

LIST OF STATIONS BY CALL LETTERS!

April 6th, 1929

15 Cents

RADIO

REG. U.S. PAT. OFF.

WORLD

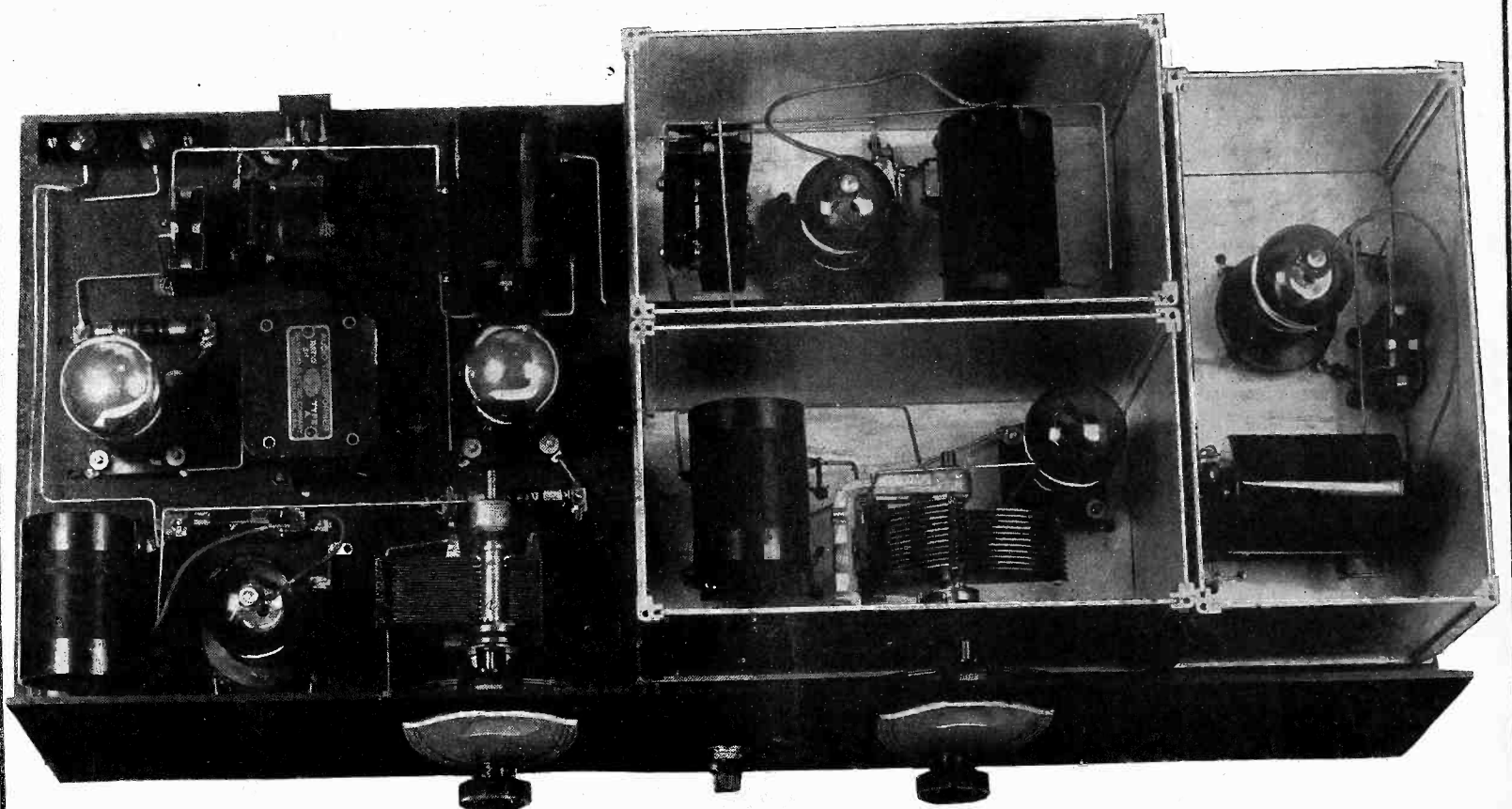
The First and Only National Radio Weekly
367th Consecutive Issue—Eighth Year

Interference Cures
By Standards Bureau

Moore-Daniels
As AC Receiver

McMurdo Silver On
New AC SG Tube

LACAULT'S LAST CIRCUIT—RE 29!



"The most sensitive receiver I ever developed," said R. E. Lacault, speaking of the RE 29, illustrated here. See Lacault's article on pages 12 and 13.

Saltzman
Appointed to
Federal Board

Boys to Sail
'Round World
In Radio Test!

Crooks Prey
On Listeners
in Sales Talks

RCA Television
Being Sent in
Regular Tests!

Bureau of Standards Report on Interference

Confirms



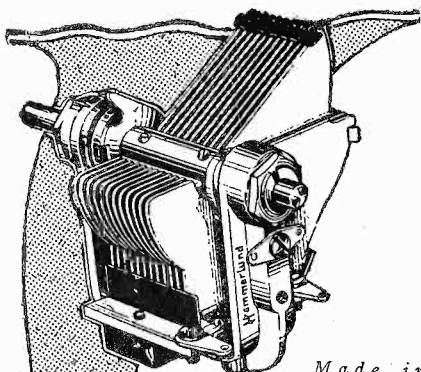
Design

IN this issue of "Radio World" there appears the Bureau of Standards report on Electrical Interference. Trutone executives, after careful reading, fully concur with the statements made by the Government investigators and further state:

"Trutone engineers after years of experimentation produced the Si-Len-Ser line noise eliminator, a true choke coil and filter condenser device."

The tremendous success of the Si-Len-Ser is due to its practical working efficiency and the fact that where filtering devices are imperative radio dealers, fans and listeners prefer to buy a ready-made, efficient device, that can be instantly installed without tools or trouble, than to try to build one.

Si-Len-Sers are sold by all good dealers and stocked by the country's best jobbers. Dealers and jobbers should write to the TRUTONE RADIO SALES CO., 114-116 Worth Street, New York City, for details of a marvelous selling proposition. Radio fans, custom-set builders and others may buy the Si-Len-Ser from all good dealers, list price, \$12.50. If your dealer does not stock it, it will be sent you direct on receipt of price.



Made in all standard capacities

**Good Receivers
Deserve
Good Parts**

Logically the
Designer of the

**MOORE-DANIELS
RECEIVER**

Uses the

HAMMARLUND

Midline Condenser
and Drum Dial

Hammarlund Condensers, Drum Dials,
Space-Wound Coils, R. F. Chokes and
Equalizers make any receiver better.

Your dealer sells Hammarlund Parts

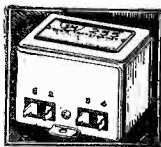
HAMMARLUND MFG. CO.

424-438 W. 33rd St., New York



SM

**Audios—
Positively
Guaranteed
Superior**



The same unchangeable purity and fidelity of tone, which has established S.M. supremacy even more firmly this year than ever before can be built into any receiver or amplifier by using the new S.M. Clough-system audio transformers. Guaranteed absolutely and unconditionally to surpass, in their uniform amplification of all notes from 5,000 down to 40 cycles, any other transformers obtainable on the American market at any price, these unique instruments make use of a principle totally different from anything used in standard transformer construction—built-in resonance to even out the amplification curve in the critical range which ordinary transformers weaken—and a circuit which keeps D.C. plate current entirely out of the transformer winding and thereby avoids the common injurious effect of hysteretic distortion. Amplification obtainable—running as high as 4½ to 1—is far higher than with any standard transformers of comparable tone quality.

255 and 256, for standard use in first and second stage respectively. Each \$6

251 Output Transformer..... \$6

Also a full line of push-pull transformers and chokes.

SILVER-MARSHALL, Inc.

846 West Jackson Blvd., Chicago, U. S. A.

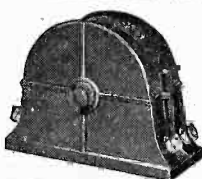
[N. Y. Representatives: F. Edwin Schmitt, Inc., 136 Liberty St., New York, N. Y.]

**Moore-Daniels
Coils-Kits-Parts-Sets**

**Blue Prints \$1.00
MOORE RADIO CO.**

74 Cortlandt St., N.Y.C.

Suite 302

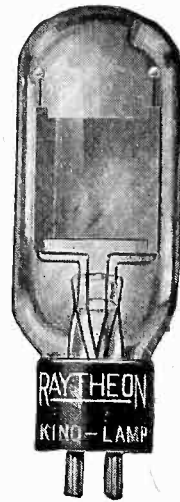


**VICTOREEN
Super Coils**

Write for Free Blueprints of New Victoreen Circuits

Geo. W. Walker Co.
2825 Chester Avenue
Dept. B Cleveland, O.

Two Outstanding Raytheon Television Achievements



Kino-Lamp

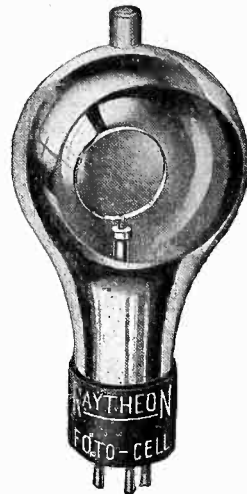


Foto-Cell

Already Raytheon has brought television tubes past the "anything that works" stage to a point where reliability and long life are added to practicality. The Raytheon Kino-Lamp is the long-life television receiving tube—adapted to all systems and made in numerous types.

List Price, \$7.50

RAYTHEON MFG. CO.
CAMBRIDGE, MASS.

Again, in this sending tube, Raytheon has developed plus-service through long experimentation and research. The Foto-Cell comes in either hard-vacuum or gas-filled types, and in two sizes of each. Information and prices upon application.

Write us for further information regarding Raytheon Television Tubes.



Shielded—Filtered
No Motorboating

**"Aero-Call"
SHORT WAVE
CONVERTER**

Factory-Built, Ready to Plug into Your Set.

This amazing instrument now makes it possible for you to reach 'round the world—England, Germany, Holland, Australia, Panama, Java and many foreign stations are some that are tuned in regularly on short wave. Gets stations your regular receiver cannot get. What a thrill it is to plug this into a tube socket on your regular set and instantly be in another world! No change or wiring required. All complete, ready to operate, tubes and coils hidden, no apparatus in sight, except the neat, golden brown, compact metal cabinet in crackle finish. Size, 9x5½x2½ in. The only converter we know of that really works on all sets. Two models—A.C. and D.C. Write for Catalog and literature, or send \$25.00 and name of your dealer.

AERO PRODUCTS INCORPORATED
4611 E. Ravenswood Ave., Dept. 1249, CHICAGO, ILL.

**HAS YOUR SET
WEAK LUNGS?**

Does it squeak instead of singing with a full voice? Probably low voltage is the cause, if A-C operated. You need lower resistance in one or more sections of voltage divider. Try a STANDARD CLAROSTAT across various sections. You'll be surprised. But that's only typical of what CLAROSTATS can do for weak radio lungs!

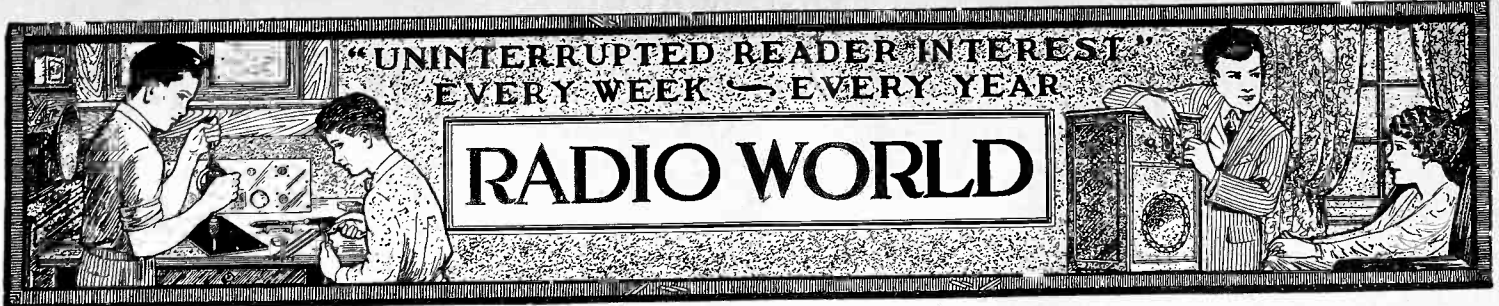
CLAROSTAT MFG. CO., Inc.
291 North 6th Street, Brooklyn, N. Y.

CLAROSTAT

LYNCH

Tubadapta for Better Tone.
Installed in ONE minute. Small cost.

ARTHUR H. LYNCH, INC.
1775 Broadway New York City



Vol. XV, No. 3. Whole No. 367
 April 6th, 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
EIGHTH YEAR

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

2 BOYS IN BOAT TO SAIL 5 YRS. IN RADIO TEST

A new sea radio station, WHDC, has been installed on the fifty-foot sail boat, The Nomad, on which two young adventurers soon will start to make a five-year trip around the world in quest of adventure and education. The boy mariners are Dan C. Blum of Chicago, son of a retired merchant, and Stephens Miranda, of Los Angeles.

In a small radio shack on board the sailing craft, now being fitted out in Seattle, both a short-wave and a long-wave set have been installed. For the antenna installation they have used the only available points of suspension, about fifty feet between the two sailing masts.

Will Rely on Radio

On top of these they have built two spruce top masts, giving the aerial a height of 55 feet at one end and 45 feet at the lead-in end, giving excellent facility for short wave system. By the combination short and long-wave sets the juvenile adventurers will be able to send and receive distress signals, get radio compass bearings and weather reports.

With this equipment, designed by Otto Johnson, the Nomad expedition is assured of a clear, high-pitched 1,000 cycle note when either set is functioning on the ship's motor generator; also a 120 cycle low pitched note, which has proven to carry well at great distance under heavy interference.

Miranda an Amateur

WHDC is not only identified with the Amateur Radio Relay League by virtue of the designer's membership, but will be operated by Miranda, who also is a member. Round-the-world direct communications schedule will be attempted between stations WHDC and W6BRO, of Los Angeles. The transmission experiment is planned to last during the entire cruise of the Nomad.

The Nomad will sail from Seattle to San Francisco, where it will make a week's stop-over before proceeding to Los Angeles. Several weeks will be spent in Los Angeles, where motion picture equipment will be taken aboard with which the boy Nomads will film all the high spots in their world adventures. The Nomad will embark under the auspices of the Adventurers of the World, whose flag the craft will fly.

From North Sea to Home

The itinerary will then take the ship from Panama to the South Seas. From there the Nomad will sail for Australia, the Philippines, China and Japan. Next come Siam, Africa and the Mediterranean sea-ports, finally the North Sea.

Pleasure First With U.S. Listeners

San Francisco.

Europeans take the radio seriously; Americans do not.

Gladys M. Petch, pioneer woman broadcaster of Europe, expressed this opinion recently over KGO, the General Electric station at Oakland, California.

Born in London of English and Irish parents, Mrs. Petch has lived in Oslo, Norway, for four years.

"Norwegians," she explained, in a still-English accent, "are most frightfully keen about anything that will improve their minds. For four years I taught English over the radio in Norway, and had a most enthusiastic audience.

"In other countries of Europe," declared Mrs. Petch, "people are equally anxious to learn by means of the radio. Shakespearean plays are very popular over the air, as well as on the stage, and the very best music is in great demand.

"Here in America the radio is thought of more as a medium of pleasure. But I do think that the standard of programs in this country is being raised. I can notice the improvement that has taken place since I visited the United States last year."

WTIC ON MOUNT TO USE 50 KW

HARTFORD.

WTIC, the station of the Traveler's Insurance Company of this city, will go on the air with its new 50-kilowatt transmitter. The plant is located on top of Avon Mountain at an elevation of 700 feet above sea level. This location was selected as the best after a series of tests, in which ninety different places were tested for interference, terrain and power absorption.

Three 200 foot towers support the antenna, which has been constructed so that most of the power will be radiated westward. The towers are painted with orange and black with white stripes separating the colors. This coloring will be a guide to aviators, and the towers will be illuminated at night so that aviators will be able to see the towers at all times.

The exterior portion of the plant, which is finished, covers an area of 75x45 square feet. The building is shielded with copper wire screening, which is electrically connected with all structural steel, plumbing and the specially constructed grounds.

The studios will be in the city where the programs will originate.

GEN. SALTZMAN APPOINTED TO FEDERAL BOARD

Washington.

President Hoover has appointed Major General Charles McK. Saltzman, former Chief of the Army Signal Corps, as a member of the Federal Radio Commission to represent the Fourth or Middle Western Zone. Maj. Gen. Saltzman succeeds Sam Pickard, who resigned February 1st to join the Columbia Broadcasting Company as vice-president.

General Saltzman was born in Iowa. He served in the Signal Corps during the war and became the chief of this division of the Army when Major General Squires retired from active service.

Former President Coolidge had nominated Prof. C. M. Jansky, of Minneapolis, to succeed Mr. Pickard, but the Senate failed to confirm the nomination.

Hoover Keeps Close Tabs

President Hoover was debating whom to appoint to succeed O. H. Caldwell, who resigned from the Commission on February 23rd. Arthur Bacheller was nominated by former President Coolidge to succeed Mr. Caldwell, but the Senate failed to confirm the nomination.

One of those considered to fill the vacancy caused by the resignation of Mr. Caldwell was Captain David W. Dodd of the Navy. Capt. Dodd, who is eligible for retirement, has been chief of the Division of Communications of the Navy. His residence is at Newport, R. I.

In order that Captain Dodd may receive the appointment and the confirmation of the Senate he must qualify as a Democrat. The law creating the Radio Commission provides that no more than three of the members shall be members of the same political party. Three of the present Commissioners are Republicans and only one is a Democrat.

Dr. J. H. Bellinger, chief of the radio laboratory of the Bureau of Standards, who had been acting chief engineer of the Radio Commission, returned to the Bureau of Standards. He had been loaned temporarily by the Bureau of Standards to help the Commission with the frequency allocation problem.

Captain Guy Hill, an Army engineer temporarily in charge of broadcasting for the Commission, it is said, will succeed Dr. Dellinger as chief engineer.

Hoover Much Interested

President Hoover has had much experience himself as radio administrator, and therefore is especially interested in the subject, and has given considerable time to weighing eligibles for Board positions.

RAYTHEON HAS TUBE LICENSE; FIRST BY RCA

The Radio Corporation of America has licensed the Raytheon Manufacturing Company, of Cambridge, Mass., to make and sell tubes under the patents held and the processes developed by the RCA and its associates, General James G. Harbord, president of RCA, announced.

General Harbord declared that the arrangement would give additional stabilizing force to the radio industry.

"The leading electrical interests of the country associated with the Radio Corporation of America," General Harbord said, "have spent millions of dollars in research and development to perfect the modern radio tube, which is the heart of the present-day radio set. The extraordinary efficiency of the modern set rests largely upon the developments given to the world through these electrical laboratories.

Extension of Policy

"Approximately thirty of the leading manufacturers of radio receiving sets now share the licensing policy of the Radio Corporation of America. In granting this license to Raytheon, the Board of Directors extends a policy that affects the interests of the great listening public as well as the industry as a whole."

Lawrence K. Marshall, president of the Raytheon Manufacturing Company, said:

"The new license signed between the Raytheon Manufacturing Company and the Radio Corporation of America is a decided step toward stabilization in the radio tube industry.

Raytheon First Licensee

"Raytheon, through extensive laboratory research, pioneered in the developments that have resulted in electric power sets and made valuable contributions in producing effective tubes for B battery elimination. Recent Raytheon improvements are another contribution to the tube's part in better reception.

