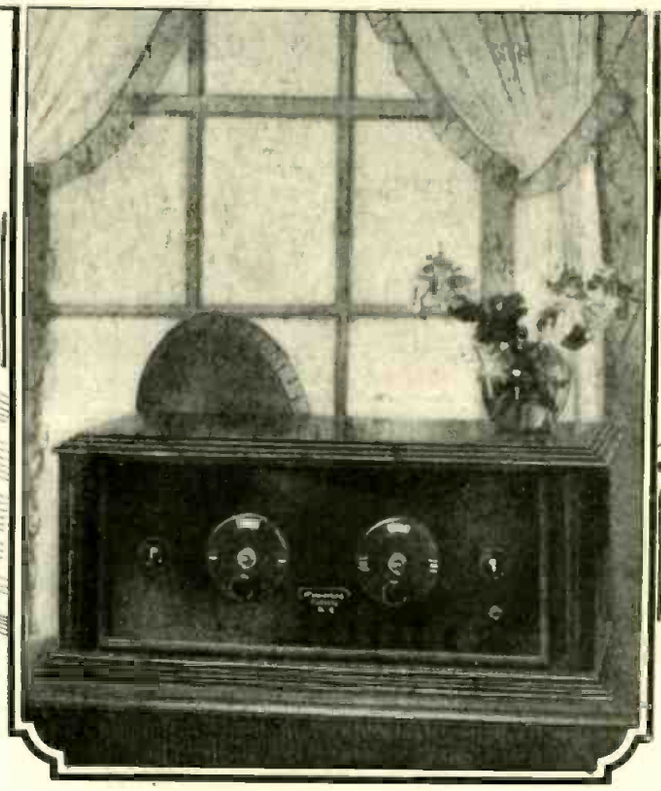
**Working voltage means more than "test voltage," It is the voltage at which a condenser may be safely used in continuous operation.*

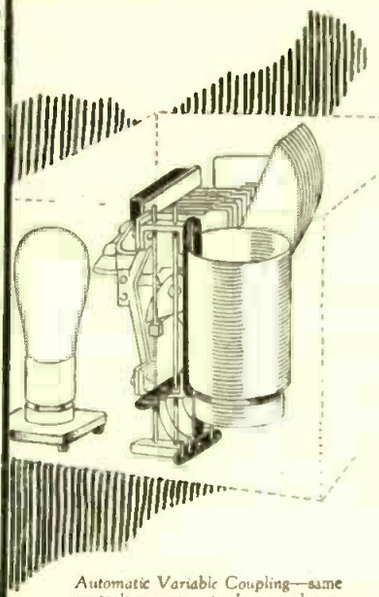
THE NEW SHIELDED HAMMARLUND-ROBERTS Hi-Q*

"HOW TO BUILD IT" BOOK

Complete instructions for assembling, wiring, and operating the Hammarlund-Roberts Hi-Q Receiver. Prepared under the direction of the Engineer-designers.

25c





Automatic Variable Coupling—same control operates tuning condenser and primary coil coupling simultaneously, gives maximum and equal amplification and selectivity over entire tuning range.

Stage Shielding—prevents coupling between stages, preventing oscillations and increasing selectivity. Clarifies reception.

Different And Finer Results From Different, Finer Engineering

THE new Hammarlund-Roberts Hi-Q is an entirely modern radio receiver, incorporating the latest approved features. The most important of these include dual tuning, stage shielding, automatic coupling variation, high detection efficiency, a high power output and that it is non-oscillating.

Tried and proven fundamentals have been adhered to; but they are applied in new and different ways that produce greater selectivity, clearer tone, simpler tuning.

This new Hammarlund-Roberts is the united achievement of ten of the leading radio engineers in the country; all concentrating on producing the most advanced and efficient receiver—regardless of cost.

YOU CAN BUILD THE HAMMARLUND-ROBERTS YOURSELF

Anyone can build the Hammarlund-Roberts Hi-Q. All the research, the selection of parts, the exact placing of units, has been worked out in advance for you. And you have a receiver that will equal an eight tube set—simplicity of design and operation hitherto unthought of—all at less than half the price you would pay for a factory made set of anywhere near equal efficiency.

HAMMARLUND-ROBERTS, 1182-B Broadway, New York

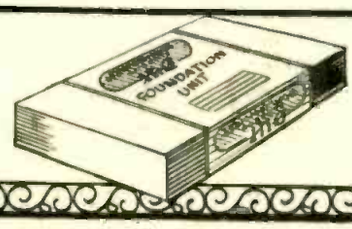
Parts complete (less cabinet) $62.85

Hammarlund ROBERTS Hi-Q*

*High ratio of reactance to resistance.
High ratio—Great selectivity—Loud signals.

HI-Q FOUNDATION UNIT

Includes drilled and engraved Bakelite panel, drilled Bakelite sub panel, two complete shields, hardware, wire, nuts and screws. **$10.50**



ASSOCIATE MANUFACTURERS

Carter Radio Co.
Martin-Copeland Co.
Radiall Company
Samson Electric Co.
Sangamo Electric Co.
Benjamin Electric Mfg. Co.
Eby Manufacturing Co.
Hammarlund Mfg. Company
International Resistance Co.
Westinghouse Micarta

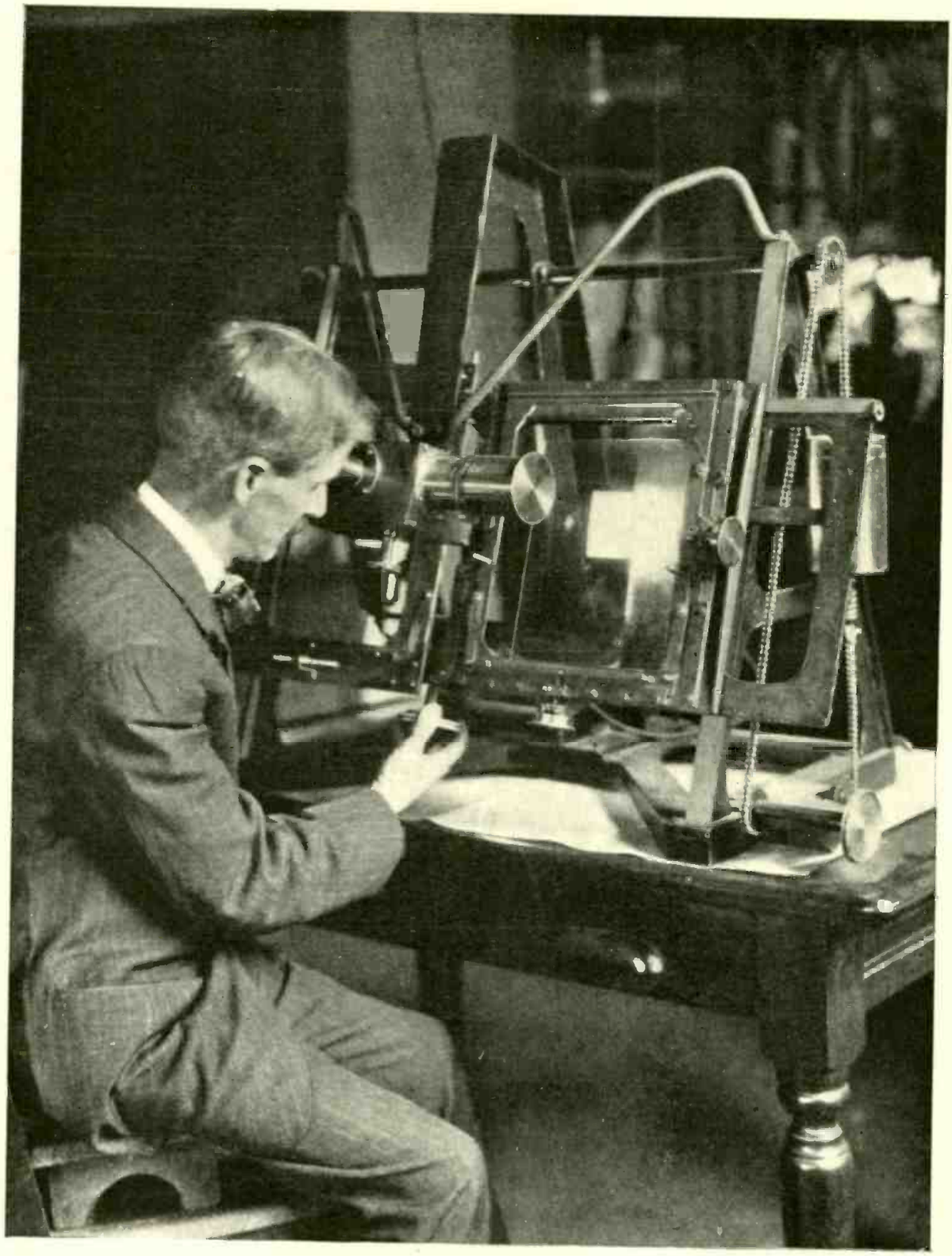
From a photograph made for POPULAR RADIO

An Important Factor in the Advance in Experimental Radio

"To POPULAR RADIO *must be given a great amount of the credit for the technical advance of experimental radio in the past five years. Its clear, concise and authoritative expositions of the new circuits and new devices in radio mean much to everyone—to the manufacturer and dealer as well as to the home experimenter. And the editorial columns of* POPULAR RADIO *give invaluable aid in the determination of the trend which radio will take in the future."*

Charles J. Morison

PRESIDENT, MORISON ELECTRICAL SUPPLY CO., INC., NEW YORK



How the Oldest Ether Waves Are Detected

Professor Shapley's remarkable achievement in discovering ether waves 10,000,000 years old, reaching us from the depths of space, is described on page 892 of this issue. In this illustration, Professor Leon Campbell, of Harvard, is shown using the blink microscope—an instrument employed to study the variable stars, from the light rays of which astronomers are able to sound these vast depths of space and to measure these enormous lengths of time.

Popular Radio

VOLUME X October, 1926 NUMBER 6

HOW TO BUILD THE NEW

LC-27 RECEIVER

POPULAR RADIO believes that this new circuit, which is the outstanding contribution of the POPULAR RADIO LABORATORY to the experimental set-builder for this year, constitutes not only one of the most important advances that has so far been made in the radio art, but that it is distinguished by a tonal quality—particularly in the lower registers—that is unsurpassed.

—EDITOR

By LAURENCE M. COCKADAY

COST OF PARTS: *Not more than $86.50*

HERE IS A LIST OF PARTS USED IN THE LABORATORY MODEL—

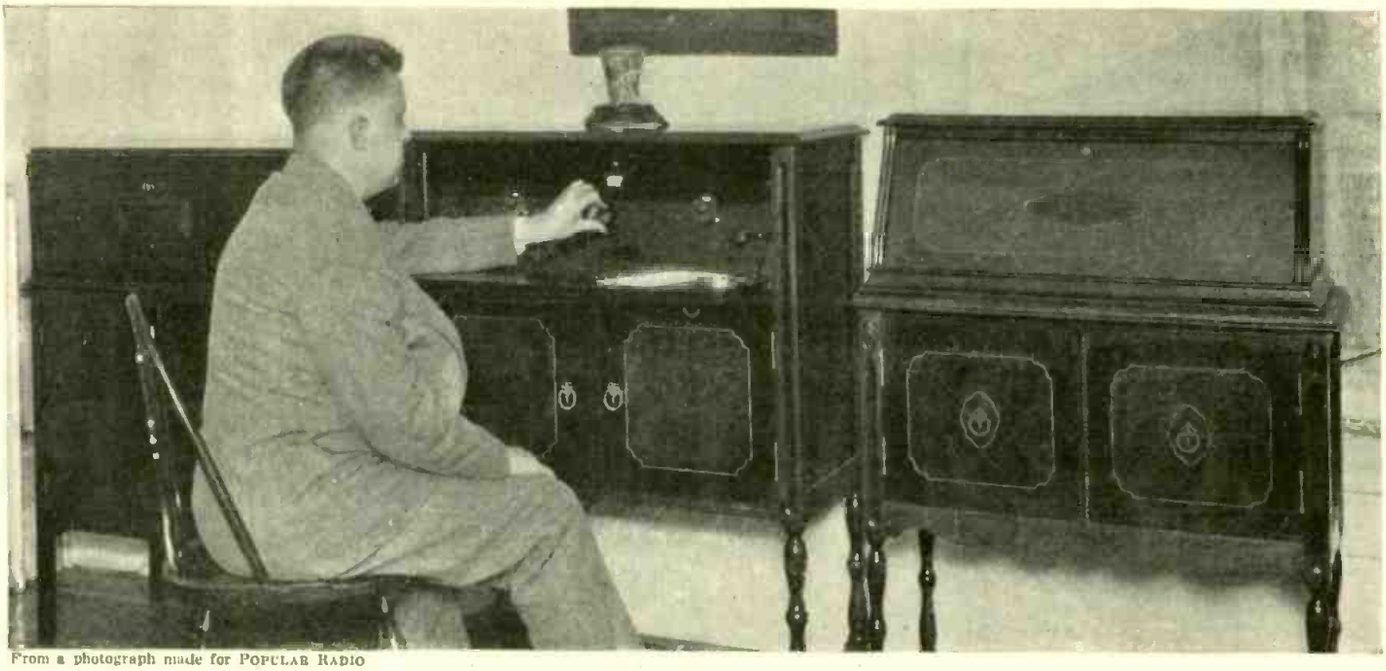
A—Hammarlund Mid-line single unit condenser, .000275 mfd.;
B and C—Hammarlund Mid-line dual condenser, .000275 mfd.;
D1, D2 and D3—Precision-Duo-Octaform coil set, comprising antenna coupler and two interstage couplers respectively;
E—binding-post strip (See Figure 9);
F1, F2, F3, F4, F5, F6, F7, F8, F9, F10, F11 and F12—any approved binding post (Eby binding posts illustrated);
G1 and G2—AmerTran DeLuxe first and second stage audio-frequency transformers;
H1 and H2—Tait metal brackets;
I—AmerChoke, No. 854;
J—Dubilier No. 902 filter condenser, 4 mfds.; or Tobe No. 604 filter condenser, 4 mfds.;
K—Dubilier No. 907 bypass condenser, .1 mfd.;
L—Marco illuminated tuning control, scale zero-100;
M1 and M2—Marco small controls, made especially for the LC-27, scale zero-50-zero;
N—wooden baseboard (furnished with the cabinet);
O—Samson radio-frequency choke coil, No. 85;
P—decorated bakelite panel for LC-27 as per specifications;
Q—Carter "Imp" battery switch;
R1, R2 and R3—any approved mica fixed condensers, .00025 mfd. (Aerovox condensers illustrated);
S—any approved variable resistance, zero-10,000 ohms (Carter resistance illustrated);
T—cabinet or console equipped with baseboard, manufactured by Corbett, Blandin, Electrotype Blocking Co., Southern Toy Co. etc. to fit the standard LC-27 foundation unit;
U—any approved grid-leak mounting (Lynch grid-leak mounting illustrated);
V—any approved resistor, 4 megohms (Durham resistor illustrated);
W1, W2, W3 and W4—aluminum shields (Aluminum Co. of America shields illustrated);
X—any approved single-circuit open jack, small size (Carter jack illustrated);
Y1, Y2, Y3, Y4 and Y5—any approved vibrationless socket (Benjamin UX sockets illustrated);
Z—any approved automatic filament control for 1 ampere load (Amperite control illustrated);
1—Belden power cable connector assembly.

THE ideal radio receiver for the experimental set-builder must be designed with certain definite points in view that cover both the construction and the actual operation of the set. Such a receiver, if it is to fit the average man's requirements, must have the following characteristics:*

1. A quality of reproduction that is as nearly perfect as possible;
2. A cabinet designed to blend harmoniously with the finest surroundings;
3. Consistently good performance with a minimum of care and attention, once the set is installed;
4. A tuning control so simple that any one of the family may operate the set without special instruction;
5. A selectivity adequate to eliminate interference from stations on adjoining wavelengths;
6. An ability to operate on any type of outdoor antenna or with no antenna at all if desired;
7. A capacity to operate on house current or batteries, as desired;
8. Adequate shielding of parts;

*These fourteen points of ideal receiver design are listed above in the order of their importance to the average set builder.

¶ *The list of parts given above includes the exact instruments used in the set from which these specifications were made up. The experienced amateur, however, will be able to pick out other reliable makes of instruments which have been approved by* POPULAR RADIO *and which may be used with good results. But we recommend that the novice follow the list, as the diagrams in this article will tell him exactly where to bore the holes and exactly where to place the connections. If instruments other than the ones listed are used, the only change that will be necessary will be the use of different spacings for the holes that are drilled in the sub-base for mounting the instruments. To any reader who has difficulty in obtaining any of the parts which are necessary in making up these model receivers and power units,* POPULAR RADIO SERVICE BUREAU, *627 West 43rd Street, New York City, will gladly assist in seeing that his requirements are promptly supplied.*



From a photograph made for POPULAR RADIO

TESTING OUT THREE OF THE NEW MODELS

These sets, which are three of the finished models of the LC-27 Receiver have been in process of development in the POPULAR RADIO LABORATORY *for almost a year. The designer, who is shown testing these models in actual use, has had them working under all kinds of conditions in various localities to determine just what they would do and what results experimenters could expect to get with them.*

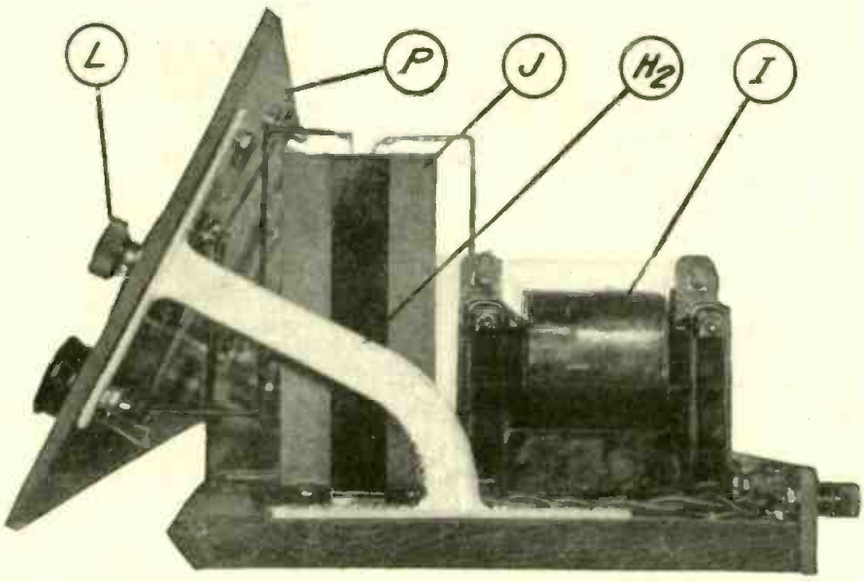
9. A power amplifier and output filter to supply ample volume without distortion;
10. A construction that provides for the use of nationally known tubes and parts that are easily obtainable in any locality;
11. A non-regenerative circuit to prevent radiation;
12. A simple construction with a minimum of adjustments, controls and balances;
13. A sensitivity adequate to provide good reception of distant programs;
14. A fool-proof construction.

In the choice and development of one particular design of circuit for the LC-27 receiver, all of these points were considered with the result that the final design, which has been in the process of evolution since January, 1926, makes a provision for every one of these features.

This means that the newest POPULAR RADIO receiver may really be called an ideal radio broadcast set for the experimental home set-builder.

The method of radio-frequency amplification that is used, gives extremely high voltage-amplification per stage over the entire broadcast frequency band. It employs three tuned circuits with a high ratio of inductance to capacity that produces great amplification. (See points No. 6 and 13).

The tuning controls have been simplified so that the input to the second radio-frequency stage and the detector stage are tuned with a dual condenser with a single control with a broadly-tuned stage for the input to the first radio-frequency tube. The condensers have a modified curve that might be classed as straight-line-tuning. This accounts for the easy tuning of the receiver. (See points No. 4 and 5).



THE RECEIVER AS SEEN FROM THE RIGHT

FIGURE 1: *This end view of the receiver gives a general idea of how the brackets and the panel are mounted on the baseboard; it also shows the arrangement of the choke coil and condenser that form the output filter.*

The use of the high-inductance, double-unit coils and the adequate shielding between stages keeps the circuits isolated so that there is little or no reaction and no possibility of oscillation or radiation. (See points No. 8 and 11).

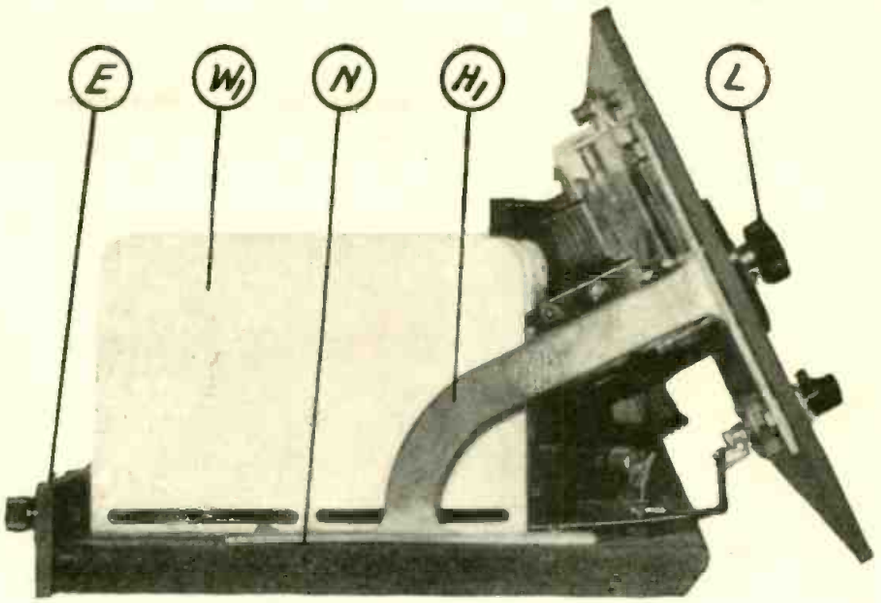
All of the units, when they are once put into the set and wired, are carefully balanced within one percent; therefore no other adjustment on the part of the builder is required. (See point No. 12).

Great care has been taken in the design of the audio-frequency amplifier of the new receiver, to obtain an amplifier that would give practically straight - line - frequency amplification over all of the important frequencies that are encountered in broadcast reproduction. Also, the use of a power tube in the last stage tends to give an adequate supply of energy so that distortion is reduced to the smallest amount. (See points No. 1 and 9).

The set may be used with ordinary "A" and "B" batteries, or it may be used in connection with the Junior or Senior Power-packs that will be described in following issues of the magazine. (See points No. 3 and 7).

All of the parts used are of standard design and manufacture so that the prospective builder will have no trouble in procuring them from nearby distributing sources. (See point No. 10).

A wide line of various types of cabinets have been provided from the "High Boy" console type, down to a simple cabinet, a range wide enough to accommodate the individual taste of any owner in housing the set. (See point No. 2).



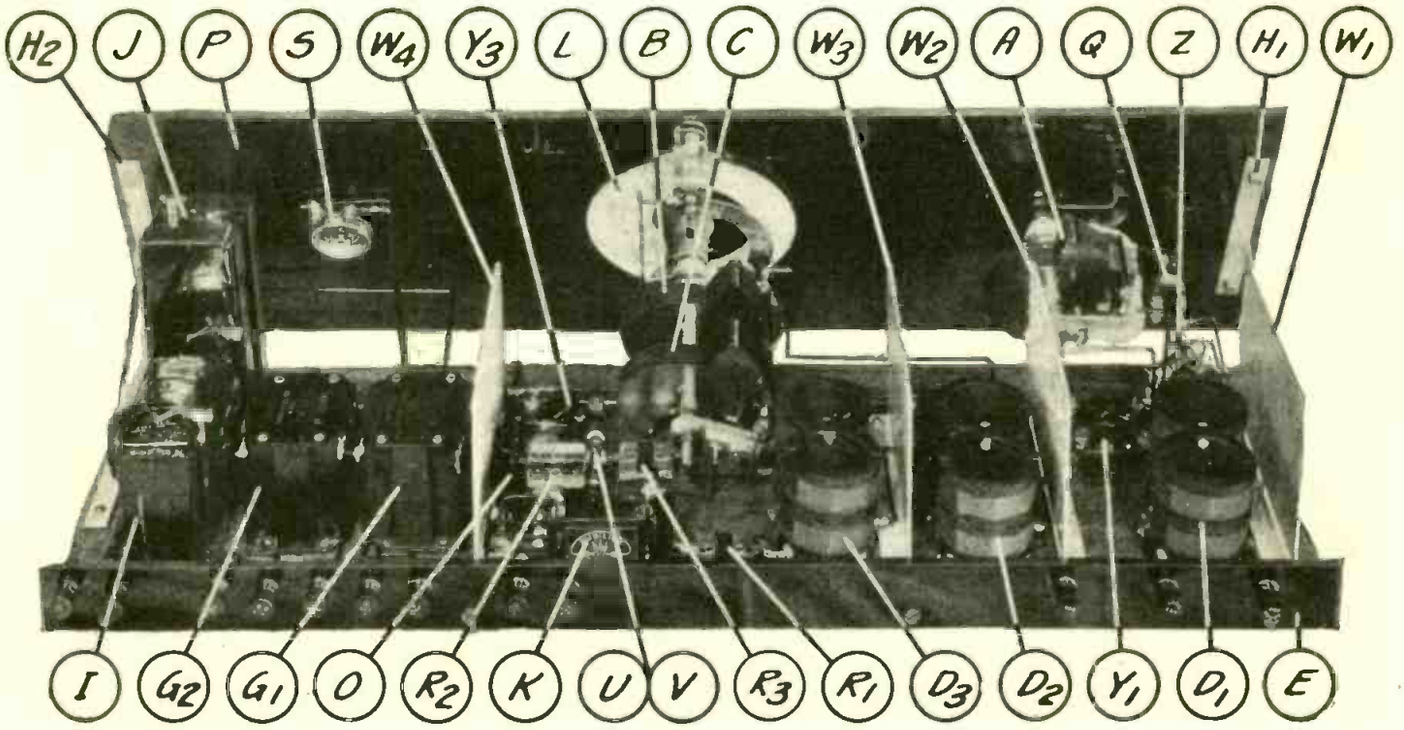
A VIEW OF THE SET FROM THE LEFT END

FIGURE 2: *This illustration shows the mounting of the battery switch, the connection block and the aluminum shields.*

The physical design of the receiver itself is such that it may be easily constructed and wired and so that when it is completed it may be placed in a home of the finest appointments. In fact, it may be made a beautiful addition to the house furniture.

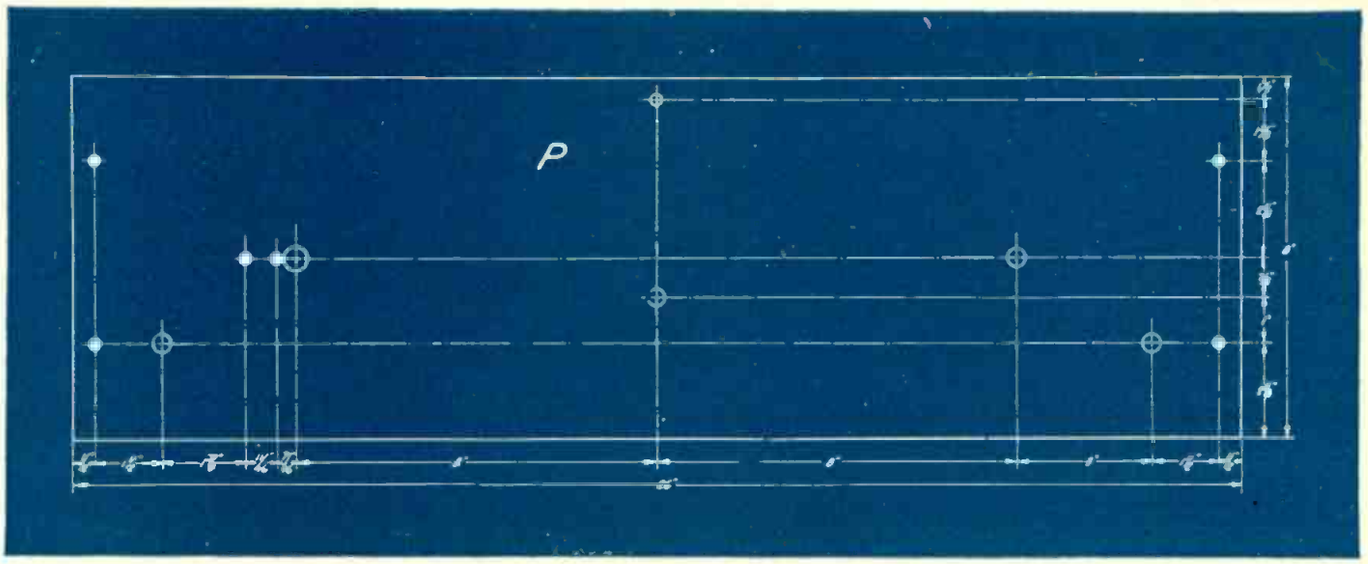
The main tuning of the receiver is accomplished by means of a small knob in the center of the panel that operates an illuminated disc in back of the main panel which is visible through a window under a hair-line adjustment. The divisions on the scale are marked in one-half degrees for extremely sharp work. There is only one adjustment outside of the tuning controls and this is an adjustment for volume. The volume control is not a regenerative control.

The set, if it is built to conform exactly with the instructions given in this article, will not oscillate and is not regenerative.



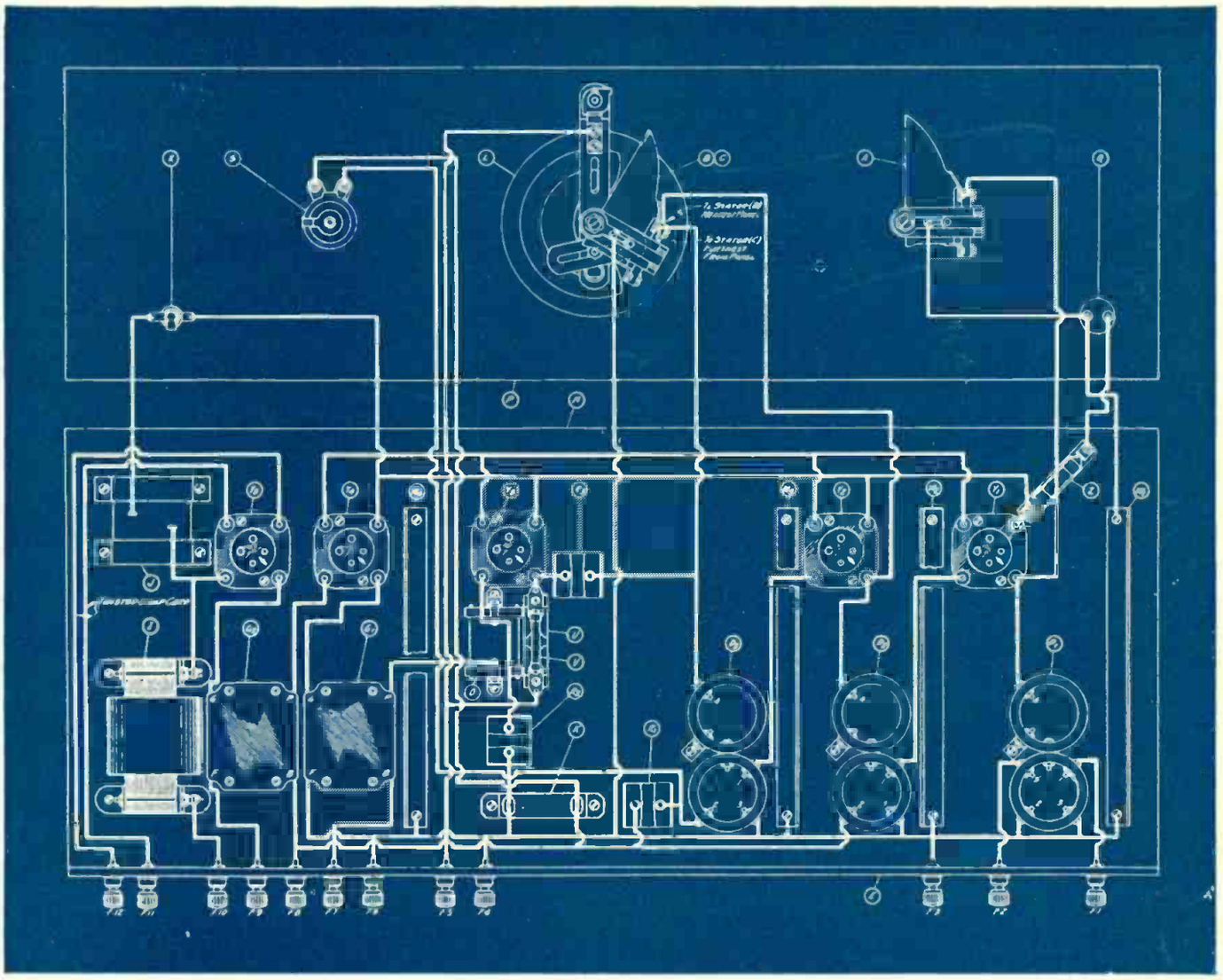
HOW THE RECEIVER APPEARS WHEN VIEWED FROM THE REAR

FIGURE 3: *This view shows the general arrangement of practically all of the instruments that are mounted on either the panel or the baseboard. The connection strip "E," is fastened directly to the baseboard by means of four wood screws as shown.*



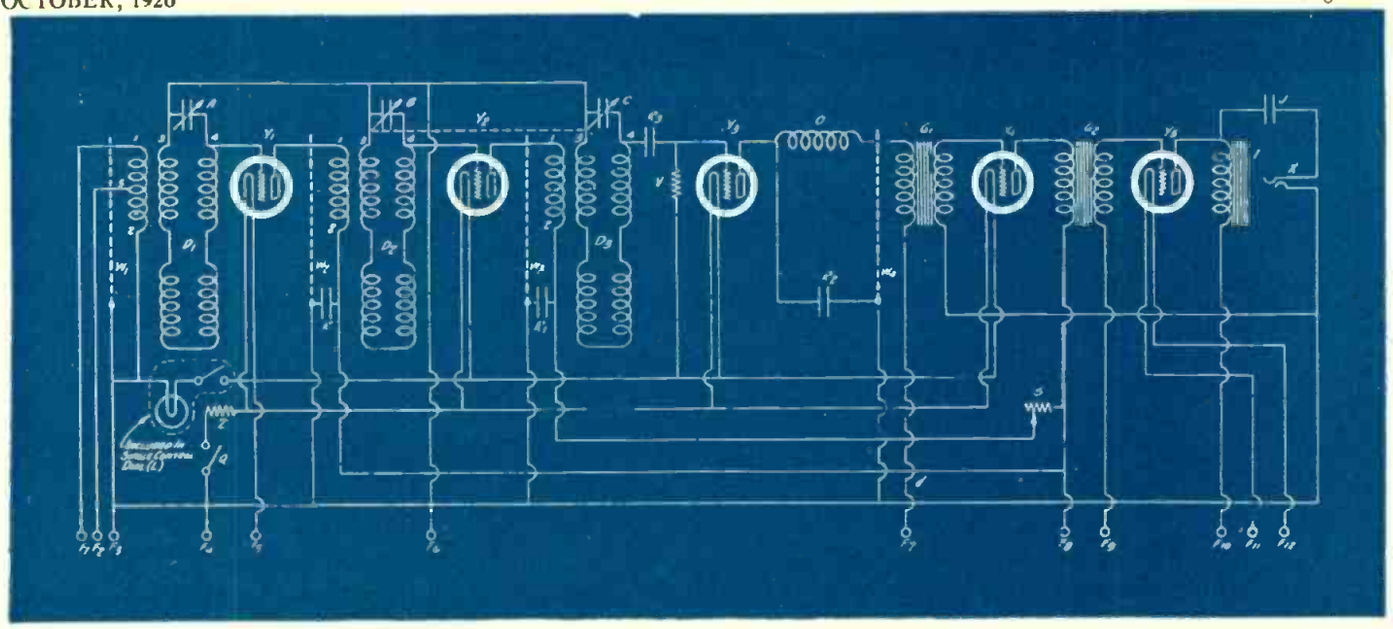
HOW TO DRILL THE PANEL

FIGURE 4: *The exact positions for the holes that must be drilled in order to mount the instruments on the panel and also to mount the panel on the aluminum brackets. The holes outlined with double circles should be countersunk. Two special templates are furnished with the tuning control and small dials that show how to drill the extra holes.*



THE PICTURE WIRING DIAGRAM

FIGURE 5: *The lower rectangle represents the wooden base and the upper rectangle represents the panel; both show the instruments in approximately their correct position. The heavy white lines show the way to connect up the instruments after they are mounted.*

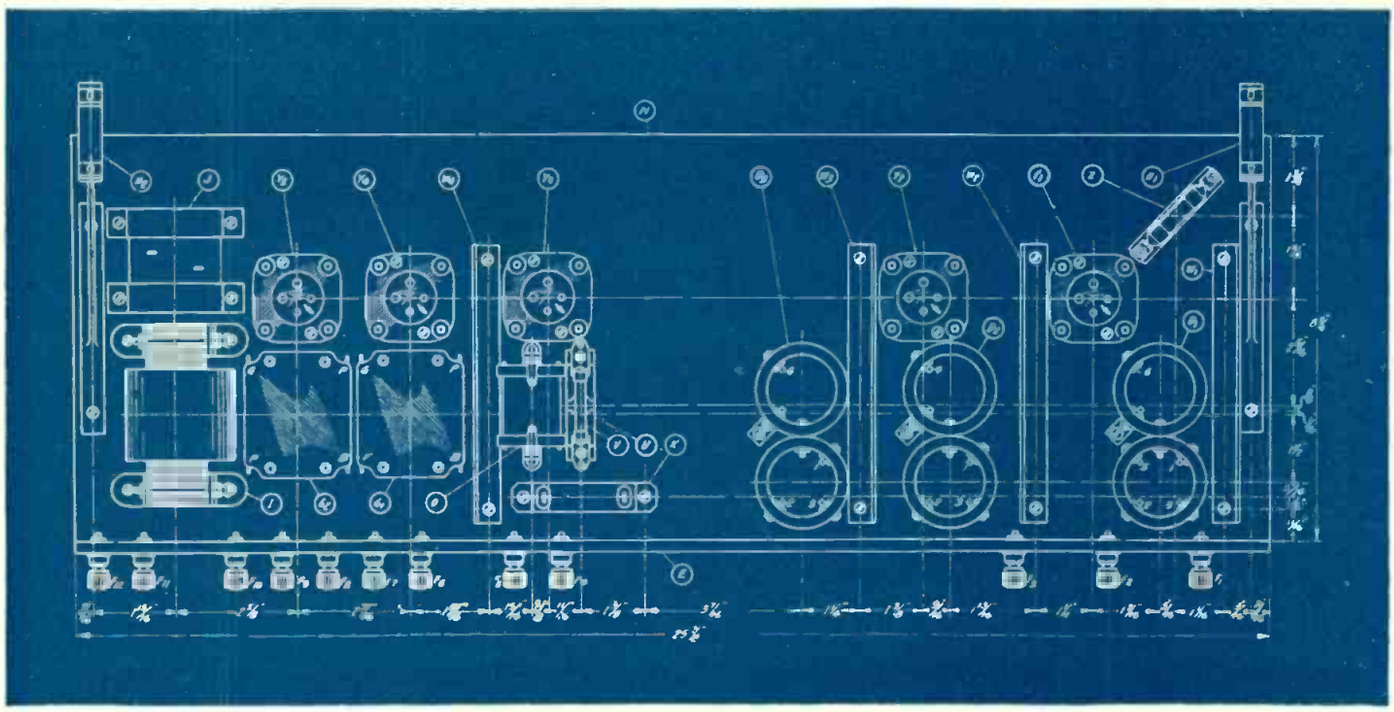


THE SCHEMATIC CIRCUIT DIAGRAM

FIGURE 6: *This gives the complete hook-up at a glance. All the symbols for the instruments bear designating letters which are repeated in the list of parts, the text and the illustrations.*

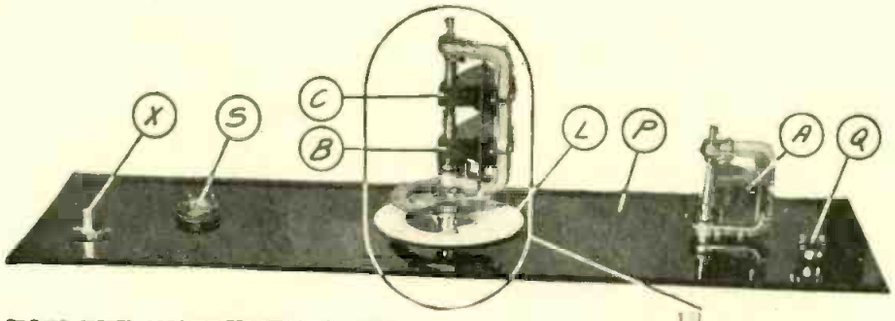
Blue Prints for the LC-27 Receiver

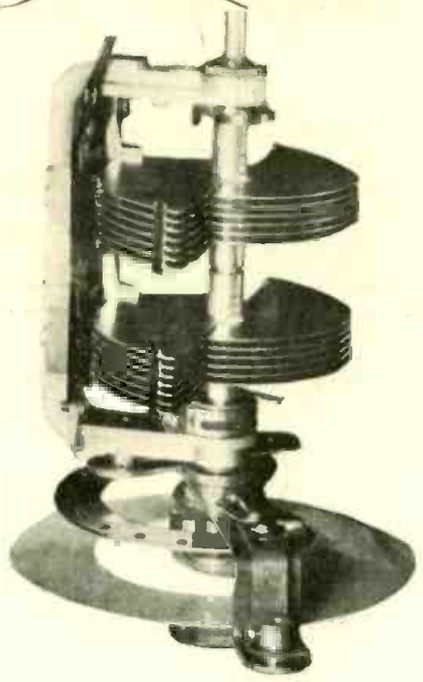
For the benefit of the experimental set builder who may prefer to assemble the LC-27 Receiver from larger diagrams than can be reproduced within the limited space of these magazine pages, a set of simplified blue prints in actual size have been prepared. This set includes (1) the working drawing for construction, (2) the panel layout, and (3) the picture wiring diagram, in addition to (4) the schematic circuit diagram and the complete list of parts used in the laboratory model. If this set of blue prints cannot be obtained from your dealer, it will be furnished upon receipt of a remittance of $1.00 sent to the POPULAR RADIO SERVICE BUREAU, *627 West 43rd Street, New York City.*



THE WORKING DRAWING FOR CONSTRUCTION

FIGURE 7: *The exact positions of all the instruments mounted on the baseboard are shown in this drawing. The dimensions are given center to center for the instruments. This drawing should be referred to constantly in building the set and each instrument should be placed exactly as shown if the results outlined in the article are to be obtained.*





HOW THE INSTRUMENTS ARE MOUNTED ON THE PANEL

FIGURE 8: *This illustration shows the panel (lying face downward) with the dual condenser and tuner control in position. It also shows the single condenser, the battery switch, the volume control resistor and the jack. At the lower right is shown the method of mounting the dual condenser on the tuning control "L" by means of the special link unit, washer, nuts and bolts that are furnished with the tuning control.*

The receiver employs three standard UX-201-a tubes and one UX-200-a tube for the detector in order to obtain high amplification. The last tube in the set may be either a UX-171 type or a UX-210 depending upon whether "B" batteries or the Senior or Junior Power-packs are used. The set may be used with an "A" battery or with one of the "A" power-packs, that will be mentioned in a forthcoming article, without any changes in circuit design.

An outdoor antenna of 60 to 150 feet, according to local conditions, may be used or the set may be used without any antenna at all.

The general theoretical diagram of connections is shown in Figure 6.

How to Construct the Set

After all of the instruments and materials for building the set have been procured, the panel, P, shown in Figures 1, 3 and 4, should be prepared.

First of all, cut the panel to the correct size, 8 by 26 inches. Then, square up the edges smoothly with a file. The centers for boring the holes (that are necessary in mounting the instruments) should then be laid out on the panel, as shown in Figure 4. A convenient method is to lay out all center holes on a piece of paper the same size as the panel; then the piece of paper may be fastened on the panel and the centers marked directly on the panel by punching through the paper with a sharp, pointed instrument.

If all of the holes to be drilled are first started with a small drill, one-sixteenth of an inch in diameter or less, they can be more nearly centered.

The holes outlined with a double circle in the diagram should be countersunk so that the flat-head machine screws used for fastening the instruments screw down flush with the panel. The holes for the pegs for the two small dials and the window holes for the large main tuning control L, have not been given as steel templates for this purpose are furnished with the dials. All the rest of the holes in the panel are straight drill-holes. Sizesf orthe diameters of these holes have not been given, but the builder can easily decide what size hole is necessary by measuring the diameter of the screws and shafts of the instruments that must go through the holes.

When the panel is drilled, the builder may give it a dull finish by rubbing the face of the panel lengthwise with fine sandpaper until it is smooth. This process should be repeated, except that light machine oil should be applied during the second rubbing. Then rub the panel dry with a piece of cheesecloth.

A permanent dull finish will be the result. Or, the panel may be left with its original shiny-black finish, if care has been exercised not to scratch it during the drilling.

After the panel has been prepared the experimenter is ready to mount the instruments on it.

If a ready-made, drilled and engraved panel is bought, this work will be unnecessary as the drilling and finishing have already been done by the manufacturer of the panel. The panel, in this case, is beautifully made of black bakelite and the dial positions are artistically marked with inscriptions in gold lettering.

After the builder has obtained the type cabinet that he has decided to use he should take out the baseboard, N, that comes with the cabinet unit and mount the binding-post strip, E, on the back edge of the baseboard by screwing into the rear end of the baseboard, with four flathead wood screws.

The method of drilling and preparing the binding-post strip is shown in Figure 9. The twelve binding posts, F1 to F12, should be mounted on the strip, E, as shown in Figures 3 and 5.

Now, place the baseboard in the set with the back edge of the binding-post strip, E, flush with the outside rear surface of the cabinet.

Attach the two brackets, H1 and H2, to the main panel, P, by means of four flat-head machine screws and nuts.

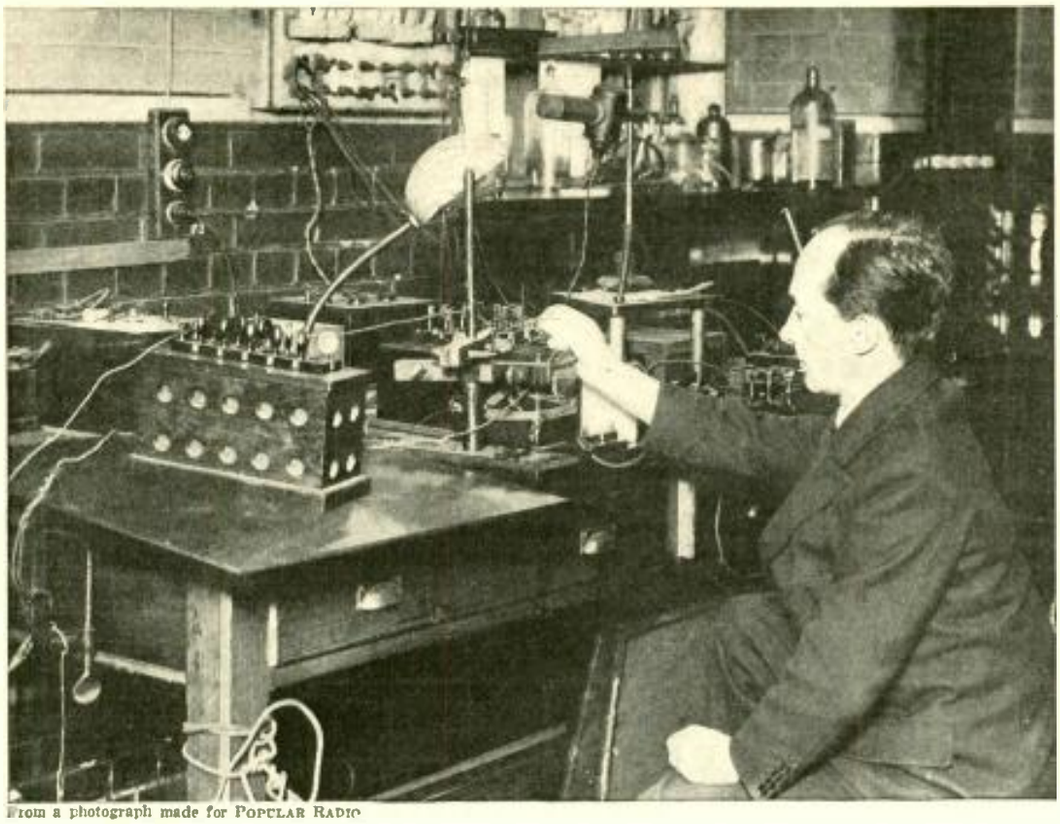
Now, place the panel assembly in position in the cabinet and mark the holes in the bottom legs of the brackets, H1 and H2, opposite where they come on the baseboard, N. When these holes are punch-pricked, brackets H1 and H2 may be fastened directly to the baseboard, N, with four wood screws. This will insure a proper fit for the foundation unit which consists of the baseboard, N, the binding-post strip, E, the brackets, H1 and H2, and the main panel, P.

Next, take the foundation unit out of the cabinet and detach the panel, P, from the top leg of the brackets, H1 and H2, by loosening up and detaching the four machine screws and nuts.

(*Continued on page 556*)

HOW TO MAKE THE CONNECTION STRIP

FIGURE 9: *This drawing shows the dimensions for the strip and the spacings for the holes that should be drilled to mount the binding posts and the connection strip itself.*



From a photograph made for POPULAR RADIO

SOME OF THE APPARATUS USED BY DR. WALL IN HIS LABORATORY

The variation of magnetic induction that occurs in samples of iron after being subjected to high magnetic fields leads the author to believe that science will some day be able to break up or at least change the atoms.

WILL SCIENCE SUCCEED IN

Releasing the Power of the Atom?

The author of this article is the head of the Department of Electrical Engineering of the University of Sheffield, England. About two years ago he startled the world by an announcement that he was at work on a magnetic process for cracking the atom; the preparations he made for his experiments were reported by him in POPULAR RADIO for May, 1925. The enormous significance of these experiments gives them importance. In the following article Dr. Wall tells of his more recent laboratory efforts to solve this problem that has so long puzzled scientists.

By T. F. WALL, D. Sc., D. Eng., A. M. I. C. E., M. I. E. E.

THE phenomenon of magnetism has been known from prehistoric times. But its actual cause has remained a complete mystery until the last few years.

About the year 1821, a bold speculation on the part of the French physicist, Ampère, referred magnetism to currents of electricity within the molecules of the iron.

However, the absence of any direct proof that such molecular currents existed and also the necessary assumption that such currents must be able to persist, apparently, for an indefinite period without decaying and without losing energy prevented the acceptance of Ampère's hypothesis for many years. It was also contended, by opponents of the hypothesis—and this was a very serious difficulty—that if such currents existed it should be possible to disturb or destroy them by electromagnetic induction effects, just as we may start and stop an electric current in a closed coil of wire by thrusting a bar magnet through the coil.

