W.C.F.L. RADIO

W.C.F.L. Radio Magazine

Contents *for*
October–November
1927

Official U. S. Federal Radio Commission's Directory of Broadcast Stations and Wavelengths
(U. S. Dept. of Commerce)

WCFL Transmitter and Studios of the "Voice of Labor"

New 50 K. W. WCFL Broadcast Station

Co-operative Farmer-Labor Radio Association

Complete Construction Articles covering Every Important Radio Circuit from five to fourteen tubes.

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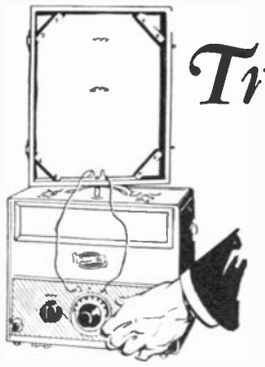
PRICE 35 CENTS

The whole family loves the little Trav-ler

Dad likes the Trav-ler because he can take it with him on fishing trips, put it in his boat and still get reports of the Cubs' victories while he's away. Mother likes it because she can take it in the kitchen or upstairs while she's working, or over to a neighbor's for a visit. The children like it because it's so simple to control. They can tune in themselves, and they can take it to the beach and on picnics and to their room to hear music at bedtime. (Mother and Dad both like the quiet, willing way the children go to bed when they have the Trav-ler in their room!) And the whole family loves the clear, sweet tone and strong volume of the little Trav-ler.

Make *your* whole family happy—get a Trav-ler Portable Radio from your nearest dealer.



Weighs only 24 pounds!

All in one small case—5 tubes, batteries, loud speaker, loop aerial. Just lift the cover and tune in—wherever you are. Costs only $84.25 complete —$65 without accessories.

There's a dealer near you.

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TRAV-LER MANUFACTURING CORPORATION · 3401 North Halsted Street, Chicago

Members of Radio Manufacturers Association

FRONT VIEW OF WORLD'S RECORD SUPER TEN

NEW WORLD'S RECORD SUPER TEN

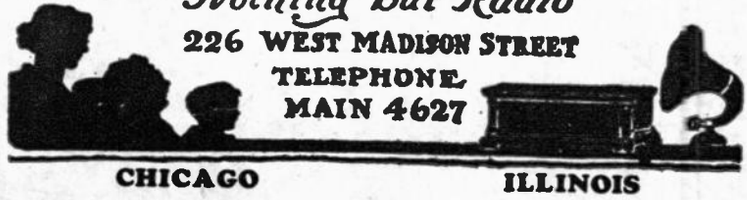
1—Remler .00035 Variable Condenser	$ 5.00
1—Remler .00035 Variable Condenser (3-Gang)	15.00
2—Remler Universal Drum Dials at $4.50	9.00
2—Remler R. F. Choke Coils No. 35 at $0.90	1.80
2—Selectone Transformers No. B-500 at $6.00	12.00
2—Selectone Transformers No. B-510 at $6.00	12.00
2—Selectone R. F. Transformers No. B-520 at $5.00	10.00
1—Selectone R. F. Transformer No. B-530	5.00
1—Selectone Oscillator No. B-540	5.00
2—Thordarson Audio Transformers R-200 at $8.00	16.00
1—Thordarson Output Transformer R-76	6.00
1—Carter Imp 400 Ohm Potentiometer	1.25
1—Carter Heavy Duty Rheostat, 1-ohm	.75
1—Carter Rheostat with Switch—15 ohms	1.50
2—Carter Tip Jacks at $0.10	.20
1—Carter .00025 Grid Condenser	.50
1—Carter .002 Fixed Condenser	.50
1—Carter .0001 Fixed Condenser	.40
1—Silver Marshall Type 340 Midget Condenser	1.50
10—Benjamin Sockets No. 9044 at $0.50	5.00
1—Pr. of Benjamin Brackets	.70
4—Tobe 1-mfd. Condensers at $1.25	5.00
1—Durham Grid Leak (3-meg'ohms)	.50
1—Jewell 0-8 Voltmeter, Pattern 135	7.00
1—Can of Kester Solder	.25
1—Drilled and Engraved Panel, 7x26x3/16 inch	6.70
1—Drilled Sub Panel, 10x25x3/16 inch	7.00
60—Kellogg Lugs, at $0.10 per doz.	.50
40—Ft. of Acme Celetsite at $0.04 per ft.	1.60
2—XL Binding Posts at $0.15	.30
1—Ekko Ground Clamp	.25
	$142.70

NEWARK ELECTRIC CO.

"Nothing but Radio"

226 WEST MADISON STREET

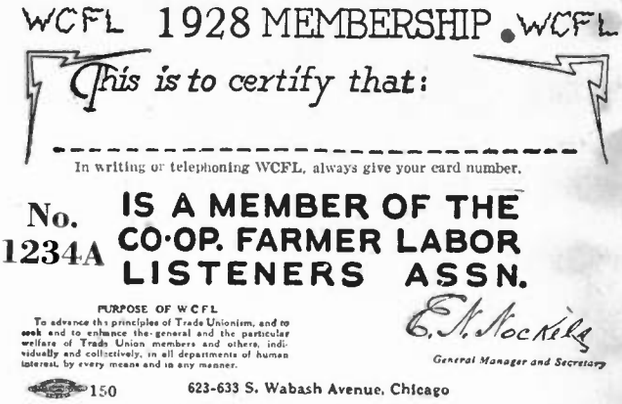
TELEPHONE MAIN 4627



CHICAGO ILLINOIS

Co-Operative Farmer-Labor Radio Listeners Association

(Front of Card.)



(Reverse of Card.)

Every subscriber to the WCFL Radio Magazine is entitled to membership in the Cooperative Farmer-Labor Listeners' Association, and a membership card properly filled in and serially numbered will be forwarded upon request. Membership in the Association is an added benefit given by the Chicago Federation of Labor to those of its friends who wish to take advantage of the special features in the *Magazine* and Official Directory of Broadcast Stations. There are no dues or assessments to pay as a member of the Association.

Members of the Listeners' Association are privileged to write WCFL Radio Magazine on any subject connected with the Broadcasting Station, or to ask for advice on building or assembling receiving sets. Also, members of the Listeners' Association may request special vocal or instrumental numbers or special announcements over the air. Just write, telegraph or telephone your request to WCFL, but be sure to give your name, address and the number of your Listeners' Association card.

The form of this card is shown in the illustrations on this page. Note the number printed on the side of the card. Your card is printed in red and blue and the number will appear at the side—but, of course, will not be the same as shown in the illustration.

If you are not now a subscriber to the WCFL Radio Magazine and Official Directory of Broadcast Stations, you are cordially invited to take advantage of this offer and become a member now. Tear out the coupon which appears on the other side of this page and send it to The Chicago Federation of Labor, together with your check, Money Order or Postal Order for the amount named. Read the printed directions carefully to avoid mistakes. The Magazine will be sent quarterly, as published, but the benefits arising from membership in the Listeners' Association will begin at once.

The Magazine and Official Directory is the exclusive property of the Chicago Federation of Labor and is not printed as a profit-making enterprise. The object is to render service to the workers and farmers and every dollar received is used to better this service. In becoming a member of the Cooperative Farmer-Labor Listeners' Association you are adding one more interested member to the thousands of earnest men and women who desire to give their cooperation to the work for humanity now carried on so ably by "The Voice of Labor," the splendid broadcast station owned and operated by WCFL, the Chicago Federation of Labor.

Fraternally,

CHICAGO FEDERATION OF LABOR,

JOHN FITZPATRICK, President
OSCAR F. NELSON, Vice-President
E. N. NOCKELS, Secretary
FRED G. HOPP, Financial Secretary
M. B. PHILP, Treasurer
HARRY E. SCHECK, Reading Clerk
CHAS HAYMAN, Sergeant-at-Arms

WCFL Radio Magazine

Published Quarterly by *(Official Publication)*

WCFL RADIO BROADCAST STATION

AND THE CO-OPERATIVE FARMER-LABOR LISTENERS' ASSOCIATION—OWNED, OPERATED AND CONTROLLED BY CHICAGO FEDERATION OF LABOR, CHICAGO—TRANSMITTER LOCATED ON THE MUNICIPAL PIER, CHICAGO—620 KILOCYCLES, 483.6 METERS

Publication Office: 720 South Ridgeland Ave., Oak Park, Ill.
Advertising Offices and Studios: 623-633 South Wabash Ave., Chicago, Ill., Phone HAR. 1182-1183.
35c Per Copy—$1.25 Per Year Application for Second Class entry made at Postoffice at Oak Park, Ill.

To the Co-operatives, Farmers and the Labor Movement—

Dear Sir and Brother:

Organized Labor and Co-operative Farmers now have their own Broadcast Station, and to preserve and amplify this service on the air have established the W-C-F-L Radio Magazine and Official Broadcast Directory. You have heard our programs and know that we are doing a work worth untold thousands of dollars for the benefit of Co-operative Farmers and Organized Labor.

We are not operating a private enterprise for profit, we give to you and your organization a service without charge that you cannot secure elsewhere at any price. You have heard our programs and you know. No doubt you have often wished that the high spots of talks made by you or your fellow officers of the movement might be preserved for reference. This is one of the objects of the W-C-F-L Radio Magazine

The Broadcast Directory will be corrected in each issue and technical articles will give you the last word in Radio Engineering. We give you a lot of value for very little money.

Station W-C-F-L is owned, supported and operated by and for the workingmen and co-operative farmers of North America. It has the official endorsement of the American Federation of Labor, the Illinois State Federation of Labor, the Chicago Federation of Labor and all affiliated unions; also of many Farmers' Unions and Co-operative Movements. This clientele of more than five million persons are not mere listeners, they are part owners; they are vitally interested in the principles and ideals for which the Station stands and to which it alone gives voice. They look to it not only for entertainment, but for information education and leadership in matters affecting their social and economic welfare.

Like all the other activities of W-C-F-L and associated bodies, no attempt will be made to make a profit on the magazine. All receipts will be used to perfect the service of the station and its official publication.

Kindly fill out the subscription blank furnished herewith and mail same with $1.25 (check, postal order or express money order) in the addressed return envelope enclosed. The Magazine and Official Broadcast Directory will be sent you for one year. Make all checks to Chicago Federation of Labor. Also find inclosed your membership card for 1928 in the Co-operative Farmer-Labor Listeners Association.

Thanking you for your interest, we remain
Respectfully,
W-C-F-L RADIO MAGAZINE

E. N. Nockels

Manager and Secretary.

WCFL Radio Magazine

Owned, Established and Operated by the
Chicago Federation of Labor

Telephone HAR. 1182-1183 623-633 South Wabash Avenue

Subscription includes membership in the Co-operative Farmer-Labor Radio Listeners' Association

Subscription Rate
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The Voice of Labor

Date _____ 192____

Published Quarterly, Containing a Complete Directory of Radio Broadcast Stations

Enclosed find $1.25 in payment for same.

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Chicago Federation of Labor Broadcast
STATION
W-C-F-L
483.6 METERS 620 KILOCYCLES
TRANSMITTER, MUNICIPAL PIER
OFFICES and STUDIOS
623-633 S. Wabash Ave
CHICAGO
AMERICAN FEDERATION OF LABOR

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VOLUME I OCTOBER, 1927 NUMBER 1

Aim and Object of WCFL

STATION W-C-F-L, on the Municipal Pier at Chicago, is near the geographical center and center of population of the United States. It is in the second largest city, in the greatest labor center, and in the center of the greatest farming region of the country. With adequate power, it will serve the entire North American Continent.

The Station is owned by the Chicago Federation of Labor. Its construction and maintenance have been and are being paid for by voluntary contributions from members of Labor Unions. A large number of Labor Unions have pledged the sum of One Dollar ($1.00) a year from each member for the support of the Station. Other Unions are making similar pledges every month, and Farmers' Unions have given assurance of similar support. It is certain that Station W-C-F-L will have abundant financial support, solely from voluntary contributions from listeners, to whom this station makes a special appeal. Without offering any objection to the method of financing a station by programs paid for by advertisers, it is submitted that the soundest method is by contributions from interested listeners. This method may not be practical for other stations, but it is for W-C-F-L, by reason of its principles and clientele.

Primarily, Station W-C-F-L, is the Voice of Labor. It is the only station in the United States through which Labor can proclaim its principles and ideals. It is the voice of more than five millions of members of Labor Unions and Farmers' Unions. It is not operated for profit, but for public service only. It stands unalterably for the freedom of the air, as well as for freedom of speech and of the press. All other leading stations are owned by Capital and speak the voice of Capital. Surely, in the entire United States, there should be one unlimited station which speaks primarily the voice of the workshop and the farm.

As stated above, Station W-C-F-L is owned, supported and operated by and for the workingmen and farmers of the North American Continent. It has the official endorsement of the American Federation of Labor, the Illinois State Federation of Labor, the Chicago Federation of Labor and all affiliated unions; also of many Farmers' Unions and Co-operative Movements. This clientele of more than five millions of persons, are not mere listeners; they are part owners; they are vitally interested in the principles and ideals for which the Station stands and to which it alone gives voice. They look to it, not only for entertainment, but for information, education and leadership in matters affecting their social and economic welfare.

The general field of its Program Service is indicated above. Being assured of adequate financial support, Station W-C-F-L is in a position to furnish a wide variety of entertainment. Because of its special and extensive clientele, it can command the services of speakers and performers of national repute. Its control studios are located in the Brunswick-Balke-Collender Building on a long term lease. By reason of its affiliation, the Station is able to avail itself of the services of the greatest artists in the country, who come here to perform for reproduction on phonographic records. By special authorization from the Society of Authors, Composers and Publishers, this Station is permitted to broadcast, without charge, copyrighted music, songs, etc.

Station W-C-F-L programs include the following:

(1) One hour a day is devoted to talks on subjects of special interest to Organized Labor, given by men and women of prominence in the Labor Movement, or by persons specially qualified to speak on the chosen subject.

(2) Frequent educational talks on subjects of special interest to the public generally. These talks cover a wide field, including Household Economics, Health, Co-operative Activities, Industrial Problems, Employment Balance and many similar topics. Department of Labor Reports and Statistics are given out.

(3) Reports to farmers on market, weather and crop conditions, and occasional talks on subjects of special interest to farmers. Government reports and statistics pertaining to Agriculture, Horticulture and Live Stock are broadcast.

(4) Religious services are conducted every afternoon and on Sunday

morning and evening, over the Station. The Station is operated not for profit, but solely for public service. It is non-sectarian and non-political.

(5) Civic Programs, Band Concerts and other Public Entertainments are frequently given on the Municipal Pier, and are broadcast from this Station.

(6) Election returns and numerous other matters of public interest are announced from time to time as they occur.

(7) Musical Festivals from Public Schools, Conventions and similar gatherings are broadcast.

(8) By far, the greater part of the time is devoted to entertainment programs, chiefly musical in character. It is also fortunate in that it has coordinated with Brunswick-Balke-Collender Company in the construction of two of the most modern and complete studios in the United States, devoted both to Radio Broadcasting and to recording and reproducing of the work of world famous musical artists. Station W-C-F-L is thereby entitled to utilize the services of many of these artists under the most favorable circumstances and at minimum expense.

(9) Station W-C-F-L operates a radio telegraph service with other cities on 1,950-meter wave length, and is on the air with short wave transmitters for extreme distance work, and ship wave sets to serve vessels plying the Great Lakes and desiring to communicate with their Chicago base of operations, the Municipal Pier.

(10) The Station owns its own workshop and experimental laboratories and builds practically all of its own equipment. At present, it operates an excellent 1,500-watt transmitter, using the 620 kilocycle channel. The Station will greatly improve its service, and expects eventually to serve its special clientele over the entire North American Continent.

History of WCFL

January 13, 1926—Department of Commerce warns that no wave length will be granted to C. F. L.

January 18, 1926—C. F. L. declares intention to go ahead and build station at all cost.

January 29, 1926—Charter granted to C. F. of L. Radio Broadcasting Association (not for pecuniary profit) by the State of Illinois.

March 27, 1926—Plans for station prepared, to be built by C. F. L.

March 31, 1926—Typographical Union No. 16 votes over $10,000 for Radio station.

April 10, 1926—City grants lease to north tower of Municipal Pier for broadcast station. Many unions vote voluntary assessment.

May 8, 1926—Aerial erected at Municipal Pier and work progressing on station.

May 8, 1926—45,000 unionists pledged to pay voluntary assessment of $2.00 each to support WCFL. Illinois Manufacturers Association attempts to block station by protesting use of Municipal Pier. Much smoke—no fire!

June 3, 1926—Amalgamated Clothing Workers donate $10,000 to WCFL.

June 19, 1926—First union-made receiving set exhibited at Union Label Exposition.

June 15, 1926—American Society of Authors, Composers and Publishers grants free license to WCFL to broadcast all copyrighted music.

June 19, 1926—WCFL tested and ready for inspection by Department of Commerce.

June 25, 1926—Radio Inspector and Department of Commerce inspects and approves WCFL.

July 10, 1926—Call letters WCFL assigned to Chicago Federation of Labor.

July 11, 1926—License granted by Department of Commerce and WCFL goes on the air at 491.5 meters.

July 15, 1926—Government license for WCFL to broadcast formally received.

July 27, 1926—Regular program begins every evening, except Monday and Sunday from WCFL.

August 5, 1926—WCFL acquires A. T. & T. license to use patents and telephone facilities for remote control.

September 2, 1926—Broadcast by remote control from Alamo Cafe begins.

September 7, 1926—Mayor Dever agrees to make announcements over WCFL by remote control from City Hall.

September 21, 1926—Contracts signed to broadcast by remote control from Brevoort Hotel, Wicker Park Lutheran Church, Irving Park Lutheran Church.

October 1, 1926—Barton $25,000 organ placed at disposal of WCFL for broadcast.

October 4, 1926—A. F. L. National Convention at Detroit, Michigan, gives official endorsement to C. F. L. for establishment of its broadcast station.

December 11, 1926—Official celebration of labor radio success at Ashland Auditorium. Speeches and entertainment broadcast by remote control. 11,000 laborites present. Mayor Dever and other prominent speakers.

March 1, 1927—C. F. L. moves to Brunswick building, 623-33 S. Wabash Ave., Chicago, where a 10,000 square foot studio and office for broadcast and musical recording is being completed.

May 14, 1927—WCFL opens new Brunswick studios with impressive ceremony and excellent program.

May 28, 1927—Federal Radio Commission awards WCFL practically an exclusive wavelength (620 kilocycles—483.6 meters) effective June 1. WCFL shares time with WLTS, Lane Technical High School, Chicago.

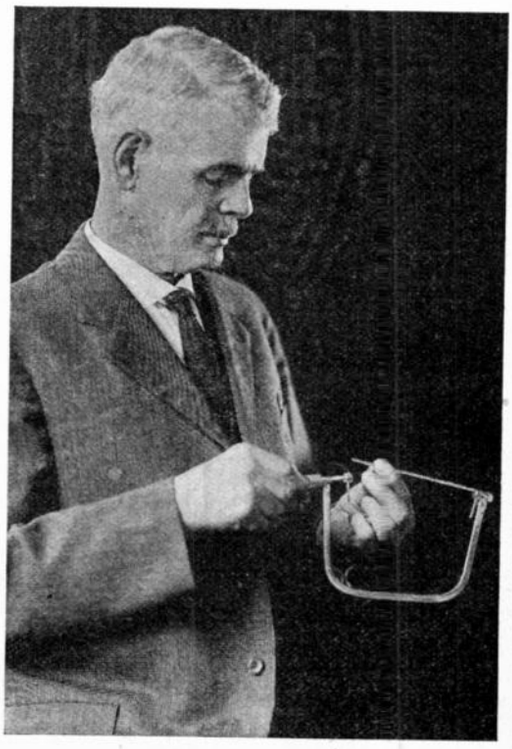
AN ALL-PURPOSE SAW

Radio has opened up a new field of usefulness for tools known to every mechanic and has encouraged the invention of new devices, particularly to cut special materials such as bakelite.

F. P. Maxson of Chicago, inventor of the coping saw some twenty-five years ago, now builds a universal tool guaranteed to cut any material which may enter legitimately into the construction of a radio set, including bakelite and similar panels, brass, steel and wood.

The F. P. M. saw outfit includes a very well made frame and five different types of blade, the frame being designed in such a way that it is possible to cut at any desired angle with respect to the material being worked.

Competent mechanics know that there are two tools on the workbench which absolutely must be of high quality on account of the unusual breaking strains to which they are subjected. Saws and drills are the implements so specified and the WCFL radio laboratory and shops know from experience that F. P. Maxson makes a saw indispensable to the mechanic on small jobs and the occasional large job which, for some reason, cannot be worked with a large saw or other tool.

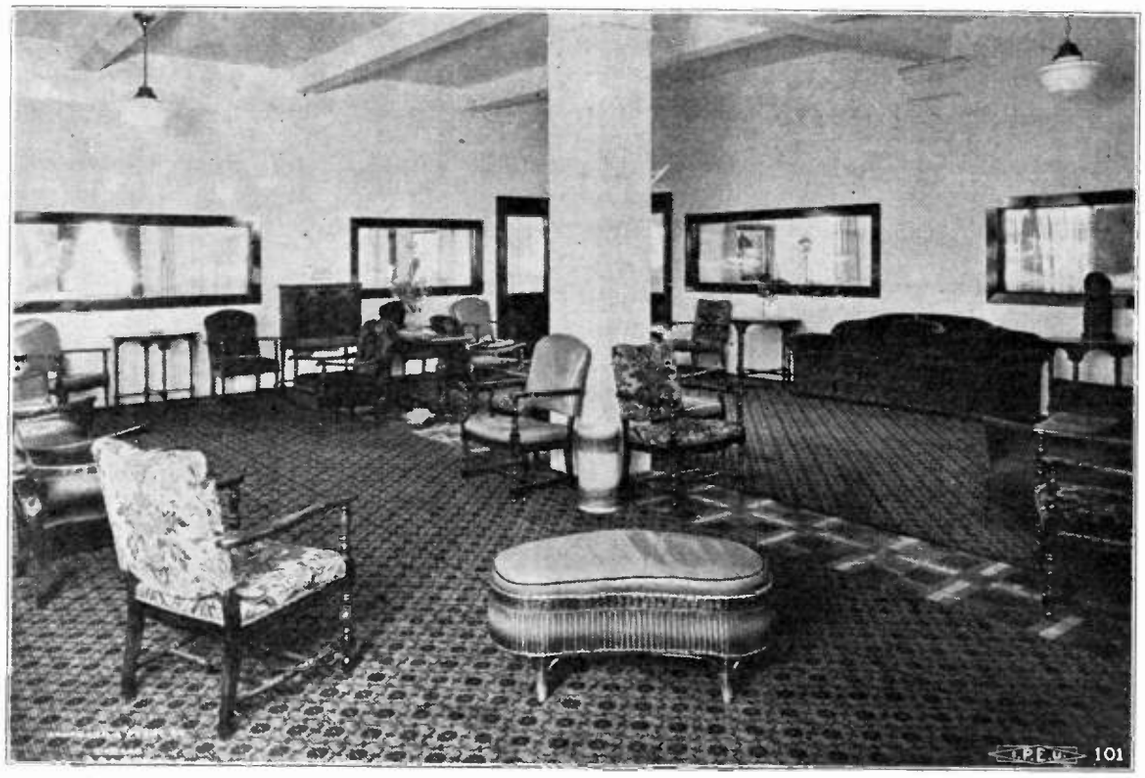


F. P. Maxon.

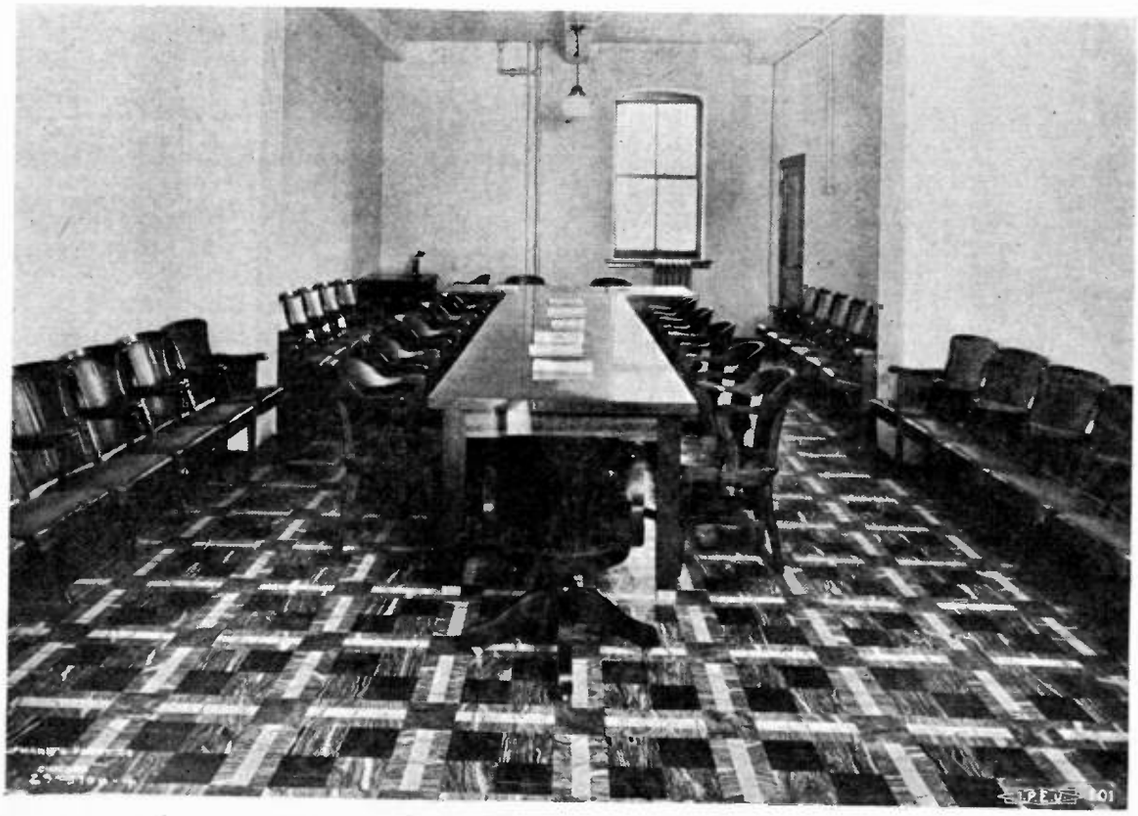
Broadcast Station WCFL, located on Municipal Pier, Chicago, one of the handsomest and most complete stations in the world. Radio Telegraph Transmitters operating with ships on the Great Lakes. Long-wave transmitter for commercial service and short-wave transmitter, capable of world-wide radio telegraph communication. Laboratories and workshops of WCFL are located in the north tower, where all apparatus and material were specially built for the Broadcast Station. Broadcast Transmitter and the Three Radio Telegraph Transmitters are all now in daily use. Intercity Radio Telegraph on 1950 Meters; short wave long distance radio telegraph on 37.6 meters; radio telegraph to ships on 715 and 875 meters.

Lobby Leading from Office of Chicago Federation of Labor and WCFL Studios

Say you saw it in the WCFL Radio Magazine

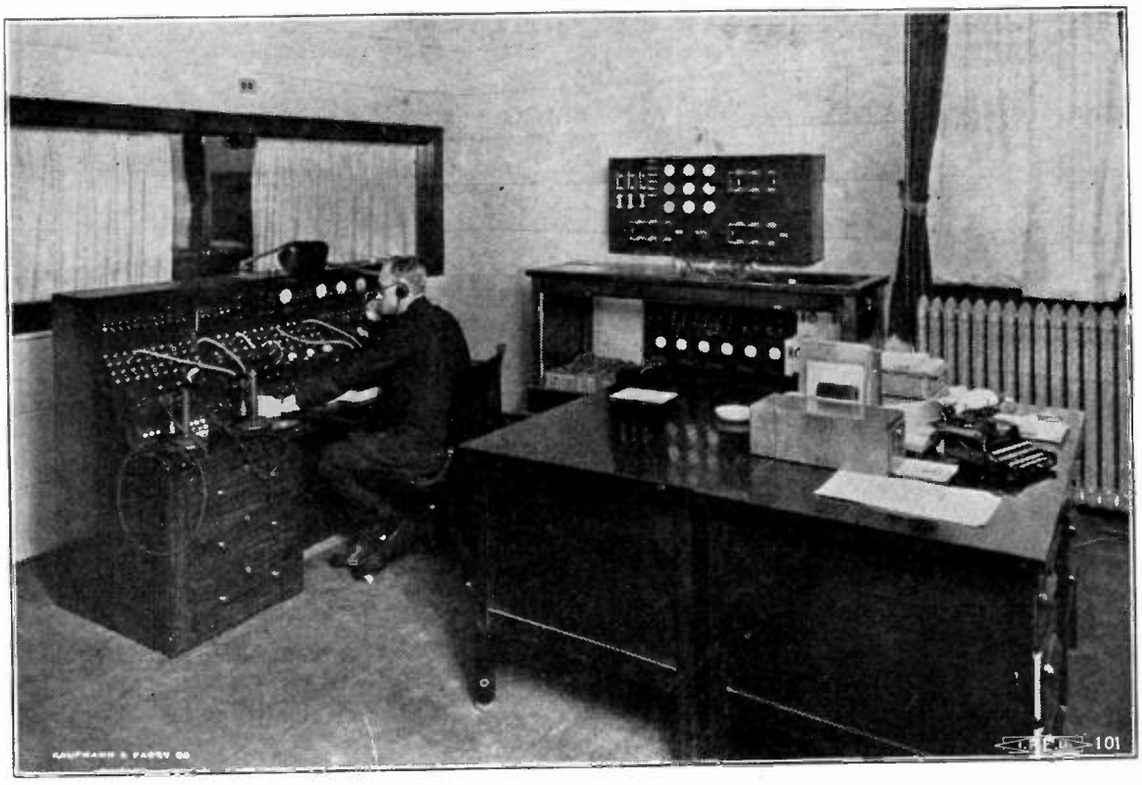


Reception Room of Station **WCFL**



Board of Directors' Room, WCFL.

Say you saw it in the WCFL Radio Magazine



Virgil Schoenberg, Chief Engineer of WCFL Station, at the Control Board.