"It is fitting that the Raytheon Company, which has rendered so much engineering service to the industry, should be the first to take a license from Radio Corporation of America, which will insure a close cooperation between the laboratories and should result in benefit to the radio industry in general."

'And So to Bed at 10' Not the Rule Any More

"People used to go to bed at 10 P. M. because there was nothing else to do after then," said C. A. Earl, president of the Charles Freshman Company.

"Recently a representative visited every home in a group of ten apartment houses in the center of a residential section of New York City between 10:30 and 11:00 P. M. to find out what percentage of the families were awake at that time and to what programs they were listening. He knocked on 424 doors during the course of his survey and found that 200 families were awake."

The investigator, Joseph M. Kohler, reported:

"Of two hundred families who were awake, one hundred talked to your investigator, and the rest shut their doors in his face due no doubt to the fact that they weren't dressed to receive visitors."

Oil Prospectors Get Wave Lenses

Washington.

Twelve licenses for radio stations to be used in explorations for oil and in communication between geophysical exploration parties have been granted by the Federal Radio Commission to the Interstate Geophysical Explorations Company of Texas, Louisiana, and New Mexico.

Under the terms of the licenses communication on the frequencies to be assigned for this purpose must be confined to messages and signals concerned with geophysical surveys in the field. The call letters assigned for the twelve licenses are WCS, KRZ, KRW, KRT, KRS, KRR, KPU, KPT, KPL, KPF, and KOZ. All the stations will be of the portable type.

At the hearings on the applications for these licenses representatives of the applicants contended that radio was the only practicable means for communication, as telephone lines cannot be established in the barren oil-field areas.

WGY RELAYS DUTCH STATION

Schenectady, N. Y.

WGY's 50,000-watt transmitter got behind PXI of Huizen, Holland, recently, and as a result everyone tuned to the Schenectady station enjoyed the experience of listening to music and speech from the land of tulips, canals and windmills.

For 36 minutes the signals of the Dutch station were poured into the air by WGY, and listeners found that at times the signal quality was as clear as the studio output of the General Electric station. The strength, as a whole, was on a par with any rebroadcast of a foreign station made by WGY.

For years WGY, through its short wave stations, has been promoting good-will in foreign countries toward the United States. Four years ago WGY first rebroadcast 2LO of London. The English station has been heard many times since then. In 1927 WGY rebroadcast station 2FC of Sydney, Australia.

The announcer at PXI gave his announcements in both English and Dutch and requested reports from distant listeners on the quality of the signal.

PXI operates on 16.88 meters, and the schedule is Monday, Wednesday, Thursday and Friday 8:00 to 11:00 o'clock a. m., E. S. T. WGY will again rebroadcast the station if the signal is received with adequate volume. The signal is picked up at the receiving laboratory of the General Electric Company, several miles from the transmitter of WGY, and in a section of the country comparatively free from man-made forms of interference.

Six Vice-Presidents Appointed by NBC

M. H. Aylesworth, president of the National Broadcasting Company, announced appointment of six vice-presidents, who will serve in addition to George F. McClelland, functioning as executive vice-president and general manager. The new vice-presidents are:

John W. Elwood, present manager of Program Department, New York; George Engles, present managing director of the National Broadcasting and Concert Bureau, New York; Frank Russell, formerly

CODE ADOPTED TO RID AIR OF FRAUD OFFERS

St. Louis.

A movement to prevent the broadcasting of misleading, inaccurate or fraudulent advertising over St. Louis commercial radio stations was inaugurated by KMOX, KWK and WIL in conjunction with the Better Business Bureau of St. Louis.

Standards suggested by the bureau and governing the type of material used by radio stations have been adopted to augment the already strict censorship being exercised over the present material sent out over these stations.

Harry W. Riehl, general manager of the Better Business Bureau of St. Louis, said:

"Fraudulent advertisers are attempting to use the facilities of commercial radio stations in various parts of the country to foist their schemes upon the public. Barred from newspaper advertising and in many instances from using the mails, these individuals are turning as a last resort to the radio stations to get their messages to the public."

The standards adopted by the St. Louis stations follow in part:

"This radio station agrees to refrain from doing or saying anything which might bring any accepted form of advertising into disrepute.

Standards Given

"This radio station agrees to a just respect and consideration for competitors, avoiding derogatory statements regarding the advertising, advertisers, equipment, quality of programs, etc., of others.

"This radio station agrees to the policy of clearly indicating to listeners the source and purpose of all commercial advertising matter broadcast.

"All material used by this station, in the furtherance of the interests of any commercial institution using the service of this station, shall be accurate and truthful.

"So far as it is within their ability so to do, this station will see that all material used by representatives of the commercial institutions who have engaged the services of this station, shall be accurate, truthful and not at variance with the ordinary tenets of good business and fair play.

Suspects to be Reported

"No advertiser using the facilities of this station shall be permitted to broadcast any material which is disparaging to the goods, advertising or sales methods of competitors of others.

"This station agrees to co-operate with the Better Business Bureau of St. Louis in a lawful manner in its effort to rid this community of misrepresentation and deception in advertising and agrees to report suspected cases of misleading or deceptive advertising or sales practices to the bureau for investigation and action."

of the Department of Agriculture, Washington, D. C.; Niles Trammel, present manager of Chicago NBC offices, and Don E. Gilman, present manager of San Francisco NBC offices. A. L. Ashby, New York, will be vice-president and general attorney.

The office of treasurer, made vacant by the recent death of Charles B. Popenoe, has been filled through promotion of M. J. Woods, formerly assistant treasurer of the company.

RCA TELEVISION SENT STEADILY FOR 8 MONTHS

A regular schedule of television transmission is now being maintained by the Radio Corporation of America at its plant at 411 Fifth Ave., New York, according to Dr. Alfred N. Goldsmith, chief broadcast engineer and vice-president of the corporation. Work began about eight months ago, or in August, 1928, and much experimental work has been conducted since that time, although few listeners have been aware of it.

Daily Schedule

The present daily schedule is from 7 to 9 p. m., and the transmission is on the channel 2,000 to 2,100 kc. (149.9 to 142.8 metres). The pictures are 60 scanning lines high and 72 equivalent elements wide. The speed is 20 pictures per second, requiring a speed of 1,200 revolutions per minute of the scanning disc.

Synchronous speed is at present maintained by means of a 60-cycle synchronous motor, but many other methods of synchronization have been tried, according to Dr. Goldsmith. The direction of scanning, looking at the received picture, is from left to right and from top to bottom, or in the same direction as printed matter.

Expects a Public Service

Dr. Goldsmith said:

"This work, it is contemplated, will in due course evolve into a service to the public on a commercial basis similar to broadcasting. Actually, there are several purposes being pursued.

"First, we are making a radio survey of the field strength, absorption and fading of a television modulated wave in New York and vicinity. We are investigating the possible production of multiple pictures, such as occurred during transmissions on sixty meters, when we found multiple pictures only several miles away.

"Our second purpose is to study and improve transmitter apparatus. We are learning many things from practical experience here in the studio.

"In the third place, we want to know the receiving conditions best for television service, and the best types of receiving arrangements.

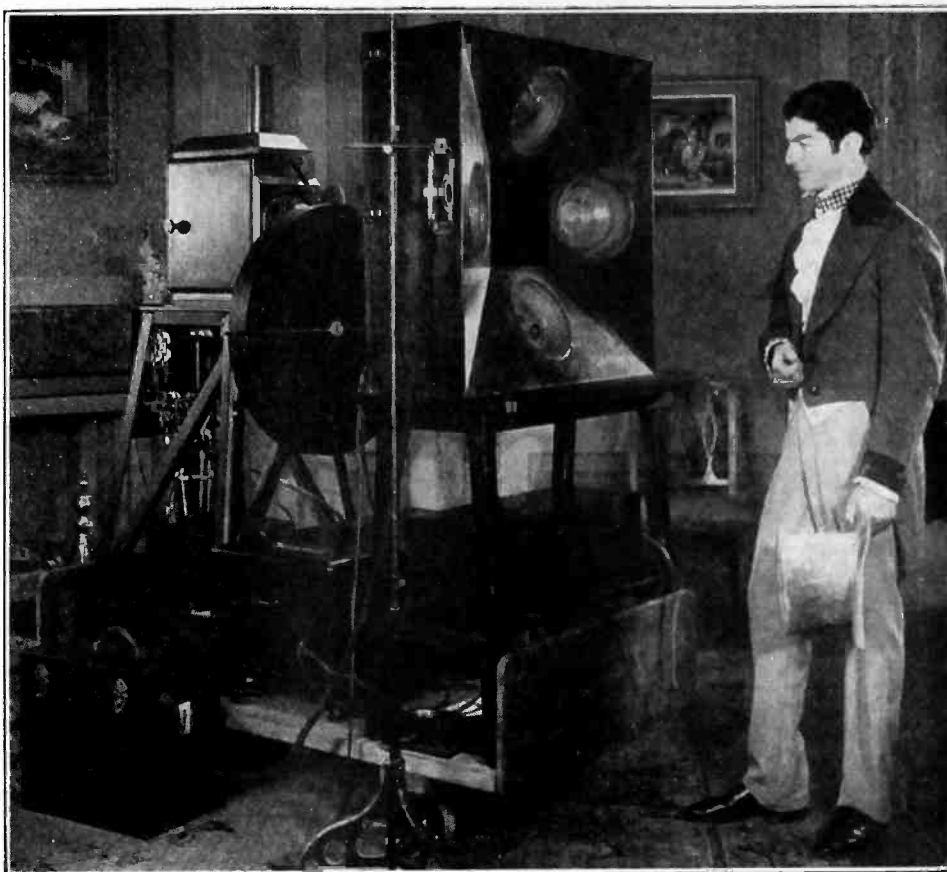
"Our fourth reason, which is the most important one, is the laying of a foundation for something that may evolve into a service for listeners. We mean seriously to investigate step by step the possibilities of a quality vision broadcasting service to the public similar to sound broadcasting."

Indirect Scanning Used

Transmissions now consist of pictures, signs and views of persons and objects. Frequently announcements are made by transmitting a picture of the call letters of the station, W2XBS. The equipment is in a room adjacent to one of the recording studios of Photophone, Inc., an RCA subsidiary. Actors from the sound movie studios frequently appear before the photocells which pick up the television signals.

The power of the transmitter is 250 watts. The indirect method of scanning is used. That is, a fine beam of light scans the picture and the light reflected from the picture is picked up by four large photoelectric cells.

ACTORS IN VISION BROADCASTS



TELEVISION TRANSMITTING EQUIPMENT AS USED BY THE RADIO CORPORATION OF AMERICA IN ITS REGULAR SCHEDULE FROM 411 FIFTH AVE., NEW YORK CITY. AN ACTOR FROM THE PHOTOPHONE RECORDING STUDIOS, WHICH ARE IN THE SAME BUILDING, IS STANDING IN FRONT OF THE TELEVISOR. THE FOUR LARGE CIRCULAR DEVICES ARE PHOTO-ELECTRIC CELLS.

EYE PROGRAMS TO START MAY 1

TELEVISORS IN SAMPLE STAGE

Construction work is well under way on a 5-kilowatt television transmitter to be installed on the roof of the Jenkins Television Corporation plant building on Claremont Avenue, Jersey City, N. J.

The Federal Radio Commission has granted a license calling for a band between 2,100 and 2,200 kc., or approximately 140 meters, with unlimited time.

The officials of the Jenkins Television Corporation state that the transmitter will be completely installed by April 15th, and will be testing on or about that time, followed by experimental television programs beginning May 1st.

Meanwhile, another station is being completed by the Jenkins Television Corporation in Montgomery County, Maryland, under a license calling for power up to 5 kilowatts maximum, on a band between 2,850 and 2,950 kc., or approximately 103 meters, with unlimited time.

For the present, regular television broadcasting is being continued from the Jenkins Connecticut Avenue laboratory in Washington, D. C. (W3XK), on the new wavelength of 147 meters, or 2,000 to 2,100 kc., on Mondays, Wednesdays and Fridays, from 8 to 9 p. m., Eastern Standard Time.

WARE BACK IN FIELD

Paul Ware announces his return to the radio field with a radio receiver utilizing the band-pass tuning system, A C screen grid tubes and the new 245 type output tube. The company office is at 480 Lexington Avenue, New York City.

Production is actually under way on the first lot of Jenkins sample television receivers.

"These sample television receivers" states James W. Garside, "are to be used out in the field, under all manner of everyday conditions, to check up on our broadcast signals and to learn more about television in practical use.

"Already many changes and refinements have been scored over the original Jenkins television receiver which serves as the basis for our engineering efforts, notably in an improved motor drive, an adjustable speed control, and a better optical system. Our engineers have evolved a vastly improved amplifier, both for the transmitting and the receiving end, insuring maximum detail within the limitations of our present screen."

NEW CORPORATIONS

Schickerling Radio Tubes Corp., New York—U. S. Corp. Co., Dover, Del.

Park Radio Service—Atty. E. Light, 27 Cedar St., New York, N. Y.

Radio Fair—Atty. B. W. Burger, 154 Nassau St., New York, N. Y.

S. Hammer Radio Co.—Atty. J. R. Lippman, 225 Broadway, New York, N. Y.

Quinlan Radio Sales—Atty. J. B. Quinlan, 262 Fulton St., Brooklyn.

Esetroc Corp., Newark, radio supplies—Atty. Ginsburg & Simon, Newark, N. J.

Aranac Radio Corp., Harrison, N. J.—Atty. J. J. Diesesa, Harrison, N. J.

Majestic Radio Tube Corporation, Paterson, N. J.—Atty. Surosky & Surosky, Paterson, N. J.

Plainfield Radio Shoppe, Plainfield, N. J.—Atty. Codington, Blatz & Smalley, Plainfield, N. J.

Allen Radio Corp.—Atty. M. Levy, 66 Court St., Brooklyn, N. J.

Pilot Radio & Television Corp., Wilmington, Del.—Corp. Trust Co. of America, Wilmington, Del.

FOUR STATIONS IN THE SOUTH ADDED BY NBC

The National Broadcasting Company added four Southern stations to its coast-to-coast network. They are WSMB, New Orleans, La.; WAPI, Birmingham, Ala.; KTHS, Hot Springs, Ark.; and WIOD, Miami Beach, Fla. These stations heretofore had not been permanently connected with the network. Their inclusion means that NBC programs direct from New York and other centers of entertainment will be available the year around to the entire South.

"The addition of these four stations, which necessitates the establishment of thousands of miles of additional permanent wire lines, is part of the National Broadcasting Company's policy of providing every section in the United States with the best radio programs available," M. H. Aylesworth, president of the company, said.

Will Continue Policy

"We intend to carry out this policy even though we do so at a temporary loss, for we believe that the NBC as a national institution must not hesitate to make its program available to everybody everywhere."

WSMB, New Orleans, has a power of 750 watts and is operated by Saenger Theatres, Inc., and Maison Blanche, a New Orleans department store. It operates on a wavelength of 227.1 meters (1,320 kc.).

KTHS, Hot Springs, has a power of 10,000 watts. It operates on a wavelength of 374.8 meters (800 kc.).

WAPI, Alabama Polytechnic Institute, is one of the pioneer radio transmitters to be operated in connection with educational institutions. Under arrangements made with the National Broadcasting Company, WAPI will be operated in cooperation with the Polytechnic Institute, the University of Alabama and the Alabama College for Women. WAPI has a power of 5,000 watts. It operates on a wavelength of 263 meters (1,140 kc.).

Farthest South

WIOD, Miami Beach, is operated by the Wonderful Isle of Dreams Broadcasting Company, the initials of the operator comprising the call letters of the station. It has been a temporary outlet of the NBC System for several months as it was added to the network at the time President Hoover was spending a Winter vacation in Florida. It is located further South than any other Network broadcasting outlet.

WIOD has a power of 1,000 watts and operates at a wavelength of 241.8 meters (1,240 kc.).

The Kentucky Derby To Be Reported by Air

The Kentucky Derby, at Churchill Downs, Louisville, Ky., will be seen through the eyes of a quintet of veteran radio announcers by nation-wide listeners the afternoon of May 18th.

A coast-to-coast network of stations associated with the National Broadcasting Company will carry the radio story of the Kentucky Derby which is tentatively scheduled to begin at 4:45 o'clock, Central Standard Time. The description of the actual horse race will be preceded by a word picture of the great throng at Churchill Downs and the actual preparations for the thrill turf event.

One Announcer at KGO Is Single

San Francisco.

Of late KGO has had a number of requests as to the matrimonial status of Howard Milholland, Byron Mills, Charles Park and Hjalmar Stromberg, announcers at the station.

All of the above admit marriage except Stromberg.

Although he is in the six-foot class, may be classed as a good-looker, and is popular, Stromberg still remains single.

BROOKLYN ASKS 'PLACE IN SUN'

Washington.

Representatives of four Brooklyn, N. Y., broadcasting stations appeared before the Federal Radio Commission in connection with the applications of two of the stations for modification of their broadcasting licenses with a view of obtaining additional time on the air with increased power. WLTH and WBBC request full time on 1,400 kc., with an arrangement between them for the division of this time. They also seek increases in power of from 500 watts to 1,000 watts during daylight and 500 watts at night. At present WCGU at Coney Island, N. Y., and WSGH-WSDA, Brooklyn, also operate on 1,400 kc. with the two applicant stations.

WLTH and WBBC, Karl A. Blaustein and W. D. Jamieson, attorneys, argued that Brooklyn has been "cut off" the radio field under the reallocation of November 11th. These stations "want their place in the sun," Mr. Jamieson asserted. William E. Leahy, Washington attorney, represented WSGH-WSDA, and James Splain, of Washington, appeared as counsel for WCGU.

S. J. Gellard, manager and director of WLTH, testified, under examination by Mr. Leahy, that he had expended \$40,000 in equipment for the station. He admitted that WLTH had been cited for off-frequency operation, but that it now is installing a crystal control to rectify this condition.

Declaring that his programs "are better than those of any other Brooklyn station," Mr. Gellard stated that under the reallocation his station now operates only 26 hours a week. The result has been, he asserted, that the commercial and advertising accounts have suffered, while the operating cost has not been reduced.

WCAV Authorized to Use 10,000 Watts

Philadelphia.

WCAU in this city has been granted permission by the Radio Commission to increase the power from 5,000 to 10,000 watts. The station is operated by the Universal Broadcasting Company. The change in power will make this one of the most powerful stations in the East.

The new transmitter will be located at Byberry, Pa., which is just on the edge of the city limits. The old equipment will be retained for emergencies.

It is estimated that the daylight service radius will be 100 miles under the most unfavorable conditions. The frequency of the new station is 1,170 kc., which will be held constant by a crystal oscillator.

A NEW BOOK ON TUBES WRITTEN BY EXPERT PAIR

By J. E. ANDERSON

Technical Editor

"Radio Receiving Tubes," by James A. Moyer and John F. Wostrel, published by McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York. (Price \$2.50.)

This is the first edition of a new book on receiving tubes by Moyer and Wostrel which fills a definite need. It is particularly valuable to service men, advanced amateurs and students of radio who want to learn the theory and practice of receiving tubes. It is written in plain and concise English. Unessentials have been omitted, the more fully to treat those phases of the subject which are necessary to understand the operation of vacuum tubes.

Mathematics is used, but only enough of it to give the properties of the tubes definite expression. Anyone who has any familiarity with simple algebra will have no difficulty understanding the book.

Many Curves

Typical characteristic curves for all the tubes are used unstintingly to supplement the theory, and those who have no knowledge of algebra can learn all the properties of tubes from the curves alone.

The book is up-to-date and includes much material which has been made available during the last few years, and which is not found in any other book treating the same subject. It contains discussions of all the principal types of circuits, types of coupling, oscillators, detectors and rectifiers.

