Feb. 16th, 1929 15 Cents

RADIO WORLD

REG. U.S. PAT. OFF.

The [First and Only National Radio Weekly

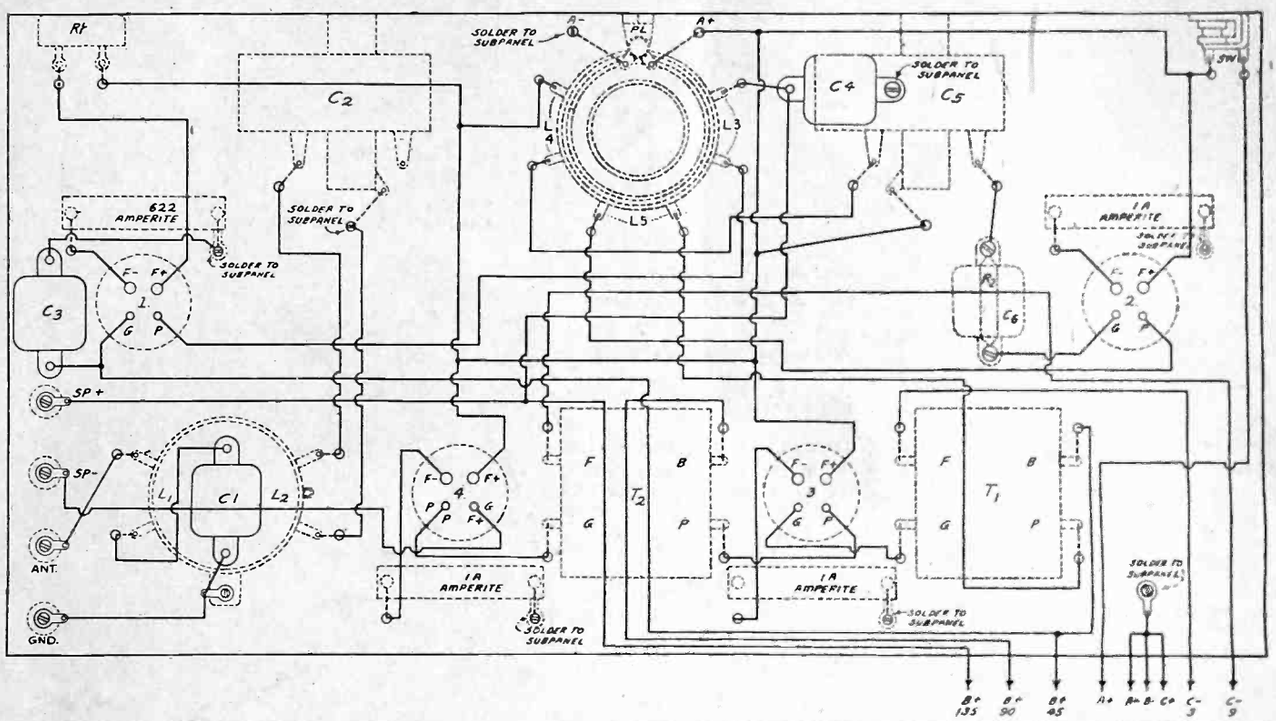
360th Consecutive Issue—Seventh Year

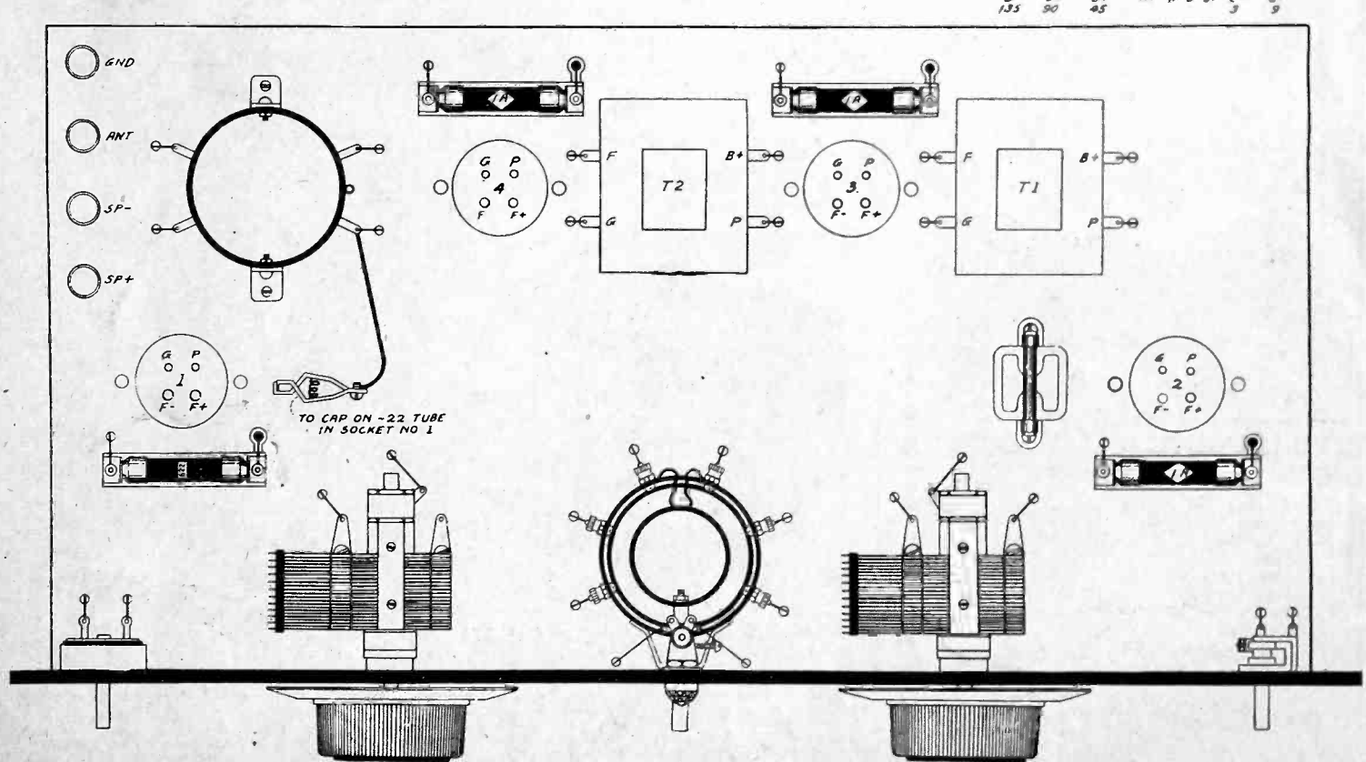
Voltage Regulation

Television's Status

Art's Speedy Growth

New Chain Possibility





Picture Diagram of the New Screen Grid Diamond

Choose Your Speaker from This Complete Array!

EXPONENTIAL TYPE HORNS

Modern acoustical science is striving to equal the performance of a large air column horn with powerful unit, while the horn enjoys its rightful popularity with trained experts. The larger the horn, the better, hence we offer two models: one with 7½ ft. tone travel, the other (where space permits) with 10 ft. tone travel. The material used is patented Racon. Nozzle is standard size.

Cat. 200
$7.50 Net

This horn has a 92-inch air column. No resonance peaks. Front, 18"x18". Depth, 13½". Weight, 5 lbs.

Driving motor, the unit needed to work the air column horns. Standard size thread. Cat. 203. Price, **$3.50 net.**

Cat. 300
$10.50 Net

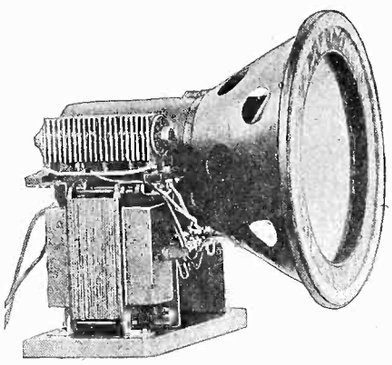
The larger horn is preferable, where space permits. Air column, 120". Front, 18"x18". Depth, 13". Weight, 7 lbs.

DYNAMIC CHASSES and Baffle

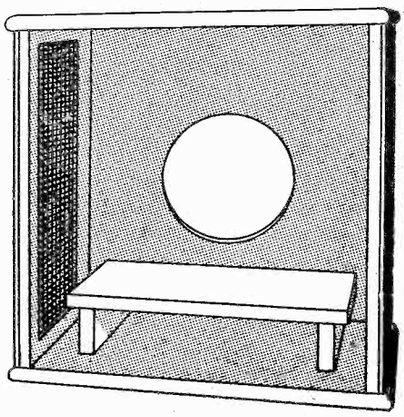
The dynamic speaker is the most popular one by far, and here is your opportunity to get a real fine chassis at a low price. Cat. 110 A.C. operates directly from the 110-volt A.C. (alternating current) lamp socket, to which built-in plug is connected, while the tipped cords go to your receiver output. Dry rectifier and output transformer built in this model.

Those whose place is wired with 110-volt D.C. (direct current) should use Cat. 110 D.C. @ **$17.50 net.** Those who have no electricity should use the model that works from a 6-volt storage battery. Cat. 6 D.C. @ **$14.75 net.**

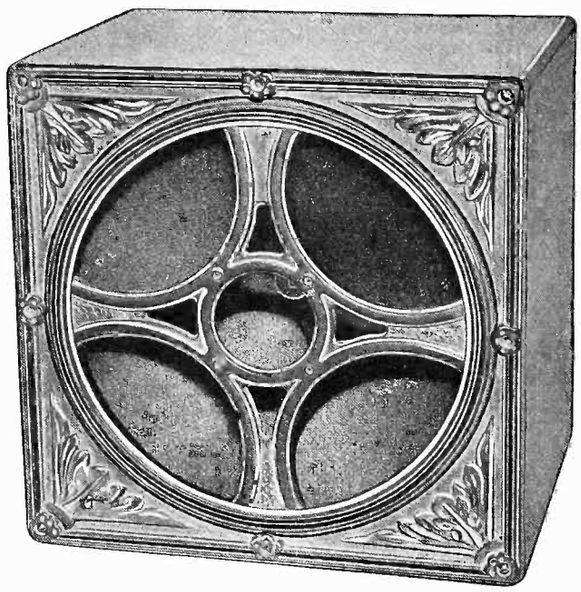
At left is illustrated an 18"x18" baffle, Cat. 111, with cane sides and top, for any dynamic speaker Specify speaker. Walnut 5 ply veneer. Price $11.00 net.



Cat. 110 A.C.; Price, $20.50 Net

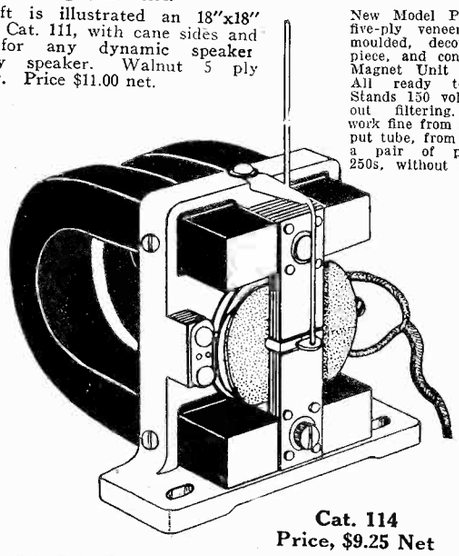


Cat. 111; Price, $11.00 Net



New Model Polo Speaker, with five-ply veneer walnut housing, moulded, decorated metal front piece, and containing Polo Twin Magnet Unit and Burtex Cone. All ready to play. Stands 150 volts without filtering. Will work fine from any output tube, from 201A to a pair of push-pull 250s, without rattling.

Cat. 113
Price, $13.50 Net



Cat. 114
Price, $9.25 Net

Polo Twin Magnet Unit—weight, 3½ lbs., or twice as heavy as ordinary unit. Twin magnets double sensitivity. This unit gives more volume, clearer tone, and stands the gaff. Supplied with 10-ft. cord. Cat. 114. Tri-foot molded unbreakable metal mounting bracket and apex constitute Cat. 114A @ $0.75.

Cat. 115; Price, $11.50 Net

Molded 9" spider, unbreakable metal, with Burtex cone and felt ring and apex, and Polo Unit mounted on the assembly, which stands on own feet. Cat. 115. Spider assembly (Cat. 115 less unit). Cat. 116 @ $3.50.

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143 West 45th Street, N. Y. City
(Just East of Broadway)

Please send me at once on 5-day money-back guarantee the following (check off):

- ☐ Cat. No. 200
- ☐ Cat. 300
- ☐ Cat. No. 110 A.C.
- ☐ Cat. No. 110 D.C.
- ☐ Cat. No. 6 D.C.
- ☐ Cat. No. 300
- ☐ Please send C.O.D.
- ☐ Remittance enclosed. Please send prepaid.
- ☐ Cat. No. 111
- ☐ Cat. No. 113
- ☐ Cat. No. 114
- ☐ Cat. 114A
- ☐ Cat. 115
- ☐ Cat. 116
- ☐ Cat. No. 203

Name .....

Address .....

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

5-DAY MONEY-BACK GUARANTEE

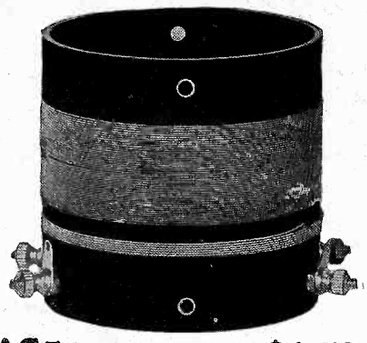
RADIO WORLD, a weekly paper, published by Hennessy Radio Publications Corporation, from Publication Office, 145 West 45th Street, New York, N. Y. Phone: BRYant 0558 and 0559. 15c per copy, $6 per year. This issue is dated February 16th, 1929, and is Vol. XIV, No. 22. Whole No. 360. Entered as second-class matter, March, 1928, at the post office at New York, N. Y., under Act of March, 1879.

Coils Built for Abundant Results!

They Meet the Needs of Battery-Operated or AC Screen Grid Tubes, and General Purpose Tubes of Battery or AC Types.

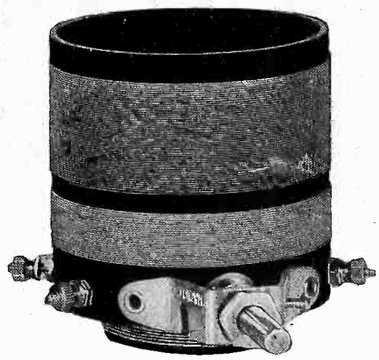
Fascinating Color Adorns the Bakelite Form as Well as the Wire Insulation

The DIAMOND Pair



AC5 . . . . $1.50

Highly selective antenna coil for any circuit, and interstage coil for AC circuits. Step-up ratio is 1-to-8. Tunes with .0005 mfd.
Model AC3, for .00035 mfd.....**$1.75**



SGT5 . . . . $2.75

Tuner to work out of a screen grid tube. The large primary is fixed and is connected in the plate circuit of the screen grid tube. Tunes with .0005 mfd.
Model SGT3, for .00035 mfd.....**$3.00**

COILS with a purpose, like people with a purpose, succeed best.

For a highly selective four-tube receiver, as great selectivity as you can command on four tubes with ample speaker volume, the two coils, AC5 and SGT5, make an unbeatable combination. Dials will track nicely. Distance will come in easily and loud. Full sensitivity is readily attained.

The AC5 coil is used in the antenna circuit and has a small primary—six turns—while the secondary has 48 turns, a step-up ratio of 1-to-8.

The radio frequency tube is a screen grid which requires a high impedance load on the plate circuit, provided by SGT5 having a 24-turn fixed, untuned primary. The secondary is tuned.

Selectivity is what you need, especially with a high-gain circuit, such as one using a screen grid tube, and this combination of coils not only gives you that but permits retention of ample—even more than ample—volume.

And, remember, the dials track nicely!

A5 . . . . . $1.75

Conductively coupled antenna coil, for maximum pickup, where selectivity is not the main consideration. Continuous winding in two colors. Tunes with .0005 mfd.
Model A3, for .00035 mfd. **$2.00**

The maximum volume is obtained by conductively coupling the antenna to the grid. This coil, with a continuous winding, delivers the antenna current and voltage to the grid without inductive transfer or through a condenser. The volume is so great that you think you added another stage of audio. However, the selectivity is less. Also the length of the antenna affects the tuning. So two taps are provided—both brought out to binding posts—and you connect the coil as follows: Select either terminal of the winding, and connect it through the binding post to the grid. Connect the opposite terminal, through its binding post, to ground. Then connect the antenna to either of the two remaining binding posts—the one that makes the dial readings more nearly correspond to those of the next tuned circuit.

Data on Coils

The coils are wound on blood-orange bakelite, with tuned windings in blue silk insulation, untuned windings in strawberry silk insulation and tickler in Litzendraht, with gold insulation.

The outside diameter is 2½ inches.

All tuners (i. e., three-circuit coils with rotor winding) have single hole panel mount.

All other coils have holes for perpendicular or horizontal mounting, and hardware to accomplish this.

All tuned windings are center-tapped.

All coils are sold on a five-day money back guarantee. If you're not delighted with them, for any reason, send them back in five days and get your money back.

HT5 . . . $3.00

Tuner to work out of a screen grid tube, like TP5, only tickler is added. Tunes with .0005. Model HT3, for .00035 mfd. **$3.50.**

Screen Grid Coil Co., 143 W. 45th St., N. Y. City (Just E. of B'way).
Please send to
Name .....
Address .....
City ..... State .....
the following coils: Model.....
Quantity.....
Quantity.....

The UNIVERSAL Pair

RF5 . . . . $1.50

Excellently selective antenna coil for **any** circuit, and interstage coil for any battery operated receiver, excepting output of screen grid tube. Tunes with .0005 mfd.
Model RF3, for .00035 mfd.....**$1.75**

TP5 . . . . $3.00

Interstage coupler to work out of a screen grid tube, where the primary in the plate circuit is tuned, the secondary, in the next grid circuit, untuned. Tunes with .0005.
Model TP3, for .00035 mfd.....**$3.25**

Enormous amplification, with more than moderate selectivity, is achieved by circuits using these two coils—RF5 and TP5. The primary of the interstage coil, TP5, is on the outside and is tuned. It is center-tapped. The secondary, on the inside, is untuned.