Small Studio of Station WCFL

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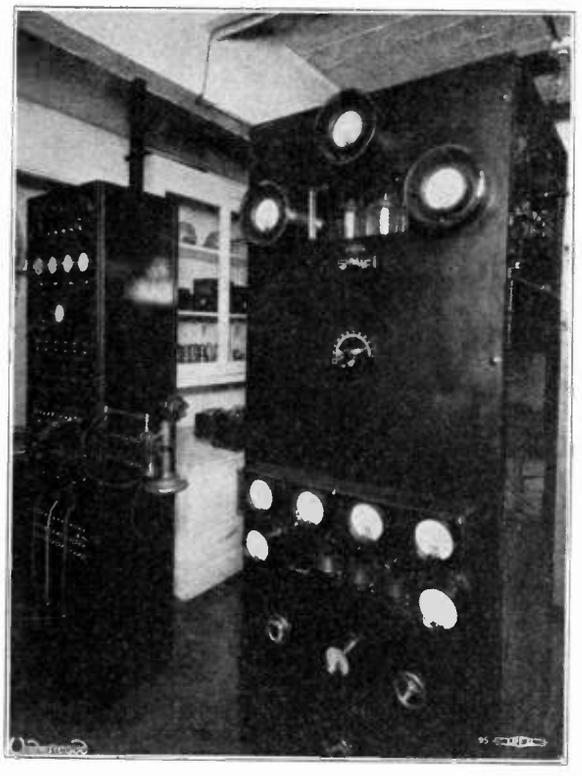
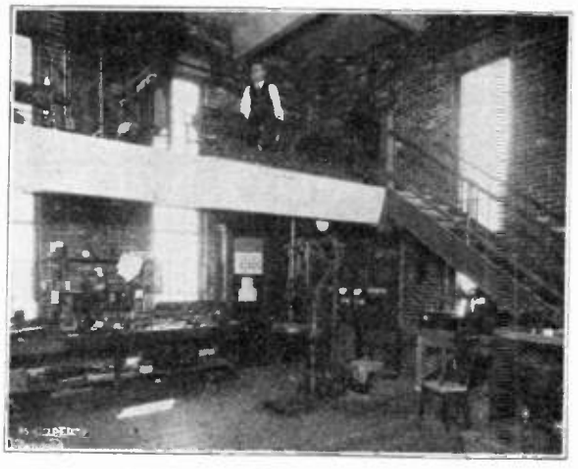
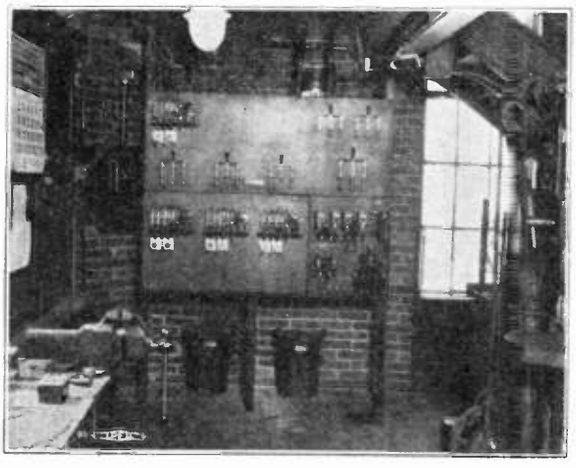


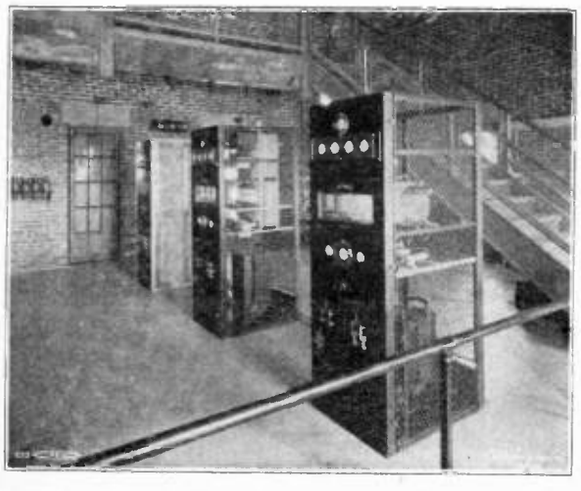
The main transmitter room of WCFL broadcast station containing oscillator modulator and input apparatus.



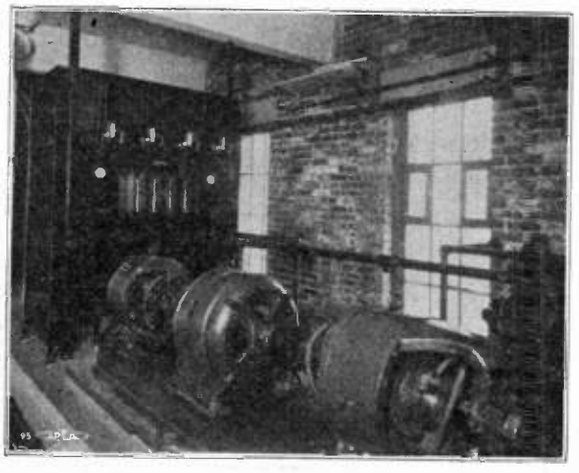
View of WCFL workshop and laboratory where transmitters are built and repaired.



Some of the many switches and relays controlling the activities of the broadcast and radio telegraph transmitters.



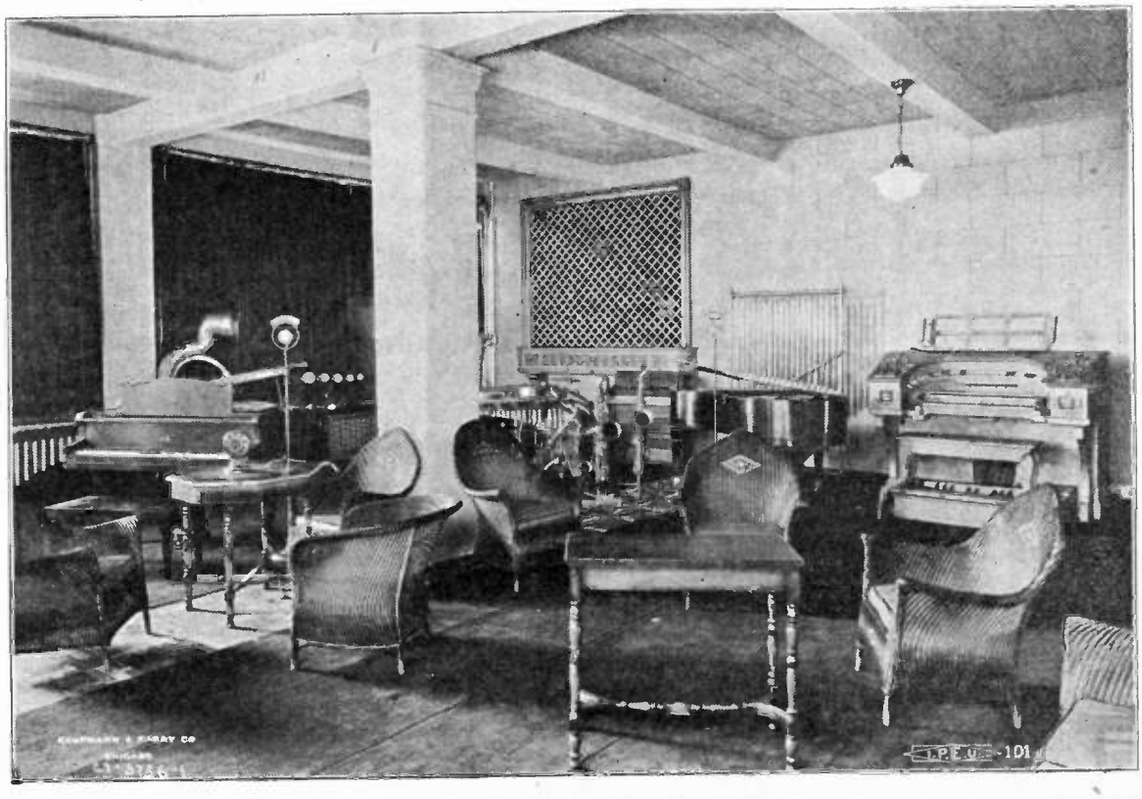
1950 meter radio telegraph transmitter handling messages to Detroit and other cities and newly completed transmitter to communicate with ships on the great lakes. Operating on 715 and 875 meters. Also short-wave transatlantic transmitter on 37.6 meters.



3,000 volt special generator which supplies power for WCFL broadcast transmitter.

Maurice Wetzel, Announcer at WCFL Station and Radio Broadcasting Pioneer.

Franklin E. Lundquist, Business Manager of Labor's Radio Station.



Large Studio of WCFL.

Say you saw it in the WCFL Radio Magazine

Free Air

By E. N. Nockels

WCFL Radio Magazine

Published Quarterly By
WCFL RADIO BROADCAST STATION
35c Copy, $1.25 Per Year.
and the Co-operative Farmer Labor Listeners' Association — Owned, Operated and Controlled by Chicago Federation of Labor, Chicago — Transmitter Located on the Municipal Pier, Chicago—620 Kilocycles, 483.6 Meters

EDWARD N. NOCKELS, Direc. and Sec.

Advertising Offices and Studios:
623-633 South Wabash Ave., Chicago, Ill.
Phone, Harrison 1182-1183

Publication Office:
720 North Ridgeland Ave., Oak Park, Ill.

Application for Second Class Entry made at Postoffice at Oak Park, Ill.

150

Vol. I OCTOBER, 1927 No. 1

A few years ago everybody thought and many still think that the air is free and that Nature intended that for all time it should be held without limitation for the use and welfare of all mankind. The startling fact is that we and they were and are mistaken. A bold statement. But nevertheless true.

The air is not free for radio broadcasting purposes. All meter wave lengths in all principal places are apportioned off, controlled and licensed by the Federal Government to broadcasting stations. Big interests, following their practice of centralization and combination, by a clever scheme of federation, hook-ups, censorship and dictatorship, have practically secured a monopoly of the air. Big interests, having secured a strangle hold upon industrial production and distribution, as well as trade and commerce, are reaching out by the aid of their monopoly of the air, to control mass transmission of thought. They are reaching out into religious fields, schools and colleges, newspapers, magazines, music and all means of thought transmission and communication. If for any cause or no real cause the regular and normal means of transmission of thought, news and action should temporarily be held up, labor and the common people would be powerless; they could not present their cause regardless of its worthiness and its right to be heard.

Through mass production and mass distribution, individually and otherwise, big interests are rapidly centralizing and crystalizing all activities into the hands of a few. I know of several trades or industries that were formerly owned by many individuals and firms—one in particular in which 150,000 people were employed with 25,000 small and individual proprietors, which are now through combinations and trust reduced to almost 6,000 factories and a few real proprietors. The same relative figures with reference to decrease of factories and individuals and independent proprietors apply in many other industries.

Twelve or fifteen years ago many workers and employers said that this could not be done. They were mistaken. It has been done. Watch your step or the captains of finance and industry by using the same process will monopolize and control the air.

Labor is not opposed to large combinations of capital. Labor, however, demands the right to organize and perform its normal activities, such as securing justice and freedom—securing fair wages, shorter hours and better working conditions for wage earners.

Labor is not opposed to capital, singly or in combination, having its radio broadcasting stations, but it does want and will continue to demand its unquestioned and unqualified right to the free and unrestricted and uncensored use of the air in all of its activities and constitutional rights. This right to the free use of the air cannot be denied by any process of monopoly or otherwise without violating our inalienable, fundamental and constitutional right of free speech. All we demand is the right to exercise and enjoy the freedom and justice that is constitutionally ours.

What the big interests have done in industrial production and distribution, they are now seeking to do in the transmission of thought, action and news through a monopoly of the air. The right of free speech, freedom of the press, freedom of action and freedom of debates has and always will continue to make for progress and for a better, greater and richer life with greater achievements—a higher and better civilization. If we permit any one faction of our common country to control by monopoly, to aupproprate to its own use any one of the foregoing principles which have made our country great and prosperous to the exclusion of others, then America and our great institutions will tremble in the balance and retrogression and decay will follow. Unless labor, its friends and thoughtful men and women with vision unite for the rescue, progress and advancing civilization will be brought to their knees.

The labor movement and membership thereof owe it to themselves to have this remarkable invention at their elbows within reach and at their service, working for labor, in labor's cause and the welfare and well being of working men and women. Newspapers misquote and often misstate our cause and our actions. W-C-F-L, the Voice of Labor, was built and opened on a $2.00 voluntary assessment contributed by the members of organized labor of Chicago. On a minimum cost of twenty-five cents quarterly Labor could build, own, control and operate not only WCFL, but superstations of 50 KW. that would reach out through the American continent. It would thus be able to find access into every school, church, labor organization and place where men and women congregate to hear and discuss all sides of the great issues, in which economics, civics and the welfare of mankind in genera could be discussed in their broadest sense.

There are opportunities for these superstations, which, with proper hook-ups throughout the length and breadth of America would enable organized labor and its friends to enjoy, uninterruptedly, music, lectures on education, talks on economics, politics, etc., vaudeville shows, by and with the very highest talent now in existence. W-C-F-L, the Voice of Labor, stands ready and is willing to do everything in its power to safeguard the rights of labor and to save the freedom of the air for the unrestricted right and use of the people in general. The directors of W-C-F-L are all delegates to the Chicago Federation of Labor. Any delegate in the Chicago Federation of Labor has a right to speak and to offer resolutions concerning the conduct, policy and other matters relating to and affecting W-C-F-L, the Voice of Labor. Any matter of vital importance can be, on motion, referred to a referendum vote. Every dollar contributed is entitled to one vote.

W-C-F-L, the Voice of Labor, is perpetually owned and in the control of Organized labor. Its officers are the officers of the Chicago Federation of Labor. If the officers of the Chicago Federation of Labor change, the officers of W-C-F-L, the Voice of Labor, automatically change to the newly elected officers.

This is Labor's own owned and controlled studio and broadcasting station. We again say that W-C-F-L does not seek a monopoly of the broadcasting stations for Labor It will offer its experience, knowledge and helpfulness to any recognized authority in the Labor Movement that will enlist in the man sized job of safeguarding and holding secure for all time the freedom of the air, and preventing this wonderful means of transmission of thought and action from falling into the hands of big interests or any other faction which would monopolize and appropriate to its own use that which rightfully belongs to the people as a whole.

Super-Power Radio Broadcast Station for the Chicago Federation of Labor

Bids Are Being Considered for 50 Kilowatt Station to Be Built Thirty Miles West of Chicago—Present Station and Studio to Be Used as an Auxiliary

A GREAT deal of preparatory work has been done during the past few months toward the culmination of labor's dream—a great radio broadcast station capable of projecting the Voice of Labor over the entire North American continent day and night, but more particularly during the day time.

The success of this ambitious undertaking will depend largely on cooperation of labor organizations on a national scale, the initial cost of the contemplated station being about $250,000 and the estimated upkeep in excess of estimated revenue being roughly $100,000 per year.

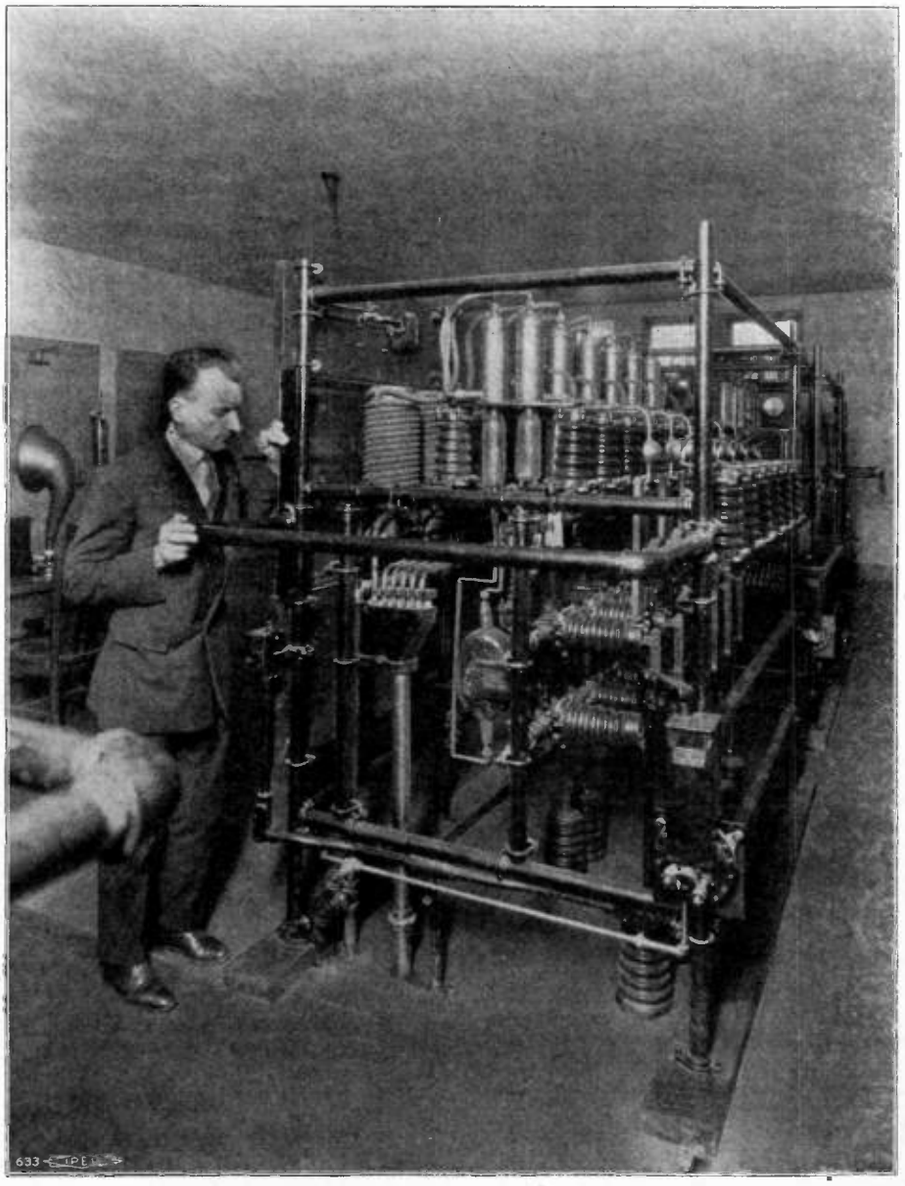
In order that readers of WCFL RADIO MAGAZINE and particularly members of labor unions, expected to participate in the great project, may have a clear idea of just what a super-power radio station is like we present a number of illustrations and a description of a station of the type under consideration by the Chicago Federation of Labor. Several other types of apparatus are being studied, but the installation presented herewith is of Westinghouse equipment similar in many respects to the present installations at KDKA Pittsburgh and KYW Chicago.

The effective power of the station shown is about 50 kilowatts on the average, but this power is momentarily boosted to 100 kilowatts without overmodulation when such a demand is placed on the apparatus by a loud input at the studio.

Although a super-power radio broadcast station is built up of really massive electrical powerhouse equipment and the transmitting tubes are veritable giants in comparison with the tubes used in receiving sets, there is a startling similarity in the principle and actual operating phenomena of the ordinary radio receiving set and a transmitter of the type described herewith. This same analogy cannot be applied between a receiver and our present transmitter of 1500 watts.

Some idea of the complexity of existing super-power transmitters may be had when we state that a minimum of thirty tubes is employed, twenty-five or more being of 10 kw. capacity. The reader who complains of his troubles with a five-tube receiver may readily grasp the engineering difficulties met in constructing and operating an affair with six times as many tubes any one of which is about one million times as powerful as the little receiver tubes to which he is accustomed.

The great transmitting tubes, handling ten to twenty times the energy of the largest electric lights used com-



Rectifier frame. Lower right shows cooling water automatic protector which shuts down the set before anything can be damaged.

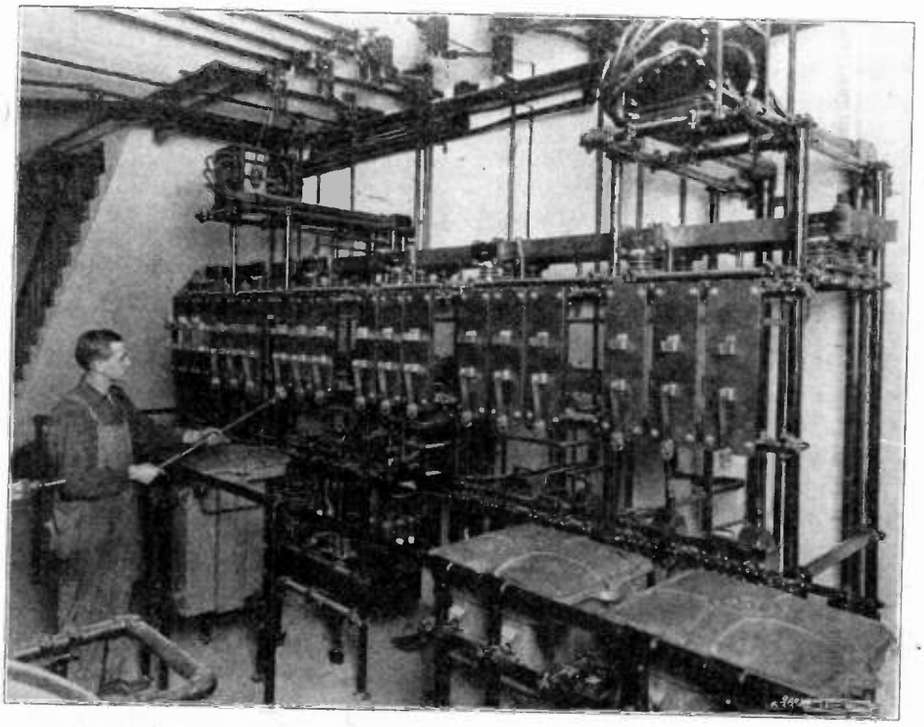
mercially develop a great deal of heat so that the water cooling system employed becomes a most important factor in actually preventing self

Main floor of transmitter building.

destruction of the apparatus. Since any kind of plumbing job may go wrong some time, the present day super-station has a safety device which automatically shuts off the "juice" if the cooling system fails. This is only one of the over-load precautions employed, there being many more automatic circuit breakers adapted to cut the power momentarily or longer if things go wrong. Considering that some $10,000 worth of radio tubes to say nothing of ten times that value in condensers, generators and the most valued of all things—human life is at stake the builders of broadcast super-stations may be excused if they pay little attention to economy and penny-pinching methods of design in certain phases of their work.

The super-station contemplated by WCFL is of the type employing a Piezo crystal to control its wavelength within the narrow limits required by present broadcast practice. This crystal, about the size of a quarter of a dollar is the start of a train of events which culminates in the hurling of about seventy-five horse power of electricty from the aerial in the form of ether waves, controlled exactly by the voice before the microphone. The Piezo crystal is in circuit with a tube scarcely larger than a receiving tube and its function is to cause this tube to vibrate electrically at exactly the right number of times per second to accord with the requirements of the Department of Commerce. In the case of WCFL the crystal must vibrate at 620 kilocycles or 620,000 times per second and its ability to do just this is a quality inherent in the crystal itself and dependent almost entirely on its thickness. If the crystal were ground down or polished one millionth of an inch it would vibrate too fast and be of no use to WCFL although it might be interesting to some broadcast station working on a slightly lower wavelength than ours. These crystals are delicate and easily get out of order so six or more of them are arranged for cutting in by means of a switch and the whole group is housed in a closed chamber in which the temperature is maintained constant by automatic electrical heating methods.

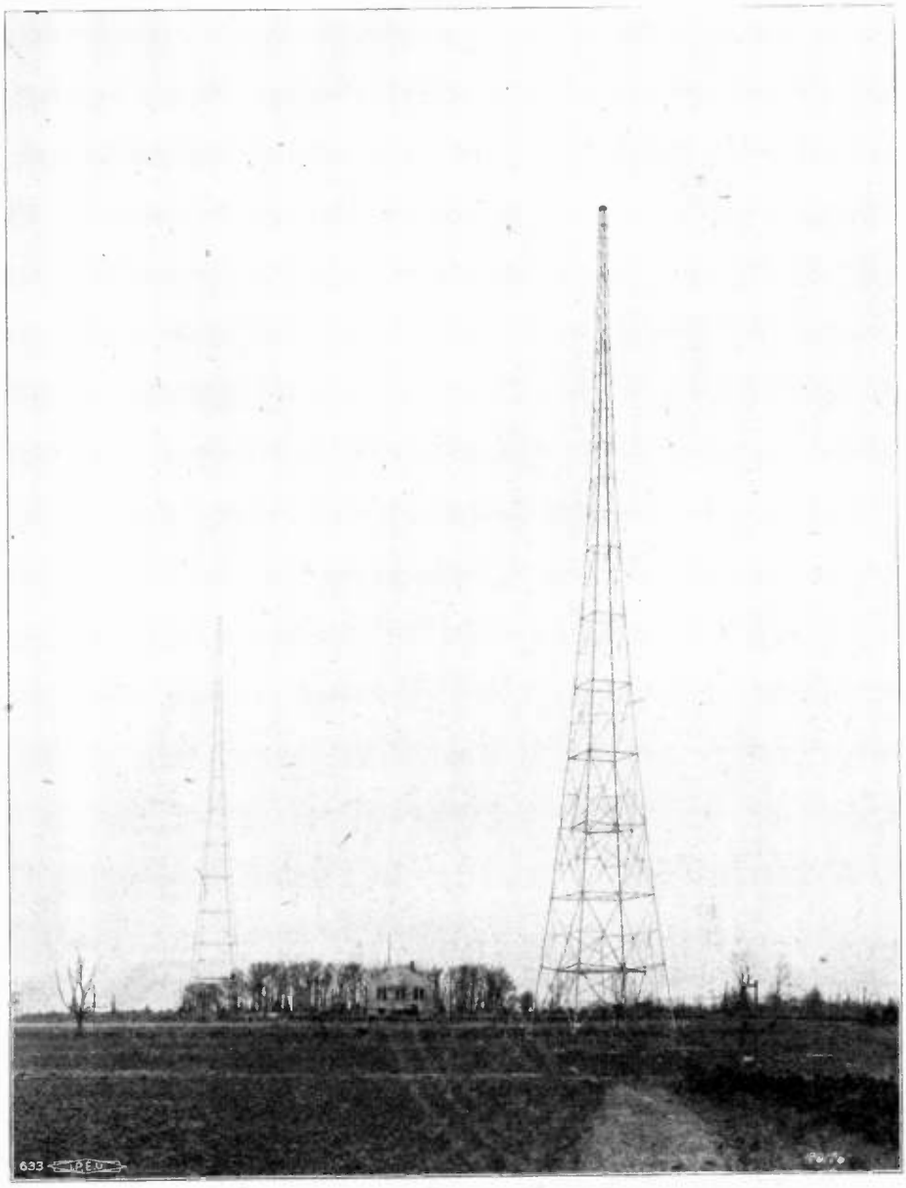
The electrical vibrations initiated by the Piezo crystal are impressed on a somewhat larger tube and so on in cascade through stages of amplification of increasing size until the output measures 50 kilowatts of energy, the final stage employing a minimum of ten, ten kilowatt tubes. At this point the magnified vibrations encounter the voice control power which, starting



2300 volt, 3 phase power switches. Oil switches can be seen down near floor.

with one forty-thousandth of a horse power or so has been built up to a figure well in excess of fifty horse power. Sixteen large water cooled tubes are used in the final stage of the voice amplifier or "modulator" as it is called and the function of this power is to mould the 50 kilowatt vibrations exactly in accordance with the varying intensity of sound originally striking the microphone.

The modulated energy representing a magnified image of the original sounds in the studio but existing now only as electrical power is fed into a "tank circuit" consisting of an enormous coil and condenser system of which your receiving set coils are a miniature edition and then into the aerial, usually suspended between steel towers hundreds of feet in midair. Remarkable insulators on which these towers are supported at their base cut down the power absorbed out of the air by the steel structures. At KDKA huge wooden masts are used to get away from this absorption of the energy thrown out by the aerial and it is possible that this system may be employed at super-power WCFL.



Side view of standard RCA 50 KW transmitter building. 300 foot towers.

In discussing the projected super-power station the question is always asked "what will you do with the transmitter on the pier?" The answer is that this station will undoubtedly be retained and often on the air when the use of the larger station is not justified or when the big station is undergoing necessary replacements and repair. The present WCFL will be ready to take over its responsibilities merely by pressing a button at the main control board at W.C.F.L. headquarters in the Brunswick building where the present excellent studio facilities will continue to be used.

Although the location of the new station has not been finally decided on an option has been secured on 255 acres of desirable land located one and one-half miles from Bartlett in Du Page County, Township of Wayne. The proposed location is about thirty miles West of the City Hall, Chicago, and is near Lake Street, a state highway. Adequate power may be obtained from a high tension line about one half mile from the property but it is expected that an isolated power plant will also be installed so as to remove any possibility of interference with operation due to a breakdown or cut-off of the public service lines. Two hundred and fifty kilowatts of energy or more will be required to meet the whole demands of the station which of course includes housing facilities for a staff of engineers and assistants.

620 Kilocycles 1500 Watts

W-C-F-L CHICAGO FEDERATION OF LABOR BROADCAST STATION

LOCATED ON THE MUNICIPAL PIER, CHICAGO

Office and Studio 623 SOUTH WABASH AVENUE

CHICAGO, ILL.

INSTRUCTIONS FOR USING W-C-F-L "RECEPTION CHECK" PAGE

Fill out this page with sufficient details regarding program heard from W-C-F-L to prove that you actually heard our station. Place the page in an envelope with 35 cents in stamps and address to W-C-F-L, Office and Studio, 623 South Wabash Avenue, Chicago, Ill. Our "reception check" stamp will be mailed to you immediately together with our Official Magazine and Broadcast Directory or send $1.25 for yearly subscription which includes annual membership card in the Co-operative Farmer Labor Listeners Association.

Name .....

Address ..... City ..... State .....

Heard your station, date ..... (*Day and Month*) time ..... (*A. M. or P. M.*)

Description of program .....

.....

Send 35 cents for copy of W-C-F-L Radio Magazine and Official Broadcast Directory. Yearly subscription $1.25.

Offices and Studios
623-633 So. Wabash Ave.
WRITE NAME AND ADDRESS PLAINLY.

DESCRIPTION OF RECEIVING SET

Number of Tubes .....

Type of Circuit .....

Name of Mfr. .....

Aerial .....

Comments .....

.....

CHECK OFF THE KIND OF PROGRAMS YOU PREFER

- ☐ Classical orchestra music
- ☐ Orchestra jazz
- ☐ Classical songs
- ☐ Popular songs
- ☐ Sports
- ☐ Theatrical productions
- ☐ Lectures
- ☐ Labor talks
- ☐ Politics
- ☐ Stories for children
- ☐ News Bulletins

Suggestions .....