The treatment of the subject follows conventional lines and is orthodox in every respect. However, the authors have carried this orthodoxy to the point of passing on to the readers, verbatim, some of the traditional fallacies which thought and experiment have not yet been able to upset.

Brave on Motorboating

One of these is the statement that the time constant of the stopping condenser and the grid leak in resistance and impedance coupled circuits should be as small as possible. Analysis and experiment lead to the opposite conclusion.

Another is that in resistance coupled circuits the plate voltage must be increased to compensate for the drop in the coupling resistor. While a higher plate voltage should be used in this type of circuit it is not because of any need of compensating the drop in the coupling resistor but to avoid distortion.

With respect to the cause of "motorboating" and the conditions for maximum voltage amplification in transformer coupled audio circuits the authors have abandoned tradition for correct explanations.

The book can be recommended heartily to all students of vacuum tubes and their uses.

A THOUGHT FOR THE WEEK

NOT so long ago officials of the musical unions of the country were declaring from the heights that radio was ruining the profession and business of making a living through the medium of the musical art. Now it's quite different. Radio's ravenous appetite for the wares musicians have to sell nets the musicians and composers millions of dollars annually—with most of it going into the waiting pockets of the exponents of Bach, Herbert and Berlin.

ALL STATIONS MUST DISCLOSE BUSINESS DATA

Washington.

Two questionnaires seeking information as to present broadcasting conditions throughout the country with a view of making further improvements upon the nation-wide reallocation of last November 11th, were sent to all broadcasting stations by the Federal Radio Commission. These were in addition to the questionnaire pertaining to renewal of station licenses.

One of the questionnaires deals entirely with engineering matters, such as the area served by the particular station, complaints of interference, and a comparison with the service of the station being rendered at this time with the service before the reallocation became effective on November 11th.

The second questionnaire, prepared by the Commission's legal division, inquires into the business operations of the station, its ownership, capitalization, rates for advertising, revenues, and similar information.

Profit Question

Another question is whether the station is being used to directly or indirectly create good-will or to advertise a business. Details as to whether the station is used for direct advertising are requested, including the amount of time the station is operating each week and how much of this time is sold, the rates charged, the names of the concerns to which time is being sold and the nature of their business.

Stations are asked whether they are operated at a profit and if so, the amount of the profit; also the gross annual cost of operating; the name of the chain to which the station belongs, if any, and similar intimate details.

The business document must be sworn to. The full text of the letter accompanying the questionnaire, signed by Carl H. Butmar, Secretary, follows:

"By direction of the Federal Radio Commission, I am enclosing two questionnaires, Forms 61 and 63. Please fill out and return in enclosed envelope prior to April 10th.

"The engineering questionnaire, Form 63, included with this letter that asks for data regarding service rendered by stations, is for the purpose of enabling the Commission to get as clear an idea as possible of the present broadcasting conditions throughout the country.

Few Replied

"Reports have so far been received from or concerning only a very small percentage of stations and such reports have varied so greatly and been so incomplete that they have been of little aid.

"It is considered that if all stations submit the data called for in the questionnaire the Commission will be able to have data to use as a basis for making any possible improvements that can be made for certain sections of the country without causing a loss to some other section.

"It is desired that the questionnaire, Form 63, be filled out from information already known by the broadcasters and that there be no delay due to attempt to get additional information.

"The second questionnaire, Form 61, covering licensee's business and legal questions should be filled out and sworn to."

New WNYC Plant Ready This Month

The new broadcast plant for WNYC, New York municipal station, will be ready for operation about the middle of April.

The new transmitter will be on the twenty-fifth floor of the Municipal Building, where the present equipment and studios are located. There will be two new studios and a roof garden fitted with microphones for use during the Summer.

The new transmitter will be crystal-controlled, which will steady the wave, and the transmitted wave will be modulated 100 per cent. It is expected that this will double the response in receivers tuned to the station. The modulation of the present transmitter is about 35 per cent.

There will be a wire control room for the routing of band concert programs from the Mall in Central Park to twenty-five other parks in the metropolitan area, where they will be reproduced through large loudspeakers.

The new studios have been designed to enliven the tonal quality of programs originating in them, because artists performing in the old studios have complained of the "dead" effect produced. Hence the new studios have been designed to have a reverberation period of .95 second.

U. S. DELEGATES AT CONFERENCE

Washington.

The United States is represented at the European Radio Broadcasting Conference by a delegation of five, headed by William D. Terrell, Chief of the Radio Division of the Department of Commerce, it was announced at the White House. The conference is being held at Prague, Czechoslovakia.

The other delegates are L. E. Whittemore, radio engineer of the American Telephone and Telegraph Company; C. J. Pannill, vice president of the Radio Marine Corporation; Gerald C. Gross, radio engineer of the Federal Radio Commission; and Commander H. P. LeClair, Assistant Attache in Paris.

According to William R. Vallance, Assistant Solicitor of the Department of State, the following countries are represented at the conference: Germany, Austria, Belgium, Denmark, Egypt, Hungary, Ireland, Holland, Italy, Latvia, Norway, Poland, Rumania, Sweden, Serbia, Switzerland, Czechoslovakia and Russia.

PEPPING UP VOLUME

Service men often run across sets that are squeaky in reproduction and with volume much below normal. This applies not only to old sets, but also to some new ones. Low voltage is generally the cause of this in AC operated sets. Placing a lower resistance in one or more sections of the voltage divider often clears up the trouble. A Standard Clarostat should be tried across various sections until the trouble is found and remedied.—J. H. C.

J. C. JENSEN ELECTED

Professor J. C. Jensen, head of the department of physics at Nebraska Wesleyan University, has been elected president of the association of College and University broadcasting stations.

HIS AIR MUSIC ON FILM HEARD BY DAMROSCH

Schenectady, N. Y.

Walter Damrosch, radio symphony director, enjoyed the unusual experience recently of listening to his own orchestra, directed by himself, exactly as the listener hundreds of miles from a radio station gets the music over the air.

On a recent visit to the General Electric Company he was shown many interesting scientific developments, but the greatest thrill came from an especially prepared surprise, a reproduction from film of a complete hour of music which he and his orchestra had broadcast five days previously from the National Broadcasting Company studio.

Made in Laboratory

Sitting in the laboratory of Dr. C. W. Hewlett, he heard the preliminary announcements made on the General Electric program of five days previous and then heard himself describe the first number to be played by the orchestra.

The record of the music was made in the laboratory from the broadcasting of WGY, one of thirty-nine stations on the network. The film record is not unlike Photophone film except that the sound channels double back and occupy the full width of the film. On Photophone motion picture records, there is a single sound channel paralleling the picture.

Much Impressed

Dr. Damrosch was especially impressed with the fidelity with which the output of a large body of musicians had been recorded, and with the brilliancy of the reproduction. He was enabled to make valuable observations on the positions of various instruments, with relation to the microphone, and in one or two places found that in future programs changes must be made in the seating of certain sections or choirs to get the best results, musically, from the organization.

CIVIL SERVICE

The United States Civil Service Commission announces the following open competitive examination:

AGRICULTURAL WRITER (RADIO)

Applications for agricultural writer radio) must be on file with the Civil Service Commission at Washington D. C., not later than April 24.

The examination is to fill vacancies in the office of the Secretary, Department of Agriculture, Washington, D. C. and in positions requiring similar qualifications.

The entrance salary is \$2,900 a year. Higher-salaried positions are filled through promotion.

The duties are to adapt agricultural subject matter for effective radio presentation; to inject interest into the radio programs; to assume responsibility for providing attractive program material and speakers from the Department staff broadcasting stations and networks; and to originate plans which will interest farmers in making application of information obtained by radio.

Competitors will not be required to report for examination at any place, but will be rated on their education and experience, specimens of writings for broadcasting or publication, to be filed by the applicant, and a practical test.

Full information may be obtained from the United States Civil Service Commission, Washington, D. C., or the Secretary of the United States Civil Service Board of Examiners at the post office or custom house in any city.

NEXT WEEK! SEE HERE!

The recording of sound on film, done in two distinct ways, and used in talking movies in two many points of interest to the radio-wise. Vacuum tubes are used and familiar audio principles invoked. So be sure to read the article on this subject, by Capt. Peter V. O'Rourke, in next week's issue of Radio World, dated April 13th. Another feature will be a 245 power amplifier with B supply, described by Herman Bernard.

COMPLETE LIST OF STATIONS BY CALL LETTERS

Corrected up to March 27th from Data of Federal Commission

The complete list of broadcasting stations in the United States and possessions is published on the opposite page. An original list was furnished by the Federal Radio Commission, which also furnished sheets containing corrections, amendments and revisions, based on results of hearings, reassignments, changes in location, etc. The amendments as furnished by the Commission were written into the list as corrections by RADIO WORLD's station editor, so that the list is as accurate as it was possible to get it, up to March 27th.

This list contains the stations by call letters, in alphabetical order, and gives also the location of the station and the frequency. Knowing the frequency, you can determine the wavelength by consulting the conversion table published herewith.

Pointer on Location

The location as given in the list is nearly always that of both the studio and the transmitter. In a small percentage of instances stations have their transmitters in districts outlying a city, while the studio is in the city. In a few other instances, even in smaller towns, the studio is located remote from the transmitter. Most stations that have different locations for studio and transmitter prefer the location of the studio be given, as the station is considered as representative of the larger community, in which its studio is.

An exception exists sometimes in New York City and Chicago, and elsewhere, because a studio in the heart of the city makes it more accessible for the artists, although the station may not be a New York City or Chicago station, but really representative of a city nearby. For instance, WOR, Newark, N. J., has its principal studios in New York City, but is a Newark station. In giving the location, therefore, since there was no room for giving both the transmitter and the studio locations, where they differed, the one given was that which the station actually preferred, or, in the absence of a stated preference, the one the station was deemed to prefer. Where judgment was exercised it was by the station editor, and not by the Federal Radio Commission. Any such mistakes of judgment that may have crept into the list will be corrected

Quick Conversion Table, Frequency to Wavelength

In the following table the entire broadcast range of frequencies is given, from the highest (1,500 kc.) to the lowest (550 kc.). The frequencies in kilocycles will be found to the left in each separate column. To the right of the frequency is the equivalent in meters, that is, the wavelength, and this is carried out to the first decimal place.

Now, in consulting the list of stations by call letters, printed on the opposite page, you will find the frequency in kilocycles at extreme right of each single line.

If you prefer to know the carrier by the wavelength designation, you can find this out in a jiffy by locating the frequency in kilocycles below and reading the corresponding wavelength in meters at right on the same line.

Here is the conversion table:

kc.	m.	kc.	m.	kc.	m.	kc.	m.
1500	199.9	1260	238.0	1020	293.9	780	384.4
1490	201.2	1250	239.9	1010	296.9	770	389.4
1480	202.6	1240	241.8	1000	299.8	760	394.5
1470	204.0	1230	243.8	990	302.8	750	399.8
1460	205.4	1220	245.8	980	305.9	740	405.2
1450	206.8	1210	247.8	970	309.1	730	413
1440	208.2	1200	249.9	960	312.3	720	416.4
1430	209.7	1190	252.0	950	315.6	710	422.3
1420	211.1	1180	254.1	940	319.0	700	428.3
1410	212.6	1170	256.3	930	322.4	690	434.5
1400	214.2	1160	258.5	920	325.9	680	440.9
1390	215.7	1150	260.7	910	329.5	670	447.5
1380	217.3	1140	263.0	900	333.1	660	454.3
1370	218.8	1130	265.3	890	336.9	650	461.3
1360	220.4	1120	267.7	880	340.7	640	468.5
1350	221.1	1110	270.1	870	344.6	630	475.9
1340	223.7	1100	272.6	860	348.6	620	483.6
1330	225.4	1090	275.1	850	352.7	610	491.5
1320	227.1	1080	277.6	840	356.9	600	499.7
1310	228.3	1070	280.2	830	361.2	590	508.2
1300	230.6	1060	282.8	820	365.6	580	516.9
1290	232.4	1050	285.5	810	370.2	570	526
1280	234.2	1040	288.3	800	374.8	560	535.4
1270	236.1	1030	291.2	790	379.5	550	545.1

in subsequent lists, if the stations will address Station Editor, RADIO WORLD, 145 West 45th Street, New York City.

All on One Page

The compression of the entire list into one page required not only the publication of only one "location" for each station, but also the use of the smallest size easily legible type, known technically as 6-point, but the result is deemed well worth while, since you can tear out the page and have the entire list of stations, with call letters, location and frequency, all on one sheet, for easy reference, placement or conveyance.

Some data, also, are omitted, such as the power a station uses, and whether the power is different for daytime and night-

time sending, and if so what is the difference; likewise, the identity of the stations that share time with the particular station investigated; also who owns the station. These data, however, were contained in the comprehensive list of stations by frequencies, published in 4 1/4 consecutive pages in the March 30th issue of RADIO WORLD.

Since the list of stations by frequencies gives you all the stations in the order in which they appear on the equivalent numerical readings of your dial, it is important to those interested in identifying stations heard that a copy of the March 30th issue be obtained.

See opposite page for complete list of stations by call letters!

- John Joseph, c. o. 32 Asbury St., San Francisco, Calif.
- Frank McBride, 2069 Bridge St., Frankford, Philadelphia, Pa.
- Jack Peedin's Tire & Radio Shop, 15-17 Grinnell Ave., Sheridan, Wyo.
- J. G. Bandissin, 667 Sackman St., Brooklyn, N. Y.
- G. C. Cassens, Glencove, Me.
- Ned. M. Bristol, 1335 F St., Lincoln, Nebr.
- R. O. Ward, Winter Park, Fla.
- Vernon B. Tabb, 30 E. Market St., Lewistown, Pa.
- R. B. Bowman, 5824 N. 6th St., Philadelphia, Pa.
- B. L. Flagg, Instructor, Wolf Junior High Sch., Easton, Pa.
- Roy E. Morgan, Box 401, Kellogg, Idaho.
- Chas. Milligan, 81 East Ave., Middletown, N. Y.
- F. C. Ryder, 11-1st South St., Bar Harbor, Me.
- H. C. Laird, Civitan Club, Norfolk, Va.
- Geo. H. Halley, Jr., 212 Locust St., Big Spring, Texas.
- Joseph H. Fritch, 921-72nd St., Brooklyn, N. Y.
- Mr. D. J. Switzer, 2009 Washington Ave., Altoona, Pa.
- R. W. Barr, Box 1402, Columbus, Ohio.
- W. J. Gerhart, 1719 Realty Ave., Beechview, Pittsburgh, Pa.
- Wm. Hamilton, 722 East 7th St., Dallas, Tex.
- Thos. F. Byones, 13 Engineers Band, Ft. Humphreys, Va.
- C. G. White, 25 Stetson Ave., Plattsburg, N. Y.
- Mr. Nichols, 32 Wandell St., East Saugus, Mass.
- C. A. Butler, 1311 Grand Ave., N. Forth Worth, Texas.
- Bernard Smith, 129 Bassett St., Syracuse, N. Y.
- Ernest E. Dubois, 47 1/2 Spring St., Adams, Mass., W. J. Drew.
- W. J. Drew, 136 So. Broadway, Yonkers, N. Y.
- Paul Capito, 637 W. 21st St., Erie, Pa.
- C. J. Schepers, 223 Wayzeta St., St. Paul, Minn.
- Macks Radio Shop, 3 1/2 E. 9th St., Coffeyville,

Literature Wanted

THE names and addresses of readers of RADIO WORLD who desire literature on parts and sets from radio manufacturers, jobbers, dealers and mail order houses are published in RADIO WORLD on request of the reader. The blank at bottom may be used, or a post card or letter will do instead.

RADIO WORLD,
145 West 45th St., N. Y. City.
I desire to receive radio literature.

Name

Address

City or town

State

- R. H. Sessions, 307 Molt St., Brunswick, Ga.
- Fred T. Johnson, 6 No. Eola Drive, Orlando, Fla.
- Fred Hoffmann, 3821 Lewellyn St., Cincinnati,

- Harry Corn, 18 W. Gravers Lane, Chestnut Hill, Philadelphia, Pa.
- The Quebec Electric Co., R. H. Doddridge, 137 St Jon St., Quebec, Canada.
- Wyane Morris, 2050 W. 83rd St., Cleveland, Ohio.
- C. R. Ogden, 802 F St., N. W., Washington, D. C.
- F. E. Harrison, 270 Turk St., San Francisco, Cal.
- Dr. Earl M. Smith, 8726-94th St., Woodaven, N. Y.
- R. B. Riesteo, 15 Benton St., Stafford Springs, Conn.
- Geo. Leisey, 417 Walnut St., Terre Haute, Ind.
- R. V. Craggs, 95 Liberty St., New York, N. Y.
- F. J. Daley, Box 36, Amblin, O.
- R. H. Meloney, R. D. No. 2, Princeton, N. J.
- B. T. Swift, 415 Allen St., LaPorte, Ind.
- W. C. Massett, Shakespeare Drive, R. F. D. No. 4, Berea, Ohio.
- S. B. Smith, 945 Lincoln St., Easton, Pa.
- F. L. Frederick, Winterset, Iowa.
- W. J. Holtzman, 2911 Campbell St., Kansas City, Mo.
- F. A. Schnell, Burgess Battery Co., Madison, Wis.
- E. C. Roome, 822 N. 8th St., Camden, N. J.
- G. R. Taylor, Box 324, Derby Line, Vt.
- J. W. Spence, 125 Windsor Ave., Highland Park, Pa.
- Arthur Rettmann, 934 Iten St., N. S., Pittsburgh, Pa.
- Andrew Winner, 436 W. Main St., Plymouth, Pa.
- Louis Koller, 473 Martin St., Roxborough, Pa.
- Alan Ferguson, Bloomington, Cal.
- H. G. Meyers, N. R. No. 1, 20 S. East Ave., Baltimore, Md.
- G. A. Schaaf, The Lima Storage Battery Co., Lima, O.
- R. E. Adams, East Point, N. C.
- A. P. Hinsky, 3101 Claredon Rd., Brooklyn, N. Y.
- P. M. Jennes, 130 Highland St., Portland, Me.
- J. R. Menagh, 14 St. Davids Ave., Wayne, Pa.

LIST OF STATIONS BY CALL LETTERS

With Location and Frequency; corrected to March 27th.

Table of radio stations with columns for Station, Location, and Frequency. Includes stations like WAAD-Cincinnati, WAAP-Chicago, WAAM-Newark, etc.

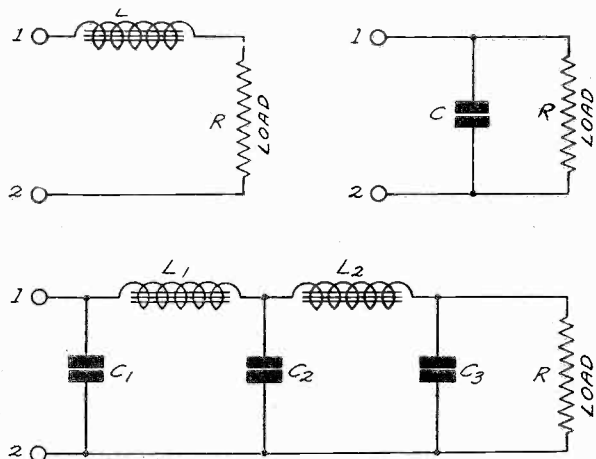
Table of radio stations with columns for Station, Location, and Frequency. Includes stations like WFLW-Hopkinsville, WFLK-Akron, WFKD-Philadelphia, etc.

Table of radio stations with columns for Station, Location, and Frequency. Includes stations like WLS-Chicago, WLSI-WDFW, WLTH-Brooklyn, etc.