8 Great Features Tell You Why 6000 RADIO-TRICIANS *Are Building 4 New Hi-Q Receivers*

10 K. C. SELECTIVITY . . . ABSOLUTE FLAT-TOP TUNING . . . COAST-TO-COAST RECEPTION . . . NEW TONE QUALITY . . . SCREEN-GRID TUBES . . . SHIELDED STEEL CHASSIS . . . CONCEALED WIRING . . . SIMPLIFIED CONSTRUCTION

THE biggest advance of the year in radio design is the "Band Pass Filter"—a system which effects absolute FLAT TOP *square cut-off* TUNING with positive 10 K.C. selectivity. This is the big feature of Master Hi-Q 29 Receivers. No other set in the world has it to our knowledge. It eliminates "cross talk" even in crowded areas which have many powerful stations and gives a Super-sensitivity and Super-selectivity which assures coast-to-coast reception. Further than this, it produces a quality of tone which we have never heard equalled in any receiver!

For 1929 there are FOUR Models of Hi-Q Receivers—for battery or A. C. operation. All are the joint creation of ten of America's leading parts manufacturers. All are stage-shielded and built on steel chasses from only the finest parts available in the radio industry.

You should own one of these wonderful receivers. Build it yourself or have it built for you by your local RADIO-TRICIAN.

Associate Manufacturers

Sangamo Electric Co.
Thordarson Elec. Mfg. Co.
Hammarlund Mfg. Co.
Yaxley Mfg. Co.
Benjamin Elec. Mfg. Co.
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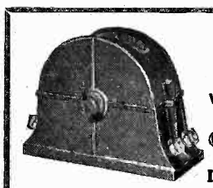
Acme Wire Co. (Parvolt)
International Resistance Co. (Durham Resistors)
Radiall Co. (Amperite)
Electrad, Inc. (Truvolt)
Westinghouse Micarta



VICTOREEN
Super Coils
Write for Free Blueprints of New Victoreen Circuits
Geo. W. Walker Co.
2825 Chester Avenue
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DYNAMIC BAFFLE
Completely built up, for any type dynamic chassis. State what make dynamic you want it for. Cane sides, open back. De luxe finish. Size, 24x24 inches..... **$12.00**

GUARANTY RADIO GOODS CO.
145 West 45th Street, New York City

SET Builders FREE
Elections have brought back Custom Set building. Business is booming. Thousands of old-timers are cleaning up. Let **Barawik** show you the way to bigger profits, more sales. Send today for **Barawik's Big Bargain Book** — the radio man's bible.


BARAWIK CO. 1312B Canal Sta., CHICAGO, U. S. A.

For That Extra Voltage Tap—

Do you need an extra voltage tap for that B-eliminator? That's easy. Just use a STANDARD CLAROSTAT or a DUPLEX CLAROSTAT between maximum tap and desired tap, with by-pass condenser of 1 or 2 mfd. from the new tap to minus B tap. You can then obtain any voltage from maximum down to zero. And there are many other ways of applying the Clarostats.

Your dealer carries the Standard and the Duplex Clarostats, as well as other types. Ask him for literature and suggestions, or write to

CLAROSTAT MFG. CO., Inc.
Specialists in Variable Resistors
291 N. 6th St. : : Brooklyn, N. Y.

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LYNCH
Tubadapta prevents overloading of power tube. Better tone quality assured.
ARTHUR H. LYNCH, INC.
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Send for free Lynch radio manual

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SI-LEN-SER
A TRUTONE PRODUCT

Takes out man-made "static" from any electric radio (A.C. or D.C.) or eliminator, caused by motors, elevators, generators, ice machines or any noise disturbing electrical device not due to aerial pickup.
Price..... $12.50
ENDORSED BY PRESS AND PUBLIC
Manufactured and Guaranteed by
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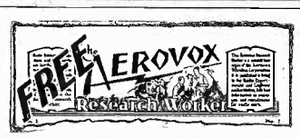
AEROVOX
BUILT BETTER
CONDENSERS AND RESISTORS

A COMPLETE CATALOG with illustrations and detailed descriptions may be obtained free of charge on request.



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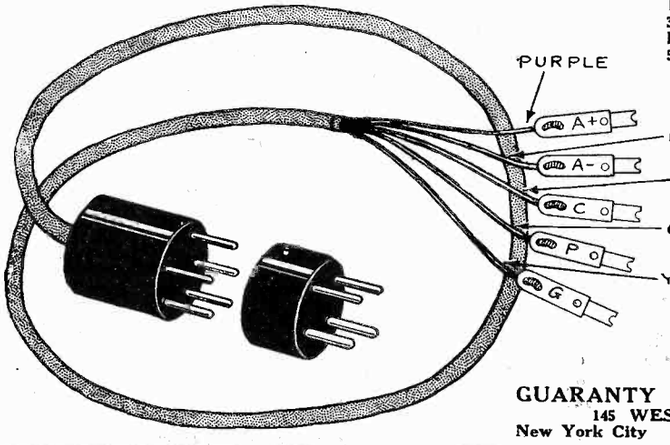
AEROVOX WIRELESS CORP
74½ Washington St., Bklyn., N. Y.
PRODUCTS THAT ENDURE

PLUG AND CABLE for any SHORT WAVE ADAPTER

Handiest thing for ANY short-wave adapter. Put detector tube of your present set in socket of any short-wave adapter you build, put plug in detector socket of your broadcast receiver. Cable, 34". Leads identified both by color scheme and tags. 5-prong plug and 5-lead cable for AC short wave adapter. May be used as 5-lead battery cable plug with UY socket. (Cat. No. 21AC) $1.50. 4-prong extra plug only, necessary addition to other for DC short-wave adapter (Cat. No. 21DC) $0.50.
Cat. No. 21AC and 21DC ordered together $1.75.

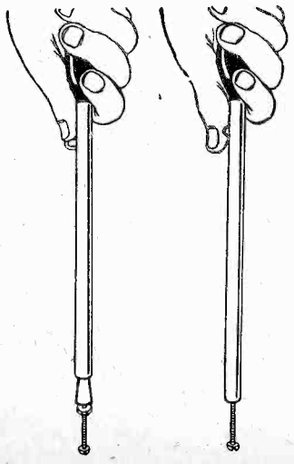


GUARANTY RADIO GOODS CO.
145 WEST 45TH STREET
New York City Just East of Broadway

SOCKET WRENCH

Push out control lever with knob (as at left) and put wrench on nut. Push down on handle only (at right), then turn nut left or right.

FREE



ONE of the handiest tools for a custom set builder, service man or home constructor is a BERNARD socket wrench.

It consists of a 6½" long metal tubing in which is a plunger, controlled by a knob. The plunger has a gripping terminal (called a socket, hence the name "socket wrench") that may be expanded or contracted to fit 6/32, 8/32 and 10/32 nuts, the most popular sized nuts in radio.

Use the knob to push out the plunger, press down on the handle to grip the nut, then turn the nut to left for removal or to right for fastening down. Total length, distended, including stained wooden handle, 10". Gets nicely into tight places. Send $1 for 8 weeks' mail subscription for RADIO WORLD and get this wrench FREE.

No other premium with this offer. Present subscriber may extend subscription by stating he is one, and entitle himself to this FREE premium, making $1 remittance.

RADIO WORLD
145 WEST 45TH ST., N. Y. CITY
A few doors east of Broadway

Vol. XIV, No. 22 Whole No. 360
FEBRUARY 16th, 1929
15c per Copy, $6.00 per Year
[Entered as second-class matter, March 1922, at the Post Office at New York, N. Y., under Act of March, 1879]

Latest News and Circuits
Technical Accuracy Second to None

A Weekly Paper published by Hennessy Radio Publications Corporation, from Publication Office, 145 West 45th Street, New York, N. Y.
(Just East of Broadway)
Phone: BRYant 0558 and 0559

WYNC CLASHES WITH WMCA AS PROGRAMS JAM

Every once in a while listeners to WNYC or WMCA, both stations in New York City, find they are listening to WNYC *and* WMCA. The reason is that both stations occupy the same wave, 526 meters, and occasionally are on the air at the same time. There is continual bad blood between the stations, also occasional misunderstanding.

When the two stations went on the same wave just after the reallocation they couldn't agree on division of time, so for a while, that Sunday, they made a "duet" of it.

A more recent example of the same situation was during the reception to the officers and crew of the "America." As WNYC is the municipal station, it went ahead with its program after 12.30 p. m., when WMCA expcted to take the air—in fact, did take it, hence the confusion.

Could Not Agree

Leo Friedman, of WMCA, said:

"We have succeeded in making an arrangement with the management of the city station whereby we would cancel our programs over and above the 50 per cent. time-sharing agreement and give WNYC additional time if we are given sufficient notice in advance of the broadcasting of events of public interest.

"The manager at WNYC called our office and asked that we stay off the air between 12:30 and 1 p. m. and 2 and 3 p. m. on this particular day.

"I told him I would be willing to relinquish the time between 2 and 3, but that the period from 12:30 to 1 was contracted for by a New York newspaper and that WNYC would have to consult our client direct. Evidently he got in touch with the publisher, who refused to cancel his program.

No Favoritism

"Early this afternoon we were called and asked to put the program running at that time off the air. We found it impossible to do that, and as a result continued our broadcast until 2 o'clock."

WNYC was alone on the 526-meter wave until the reallocation. It applied for an exclusive wave and a cleared channel, because of its "public service," but the Commission ruled that a municipality, as such, is entitled to no more privileges than a private owner, but that the nature of the programs and facilities is the test.

ARCTURUS CHANGES NAME

The name of the Arcturus Radio Company of Newark, N. J., has been changed to the Arcturus Radio Tube Company.

KGO Player Double Of Wallace Reid

Oakland, Calif.

If Charles Park of the KGO staff hadn't dropped around to pick up Paul Revere's pictures, the General Electric station would still be unaware of the presence of a former movie actor on its staff of entertainers.

In glancing over staff pictures with a photographer, a former movie camera man, Charles Park of KGO was struck by Paul Revere's likeness to the late Wallace Reid. Park learned from the photographer that Revere, a KGO entertainer, was the double for Wallace Reid just before the movie star's death. Reid was so ill that he was used only in the close-ups during his last two pictures.

TWO MEMBERS LEAVE BOARD

Washington.

Federal Radio Commissioners Orestes H. Caldwell and Sam Pickard have resigned from the Commission. Pickard's resignation was accepted by President Coolidge and Pickard became a vice-president of the Columbia Broadcasting System. Mr. Pickard took up his new duties at once.

Mr. Pickard was named Commissioner for the Fourth (Middle Western) zone after the resignation of Henry A. Bellows. He first entered radio work as director of KSAC, the broadcasting station of Kansas State Agricultural College, Manhattan, Kansas. Later he was Federal director of broadcasting agricultural information. Pickard was secretary of the Commission before becoming Commissioner.

Caldwell, one of the original members of the commission, plans to return to his former position as editor of "Radio Retailing," a McGraw-Hill publication.

Much opposition developed against Mr. Caldwell in the Senate when his appointment was up for confirmation. The Senate adjourned without confirming him and he served the first year under a recess appointment without pay. The second time his name came up in the Senate he was confirmed by a small majority. The opposition against him was based on editorials he had written in his paper in which he went on record as opposing the bill creating the Commission.

Caldwell had long experience in radio matters and had an engineering training. Throughout his tenure of the commissionership he was one of the most active of the members. He and Pickard were the only radio-trained Commissioners.

HOOVER VIEWS ON RADIO DUE AT INAUGURAL

Washington.

The radio industry is anxiously awaiting the inaugural address of Herbert Hoover, on March 4th, as intimations have been received that he will discuss the radio situation, and, for the first time in two years, tell where he stands on the big problems of the art, including wavelength assignments in the broadcast band, high power, institution of a Department of Communications, distribution of short wave channels, etc.

Mr. Hoover's last official act in radio, as Secretary of Commerce, was to relinquish control over radio when a court decision held that the Department had no express authority to exercise such control, hence no power to enforce its rulings.

Then followed chaos in the air, due to wave jumping by stations, and later the Federal Radio Commission was created, as an instrumentality of Congress, to administer radio affairs. This the Commission has done with no glowing success, although the most recent reallocation has produced improvement in some sections, while making matters worse in others.

Silent Since Candidacy

As candidate and President-elect, Mr. Hoover has been silent on radio topics. His friends say that, as the Commission has been functioning as an agency responsible to Congress, he has felt there was no occasion for him saying anything.

Since his election, however, he has been giving the radio situation considerable thought, his friends say, and may be relied on to air his views in his inaugural message. He is not expected to deal with the subject very extensively in that address, since other important domestic and foreign topics make a lengthy discussion of radio unpractical.

As Secretary of Commerce Mr. Hoover had almost six years' experience in radio affairs.

As President he will be able to exercise a powerful influence over radio affairs.

Dissatisfaction Is Inevitable

The demand for wavelengths, high power, time on the air, etc. is so great that it is impossible to grant more than a small percentage of requests, so that much dissatisfaction is generated, no matter if the most deserving receive the rewards of their accomplishments. This aspect of the problem removes temptation to welcome authority over radio, but Hoover as President is deemed likely to accept control if it be placed by Congress in the Department of Commerce. This would put into the President's hands the power to appoint the particular person (acting under the Secretary of Commerce) who would have charge of the radio division.

WESTINGHOUSE AND GE SHARES IN RCA STATED

Washington.

How the Radio Corporation of America was formed, and how much financial interest in it is now owned by the General Electric Company and the Westinghouse Electric & Mfg. Co., were told before the House Committee on Merchant Marine and Fisheries, by Col. Manton Davis, a vice-president and the general attorney of the RCA. He was a witness during hearings for the White Hill to extend the life of the Federal Radio Commission one year.

Representative Davis cross-examined Colonel Davis.

The steps leading up to the organization of the corporation at the request of the United States, beginning in 1919, were the basis of Representative Davis' first questions. He asked Colonel Davis about the negotiations between the General Electric Company of Schenectady, N. Y., and the British Marconi Company for the establishment of a radio communications company within the United States.

Colonel Davis explained that the plan for the formation of a national radio company to compete with foreign communications companies was carried into fruition, in line with the original suggestion of Rear Admiral W. H. G. Bullard.

Formation Related

By order of President Wilson, Admiral Bullard was appointed to the Board of the corporation, he said. The original owners of the corporation were the General Electric, and the American Marconi Company. Later Westinghouse, and the American Telephone & Telegraph Company joined. The latter two were original parties, but did not actually acquire stock until after the corporation had been formed.

Colonel Davis inserted in the record the stock holdings of the companies associated with the corporation as follows:

The total number of shares on hand of the corporation's stock on December 1st, 1927, was 500,000 shares of "A" preferred and 1,500,000 shares of "A" common. The number of shares outstanding, he stated was 395,395 "A" preferred, and 1,155,400 "A" common.

How Much They Own

As of August 23d, 1928, the General Electric Company held 248,106 common shares and 27,080 preferred, Colonel Davis said. The Westinghouse Company held 27,760 common and 50,000 preferred shares. The A. T. & T. and United Fruit Company, which formerly held stock, own none at this time, said Colonel Davis. There are 18,000 corporation stockholders, distributed through all states of the country, said he.

"The influential voices in the control of the policies of the corporation are the General Electric and Westinghouse," said Colonel Davis.

The only dividend ever paid by the R. C. A. has been 7 per cent on the preferred stock, he said.

The international communications business of the corporation, operating to 30 countries, was taken up by Representative Davis in his cross-examination of Colonel Davis.

"A monopoly is best for international communication to serve the people of the United States," declared Colonel Davis. "I say this unhesitatingly," he declared.

Why R.C.A. License Is $100,000 Yearly

Washington.

The receiving set phases of the R.C.A.'s business was taken up by Colonel Davis before the House Committee on Merchant Marine and Fisheries. Replying to Representative Davis, he outlined the reasons why the corporation licenses only radio manufacturers able to pay a minimum royalty annually of $100,000 to use its patents for the manufacture of receiving sets.

The company, he said, does not believe it can afford to allow its license plates, denoting corporation patents, to be used on sets unless the manufacturer was able to sell to the public "some real merchandise."

These licenses, some twenty-five in number and including the largest of the radio set manufacturers, said Colonel Davis, pay a royalty to the corporation of 7½ per cent of the sale price of their sets, including cabinets. In return they get the use of the corporation's exclusive patents, as well as the benefits of its laboratory experiments and patent protection that is guaranteed them.

TRADE SEEKING GYP INSURANCE

Plans for the passage of a law to maintain the radio manufacturer's identity, and concentrate on him responsibility for his product during successive changes in ownership to the retail customer, will be mapped out at the convention of the Federated Radio Trade Association in Buffalo, N. Y., Monday and Tuesday. Uniform State legislation regarding serial numbers on models will be discussed.

"This serial number legislation will provide punishment for persons who sell or offer to sell any machine or article of merchandise, the serial number or distinguishing number of which has been removed, altered, defaced, covered or destroyed."

In states other than California and Pennsylvania both the radio public and the industry have been without protective legislation, says the Federated.

For the good of the industry, radio is seeking the same protection accorded other valuable products whether radio receivers are considered electrical, musical, or mechanical devices. Pennsylvania handles the matter by specifically mentioning radio apparatus as coming within the meaning and intent of its Act.

Peter Sampson, Chicago, president of the Radio Wholesalers Association, conducted a survey for the Federated which disclosed that the public was not even partly protected from unscrupulous dealers in most of the States.

Precise Appoints Smith and Daniels

The Precise Products, Inc., of Rochester, N.Y., have appointed the Gotham Engineering and Sales Co., of 50 Church Street, New York City, to handle sales of variable condensers, friction drives, and dials in the Metropolitan District and New Jersey. Bert Smith and Al Daniels, of the Gotham organization, are well known to most of the trade through their previous connections. They are also Metropolitan agents for the Potter Co., of North Chicago, Ill.

INDUSTRY'S BIG STRIDE UNIQUE IN ALL HISTORY

East Pittsburgh, Pa.

The radio industry in ten years has developed a business volume in excess of $600,000,000 annually, with receiving sets in 10,000,000 homes in the United States and 40,000,000 listeners-in.

Television may be "tapping on the window-pane" but it is still in the laboratory stage.

These points were made by David Sarnoff, executive vice-president of the Radio Corporation of America, in an address before the Veteran Employees' Association of the Westinghouse Electric & Manufacturing Company, at their 16th annual dinner.

Binns Dramatized Radio

Mr. Sarnoff recalled that Jack Binns' call of distress from the sinking steamship Republic on the night of January 23d, 1909, dramatized for the public mind the important service of radio marine communication.

Again, on the night of November 2d, 1920, nation-wide attention was sharply focused on another phase of radio projection through space—announcement of Warren G. Harding's election as President of the United States, broadcast from the pioneer station, KDKA.