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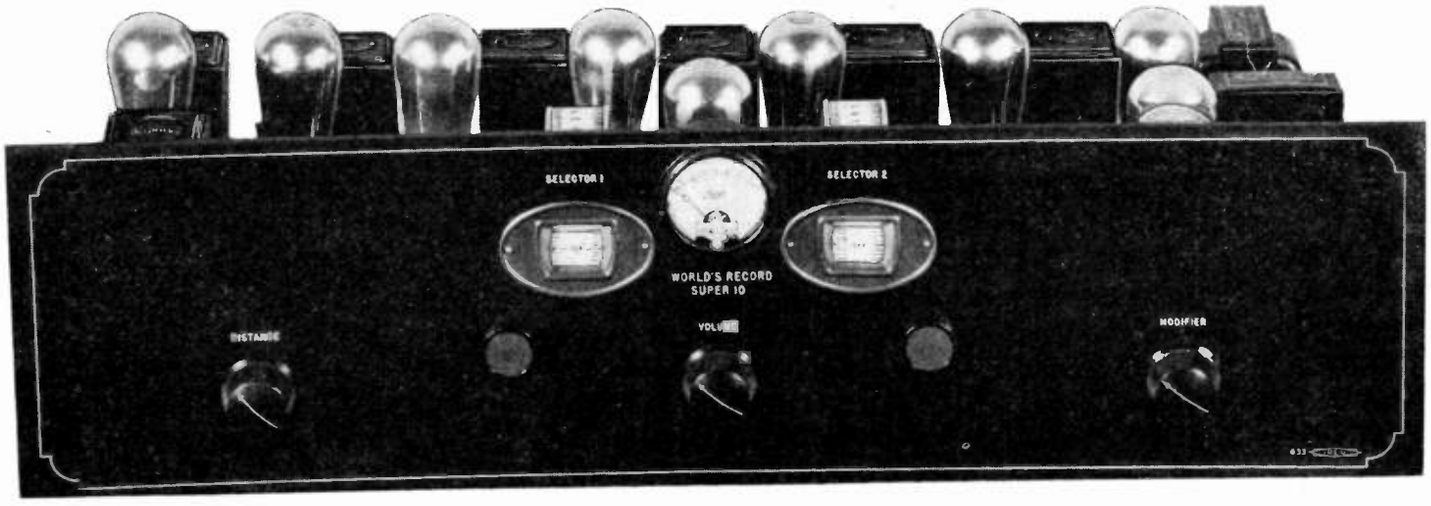
The New World's Record Super-10

An Improved Model of the Receiver That Established Four World's Records for Reception of Stations 6,000 Miles or More Distant

By Felix Anderson



In radio, distance lends enchantment. There is no thrill, no sense of satisfaction, no pride of ownership in possessing a sluggish, non-sensitive radio receiver. The reception of programs from distant places is one of the greatest reasons for the popularity of radio entertainment—the ability to conquer space is one of the pleasures of owning a radio receiver.

This fact should be carried prominently in mind when the purchase of a radio receiver is considered. To install a radio set capable of tuning local programs only, is to deprive yourself of many thrills and full satisfaction. Unless the receiver you buy has the attribute of being sensitive and selective enough to enable the tuning of both local and long distance programs, you will miss much of the charm of radio broadcast entertainment.

Consistent with sensitivity and selectivity is the necessity of good tonal quality. A radio receiver to be enjoyable must be pleasant to listen to. The programs that are intercepted must be reproduced with fidelity and faithfulness, and without distortion. There are many receivers that accomplish one of these qualifications at the expense of the other. The sets that have both sensitivity and selectivity with perfect tonal quality are mighty few indeed. Usually, when good tonal qualities are present, they are obtained at the expense of selectivity in the receiver, the result being that the distant stations are not heard. The other extreme, the reception of long distance with good quality is even more scarce, since in striving to make the receiver sensitive and selective, tone is neglected or sacrificed. To find the optimum between these factors had long been a problem in radio engineering circles.

Mr. E. H. Scott, whose work in developing superhetrodynes and devices related thereto, is widely known to radio engineers and advanced set builders for his many useful discoveries along the lines above mentioned, and in the World's Record Super 10, has quite definitely proven his contention that long distance reception can be attained with good tonal quality. Just how his opinion became an established fact is best explained by telling briefly the story of the development of the World's Record Super Receiving sets.

Some time ago, Mr. Scott, with the intention of developing the most practical and sensitive receiver that could be made, journeyed to New Zealand, taking with him a nine tube superhetrodyne of his own design, with the object of giving it the most rigorous sensitivity test ever given a radio receiver. The tests results in the establishing of four World's Records for long distance reception, records which have not since been equalled or challenged. Due to lack of space, these records will not be herein notated, but the verified log contains over 70 pages of closely written data, all of which has since been verified by the stations whose programs were received. Suffice it to write that the distance of more than 6,000 miles was a supreme test of the sensitivity of the set, and that the results were far beyond all expectations. Practically all programs were received on the loudspeaker.

Upon returning to the United States, Mr. Scott continued his research in the extensive laboratories maintained by the Scott Transformer Company and these developments were incorporated in the successive models. The New World's Record Super 10 is the culmination of all the virtues of these preceding models, together with the incorporation of all the latest refinements of proven performance.

The receiver consists of two stages of tuned radio frequency amplification, with antenna pickup arrangement preceding the first detector of the familiar World's Record Super Circuit. The first two tubes of the circuit are devoted to radio frequency amplification, an oscillator, a first detector, three stages of intermediate frequency amplification (the heart of the super-hetrodyne) a second detector, and two stages of audio frequency amplification. Subpanel type of construction is used, which facilitates the assembly and wiring, beautifies the appearance, and adds considerably to the efficiency of the set as a whole because of the shorter leads thus made possible.

In sharp contrast to the previous models, the Super 10 is designed for antenna operation. This system of signal pickup is possible because of the two radio frequency amplifying stages, which intensify weak and feeble signals, ordinarily too feeble to actuate the first detector tube of the average super. The use of the two stages of tuned radio frequency preceding the detector in connection with the exterior antenna, thus extends the range of the receiver to heretofore unattained distances. In connection with the great sensitivity of the intermediate stages, it becomes unnecessary to use a long antenna, a 20 or 30 foot wire con-

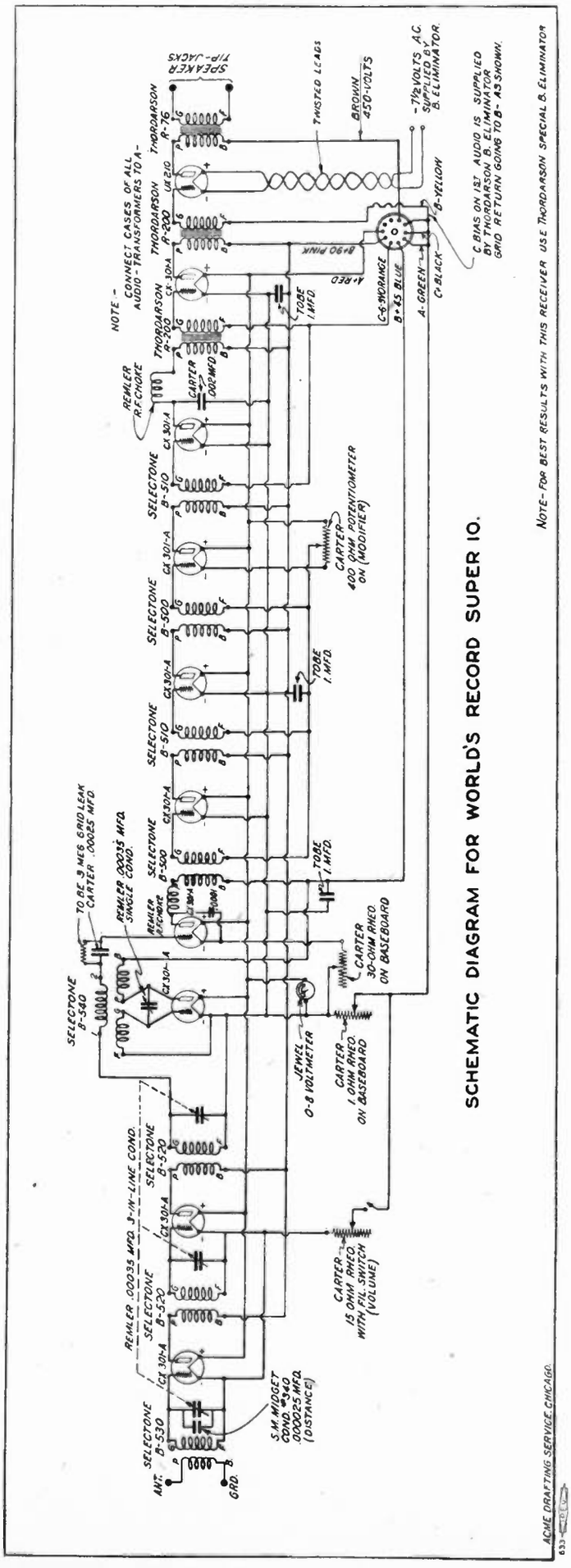
veniently hidden around a moulding or in an attic serving effectively as the collector on even the most distant stations.

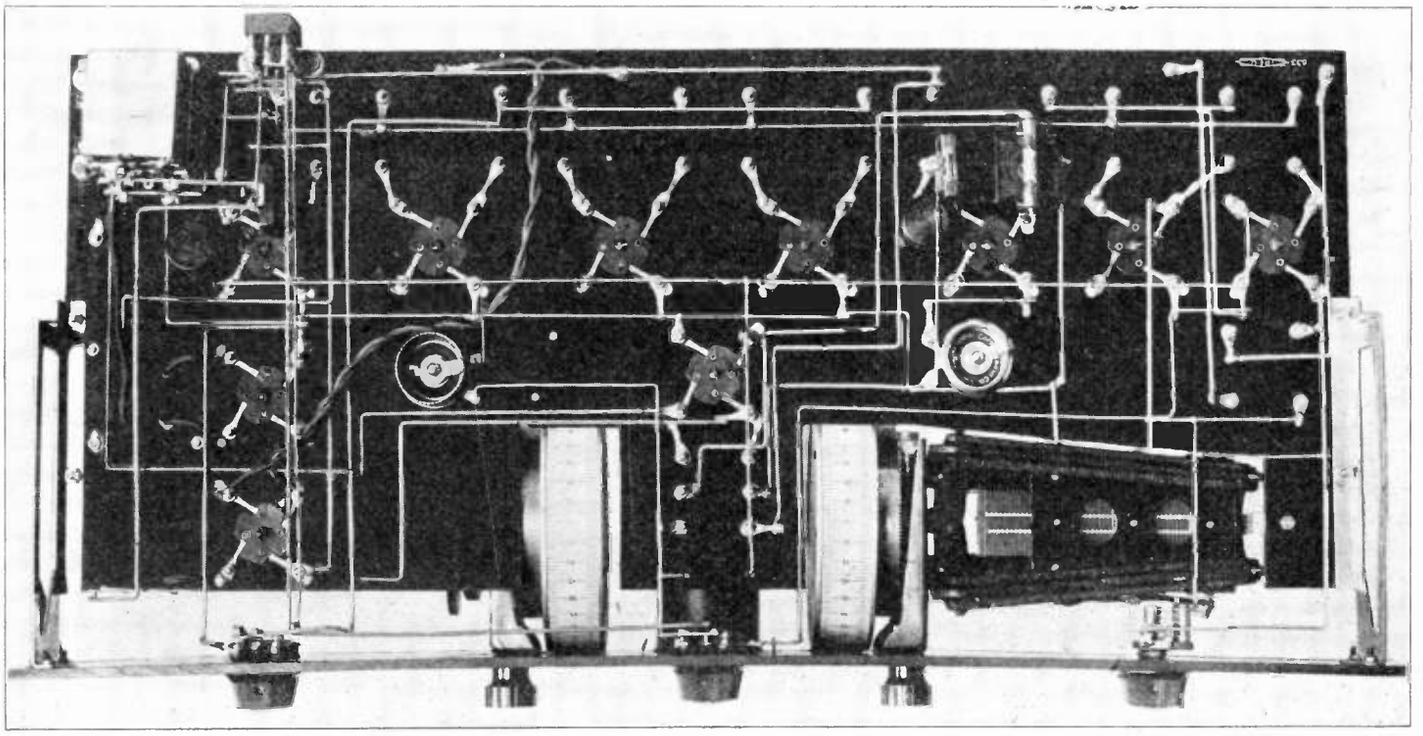
The use of so short an antenna of course contributes materially to the selectivity, and this selectivity becomes super tuning without being critical, due to the action of the intermediate stages in connection with the oscillator. The RF has also the virtue of decreasing the number of repeat points, common to ordinary superhetrodynes, and practically all stations come in at one point only on the dials.

Aside from the extended range and sensitivity added by the RF amplifier, there are a number of other minor but important features that are only peculiar to the World's Record Super 10. It employs in the RF stages three RF couplers expressly designed and matched for use with gang control tuning. Each Selectone B-530 Antenna Coupling Unit, and every Selectone B-520 Radio Frequency Unit is a laboratory product. The secondaries of these new units are matched to within one turn of uniformity, so that resonance of each stage will take place when all three sections of the Remler 3-In-Line Condenser are alike in setting. Only the utmost care in design and manufacture of the Radio Frequency units makes possible the use of a three section multiple tuned condenser. Unless the RF units are accurately matched and of the same value in inductance, the convenience of multiple tuning must be abandoned for the separate adjustment of each of the three radio frequency circuits.

Differences in wiring, and the effect of different types of antennae are compensated for. Changes in the inductance of the selectone B-530 Antenna Coupling Unit caused by antenna resistance and absorption are compensated with a Silver Marshall No. 340 Midget Condenser which is shunted across the end section of the Remler 3-In-Line, which tunes this unit. The Silver Marshall Midget is located at the extreme left of the panel, and is only semi-active in operation, being one of the auxiliary controls used when tuning extreme long distances. Inequalities in the two remaining circuits, caused by differences in wiring are balanced off with small trimmers located on the frame of the Remler 3-In-Line. The adjustment of these trimmers is accomplished by tuning in a comparatively weak station with the Midget condenser set so that the plates mesh about one-half. The Trimmer set screws are then adjusted until the station comes in with maximum strength and clarity, and requires no further attention or adjustment.

The New Selectone B-530 Antenna Coupling Unit and the B-520 RF Transformers are all housed in a new style bakelite case, highly polished and finished. They are truly a laboratory product, and the manner in which they are matched makes them a most unusual set of RF couplers. In matching these units, special items of test equipment are used and the coils undergo an actual characteristic and operating test at the same time. A resonance indicator of a sensitivity showing a few microamperes change in current is used to check the tuning of these coils with a fixed standard. The signal





generated by the local oscillator acts as a small broadcasting station, but very much more minute in current, and the tested coil is matched with the standard so that its inductance is practically the same as that of the standard. This procedure of testing RF coils is a new departure in manufacture, but insures the set builder of absolute uniformity and results.

The output of the RF stages is delivered to the first detector of the receiver, where the heterodyne frequency is impressed on the incoming signal. This takes place in the grid lead of the detector where the oscillator pickup coil is located. Testing the oscillator coil and matching for uniform value of inductance makes the New World's Record Super 10 practically a one spot superhetrodyne.

A Remler RF choke in the plate, lead of the first detector prevents RF strays from finding their way into the IF stages, being by-passed by the .0001 MFD fixed condenser shunted across the plate and A negative filament lead.

This brings us to the second amplifying circuit of the receiver, the intermediate stages which amplify the signals after they have been intensified by the RF stages and changed to a beat frequency by the oscillator and first detector. Two B-510 Selectones are used as filters and two B-500 are used to step up the amplification. The circuit of the IF amplifier is standard, the same as that used so successfully in the New Zealand tests.

Insofar as the Intermediate Stages are the heart of any receiver of this type, it is well to admonish those unacquainted with the trait of superhetrodynes as to the selection of the best transformers. The Super 10 is a superhetrodyne, and as most set builders are aware, the degree of success you have with this type of receiver lies principally in the efficiency and perfect matching of the intermediate transformers. Real long distance reception, stability and good tone is only possible when all transformers used are perfectly matched. Intermediate frequency transformers with dissimilar peaks of amplification and unlike characteristics are the cause of the failure of many superhetrodyne receivers. Overall amplification and gain is low, the receiver has no selectivity, and stations are received on as many as eight or ten points on the oscillator dial. Laboratory matching is the only method by which absolute perfection can be obtained in the IF transformers.

Selectone transformers undergo three separate and rigid inspections and tests, in addition to an actual operating test on the air. The first of these tests checks the continuity of the winding, insuring no open circuits or poor windings, and guarantees uniformity in the dimensions of the coils. The condensers used to peak the filters are all tested on special equipment so that the capacities are within a few percent of rating. Thus no exterior condensers are necessary to peak the filters, as a condenser of precise capacity is placed across the secondary winding during assembly. The coils are then sealed in their cases so that their characteristics cannot change.

In spite of all this care in manufacture and assembly, there are slight irregularities in the characteristics of transformers, comparing them with each other. To insure that the set builder gets transformers of the same peak values and amplification, the exact amplification and peak frequency of each individual transformer is measured on a very sensitive direct reading device, and the number of the frequency coded by the laboratory. The transformers are then sorted into numbers of the same peak frequency, and packed into sets. This method is a rather lengthy and intricate method of producing transformers and filters that are uniformly the same, but it is the only way that finest results can be obtained with a superhetrodyne.

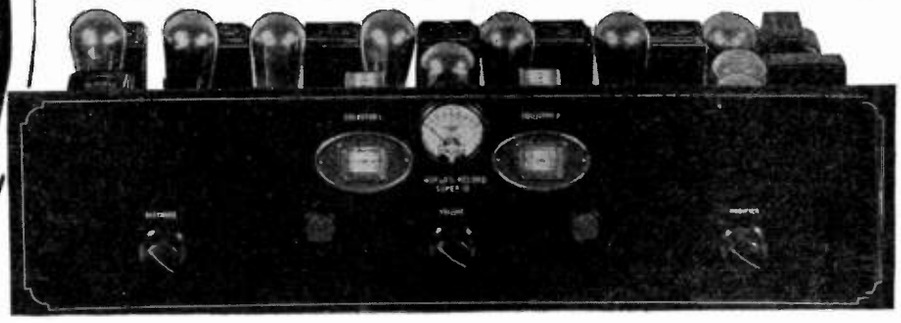
The intermediate frequency amplifier is stabilized with a 400 Ohm Carter potentiometer which enables operation on the right portion of the curve of the transformers, and makes control of the amplification and volume simple and smooth. This potentiometer is the sensitivity control of the intermediate frequency stages and should be so adjusted that the tubes are always just below the point of oscillation, as it is here that the highest sensitivity and amplification is obtained.

The output of the Intermediate Frequency Amplifier is delivered to the second detector, which is of the grid bias rectification type. The use of this method of rectification accounts for the great stability and freedom from noise which is an outstanding characteristic of the New Super 10. The second detector is heavily loaded, and the grid bias eliminates the possibility of distortion caused by overloading. A second Remler RF Choke in the plate lead of this detector in connection with a .002 MFD Carter Fixed condenser makes certain that no strays find their way into the AF Amplifier.

The Audio Frequency Amplifier is so generally and favorably well known, that it hardly needs description. Two Thordarson R200 Super Audio Transformers are used in connection with a CX-301A and CX-310 in the first and second audio stages respectively. The output of the set is fed to the speaker through a Thordarson R-76 Output Speaker Coupling Transformer used

Build Radio's New

Mr. E. H. Scott, himself, will tell you how he designed the original DX receiver, with which he made the four World's Records described on the opposite page—how that set has been duplicated hundreds of times, each one performing as well as the original—how later developments and refinements have enabled him to improve on the original in the New World's Record Super 10—and how you can, even without any previous experience, build a World's Record Super 10 for yourself.



DISTANCE—Here is the receiver for the man who wants the most powerful and sensitive set it is possible to build. Many claim to have received far distant stations once or twice, but Mr. Scott with his World's Record Super proved his claims to record honors by bringing in consistently, night after night, stations distant six thousand miles or more. The new World's Record Super 10, in actual comparative tests with the original receiver on which the records were made, has proved that it is even more powerful and brings in the far distant stations with almost unbelievable volume.

No other receiver has approached the marvelous DX records that the World's Record Super has established, and it is safe to say none will for years to come.

REMARKABLE SELECTIVITY—Here is a receiver for today's conditions. In Chicago, where there are about forty broadcasting stations, the New World's Record Super 10 cuts through with the greatest of ease. It brings in distant stations only a few meters apart with such volume that you think you have a local station until you hear the call letters and find you are listening to a station hundreds of miles away.

NATURAL TONE QUALITY—A receiver may have great DX ability and wonderful selectivity, but what good is it if the tone is raspy or distorted? When you hear the New World's Record Super 10, you will realize that here at last is a receiver that it is a pleasure to listen to.

EASY TO BUILD—With the parts here listed, any one can build an exact duplicate of the New World's Record Super 10. The only tools required are a screw driver, pliers, and soldering iron. The building instructions and full size blue prints show exactly where to place each part and how to run every connection, and are so simple and easy to follow that any one, even without previous experience in building a radio receiver, can duplicate this marvelous receiver and own the finest radio set available today.

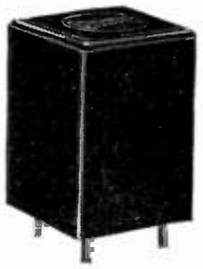
— LIST OF PARTS —

1 Formica panel drilled and engraved 26x7x3/16	$ 6.70
1 Formica sub panel drilled 25x10x3/16	7.00
1 Remler 3-in-line condenser No. 633 00035	15.00
1 Remler condenser No. 638 00035	5.00
2 Remler drum dials No. 110	9.00
2 Remler R. F. choke coils No. 35	1.80
2 Thordarson audio transformers R200	16.00
1 Thordarson output transformer No. 76	6.00
2 Selectone L. W. transformers No. B500	12.00
2 Selectone L. W. transformers No. B510	12.00
2 Selectone R. F. transformers No. 520	10.00
1 Selectone Antenna coupler No. 530	5.00
1 Selectone Oscillator coupler No. 540	5.00
10 Benjamin sockets No. 9044	.00
1 pr. Benjamin brackets No. 8629	.75
1 Carter Imp. rheostat 1R-15S ohms	.50
1 S. M. balancing condenser No. 340	.50
1 Carter power rheostat MW-1 ohm	.75
1 Carter Imp. pot. 1R-400 ohms	1.25
1 Carter fixed condenser 00025 with grid clips	.50
1 Carter fixed condenser 002	.50
1 pr. No. 10 Carter pin jacks	.20
1 Jewel Voltmeter 0.8v Pat. 135	7.00
4 Tobe Bypass condensers 1 Mfd	.60
1 Tobe grid leak	.50
1 Jones 10 contact multi-plug and 4 ft. cable type BM	3.50
40 Kellog soldering lugs	.25
30 ft. rubber covered hook-up wire	.50

Here's your chance to build a radio set that will give you all that radio has to give—distance, selectivity, clear and natural tone. Experience is not required, for full instructions will be sent you by Mr. Scott himself. Don't hesitate—don't delay. Send *now* for full details. Then you can't forget it, and you'll never regret it.

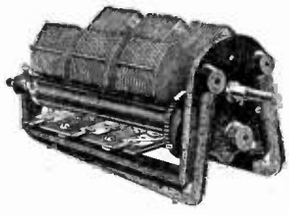
Greatest "DX" Receiver

World's Record Super 10



Selectone Transformers cut through the local stations with ease, and their tremendous amplification brings in the distant stations with great volume.

They are supplied in perfectly matched sets, insuring maximum amplification and the finest tone quality.



The new Remler Three-in-Line Condenser with the Remler Drum Dial represents the last word in gang condenser construction. Balancing condensers are integral with the main unit, and are easily and quickly adjusted. A special staggered connection of plates makes it self-shielding, preventing interstage coupling. All insulation is of genuine Bakelite.

Thordarson Amplifying Transformers were used in the original World's Record Super, designed by Mr. Scott. Because of the unusual tone quality obtained Thordarson apparatus is again selected. Two Thordarson R-200 Amplifying Transformers and one R-76 Output Transformer are used in this receiver.

If you enjoy good music, insist on Thordarson amplification.

The famous Benjamin Spring Cushioned Shock Absorbing Socket was the choice of Mr. E. H. Scott in his original World's Record Super.

Mr. Scott has paid the very highest tribute to the efficiency of Benjamin Shock Absorbing Sockets by again selecting them for this newest and greatest of radio receivers.

Tobe Condensers. Only the highest grade parts were selected by Mr. Scott for the World's Record Super 10, and the fact that Tobe parts are specified is one more proof of their claim for leadership in the condenser field.

Here Are the Verified Records

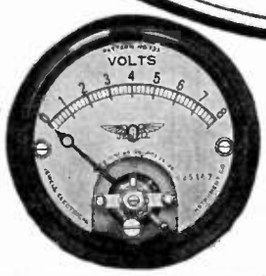
The authenticity of the startling achievements of the World's Record Super (as listed below) is based upon hundreds of verifications by leading Broadcasting Stations and Publications from Coast to Coast.

1 On March 17th established new World's Record for *loop aerial reception*—8,375 miles with Loud Speaker Volume.

2 On the night of March 29th established new World's Record with the reception of *six foreign stations* distant 6,000 miles or more.

3 Established new World's Record for *greatest number of broadcasting stations* heard that are located 6,000 or more miles away.

4 Established new World's Record for *most consistent reception*, night after night, of Stations 6,000 miles or more distant—117 programmes from 19 different Foreign Stations, heard between December 27th and April 10th.



In the careful selection of parts and accessories for the New World's Record Super 10, it is quite natural that a Jewell Pattern No. 135 Radio Voltmeter should be chosen. The black enameled case encloses a fine, D'Arsonval, moving coil type movement having silvered parts and equipped with a zero adjuster. The scale is silver etched with black characters. A special mounting arrangement makes it easy to mount in a radio panel. It is the ideal instrument for filament control.

Half Size

Carter Rheostats are so designed that they are self-cooling and contact arm shaped so that it provides smooth contact with constant pressure at all times, making control of filaments noiseless.

Jones Ten Contact Multiplug and 4 ft. Cable enable all batteries to be placed out of sight and simplify wiring. Now used on over one million receivers; endorsed by leading radio engineers.

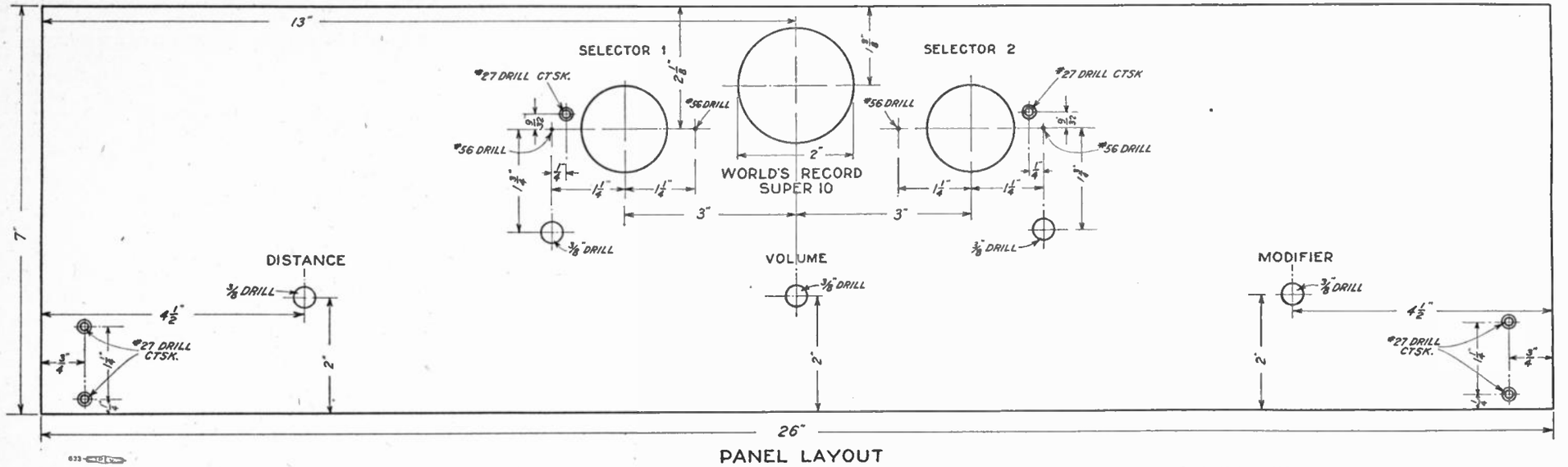
Send Coupon for Full Details

MR. E. H. SCOTT,
7620 Eastlake Terrace,
Chicago, Ill.

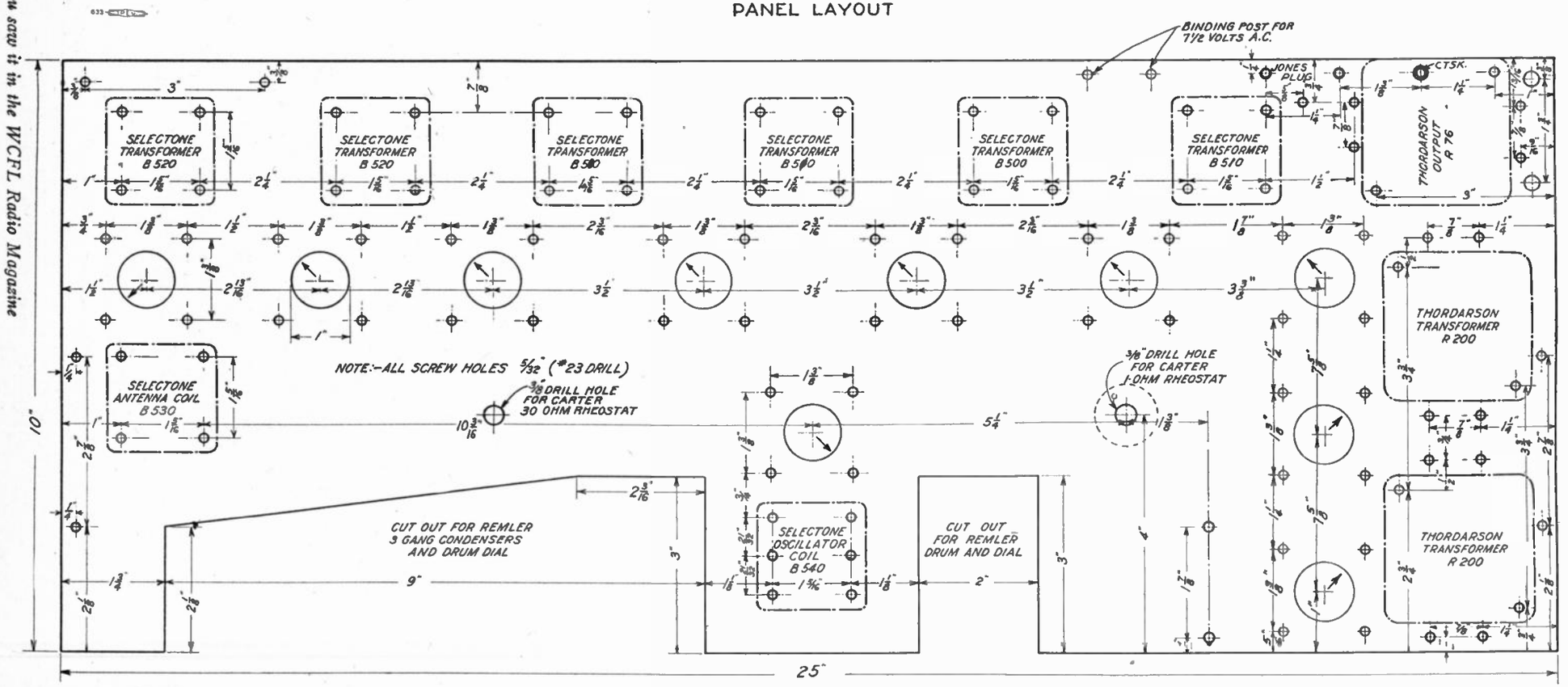
Without obligation, please send me details of the World's Records you made with your Super 9, and full instructions for building your NEW World's Record Super 10.