Table of radio stations with columns for Station, Location, and Frequency. Includes stations like WSYR-Syracuse, WTAD-Quincy, WTAG-Worcester, etc.

Table of radio stations with columns for Station, Location, and Frequency. Includes stations like KGHB-Honolulu, KGHD-Missoula, KGHF-Pueblo, etc.

How to Get Rid of



Three types of interference eliminators. The first is simply a choke coil in series with the line and the load. The second is large condenser across the line. The third is a two section filter consisting of two chokes in series with the line and three condensers across it.

Installation of Filtering Devices
for Nuisances Created by Door
Appliances, Including
Currents That Travel Miles
Aerial and Contacting Lines
Always

A Report by the

RADIO reception is, in some localities, seriously disturbed by interference arising from electrical apparatus in the vicinity. A brief outline of the sources of such interference and the methods usually used in mitigation is given herein, together with references to further information. No consideration is given herein to interference produced by radio apparatus.

The only general remedy for electrical interference is co-operative effort on the part of users of radio and users or owners of the electrical sources of disturbance, to reduce or eliminate the causes of the trouble.

Much of the work in mitigation of electrical interference results in an improvement in the operation of the electrical devices or supply lines and is thus a double gain.

Remedy Exists

There are, however, some electrical devices which, even when in perfect working order, cause disturbances which result in interference with radio reception. In many cases it is possible to provide filters, shields, chokes, etc., either at the sources of disturbance or at the receiving set, which do much to relieve the difficulties.

Part of the disturbance from the electrical devices is practically inevitable and must be regarded, like atmospheric disturbances, as part of the inherent limitation of radio reception. In other words, the limitation upon radio reception is not only the distance and the power of the transmitting stations and the sensitiveness of the receiving set, but also the omnipresent background of slight electrical disturbances which drown out signals below a certain intensity.

Why Locals Are Better

This background of electrical disturbances is the underlying reason why reception from local stations is inherently superior to reception from distant stations.

Power-line Induction.—A frequent cause of interference is the presence of alternating-current power wires near the antenna or receiving set. Low-frequency voltages (usually 60 cycles) are induced and the resultant current flowing in the receiving circuit causes a "humming" sound in the telephone receivers. The low pitch of the hum will usually identify this source of interference. A method of eliminating or at least reducing the magnitude of this interference is to place the antenna as far as possible from the wire lines and at right angles to them.

When the interference cannot be eliminated by such means, the proper choice

of a receiving set may help. An inductively-coupled (two-circuit) receiving set is less susceptible to such interference than a single-circuit set.

The use of one or more stages of radio-frequency amplification should also help to filter out the audio-frequency interference.

It has been suggested that audio-frequency interference might be shunted around a receiving set having a series antenna condenser by connecting between the antenna and ground terminals of the set a high resistance, which will offer lower impedance to the audio frequency than will the receiving set itself.

Electrical Machine Noises

Sparking Apparatus.—Sparks are produced in the normal operation of many types of electrical apparatus (such as motors, doorbells, buzzers, gasoline engines, X-ray apparatus, violet-ray machines, some forms of battery chargers, rural telephone ringers, heating pads and thermostats).

Sparks are also sometimes produced at defective insulators, transformers, etc., of electric wire lines. Sparks usually give rise to electric waves which travel along the electric power wires and by them are radiated out and are then picked up by radio receiving sets. The noise thus produced in a radio set may come from a disturbance which has traveled many miles along the electric power wires.

One remedy for such types of interference is to eliminate the spark. This is possible if the spark is an electrical leak and not necessary to the operation of the device in which it occurs.

Radiation Reduction

Many very useful electrical machines, however, require for their operation the making and breaking of electrical circuits while they are carrying current and whenever this happens a spark is produced.

It is impossible to eliminate these machines so that it is necessary to make the spark of such nature or so arrange the circuits that the radio-frequency current is reduced or prevented from radiating.

To prevent the radio frequency current produced by a spark from getting on to the lines connecting the sparking apparatus some form of filter circuit is necessary. A condenser (1 microfarad, more or less) connected across the sparking points will short circuit a considerable amount of the radio frequency current, or, a condenser connected from each side of the line to ground will serve the same purpose. When any connections are made to the power line, in order to avoid fire and personal injury, only apparatus that

is carefully tested as to voltage and current-carrying capacity should be used and the power company should be consulted before making the installation.

Additions to the power lines should be made only by qualified persons.

Choke Coils Help

A choke coil in each side of the line in addition to the condensers connected to ground forms a simple filter circuit which should prevent frequencies in the broadcast range from getting in the line. A high inductance (choke coil) or high resistance connected in each side of the line changes the characteristics of the circuit so as to reduce the amount of power radiated.

If such a filter circuit is not effective or is impractical, the apparatus may in some cases be surrounded by solid metal sheet or wire screen which is thoroughly grounded. The screen should completely surround the apparatus.

This may be difficult. For example, in shielding the ignition system of a gasoline engine the spark coils and all wires and other parts of the system must be enclosed in metal shields and these must be very well grounded.

Sources Spotted

Location of Source of Interferences.—The first thing to do in tracing the source of trouble is to make sure that it is not in the receiving set itself. The next thing is to open the electric switch at the house meter. If the interfering noise is still heard in the radio set, the source is then known to be outside the house. It is then desirable to report the situation to the electric power company.

Many of the companies have apparatus for the purpose of following up complaints of this kind. Usually a receiving set with a coil antenna is used to determine the direction from which the interfering noise comes, and this outfit is taken from place to place until the source is found.

Often Up Against It

The location of such sources is often a very difficult and baffling undertaking. It sometimes requires that the power be cut off of parts of the line, in order to trace down the part of the line where the trouble arises.

The trouble sometimes comes from a spark discharge over an insulator to ground, or between a pair of wires, or it may be that the wire is touching some object such as a tree, pole, guy wire, etc. Such a spark discharge is a loss of power to the operating company and a potential

Electrical Interference

**Recommended—Remedy Exists
Bells, Heating Pads, Sparking
Commutators, and Even Induced
in Electric Wires—Hum from
Two Baffling Annoyances Not
Remediable**

Bureau of Standards

source of serious trouble, and for these reasons the company is probably more interested in finding and eliminating this type of trouble than the radio listener.

Large leaks and sparks may be observed at night, especially in wet weather. However, sparks which are too small to be readily noticed may cause serious interference to radio reception.

Sparking Brushes

Commutators.—Where direct-current motors are in operation near a radio receiving set, interference is sometimes caused, especially when the brushes on the motor are sparking badly.

The sparking should be reduced as much as possible by cleaning the commutator and proper setting of the brushes. The remaining interference is sometimes overcome by placing two condensers (about 2 microfarads each) in series across the power supply line and connecting their midpoint to a good ground system. This is substantially as outlined above under "Sparking Apparatus."

Bell Ringers.—Another source of interference is the ringing machine used in rural telephone exchanges. Telephone engineers can reduce or eliminate interference by connecting a filter between the machine and the ringing key.

Precipitators Troublesome

Precipitators.—Many cases of radio interference have been caused by electrical precipitators which are used to prevent smoke and noxious fumes or material from leaving the chimney.

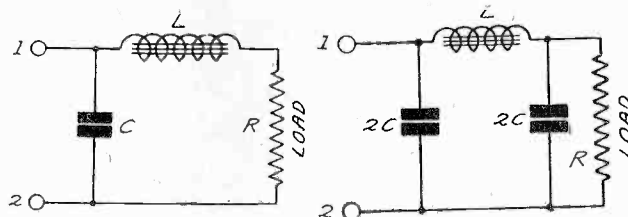
The precipitator operates by establishing a highly charged electric field inside the chimney of such a nature and direction that particles going up the chimney are charged and driven against the walls where they stick.

Precipitators cause interference for the reason that the high voltage used in their operation is obtained from a rectifier which produces sparks and generates radio frequency alternating currents as well as the direct current which the precipitators need.

Will Radiate

If the precipitator is so designed and arranged that the distance between the rectifier and the chimney is only a few feet or if the entire apparatus including all leads is housed in a metal building there is usually no trouble. But if the rectifier is separated from the chimney the wire which joins them forms a good antenna which will radiate and cause interference for 20 miles or more. Interference from these precipitators can be

Two simple filters which can be used to suppress line noises. At left is only a coil and a condenser. At right two condensers and one coil are used.



eliminated by placing a grounded wire screen entirely around these wires and thoroughly grounding the wire screen and the rectifier. If screening of the various parts is impracticable, damping resistances can be inserted at various points in the wire line which will reduce the amount of power radiated. Tuned circuits connected across the spark gap of the rectifier will assist by absorbing the radio-frequency power.

Proskauer Answers Interference Questions

So many questions arise as to the possibility of diminishing or eliminating extraneous noises that hamper radio reception, that they were put up to Julien J. Proskauer, inventor of the Si-Len-Ser and other successful radio devices.

Mr. Proskauer said that by the proper employment of filter condensers, except with the possibility of one or two extremes and isolated cases, all extraneous noises now hampering reception on electrically operated receivers may be entirely eliminated or diminished to the extent where listening to the program once more becomes a delight.

The types of filter which should be used, and which is most effective for reducing the annoyance of man-made static or electrically operated machine-made interference, he said, is that utilizing choke coils and condensers, wired and connected in such a way that the disturbance will be filtered out either at the source of the interference or, as in the case of one commercially made unit, by application of the filter directly at the set.

Mr. Proskauer brought out that other filtering devices which eliminate or diminish the extraneous noises are intended for use at the source of interference, but the Si-Len-Ser was designed to work directly at the set, chiefly because of economy and convenience. It may be used at the source, however, in extremely bad cases of interference.

Mr. Proskauer attributed the chief causes of interference with good reception to all oil burners and electric refrigerators where electrically operated means are used. On these, a filter depending upon a combination of inductance and capacity should be used. This filter is critical both to potential and load. The capacitive type of filter is applicable to most types of electrical apparatus, but the combination of inductance and capacity he found to be desired. Mr. Proskauer may be addressed at 114 Worth Street, N. Y. City.—J. H. C.

What Do Talkies Mean to Radio?

What have the talking movies to do with radio?

Well, with the radio-frequency side of radio they have nothing to do. But with the audio frequency side they have a lot to do, because the same audio that we are familiar with is used in the talking movies.

Another interesting point is that photo-electric cells, kino-lamps, and amplifying tubes generally, are used in abundance, and in familiar ways. Besides, physics in various phases enters the discussion, and our own radio is a branch of physics.

Particularly there are two ways of recording sound on films, and what these methods are, and how they are accomplished, will be revealed by Capt. Peter V. O'Rourke in next week's issue of RADIO WORLD, dated April 13th. His illustrated article also will tell of the wax record method, and you will learn which companies use which.

Owners of theatres, large and small—movie theatres, vaudeville theatres, any place where there's a roof under which a public movie may be shown—will be interested in Capt. O'Rourke's article, for the quality of reproduction of sound and will be compared.

Bernard's Power Pack

In line with quality audio, Herman Bernard's one-stage of fine transformer coupled audio, in a B supply that is entirely AC operated, and which will afford filament voltages for 227 or AC screen grid tubes in a receiver proper, should prove highly interesting. The output tube is a single 245, the new power tube that does not hum, although directly heated by AC. An exceptionally fine B supply, power amplifier and filament supply—and, remember, AC! The last tube gets 250 volts on the plate and works into a dynamic speaker, for which this particular output circuit is especially intended. See the details in next week's issue of RADIO WORLD, dated April 13th.

Lacault's Article

The second part, and final text, of R. E. Lacault's article on the 6-tube part of the RE29, his last and best circuit, will be published in the April 13th issue. Although the 6-tube receiver text will be completed then, detailed constructional drawings will be published subsequently. Keep in touch from week to week with this amazing circuit, designed by the man who designed the Ultradyne, the greatest DX circuit of its time!

Lacault's Last and Best

[Having spent months on the perfection of a screen grid Super-Heterodyne, using the Ultradyne system of modulation which he invented, R. E. Lacault, noted Super-Heterodyne specialist, was just able to complete the constructional text and diagrams when death overtook him. Although having hardly enough strength to move his hands, Mr. Lacault nevertheless saw his task through to its utter completion. And herewith the circuit—the RE 29, he called it—is presented for the first time anywhere,—a confident call from a gifted engineer to his thousands of Ultradyne, Strobodyne, REL 28 and other followers to build his last and best circuit. As the reader will find narrated in detail in the article, the circuit incorporates an inter-

Ultradyne Modulation Used
 Extreme Sensitivity—Band Pass
 Intermediate Frequency—Super
 Scientifically Avoided—“
 Utter Satisfaction,” Laca
 First Presentation of Famo

By R. L.

LIST OF PARTS

- C1, C2—Two Hammarlund .0005 mfd. Midline tuning condensers
- C3, C4, C5, C8, C9, C10—Six Sangamo .00025 mfd. fixed condensers
- C6, C7—Two Acme Parvovolt .5 mfd. fixed
- C11—One .001 mfd. Sangamo fixed condenser
- L1—One Lacault B1 antenna coupler, with base
- L2—One Lacault B2 oscillator coil, with base
- L3—One Lacault F2 intermediate frequency transformer with base

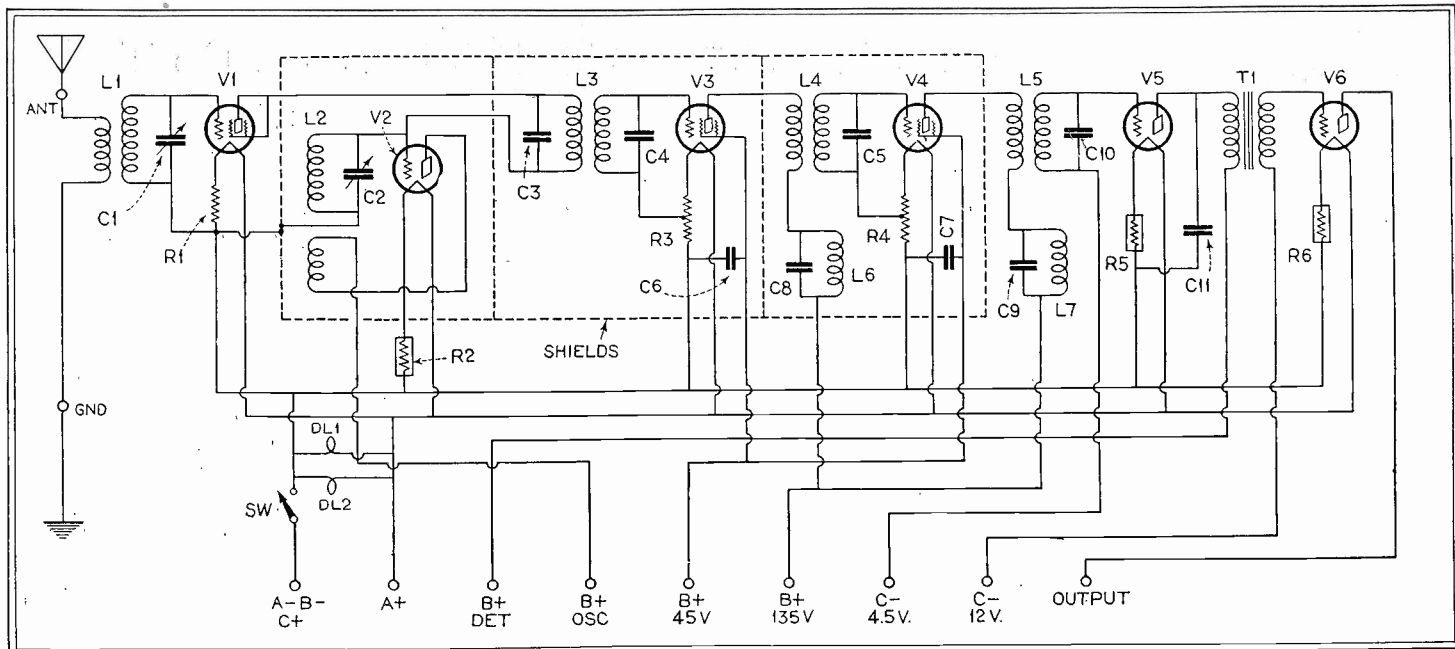


FIG. 1

THE CIRCUIT DIAGRAM OF LACAULT'S LAST CIRCUIT, THE RE29, WHICH INCORPORATES THREE SCREEN GRID TUBES AND LACAULT'S FAMOUS MODULATION SYSTEM. THE DIRECT COUPLING OF THE PLATE OF THE MODULATOR V1 TO THE GRID OF THE OSCILLATOR, V2, MADE POSSIBLE BY ABSENCE OF DIRECT PLATE VOLTAGE ON V1, IS A FUNDAMENTAL OF THIS FAMOUS SYSTEM OF MODULATION.

mediate frequency band pass filter. So you have the extreme amplification and sensitivity of the screen grid tube with the qualitative virtue of the band pass filter, all in the remarkable RE 29.—Editor.]

MY previous Super-Heterodynes have been received by fans everywhere with much enthusiasm, and many of these fans have urged me to design a circuit of the same type incorporating the screen grid tubes.

I have always felt that an outstanding circuit could be built with these tubes but I realized that much experimental work had to be done before one could be made so as to take utmost advantage of the exceptional properties of the screen grid tube. I would not betray the confidence of the fans which my previous circuits have won for me by merely assembling another circuit, and therefore I deferred bringing out this circuit until all the details had been worked out to my utter satisfaction.

The present screen grid Super-Heterodyne, the RE 29, is the result of long and painstaking experimental work. It was necessary to devise an oscillator which would be free from body capacity effects and which would give uniformly good service throughout the tuning range. It was necessary to devise a suitable modulator or first detector which would be selective enough to eliminate cross-

- L4, L5—Two Lacault SG intermediate frequency transformers with two bases
- L6, L7—Two Lacault CL radio frequency choke coils
- T1—One Sangamo type A (3-to-1 ratio) audio transformer
- R1—One 622 amperite.
- R2—One 1A amperite
- R3, R4—Two Carter 25 ohm resistors with a tap on each at 15 ohms
- R5, R6—Two 1A amperites.
- DL1, DL2—Two dial lights
- Sw—One Carter filament switch
- V1, V2, V3, V4, V5, V6—Six Benjamin sockets
- Three Carter tube shields
- Three Peewee clips
- Two National Type E dials
- Three Alcoa aluminum shields
- One Ant. and one Gnd. binding posts, with 1x3 bakelite strip and two brackets
- One Jones multiplug 10 way
- One 7x24 inch bakelite front panel
- One 12¼x25½ inch baseboard
- One Fritts cabinet, Cat. SS24.

talk and sensitive enough to pass a strong intermediate frequency signal to the amplifier. It was necessary to design special intermediate frequency transformers which

would be selective and at the same time take advantage of the high amplification possibilities of the screen grid tube.

And it was also necessary to coordinate all the parts so that the circuit would be stable in all the three frequency levels.

All these conditions have been met in a way which has led to optimum overall results.

Fewer Tubes Used

A casual glance at the circuit diagram might lead to the conclusion that the receiver cannot be very sensitive due to use of only six tubes. This conclusion is based on the notion that the sensitivity of a receiver is proportional to the number of tubes used.

Many factors other than tubes enter into the question of sensitivity. One of these is the stability of the circuit, another is the volume-handling capacity of the tubes. No gain in the sensitivity is achieved by adding tubes when the adding makes it necessary to introduce stabilizing devices which take away whatever extra amplification the additional tubes should give.

While the circuit diagram shows only six tubes, the receiver actually contains eight, for the second audio is a push-pull stage, built into the power supply device which has been designed to go with the receiver.