The discovery of the electron and the almost certain knowledge which followed this discovery that each atom of matter is made up of a central nucleus with a number of electrons revolving about this nucleus has given a vindication of Ampère's flight of imagination of over a hundred years ago—at a time long before the existence of the electron was dreamed of.

An electron revolving about the nucleus of an atom is, in fact, an electric current and as such produces a magnetic field. The magnetic properties of iron, steel and other metals are now generally believed to be the manifestation of these revolving electrons.

There then remains the question of why we are not able, by electromagnetic induction, to influence these electronic currents in the atom and make a magnetic substance like steel into a non-magnetic substance like copper.

The answer, in part, is that the internal magnetic field in the atom which is due to the electronic currents is so immensely strong that we have not hitherto been able to produce magnetic fields of anything like the strength necessary to disturb the atom's inherent field. Although we have been able to act upon the electron by means of electromagnetic induction, the disturbing effect which has been obtained has been so minute that it has escaped detection.

In a previous article, which was published in the May, 1925, issue of POPULAR RADIO, the writer described the apparatus which he has designed and which has been constructed and put into operation for the purpose of producing magnetic fields which are immensely

more powerful than any which have been obtained before. The intention of this undertaking was to produce a marked and permanent disturbance of the electronic structure. By repeated application of powerful magnetic fields it was thought that the electrons might be progressively pushed out of their orbits and that a permanent transformation of the atomic structure might in this way be attained.

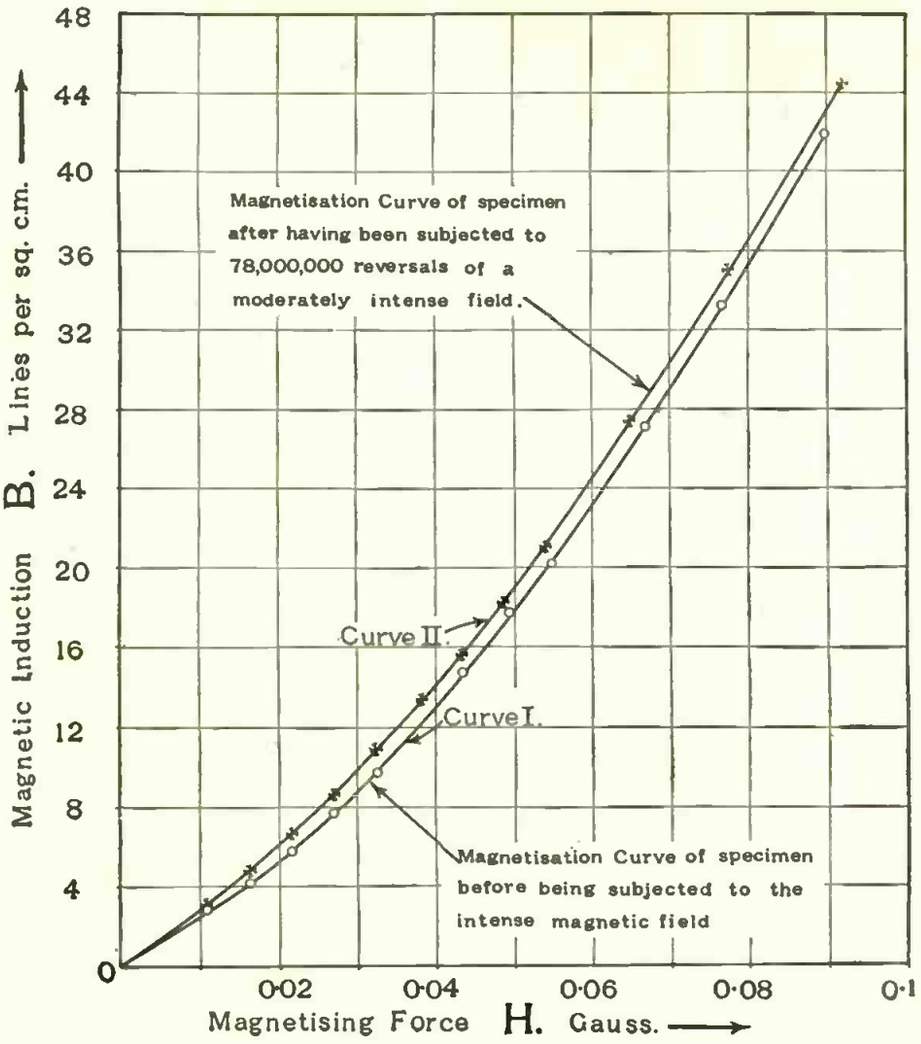
It is remarkable that this field of research has not attracted more attention, particularly as many extraordinary facts concerning magnetism have been known for years.

When iron is heated, for instance, there is no marked change in its magnetic properties until a temperature of about 770° C. is reached, when the iron begins to lose its power for becoming magnetized. If the iron is further heated to about 810° C. *it becomes non-magnetic.* As the iron cools down again to 770° C. it again becomes magnetic.

In the light of modern knowledge this can mean nothing less than that a profound modification of the electronic structure is taking place; but as to what that modification is we are still ignorant.

It was discovered in the year 1873 by the late Sir W. F. Barratt that if a piece of steel (*e.g.*, an old file) is heated to bright redness, and is then allowed to cool, it suddenly shines up again more brightly on reaching a deep red color, as if it had been heated up from within. In other words internal energy is suddenly released. The remarkable fact is that the temperature at which this glowing up occurs is the temperature at which the iron changes from the magnetic to the non-magnetic state.

The more one ponders over these strange facts the more startling they become.



HOW STEEL WAS ALTERED BY THE APPLICATION OF INTENSE MAGNETIC FIELDS.

FIGURE 1: *Curve I shows a part of the magnetization curve for a piece of magnetically matured alloy steel, giving the relationship between the magnetic induction, B, and the magnetizing force, H. Curve II is the magnetization curve of the same specimen after it has been subjected to 78 million reversals of a moderately intense magnetic field and then has been thoroughly demagnetized before testing. The difference between these two curves seems to give presumptive evidence that the electronic structure of the material has actually been disturbed to a marked extent.*

It is the writer's firm conviction that a full knowledge of the cause of these and other magnetic phenomena will provide the solution to the control of the atomic structure and consequently to the control of whatever latent energy is bound up in the structure of the atom. In other words, research as to the fundamental cause of magnetism will prove to be the most fundamental research of all.

The purpose of the present article is to produce evidence which, failing any adequate alternative explanation, appears to afford an indication that an actual disturbance of the electronic structure has been obtained by the application of intense magnetic fields, in accordance with the principles outlined in the previous article.

In the previous article it was pointed out that any marked disturbance of the electronic structure would give rise to a notable modification in the magnetic properties of the material. Conversely, any marked modification which may be observed, after the specimen is subjected to the intense magnetic field, would give strong presumptive evidence that a marked disturbance of the electronic structure had taken place.

The writer has now been able to obtain definite results which, in his view, give presumptive evidence that the electronic structure is actually disturbed to a marked extent by the application of intense magnetic fields. Some of the evidence for this conclusion is provided by the curves which are reproduced in Figure 1.

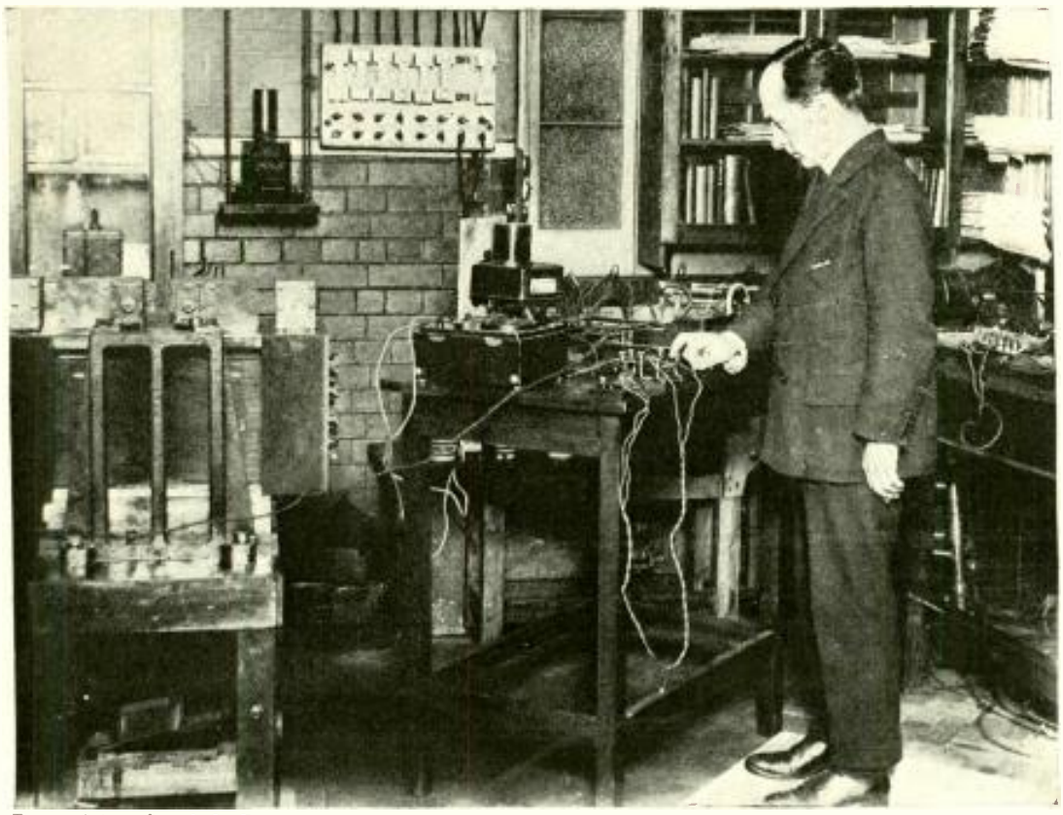
In Figure 1, the Curve (I) shows a part of the magnetization curve for a piece of magnetically matured alloy steel. This magnetization curve gives the relationship between the magnetic induction B and the magnetizing force H, as is well known to all students of electrical engineering.

It will be observed that this curve has been taken for low values of the magnetizing force.

The Curve (II) of Figure 1 shows the magnetization curve of the same specimen immediately after it has been subjected to about 78 million reversals of a moderately intense magnetic field and then has been thoroughly demagnetized before testing.

A comparison of the Curves (I) and (II) of Figure 1 is extremely interesting. It will be noticed that after the specimen has been subjected to a large number of reversals of a moderately intense field, the magnetization for a given value of the magnetizing force is greatly increased.

The comparison of these two curves is more easily made by the aid of the following table, the data in which have been taken from the curves in Figure 1:



From a photograph made for POPULAR RADIO

THE AUTHOR TESTS THE CIRCUIT

Measuring the capacity of the large static condensers in preparation for the surge of current which produces the intense magnetic field used in the experiments.

Magnetizing Force H	Magnetic Induction		Ratio:
	Curve I. B_I	Curve II. B_{II}	B_{II}/B_I
0.01	2.5	2.8	1.12
0.02	5.3	6.1	1.15
0.03	8.8	9.9	1.12
0.04	13.0	14.2	1.09
0.05	17.8	19.0	1.06
0.06	23.2	24.5	1.05
0.07	29.0	30.3	1.04
0.08	35.2	36.4	1.03

Reference to this table shows that the magnetic induction given by Curve II reaches values which are as much as 15 per cent higher than those given by Curve I.

When the specimen had been left at rest for a few days after the Curve II had been taken, the magnetization curve agreed closely with the Curve I. In other words, the condition of the specimen represented by Curve II is a temporary one, and the magnetic state gradually reverts to that more stable condition represented by Curve I.

The curves in Figure 1 refer to low values of the magnetizing force because the maximum intensity of the impressed magnetic field referred to in connection with Curve II was only moderately large and also because any electronic disturbance which might be expected to take place would be most likely to be evident at the lowest ranges of the magnetization curve.

The experimental results obtained and detailed in the foregoing may possibly be accounted for by assuming that it is the electrons in the outer orbits of the atom which have been disturbed by the intense magnetic fields. These electrons are the most loosely held and consequently most easily disturbed. After the disturbing force has been removed, however, these displaced electrons gradually find their way back to their normal positions in the atomic "planetary system."

When the magnetic solenoid, described in the previous article, breaks down because of an excessive current, the arc, at rupture, causes an explosion in the oil and the specimen thus becomes subject to a mechanical shock. This has the effect of lowering the magnetizability.

As the intense magnetic fields are subsequently applied, the magnetizability improves and thus the effect of the mechanical shock becomes eliminated.

In order to avoid this complication, the strength of current in the solenoid is now kept well below the value which causes rupture of the solenoid winding. This, of course, implies that the intensity of the magnetic fields is correspondingly reduced. The advantage thus obtained of freedom from complications which are due to mechanical shocks more than outweighs the disadvantage of a somewhat reduced magnetic field intensity.

Whether the apparatus now in action is sufficiently powerful to produce a permanent rupture of the atomic structure is a question which it is not yet possible to answer. In the writer's view however, the evidence points to the conclusion that the disruption of the atomic structure by the application of extremely intense magnetic fields is possible.

And, if this is so, no one can foretell what the final results will be.

The New LC-Senior Power-pack

IN next month's issue of POPULAR RADIO*—for November—will be published the complete constructional details of the LC-Senior power-pack, together with installation and operating data and also full instructions for operating the LC-27 receiver without batteries.*

¶ *Before you accuse your neighbor of cluttering up the ether with squeals, be sure that you are not yourself an unconscious offender.*

From a photograph made for POPULAR RADIO

The RADIO ROAD HOG

By J. E. ROBERTS

Don't blame the regenerative receiver for *all* of the "blooping" that mars radio reception; there are other types of trouble-makers too. For instance—

THE large and growing pack of radio fans is hot on the trail of the annoying regenerative receiving set.

One can hardly pick up a radio magazine or the radio section of a newspaper these days, without finding at least a paragraph on the evils of "bloopers." Usually the paragraph contains an inference that all the racket is caused by regenerative sets—and often winds up with the suggestion that "there should be a law" against them.

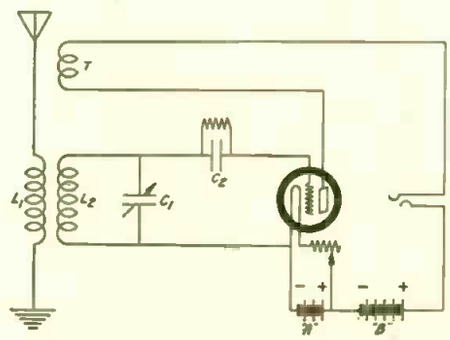
That inference and the heated remarks that go with it are possibly justified—but not to the extent that is usually indicated.

There are other "bloopers" besides the regenerative sets—lots of them.

Any badly neutralized neutrodyne may furnish a high grade of blooping, and so will a badly designed tuned-radio-frequency set—while a home-made "super" on an antenna (yes, they do that too) will spoil reception for a radius of miles, when it is feeling poorly. Some of them will radiate for 300 to 500 feet from a loop, which is serious in a city.

Admitting that the regenerative set is responsible for a share of the cat calls, it behooves the owner of one to reduce this annoyance to the minimum. The time may come when no set of any kind will be able to radiate, but until that time comes it is up to us, who believe in regeneration, to minimize the trouble as far as that is possible.

Agreeing that blooping is the effect of over regeneration—to a point where the tube "spills over" into violent oscillation, it would seem that the solution of the problem is to operate one's set in such a manner that the tube never reaches the point where it spills over. By keeping the tickler far enough "out" at all times when tuning, and only bringing it up to the best operating point *after* the station had been tuned in, this trouble may be avoided.



A COMMON TROUBLE MAKER

FIGURE 1: *This circuit is one of those that squeal and produce interference to neighbors, if the coil T, is brought into too close relation with the coil, L2, thus causing the circuit to radiate oscillations.*

This has been difficult because the tickler mechanism has been more or less crude both in design and operation.

We insist on absence of backlash and the highest ratio of vernier dials, we use verniers on rheostats and micrometer threads on variable grid-leaks to obtain smooth action, yet we continue to use ticklers, controlled by an inadequate knob, which wobble in and out of the field of the secondary about as smoothly as a springless truck on a cobblestone pavement—and with about the same resultant noise.

The usual tickler arrangement is shown in the schematic diagram in Figure 1.

The two coils, L2 and T, are variable in relation to each other, and the coils may be the cylindrical pattern, with the

tickler on a rotor ball, revolving inside one end of the secondary form. Or they may be a pair of low-loss coils or a pair of spider-web coils arranged to vary by rotation. In most cases the rotation or movement is controlled by a shaft and a small knob, which has its entire effective action within about 20 degrees, making accurate adjustment difficult and making spilling over, from too tight coupling, easy. Another fault of this scheme lies in the fact that a variation of the coupling often causes, or makes necessary, a change in the setting of the variable condenser across the secondary coil; thus altering the tuning.

Figures 2 and 3 illustrate methods that have been in use for a long time (comparatively) and are known as the tuned plate system of feedback.

Figure 2 shows the plate circuit tuned by a variometer.

Figure 3 is another variation of the tuned-plate circuit, employing a coil with a variable condenser across it, in the plate circuit. The coil L4 and the condenser C3 should be of the same values in inductance and capacity approximately as L2 and C1. A vernier dial may be used in this case to make the control still more smooth and accurate.

Figure 4 is a diagram of another circuit that controls regeneration with a variable condenser. The value of coil L4 in this arrangement should be from ½ to ⅔ of that coil L2, and the value of condenser C4 approximately that of condenser C1. A radio-frequency choke coil of about 30 millihenries is sometimes required as shown, for proper operation. This method is very smooth in its action, and coil L4 may be made in almost any shape, bunch-wound, spider-web, or a similar coil to L2.

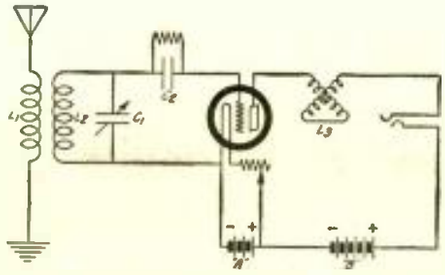
Figure 5 shows a distinct departure from the foregoing methods; it employs a tickler coil as in Figure 1, of the same inductance as the movable tickler in Figure 1, but it is stationary. It may be wound in a fixed position on the same form as L2, or it may be on a rotor inside of L2—but the rotor is fixed in position; it does not wabble. Regeneration is controlled by a variable high resistance shunted across the tickler coil, and indicated by R1 in the diagram.

This resistance should be of a maximum resistance of about 500 to 10,000 ohms—the Royalty High Resistance Type C, the Bradleyohm No. 5, the Clarostat, the Centralab and other makes are well suited for this purpose. The employment of this arrangement means that instead of having about 20 degrees movement of a knob to cover the entire range of possible regeneration one has one to three complete turns available and it is easy to keep regeneration at the best point for the finest DX work without allowing the tube to oscillate or "spill."

Figure 6 shows a variation of the method of Figure 5 and may be found preferable by some. In this case, the resistance is not in shunt to the tickler coil, but in series with it. The resistance should be a variable one with a range from 10,000 to 100,000 ohms, and it must be shunted with a fixed condenser in parallel, of a value between .0001 and .001 mfd. capacity as a by-pass for the radio frequency current (shown as C5, Figure 6).

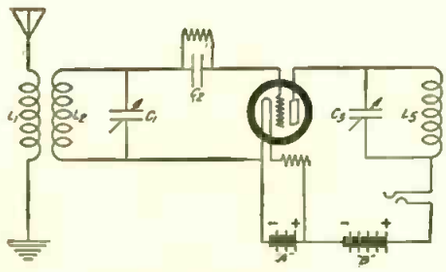
Either one of these two methods (Figures 5 and 6) will give fine control of regeneration, and in addition, they enable one to obtain satisfactory reproduction through control of the output.

(*Continued on page 540*)



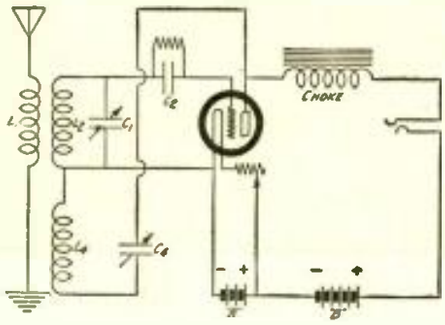
ANOTHER SQUEALING CIRCUIT

FIGURE 2: *If the variometer, L3, is turned too far around, the circuit will radiate squeals and howls.*



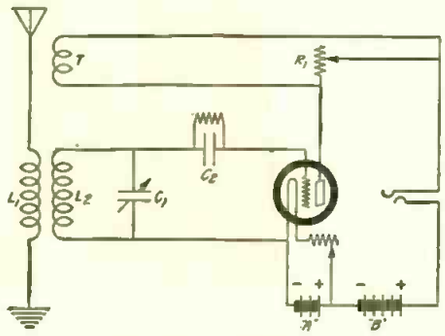
A THIRD OFFENDER

FIGURE 3: *If the variable condenser, C3, is rotated to too high a value, objectionable radiation will occur.*



A HEARTY "HOWLER"

FIGURE 4: *In this circuit the condenser, C4, controls regeneration and if it is set at too high a value squeals will be produced.*

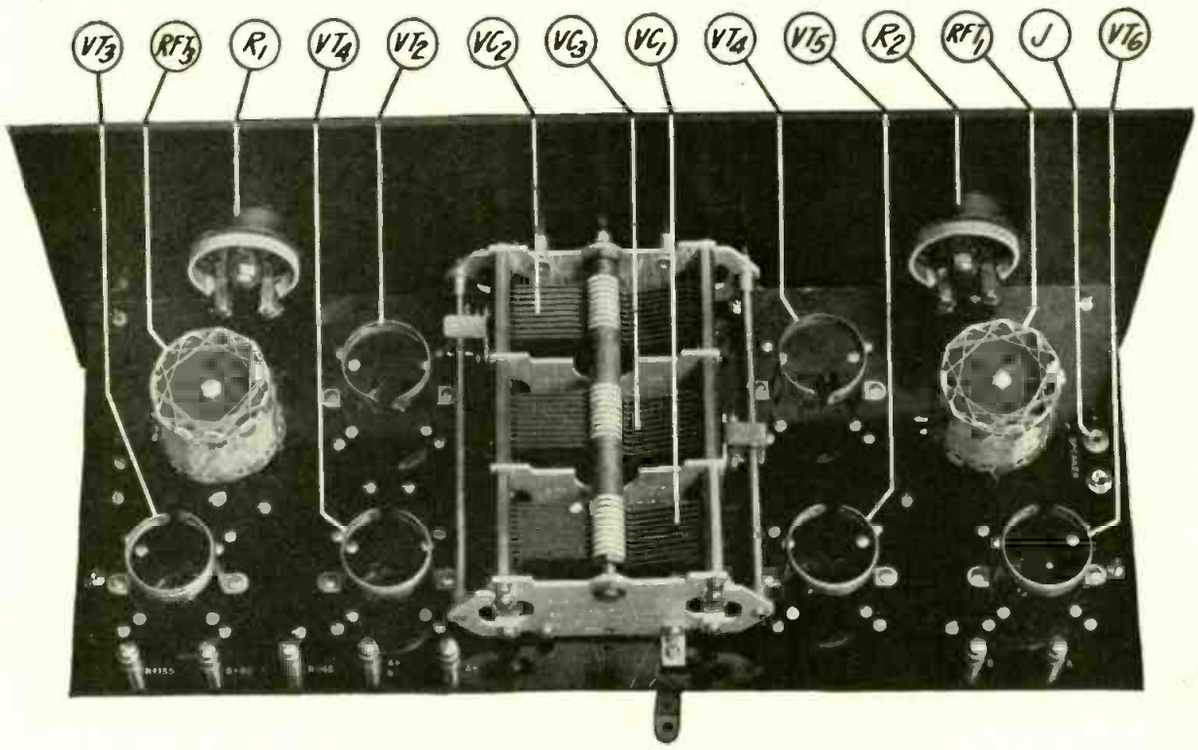


A BETTER CONTROL OF REGENERATION

FIGURE 5: *Regeneration is controlled by resistance, R1; if the maximum resistance is low enough, the circuit cannot howl.*

EVEN MULTI-TUBE CIRCUITS MAY RADIATE

Homemade, tuned-radio-frequency sets, unless they are properly neutralized, may oscillate in one or more stages. If this is the case, this type of circuit may be just as bad an offender as the simple one-tube regenerative receiver.



The "Pierce-Airo" Receiver

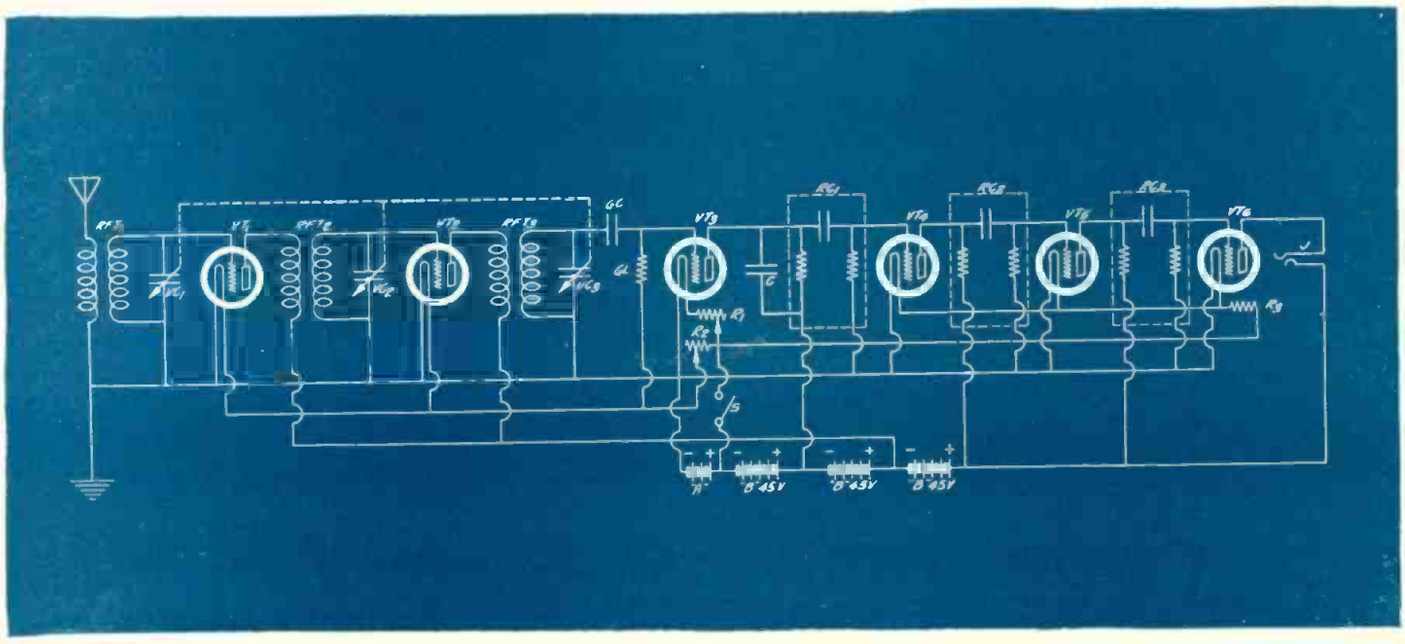
A fine quality of reproduction may be obtained with this set which consists of two stages of tuned-radio-frequency amplification, a vacuum-tube detector and three stages of resistance-coupled audio-frequency amplification. The receiver is tuned by means of a single control; variations in the tuned circuits are compensated for by a specially constructed multiple condenser. The audio amplifier is mounted beneath a sub-panel.

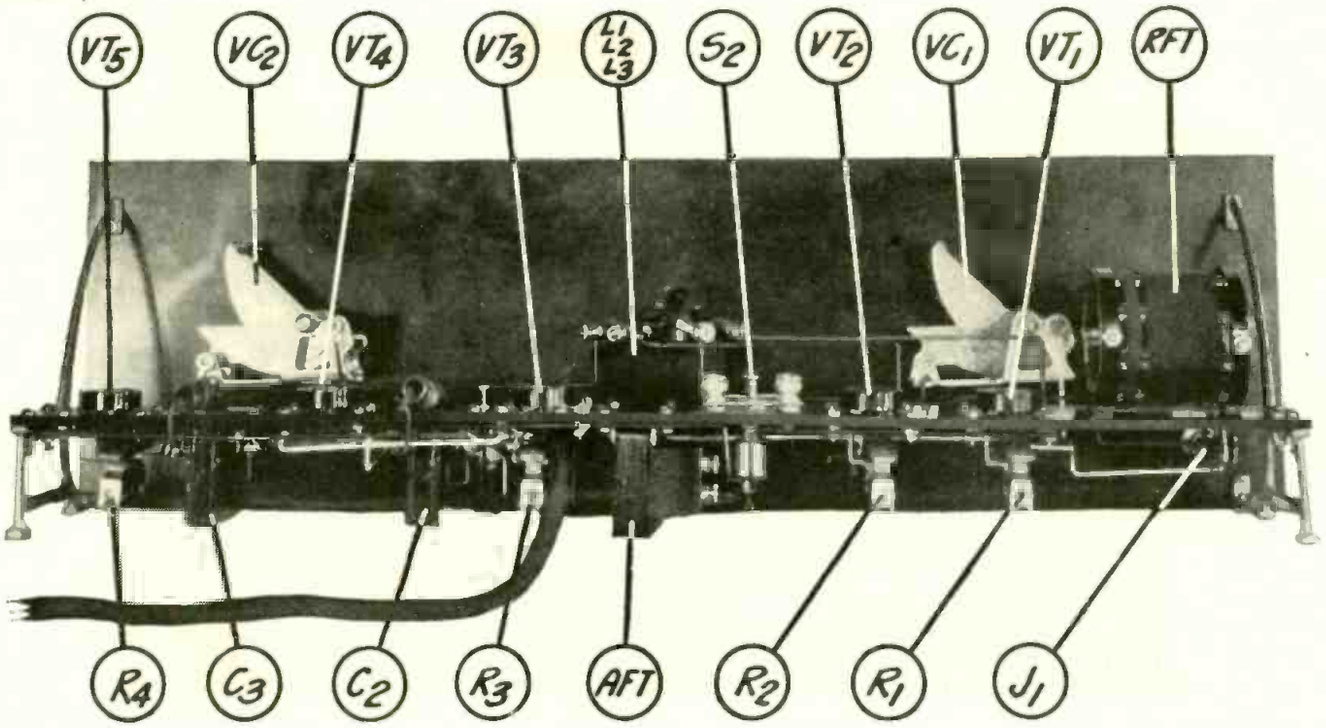
Popular Radio Circuits

INSTALLMENT NO. 3

THE PARTS THAT ARE RECOMMENDED FOR USE IN THIS RECEIVER ARE—

RFT1, RFT2 and RFT3—U.S.L. radio-frequency coils;
VC1, VC2 and VC3—U.S.L. compensated multiple straight-line-frequency condenser unit;
RC1, RC2 and RC3—Aerovox resistoformers;
VT1, VT2, VT3, VT4, VT5 and VT6—sockets (integral with U.S.L. sub-base);
J—single-circuit jack;
R1—U.S.L. rheostat, type MR, 20 ohms;
R2—U.S.L. rheostat, type MR, 10 ohms;
R3—U.S.L. fixed resistance, 2 ohms;
GC—Aerovox grid condenser, .00025 mfd.
GL—Aerovox grid-leak, 2 meg.;
C—Aerovox by-pass condenser, .002 mfd.
S—filament switch;
Kurz-Kash vernier dial;
Binding posts (7 required);
Composition panel and sub-panel.



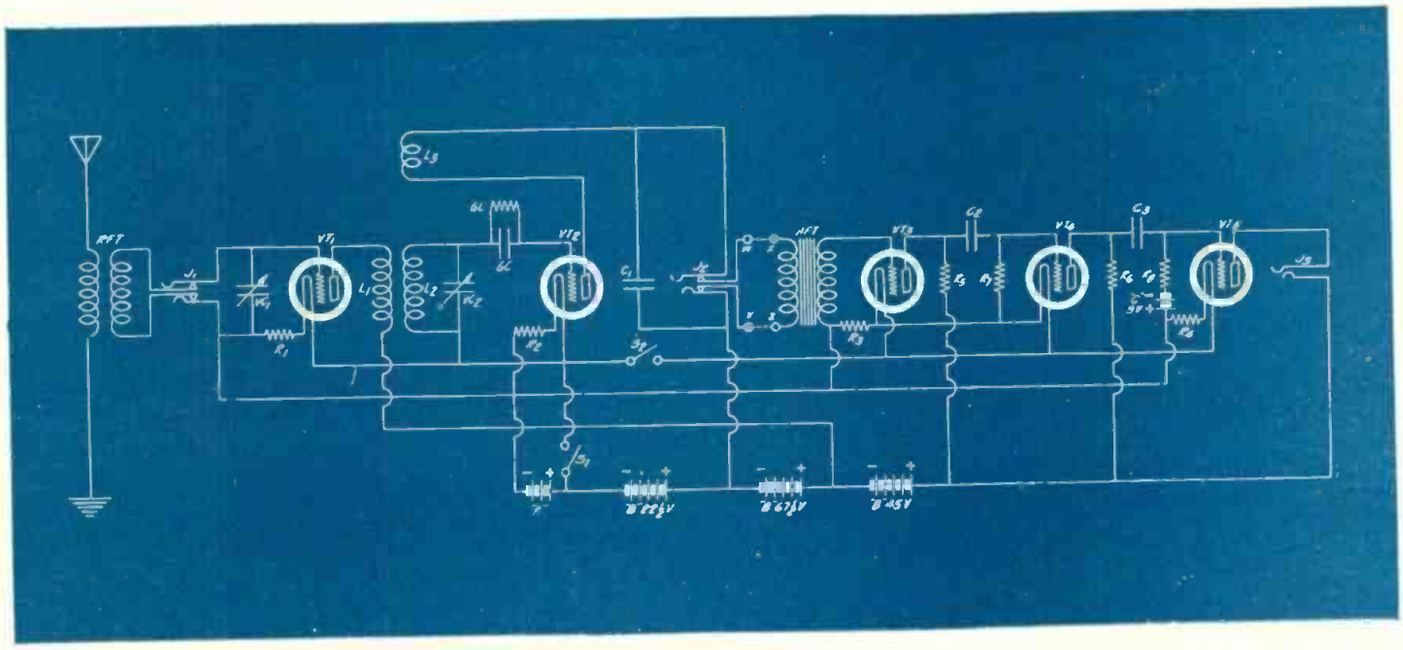


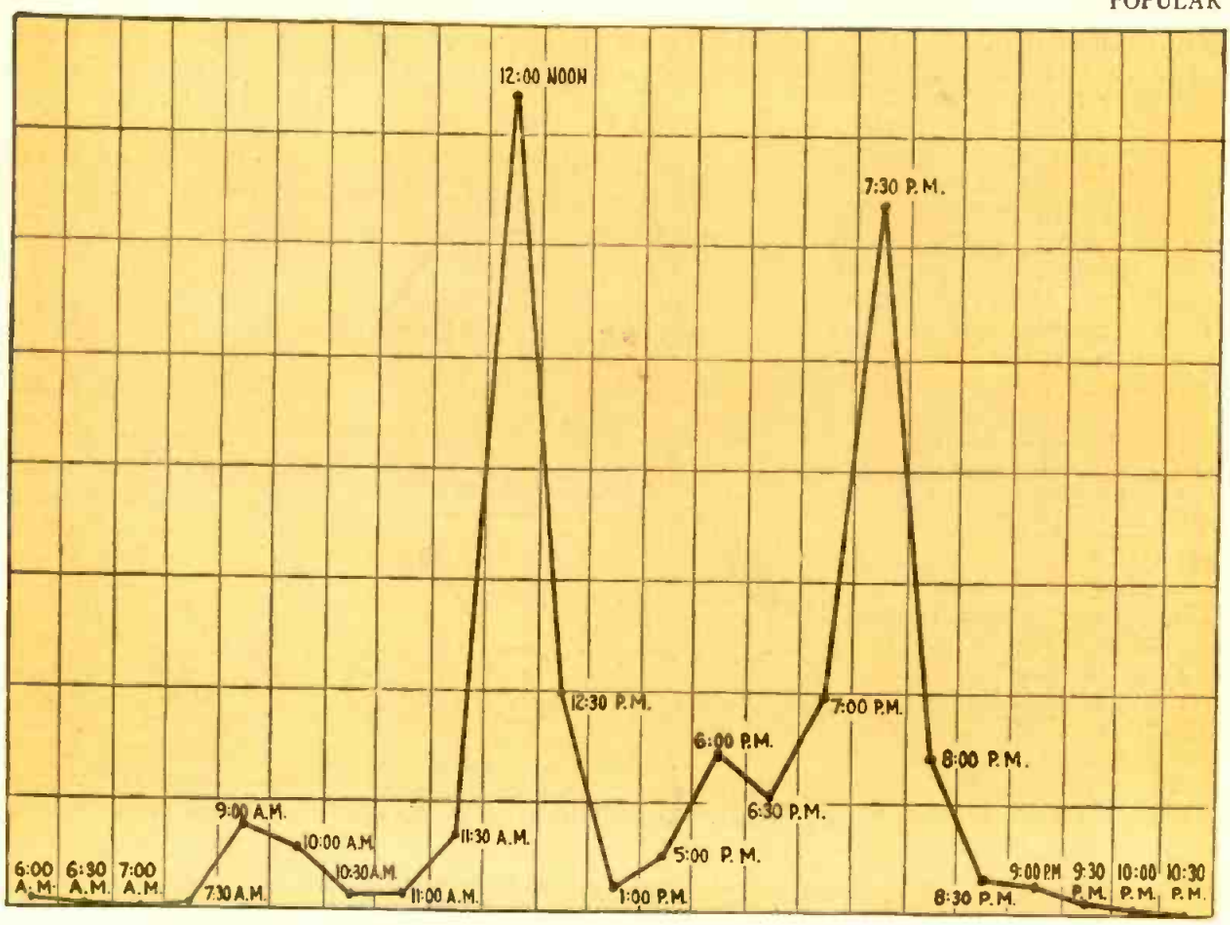
"The Diamond of the Air" Receiver

This receiver contains one stage of radio-frequency amplification, a regenerative detector and three stages of resistance-coupled, audio-frequency amplification, with a power tube in the last stage. A good quality of reproduction and adequate volume and selectivity are the outstanding characteristics of this receiver. As an additional feature, the tuning unit is made so that it may be readily separated from the amplifier; this makes it easy to compare either part of the receiver with any other unit.

The Parts That Are Recommended for Use in This Receiver Are—

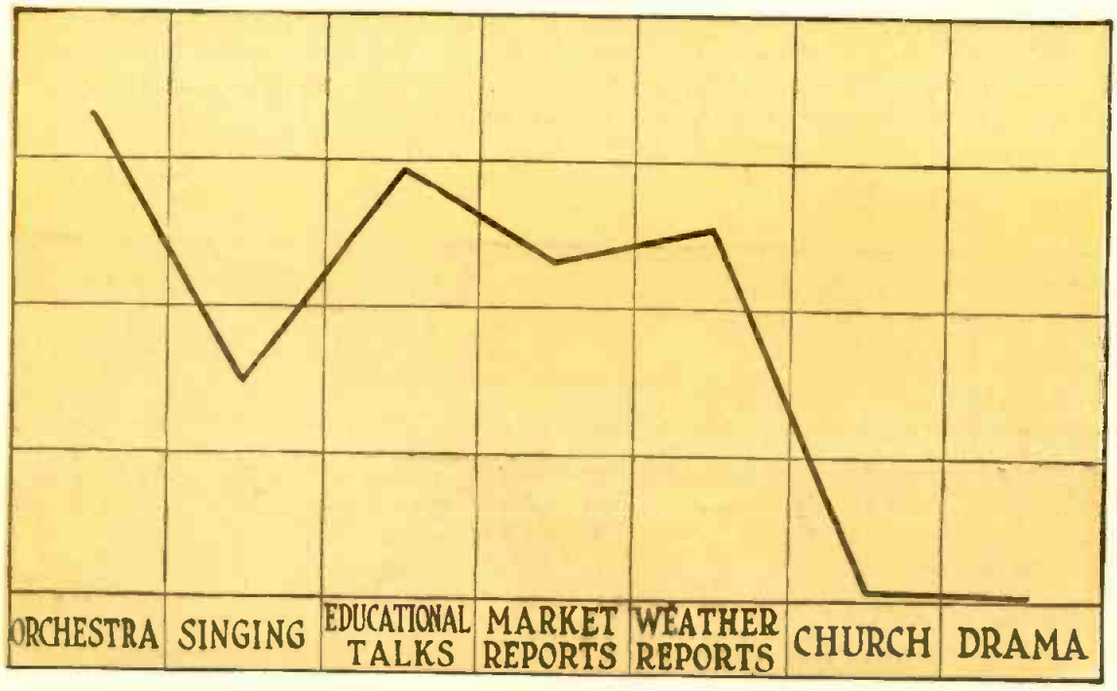
RFT—Bruno No. 99 RF antenna coupler;
L1, L2 and L3—Bruno three-circuit coupler;
VC1 and VC2—Bruno "Streamline" SLF condensers, .0005 mfd;
AFT—Bruno audio - frequency transformer, ratio 3½ to 1;
VT1, VT2, VT3, VT4 and VT5—Benjamin sockets, type UX;
GL—variable grid-leak;
GC—Aerovox grid condenser, .00025 mfd.;
C1—Aerovox mica fixed condenser, .001 mfd.;
C2 and C3—Aerovox mica fixed condensers, .25 mfd.;
R1 and R2—Amperites, No. 1A;
R3 and R4—Amperites, No. 112;
R5, R6 and R8—General resistors, 100,000 ohms.;
R7—General resistor, 250,000 ohms;
S1—Bruno filament switch with pilot;
S2—Bruno "A" switch;
J1—double-circuit jack;
J2—single-circuit jack;
W, X, Y and Z—binding-posts;
Composition panel, 7 by 24 inches;
Sub-base, 2½ by 23 inches;
Bruno orackets (2 required);
Bruno vernier dials (3 required).





THE TWO HOURS DURING THE DAY WHEN THE FARMER WANTS TO TUNE IN ON MARKET REPORTS

One of the conclusive facts revealed by the nation-wide survey of the farmer audience is the time when the farmer wants his market news—at exactly 12:00 o'clock noon and at 7:30 in the evening. He wants them at the former hour in order to decide whether or not to carry his produce to market in the afternoon, and he wants them at the latter hour so that he may make his plans for the following morning.



THE PROGRAM FEATURES THAT THE FARMER FAMILY FINDS MOST ENTERTAINING

In the survey 7,616 individual expressions of opinion demonstrated that orchestral (or band) music is the most popular broadcast feature, followed by educational talks, weather reports and market reports. Other features than those shown above did not reveal sufficient interest to be charted.

J. C. Allen, Indiana

HIS SET INCREASES HIS INCOME ABOUT $500 A YEAR

Not as a luxury but as a necessity—as a part of his farm equipment—does O. G. Kirkpatrick of Frankfort, Indiana, regard his receiver. Market information which he receives from broadcast stations has increased his earnings many times in excess of the original cost and upkeep of his radio equipment.

Sets *that* Earn Incomes

Many of the 1,000,000 up-to-date farmers who own radio receivers are finding out that radio is reducing their farm wastes and increasing their cash returns. This article points out how the 5,500,000 farmers who are not yet equipped with radio may make a set pay for itself several times over each year.

By H. R. KIBLER

LAST winter Harvey M. Anderson, a typical mid-west farmer, bought a radio receiver and installed it in his farm house in Walnut, Illinois.

A few weeks later, while listening in, Mr. Anderson picked up the voice of a speaker who was giving out a market report and who observed that "during the coming week the price of corn will go up."

It happened that the listener had on hand a considerable quantity of corn that he was intending to sell the following day at the prevailing market rates. But the advice of the speaker whose voice had so unexpectedly been introduced into the Illinois farmhouse caused Mr. Anderson to pause. He decided to hold his corn a few days.

A week later Mr. Anderson sold his corn at an advance of three cents a bushel—representing a cash value many times in excess of the price that he paid for his radio apparatus.

Since that time the receiving set has been established as a necessary item in the Anderson farm's mechanical equipment.

Mr. Anderson's case is cited not because it is exceptional but because it is becoming representative. Farmers are beginning—but only just beginning—to learn that the radio set has a distinctly utilitarian value that may be measured in dollars and cents.

"We were about to sell our lambs at 10 cents a pound, but we received the latest reports by radio that lamb was selling at 12 cents. So we made 2 cents a pound more", reported George L. Reynolds, R.F.D. No. 4, of Moravia, New York.

"Radio saved me money on my hay", reported Mrs. P. Aldi, R.F.D. No. 3 of Canajoharie, New York. "I learned by radio that the New York market had gone up, so I held my hay a month and made $2.00 a ton more on it."

Instances of this kind are being recorded in increasing number. Radio is beginning to change the methods—particularly the marketing methods—of entire groups of farmers.

This was the one outstanding disclosure of a nation-wide survey recently conducted by the National Farm Radio Council.*

*The National Farm Radio Council is an agency created to provide a medium through which various groups may co-operate in making radio of greatest use to the farmer. The Council was organized in 1925 and is incorporated in the State of Illinois as a non-profit institution; among the groups that have co-operated in its development are the American Farm Bureau Federation, the National Grange, the National Committee on Boys and Girls Club Work, the National Live Stock and Meat Board, the National Lumber Manufacturers Association, the Wholesale Grass Seed Dealers Association, the U. S. Department of Agriculture, the Federal Board for Vocational Education, the National

In this survey an effort was made to find out what part radio was playing in the farmer's daily life; what changes radio was making in the farmer's social habits and to what uses the farmer was putting his receiving set.

In this nation-wide survey the investigators gathered and tabulated 44,550 individual expressions of opinion. They gathered this information in cooperation with fifteen farm publications, 450 county agents, 200 boys' and girls' club leaders, 150 home demonstration agents, the National Grange, the American Farm Bureau Federation, several hundred teachers of vocational agriculture, the deans of thirty-seven colleges, and many radio stations.

The importance of radio in the marketing of farm products stood out as the pre-eminent interest in radio on the farm.

More than 46 percent of the replies gave specific examples of cash savings effected by the use of radio.

Sheep herders in Colorado, hog feeders in Iowa, corn raisers in Missouri, fruit men of New York, poultry men of Indiana, all contributed stories of dollars and cents saved through market reports.

Ninety-five percent of the farmer radio-owners think of their radio set as a utility as well as an amusement device, this survey disclosed. And not only do they think of it as a medium of useful information about the market (and market reports alone are of sufficient interest to justify many farmers in equipping their farms with receiving sets), but also for the weather reports, particularly in truck and fruit territory and for educating the farmers to take protective measures which save hundreds of thousands of dollars a year.

After they had established the fact that the farmer's first interest in radio was based upon its dollar-and-cents value to him, the investigators next started out to learn at what time of the day the farmer wanted his programs.

The tabulation of many thousands of replies left no doubt on this point. The farmer wants his market reports exactly at 12:00 o'clock noon and at exactly 7:30 o'clock in the evening. In certain sections of the country a 9:00 o'clock in the morning market report is desired.

The significance of all these facts is this:

The introduction of radio on the farm is making the farmer a business man.

Radio is teaching him what business men have long known—the importance of keeping in constant touch with the market, particularly with the prices of commodities in which he deals. Complicated machinery has been developed to supply this information to business men with the least loss of time: the ticker machine is familiar in every broker's office. Yet with all this development of machinery for disseminating market information, the farming interests—the largest industry in the United States, with a total capitalization of $78,000,000,000 with an annual turnover of about $11,000,000,000, —has limped along through the years without any adequate equipment for keeping the farmers informed concerning the prevailing prices on farm products.

Now the farming industry has found an instrument for filling this essentially practical need for quick information.

But the value of radio to the farmer as a business man has not stopped there. Broadcast weather reports now enable him to direct his farm operations on a plane heretofore denied him, eliminating many of the hardships and much of the loss to which the farmer was formerly exposed. The broadcasting of talks by farm experts as well as by leaders in the farming industry enable the farmer to keep in touch with men who can serve his interests, who can tell him of the new developments in industry, of new marketing devices, of new farm machinery, of new selling methods, of new production practices.

In other words, radio is making available to the farmer the advantages that the city business man enjoys from his Kiwanis, his Rotary, his Commercial and other club activities. It is even serving as an instrument through which farmers are holding mass meetings. The first radio-farmer mass meeting was held last winter by the American Farm Bureau Federation; community groups in twelve states adjacent to Chicago assembled before loudspeakers. A special program, with the national officers participating, was broadcast from station KYW, Chicago.

Actual returns from these local community meetings showed that more than 250,000 were in attendance at this single radio community meeting!

But while the farmer is making valuable use of his radio receiving set—making it a part of his farm equipment—he is not neglecting to enjoy with his city brother the entertainment value of his set.

Orchestral and band selections stand first on the list of pure entertainment. A surprising number of farmers registered objection to jazz. There was a general demand for more Hawaiian and old-time music.

The broadcasting of vocal selections are not popular; the few farmers who have expressed a desire for vocal programs are carefully discriminatory. Male quartettes are generally favored, while the soprano voice is generally

Association of Land Grant Colleges, Horse Association of America, the National Committee on the Relation of Electricity to Agriculture, the Farm Association (Fire Prevention), and other national groups of similar character. The program of the Council includes the making of area surveys, and of analyses of radio demand in the specific territory served by a broadcasting station, as well as the building of farm programs. President Coolidge is the Honorary Chairman of the Council.

J. C. Allen

Sets That Earn Money

TO THE EDITOR OF POPULAR RADIO:

"I find the value of radio on the farm is unlimited; it would be impossible to estimate in dollars and cents my profits made by its use. I sell my hogs by watching the market; also my cows. I plant my crops according to advice received from the speakers from the agricultural colleges; I figure the profits on my dairy by their cost-accounting plan, and even cover my garden when the radio warns me that a frost is due. My neighbors call in for this information, which I gladly give them."

—NED B. THORNE, *Kokomo, Ind.*

"I had planned marketing 36 hogs, averaging 200 pounds, on April 1, 1925. Information from station WOS influenced me to sell on March 23, when I received $1.00 more per cwt.

—L. V. SUTTON, Delhi, Iowa

"I had a crop of corn on hand and I heard over the radio that a large number of cars had been received at Chicago. So I thought I had better sell, and I did. The next day corn dropped in price 10 cents on the hundred pounds."

—T. E. PROCTOR, Sidney, Ohio

"Radio reported that hogs were due to drop in price in two days. I shipped at once and saved $150.00."