Name .....

Address .....



PANEL LAYOUT



Say you saw it in the WCFL Radio Magazine

in the plate circuit of the last tube to isolate the D.C potential from the speaker windings.

Due to the terrific volume delivered to the last stage by the amplifying circuits of the receiver, it has been found advisable to use a CX-310 Power Tube, because of its heavy load carrying capacity, in the last stage of audio. The use of this tube makes it possible to operate the set at full volume without the slightest trace of distortion even on the most adjacent local stations.

It is a revelation in volume and tone quality to hear the Super 10 perform with this heavy duty tube in the last stage of audio. The highest and lowest notes are fully and thoroughly brought out with a deep masterful timbre that defies written description. The extent of the volume is so great that with a Western Electric 36 inch cone speaker, one can actually feel the floor under the feet vibrate and respond to the tremendous energy delivered by the speaker.

The use of the CX-310 makes necessary the construction of a Thordarson Heavy Duty Plate Supply Unit to furnish sufficient current to handle the load of this tube and the other loads of the receiver, but as this is easily assembled, from standard parts in about an hour, it is recommended as the best source of plate potential for the World's Record Super 10. The Unit is so designed as to permit taps for the various necessary voltages, and its ample reserve supply of current makes it one of the most effective types of power supply for use with other large sets as well as the Super 10.

The construction of the receiver is even easier than previous models, due to the use of the subpanel, which facilitates the wiring of the set greatly. In assembling the set and wiring, as much of the apparatus as can be conveniently put in place should be accomplished and the greater part of the wiring may be done with the panel and base separate. When all the connections have been made that are possible with the panel and sub-base apart, they can be fastened together and the receiver completed.

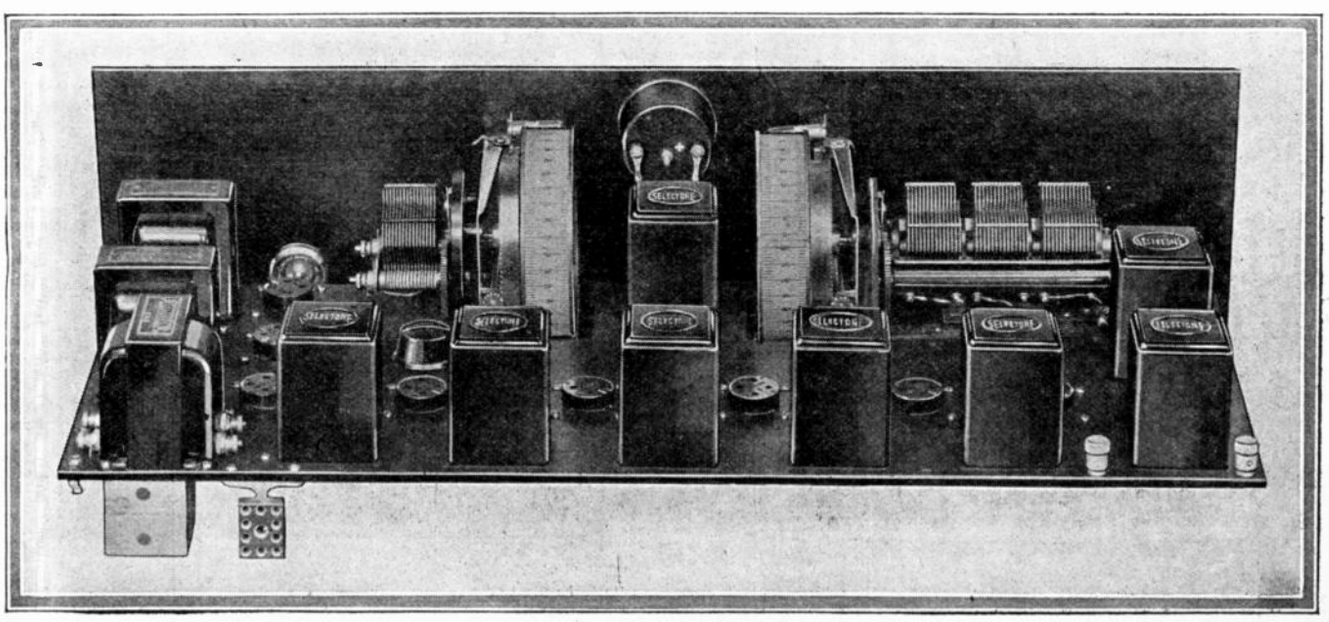
In appearance, the World's Record Super 10 excels all previous models for beauty. The symmetrical layout of the panel, and the high standard of workmanship characterized in the design, is of such calibre as to satisfy the most exacting and discriminating radio fan. The sub-panel hides practically every trace of wiring, only a few necessary leads making their way above the bakelite shelf. The sub-panel simplifies wiring to an amazing extent, many of the plate and grid leads being made by the adjustment of the tips of two lugs to touch one another and the junction soldered.

It is interesting to recount some of the results obtained with the Super 10 as regards reception.

At the laboratory where this remarkable receiver was designed and tested, a recent operating test surprised and amazed those present who witnessed the demonstration. The location of the laboratory of the Scott Transformer Company is probably one of the worst possible for DX reception. Located on the North Side of Chicago, it is within a stone's throw of the powerful transmitter of WBBM, operating on 5,000 watts, and the energy radiated by the antenna of this station is so great as to charge nearly every metallic object with radio energy so that each one forms a miniature antenna of its own wavelength and characteristics. The telephone in the office of the laboratory is so heavily charged with energy that the programs are heard in the receiver when the station is transmitting and the phone is being used in conversation. Two miles to the south is located WIBO, operating on 720 KC, using 5,000 watts of power, and just a short distance away from WIBO is located WEBH, widely known for its great power and strength of signal. WQJ on 670 kilocycles, is located within three miles of the labratory and operates on 1,000 watts power. Within a radius of ten to fifteen miles are located more than twenty other Chicago broadcasters, only a small frequency band between each to permit simultaneous operation. The average receiver, when operated in the laboratory location, hears nothing else but WBBM, and if it is an exceptional one, will permit the reception of various other Chicago stations. Long Distance is a thing unexpected and unheard of in the north Rogers Park District, with very few exceptions, and silent nights.

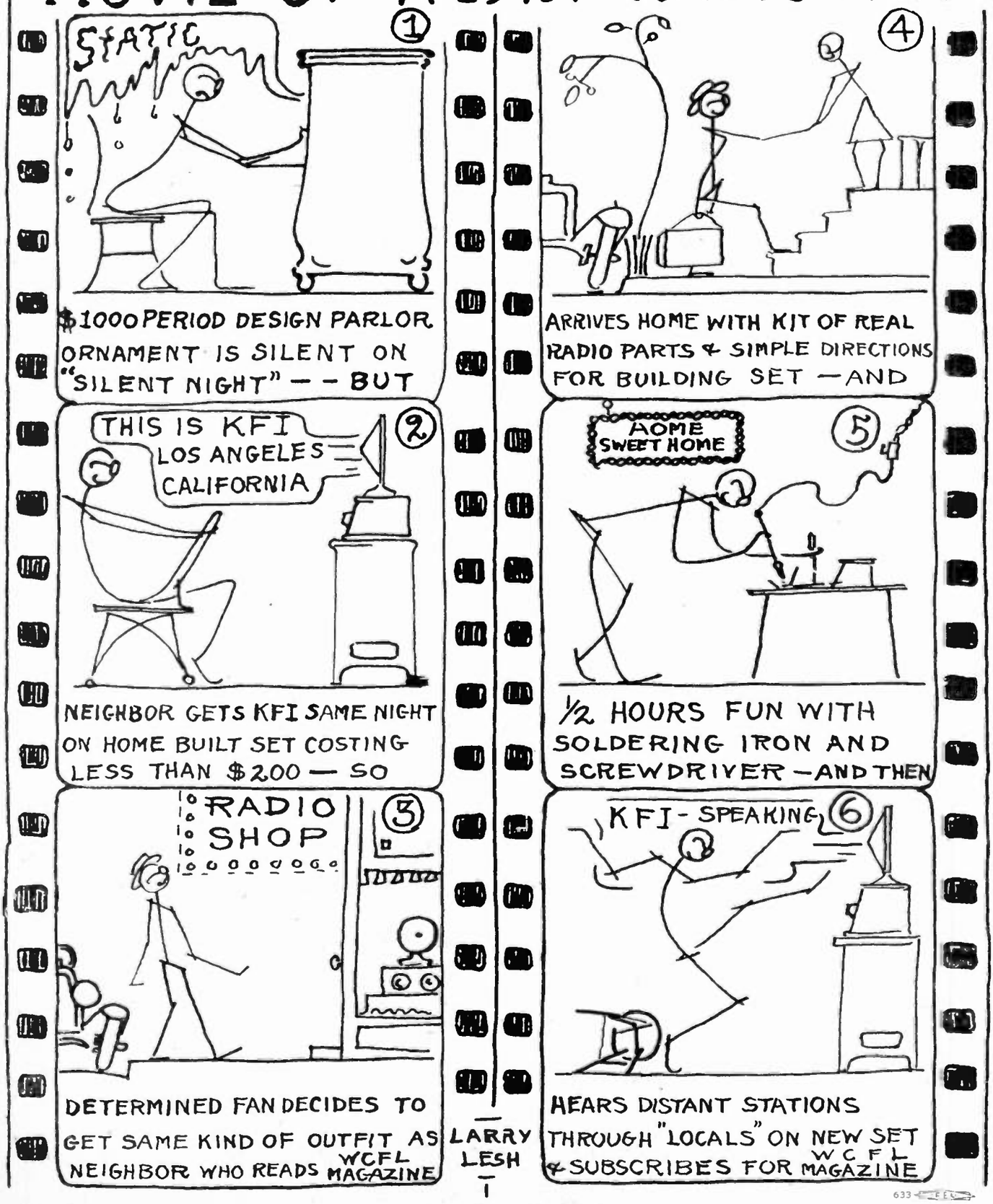
Using a twenty foot antenna, on the ground floor of an apartment, the World's Record Super 10 accomplished tuning that can only be duplicated with another World's Record Super 10. Between WENR and WTMJ of Milwaukee, Wisconsin (just 90 miles distant), the Super 10 tunes in CJBC of Toronto, Canada—only 20 kilocycles separating the three stations, 10 KC on each side of CJBC! Going up on the dial, we come to the setting for WGN on 990 KC, and between WGN and WLS (870 KC) it was possible to tune in WGR, 970 KC; KDKA, 950 KC; WGHP, 940 KC; WRRS, 930 KC; WABC, 920 KC; and WBZ, Springfield, Mass., 900 KC. Ten kilocycles separation, with WBBM going full blast two blocks away! On each side of WLS on 870 kilocycles, a 20 KC separation brought in WHB on 890 KC and WOC at 850 KC. Advancing the dials, we creep still closer to WBBM. With WOC thundering away on 850 KC, the dials tuned to 830 KC, bring in WSAI clear and loud. WEBH two and one-half miles away is operating on 820 KC, but two miles is as good as 1,000 with the Super 10. Tuning higher, WGY at Schenectady operating on 790, rolls in with the familiar old punch and power. The surprise comes when you consider that this is within 20 kilocycles of WBBM just two blocks away! WBBM is on 770. On the other side of the tuning point for WBBM, just 20 kilocycles separation, WTAM is heard on 750 KC, ample volume and good tone.

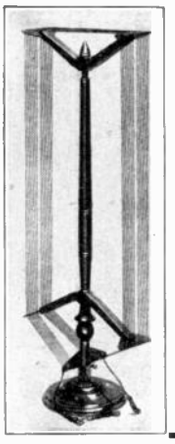
We next come to WHT—WIBO, both powerful local stations, splitting time on 720 kilocycles, and the next local transmitter is WMAQ—WQJ, operating on 670. WQJ, it should be remembered, is less than



Say you saw it in the WCFL Radio Magazine

MOVIE OF A 1927 RADIO FAN





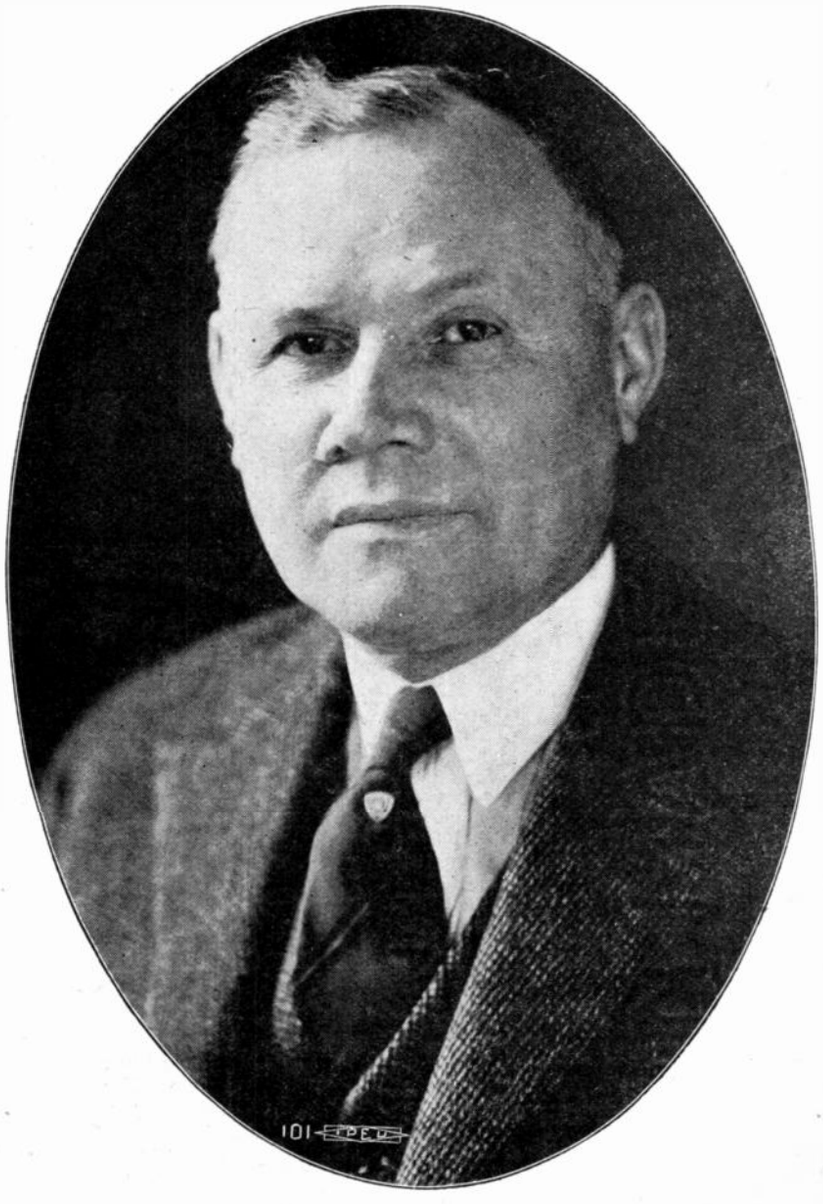
four miles away, and WMAQ only a scant nine. Yet the World's Record Super 10 brought in between WHT—WIBO and WQJ—WMAQ—WSUI on 710, WLW on 700, WJR on 680 and WJZ on 660 kilocycles, respectively. WJZ thundered in with such tremendous volume, just 10 kilocycles away from WMAQ that it was possible to remove the antenna and ground and still hear the program on the speaker more than 200 feet away!

At the upper end of the spectrum, no difficulty was encountered in tuning in WEAF alongside of WCFL. These stations operate on a 10 KC separation, and WCFL is only some seven miles from the laboratory.

No trouble whatsoever was encountered in separating KYW (570) from WHO (560).

Certainly, anyone considering the purchase of a radio receiver should give serious consideration to the receiver availing performance as noted above. Remember that aside from the keen selectivity demonstrated by the above log, the World's Record Super 10 is easily equal, if not superior, to any other set on the market for tone quality and beauty of performance. It is a radio receiver built to meet the trying conditions of present day broadcasting, and it will serve as the standard of comparison for years to come. It has, we are sure, all that the exacting and discriminating enthusiast can expect and desire from a radio receiver.

Memo



William Green, President of the American Federation of Labor.

A Push-Pull Amplifier for Home or Auditorium Use

An Extremely Powerful Amplifier of Marvelous Tone Quality and Volume Sufficient for Home and Auditorium Use

By McMurdo Silver

The light-socket operated super-power amplifier described in this article is of interest not only to radio fans desirous of obcontaining the finest possible quality of reproduction, but it opens up a field of great entertainment possibilities in connection with labor union gatherings and conventions. As an example, the larger push-pull Unipac, preceded by two more amplifying tubes operated entirely from the power supply of the Unipac, is used at the famous Mills Athletic Stadium in Chicago for announcment and entertainment purposes. In addition to being the center of many important ball games, the Mills Park, which is over three blocks square, witnesses many prize fights, the majority of them attended by from 10,000 to 25,000 people. At these gatherings the Unipac amplifier, in connection with six loud speakers distributed thruout the Grandstand and fed by a small microphone, serves to make the voice of a ringside announcer audible to the entire crowd of thousands of people. Every blow and every move is carried to each spectator with the same clarity and intelligibility as though the announcer were at his side. In the intermission between bouts or innings, music from the famous Mills electrical violin is broadcast to the audience by means of the Unipac amplifier and it is not unusual to find crowds leaving the stadium at the end of an exhibition commenting enthusiastically upon the marvelous tone quality of the music provided by the Mills electrical violin and its associated amplifying system.

For use in union meeting halls, such an amplifier would be a great asset, for it would enable a speaker possessed of a voice of poor carrying quality to be heard by every member of the audience, or the Unipac could be used in conjunction with a standard radio set for bringing the more important political and sporting events directly to the union members gathered in the hall. Thus the combination of an ordinary radio receiver with one of the Unipac amplifiers described herewith, would permit from 5,000 to 15,000 people gathered in a hall to hear every detail of the forthcoming Tunney-Dempsey fight. The same Unipac amplifier in connection with an electrical record pick-up replacing the sound-box on an ordinary victrola would provide music for the labor audience, or, if the amplifier were moved to a dance-hall—as could easily be done—choice dance music, with reproduction far superior to that of an ordinary phonograph, could be obtained with ample volume for hundreds of couples.

McMurdo Silver, president of Silver-Marshall, Inc., versatile young radio expert with high executive as well as engineering ability.

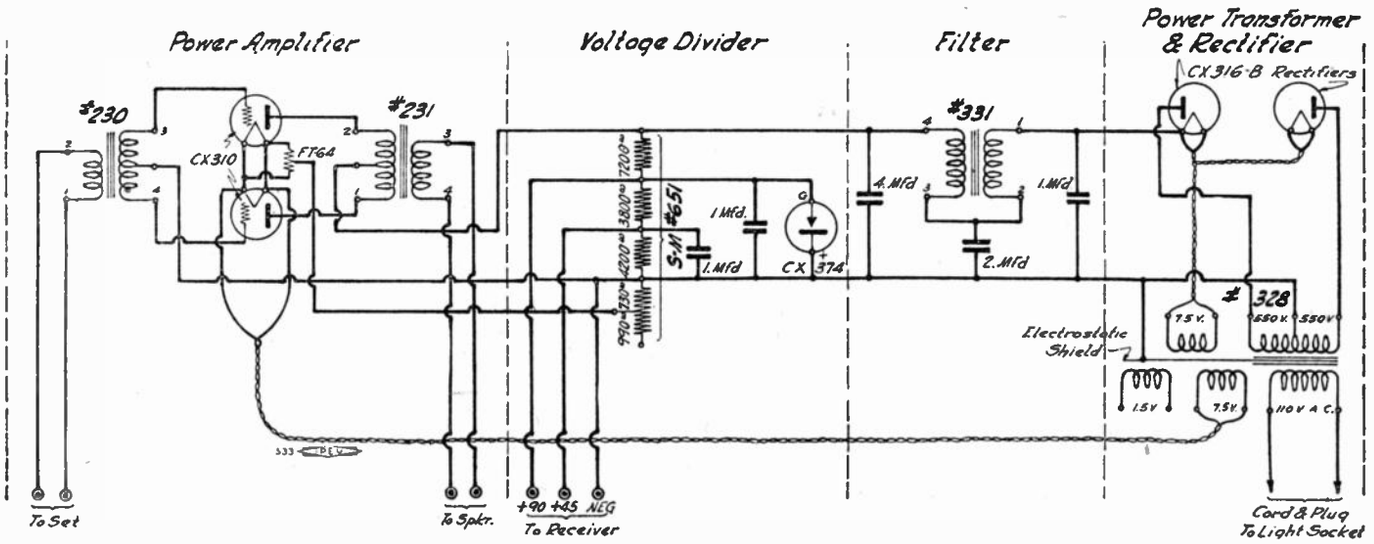
As a result of the interest that has been displayed in the push-pull 171 Unipac, a higher powered model has recently been developed employing a pair of 210 amplifier tubes capable of delivering from 4 to 5 watts of undistorted power to a loud speaker such as the popular Western Electric cone. It is probably quite safe to say that this is the most powerful receiving amplifier yet developed for the home constructor, and the quality of reproduction it provides is really remarkable—in fact, after listening to the push-pull 210 amplifier, the significance of the popular phrase "tube overloading" is really borne home as applied to conventional receiving amplifiers.

This newer combination is illustrated herewith, and closely resembles the 171 push-pull model. The 210 combination consists of a full-wave rectifier which may use either 316B or the new 381 type tubes, and a push-pull amplifier stage with two 310 power tubes. A good idea of the details of the device may be gained from the circuit diagram, in which most of the circuit constants appear.

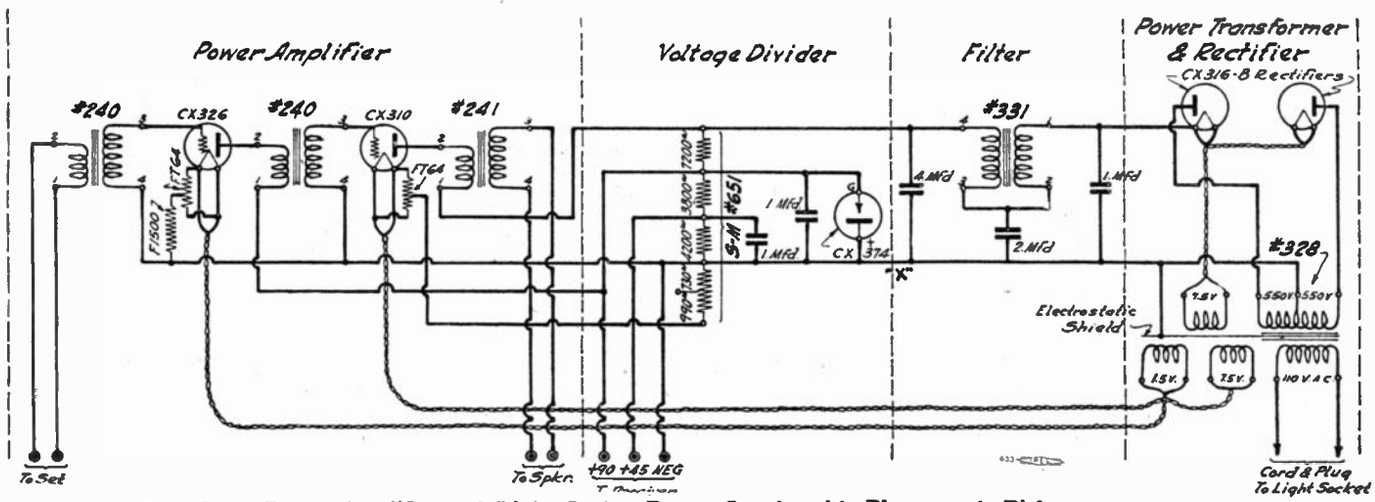
The power supply uses a large, heavy full-wave power transformer supplying 7.5 volts from two separate windings for lighting the rectifier and amplifier tubes. Its primary is designed for 105 to 120 volt, 60 cycle, lighting circuits, while a split high voltage secondary supplies 550 volts A.C. (R.M.S.) to the plates of the rectifier tubes. Due to a very good transformer design, the rectifier and transformer will deliver from 500 to 530 volts of unfiltered D.C. at a 100 M.A. load. This voltage is about all that may safely be used upon 210 amplifier tubes, after a 40 volt drop has been allowed for the filter system. The filter output is about 450 to 480 volts D.C. of which 35 to 40 is used for C bias on the amplifier tubes, the remaining 415 to 440 volts being actual plate potential supplied to the push-pull amplifier. The rectifier life will be quite good, since each 316B is called upon to furnish only 53 of an allowable 65 M.A. One 381 rectifier would deliver nearly the same power output as the 316B's, but the use of a single-wave rectifier is generally to be discouraged as increasing the filtration problem, and almost invariably resulting in an excessively high value of hum in the loud speaker. Two 381 rectifier tubes will give a higher output than two 316B's by about 50 to 60 volts, and their use is recommended, not so much because of the increased power output, but because of their probable longer life due to oxide-coated filaments and rather generous design. The filter system is substantially the same as is used in the smaller Unipac and the Reservoir B supplies, except for the use of 1,000 volt condensers for absolute safety. A combination selective and brute-force filter scheme is employed resulting in very good filtration at high currents. The amplifier stage consists of a split winding input push-pull transformer with a step-up ratio of 3.1 per tube, and a split winding output transformer matching the impedance of the 310 amplifier tubes to that of a Western Electric or similar speaker at 30 cycles to compensate for the poor speaker performance at low frequencies.

The construction of the Unipac is quite simple, involving only the mounting of a number of standard parts upon a standard steel chassis, the wiring up of these parts, and the final attaching of the cabinet or ventilated housing after the unit has been tested. The parts needed are listed below:

1—S-M 328 super power transformer	$18.00
1—S-M 331 Unichoke	8.00
1—S-M 230 push-pull input transformer	10.00



A Single Stage Push-Pull Power Amplifier Using 210 Tubes with Self-Contained Power Supply. This Amplifier Will Add Volume and Tone Quality to Any Radio Set and Also Replace "B" Batteries



A Complete Two-Stage Power Amplifier and Light Socket Power Supply with Phonograph Pickup

1—S-M 231 push-pull output transformer	10.00
5—S-M 511 tube sockets at .50	2.50
1—Tobe 662 condenser block	18.00
1—S-M 651 resistor (Ward Leonard) set	7.00
4—Frost 253 tipjacks at .15	.60
1—Frost FT64 balancing resistance	.50
1—Van Doorn 661 steel chassis and cabinet with hdwe	8.00
3—Eby binding posts (B—, +45, +90) at .15	.45
25—ft. Kellogg fabricated hook-up wire	.20
	$83.25

The tubes required for the operation of the Unipac are as follows:

2—UX216B or CX316B single-wave rectifier tubes at $7.50 (CX381 or UX281 optional)	$15.00
1—UX874 or CX374 Ballast tube	5.50
2—UX210 or CX310 power tubes at $9.00	18.00
	$38.50

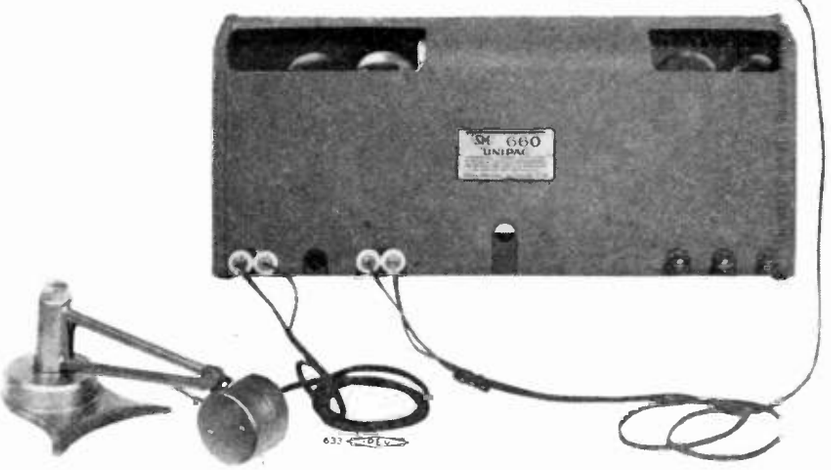
In operation, the Unipacs will furnish ample power to a radio receiver at 45 and 90 volts, held constant by a potential dividing resistance and a glow tube voltage regulator preventing development of high open circuit voltages which might damage receiver condensers. The amplifier replaces the conventional second audio stage of a receiver, the input tipjacks connecting to the first audio stage output terminals, and the loud speaker connecting to the output jacks of the Unipac.

By eliminating the push-pull feature and building the Unipac with one 210 amplifier tube providing 1.5 to 1.8 watts undistorted power output, the extra tube socket may be used for a CX326 A.C. amplifier tube, which may be lighted by the extra 1.5 volt filament winding of the power transformer. This input tube allows the Unipac to be used as a phonograph amplifier with the addition of a magnetic pick-up connected to the input tube's grid circuit. The Pacent Phonovox gives quite satisfactory results, and is equipped with a needle-scratch filter and volume control. A four-contact jack is used to drop the input tube when amplifier is used with a radio set if desired. If preferred, a full two stage amplifier may be built in the Unipac case, using the smaller S-M 240 and 241 audio and output transformers. In this case, either detector output or record pick-up may be connected to the first transformer primary at will. A suitable circuit is given herewith, as employed in the LC-28 Unipac, designed for Laurence M. Cockaday, editor of *Popular Radio Magazine*.

In operation, all tubes will get quite hot, as will the larger Ward-Leonard resistor. This is correct, as is noticeable warmth of the power transformer core. One caution it is necessary always to observe is to see that the B-post is grounded directly or indirectly, and, if a magnetic record pick-up is connected to the primary only of a first stage amplifying transformer, one side must be grounded (as in the two stage amplifier circuit shown, where either radio set output or pick-up may be connected to an electrically isolated transformer primary winding).