It has been stated many times that a

Circuit—the RE 29

Screen Grid Receiver of Ex-Ferodyne's Usual Troubles Details Worked Out to My wrote, just before he died; Designer's Masterpiece.

Lacault

form an enlarged plate. This connection gave high modulation efficiency.

The method of coupling the modulator tube and the oscillator should be noted carefully. There is no pick-up coil. The composite plate of the screen grid tube is connected directly to the grid of the oscillator tube. Since this grid returns to ground, there is no polarizing voltage on the plate of the modulator. But there is a high alternating voltage on this plate, the resonant radio frequency voltage across the tuned circuit controlling the oscillator frequency. This voltage is alternately positive and negative. It is the positive loops of this voltage which are modulated by the signal impressed on the grid of the first tube.

One reason for using a high intermediate frequency is to insure a low impedance to the signal frequency in the oscillator circuit. But there are more important reasons which will be discussed later. [See next week's issue of RADIO WORLD.—Editor.]

R2 is a 4-ohm ballast resistor which not only limits the filament current to the oscillator tube but also furnishes that tube a grid bias of one volt.

Intermediate Amplifier

The intermediate amplifier consists of two screen grid tubes and four tuned circuits. The first of the intermediate transformers L3 is doubly tuned. That is, the primary is tuned with C3 and the secondary with C4.

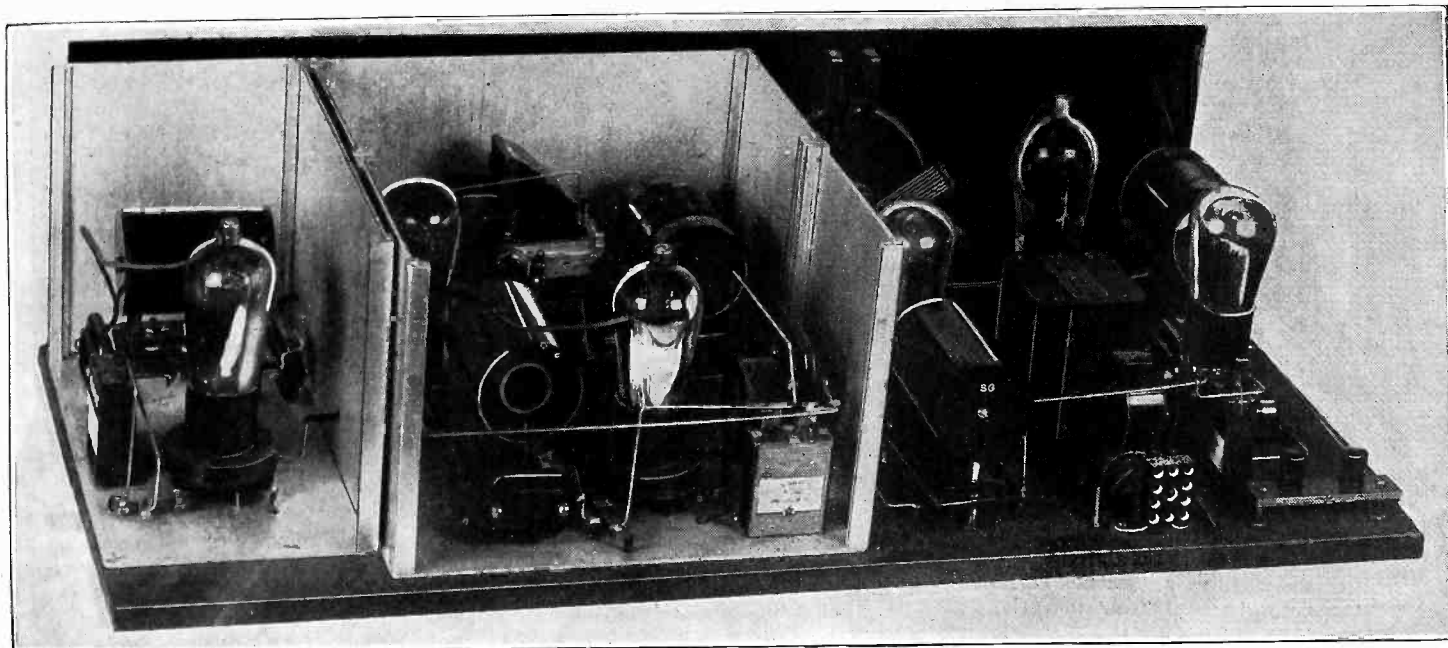


FIG. 2
THE OSCILLATOR AND INTERMEDIATE AMPLIFIER ARE SHIELDED, STAGE FOR STAGE.

Super-Heterodyne cannot be used successfully with an antenna, and that a coil aerial must be used. That statement was made when the Super-Heterodyne was first introduced, when little was known about details of the circuit, and it has been handed down to us as a tradition. The idea has been disproved many times. Antennas are coming into use more and more all the time for this type circuit.

Hence an antenna is used in this circuit because it is more effective, eliminates the necessity of another tube, is much more convenient to use once it has been installed, and it is less conspicuous in the home.

The antenna coil L1 and the oscillator coil L2 are of special design and are provided with plugs so that other sizes of coils may be inserted into the circuit to cover other wavelength ranges. These coils are tuned with .0005 mfd. Hammarlund Midline condensers (C1 and C2). Note that the rotors of both these condensers are grounded to the shield so that there will be no body capacity. While this is usual for the antenna condenser C1 it is not for the oscillator condenser. One of the chief difficulties with Super-Heterodynes is eliminated by this simple connection.

Screen Grid Tube Modulator

The first tube V1 is a screen grid tube, but it is not used as such. The plate and the screen grid have been connected together to

The modulator grid is kept negative with respect to the filament by means of the 25-ohm resistor R1. Since the resistance of the filament is also 25 ohms, the battery voltage is divided equally between the resistance R1 and the tube. That is, when the battery voltage is 6 volts the bias on the tube is 3 volts. This is the optimum bias for detection with this type of tube and connection.

High Detecting Efficiency Attained

High detecting efficiency requires that the load impedance on the tube be high for the detected frequency and low impedance for the signal frequency. Both of these conditions are met in the first tube. The tuned circuit, consisting of the primary of L3 and condenser C3, is a parallel tuned circuit for the intermediate frequency, and its impedance or resistance is extremely high.

The condition for low impedance at the signal frequency would not be met were not the signal frequency always much different from both the intermediate frequency and the oscillator frequency. Currents of the signal frequency pass through C3 with practically no impedance. Likewise they pass through either C2 or the secondary of L2. If the higher frequency setting of the oscillator is used, the signal frequency is lower and hence passes through the coil. If the lower oscillator frequency is used the signal frequency is higher and passes through the condenser C2.

This coil is constructed so that it is a band pass filter having a suitably wide transmission band. The double tuning insures thorough filtering as well as a high step-up of the intermediate frequency voltage.

The coupling coils L4 and L5 are identical in construction and tuning, the secondary of each being tuned. The primaries are wound to match the plate impedance of the screen tubes and to utilize the amplification of the tubes to the fullest extent.

Carefully Constructed

All the three coupling devices (L3, L4 and L5) have been constructed to rigid specifications as dictated by careful laboratory experiments. They provide a highly selective intermediate filter without cutting of sidebands, and at the same time step up the amplification tremendously in the transmission band.

Tapped resistors R3 and R4 are used in the filament circuits of the screen grid tubes to limit the current and to provide a suitable grid voltage. The total value of each of these resistors is 25 ohms and the tap is placed 15 ohms from the filaments.

[Part II of this article, to be published next week, issue of April 13th, will contain certain intimate information on construction and operation of the 6-tube design. There will follow articles on the B supply and power amplifier.]

Radio University

QUESTION and Answer Department conducted by **RADIO WORLD**, by its staff of experts, for **University members only**.

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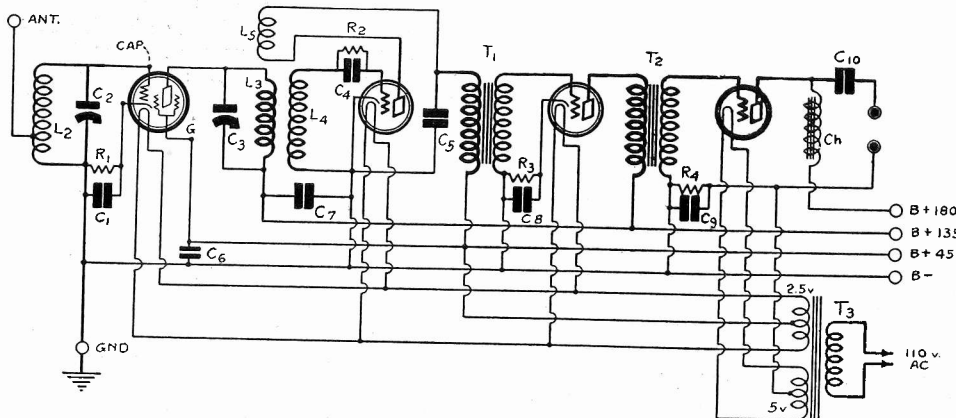


FIG. 739

DESIGN FOR A 4-TUBE ALL-ELECTRIC AC RECEIVER, WHEREIN A SCREEN GRID TUBE, TWO 227 TUBES AND A 171A POWER TUBE ARE USED. THE ANTENNA IS CONDUCTIVELY COUPLED, FOR STRONG PICKUP, BUT THE TWO TUNED CIRCUITS SHOULD BE TUNED INDEPENDENTLY. GANGING IS NOT PRACTICAL WITH THE CONDUCTIVELY TUNED ANTENNA CIRCUIT.

IN CALCULATING the grid bias resistor for a screen grid tube should only the plate current be used or should both the plate current and the screen grid current be used?

(2)—What should the grid bias be on the 622 and AC screen grid tube?

(3)—If I insert a milliammeter in the lead to the cathode, will the meter read the plate current?

HOWARD RICHARDSON,
Toledo, Ohio.

(1)—The total current flowing in the cathode lead should be used, that is, the sum of the plate current and the screen grid current.

(2)—The bias should be 1.5 volts for both tubes.

(3)—The milliammeter will read the sum of the plate and the screen grid currents. It is this which should be used in computing the grid bias resistor. But the current should be measured when the grid bias is 1.5 volts. A dry cell may be used to obtain the bias while the measurement is made.

* * *

WILL YOU PLEASE publish a circuit diagram of a four tube AC receiver using one screen grid tube, two -27s and one -71A.

(2)—Also please give the grid bias resistors and the capacities of the by-pass condensers.

(3)—What should the voltages on the AC screen grid tube be?

WALLACE KIRK,
Brooklyn, N. Y.

(1)—Fig. 739 shows such a circuit.

(2)—R1, 600 ohms; R3, 1,750 ohms; R4, 2,000 ohms; C1, .001 mfd.; C8, 1 mfd.; C9, 4 mfd.; C6, .01 mfd.; C7, .01 mfd.; C5, .0005 mfd.

(3)—The plate voltage should be 135, screen grid voltage 75, filament voltage 2.5, and grid voltage 1.5 volts.

* * *

I BUILT the four tube screen grid Diamond just exactly as you described it, except that I used a bakelite subpanel and tuning coils, condensers and audio transformers from an old set. But the circuit does not work. I only get a local station very faintly. I have checked the wiring many times and I am sure that it is all right. What can I do to get the set going?

CHARLES JACOBSON,
Newark, N. J.

Don't trust a visual test of the wiring. You cannot possibly see that all the circuits are continuous by looking at the wiring. Test all grid, plate and screen grid circuits with a meter or a head-set and battery. Make sure that all the tubes get the proper voltages. Also make sure that the screen grid tube is functioning. This tube is best tested in another screen grid tube set. Test for open and short circuits all through. When wired properly the receiver is remarkable.

* * *

IS IT NECESSARY to provide a center-tapped resistor for each of the -27 type tubes in a receiver or will one do for all of them?

(2)—If one will do, what should be the value of the resistance?

(3)—Where should it be placed and to what point in the circuit should the center-tap be connected?

LOUIS WATSON,
Pensacola, Fla.

(1)—It is not necessary to use more than one resistor for all the tubes on one winding, but there should be one for each 2.5 volt winding. If the winding is center-tapped, of course the resistor is superfluous.

(2)—The value is not critical, but 30 ohms is a good value.

(3)—It should be put across the transformer winding anywhere between the terminals on the transformer and the terminals on one of the sockets. The mid-tap should be connected either to the cathode lead or to the plus 45, whichever gives least hum.

* * *

I HAVE a receiver now using two -71A tubes in the last stage. If possible I should like to substitute two -45 type tubes, now that they are available. What changes are necessary in the circuit?

(2)—Will I get more volume out of two of these tubes than out of the -71A tubes for the same signal voltage input?

SUTTON GREER,
Racine, Wis.

(1)—Boost the total voltage on the plate and grid to 300 volts. Change the filament voltage from 5 to 2.5 volts and use an 800-ohm grid bias resistor in place of the 1,000 ohm unit.

(2)—You will get more volume out of the new tubes because they have a higher amplification factor and approximately the same mutual conductance.

* * *

I AM PLANNING to rebuild my five-tube radio receiver to get greater sensitivity. It is now of the TRF type with two good audio frequency transformers. Would it be worth while to install one screen grid tube?

(2)—How will the selectivity and sensitivity of the circuit be compared with the old circuit?

TOWNSEND KING,
Paterson, N. J.

(1)—The screen grid tube is very much worth while as a radio frequency amplifier provided it is operated correctly.

(2)—The selectivity will be somewhat lower but the sensitivity much greater.

* * *

I WISH to wind some coils for .0005 mfd. condensers on 2-inch tubing, using No. 26 D.S.C. wire. Please give the turns required.

(2)—How many turns should be used on the primary when the coil is to follow a screen grid tube?

(3)—What wire should be used on the primary?

RUDOLPH JOHNSON,
Fort Dodge, Iowa.

(1)—See the article on page 16, March 16 issue of RADIO WORLD.

(2)—As many as on the secondary.

(3)—Any fine insulated magnet wire.

* * *

WHAT IS an inductive trimmer? How is it made?

(2)—Is it possible to gang several condensers and adjust the tuned circuits so that they are all in tune identically at any dial setting?

(3)—Please explain how it is done if it is possible.

SAUL KATZ,
Milwaukee, Wisc.

(1)—An inductive trimmer is a small coil in series with the main tuning coil so mounted that the coupling between it and the coil can be varied. It may have from one to ten turns depending on the size of the turns. Its object, of course, is to compensate for differences in circuits tuned by the same control.

(2)—It is possible but it is not simple.

(3)—See an article on page 12 in the December 22 issue of RADIO WORLD for a detailed explanation.

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'Antennaless' Sets Next!

New AC Screen Grid Tube Makes Circuit Autonomous

By *McMurdo Silver*

FROM the viewpoint of engineering merit, the new AC screen grid tube, soon to be announced by RCA and Cunningham, is nearly eight times as good as the 226 and 227 type AC tubes which are today used as radio frequency amplifiers in almost every modern receiver.

Just what does this mean, not in amplifications, selectivity factors, and stability, but in terms of home enjoyment and convenience?

Briefly, this means that the screen-grid tubes, followed by a power detector and two good audio stages, will give a sensitivity of 10 microvolts per meter—an engineering definition of what is generally considered a far greater sensitivity in a radio set than can be used in most homes, due to static and other interference ordinarily never heard on less sensitive sets.

"Antennaless" Set Next

Translated into non-technical language, the superiority factor of the new AC screen grid tube means that sets can be built commercially requiring no outside antenna or ground connections, and operating entirely from self-contained screen antennas fastened into the wooden cabinets housing set and loudspeaker.

Such sets, if well designed, will receive more distant stations, with less interference, than sets using an equal number of less sensitive tube, although the usual outside antenna installation is used with the less sensitive tubes. The lessened interference of the screen grid set means finer, clearer tone quality.

From the viewpoint of convenience alone, screen grid tube superiority means the elimination of all antenna and ground installation bother in all but a very few percentage of installations. The great stride this development represents can best be grasped when it is realized that ever since wireless became a really countless thousands of engineers have striven to build a truly self-contained radio needing no outside antenna, ground, or speaker

connections, and requiring simply to be plugged-in like an electric iron or toaster to operate.

Dream Now a Possibility

This dream, with the almost complete elimination of dealer and consumer installation problems that it brings, is now a possibility.

Speaking technically for a moment, the eight-time superiority of the new AC screen grid tube means that for a given sharpness of tuning a stage of radio frequency amplification can be made to give nearly eight times more amplification with one of the screen grid tubes than it will with a 226 or 227 type tube, without oscillation, and that the screen grid tube does away with neutralizing adjustments, the new tube itself being inherently a much more stable RF amplifier than any other known tubes.

Unfortunately, however, the superiority factor of eight for the new type tube cannot be fully realized, and all that can be realized in practice cannot go into amplification.

As amplification is increased, with absolute selectivity held constant, apparent selectivity as observed by an operator falls off much more rapidly.

Selectivity Considered

By rule of thumb, if amplification is doubled, absolutely selectivity must go up four times (selectivity must go up as the square of amplification if a satisfactory practical receiver is to be obtained). Briefly, this means that the superiority factor of nearly eight for the new tubes translate into an actual amplification of four times greater than can be gotten from a 226 or 227 type tube, holding the selectivity apparent to anyone tuning the amplifier to the same value.

The screen grid amplifier is completely stable, inherently free from oscillation troubles, and yet requires no neutralizing or stabilizing adjustments.

NEW SILVER-MARSHALL FACTORY NEAR CHICAGO AIRPORT

The new radio receiver factory of Silver-Marshall, Inc., largest American makers of radio parts and kits, is now well under way in the Clearing Industrial District of Chicago—within the "Whirr" of the Chicago Municipal Airport, according to McMurdo Silver, president of the corporation. The plant will be the third radio manufacturing enterprise to locate in the modern Clearing Industrial District, nine miles from the heart of the Chicago "loop." The Silver-Marshall plant, however, is the largest radio factory yet to locate at Clearing, being in itself bigger than its two predecessors put together. The last word in modern one-story industrial buildings, the new S-M plant, with over 100,000 square feet of floor space, will be in operation early in May, with a capacity of 1,000 to 2,000 complete radio sets per day, in addition to a greatly augmented line of radio parts, accessories and power amplifiers—the latter in great demand since the widespread popularity of talking movies.

The organization thus occupying the largest radio plant on Chicago's south side was founded less than five years ago. Operating in the past only in the radio parts business—where gross sales have fallen off at the rate of about 40% a year since 1925—the company has steadily lifted itself, almost "by its bootstraps," until it is now doing over 10% of the total parts business of the country. While other parts manufacturers have withdrawn from the business or fallen by the wayside, sales and profits of the young company have mounted by leaps and bounds until, early in 1929, it was able to obtain an RCA set-manufacturing license and assume an obligation of minimum guaranteed royalty payments to R. C. A. of \$100,000 a year. The corporation has been continuously directed by its president and founder, Mr. Silver.

Some Inside Facts on the New AC Diamond

[The construction of the AC Diamond was described in the March 23d and 30th issues. The circuit uses one AC screen grid tube, two 227 tubes and one 112A or 171A (power tube.) Next week, issue of April 13th, constructed plans will be published in diagrammatic form.]

The AC Diamond, a 4-tube design, is sensitive over the entire broadcast band. You will get fine reception.

Also please be assured that you will positively get rid of squeals. The only reason why so much space has been devoted to the squeal problem is that it is still the biggest problem in radio receiver design—the stabilization of a receiver without undue loss of amplification. The success of the receiver, or of any other receiver, depends largely on its stability, and you may be certain that the measures outlined March 23d and 30th assure you of a stable set.