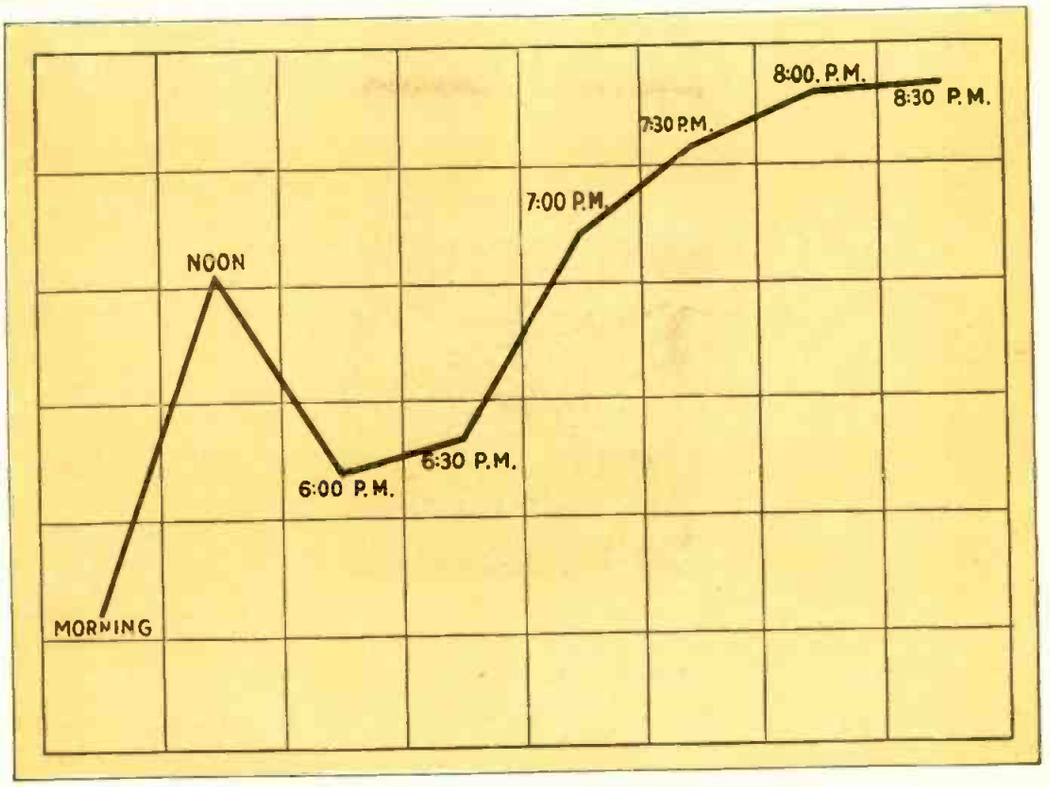
—MARVIN DRACE, Keytesville, Mo.

"Radio market reports have saved me money. I was selling 1,000 bushels of wheat when the market declined, on opening, six cents. I sold before our local market changed, saving $60.00."

—I. G. GALLOWAY, *Flaxville, Mont.*

"Radio market reports recently made me money, as I learned when to pick and ship a lot of tomatoes when the price rose for a day."

—WM. RAINEY, *Swedsboro, N. J.*



WHEN THE FARM AUDIENCE LISTENS IN

This graph is based upon 34,784 individual expressions of opinion from farmers in 45 states of the United States and one province in Canada. It shows fairly definitely when the program feature that is designed for the farm audience should "get on the air."

frowned upon among farm radio audiences.

News bulletins and current events are features that are in general demand.

Some interest is expressed in the broadcasting of plays.

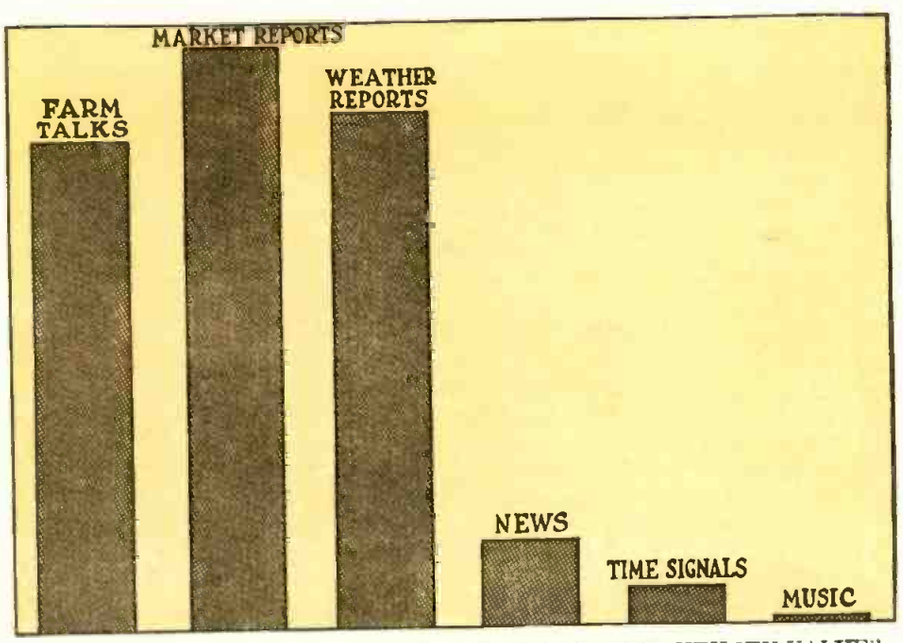
While there is some slight interest shown in church services, a goodly number protested against any broadcasting of church services at all, believing that such services can properly be held only within the four walls of a church building.

Farmers who enjoy listening to baseball, basket-ball and foot-ball games are just about equal in number to those who do not enjoy this particular feature.

The farm woman, the investigators disclosed, has her own particular interests in radio. About 50 percent of the farm women indicated that they tuned in regularly on Home Makers' programs. The New England housewives were the most inclined to listen in on the Home Makers' Hour, with the Cornbelt farm women running a close second.

After surveying the country to de-

(*Continued on page 542*)



PROGRAM FEATURES THAT HAVE "THE GREATEST UTILITY VALUE"

After asking the farmer what program features he found "most entertaining" (see the graph on page 524), the investigators asked in what ways he found radio most useful. The replies are tabulated on the above graph.

The New Freed-Eisemann "800" Receiver

WHEN the discriminating radio fan picks out a new receiver he wants to be sure to get a set that will meet his demands for good all-around reception with a minimum of trouble—that is, he wants it to give natural reproduction, to have a reasonable degree of sensitivity, selectivity and volume and to operate as easily as possible.

The new model Freed-Eisemann "800" receiver is a set that contains the features that this fan will demand of a radio receiver of the first class.

It has an exceptional sensitivity that makes it possible to use either a loop or a small indoor antenna; it has a great "maximum" volume that may be brought down to any desired volume immediately by means of a convenient control; and a fine, natural reproduction is obtained by means of a well-designed audio-frequency amplifier.

The operation of the receiver is simple; it is tuned by a single control that has a scale which is calibrated directly in wavelengths; and a voltmeter is mounted on the front of the receiver which is provided with a switching arrangement to make it easy to get an instantaneous check on the condition of the individual batteries at any time.

The "800" receiver uses eight tubes in all: four of the UX-201-a type, in the neutralized radio-frequency amplifier stages, a detector tube (UX-201-a or UX-200-a) and three tubes in the two stages of transformer-coupled audio-frequency amplification. These last three tubes are of the UX-201-a type.

The second and third audio-frequency amplifier tubes are connected in parallel and are thus capable of handling, without distortion, the great volume that is developed in the receiver. The same end may be attained by using a power tube, such as the UX-171, in place of the seventh tube and leaving the eighth socket empty.

The use of four stages of radio-frequency amplification is an achievement that was considered commercially impossible a year ago. At that time great difficulty was encountered in obtaining a high efficiency per stage combined with stability, even in a two-stage radio-frequency amplifier. Now, with four stages, the efficiency per stage is as great as that which was obtained previously with fewer stages with the result that the over-all radio-frequency amplification is greatly increased. In addition, the amplifier is perfectly stable and cannot oscillate or radiate.

The big problem in the development of the amplifier is the elimination of interaction between stages. Interstage coupling between coils, through the tubes and through the battery leads is the factor that had to be eliminated. When only one or two stages of radio-frequency amplification are used, a partial elimination of this coupling is all that is necessary. The usual practice has been to eliminate just enough of it to prevent actual oscillation.

Recent developments have demonstrated the practicability of eliminating this harmful coupling to such an extent that additional stages may be used with stable operation and great gains in sensitivity. This has not been a simple matter by any means and in the case of the "800" receiver many months' work was necessary before the proper solution was found.

The high degree of amplification that is obtained means extreme sensitivity that is practically uniform throughout the entire broadcast wavelength band.

To attain this great sensitivity it was necessary to provide metallic shields, in the form of copper boxes, that completely inclosed each individual radio-frequency amplifier stage. Additional shields were provided to isolate each tube and coil from the variable condensers, thus making a shield within a shield. Finally, to further isolate the parts and to prevent interstage coupling through the batteries, filters were placed between each stage and the batteries themselves.

The detector tube circuit required the same precautions as the preceding stages. In fact, greater care was required here because of the proximity of the loop (the input to the radio-frequency amplifier) and the detector (the output of the radio-frequency amplifier), which made the feed-back tendency greatest at this point. This difficulty was overcome by providing extra shielding for the detector circuit.

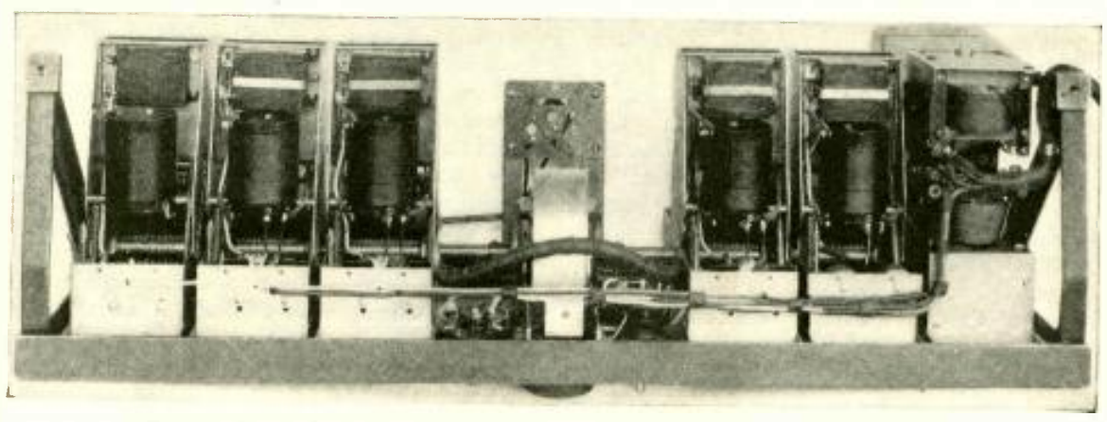
A partial idea of the sensitivity of this receiver may be obtained from the following log of stations that were tuned in during a warm summer's evening.

A partial list of stations that were tuned in during the evening of June 26, in New York City using a Freed-Eisemann "800" Receiver.

WOR	217	Chicago, Ill.
WBBM	226	Chicago, Ill.
WBAL	246	Baltimore, Md.
WNJ	252	Newark, N. J.
WGCP	252	Newark, N. J.
WRNY	259	N. Y. C.
WEAR	389	Cleveland, O.
WREO	286	Lansing, Mich.
WHAR	275	Atlantic City, N. J.
WPG	300	Atlantic City, N. J.
WLIB	303	Chicago, Ill.
WGBS	316	N. Y. C.
WJAZ	330	Chicago, Ill.
WMCA	341	N. Y. C.
WWJ	353	Detroit, Mich.
WJJD	370	Moosehart, Ill.
WEBA	370	Chicago, Ill.
WGY	380	Schenectady, N. Y.
WTAM	389	Cleveland, O.
WHT	400	Chicago, Ill.
WOR	405	Newark, N. J.
WCCO	417	Minneapolis, Minn.
WSB	428	Atlanta, Ga.
WLW	422	Cincinnati, O.
WQJ	447	Chicago, Ill.
WJZ	455	N. Y. C.
WCAP	469	Washington, D. C.
WEAF	492	N. Y. C.
WIP	509	Philadelphia, Pa.
WJR	517	Detroit, Mich.
WOAW	526	Omaha, Neb.
KSD	545	St. Louis, Mo.

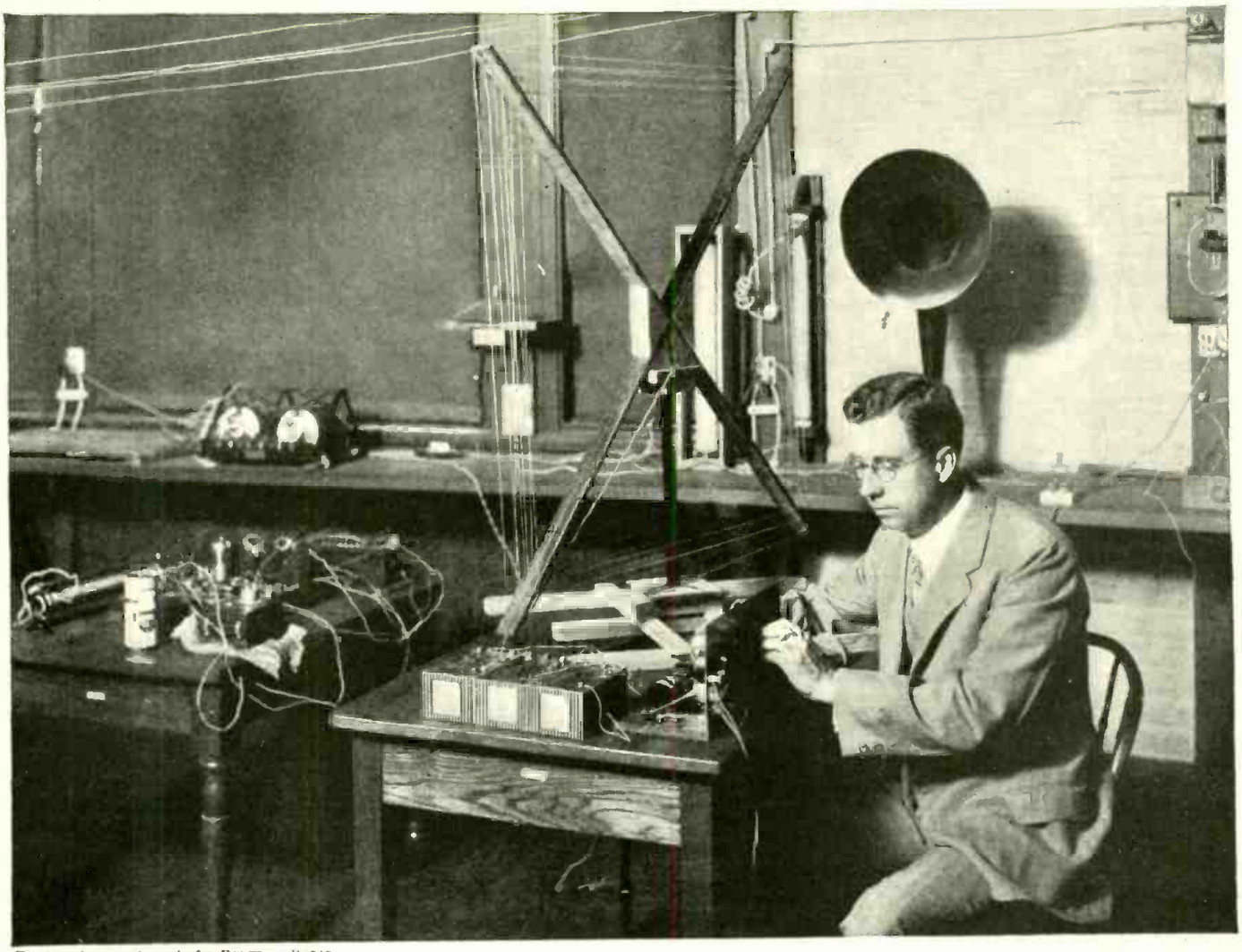
In addition to great sensitivity, a multi-stage radio-frequency amplifier has the advantage of a high degree of

(*Continued on page 580*)



A VIEW OF THE WORKING UNITS WITH THE SHIELD TOPS REMOVED

FIGURE 6: *This view of the inner parts of the Freed-Eisemann "800" receiver shows the coils and condensers in their separate cans. Notice that the wiring is neatly cabled. The whole unit is mounted on a steel chassis.*



From a photograph made for POPULAR RADIO

HOW A FADING RECORD IS MADE

This set-up includes a loop that picks up the signals from the distant transmitter and a calibrated receiver that determines the signal strength of the wave at various intervals. The direction of the wave is determined by rotating the loop to find where the signals are loudest.

WHY SIGNALS FADE

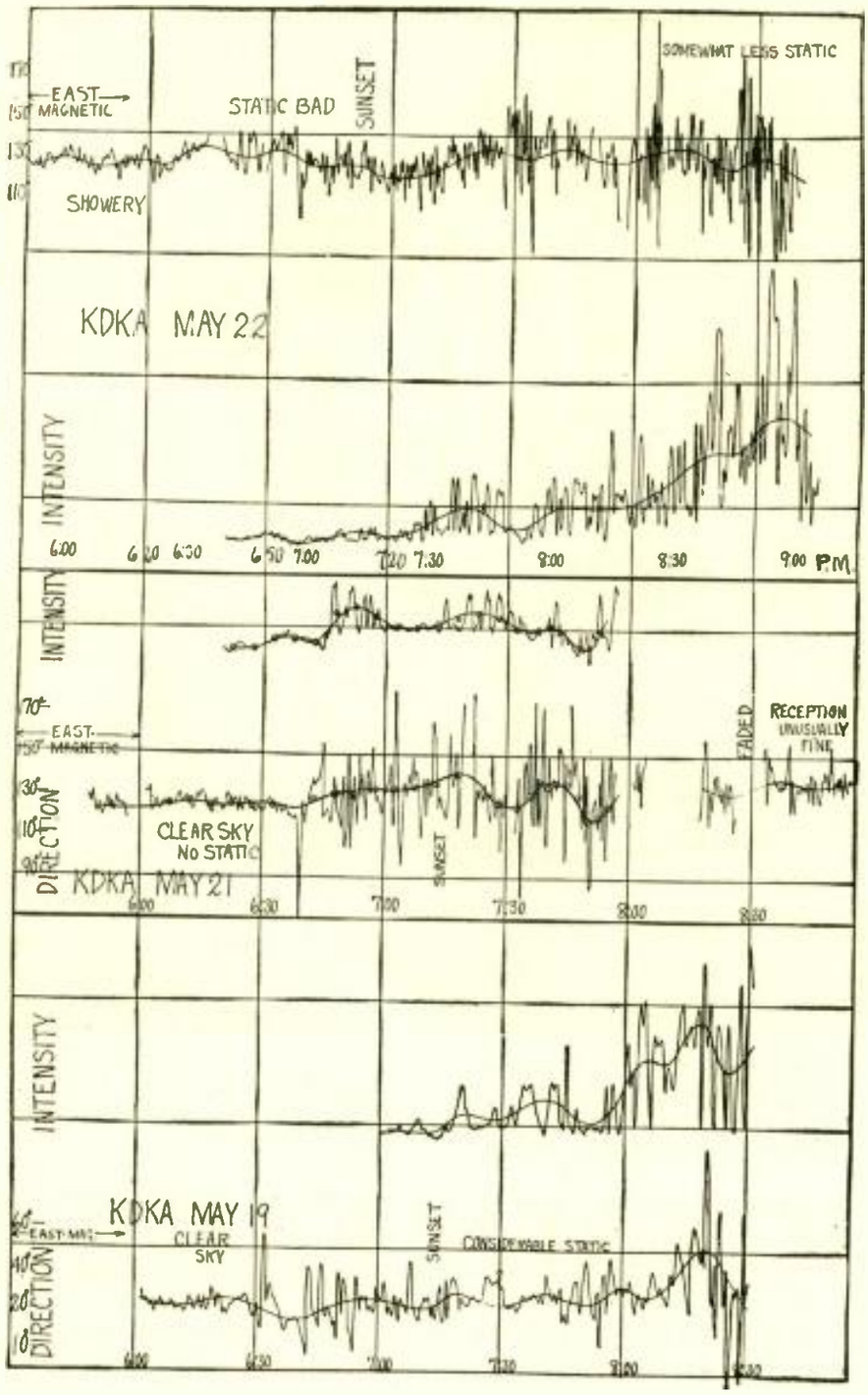
The under surface of the Heaviside Layer is not smooth, like a mirror. On the contrary, the recent studies of Breit, Hurlburt and others in America and of Appleton, Smith-Rose and others in England, have shown that it is corrugated or billowed, like waves on the sea or like an irregular cloud layer in the sky. The searching study of fading which Professor Bidwell describes in this article brings new support to these ideas. Much fading, if not all of it, turns out to be due to these irregularities of the Heaviside Region.

By CHARLES C. BIDWELL

FOR several years the U. S. Bureau of Standards has been accumulating data on fading and has been assisted by observers scattered over the country, particularly in the college and university laboratories.

In a recent report on these co-operative tests, some interesting correlations were pointed out, particularly with regard to the sunset effect or the changes occurring in the transition from daylight to dark. About an hour before sunset there usually occurs a rise in the average intensity of radio signals, then a drop at sunset and a rise to a first maximum about an hour after sunset. During the night the average intensity varies but shows its greatest value about two hours before sunrise. The sunrise effect is similar to the sunset effect but reversed. The amount of fluctuation is closely related to the average intensity. During the pre-sunset intensity rise, wide fluctuations in intensity occur, while just at sunset when the intensity has dropped, the fluctuations disappear. With the increase in night intensity, the fluctuations again increase, both in rapidity and amplitude.

As a result of the widespread distribution of observers over the country, the interesting discovery was made that fading does not increase continuously



FADING RECORDS FOR THREE DAYS

FIGURE 1: *These three sets of curves show the variations in the intensity of signal strength and in direction for a given station (KDKA). The data from which the curves were plotted were taken in the late afternoon and early evening of three different days. It should be noted that the intensity fluctuations are superimposed upon a gradually increasing intensity of signal strength as night comes on.*

with the distance, but that there are zones where the fading is less alternating with zones where the fading is greater. Thus a listener may hear a distant station much better than a nearer one, because he is in a favorable zone for the distant station but in a zone of fading for the nearer one.

In connection with a series of these tests a record of direction changes was obtained at Cornell University, supplementing the intensity measurements. These are the only long continued direction measurements taken simultaneously with intensity measurements and repeated over a series of tests. As the results, shown graphically, indicate rather striking correlations, it is of interest to explain how these data were obtained.

For the purpose of the tests a continuous audible note or whistle was broadcast by either station KDKA or WGY beginning at 5 P.M. and lasting until the regular evening program, thus giving continuous broadcasting through the transition from daylight to dark. Direction measurements were obtained with a three-foot loop of twelve turns mounted with a protractor scale and pointer and connected to a four-tube regenerative receiving set which permitted the use of a loudspeaker. After tuning to the desired station, the coil was rotated until the signal disappeared or was reduced to a minimum. Settings were obtained in this way every half minute, or every fifteen seconds when the fluctuations were very rapid. No special refinements were necessary as settings were usually sharp and certain within one degree. With the regular broadcast program of music or voice, settings for minimum were much more difficult than with the earlier sustained note and it was found advisable to tune off slightly, or heterodyne with the carrier wave, thus bringing in a sustained beat note similar to the note directly broadcast earlier. The intensity could be adjusted by the regeneration so that the note would just disappear at the minimum setting. Readings once started were continued usually for four hours, beginning with broad daylight and extending through the sunset period and well into the night.

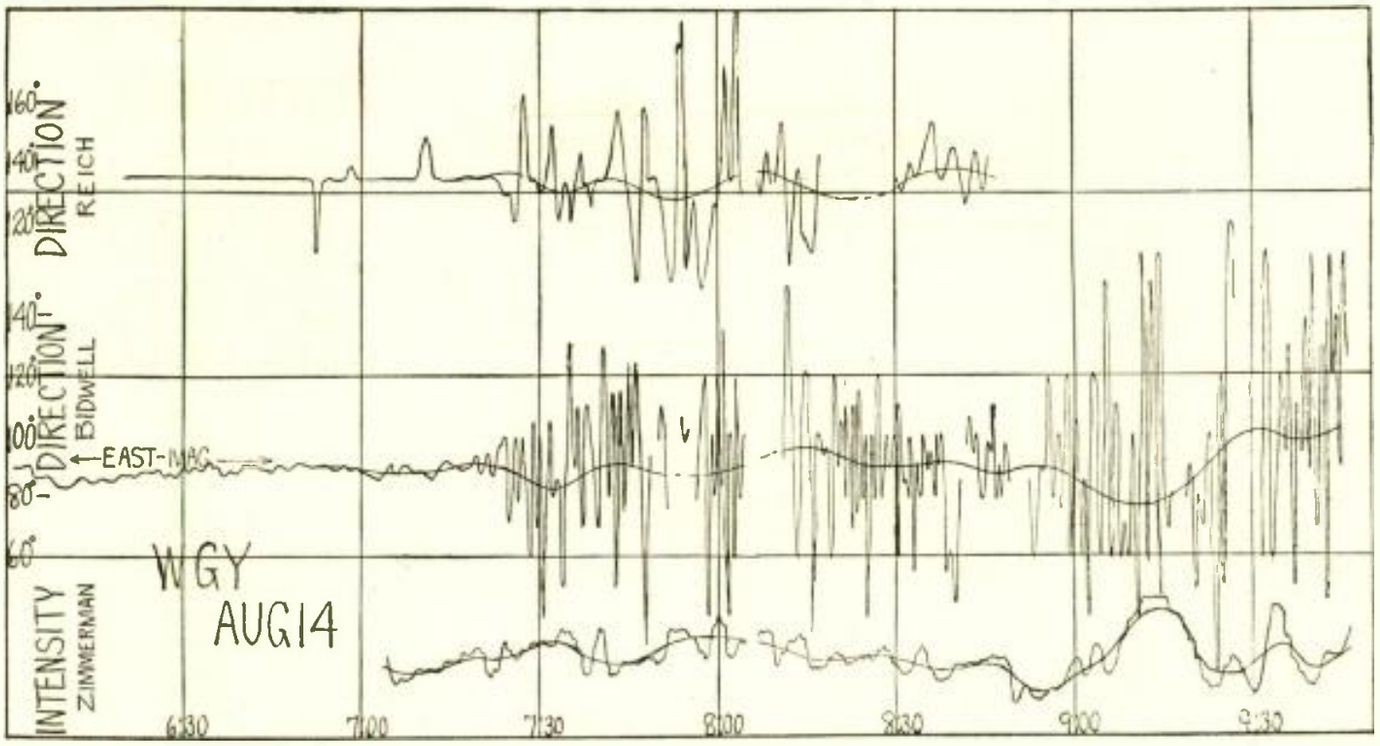
Intensity measurements were made by means of a sensitive galvanometer connected to the output of a five-tube neutrodyne. The galvanometer pointer was made to play over a drum which was rotated by clockwork, winding up a strip of paper. Seconds were automatically recorded on the strip and intensity records obtained by following the pointer positions with a pen especially mounted to swing across the drum. To avoid interference the direction measurements were taken in the country about one mile from the station at which the intensity work was done. On two occasions an additional direction record was obtained by another observer at a third station four miles away.

The records reduced to the same time scale are shown for five different days in Figures 1 and 4.*

These plots show the gradual increase in the amplitude of the direction swings as one passes from daylight to dark and also the increase in intensity and in the intensity fluctuations over the same period.

In Figure 1 it will be noted that the intensity fluctuations are superposed upon a gradually increasing intensity as night comes on. For the direction record the vertical scale gives protractor or compass readings, the direction of magnetic east being indicated on the chart. On the record for May 22nd, for example, the reading for the axis of the coil, when set for a minimum, was

*Figures 1, 2, 4 are reproduced from Journal of The Franklin Institute, Vol. 201, No. 1, 107-112, 1926.



HOW THE DIRECTION OF SIGNALS FROM ONE STATION VARIED IN AN EVENING

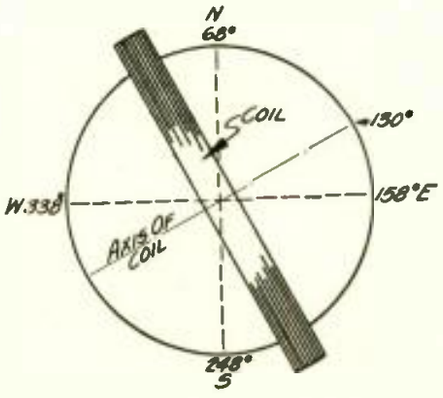
FIGURE 2: *The two upper curves, made by two different investigators, were taken on the evening of August 14; they show how broadly the direction of signals varies over short periods of time. The bottom curve gives the variations in the intensity of signal strength for the same station; it covers the same period of time.*

about 130° whereas when the axis pointed east and west its reading was about 158°. Thus the signals (see Figure 4) were coming from a direction about 28° south of west, which was the direction of Pittsburgh from Ithaca.

There is no clear correspondence between the very rapid direction and intensity fluctuations. Indeed the direction changes are at times so rapid that it is impossible to follow all of them. The plots give, however, an indication of the amplitude of these changes. If average intensity and average direction over five minute intervals are plotted there then comes into view a striking correspondence between direction and intensity. These average values are shown in the wavy lines drawn through the plots.

In the records of May 19th, 21st, 22nd, and 25th, the curves correspond, crest to crest and trough to trough throughout, while in the records of May 27th and Aug. 14th the correspondence is between crest and trough. The plots show a fading from maximum to minimum in a period of ten or fifteen minutes definitely associated with a direction shift of five or ten degrees to the north or south.

We can only speculate as to the meaning of these corresponding intensity and direction of fluctuations. A disturbance leaves the wave presumably traveling with equal velocity in all directions above the earth's surface. The portion of the wave which travels along the earth's surface, however, is retarded by the greater refractive power of the lower atmosphere and is continually bent toward the ground. The lower portion of the wave (the so-called ground wave), seems to be rather rapidly absorbed, for it persists only for a short distance from the transmitter. The upper portion is reflected back to the earth from the Heaviside layer. This is an ionized or electrically conducting layer at a height which probably varies but is estimated at about 100 miles above the earth's surface. This ionization is probably due to the absorption of the energy of the ultraviolet in the sun's rays leading to the release of electrons from the molecules to which they are normally bound.



HOW THE LOOP WAS CALIBRATED

FIGURE 3: *To determine the variation in the direction of the signals that were received at the observation station the loop was calibrated in degrees, as shown above. Settings were obtained every half minute, or every 15 seconds when the fluctuations were very rapid.*

In the daytime the whole atmosphere is thus to some extent ionized, or filled with negative electrons and positively changed molecules or ions. The energy of an electric wave is quickly absorbed or converted to energy of oscillation of these charged particles and ultimately to heat. Thus poor daylight transmission is explained. After sunset the slight ionization in the lower atmosphere quickly disappears owing to recombination, but in the upper layers the condition persists due to the rarity of the atmosphere and the more complete ionization which must exist there. Radiation will be reflected from the lower surface of the ionized layer just as light is reflected from the surface of a differently refracting medium.

At the distance of Ithaca from Pittsburgh the ground wave has faded out, and we are dealing only with the reflected wave. The intensity and direction changes which we have been discussing are therefore apparently associated with the varying level or the billowing of the reflecting surface.

Recent and conclusive evidence of the existence of the reflecting surface has been obtained by Dr. G. Breit of the Department of Terrestrial Magnetism of

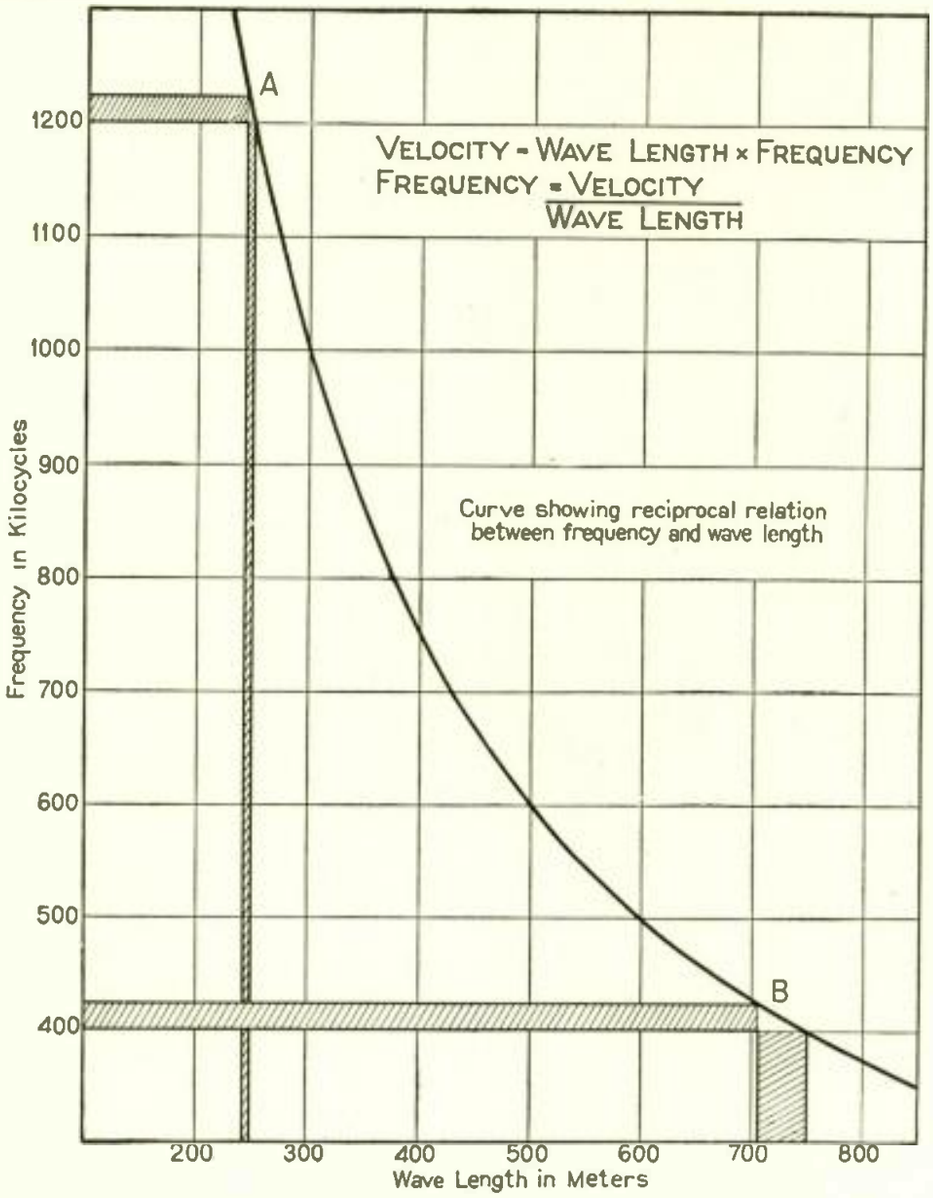
(*Continued on page 538*)

Why the Standard of Wa:

"Wavelengths"

Do you know what these really mean, how they simple relationship that This article answers these that goes with it enables diately just what wave- given

By J. O. PERRINE



THE RELATIONSHIP BETWEEN WAVELENGTH AND FREQUENCY

FIGURE 1: *From this curve it will be seen that a range of 25 kilocycles at the high frequencies covers only a small wavelength band, as shown at A. At low frequencies the same frequency range covers a much greater wavelength band.*

LONG before the invention of the radio telegraph and radio telephone, scientists and engineers were conversant with the problems of sound and light. For many years each had been recognized as a vibratory phenomenon.

In the study of sound, the vibrations of tuning forks were readily visualized and one could actually see the bass string of a musical instrument execute its back-and-forth motion. On the quantitative side, studies in sound were based on measuring a distance and also measuring a frequency. However, the term "frequency" became the more common term when thinking and speaking about sound phenomena, probably because the small number of vibrations per second could easily be imagined.

In the study of light, however, which is an electromagnetic wave phenomenon of exactly the same nature as radio, the very high frequencies were not easily visualized. Furthermore, quantitative studies in light were the result of measurements of distance or angle, and not of frequency. Differences in path which the light traveled were used to explain known phenomena of interference and diffraction. In these explanations the wavelength of light entered the geometrical drawings and not the frequency. Hence the term "wavelength" became the prevalent term in the study of light.

In the early history of radio, as in the early history of most sciences, the qualitative side received practically all the attention. Great interest and thrill in the fundamental visual and aural phenomena, together with the ease with which results could be obtained, precluded serious attention to the quantitative side. With the progress of radio and its entrance of the engineering field, quantitative measurements became necessary. In these measurements neither distance nor frequency were factors actually measured, but rather a resonance and tuning phenomena was used, from which calculations for either wavelength or frequency could be made. In the phenomena of resonance and tuning, the concept of frequency was more satisfying to one's imagination than the concept of wavelength. This consideration, together with the electrical engineers' general aptitude and desire to talk about alternating currents in terms of frequency, made it an accepted term.

In radio broadcasting sound waves and electromagnetic waves both are important factors. In talking about the voice, music, musical instruments and the ear, it was natural to use the term "frequency."

On the other hand, the tradition of wavelength in electromagnetic phenomena persisted, so that, in speaking of radio, the term "wavelength" was used. The question arose, therefore, as to which term would be more generally acceptable.

As has been pointed out, frequency and wavelength are both readily understandable concepts and after repeated use each may be used with equal facility. To say that "one term is more scientific than the other" means nothing. A choice between them, therefore, must be found in such considerations as the following:

The sounds of speech and music cover a range of frequencies extending from about 20 cycles per second to over 5,000 cycles per second (5 kilocycles). When these frequencies are superposed on the radio carrier frequency the antenna no longer radiates a single frequency but a band of frequencies.

For example: if the radio carrier frequency were 500,000 cycles (500 kilocycles), then during the transmitting of a program the frequencies radiated would extend from 495 kilocycles, (500-5) known as the lower side band, to

Measurement Is Changing from

to "Frequencies"

commonly used terms are calculated and the exists between them? questions—and the chart you to determine immelength corresponds to a frequency.

505 kilocycles (500+ 5), known as the upper side band.

In terms of wavelength, this means that instead of the station radiating a 600 meter wave, it would radiate wavelengths ranging from 606 to 594.

For all broadcasting, therefore, we need a range of frequencies rather than a single frequency and for "high quality" broadcasting this range of frequencies should be at least 10 kilocycles. In any particular locality each broadcasting station must have an ether channel of at least 10 kilocycles for its exclusive use.

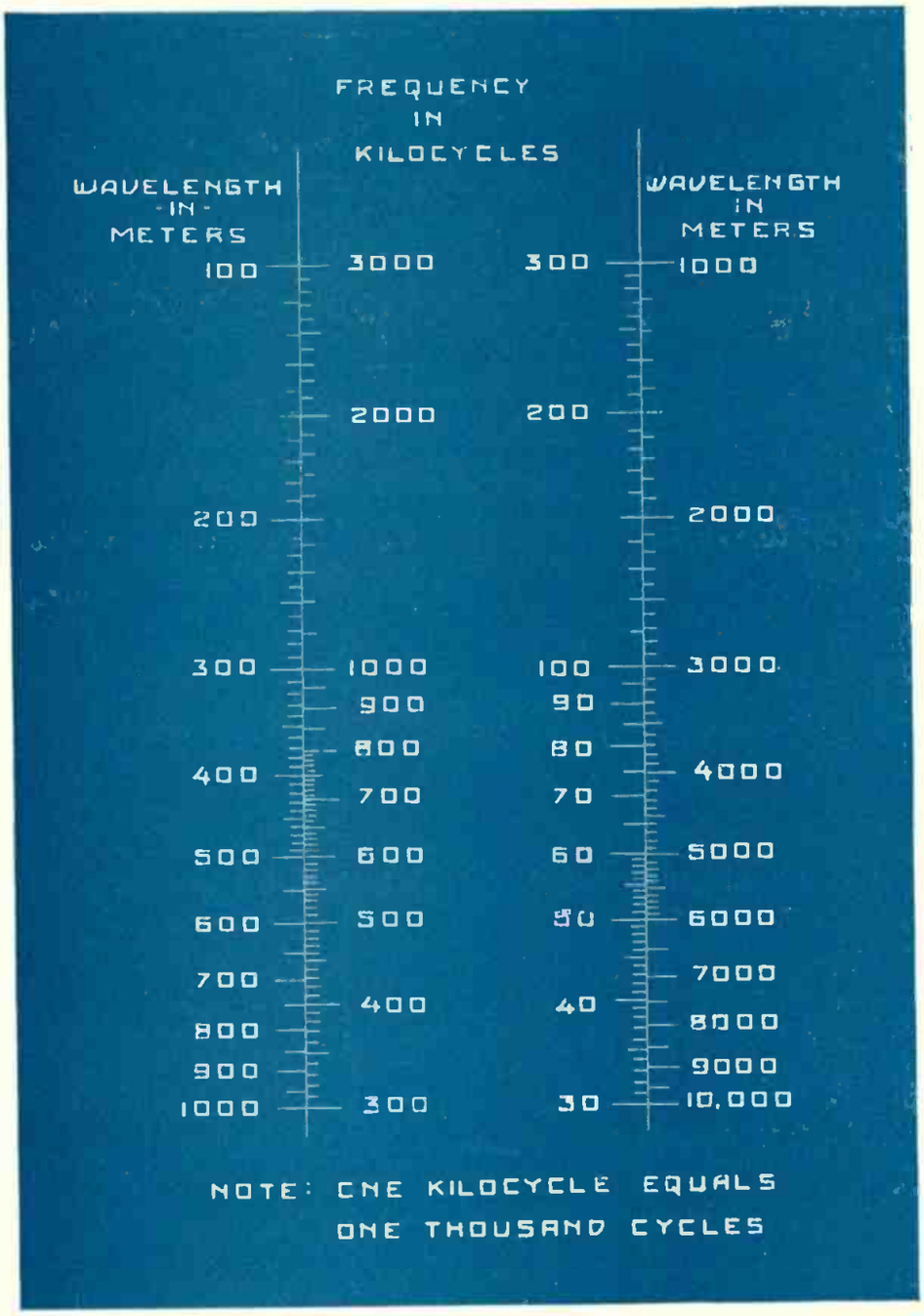
It does not follow that the wavelength requirements of a broadcasting station can be so simply stated because wavelength and frequency are related in a reciprocal manner. A simple equation applicable to all wave phenomena states that the velocity of propagation equals the product of wavelength and frequency.

Putting it a different way, frequency equals the velocity divided by wavelength. This statement connotes the reciprocal relation.

In the accompanying chart (Figure 1), the radio frequencies have been plotted on the vertical axis and wavelengths on the horizontal axis. Curiously enough, instead of the resulting line being a straight line it is a curved line; in fact, using the language of the geometrician, it is a hyperbola. It is in this curved line that we will find the answer to the problem before us.

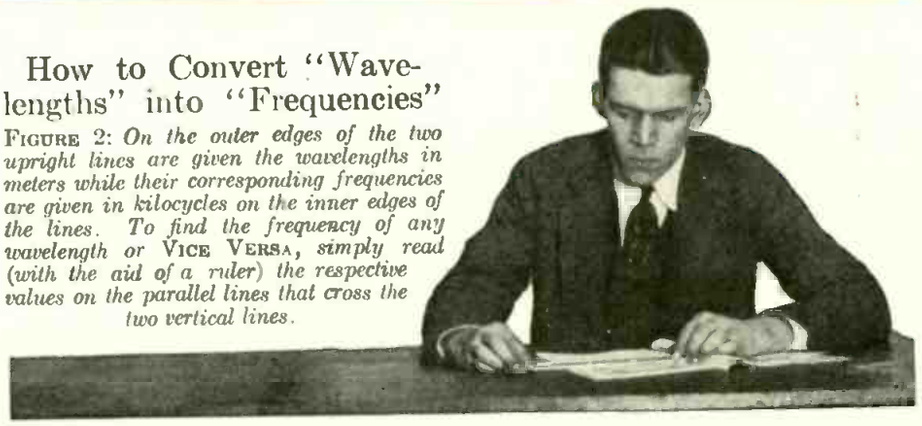
The reciprocal relation means in the first place that high frequencies correspond to short wavelengths and low frequencies to long wavelengths, and in the second place, that if the frequencies are changed by a fixed amount, the wavelength changes resulting are not equal.

This point is well illustrated in the accompanying chart which shows that a range of 25 kilocycles from 1,200 to 1,225 (see A) corresponds to a range of wavelengths from 250 meters to 243 meters, only 7 meters different. At 400 kilocycles (see B) a range of 25



How to Convert "Wavelengths" into "Frequencies"

FIGURE 2: *On the outer edges of the two upright lines are given the wavelengths in meters while their corresponding frequencies are given in kilocycles on the inner edges of the lines. To find the frequency of any wavelength or* VICE VERSA, *simply read (with the aid of a ruler) the respective values on the parallel lines that cross the two vertical lines.*



kilocycles means a range from 750 meters to 705, a difference of 45 meters. A 25 kilocycle range at a particular carrier frequency corresponds to an entirely different range of wavelengths than at some other carrier frequency.

Contrary to popular impression, there are actually fewer radio broadcasting channels at long wavelengths than at short wavelengths. There is a greater range of wavelengths, to be sure, but wave range is not the real criterion; frequency range is the real criterion.

In other words, the ether channel requirements of all broadcasting stations

(Continued on page 544)

WITH THE EXPERIMENTERS

CONDUCTED BY LAURENCE M. COCKADAY

A Chart of Wire Sizes for Use in Winding Coils

HERE is a chart that has been prepared to help the experimenter solve rapidly and accurately some of the problems that he encounters in the design and winding of coils.

The number of turns to the inch that a given size of wire will occupy; the size of wire on a given coil, when the length of the coil and number of turns are known and the number of turns of a certain size of wire that must be used to wind a given length of coil—these useful points may all be determined quickly by the use of this chart.

The horizontal lines give the length of the coil in inches. The scale at the top is graduated according to the sizes of wire, and the scale at the bottom is graded according to the number of turns.

To find the number of turns to the inch of a given size of wire, follow the line representing the wire size down to the point where it meets the horizontal line, corresponding to the length of coil, in this case, 1 inch. It will be found that by consulting the bottom scale, the number of turns may be read directly.

EXAMPLE: How many turns of number 26 DCC wire are there to the inch?

Following the 26 DC wire down we find that it intersects the horizontal line at approximately 42, the number of turns to the inch.

To find the size of wire on a given coil when the coil length and number of turns are known, find the point where the horizontal line, representing the coil length, intersects the vertical line, representing the number of turns, and read off the wire size by following the nearest oblique line to the top scale.

EXAMPLE: The length of the coil is known to be 2½ inches and the number of turns, 70. What is the most convenient size wire to use?

Following the two lines mentioned above on the chart, the point of intersection is found to be directly upon the line which leads to 20 DS on the top scale, the size of the wire.

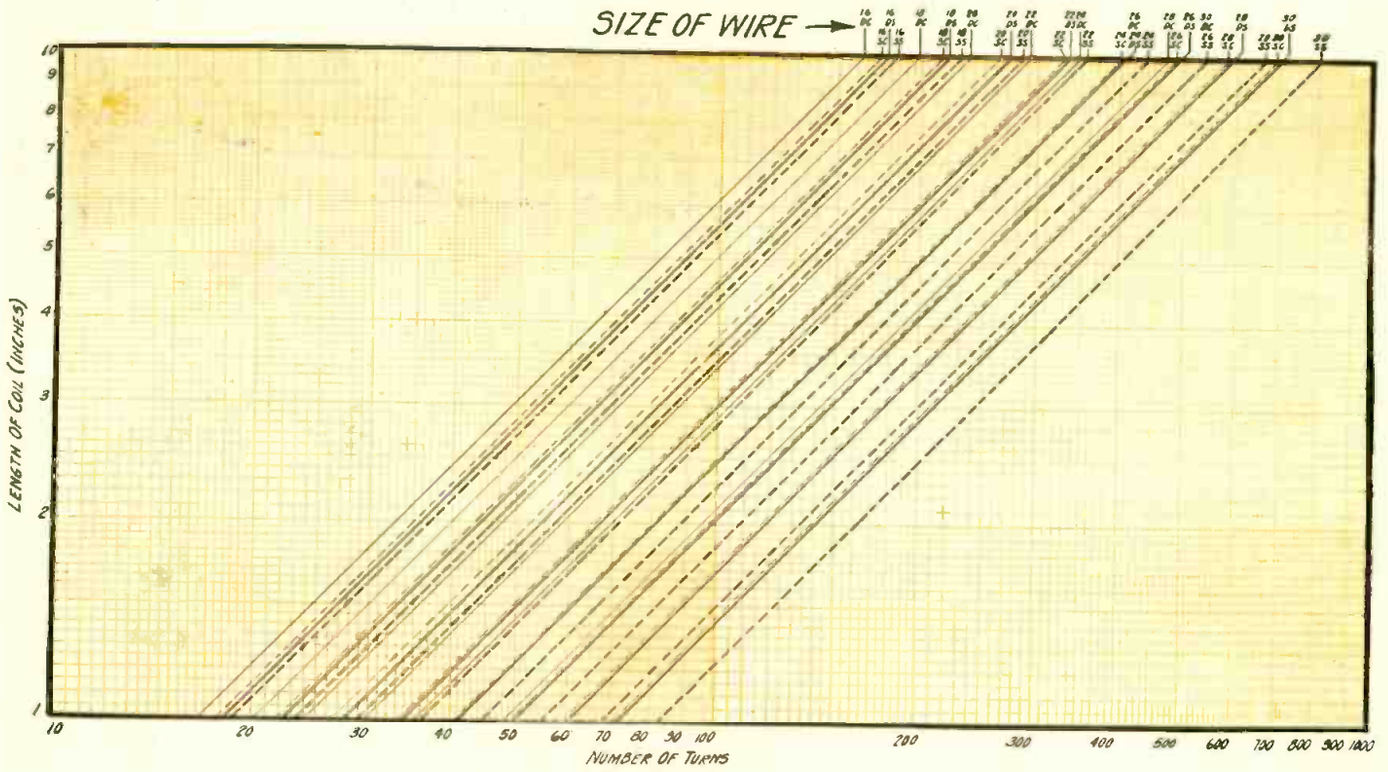
To find the number of turns of wire of a given size that must be used to wind a coil of a given length, note the point where the horizontal line representing the length of the coil cuts the oblique line representing the coil size and follow the nearest vertical line down to the bottom scale where the number of turns may be read off.

EXAMPLE: How many turns of number 30 SSC wire are to be used to wind a coil 1¼-inch long?

Following out the two lines, the intersection is found to read approximately 105 turns. As it is slightly to the left of this value, however, a much closer figure will be found to be 104 turns.