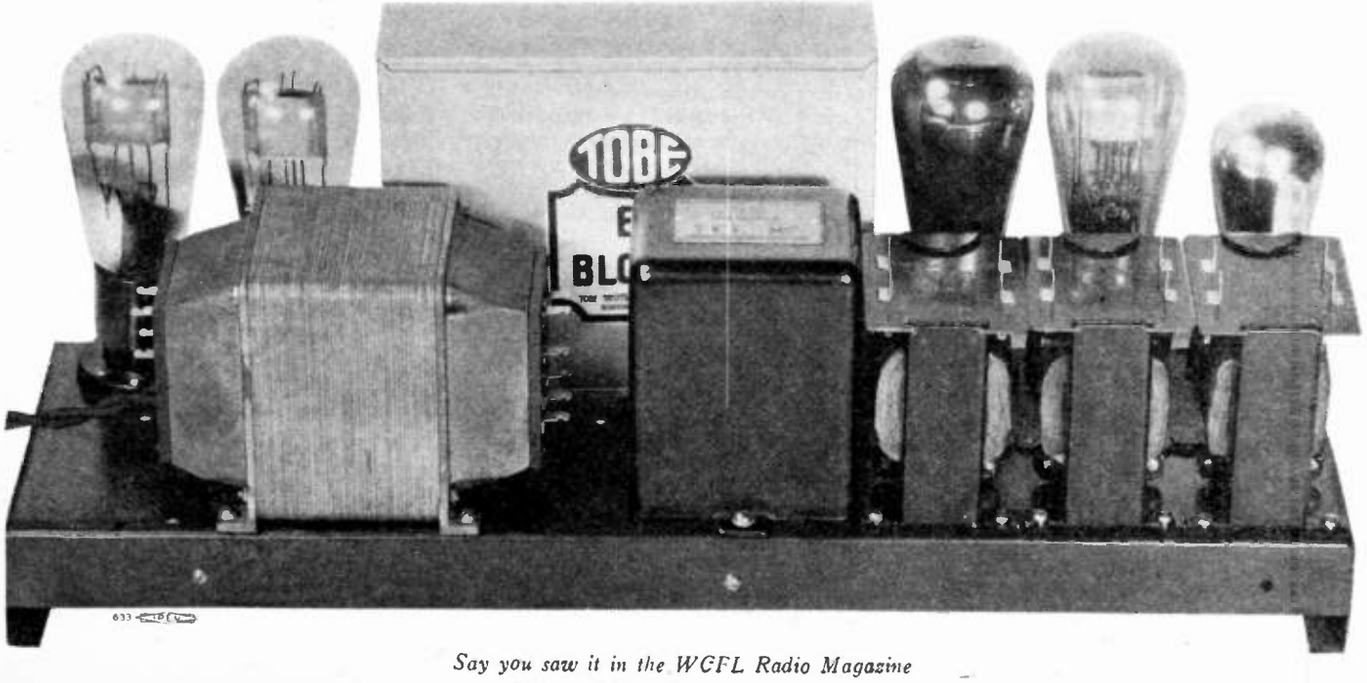
AT RIGHT.

The Unipac Amplifier, Record Pickup and Loud Speaker Will Electrify Any Old Phonograph and Give Enough Volume for a Small Hall.



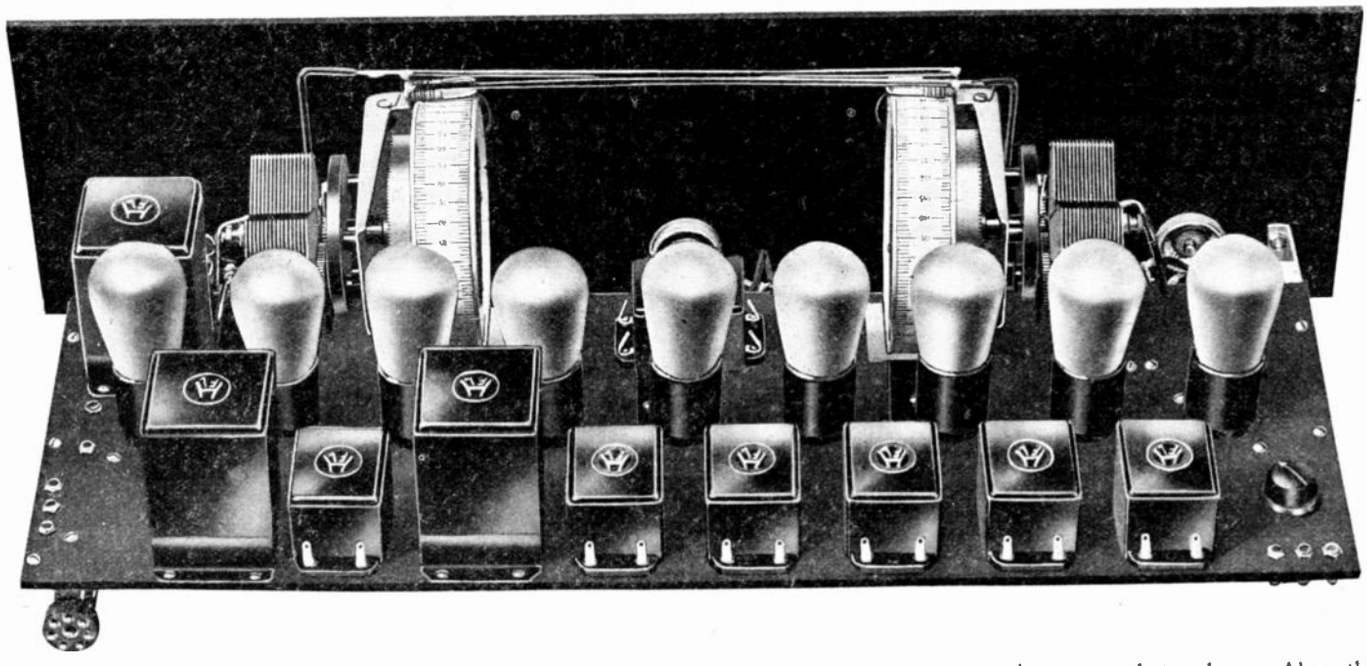
BELOW.

Interior of the Two-Stage Light Socket Power Amplifier. Tubes from Left to Right Are—Two CX 316R Rectifiers, ACX 374 Voltage Regulator, A 310 Super Power Amplifier and CX 326 Input Amplifier.



The Improved "Nine-in-Line"

By A. M. Powers



Receivers may come and receivers may go but the superheterodyne receiver does seem to go on forever. From the date of Armstrong's origination of this circuit principle in France during the war, the superheterodyne receiver has opened up intriguing vistas to the dyed-in-the-wool radio fan. The builder and owner of a good superheterodyne receiver is in a class apart from the ordinary run of radio devotees.

It stands to reason that a single type of circuit could not hold its intense popularity through the entire period of radio broadcasting to date unless it had some features to recommend it above all others. In every stage of the development and popularization of radio reception the receivers which incorporate the superheterodyne principle have managed to keep just a step ahead of others. In fact there is no other receiver or type of circuit that has been able to hold the popular favor of the radio public for anything like the length of time that the "super" has remained in favor.

Most of the outstanding records of distance reception on the broadcasting or higher wavelengths have been made with superheterodyne receivers. In the great trans-oceanic radio stations the superheterodyne receiver is used for reception. Practically all of our broadcasting stations use superheterodyne receivers for listening in on their own and other broadcasters, and for the constant watch that is kept for S O S calls.

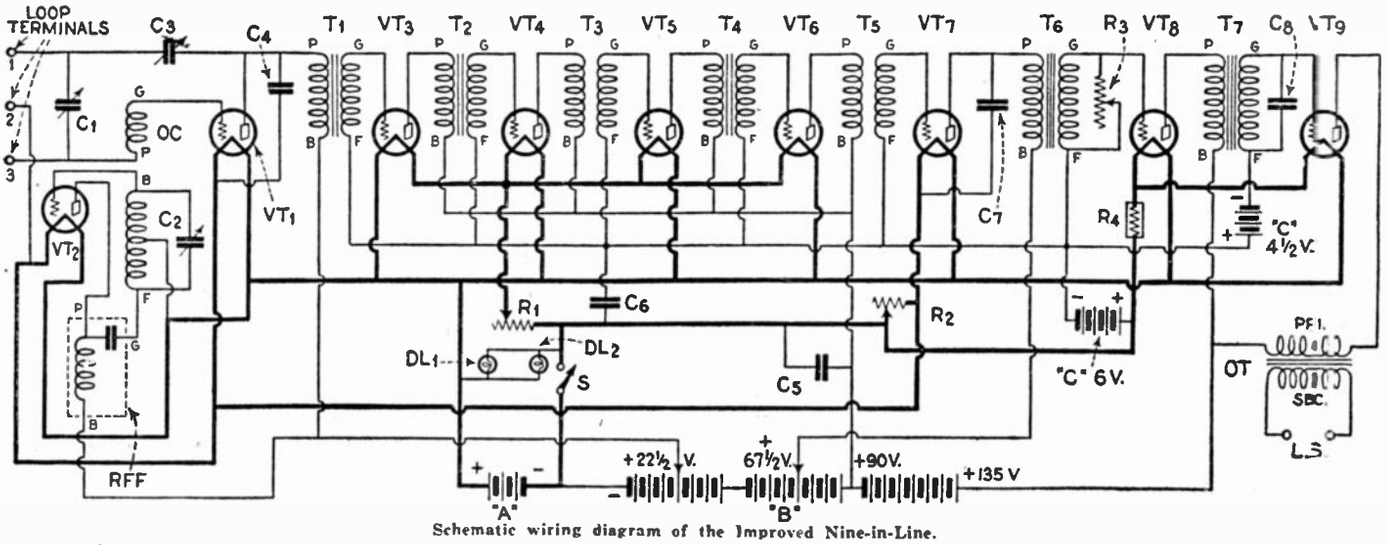
The reason for all of this is that the superheterodyne will do everything that any other receiver will do—and in most cases do it better. In sensitivity it is incomparable. Its volume is tremendous and its quality is governed only by the quality of the audio amplifier included in its make-up.

Aside from all its other advantages, this type of receiver may be used without an outdoor antenna of any kind and without a ground connection. Connected with an ordinary receiver a small loop antenna resting on the receiver cabinet, and with no other external wires, provides so little "pickup" that, except in the case of reception from local stations, the average receiver would not be able to reproduce broadcast signals at all. But connect the same loop to a super-heterodyne receiver and stations all over the country may be tuned in. The tremendous amplification obtained with a superheterodyne receiver is capable of overcoming this obstacle of extremely minute "pick-up" and reproducing the signals with strong loud-speaker volume.

Of course the whole trick lies in the fact that the amplification is obtained at a high wavelength where radio-frequency amplification is vastly more efficient than it is at the ordinary broadcast wavelengths. A long wave amplifier is also far more stable than one which amplifies at broadcast wavelengths and this fact permits the use of more R. F. amplifier stages in the "super." Where two stages of R. F. are the practical limit in an ordinary, unshielded type of broadcast receiver, it is quite possible and practicable to use three and even four stages in a super-heterodyne. Also, the amplification per stage in the latter is considerably higher than that of the average broadcast receiver.

But with all this sensitivity and volume there is still another feature to recommend this type of receiver—its selectivity. In spite of the good already accomplished by the radio commission in Washington, there is still an overcrowded condition on the air as every radio listener knows. The old days when any number of out of town stations could be tuned in during the early evening when the locals were going full force, and with an ordinary receiver, seem to be gone for good. If one desires to listen to out of town stations now he must, except in rare instances, burn the midnight oil to do it. But not so with a good super-heterodyne receiver. With such equipment the local stations are confined to one or two degrees on the dials. With such confinement, and with local stations spaced approximately seven degrees apart on the dials as they now are with an up-to-date receiver and the .50 kilocycle separation between stations that now prevails, it is evident that there is plenty of room between the local stations for going far afield in the world of DX.

There have been constant improvements in the super-heterodyne receiver. The fundamental circuit remains pretty much the same but almost unbelievable refinements have been made in the parts used in the circuit. The original receivers of this type were extremely complicated in operation and in the construction. If



Schematic wiring diagram of the Improved Nine-in-Line.

memory serves correctly there were something like 34 adjustments to be made in some of the earlier models in order to bring them up to full efficiency.

Perhaps nowhere are the numerous refinements in this circuit exemplified as in the H. F. L. "Nine-in-Line" superheterodyne receiver. The physical simplicity is evident from the top and bottom views of the receiver, shown below. The circuit itself is rather complex; although not more so than that of other superheterodyne receivers; but the design of the individual parts and the carefully designed layout result in the most simple kind of assembly and wiring. The entire receiver in spite of its nine tubes, requires less connecting wire than many three tube receivers. The grid and plate leads are all short and direct and there is no posibility for the constructor to go wrong.

An unusual feature of this receiver is the fact that it makes use of *four stages of intermediate frequency amplification* to provide unprecedented sensitivity, and *two of these are sharply tuned* to provide a degree of selectivity even in excess of the average good super-heterodyne receiver.

The intermediate frequency amplifier consists of an untuned input transformer followed by another untuned transformer in the first stage. Next comes a tuned transformer, then an untuned transformer in the third stage and this is followed by another tuned transformer. Each of the untuned transformers will pass a wide band of frequencies. Their function is to provide coupling which will result in a high degree of amplification. But selectivity cannot be neglected and it is for this purpose that the tuned transformers are included. The broad band of frequencies passed by the untuned transformers are applied to the stage which contains the first tuned transformer. Because of the effect of this sharply tuned transformer, the output of this stage is in the form of a narrow frequency band. But wishing to go even further than this the designers of this receiver added another untuned, intermediate stage for the sake of additional amplification, and followed this with a second tuned stage, for greater selectivity. This arrangement will surely appeal to the radio fan as being a most logical method of obtaining the maximum sensitivity and selectivity.

Another feature which tends to increase sensitivity is the inclusion of regeneration in the circuit of the first detector. It is a known fact that regeneration, at broadcasting frequencies, is approximately the equivalent of a stage of tuned radio frequency amplification. Therefore, by including regeneration in the circuit of the first detector the effect of an additional amplifier stage is obtained, without adding another tuning control.

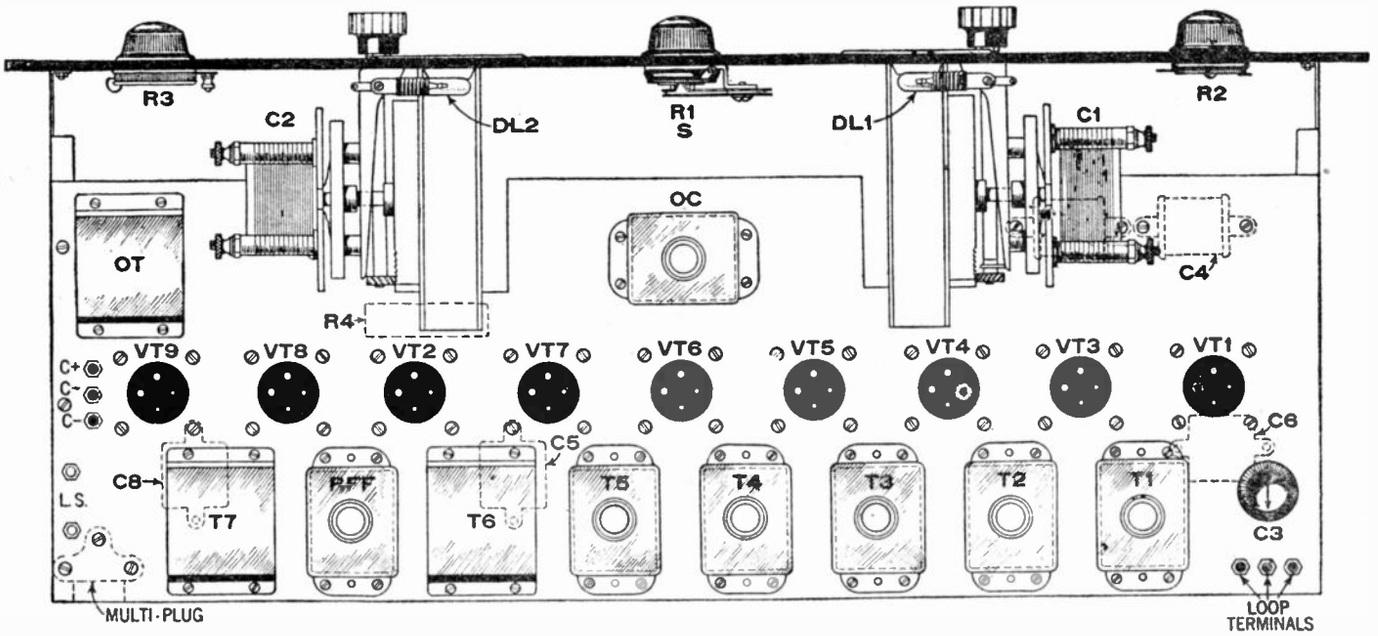
The input and frequency changer circuits are not unusual and employ a tried and true circuit. The broadcast signal energy picked up by the loop antenna is applied to the grid of the first detector tube, VTI. The regeneration in this circuit is provided by the center tapped loop and is controlled by the midget variable condenser C3. In the lead from the loop to the grid of the first detector a small coil is inserted and this coil is coupled to the tuned circuit of the oscillator, VT2. Through this coupling medium a locally generated frequency is also impressed on the first detector. This latter frequency is, of course, the frequency to which the oscillator circuit is tuned. The output of the detector tube is therefore a composite of the two impressed frequencies. An incoming signal of any frequency can be changed to any other pre-determined frequency by simply varying the frequency of the local oscillator. In this particular case it is desired to have the detector output correspond in frequency to that to which the intermediate amplifier is tuned. This is accomplished by tuning the detector input circuit by means of the condenser C1 to the wavelength of the broadcasting station to which it is desired to listen, and then adjusting the oscillator tuning condenser to a frequency which will combine with the incoming signal frequency to form a third frequency equal to that to which the intermediate amplifier is tuned.

The two variable condensers C1 and C2 are therefore the only tuning controls for the entire receiver. The principle of frequency changing as decribed may sound complicated but in tuning this principle may be forgotten and tuning accomplished in just the same manner as with any two control receiver. For all ordinary reception the regeneration control condenser C3 may be set at zero and left that way. The only time it is used is when it is desired to tune in some very distant station, in which case it can be moved up until the detector circuit is just below the oscillating point.

After the signal passes through the intermediate amplifier it is impressed on the grid of the second detector, VT7. Here the "plate detection" method is used, which eliminates the grid leak and grid condenser. The signal then passes on through the two stage audio frequency amplifier. Normally the output of the second audio stage would be too great in volume, even on distant stations. To permit the operator to control volume to suit his taste a variable resistance, R3, is included across the secondary of the first audio transformer. This resistance is mounted on the panel and is controlled by means of the knob shown at the right hand end of the front panel.

In order to protect the loudspeaker winding from the high direct current flowing in the plate circuit of the power tube used in the last stage, an output transformer, OT, is included in this circuit. The direct current can flow only through the primary of this transformer, while the useful, alternating current which comprises the signal energy is transferred to the secondary by induction and flows on through the speaker winding.

The construction of the receiver can be accomplished through the diagrams



Instrument layout of the receiver. All parts are lettered to correspond with wiring diagrams.

and illustrations which accompany this article. The panel and sub-panel templates are given, and show the location of all instruments. All of the parts except the condensers and resistances are identical in form. Each of these bears a type number, and these type numbers are shown in the layout diagrams so there is no possibility of the constructor misplacing any of the units.

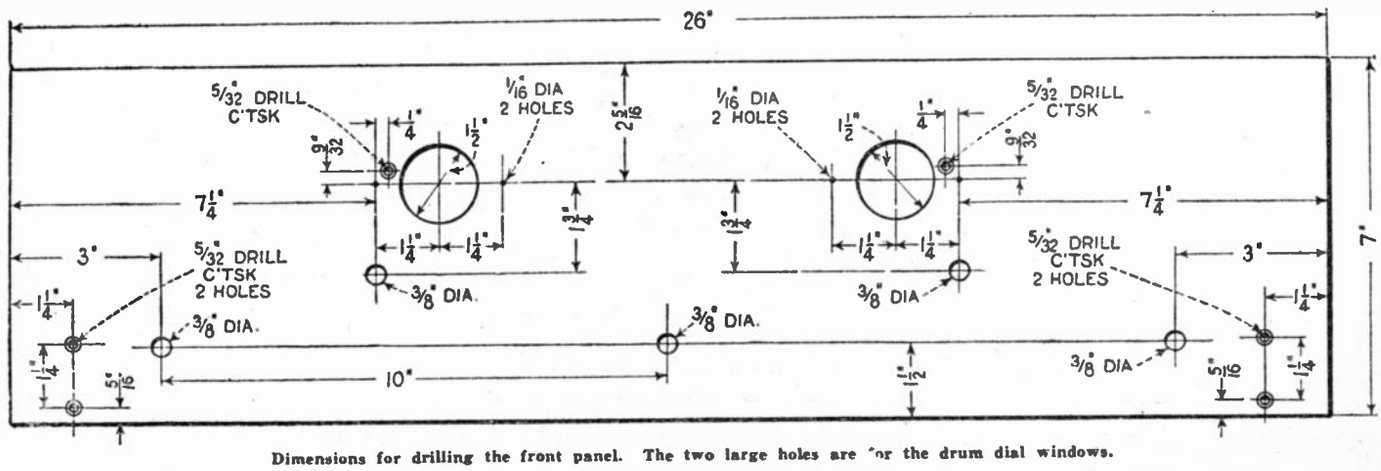
The "Nine in Line" receiver employs eight tubes of the 301-A type and either a 312 or a 371 type in the last audio stage, which is the last socket at the right. If a "B" supply of over 135 volts is available, the use of the 371 type power tube is recommended. Otherwise the 312 type tube should be used. The grid bias voltage values for this stage will depend on the type of tube used.

In spite of the use of nine tubes, the plate current drain on the "B" batteries is no higher than that of the average five tube receiver. This is due to the use of comparatively high "C" battery voltage on the intermediate frequency amplifier tubes. The total "B" battery drain, including that of the power tube in the last audio stage is from 20 to 30 milliamperes, depending on the type of power tube used. This makes practical the use of heavy duty "B" batteries, if desired.

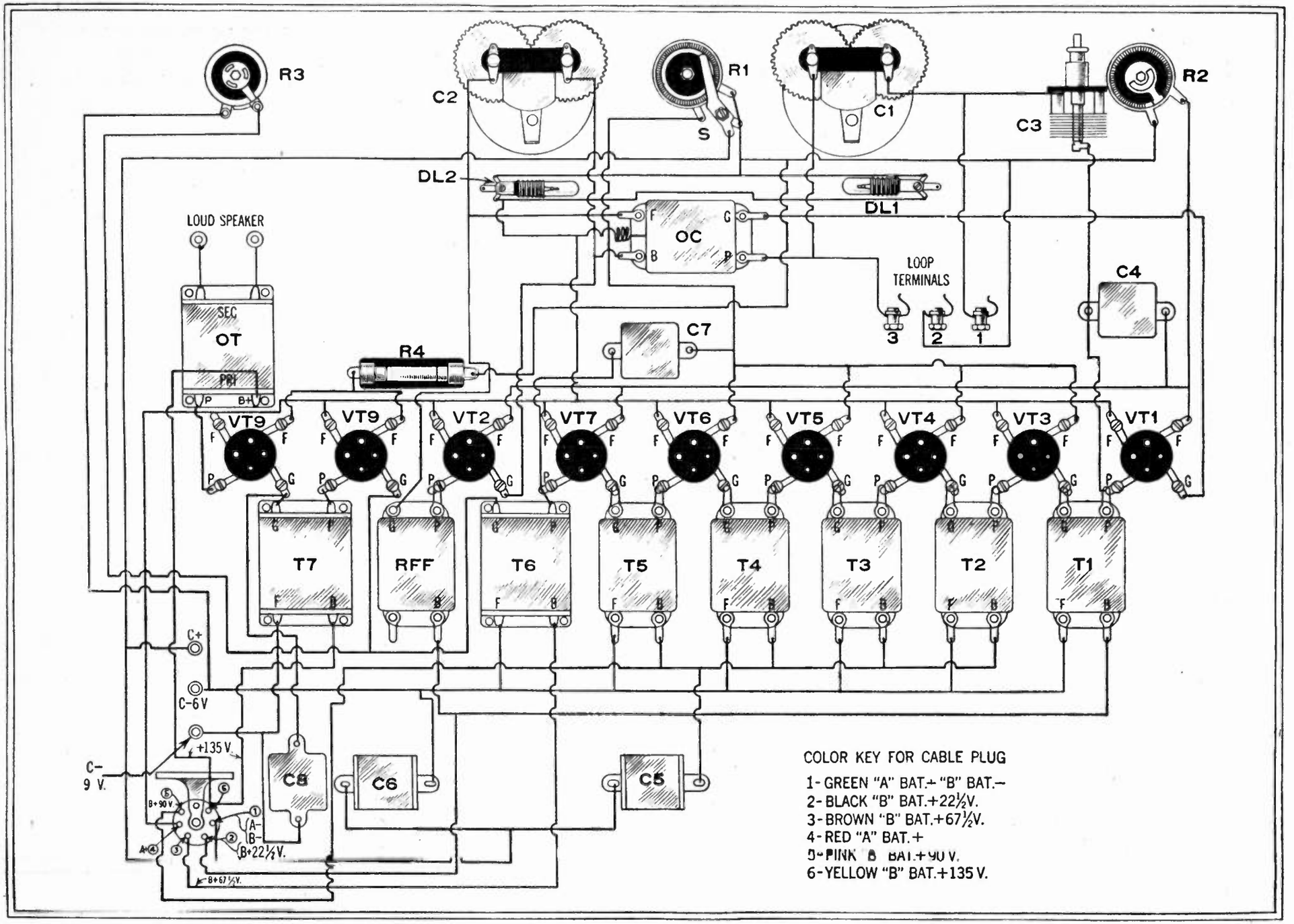
The filament supply voltage is obtained from a six volt storage battery. The two detectors and the oscillator draw their supply through a six ohm rheostat R2. The four intermediate amplifier tubes are controlled through a combination rheostat and battery switch, R1 and S. The audio tubes are provided with a fixed resistance, R4. It is also advisable to include fixed resistances in series with rheostats R1 and R2 to prevent higher than five volts

LIST OF PARTS FOR THE NINE-IN-LINE

3 H.F.L. No. H. 210 Transformers....$8.00
2 H.F.L. No. H. 215 Transformers.... 8.00
2 H.F.L. No. C. 16 Transformers..... 8.00
1 H.F.L. No. L. 425 R. F. Choke Unit 5.50
1 H.F.L. No. L. 430 R.F. Transformer 5.50
1 H.F.L. No. C. 25 Output Transformer 8.00
9 Benjamin Sub-Panel Mounting Sockets No. 9044.
2 Remler Drum Dials Right and Left.
2 Remler .0005 Variable Condensers.
1 Pr. Benjamin No. 8629 Brackets.
1 S.M. No. 340 Midget Condenser.
2 1 M.F.D. Carter By-Pass Condensers.
1 Carter (Tobe) .0005 Condenser.
2 Carter (Tobe) .002 Condensers
1 3A Amperite or 1 Daven ¾ Amp. Ballast.
1 Jones Multi-Plug.
1 Carter 6 Ohm Rheostat with Switch.
1 Carter 6 Ohm Rheostat without Switch.
8 Carter Pup Jacks.
1 7x26 Celeron or Formica Front Panel.
1 8x24 Celeron or Formica Sub-Panel.
1 Carter 200,000 Ohm Volume Control. Qualitone Loop is recommended.



Dimensions for drilling the front panel. The two large holes are for the drum dial windows.


R3
C2
R1
C1
R2
S
C3
DL2
DL1
LOUD SPEAKER
OC
LOOP TERMINALS
C4
SEC
OT
PRI
C7
R4
VT9
VT9
VT2
VT7
VT6
VT5
VT4
VT3
VT1
T7
RFF
T6
T5
T4
T3
T2
T1
C+
C-6 V
+135 V.
C-
9 V.
C8
C6
C5
B+90 V.
A-
B-
B+22½V.
B+67½V.
COLOR KEY FOR CABLE PLUG
1-GREEN "A" BAT.+ "B" BAT.-
2-BLACK "B" BAT.+22½V.
3-BROWN "B" BAT.+67½V.
4-RED "A" BAT.+
5-PINK "B" BAT.+90 V.
6-YELLOW "B" BAT.+135 V.

being applied to the tubes, even when the rheostats are turned up full.

The "B" supply is tapped at 22½ volts for the first detector and oscillator and 67½ volts is applied to the second detector. The four intermediate stages are provided with 90 volts. This may in some cases be increased to 112 to good advantage. The second detector is tapped in at 67½ volts. 135 volts is required for the first audio tube, and also for the second audio stage provided a 312 type tube is used. If a 371 tube is used here the "B" voltage should be 180 for best results. In this latter case a separate lead should be brought out from this last tube because this voltage cannot be applied safely to the first audio tube.

It will be found easiest to wire up the instruments on the sub-panel before the front panel is attached. Then the panel may be attached and it will only be necessary to bridge wires over from the panel instruments to their proper connections on the sub-panel.

The appearance of the receiver is considerably enhanced by installing it in a style R-16 Excello radio console.

This particular console is of the wall type and is provided with a special tone chamber above the receiver panel space to which the constructor's favorite speaker unit can be atached. In the battery compartment below this console there is ample room for either "A" and "B" batteries or eliminator.

"9-In-Line" Used With Ehlert Cabinet.

Memoranda

A-C Tubes for Batteryless Receivers

"Build Your Own Batteryless Set or Change Your Set Into a Batteryless One"

By L. B. Newman

INTENSE interest has been created by the development of the A-C Tube. The dream of a radio set that could be plugged into the electric light socket and operated by the mere turning of a switch, has now been realized.

To secure a true Batteryless Receiver, two sources of power supply must be contended with, the "A" supply and the "B" supply. The "B" Battery problem has been very satisfactorily solved by the design of present day "B" Eliminators. The "A" Battery presents a much more difficult problem and has been a severe obstacle in the path towards securing a Batteryless Receiver.

A number of methods and devices have been tried, some having laboratory possibilities and not commercial value, others have been discarded, for no device can ever be successfully marketed that is delicate and requires constant attention.

The most logical trend of thought turns to the design of the tube itself for the solution of the "A" Battery problem, for instead of resorting to "A" Eliminators, Trickle Chargers, Rectifier and the like, the answer is, design the tube to operate direct from the light socket.

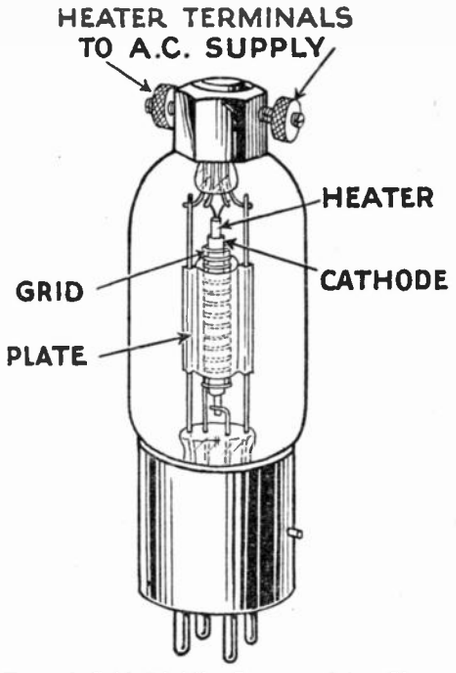
With this ideal in mind, THE SOVEREIGN ELECTRIC & MANUFACTURING COMPANY, CHICAGO, after over three years of research has developed a tube for true Light Socket Operation.

THE A-C TUBE is designed to eliminate the "A" Battery and operates directly from the Alternating Current Source through a small step-down transformer.

THE A-C TUBE differs from the conventional tube in that it does not depend upon the usual filament heated to incandescence for electron emission.