"The world awoke," said Mr. Sarnoff, "to the realization of another miracle—direct communication by the human voice from a single source to a thousand or a million listeners-in.

"History holds no parallel for the development of radio broadcasting as a service to the public, or for the phenomenal growth in the manufacture and distribution of radio equipment as an industrial achievement.

"In a little more than a decade the radio industry has developed a business volume in excess of $600,000,000 annually. Today radio receiving sets are in 10,000,000 homes and more than 40,000,000 people in the United States have become radio listeners.

Television Just "Tapping"

"Tonight television may be tapping on the window-pane—but that is the most that can be said about it. Its proud parents have labored hard to bring it into the world; a vast assemblage of relatives and friends stand ready to greet it; it carries the highest fulfillment of radio communication—the transmission and reception by radio of both sound and sight. But the fact remains that the infant is still too delicate for any except laboratory treatment.

"An organized and dependable radio service for the communication of sight as well as sound is not yet around the corner, but the future of this service is bright with promise.

"The regular exchange of broadcasting services as between nation and nation is certain to bring about a more solid understanding between peoples—the spectacle as well as the sounds of life broadcast to our firesides by radio television—the scenes and sights of the world reproduced on much larger screens and in natural colors—three dimensional or stereoscopic projection, if you please, which with color and speech would make the fleeting visions on the screen palpitate with the reality and expression of life—new educational and cultural services which such facilities are bound to call into being; all these, I am confident, will come to pass."

JAZZ OCCUPIES 15% OF TIME OF BIG CHAINS

There are four classes of radio listeners, according to the people who do their best to please those radio listeners. The groups are:

Listeners who think there is too much jazz music on the air;

Listeners who think there is too much classical music on the air;

Listeners who think there are too many educational talks on the air;

Listeners who think there is either not enough of anything or too much of everything.

Programs emanating from WEAF and WJZ, key stations of the National Broadcasting System, were taken as examples of what goes on the air from first-class transmitters. In one week WEAF and WJZ are on the air a total of 225 hours, or an average of more than sixteen hours a day for each station.

15% for Jazz

Broadcast jazz music, that form of entertainment so often used as material for editorials by writers who would not like it if it were good, actually takes up 15 per cent of program time. An analysis of a week's programs from WJZ and WEAF revealed that only thirty-six hours was given over jazz, or less than three hours a day from both transmitters.

Classical music, music of the type that has the stamp of approval of the most austere musical educators, takes up 28 per cent of program time. This group includes operatic broadcasts, oratorios, vocal and instrumental soloists, chamber music, symphony orchestras, salon orchestras and many short concerts by small instrumental groups featuring the best known and most appealing selections of the better music.

Sentiment Midway

Midway between jazz and classical music one finds sentimental melodies, old favorites and folk songs. Music of this type often is found in what is classed as the novelty program. Negro spirituals—and some people insist they are classics—songs of the Mauve Decade, selections arranged especially for quartets, octets and male and female choruses and other numbers hard to define, but pleasing to the majority, fall in this group. It takes up approximately 10 per cent of the time on the air.

During one week, eight hours of military band music went on the air from WJZ and WEAF and network stations associated with the NBC, taking up less than 4 per cent of the program time.

Columbia's Offer for WOR Requested

A very substantial offer was made by the Columbia Broadcasting System for WOR, which it sought to purchase, because the chain needed more time for its programs, but the offer was rejected, said Alfred J. McCosker, director of WOR.

The purchase of WABC, New York City, from A. H. Grebe & Co., followed the refusal of WOR to sell. WOR is to remain with the Columbia chain, under contract, until September 2d. WOR is devoting about ten per cent. of its 90 to 100 hours a week to network programs, and is supplying the rest of its program material itself. L. Bamberger & Co., a Newark, N. J. department store, owns WOR.

Boy Drum Major Thrills As Orator

Oakland, Calif.

Norman Law, the 11 year old drum major of the party of 160 Australian boys who are now making a good-will tour of the United States, recently made his radio debut over KGO. Norman told the radio audience in an impromptu speech that he and his fellow comrades were in the United States to unite hearts, hands and sentiments of two countries. KGO was swamped with telephone calls, telegrams and letters as a result of his talk.

BOARD RENEWS SOME LICENSES

Washington.

Licenses of all coastal, point-to-point, experimental, and ship radio transmitting stations, expiring on February 1st, were extended by the Federal Radio Commission for 45 days, or until March 16th, under General Order No. 58.

The "injunction-proof" clause, adopted after Charles Evans Hughes argued WGY had a vested right in its wavelength that the Commission couldn't disturb, is contained in the new order. The right to alter a station's frequency assignment is asserted. The provision follows:

"This order, however, is subject to the conditions that it shall not be deemed or construed as a finding or decision by the Commission, or as any evidence whatsoever that the continued use or operation of any said stations serves, or will serve, public interest, convenience or necessity, or that public interest, convenience or necessity would be served by the granting of any pending application for a renewal of any of said licenses; and any licensee subject to this order who continues to use or operate his station during the period covered by this order, shall be deemed to have consented to said conditions.

"The Commission reserves the right to change the frequency assignment of any station, the license of which is affected by this order, during the extension herein provided if, in the opinion of the Commission, such changes are advisable."

Eliminator More Efficient By Adjustable Voltage

There are many times when one may need an extra tap on the B eliminator. For instance, one may switch to a new detector tube which requires only 22½ volts and the lowest available tap is 45 volts. Here a standard clarostat proves invaluable; inserted in the 45 volt lead it makes it possible to regulate the voltage down to the voltage required or to any fine graduation that will give best results for a critical detector. Or, perhaps, it may be necessary to use an extra voltage tap for a voltage not provided by the eliminator.

In this case, a standard or a duplex clarostat may be inserted between the maximum tap and the added tap, with bypass condensers of 1 or 2 mfd. inserted between the new tap and B minus tap on the eliminator. Many other combinations may be evolved by the use of clarostats, all of which are conducive to better radio operation and reproduction. —J. H. C.

USURPATION OF NEWS SERVICE WAVES FEARED

Washington.

A protest against the tentative allocation of wavelengths among the various newspapers and press associations, parties to the American Publishers' Committee which was awarded 20 continental short wave channels for a public service press radio-telegraph network, has been received by the Federal Radio Commission from John Francis Neylan, representing those organizations of William Randolph Hearst which are members of the Committee.

It was explained at the Commission that the channels were awarded to the Publishers' Committee, headed by Joseph Pierson of Chicago, for allocation among the various companies which are members of the Committee, and with the condition that the channels be divided to serve the entire press of the country. The tentative allocation, it was stated, has been filed with the Commission by Mr. Pierson for approval.

Wants Press to Agree First

Donald D. Hughes, Assistant Counsel of the Commission, said that the Commission has notified all parties that it will not act upon the tentative allocation until "after the press interests are satisfied." No future hearing date on the matter has been set at this time, he declared.

The teleram from Mr. Neylan did not designate the newspapers and news services he represented, but the Commission files shows the Hearst organizations which applied for channels as Universal Service, International News Service, Los Angeles Examiner and San Francisco Examiner.

Mr. Neylan's telegram follows, in part:

"I am transmitting by mail to your honorable commission a detailed protest against allocation of wavelengths contained in the alleged report of Joseph Pierson dated January 18, 1929. I herewith respectfully request a public hearing on this protest on or about March 7.

"10% Representation"

I believe a reasonable opportunity should be afforded 90 per cent of the American press, now lacking information on this subject, be advised and to arrange for proper representation. Joseph Pierson is without authority to represent any newspaper or news association I represent and on information and belief and predicating my statement thereon I herewith advise you that said Pierson is without authority to speak for 90 per cent of the press of the United States."

THORDARSON DOUBLES SPACE

Thordarson acquired a building adjoining its factory in Chicago, increasing its manufacturing space 100 per cent. The total space is 250,000 square feet. Thordarson reports consumer parts business of close to a million dollars annually.

NEMA SPRING MEETING

The spring meeting of the National Electrical Manufacturers' Association will be held at The Homestead, Hot Springs, Va., May 20th to 25th.

NEXT WEEK—How to Measure Voltage Correctly—A study of Harmonics—Band Pan Filter 5-Tube.

RADIO TALKIES STAR GRIFFITH, UNITE COASTS

Schnectady, N. Y.

The General Electric Company staged a "television talkie" with David Wark Griffith, moving picture director, as the star.

Mr. Griffith, at the studio of the General Electric Company's station WGT, told some experiences in discovering latent talent in movie actor "material." His voice was carried on the long-wave, 2XO, and also on a short wave, W2XAF (31.48 meters). His features were carried by 2XO, on 22.5 meters. All three transmitters are in the G. E. broadcasting plant.

Los Angeles, Calif.

Gilbert Lee, an amateur experimenter associated with David Wark Griffith, reported success in tuning in both the "talkie" and the "television" in the recent General Electric Company experiment. The speech was brought in on the short wave and came in plainly, said Lee. The television was plain at times, indistinct at other times, Lee reported.

"I recognized Mr. Griffith by his eyes, nose and mouth, and watched the movement closely," added Lee. "I was thrilled."

The test lasted during the entire fifteen minutes that Mr. Griffiths' voice and features were on the air.

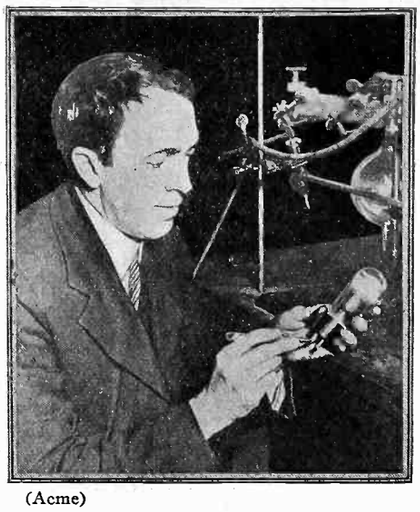
Requests were received for reports to be sent to Schnectady, so that a compilation will tell how the experiment really turned out. Cross-continent reception was the real test sought, for both sound and sight.

Big Demand for Si-len-ser

The Trutone Radio Sales Co., 114 Worth Street, New York City, wish to announce that any delay in shipping Si-len-sers to fans, jobbers and dealers who have recently ordered, is due to the tremendous demand for this new device which so effectively eliminates electrical noises in AC and electrically operated sets, induced by man made means and not by aerial pickup. So great has grown the demand that factories are working night and day to catch up with orders.

This response is not only nation-wide but the orders that are coming in from the Metropolitan District and nearby points are enough to take the entire output of one factory alone. Every day, new dealers are falling into line and more fans are realizing that relief is at hand. However, the producers are making every effort to turn out more Si-len-sers and any delay in shipments will only be temporary.—J. H. C.

INVENTS A TUBE



(Acme)

WILLIAM L. CUMMINGS, OF BERWYN, ILL., HAS INVENTED A NEW TYPE OF ELECTRON RELAY FOR TELEVISION REPRODUCING LIGHT. THIS PRODUCES A WHITE LIGHT RICH IN ACTINC RAYS AND ULTRA-VIOLET LIGHT WHICH MAY BE USED FOR PROJECTING THE PICTURES ON A SCREEN OR GROUND-GLASS. THE LIGHT IS PRACTICALLY A POINT SOURCE OF INTENSE BRIGHTNESS WHICH RESPONDS QUICKLY TO INTENSITY VARIATIONS. IT IS SUITABLE FOR RECORDING AS WELL AS FOR REPRODUCTION.

U. S. Is Invited To European Parley

Washington.

The Department of State received a cablegram from the American Legation at Berne stating that the International Bureau of the Telegraph Union has advised the Legation that a European Broadcasting Conference will be held at Prague, Czechoslovakia, from April 4th to April 13th.

The agenda of the conference is as follows: (a) allocation of wavelengths for European broadcasting; (b) allocation of waves attributed to telegraphy; (c) other questions.

The American Minister at Berne has notified the department that the following governments will be represented at the conference: Germany, Austria, Belgium, Denmark, Egypt, Spain, Estonia, France, Great Britain, Hungary, Ireland, Italy, Latvia, Norway, Netherlands, Poland, Rumania, Servia, Sweden, Switzerland, Czechoslovakia and Russia.

The American Legation at Prague has advised the department that an invitation will be extended to the United States to send non-voting observers to this conference. The United States is in charge of matters relating to the International Radio Convention and Regulations until the conference scheduled to be held at Madrid in 1932.

WAVE ACCORD WITH CANADA CALLED NEAR

Washington.

Settlement of the questions involved in the allocation of short wavelengths between the United States and Canada is likely to be reached shortly, H. A. Lafount, a member of the Federal Redio Commission, told the Senate Committee on Interstate Commerce.

Proposal Modified

The original Canadian proposal for a fifty-fifty division was rejected, he said, and a counter proposal giving the United States more than is now under consideration. He expressed the opinion that it would be better to handle this problem by means of an agreement rather than by a formal treaty because of the uncertainty as to how the arrangement will work out. Because the agreement has not yet been accepted, he said he did not feel free to reveal its details and the committee did not press him to do so.

Wants Board Retained

Extension of the life of the Radio Commission as an administrative body for one year also was advocated by Mr. Lafount, who appeared before the committee in connection with the bill, which would extend the Commission's administrative powers until March 16th, 1930. Under existing law the Commission would become an appellate body on March 16th, 1929, and its administrative functions transferred on that date to the Department of Commerce.

Taylor to Start New Tube Course

So successful have been the series of courses on the theory and operation of vacuum tubes,, given by E. Gordon Taylor, M.S., at the College of the City of New York, 140th Street and Convent Avenue, New York City, that a Spring course will be given. It will run sixteen weeks, beginning February 19th, every Tuesday evening, from 7:30 to 10:30. The work consists of two hours of lecture and discussion and one hour of laboratory work each week.

The course will cover the general theory of the ionization of gases; thermionic emission of filaments; vacuum tubes containing two or more electrodes; characteristic curves of different types of tubes; vacuum tubes as power or voltage amplifiers; rectification of alternating currents by means of vacuum tubes; photo electric cells. Further information may be had from Mr. Taylor at the above address. Mention RADIO WORLD.—J. H.

London Heard All Over U. S.

"This is London calling," echoed recently for the first time in American homes from coast to coast, when the last movement of the Rachmaninoff "Symphony in E Minor," performed in Queen's Hall, London, was broadcast over the nation-wide network of the National Broadcasting Company. It was 9:45 P.M. in London, 4:45 P.H. in New York, and 1:45 P.M. in San Francisco when Milton J. Cross, NBC announcer, told radio listeners of the nation of the surprise in store for them. He pressed a button, and in less than one second music of a full symphony orchestra playing in Queen's Hall, London, streamed from radio speakers in American homes throughout the continent. Shortly after 10:00 P.M., London time, the concert ended.

"This is London calling," the announcer said, but failed to identify the music. Program workers of the National Broadcasting Company recognized it.

A New Chain System

Stations Could Use Same Beat Wave Without Interference

By J. E. Anderson

Technical Editor

Many attempts have been made to synchronize two or more broadcasting stations on the same wave. There are many methods available for doing this, and some of them are successful as long as the same program is radiated from the synchronized stations.

Now a company proposes to link 200 stations throughout the country on the same channel by means of two short-wave channels differing in frequency by such an amount that the beat between the two would fall in the broadcast band. For example, the two short-wave channels may be 7,000 and 7,900 kc. When these two are mixed in a modulator or detector there will be a beat frequency of 900 kc, which can be modulated locally for the radiation of any local program desired.

High Powers in Carriers

It is proposed to use 50,000 watts in each of these channels so that both may be received at any point in the United States. Any station desiring to join the synchronized chain would pick-up both of the high frequencies, beat them together in a detector, amplify the beat frequency and ultimately modulate it with a local signal and then radiate it.

It is clear that all the stations using this beat frequency as a local carrier will have exactly the same frequency no matter what may happen to the frequencies producing the beat. If either of the high frequencies varies, then the beat frequency, or the synchronized carriers, will vary also, but all will vary simultaneously and by the same amounts.

Variations Possible

It will of course be necessary to hold both of the high frequencies very steady, for a small relative variation in frequency in any one of them will produce a large variation in the beat frequency. While this will not upset the synchronization it will throw all the receivers of the beat frequency stations out of tune.

The statement that the various stations operating on the beat frequency will at all times be on the same frequency regardless of what that frequency may be, needs some modification. That may not be true while the beat frequency changes, due to changes in the two beating frequencies. There may be momentary differences due to this change while the change is taking place. Also if there are any changes in the transmission paths between any two members of the chain or between the short wave transmitter and any of the members, there may be memomentary differences in frequency.

Neither of the two high frequency waves will carry a signal. The sole purpose of these two waves is to produce a beat frequency which will be used as the carrier of the local signals.

Difficulties Arise

It has been proposed that the local programs consist of similar recorded numbers reproduced mechanically and that all of the stations start at the same time and run their reproducers in synchronism. If the system depends on its success on this synchronization it will obviously prove a failure. No two stations can start their programs simultaneously. But it is not at all certain that this synchronization is necessary to the successful operation of the system. The chief requisite is that the carriers shall be synchronized, and they will be, except for momentary differences.

Of course, if two members of the system are close together so that a receiver is able to pick both up at the same time, the signals will be a hopeless jumble of sounds unless the audio signals of both are identical and closely synchronized. It will not be possible to tune one of them out for they will be on exactly the same frequency. However, if one of the stations is much weaker than the other it will be possible to receive the stronger, as the background of interference will not detract from the desired signal.

High Frequency Modulated

The system as proposed does not include modulation of either of the high frequency carriers. If one were modulated the best frequency could not be used for local modulation because the beat would contain the modulation of the high frequency, just as the beat frequency in a Super-Heterodyne contains the modulation of the high frequency signal.

But for the transmission of chain programs it would be much better to modulate one of the high frequency waves instead of the local beat frequency carrier. Then not only would the carriers of all the local transmitters be synchronized but also the audio signals carried by them, and they would be identical.

When this scheme is employed two transmission channels for the high frequencies would not be sufficient always to insure interference-free reception. A third channel might have to be set apart for the system. This third channel would not be used for anything at all. It would simply be a stand-by.

Why Three Channels

The reason the third channel is necessary to insure freedom of interference is made plain by considering the Super-Heterodyne, for the system is nothing but a Super-Heterodyne on a large scale.

It is well known that any station comes in at two points of the oscillator dial of a Super-Heterodyne, and it is also equally well known that this usually gives rise to squealing and interference. The squeal occurs if there is a broadcasting station in the field which operates on a frequency which differs by twice the intermediate frequency of the Super-Heterodyne.