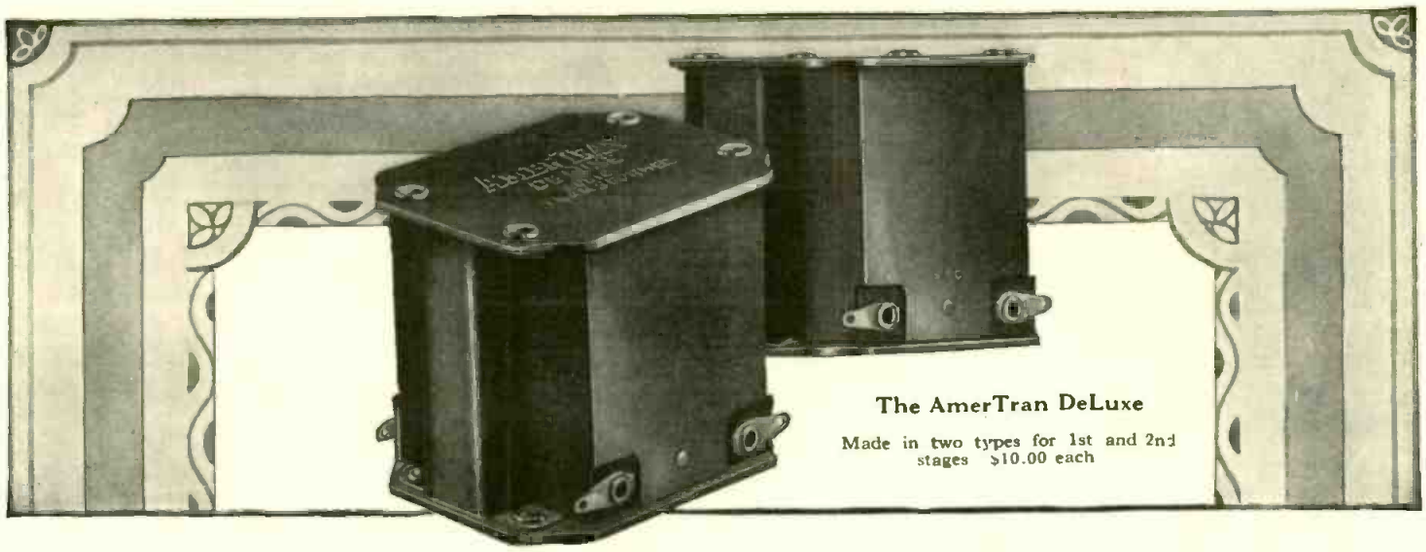
It will be noticed that the chart will give any convenient length of coil from 1 to 10 inches. If it is desired to use

(*Continued on page 565*)



A CHART THAT WILL HELP TO SOLVE YOUR COIL PROBLEMS

FIGURE 1: *All that you need to do is decide upon the size of wire and the number of turns and this chart will give you the length of the coil in inches. Or, if you want a coil of a certain length and a certain number of turns, the chart will show the size of wire that you must use.*



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Made in two types for 1st and 2nd stages $10.00 each

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Standing out prominently among recent developments toward better reproduction, the AmerTran DeLuxe sets an entirely new standard of audio amplification.

Here is an audio transformer which reproduces the deep boom of the bass drum, the roll of the pipe organ and the lowest tones of the bass viol with startling realism, at no sacrifice of the highest sounds within the audible range. Used in connection with the new cone speakers and new tubes these transformers amplify uniformly over the entire audible range. The approach to absolute perfection is so close that the human ear is unable to note further improvement.

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This is a scientifically designed impedance or choke coil of general utility, designed primarily for use in filter circuits. As an output impedance for by-passing direct current from the loudspeaker it is both efficient and economical

$6.00 each

The AmerTran Power Transformer and the AmerChoke are the result of over twenty-five years experience in transformer building. They are among the finest units available for the construction of a power supply of the better type. The Power Transformer has filament supply windings for the rectifying tube and furnishes sufficient plate current, after rectification, for the operation of the set.

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AmerTran Audio Transformer types AF-7 and AF-6 have been considered for years among the leaders in audio amplification. These popular and efficient models may now be purchased at a considerable saving in cost. Types AF-7 (ratio 3½:1)—AF-6 (ratio 5:1) $5.00 each

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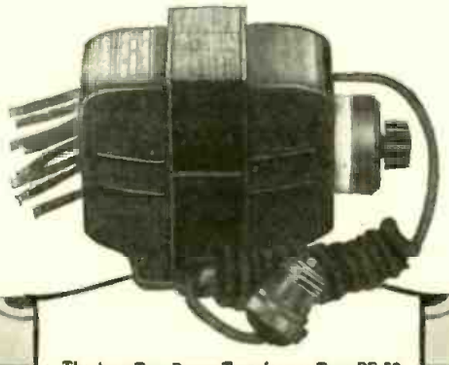

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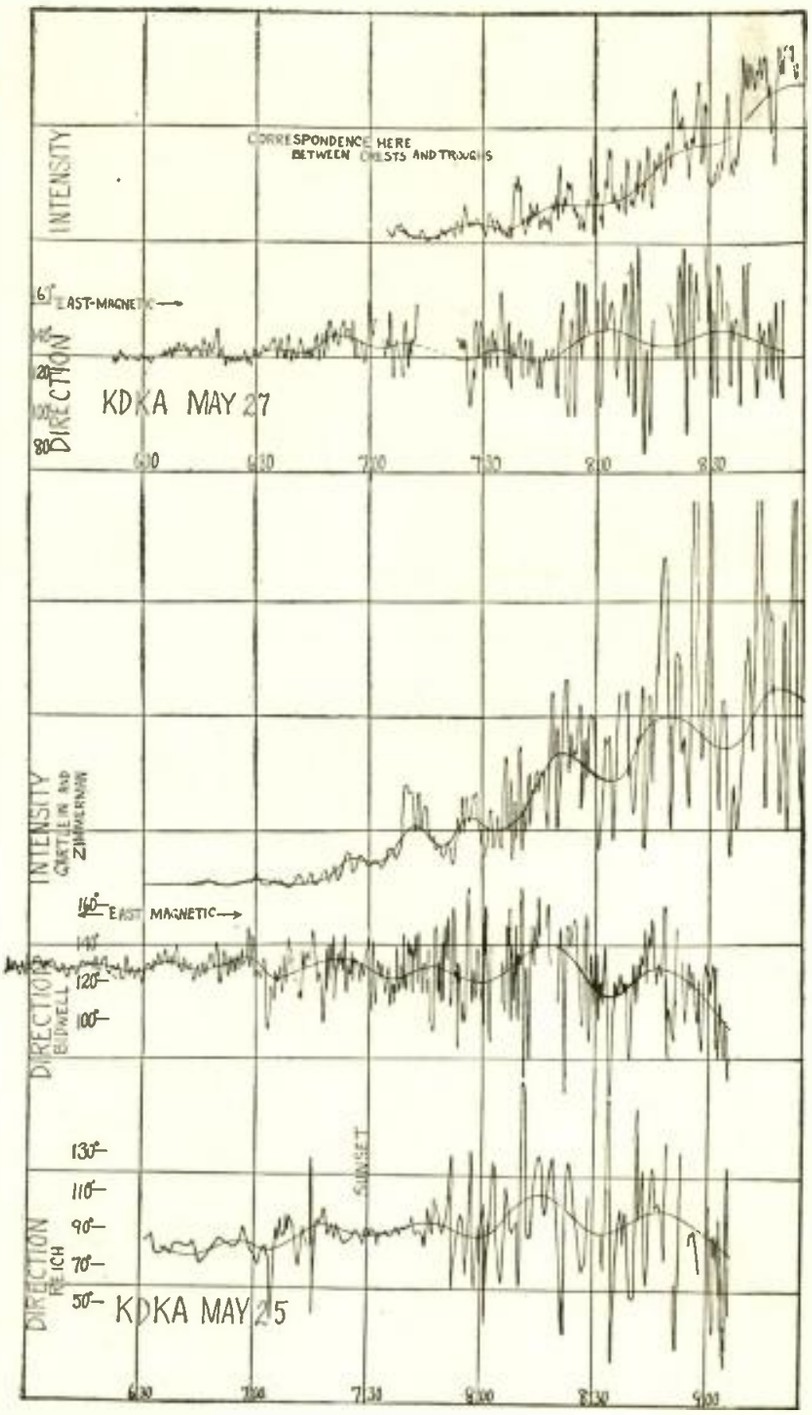
The AmerTran Power Transformer Type PF-52 Type PF-52 is intended for use in the best power supply developments. It will convert the standard 110 volt, 60 cycle alternating house lighting current to a higher voltage for the plate and low voltages for filament supply. $18.00 each.

Why Signals Fade

(Continued from page 533)



ANOTHER FADING RECORD FOR STATION KDKA

FIGURE 4: *The supplementary data on variations in direction and signal strength from this station were obtained in experiments made several days after those recorded in Figure 1. The direction experiments were taken at a station about a mile distant from the station at which the intensity measurements were taken in order to avoid interference. In cases where two direction measurements were made simultaneously, a third station, four miles distant from the first station, was used.*

the Carnegie Institute of Washington. An oscillograph record obtained on a rapidly moving photographic strip of 500 cycle note showed two waves of the same frequency superposed but displaced, the displacement of the fainter wave corresponding to an increased path of about 200 miles. Since the receiving station was only about seven miles from the transmitter the height of the reflecting layer thus appears to be about 100 miles.

Radio for "Telling the Future"

IN *the previous number of* POPULAR RADIO *Dr. E. E. Free told about quack doctors who use radio terms to impress their patients; in the next article he will tell of the fakers who employ radio apparatus as part of the "come-on" for fleecing their credulous victims.*

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Chief Engineer Station WEMC

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Photo shows Graduate E. F. Spadoni in his own Radio store at Chicago, Ill. "Your course gets the credit," says Spadoni.

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Make more money quick when you take up this practical course. I show you how to increase your earnings almost from the start of your course through practical pointers I give you.

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And when you graduate, my big Free Employment Department helps you get the job. You get just the same preparation and assistance toward success we gave C. C. Gielow, Chief Operator of the Great Lakes Radio Telegraph Co., E. W. Novy, Chief Operator of Station WRNY, Erle Chambers, Radio Engineer for Stewart-Warner, J. E. Fetzer, Chief Engineer of Station WEMC. The National Radio Institute, established 1914, today offers you the same opportunity these men had under a bond that guarantees you full satisfaction or money refunded. It's your big chance to get into the great Radio field—mail coupon TODAY for my big Free Book and proof!

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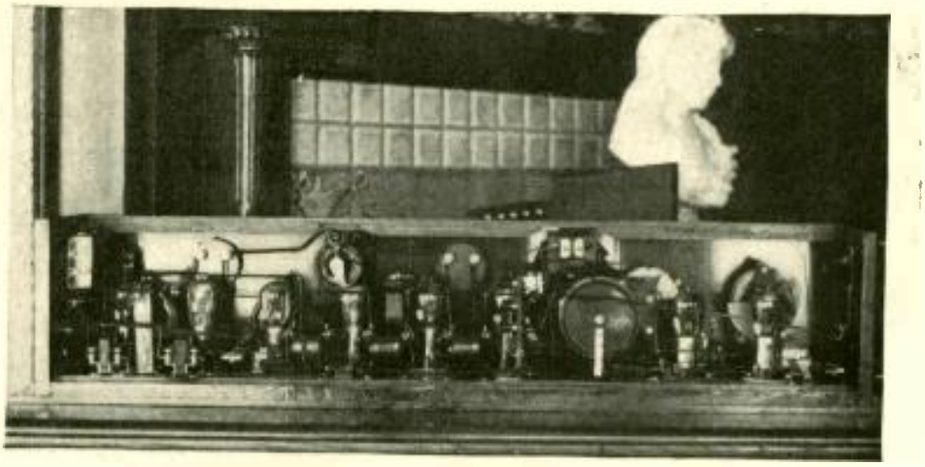
Street Address.....

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

The Radio Road Hog

(*Continued from page 521*)

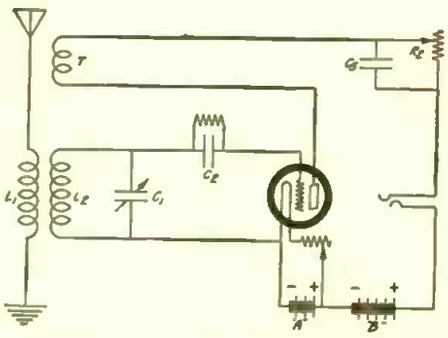


HOME-BUILT SUPERHETERODYNES MAY CAUSE TROUBLE TO OTHER LISTENERS

If the oscillator is coupled too closely to the input circuit or if an outdoor antenna is used, the oscillations set up by this receiver may be radiated into the antenna and may cause serious trouble.

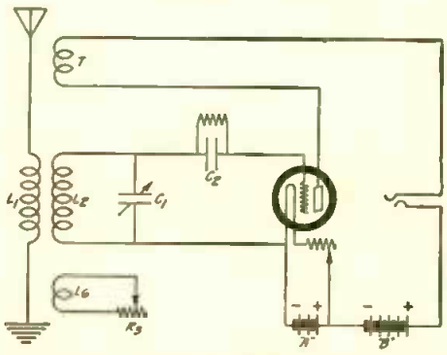
Also either one of these two arrangements may be installed in a set without any serious change; it is necessary only to fix the moving tickler coil in a stationary position, locate the variable resistance in a convenient place on the panel, and carry out the tickler connections as shown, to include the resistance, either in parallel or series with the tickler coil. Change of setting of the variable resistance has little effect on the position of the other dials in the set. This is the simplest method of converting a circuit into a smooth handling receiver, as it includes no major changes of any sort.

Figure 7 illustrates a newer method, but one that works satisfactorily not only in control of regeneration but also in control of volume, as it will furnish a smooth graduation of output from a maximum down to a faint whisper. In this diagram, L2 is the usual secondary coil and T is the usual tickler coil which is in stationary inductive relation with L2. The tickler T is connected in the usual manner, one end to the plate and the other is the output (to phones or primary of the audio-frequency transformer). A third coil, L6, located between L2 and T, on the same form, consists of one turn of loop wire and is shunted by a Bradleystat—the type that is used as a rheostat. No other connections are made to this single turn or to the Bradleystat; they are a separate circuit, all by themselves. In operation this is an absorption circuit somewhat similar to that used in the 4-circuit tuner of which the effect is variable, through the increase or decrease of the resistance in the circuit. When the Bradleystat is set at a point of maximum resistance, the circuit is open and has no effect on the transfer of energy back and forth between the secondary and tickler coils—but when the Bradleystat is "screwed in" to the point of minimum resistance the circuit is closed, and in this condition will absorb a large proportion of the energy, due to the inductive relation between the coils L2, L6, and T. A variation of the amount of resistance directly affects the amount of energy absorbed —which in turn, affects the amount of regeneration in the circuit.



A VARIATION OF THE CONTROL SHOWN IN FIGURE 5

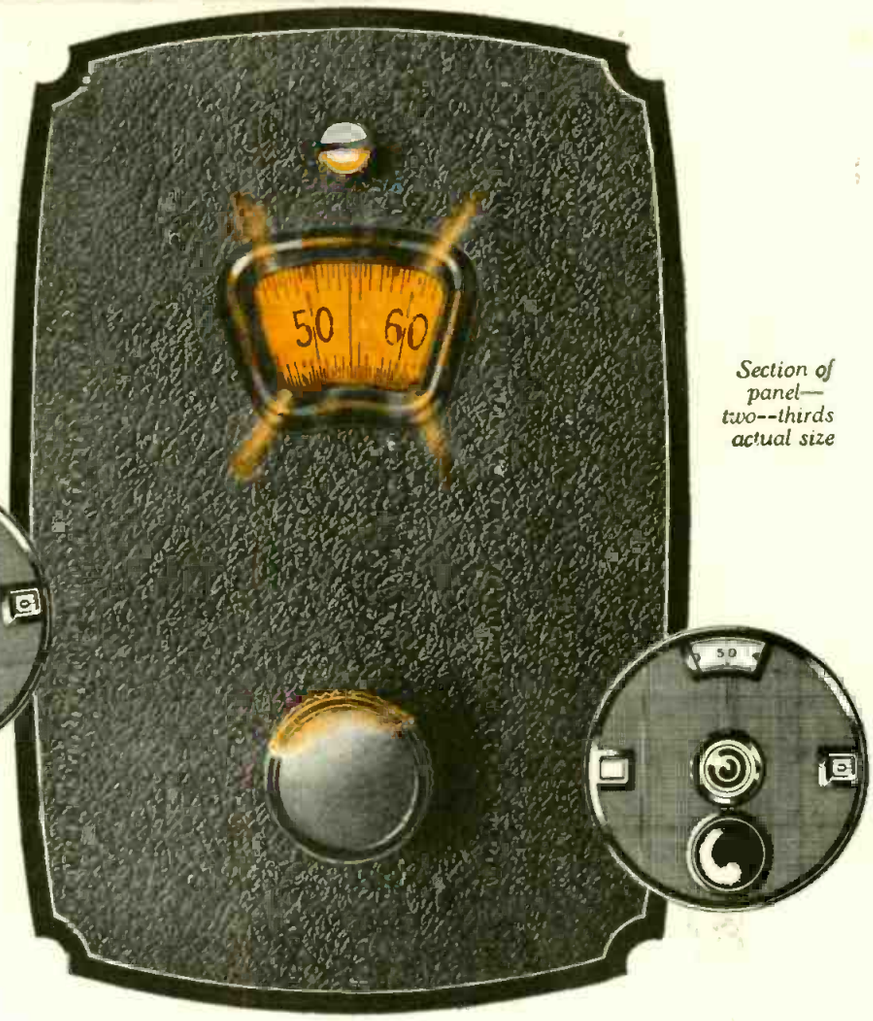
FIGURE 6: *The series resistance and shunt capacity, shown at R2 and C5, may improve control although the resistance, R2, must have a high enough minimum resistance to prevent actual oscillation.*



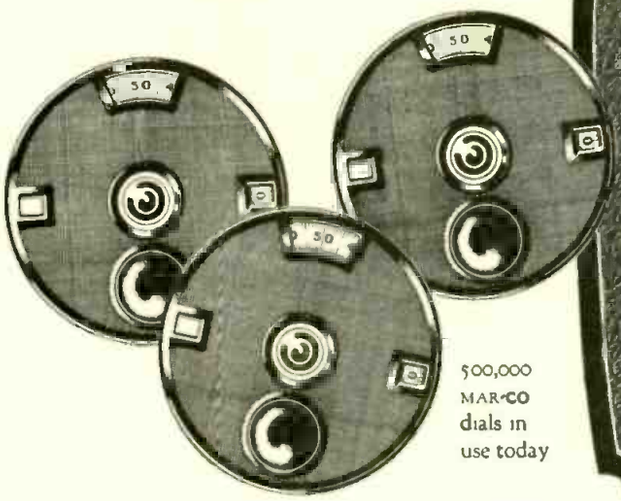
A THIRD RESISTANCE CONTROL

FIGURE 7: *By the use of an absorption coil, shown at L6, and a series resistance, shown at R3, regeneration may be controlled without allowing the set to oscillate. The resistance at R3, however, should be low enough at its maximum to keep the circuit from ever breaking into oscillation.*

"Friction-drive", in place of gears, gives the celebrated MAR-CO dial its instant response, its complete freedom from backlash. Improved "friction-drive" characterizes this new MAR-CO illuminated control.



Section of panel—two-thirds actual size



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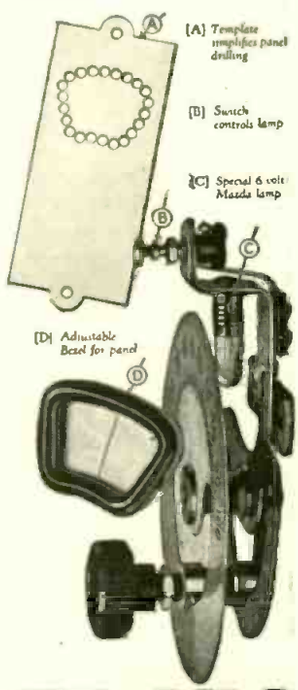


MAR·CO *Illuminated* CONTROLS

COCKADAY'S new *L. C. 27* receiver combines micrometer accuracy with simplified control and handsome panel layout, through the use of MAR-CO tuning instruments: the illuminated control and 2 MAR-CO rheostat dials.

In the case of winding coils for the particular purposes suggested by figures 5, 6, and 7 it should be remembered that in all cases the value of the new L2 coils should be the same as that previously used, in order to tune properly with the variable condenser, C1. The primary coil, L1, should have approximately one-third as many turns as L2 and the tickler coil, T, should have about three-eighths as many turns as L2. In the matter of spacing stationary tickler coils, wound on the same form as the secondary, a good average distance of 3/16 of an inch.

Any one of the methods shown in Figures 5, 6 and 7 will do a great deal toward making the handling of regeneration in the regenerative set easier.

Sets That Earn Incomes

(*Continued from page 527*)

termine the farmers' interest in radio, the investigators turned their efforts to find out the hour at which the farmer listens in.

The result of the time survey indicated that the maximum farm audience is on the air between 8:00 and 8:30 in the evening. Starting at 6:30 P.M. the audience rapidly increases up to 8:00 o'clock. Somewhere between 8:00 and 8:30 P.M. begins a sharp decline.

The size of the noon farm radio a dience furnished one of the surprises of the survey. A little more than 60 percent of the farm radio owners are on the air at 12 o'clock noon. In some states, notably Illinois, Kansas, Pennsylvania and New York, the noon audience approaches 75 percent.

Very few farm folks listen to radio programs before noon; the average morning audience runs less than one-tenth of the total. However, in a few instances the results depart from this average; in Illinois, Indiana, Iowa, Minnesota and New York, the audience before noon averaged around 30 percent. In these states a 9:00 A.M. market report apparently draws a fair audience.

The survey disclosed very little, if any, interest in afternoon programs.

The farmer wants something more from his receiving set than mere amusement. He wants cash dividends from it.

He wants his receiving set to bring him information that will help him to raise better crops and better stock, to get better prices, to fertilize his soil to better advantage, to make a better business of his farming.

He knows that there are many sources of this information. As these sources increase their efforts to furnish information through the farmer's receiving set, just that fast will the farmer encourage his neighbor to purchase a receiving set and just that fast will the 6,500,000 farm homes of America be equipped with radio receivers.

7 Tube Set Single Dial Radio

30 DAYS FREE TRIAL

The Metrodyne

ONLY ONE DIAL TO TUNE

Retail Price
$75
Completely Assembled
Big Discounts to Agents and Dealers

Wonderful offer direct from the factory!

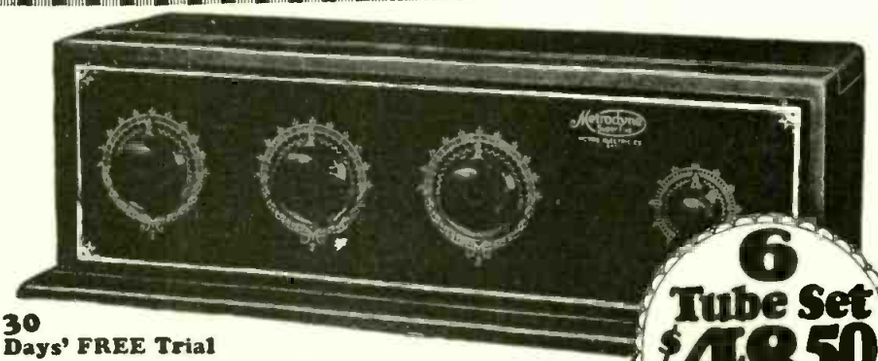
A perfect working, single dial control, 7 tube receiver. And just to prove our claims, we will ship it to your home for **30 days' free trial.** Test it under all conditions. Test it for distance, volume and tonal quality — and if you are not convinced that it is the best single dial set you ever heard, return it to the factory. We don't want your money unless you are completely satisfied.

BIG PROFITS TO AGENTS AND DEALERS

Our Agents and Dealers make big money selling Metrodyne Sets. You can work all or part time. Demonstrate the superiority of Metrodynes right in your home. Metrodyne Radios have no competition. Lowest wholesale prices. Demonstrating set on 30 days' free trial. Greatest money-making opportunity. Send coupon below—or a letter—for our agent's proposition.

Metrodyne Super-Seven Radio

A single dial control, 7 tube, tuned radio frequency set. Approved by America's leading radio engineers. Designed and built by radio experts. Only the highest quality low loss parts are used. Magnificent, two-tone walnut cabinet. Artistically gilded genuine Bakelite panel, nickeled piano hinge and cover support. All exposed metal parts are beautifully finished in 24-k gold. Easiest set to operate. Only one small knob tunes in all stations. The dial is electrically lighted so that you can log stations in the dark. The volume control regulates the reception from a faint whisper to thunderous volume, 1,000 to 3,000 miles on loud speaker! The Metrodyne Super-Seven is a beautiful and efficient receiver, and we are so sure that you will be delighted with it, that we make this liberal **30 days' free trial offer.** You to be the judge.



30 Days' FREE Trial

6 Tube Set $48.50 RETAIL PRICE *Completely Assembled*

Metrodyne Super-Six

Another triumph in radio. Here's the new 1927 model Metrodyne 6 tube long distance tuned radio frequency receiving set. Approved by leading radio engineers of America. Highest grade low loss parts, completely assembled in a beautiful walnut cabinet. Easy to operate. Dials easily logged. Tune in your favorite station instantly on same dial readings every time. No guessing.

Mr. Howard, of Chicago, said: "While five Chicago broadcasting stations were on the air I tuned in seventeen out-of-town stations, including New York and San Francisco, on my loud speaker horn, very loud and clear, as though they were all in Chicago."

We are one of the pioneers of radio. The success of Metrodyne sets is due to our liberal **30 days' free trial offer,** which gives you the opportunity of trying before buying.

MAIL THIS COUPON or send a postal or letter. Get our proposition before buying a radio. Deal direct with manufacturer— **Save Money.**

Mail COUPON Below!

Let us send you proof of Metrodyne quality

F. L. Warnock, Greentown, Ind., writes: "I received the Metrodyne in good shape and am more than pleased with it. Got stations 2,000 miles away."

C. J. Walker, Mariposa, Calif., writes: "Received my Metrodyne Single Dial set O. K. I believe that these one-dial sets are going to be excellent sellers. I had no trouble in tuning in stations enough to satisfy anyone, so you will please send me another set."

Roy Bloch, San Francisco, Calif., writes: "Very often we travel from New York to the Hawaiian Islands quickly — from station to station — by means of the little tuning-knob which operates the electrically-lighted dial. The Metrodyne Single Dial Set is much easier to operate than any radio set I've ever seen."

We will send you hundreds of similar letters from owners who acclaim the Metrodyne as the greatest radio set in the world. A postal, letter or the coupon brings complete information, testimonials, wholesale prices, and our liberal **30 days' free trial offer.**

METRO ELECTRIC COMPANY
2161-71 N. California Ave., Dept. 137
Chicago, Illinois

Gentlemen:

Send me full particulars about Metrodyne 6 tube and 7 tube sets and your **30 days' free trial offer**

Name _____

Address _____

_____

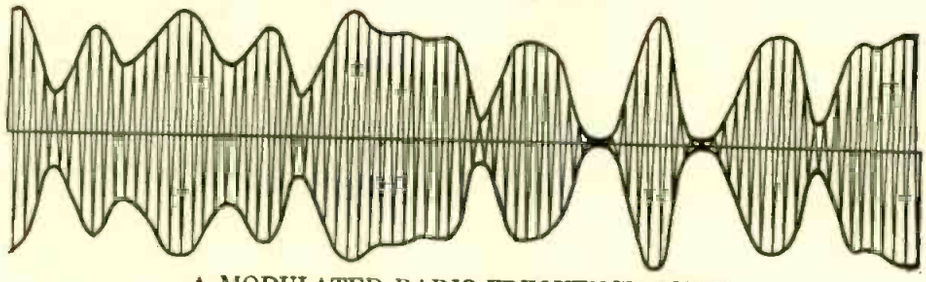
If you are interested in AGENT'S proposition, place an "X" in the square ➡ ☐

METRO ELECTRIC COMPANY

2161-71 N. California Ave. • Dept. 137 • Chicago, Illinois

"Wavelengths" to "Frequencies"

(*Continued from page 535*)



A MODULATED RADIO-FREQUENCY WAVE

FIGURE 3: *A diagrammatic picture of a radio wave that has been modulated by a voice frequency. Such a modulated broadcast wave would be liable to take up a frequency band of about 10 kilocycles.*

can be uniformly stated without ambiguity in terms of frequency regardless of the frequency of the carrier waves, while they cannot be uniformly stated in terms of wavelength.

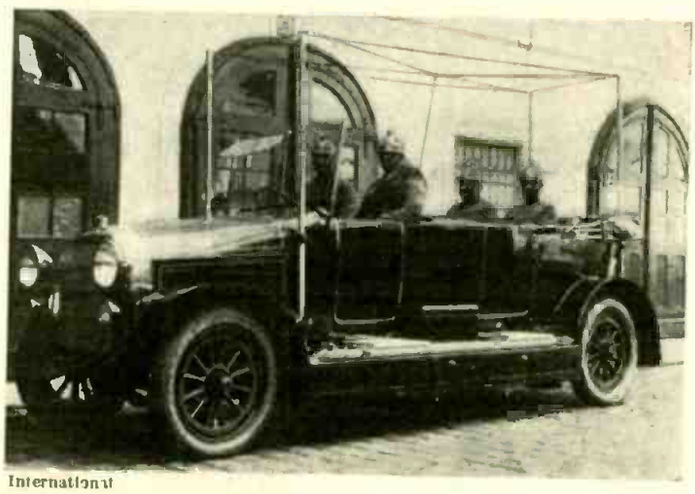
The above commentary is *apropos* to the recent announcement of the Department of Commerce regarding changes in allocation of frequencies and wavelengths. In some cases a new frequency has been given to certain existing stations, but in other cases the frequency assignment has not been changed. In these latter cases there have been slight changes in wavelengths about which there has been considerable questioning on the part of the radio enthusiast.

As has been pointed out, wavelength equals the velocity divided by the frequency. The actual wavelength of a radio wave is seldom if ever measured, but is an incidental and secondary matter, dependent entirely on frequency and velocity. Therefore, if a more accurate measurement of velocity is made the wavelength will, in turn, be effected. The change is purely one of engineering calculation and has been prompted by the recently announced new value for the velocity of light, that is, the velocity of radio waves.

In an address given at the Centennial celebration of the Franklin Institute at Philadelphia, in September, 1924, Prof. A. A. Michelson of the University of Chicago, long famed for his accurate measurement of the velocity of light, announced that the most accurate value to date is 299,820,000 meters per second. Usually as a matter of easy memory and easy arithmetic, the velocity of light is given as 300,000,000 meters per second; written sometimes 3×10^8 meters per second. Formerly, this velocity of 300,000,000 meters per second has been divided by the number of cycles per second to give the wavelength.

WEAF is one of those stations for which a slight change in wavelength has been announced, based on Michelson's latest value of the velocity of light. In calculating the old wavelength of WEAF, 300,000,000 meters per second was divided by its carrier frequency, 610 kilocycles, to give a wavelength of 491.97 meters, or 492. However, using the more accurate value for the velocity, announced by Professor Michelson, one should divide 299,820,000 by 610 to give a wavelength of 491.47 meters, or 491.5.

It is noted that the frequency settings on the dial are exactly the same as the wavelength settings whether the terms of frequency or the terms of wavelength are used in calculation.



International

A NOVEL METHOD OF FIGHTING FIRE BY RADIO

The fire department in Vienna has been experimenting with radio installations on its "hurry call" motor cars, with the purpose of keeping its offices in communication with the central office. Here is one of the experimental installations.

Constant Dependable B Power Direct from Your Light Socket is Now a Reality in Majestic Units

Give that set of yours the power it needs—power for any variation in tone. Then you'll have a new appreciation of radio. You will have one delightful program after another—summer evenings—winter evenings—All the Time!

That's when your set is equipped with Majestic "B" Current Supply. Your set seems Alive with marvelous energy. You sense a new joy in radio.

Reliable, invarying power at an average cost of about one-tenth cent an hour! Economical, Powerful—Lasts as long as any Receiver. Fully guaranteed.

Majestic "B" Current Supply

delivers pure direct current-From your light socket

You at last forget its mechanics, for a simple switch releases all the power you need for any program. Power—clean—constant—abundant! Power that instantly reponds to high soprano, and as easily brings you the full resonance of an orchestration! They attach direct to your light socket saving you constant bother and attention.

Their low purchase cost and the savings they bring to you make them an investment that soon is repaid. Don't delay—see your dealer at once or write for free literature.

DEALERS: If you are not yet equipped to get your share of the Majestic business, see your jobber or write direct giving us his name.

New York Show—Booth No. 10—Section "B"
Chicago Show—Booth No. 6—Section "F"

No Filament to Burn Out

All the Majestic "B" Current Supply units are manufactured complete in our factory and are equipped with the famous Raytheon Tube. (Endorsed by numerous radio engineers and editors) which is a non-filament tube with full wave rectification, no acids or back surge. Tests of the Majestic "B" on the Oscillograph demonstrate that all A-C hum is entirely eliminated.

Majestic Standard-B Current Supply

Especially adapted for sets having not more than seven 201-A tubes, or six 201-A plus one 135-150 volt power tube. Popularly priced for the average set. Improves tone—betters reception.

Price $32.50
West of Rocky Mts. 35.00

Majestic Super-B Current Supply

Capacity 1 to 12 tubes, including the use of 135-150 volt power tubes. Complete with switch to control current from light socket.

Price $35.00
West of Rocky Mts. 37.50

Majestic Master-B Current Supply

Particularly adapted for Radiola 25, 28, and 30 and super heterodynes. Will operate all power tubes, also the new super power tube UX-171 (180 volts.) Unequalled for sets having a very heavy current draw. Rating about 60 mils at 150 volts.

Price $42.50
West of Rocky Mts. 45.00

GRIGSBY-GRUNOW-HINDS CO.

4562 Armitage Avenue — Chicago, Ill.

The YES *and* NO MAN

LITTLE MAN.—*Quinn Ryan*—let's see, Quinn Ryan—oh, yes, he's the sports announcer from WGN, Chicago! * * * What do we look like? Well, we're very small, very fussy and altogether a very modest little person; further than this we refuse to go. * * * Our good friend *Louis Reed*, formerly of WJZ is now announcing from WFBH, N. Y. C.

TESS.—So we're Mr. Banning, are we? Guess again. You're thinking of *John Daniels* at WJZ. * * * Yes, a charming boy—if he'd stop trying to mimic that microphone—Musketeer *Brokenshire*. * * * What do we do for a living aside from this? We eat little boys and girls who get too curious.

FIDDLESTICKS.—Write to WGY for information about the biography of Steinmetz; it was broadcast by *Mr. Hammond* the General Electric librarian. * * * *Edwin H. Armstrong*, my dear, is the inventor of the super-heterodyne and *not* a Scotch tenor, as you seem to think.

PAUL B.—Are you thinking of Mr. *Vincent J. Moore* the soprano of KOA? For the umpteenth time, *Roxy* is due back on the air early in 1927; address him at the Roxy Theatre, 383 Madison Ave., New York City.

RALPH.—Now don't get too fresh. * * * We're not the obsequious old thing that you think we are. * * * *Louis John Johnen* is the blah-blah boy of WLW. He is almost able to stick his finger in a pail of water and leave a hole there.

GINGERBREAD.—*Arthur Bagley* the genial physical director of the Metropolitan daily dozen was formerly physical director of the Newark YMCA; his picture is published herewith. * * * *Charlie Cornell* and *Freeman Goslen* make up the team of "Sam and Henry" (WGN). * * * We are not interested in Allen McQuhae's stock.

ARTHUR SHELDON.—Why do you want to introduce State Game laws that make it open season for *Brokenshire*, *McNamee* and *Carlin*?

AMY W.—*Gordon Morrison* is the guitarist artist from KMOX. * * * You are thinking of *Joe Cook*, the gagman at WOR.

GEORGE FROSTMAN.—*Albert Downing* is the WTAM tenor; never having listened to the gentleman we cannot endorse your statement that he "quivers a mean vocal cord." * * * "Border Lines" (KOA July 19th) is the play you must have in mind; directed by *Iris Gilmore*.

RINKY DINK.—*Lamdin Kay* is still in business at old WSB (Atlanta, Ga.); here's his photo. * * * *Rosaline Green* is the leading lady of the WGY Players; *Clay Ten Eyck*, the leading man. * * * Why don't we write a radio play? Because my dear, the art is not yet ready to do justice to a great work. (Watson, cancel that appointment with Belasco).

HENRY CARY.—We don't know what happened to *Maxime Brown* since she came to New York; she gave radio nothing but took from it as much publicity as she could get. * * * Yes, we like *Goldy and Dusty very* much. So you want a list of our favorites? Well, here they are·

B. A. Rolfe
Ben Bernie
Eveready Hour
Happiness Boys
Eskimos
Maxwell Hour.
Goodrich Hour
Atwater Kent
Keystoners
Royal Typewriter
Capitol

GRAND-DADDY.—We have never heard your daughter Martha sing "Pale Hands" with her dramatic soprano voice. It is very difficult, dear sir,—very difficult—to win us over with high C's and Pale Hands. * * * She would have to have an audition with *Dr. Billy Axt* at the Capitol. * * * Dr. Billy knows his alligator pears when it comes to music. * * * Good luck!

THREE A's.—*The Happiness Boys* are not soda fountain brakemen. * * * If you want to see *Billy Jones* in person, drop into the billiard room of the New York Atheltic Club any noon hour. * * * Sure, send on the bushel of peaches. * * * Navarro would make a whale of an announcer—as announcers go

ADAM EXPRESS.—You should not resent our admonishments; we shall try to reform but don't expect too much of us. * * * If we're so fresh why don't we try announcing? Well, we heard a man complaining about the service on the 42nd Street crosstown yesterday, but he had no ambition to become a motorman. * * * Announcers receive very little pay and a great deal of abuse. * * * They should get more—abuse.

LIZZIE TISH.—So you want to hear a good old-fashioned burlesque broadcast? * * * That's an idea; but don't forget the optical features of such entertainment. * * * You talk like an old chorus girl.

The Tube of Long Life!

PATENTS PENDING

CECO

TRADE MARK

The quality of CECO Tubes is not a matter *of* accident or guess work. Every tube is *tested* at every important stage of manufacture.

Electrically, mechanically CECO tubes are built for service. They are guaranteed—

"Best by Test" in the laboratory—

"Best by Performance" in the home whether used as detectors or amplifiers.

Radio laboratories of national reputation and engineers of international fame confirm the results of our own tests.

Practice **true** economy by buying the best.

Specify *CECO TUBES*, your dealer has them or can get them for you. **There's a type for every radio need.** Public demand has forced a doubling of CECO floor space and productive capacity which assures service to dealers and quality to the public.

C. E. MFG. CO., Inc.

Providence, R. I.

MEMBER R.M.A.

2 New Wonderful Tube Developments

TYPE "G"
HIGH MU

For Impedance or Resistance Coupled Receivers

Fil. V.....5.0
Fil. Amp.....0.25
Plate Volts.....90-180

Gives Clearer Reproduction With Increased Volume.

Price . . . $2.50

Especially recommended for LYNCH Power Amplifier and B Supply System and for BROWNING-DRAKE hook-ups.

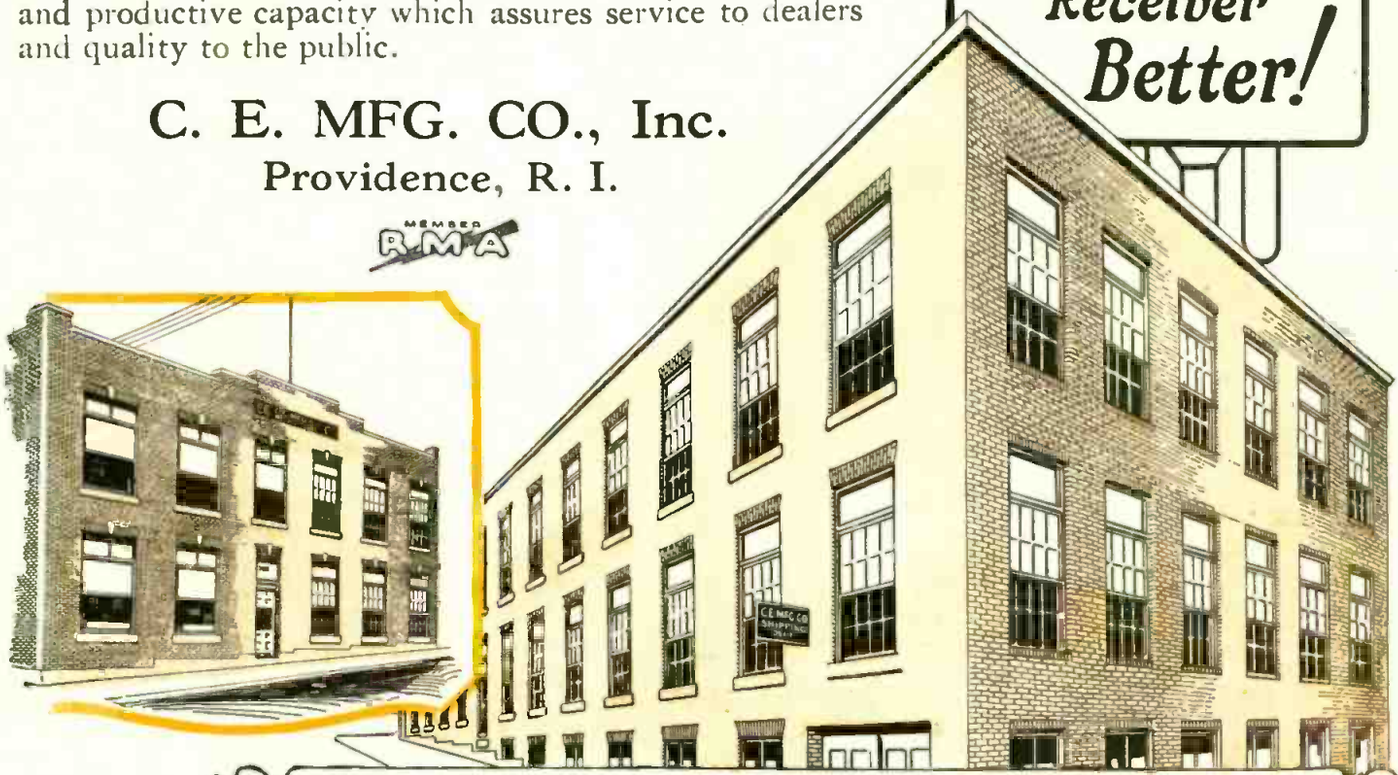
TYPE "H"
SPECIAL DETECTOR
RATING

Fil. V.....5.0
Fil. Amp.....0.25
Plate Volts.....67-90

Improves Reception Especially on Weak or Distant Stations.

Price . . $2.50

CECO TUBES *Make Any Good Receiver Better!*



The New CECO Plant Located at Providence, Rhode Island.
The Largest in the World Devoted Entirely to Radio Tube Manufacture

CHARLIE MY BOY.—*Redferne Hollinshead* was the tenor in WEAF's opera "Lohengrin"; *Devora Nodivorney* was Ortrud, the contralto. * * * 6XBR is the portable broadcaster owned by Warner Brothers. It is due to arrive in New York on Thanksgiving Day. * * * So you want to play a piccolo solo over the air. My, that should be exciting!

ORVIN F.—*Walter Logan* is the conductor of the Willard (WTAM) Symphony Orchestra. * * * George Olsen is a WJZ artist. * * * Ben Bernie (WEAF) has a chain of orchestras; perhaps you heard one of his offsprings. * * * If WHN is your idea of a real station and if you like informality, you can certainly get it from that studio. * * * WHN makes plenty of noise with its soup!

HOTSY-TOTSY.—*B. A. Rolfe's* (WEAF) is now our favorite jazz band. Ingenious orchestration, plenty of brass, no mutes and capable direction. * * * We should not attempt to comment on *Paul Ash's* bands; he's too far away. * * * *Harry Richman* is now in George White's "Scandals," and has not been broadcasting lately. Yes, he's a scream. * * * We do miss "There's No Hot Water In The Bronx" and "The Old Man's Whiskers."

EDWARD BLOTMAN.—A monitor, dear sir, is a young man who listens to the output of a broadcasting station; he shaves the whiskers off the modulation to put it in a colloquialism; he is, in short, a vigilance committee of one watching over the carrier wave.

BERTRAM HOUCK.—*Siemon Sobro* was formerly of the "Student Prince" company; he has appeared at WRNY only, once that we know of. * * * We don't know where *Evelyn Herbert* is now; we do hope she is safe, however, for her "Kiss Me Again" used to be one of our great thrills.

BILLY THE KID.—Better stay out in Montana where you can breathe fresh air; perhaps your musical act is a trifle too provincial to meet the requirements of WJZ.

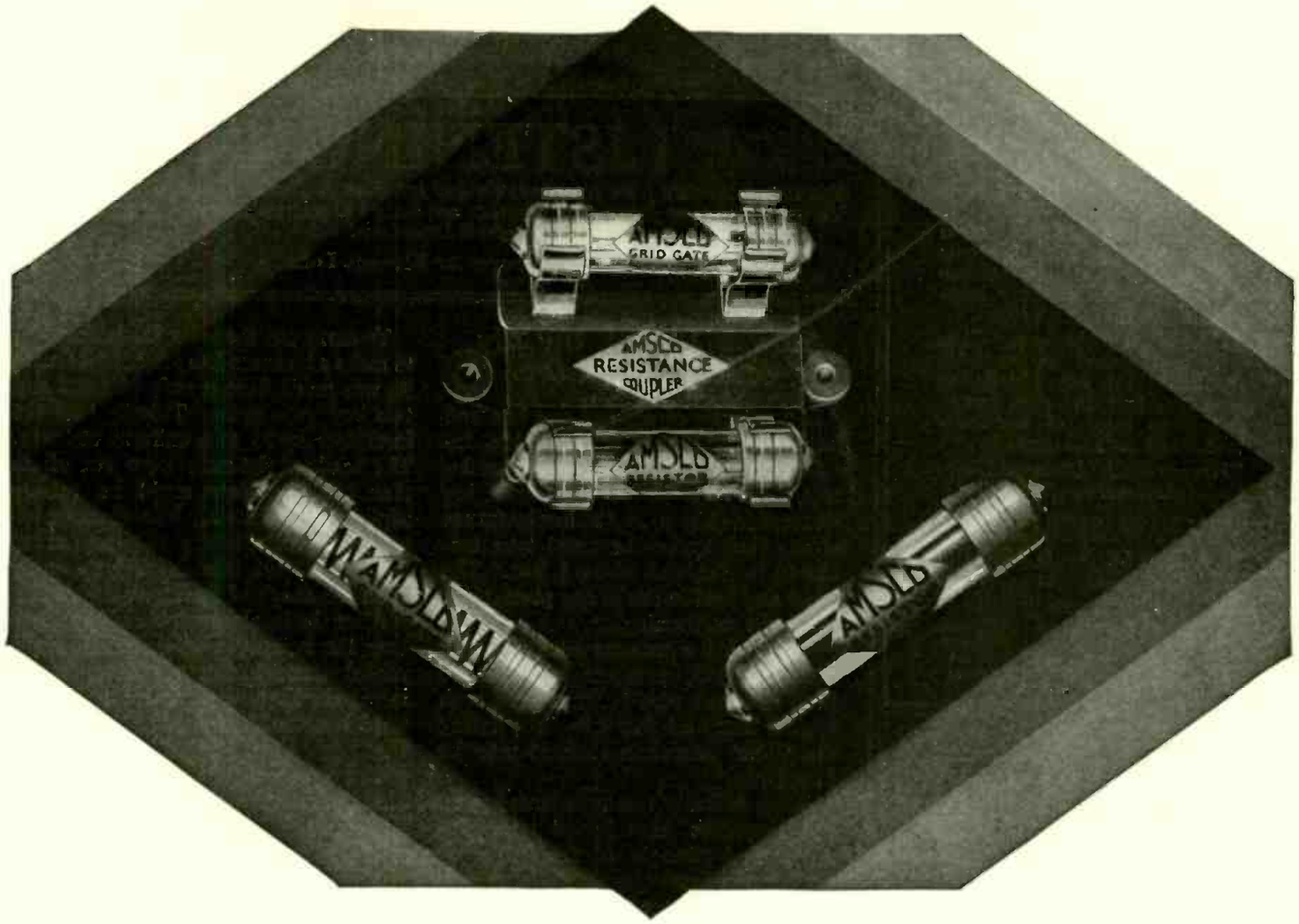
W.E.D.—*May Singhi Breen* is married and conducts a musical studio in New York. * * * Are we a lady? Well, we eat at Schraffs; we'll admit *that* much.

SIMBO.—We don't know what happened to *Lufrio* the old WEAF announcer; he was with WGBS for a spell. * * * Thanks for the invitation to read your sonnets over WJZ but really we microphone *very* poorly. Your "Sonnet to Sue at Sunnyside Farm" is lovely. * * * Please do excuse us.

S.B.M.—*Wendell Hall* is still broadcasting here and there. * * * The "Little Girl in Chicago" is his wife, who, of course, must be his "severest critic."

AMSCO

FOR EXCELLENCE



SILENCE, PLEASE!

AMSCO METALOID Grid Gates and Resistors are uniquely silent. There is no thunder in them. They do their work noiselessly—and they give you—*TONE*.

The secret of AMSCO excellence is in the new Metaloid resistance element—*colloidal and unbroken*, superseding crystalline forms, with their jagged, noisy pathway to the current flow.

It pays to insist upon getting Amsco Metaloid Grid Gates, Amsco Metaloid Resistors, Amsco Resistance Coupled Amplifier Units.

AMSCO PRODUCTS, INC., BROOME AND LAFAYETTE STREETS, NEW YORK CITY

AMSCO

RMA

LISTENING IN

PRACTICAL *pointers from experimenters and broadcast listeners. What helpful hints can* YOU *offer to your fellow fan? Readers are invited to address their letters to the Editor of this Department.*

CONDUCTED BY RICHARD LORD

How I Linked Up My Antenna Insulators

MY antenna consists of one hundred feet of seven-strand copper cable, insulated at each end with three insulators. As seen in the accompanying illustration (Figure 1), the insulators are of the shell type—the usual type employed in England where I live. The aerial and lead-in are in one piece, right up to the set terminals.

Although the antenna is only 25 feet above ground, excellent results have been obtained with it when used with typical four and five-tube sets; during the winter American stations may be tuned in.

Some difficulty was experienced when the insulators were joined up. The mechanical strength of the link wires between the insulators should be at least as great as that of the antenna wire. The method adopted is shown below.

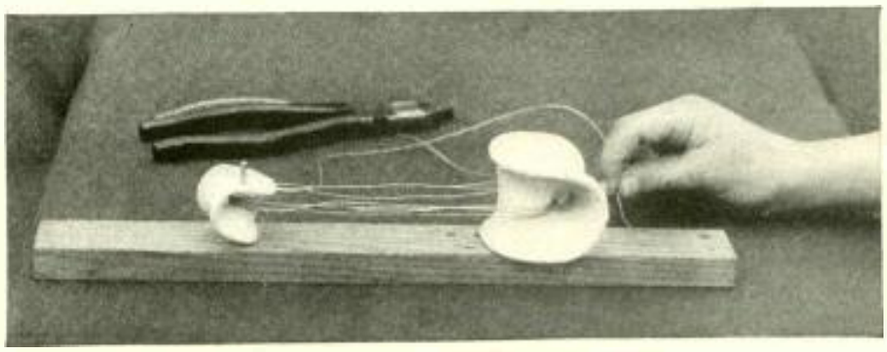
Galvanized steel wire of about 22 gauge was used for joining up the three insulators at each end. A turn was first taken around the right-hand insulator (see the illustration), and the free end twisted around the longer wire. Then the wire was passed several times through the holes in the insulator, the end being secured to the free end of the first turn which had been left sufficiently long for this purpose.