For Electron Emission, the A-C Tube has a thimble coated with special rare elements, which, when heated at a low temperature, emit electrons for the operation of the tube. This thimble is called the CATHODE and is heated by the heater element which connects to the prongs on the cap of the tube. This heating element is electrically insulated from the tube and the receiver circuit, thereby eliminating all possibility of electric line noises and disturbances being transmitted through the set. *There is no change in volume due to fluctuations in line voltage.*

The tube has incorporated the conventional grid and plate and also a



Top of Grid Rigidly Supported by Glass Bead, not shown on sketch
Sectional View of Sovereign A-C Tube
Operates Direct from Alternating Current Source
(Through step-down transformer)

standard base and thereby does not require a special socket.

All the elements are ruggedly secured at both ends thereby obtaining a tube that is absolutely non-microphonic, eliminating the necessity of cushion spring sockets. Tests have shown an average life of 1500 to 2000 hours. The electron emission is practically constant for the life of the tube, for instead of depending upon a thin hair-line filament for the Electron Emission, the Sovereign A-C Tube utilizes a large emitting surface (CATHODE).

The A-C Tube can be used as an Amplifier, Detector, or Oscillator and operates on either 25 or 60 cycles—110 or 220 volts.

The Tube is applicable to any type of receiver with but slight modifications in the circuit.

SPECIFICATIONS

Heater Voltage .....
.....2½ to 3 volts—Not Critical
Filament Current.....1.10 Amperes
Plate Voltage.....190 volts—Maximum

Absolutely Eliminates
"A" Batteries
"A" Eliminators
Rectifier Tubes
Trickle Chargers
Battery Charging
Solutions and Acids
Entire Absence of Hum

The Alternating Current is entirely insulated and independent of the radio receiver circuit, thereby eliminating all possibility of any hum.

Greater Amplification

The design and characteristics of the Sovereign A-C Tube results in Greater Amplification.

Non-Microphonic

Rugged supporting at both ends of the elements in the tube gives freedom from microphonic noises caused by vibration. This feature permits the loud speaker being installed as a unit with the Radio Receiver without special means of cushioning.

Longer Life

The tube is operated at a comparatively low temperature, about one-half of the filament temperature of the standard tube, resulting in longer life. The Electron Emission is practically constant for the life of the tube.

Improved Tonal Quality

Characteristics of the tube permit greater volume with a minimum of tube distortion. Full round tone.

Efficient and Economical

The Radio receiver by means of the A-C tube is always operated at full voltage. There are no half charge or run down batteries to contend with. No weakening of signal due to run-down batteries.

The current consumption is practically negligible as the average 5 tube set will consume about the same current as a 25 watt lamp.

Reduced Servicing

Since the largest percentage of service is caused directly by run-down batteries, inefficient eliminating devices, and tubes that weaken with every hour of use, the Sovereign A-C Tube by its design and inherent characteristics can be relied upon to reduce servicing and upkeep to a minimum.

"Build Your Own Batteryless Receiver"

By means of the Sovereign A-C Tubes and Kit and any standard "B" Eliminator instead of "B" Batteries, present designed sets can be easily converted into Light Socket Batteryless Receivers, simply plug into the socket. Good Clear Reception with unfailing power by the mere turning of a switch.

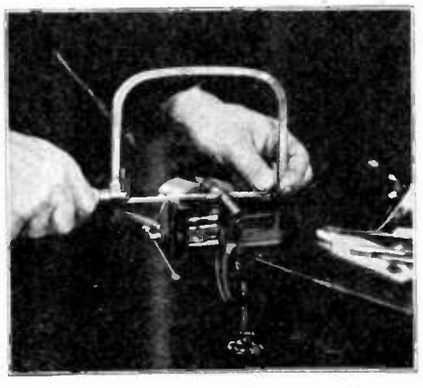
The Sovereign A-C Kit consists of:

- Special Heater Transformer
- Power Rheostat
- Power Switch
- Oscillation Control—Variable Resistor
- Volume Control—Variable Resistor
- Blue Prints and Directions.

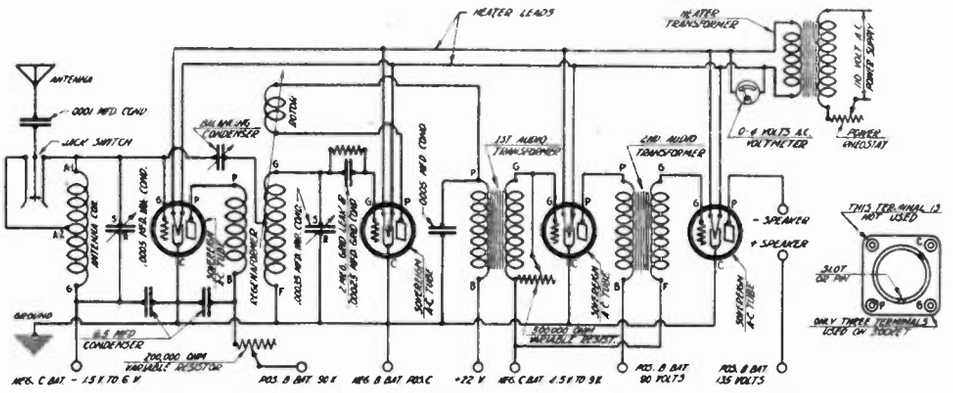
The Sovereign A-C Kit can be adaptable for use on 110 or 220 volts—25 or 60 cycles.

SOVEREIGN A-C TUBES Fit Into All Standard Sockets.

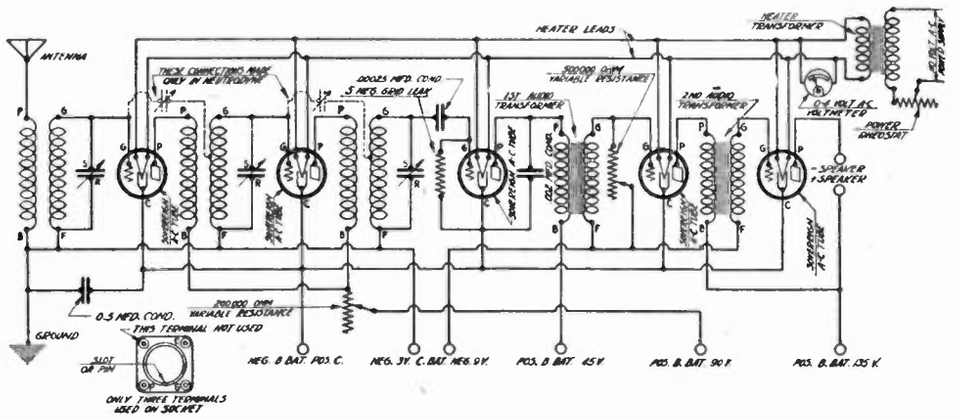
The following circuits show a few typical applications of the Sovereign A-C Tubes.



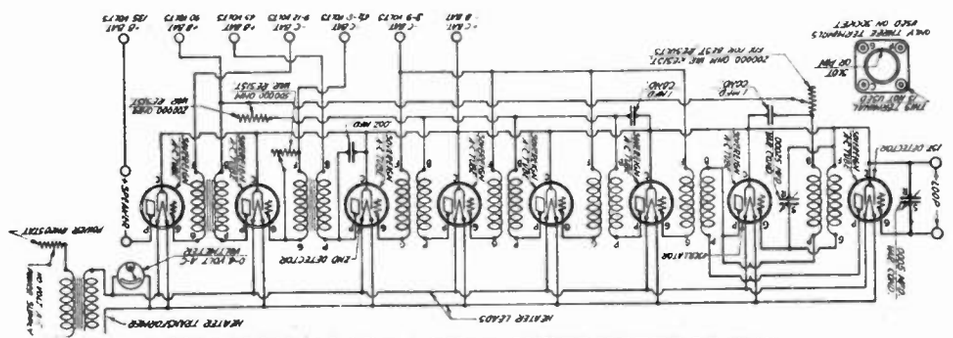
Even a heavy bolt may be cut off with this type of saw if properly handled. The mechanic is demonstrating the possibilities of the F.P.M. "all purpose" saw. Note that both hands are used—the first rule for quick results without breaking blades.



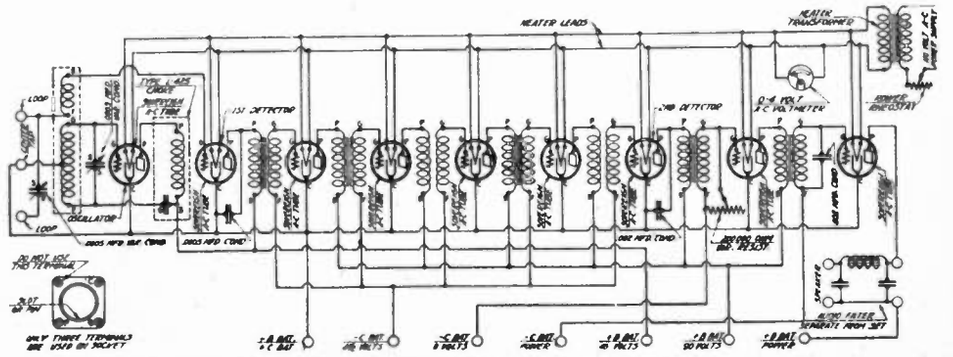
BROWNING-DRAKE 4-TUBE—Electrically Operated with SOVEREIGN A-C TUBES



5-TUBE TUNED RADIO FREQUENCY or NEUTRODYNE Electrically Operated with SOVEREIGN A-C TUBES



MADISON-MOORE 8-TUBE SUPERHETERODYNE Electrically Operated with SOVEREIGN A-C TUBES



NINE-IN-LINE SUPERHETERODYNE Electrically Operated with SOVEREIGN A-C TUBES

The Tyrman Ten

A Receiver Incorporating New Principles of Radio Engineering—"Wireless Wiring" Simplifies Construction

THE success of the receiver to be described is due to the co-operation of two men in the radio field whose previous efforts culminated in several of the past's most successful radio instruments. Mr. E. T. Flewelling with his invention of the Kurz-Kasch Capacity Connector has created an innovation to benefit the construction of multitube receivers. Circuits heretofore consisting of an endless spider web of wire with all its feedback, distributed capacity, terminal losses, etc., which could be handled by first-class experts only, are now thrown open to the amateur set builder. A number of super-heterodyne circuits failed despite the faultless performance in the designers' laboratory, simply because the amateur set builder was not able to follow one or more details, where the solution was natural to the laboratory engineer, but overlooked by the man, who could not afford expensive measuring instruments. The use of the Capacity Connector, nothing else but a moulded wiring system, as pictured in Figure 2, however, required a certain terminal standardization of instruments and Mr. E. Tyrman, head of the Tyrman Electric Corporation, decided to construct apparatus especially fitting this purpose. The result exceeded all expectations and set builders are now enabled to "build" instead of assemble, to follow engineering considerations without the necessity of instrumental measurements, to avoid electrical troubles and with this all drawbacks of home-built receivers.

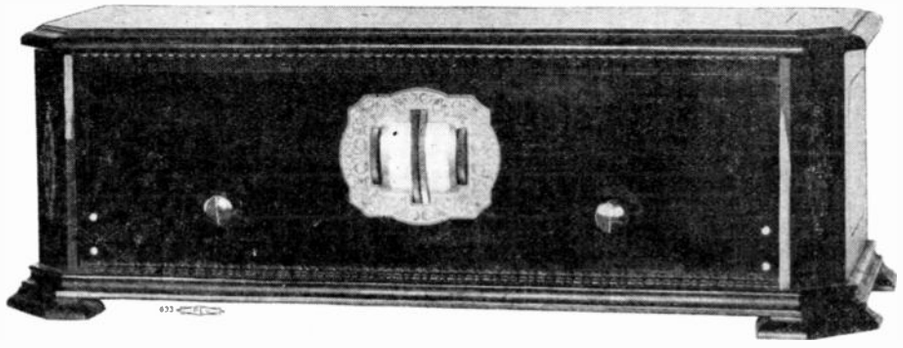


Fig. 1. Front View of the Tyrman Ten, Showing Vernier Drums

Despite the efforts of the Federal Radio Commission to regulate broadcast conditions, at present it is still very problematic whether an average receiver could cut through a local barrage of broadcasters in congested areas. There are a number of cities with ten or more broadcasting stations and the experiments to determine the efficiency of this receiver have been conducted in one of the worst locations of Chicago, a city where twenty broadcast stations are sending their powerful signals simultaneously. The main test was performed two blocks east of the station WBBM, rated at ten kilowatts and known to be one of the most interfering stations on the north side of the city. On the "Tyrman Ten" this station was tuned out with ease and a number of long distance stations were received under weather conditions where other super-heterodyne receivers along side of it could not even reproduce the carrier wave of these signals.

An interesting problem has been solved in this receiver, a problem attempted many times without much success. As well known the selectivity of super-heterodyne circuits depended on the sharp tuning of the oscillator while the loop or aerial was too broad to figure as a tuning element, especially on powerful nearby stations. The result was that in order to obtain the desired selectivity, the oscillator had to be designed to "cut sidebands," that is, not to pass all audible frequencies. The present average super-heterodyne outfit tunes on the higher stage within 50 to 60 K.C., while many oscillators range only within 2 to 3 K.C., not enough to pass all notes fully amplified. No audio frequency system is able to make up for this deficiency, and many good audio transformers have been blamed, where the radio frequency input was causing trouble. It remains to solve the problem of selectivity on the aerial without the necessity of too many tuned radio frequency stages. One tuned stage of radio frequency proved to be sufficient in this receiver to reach the goal and this was achieved simply by input details and elimination of wiring feedbacks. It was important to keep this stage close to the oscillation point of the tube. One important factor is the capacity feed (midget condenser) from the aerial into the grid and its adjustability as to coupling, thus regulating selectivity to the length of the aerial. Another important factor is choosing the right grid resistance between the condensers and the radio

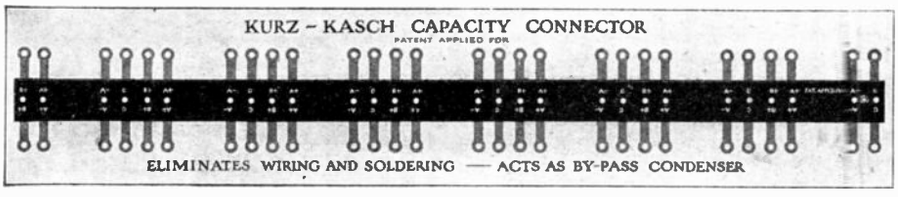
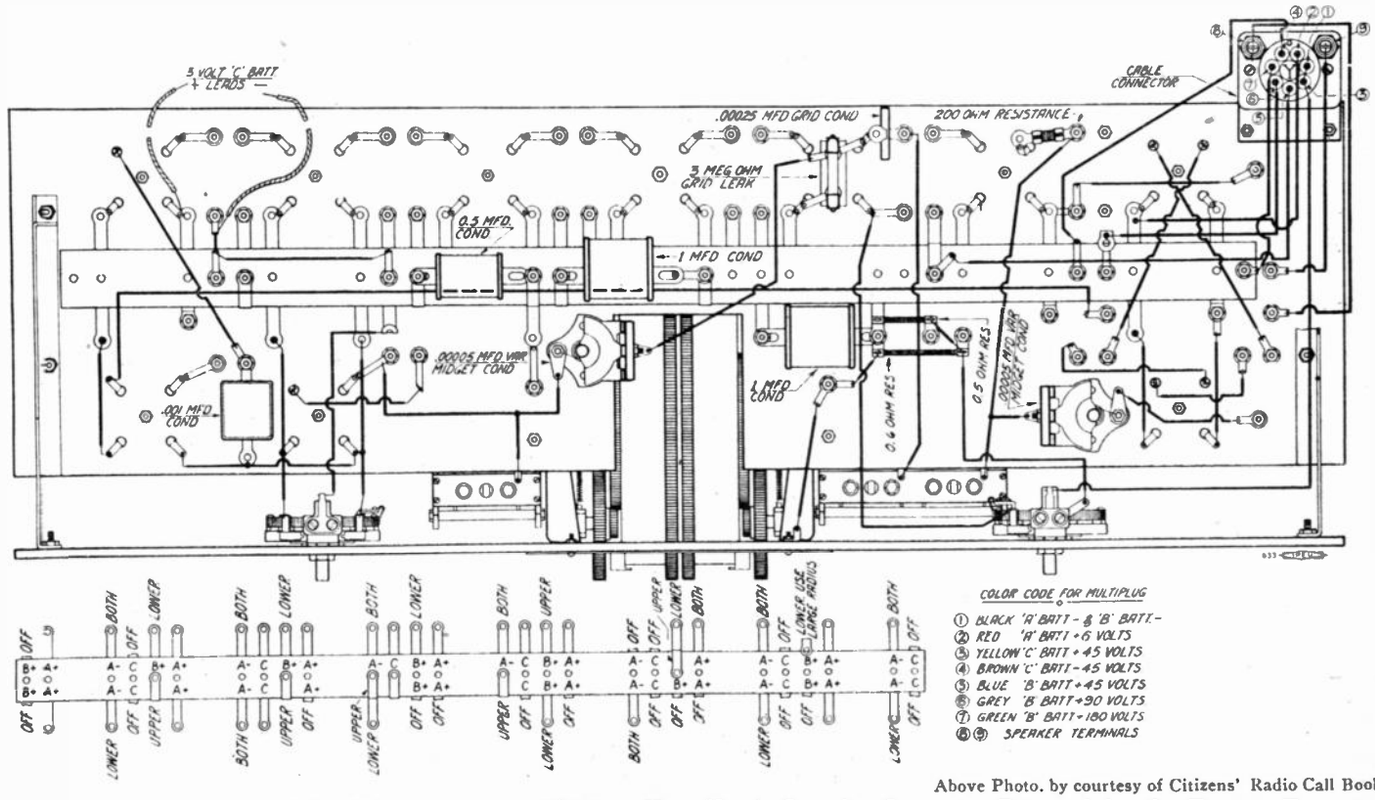


Fig. 2. Kurz-Kasch Capacity Connector

E. T. FLEWELLING
Inventor of the Kurz-Kasch Capacity Connector

E. TYRMAN
President and Chief Engineer of the Tyrman Electric Corporation

frequency tube. A perfect mixing system between the oscillator signal and the first detector input is provided; again capacity feed was employed and the midget condenser between the grids of the oscillator and first detector tubes gives a chance of adjusting both to greatest efficiency. A high resistance of three megohms is employed to give the first detector grid a positive bias large enough to obtain proper rectification of the radio frequency signal before entering the intermediate frequency stages. It was not difficult to follow this perfect input system with an intermediate frequency amplifier. However, this part of the circuit, always emphasized as the vital part of all super-heterodynes, had to undergo a number of changes in order to avoid the drawbacks of its predecessors. As well known, in the super-heterodyne system, the radio frequency mixed with that of the oscillator signal creates an intermediate frequency wave, which is amplified in cascade through a number of stages matched to its particular frequency. For example, if the intermediate frequency amplifier is tuned to 50 K.C. a 1000 K.C. (300 meter) signal ahead would be matched with an oscillator signal of 1050 or 950 K.C., and the difference between the two frequencies had to be fed through the 50 K. C. intermediate frequency transformer. Thus the oscillator was able to produce the same signal twice, and many times the upper setting of one station interferred with the lower setting of the other signal. Here was one of the greatest drawbacks of super-heterodynes. Two partly successful efforts have been made to eliminate this deficiency and during the last twelve months considerable progress is noted in this direction. The Tyrman transformers are particularly designed to meet this new demand of "one spot" reception and the laboratory experi-



Above Photo. by courtesy of Citizens' Radio Call Book.

Fig. 3. Pictorial Wiring Diagram

Fig. 3a. Kurz-Kasch Capacity Connector Prepared for the Tyrman Ten

ments culminated in the creation of an intermediate frequency amplifier passing a frequency of 310 K.C. The advantages of this are eminent. It simply means that the two beat notes (dial settings of the oscillator) have a separation of 680 K.C., which means that they are too far apart to repeat stations on the dial. The second beat of most of the broadcast frequencies is beyond the tuning range and lower waves theoretically creating a second setting are tuned out by the sharp R. F. tuning.

For rectification of the intermediate frequency in the second detector tube a C bias of three-volts is provided, the same bias serving the oscillator and first audio stages.

One of the features of this circuit is the incorporation of transformer coupled straight audio in the first, and push-pull amplification in the second stage. The 3:1 ratio first stage transformer is followed by a 2:1 ratio push-pull input unit and the step down transformer in the output is responsible for the full amplification of the deepest base. The step down output system will decrease voltage and increase the amperage for the speaker windings, thus aiding the uniform amplification of all audio frequencies. The direct current (battery) component is kept out of the speaker and only the pure pulsating current of speech and music is introduced.

Constructively the "Tyrman Ten" is the most interesting piece of engineering in its line. It is a proof, that possibilities in amateur-built receivers are unlimited and is undoubtedly the best possible reply to statements of some manufacturers that the days of home-building are gone. No doubt, a sensitive ten-tube instrument should be built by an expert, but in our case every precaution was taken to enable any builder to make an exact duplicate of the laboratory model. The Kurz-Kasch Capacity Connector, if prepared as to instructions, excludes any change in wiring, voltages, etc.

Figure 3a represents the connector as actually used in the set. It will be noted that not all of the connector tabs are made use of, and all terminals marked with (off) should be removed by bending them back and forth until they break. Two tabs are provided for each Minus A and each Plus B connection. It will be noted that both (Minus A) tabs are used for the filaments throughout except the first detector, which is controlled by a 25 ohm rheostat. It is emphasized, that the removing of tabs has to be done very carefully, especially, where only one of the double tabs (Plus B, Minus A) is used. The terminal strips are separated by a very thin strip of bakelite and there is a possibility of short circuiting if the tabs are not broken off close to the strip. Of the Plus B terminals the upper tabs represent the 45 V lead, while the lower one contains the 90 V connections. It will be noted that a number of tabs are bent above the strip, where the center holes are used for mounting other apparatus. Utmost care should be taken of the extreme left Plus B terminal, where the upper (Plus 45V) tab is removed, while the lower tab is bent around; at this place the bend is not made close to the edge in order to avoid short circuiting the two Plus B leads. Where both of the double B and double A tabs are removed both breaks should be inspected for short circuiting and in case of touching, the stubs should be separated with a knife.

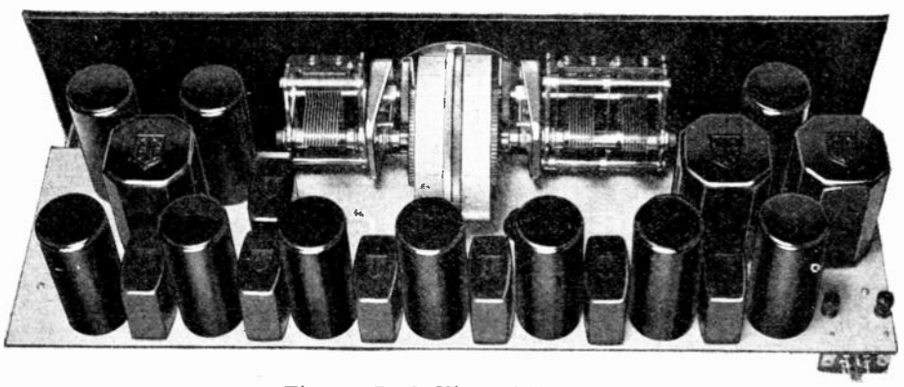


Fig. 4. Back View of Receiver

However, inspecting the Capacity Connector at first sight it will give a clear picture of all dangers and, if the above instructions are carefully followed any mishaps can be avoided easily. Extreme care in handling—and keeping close to details of figure 3a is essential.

It is advisable to keep the following schedule of assembling:

1st. Front Panel and Subpanel.
2nd. Audio Transformers.
3rd. Capacity Connector.
4th. All other apparatus on subpanel.
5th. Vernier Drums and Condensers.

Fig. 6. Tyrman Shielded Socket

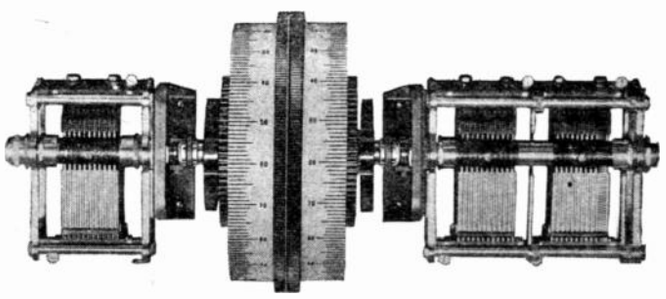


Fig. 5. Tyrman Vernier Drum

It will be noted that several terminals of the audio transformers and two terminals of the 7-71 R. F. Transformer (oscillator coupler) fit through the center holes of the capacity connector. If the latter is prepared according to the instructions given above, the terminals of the transformer will fit through the tab holes

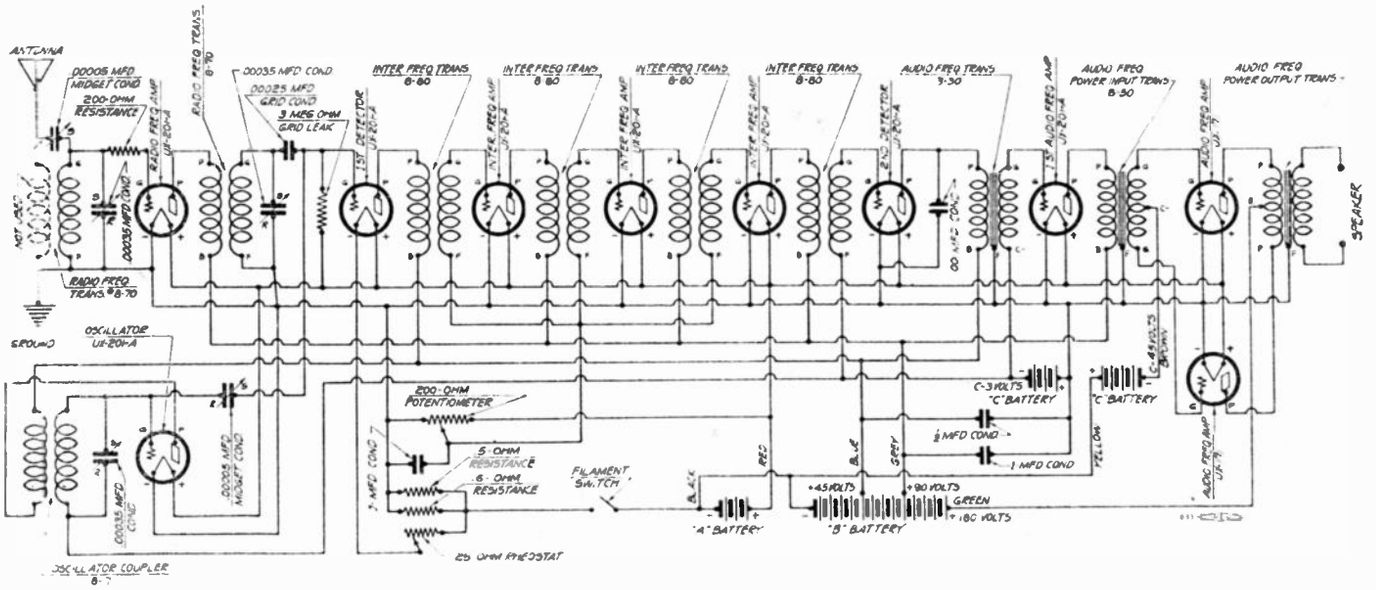


Fig. 7. Schematic Diagram

of the capacity connector and actually fit the circuit diagram. Figure 3 will show all wiring connections as they are made on the lower part of the subpanel. Where possible solder lugs are used instead of wire, thus assuring short leads. The dial brackets are connected with the subpanel by means of auxiliary brackets and this system, representing the rotor terminal of the tuning condenser, is used also for connecting it to the Minus A tab of the Capacity Connector.

It will be noted that a midget condenser is used for aerial coupling. The advantage of this coupling is eminent, as it allows positive regulation of the signals whatever antenna is to be used and also serves for regulation of selectivity to any desired degree. For average use thirty to forty feet of indoor aerial would be sufficient to bring in long distance stations. It is advisable to set the midget condenser receiving a wave of approximately three hundred meters to the best volume without oscillation and leave it in this position. The midget condenser regulating the capacity feed of the oscillator should be tuned to the lowest volume on a distant station.

It is advisable to ground the escutcheon on the front panel to the minus filament utilizing one of its mounting screws for this purpose. The speaker jacks are incorporated in the new No. 669 Yaxley Cable being especially designed for this purpose and connected to the output terminal of the Type 3-51 Tyrman transformer. No external capacities are required for these audio units. All necessary by-pass condensers are incorporated in the transformers.

Utmost care in building; proper solder joints are important. It is especially advised to use the very highest grade accessories in connection with this receiver.

The front panel with its highly ornamental dial arrangement is one of the attractions of this receiver. The new Tyrman vernier drum dial (Fig. 5) represents a clever combination of direct and vernier tuning: the center knurls of the large 5½ inch drums allow tuning both dials in one movement, while the verniers provide individual adjustment. The entire system is supported by brackets, the latter serving as connection between front and subpanel and thus adding to the rigidity of the whole construction. Another feature introduced in this receiver is the shielded tube socket (Fig 6), the advantages of which are eminent.

List of Parts for Tyrman Ten

2 Tyrman Type 8-70 R. F. Transformers
1 Tyrman Type 8-71 R. F. Transformer
4 Tyrman Type 8-80 R. F. Transformers
1 Tyrman Type 3-30 Audio Transformer
1 Tyrman Type 3-50 Power Input Transformer
1 Tyrman Type 3-51 Power Output Transformer
1 Tyrman Vernier Drum, double
10 Tyrman Shielded Sockets
1 Kurz-Kasch Capacity Connector
1 7x26" Front Panel, drilled and decorated Bakelite
1 7x26" Sub Panel, Ivory Bakelite
2 Benjamin Brackets
2 Carter 1 mfd. Condensers
1 Carter ½ mfd. Condenser
1 Carter .00025 Mica Condenser
1 Carter .001 Mica Condenser
1 Yaxley No. 669 Cable Connector, complete
1 .....3 Meg Resistance with mounting
1 Yaxley 6L Filament Resistance 1½ amp. 5 volts
1 Yaxley 5L Filament Resistance 1¼ amp. 5 volts
1 Yaxley 200 ohm Potentiometer
2 .....50 mmf. Midget Condenser
1 Yaxley 25 ohm Rheostat with Switch
2 .....Binding Posts
1 Type 351 Camfield .00035 Condenser
1 Type 352 Camfield .00035 Two-Gang Condenser
1 Yaxley No. 7200 Grid Resistance

Memoranda

A New Nine-Tube Super-Selective and Super-Sensitive Circuit

The Design of This Receiver Incorporating an Accurate 10 Kilocycle Band Pass Fiter Represents an Outstanding Achievement in the Radio Art, Namely, the Simultaneous Increasing of Selectivity, Sensitivity and Tone Quality

The Circuit

THE CIRCUIT used in the Camfield Super-Selective 9 has been developed to fill the requirements for a super-sensitive and super-selective receiver that could be satisfactorily operated in congested broadcasting districts such as the metropolitan areas of New York and Chicago.