The intermediate frequency in this synchronization system is the difference between the two high frequencies. If these two are 7,900 and 7,000 kc, the intermediate frequency is 900 kc. Thus if there is a station in the field which differs from either of the high frequencies by 1,800 kc there will be interference from that station. Suppose that the 7,900 kc wave is modulated. It may then be brought in by making the other either 7,000 kc or 8,800 kc. It may well be that a station i operating on 8,880 kc, unless that frequency has been reserved for the system as a stand-by.

Case Is Simpler

However, the present case is a little simpler than the ordinary Super-Heterodyne, because there are only two frequencies, whereas in the Super there are about ninety frequencies. It is possible to eliminate the interfering frequency by suitable circuits. For example, each station might introduce a very effective wave trap for the interfering wave so that it cannot enter the modulator. This might be made directional to make it still more effective. Again, the 8,800 kc wave, or whatever it may be, is so far removed from the modulated wave that an ordinary tuner will be quite effective in suppressing it.

Application has been made to the Federal Radio Commission for construction permit of an experimental station for demonstrating the practicability of the proposed system. The Commissioners are disposed to grant both the construction permit and the station license, but the engineers of the Commission have not yet assented, on the ground that the scheme requires further study.

The applicant is the Continental Broadcasting Company of New York. The proposal is to use 7,000 and 7,900 kc, with 50,000 watts on each for transmission to small stations throughout the country, each of these stations to use the 900 kc beat and to modulate it locally.

The main object of the plan is to enable a large number of stations to operate on the same wave without interfering with one another, and thus conserve channels.

RATES SERVICE FIRST

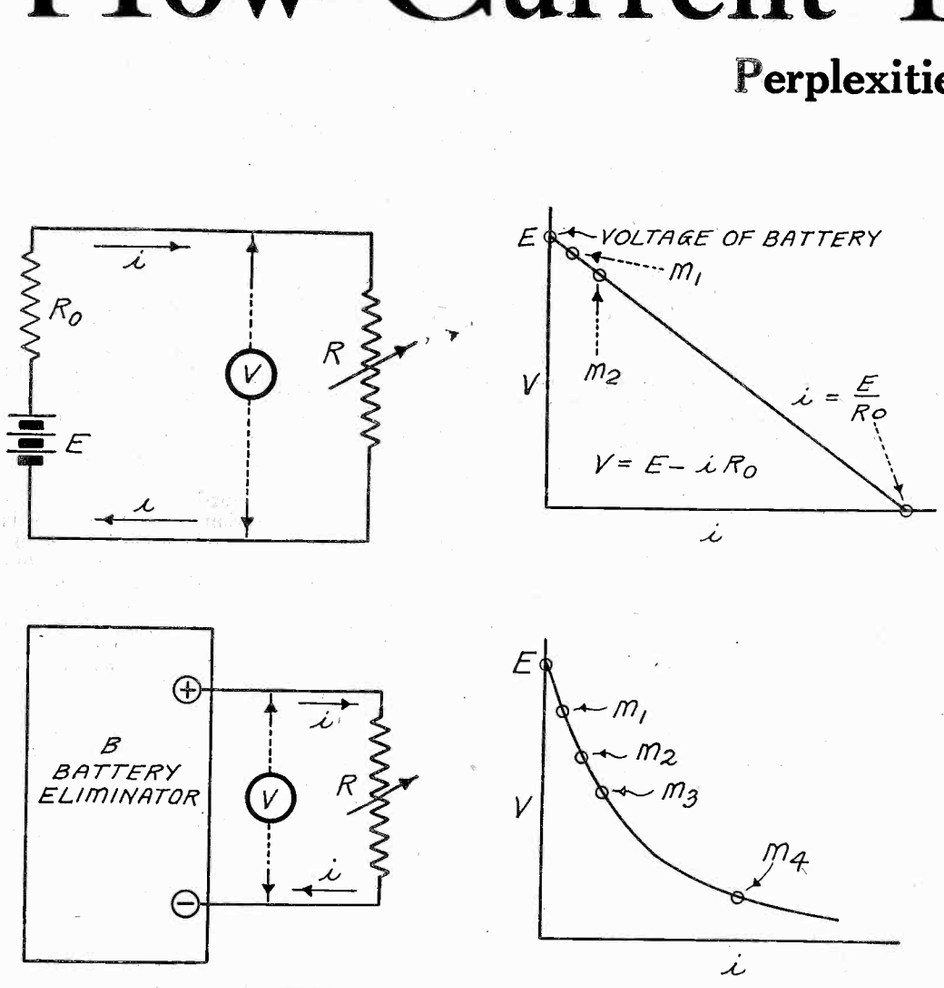
FIGURING THE RADIO RETAIL BUSINESS HAS COME TO THE POINT WHERE SERVICE IS PARAMOUNT, SAMUEL LAGER, PRESIDENT OF STREAMLINE RADIO STORES CORPORATION, WITH HEADQUARTERS AT 223 FULTON STREET, NEW YORK CITY, HAS OPENED A DEPARTMENT INCLUDING VARIOUS MAKES OF ALL-ELECTRIC SETS

How Current Flow Reg

Perplexities Arise From Low Resist

By J. E.

Technical



FIGS. 1 AND 2 (L. TO R., TOP)
FIGS. 3 AND 4 (L. TO R., BOTTOM)

FIG. 1. A SIMPLE CIRCUIT ILLUSTRATING THE DROP IN OUTPUT VOLTAGE AS A RESULT OF THE VOLTAGE DROP IN THE INTERNAL RESISTANCE RO.

FIG. 2. THE REGULATION CURVE OF THE CIRCUIT IN FIG. 1 IS A STRAIGHT LINE WHEN OUTPUT VOLTAGE IS PLOTTED AGAINST CURRENT.

FIG. 3. A B BATTERY ELIMINATOR WHEN REDUCED TO ITS SIMPLEST TERMS IS SIMILAR TO THE CIRCUIT IN FIG. 1.

FIG. 4. THE REGULATION CURVE OF A B BATTERY ELIMINATOR IS CURVED DOWNWARD DUE TO VARIATIONS IN THE INTERNAL RESISTANCE RO AND VARIATIONS IN THE EFFECTIVE VOLTAGE E.

VOLTAGE variations in B battery eliminators are bothering some radio fans. They have a power compact rated at certain voltages, such as 45, 90, 135 and 180 volts. They also have voltmeters, some very good, and they find on measuring the voltages at the various taps that they are not as rated. They may be higher but usually they are lower. One of two conclusions is reached as a result of the measurements. First, the meter is no good, if that was acquired after the acquisition of the B battery eliminator. Second, the B battery eliminator is no good, if that is a new acquisition.

The fact probably is that both are good for purposes for which they were intended. But the meter may not be suitable for measuring the voltage on the B battery eliminator, or the eliminator may not have been designed for as heavy duty as it is required to do.

Voltage Regulation

That brings us to the subject of voltage regulation, which might be defined as the variation in the output voltage with current drawn.

The behavior of a B battery eliminator is not unique. All electrical devices furnishing current behave in a similar way. The output voltage depends on the amount of current that is drawn from them. It is true of power transformers and generators supplying the power for all electrical purposes. It is true of batteries, of audio frequency transformers, of vacuum tubes and of filament transformers. It is general in electrical circuits.

Voltage Regulation Explained

And the principal is not confined to electrical systems. It is much more general. The pressure in a water distributing system depends on the current that is drawn from the taps. The pressure in gas pipes depends on the amount of gas that is being drawn, that is, on the number of gas jets that are burning. The pressure in steam pipes depends on the flow of steam, or on the amount of steam that is condensed in the radiators. The same principle holds in air pipes or any other pipes carrying gas or liquid under pressure.

The voltage regulation, or pressure regulation, may be explained with the aid of a simple circuit, Fig. 1, consisting of a battery, a resistance and a voltmeter. The resistance Ro may be either the internal resistance of the battery the voltage of which is E or it may be that together with an external resistance. Though Ro is shown externally it will be assumed that it contains all the resistance. The current in the circuit for any given load resistance R is i amperes. This current also includes that which flows through the voltmeter to cause a deflection of the needle.

The regulation curve of this system is shown in Fig. 2. It is a straight line between the points E on the voltage axis and E/Ro on the current axis. When no current flows the voltage across the voltmeter terminals is the emf of the battery. Hence the line crosses the voltage axis at V equals E. Of course this point cannot be reached with an ordinary voltmeter because there will always be some current through the meter. But it could be reached with a vacuum tube voltmeter.

Drop in Ro

Now suppose that resistance R be set so that a small current flows in the circuit. There will be a voltage drop in Ro which will amount to iRo. The voltage across the meter is the voltage drop in R, which is also equal to E—iRo. This relation holds no matter what the value of the current is. Hence for any value of current the voltage V as given by the meter will be V=E —iRo. This is the equation of the straight, sloping line in Fig. 2. When E equals iRo the reading on the voltmeter is zero and the current is E/Ro. This is the greatest current that can be obtained from the battery through the resistor Ro.

The points to note in this case are that the voltage across the voltmeter, which is termed the output voltage, is reduced by the voltage drop in the internal resistance Ro and that this reduction is dependent on the amount of current that flows in the circuit.

Case of the Eliminator

The voltage regulation in a B battery eliminator is exactly parallel to the above simple case. Fig. 3 shows the circuit in a simplified form. Between the terminals plus and minus there is a voltage difference which is indicated by the voltmeter. This is the output voltage, which depends for its value on the current i, the internal resistance of the rectifier and filter on the emf in the circuit, on the load resistance R, which is made up of the various plate resistances in the circuit served and on other resistances connected in parallel.

The lower the value of R, that is the more tubes that are used, the lower grid bias and the lower the resistance in the voltage distributor, the greater will be the current. It is not possible to reach the point represented by E/Ro in Fig. 2 in the eliminator circuit without actually short-circuiting the output. And this happens at times when a condenser blows.

Curve Not Straight

The regulation curve of a B battery eliminator usually has the shape shown in Fig. 4. It is not a straight line as it is in the case of the simple circuit in Fig 1.

ılates Output Voltages

ıce Meters and Overtaxing B Supply

Anderson

Editor

There are two reasons for the curvature. First, the emf E does not remain constant. Second, the internal resistance Ro does not remain constant.

The resistance changes because this depends on the emission of the filaments in the rectifier. And this in turn depends on the current drawn and on the amplitude applied to the rectifier.

The DC emf in the circuit is fictitious. There is only AC emf in the circuit, that across the secondary of the supply transformer. The transformer winding has resistance so that as soon as current is drawn less voltage is applied to the rectifier tubes than when no current is drawn. Then the tubes have resistance which adds to the voltage drop. Again, the filter chokes have resistance, causing an additional drop in the voltage. And all these drops are greater the greater the current drain.

If we assume that all these resistances are constant, the regulation curve would still be curved downward, because the value of that effective DC voltage in the circuit varies with the current. This variation is due to the fact that the AC voltage is peaked, the value of the voltage at the peaks being 1.4 times greater than the effective voltage. The voltage varies from zero to this peak twice every cycle. If no current is drawn the voltage across the output is the peak value. As current is drawn the voltage falls, first rapidly and then more slowly.

Output Voltage Lowered

Suppose the voltage at the output of the B battery eliminator be measured with a vacuum tube voltmeter, or with some other static meter, and also suppose that no current is drawn. The meter indicates the peak voltage E. Fig 4. If a high resistance meter be used the voltage falls a little and the value obtained is M1. If a low resistance meter be used the voltage is still lower and point M2 gives the value. Now if some current flows through the voltage distributor resistance the point M3 is obtained as the output voltage. If the device is also delivering current to a number of tubes the voltage may fall to point M4.

There are corresponding points on the regulation curve in Fig. 2. Point M1 is that obtained with a high resistance meter and M2 that obtained with a meter of lower resistance.

The shape of the regulation curve has much to do with the operation of the device. Suppose that the current drawn is such that the operating point is high up on the curve where the curve is steep. A small change in the current drawn will then produce a large change in the output voltage. As a signal is being received there is a continuous change in the current. Particularly when the signal is loud, the variation in the current is great. The effective output voltage will vary correspondingly. Hence if the eliminator is operated high up on the curve there is likely to be distortion. The effect may be oscillation or motorboating.

Bleeder Current

Since the slope of the curve is the resistance of the device, the higher the operating point the greater the internal resistance of the eliminator. It is well known that when the internal resistance is high there results motorboating or distortion.

If a greater current is drawn the slope of the curve, that is the internal resistance, is lower, as at M4. A given change in the current drawn will cause a small change in the voltage. It is for this reason that the voltage distributor is proportioned so that a considerable current flows even when the tubes don't draw any current. The current through the lower portion of the voltage distributor is called the "bleeder current." It has a stabilizing effect on the circuit, but it lowers the effective voltage.

There is a limit to the intensity of the bleeder current, or to the total current that is drawn. This is determined by the maximum safe current that the rectifier tubes will deliver and also by the current that the chokes will pass without saturating the cores. When the current is so large that the cores become saturated magnetically the chokes cease to be effective and the output will contain a strong hum component. This is one of the defects of many eliminators; or it is a defect which shows up when the eliminators are operated beyond their capacity.

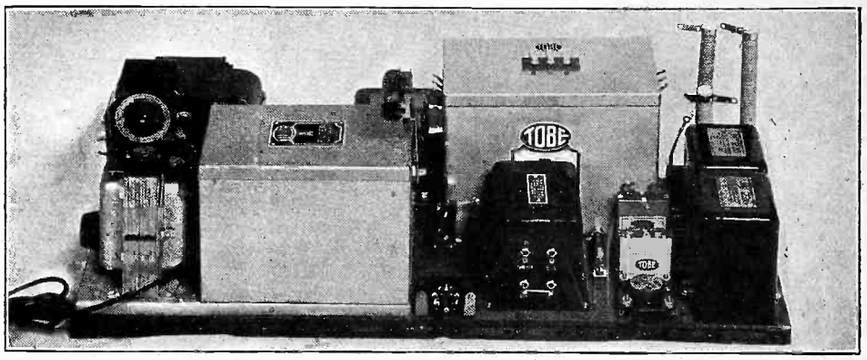


FIG. 5.
A B SUPPLY AND A FILTER, PROVIDING A C OPERATION FOR BATTERY TYPE TUBES, REQUIRES GOOD REGULATION IN BOTH A AND B SOURCES. THE ABOVE OUTFIT HAS AN AUDIO AMPLIFIER BUILT IN.

Use a Large Reservoir

It is well in the interest of good regulation to select an eliminator which has been designed for a larger set than that used. Particularly, it is advisable to select an eliminator which contains many and large bypass condensers. Assembled eliminators from standard parts, of which Fig. 5 is a good example, usually give better satisfaction at heavy drain than those made in factories and put up in small containers. The assembled job may not look so well as the factory made unit but appearance is not the criterion of good performance at heavy current.

The eliminator should be concealed in a cabinet and its merits should be judged by its performance alone.

Importance of Condensers

It is not obvious that the size of the condensers have anything to do with the regulation of the voltage from a B battery eliminator. It is well known that if the condensers in the filter are large the voltage obtained from a given rectifier and power transformer is higher than when small condensers are used.

This is particularly true of the first condenser in the filter, that is, the one next to the rectifier.

Steadying Influences

Some eliminators are so constructed that the bleeder current does not flow through the choke coils. This is an advantage in that the cores are not saturated so quickly. However, the object of the connection is not to reduce the load on the chokes but to relieve the stress on the condensers. It is often done when the condensers are of the electrolytic type.

In some instances the regulation is improved by the use of voltage regulator tubes of the 874 type. The voltage across one of these remains constant at 90 volts regardless of what the drain may be within wide limits. Another advantage of these tubes is that the common impedance is reduced by them. In this respect they serve the same purpose as very large condensers, provided that they are connected next to the rectifying tubes.

But these regulator tubes take considerable current, and when the tubes are connected so that they are most effective in regulating the voltage the current they draw flows through the filter chokes and thus adds to the saturating effect.

However, when one of these tubes is used it is not necessary to use additional bleeder current.

In any instance the power transformer which supplies the power to the rectifier tubes should be of large proportions, both as to iron and copper content. And the tubes used for rectification should be of ample size to have some reserve. Also the size of the choke coils should be large enough to prevent saturation.

Filament Voltage Regulation

When an A battery substitute is used, the regulation of that device should be good or else no changes should be made in the filament circuit during operation.

For example, if a tube should be taken out of its socket the voltage across the others will rise, sometimes to a dangerously high point. If the regulation is good there will be little change in the voltage when a tube is removed.

Where Televisi

Silhouettes Reliably Received, Problems

By D.

Engineering Staff,

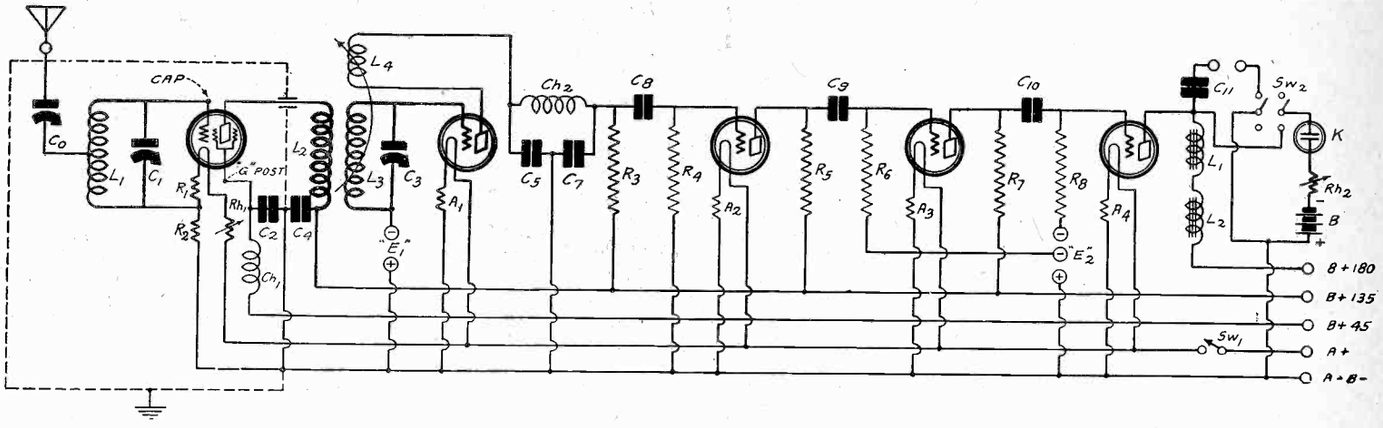


FIG. 1
A RECEIVER SUITABLE FOR THE RECEPTION OF TELEVISION SIGNALS. THE RESISTANCE COUPLING INSURES THE AMPLIFICATION OF BOTH THE HIGH AND THE LOW FREQUENCIES, WHICH ARE ESSENTIAL FOR BRINGING OUT DETAILS.