To carry out the work in comfort and to make a business-like job of it, a simple jig was made from a strip of wood and two long wire nails. This jig held the insulators apart at a uniform distance. The heads of the nails were cut off so that the insulators could be readily slipped off the nails. The distance between the nails, in my case, was about ten inches, but this depends naturally upon the shape of the insulator used.

After the insulators have been slipped over the nails, the wire may be easily passed through the openings, as the insulators have no tendency to turn or twist because they are held securely in the jig. Furthermore, all insulators joined up on the same jig will be the same distance apart, and a neat job will result.

When the last joint has been made, the insulators are slipped off the jig; holding one of them firmly in the left hand, the other insulator is turned with the right hand so that the formerly parallel strands of wire are twisted into a multi-layer cable. In this way, the openings in the insulators can all be made to face the same way; and the insulators cannot move relative to each other as they are held in position by the wire spiral which extends right up to the stem of the insulator.

—C. A. OLDROYD, *Barrow-in-Furness, Lancashire, England.*



THE ANTENNA INSULATOR LINK

FIGURE 1: *The jig that is used to wire up the stress leads to the insulators for the antenna is shown here. Two insulators connected in series are used in this case.*

The New Amplification

A revolutionary principle sets a new standard for reproduction

THE achievement of reproduction so perfect that the music itself is reborn and lives again has been the goal of radio progress since radio began. To achieve—

The human voice with diction crisp and lifelike.

The flute, its high notes pure and flawless.

The organ with all its deep throated resonance.

The piano without the flatness of a gong, but each note in ringing clarity; each cord mellowed by the overtones blending in perfect harmony.

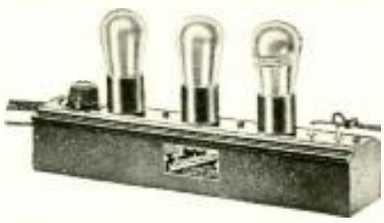
The full symphony orchestra, no longer the pale thinness of a single sound, but an ensemble of instruments with the individuality of each so distinct that the themes of everyone can be followed: The violins as they weave their delicate pattern against the background of the whole. The bass viols as they pursue their lone and solitary air.

Applause, no jumbled roar, but the clapping of hands.

THIS has been a goal as baffling and as elusive as the hidden notes themselves. And yet, these are some of the demonstrable results accomplished by the Na-Ald Truphonic Coupler.

The Na-Ald Truphonic Coupler is a new instrument; new in principle, new in design and new in construction. It is neither a resistance, transformer or impedance coupling, but a new differential system, invented by H. P. Donle, balancing transformer and impedance action in such a way as to produce amplification precise, undistorted and at a volume hitherto thought impossible.

The complete Na-Ald Truphonic Audio Amplifier is installed on any set by simply slipping in the special adapter and tubes and connecting the loud speaker. Maximum power tube volume may be safely employed as an output unit for the protection of the loud speaker is included.



Truphonic Power Amplifier

Individual couplers or complete amplifier assemblies are supplied for the set builder.

Words can't convince you of the performance of this remarkable little device. A demonstration will. Call at your dealer's and he will gladly give one.

Price complete amplifier ready to attach ***$20.00***
(includes battery leads, sockets, output unit for protecting loud speaker with power tubes, connecting adapter).

Individual Truphonic Coupler or Output Unit ..... ***$5.00 per stage***

Complete amplifier parts for set builders ***$20.00***
(3 couplers, output unit, sockets, battery leads, catacomb).

For complete information write—

THE ALDEN MANUFACTURING CO.
Dept. C-15 **Springfield, Mass.**

NA-ALD

Na-Ald Localized Control Tuning Unit

FROM station to station with the touch of but three fingers of one hand. From one program to another as easily as turning the pages in a book. This amazingly simple tuning device reduces the complications of tuning to a single action and leaves you free to wander thru the air at will. All three condensers operated at one opening in the panel. All can be moved together. Each can be moved separately. Simple and exact tuning results.

Price Quadruple..**$16.00**
Triple.....**10.00**
Double.....**8.00**

Na-Ald 481-X S Cushion Mount Socket

IMPROVED amplification demands a cushion mount socket if microphonic disturbances within the tube are to be removed. The Na-Ald 481-X S Cushion Mount Socket by means of a perfected resilient mounting floats the tube and gives complete protection against vertical as well as lateral shocks. The only socket on the market with this feature. Fits all tubes.

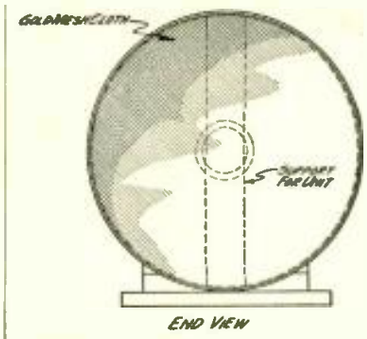
Price.....**50c**

Na-Ald Connectoralds

The improved tone and quality of the new UX power tubes 171, 112 and 120 can now be had on any set without the need of rewiring for the additional B and C batteries required. Na-Ald Connectoralds function as adapters and, at the same time, provide cables for attaching the B and C batteries without affecting the rest of the set.

Price, 120 Connectorald...**$1.25**
Price, 112 Connectorald...**1.50**

A Simple Way to Cut Out the



A FRONT VIEW OF THE SPEAKER

FIGURE 3: *This front elevation of the home-made loudspeaker shows where the supporting bar for the phonograph unit is placed.*

paper into a horn of the right size and gluing it together. To make the horn stronger, glue is put on the outside of it, and another layer of wrapping paper put on; then more glue, and another layer of paper. This may be continued until the horn is of sufficient rigidity.

The completed loudspeaker may be built into a wood cabinet of suitable dimensions, with metallic cloth across the opening in front; or it may be mounted as shown, and gold cloth can be put over the opening of the larger megaphone. A support for the large end of the smaller megaphone can be made if necessary.

A loudspeaker of this type is excellent for use with a portable set because it is so compact. Because of the two horns, the same effect is obtained as if one horn almost twice as long as the larger megaphone were used.

—CHARLES F. FELSTEAD, 6CU, *Los Angeles, Calif.*

* *

Stations I Have Heard With My LC-26 Receiver

SINCE the first of January, 1926, I have logged 205 stations on my LC-26 receiver. Here is a list of the stations that I have picked up; are these results at all extraordinary?

KSD, KFUO, KYW, WHO, WNYC, WOAW, WCX, WJR, WIP, WOO, WMC, WEAF, WOC, WSUI, FAM, WTIC, WBAP, WFAA, WCAP, WRC, KFI, WCAE, WJZ, WMAQ, WQJ, WOS, KLDS, WDWF, WLSI, WMAF, NAA, CNRO, WSB, WLW, WKRC, WCCO, CFCF, CFYC, CKAC, CNRM, WOR, WJY, WHAS, WHT, PWX, WFI, WLIT, WEAR, WTAM, WMBG, WGY, WHAZ, KTHS, KVOO, WEBH, WJJD, WDAF, WHB, WHN, WQAO, CFCA, CHIC, CKCL, CNRT, WJAD, WWJ, CZE, WEEI, WCBD, WLS, WMCA, WKAQ, 6KW, CKOC, KFMX, WCAL, WJAX, WBZ, WJAZ, WSAI, WKRC, KOA, WJAZ, WGR, WSMB, WAHG, WGBS, CNRA, KDKA, WJAR, WGN, WLIB, WPG, KPRC, WAIU, WEAO, KFKX, WLWL, WEMC, WKAR, WREO, WOAN, WSM, KMOX, WNAC, WCAU, WFBG, WGBU, WHAM, WAFD, WCAC, WCEE, WCAO, WHAR, WJAS, WORD, WMAC, WBBR, WEBJ, WFBH, WHK, WRW, WEAN, WGHP, WJBL, KFH, WFBM, WJAM, WNOX, WRAX, WTAG, WBCN, WENR, WMAK, WTAB, KFNF, WBPI, WCAD, WQAM, WSDA, WAAM, WABQ, WEAM, WKAF, WSKC, WADC, WHEC, WRNY, KTNT, WBDC, WCSH, WDOD, WMBC, WRVA, WFBR, WASR, WFBL, WGCP, WNJ, WGES, WIAD, WMBD, WNAB, WQAN, WWAD, WIOD, WBAL, WSOE, WGBB, KSO, WBZA, WEBC, WOOD, WWAE, WHAP, WOAX, WGBI, WHT, WBOQ, WCAM, WCBQ, WIBA, WFDF, WOKO, WDBZ, WBRE, WKBE, WBBL, WSAN, WDBJ, WGBR, WOWO, WBBM, WIBO, WODA, WJBI, WOK, WIBM, WHBW, WCLS, WMSG, WBNY, WSBC, WFRL, WIBX.

Can anyone beat this record?

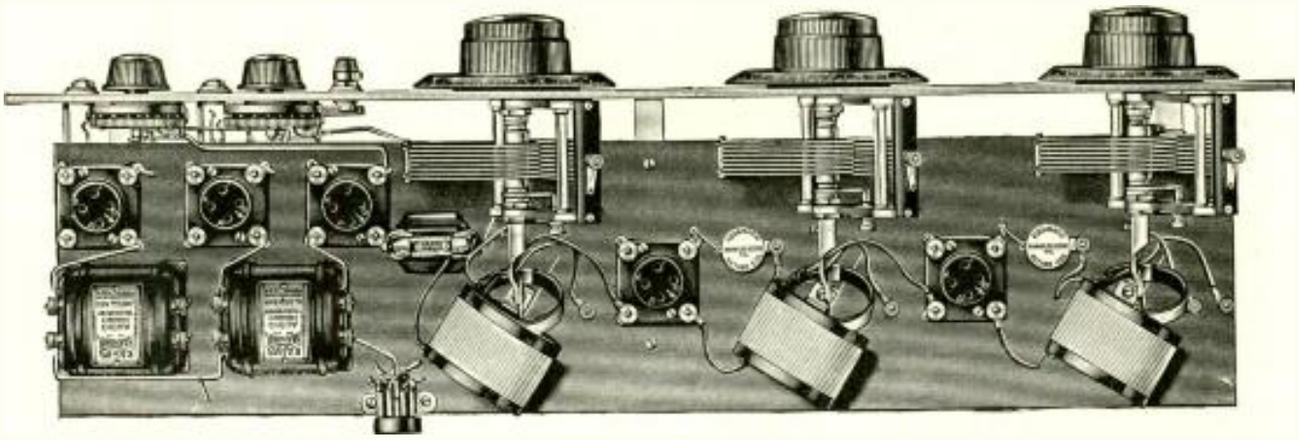
—JOHN B. TRACY, *Hotchkiss School, Lakeville, Conn.*

The New Karas Equamatic* Five Tube Sensation

Now Being Featured By Radio Broadcast

FULFILLS in an extremely simple manner a very desirable and HIGHLY IMPORTANT FUNCTION that our foremost radio engineers have been striving to accomplish ever since the advent of radio broadcasting.

THE EQUAMATIC SYSTEM AUTOMATICALLY provides a CONTINUOUS MAXIMUM and an absolutely EQUAL TRANSFER OF ENERGY between primary and secondary inductances at all wave lengths by a coupling system unique to radio engineering practice—it also ELIMINATES the overlapping of electrostatic and electromagnetic fields with their harmful, broadening and distorting effects.



Pure Tone—Great Volume

The result of the EQUAMATIC SYSTEM from five tubes is a clean, clear, pure and powerful signal—equal in VOLUME to the usual six and seven tube sets—sharpness and SELECTIVITY equal to the superheterodyne—SENSITIVITY equal to a regenerative circuit—and a PURITY of tone equal to a crystal detector.

How It Works

In the EQUAMATIC SYSTEM the primary coils are attached to the shafts of the condensers—and are adjustable in their relation to both the condenser shafts and the secondary coils. The primaries are also ENTIRELY SEPARATED from the secondaries. The secondaries are adjustable to any angle in relation to the primaries and also as to their degree of coupling with the primaries. The primaries are AUTOMATICALLY, constantly and CONTINUOUSLY varied—at a definite, everchanging rate of variation—with the turning of the condenser dials.

This POSITIVE, AUTOMATIC action provides the ABSOLUTELY EXACT amount of coupling—at every wave length setting—necessary to deliver to the secondary coils EXACTLY the amount of energy required to cause the tubes to constantly operate at their HIGHEST EFFICIENCY.

The Reason for It

In order to keep radio tubes CONSTANTLY operating at their highest efficiency—just under the oscillation point—it is ABSOLUTELY necessary to continuously maintain an EQUAL TRANSFER OF ENERGY between primary and secondary coils. In order to maintain this equal transfer of energy every wave length setting must have a DIFFERENT AND EXACT coupling between primaries and secondaries. To secure PERFECT reception every successively longer wave length requires a greater transfer of energy—therefore a correspondingly greater degree of coupling—than the preceding shorter wave length. The problem has been to provide this exact and constantly varying coupling by some simple mechanical means.

The EQUAMATIC SYSTEM solves this problem—does it POSITIVELY, SIMPLY and AUTOMATICALLY and does not resort to ANY losser methods whatsoever.

On account of the extremely high efficiency of this system the reception from a home built five tube KARAS EQUAMATIC receiving set is as nearly perfect as radio reception can be with present day knowledge.

Easy to Build

A manual of complete diagrams and instructions for building this five tube KARAS EQUAMATIC receiver in complete detail is included with each set of KARAS EQUAMATIC coils. (This manual will be sent separately upon receipt of 10c to anyone interested.) The placing of every part and every wire connection is clearly explained. Even though you may never before have built a set you can proceed without hesitation, confident of successfully constructing as efficient a receiving set as can be made. To build this powerful, sweet toned, long range receiver, you will need the Karas parts listed on the accompanying coupon.

Licensed Under King Patents Pending.

Order Through Dealer or Direct on This Coupon

The Karas apparatus essential to the construction of the five tube EQUAMATIC receiver is carried by nearly every good radio parts dealer in most cities. Secure the parts from your dealer. If he is out of them order direct from us using this coupon. Send no money. Just hand the postman purchase price plus a few cents postage.

KARAS ELECTRIC CO.

Manufacturing Plant: N. Rockwell St.

Offices: 1017 Association Bldg., Chicago, Ill.

KARAS ELECTRIC COMPANY,
1017 Association Building, Chicago, Ill.

Please send me set of 3 Equamatic Inductance Coils, $12; 3 special Orthometric Condensers with extended shafts, $7 each; 3 Micrometric Vernier Dials, $3.50 each; 2 Harmonik Audio Transformers, $7 each; 2 Equamatic Retard Coils, $1 each; and 3 sub-panel brackets, 70c, for which I will pay the postman $60.20 plus postage, upon delivery. It is understood that I have the privilege of returning any of this apparatus for full refund any time within 30 days if it does not prove entirely satisfactory.

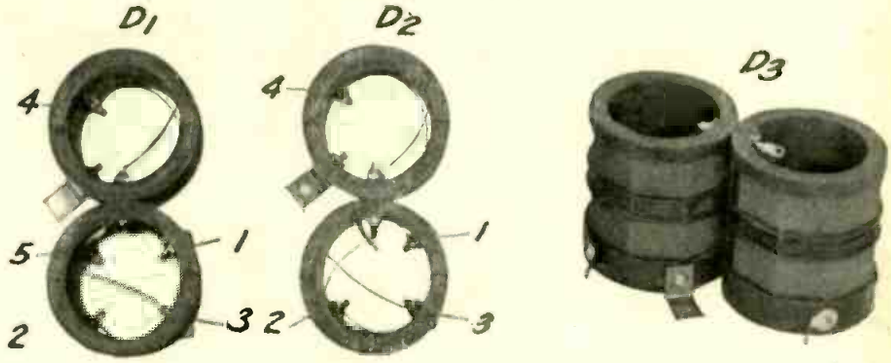
NAME.....

ADDRESS.....

If you send cash with order we will ship these parts postpaid.

How to Build the New LC-27 Receiver

(Continued from page 516)



THE COIL DATA

FIGURE 10: *The coupler at the left, D_1, is the antenna unit and the terminals are marked with the same letters as given in the picture wiring diagram in Figure 5. This unit consists of a primary of 8½ turns of No. 28 DSC copper wire wound in the middle slot of the lower coil form shown. The two outside ends of the wire are brought to terminals No. 1 and No. 2. This coil is capped at 4½ turns and the connection is brought out to terminal No. 5. The secondary is wound in four sections in the four outside slots on the two coil forms. It consists of 124 turns of the same size of wire. The winding runs in the same direction as the primary on the one coil form and in the opposite direction on the other coil form, so that the fields of the windings on the two coil forms will be in opposite directions. The middle coil, D_2 and the right-hand coil, D_3, are exactly similar to coil D_1, except that they have no tap on the primary and the primary consists of simply the terminals No. 1 and No. 2. The two coil forms are bolted together top and bottom and one of these bolts is used to join the two sets of secondary units in series. The small brass bracket shown in the pictures is used to fasten the coil to the baseboard.*

You are now ready to fasten the instruments that go on the baseboard, N, in position. Place the baseboard in front of you with the binding-post strip, E, facing you.

Attach, in the correct position, as shown in Figure 7, the first aluminum shield, W1. This should be fastened to the baseboard, N, by means of two short round-head brass screws with connection lugs placed between the screw and the aluminum shield for future connections.

Next, mount the socket, Y1, in position, as shown in Figures 3 and 7. This should also be fastened down by means of two round-head wood-screws.

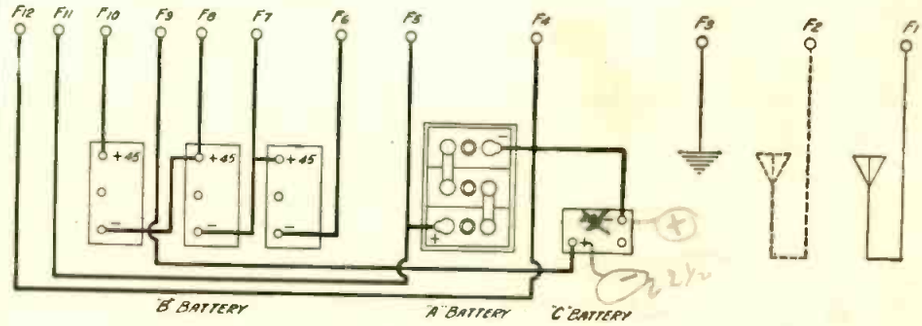
Fasten the coil, D1, after attaching the small brass bracket, to the baseboard by means of a single wood screw. Be sure that all the instruments you mount are spaced exactly as shown in detail in Figure 7. The spacing of these instruments is very important from both a mechanical and an electrical standpoint and they should not vary ⅛ of an inch from the specified dimensions.

Next, mount the automatic filament control unit, Z, in position by means of a single wood screw, as shown in Figures 3 and 7.

Mount the second shield, W2, in a similar manner, continuing with socket Y2 and coil D2. These are the units for the second stage of radio-frequency amplification.

Next, mount the third shield, W3, and the third coil, D2. This coil is for the input to the detector stage.

The next job is to mount the third socket Y3 by means of two wood screws. Then, fasten down the resistor mounting, U, the choke coil O, and the bypass



HOW TO USE THE SET WITH BATTERIES

FIGURE 11: *This diagram shows the proper connection for the set if it is to be used with batteries. If the set is to be used without an antenna, the ground wire, instead of being fastened to binding post F3, should be fastened to binding post F1. If the set is to be used with an antenna the connections will be as shown. In cases where utmost selectivity is necessary the antenna should be connected to binding post F2 instead of binding post F1.*

RAYTHEON ANNOUNCES

89% MORE POWER

Greater Reliability in Radio Power

Light Socket Power for Filament and Plate of Type 199 Tubes Now Practical

FOUR years ago the scientists in the Raytheon Laboratory tackled the problem of using alternating current as a supply for radio power. After three years of research the well-known Raytheon, Type B, was developed. In the one short year since this tube was introduced the B-power market has been revolutionized, and the Raytheon equipped B-power units today are unquestionably the leaders in quality.

Raytheon, Type B, the 60 milliampere tube, remains the standard for regular B-power service.

Now these same engineers have perfected the next logical step toward a. c. operation—a new and exceptional rectifier for a new and exceptional service. Raytheon, Type BH, has a rated capacity of 85 milliamperes, more than enough to supply the 60 milliampere current for the filaments of Type 199 receiving tubes connected in series. Here is a wonderful opportunity for the home constructor to obtain complete a. c. operation. Think of it, both A and B power from a single rectifier! Leading radio magazines will carry detailed information on how this may be accomplished.

The new tube has been rated 200 volts output. This is just what has been needed for the new power amplifiers using the UX-171, the latest development in quality reproduction for the home. This unit will also be described in articles by radio authorities, and complete factory-built B-power units of this type are now available at radio dealers for those who require the extra power.

One last word on Reliability to those who are not already familiar with Raytheon and the Raytheon policy. Complete power units, equipped with Raytheon tubes, are manufactured by Companies selected for their excellent engineering and production facilities. No others are authorized to sell Raytheon rectifiers or to use the trademark word RAYTHEON. Hence, by making certain that you are purchasing a genuine Raytheon unit you are not only assured of the utmost in reliable rectification, but also that the unit has been carefully designed for the service for which it is intended. You will find a variety of prices and styles to meet every requirement.

Raytheon is the Heart of Reliable Radio Power.

RAYTHEON MANUFACTURING COMPANY, CAMBRIDGE, MASSACHUSETTS

condenser, K, as shown in Figures 3 and 7. Be sure that they are mounted exactly as shown. The fixed condensers, R1, R2 and R3, are held in position by the wiring and need not be accounted for until that time.

Mount the fourth shield, W4, in the same way as the other three.

Now, mount the sockets, Y4 and Y5, as shown in Figure 7 with two wood screws.

When this has been done, mount the first-stage transformer, G1, and the second-stage transformer, G2, by means of four wood screws to each instrument. Be sure that they are turned around in the correct position, as indicated in Figure 7.

Now, you can fasten down the choke coil, I, and the filter condenser, J, as shown in Figures 1 and 7. These are also fastened down with wood screws that go into the baseboard space. Notice that the filter condenser is held in place with two sets of metal strips.

This completes the work on the baseboard, N, and you are ready to mount the instruments on the panel, P.

First of all, mount the dual condenser, BC, on the tuning control assembly, L, by means of the special link arrangement that is furnished with this assembly. The shaft should be placed in the center bearing of the tuning assembly and left there loosely while the link is attached to the forward hole in the condenser shaft by means of a screw and washer. The other end of the link should be fastened, by means of another screw, through the hole in the strip near the secondary shaft that attaches to the small tuning knob.

When the condenser, BC, is fastened in the proper position, the screw should be tightened and the set screw should be fastened tightly to the shaft. Care should be taken that this condenser is fastened in the same relative position to the tuning control, L, as shown in Figure 8. If this is not properly done, the baseboard, N, will interfere with the movement of the condenser, BC, when it is finally mounted (see also Figures 3 and 5 for the proper arrangement).

Next, attach to the main panel, P, the bezel and indicator for the main dial, L. This is fastened from the rear by means of two small machine screws that fit into brass inserts in the bezel itself.

Next, attach the main dial, L, which holds the condenser BC to the panel, P. Fasten the small knob in position, as shown in Figure 3.

The next job is to fasten to the panel P by means of a flat-head machine screw and a large nut the variable condenser, A, as shown in Figure 5.

Attach the battery switch, Q, to the panel, P, in the lower left-hand corner, looking from the front of the panel.

Next, attach the variable resistance unit, S, to the main panel with the two terminals pointing to the top.

For All Popular Makes and Circuits *of radio receiving sets*

A Constant "B" Voltage Supply Unit with Power Amplification

TYPE 400

***Price* $68.**

The New GENERAL RADIO "B" Eliminator *and* Power Amplifier

BROADCAST listeners everywhere are now demanding above all else "B" elimination and reception that is NATURAL.

The answer to this demand is the new General Radio Type 400 "B" eliminator and Power Amplifier which is designed to operate with all popular makes and circuits of radio receivers, regardless of whether they may be operated by storage battery or dry cell tubes.

Wherever A. C. 110 volt (60 cycle) lighting current is available the use of the Type 400 unit is the most practical and satisfactory method of supplying all necessary "B" voltages. The Power Amplifier in conjunction with the "B" eliminator permits the convenient use of a high power tube in the last audio stage. This overcomes the tendency toward tube overloading and removes the most common cause of distortion in loud speaker operation.

An outstanding feature of the General Radio Type 400 "B" Power Unit is that it has no variable resistance voltage controls to get out of order and cause noisy reception.

Voltages in this unit are controlled by fixed resistances which are properly designed to make the Type 400 readily adaptable to all average receivers.

Once installed it requires no further alteration and is ready for years of unfailing service.

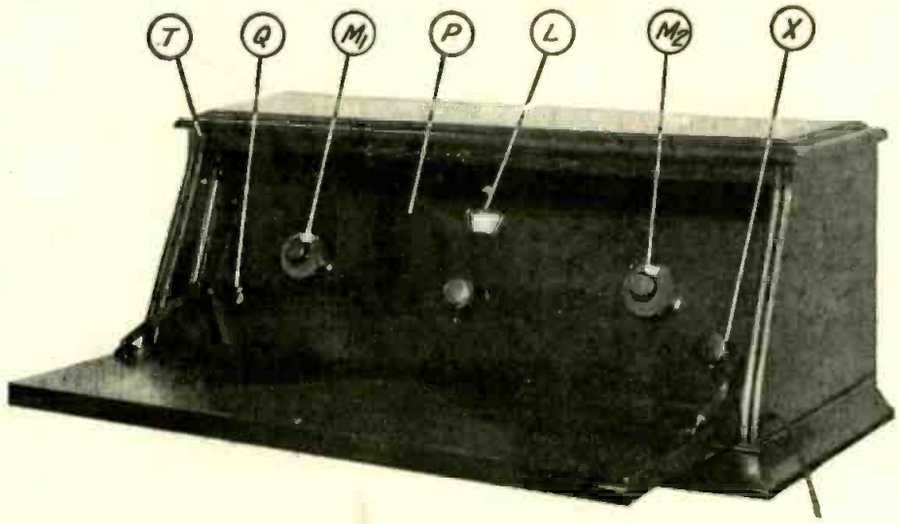
The Type 400 Unit is designed to use UX-213 Rectron rectifier tube and UX-171 power tube in the amplifier.

See one at your dealer's or write for our booklet 400 containing full information.

GENERAL RADIO CO., Cambridge, Mass.

GENERAL RADIO INSTRUMENTS

Behind the Panels of Better Built Sets



A FRONT VIEW OF THE RECEIVER

FIGURE 12: *The knobs and dials and other instruments are marked with letters corresponding to the illustrations and the text of the article. This will give the prospective operator a chance to identify the tuning instruments as outlined in the data on installation.*

Then, attach the short jack, X, in the lower right-hand corner of the panel, P, looking from the front.

This completes the work on the panel and the parts on the baseboard N, are ready to be wired up.

How to Wire the Set

The design of this set is such that the wiring of the grid circuit of each of the five tubes is made extremely short and is isolated from other parts of the circuit. In fact, this idea has been employed throughout and the leads are so arranged that the shortest connections may be used. As this is the case, the set should be wired with bus-bar.

Either a tinned-copper, round bus wire or an insulated, round bus wire such as "Celatsite" n ay be used for the connections. All connections should first be shaped so that they will fit. They should then be soldered in place.

Refer to the wiring diagram in Figure 6 and more specifically to the picture diagram in Figure 5 for the exact way in which to run the wires.

As the wiring instructions given in Figure 5 are so explicit, it is not necessary to explain them verbally. However, a few pointers about the procedure may be helpful.

Start by wiring up the filament circuits of sockets Y1, Y2, Y3 and Y4.

Then, wire up the antenna and ground connections for the coil, D1. Wire the grid and plate connections for this coil and then do the same for the coil, D2, following along with the connections to the coil, D3.

Then, wire up the connections that come within shields W3 and W4.

Next, wire up the connections from the first and second-stage transformers, G1 and G2, to the sockets, Y4 and Y5, and continue the wiring to the binding-posts F1 to F12 on the binding-post strip, E, the connections to the choke, I, and the condenser, J.

After all the instruments on the baseboard, N, are wired and the shields are connected to the ground, the panel, P, should be put back on the two brackets, H1 and H2. The wiring should then be completed to the battery switch, Q, the condenser, A, the dual condenser, BC, the small panel light which is a part of the tuning control, L, the variable resistance, S, and the jack, X.

If this general procedure is followed carefully, the wiring may be done quickly and neatly. The two wires that run to the filament of the last tube should be of twisted lamp-cord and should run around the outside of the filter condenser, J, and the choke, I, to the two end binding posts, F11 and F12, as shown in Figure 5.

If a UX-171 tube is to be placed in the last socket Y5, an extra ½-ampere automatic filament control should be placed in series with one of these two wires.*

When the wiring has been completed, the foundation unit should be slid into the cabinet from the front, so that the binding posts will project from the rear. The set is now ready to be installed.

A Temporary Installation for the Set

As the power unit for the new LC-27 receiver will not be described until the November, 1926, issue of POPULAR RADIO, there may be some question in the minds of builders as to how to operate it until the time that they have this unit completed.

The set works very well on regular "A," "B" and "C" batteries and the following explanation will tell exactly how to it use until either the Junior or Senior power-packs have been constructed and placed in operation.

*A UX-171 tube should be used only when the set is operated with "B" batteries or with a Raytheon or an LC-Junior power-pack. If the LC-Senior power-pack is used, a UX-210 tube *must be used* and the connections should be left as shown in the diagram.

Operate radio set f light sc

Either with a Balk and Balkite "B" or with Combination Radi

Now you can operate your ra socket. Merely by adding tl Power Units—either by adc and Balkite "B," or by adding bination Radio Power Unit.

In either case the result is the ation, maximum convenience, a

Balkite Light Socket Powe- no hum. It is never low and r always exactly what is requir manent. Balkite Radio Pow pieces of equipment. They em— nothing to replace or renew. from either use or disuse. amount of household curren last. With sets of high curr- use is highly desirable for the quire no changes in your set.

Over 600,000 radio receiv are already Balkite equipped. kite and convert it into a ligh the pleasure of owning a set at full power.

Listen to the Balkite Radio Symphony and his New York Symphony, Saturday Time beginning October 23. Stations: WW. WSAI, WTAM, WWJ, WGN, WCCC

FAN STEEL *the trained service behind it.*

The New Balkite Charger

ODEL J. Has two charging rates. A v trickle charge rate and a high rate r rapid charging. Can thus be used ier as a trickle or as a high rate rger. Noiseless. Large water capac- . Rates: with 6-volt battery, 2.5 d .5 amperes; with 4-volt battery, .8 d .2 amperes. Special model for 25- cycles. Price $19.50. West of Rock- $20. (In Canada $27.50.)

Balkite Trickle Charger

MODEL K. With 6-volt "A" batteries can be left on continuous or trickle charge thus automatically keeping the battery at full power. With 4-volt batteries can be used as an intermittent charger. Or as a trickle charger if a resistance is added. Charging rate about .5 amperes. Over 200,000 in use. Price $10. West of Rockies $10.50. (In Canada $15.)

A New Balkite "B" at $27.50

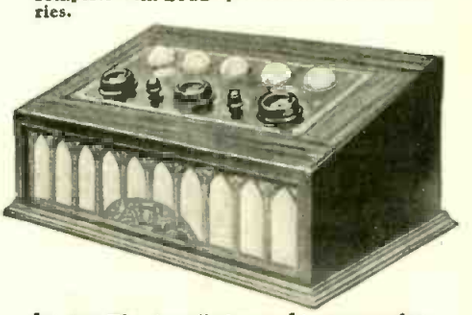
Balkite "B" eliminates "B" batteries and supplies "B" current from the light socket. Noiseless. Permanent. Employs no tubes and requires no replacements. Three new models. Balkite "B"-W at $27.50 for sets of 5 tubes or less requiring 67 to 90 volts. Balkite "B"-X for sets of 8 tubes or less; capacity 30 milliamperes at 135 volts—$42. Balkite "B"-Y, for any radio set; capacity 40 milliamperes at 150 volts—$69. (In Canada: "B"-W $39; "B"-X $59.50; "B"-Y $96.)

Balkite Combination

connected to your "A" battery

Occasionally little things will go as

$132.50 Plus installation and transportation; Ozarka Senior 5 Tube Model complete with Loud Speaker and all accessories.



$100 Plus installation and transportation Ozarka Junior 5 Tube Model complete with built-in speaker and all accessories.

$215 Plus installation and transportation Ozarka Console 5 Tube Model, solid walnut cabinet, complete with all accessories.

We have a few Openings for the Right Men

WHILE there are today 4364 Ozarka representatives, some territory is still open. We want men who believe in the future of radio —men who are tired of working for some one else— men who would like to add to their present income by devoting their evenings to Ozarka.

At the start you can keep your present position. Later on, after you have proven what you can do, then you will give us all your time because it will pay far more than your present position.

The man we want may not have much money but he is not broke. He has lived in his community for some time—he has a reputation that his word is good. He may not have made any startling success but he has never "put over something" just to make money. He may know nothing about radio or salesmanship but he will be successful if he is willing to study what we are willing to teach him, without cost.

The field in radio is wide open for the trained man. The success of the 4364 Ozarka representatives proves what men can do. If you are interested, ask for a copy of the Ozarka Plan, a 108 page book which tells a true story of how big money and a permanent business can be built in radio. It is a story of life; of why some men fail while others succeed. This book has shown many men how to start making extra money immediately and within a very short time establish a business of their own.

OZARKA

INCORPORATED

120 W. Austin Avenue D CHICAGO, ILL.

about 22 volts should be used if a UX-171 tube is used. Remember that if the UX-171 type of tube is employed, a ½-ampere automatic filament adjuster should be placed in series with the filament of the last tube.

Notice that in Figure 11, the two binding posts for filament current supply for the last tube are bridged over to the "A" (−) minus binding post, F4, and "A" (+) positive binding post F5, for the other four tubes.

When the batteries have been connected up, three UX-201-a tubes should be inserted in sockets Y1, Y2 and Y4. A UX-200-a tube should be inserted in socket Y3 and either a UX-171 or a UX-210 tube should be placed in the last socket, Y5. The loudspeaker plug should be inserted in the jack X, and the battery switch, Q, should be turned on. All tubes should light immediately at the correct brilliancy.

The middle tuning control, L, should be adjusted to zero when the condenser plates are all out and the right-hand control M1, that is marked "resonator," should also be set at zero when the condenser plates are all out of mesh. The right-hand volume control, M2, should be turned in an anti-clockwise direction all the way and the dial set at zero.

To start the receiver in operation, tune the middle dial, L, to the wavelength of the station that you wish to hear, after you have determined the approximate position on the dial from the tuning chart on page 562. Adjust the resonance control, M1, until the signal strength is brought up to sufficient volume, and then regulate the volume to just the right tone with the volume control, M2.

The small flashlight bulb that should be placed in the socket in back of the panel on the tuning control, L, is a 6-volt flash lamp and it may be turned "on" and "off" at will by the small twist button at the extreme top and middle of the panel, P, that forms part of the control unit, L.

This is all that there is to the tuning operation of the LC-27 receiver.

Builders are advised to use their regular "A," "B" and "C" batteries on the set until the November issue appears with further and complete data on the LC-Senior power-pack with complete operating data for using the set without any batteries.

The antenna may be connected to either of the two posts, F1 or F2, shown in Figure 11, although sharper tuning, where it is necessary, will be obtained from the post, F2, that is located next to the ground binding post. If the set is to be worked without any antenna at all, the ground wire, instead of being fastened to the ground binding post, F3 should be connected to the end post, F1 on the right end of the cabinet, when looking from the rear. The ground may be either a radiator pipe or a cold-water pipe.

With the Experimenters

(Continued from page 536)

lengths above 10 inches, merely multiply the number of turns by ten and the length of coil by the same amount.

If lengths are required below 1 inch, divide the length of coil in the chart by ten and the number of turns by the same amount. In the latter case the length of coil will naturally be read in tenths of an inch.

EXAMPLE: The length of the coil is to be .3 of an inch and the wire, number 16 DCC.

Proceeding as before, the number of turns for a 3-inch length of coil will be found to be 50; divide this by 10, and the number for the .3 inch coil is found to be 5 turns. For a 30-inch coil, the number of turns will be just ten times as much as for the 3-inch coil, or 500 turns.

—MORRIS M. SILVER

How to Get the Most Out of Your Browning-Drake Receiver

SINCE the publication of the original article on the Browning-Drake Receiver in the August, 1926, issue of POPULAR RADIO, a great deal of experimental work has been done in an effort to develop the receiver to an even higher point of efficiency than it showed in the first tests.

Because of the comparatively large variety of tubes now on the market it seemed logical to take the tube equipment for this receiver as the first subject for experiment.

It is evident that the selection of the proper tubes for the set cannot be based solely on the volume and quality of reproduction that is obtained. Other factors must be taken into consideration, such as filament-current consumption, plate-current consumption and grid-bias requirements.

In the case of the power tube to be used in the last audio stage, there is no question but that the UX-171 tube best fits the requirements as it will handle a greater amount of power without distortion than will any of the other 5-volt tubes. It must be remembered, however, that this tube requires a comparatively high "C" battery value; but this is not difficult to provide.

A more important consideration is the high "B" battery current consumption which results when this tube is used. If the "B" battery voltage that is applied to this tube in the Browning-Drake receiver is 180, for instance, the current consumption becomes so high that the "B" batteries will have a comparatively short life. From the standpoint of economy it is preferable to use a good "B" power-pack in this case rather than batteries. If the voltage applied to this tube is reduced to 135 volts, conditions will be somewhat better and the current

consumption will be reduced to a point where the use of "B" batteries becomes practical. They should be of the "heavy duty" type in any case because the drain would still be too heavy for the ordinary "large" size batteries.

To sum up, if the maximum results are desired so far as volume and distortionless reproduction are concerned, the UX-171 is the type of tube to use in the last stage of this receiver. It should be used in conjunction with a "B" power-pack that is capable of delivering a maximum voltage of 135 to 180 volts. In all cases where this type of tube is used, a proper "C" battery should be provided with a value up to 40 volts, if the plate-supply voltage is 180, or up to 27 volts if the plate supply is 135 volts.

The UX-112 type of tube will serve very well in the last audio stage and it has the advantage that the "B" battery current drawn by this tube is much lower than that required by the UX-171. It is capable of handling all except extremely loud signals with a high degree of quality. Its one drawback seems to be that it is not quite capable of handling extremely strong signals from nearby broadcasting stations. This may easily be taken care of by tuning one of the wavelength controls slightly off resonance and in this way reducing the volume on strong signals to a point within the limitations of the UX-112 tube.

If the "B" battery voltage used is 180, the current drain with the UX-112 tube will be sufficiently high to warrant the use of "heavy duty" "B" batteries. With a voltage of 135, the current drain drops considerably and the use of the "large" size "B" batteries becomes practical. A set of these batteries will have extremely long life, running into several months, if the set is used at an average rate of from two to four hours daily. The "C" battery voltage required with the UX-112 tube will be approximately 10 volts when the "B" battery voltage is 180.

A "B" supply unit may be used with the UX-112 tube, of course, and it may have a voltage output of anywhere from 135 to 180 volts.

A properly designed high mu tube sometimes works out very satisfactorily as a radio-frequency amplifier. This is particularly true when the amplifier is of the neutralized type, such as is employed as the radio-frequency unit of a circuit like the Browning-Drake. Then, too, the small type high-mu tubes, which consume the same filament current as the UX-199, may well be employed in the resistance-coupled audio-frequency amplifier system of the improved Browning-Drake.

The best over-all performance of the Browning-Drake receiver was obtained when the CeCo high-mu, small-sized tubes (long prongs for use with the new type UX socket) were used in the radio-

frequency and first two audio-frequency stages. A standard UX-199 tube works out most satisfactorily for the detector and a UX-171 and UX-112 for the last audio stage.

In the arrangement described, the coupling resistors which perform most satisfactorily, are 100,000 ohms. The value of the grid resistors varies somewhat with the particular tube used but should be about .075 megohms (75,000 ohms) in the second stage and about .025 megohms (25,000 ohms) in the first stage. The resistors used to supply the plate of the detector and radio-frequency tubes, should be approximately .075 megohms in the detector plate circuit and from .05 to .075 megohms in the radio-frequency plate circuit.

In connection with these resistors, it has been found advisable to use rather large sized fixed condensers. In fact, the author has been able to secure very satisfactory results by running the size of the condenser up to 1 microfarad.

In the original article in the August issue it was suggested that an antenna 75 feet long, exclusive of the lead-in, would be most satisfactory. The characteristics of an antenna vary a great deal with location, so that a given length of antenna cannot be said to be the very best that may be used. Later experience seems to show that a forty to eighty foot antenna with as much vertical part as possible operates most efficiently.

The vertical part of an antenna is sometimes called the lead-in, but as the vertical component of the antenna is the factor that picks up a large percentage of the signal it should be included in speaking of the length of the antenna as it is above. In view of these foregoing facts, the vertical part of the antenna should be as long as possible. That is, the antenna should be placed as high as possible.

With the antenna tuning system used in the receiver described, a large horizontal antenna is not necessary and a vertical wire thirty or forty feet long will be found to give ample signal strength in many cases.

It is sometimes found that a receiver will go into oscillation with a "snap" or "plop" as the tickler coil is rotated. This condition is wrong. It should go into oscillation smoothly. There are several things that regulate the regeneration in the receiver and, as smooth regeneration is absolutely essential for maximum signal strength and stability, the several items which would give this condition are listed.

First, the larger the bypass condenser in the plate of the detector tube is, the more easily will the set oscillate. Consequently, if the receiver breaks into oscillation when the tickler coil is turned only a slight way past its right angle position with the secondary of the R.F. transformer, this bypass con-

denser should be made smaller. It was formerly .001 mfd. and it might help to make it .0005 mfd.

Second, the grid-leak and the grid-condenser have a marked effect on the regeneration control. If the grid-leak is quite large, say five to eight megohms, and the grid-condenser has a capacity of from .0001 to .0005 mfd., a smooth control of oscillation is obtained. The exact size cannot be specified for all tubes, as their characteristics differ materially.

However, it has been found that a grid-condenser considerably smaller than the standard size of .00025 mfd. may be used to advantage. A larger grid-leak may be used with this size condenser without damaging the quality of the signals received.

The plate battery voltage applied to the detector tube may also be varied somewhat so as to obtain smoother regeneration. The number of turns on the tickler will also effect this condition, but in the coils put out, the correct number of turns has been carefully determined by experiment.

It may occasionally be found that the Browning-Drake receiver gives a continuous howl or perhaps a high pitched whistle when the loudspeaker is turned on. When this is the case, the trouble can practically always be eliminated by one or two things. First, the loudspeaker should be moved further away from the receiver and should be kept a fair distance from the body of the person operating the receiver. In most cases it is inadvisable to stand the speaker on top of the receiver, or even on the same table with the receiver, because the vibration of the speaker may cause the tubes to vibrate, with a resulting howl.

The second scheme for eliminating these undesirable noises is to ground the case of the audio transformer. A "peanut" whistle may, of course, be due to the use of run-down "B" batteries and if any trouble of this kind occurs it is always well to test the voltage of these batteries.

There has been some question as to why the UX-199 type of tube is always used in the radio-frequency amplifier of this and former models of this receiver.

The UX-199 tube has a very small internal grid to plate capacity and is consequently easier to balance than would be the case if a UV-201-a type tube were used. There are other tubes than the UX-199, however, which have a small capacity such as the Magnavox tube or the Ce-Co high-mu tube and any one of these may be used.

—ARTHUR H. LYNCH

The photograph of the North Pole taken by American airmen discloses only a hole in the ice. It is presumed that some unscrupulous Eskimo stole the thing for this antenna.

—LONDON OPINION

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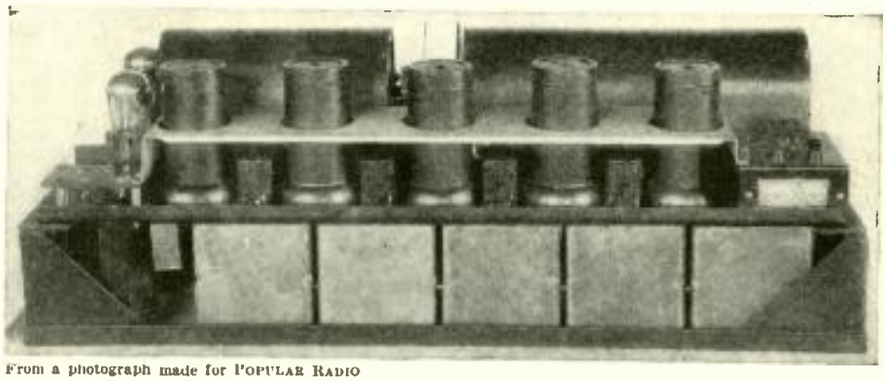
STORAGE BATTERIES FOR MOTOR-CARS AND RADIO

Inside Information on New Radio Receivers

The Bosch "Amborada"

(*Continued from page 528*)



From a photograph made for POPULAR RADIO

TOTAL SHIELDING IS EMPLOYED

FIGURE 2: *This view of the "Amborada" shows how completely each stage is shielded by a metal can; each of the tubes except the audio-frequency amplifier tubes is placed in its individual, round metal can. A sturdy chassis prevents warping in the set.*

last year's manufacture, it was found that stations were brought in with great volume on the "Amborada" (using a ten-foot antenna) that could not be picked up at all on the older set, even with the use of an outdoor antenna.

The radio-frequency amplifier is, in addition, so well balanced that there is no trace of oscillation in the set, no matter to what wavelength it may be tuned.

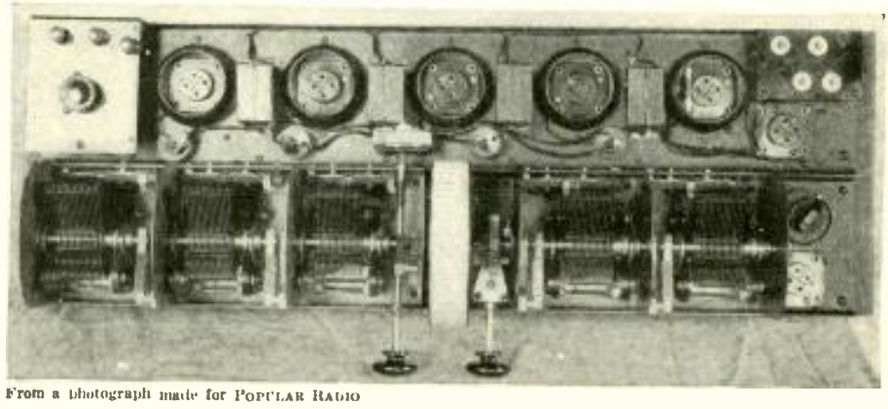
What is more, a real single-control operation of the receiver has been obtained by perfectly matching the four stages of the radio-frequency amplifier so that it does its work as efficiently as if every stage were individually tuned. There are no additional balancing controls; the necessary balancing of the tuning units is accomplished before the receiver leaves the factory.

These four stages of amplification, the detector, and each of the coils are individually shielded in accordance with the latest approved methods of set design. The whole receiver is assembled on a steel frame to assure a rigid foundation. This is especially important in the case of the five variable tuning condensers which must always be kept in exact alignment, as they are all operated by means of a single control.

When the receiver is installed in the home it is necessary to make only one adjustment inside of the receiver; this is to adapt it to the antenna with which the particular receiver is to be used. This adjustment takes only about ten seconds, and once made it need never be changed unless a different antenna is used at some later date, in which case a readjustment of this internal control must be made to match the receiver to the new antenna.

A good idea of the fine sensitivity of the receiver may be obtained from a list of the stations that were tuned in on July 8, a warm summer night. During the evening of this test, which was conducted by POPULAR RADIO, the usual summer reception conditions, with a fair amount of static, prevailed. The antenna used throughout this test consisted of a 10-foot length of No. 28 wire that reached from the receiver up to the picture moulding.

All of the stations were received on the loudspeaker and even the most distant of the stations listed were easily audible throughout an ordinary room. The majority came in with such volume that it was necessary to turn the volume control well down.



From a photograph made for POPULAR RADIO

WHAT THE SHIELDS HIDE

FIGURE 3: *How the "Amborada" looks when the top portion of the shields have been removed. The tuning is done by the small knob at the right center that rotates all of the condensers in unison by a gear arrangement; the other small knob controls the volume.*

YOUR INDIVIDUAL RADIO PROBLEMS SOLVED

POPULAR RADIO maintains for the benefit of its readers a Technical Service Bureau and Laboratory, under the personal supervision of Laurence M. Cockaday which will, without charge, answer by personal letter any question, problem or request for information submitted by a subscriber. This service is, however, also available to readers, other than subscribers, at the very nominal rate of $1.00 the inquiry.

In writing please confine your questions to one general subject, writing on one side of the paper only, and enclose a self-addressed and stamped envelope.

It is possible that your individual problem has been covered in an issue of POPULAR RADIO, and so as an aid to you we endeavor to keep a supply of back numbers in stock. The condensed index below gives a few of the subjects that have appeared recently, look this list over and if the information you want is covered, we will be pleased to supply back numbers at 35c. a copy.

January, 1926
—How to Get the Most Out of Your LC-26 Receiver.
—Some New and Useful Facts About Coils.
—When Your Set Won't Work.
—Straight-Line-Frequency Condensers.
—What's New in Radio Apparatus.

February, 1926
—How to Reduce Distortion in Amplification.
—Some Stunt Sets.
—Important Kinks in Wiring.
—How to Cut Down Your "B" Battery Bill.
—Hints for Amateurs.

March, 1926
—Why and How the Milliammeter Increases the Efficiency of Your Set.
—What "Inductance" Really Is.
—List of Broadcast Stations in the U. S.
—How to Build the S-C Receiver for Short and Long Waves.

April, 1926
—How to Get an Operator's "Ticket."
—What a Straight-line Frequency Condenser Really Is.
—How to Build a Power-pack Amplifier.
—The New "Crystal Pilot"
—How to Build and Operate a Low-Power Transmitter.
—The Popular Radio Medal for Conspicuous Service.

May, 1926
—How to Draw Up Your Own "Tuning Graphs."
—How to Build the Improved Raytheon Power-pack.
—How to Build an Antenna Mast for $15.00.
—Fifteen Ways to Reduce Static.
—Do Your Coils Broadcast?

June, 1926
—How to Build the New Home Receiver.
—How to Put Up a Good Outdoor Antenna.
—How to Get the Most Out of Your Ready-made Receiver.
—Audio-frequency Amplification. How to Get it Without Distortion.
—Four New Combinations of Units for Assembling the Raytheon Power-pack.

July, 1926
—How to Get the Best Reception in Summer.
—The Best Crystal Set for $13.00.
—How to Build the Newest Portable "Town and Country" Receiver.
—Four New Combinations of Units for Assembling the Raytheon Power-Pack.
—How to Get the Most Out of Your S-C Receiver.

August, 1926
—A New Method of Using Harmonics for Determining Frequencies.
—Popular Radio Circuits.
—How to Build the Improved Browning-Drake Receiver.
—How to Pick Out a Loudspeaker.
—How to Get the Most Out of Your "Town and Country" Receiver.
—Three Vacuum Tubes in One.