For several years the Super-Heterodyne circuit has been very popular whenever extreme sensitivity combined with selectivity has been desired. About three years ago the Super-Heterodyne was considered to be the most satisfactory circuit for use under any conditions, but with the large number of broadcasting stations now on the air in the metropolitan areas a serious drawback of this type of circuit has developed. This difficulty is the presence of so-called oscillator harmonics.

Many Supers that were popular several years ago can be operated in New York and Chicago today with the oscillator tube entirely removed from the circuit. A super that is designed to operate on an Intermediate Frequency of 50 Kilocycles will receive any local broadcasting station regardless of the oscillator dial setting if there happens to be another local station on the air having a frequency of 50 Kilocycles above or below the first station. This condition spoils the selectivity of the Super, which is one of its chief advantages and has resulted in decreased popularity of this type of circuit for use in Metropolitan areas.

Camfield Super-Selective 9 Eliminates Oscillator Harmonics

In the Camfield Super 9 this condition of oscillator harmonics has been entirely eliminated. This is accomplished by the use of two stages of tuned radio frequency amplification ahead of the first detector tube and also by the choice of an Intermediate Frequency of 95 Kilocycles. There are no stations in the United States that are exactly 95 Kilocycles apart. Furthermore, when the two radio frequency stages are tuned to resonance with the station that it is desired to receive they will not pass signals from stations broadcasting at a frequency 90 or 100 kilocycles above or below the station being received. Hence, no energy from such stations can get to the first detector tube to heterodyne with the incoming signal and thereby spoil selectivity and cause squeals and howls or heterodyne beat notes in the loud speaker, as would be the case with the previous type loop operated Super.

Radio Frequency Amplifier Adds Sensitivity

In any Super-Heterodyne there must be a definite minimum of input energy to the first detector tube before the circuit will function. This factor forms one of the most important limits to the sensitivity of the circuit.

Signals so weak that they will not actuate the first detector tube in an ordinary super are picked up and amplified through two stages of tuned radio frequency amplification before reaching the first detector tube in the Camfield Super-Selective 9. This makes it possible to get satisfactory reception of distant stations with this new circuit that could not be received at all with the previous type of Super.

Band Pass Filter Results in Unusual Selectivity

The Camfield Super-Selective 9 is the first circuit made available to radio fans using a Band Pass Filter in the Intermediate Frequency Amplifier

A Band Pass Filter is a network of inductance and capacity designed to pass a particular band of frequencies with uniform amplification and to reject all other frequencies.

The filter used in the Camfield Super-Selective 9 has been designed to pass a band of frequencies 10 kilocycles wide between 90 and 100 kilocycles. All Frequencies lying within this band are amplified equally by the intermediate stages of the Camfield Super-Selective 9. The filter is designed to cut off very sharply on both sides of this band and the circuit, therefore, has excellent selectivity.

Band Pass Filter Important Factor in Maintaining Tone Quality

It must be remembered that the frequency of a broadcasting station on any given wave length is not absolutely constant. It is modulated by the frequency of the voice or music being transmitted and, therefore, varies about five kilocycles above and below the rated frequency. If a circuit is not designed to give practically uniform amplification over a band of frequencies 5 kilocycles above and below that of the incoming wave some of the voice or music frequencies will not be properly amplified and distortion results. This action and consequent distortion has been very noticeable in Super-Heterodyne circuits where extreme selectivity was obtained by the use of the so-called peak Intermediate Frequency Transformers.

In the Camfield Super-Selective 9 the use of the 10 Kilocycle Band Pass Filter absolutely eliminates this cause of distortion.

Band Pass Filter Aids Sensitivity

All former Super-Heterodyne circuits have been designed to operate on a loop. It is well known that the loop does not pick up as much energy as even a short Antenna and for this reason many experimenters have attempted to couple an Antenna to a Super-Heterodyne. The result has always been to utterly spoil the selectivity.

In the case of the Camfield Super 9 the use of the band pass filter gives such perfect selectivity that it is possible to not only use an antenna but also to use two stages of radio frequency amplification. This naturally results in greater sensitivity than can be obtained with any other type of circuit.

Combination 5 and 9 Tube Receiver

The Camfield Super 9 may be operated either as a 5-tube two-control tuned radio frequency set or as a 9-tube Super-Heterodyne. This transfer from 5 to 9 tubes is accomplished by a jack switch mounted on the front panel as shown in figure 2. The manner of connecting this switch in the circuit is illustrated in the schematic wiring diagram. The circuit is so arranged that when the switch is thrown to the left only the two radio frequency tubes, the first detector and the audio amplifier tubes are lighted. When operated this way the output of the first detector tube is connected direct to the audio frequency amplifier. When the switch is thrown to the right the other 4 tubes are automatically lighted and the proper circuit connections are made for the operation of the set as a 9-tube Super.

This feature provides for the economical operation of the receiver when the reception of local stations only is desired. This is an exclusive feature of the Camfield Super 9 and is not found in any other circuit. Furthermore this arrangement of the wiring makes it possible to construct the receiver in two units. It fills the requirements of those who at present can only afford a 5-tube set but who will want a 9-tube Super at some later date. The 5-tube end of the circuit may be constructed first and the other 4 tubes added at any later date without changing any of the original wiring.

Camfield Circuit Stable in Operation

In the Camfield Super-Selective 9 squeals and whistles due to oscillator harmonics have been eliminated in the manner described above. Further stability is obtained by designing the circuit and the parts used so as to prevent oscillation of the radio frequency amplifier tubes.

Special Construction of Radio Frequency Transformers Prevents Oscillation

Special construction of the Camfield Duoformers used as the Radio Frequency Transformers in the Camfield Super 9 prevents disturbing oscillations in the radio frequency end of the circuit.

Oscillation in a tuned radio frequency amplifier is caused by coupling between the plate or output circuit of the tube and the grid or input circuit. One or more of the following forms of coupling are always inherent to some degree in tuned radio frequency amplifier circuits:

First—Inductive coupling between the winding of inter-stage radio frequency transformers.

Second—Capacity and conductive coupling in the wiring of the set.

Third—Capacity coupling between the two circuits due to the capacity between the grid and plate of the vacuum tube.

The first and second causes of oscillation are comparatively easy to eliminate. The Camfield Duoformer has been designed to minimize its effective external magnetic field. Thus, when three of these transformrs are usd in a set, magnetic coupling between them is negligible.

The second cause of oscillation may be eliminated by the proper arrangement of parts and wires in the set and the proper use of by-pass condensers. This has been done in the set layout recommended for the Camfield Super-Selective 9, and for this reason it is advocated that the builder of the set follow our detailed instructions as closely as possible.

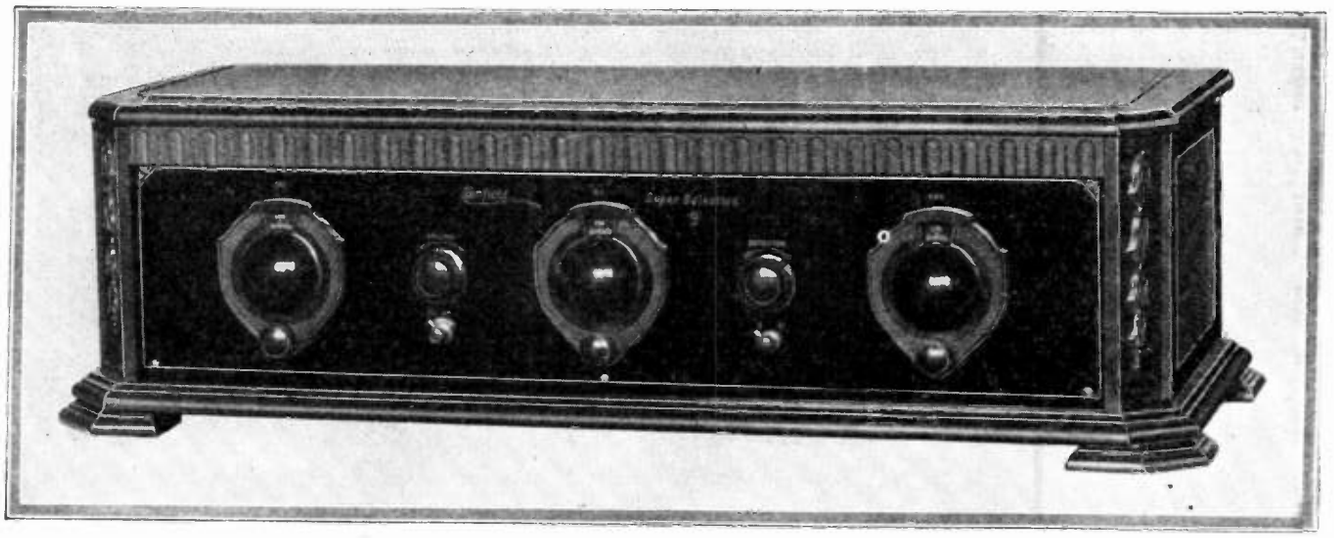
The third cause of oscillation; that is, the grid plate capacity of the vacuum tube, cannot be eliminated without entirely changing the design of the tube itself.

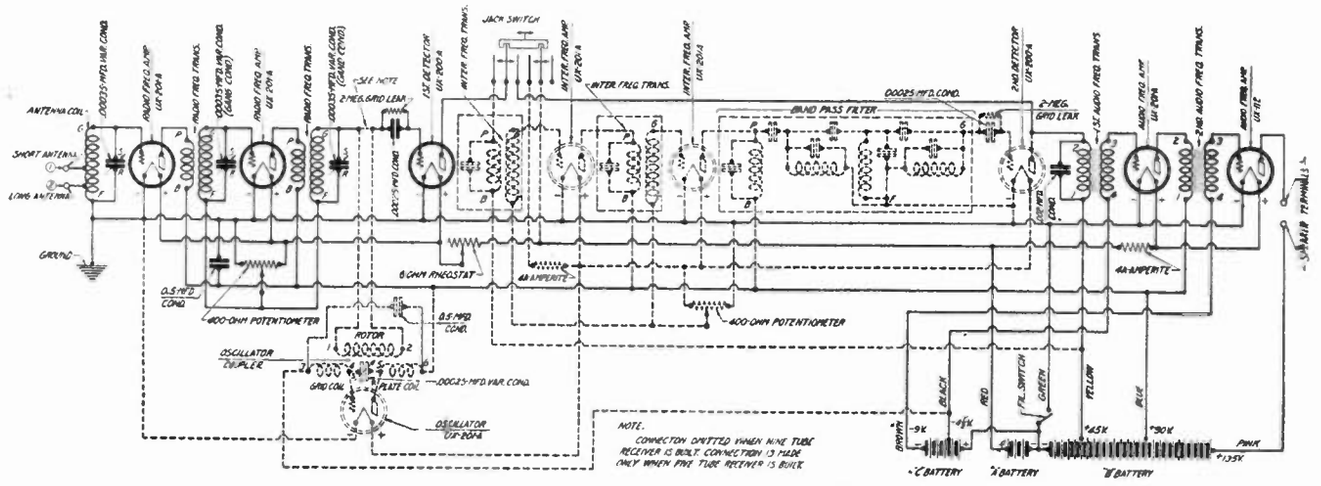
In the past few years, several methods of compensating for the energy fed back from the plate circuit to the grid circuit through the tube capacity have been developed. The most noteworthy of these is the use of some means to feed back additional energy from the plate circuit to the grid circuit in such a manner that it is out of phase with the energy fed back through the tube, thus preventing oscillation. Several different ways of doing this are in use today, and some of them unquestionably have a great deal of merit. However, this system has several disadvantages, principal among them being that the means of feeding back compensating energy is often very critical in its adjustment, and that circuits using it are not equally efficient over the full range of wave lengths.

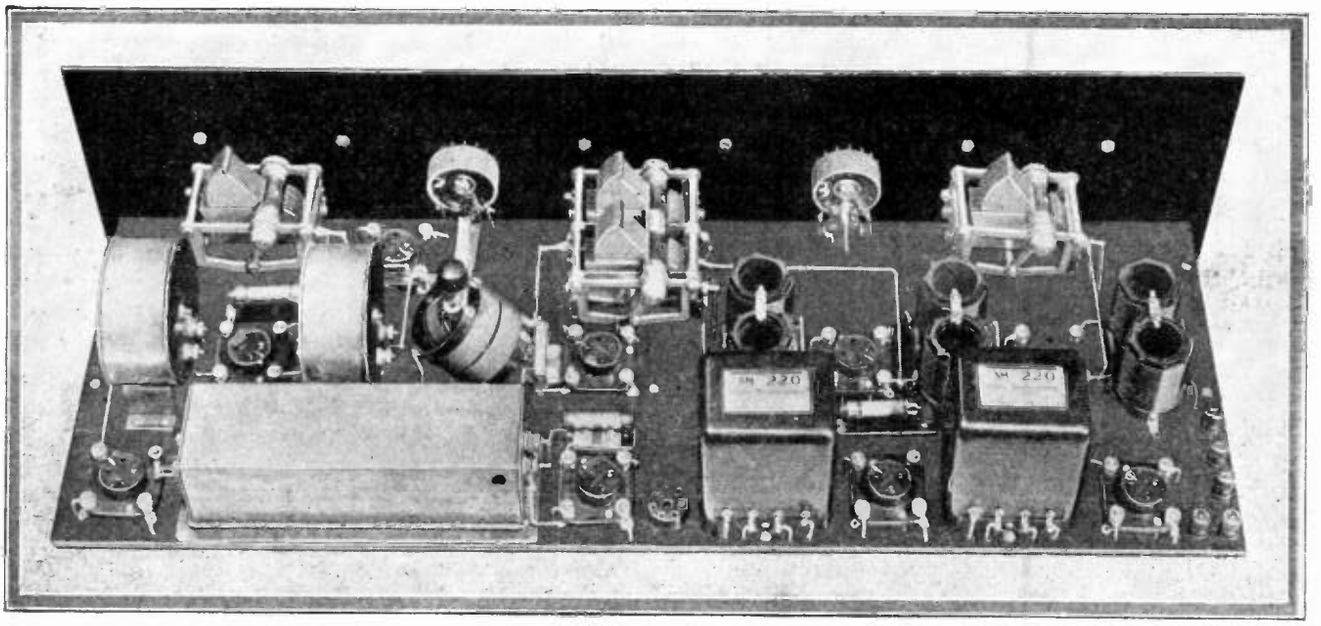
Another means of preventing oscillation in general use today is to place a resistance, or in some other manner to introduce a loss, in the grid circuit of the tube. It is very easy to prevent oscillations in this manner, but at the expense of decreasing the sensitivity of the circuit and broadening its tuning.

Some set and part manufacturers prevent oscillation by using tuned radio frequency transformers of very low efficiency, so that the over-all gain in each stage of the radio frequency amplifier is so low that oscillations are not produced. This is generally accomplished by making the primary inductance so small that the proper degree of coupling between the primary and secondary is not obtained. Practically all transformers that do not necessitate the use of some form of compensating feed-back or resistance in the grid circuit are made in this manner. They usually have the characteristics of being fairly efficient on the low wave lengths and inefficient on the upper range of the broadcasting scale.

In support of this comparatively inefficient type of transformer, some manufacturers and technical writers have made the radical statement that







Front View Wiring Diagrams and Back View of Camfield New Nine Tube Superheterodyne and Supersensitive Circuit.

Say you saw it in the WCFL Radio Magazine

the minute capacity between the grid and plate of a tube does not cause a sufficient transfer of energy to produce oscillation. They claim that oscillations are caused entirely by coupling between transformers and coupling in the wiring, and that it can be overcome by the use of close-field transformers. This, however, is not the case. Feed-back due to tube capacity does exist in all well designed radio frequency amplifiers and must be compensated for if the circuit is to be prevented from oscillating. To substantiate this we quote the following statement from "Principles of Radio Communications," by J. H. Morecroft, chapter six, page 433:

"It would seem as though the capacity (electrostatic) of a vacuum tube is so small as to be negligible, but such is far from the truth. The internal capacity of a tube may have very great effect on its operations, especially at high frequency."

In designing the Duoformer, the engineers of the Camfield Radio Manufacturing Company fully recognize the existence of feed-back through the tube capacity and the necessity of compensating for it in order to prevent oscillations when all stages of the radio frequency amplifiers are tuned to resonance. Not satisfied with the means previously employed, which either resulted in inefficient operation or in the necessity of making critical internal adjustments, our engineers worked along an entirely new line.

Under the usual conditions existing in tuned radio frequency amplifiers, the currents fed back from the plate circuit to the grid circuit though the tube capacity is of such phase as to add to the voltage already existing between the grid and filament of the tube, and therefore cause oscillation. It obviously follows that if the right phase relation is obtained between the current fed back through the tube and the current existing in the grid circuit, oscillation would not be caused.

It is well known that the phase relation between current and voltage in any circuit or group of circuits depends upon the relative constants of such circuits, namely, the inductance, the resistance and the capacity. In the case of transformers, the mutual inductance and the distributed capacity between the primary and the secondary must also be taken into consideration.

In designing the Duoformer the relative proportion of all the constants mentioned above were arranged in such a manner that the current fed back from the plate to the grid circuit of the tube used in connection with these transformers would be in the proper phase relation with the current in the grid circuit to prevent oscillations.

This feature, combined with the physical design of the Duoformer Coils, which practically eliminates all electro-magnetic coupling between successive stages, and a circuit design embodying the proper use of by-pass condensers, makes it possible to build a five tube tuned radio frequency set that is extremely simple to construct, and that has a high and uniform efficiency over the entire range of broadcast wave lengths.

Three Tuning Controls Provide Greater Efficiency

In the Camfield Super-Selective 9 three tuning controls are used in order to provide for maximum efficiency in the reception of distant stations. It would be possible to use a 3-gang condenser to tune the three Radio Frequency Coils, but this would result in the loss of some of the efficiency due to the fact that it is impossible to make the Antenna Coil tune exactly the same over the full range of wave lengths as the two Radio Frequency Transformers. By providing a separate tuning condenser for the Antenna Coil greater efficiency is obtained particularly in the reception of weak signals from distant stations. This gives the circuit two tuning controls when it is operated as a 5 tube set and three controls when it is operated as a 9 tube set. However, these three controls are not hard to handle even by an inexperienced operator, as will be explained later in connection with notes on balancing and tuning.

The Construction of the Receiver

The following is a list of all of the parts required for the construction of the Camfield Super-Selective 9:

1 Camfield No. 251 .00025 Equaltune Variable Condenser
1 Camfield No. 351 .00035 Equaltune Variable Condenser
1 Camfield No. 352 .00035 Equaltune Variable Condenser, 2-gang
1 Camfield No. 22K Kit of 3 Camfield Duoformers
1 Camfield No. 620 Coupling Unit
1 Rusco No. 10KC Band Pass Filter
2 Rusco No. 95KC I. F. Transformers
1 Dubilier No. 601 .002 Fixed Condenser
2 Dubilier No. 601G .00025 Grid Condensers
2 Dubilier 3 Megohm Grid Leaks
2 Tobe ½ mfd. Condenser.
2 Silver-Marshall No. 220 Audio Transformers
1 Frost No. 806 6 ohm Rheostat
3 Kurz-Kasch No. 592 Dials
9 Benjamin No. 9040 Sockets
3 Karas Brackets
1 Carter Midget Battery Switch
1 Carter No. 6 Jack Switch
5 Eby Binding Posts
1 Jones Type P. M. Multiplug Sub-Panel
1 Amperite No. 4-A
1 Amperite No. 3-A
2 Frost No. 824 400 ohm Potentiometer
1 Micarta 7x30" Drilled and Engraved Panel
1 Micarta 10x29x3/16" Drilled Sub-Panel
Miscellaneous lugs, wire, screws, etc.

Substitutions in this list of parts should not be made except in the case of Rheostats, Switches, Fixed Condensers and Grid Leaks. For these parts any good make may be used provided their electrical characteristics conform to the specifications given.

The 7x30 inch front panel and the 10x29 inch sub-panel may be purchased with all holes drilled. If the builder prefers to do this drilling a complete set of actual size blueprints may be obtained through any of the stores selling complete parts for the Camfield Super-Selective 9. For people not experienced in the construction of radio sets it would be advisable to obtain these blueprints even if drilled front panels and sub-panels are to be used.

The first step in the construction is to mount the sub-panel on the 3 Karas Brackets as shown in figure 2. Next mount all of the parts that are to be by means of the Karas Brackets and then mount the three condensers, the 6 ohm Rheostats, 1 of the 400 ohm Potentiometers, the Filament Switch and the transfer switch to the front panel.

The set is now ready for wiring. It is advisable to wire the negative filament and ground circuit first. Next make all of the positive filament connections. The rest of the wiring should be completed by starting with the Antenna circuit and making all of the connections to the first Duoformer Coil, the Antenna tuning condenser and the first tube socket. Next make the grid and plate connections to the second tube and so on throughout the entire circuit, wiring each tube in order. All of the B and C battery leads from the Jones Plug to the various parts of the circuit should be put in last.

The wiring of the set is very simple and no difficulty will be encountered if the builder will closely follow the schematic wiring diagram of figure 7 and the actual wiring diagram of figure 4.

After the set has been completely wired the wiring should be checked and re-checked several times to be sure that absolutely no mistakes have been made.

The next step is to hook up the batteries with the Jones Plug using the color code given in the actual wiring diagram of figure 4. After the batteries have been connected insert a tube in the first radio frequency socket. This tube should light up when the filament switch is thrown to the right. It should remain lighted regardless of whether the 5 and 9 tube transfer switch is thrown to right or left. It should also respond to variations of the 6 ohm Rheostat on the right of the panel above the transfer switch. If the tube functions properly in the first socket it should be inserted in each succeeding socket in rotation. Its action in the second radio frequency stage and in the first detector should be the same as when in the first socket.

When the tube is inserted in the oscillator socket it should light only when the filament switch is thrown to the right and when the transfer switch is thrown to the right. It should not respond to variations of the Rheostat on the panel. This action should be the same when the tube is inserted in both Intermediate Frequency Amplifier sockets and the second detector socket.

When the tube is inserted in the audio amplifier sockets it should light when the filament switch is thrown to the right and remain lighted regardless of the position of the transfer switch and it should not respond to variations of the 6 ohm Rheostat.

After this checking has been done the set is ready for an actual test on the air.

Notes on Balancing, Tuning and Operating the Camfield Super-Selective 9

It is important that the 2-gang condenser be installed exactly as received. Do not try to make any adjustment until after the set is in operation. Camfield Condensers and Coils are manufactured with a high degree of accuracy and little or no adjustment of the condenser is required when it is used with our Duoformer Coils.

When the set is completely assembled, wired and ready for test you should first attempt to operate only the 5 tube set. When the jack switch is thrown to the left you will have a 5 tube two control receiver. This part of the circuit should give satisfactory reception on all local stations and outside stations within a radius of two to three hundred miles. After you are satisfied that this 5 tube set is operating satisfactorily on the local stations you should then proceed to the balancing of the 2-gang condenser. To accomplish this, tune in a station on the lowest wave length possible. A weak signal just audible in the loud speaker should be used. When this is obtained tune the second dial, that is, the one on the two gang condenser for maximum volume. Then loosen the set screws on one of the shield plates, move this shield plate back and forth on the rod adjusting for volume. When maximum volume is obtained tighten the set screws and lock the shield plates in place. Next tune in a station on approximately 300 meters. Then take the tool provided with the 2-gang condenser and loosen the nuts on the right-hand side of one of the stator plate sections. Then insert the other end of the tool in the hole between the nuts and move the handle of the tool back and forth, to and from the panel. You will note that this motion shifts the entire section of stator plates. Make this adjustment for maximum signal strength. Leave the stator plate set in the position for maximum signal strength and lock them in that position by tightening the nuts. Next repeat this operation with the other section of stator plates. Then tune in some high wave length station at about 500 meters or higher if possible and repeat the same series of stator plate adjustments but from the left-hand side of the condenser. After these adjustments have been made your two radio frequency circuits will be practically in perfect balance over the full range of wave length.

After the 5 tube set is operating properly leave the first two dials tuned in on some station, throw the transfer switch over to the 9 tube position and pick up the station again by turning the oscillator dial. On all of the lower wave length stations there are two possible settings of the oscillator dial. The correct one to use is the one that occurs lowest on the scale. As soon as this station has been received and tuned in for maximum volume adjust the potentiometer mounted on the sub-panel for the maximum volume consistent with good tone quality. Once this potentiometer is adjusted it may be left fixed for the reception of stations on all wave lengths and the adjustments will not have to be changed until tubes are changed or until the batteries become considerably run down. Next adjust the rotor of the 620 Coupling Unit for maximum volume. This adjustment is not critical, about 50 per cent Coupling generally gives best results.

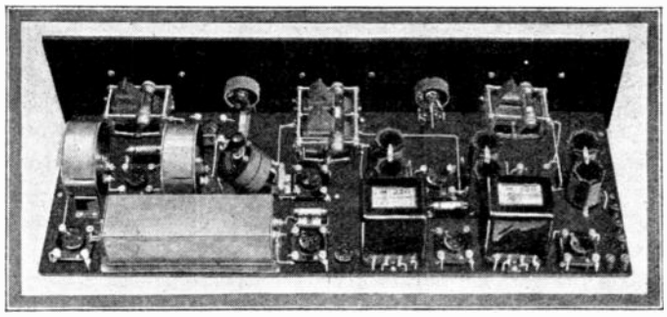
When you are tuned in to any distant station you can in many cases receive the station broadcasting on the next wave length above or below by merely moving the oscillator dial up or down a degree or two. After this station has been received you can

Camfield Super-Selective "9"

THE Camfield Super-Selective 9 circuit has many features of proven merit never before incorporated in a radio receiving set. Outstanding among these features is the use of the famous Rusco Band Pass Filter in the intermediate frequency amplifier. This filter is designed to pass a band of frequencies 10 kilocycles wide. The amplification over this band is uniform and the cut-off on either side is extremely sharp. The result is perfect selectivity between wave bands of only 10 kilocycle separation in frequency. The uniform amplification over the band maintains perfect tone quality. The selectivity of this device is so perfect that it permits the use of radio frequency amplification ahead of the Super and the operation of the set on an antenna. This makes the Camfield- Super-Selective 9 the most sensitive receiver ever developed. The net result is the simultaneous increasing of both sensitivity and selectivity to a degree heretofore considered impossible.

The turning of a switch on the panel converts this set from a five-tube two-control radio frequency receiver for the reception of local stations to a nine-tube super-selective and super-sensitive circuit capable of tuning through powerful local stations and receiving distant stations from coast to coast on a 10-kilocycle separation of frequencies.

This new circuit is easy to construct and simple to operate and comparatively inexpensive. It is entirely free from disturbing oscillator harmonics and it will out-perform any radio set you have ever used.



"A Tribute to a Leader"

Camfield Equaltune Condensers are the unanimous choice of discriminating manufacturers, jobbers, dealers and set builders. There is proof of this in the fact that they are being officially specified in the following circuits for the 1927-28 season:

Camfield Super-Selective 9.
The Tyrman Ten.
Madison Moore Super.
Madison Moore AC Operated Radio Frequency Circuit.
Citizens Super 8.
Camfield Duoformer 7.
The New St. James U240.
Camfield Duoformer 5.
Thompson Super 7.
Hagerman's Organtone.
Dar-Mac Nine.
Strobodyne.
And many others.

On actual demonstration the Camfield Super-Selective 9 will out-perform any other receiver. Its exclusive features mean real service and satisfaction to the man who builds his own. Do not pass up this wonderful opportunity. Set Builders in all parts of the country who have built the Camfield Super-Selective 9 are enthusiastic.

We stand back of this circuit and are ready to help you in every way. If you have any special questions regarding this circuit we will welcome a personal call or a letter from you. Either will receive our immediate attention.

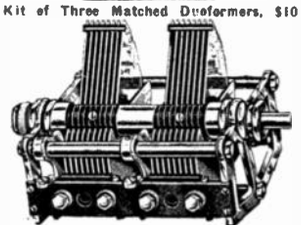
Free Literature Sent on Request.

The following features of the Camfield Equaltune Condensers are not to be found in any other one Condenser on the market:

1. To facilitate sharp tuning and perfect balancing in sets of the unit-control type, condensers are adjustable, which makes possible the perfect equalization of all circuits after the receiver has been completely wired. This eliminates use of vernier or trimmer condensers. Complete instructions and a special tool for making adjustment are packed with each double and three-gang condenser.
2. The shaft may be shortened or lengthened or entirely removed without affecting the adjustment of the rotor plates. This provides a simple means for connecting several units together with a single shaft any anywhere from one to six condenser units may be operated with one dial.
3. May be mounted from either end by reversing the shaft cap nut and the panel mounting nut. After shaft cap nut has been removed, shaft may be extended from opposite end of condenser by loosening set screws on rotor hub.
4. A variable spring tension is provided and the rotor is mounted on ball bearings which insure extremely smooth running over a long period.
5. Beautifully finished. Rotor and stator plates are of bright dipped brass. All other parts are hand buffed and nickel plated.
6. A pair of special brackets for mounting condensers on base-board or sub-panel furnished at a slight additional cost. With the use of these brackets, several single condensers may be mounted in a row on a base-board or sub-panel and all operated with a single shaft.