AT a recent meeting of the Radio Manufacturers Association, that conservative organization favored "experimental television on experimental wavelengths." It would therfore appear that television is on the eve of making its bow to the American public, in experimental form at least.

Nevertheless, undue optimism is entirely out of order, for there are many and serious problems in the way of satisfactory television service at this time.

Television, be it noted, is a most complicated branch of engineering, involving an intimate knowledge of radio, electricity, mechanics, gaseous conduction, distortionless amplification, modulation and demodulation, photography, optics and even a new stage technique. We have much to learn of all these.

Some hold that the major problems of television are those of presentation, but with this view we are not wholly in accord. They exist, to be sure, but they are secondary and their solution is in capable hands.

Subjects Galore

Once we have mastered the technique of television transmission, there should be no dearth of subjects. All the world is our stage and we may draw upon it as we will. For the present we must content ourselves with simple shadowgraphs or silhouettes; later, as our knowledege and technical facilities increase, we shall perhaps stage playlets; and ultimately we shall televise speakers and artists before the broadcast microphone, leaving the aural accompaniment entirely at the option of our audiences.

After all, the television presentation is a fleeting and instantaneous thing, best suited by long odds to portraying a given subject at a given instant of time. But, before we concern ourselves with the pictorial nature of our television images, we must first solve the problems attendant upon their propagation and reception.

Affording Detail in Pictures is Television's Most Intricate Problem — Short Wave Transmission Necessary Because of Modulation Width

detail. And it is a most intricate one, involving dot elements, time coefficients, luminous intensity, accurate synchronization and available wave channels.

Because of the width of channel required, television is not possible on standard wavelengths. We are therefore compelled to resort to short waves or high frequencies, thus automatically assuming the responsibility for the solution of a number of intricate problems. Short waves, it will be noted, are by no means *universal* in their application. Indeed, a critical analysis of the essentials of a satisfactory television service discloses the fact that we shall have to utilize *three* separate but simultaneous short-wave channels in meeting the peculiarities and requirements of urban, rural and long-distance reception.

Sound Transmission Different

As sound broadcasting is carried on within relatively narrow limits, it may occur to some to ask why we require an excessively wide channel, say 100 kilocycles, for the propagation of the television image. The width of channel determines not only the dimensions of the image itself, but the amount of pictorial detail possible. For example, a standard radio channel 10 kilocycles wide would permit us to handle only close-ups and other simple figures and would admit only of the crudest detail.

At the transmitting end, we simply break up our subject into a number of parallel and overlapping lines by means of the familiar scanning disc—a circular plate with *eccentrically* placed holes. A photoelectric or light-sensitive cell converts the varying intensity of these lines into varying electrical impulses. These are amplified and impressed on the outgoing waves of a broadcast transmitter.

At the receiving end the signals are further amplified and fed to a neon glow tube or kino-lamp—a sensitive device whose luminosity varies with the modulation of the incoming wave.

Our problem is to re-convert this luminosity into lines whose gradations are similar to those obtained at the transmitting end. For this purpose we employ a scanning disc which must be revolved in perfect step with the one at the transmitting end. The holes in the disc break up the glowing plate of the kino-lamp into a series of lines of varying intensity.

The Illusion of Motion

At any given instant, however, there is just a single dot of light on the television screen, and its brilliancy or dullness is a function of the modulation of the incoming radio wave at that particular instant. These dots at a speed of fifteen per second seem to form lines which in turn unite to weave an entire animated image.

Television is basically an optical illusion which depends upon the persistence of human vision and upon the slowness of the eye to assimilate ultra-rapid changes of scene.

We thus see that the television image, like the newspaper half-tone engraving, is simply a pattern of closely-woven, successive lines. The problem therefore resolves itself into questions of how many lines we are using, how much contrast we have between the maximum and minimum intensity, how accurately our lines meet or overlap, and how well we are able to maintain synchronism between two scanning discs.

on Stands Today

ction in Detail to Come Later—
Analyzed

eplogle

on Manufacturing Co.

There is, however, a great difference between the half-tone engraving and the television image. Crude in detail as the half-tone is, it contains 65 vertical and horizontal rows to the square inch, or a total of 4,225 dots per square inch. Now, to weave an even cruder television image, let us say of 50-line texture, or corresponding to 2,500 dots to the square inch, we have to transmit its lines in less than 1/16th of a second, or at the stupendous rate of 40,000 dot elements per second.

100-Line Image Standard

Referring again to the half-tone, let us call attention to the fact that a minimum image of about 3x5 inches is required for viewing persons and events intelligibly. To achieve this in television practice, even with a 50-line texture, we would have to build up an image 150 lines high and 250 lines wide, a feat which would compel us to transmit the equivalent of 37,500 dots elements in 1/16th of a second.

For the present, we have accepted the 100-line image as standard technique, as it can be transmitted within an 80-kilocycle wave band and permits of a reasonable amount of detail. Even, however, with a 100-kilocycle wave band, we may not hope to attain anything like the crystal-clear detail of the present-day motion picture.

It must now be obvious that the systems employing 24-line images which may be crowded into a wave band of 4 or 5 kilocycles are wholly inconsistent with a serious television service.

In addition to being critical in the matter of screen dimensions, a wide channel, as we have intimated, is essential for proper detail. Both high and low frequencies are absolutely essential. If, for example, we delete the low frequencies, we introduce extraneous shadows and change the tone of the picture.

Slowing-up Effect

On the other hand, if we slight or cut off the high frequencies, we eliminate the sharp lines which are essential to good detail. Further, cutting off the high frequencies will also limit us to slow motion, as any rapid action will always appear blurred and indistinct. In general, we might say that television requires a band at least twenty times as wide as that required for the broadcasting of music and speech.

We now come to a consideration of our second major problem, that of luminosity. We have accomplished wonders with present neon tubes with their low candle-power, but there is still room for a world of improvement. It seems highly probable that we shall have to develop a lamp which, while retaining the delicate sensitivity of the neon tube, is capable of vastly greater illumination.

Further, we must work out more efficient methods for utilizing and conserving the limited amount of light at our disposal.

Considerable progress has already been made along these lines by C. Francis Jenkins, of Washington, D. C., who has developed a multiple target neon lamp and an ingenious scanning drum which utilizes light-conducting quartz rods.

Practical Means of Universal Synchronism Awaited—Progress Made in Transmitting Film Records of Action — Jenkins, Alexanderson and Conrad Commended

Mr. Jenkins, E. F. W. Alexanderson and others have developed scanning discs with matched lenses which permit us to make a more efficient use of the light source. The matched-lens scanning disc requires an exceptionally powerful neon spotlight, but so much progress already has been made by both American and European experimenters in this field that we may consider the problem well on the way to a satisfactory solution.

Synchronization Problem

Our third major problem is that of synchronization. If television were to be limited to metropolitan areas where the same alternating current systems are available it would be simple matter to keep the sending and the receiving scanning discs in step by means of synchronous motors. Television, however, will doubtless extend to territories in which the same current is not universally available and we must therefore develop some independent means of achieving our end.

Already ingenious speed controls with centrifugal governors, making and breaking contacts across speed-control resistances, have been developed. Another ingenious device is a gear arrangement which permits adjustment of the phase relation between a synchronous motor and the position of the disc when it is in motion. Under this arrangement a synchronous motor can be used to drive the transmitting mechanism, and the scanning disc at the receiving end can be controlled so that it can compensate for the difference in phase between transmitter and receiver.

It seems highly probable, however, that the ultimate solution of the problem of synchronization will be found in the use of ingenious breaking devices which will regulate the scanning disc by means of a definite frequency impressed on the television carrier wave along with the signals themselves. Or perhaps there will be a synchronization signal which will be sent out for each revolution of the scanning disc at the transmitting end, and which will tend to start out the scanning disc at the receiving end in step with the transmitting disc at each revolution.

These, however, are just possibilities. There are many ways of achieving synchronous operation.

Telecasting—What About That?

Then, too, the problem of a nation-wide television service is a most serious one, and the production of television receivers on a commercial basis is going to be impaired until some such service is available. The general public hardly can be expected to purchase televisors for home use until it is assured that there are really pictures to tune in.

It seems highly probable that in the beginning at least we shall make use of the so-called "radio movies." Jenkins, Frank Conrad of Westinghouse, and others have already worked out practical systems operating on this principle. The subjects are first recorded on a motion picture film from the negative of which any desired number of positive prints may be made. One of these is placed in a transmitting device which scans each frame line by line.

The advantages of the film pick-up are numerous. The subjects may be filmed under the ideal conditions of the motion picture studio and with all the talent desired. The positive prints may be widely distributed and broadcast by any station without special skill or expensive equipment. Thirdly, it is possible to effect a nation-wide hook-up without the use of wire lines. Lastly, this uniform service over a large part of the country will usher in an era of what we may call "sponsored television." In other words, it will be at once possible to sell television service to large advertisers, much after the manner in which time on the broadcast air is now sold.

Jenkins Tells Why 'Shadows' Are Used

Indianapolis.

Television is now on a practical basis, C. Francis Jenkins, inventor and television experimenter, told the listeners of WFBM when he broadcast from that station recently.

In describing the apparatus used in television Mr. Jenkins said:

"The pictures seen are black and white, comparable to the cartoon movies in the theater.

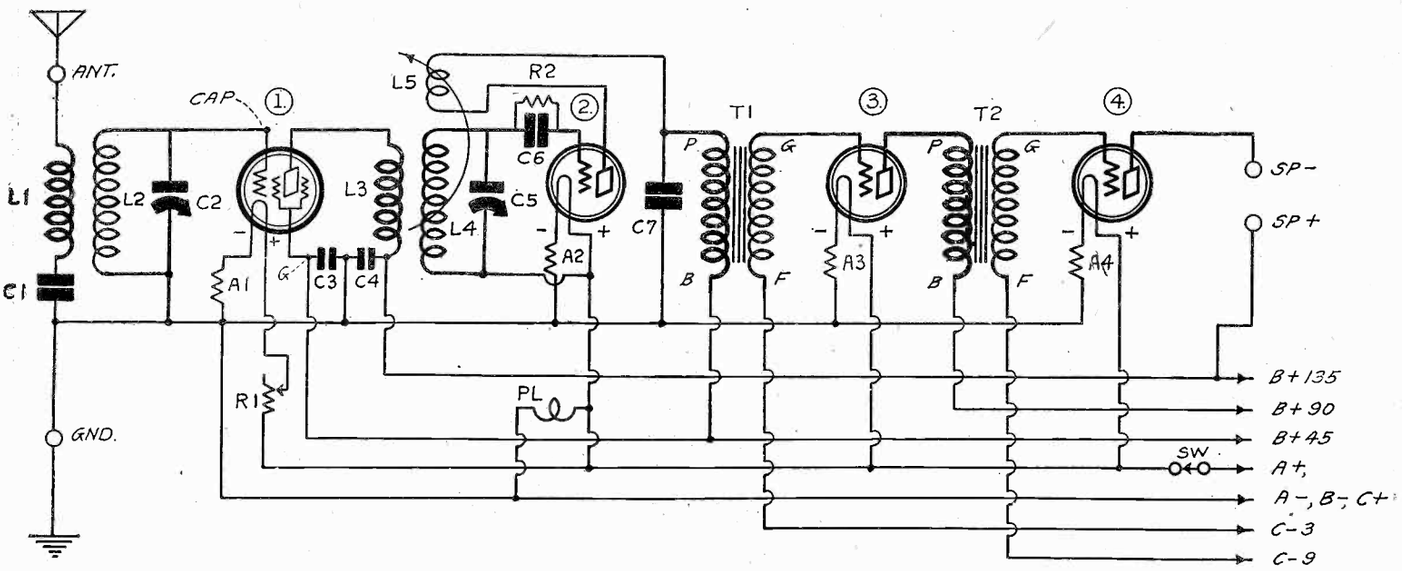
"We are broadcasting only in black and white at present in order that the frequencies involved in motion picture transmission may stay within the legally permissable width of the carrier channel.

"The halftones in regular movie film, and in broadcasting from living subjects and scenes, require a broader band. This was recognized by the Federal Radio Commission and bands 100 kilocycles wide have been assigned for such work. The new, more powerful, broadcast stations we are building outside of Washington are for this width of band, and fireside entertainment pictures are contemplated.

"Present transmission on 6,420 kilocycles was undertaken principally to learn the possibilities and the limitations of this new entertainment; to build up a radio movies technique; and to insure later the availability of radio-visors giving larger and brighter pictures which may be watched conveniently by the whole family."

Screen Grid Tu
Selectively in the

By Herman



THE NEW MODEL SCREEN GRID DIAMOND PROVIDES A REALLY REMARKABLE DEGREE OF SELECTIVITY AT HIGH VOLUME AND CONSTITUTES ONE OF THE OUTSTANDING FOUR-TUBE DESIGNS OF ALL TIMES.

[*Greater selectivity is provided by the new model Four-Tube Screen Grid Diamond of the Air, the exposition of which was begun in last week's issue, dated February 9th. The dials are made to track nicely. Although in an occasional installation there may be a discrepancy at low wavelengths between the readings of the two dials, because of unexpectedly high capacity encountered in particular screen grid tubes between plate and lament, the two dials always can be made to track, by introducing a small fixed capacity across the first tuning condenser, C2. This extra capacity may be a 70 mfd. equalizing condenser of the type attachable to the tuning condenser itself. Set once, for a relatively low wavelength, this small equalizing condenser need not be adjusted again.*]

THE current and voltage set up in the antenna are of different intensities, according to the strength with which the modulated carriers reach your particular location.

The difference in amplitude or strength may be great for a given station, even as between neighboring antennas.

A particular instance in the Yorkville section of New York City was noted the other day, when I discovered a friend could not get WEAF well, but that a man in the next house got it so loud that when he opened his window my friend could hear his neighbor's set reproducing WEAF with far greater relative volume in that room than when my friend reproduced the signal from his own set in that very room. My friend lived in a tall building, and the neighbor's roof was four stories below, so phenomena will happen. It is all a question of field strength at the antenna, and this is determined essentially by the power of the broadcasting station, the frequency of the carrier and the antenuating effects between station and point of reception, these effects being mysterious enough even in the present progressed state of the art.

Will Give Excellent Results

Given a fair show, rid of freak situations like the one confronting my friend, the new model of the Four-Tube Screen Grid Diamond will give excellent results in abundance, and in any instance equal in sensitivity and selectivity factory-made receivers of seven or eight tubes.

The pickup is kept purposely rather low, since selectivity is gained that way, and this selectivity gain is permissible in the present circuit design because of the enormous amplification obtained from the screen grid tube.

It must not be assumed that this tube is worked at its maximum, either, for although the tube may have an amplification of 400 under special test conditions, it is impractical to attempt to work the tube at this enormous gain factor, chiefly because of instability. Therefore the gain is kept relatively low—around 75 or 80—but when one considers that a 201A tube would afford a gain of about 7 or 8, the tenfold increase becomes manifest.

Also the complaint that the screen grid tube is a powerful radio amplifier but destroys selectivity is removed entirely. In fact, it is not a just complaint, for the screen grid tube is more selective at a given amplification level than is the 201A. The secret lies in working the tube in such fashion that you get moderately high gain, considering the tube's theoretical maximum, yet obtain far greater selectivity than you would with a 201A, the tube that the screen grid value usually replaces.

Both Advantages Obtained

So you have both desired qualities—high gain and high selectivity—endearing advantages commonly associated only with six-tube, seven-tube and eight-tube sets. And you have easy tuning, using two dials for their greater sensitivity, and covering a 1,500-mile range at night with easy repetition, even unto 100-watt stations, meanwhile separating powerful locals from weak distant stations on adjoining chan-

LIST OF PARTS

L1, L2—One antenna coil (AC5).
L3, L4, L5—One screen grid three-circuit tuner (SGT5).
C1—One Aerovox .0005 mfd. mica fixed condenser.
C2—One Hammarlund .0005 mfd. Midline variable condenser.
C3, C4—Two Aerovox .006 mfd. mica fixed condensers.
C5—One Hammarlund .0005 mfd. Midline.
C6—One Aerovox .00025 mfd. mica fixed condenser with clips.
C7—One Aerovox .0005 mfd. mica fixed condenser.
A1—One 622 Amperite with mount.
A2, A3, A4—Three 1A Amperites with three mounts.
R1—One 50-ohm Frost rheostat.
R2—One 5-meg. Lynch metallized grid leak.
T1, T2—Two National A 100 audio frequency transformers.
Ant., gnd., speaker —, speaker +, four binding posts.
PL—One pilot light bracket with jewel window and lamp.
SW—One A battery switch.
One 7x21-inch front panel.
One 10x20-inch aluminum subpanel, self-bracketing, with four sockets (1, 2, 3, 4), affixed, and supplied with subpanel hardware and insulated bushings and washers.
Two dials, with two pointers.
Two knobs (one for tickler coil, the other for rheostat).
One roll of stranded Braidite wire.

be Worked Most New Diamond

Bernard

nels. And the distant stations are weak only as compared with the most powerful locals. Surely the distant ones come in with abundant volume—enough sound level to make you feel glad there's a power tube in the set.

The primary of the antenna coil has only six turns, while the condenser C1 in series with that primary and ground is of .00025 mfd. capacity. These values were chosen because it was desired to remove as far as possible the capacity effect of the antenna upon the tuned secondary, C2 L2, and this has been done; also, to keep the circuit C1 L1 far above the broadcast band on a frequency scale (below in wavelength), and this is assured, as the natural frequency of this circuit is above 2,500,000 cycles.

Moreover, the coupling between antenna winding and secondary is relatively loose.

Must Have Selectivity!

"My set isn't selective enough" is a common enough complaint, therefore one of the first considerations should be the development of wholly adequate selectivity by proper circuit design and choice of parts and constants.

Not until you have a selective receiver do you have a receiver that is really useful, with a reallocation in force that permits bringing in more distant stations than prior to November 11th, but denies you the privileged advantage unless your receiver is as selective as that semi-ideal type that the Federal Radio Commission must have had in mind when it decreed the reallocation.