September, 1926
—Foretelling Radio Reception from the Weather Map.
—How to Build an Impedance-coupled Amplifier.
—A Radiant Crystal Pilot.
—Popular Radio Circuits.
—How to Simplify Your Set with Automatic Filament Controls.
—Inside Information on New Radio Receivers.
—How to Wire Your House for Radio.

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But when a leading authority, untouched by partisanship, indicates his preference for a particular product his choice is sure to command attention and respect.

Laurence M. Cockaday, celebrated radio engineer, has just perfected a new and notable circuit—known as the LC-27. In selecting a resistance unit for his LC-27, Mr. Cockaday elected to use the Durham *Metallized* Resistor in his original design.

The reasons for his choice are plain. The *Metallized* character of the Durham Resistor renders it impervious to moisture and atmospheric changes and assures a constant resistance value under all conditions. This means clear reception devoid of distortion and noises.

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STATIONS TUNED IN DURING THE EVENING OF JULY 8, 1926 AT SPRINGFIELD, MASS., USING A NEW MODEL BOSCH "AMBORADA" RECEIVER

WMSG—New York City
WBNY—New York City
WJZ—New York City
WEAF—New York City
WEEI—Boston, Mass.
WIP—Philadelphia, Pa.
WNYC—New York City
WGR—Buffalo, N. Y.
WBBM—Chicago, Ill.
WGBB—Freeport, N. Y.
WNJ—Newark, N. J.
WAAM—Newark, N. J.
WFBH—New York City
WNAC—Boston, Mass.
WLWL—New York City
WEAO—Columbus, O.
KDKA—Pittsburgh, Pa.
WAHG—Richmond Hill, N. Y.
WEBH—Chicago, Ill.
WGY—Schenectady, N. Y.
WLIT—Philadelphia, Pa.
WLW—Cincinnati, O.
WCAE—Pittsburgh, Pa.
WOO—Philadelphia, Pa.
WEAR—Cleveland, O.
WJAZ—Chicago, Ill.
WGN—Chicago, Ill.
WLS—Chicago, Ill.
WHN—New York City
WJJD—Mooseheart, Ill.
WHO—Des Moines, Ia.
WHT—Chicago, Ill.
WCCO—Minneapolis, Minn.
KYW—Chicago, Ill.
WJR—Detroit, Mich.
WOC—Davenport, Ia.
WCAP—Washington, D. C.
WIBO—Chicago, Ill.
WMCA—New York City
WSBC—Chicago, Ill.
WGES—Chicago, Ill.
WJBL—Decatur, Ill.
WSWS—Chicago, Ill.
WQJ—Chicago, Ill.
WGBS—New York City
WRNY—New York City
WHAP—New York City
WGCP—New York City
KSD—St. Louis, Mo.
WTIC—Hartford, Conn.
WBZ—Springfield, Mass.

The operation of the "Amborada" receiver is simplicity itself. The front of the cabinet carries two knobs and it is by means of these knobs that the operation and tuning of the receiver is accomplished. One knob is the wavelength control, described above; this, by means of a gear arrangement and mechanical coupling, tunes the antenna circuit and the circuits of the four radio-frequency amplifier stages in a single operation.

The other knob serves to control the volume of sound. It operates a continuously variable resistance in the filament circuits of two of the radio-frequency amplifier tubes and it permits a variation in the volume of reproduction from zero to maximum.

To make the tuning of the receiver even more simple a small window is set into the top surface of the receiver cabinet through which may be seen a calibrated scale showing the wavelength to which the receiver is tuned. This scale is mounted on the edge of a drum which turns with the wavelength tuning knob.

This calibrated scale is of translucent material located just beneath the window. Fixed in a permanent position underneath the scale is a small incandescent lamp which makes the scale calibration figures stand out in bold relief even in a dark room.

Between the lamp and the scale is another piece of translucent material

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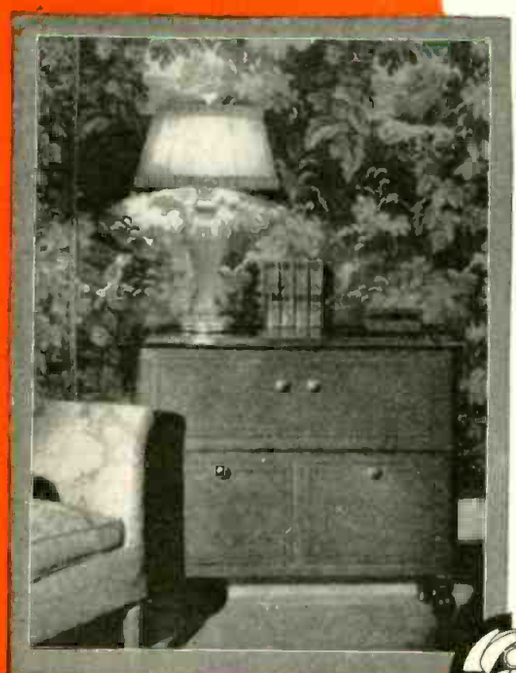
The Bosch Amborada is a seven tube receiver completely Armored and Shielded against interferences and has tonal range from a whisper to dance volume. It successfully and instantly separates "close in" stations without whistling or blurred reception. Two controls only: one for station selection and one for volume. Ample room is provided in the handsome early American period Amborada cabinet for all batteries, chargers or power units—perfect radio and quality in furniture is embodied in this New receiver.



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All prices slightly higher, Colorado and west and in Canada

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Every receiver, every item in the line is Bosch precision built, ahead of the industry, and you can prove it for yourself, just visit a Bosch Radio Dealer. We will tell you his name upon request. Be sure and hear Bosch before you buy.

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with a slit across its center. This throws a narrow, and sharply outlined band of light across the scale and it is where this line of light coincides with the markings of the scale that the wavelength readings are taken.

The small lamp under the indicator window also serves as a pilot light because it is connected in the filament supply circuit and therefore is lighted only while the receiver is in operation.

It is only necessary to listen to an "Amborada" receiver in operation to realize that natural, full-toned reproduction of music and voice has been one of the chief aims of the designers.

The manufacturers recommend the use of their loudspeaker with the "Amborada" receiver to obtain the best results as these two instruments were designed to work together.

The examination which the receiver underwent during the POPULAR RADIO tests demonstrated clearly that the selectivity of the new model is sufficient to cut out interference even in crowded areas.

In addition to the actual selectivity of the set, there is an "apparent" selectivity that results from the design of the tuning condensers which provides a straight-line-frequency tuning curve up to about 300 meters and a straight-line-wavelength characteristic from there to 550 meters. This arrangement has the effect of spreading the numerous low-wave stations over a larger part of the scale while the higher wave stations are brought closer together on the scale—still not bunching these higher wave stations as the case would be if the tuning had a straight-line-frequency characteristic throughout.

The fine workmanship of the "Amborada" receiver is evident in the cabinet. This cabinet is built to resemble a low-boy chest of drawers and it is only thirty inches in height so that it is low enough to be placed beside the arm of an easy chair, or directly in front of a window. It is as long as it is high and it measures approximately twelve inches from front to back. The top surface is unbroken and may be used for any purpose ordinarily served by a small table.

The front of the cabinet contains what appear to be three drawers. One large dummy drawer occupies the entire upper half of the cabinet and is nothing more nor less than a shield behind which the receiver proper is installed. The two knobs on this drawer are actually the volume and wavelength-control knobs.

The two dummy drawers in the lower part of the front are doors that give access to the battery compartment in the lower half of the cabinet.

The whole unit is of solid walnut finished in a warm brown and with outline inserts of darker material. The construction and finish are of the highest order with a prevailing note of sim-

plicity that will blend with any type of room furnishings.

A loudspeaker has not been included in the cabinet because of the difficulty of providing proper acoustic qualities in a confined space. Instead, the Bosch Company have placed a special art pedestal on the market, to use in conjunction with their various styles of cone-type loudspeakers.

The battery equipment that is required for the operation of the "Amborada" receiver consists of a 6-volt storage "A" battery to supply the filaments of the tubes, an "A" battery charger, 135 to 150-volts of "B" battery and a small "C" battery. A Bosch "Nobattery" unit may be used in place of the "B" batteries. Ample room for all of this equipment is furnished in the battery compartment provided in the lower half of the cabinet.

The antenna requirements of this receiver are most lenient. If the receiver is used in the vicinity of one or more broadcasting stations an indoor antenna anywhere from 10 to 30 feet in length will be best. If a larger antenna is used under these conditions the signal strength of the local broadcasters will probably be too great because of the extreme sensitivity of the receiver.

In suburban locations or in places some distance from the nearest broadcast station the antenna may be installed either indoors or outdoors but in no case should it be over 60 feet in length. An antenna larger than this will provide too much signal energy, even on distant stations.

The ground connection may be made to the nearest cold-water pipe or steam radiator. If both are available, it is advisable to try both and then make the permanent ground connection to the one that provides best results—if there is any noticeable difference.

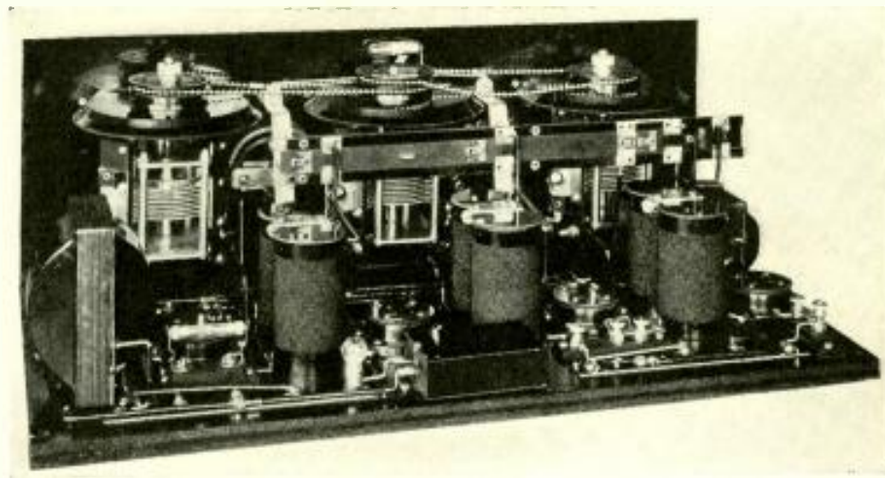
The New Model Grebe Synchrophase Receiver

(*Continued from page 529*)

high-wave range to go down so low. Its approximate range is therefore 250 to 550 meters. Figuring on the same basis as above this would mean an average variation of 3 meters per degree of the dial, as compared with 3½ meters per degree of the dial on a receiver having a 200 to 550 meter range.

The switch-over from the high-wave range to the low-wave range is accomplished by throwing over a lever inside of the receiver, or it may be done automatically by turning the main tuning control dial to zero which engages the lever automatically. Thus, if the operator is tuning downward in the higher range, when he reaches the bottom of that range the switch is automatically thrown and he may tune on down in the lower range.

Another feature which, so far as the author knows, is exclusive to the Syn-



From a photograph made for POPULAR RADIO

A REAR VIEW OF THE SYNCHROPHASE RECEIVER

FIGURE 5: *All of the instruments in this receiver are placed in their logical positions, so that the wiring and the construction work in general is greatly simplified. Notice the connecting chains that tune the three sets of condensers as one.*

chrophase receiver, is the "Tone Color" control. It is known that human ears differ in their ability to hear certain sound frequencies. Some persons, for example, hear extremely low-pitched tones with difficulty, while others may have difficulty on the high notes. This explains why two persons may disagree as to the quality of reproduction of a radio receiver.

This fact has been recognized by the makers of the Synchrophase receiver and a "Tone Color" control knob has been placed on the panel.

This "Tone Color" control, at one adjustment, provides high amplification on the lower notes and somewhat subdues the higher notes while another adjustment emphasizes the higher. There is an intermediate adjustment that provides practically uniform amplification on all notes within the audible range. This adjustment produces what is normally considered the best quality of reproduction.

The Synchrophase receiver employs two stages of neutralized, tuned-radio-frequency amplification, a detector and two stages of transformer-coupled audio-frequency amplification, that require five vacuum tubes in all. The UX-201-a type of tubes are used in the radio-frequency amplifier and in the first audio amplifier stage. The detector may be either a 201-a or one of the new UX-200-a tubes. The last audio stage makes use of a UX-112 power amplifier tube to handle the great volume of which this receiver is capable.

The coils in the radio-frequency amplifier are the famous Grebe "Binocular" coils, so called because of their double-barrel form. This form is used to concentrate the electro-magnetic field of the coils and thus reduce the interstage coupling thereby increasing the stability of the tuned circuits.

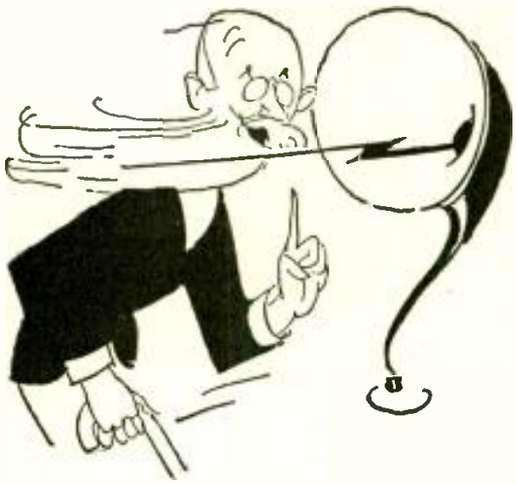
The coils are tuned with variable condensers that have a maximum capacity of about .00025 mfd. Low tuning capacity such as this with coils of high inductance is generally considered to be a most efficient combination, and probably accounts in part for the great sensitivity of this receiver.

From the standpoint of sensitivity the Synchrophase receiver rates high, especially in view of the fact that it uses only two stages of radio-frequency amplification.

When used with an antenna not exceeding 45 feet in length, including the lead-in wire, the receiver provides ample selectivity, even for use in congested districts such as New York City and Chicago. In suburban districts an antenna longer than this may be used and still maintain proper selectivity. In general, a 45-foot antenna, used with this receiver, provides all the volume desired and enables the operator to tune in stations at a distance. A loop antenna, or an indoor antenna twenty or thirty feet long will provide all the energy required for excellent results with the single exception that the distance range will be somewhat reduced.

The maximum volume of reproduction of this set is greater than could conceivably be used in a room of average size and it is adequate for use in a good sized hall. By means of the "Volume" control on the panel the volume may readily be cut down to the proper degree suitable for home use, however. This is well because the energy picked up by the antenna from distant stations is so small that a goodly reserve of volume is essential to provide loud-speaker reproduction.

There are five operating controls in all. Each of the three tuned circuits is provided with a knurled disc that projects through the lower half of the panel. These controls are connected by a flexible coupling so that all three may be operated at once as explained earlier. Directly above these three controls are the three revolving scales with their edges calibrated in degrees. These



There's sound sense in quiet charging—

Clear, full, volume in your reception is the only way in which your Rectigon "makes itself heard." All because of the wealth of pep it packs into your batteries. But you'll never hear a peep from a Rectigon, itself, while it's doing its charging job. Not a murmur—not a bit of fuss. It's so quiet it wouldn't disturb the snooze of the lightest sleeper. Rectigons are popular for home charging because they do away with even the slightest annoyance and bother.

when you keep batteries lively with

The Westinghouse Rectigon Battery Charger

No acids, no chemicals—no moving parts—nothing to spill or burn. No muss, no worry. You'll have no spoiled rugs, no ruined clothing.

Saves its cost in short order—Count the dollars spent in a few trips to the service station and you'll hotfoot it for a Rectigon, for the good it does your pocketbook as well as your batteries.

Snaps on in an instant—Just plug into the light socket, snap on the terminals. Saves service station bother. Spares interruptions caused by absent batteries.

Charges both "A" and "B" batteries—Keeps both packed with power. Bulb is used for "B" battery charging and it is enclosed, like all other parts, in metal, safe from accident. (Rectigon charges automobile batteries, too.)

Perfect safety for your set—If you tune in while you're charging there'll be no harm either to set or batteries. Nor will batteries be discharged if anything happens to the current while your Rectigon's attached.

No Storage Battery Radio is Complete Without a Rectigon

THE RECTIGON'S a superb Westinghouse product. Things you *can't* see, like extra heavy insulation, things you *can* see, like the durably enameled case—all are of highest quality. Westinghouse also manufactures a complete line of radio instruments, and Micarta panels and tubes.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

Tune in on KDKA • KYW • WBZ • KFKX

show the settings of the corresponding tuning controls. A small light bulb is arranged behind the panel in such a way as to throw a beam of light on the scale of the master tuning control. Thus the receiver may be tuned comfortably even in a darkened room.

This light also serves as a pilot light. It is connected in the circuit with the tube filaments and operates from the storage "A" battery. It therefore lights only when the receiver is turned on.

Centrally located on the panel, above the wavelength controls, are the two knobs by means of which the volume and the tone are regulated. The "Tone Color" control is usually set at one place and left permanently fixed in that position and can therefore hardly be considered as an operating control. The "Volume" control is, of course, continuously useful.

The power for operating the receiver is furnished by a six-volt storage "A" battery that lights the filaments; a "B" battery voltage of 135 for the high-voltage plate supply; and two small "C" batteries for the necessary grid-bias voltage. A power supply unit that operates from the electric light lines may be used in place of the "B" batteries. Such a unit may be of any standard make, and should be capable of supplying voltages of 22½, 90 and 135 volts.

The New "800" Receiver

(*Continued from page 530*)

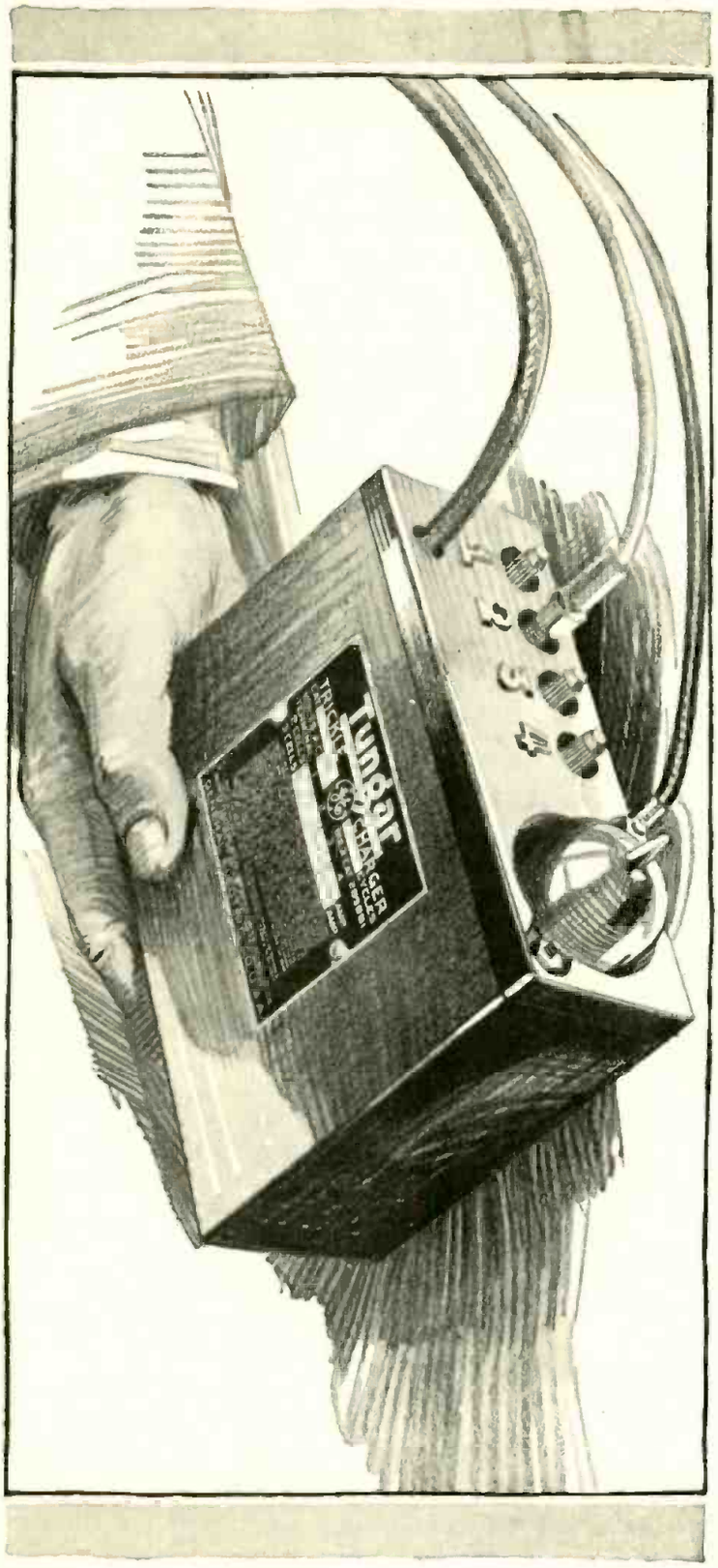
selectivity. This is easy to understand when it is remembered that each tuned circuit in a receiver serves as a filter to keep out signals on all wavelengths other than that to which the circuit is tuned. When this trap process is repeated five times, as in the five tuned circuits of the "800" receiver, it is natural that interfering signals should be eliminated to a greater degree than would be the case if there were fewer tuned circuits.

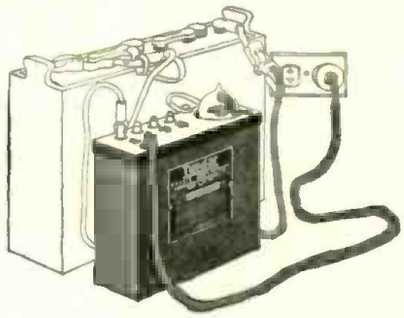
Tests made on the "800" receiver indicate that the manufacturer has been successful in developing a radio-frequency amplifier that provides approximately the maximum selectivity that is obtainable without cutting off side bands. In addition, it is so well balanced, shielded and neutralized that it provides clear, undistorted output to the audio-frequency amplifier.

This fine quality is maintained in the audio-frequency amplifier.

The design of this portion of the circuit has been given careful attention. The audio-frequency transformers that are used are specially designed and have a good characteristic amplification curve.

The volume output of the "800" receiver is tremendous—much too great or the ordinary UX-201-a tube to handle, as the second audio-frequency amplifier tube. To overcome the dif-





General Electric *presents the new* Tungar Trickle Charger

Been waiting for this? So many fans have! A small, compact charger that does a full-size job.

Connect a G-E Tungar Trickle Charger to your radio "A" battery. Put it in your radio cabinet—and your set will have constant power.

This new General Electric Charger allows just enough current to trickle continuously into the battery to replace the power used by the set.

The Tungar Trickle Charger is convenient, clean, complete—ready for installation. It is moderate in its price—and in its running cost.

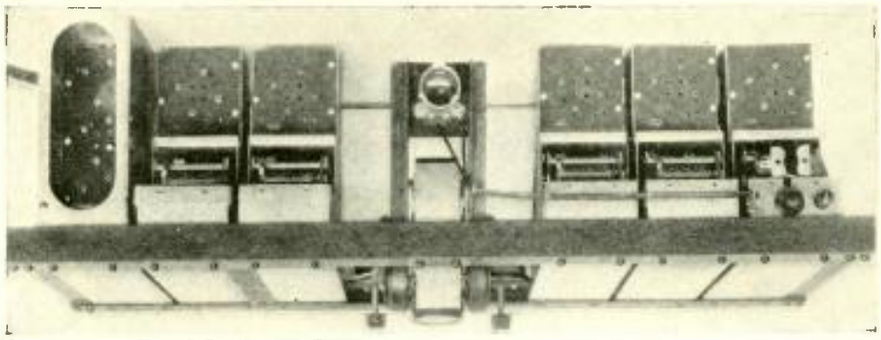
East of the Rockies
$12 complete with bulb.
(60 cycles, 110 volts)

Merchandise Department
General Electric Company
Bridgeport, Connecticut

Tungar
REG. U.S. PAT. OFF.
TRICKLE CHARGER

Tungar—a registered trademark—is found only on the genuine. Look for it on the name plate.

GENERAL ELECTRIC



From a photograph made for POPULAR RADIO

THE SHIELDED UNITS SEEN FROM ABOVE

FIGURE 7: *The arrangement of the four tuned stages of radio frequency and the detector stage are shown here with the audio-frequency stages in single can at the left. The middle unit is the tuning control and directly in back of that may be seen the socket for the loop antenna.*

ficulty, the second audio-frequency stage is arranged so that two of these tubes may be used in parallel. This divides the load equally between the two tubes and, as a result, neither of them can be overloaded. A single power tube of the UX-171 type may be used, if preferred; in this case no tube is inserted in the other parallel socket.

The Freed-Eisemann, type No. 14, full floating, cone speaker is recommended by the manufacturer for use with the "800" receiver. In tests made by the author this speaker proved to be a fitting running mate for the receiver.

Protection for the loudspeaker is afforded by the use of an output transformer, which is included directly in the receiver. This transformer allows the audio-frequency modulations to pass on to the loudspeaker but keeps the high-voltage, direct current out of the speaker winding.

The cabinet of this new set is of mahogany, finished in a rich brown, two-tone effect. It is of the table mounting type and it is of suitable size to be placed on a standard console, battery cabinet or other table. The set is also supplied in an elaborate high boy cabinet with enclosed loop and loudspeaker and with space for concealing all batteries. This is designated as model No. 850.

The sloping front of the cabinet is of mahogany. A pleasing effect is obtained by arranging this in panels of opposing grain, with a mild parquet effect.

In the center of the panel is a gold-plated, bronze escutcheon plate which accommodates the operating controls and voltmeter. An opening is also provided in the plate through which a portion of the wavelength indicator drum projects. This opening is surmounted by a small, incandescent lamp that illuminates the wavelength scale and at the same time serves as a pilot light to show when the set is turned on or off.

In the center of the top of the cabinet is provided a socket for carrying the loop antenna. The loop is supported by this socket, directly over the center of the receiver, and it is small enough not to project beyond the front or back of the cabinet.

The receiver is very simple to operate. There are only two controls, in the form of knurled bakelite discs. One of these controls is for wavelength tuning and tunes the five circuits of the receiver simultaneously, thus providing absolute "single" control. The other disc controls the volume to any degree desired from zero to maximum.

These two controls are so placed that they may both be operated by one hand, one with the thumb and the other with the index finger. The more normal plan, of course, is to use the right hand to operate the wavelength control and the left hand to control the volume.

The volume control operates a rheostat in the filament circuit of the four radio-frequency amplifier tubes; this varies the input to the detector.

The receiver comes equipped with a specially designed loop antenna. This loop provides enough energy "pick-up" to operate the receiver on local and distant signals and eliminates the necessity for both an antenna and a ground connection. Nevertheless provision is made to permit the use of any type of indoor or outdoor antenna, and ground connection, if desired.

The power to operate the filaments of the tubes is drawn from a 6-volt storage battery. For the high-voltage, plate supply the regular dry-cell or storage "B" batteries may be used or the Freed-Eisemann Model No. 16 high voltage supply unit, which draws its power from the house lighting lines.

The plate voltages required are: 22½ volts for the detector, 90 volts for the radio-frequency amplifier tubes and the first audio-frequency amplifier tube, and 135 volts for the last audio-frequency stage. The use of a small, dry-cell "C" battery is also necessary, the exact voltage depending on the tubes that are used in the last stage of amplification.

By means of the voltmeter and voltmeter switch, located on the front of the receiver, it is easy to determine when any of the batteries need replacement and to keep the set in best working conditions at all times.

The secret of its marvelous tone
—*filtered output*

NOW, for the first time you can build a receiver embodying the three necessary requirements for perfect tone results:

1. A clean undistorted signal through the detector.
2. Uniform amplification of all voice and musical frequencies.
3. A filtered output by which nothing but pure voice current is permitted to actuate the loud speaker.

These features together with good distance range. simplicity of tuning and high selectivity makes the LC-27 the supreme broadcast receiver, the LC-27 is non-regenerative. can be used with batteries, or power supply units, and is designed to fit the console and table type cabinets of the leading manufacturers of cabinets. It is the foremost example of what can be accomplished by the handiwork of the amateur set builder.

(*Write for free descriptive folder.*)

THE newest contribution to radio by Mr. Laurence M. Cockaday. Mr. Cockaday fully realized that no receiver could be better than its parts, and every part used in his new receiver was given a most thorough test for serviceability, and uniform quality, before he selected it for his original model.

A New Receiver by Cockaday

Following is a complete list of parts used in building the LC-27 Receiver:

1—Hammarlund mid-line dual condenser, .000275 mfd	$7.50
1—Hammarlund mid-line single condenser, .000275 mfd	4.65
1—Precision Duo-Octaform coil set, one antenna coupler and two interstage couplers	10.50
1—Amertran De Luxe first-stage transformer	10.00
1—Amertran De Luxe second-stage transformer	$10.00
1—Amerchoke No. 854	6.00
1—Dubilier No. 902 filter condenser, 4 mfd	5.50
1—Dubilier No. 907 filter condenser, .1 mfd	.60
1—Mar-Co. illuminated control, scale 0 to 100	3.50
2—Mar-Co small controls for LC-27	1.50
1—Carter battery switch	.65
1—Samson radio-frequency choke coil No. 85	1.50
4—Aluminum shields	1.75
3—Aerovox mica fixed condensers, .00025 mfd	1.05
1—Durham resistor, 4 megohms	.50
1—Lynch grid leak mounting	.35
1—Carter Gem Jack	$ .25
1—Carter resistance, 0-10,000 ohms	2.00
10—Eby binding posts	1.50
1—Binding post strip 1½" wide x 25⅜" long x ⅛" thick	.76
1—Bakelite decorated panel, 8 x 26"	9.00
5—Benjamin UX sockets	3.75
1—Amperite	1.10
2—Tait Brackets	2.00
With Corbett cabinet	**$103.91**
Without cabinet	**85.91**

COMMITTEE OF 21 MANUFACTURERS
225 W. 34TH STREET
NEW YORK CITY

LC-27 MECHANICAL KIT $12.50

Kit includes drilled and engraved panel; 2 Tait brackets; 4 aluminum shields; wire and screw and nut assortments; and constructional data. *Jobbers and dealers write for discounts.*

The LC-27 Receiver

Watch for this seal. It stands for parts of proven worth.

"—used in the LC-27"

MAIL THIS COUPON NOW!

Committee of 21 Manufacturers,
225 West 34th Street,
New York, N. Y.

Gentlemen:

I enclose 10c for which please send me full constructional data for building the LC-27 Receiver.

Name .....

Address .....

IN THE WORLD'S LABORATORIES

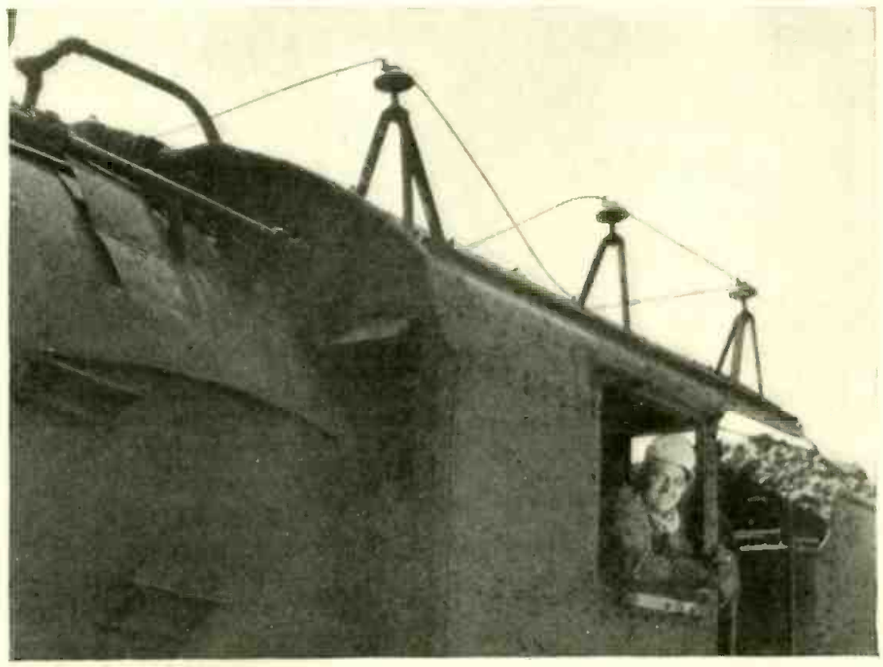
CONDUCTED BY DR. E. E. FREE

Radio to Aid Railway Safety

A RECENT disastrous wreck on the Pennsylvania Railroad, near Pittsburgh, again emphasizes the aid which radio is prepared to give to railway safety if it is permitted to do so. On this occasion a train had stopped for some emergency repair. A flagman went back, as usual, set his signal lights and waved his lantern. A following train came along, ran past the flagman's signals and crashed into the rear end of the train ahead. It developed later that the engineer of the following train had probably suffered a stroke of heart disease and was unconscious in his cab, unknown even to the fireman on the other side of the engine, when he ran past the flag and caused the wreck.

It is unusual for locomotive engineers to suffer strokes of heart disease at a critical moment. Nevertheless it can happen. It, and many other even more frequent disasters, it is possible to avoid by the simple expedient of installing radio transmitters and receivers on every locomotive, baggage car and freight car. Had such devices been available on the two trains which figured in the recent Pittsburgh wreck, the whole train crew of the following train would have known that the train ahead had stopped. No accident to any one of them, even to the engineer, would have been sufficient to cause a wreck.

Radio apparatus for communication between the engine and caboose of a freight train has recently been tested by the engineers of the New York Central Lines, near Chicago. Antennas are affixed to the locomotive and the caboose. Connected to these are transmitters and receivers operating on 115 meters wavelength. Three tubes are used for transmission and four for reception. The sets can be thrown over from transmission to reception by moving a hand lever. Speech is transmitted as by an ordinary telephone, no special radio skill being required on the part of either the engineer or the crew in the caboose. Speech can be carried on with a loudspeaker and a special signal is provided, so that the attention of the

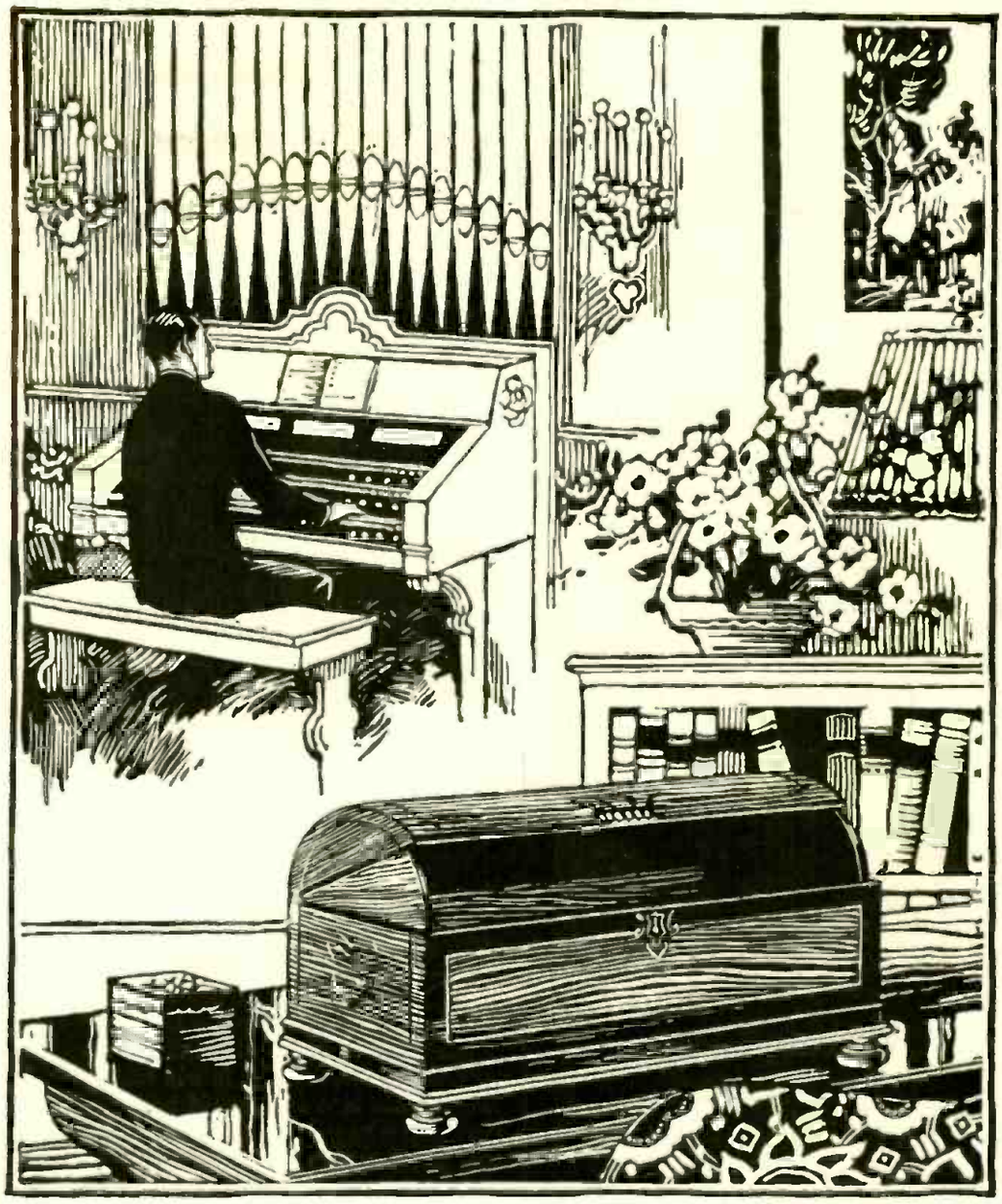


New York Central Lines

HOW THE ANTENNA IS PLACED ON A LOCOMOTIVE

The antenna connects to a combined transmitting and receiving set in the cab. By means of this the engineer and fireman can communicate with the crew in the caboose, where there is a similar set.

The Trappings of the Laboratory are gone!



The "Jewel Case"
Number 21
Illustrated at the right
$45.00

$27.50

Model 18
The Chinese "Cone-flex"

All the low notes of the cone, and the higher pitch of the horn---no distortion on volume and power amplification. Will not deteriorate, not affected by climate or moisture. 33 inches of orthophonic type horn.

Just as if you were there!

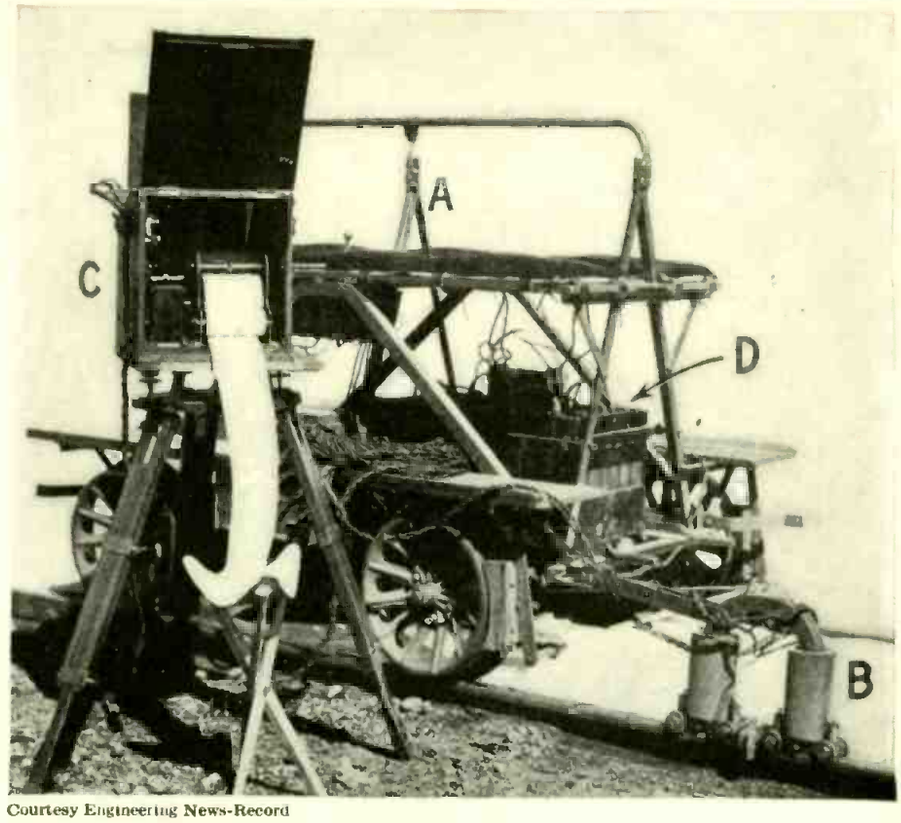
The spell of radio magic unbroken!

Here is the Radio sensation of years---the Velvet "Jewel Case". Its grace of contour and quiet finish naturally blend into the most tasteful surroundings, and reproduction is so complete and natural that you lend yourself to the full enjoyment of the melody *"just as if you were there!"* Sales will reach unprecedented volume for the public wants it! Write or wire for dealer or jobber franchise quick!

Sales Department
THE ZINKE CO.
1323 S. Michigan Ave.
Chicago, Ill.

Manufactured by
THE BORKMAN RADIO CORP.
Salt Lake City, Utah
Kalamazoo, Mich.

Velvet Radio Speakers



Courtesy Engineering News-Record

A JAPANESE DEVICE TO FIND FLAWS IN RAILS

Electro-magnetic waves from the atoms in the magnet enter the rail and couple with the atoms in it. If there is a flaw in the rail it will disturb the electro-magnetic field. This disturbance is indicated by the small coil located between the pole pieces of the magnet. A relay system makes a mark on the record chart.

crew at either end can be attracted, even above the noise of the train. The outfit was built and installed by the Zenith Radio Corporation, of Chicago.*

The tests of this equipment are described as successful, as it was reasonably certain that they would be. The next step is to provide apparatus which will enable one train to communicate with others ahead of it or behind it, as well as with the signal towers along the track and with the central office of the train despatchers. When this has been done, and when all trains on congested railways are equipped with the devices, there will be an increase in railway safety quite comparable with that which resulted from the introduction of the block signal system.

*The test is described in a statement issued, July, 1926, by the Publicity Department of the New York Central Lines. It was described, also, in an article by William J. Morris, of the New York Central Lines Magazine, in the Radio Magazine of the New York Herald Tribune, July 25, 1926, pages 3-4.

Magnetic Radio Detects Bad Rails

THE use of radio devices or other devices employing electro-magnetic waves to detect flaws in iron or steel objects has been reported frequently in this Department. An unusually ingenious application of these principles to the examination of railway track for flawed or imperfect rails has recently been worked out by Mr. M. Suzuky, a research engineer of the Japanese Government Railways.* A magnet is fixed to a small hand car, so that the magnet can be rolled along just on top of the rail. Near the magnet is a small electric coil. So long as the rail is composed of uniform steel, the effect of the magnet and rail on the coil is uniform. Suppose, however, that the rail is flawed. There is an immediate response in the coil, indicated by a pulse of electric current. This is indicated on a record. The bad rail can be replaced before an accident occurs.

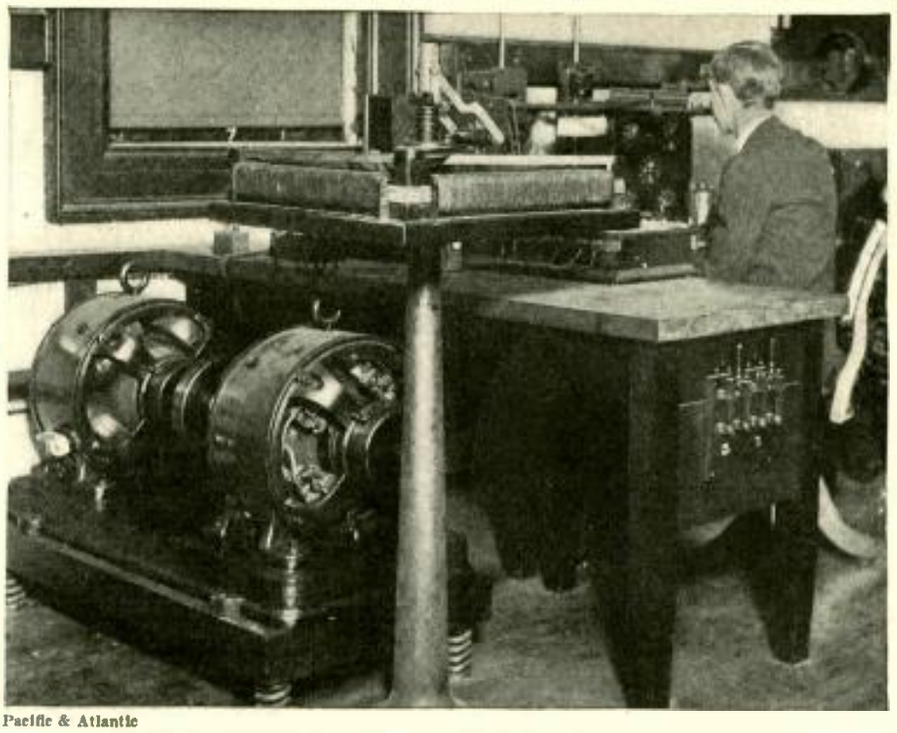
There is now small doubt that what is called magnetic attraction is due to the fields produced by many small electric circuits inside the substance of the iron. These circuits may be rotating electrons in the iron atoms; they may be some other electronic movement. The exact picture is not known. An electro-magnet, such as is used in Mr. Suzuky's experiments, is merely a device in which the electro-magnetic field created by the current strengthens that of the iron inside the coil.

When such a magnetic system is applied to the rail, the electro-magnetic impulses set up by the moving electric charges in the atomic structure of the magnet, pass out into the rail, where they react with the similar atoms there.

In a sense, the atoms in the magnet may be thought of as radio transmitters and those in the rail as radio receivers.

Although this is not a usual way to

*"Track Device for Detecting Defects in Rails," by M. Suzuky. *The Engineering News-Record* (New York), vol. 96, pages 520-522 (April 1, 1926.)



Pacific & Atlantic

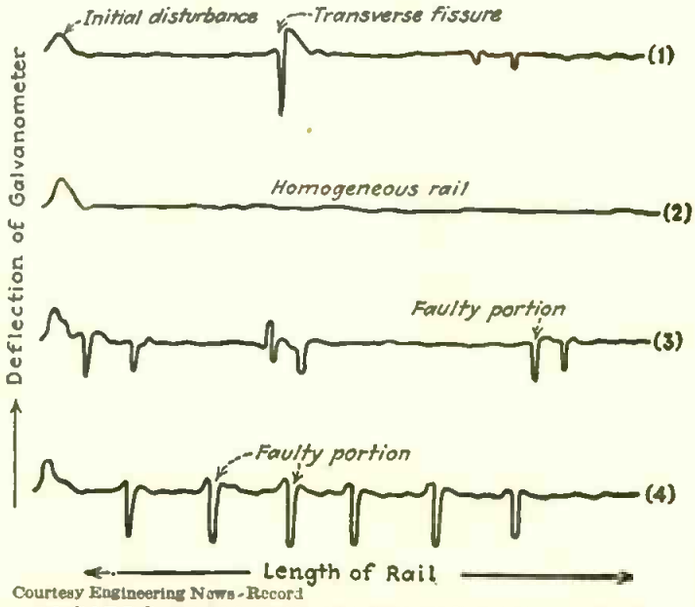
ANOTHER MAGNETIC METHOD OF TESTING STEEL

Sheet steel for purchase by the United States Government is tested by the United States Bureau of Standards to make sure that its magnetic properties are correct. Dr. R. L. Sanford, of the Bureau, is testing a sample by applying an electro-magnetic field to it, much as Mr. Suzuky does in his device for locating flawed railway rails.

visualize what are called magnetic circuits it is quite a correct way, the transmitter and receiver being assumed to operate only with the so-called electro-magnetic component of the "wave," leaving the so-called electro-static component out of account.

So long as the atoms in the magnet are properly "in tune," the transfer of energy between them remains uniform. Suppose, however, that we come to a break or flaw in the rail. This upsets the "tuning" between the atomic transmitters and the atomic receivers. A change in the chemical composition of the rail will do the same. Naturally, the electro-magnetic field in the surrounding space will be disturbed. This is what the external receiving coil detects. The whole apparatus is not only a convenient and practical device for preventing railway wrecks by broken rails; it is also an object lesson in the electro-magnetic aspect of magnetism.

A careful use of such a system should result in a still greater factor of safety for those who "ride the steel rails."



Courtesy Engineering News-Record

RECORDS FROM THE MAGNETIC RAIL TESTER

Rail number two is of good quality and without flaws, the initial bump in the curve being due to the starting of the magnet on the rail. All of the three other rails show flaws, as indicated by the arrows; the galvanometer deflections being produced by the disturbance of the electro-magnetic field by the flaws.

First in the field!

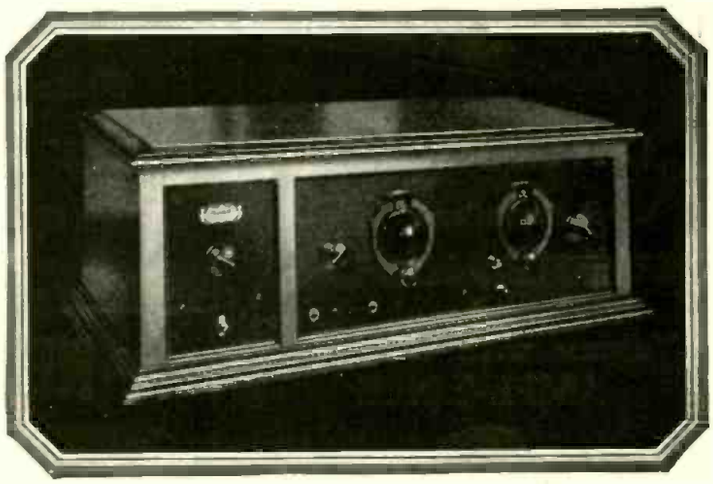
"A" and "B" Battery Elimination Successful - at a price within reach of all...

The Best in Radio Today

$231

with 5 McCullough AC Tubes and Rectron 213

without Loud Speaker



You radio fans who want a set that will eliminate both "A" and "B" Batteries can now have one at a reasonable price. The Cleartone Radio Electric Model 110, operating from the house current and using no fluids or acids, costs only $231, with 5 McCullough AC Tubes, and one Rectron 213—without loud speaker.

This remarkable set uses McCullough AC Tubes to abolish the battery problem and they are undoubtedly the greatest achievement in radio today. It has been highly approved by such a great authority as Professor Wilcox of the Armour Institute of Technology of Chicago.

The Cleartone Radio Electric Model 110 is the result of five years of exclusive radio receiving set manufacturing. Tone quality and volume are exceptional. Two vernier dial controls with the proper degree of selectivity simplify operation. The high quality of workmanship insures a set which will give years of satisfactory service, fully guaranteed by a manufacturer of the highest standing in the radio industry.

THE CLEARTONE RADIO COMPANY

2427 Gilbert Ave., Cincinnati, Ohio

DEALERS

Let us tell you how this set will help you do away with losses due to heavy service costs.

We have some interesting facts and figures FOR YOU.