If you stick to the parts as specified

you will have no trouble from motorboating, even though this is a fine quality circuit in the audio channel, i. e., transformer coupled. You may hear a stuttering sound, but it will be due to self-oscillation at radio frequencies producing a beat that sounds like motorboating, but is wholly unlike it electrically, since motorboating is low-frequency oscillation only. Correct the RF oscillatory condition and the supposed motorboating will disappear.

The receiver will hum ever so slightly. There is little hum produced by the operation of the 227 tubes and the AC 222 tube, especially when the midtap of the 2.5 winding that heats the heaters goes to B plus 45 more or less. The last tube, if a 245, contributes no hum, since it is designed to be as hum free as a directly heated AC tube can be, because of low voltage across the filament and high current. The last tube, of course, if the new 245, has 180 volts on the plate, and greater

undistorted maximum power than the 171A at the same plate voltage, despite lesser bias.

If you are using a dynamic speaker and you hear a hum you may feel certain that this is due to the speaker primarily, as you can prove by putting a large capacity across the field coil of the speaker. Lo! the hum will disappear. Such a capacity—about 9 mfd. or so, which may be an electrolytic condenser—is often essential in DC types of dynamics that are at a distance from the receiver itself, since the length of the cord offers a suitable impedance across which the alternating current of the hum frequency finds a stamping ground. The condenser across the field coil kills off this hum.

The circuit was well tried and tested before a word of this article was written, so that you are assured, in building this receiver, that you will have something indeed sensitive, easy to operate and that produces excellent tone quality.

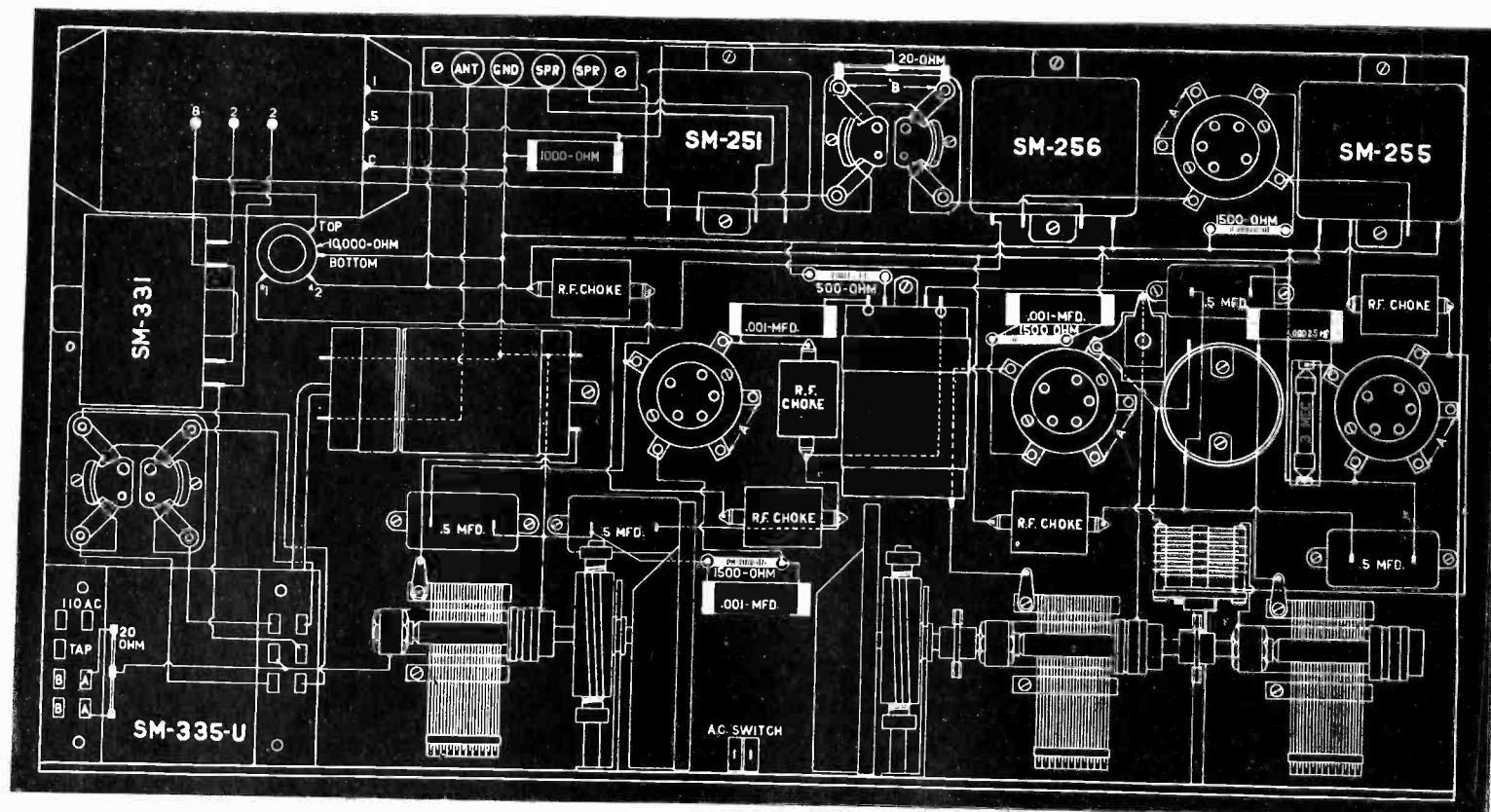
THE All-Electric model of the Moore-Daniels Receiver in a great many respects is similar to the battery model described in the March 23rd and 30th issues.

In the vacant spaces at the left end of the board are placed the additional parts necessary to transform the 110-volt AC lighting current to the low filament voltages and to rectify the AC for plate and bias supply needed to operate the tubes. These parts consist of a power transformer, rectifier tube and socket, filter choke and condenser assembly, and voltage dividing resistor. The balance of the

The Moore

Great DX-Getter Uses Two

By E. Buntin



layout is identical with the earlier model, and a reference to last week's issue, dated March 30th, will give complete instructions for the placement and assembly of the parts.

Attention is called particularly to the tubes used. In the first radio frequency stage the new AC screen grid tube is used.

Similar in heater design to the 227, the AC screen grid tube's characteristics otherwise are strongly reminiscent of the 222. A plate voltage of 180 is specified for the AC screen grid tube, with a screen grid voltage of 75 (G post of socket). The control grid (cap) is biased a trifle more than 3 volts negative, resulting in a very low input conductance with consequent low decrement in the input circuit, so that the selectivity of the first tuned stage is increased.

245 as Last Audio

The last audio stage also employs a tube which has just been released, the 245, designed especially for AC operation where large amounts of power are necessary. It approaches very closely the 210 in ability to handle large amounts of power, and its greatly lower plate impedance approaches much more closely to the characteristics of the inductive load impedance ordinarily employed in output circuits, so that the bass notes are brought through with much nearer their original characteristics. At the same time, instead of requiring the use of high transformer secondary voltages, and two expensive rectifier tubes, as well as high-voltage strain filter condensers, the power supply is kept to a total output voltage of 300, and this can be handled by a single 280 rectifier tube.

To supply the necessary voltages for both plate and filaments, the new Silver-Marshall 335 B Transformer is employed. This has 350 volts each side of center on

the power secondary, a 5-volt center-tapped filament winding for the 280 rectifier tube, a 2½-volt filament winding for the 245 Power tube, and another 2½-volt winding for the UY 227 tubes.

Filter Described

The filter for the power equipment consists of a Silver Marshall No. 331 uni-choke and a type 245 Condenser Block. The first section of the choke is preceded by a 2 mfd., 600-operating-volt condenser, and followed by an 8 mfd. block, giving ample reservoir for the drain of the 245.

The second section of the choke follows, and another 2 mfd. condenser section is placed directly across the 180-volt tap. On the side of the condenser block is a 1 mfd. 200-volt tap, which is connected across the detector B plus, and a .5 mfd. unit which is used to bypass the biasing resistance on the power amplifying tube. Higher capacity than .5 mfd. gives better low notes, say, 4 mfd.

Reference to the circuit diagram will show a resistor between the negative line and the cathode of each of the amplifying tubes. The voltage drop across these resistors, which are ordinary flexible grid suppressors in the case of the first four tubes, and wire wound capable of handling 5 watts in the case of the power tube, supplies the necessary negative bias to each tube.

Across the resistor in the radio frequency circuits is placed a .001 mfd. condenser having unusually low RF resistance, so that no obstruction will be offered to the passage of the tiny radio frequency impulses.

Simple Diagrams

On the pictorial wiring diagram, in order to simplify it and not confuse the builder by a multiplicity of lines, the AC filament wires are not shown, as is also the case with the 110-volt wiring.

It will be noted that two of the terminals on the transformer are labeled "A", and also two terminals on each of the five-prong tube sockets are marked "A" on the pictorial. This indicates that these are the connections for the filaments of these tubes. One lead from the transformer terminal labelled "A" should be run to one of the corresponding leads on each socket, and a connection made from the remaining "A" lead on the transformer to the remaining "A" leads on the sockets. The same procedure should be followed with the "B" markings.

The filament leads should be twisted tightly together and kept well isolated from all other leads.

As in the battery model, described previously, all other low potential wires should be carefully tied into a cable extending down the channel just in front of the audio frequency amplifier, where they will be found to terminate conveniently to the voltage dividing resistor and filter block.

Electrad Resistor as Divider

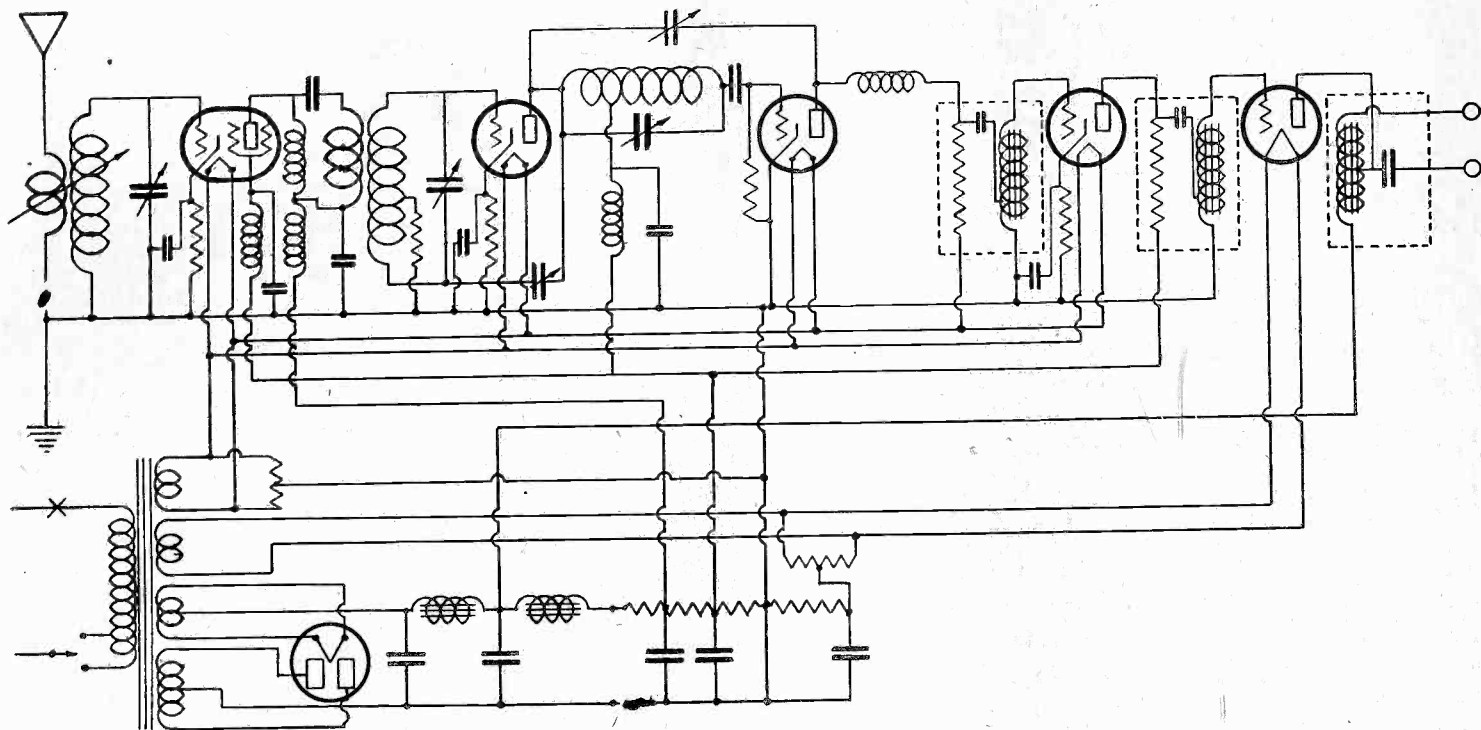
The Electrad Truvolt 10,000-ohm resistor used as a voltage divider is provided with two adjustable sliding taps. These should be carefully spaced so that they are exactly the same distance apart and from the end terminals. Under load, with all the tubes in the receiver and operating properly, this arrangement will give exactly 300 volts for the B and C of the 245, 180 volts for the plate of the AC screen grid tubes and for the first audio 227, 75 volts for the screen grid of the SG tube, and the plates of the second RF tube and detector.

These voltages may seem in some instances a trifle high, but it must be remembered that the Clough System Silver-Marshall transformers which are employed embody a resistance in the plate circuit

Daniels AC5

New Tubes in Expert Design

Moore



of appreciable value, so the 75 volts applied to the plate of the detector is effectively only about 45 volts at the plate, and the 180 volts apparently reaching the first audio stage amounts to only 135 at the plate, for which the bias is entirely adequate.

Line Voltage Compensation

To compensate for varying line voltages in various localities the Silver Marshall 335-U transformer is provided with two input voltage taps. At the left-hand side of the transformer there are two terminals at the rear, then a single terminal which in the drawing is labelled "tap." In the event of the line voltage being known to be under 110 volts, use the extreme left terminal, but unless you know it is below 110 volts, use the "tap" terminal.

The small center-tapped resistances by which the electrical center of the filament windings is obtained are not critical either for exact position of the center-point or as to value. Anywhere from 20 to 50 ohms will be found satisfactory, and the position of the center-tap may be 10% or 15% off without audible hum being produced.

The All-Electric Moore-Daniels model operates in exactly the same way as the battery-operated model. The completely wired set is tested differently, however.

After the set is wired, connect the 110-volt leads to the electric light socket with a 100-watt or larger lamp in series with one of the leads. If the lamp lights at all, after an initial flash, it should be well below full brilliance.

Sign of a Short

If it lights up brightly, there is a short circuit in the wiring somewhere, which should be checked up immediately. If that is unnecessary or after it has been corrected, leave the series lamp and insert the 280 rectifier tube in its socket. The series lamp should glow a trifle more brightly, and the filament of the 280 should attain a barely perceptible red

- ### LIST OF PARTS
- One Set Transcontinental Moore-Daniels coils.
 - Five Transcontinental radio frequency chokes.
 - Two Air-Gap sockets.
 - Four DeJur five-prong Sockets.
 - Two Hammarlund Illuminated Drum Dials.
 - Three Hammarlund Midline Condensers, .0005 mfd.
 - One Hammarlund neutralizing condenser.
 - Three Hammarlund Universal couplers.
 - One microdenser, 55 mfd.
 - One 245 filter condenser block.
 - Three .5 mfd by-pass condensers.
 - One fixed condenser, .00025 mfd.
 - Three fixed condensers, .001mfd.
 - One Silver Marshall Power Transformer, 335-U.
 - One Silver Marshall Unichoke 331.
 - One Silver Marshall Audio Unit 255.
 - One Silver Marshall Audio Unit 256.
 - One Silver Marshall Audio Unit 251.
 - One DeJur 3-meg. grid leak, with mount.
 - One Electrad 10,000-ohm resistor, two taps.
 - One Electrad 500-ohm resistor strip.
 - Two Electrad 1,500-ohm resistor strips.
 - One Electrad 1,000-ohm resistor strip.
 - One Electrad 1,000-ohm 5-watt resistor.
 - One 110-volt toggle switch.
 - Four binding posts.
 - One binding post strip.
 - One 7 x 24 Bakelite Panel.
 - One 11 x 23 baseboard.
 - One roll Corwico hook-up wire.
 - Two knobs.

glow. In daylight, the glow of the filament may not show.

Now remove the series lamp. The 280 should glow a trifle brighter, and the Electrad divider should warm up somewhat. Now turn off the current. Insert the tubes in the set proper. Turn on the

juice again. The heaters should take from ten to twenty seconds to attain their full heat, after which the set may be checked through and tested in exactly the same way as the battery operated model already described.

By careful study and comparison of the schematic and pictorial wiring diagrams before starting, the builder should so familiarize himself with the identity of each wire and instrument that when he starts to put them together he will be able to do so with skill.

Before commencing to build the set, we

strongly recommend that the reader consult his copies of RADIO WORLD dated March 23rd and March 30th, and read what James H. Carroll and the writer have already said about the characteristics of this truly extraordinary receiver. You will find selectively fine, tone excellent, DX plentiful.

The usual procedure in tuning a distant station is to turn up the regeneration until the set just oscillates, then rotate the dials slowly in the vicinity of the desired station until its squeal is heard.

At this point we diverge to say that you can let this set squeal all you please without fear of annoying other listeners—the shield grid tube and its associated circuits make radiation nil, or too feeble to be of any annoyance to neighbors.

After the squeal is heard, vary the left-hand dial until it is loudest, and then slide it gently out of oscillation. The antenna variometer can be readjusted for maximum volume (you'll only need that for stations three or four thousand miles away) and the requisite selectivity can be attained in the same way.

One very desirable arrangement which is not shown in the diagrams because it is not absolutely essential is the attachment of two Hammarlund Equalizers across the sections of the two left-hand condensers. These can be varied when installed until a weak signal reaches maximum strength after which they should be let alone.

[The construction of a three-stage balanced amplifier and power pack will be described next by the designers of the Moore-Daniels receivers. This amplifier has sufficient gain to produce good volume even from very weak signals. It employs two of the new 245 tubes in the last stage and has sufficient power to operate several dynamic speaker units, if desired. This amplifier was designed primarily as a deluxe amplifier and power supply for the Moore-Daniels receiver, but will serve equally well with other receivers or as a phonograph amplifier.—Editor.]

Radio University

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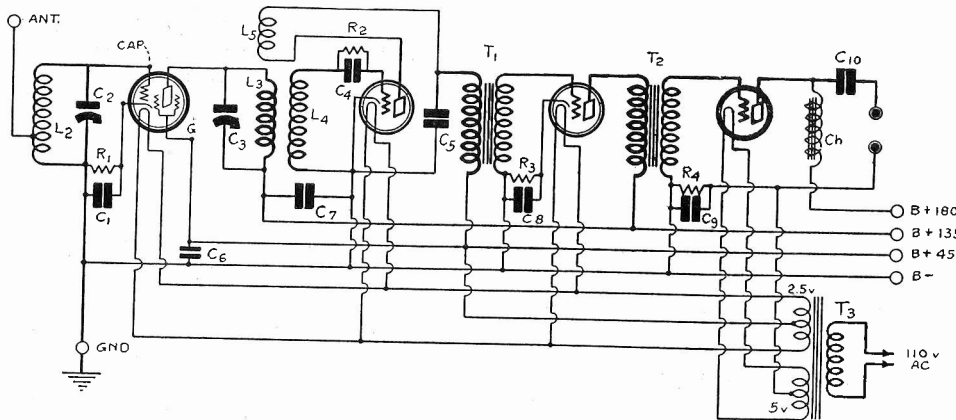


FIG. 739

DESIGN FOR A 4-TUBE ALL-ELECTRIC AC RECEIVER, WHEREIN A SCREEN GRID TUBE, TWO 227 TUBES AND A 171A POWER TUBE ARE USED. THE ANTENNA IS CONDUCTIVELY COUPLED, FOR STRONG PICKUP, BUT THE TWO TUNED CIRCUITS SHOULD BE TUNED INDEPENDENTLY. GANGING IS NOT PRACTICAL WITH THE CONDUCTIVELY TUNED ANTENNA CIRCUIT.