With the new model Screen Grid Diamond you won't have to apologize to guests for background reception that darkens the bright spots of the predominating program, for the receiver brings in only one station at a time, and yet with abundant volume on every frequency channel. Ninety-six channels you may tune in (including Canadia's six), and yet there is wholly adequate volume at 545 meters, and more than enough to spare. Of course, at 200 meters, where the amplification is greater, due to the rising characteristic of tuned radio frequency amplification.

The bias is held more highly negative than usual in the first stage, equalling 2.7 volts, the voltage drop in the No. 622 Amperite, A1. You would be surprised to note by curves how much this higher bias increases the selectivity, if you were to chart the selectivity as frequency versus amplification. While it is not possible to give an accurate picture by stating a percentage of selectivity increase, it may be said with safety that the selectivity gain is very substantial. The volume is only a little less than it would be were the bias held to 1.5 volts negative, but, as has been stressed, the volume at all hazards is generous and plentiful, and you need have a worry on that score.

Include the T-Formation

The T-shaped structure consisting of condensers C3 and C4 and the ground lead is an important feature of the circuit. Often it is left out for no better reason than to save the cost of the two small condensers. That is an error because many circuits fail to measure up to expectations when these condensers are omitted.

Of course, these condensers are filters which prevent feedback. Hence, they stabilize the receiver and prevent oscillations. C3 is tied up with the functioning of the screen grid.

The objects of the screen grid are to shield the grid from voltage fluctuations on the plate and to establish an artificial ground near the plate as regards radio frequency fluctuations of voltage, and at the same time maintain the screen grid at a suitably high steady positive voltage.

Now, if there is any resistance in the external screen grid circuit, there will be a radio frequency voltage drop in this resistance because there is an RF current in this circuit. This drop immediately nullifies the effect of the extra grid. That is, the extra grid no longer shields the plate effectively.

An RF Ground

When condenser C3 is connected from the screen grid to ground the radio frequency currents will flow through this condenser rather than go through the higher impedance path represented by the external resistance.

The larger C3 is, the more freely does the RF current pass through it and the more nearly is the screen grid maintained at ground potential for high frequency voltage fluctuations. A condenser of .01 mfd. has a maximum impedance of 30 ohms in the broadcast band. This cannot cause much voltage drop, nor can a value down to .006 mfd. Hence, .006 is a suitable value, but a larger condenser may be used.

The other condenser, C4, serves a similar purpose in the plate circuit. It maintains the low potential side of the primary L3 at ground potential. This it does by shunting the radio frequency currents around the resistance of the plate voltage supply directly to ground. Thus no radio frequency current need go through the B battery eliminator, where it might cause feedback and coupling with other circuits. The size of C4 should be about the same as C3, since it works at the same frequency and it shunts approximately the same resistance. Omission of either of these condensers invites oscillation and unsatisfactory operation of the circuit.

High Sensitivity

The need for these bypass condensers is greater, the greater the amplification in the circuit. And this amplification may be made very large in a receiver incorporating a screen grid tube and a regenerative detector.

The necessary condition for high sensitivity in a screen grid tube circuit is that the plate load impedance be large. In the Screen Grid Diamond this condition is satisfied by having the primary of the coupling transformer large, by using 24 turns.

But that alone will not insure high sensitivity. There must be a selective tuner between the screen grid tube and the detector, for the sensitivity depends on the selectivity. The selectivity, and hence the sensitivity, are augmented by employing an effective tickler. It has been estimated that regeneration when adjusted to its critical value increases the sensitivity 1,000 times. This, of course, is too optimistic because in broadcast reception critical regeneration can be approached only approximately.

But this fact does not detract from the value of regeneration. Suppose that the practical gain from regeneration is only 10 times. That is indeed a great gain, as after detection this is equivalent to a gain of 100. That is about as much as can be gained by the use of two ordinary stages of audio amplification if the gains are compared on the basis of equal quality. And a gain of 10 from regeneration alone is a very conservative estimate.

Depends on Grid Leak

Of course, the actual gain resulting from regeneration depends on the combination of grid condenser and grid leak. If the grid leak. If the grid condenser C6 is small there is a loss of the signal voltage impressed on the grid because the signal must pass through the condenser. If the condenser is too large, on the other hand, the circuit does not detect well. If the resistance R2 is too high, the circuit blocks when the regeneration is advanced. When it is too small the circuit does not detect well. Good values for C6 and R2 are .00025 mfd. and 5 megohms, respectively, and these values are a compromise between quality and sensitivity.

Full advantage of the regeneration cannot be taken without using a bypass condenser iC7 in the plate circuit of the detector so that the radio frequency currents which induce regeneration do not have to travel through the audio frequency transformer.

Fine Audio Channel

Now, as for the audio channel.

There is no known method of producing so much gain per stage as with transformer coupling, and if excellent transformers, like the National A100, are used, you are assured of superb quality.

Ninety volts are enough on the plate of the first audio tube, and the negative bias may be three volts applied, or a total of four volts, when you count the one volt drop in the No. 1A Amperite, designated A3 in the diagram.

The transformers are 3½-to-1, and as the two audio tubes have a mu of 8 you have a gain of 28 per stage or a total audio amplification of 84, which is all-sufficient; indeed, will require you to make generous use of the volume control rheostat, R1, which is of 50 ohms resistance, because the maximum volume on an average station is so remarkably high.

[*Next week constructional details will be set forth, in the issue dated February 23d.*]

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Radio University

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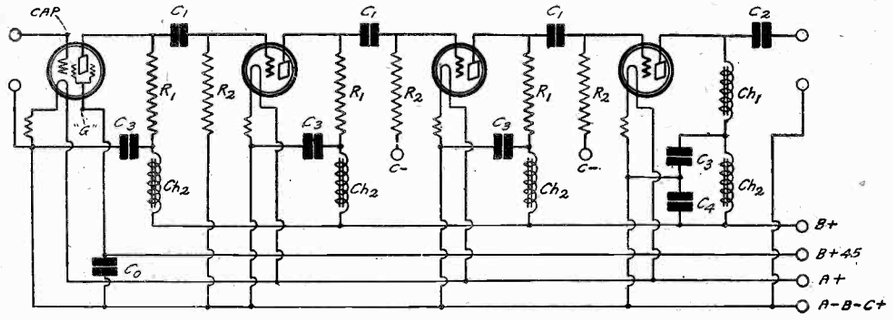

FIG. 732

THIS CIRCUIT SHOWS HOW TO PUT IN FILTERS IN THE PLATE CIRCUITS OF A RESISTANCE COUPLED AMPLIFIER SO AS TO ELIMINATE MOTORBOATING WHEN THE AMPLIFIER IS USED ON A B BATTERY ELIMINATOR. REQUESTED BY FRANCIS O'DONNELL.

I WISH to build a resistance coupled amplifier which can be used on a B battery eliminator without danger of motorboating. Will you please publish a circuit diagram showing how to use filters in the plate circuits to prevent feedback?

(2)—What size coupling condensers do you recommend?

(3)—What size should the bypass condensers in the filter be?

(4)—Is it all right to use audio transformers for choke coils?

FRANCIS O'DONNELL,
Boston, Mass.

(1)—See Fig. 732. Although a screen grid tube is used as detector in this circuit, any other detector tube may be substituted by removing the lead to the screen grid from the 45 volt tap.

(2)—Either .01 or .02 mfd. with mica dielectric.

(3)—The bypass condensers should not be smaller than 2 mfd.

(4)—Yes, in the first three plate circuits. Use the secondaries. The coils in the plate circuit of the last tube should be able to carry 60 milliamperes.

* * *

THERE IS AN intermittent popping sound in my loudspeaker. The disturbance is not regular and it is not present all the time. There is a pop about every second when the noise is on. What could cause it?

(2)—Could such a noise be caused by the B battery eliminator, and if so what is the remedy?

(3)—My set is entirely operated by AC. There is a very annoying hum in the speaker all the time. What causes this hum and how can it be eliminated?

ALBERT ARNOLD,
Bronx, New York.

(1)—It is probable that the popping noises are due to a thermostat in the building. These are always making and breaking a circuit and every time the circuit breaks there is a sharp disturbance. The disturbance often comes through the air, rather than through the AC line.

(2)—Sometimes the eliminator causes noises like this, but it is probably all right in this respect in your case.

(3)—There are many causes for hum in an AC operated receiver and it is not possible to tell which cause predominates in your set. It is quite possible that the hum arises from overloaded choke coils in your eliminator filter.

* * *

I HAVE AN AC set the volume from which is difficult to control. Can you suggest some good methods of volume control which do not affect the tuning or the quality of the output?

(2)—I have tried variable resistances in the plate circuit of the radio frequency tubes but they are not satisfactory because adjustments are accompanied by crackling noises. Is there any way of reducing this noise so as to make this method suitable?

(3)—How can the current rating of a resistor be determined from its wattage rating?

(4)—What happens if the wattage rating is exceeded, that is, if the wattage dissipated in the resistor is greater than the rated wattage?

FRANK OLLERTON,
Tampa, Florida.

(1)—One of the most satisfactory volume controls is a variable resistor in series with the antenna. A wire-wound resistance of 5,000 ohms is usually satisfactory. But if it is used it should be such that the resistance can be made zero.

(2)—The crackling is due to the making and breaking of the circuit as the slider moves over the resistance turns. The crackling may be reduced by connecting a condenser across the contact. But this condenser must not be connected across the resistance as a whole, only across the contact. Otherwise the resistance will do little good.

(3)—Divide the power rating in watts by the resistance in ohms and extract the square root. The result is the current rating in amperes of the resistor.

(4)—If the rated wattage is exceeded by allowing greater than rated current to flow through the resistor, it will heat up badly. The wattage rating is based on a certain arbitrary heating of the resistor, which is low enough to be considered safe. The temperature permitted depends on the service for which the device is intended.

* * *

IS IT NECESSARY to use individual filters in all the plate circuits of a radio receiver when transformer coupling is used?

(2)—What are the advantages of using individual filters?

(3)—Are the same advantages gained in the case of resistance and impedance coupled circuits when individual filters are used?

(4)—Which are better, resistance-capacity filters or choke-capacity filters?

JOSEPH GARCIA,
San Diego, Calif.

(1)—It is not necessary because very few amplifiers in use have individual filters. But it is highly desirable.

(2)—Elimination of feedback from one stage to a preceding stage and the elimination of distortion and motorboating from this cause.

(3)—Individual filters are more advantageous in these circuits than in transformer coupled circuits. In direct coupled circuits the filters are really necessary except when a storage B battery is used to serve the set.

(4)—There is little to choose between these two types of filters. The resistance filters have the disadvantage of lowering the effective voltage for a given applied voltage. The choke coil filters have the disadantage of frequency discrimination. In either case the advantages far outweigh the disadvantages, assuming that reasonably good chokes, large enough condensers and suitable resistors are used.

* * *

I HAVE an AC operated receiver with a —17A tube in the last stage. The plate voltage is supposed to be 180 volts but when I connect a high resistance voltmeter across the B battery eliminator I get 220 volts. Can you suggest any way of reducing the voltage to the proper value?

(2) Can you suggest a simple way of eliminating the hum in a dynamic type speaker. My set does not hum when I use a magnetic speaker so I know the hum originates in the speaker. The speaker is AC operated also.

(3) Although the speaker hums badly it seems to be lacking in strength on the low notes. How can this be remedied?

AARON IMMELMAN,
Chicago, Ill.

(1)—The voltage is correct now. The tube only gets 180 volts. The extra voltage is grid bias.

(2)—Connect a high capacity electrolytic condenser across the field winding of the speaker.

(3)—Use a baffle board on the speaker to bring out the low notes. If you have one already, get a larger one.

* * *

I HAVE TWO voltmeters, one a 1,000 ohms per volt and another which is supposed to have a resistance of 50 ohms per volt. When I measure the voltage of a dry cell battery I get different results with the two meters. But when I measure the voltage at the same time with both the meters, they read the same. Please explain the discrepancy.

MILTON JONES,
Covington, Ky.

(1)—The difference is due to the resistance in the battery. The high resistance meter alone measures nearly the full voltage of the battery. The other meter measures a lower value. When the two are connected across the battery at the same time, both read the same but that reading is lower than either of the other readings. What is read in each case is the difference between the voltage of the battery and the voltage drop in the resistance of the battery. In any case a voltmeter measures the voltage across its own terminals, not the voltage existing somewhere else.

* * *

WHAT IS the meaning of the term lumen? I have seen it used in literature concerning photo-electric cells.

(2)—Is there any relation between the lumen and illumination, and if so, what is it?

JOHN ERICKSON,
Bridgeport, Conn.

(1)—The lumen is the amount of light that radiates from a unit point source of light through each unit of area on a sphere of unit radius described about the light source as center. The unit light

source is the international candle. Hence 4π lumens radiate from the candle.

(2)—The illumination on a surface is the number of lumens that falls on unit area of that surface. The lumen is important in connection with photo-electric cells because the electric current produced by the cell is directly proportional to the number of lumens entering it.

* * *

I WISH TO CONSTRUCT a calibrated intermediate frequency generator using two beating high frequency oscillators. Can this be done so that the calibration of the construction is reliable?

(2)—Which is better, to vary the frequency of one of the oscillators by the main tuning condenser or to vary it by means of a vernier condenser?

ARTHUR BAILEY,
Seattle Wash.

(1)—Yes, it is very often done that way now. Even audio frequency oscillators are made by beating two high frequency oscillators.

(2)—It is better to use a vernier condenser for varying the frequency of one of the high frequency oscillators. If this vernier is provided with a large dial, it can be calibrated in terms of kilocycles over any desired range.

* * *

PLEASE TELL me a simple way of determining the ohms per volt of a voltmeter.

(2)—If the resistance per volt is known how can the meter be changed so that it may be used to measure higher voltages?

FRED TILLMAN,
Dover, Del.

(1)—Connect a milliammeter in series with the voltmeter and with a battery of suitable voltage. Read the voltage on the voltmeter and the current on the milliammeter. Divide the voltage reading by the current reading, reducing the current to amperes. The result is the total resistance of the voltmeter. Divide this by the full scale reading on the voltmeter. The result is the ohms per volt.

(2)—To double the range of the voltmeter put an external resistor equal to the total resistance of the meter in series with it. The total resistance of the meter is the product of the ohms per volt and the full scale reading of the instrument, as is evident from the way the ohms per volt is determined in (1).

* * *

WHAT IS MEANT by amplitude distortion? By frequency distortion? By wave form distortion?

ABRAHAM FEINBERG,
St. Paul, Minn.

(1)—There is no definite meaning of the term amplitude distortion. It could mean either wave form or frequency distortion. Some writers use the term one way, some in the other. By frequency distortion is generally meant that the amplification depends on the frequency so that a curve plotted with amplification against frequency is not a straight line. By wave form distortion is meant that harmonics are introduced into the signal.

* * *

IS IT POSSIBLE to build a circuit with an automatic volume control which will eliminate the effects of fading?

CHARLES MILLER,
Akron, Ohio.

(1)—There is a method of automatically controlling volume which has this effect. It works on the principle of variation of grid bias. As the signal strength increases, the grid bias on a radio frequency tube is increased by the increasing signal, thus reducing the amplification. The scheme holds the audio signal nearly constant but there is a rise and fall in the amount of static and other disturbances.

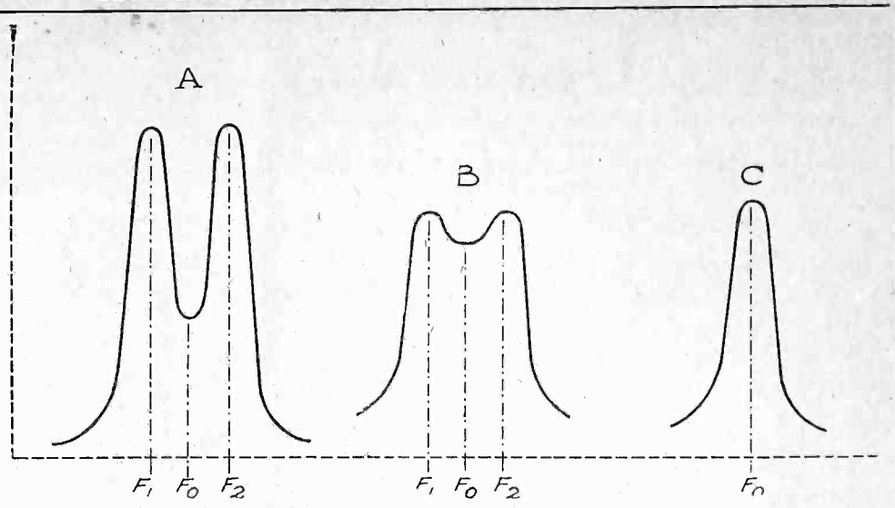

FIG. 733. CURVES ILLUSTRATING THE CHARACTERISTICS OF BAND PASS FILTERS FOR VARIOUS DEGREES OF COUPLING BETWEEN TWO TUNED CIRCUITS CONSTITUTING A BAND PASS FILTER. REQUESTED BY CLINTON OLIVER.

* * *

WHENEVER I plug in an electrical appliance the voltage on my radio set drops about 20 per cent, and at the same time the lights in the house go dim. What causes this?

(2)—Is there any way of remedying this condition?

ALFRED MAESER,
St. Louis, Mo.

(1)—A drop in the voltage of 20 per cent is much more than can be attributed to poor regulation of your power supply line, unless the appliance you plug in draws very much current. But some drop in the voltage always occurs when an additional appliance is plugged in. This is caused by the resistance in the line. There must be some other condition which accounts for the high drop.

(2)—Take it up with the power company.

* * *

WILL YOU PLEASE publish a diagram showing the effect on tuning of band pass filters, and explain the effect of coupling?

(2)—What determines the sharpness of the cut-off frequencies in a filter of this type?

(3)—Can the response characteristic be made symmetrical with respect to the carrier frequency?

CLINTON OLIVER,
Sandusky, Ohio.

(1)—Fig. 733 shows three different curves of a band pass filter. In these curves F1 and F2 are the frequencies at which the signal is maximum and F0 the square root of the product of the other frequencies. Curve A shows the case for closest coupling and Curve C for loose coupling.

(2)—The ratio of the reactance in the coils to the resistance determines the sharpness. The greater this ratio the sharper the curves. This means that the lower the resistance in a coil the sharper the cut-offs and the higher the peaks. This holds for any type of filter, including a plain tuning circuit.

(3)—Yes, the curves can be made symmetric about the carrier frequency on a frequency ratio scale, not on an absolute frequency scale. Symmetry in this respect means that the response is the same at any two frequencies differing by the same percentage from the carrier frequency.