CLEARTONE *Complete* RADIO SETS

Progress with Radio Direction Finders

THE radio direction finder, especially for ships at sea, has passed from an experiment to a practical and indispensable instrument. This is indicated by the increasing use of these devices on many kinds of vessels as well as by the several recent instances in which such direction finders have played important rôles in rescues at sea or in difficulties of navigation.

From a recent review of progress in these devices by Dr. Smith-Rose* it appears that the average accuracy of bearing now attainable on shipboard is better than one degree, which is ample for all practical purposes.

For use on shipboard the direction-finding apparatus consists, almost invariably, of a rotating loop antenna connected to any kind of sensitive receiver. The reception is strongest when the plane of the loop is in a line with the transmitting station and weakest when the flat side of the loop faces toward the transmitter. It has been found, Dr. Smith-Rose reports, that only three classes of errors are important with these instruments. The first class are those due to the iron work or other conducting objects surrounding the receiver. Usually these can be compensated or allowed for by testing the receiver on stations in known directions, in the same way in which a magnetic compass is tested by swinging the ship. The second class of errors includes those which occur when the path of the waves crosses a coast line. This sometimes bends the waves out of their true direction, in much the same way in which light rays are bent on entering or leaving the surface of a bowl of water. In most parts of the world it is possible to avoid this error by using for bearing stations transmitters which do not lie across a coast line from the receiving vessel.

The third class of errors are those experienced with stations at considerable distances from the receiver and which are supposed to be due to the arrival of two simultaneous waves over different paths. One wave is supposed to come directly over the surface of the land or of the sea. The other wave comes through the higher atmosphere, having been carried by the more highly conductive strata of the Heaviside regions. Sometimes these two waves interfere, with many resultant disturbances.

In addition to increased experience with these errors and with means for detecting and combating them, there have been substantial improvements in the mechanical accessories of the direction finders and in the devices to operate them. Before long such finders will probably be as universal a part of the equipment of an ocean liner, as radio transmitters and receivers already are.

*"The Progress of Directional Wireless Communication," by R. L. Smith-Rose. *Nature* (London), volume 117, pages 90-92 (January 16, 1926).

Radio Tests of Continental Earth Movement to Begin

THE geologic theory that the continents of the earth are not fixed masses, but drift slowly across the globe on a substratum of viscous rock, has already been described in this Department, as has the fact that the only known way to prove or to disprove this theory is by means of very accurate radio time signals exchanged between the different continents at intervals of several years. The movement of the continents, if it exists at all, is certainly very slow, probably not exceeding a few feet a century. This is far too small to be detected by any possible direct measurement.

But if the continents shift, the difference in time between, for example, Greenwich and Washington, will also change. The times at both places are determined from the stars. If the places move on the earth's sphere, the star times must change also. No chronometer, carried from one continent to another in order to determine the difference in the times, would be accurate enough to detect the small change of time involved. But radio time signals, many times repeated and sent and received with all possible care, will probably be sufficiently exact for the purpose. Such a series of exceedingly careful signals is to be exchanged between the continents this fall.*

There will be three principal stations in the test; one at San Diego, California; one at Algiers, Africa; the third at Shanghai, China. These cities are nearly at the same latitude north of the equator and are about equally spaced around the earth. Also, they are located on three different continents. A number of other stations, including some in Europe and Australia, one in Hawaii and one in the Philippines, are expected to be tied in to the tests between the three fundamental stations. Doubtless a great many other observatories and radio laboratories will receive and record the time signals, as these tests will provide an exceptional opportunity to obtain the exact longitude of any station which receives and computes the signals.

Time signals will be sent out thrice daily, between October first and December first, from seven stations. Annapolis will transmit on 17,145 meters; Arlington on both 74.7 meters and 24.9 meters; Honolulu on both 11,500 meters and 36.8 meters; Saigon (French Indo-China) on 17,000 meters and 25 meters; Bordeaux on 18,900 meters, and Issy (near Paris) on 32 meters. Both short waves and long waves are to be used so that the receiving observatories can make use of whichever happens to come through better from day to day.

Radio amateurs in isolated places, who wish to use these signals to obtain

*The project is described in *Science* (New York), vol. 64, pages 85-86 (July 23, 1926).

their longitude accurately, or astronomical observatories or others who have a real need for information about the tests, can obtain full details from the United States Naval Observatory, Washington, D. C., which institution is in charge of the project for the United States. It will be many months after the tests are over before they can be fully computed and reported. They must then be repeated, after a few years, to solve the problems of continental drift. This year's tests will fix the exact distances between the continents as they exist now. Later tests will tell whether these distances have changed.

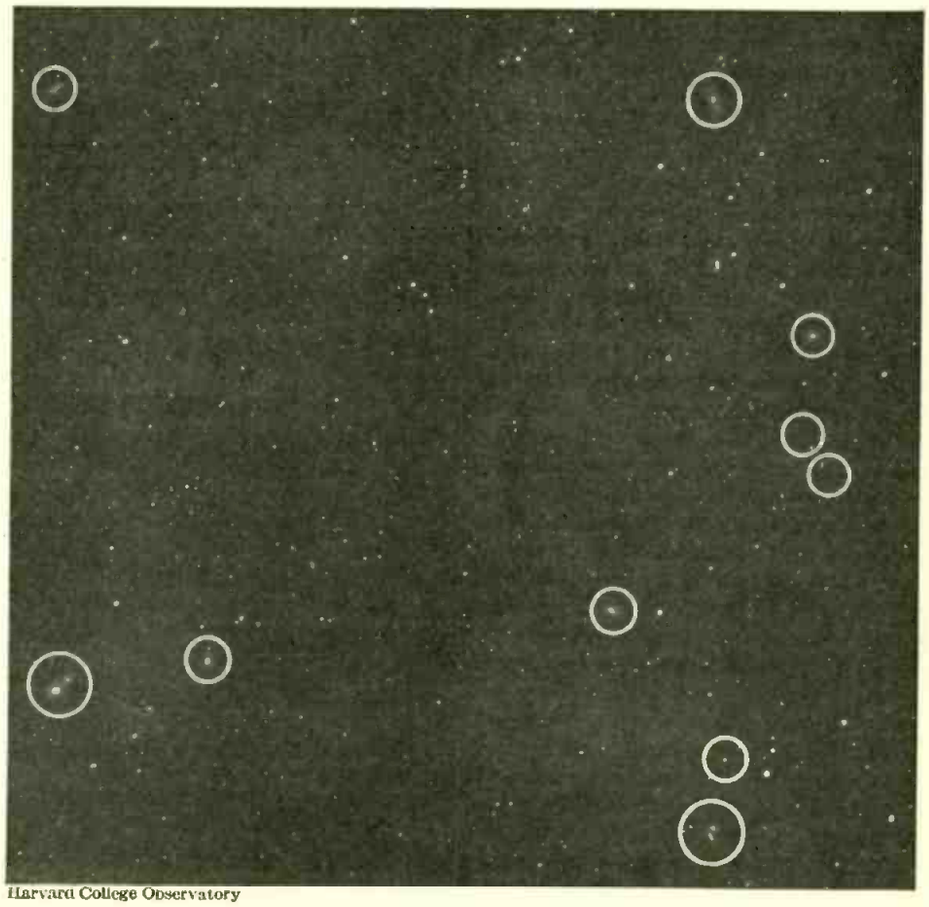
Ether Waves Ten Million Years Old

AN astronomic discovery of the greatest interest to every student of ether waves has been made at Harvard University; it is no less than the widening of the known universe to ten times the greatest dimension previously known, together with the discovery of ether waves that have been on their way toward us for a time reckoned as approximately ten millions of years.

Accordingly this discovery gives us not only the greatest measures of distance ever made by man, but also the greatest actual measures of time. Indeed, these two, time and distance, are interchangeable terms in astronomy, for the astronomer's distances are reckoned in lightyears, which is the distance that light, with its enormous speed of 186,000 miles a second, can travel in a year.

The new ten-million lightyear measurement was made by Dr. Harlow Shapley, Director of the Harvard Observatory, and Miss Adelaide Ames on a group of spiral nebulae visible when a powerful telescope is pointed to the part of the sky occupied by the constellation *Virgo*, the Virgin.* Spiral nebulae are common in many parts of the sky. Some are much nearer than the ones newly studied by Dr. Shapley and Miss Ames, although none are known to be near enough to be included in the star cloud to which the solar system belongs. This star cloud which constitutes our own private galaxy is believed to be some 300,000 lightyears in diameter. The nearest of the spiral nebulae yet measured lie at least twice this distance from the earth; a very short distance when compared with Dr. Shapley's new one, but far enough, none

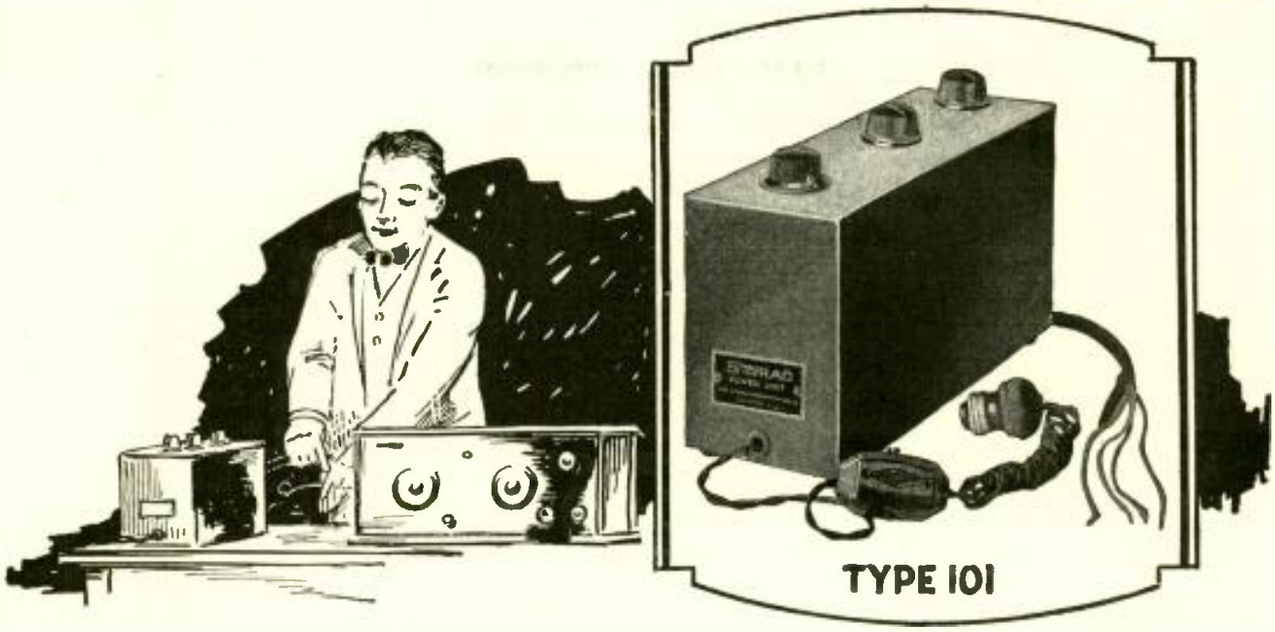
*"A Study of a Cluster of Bright Spiral Nebulae." by Harlow Shapley and Adelaide Ames. Harvard College Observatory, Circular Number 294. 8 pages. Dated April 5, 1926. Distributed July, 1926.



Harvard College Observatory

MADE BY LIGHT TEN MILLION YEARS OLD

This print is made from one of the photographic plates used by Dr. Harlow Shapley and Miss Ames in making their recent measurement of a cloud of spiral nebulae at the enormous distance of ten million lightyears from the earth. Inside each of the white circles is a faint dot, each representing one of the nebular universes at that vast distance away. On the original plate these can be seen as tiny spirals.



Continuous Reliable Power with STORAD POWER SUPPLY

THE idea of Power Supply Units to furnish current from the lighting socket, automatically and continuously, has appealed to the radio public as something that would add greatly to radio enjoyment.

Storad Power Supply will give the kind of service and large capacity that are necessary to operate sets satisfactorily. Three years of development work and one year of actual tests have been put into Storads before placing them on the market.

Storad B Power Supply is a Raytheon Tube Type Unit. All parts are carefully selected—Tobe Deutchmann Condensers and Storad Special Transformers and Filters are used. There is no hum to a Storad Power Supply even with the larger sets. Storads are high capacity units and always have abundance of reserve power.

Here is the complete Storad line. Visit a Storad dealer and ask for a demonstration.

Storad "A" and "B" Storage Batteries

"A" BATTERY

"A" BATTERY

Rubber-case, non-corroding rubber terminal nuts. Made in three sizes: R3-60 amp. hr.; R4-80 amp. hr.; R5-100 amp. hr.

"B" BATTERY

Made in two sizes.
No. 4548, 4500 milleamp hr. 48 volt.
No. 4524, 4500 milleamp hr. 24 volt.

"B" BATTERY

Dealers: The Storad line offers you a wonderful opportunity in up-to-date power supply merchandise. Write for prices and information.

Type 101, "B" Power Supply

Raytheon Tube Type Unit of large capacity. Will operate sets using power tubes on last stage audio. Operates on house lighting socket. Three variable controls from 180 volts down.

Type 201, "B" Power Supply & Trickle Charger

Raytheon Tube Type "B" Power Unit—high capacity, with a bulb type Trickle Charger for Storage "A" Battery. Operated from one switch which turns off set and "B" Power and turns on Trickle Charger. 4 variable controls.

Type 501, Storad combination Power Amplifier and "B" Power Supply

This Unit will work in any position following the detector tube and gives undistorted quality and large volume. "B" Power Supply is from a Raytheon Tube Type Unit of large capacity. Variable controls from 180 volts down.

Type 701, Trickle Charger.

Sufficient capacity for "A" Batteries used with larger sets. Switch turns on charger when set is turned off. Variable control regulates charging current form ½ to 1 amp.

Literature will be gladly forwarded on request.

The Storad Manufacturing Co.

2417 Detroit Ave. **Cleveland, Ohio.**

the less, that a radio message starting from the nearest nebula to the earth before man had developed into a thinking creature, would still be on its way and with about nine-tenths of its journey yet to be completed. The light rays from the new, more distant nebulae started toward us while man was still in early stages of development, with few if any signs of his future destiny discernible about him.

The measurement of this vast distance was not accomplished by any direct method. For near-by astronomic objects, such as the moon or the planets or even a few of the nearer stars, it is possible to set up a base line, measure the direction of the object from each end of the base line and thus compute the distance in exactly the same manner as is used in the familiar range finder of the Navy battleships. But the longest such base line which we can occupy is that between the two sides of the earth's orbit, which is a mere infinitesimal point in comparison with the vast distances to be measured when we deal with the nebulas. No range-finding method is of the slightest use when we are sounding space to distances like a million, or ten million, lightyears.

The method actually used depends on the properties of a certain kind of variable star, the stars called Cepheid variables because the first one of them to be studied happened to be in the constellation Cepheus. These variable stars change in brightness from day to day and it has been found that the period of this change corresponds to the real brightness of the star. Some variable stars of this type have been found in the closer examples of spiral nebulae, so that we know the real brightness of these stars. From that we can compute the distances of the nebulae, just as you can compute the distance of a small lamp a mile or two away, provided you know the real brightness of the lamp. The farther it is away from you the dimmer it will seem.

Knowing, in this way, the distances, dimensions and real brightnesses of some of the nearer spiral nebulae in space, Dr. Shapley and Miss Ames were able to compare these with the much more distant ones now studied. The new ones are far fainter. There is good reason to believe that all of the spiral nebulae would average about alike in real brightness and probably in size. Accordingly, the greater apparent dimness of the group now studied means that they are farther away. A quantitative comparison of their average brightness with that of the better-known nearer ones led to the estimate of ten million lightyears as their distance.

To the radio student the most interesting feature of this remarkable measurement is not, however, its mere magnitude or the vast reach of

time which it indicates. It is the indication of the sameness of ether waves over that vast expanse of time and space. The light rays received from those distant universes are exactly the same as light rays produced by the same atoms here on earth. The fact that the incoming rays are ten million years old and the fact that they were produced in the most distant regions of space yet surveyed by our telescopes, apparently make no difference at all in the rays. If radio waves were generated in those same nebulae ten million years ago, as no doubt they were, those waves are doubtless reaching the earth now, also unchanged, as are the light rays.

To speak of ether waves is to use, of course, a word which means little. We do not know whether any such thing as ether exists. We do not know that light or radio is carried by any medium at all. These are merely convenient ways of thinking. Light consists, some physicists think, of particles, not of waves. Radio may be similar. In spite of these uncertainties, what we can be reasonably sure that we do know is that the radiations which reach us from depths of space so vast as to be virtually inconceivable have exactly the same properties as similar radiations produced here on earth today.

Radio Apparatus to Prevent Smoking Chimneys

A FEW weeks ago Mr. C. F. Elwell, delivered before the Royal Society of Arts, in London, a lecture on the "past, present and future" of radio. In the course of the discussion, Mr. Elwell made the interesting suggestion that radio vacuum tubes might be used to take the soot out of coal smoke before it left the chimney.

The process contemplated is, of course, the well-known Cottrell process, invented by Dr. F. G. Cottrell, now the director of the Fixed Nitrogen Laboratory of the United States Department of Agriculture, in Washington. By this process a high-voltage direct current is applied to electrodes between which the smoky air is allowed to pass. The electrostatic attraction of the charged electrodes causes the dust to collect on them or to gather into larger aggregates, which then sink to the bottom of the flue. This method of dust collecting is in common use in many industries but no one has attempted hitherto, to apply it to the domestic chimney. However, the suggestion is by no means impossible. A high-voltage transformer and a rectifying tube would provide the current. The power used might be, as Mr. Elwell said, only a few watts. If smoky chimneys are to be forbidden by law, as is by no means impossible either in England or in the U. S., Mr. Elwell's radio chimney sweep may be an invention well worth some one's time to work out.

Bell Telephone Laboratories

A METER FOR BROADCASTERS' FIELD STRENGTH

Mr. Axel G. Jensen, using the new meter which measures the strength of a broadcasting wave at a distance from the station. The meter contains a local oscillator, for comparison with the incoming wave. This is housed in the metal box at the lower right-hand side of the apparatus. The metal cover of this box, here shown unscrewed, is clamped tightly in place when a reading is made.

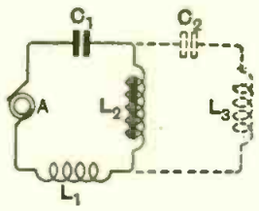
A Portable Meter for Testing the Broadcaster's Field Strength

WITH the growth of broadcasting and the ever increasing necessity for precise knowledge of how broadcasting stations are operating, has come increased need for accurate information concerning the field strength produced by a broadcasting transmitter at long distances from the antenna. Three years ago the Bell Telephone Laboratories made a series of such measurements on the strength of WEAF in and near New York City, which measurements have become a radio classic. These were made with what was essentially a laboratory apparatus, mounted temporarily on an automobile. This apparatus has now been modified slightly, with increases in portability and ease of use.

The method consists essentially in matching the voltage created by the incoming signal against a known voltage, generated by a local oscillator. A loop antenna is used, the local voltage being introduced into the loop through a small resistance. The oscillator is adjusted to the same frequency as the incoming signal. The modulation of the incoming signal is immaterial, as the measurements are made on the strength of the carrier wave, as received. As the radiation from the local oscillator would be picked up by the loop and would alter the readings, this oscillator is shielded as perfectly as possible.

The New Lorenz Radio Generator

AMONG the several devices proposed or constructed to supply high-frequency current for radio uses without employing vacuum tubes the only one well known in America is the magnetic alternator devised by Mr. E. F. W. Alexanderson and in use by the Radio Corporation of America.



The scheme of the Lorenz generator is shown by this diagram. L_2 is the iron-cored inductance coil. The secondary circuit, which is shock-excited, is shown at the right.

Another system, devised by Dr. Karl Schmidt, of the German firm of Lorenz Company, has attracted some attention in Europe.* Essentially this is an alternating-current dynamo of usual intermediate frequency, connected to a frequency - multiplying transformer which raises the frequency to any desired odd multiple of the dynamo frequency.

This frequency multiplier works on the principle of shock excitation of the secondary circuit. The primary circuit consists of a condenser, an inductance and an iron-cored choke connected in series with the dynamo and tuned to the dynamo's frequency. The iron core of the choke is so arranged that its magnetic circuit is easily saturated by the current flowing in the primary electric circuit. The winding of this choke is also part of the secondary circuit, which consists of a condenser and an inductance and is tuned to the desired output frequency, this being some odd multiple of the input frequency. In operation, the alternating magnetic impulses corresponding to the reversal of magnetization in the iron core of the choke set up sudden, alternating electromotive forces which serve as the shock exciters for the secondary circuit.

*"The Lorenz High-Frequency System for Radio Transmission," by F. W. Gillard. *Experimental Wireless* (London), volume 3, pages 215-219 (April, 1926).

A New Kilocycle Table

THE United States Bureau of Standards has issued a convenient table for the conversion of kilocycles into wavelengths in meters, and vice versa. The table is printed on a single sheet of cardboard, so that it may be tacked or hung on a wall. It gives values for every ten kilocycles from 10 to 10,000; or, conversely, from 10 meters to 10,000 meters. It is designated as Miscellaneous Publication No. 67 of the Bureau of Standards, and may be purchased for five cents a copy, *not* from the Bureau of Standards, but from the Superintendent of Documents, Washington, D. C.

The obverse of the medal; this original is two-and-one-half inches in diameter.

The Popular Radio Medal *for* Conspicuous Service

TO every radio amateur, to every amateur experimenter and broadcast listener, who is instrumental in alleviating human suffering or saving human life, directly through the medium of radio, recognition will hereafter be extended in the form of a medal that shall be known as "The Popular Radio Medal for Conspicuous Service." This medal is unique within the realms of radio in that it shall be awarded, not for scientific achievement or invention, but for service to humanity.

To insure a fair and unbiased consideration of all claims, a Committee of Awards has been appointed that includes five distinguished citizens of international fame. To assist this Committee of Awards, an Advisory Committee has been appointed that numbers among its members some of the most eminent citizens of the United States, including representatives of many of our most distinguished institutions.

The conditions under which the medal will be awarded are here specified:

1. The medal shall be known as the Popular Radio Medal for Conspicuous Service.
2. The medal shall be awarded, without discrimination as to sex, age, race, nationality, color or creed, to those radio amateurs, radio experimenters, broadcast listeners and other non-professionals through whose prompt and efficient action radio is utilized to perform an essential part in the alleviation of human suffering or in the saving of human life within the territorial confines of the United States and its possessions, or in the waters thereof.
3. The medal shall be awarded by a Committee of Awards that shall not exceed five in number. No member of this Committee shall be an employee, officer or stockholder of POPULAR RADIO, INC., nor shall any such employee, officer or stockholder have a vote in the deliberations of the Committee.
4. An advisory Committee, which shall cooperate with the Committee of Awards and which shall be particularly charged with the responsibility of making recommendations for awards of this medal, shall be made up of men and women who, because of their interest in the public welfare or because of their connection with institutions that are consecrated to public service, are in positions to bring to the attention of the Committee of Awards the exploits of candidates who are within their own special fields of activity.
5. The medal will be awarded for services rendered since Armistice Day, November 11, 1918.
6. Recommendations for awards may be submitted to the Committee of Awards at any time and by any person. Every recommendation must contain the full name and address of the candidate, together with a detailed account of the accomplishment on which the proposed award is based, and must be accompanied by corroboratory evidence from persons who have first-hand knowledge of the circumstances and whose statements may be verified to the satisfaction of the Committee of Awards.
7. The medal will be awarded to as many individuals as qualify for it and at such times as the Committee of Awards may authorize.

The reverse; the name of each recipient will be engraved in the space provided.

8. All considerations not specified herein shall be left to the discretion of the Committee of Awards.
All communications to the Committee of Awards may be addressed to—
The Secretary of the Committee of Awards, POPULAR RADIO Medal for Conspicuous Service, 627 West 43rd Street, New York.

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Kadel & Herbert

MUSIC FROM A $3,000 RECEIVER

What is reported to be the world's biggest radio receiver has been built by Robert J. Sieglack, a hotel owner of Sheepshead Bay, N. Y. It contains twenty-three tubes. Here is drawn one of the six loudspeakers which are distributed at as many points through the hotel.

BROADCAST LISTENER

Comments on radio programs, methods and technique —from the point of view of the average fan

By RAYMOND FRANCIS YATES

Stations That Are Beginning to Lead the Pack

ALTHOUGH the majority of our studio managers have long since exhausted themselves of any sound ideas and, although their specifications of a rattling, slambang program still calls for the industrious noise-making of a road-house jazz band, the off-key yodeling of a concert-struck soprano, the colorless sawing of violin students fresh from the hinterlands of music and the glamorless drumming of pianists of the moving picture school of interpretation, the last three months of broadcasting have, despite the pitiful floundering of the novitiates, shown magnificent improvement.

Perhaps we should make ourselves better understood by saying that our good studios are getting better and that our perspiring purveyors of broadcasting tin-cannery, still frightfully in the majority, are getting worse. Thanks to Allah and the capitulation of many of our big radiators to the flirtatious wink of national advertisers, the better studios are (if one is willing to overlook the bold credit lines and the puerile literary excursions of all of the members of the Brokenshire school of flapdoodle announcing), nosing out into virgin soil. WGN, WJZ, WEAF and WGBS, are, in the mind of this humble reviewer—leaders in a movement that will, unless checked by the protests of a radio public that is either lulled into fits of ecstacy by "Love's Old Sweet Song" or seduced by the lavish bellowing of a dance hall orchestra, eventually relieve the art of its grippes and fallen arches.

* *

The Struggling Efforts of the "Radio Drama"

FOR the past three months now, we have been keeping a friendly ear on WGBS and, although it is often as clumsy almost to the point of being preposterous, one cannot help but admire the rash, impetuous spirit that it manifests. Always willing to try anything once and motivated it would seem by a wholesome desire to transcend the trite and obvious radiations of its sister studios, it has managed to put in something more than a feeble bid for leadership. While we are not yet ready to acclaim dashing young Daily Paskman (its director) as the *generalissimo* of the art, we have come to respect him as someone more important than a naive dabbler or a swashbuckling pioneer. His reasoning is sound and practical, more often than it is ridiculous, and this much cannot be said of many studio directors.

Although a student of dramatic expression, Mr. Paskman has many things to learn about the successful

presentation of air-plays. Here he displays a poor hand. He is hasty, impatient and betrays an ignominious lack of dramatic appreciation. The recent broadcasting of "Beau Nash" an inane melodrama wherein the villain, a Captain O'Keefe supposedly of the Irish Dragoons, attempts to force his marriage to the beautiful daughter of Sir George Silinger, was nothing less than an unmitigated flop. Yet it has many admirable qualities; the cast was small, the plot, though hackneyed and profoundly obvious, was simple and easy to follow.

Sir George Silinger, it seems, was a party to intrigue in an effort to place the Stuarts on the throne of England and, in a moment of passion, he dispatches a rash note to Sir McDonald who is hiding in France. The note is entrusted to Walpole, Sir George's secretary who, although his father is "in trade" is a lover of Dora the nobleman's daughter. True to the specifications of this type of drama, Walpole loses the communication and it falls into the hands of the cad O'Keefe who holds it over Sir George's head in an effort to win the daughter. As you might well imagine, Dora loves her honorable but, ostracized suitor, Walpole. Beau Nash the handsome and gentle master of ceremonies at Bath, is also a silent, unprotesting lover of Dora. Nash outwits the Irish impostor, returns the lost note and succeeds, although it tortures him, in reconciling papa to the marriage of Dora and Walpole.

In the microphoning of this out-of-my-house-forever skit, Mr. Paskman successfully avoided every opportunity to add even momentary dashes of realism to the illusion. Consequently, it was nothing more than a painfully automatic and, at times boresome, reading of the script by a sextette of jobless actors. A duel between Nash and O'Keefe without the clash of steel or as much as the breaking of a ten-cent piece of pottery, left one feeling that he was eavesdropping on a mere rehearsal. Doors, though knocked on, were never "opened" or "closed" and a score of opportunities to convey to the patient listener other evidence of realism were shamelessly ignored. Mr. Paskman appears to know well the requirements as they involve plot and characters but he is careless in his stage-craft.

While the alert Mr. Paskman may have sinned against the tenets of radio drama, it was at least a venial transgression and this is more than we can say for the sagacious director of the New York Edison Hour (WRNY) and his exoterical sketch "Mrs. Rip Van Winkle." Here was a crass piece of advertising, dull, stupid and hambone-ish, carefully wrapped in the adroit propaganda of the "do it electrically" idea. Pointless, plotless and bland, it stumbled on to a climax designed to send you on a shopping tour for the

latest electrical conveniences and, failing in that, to put you in a tolerant frame of mind ready to withstand the shock of your next electric light bill. Launched in a living room provided with an "electric waffle iron, percolator, teapot and electric heater" it reiterated the convenience, if not the utter necessity of electrical appliances, until you were ready and willing to concede to Edison everything that makes life tolerable. You were either willing to make this concession or to put WRNY and the Edison Hour on the black list. The plot, if by any elasticity of the imagination, it could so be called, was a sort of dramatic dishwater poured into spaces between heating pads, electric curling irons, electric refrigerators and sewing machines. Shamelessly and unabashed, it did everything but afix the price tag and put the date on the kilowatt hour.

Not that our aesthetic sensitiveness was outraged or that our years at the radio have accustomed to more entertaining dramatic devices. Far from it. We have simply reached a point where we refuse to permit the copy wiseacres to even attempt to beguile us without an admonishing retort. (Watson, pack the bag. This is no place for Us).

* *

A Pat on the Back for WGBS

THERE is nothing but softness in this old heart for WGBS. No patriarch of the radio can listen to its programs for long without coming to the honest and, in fact, justified conclusion, that its sanguine staff is putting forward a sincere and laudable effort to amuse its public with something more penetrating and exotic than the standardized flapdoodle. That it often fails is to be regretted but we have never doubted the genuineness of its pioneering spirit nor the perspiration on its brow.

It was only recently that WGBS billed a series of lectures on "The History of Civilization." Although the title promised a take-off on the work of the world's gold-medal romanticizer, the Cosmopolitan-American Magazine philosopher, Mr. Wells, it was new to the air and we looked forward to the initial lecture with more than luke-warm interest.

WGBS, as is often the case with this studio, had a splendid idea which it promptly and unceremoniously murdered. To be again informed that our earth was born of a fiery mother somewhere in the illimitable voids of the cosmos and that we humans sprang from a sleezy morsel of protoplasm warmed in the primeval steam, was to deal in the primary articles of biological sophistication which are part of the everyday equipment of the modern high school boy. But that might have been well enough had not the announcer introduced the lecturer, Mr. C. K. Ogden, as the editor of a new world history soon

to be published by so-and-so publishing company. This prostrated our interest and sent us dialing for relief in the smothering wave of WJZ.

Yet in practically the same breath WGBS redeemed itself in a large measure with plaintive solos from the *esrha*, an oriental string instrument that, plucked by the adept fingers of an Indian musician, broke into mellow overtones of great beauty. "A Chant to Sheba" introduced by a brief sketch of its poetical and religious significance was a most edifying bit of entertainment and it left us feeling that, given half a chance to shake off its numbskulls, the radio might mature into something more social, beneficial than a medium expression of musical and rhetorical charlatans.

* *

High Spots in the Last Month's Programs

AUGMENTED by such heavy features as the Goldman Band, the New York Philharmonic, the Royal Hour, the WEAF Operas, the Army and Navy Bands, the Berlenbach-Delaney fight (although poorly done) the Indianapolis Auto Races, Atwater-Kent, the Capitol Hour, and a goodly number of more than ordinary acts, summer broadcasting has managed to lose its baggy trousers and celluloid collar. To use a metaphor, it moved from the Mills Hotel to the McAlpin whereas, two years ago, it was sleeping in Bryant Park and licking the steam off the windows of the Sixth Avenue beaneries. With precious few exceptions, one could go to the radio during the nights of June, July and August and enmesh a wave laden with satisfying merchandise. And during the entire period one could not help but feel that our better studios are improving and that our hash-houses are gradually approaching total ignominy and the bow-wows.

* *

A Commendable Effort to be "Different"

IT IS a gratifying retrospection to go back over the last ten months of WGN's broadcasting. Here too, as in the case of WGBS, we find an imaginative effort to increase the utility and breadth of the art. There is something noble about WGN's attempt to be "different" for it always is well within the bounds of propriety and rarely loses sight of its dignity. Patiently and with admirable reserve it carries on its experimental and "shunt" broadcasting searching out new services that will win the approbation of its public.

A SET capable of receiving a thousand miles in the United States is not effective for more than 500 miles in India, due to peculiar atmospheric conditions there.

A Dramatic Experience With Radio

WE have had our radio set for more than two years, but I am still as fascinated as ever by the mystery and wonder of "listening in." They tell us that radio can be explained by cold scientific facts, but I am rather glad that it seems impossible for me to fully comprehend them! To turn a little dial and hear a voice speaking in Los Angeles; to move it a bit farther and hear music playing in New York; then a little more—and someone talking in Chicago! It surely seems like pure magic.

One evening when I was turning the dials slowly, I chanced to tune in on a station in Minnesota. After the usual announcement of the call letters and location of the station, the announcer said:

"We have an emergency message for Colorado Springs, Colorado. If anyone is listening in in that city, please notify the following. . . . "

The man paused, while I called for someone to bring me a pencil and paper. The voice went on (I am, of course, changing the names of streets and persons).

"Miss Mary Anderson, 614 North State Street, Colorado Springs," and the announcer carefully spelled the name and address. "The message is as follows: Dr. Barry of Hutchinson, Minnesota, is critically ill with pneumonia and is very low. Mrs. Barry wishes her sister, Miss Anderson, to come at once. Anyone in Colorado Springs receiving this, please notify Miss Anderson immediately."

I wrote down the message as well as I could in the excitement of the moment. Afterwards I was amused to think that although I had studied shorthand, the idea never occurred to me to make use of my knowledge of it at the opportune time!

Turning off the radio I rushed to the telephone. Miss Anderson's name was not in the directory, but "Information" soon gave me her number; and in less than five minutes from the time that the message was sent into the air from Minnesota, it had reached its destination in Colorado.

I think that Miss Anderson hardly believed me at first—and who could blame her? Her voice sounded bewildered. I repeated the message once or twice, telling her carefully how I happened to receive it, and at last she understood.

The next day I heard that she had left that very night for Minnesota, but her brother-in-law died before she could reach his home.

But I am glad that I chanced to tune in on that particular station at just that particular moment.

It makes me think radio more "magical" than ever!

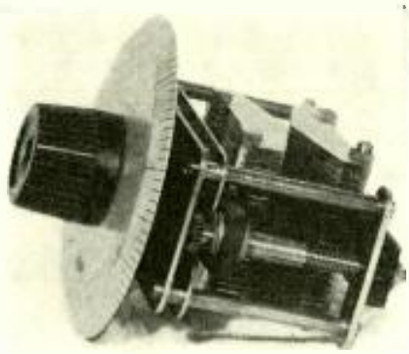
—CATHERINE PARMENTER

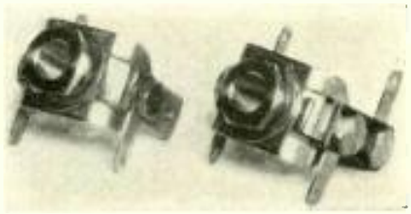
WHAT'S NEW IN RADIO

THIS *department is conducted by* POPULAR RADIO LABORATORY *for the purpose of keeping the radio experimenter and the broadcast listener informed concerning the newest inventions and the approved developments in radio equipment. Only such apparatus as has been tested and endorsed by the Laboratory is noted in these columns.*

AN EFFICIENT TUNING UNIT

Name of instrument: Variable condenser.
Description: In this unit the two sets of plates, which are cut away to give better separation on the high frequencies, instead of revolving are moved ahead and meshed with each other with a horizontal motion.
Usage: In any radio receiving unit as a tuning capacity.
Outstanding features: Rugged construction. Easy tuning on crowded frequencies. Neat appearance. Efficient.
Maker: Viking Tool & Mfg. Co.





JACKS THAT TAKE UP SMALL SPACE

Name of instrument: Radio jacks.
Description: Unlike the old bulky type of jacks this new jack takes up less than one inch of space in the back of the panel and it does the same work just as efficiently as the old type of unit. The jacks are furnished in various sizes and with multiple connections, as the old type, and should be of help in laying out a modern receiver. The space they save may be used to advantage for placing other apparatus inside of the set.
Usage: In a radio receiver for connections to telephones or to the loudspeaker.
Outstanding features: Simplicity of design. Neat appearance. Takes up but small space. Efficient operation.
Maker: Herbert H. Frost, Inc.

Apparatus Approved by Popular Radio

This list of apparatus approved by the POPULAR RADIO LABORATORY will be continued as a part of the WHAT'S NEW IN RADIO department until all instruments, parts and complete sets have been included. The listing is alphabetical by manufacturer's name and the installment in this issue includes only the letters A and B.

AERIALS

Stranded enameled antenna; Acme Wire Co.
Ribbon copper aerial; Acorn Radio Mfg. Co.
Enameled ribbon aerial; Acorn Radio Mfg. Co.
Hollow radio aerial; American Display Co.
Antennaphone; Antennaphone Co.
Flat copper antenna ribbon; Baltimore Brass Co.
Beldenamel aerial wire; Belden Mfg. Co.
"Storm King" complete aerial outfit; L. S. Brach Mfg. Co.

AMPLIFIERS

"Rauland-Lyric" Trio; All-American Radio Corp.
Bradley resistance-coupled amplifier; Allen Bradley Co.

AUDIO-FREQUENCY TRANSFORMERS

Acme audio-frequency transformers; Acme Apparatus Co.
Algo audio-frequency transformer; Algonquin Electric Mfg. Co.
"Rauland-Lyric" A. F. transformers; All-American Radio Corp.
Ambassador "Low Boy" transformer; Ambassador Sales Co.
Kelford audio transformer; American Spec. Co.
"Amertran DeLuxe" transformer; American Transformer Co.
Fada audio transformer; F A D. Andrea, Inc.
"King Cole" audio transformer; Anylite Electric Co.
Brandes A. F. transformer; Brandes Products Corp.
Twin audio-frequency transformer; Chas. A. Branston, Inc.

BATTERIES

Radio "B" batteries at "factory prices"; Ayres Battery Corp.
Burgess batteries; Burgess Battery Co.

BATTERY CHARGERS AND RECTIFIERS

Acme battery charger; Acme Electric & Mfg. Co.
Acme "Silent" charger; Acme Engineering Co.
Apco "A" and "B" chargers; Apco Mfg. Co.

BATTERY ELIMINATORS

Acme "B" eliminator; Acme Apparatus Co.
Bosch Ne'sutry; American Bosch Magneto Co.
Burns "B" battery eliminator; American Electric Co.
"Apco" Rectodyne; Apco Manufacturing Co.

CRYSTAL DETECTORS
"Airader" detector; Bernard's Radio Co.
"B Metal" crystal; B-Metal Refining Co.

DIALS
Na-ald dials; Alden Mfg. Co.
Bradleynier; Allen-Bradley Co.
Radion dials; American Hard Rubber Co.
Radion knobs and dials; American Hard Rubber Co.
Split-Em vernier instrument; American Instrument Works
Royal knobs and dials; American Specialty Co.
Amsco vernier dial; Amsco Products, Inc.
Apex vernier dial; Apex Electric Mfg. Co.
Bell dial: Bell Mfg. Co.
Bruno Magic dial; Bruno Radio Corp.

FIXED CONDENSERS
Mica fixed condensers; Aerovox Wireless Corp.
Aerovox bypass condenser; Aerovox Wireless Corp.

ELECTRICAL TERMINALS
Binding post; Ajax Electric Specialty Co.
Phone plug post; Barkelew Electric Mfg. Co.
Four-phone post; Barkelew Electric Mfg. Co.
Belden terminals; Belden Mfg. Co.
Bel-Tone mounted binding post; Bel-Tone Radio Co.

GRID-LEAKS AND RESISTANCES
Craig Resistors; Aerovox Wireless Corp.
Lavite resistances; Aerovox Wireless Corp.
Tubular grid-leak; Aerovox Wireless Corp.
Bradleyleak; Allen-Bradley Co.
Bradleyunit; Allen-Bradley Co.
Clarostat; American Mechanical Labs.
Amplex grid-leak; Amplex Instrument Labs.
Amplex "Lavite" resistance; Amplex Instrument Labs.
Amsco resistors; Amsco Products, Inc.
Arbee grid-leak and resistance; Arbee Mfg. Co.
Volt-X variable grid-leak; Burton-Rogers Mfg. Co.

HEADPHONES
Bel-Canto headset; Bel-Canto Radio & Telephone Equipment Co., Inc.,
Berstan headset; Berstan Radio Products
Brandes Navy type headset; Brandes Products Corp.
Brandes Superior headset; Brandes Products Corp.

IMPEDANCE COILS
Acme Z-2 amplifying impedance; Acme Apparatus Co.
All-American choke, type R-8; All American Radio Corp.
Amerchoke; American Transformer Co.

INSULATORS
Radion insulators; American Hard Rubber Co.

JACKS
Jack; Adams Radio Mfg. Co.
Jack; Amplex Instrument Laboratories
"B. M. S." radio jacks; Brooklyn Metal Stamping Co.

KITS
Acmeflex kit set; Acme Apparatus Co.
Tuned R. F. kit; Aero Products, Inc.
Aero Coil R. F. regenerative kit; Aero Products Inc.
All-Amax Senior kit; All-American Radio Corp.
Neutrodyne and Tobias kits; Amplex Instrument Laboratories
Amsco resistance-coupled amplifier kits; Amsco Products, Inc.
Kit for 7-tube superheterodyne; Apex Electric Mfg. Co.
"Pacific Rainbow" Super-Het kit; Baldwin Pacific & Co.
B-C-L New Home Kit; B-C-L Radio Service.
Bel-Tone Superdyne kit; Bel-Tone Radio Co.
Dyne-O-Might kit; Birch-Field Radio Corp.
Superheterodyne transformer kit; J. T. Boone Radio Corp.

LIGHTNING ARRESTERS
Radio lightning arresters; Ajax Electric Specialty Co.
Lightning arresters; Barkelew Electric Mfg. Co.
Brach lightning arrester; L. S. Brach Mfg. Co.

LOOPS
Aalco folding loop; Aalco Radio Laboratories, Inc.
Amplifex loop; Amplifex Radio Corp.
Bodine basket-weave folding loop aerial; Bodine Electric Co.
Boone-Super-Folding loop aerial; J. T. Boone Radio Corp.

LOUDSPEAKERS
Acme cone loudspeaker; Acme Apparatus Co.
Acme loudspeaker (cabinet model); Acme Apparatus Co.
Royal radio speaker; Adler Mfg. Co.
Junior Ambotone; American Bosch Magneto Corp.
Ambotone reproducer; American Bosch Magneto Corp.
Burns loudspeaker; American Electric Co.
Radion loudspeaker horn; American Hard Rubber Co.

Amplion loudspeaker; Amplion Corporation of America
Bell-type loudspeaker; Apex Electric Mfg. Co.
Cabinet-type speaker; Apex Electric Mfg. Co.
Armstrong Speaker; Armstrong Speaker Co.
Atwater Kent loudspeaker; Atwater Kent Mfg. Co.
Bel-Canto loudspeaker; Bel-Canto Radio & Telephone Equipment Co., Inc.
"Sonochords" loudspeaker; Bondette Mfg. Co.
Brandes Cone; Brandes Products Corp.
Brandes Cabinet Speaker; Brandes Products Corp.
Orchestrion De-Luxe; F. Bremerman & Sons
Audiophone loudspeaker; Bristol Co.

MISCELLANEOUS ACCESSORIES

Lead-in; Acorn Radio Mfg. Co.
Aero Coil wave-trap unit; Aero Products, Inc.
"Little Jiant" circuit breaker; Bruno H. Ahlers
Na-ald sponge rubber cushion; Alden Mfg. Co.
Na-ald connectoralds; Alden Mfg. Co.
Standard tube base; Alden Mfg. Co.
Radio soldering paste: L. B. Allen Co., Inc.
Alpha spaghetti; Alpha Radio Supply Co., Inc.
Goscilco sleeve connection; American Luminous Products Co.
"Nifty" Lead-in; Amoroso Mfg. Co.
"Nifty" ground clamp; Amoroso Mfg. Co.
Apollo nickel zinc; Apollo Metal Works
Solderless cord tip; Barkelew Electric Mfg. Co.
Porcelain pedestal; Barkelew Electric Mfg. Co.
Ear cushion; Bates & Co.
Belden radio battery cord; Belden Mfg. Co.
Benjamin bracket; Benjamin Electric Mfg. Co.
B-H radio tubing; Bentley-Harris Mfg. Co.
Blackburn ground clamp; Blackburn Specialty Co.
Radio cement; Boyer Chemical Laboratory Co.
Radio cement thinner; Boyer Chemical Laboratory Co.
Brach extension cord connector; L. S. Brach Mfg. Co.
Brach solderall; L. S. Brach Mfg. Co.

PANELS

Radion panels; American Hard Rubber Co.

PHONE PLUGS

Multi-Radio phone plugs; Ajax Electric Specialty Co.
Four-phone plug; Barkelew Electric Mfg. Co.
Multiple phone plug; Barkelew Electric Mfg. Co.
Brach radio plug; L. S. Brach Mfg. Co.

PHONOGRAPH ATTACHMENTS

Burns Concert loudspeaker unit; American Electric Co.
Amplion phonograph unit; Amplion Corp. of America
Velvet loudspeaker unit; Borkman Radio Corp.
Phonograph attachment; Brandes Products Corp.

POTENTIOMETERS

Bradleyometer; Allen-Bradley Co.
Regal potentiometer; American Specialty Co.
Amsco potentiometer; Amsco Products, Inc.
Amsco "Dublwunder" Potentiometer - rheostat; Amsco Products, Inc.
Fada potentiometer; F.A.D. Andrea, Inc.

POWER EQUIPMENT

Brach "Controlit" (power control relay); L. S. Brach Mfg. Co.

RADIO CABINETS

Blandin radio cabinet; Blandin Phonograph Co., Inc.
Blandin semi-console cabinet; Blandin Phonograph Co., Inc.

RADIO-FREQUENCY TRANSFORMERS

Acme R. F. transformers; Acme Apparatus Co.
Radio-frequency transformer; Aero Products, Inc.
"Lekeless" R. F. tuned transformer; Benjamin Electric Mfg. Co.
"Twin-Eight" R. F. transformer; Bodine Electric Co.
Radio-frequency transformer; Chas. A. Branston, Inc.
"Tri-Coil" R. F. transformer; Brooklyn Metal Stamping Co.

RECEIVING SETS

A-C Dayton XL-5 knocked down set; A. C. Electrical Mfg. Co.
A-C Dayton XL-10 receiver; A. C. Electrical Mfg. Co.
Paragon receivers; Adams-Morgan Co.
Adler-Royal neutrodyne; Adler Mfg. Co.
Torodyne receiver; Ainsworth Radio Co.
Air-way receivers; Air-Way Electric Appliance Corp.
Ajax crystal receiving set; Ajax Electric Specialty Co.
Aladyne receiver; Alladin Mfg. Co.
All-American Model R receiver; All-American Radio Corp.
Mary-O-Dyne 5-tube set; Amber Sales Corp.
Bosch receivers; American Bosch Magneto Corp.
Electrola receiver; American Specialty Co.
Amplex DX-5 receiver; Amplex Instrument Laboratories
Melco "Supreme" receiver; Amsco Products, Inc.

Fada receivers; F. A. D. Andrea, Inc.
Deresnadyne broadcast receiver; Andrews Radio Corp.
King Cole receiver; Anylite Electric Co.
Microdyne receiver; Apex Electric Mfg. Co.
Apex Super-5 receiver; Apex Electric Mfg. Co.
Atwater Kent receiving sets; Atwater Kent Mfg. Co.
Standard "B" pocket radio; Auto Indicator Co.
Aragain receiver; Autometal Corp.
Superlatone receiver; Warren J. Bauman Co.
"Baby Grand" crystal receiver; Beaver Machine & Tool Co., Inc.
"Ortho Big Six" receiver; Big Six Radio Co.
Biltmore Master Reflex receiver; Biltmore Radio Co.
Dyne-O-Might receiver; Birch-Field Radio Corp.
Blair Radio Model No. 11 receiver; Blair Radio Laboratories

RHEOSTATS

Acme rheostat and potentiometer; Acme Apparatus Company
Bradleystat; Allen-Bradley Co.
Regal rheostat; American Specialty Co.
Amplex rheostat; Amplex Instrument Laboratories
Amsco double rheostat; Amsco Products, Inc.
Amsco "Dublwundr" Rheostat-potentiometer; Amsco Products, Inc.
Fada rheostat; F. A. D. Andrea, Inc.
Brach charging rheostat; L. S. Brach Mfg. Co.
Brach-stat; L. S. Brach Mfg. Co.

SOCKETS AND ADAPTERS

Airgap socket; Airgap Products Co.
Na-ald "De-Luxe" sockets and adapters; Alden Mfg. Co.
All-American radio tube socket; All-American Radio Corp.
Radion sockets; American Hard Rubber Co.
Amplex socket; Amplex Instrument Laboratories
Amsco Universal socket; Amsco Products, Inc.
Belden socket; Belden Mfg. Co.
Socket; Bell Mfg. Co.
Cle-ra-tone sockets; Benjamin Electric Mfg. Co.
V. T. Sockets (black and brown); Bennington Radio & Electric Mfg. Co., Inc.
Flewelling socket; Buell Mfg. Co.

SWITCHES

Fil-fone control switch; A. C. Electrical Mfg. Co.
Bradleyswitch; Allen-Bradley Co.
Regal switch; American Specialty Co.
Switch; Amsco Products, Inc.
Antenna selector switch; Barkelew Electric Mfg. Co.
Bruno single and double inductance switch; Bruno Radio Corp.
Bruno light switch; Bruno Radio Corp.

TESTING INSTRUMENTS

Perfection hydrometer; Bemco Mfg. Co.
Bosch hydrometer; Robert Bosch Magneto Co., Inc.
Hoyt meters; Burton & Rogers Mfg. Co.

TOOLS AND EQUIPMENT

Jack wrench; Adams Radio Mfg. Co.
"Solderette" electric soldering iron; Bechler Steel Products Co.
Junior Bench Saw; W. B. & J. C. Boice
Brach electric soldering iron; L. S. Brach Mfg. Co.
Panel engraving machine; Branch Tool Co.

TUBES

Sea Gull amplifier and detector tube E; Aberdeen Specialty Co., Inc.
Sea Gull amplifier tube "P"; Aberdeen Specialty Co., Inc.
Sea Gull rectifier tubes "R" and "X"; Aberdeen Specialty Co., Inc.
C. R. A. Sky-Sweeper vacuum tube, type 201-a; Charles R. Ablett Co.
Empire-Tron vacuum tubes; American International Trading Co.
Bluebird radio tubes; Bluebird Tube Co.
Vacuum tubes; Brendonne Corp.
"Tube Blue" vacuum tubes; Brightson Laboratories, Inc.

TUBE REJUVENATORS

Hoyt tube flasher; Burton & Rogers Mfg. Co.