IN CALCULATING the grid bias resistor for a screen grid tube should only the plate current be used or should both the plate current and the screen grid current be used?

(2)—What should the grid bias be on the 622 and AC screen grid tube?

(3)—If I insert a milliammeter in the lead to the cathode, will the meter read the plate current?

HOWARD RICHARDSON,
Toledo, Ohio.

(1)—The total current flowing in the cathode lead should be used, that is, the sum of the plate current and the screen grid current.

(2)—The bias should be 1.5 volts for both tubes.

(3)—The milliammeter will read the sum of the plate and the screen grid currents. It is this which should be used in computing the grid bias resistor. But the current should be measured when the grid bias is 1.5 volts. A dry cell may be used to obtain the bias while the measurement is made.

* * *

WILL YOU PLEASE publish a circuit diagram of a four tube AC receiver using one screen grid tube, two -27s and one -71A.

(2)—Also please give the grid bias resistors and the capacities of the by-pass condensers.

(3)—What should the voltages on the AC screen grid tube be?

WALLACE KIRK,
Brooklyn, N. Y.

(1)—Fig. 739 shows such a circuit.

(2)—R1, 600 ohms; R3, 1,750 ohms; R4, 2,000 ohms; C1, .001 mfd.; C8, 1 mfd.; C9, 4 mfd.; C6, .01 mfd.; C7, .01 mfd.; C5, .0005 mfd.

(3)—The plate voltage should be 135, screen grid voltage 75, filament voltage 2.5, and grid voltage 1.5 volts.

* * *

I BUILT the four tube screen grid Diamond just exactly as you described it, except that I used a bakelite subpanel and tuning coils, condensers and audio transformers from an old set. But the circuit does not work. I only get a local station very faintly. I have checked the wiring many times and I am sure that it is all right. What can I do to get the set going?

CHARLES JACOBSON,
Newark, N. J.

Don't trust a visual test of the wiring. You cannot possibly see that all the circuits are continuous by looking at the wiring. Test all grid, plate and screen grid circuits with a meter or a head-set and battery. Make sure that all the tubes get the proper voltages. Also make sure that the screen grid tube is functioning. This tube is best tested in another screen grid tube set. Test for open and short circuits all through. When wired properly the receiver is remarkable.

* * *

IS IT NECESSARY to provide a center-tapped resistor for each of the -27 type tubes in a receiver or will one do for all of them?

(2)—If one will do, what should be the value of the resistance?

(3)—Where should it be placed and to what point in the circuit should the center-tap be connected?

LOUIS WATSON,
Pensacola, Fla.

(1)—It is not necessary to use more than one resistor for all the tubes on one winding, but there should be one for each 2.5 volt winding. If the winding is center-tapped, of course the resistor is superfluous.

(2)—The value is not critical, but 30 ohms is a good value.

(3)—It should be put across the transformer winding anywhere between the terminals on the transformer and the terminals on one of the sockets. The mid-tap should be connected either to the cathode lead or to the plus 45, whichever gives least hum.

* * *

I HAVE a receiver now using two -71A tubes in the last stage. If possible I should like to substitute two -45 type tubes, now that they are available. What changes are necessary in the circuit?

(2)—Will I get more volume out of two of these tubes than out of the -71A tubes for the same signal voltage input?

SUTTON GREER,
Racine, Wis.

(1)—Boost the total voltage on the plate and grid to 300 volts. Change the filament voltage from 5 to 2.5 volts and use an 800-ohm grid bias resistor in place of the 1,000 ohm unit.

(2)—You will get more volume out of the new tubes because they have a higher amplification factor and approximately the same mutual conductance.

* * *

I AM PLANNING to rebuild my five-tube radio receiver to get greater sensitivity. It is now of the TRF type with two good audio frequency transformers. Would it be worth while to install one screen grid tube?

(2)—How will the selectivity and sensitivity of the circuit be compared with the old circuit?

TOWNSEND KING,
Paterson, N. J.

(1)—The screen grid tube is very much worth while as a radio frequency amplifier provided it is operated correctly.

(2)—The selectivity will be somewhat lower but the sensitivity much greater.

* * *

I WISH to wind some coils for .0005 mfd. condensers on 2-inch tubing, using No. 26 D.S.C. wire. Please give the turns required.

(2)—How many turns should be used on the primary when the coil is to follow a screen grid tube?

(3)—What wire should be used on the primary?

RUDOLPH JOHNSON,
Fort Dodge, Iowa.

(1)—See the article on page 16, March 16 issue of RADIO WORLD.

(2)—As many as on the secondary.

(3)—Any fine insulated magnet wire.

* * *

WHAT IS an inductive trimmer? How is it made?

(2)—Is it possible to gang several condensers and adjust the tuned circuits so that they are all in tune identically at any dial setting?

(3)—Please explain how it is done if it is possible.

SAUL KATZ,
Milwaukee, Wisc.

(1)—An inductive trimmer is a small coil in series with the main tuning coil so mounted that the coupling between it and the coil can be varied. It may have from one to ten turns depending on the size of the turns. Its object, of course, is to compensate for differences in circuits tuned by the same control.

(2)—It is possible but it is not simple.

(3)—See an article on page 12 in the December 22 issue of RADIO WORLD for a detailed explanation.

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'Antennaless' Sets Next!

New AC Screen Grid Tube Makes Circuit Autonomous

By *McMurdo Silver*

FROM the viewpoint of engineering merit, the new AC screen grid tube, soon to be announced by RCA and Cunningham, is nearly eight times as good as the 226 and 227 type AC tubes which are today used as radio frequency amplifiers in almost every modern receiver.

Just what does this mean, not in amplifications, selectivity factors, and stability, but in terms of home enjoyment and convenience?

Briefly, this means that the screen-grid tubes, followed by a power detector and two good audio stages, will give a sensitivity of 10 microvolts per meter—an engineering definition of what is generally considered a far greater sensitivity in a radio set than can be used in most homes. due to static and other interference ordinarily never heard on less sensitive sets.

"Antennaless" Set Next

Translated into non-technical language, the superiority factor of the new AC screen grid tube means that sets can be built commercially requiring no outside antenna or ground connections, and operating entirely from self-contained screen antennas fastened into the wooden cabinets housing set and loudspeaker.

Such sets, if well designed, will receive more distant stations, with less interference, than sets using an equal number of less sensitive tube, although the usual outside antenna installation is used with the less sensitive tubes. The lessened interference of the screen grid set means finer, clearer tone quality.

From the viewpoint of convenience alone, screen grid tube superiority means the elimination of all antenna and ground installation bother in all but a very few percentage of installations. The great stride this development represents can best be grasped when it is realized that ever since wireless became a really countless thousands of engineers have striven to build a truly self-contained radio needing no outside antenna, ground, or speaker

connections, and requiring simply to be plugged-in like an electric iron or toaster to operate.

Dream Now a Possibility

This dream, with the almost complete elimination of dealer and consumer installation problems that it brings, is now a possibility.

Speaking technically for a moment, the eight-time superiority of the new AC screen grid tube means that for a given sharpness of tuning a stage of radio frequency amplification can be made to give nearly eight times more amplification with one of the screen grid tubes than it will with a 226 or 227 type tube, without oscillation, and that the screen grid tube does away with neutralizing adjustments, the new tube itself being inherently a much more stable RF amplifier than any other known tubes.

Unfortunately, however, the superiority factor of eight for the new type tube cannot be fully realized, and all that can be realized in practice cannot go into amplification.

As amplification is increased, with absolute selectivity held constant, apparent selectivity as observed by an operator falls off much more rapidly.

Selectivity Considered

By rule of thumb, if amplification is doubled, absolutely selectivity must go up four times (selectivity must go up as the square of amplification if a satisfactory practical receiver is to be obtained). Briefly, this means that the superiority factor of nearly eight for the new tubes translate into an actual amplification of four times greater than can be gotten from a 226 or 227 type tube, holding the selectivity apparent to anyone tuning the amplifier to the same value.

The screen grid amplifier is completely stable, inherently free from oscillation troubles, and yet requires no neutralizing or stabilizing adjustments.

NEW SILVER-MARSHALL FACTORY NEAR CHICAGO AIRPORT

The new radio receiver factory of Silver-Marshall, Inc., largest American makers of radio parts and kits, is now well under way in the Clearing Industrial District of Chicago—within the "Whirr" of the Chicago Municipal Airport, according to McMurdo Silver, president of the corporation. The plant will be the third radio manufacturing enterprise to locate in the modern Clearing Industrial District, nine miles from the heart of the Chicago "loop." The Silver-Marshall plant, however, is the largest radio factory yet to locate at Clearing, being in itself bigger than its two predecessors put together. The last word in modern one-story industrial buildings, the new S-M plant, with over 100,000 square feet of floor space, will be in operation early in May, with a capacity of 1,000 to 2,000 complete radio sets per day, in addition to a greatly augmented line of radio parts, accessories and power amplifiers—the latter in great demand since the widespread popularity of talking movies.

The organization thus occupying the largest radio plant on Chicago's south side was founded less than five years ago. Operating in the past only in the radio parts business—where gross sales have fallen off at the rate of about 40% a year since 1925—the company has steadily lifted itself, almost "by its bootstraps," until it is now doing over 10% of the total parts business of the country. While other parts manufacturers have withdrawn from the business or fallen by the wayside, sales and profits of the young company have mounted by leaps and bounds until, early in 1929, it was able to obtain an RCA set-manufacturing license and assume an obligation of minimum guaranteed royalty payments to R. C. A. of \$100,000 a year. The corporation has been continuously directed by its president and founder, Mr. Silver.

Some Inside Facts on the New AC Diamond

[The construction of the AC Diamond was described in the March 23d and 30th issues. The circuit uses one AC screen grid tube, two 227 tubes and one 112A or 171A (power tube.) Next week, issue of April 13th, constructed plans will be published in diagrammatic form.]

The AC Diamond, a 4-tube design, is sensitive over the entire broadcast band. You will get fine reception.

Also please be assured that you will positively get rid of squeals. The only reason why so much space has been devoted to the squeal problem is that it is still the biggest problem in radio receiver design—the stabilization of a receiver without undue loss of amplification. The success of the receiver, or of any other receiver, depends largely on its stability, and you may be certain that the measures outlined March 23d and 30th assure you of a stable set.

If you stick to the parts as specified

you will have no trouble from motorboating, even though this is a fine quality circuit in the audio channel, i. e., transformer coupled. You may hear a stuttering sound, but it will be due to self-oscillation at radio frequencies producing a beat that sounds like motorboating, but is wholly unlike it electrically, since motorboating is low-frequency oscillation only. Correct the RF oscillatory condition and the supposed motorboating will disappear.

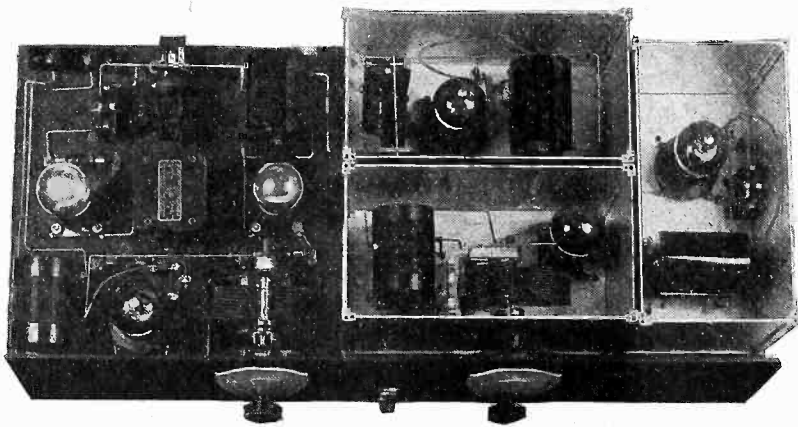
The receiver will hum ever so slightly. There is little hum produced by the operation of the 227 tubes and the AC 222 tube, especially when the midtap of the 2.5 winding that heats the heaters goes to B plus 45 more or less. The last tube, if a 245, contributes no hum, since it is designed to be as hum free as a directly heated AC tube can be, because of low voltage across the filament and high current. The last tube, of course, if the new 245, has 180 volts on the plate, and greater

undistorted maximum power than the 171A at the same plate voltage, despite lesser bias.

If you are using a dynamic speaker and you hear a hum you may feel certain that this is due to the speaker primarily, as you can prove by putting a large capacity across the field coil of the speaker. Lo! the hum will disappear. Such a capacity—about 9 mfd. or so, which may be an electrolytic condenser—is often essential in DC types of dynamics that are at a distance from the receiver itself, since the length of the cord offers a suitable impedance across which the alternating current of the hum frequency finds a stamping ground. The condenser across the field coil kills off this hum.

The circuit was well tried and tested before a word of this article was written, so that you are assured, in building this receiver, that you will have something indeed sensitive, easy to operate and that produces excellent tone quality.

Build the Greatest Circuit—RE 29!



The neat and efficient arrangement of parts in R. E. Lacault's RE29.

Lacault's Last and Best Receiver!

FOR sheer sensitivity the screen-grid receiver, the RE29, surpassed any circuit he ever tried, R. E. Lacault said, just before his death. So that this extreme sensitivity could be utilized properly, Mr. Lacault spent many trying months until he developed the circuit to a remarkably high point of selectivity, with utter stability. That done, he knew he had a wonderful receiver, one that his large following, eagerly awaiting a screen grid adaptation of his original modulation system, would build with delight and operate with ecstasy! The RE29, successor to a long line of successful Lacault receiver designs, is here. His last circuit,

his best circuit, may now be duplicated by constructors!

THE receiver consists of six tubes (including first audio) in the table chassis and two tubes (a push-pull output) in the B supply and power amplifier. Hence the receiver proper uses eight tubes. Two 281 tubes are used as rectifiers. So well are each independent stage and the group of stages designed that abnormally high amplification prevails. Distant stations "roll in" easily, with volume to spare. The master designer of DX circuits took good care of that!

Build this receiver and the Push-Pull Power Amplifier B supply from the official blueprints.

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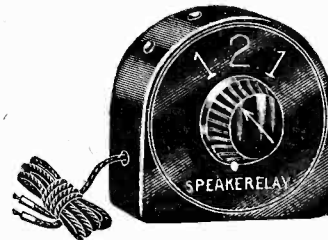


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Instead of using two speakers you may use one speaker and one pair of earphones. This is a great asset when tuning in DX, for with earphones you may readily discern the call letters that might not be so plain on the speaker. Also, any weak station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

You can get \$100 worth of service out of one of these \$2 products

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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.

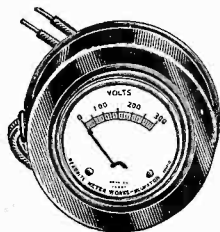
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0-300 v., in portable type, full nickel finish, 30" tipped cord (illustrated at left). (Cat. No. 346) \$4.50

0-500 v., Tests ALL power packs, B eliminators, etc. Same casing as above. (Cat. No. 347) \$5.00

Just the thing for service men, custom set builders, home experimenters.

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

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. SEVEN YEARS OLD!

You can find no magazine that better caters to your needs than Radio World, which specializes in most intimate revelations of the ins and outs of the best circuits, with technical accuracy second to none. Enjoy the weekly companionship of Radio World's famous contributors, and glean the news of radio, from the four quarters of the earth.

Short waves? Radio World will tell you all about them. Extremely sensitive broadcast receivers? Their construction and operation are fully discussed with confident regularity. Power supplies—push-pull or otherwise? AC receivers? Screen grid tubes? Large receivers that give a super-abundance of performance—small, economical receivers that give performance out of all comparison to their size? Are you interested in these? Then you're interested in Radio World. Send \$1.00 now for a ten-week subscription for Radio World (regularly \$1.50), and in addition you will be sent FREE any one of the following panel meters:

- 0-6 Voltmeter D.C.
- 0-50 Voltmeter D.C.
- 6-Volt Charge Tester D.C.

- 0-10 Amperes D.C.
- 0-25 Milliampers D.C.
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- 0-100 Milliampers 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

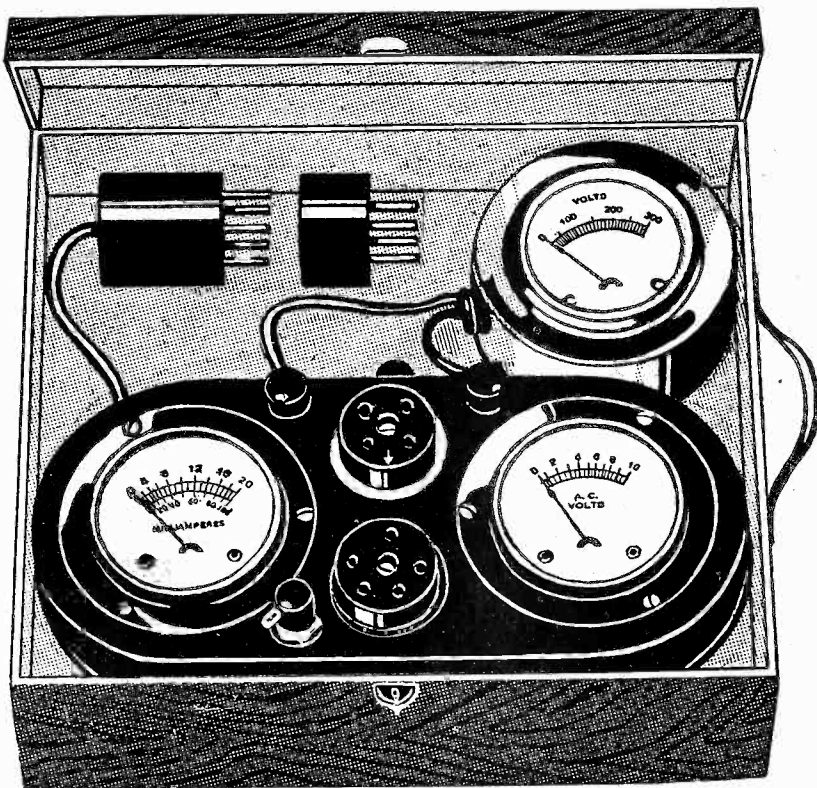
De Luxe Carrying Case **FREE**

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. Ample 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. Those 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 milliamperes 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 post-man 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

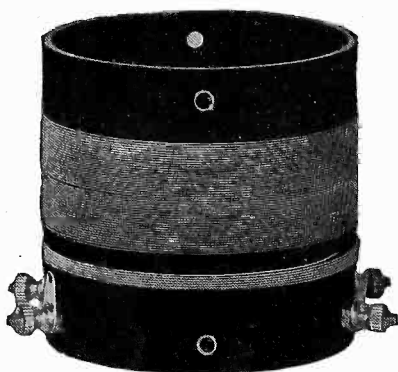
NAME.....
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5-DAY MONEY-BACK GUARANTY

Coils Built for Abundant Results!

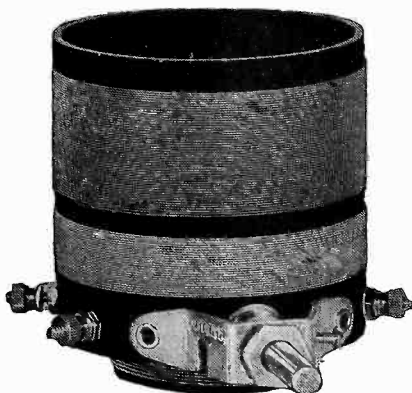
They Meet the Needs of Battery-Operated or AC Screen Grid Tubes, and General Purpose Tubes of Battery or AC Types.