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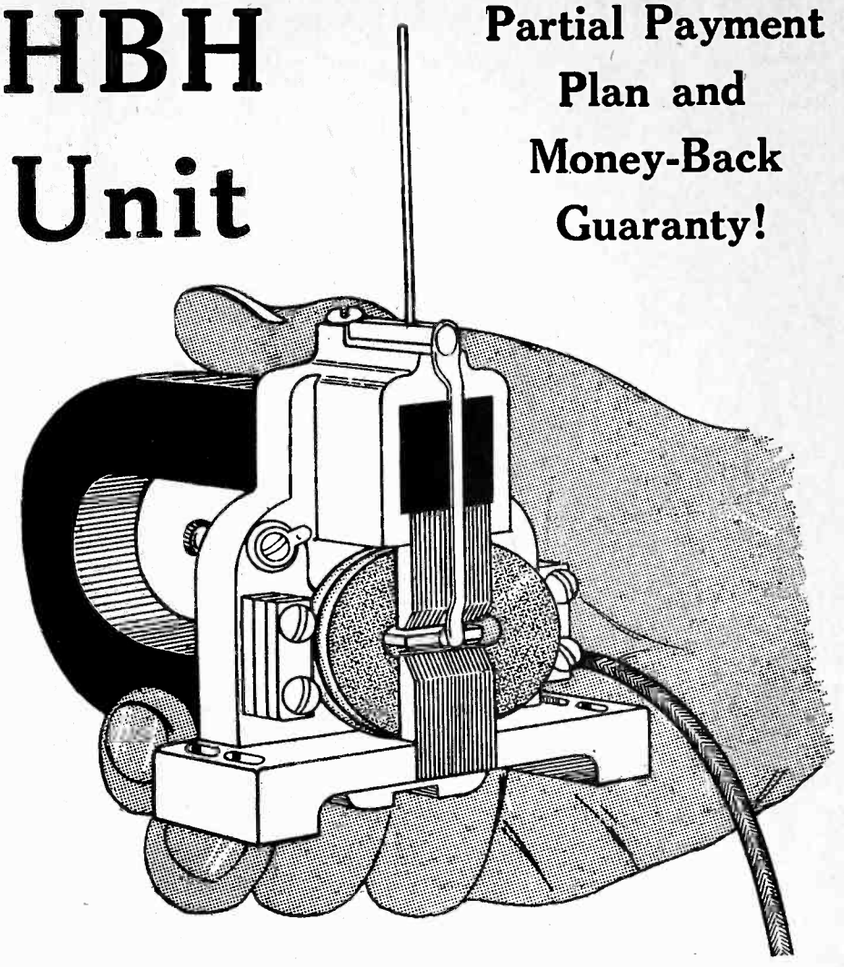

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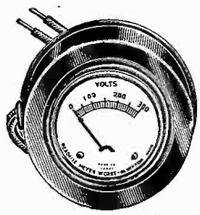

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WHAT RADIO COMPANIONSHIP DO YOU ENJOY?

ARE you meeting weekly the best minds of radio? Do you keep abreast of all the new circuits, the intimate details on perfecting existing sets, and get the inside track on sensitivity, distance reception, tonal quality, and how to achieve them? Do you keep fully abreast of the news of radio, technical and non-technical? If not, here is your chance to enjoy the writings of Dr. Lee De Forest, McMurdo Silver, J. E. Anderson, Herman Bernard and a host of other radio engineers who contribute their knowledge to you through the medium of Radio World, the first and only illustrated national radio weekly.

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☐ 0-6 Voltmeter D.C.
☐ 0-50 Voltmeter D.C.
☐ 6- Volt Charge Tester D.C.
☐ 0-10 Amperes D.C.
☐ 0-25 Milliamperes D.C.
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☐ 0-100 Milliamperes D.C.
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Put a cross in the square next to the meter you desire, and return this slip with one dollar, whereupon we will send you Radio World by mail each week for ten weeks. Present mail subscribers may renew their subscription under this remarkably generous offer by putting a cross in this square. ☐

15c per copy
$6 per year

RADIO WORLD
145 West 45th St., New York City

Published Weekly

Complete Kit of Parts for the Four-Tube

Screen Grid Universal

As Specified by Herman Bernard

What You Get L1, L2—One Screen Grid two-winding RF transformer, with center-tapped secondary; Model 5RF for .0005 mfd. L3, L4—One Screen Grid high impedance interstage coupler, with center-tapped primary; Model 5TP for .0005 mfd. C1—One .00025 mfd. Aerovox grid condenser, with clips. C2, C3—Two Hammarlund Midline .0005 mfd. tuning condensers. C4—One Hammarlund junior condenser; Cat. No. MC11 (50 mmfd.). R1—One Lynch metallized grid leak, 2 meg. R2—One No. 622 Amperite, with mount. R3, R4, R5—Three No. 1A Amperites with three mounts. Rh—One 50-ohm rheostat. T1, T2—Two National new audio transformers. SW—One filament switch. PL—One pilot light bracket with lamp. Two dials with two dial pointers. Two knobs. Four binding posts (Ant., Gnd., Speaker plus, Speaker minus). One 10x20-inch aluminum self-bracketing subpanel, with sockets affixed, and including hardware and insulating washers. One 7x21-inch drilled Bakelite front panel. One nine-lead battery cable. One Peewee clip.

$35.00 NET

Blueprint Free With Each Kit Order

CUSTOM SET BUILDERS SUPPLY CO.
57 Dey Street, New York City
Tel. Barclay 8659 Corner Greenwich Street

SCREEN GRID COILS
for the
4-tube SG Universal

Antenna coil, Model RF5 for .0005 mfd..... $1.00
Antenna coil, Model RF3 for .00035 mfd..... 1.25
Coupler, Model TP5, for .0005 mfd. 2.00
Coupler, Model TP3, for .00035 mfd..... 2.25

SCREEN GRID COIL CO.
143 West 45th Street
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Immediate Delivery and 10-Day Money-Back Guarantee

KELLY TUBES
Prescribed for the
Screen Grid Universal

One screen grid 422..... $3.50
Two 410A at $1.00 each..... 2.00
One 412A (for 135 volts)..... 2.00
or One 471A (for 180 volts)..... 2.00
Send $7.50 for set of four tubes for this receiver. Specify whether power tube wanted is 412A or 471A

KELLY TUBE COMPANY
57 Dey Street New York City
10-Day Money-Back Guarantee

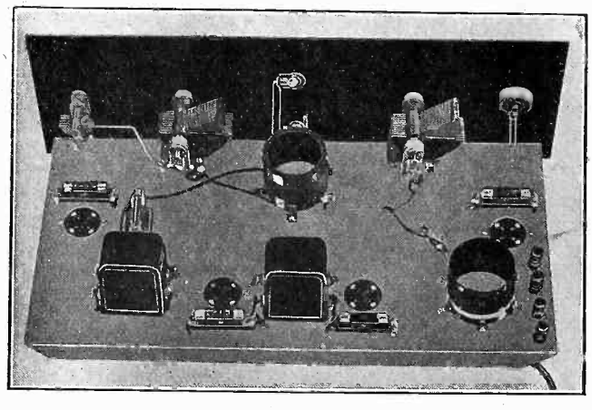
Front Panel and Subpanel
for the
Screen Grid Universal

Bakelite front panel alone, drilled....$2.35
Drilled aluminum subpanel alone, with self-bracketing feature, built-in sockets, extra washers and hardware 3.00
Both front and subpanel together.... 5.00

GUARANTY RADIO GOODS CO.
145 West 45th Street, New York City
(Just East of Broadway)

Build the New

SCREEN GRID UNIVERSAL!



Unusual Results on Four Tubes!

HOW much can one achieve on only four tubes? The new Screen Grid Universal is the answer. It meets all the requirements of the wavelength reallocation, brings in distant stations distinctly, affords exceptional tone, and is easy to build. You'll be surprised at the results. Your friends, too, will admire your receiver. You can sit them down in your parlor and give them loudspeaker reception of distant stations they never heard of—100-watt stations, too!

The screen grid tube is used as a radio frequency amplifier in a new and most efficient manner. Correct circuit design and co-ordinated parts make this circuit outstanding. Build it now!

Very Selective, Yet Lots of Volume!

Two dials tune in the entire wavelength band, using either .0005 mfd. or .00035 mfd. tuning condensers. The circuit affords all the selectivity you need, separates stations excellently and without "background reception," and despite this fine selectivity, affords more than enough volume, so that you must tone it down with the volume control, even on far-distant stations!

The screen grid RF tube is followed by two -01A tubes, while the output tube may be a —12A or —71A power tube, depending on whether you have 135 volts or 180 volts maximum at your disposal.

Screen grid coils especially designed for this receiver permit you to obtain any desired degree of selectivity, but always with a high level of reproduced sound. The primary of the interstage coupler is tuned, while the secondary doubles the voltage by step-up ratio.

The circuit is stable, easy to build, easy to tune. Build it from the official blueprint and the theoretical expression and constructional details in the December 1st, 8th and 15th issues. This blueprint was made directly from the laboratory model of this receiver as constructed by Herman Bernard, the designer. It is a remarkable blueprint, because the wiring that is done on top of the subpanel is shown just as you want it, in the actual manner of its appearance. Also, the wiring underneath the subpanel is shown as it actually appears. Hence there are two separate, clear life-sized views on one sheet, not just one view, made to appear "transparent."

When you turn the subpanel upside down for underneath wiring you don't have to imagine the direction the leads take. Nothing is left to the imagination.

RADIO WORLD, 145 W. 45th St., New York City
(Just East of Broadway)

Enclosed please find $1.60 for which send me at once a blueprint of the 4-tube Screen Grid Universal Receiver, as designed by Herman Bernard.

45c extra for Dec. 1st, 8th, 15th issues of Radio World.

Name.....

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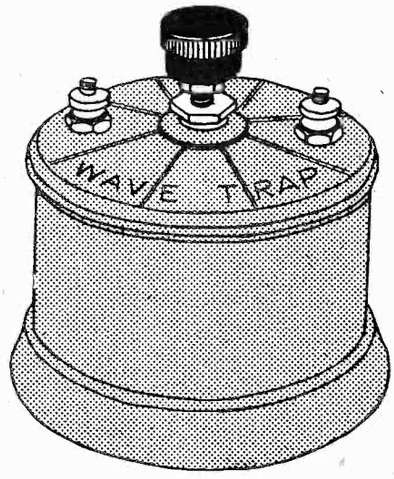
City..... State.....

Reallocation Requires Greater Selectivity



Use a Wave Trap. Spend $1.50 to get clear reception.

How to hook up wave trap: disconnect aerial lead from set. Connect aerial to either post of the trap, other trap post to "Ant." post of set. Turn trap knob until interference disappears. Each different wave requires a different adjustment.

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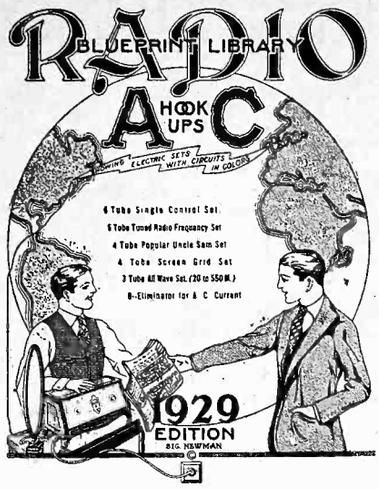
RADIO WORLD
145 WEST 45TH ST., N. Y. CITY



Fourteen Circuits

Each Shown in Colored Picture Diagram, Colored Schematic Diagram and Front Panel Layout

Get This FREE Book!

Complete AC electric receivers, with B eliminators included, also AC receivers without B eliminators, also battery operated models, all easy-to-build circuits, using your own parts.

Colors Prevent Error

Red lines are used in all the diagrams to denote filament leads, light blue lines for grid connections, green lines for plate leads and heavy and light black lines for the rest. You can't make a mistake if you let the colors be your guide.

The Radio Blueprint Library of AC and Battery Hookups, one volume, in FOUR COLORS, is a veritable encyclopedia of tested DX hookups, with 45 illustrations of fourteen different circuits, and a textual explanation of each circuit. Besides, the booklet contains the Story of Radio, lists of parts for all fourteen circuits, and a Station Log Chart on which to record the stations you receive and the dial settings.

This is the very volume you've been wanting for a long time, and you can get a copy of the latest edition (1929), just off the press.

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Gentlemen: Enclosed please find $1.00 for which please send me Radio World each week for eight weeks (regular price, $1.20) and besides send me a FREE copy of the 1929 edition of The Radio Blueprint Library of AC and Battery Hookups.

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Note: Present mail subscribers may take advantage of this offer by putting a cross in this square. ☐ Your subscription will be extended eight weeks.

Blueprint of the

AC4

Price $1.00

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SPEAKERELAY

Cat. No. 121

$2

For connecting two speakers by turn of knob so that at No. 1, left, you operate one speaker alone; at No. 2 you operate both speakers together; at No. 1, right, you operate the other speaker alone. Excellent for store demonstrations or home use. Earphones may be substituted for one speaker.

Cat. 1234 for connecting 4 speakers, one to play at a time.....$2.50

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PARTS FOR THE AC 4

Complete Kit of Parts for the AC4, less B eliminator $36.75
Complete Kit of Parts for AC4, with National B eliminator (180 v.) including 280 tube $54.75
Complete Kit of Parts for AC4, with National B eliminator, 280 tube, cabinet, three 227 tubes, one 171A tube and Table Model Polo Speaker (nothing else to buy) $75.00

GUARANTY RADIO GOODS CO.
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Front and Subpanel for the

AC4

Front panel, drilled for National Drum Dial, volume control switch, and for "dummy".$2.35

Subpanel, 6x19", cut milk ladel shape, to permit room for B eliminator; 4 sockets built into subpanel; other holes drilled.....$3.65

SPECIAL: We carry National Velvet B (type 3580) in stock, also 280 tube. Get our prices on these. Blueprint for AC4.....$1.00

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COILS FOR THE NEW AC 4

Two AC5 (for .0005 mfd.) @ $1.50 each....$3.00
Two AC3 (for .00035 mfd.) @ $1.75 each.... 3.50

SCREEN GRID COIL CO.
143 West 45th Street
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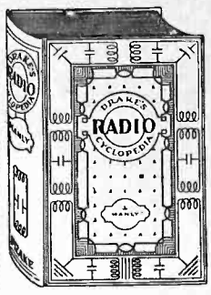
YOU *MUST* GET THIS BOOK!



BOOK IS 2½" THICK, WEIGHS 3¾ LBS., 1,025 ILLUSTRATIONS.

DRAKE'S RADIO CYCLOPEDIA
(New Edition)

has been developed to answer the questions of service men, custom set builders and home constructors, of experimenters, students, salesmen and operators of receiving equipment and to allow all these to have instant access to the information they want. The author, Harold P. Manly, has collected and translated into plain English the material formerly obtainable only from dozens of scattered sources.

Each rule, fact, method, plan, layout and diagram is instantly picked out and separated from everything else by placing all subjects in alphabetical order with cross references for every imaginable name under which the information might be classed.

This alphabetical arrangement lets the experienced worker refer directly to the one thing in which he is interested at the moment without hunting through non-essentials. The needs of the beginner are cared for.

The important articles deal primarily with receivers and reception. They do not stop with the electrical end, but go also into the mechanics of construction. Every new thing in radio is covered in detail.

1,680 Alphabetical Headings from A-battery to Zero Beat
1025 Illustrations, Diagrams, Layouts and Graphs
920 Pages, Each 6 by 9 inches
240 Combinations for Receiver Layouts

OF THE PRINCIPAL ARTICLES

159 concern service men, 129 help the set builder, 162 help the experimenter, 155 interest the student, 75 assist in sales work, 73 interest set owners.

Radio World: "The most suitable volume for those who want the facts stripped as far as possible of intricacies. Useful addition to any library."

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Gentlemen: Please mail me at once the new (second) edition of "Drake's Radio Cyclopedia," by Harold P. Manly, just published, with all the latest technical information in it. I will pay the postman $6.00 plus a few cents extra for postage. If I am not delighted, I may return the book in five days and you will promptly refund my purchase money.

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Cash in on This Offer *Now!*

ONE full year's subscription for any TWO of the following magazines given to you—**RADIO NEWS** or **SCIENCE AND INVENTION** or **RADIO** (San Francisco) or **BOYS' LIFE.**

Select any TWO of these four publications, each of which will be sent to you (at only one address, however) each month for twelve months— in other words, 24 issues—if you will send in now your subscription for **RADIO WORLD** for two years (104 numbers) at $10.00. RADIO WORLD'S subscription price for one year is $6.00, so you gain the extra 2 dollars by taking advantage of the liberal offer for two-year subscriptions; and, besides, you get a subscription for each of the TWO other magazines selected from the enumerated list, making a total of 128 numbers for $10.00.

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If you want one of each, put a cross in a square next to the name of each of the two other magazines. If you want a two-year subscription for ONE of the above magazines, with the two-year subscription for RADIO WORLD (same grand total of 128 numbers), put two crosses before the name of one magazine.

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COMPLETE KIT OF PARTS for the New, Highly Selective

SCREEN GRID DIAMOND

(Four-Tube Battery Model)

Exactly as Specified by Herman Bernard

$29.00 Net

WHAT YOU GET:

L1L2—Antenna coil (AC5).
L2L3L4—Screen grid tuner (SGT5).
C1—Aerovox .0005 fixed.
C2—Hammarlund .0005 mfd. Midline.
C3, C4—Two Aerovox .006 mfd.
C5—Hammarlund .0005 mfd. Midline.
C6—Aerovox .00025 mfd. with clips.
C7—Aerovox .0005 mfd. fixed.
A1—622 Amperite with mount.
A2, A3, A4—Three 1A Amperites, three mounts.
R1—50 ohm Frost rheostat.
R2—5 meg. Lynch metallized leak.
T1, T2—Two National A100 audios.
Ant., Gnd., Sp. –, Sp. + posts.
P1—Jewel window and lamp.
Sw—A battery switch.
7 x 21 inch front panel.
10 x 20 inch subpanel, self-bracketing, with four sockets affixed; subpanel hardware, insulated bushings, washers.
Two dials with pointers.
Two knobs.
One roll stranded Braidite.
Hammarlund 70 mmfd. Equalizer.