TUNING INDUCTANCE UNITS

"Copp" vario-selector; A. C. Electrical Mfg. Co.
A-P coils; Acme Products Co.
Aero coil 3-circuit tuner; Aero Products, Inc.
Aero coil oscillator; Aero Products, Inc.
All-American toroid coil; All-American Radio Corp.
All-American Filtrola; All-American Radio Corp.
All-Henry basket wound inductance; All-Henry Coil Co.
Resistance couplers; Amsco Products, Inc.
Honeycomb coil; Amsco Products, Inc.
Variometer; Amsco Products, Inc.
B & P Micrometer-type low-loss tuner; Barrett & Paden
Bel-Tone variocoupler; Bel-Tone Radio Co.
Bel-Tone variometer; Bel-Tone Radio Co.
Major Tuner; Chas. A. Branston, Inc.
Oscillator coupler; Chas. A. Branston, Inc.
Honeycomb coil; Chas. A. Branston, Inc.

A USEFUL LABORATORY INSTRUMENT

Name of Instrument: Tube tester.

Description: This device incorporates four meters, the necessary resistance controls and a buzzer for measuring the characteristics of modern vacuum tubes for reception. It is self contained and it is furnished with a set of special headphones for use in balancing to obtain the amplification constant of the tube. Two vacuum-tube sockets, one for a large standard tube and one for a small standard tube, are mounted at the center of the panel with the switching arrangements and meters arranged in a business-like way for simplicity of operation.

Usage: For determining the electrical characteristics of vacuum tubes for reception.

Outstanding features: Compactness. Simplicity of operation. Quick reading.

Maker: DeWitt-LaFrance Co.

A HIGH QUALITY REPRODUCER

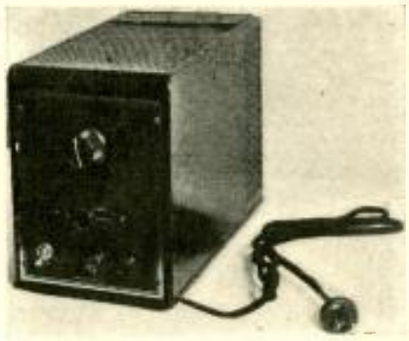
Name of instrument: Loudspeaker reproducing unit.

Description: This unit, which is housed in a sturdy metal casing, may be used as a reproducer for a loudspeaker or as a unit to be attached to a phonograph. It is powerful in operation and produces a remarkably clear tone signal. It is equipped with a long extension cord that may be run over to the radio receiving set and attached to the jack of that instrument.

Usage: In combination with a receiving set as a reproducer of broadcast signals.

Outstanding features: Compact design. Sturdy manufacture. Produces great volume with clarity of tone.

Maker: Borkman Radio Corporation.



AN EFFICIENT "A" BATTERY ELIMINATOR

Name of instrument: "A" power unit.

Description: This device is one of the first satisfactory "A" eliminator units to be placed on the market. It operates directly on 110 volts, 60 cycles and furnishes filter direct current for supplying "A" current for the filaments of vacuum tubes. It has three current variations for supplying the filaments of three to seven tubes. It is also equipped with an "on" and "off" switch that is connected to a relay that protects the filaments of the tubes from burning out in case of overload. The unit also contains a rheostat for applying just the right voltage to the tube. Two binding-posts are also provided, marked negative and positive, for the leads that go to the "A" circuit of the receiver with which the unit is to be used. No changes are necessary in the wiring of the receiver to accommodate this unit. Two tungar small size bulbs are used as rectifiers.

Usage: With a receiving set for furnishing "A" current.

Outstanding features: Supplies filtered direct current. Neat in appearance. Smooth action. No hum.

Maker: Davy Electric Corporation.

AN IMPEDANCE FOR AN AUDIO-FREQUENCY AMPLIFIER

Name of instrument: Impedance coupler.

Description: This is a new audio-frequency device made especially for impedance - coupled amplification work. It contains an adequate core of laminated material with a single winding to give the necessary high inductance for use in the plate circuit of an audio-frequency amplifier tube. It is neatly mounted into a shielded metal case finished in gray enamel and equipped with two binding posts for connection to the other components in the circuit.

Usage: In an impedance-coupled amplifier as an interstage coupling device.

Outstanding features: The high impedance necessary for low-frequency work. Low distributed capacity. Neat appearance. Easy to install.

Maker: Acme Apparatus Co.

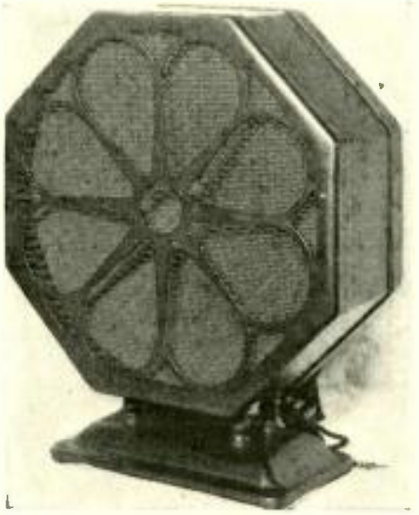
Hetorus coil; Chas. A. Branston, Inc.
B-T low loss tuner; Bremer-Tully Mfg. Co.
Bruno "77" low-loss tuning coil; Bruno Radio Corp.
Bruno short-wave tuning coil; Bruno Radio Corp.
Bradley Quartzite coil; Bruno Radio Corp.
Flewelling tuner; Buell Mfg. Co.

VARIABLE CONDENSERS

Acme variable condenser; Acme Apparatus Co.
Kelford variable condenser; American Specialty Co.
Amplex grid-denser; Amplex Instrument Laboratories
Amsco SLF condenser; Amsco Products, Inc.
Siamese Allocating condenser; Amsco Products Inc.
Fada variable condenser; F. A. D. Andrea, Inc.
Variable condenser; Barrett & Paden
Variable air condensers; Beacon Radio Mfg. Co.
Benjamin SLF variable condenser; Benjamin Electric Mfg. Co.
Boone Super variable condenser; J. T. Boone Radio Corp.
B-T tandem condenser; Bremer-Tully Mfg. Co.
Bruno 3 in 1 variable condenser; Bruno Radio Corp.

WIRE

Battery cable (black and red) "Celatsite"; Acme Wire Co.
Alpha insulated, square and round bus bar wire; Alpha Radio Supply Co., Inc.
Gosilco wire; American Luminous Products Co.
Belden loop wire, "Litz" wire, hoop-up and magnet wire; Belden Mfg. Co.



A FINE NEW REPRODUCER

Name of instrument: Cone-type loudspeaker.

Description: This instrument which is housed in a well-designed octagonal metal case contains a freely balanced offset cone with a rugged and powerful electromagnetic unit as the prime mover. The whole unit produces great volume with remarkable tone quality especially on the low notes and is free from vibration at any particular frequency. It is furnished with a long extension cord and a suitable base for standing on a table or other support.

Usage: In combination with a radio receiver as a reproducing device.

Outstanding features: Beautiful appearance. Sturdy construction. Fine tone quality. Low cost.

Maker: Pausin Engineering Co.

Australians, as indicated by a popular vote, have shown a greater preference for religious programs than anything else. They cared the least for fashions.

* *

WEATHER and meteorological data supplied by the Weather Bureau are broadcast today from 138 broadcasting stations located in various parts of the United States.

BROADCASTS

CONDUCTED BY CHARLES L. REESE, JR.

Why Fans Prefer Men Announcers

Do radio fans want women announcers? To get a convincing answer to this question, station WJZ recently made a canvas of over 5,000 broadcast listeners who thundered an almost unanimous "No!" Those who favored men numbered about 99 percent. The reasons for this decision may be summarized thus:

Most receiving sets do not reproduce perfectly the higher notes. A man's voice "takes" better; it has more volume:

Announcers cover sporting events, shows, concerts, operas and big public meetings, and men are naturally better fitted for assignments of this nature:

Women prefer to hear the voice of a man; the vote does not indicate that men prefer to hear women announcers:

The woman's voice over the radio usually has too much personality; a voice that is highly individual and full of character does not seem to be appreciated by the audience that cannot see the face and expression which go with the voice:

The listener resents a voice that is too intimate on short acquaintance—and the woman announcer has difficulty in repressing her enthusiasm and in maintaining the necessary reserve and objectivity:

Women cannot avoid the patronizing note in their effort to speak effectively over the radio; the struggle to avoid being too patronizing results in the opposite vice of monotonous, colorless delivery; and only male announcers—and only a few of them—are able to strike the right key.

* *

Experimenting with "Radio Beacons" in Motor Cars

PERFECTING radio beacons for use in guiding airplanes is the big thing at the Bureau of Standards these days. To ascertain, on a small scale how the beacons will work, an automobile has been equipped with radio, just as an airplane is, and will be guided by the beacons experimentally just as an airplane in flight will be. The auto carries with it radio-telephone transmitting and receiving sets, including apparatus for measuring the field intensity or strength of radio signals from broadcasting stations, a semi-automatic recorder for studying the phenomenon of fading of radio signals and radio direction finders.

As the auto goes along a mensured course, it will be guided through imaginary fog and storms by double-beam radio beacons.

* *

Fans Call a Strike on "Air-Pirates"

A NATION-WIDE strike against "unfair stations" was recently called by the Broadcast Listeners Association to try to force broadcasting stations that had jumped their wavelengths to return to their originally assigned part of the wave band. The association furnished its members with a list of all of the stations which had increased their power or changed their wavelength since the government restrictions were removed and urged everyone not to listen in to any broadcaster on the list. It is too early to forecast the result of this strike; but it may be added that a previous strike of listeners in to force Chicago broadcasters to adopt a silent night each week met with almost instantaneous success.

* *

Short-wave Experiments in a Flying Laboratory

WHEN Captain René Fonck hops off from New York this fall on his flight to Paris, his giant Sikorsky plane will carry short-wave transmitting and receiving apparatus in addition to the regular radio equipment. Captain Jack Irwin, the radio expert for the flight, is a believer in the value of short waves and he thinks that he can prove their usefulness for long-range airplane communication on this flight. While the plane is on its way across the Atlantic, Captain Irwin will try to keep in constant communication with amateurs along the Atlantic coast by means of short-wave transmissions.

Does Radio Affect Watches?

THE watchmakers of London claim that ever since broadcasting has been going on in England the watches of thousands of Britishers have failed to keep time as accurately as before; they say that watch troubles have increased from 5 to 75 percent "under the malign influence of radio." American jewelers also say that they have noticed an increase in watch faults. Their theory is that the mechanism of the watch is peculiarly susceptible to magnetism and that when the watch is exposed to the high-frequency vibrations that are used in radio it becomes magnetic. Current is then induced in the delicate springs which become tiny induction coils and attract ultra short waves. This, they say, ruins the action of the watch and prevents it from giving accurate and dependable time.

* *

Only Experts Will Broadcast Ringside Reports of Fights

THAT the broadcasting of ringside reports of boxing contests has become an art for which only a few are qualified is the implication in the recent ruling of the New York State Athletic Commission, which has proclaimed that hereafter only those broadcasters shall be permitted to officiate as radio reporters who meet the Commission's approval as qualified boxing experts.

* *

"Singing Down the Cattle" by Radio

ANOTHER one of the traditional customs of the old West seems headed toward extinction—the cowboy habit of "singing the cattle down," as the night herder's crooning melody to quiet the herd is described. The most picturesque "fan letter received by Station WGES was from Tom Blevins, a Utah cowman, who wrote that he had set up a portable radio out on the range and treated the cows to metropolitan dance music.

"It sure is a big saving on the voice," Blevins wrote. "The herd don't seem to tell the difference. Don't put on any speeches, though. That'll stampede 'em as sure as shootin'."

* *

"Nickel-in-the-slot" Radio Receivers on Railroad Trains in Austria

FROM Vienna comes the report that special railroad cars, fitted with radio receiving sets, are being introduced as an experiment on some fast trains in Austria. Each car is equipped with receiving sets for fifty persons, and passengers of the first, second and third classes may transfer to these cars and listen in for 13 cents an hour. If the experiment is successful, entire trains will be fitted up with receiving sets, which will operate on the nickel-in-the-slot system.

Outstanding Program Features of the Month

SEPTEMBER 15 TO OCTOBER 15

DURING the coming month, September 15th to October 15th, the following regular and special program features are scheduled. This list, which will be augumented monthly as advance information is received, will be published in each issue of this magazine; all broadcast stations are invited to report coming program features of outstanding interest or importance. Reports should reach the Editor of POPULAR RADIO on or before the 23d of the month preceding.

SEPTEMBER
(Daylight Saving Time)

15; *Eastman Theatre Orchestra*, WHAM; 6:30 P. M. (Also from WGY).

15; *Radio Nature League*, WBZ; 8:30 P. M.

16; *Judge, Jr.*, WJZ; 7:40 P. M.

16; *Eskimos*, WEAF; 9:00 P. M. (Also broadcast from WEEI, WJAR, WTAG, WFI, WCAE, WSAI, WTAM, WGR, WWJ, WOC, WCCO, KSD and WGN).

16; *Silvertown Orchestra*, WEAF; 10:00 P. M. (Also broadcast from WEEI, WFI, WCAE, WWJ, WGR, WOC, WCCO, WTAG, KSD, WSAI, WJAR, WGN, WADC and WCSH).

16; *Royal Typewriter Hour*, WJZ; 9:30 P. M. (Also broadcast from WGY, WRC and WCAD).

17; *Happiness Boys*, WEAF; 8:00 P. M.

19; *Atwater Kent Hour*, WEAF; 9:15 P. M. (Also broadcast from WEEI, WGR, WCAP, WWJ, WGN, WCCO and KSD).

20; Opera *"Samsan and Delilah,"* WEAF; 10:00 P. M. (Also broadcast from WCSH, WCCO, WOO, WCAE, WDAS, WJAR, WTIC, WCAP, KSD and WSAI).

20; *Rolfe's Palais D'Or Orchestra*, WEAF; 11:00 P. M.

21; *George Olsen's Orchestra*, WJZ; 10:45 P.M.

21; *Keystoners*, WJZ; 9:00 P. M. (Also broadcast from WRC and WGY).

21; *Eveready Hour*, WEAF; 9:00 P. M. (Also broadcast from WEEI, WFI, WCAE, WGR, WWJ, WOC, KSD, WJAR, WCCO, WTAM, WGN, WSAI and WTAG).

22; *Eastman Theatre Orchestra*, WHAM; 6:30 P. M. (Also broadcast from WGY).

22; *Radio Nature League*, WBZ; 8:30 P. M.

23; *Judge, Jr.*, WJZ; 7:40 P. M.

23; *Dempsey-Tunney Fight*, KDKA.

23; *Royal Typewriter Hour*, WJZ.; 9:30 P. M. (Also broadcast from WGY, WRC and WCAD).

23; *Silvertown Orchestra*, WEAF; 10:00 P. M. (Also broadcast from WEEI, WFI, WCAE, WWJ, WGR, WOC, WCCO, WTAG, KSD, WSAI, WJAR, WGN, WADC and WCSH).

23; *Eskimos*, WEAF; 9:00 P. M. (Also broadcast from WEEI, WJAR, WTAG, WFI, WCAE, WSAI, WTAM, WGR, WWJ, WOC, WCCO, KSD and WGN).

24; *Happiness Boys*, WEAF; 8:00 P. M.

26; *Atwater Kent Hour*, WEAF; 9:15 P. M. (Also broadcast from WEEI, WGR, WCAP, WWJ, WGN, WCCO and KSD).

26; *Selections from comic operas, "Florodora," "The Only Girl," etc.*, KFI; 9:00 P. M.

27; *Rolfe's Palais D'Or Orchestra*, WEAF; 11:00 P. M.

27; *Opera "The Barber of Seville,"* WEAF; 10:00 P. M. (Also broadcast from WCSH, WCCO, WOO, WCAE, WDAS, WJAR, WTIC, WCAP, KSD and WSAI).

28; *Gold Dust Twins*, WEAF; 8:30 P. M. (Also broadcast from WEEI, WFI, WCAE, WGR, WWJ, WOC, WCSH, WJAR, WCCO, WLIB, WTAM and KSD).

28; *Keystoners*, WJZ; 9:00 P. M. (Also broadcast from WRC and WGY).

28; *George Olsen's Orchestra*, WJZ; 10:45 P. M.

28; *Eveready Hour*, WEAF; 9:00 P. M. (Also broadcast from WEEI, WFI, WCAE, WGR, WWJ, WOC, KSD, WJAR, WCCO, WTAM, WGN, WSAI and WTAG).

29; *Eastman Theatre Orchestra*, WHAM; 6:30 P. M. (Also from WGY).

29; *Radio Nature League*, WBZ; 8:30 P. M.

30; *Eskimos*, WEAF; 9:00 P. M. (Also broadcast from WEEI, WJAR, WTAG, WFI, WCAE, WSAI, WTAM, WGR, WWJ, WOC, WCCO, KSD and WGN).

30; *Silvertown Orchestra*, WEAF; 10:00 P. M. (Also broadcast from WWI, WFI, WCAE, WWJ, WGR, WOC, WCCO, WTAG, KSD, WSAI, WJAR, WGN, WADC and WCSH).

30; *Judge, Jr.*, WJZ; 7:40 P. M.

30; *Royal Typewriter Hour*, WJZ; 9:30 P. M. (Also broadcast from WGY, WRC and WCAD).

OCTOBER

1; *Happiness Boys*, WEAF; 8:00 P. M.

3; *Atwater Kent Hour*, WEAF; 9:15 P. M. (Also broadcast from WEEI, WGR, WCAP, WWJ, WGN, WCCO and KSD).

4; *Rolfe's Palais D'Or Orchestra*, WEAF; 11:00 P. M.

4; *Opera "Carmen,"* WEAF; 10:00 P. M. (Also broadcast from WCSH, WCCO, WOO, WCAE, WDAS, WJAR, WTIC, WCAP, KSD and WSAI).

5; *Keystoners*, WJZ; 9:00 P. M. (Also broadcast from WRC and WGY).

5; *George Olsen's Orchestra*, WJZ; 10:45 P. M.

5; *Eveready Hour*, WEAF; 9:00 P. M. (Also broadcast from WEEI, WFI, WCAE, WGR, WWJ, WOC, KSD, WJAR, WCCO, WTAM, WGN, WSAI and WTAG).

6; *Eastman Theatre Orchestra*, WHAM; 6:30 P. M. (Also from WGY).

6; *Radio Nature League*, WBZ; 8:30 P. M.

7; *Eskimos*, WEAF; 9:00 P. M. (also broadcast from WEEI, WJAR, WTAG, WFI, WCAE, WSAI, WTAM, WGR, WWJ, WOC, WCCO, KSD and WGN).

7; *Silvertown Orchestra*, WEAF; 10:00 P. M. (Also broadcast from WEEI, WFI, WCAE, WWJ, WGR, WOC, WCCO, WTAG, KSD, WSAI, WJAR, WGN, WADC and WCSH).

7; *Judge, Jr.*, WJZ; 7:40 P. M.

7; *Royal Typewriter Hour*, WJZ; 9:30 P. M. (Also broadcast from WGY, WRC and WCAD).

8; *Happiness Boys*, WEAF; 9:00 P. M.

10; *Atwater Kent Hour*, WEAF; 9:15 P. M. (Also broadcast from WEEI, WGR, WCAP, WWJ, WGN, WCCO and KSD).

I. C. A. PANELS

for the

COCKADAY LC-27

and all other popular circuits

GIVE your set a strictly professional finish by using an I.C.A. Panel of Insuline or Bakelite, the standard insulating materials. Drilled and decorated ready for mounting. Decoration by our exclusive Etch-O-Gravure Method, insuring highest artistic effects.

I.C.A. Panel for Cockaday LC-27, size 8 x 26 in., Black or Mahogany finish, $6. I.C.A. Bakelite Panel, same as above, Black or Mahogany finish, $8.50.

We also Furnish Sub-Panels for the "LC-27" and All Other Popular Circuits.

FANS!

Before building any circuit get the I.C.A. FREE BOOKLET giving complete list of Foundation units and all insulating parts. Also for particulars of the new I.C.A. Non-Microphonic Socket.

Don't take substitutes for the genuine I.C.A. Products. If your dealer can't supply you write us direct. Dept. 10.

Insulating Company of America, Inc.
Insuline Bldg., 59 Warren St.
New York City

22½ Volt un-acid everlasting

rechargeable "B" Storage Battery

$2.65 *includes chemical*

45 Volts $5.25, 90 volts $10.00, 112½ volts $12.50, 135 volts $14.75, 157½ volts $16.80. Truly the biggest buy today. Easily charged on any current including 32 volt systems. Any special detector plate voltage had. Tested and approved by leading authorities such as POPULAR RADIO laboratories. Over 3 years sold on a non-red tape 30 day trial offer with complete refund if not thoroughly satisfied. Further guaranteed 2 years. Knock-down kits at greater savings. Complete "Hawley" "B" Battery Charger $2.75. Sample cell 35c. Order direct—send no money—simply pay the expressman cost on delivery. Or write for my free literature, testimonials and guarantee. Same day shipments.

B. HAWLEY SMITH
315 Washington Avenue
Danbury, Conn.

VERNIER DIAL $1.00
Ratio 10:1. Makes fine tuning positive. Genuine Bakelite. Diameter 4".

FITALL UNIVERSAL SOCKET 40c
Accommodates all tubes, old style or new UX tubes. Genuine Bakelite. Binding posts reversible.

SERIES RHEOSTATS 70c
(One hole mount)
Genuine Bakelite. Adjustable to panel of any standard thickness. Slider built as unit assembly. Rheostats—6, 10, 20, 30 ohm.

POTENTIOMETERS
200 ohm 90c
400 ohm $1.20

1251 15c 1252 20c
PILOT SMALL KNOBS
Genuine Bakelite. No. 1251 has 8x32 threaded bushing or hole and set screw for ⅛ inch shaft. No. 1252 has hole and set screw for ¼ inch shaft.

PILOT LUG-JACKS
May be used with or without solder connections.
Single circuit open 35c
Single circuit closed 40c
Filament control, Single Jack 45c
Filament control, Double Jack 50c

PILOT SWITCH 45c
Bakelite Insulated. Complete with "on" and "off" name plate. Single hole mounting.

PILOT PLUG 40c
Genuine Bakelite, automatic plug of the spring grip type. Tips inserted and removed in a jiffy.

PILOT LIGHT 45c
Tells at a glance when tubes are lit from front panel. Single hole mount. Saves Batteries.

TRADE MARK

BUILD WITH PILOT PARTS AND SAVE MONEY

Set Builders

WHO for the first time use Pilot Parts marvel at their high quality and perfect performance. They wonder how such low prices are possible.

Tremendous quantity production makes Pilot prices possible without in the least sacrificing their high standard of excellence.

Pilot is the world's largest radio parts plant. It enjoys the cooperation of America's greatest chain store system and through their radio departments sells millions of parts every year.

Pilot does not excuse its low prices. It explains them by quantity sales. And Pilot does not have to talk high quality: it proves it by perfect performance.

In a recent international contest announced through Radio Broadcast, the winner—J. H. Butler, of Brooklyn, N. Y.,—used Pilot Capacigrad variable condensers and Uncle Sam in his Navy Department recently adopted Pilot Isograd fixed condensers.

Pilot parts are sold and used all over the civilized world.

Miss Australia (Beryl Mills) enroute to America's Radio Shows "tuned in" on American and Australian Stations from the mid-pacific using a set built of pilot parts.

If there is an S. S. Kresge Co. store in your town you will find Pilot Parts in their Radio Department exclusively. If there is no Kresge Co. store, look for a Pilot dealer. Insist on Pilot parts and get perfect performance at low cost.

If no store selling Pilot parts is convenient you may order direct from us. Send cash or money order, adding ten cents additional to the prices quoted and be sure to send us the name of your Radio Dealer.

PILOT ELECTRIC MFG. CO.

Dep't 96 P
100 South 3d Street
Brooklyn, N.Y.

DEALERS: If there is no Kresge store in your town write to us regarding a Pilot Franchise and *do it now!*

PILOT PARTS *for* PERFECT PERFORMANCE

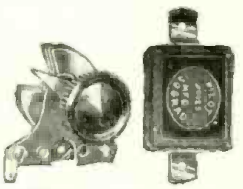
PILOT CAPACIGRAD CONDENSERS (Velvet Feel)

Modified Straight Line. Centrally located bearings, cut out stator and rotor plates, extra reinforcements of rotor plates.
(8 Plate) 170 M.M.F. ... $1.60
(13 Plate) 300 M.M.F. ... 1.90
(17 Plate) 380 M.M.F. ... 2.10
(23 Plate) 500 M.M.F. ... 2.25

Double Condenser
17 Plate Each section 380 M.M.F $4.00

True Straight Line Frequency, solid brass plates. Special Bushings—free from chatter. Ask for Series 1800.
(8 Plate) 170 M.M.F. ... $1.60
(13 Plate) 300 M.M.F. ... 1.90
(17 Plate) 380 M.M.F. ... 2.10
(23 Plate) 500 M.M.F. ... 2.25

Double Condenser
17 Plate Each section 380 M.M.F $4.00



MIDGET CONDENSER
Compensates for variations in coils and condensers. Especially important where uni-control is employed. One hole mount.
(7 Plate) 25 M.M.F. ... $ .80
(13 Plate) 50 M.M.F. ... 1.00

FIXED CONDENSERS
Accurate, permanent, noiseless mica condenser. Bakelite moulded, small in size. Terminal lugs flush with Bakelite. Completely sealed. Approved and purchased by U. S. Naval Research Labs.
Capacity:
.00025 and .0005 ..... 35c ea.
.001 and .002 ..... 40c ea.
.003 and .004 ..... 50c ea.
.005 60c .006 70c
.01 90c .015 $1.20
Grid resistance clips 10c additional attached. Prices on capacities not shown furnished on request.

COIL MOUNTING BRACKET
Especially designed to accommodate basket weave coils. Attachable anywhere. Genuine Bakelite. 10c

BINDING POSTS
Top genuine Bakelite. Non-removable head, all standard markings in white enamel.
(state markings desired) ..... 20c each
Unmarked Nickel Posts 10c

SUB-PANEL BRACKET 50c
Designed for mounting front and sub-panel. Genuine Bakelite. 6¾ in. long by 2 in. wide.

Short Wave "Plug In" Coils
Ask for Special Folder

SNAP TERMINALS AND STRIPS
Takes all standard phone tips and Pilot snap terminals. Genuine Bakelite and nickel plate. Markings white enamel.
7 terminal strip 50c
Snap terminals accommodates any standard size wire. No soldering, positive permanent connections.
Snap Terminals each 10c

Made By Worlds Greatest Radio Parts Manufacturer

11; *Rolfe's Palais D'Or Orchestra*, WEAF; 11:00 P. M.

11; *Opera "The Bohemian Girl,"* WEAF; 10:00 P. M. (Also broadcast from WCSH, WCCO, WOO, WCAE, WDAS, WJAR, WTIC, WCAP, KSD and WSAI).

12; *Keystoners*, WJZ; 9:00 P. M. (Also broadcast from WRC and WGY).

12; *George Olsen's Orchestra*, WJZ.; 10:45 P. M.

12; *Eveready Hour*, WEAF; 9:00 P. M. (Also broadcast from WEEI, WFI, WCAE, WGR, WWJ, WOC, KSD, WJAR, WCCO, WTAM, WGN, WSAI and WTAG).

13; *Eastman Theatre Orchestra*, WHAM; 6:30 P. M. (Also broadcast from WGY).

13; *Modern Music Night*, KDKA.

13; *Radio Nature League*, WBZ; 8:30 P. M.

14; *French Music Night*, KFI; 9:00 P. M.

14; *Judge, Jr.*, WJZ; 7:40 P. M.

14· *Royal Typewriter Hour*, WJZ; 9:30 P. M. (Also broadcast from WGY, WRC and WCAD).

14; *Silvertown Orchestra*, WEAF; 10:00 P. M. (Also broadcast from WEEI, WFI, WCAE, WWJ, WGR, WOC, WCCO, WTAG, KSD, WSAI, WJAR, WGN, WADC and WCSH).

14; *Eskimos*, WEAF; 9:00 P. M. (Also broadcast from WEEI, WJAR, WTAG, WFI, WCAE, WSAI, WTAM, WGR, WWJ, WOC, WCCO, KSD and WGN).

·15; *Happiness Boys*, WEAF; 8:00 P. M.

* *

Radio Terminology Enters the Trade

IF you think you know what a "Radio" or a "Broadcast" or a "Radio Station" is you had better watch your step when you next wander into a drug-store and mention one of these words. For the latest thing at the soda fountains is the "Radio Station Sundae;" "Radio" is the name of a new starch manufactured in Illinois; and "Broadcast" is the trade name that is now used for a line of toilet and perfumery articles made in New York.

* *

A Radio-Controlled "Air Ram"

ONE of the war weapons that ingenious radio engineers have been experimenting with is the pilotless, radio-controlled "air ram" that has recently been demonstrated at Quesqueville near Cherbourg, France. This steel-nosed plane, it is reported, "may be sent straight at a formation of enemy planes and so damage or scatter them that they will fall an easy prey to the guns of attacking planes." The radio-controlled plane it is claimed, may be directed either from the ground or from another plane and it may be put through all of the stunt tactics of which any piloted plane is capable. Thus the air duels of the future may be fought by radio operators.

Broadcasting High School Education

PUBLIC school students in New York, within the next few years, may get a large part of their instruction over the radio, according to plans now under way. To meet the demand for radio receivers for the schools the Board of Education has decided to install a radio receiver this year in the Washington Irving High School; if the experiment succeeds sets will be installed in the other schools throughout the city.

* *

Tracking a Hurricane by Means of Radio

THE newest use for the radio compass —and one which may save many lives at sea—is the plotting of paths of storms on the ocean so that they may be successfully avoided. During the recent hurricane that swept the West Indies and the coast of Florida, Lieut. Kincaid, navigator of the navy transport *Kittery*, found that he could follow the entire course of the storm with his radio compass; he took bearings on the point of heaviest static and from these data computed the center of the sweeping storm. When he was able to check his data later with the official weather reports, he found that his radio had accurately plotted the storm's travels.

* *

Changes in the List of Broadcasting Stations in the U.S.

These corrections and additions to the list which was published in the March, 1926, issue of POPULAR RADIO *(together with the changes which have been published in succeeding months) make the list correct as of August 20, 1926. Further changes will be published each month in this magazine.*

STATIONS ADDED

KGBS	Seattle, Washington	209.7
KGBU	Ketchikan, Alaska	228.9
KGBW	Joplin, Missouri	282.8
KGBX	St. Joseph, Missouri	347.8
KRCA*	San Francisco and Los Angeles, Cal	305.0
WCRW	Chicago, Illinois	239.9
WJAF	Ferndale, Michigan	400.0
WJBV	Woodhaven, New York	469.9
WJBW	New Orleans, Louisiana	340.7
WJBX	Osterville, Massachusetts	280.0
WJBY	Codsden, Alabama	270.1
WKBA	Chicago, Illinois	288.3
WKBC	Birmingham, Alabama	225.0
WMBI	Chicago, Illinois	288.3

CHANGES IN CALL LETTERS

WQAO	New York City	*change to*	WQAO† WPAP

CHANGES IN WAVELENGTHS

KFDD	Boise, Idaho, 277.6	*change to*	275.1
KFNF	Shenandoah, Ia., 263	*change to*	461.3
KFPY	Spokane, Wash., 265.3	*change to*	273.0
KFQU	Holy City, Cal., 217.3	*change to*	230.6
KGY	Lacey, Wash., 245.8	*change to*	277.6
KMA	Shenandoah, Ia., 252	*change to*	461.3
KTAB	Oakland, Cal., 240	*change to*	302.8
KTNT	Muscatine, Ia., 256	*change to*	333.1
WBBR	Rossville, N. Y., 272.6	*change to*	416.4
WBNY	New York City.. 209.7	*change to*	322.4
WEW	St. Louis, Mo., 247.8	*change to*	380.0
WCMA	Culver, Ind., 222.1	*change to*	258.5
WHAP	New York City, 240	*change to*	431.0
WMSG	New York City, 212.6	*change to*	302.8
WNAB	Boston, Mass., 250	*change to*	280.2
WNAC	Boston, Mass., 280.2	*change to*	430.1
WRNY	New York City, 258	*change to*	374.8
WTAG	Worcester, Mass , 268	*change to*	545.0

CHANGES IN LOCATIONS

WJZ	New York City	*change to*	Bound Brook, N. J.
WQAO	New York City	*change to*	Cliffside, N. J.
KMTR	Los Angeles, Cal.	*change to*	Hollywood, Cal.

*Temporary license.
†One station broadcasting under two call signs.

Uncle Sam Owns 80 Percent of World's Receivers

AMERICA'S claim to the position of the leading radio nation of the world is strikingly supported by figures recently made public by the Department of Commerce. Of the world's radio broadcasting stations we operate 65 percent and of the world's radio receiving sets we own the amazing total of 80 per cent.

* *

Sovereignty of Nations Held to Include Radio

ONE of the most important legal decisions of a generation was recently made in Vienna, when the Aerial Laws Section of the International Law Association Congress unanimously decided that the old principle of the sovereignty of nations over the land and water within their borders should be extended to include the air above a nation, allowing each nation to control the radio waves that pass over it. This action was taken against the advice of Dr. Temple Grey, an English radio expert, who declared that any such control was impossible as the ether permeates everywhere and no part of it may be isolated as is the case with land or water; he said that radio necessitated a new conception of sovereignty and suggested that this be based upon the prescriptive use of certain wavelengths. Thus, if the chief German broadcaster obtained by usage a monopoly upon a certain belt of the ether, Germany should have the sole use of that portion of the ether.

The view of the lawyers, however, was supported by J. Arthur Barratt, an American, who argued that as radio may become one of the most destructive forces known to mankind through the distant control of explosives and other instruments of warfare, it is necessary for every nation to retain the sovereign right to control the air. And although such a control is virtually impossible at present, he believed that science in the future may evolve some means of control.

* *

An Amateur's Short-Wave Reception Record

ONE of the most interesting and unusual records of short-wave reception ever recorded has been made by a British amateur, H. Hizett of Sheffield, England. In the thirty days between May 22 and June 22 of this year, Mr. Hizett picked up messages from 223 foreign stations including 134 American amateurs from all but the Pacific Coast district, 22 in Brazil, and one or more in Canada, Chile, Porto Rico, Poland, Algeria, Tunis, Austria, Hong Kong, India, Jugoslavia, Italy, Denmark, Finland, Spain and Sweden. All reception was on an indoor antenna.

* *

"Radio Kelly" Dies

"RADIO KELLY," the well-behaved rattlesnake who was perhaps the first reptile to broadcast to large audiences when his warning rattle was sent out over the air a little over two years ago from station WPSC, gave his last of many performances for the radio the other night. Worn out by daily rattling "Kelly" curled up and died.

Signal Corps, U. S. A.

WHERE THE ARMY RADIO OPERATOR LEARNS TO "READ A SPEEDY FIST"

One of the instruction rooms in the Signal School of the U. S. Army at Fort Monmouth, N. J., where the doughboy who signs up for the radio course is led through the mysteries of codes, circuits and the operation and repair of radio sets. The class shown above is busy taking down a message in code; each student must be able to receive at a speed of twenty-words a minute with no errors before he can graduate. At the end of his course he must be able to assemble any kind of circuit from the raw parts—and make it work.

A Word About
PRECISION COILS

Precision Coils are specifically designed to meet the needs of those radio engineers who are constantly working to improve radio reception. In many cases they have proved to be the foundation for decided improvements in broadcast reception.

No. 340

THE PRECISION R. F. CHOKE COIL

Can be used wherever this type of coil is necessary. Very compact, being one inch in diameter and one and one-half inches long. Can be mounted on a sub-panel or a base-board. Bracket for baseboard mounting provided with each coil. Has a very low distributed capacity, due to the slotted form of winding. List price $1.00.

No. 135

PRECISION POWER BLOCK

Especially designed for use with "B" Battery Eliminators. It contains 13½ mfds. DC voltage of 200. In 5 units of 2, 2, 8, 1 and ½ mfd. capacity. Strong olive green case. Size 4½" by 3⅝" by 3¼". List price $11.50.

BY PASS CONDENSER NO. 135A

To be used in conjunction with power block No. 135 when it is used in the Raytheon Circuit. Contains two .1 mfd. condensers. List price $1.25.

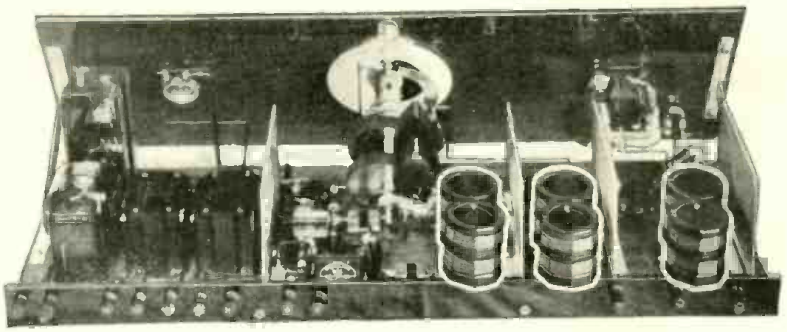
PRECISION POWER BLOCK NO. 80

For use in the Power Pack Amplifier designed by and using the parts of the American Transformer Company.
It has a common lead, and 2 mfd., 4 mfd. and 2 mfd. leads. The condensers used are given a flash test of 2000 volts and will bear the conservative working voltage of 400. Same size and appearance as No. 135. List price $12.50.

THE ORIGINAL COCKADAY COIL

The only coil ever specified by Laurence M. Cockaday, inventor of the famous Cockaday Four Circuit Tuner for use in his set. The best hard rubber tubing and double silk covered copper wire insures a coil of unusual quality, resulting in increased volume and greater selectivity. Dielectric and leakage losses are extremely low. Price, $5.50.

No. 200



USED IN THE COCKADAY LC-27

The Precision Duo-Octaform Coils, shown above, are the coils used in Mr. Cockaday's new LC-27 Receiver. Price $3.50 each.

THE COCKADAY LC-27 RECEIVER KIT

For the convenience of those consumers and dealers who wish to buy Cockaday's LC-27 in complete kit form: we offer the following parts exactly as used in Mr. Cockaday's laboratory model.

1—Hammarlund mid-line dual condenser, .000275 mfd.	$7.50
1—Hammarlund mid-line single condenser, .000275 mfd.	4.65
1—Precision Duo-Octaform coil set, one antenna coupler and two interstage couplers.	10.50
1—Amertran De Luxe first-stage transformer	10.00
1—Amertran De Luxe second-stage transformer	10.00
1—Amerchoke No. 854	6.00
1—Dubilier No. 902 filter condenser, 4 mfd.	5.50
1—Dubilier No. 907 filter condenser, .1 mfd.	.60

"—used in the LC-27"

1—Mar-Co. illuminated control, scale 0 to 100	$3.50
2—Mar-Co small controls for LC-27	1.50
1—Carter battery switch	.65
1—Samson radio-frequency choke coil No. 85	1.50
4—Aluminum shields	1.75
3—Aerovox mica fixed condensers, .00025 mfd.	1.05
1—Durham resistor, 4 megohms	.50
1—Lynch grid leak mounting	.35
1—Carter Gem Jack	.25
1—Carter resistance, 0-10,000 ohms	2.00
10—Eby binding posts	1.50
1—Binding post strip 1½" wide x 25⅞" long x ¼" thick	.76
1—Bakelite decorated panel, 8 x 26"	9.00
5—Benjamin UX sockets	3.75
1—Amperite	1.10
2—Tait Brackets	2.00
Complete	$85.91

Without Cabinet $85.91 **With Corbett Cabinet $103.91**

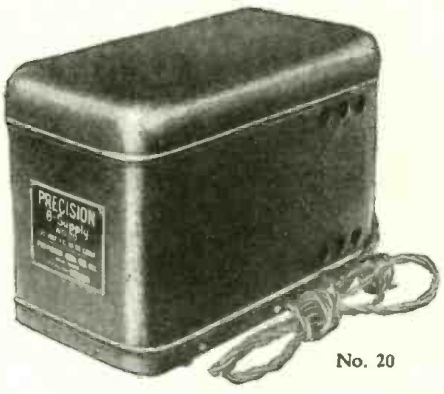
Built complete with cabinet $10.00 extra

180 VOLT B-SUPPLY

FOR USE WITH 110 VOLTS AC 50-60 CYCLES

A very powerful and strongly constructed tube eliminator. Designed to withstand heavy loads and give up to 180 volts at 60 mils. Terminals are Neg. B. Pos. 22, 45, 90 and 180. Particularly designed to supply current for the new UX171 tube. Uses the UX216B tube, which gives a very constant current.

Strong metal olive green case. Seven feet of wire and plug. Size of case 6" by 10¾" by 8". List price $47.50.



No. 20

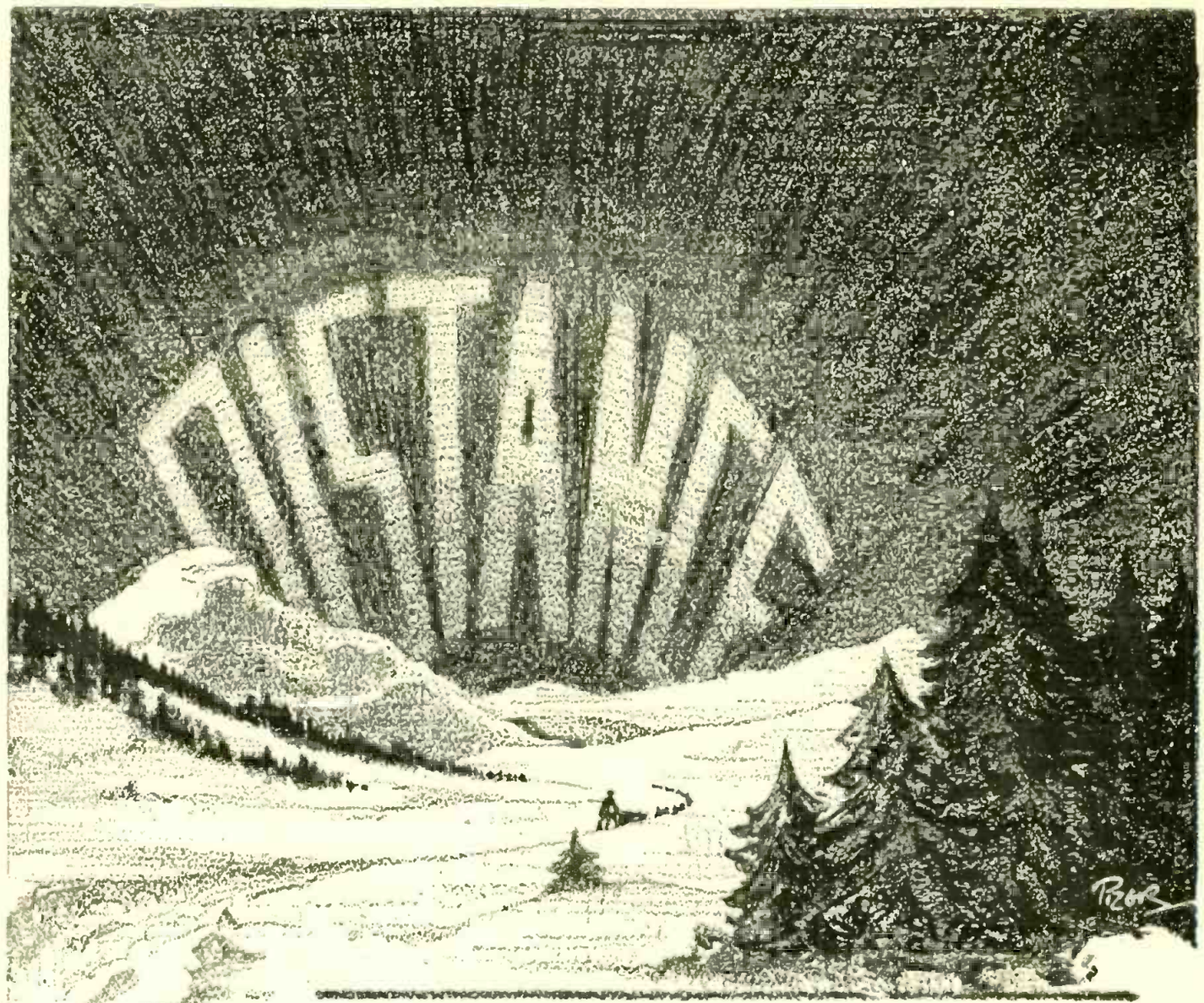
INFORMATION EVERY DEALER SHOULD HAVE

Write for a set of Precision Coil catalog sheets. They describe in detail all of the Precision Coils used in POPULAR RADIO designed receivers for the past two years.

Be able to tell your customers all about the coils used in the New LC-27, the LC-26, the Cockaday Four-Circuit Tuner, and other famous circuits published in leading magazines and newspapers.

A complete list of the new Precision Line of Radio Power Units are also given in easily filed catalog form.

PRECISION COIL CO., Inc.
209 Centre St. New York, N. Y.



NINE out of every ten radio fans know Browning-Drake. Since its introduction over two years ago, when Glenn H. Browning and Frederick H. Drake set a mathematical standard of design for radio frequency transformers, a hundred thousand Browning-Drake fans have praised its distinct improvement in radio receiving.

This good-will, coupled with the nation-wide publicity following every recognized advance, has given Browning-Drake a place in radio no dealer can afford to overlook.

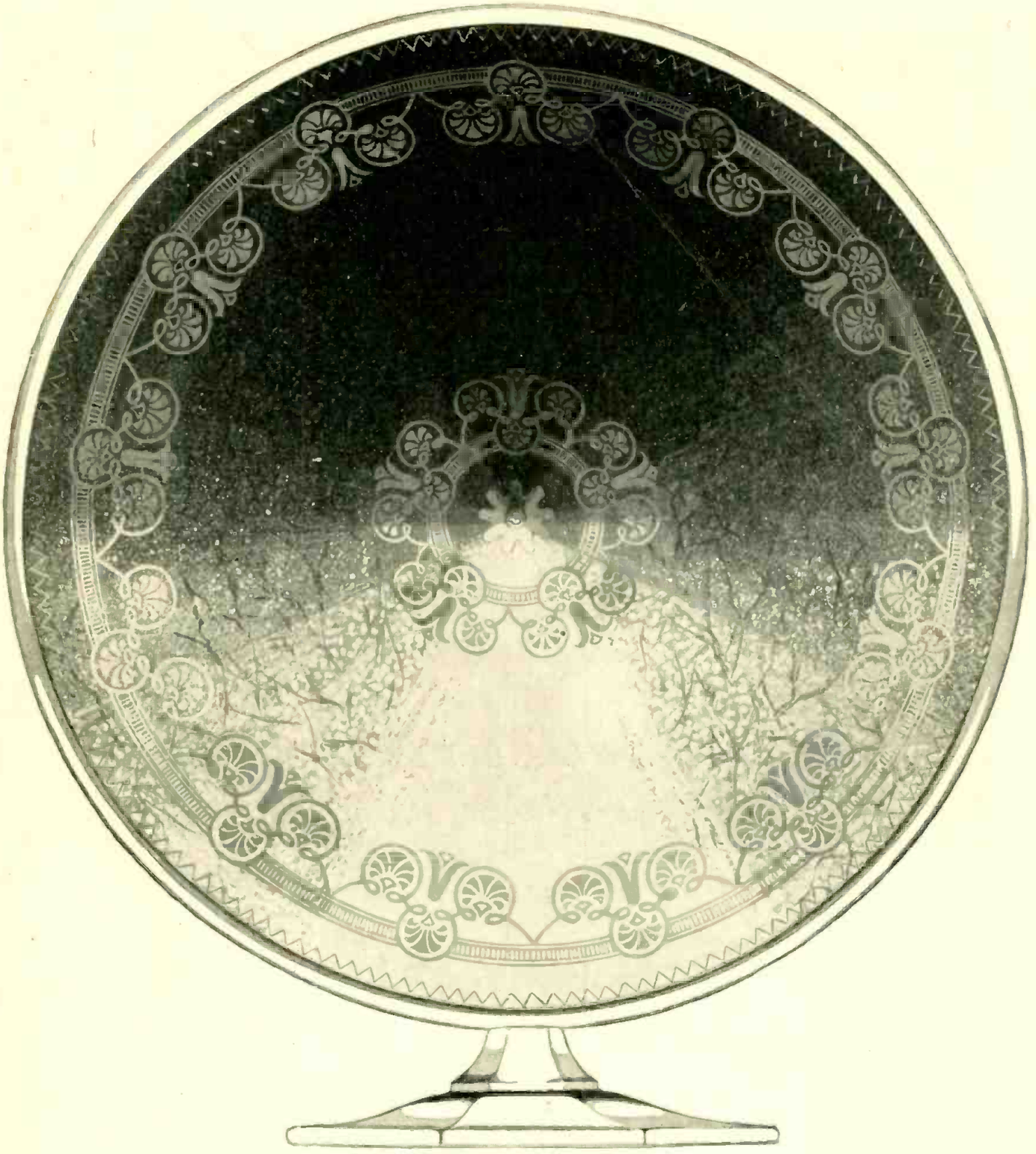
One stage of scientifically designed radio frequency, incorporating the Browning-Drake transformer, together with the flexibility of a two-control receiver, has yet to be improved upon for all around satisfactory reception. Constantly improved as new refinements are proved worthy, Browning-Drake has no yearly models to become obsolete.

Browning-Drake produces only one model, built complete at its Brighton laboratories. Fairly priced at $95, and handled only by the highest grade jobbers, the Browning-Drake Receiver has never been cut, and no dealer has ever lost money on Browning-Drake.

The BROWNING-DRAKE FIVE

For further information address the Browning-Drake Corporation, Brighton, Mass.

BROWNING-DRAKE



The Crosley Musicone, announced little more than a year ago, introduced a revolutionary speaker principle and took the radio loud speaker market by storm.

Its overwhelming popularity, which has involved the replacement of hundreds of thousands of old type loud speakers, establishes beyond challenge the Musicone's superiority.

And now Powel Crosley, Jr., announces ... the Crosley *Super* Musicone!

This larger 16-inch cone utilizes the same Crosley patented actuating unit as the smaller Musicone ... and this, not the cone shape, is the secret of Musicone excellence.

It offers, by virtue of its larger proportions, still more superb volume. It produces, especially in the bass, still richer resonance!

The 12-inch Musicone has been reduced to $12.50. Also at $32 in the form of a beautiful Console, in which both receiver and batteries may be placed.

THE CROSLEY RADIO CORPORATION, CINCINNATI, OHIO ··· POWEL CROSLEY, Jr., President.

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Volume
-without forcing

THE man who likes plenty of volume for easy listening usually has to drive the last tube of his set beyond its limit to get the music loud enough. And then it is no longer music. The RCA power Radiotrons are specially made to stand the strain in the last audio stage. They can handle plenty of volume without blasts or rattles, and therefore mean finer, clearer tone!

Dry battery power Radiotron UX-120 . . . . . $2.50

Storage battery or A. C. power Radiotron UX-171 . $6.00

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Quality is a research story

The high quality of performance you get with a genuine RCA Radiotron is due to incessant research. The Radiotron laboratories find ways to make better tubes—they find ways to improve manufacturing processes—and they keep a constant check on the uniformity of the manufactured Radiotron. It pays to look for the RCA mark.

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