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, 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



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.

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!

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 2 1/2 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.

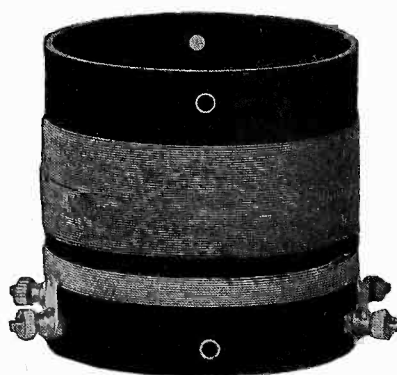
All coils are sold on a five-day money back guarantee. If you're not delighted with them, for any reason, send them back in five days and get your money back.



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.

The UNIVERSAL Pair



RF5 \$1.50
Excellent 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.

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

Build the New Diamond (AC or Battery Model)

The 4-Tube Circuit Supreme!

USE THE OFFICIAL PARTS
AS SPECIFIED BY
HERMAN BERNARD,
Designer and Author

The parts listed herewith are exactly the same as those used by Mr. Bernard in his laboratory model.

PARTS FOR THE AC DIAMOND

CA, CG, C7—Three Aerovox .0005 mfd. mica fixed condensers, moulded, @ .25	\$0.75
C3, C4, C8—Three Aerovox .008 mfd. mica fixed condensers, moulded, @ .50	1.50
C6, C9—Two Aerovox .02 mfd. mica fixed condensers, moulded, @ \$1.00	2.00
C10—One Aerovox 4 mfd. condenser	2.50
C1—One Hammarlund Equalizer, 70 mfd.	.40
C2, C5—One Hammarlund Midline double condenser, each section .0008 mfd. (MID23)	6.00
R1, SW—One Electrad Royalty volume control (0-5,000 ohms) with 110-volt Hart & Hegeman AC switch built in	1.50
R2—One Electrad 900-ohm resistance strip (grid suppressor type)	.20
R3—One Lynch 50,000-ohm resistor, with clips	.20
R4—One Electrad 2,000-ohm resistance stub	.20
R5—One Electrad 2,000-ohm type B resistor (B20)	.20
T1, T2—Two National A100 audio frequency transformers @ \$5.70	11.40
T3—One filament transformer; one winding 2.5 volts at 9 amperes or more, one winding 2.5 volts at 3.5 amperes or more, one winding 5 volts at 2 amperes or more (merchandise by Guaranty Radio Goods Co.)	6.00
PL—One Yaxley pilot light bracket with green jewel and lamp	.55
Ant., ground, speaker —, speaker +, four binding posts @ .10	.40
One roll Braidite wire	.30
One 7 x 21-inch front panel	2.35
One 10 x 20-inch official AC Diamond aluminum subpanel, self-bracketing, with three five-prong sockets and one four-prong socket built in	3.25
Front and subpanel together	5.25
Porcelain AC socket, screw plug 3-way plug, cable (lamp cord) and wall plug	.75
One dial	.90
Two knobs (one for tickler, the other for volume control) @ .20	.40
Note: The optional condenser, CX, is .006 mfd. @ .50	.50

ACCESSORIES

One National elvett-B, type 3580, with 280 tube	16.13
One 222 AC tube, two Kelly 227 tubes, and one Kelly 112A or 171A tube	11.00
One 7 x 21 x 12-inch cabinet (walnut)	12.00

PARTS FOR BATTERY MODEL DIAMOND

C1—Aerovox .0005 moulded fixed	.25
C2—Hammarlund .0005 mfd. Midline	3.30
C3, C4—Two Aerovox moulded .008 mfd. @ .50 ea.	1.00
C5—Hammarlund .0005 mfd. Midline	3.30
C6—Aerovox .00025 moulded fixed with clips	.30
C7—Aerovox .0005 moulded fixed	.25
A1—622 Amperite with mount	.85
A2, A3, A4—Three 1A Amperites, three mounts @ .85	2.55
R1—50-ohm Frost rheostat	1.00
R2—5-neg. Lynch metallized leak	.40
T1, T2—Two National A100 audios @ \$5.70 ea.	11.40
Ant., Gnd., Sp. —, Sp. + posts @ .10 ea.	.40
P1—Yaxley jewel window bracket .35 with pilot lamp	.20
Sw—Yaxley No. 10 A battery switch	.35
7 x 21-inch front panel	2.35
10 x 20-inch official battery Diamond subpanel, self-bracketing, with four sockets affixed; subpanel hardware, insulated bushings, washers	3.00
Front panel and subpanel together	5.00
Two dials with pointers	2.00
Two knobs @ .20	.40
One roll stranded Braidite	.30
Hammarlund 70 mmfd. Equalizer	.40
Four Kelly tubes: one 222, two 201A, one 112A or 171A	7.00

GUARANTY RADIO GOODS CO.
145 WEST 45th STREET
(Just East of Broadway)
NEW YORK CITY

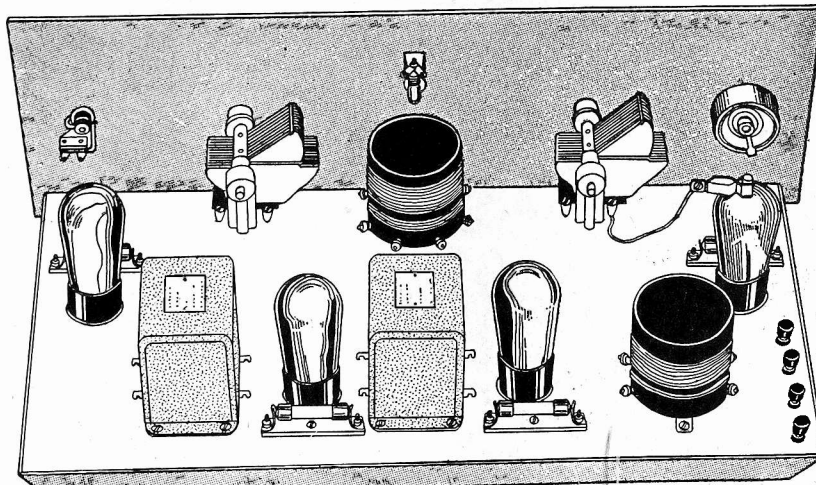
Complete List of Radio Stations

RADIO WORLD dated March 23d carried a full and thoroughly up-to-date list of broadcasting stations as they stood at the time of going to press. This list contained the stations in the order of frequency and gave the owner, location, power and time sharers.

Mailed for 15c a copy; or subscribe now and start with the March 23d issue.

Radio World, 145 W. 45th St. N. Y. City.

Most Selective DIAMOND



See what a dandy appearance this simple, efficient receiver makes! One SG tube, two 201A and one 112A (or 171A) are used. Aluminum subpanel shown.

Follow Blueprint

THIS IS THE BATTERY MODEL

Here is the circuit of circuits—the design that makes a neighboring cleared-channel, high-power broadcaster snap out of audibility at a slight turn of the dial.

No need to worry about the selectivity requirements imposed on receivers by the reallocation.

Volume "to fill the house"—even on distance. Tone quality excellent.

Get the official blueprint of the laboratory model of the new SG 4-tube Diamond, exactly as built by Herman Bernard, the designer.

RADIO WORLD
145 W. 45th St., N. Y. City
(Just E. of B'way)

Enclosed please find \$1.00 for which please send at once the official blueprint of the new, highly selective 4-tube screen grid Diamond of the Air battery model.
 50 cents extra for the February 9th, 16th, 23d and March 2nd (1929) issues of Radio World, containing Bernard's articles on the construction of this receiver.
 \$3.00 for 6 months (26 numbers) subscription for Radio World. Send Diamond blueprint and four Diamond issues FREE, in addition to 26 current issues.

Name

Address

City State

Blueprint of the AC Diamond

BUILD this 4-tube receiver, using one 222 tube, two 227 and one 112A (or 171A), and enjoy tone quality, selectivity and ease of control. The official blueprint gives the picture diagram life size, both top and bottom views; also schematic diagram and list of parts. You can use your present B eliminator externally, but the filament transformer is a part of the circuit.

Enjoy the convenience of AC operation, and still have just as selective and sensitive receiver, by building the AC Diamond. If you have 110-volt, 50 to 60 cycle AC house current, then this is the circuit for you. Fine performance. No hum.

Radio World, 145 W. 45 St., N. Y. City (Just East of Broadway)
 Inclosed please find \$1.00 for which send at once official blueprint of the 4-tube AC Diamond.
 30c for the March 23d and 30th issues (1929) describing this circuit.
 \$3.00 for 6 months subscription for Radio World. Send blueprint and two AC Diamond issues FREE.

NAME

ADDRESS

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

Aluminum Subpanel

for the New, Highly Selective

SG Diamond

Battery or AC Model (specify which)

The best appearance of the New Diamond of the Air results from using the official aluminum subpanel, 10 x 20 inches, with the four sockets built in, and with self-bracketing front. Hardware and insulating washers supplied with each sub-panel. The aluminum sub-panel is exactly the same as the one used in the laboratory models of the battery operated and the AC Screen Grid Diamonds. Holes are drilled for mounting parts, but as this aluminum drills like bakelite you can drill any holes you want.

Front Panels

The front panels for the battery model or the AC Diamond are of Bakelite, 7x21 inches, and are drilled with all necessary holes, each in exactly the right place. High-polish finish.

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

Enclosed please find \$3.00 for which please send one aluminum subpanel 10x20" for the new battery model 4-tube SG Diamond of the Air, with sockets built in, and with self-bracketing front and side and rear supports; also send hardware and insulating washers.
 Enclosed please find \$1.35 for which please send 7x21" drilled Bakelite front panel for the new battery model Diamond.
 Enclosed please find \$3.25 for the 10x20" aluminum subpanel, etc., for the new AC Screen Grid Diamond.
 Enclosed please find \$1.35 for the 7x21" drilled Bakelite front panel for the new AC Screen Grid Diamond.
 Enclosed please find \$5.00 for both the aluminum subpanel, etc., and the drilled Bakelite front panel of the battery model.
 Enclosed please find \$5.25 for both the aluminum subpanel, etc., and the drilled Bakelite front panel of the AC model.

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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 7 $\frac{1}{2}$ 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, 13 $\frac{1}{2}$ ". Weight, 5 lbs.

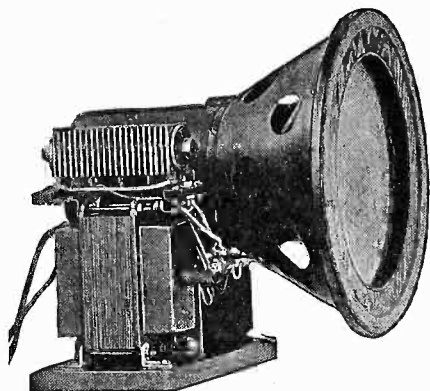


Driving motor, the unit needed to work the air column horns. Standard size thread. Cat. 203. Price, \$3.50 net.



Cat. 300
\$10.50 Net

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



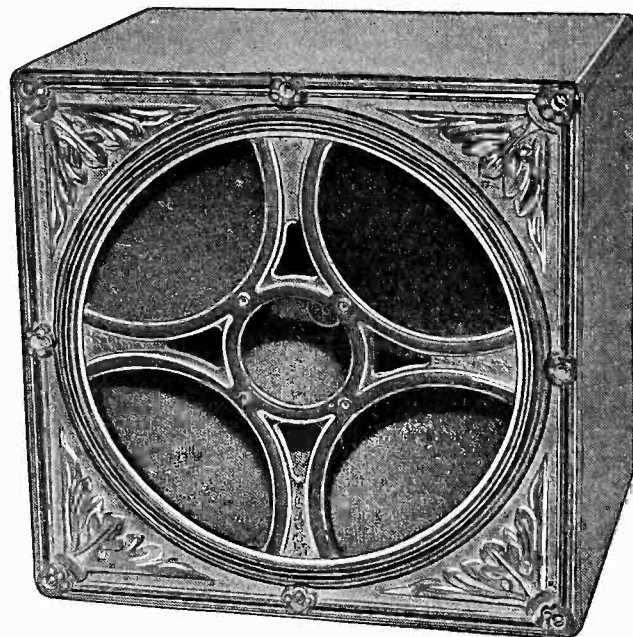
Cat. 110 A.C.; Price, \$20.50 Net

DYNAMIC CHASSES and Baffle

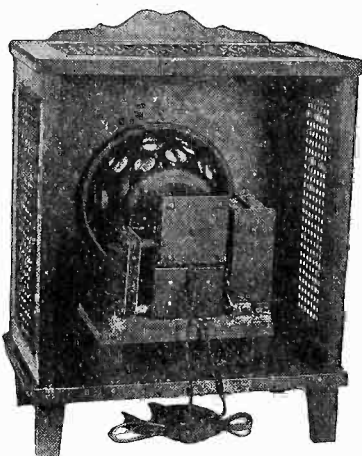
The dynamic speaker is the most popular one by far, and here is your opportunity to get a real fine chassis at a low price. Cat. 110 A.C. operates directly from the 110-volt A.C. (alternating current) lamp socket, to which built-in plug is connected, while the tipped cords go to your receiver output. 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. 113
Price, \$13.50 Net



Cat. 111; Price, \$11.00 Net

Cat. 110 A.C., shown inside, \$20.50 extra.

FILL OUT AND MAIL COUPON

ACOUSTICAL ENGINEERING ASSOCIATES,
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):

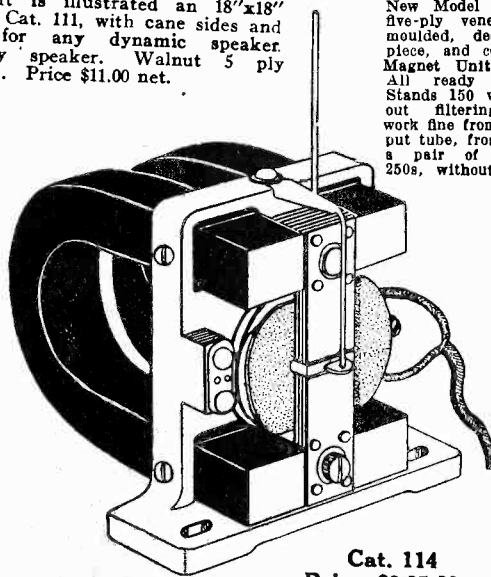
- | | |
|---|---|
| <input type="checkbox"/> Cat. No. 200 | <input type="checkbox"/> Cat. No. 111 |
| <input type="checkbox"/> Cat. 300 | <input type="checkbox"/> Cat. No. 113 |
| <input type="checkbox"/> Cat. No. 110 A.C. | <input type="checkbox"/> Cat. No. 114 |
| <input type="checkbox"/> Cat. No. 110 D.C. | <input type="checkbox"/> Cat. 114A |
| <input type="checkbox"/> Cat. No. 6 D.C. | <input type="checkbox"/> Cat. 115 |
| <input type="checkbox"/> Cat. No. 300 | <input type="checkbox"/> Cat. 116 |
| <input type="checkbox"/> Please send C.O.D. | <input type="checkbox"/> Cat. No. 203 |
| <input type="checkbox"/> Remittance enclosed. | <input type="checkbox"/> Please send prepaid. |

Name

Address

City State

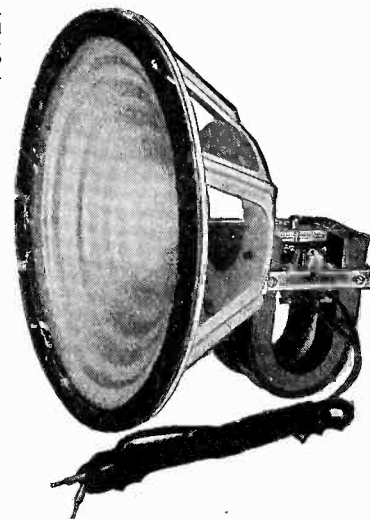
5-DAY MONEY-BACK GUARANTEE



Cat. 114
Price, \$9.25 Net

Polo Twin Magnet Unit—weight, 3 $\frac{1}{2}$ 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.

New Model Polo Speaker, with five-ply veneer walnut housing, moulded, decorated metal front piece, and containing Polo Twin Magnet Unit and Textile 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. 115; Price, \$11.50 Net

Molded 9" spider, unbreakable metal, with Textile cone and felt ring and apex, and Polo Unit mounted on the assembly, which stands on own feet. Cat. 115.

RADIO BLUEPRINT LIBRARY

RADIO AC UPS

6 Tube Single Control Set
5 Tube Tuned Radio Frequency Set
4 Tube Popular Uncle Sam Set
4 Tube Screen Grid Set
3 Tube All Wave Set (20 to 550 M)
B-Eliminator for A. C. Current

1929 EDITION
BIG NEWSMAN

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.

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

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.

Orders - Inquiries

60 pages
Send for **FREE** Copy
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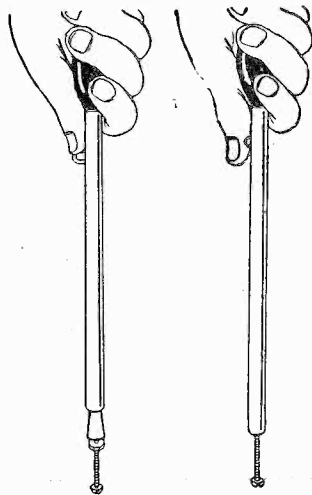
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9½-inch (large size) Musicone!
Tri-Foot Stand!
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Factory-Sealed Carton!

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You can order one of these complete Musicones—with Tip-Top solid mahogany baffle, tri-foot stand and 9½-ft. cord, with perfect safety, because:

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(2) Besides our own guarantee you will receive with your speaker the following guarantee signed by the Crosley Radio Corporation: "Purchase this Crosley Musicone. Try it in your home for five days. Test it in comparison with any loudspeaker made. If you are not satisfied, return it to the dealer from whom you purchased it. He will promptly refund your money without argument, delay or question. There will be no annoying red tape to go through."

(3) Each speaker is marked: "M'fd. by the Crosley Radio Corp., Cincinnati, Ohio, U. S. A." and bears the following notice: "Patd. U. S. A., April 22, 1924—Feb. 10, 1925—May 4, 1926. Canada, Jan. 26, 1926—July 13, 1926. Great Britain, July 1, 1926. France, Aug. 21, 1926. Other U. S. A. and foreign patents pending."

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THERE is nothing the matter with this speaker. We assure you of that. The Crosley Radio Corp. assures you of that. You assure yourself of that, because you don't have to keep the speaker if you don't think it's all we say of it and more!

This speaker—including stand and baffle—stands 40" high. A thumb-nut easily locks the baffle in place on the stand. Without loosening the nut you may turn the baffle to another angle. You can not tilt the baffle forward and backward.

The front is a beautiful sight, the bold grain of the sturdy mahogany catching the eye with almost hypnotic appeal. The finish is extra de luxe, a high polish rubbed in by expert hands. The gold-and-black weave of the grille (at center) blends exquisitely with the master workmanship of the baffle. The edge of the baffle is scalloped.

At rear is the cone proper, with its apex. This Musicone should need no adjusting, as it was carefully adjusted before it left the Crosley factory. A small opening in the rear of the cone renders access to the armature by insertion of a screwdriver. Full directions for adjustment are furnished with each speaker, for those rare instances when adjustment is deemed advisable.

The 9½-ft. cord emerges gracefully at rear, from the golden fold of the turned-back flap of the grille.

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