Guaranty Radio Goods Co.
145 West 45th Street
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BLUEPRINT of the New, Highly Selective Screen Grid DIAMOND

(Four Tubes)

$1.00

RADIO WORLD

145 West 45th Street New York City
Few Doors East of Broadway

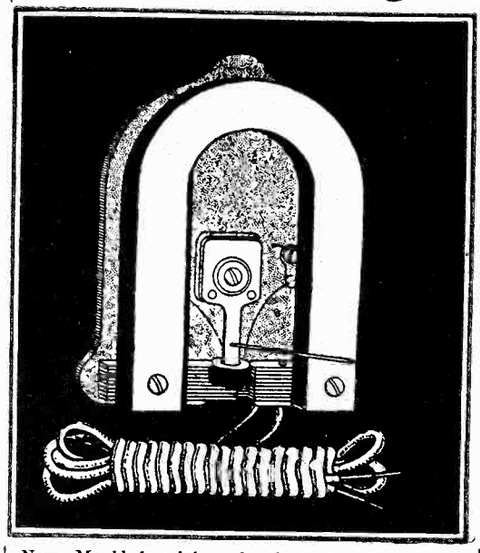
RADIO WORLD, published every Wednesday, dated Saturday of same week, from publication office, Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y., just east of Broadway. Roland Burke Hennessy, President; M. B. Hennessy, Vice-President; Herman Bernard, Secretary. Roland Burke Hennessy, Editor; Herman Bernard, Managing Editor; J. E. Anderson, Technical Editor; Anthony Sodaro, Art Editor

New Powertone

Cone or Cloth Diaphragm Speaker

Unit

With 5-foot cord, less bracket, apex, chuck and nut. Cat. PA. **$3.00**



New Moulded tri-foot bracket, fits Powertone, Polo, B.B.L., Brielle, Paratone and other units Cat. BA.....65c

Apex, Thumbscrew and Chuck. Cat. AA.....10c
(*Note: Cat. AA not sold alone.*)

You Cannot Buy a Better Unit at Anywhere Near This Price!

The 1929 Model Powertone Unit, that drives any cone or similar type speaker, is an extremely sensitive and faithful reproducer. The magnet coil (the black ring under the pin in illustration) is wound to higher impedance than is ordinarily encountered. Volume is greater. The unit has an adjustable armature.

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145 West 45th Street, N. Y. City
(Just East of Broadway)

Please mail me at once C.O.D. (Check off).
☐ One Powertone Unit alone, Cat. PA. @ $3.00.
☐ One Tri-foot Bracket, Cat. BA @ 65c.
☐ One Apex, one Chuck, one Thumbscrew, Cat. AA. @ 10c.

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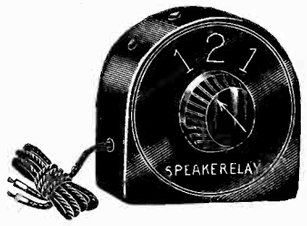
$100.00 WORTH of Pleasure and Convenience for Only $2.00



IF you have two loudspeakers and want a convenient method of playing both at the same time, or one at a time, the Speakerelay gives you that service at the turn of a knob. Simply connect the Speakerelay cord tips to the output (speaker posts) of your receiver, and put the cord tips of one speaker in the first two holes (shown on top in illustration) and the cord tips of the other speaker in the remaining two holes (not shown). Then point the knob to "1" at left to play the speaker whose cords are at left, or point the know to "1" at right to play the other speaker. Or, to play both together, point the knob at "2".

Instead of using two speakers you may use one speaker and one pair of earphones. This is a great asset when tuning in DX, for with earphones you may readily discern the call letters that might not be so plain on the speaker. Also, any weak station may be tuned in with more accurate sharpness with earphones—and remember the speaker may be going all the while!

Another fine advantage is that anybody hard of hearing can listen to any program on the earphones, while the others hear it from the speaker—all simultaneously, remember!

Or you might want to listen in late at night on earphones alone, so as not to disturb anybody. Your set may have no detector listening post. Simply cut out the speaker—by a mere turn of the Speakerelay knob—and adjust the volume control of your receiver until reception is just comfortably loud on earphones.

Get one of these Speakerelays today, at only $2. It is sturdily built in a molded bakelite casing, only 2¾" high. Positive, unerring contact affords dependable results. It offers instantaneous convenience. There is no loss in volume when this device is used.

Members of the trade, service men, salesmen, etc., use the Speakerelay to compare two speakers in a store or in the home.

You can get $100 worth of service out of one of these $2 products
Cat. No. 121 (illustrated).....$2.00

If you desire a Speakerelay that enables comparison of four different speakers so any one may be played at a time, but all connected in the casing, then order Cat. No. 1234.
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We stock the Speakerelays in quantity and sell them singly or in multiple lots, on an immediate delivery basis. We also have them on display at our office, so, if convenient, come in and see them.

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Kelly
RADIO TUBES

LONGER LIFE
BETTER TONE
MORE VOLUME

401A	$1.00
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412A	2.00
471A	2.00
UX499	1.25
426AC	2.00
427AC	3.50
440 (high mu)	1.50
422 (screen grid)	3.50
480	3.50

422 SCREEN GRID

Our 422 stands up.

440 HIGH MU

great for resistance or Impedance audio

KELLY TUBE COMPANY
57 Dey Street, New York City

BUILD A 24-INCH CONE—LOWEST COST FOR FINEST TONE!

NEW POWERTONE UNIT
with 5-ft. cord
Designed Front Sheet
Plain Rear Sheet
Radio Cement
Mounting Bracket
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Nut
Tri-Foot Pedestal
Instruction Sheet
ALL FOR ONLY
$6.00

REMARKABLE GUARANTY!
This 24" Cone Speaker Kit is sent complete, as listed, carefully packed. Order one sent C. O. D.

SEND NO MONEY!
Build the speaker. If not overjoyed at results, return the built-up speaker in five days and get ALL your money back!

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145 WEST 45TH STREET
N. Y. City Just East of Broadway

RADIO WORLD, published every Wednesday, dated Saturday of same week, from publication office, Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y., just east of Broadway. Roland Burke Hennessy, President; M. B. Hennessy, Vice-President; Herman Bernard, Secretary. Roland Burke Hennessy, Editor; Herman Bernard, Managing Editor; J. E. Anderson, Technical Editor; Anthony Sodaro, Art Editor.

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METERS
For Portable or Panel Use

High resistance 0-300 Voltmeter, accurate to 1%. Measures any DC voltage to 300, including B eliminators. Provided with 30" cord, with luxurious jack tips and hanger. Meter full nickel de luxe finish. No. 346F. **$4.50**
No. 347F, same as above, but 0-500 volts, $6.00

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(Panel meters take 2-5/64" hole)

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(See No. 348 under "Pocket and Portable Voltmeters.")

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No. 316—For reading DC voltages, 0-16 volts, 1.00
No. 326—For reading DC voltages, 0-6 volts, 1.00
No. 337—For reading DC voltages, 0-50 volts, 1.00
No. 339—For reading DC voltages, 0-100 volts, 2.25
No. 342—For reading DC voltages, 0-150 volts, 2.25
No. 340—For reading DC voltages, double reading, 1-8 volts, 0-100 volts..... 1.50

VOLTAMMETERS

No. 18—For testing amperage of dry cell A batteries and voltage of dry or storage A batteries, double reading, 0-8 volts, and 0-40 amperes DC.....$1.25
No. 35—For testing amperage of dry cell A batteries and voltage of B batteries (not B eliminators); double reading, 0-50 volts, 0-40 amperes DC 1.50

PANEL MILLIAMMETERS

No. 311—For reading 0-10 milliamperes DC..$1.75
No. 325—For reading 0-25 milliamperes DC.. 1.00
No. 350—For reading 0-50 milliamperes DC.. 1.00
No. 390—For reading 0-100 milliamperes DC.. 1.00
No. 399—For reading 0-300 milliamperes DC.. 1.00
No. 394—For reading 0-400 milliamperes DC.. 1.00

VOLTAGE REGULATOR

No. 218—For preventing excess voltage on the filament and cathode of AC tubes, by compensating for excess line voltage.....$5.00

POCKET AMMETER

No. 1—For testing dry cells, 0-50 ampere DC scale pocket meter.....$ .75

6-VOLT A BATTERY CHARGE TESTER

No. 23—For showing when 6-volt A battery needs charging and when to stop charging; shows condition of battery at all times.....$1.00

PANEL AMMETER

No. 338—For reading amperage, 0-10 amperes DC $1.00

Immediate Shipment

GUARANTY RADIO GOODS CO.,
145 West 45th Street, New York City.
Just East of Broadway

Send me the following individual meters (quantity in square):

☐ Cat. No. ☐ Cat. No. ☐ Cat. No.
☐ Cat. No. ☐ Cat. No. ☐ Cat. No.

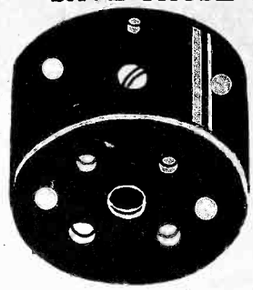
NAME .....

ADDRESS .....

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

TEN-DAY MONEY-BACK ABSOLUTE GUARANTY!

SAVE THOSE TUBES!

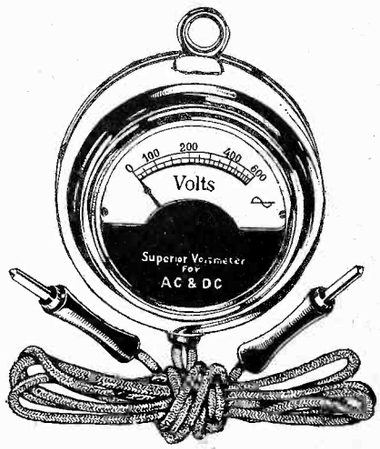


Many persons have sets with Navy type sockets—the kind with the collar on and the bayonet hinge for the pin on the base of the tube. If you put a UX 199 tube in a Navy type socket a short may blow out all the tubes. Play safe and have fine contact besides. Use an adapter that fits UX 199 into Navy sockets (Cat. No. UX). Price 20 cents each.

GUARANTY RADIO GOODS CO.
145 West 45th St., N. Y. City

BLUEPRINT
FOR
Bernard's Economy 3
Price $1.00
PHILIP COHEN
(Suite 1214) 145 WEST 45th ST.
NEW YORK CITY

O-600 V. AC and DC
High Resistance Meter
Same Meter Reads Both
Accurate to 1 per cent.



The O-600 volt AC and DC meter (Cat. No. 600), with 3-ft. cord, de luxe tips and hanger $7.00.

THE output voltages of all B eliminators, the voltages of all B batteries, as well as the house current line voltage, whether AC or DC, and the voltage across power transformer secondaries, can be accurately measured by this meter. The full scale is 0-600 volts, and this same meter measures both AC and DC. Since it is a high resistance meter, of extraordinary range, and accurate to 1% plus or minus, it is advisable to get this meter for your testing purposes, since it is like two meters in one—AC and DC. You can find trouble more quickly. Without it you can't tell if a power transformer secondary is delivering voltage. 10-day money-back guaranty.

GUARANTY RADIO GOODS CO.,
145 West 45th Street, N. Y. City.
(Just East of Broadway)

Please ship at once one 0-600 volts AC and DC high resistance voltmeter, accurate to 1% plus or minus (Cat. No. 600); meter equipped with 3-ft. cord, moulded tip receptacles, tips and hanger.
[Put cross in proper square below.]

☐ $7.00 enclosed

☐ I will pay postman $7.00 plus few cents extra for postage.

Name .....

Address .....

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

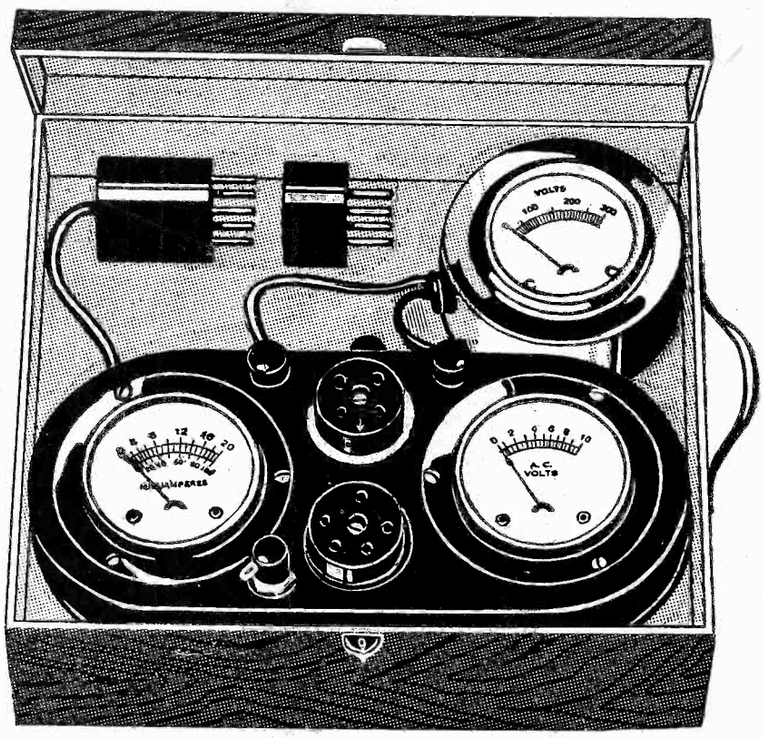
De Luxe Carrying Case FREE

With Each Jiffy Tester Combination!

This Meter Outfit Makes Thirteen Vital Tests in Only 4½ Minutes!

INSTRUCTION SHEET GIVES FULL DETAILS OF THESE THIRTEEN TESTS

The Jiffy Tester in its Case is a Testing Laboratory All by Itself. Leave the meters in the case. Simply lift out the plug, attaching the four-prong adapter, if testing a four-prong tube. Put plug in socket of receiver to be tested; put tube in Tester socket. The B voltmeter automatically connects to the proper points when its tipped leads are inserted in the two binding posts at rear.



This housed Jiffy Tester, with high resistance voltmeter for measuring B voltages, including those of eliminators, is a service kit of the highest value. The case is furnished in a de luxe finish, with handle. A patented snaplock makes it impossible for the lid to open accidentally. The Tester and high resistance meter fit so snugly in place that they will not jar in transportation. A 5-day money-back guaranty attaches to each sale.

Jiffy Tester Combination, shown one-third size, includes 0-10 voltmeter reading AC or DC (same meter reads both); 0-20, 0-100 milliammeter, with change-over switch; cord and plug with 4-prong adapter; 0-300 high resistance voltmeter. Price $13.50. Complete instruction booklet and de luxe carrying case FREE with each order.

Jiffy Tester a Scientific Trouble Shooter

Every service man, custom set builder, home experimenter, student or teacher needs one of these Jiffy Tester Combinations. Amply accurate for this class of work. You will be well satisfied with assured 5% plus or minus accuracy. Jiffy Tube and Set Tester, consisting of 0-20, 0-100 combination milliammeter, 0-10 AC and DC voltmeter and 0-300 high resistance voltmeter. De luxe carrying case and instruction booklet FREE with each order. Jiffy Tester Combination A. **$13.50**

The 0-300 high resistance voltmeter in "Jiffy Tester Combination A" is accurate to 5% plus or minus, so that at maximum reading it is not more than 15 volts off. These desiring a more accurate 0-300 high resistance meter, never more than 3 volts off, at maximum reading, should order "Jiffy Tester Combination B," which has a 0-300 meter accurate to 1%, at a cost of $1 extra. Order "Jiffy Tester Combination B." De luxe carrying case and instruction booklet FREE. **$14.50**

Here Are the Thirteen Vital Tests!

(1) to measure the filament voltage, up to 10 volts, of AC and DC tubes;

(2) to measure the plate current of any one tube, including any power tube, from less than 1 milliampere up to 100 milliamperes;

(3) to measure the total plate current of a receiver or amplifier, up to 100 milliamperes. (Hardly any set draws more);

(4) to measure the B voltage applied to the plate of tube; the voltage across B batteries or B eliminators, up to 300 volts;

(5) to determine the condition of a tube, by use of the grid bias switch;

(6) to measure any tube's electronic emission;

(7) to regulate AC line, with the aid of a power rheostat, using a 27 tube as guide;

(8) to test continuity of resistors, windings of chokes, transformers and circuits generally;

(9) to find shorts in bypass and other condensers, as well as in inductances, resistors and circuits generally;

(10) to read grid bias voltages, including those obtained through drops in resistors;

(11) to determine the presence of distortion and overloading;

(12) to test for correct bias;

(13) to determine starting and stopping of oscillation.

[*Note—Instruction booklet fully informs you how to make each and every one of these tests in a jiffy.*]

Note All That You Get!

For $13.50 you receive:
(1) One Two-in-One 0 to 10 voltmeter for AC and DC. Same meter reads both. Scale especially legible at 1½ to 7½ volts. This meter reads the AC and DC filament voltages.
(2) One DOUBLE reading DC milliammeter, 0 to 20 and 0 to 100 milliamperes, with changeover switch. This reads plate current, which is always DC in all sets.
(3) One 0-300 volts high resistance voltmeter, No. 346, with tipped 30" cord to measure B voltages.
(4) One 5-prong plug with 30" cord for AC detector tubes, etc., and one 4-prong adapter for other tubes.
(5) One grid switch to change bias.
(6) One 5-prong socket.
(7) One 4-prong socket.
(8) Two binding posts.
(9) One handsome moire metal case.
(10) One instruction sheet.
(11) One de luxe carrying case.

If 0-500 volt 5% accuracy high resistance meter is preferred to 0-300 volts, add $1.00, and order Combination C at $14.50.
If 0-500 volt 1% accuracy high resistance meter is preferred to 5% accuracy 0-500 voltmeter, add $2.00, and order Combination D at $15.50.
[*Note—A pair of adapters for UV199 tubes, Cat. No. 999, at $1.00 extra. These are not sold except with Jiffy Tester Combination.*]

GUARANTY RADIO GOODS CO.,
145 West 45th Street, New York City.
(Just East of Broadway.)

Please ship at once your Jiffy Tester Combination for which I will pay postman advertised prices, but no shipping charges. (Check off below.)

- ☐ One Jiffy Tester Combination A (0-10 v., 0-20, 0-100 m. a., 0-300 v., carrying case, instruction booklet FREE.....Price $13.50
- ☐ One Jiffy Tester Combination B (same as above, but with 0-300 voltmeter accurate to 1%). Price.....$14.50
- ☐ One Jiffy Tester Combination C (same as A, except 0-500 voltmeter replaces 0-300). Price.....$14.50
- ☐ One Jiffy Tester Combination D (same as C, except 0-500 voltmeter is accurate to 1%). Price.....$15.50
- ☐ Set of 199 adapters. Price..... $1.00

NAME.....

ADDRESS.....

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

5-DAY MONEY-BACK GUARANTY