TYPE 22K DUOFORMER

Kit of Three Matched Duoformers, $10

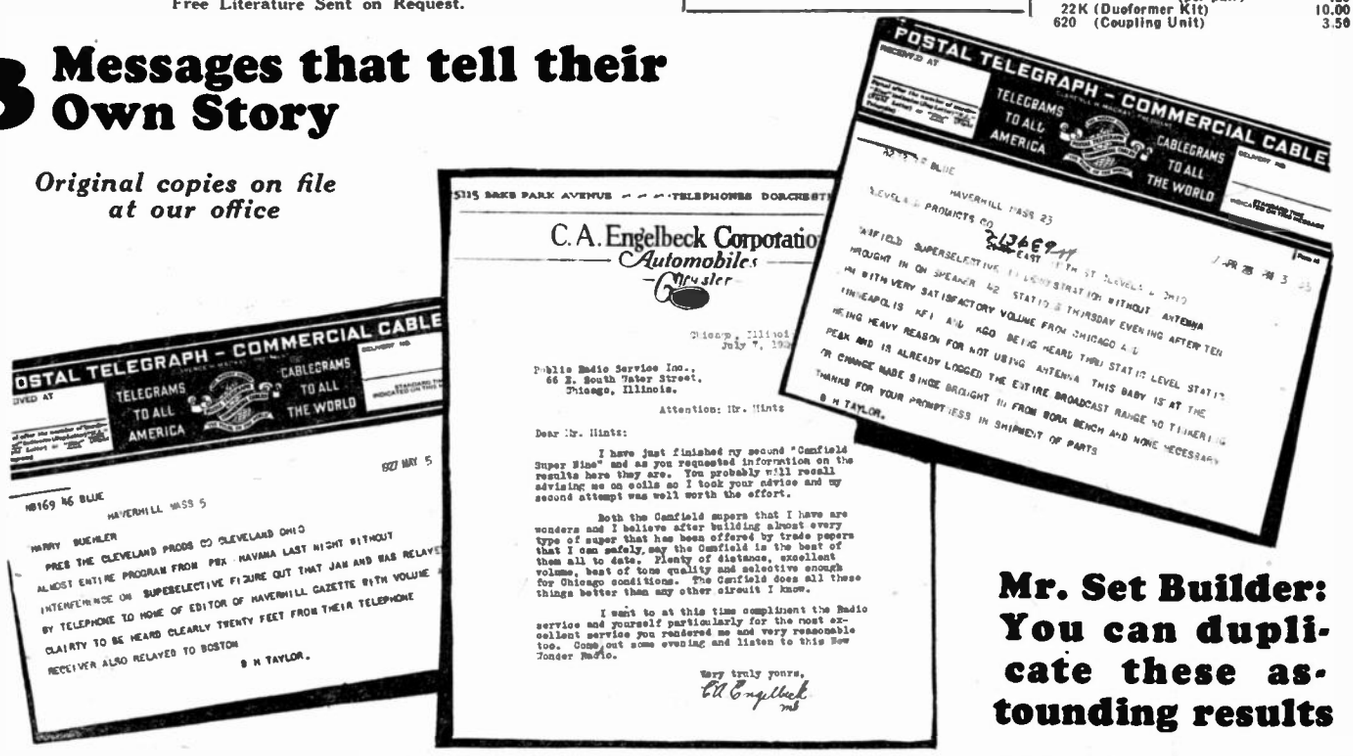


PRICES—CAMFIELD PRODUCTS

Type		Capacity	Price
151	(Single)	.00015	$ 5.00
251	(Single)	.00025	5.50
252	(Two-Gang)	.00025	10.00
253	(Three-Gang)	.00025	14.00
351	(Single)	.00035	5.75
352	(Two-Gang)	.00035	10.50
353	(Three-Gang)	.00035	15.00
354	(Four-Gang)	.00035	18.00
355	(Five-Gang)	.00035	21.00
501	(Single)	.0005	6.00
502	(Two-Gang)	.0005	11.50
503	(Three-Gang)	.0005	16.00
11	Mounting Brackets (per pair)		.25
22K	(Duoformer Kit)		10.00
620	(Coupling Unit)		3.50

3 Messages that tell their Own Story

Original copies on file at our office



POSTAL TELEGRAPH - COMMERCIAL CABLE
TELEGRAMS TO ALL AMERICA — CABLEGRAMS TO ALL THE WORLD

HAVERHILL MASS 23

HARRY BUEHLER
PROBS THE CLEVELAND PROBS CO CLEVELAND OHIO
WINFIELD SUPERSELECTIVE ... STATION WITHOUT ANTENNA
BROUGHT IN ON SPEAKER 42 STATIONS THURSDAY EVENING AFTER TEN
OH WITH VERY SATISFACTORY VOLUME FROM CHICAGO A L
INDIANAPOLIS KFI AND KGO BEING HEARD THRU STATIC LEVEL STATIC
BEING HEAVY REASON FOR NOT USING ANTENNA THIS BABY IS AT THE
PEAK AND IS ALREADY LOGGED THE ENTIRE BROADCAST RANGE NO TINKERING
OR CHANGE MADE SINCE BROUGHT IN FROM BORA BENCH AND NONE NECESSARY
THANKS FOR YOUR PROMPTNESS IN SHIPMENT OF PARTS
O H TAYLOR.

5315 BLACKSTONE PARK AVENUE ... TELEPHONES DORCHESTER

C. A. Engelbeck Corporation
Automobiles
Chrysler

Chicago, Illinois
July 7, 1927

Public Radio Service Inc.,
66 E. South Water Street,
Chicago, Illinois.

Attention: Mr. Hintz

Dear Mr. Hintz:

I have just finished my second "Camfield Super Nine" and as you requested information on the results here they are. You probably will recall advising me on coils so I took your advice and my second attempt was well worth the effort.

Both the Camfield supers that I have are wonders and I believe after building almost every type of super that has been offered by trade papers that I can safely say the Camfield is the best of them all to date. Plenty of distance, excellent volume, best of tone quality and selective enough for Chicago conditions. The Camfield does all these things better than any other circuit I know.

I want to at this time compliment the Radio service and yourself particularly for the most excellent service you rendered me and very reasonable too. Come out some evening and listen to this New Wonder Radio.

Very truly yours,
Ed Engelbeck
mb

Mr. Set Builder: You can duplicate these astounding results

Camfield Radio Mfg. Co., 35 E. Wacker Drive, Dept. WCFL, Chicago

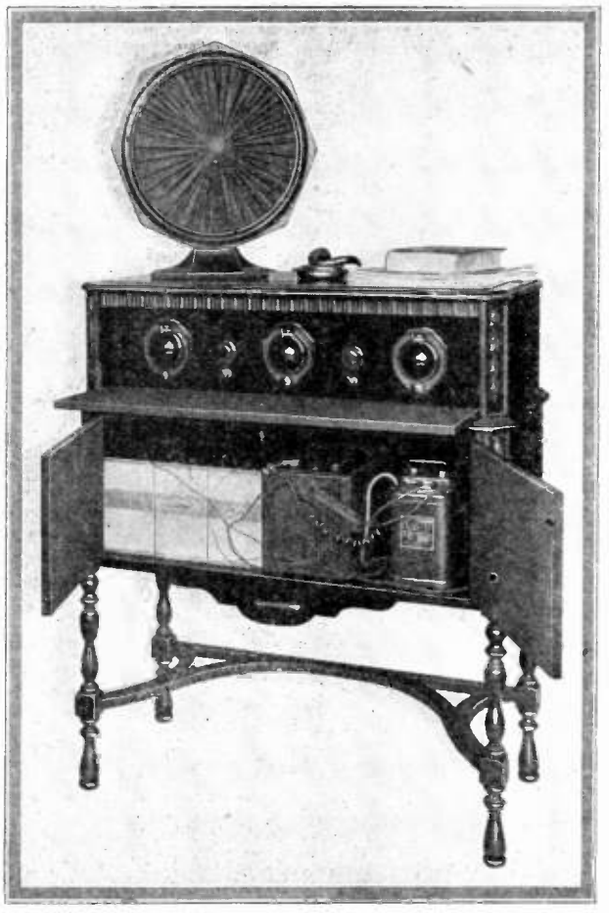
Say you saw it in the WCFL Radio Magazine

then adjust the other two dials for maximum volume.

Accessories

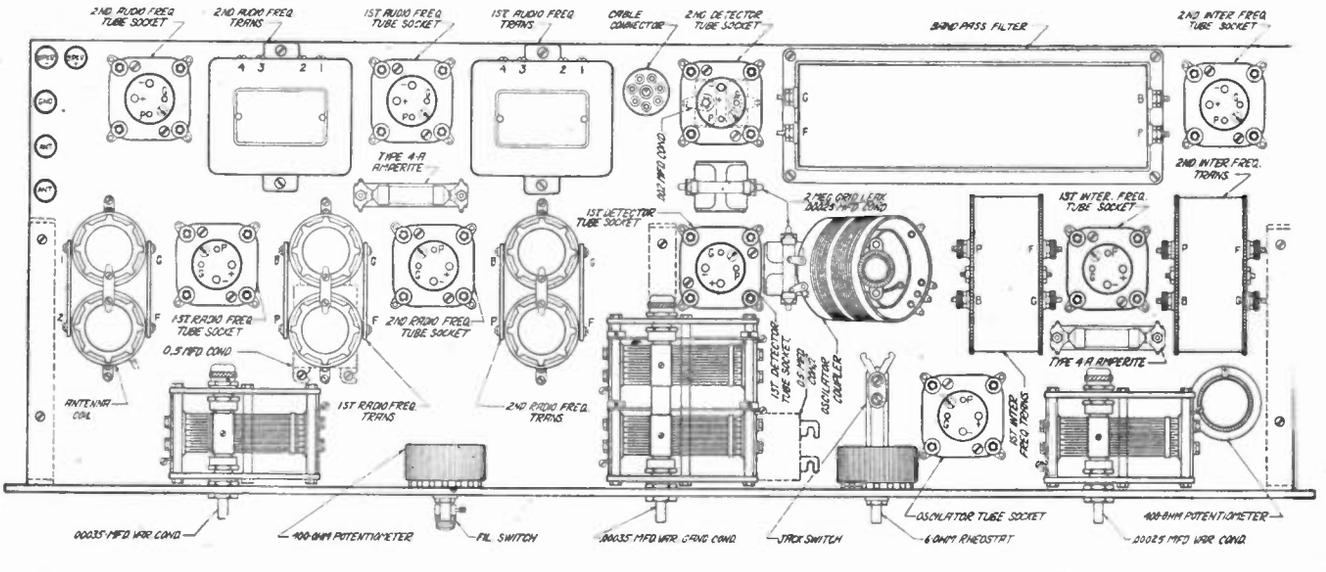
Perfect musical tone reproduction is the ultimate desire of the receiving set owner. To handle perfectly the wide range of musical frequencies gained through the use of the band pass filter in the Camfield Super-Selective 9 receiver it is recommended that a cone type speaker of the highest class be used. One of the most satisfactory cone speakers in this class is the type 540 A. W. Western Electric. The proper power tubes in the last stage of audio amplification in the Camfield Super-Selective 9 will bring out perfect reproduction of the broadcast program.

AT RIGHT.
Camfield Superhet in Console Cabinet.



Camfield Superhet in Console Cabinet

BELOW.
Actual Placement of Apparatus on Baseboard of Camfield Superhet.



Actual Placement of Apparatus on Baseboard of Camfield Superhet

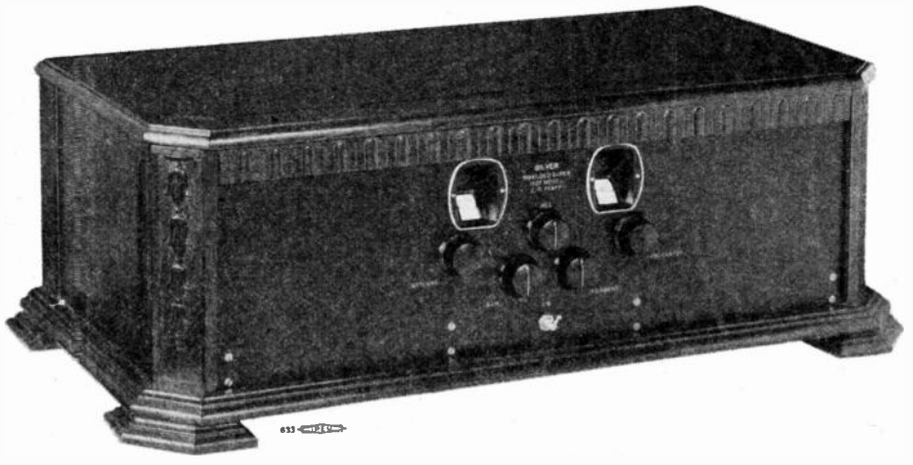
Say you saw it in the WCFL Radio Magazine

A Shielded All-Wave Length Super Heterodyne

The Laboratory Super Can Be Put Together in a Few Hours, for the Intermediate Amplifier Comes All Wired and Tested

By Earnest R. Pfaff, A. I. R. E.

THE performance of any radio receiver is dependent upon the excellence of the design of every individual part of the whole receiver. Particularly is this true of the superheterodyne, which really consists of three separate circuits, each of which alone may be likened to a whole set. An inkling of the great efficiency of the Laboratory Model Super can be gotten when it is realized that with seven of its eight tubes removed, the set, with but one tube, is still sensitive enough to bring in European amateur code stations on headphone, or to get the short-wave programs of



KDKA and WGY almost anywhere in the United States using but a twenty foot antenna. Or the single tube will give headphone reception over ranges of 1,000 to 1,500 miles. So great is the receiver's efficiency that, adding the two audio amplifier tubes to the first, the range for loud speaker operation becomes 500 to 1,000 miles or more, while on short waves it is from 1,000 to even 5,000 or 6,000 miles. In fact, the performance of the set using but three tubes will put many factory-built five and six tubes sets to shame, and when the set is operated at full power with all eight tubes it will get more distance, with far less interference, than any known factory-built receiver.

Just why this is possible can be understood very easily by an examination of the over-all amplification of the receiver considered sectionally. The voltage amplification of the first detector goes up for weak signals, exactly where great sensitivity is needed. Thus, on very distant stations, the amplification of the first detector and oscillator section is on the order of 200 times, while in normal operation it ranges from 25 to 50 times. The intermediate amplifier is an almost revolutionary development, for, instead of the builder having to put it together himself from individual parts, it comes all ready finished, and with the guarantee of perfect performance provided by careful laboratory tuning, matching, and calibration, not only of individual parts, but of the whole unit's operation as well. The engineers who built this unit, computed a voltage amplification of 20 per stage, almost twice as much as can be gotten from average amplifiers, and in preliminary measurements, this figure was checked for actual production transformers. This value of amplification is obtained from the four tuned circuits making up the unit containing the three intermediate amplifier and the second detector stages, when the unit is carefully operated with optimum regeneration. Nevertheless, with an adjustment well below peak efficiency, the gain is 10 per stage, or an over-all amplification of 100,000 for the amplifier unit as compared to a measured over-all gain of 3125 for a very popular intermediate amplifier employing a combination of iron and air-core transformers without total amplifier shielding. The audio amplifiers, with a 112 or 310 output tube, give a gain of 20 per stage, or 400 over-all. Thus the gain of frequency changer, I. F. amplifier, and A. F. amplifier becomes 25 × 10,000 × 400 or 100,000,000 times. This figure compared to an average of 50,000 for a seven tube shielded neutrodyne, or 3,125,000 for a popular eight tube super-heterodyne, illustrates forcibly the remarkable sensitivity and amplification of the Laboratory Model. It must be remembered, also, that the amplification figure given above for the Laboratory Model was not the full value obtainable through careful operation—handled by an experienced operator, its performance is uncanny, to say the least.

The selectivity of the receiver is equally remarkable, and in Chicago it is quite possible to bring in stations at distant points, with but 10, or, in some cases, even 5 to 7, Kilocycles separation from powerful local broadcasters. This is made possible through judicious use of shielding of detector, oscillator, and I. F. amplifier. The shielding is so effective that local stations can barely be heard with no antenna connected to the set; but upon the addition of a 24-inch length of wire

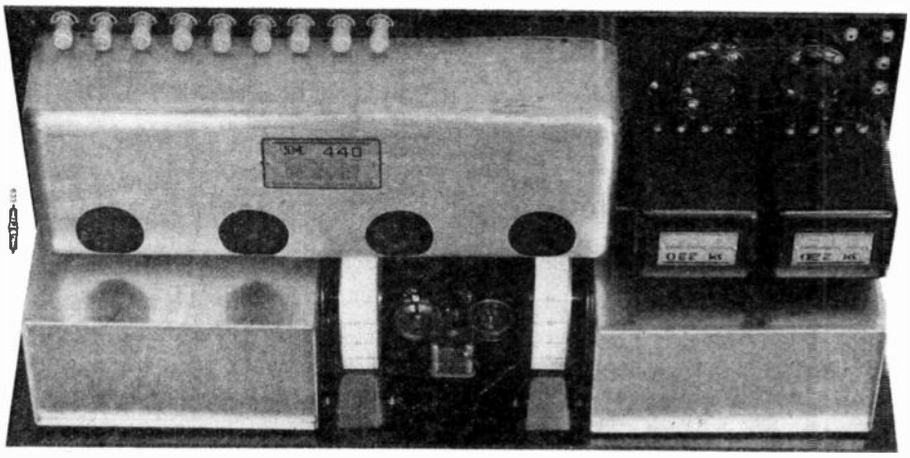
for an antenna, all the locals roar in, as do stations in some cases several hundred miles away.

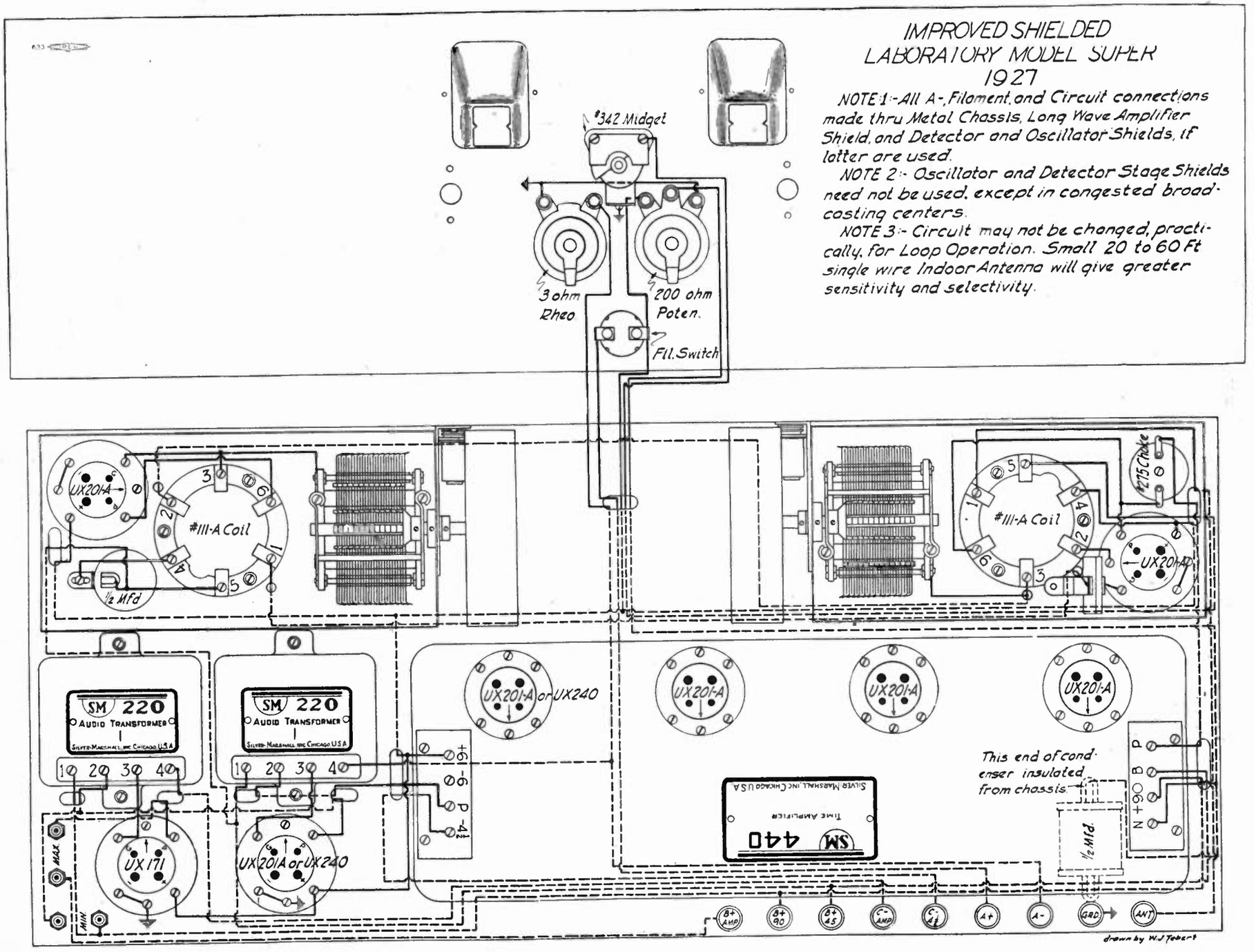
In the Improved Laboratory Super-Heterodyne is also found a receiver free of the almost age-old bugaboo of individually matched long wave transformers, for the long wave amplifier is a sealed laboratory-calibrated unit that will not vary one kilocycle in operation with standard tubes. Almost every builder of a super-heterodyne has either been disappointed in his set's not possessing the expected knife-like selectivity, or, if he has employed really sharp, efficient transformers, they only too frequently do not function properly. This condition is not always due to the individual transformers not having been properly matched to begin with, but because individual assembly conditions result in altered circuit capacities and operating conditions which do not duplicate the laboratory conditions under which the transformers were first matched. Then, again, any of the popular iron-core 30, 40, 50 or 60 kilocycle transformers have very low winding capacities for operation with low circuit and low tube capacities. Since the operating frequency of the transformers is largely determined by the total circuit capacity, and since winding capacity is low, it follows that any small variation in wiring, assembly, or tube capacity will represent a large proportionate change of the total capacity, with the result that individual receiver stages built with accurately matched transformers may often be as far as 15 to 20 kilocycles apart. This, of course, means little or no selectivity, even if there still remains fair amplification. The logical way to build an intermediate amplifier is to use, not iron-core—air-core transformer combinations, but to follow along the lines of best RF amplifier design practice, and use low resistance air-core transformers throughout. Tuned with large fixed capacities, so that variations in tube capacities represent such a small percentage change of the whole as to be ineffectual. Exactly this course has been followed in the Laboratory Super, but it has been carried a step farther, and the whole amplifier built into a single, carefully tested unit, so that two causes of variation have been eliminated, and the remaining third—tube capacity—rendered so small a percentage change as not to affect operation. On top of this, the whole amplifier is completely shielded, each of the RF stages and detector being housed in individual compartments of a copper-brass catacomb. The amplifier without shielding is remarkably efficient, but when the shielding is added, the amplification jumps tremendously. Actually, shielding adds at least 50 to 100 per cent in volume on weak stations—exactly as it would intelligently applied to any multi-stage R.F. amplifier. This is because of the elimination of detrimental feed-backs, always and invariably present with unshielded amplifier stages.

Eight tubes are employed in the Improved Laboratory Model Super-Heterodyne—a first detector, an oscillator, three long wave amplifiers, a second detector and two audio stages. The first detector circuit is very similar to the conventional short-wave regenerative circuits so popular, a small 75 mmf. midget condenser controlling regeneration; while a .00035 modified SLW-SLF condenser does the tuning. The coil system is a conventional S-M plug-in coil, so connected that both regeneration and tuning condenser are at ground potential, with consequent total absence of hand-capacity effect. No provision is made to use a loop, as it has been found that for extreme selectivity the use of an antenna—the coupling of which is variable—provides for greater flexibility than a loop.

The oscillator circuit is designed to keep harmonics at a minimum so that stations are heard at but one, or, at the most, two dial points. It is grid-tuned with a 350 mmf. condenser with consequent absence of hand capacity effect. Its output at different wave lengths is sufficiently constant for practical requirements, as is its calibration, while the coupling to first detector is variable.

A copper can 15 inches long 5 inches wide, and 3 inches deep holds the I. F. amplifier and second detector. It contains four individual stage compartments, each holding an RF transformer and its tuning capacity, a tube socket, and the necessary wiring and by-pass condensers. Three RF stages and a detector are employed, with the whole unit tuned to exactly 112 kilocycles. The reason for the selection of this intermediate frequency is that very satisfactory low resistance air-core tuned RF transformers may be built for operation there. The 112 kilocycle amplifier frequency results in decreased interference possibilities. Normally, in a super employing, say, 50 kilocycle intermediate frequency, two stations 50 kilocycles away will heterodyne each other and be received without the use of the local oscillator at all, selectivity being dependent upon the selectivity of the antenna tuner and the local





coil pick-up. As the intermediate frequency is increased, this possibility decreases, since it is far easier for an antenna tuner to discriminate between stations 112 kilocycles apart, than between powerful locals 30, 50, or even 60 kilocycles apart. Further, powerful stations are generally spaced on even 10 kilocycle separations, so that the odd 112 kilocycle frequency is a greater aid to selectivity. Coil pick-up is, of course, absent in the shielded amplifier, and wiring pick-up is almost negligible, since all wiring is very close to the grounded metal panel or chassis. Complete shielding of first detector and oscillator sections prevents pick-up of strong local stations on the coil systems themselves, though for receivers to be operated in the country, or in non-congested broadcasting centers, these two shields might be omitted.

The audio amplifier offers a very unusual point of very great value in an ultra-selective receiver. This is the 5,000 cycle cut-off, or decrease in amplification, which aids receiver selectivity. Frequencies above 5,000 cycles do not contribute to realism of reproduction, according to no less an authority than the Bell Telephone Laboratories, while in the range above 5,000 cycles lie practically all parasitic amplifier noises, atmospheric disturbances and the only too prevalent heterodyne squeals. These the 5,000 cycle cut-off tends to decrease very markedly, and almost entirely eliminate.

Parts Required

The parts required to build the 1927 Model Improved Laboratory Super have been most carefully selected for the perfect coordination of the operating characteristics of the receiver. It is imperative that the exact parts specified be used in building the set if its truly remarkable performance is to be realized to the fullest possible extent. Every item is the product of a well-known and reputable manufacturer, and unconditionally guaranteed.

Parts List

1—Van Dorn panel and chassis unit, pierced, with hardware	$ 8.50
1—Carter .00015 condenser with leak clips	.50
1—Carter M-200 potentiometer	.75
2—Carter ½ mf. condensers @ .90	1.80
1—Carter 3 ohm rheostat	.50
1—Carter battery switch	.50
4—Carter No. 10 tipjacks @ .10	.40
1—Polymet 2 megohm leak	.25
2—S-M 220 audio transformers @ 8.00	16.00
2—S-M 511 tube sockets @ .50	2.00
2—S-M 805 vernier drum dials @ 3.00	6.00
1—S-M 275 RF choke	.90
1—S-M 342 .000075 mf. condenser	1.50
1—S-M 440 time signal amplifier	35.00
2—S-M 515 Coil sockets @ 1.00	2.00
2—S-M 111A coils @ 2.50	5.00
2—S-M 320 .00035 condensers @ 3.25	6.50
9—X-L binding posts @ .15	1.35
	$89.45

(If shielded oscillator and first detector are desired, add $4.00 for two S-M type 631 stage shields.)

With each chassis should come the following items of hardware, contained in a small envelope:

9—sets binding post insulating washers (1 plain, 1 extruded to a set).
4—sets tipjack insulating washers (1 plain, 1 extruded to a set.)
3—sets instrument insulating washers (1 plain, 1 extruded to a set).
27—¾" 6/32 RHNP brass screws.
1—1¼" 6/32 RHNP brass screw.
28—6/32 NP brass nuts.

Assembly

Upon the chassis should be mounted the detector and oscillator assemblies, inside the stage shield pans if shields are to be used. The end mounting screw of each 511 tube socket is used to join the A— to the chassis, so a lug should be placed under the screw head, to be soldered to the F— socket terminal, and the under side of the chassis scraped bright for good contact with the fastening nut. One terminal of the .00015 grid condensers should be bent at right angles and fastened directly under the "G" terminal screws. The single long screw holds the 275 choke coil in the detector stage assembly.

The binding posts mount in the nine holes at the rear of the chassis using the insulating washers to positively insulate them from the chassis, as do the four tipjacks The "Ground" post grounds to the metal chassis, and the fastening screw of this post holds one end of the second ½ mfd. condenser tightly to the chassis, while the free end must be bent up clear and free of the metal chassis.

The A— connection is made to the amplifier through a contact between amplifier shield and chassis to which it is fastened with four screws. The two audio amplifier tube sockets mount using their rear fastening screws to connect the F— posts to the chassis. All possible wiring should be done on the chassis before proceeding further, leaving free the wire ends that will connect to the instruments on the front panel; and to the two audio transformers which mount last. The potentiometer should be mounted as shown, using insulating washers to thoroughly insulate its frame from the panel. The rheostat and the midget condenser are similarly mounted, except that care is taken to make good contact between them and the panel.

The drive mechanisms of the dials should be dropped into the bracket bearings intended for them, the shafts pushed through the holes in the front panel, and the two brackets bolted to the panel using the screws provided. One variable condenser fastens to either bracket, using the shaft mounting nut provided. A drum should be slipped over each condenser shaft, with set screw loosened, and pushed up until the drum scale edge is just ready to enter the crack in the drive mechanism shaft. With a knife blade this crack should be widened to receive the drum scale edge, and the drum pushed well up on the condenser shaft. The scale should then be ad-

justed to read 100 degrees against the indicator points in the panel windows, when the condenser plates are entirely disengaged, upon which the set screw in the drum dial hub should be tightened on the condenser shaft. With the knobs fastened on the drive shafts, the condenser dials should rotate if the knobs are turned.

The connections to the condensers, rheostat, and potentiometer should be made before fastening the panel to the chassis. After they have been put in, machine screws and nuts serve to hold panel and chassis together. The on-off switch mounts in the one remaining panel hole, with insulating washers to thoroughly insulate it from the panel and chassis. (It may have been previously connected in circuit, and allowed to hang on the wiring until ready to be mounted.) In wiring, a little slack should be left in each connecting wire, which should be cut to fall about as shown in the bottom view of the chassis. After testing, all wiring may be bunched and laced into neat cables, using very heavy waxed shoemaker's thread. Two leads should not be jointed or included in the cable—they are the wires running from the detector stage along the bottom of the chassis and up to posts 1 and 2 of the oscillator coil socket.

Operation

To operate the set, all tubes (a total of six CX301A, one CX340, and one CX371 tubes, are needed) should be inserted, except the first detector tube. The CX371 goes in the right rear socket; the CX340 in the adjacent rear socket. With the on-off switch on, the rheostat should be turned to within ⅛ to ¼ inch of the full right position. If the potentiometer "GAIN" knob is turned to the right, a "plunk" will be heard at some point. This can be detected by varying the oscillator drum, which should cause a number of shrill whistles to be heard. The "GAIN" knob should always be operated just to the left of the "plunk" point—to the right of which squeals were heard when the "OSCILLATOR" dial was varied. The receiver is least sensitive when the "GAIN" knob is at the left, and the most sensitive when the "GAIN" knob is just to the left of the "plunk" point.

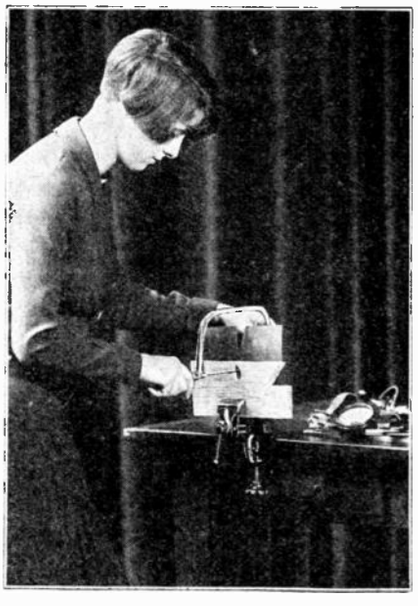
The first detector tube should be inserted, and the midget condenser set all out. The antenna coil rotor should be set at 45 degrees—the oscillator rotor all in. A small antenna 30 to 60 feet long should be used, or even a larger one if the set is not too close to powerful local stations. Stations may be tuned in using the two drum adjustments only. Weak stations may be intensified by turning up the "REGENERATION" condenser on the front panel. This condenser functions similarly to the "GAIN" knob, in that as it is turned to the right to interleave the plates, signal strength on weak stations will increase up to the point where the first detector oscillates, and the signal turns into a squeal. Adjusting the midget condenser will react slightly on the setting of the "ANTENNA" drum. The position of the antenna coil rotor should generally be at about 45 degrees. With a small antenna, it may work best all in; with a large antenna at nearly right angles. The sharpness of tuning of the antenna dial depends upon the setting of this rotor, as well as that of the midget condenser. The oscillator rotor should be adjusted once on a very weak signal at about 300 to 350 meters, and once set for maximum volume, may be left alone.

Battery or Power Operation Optional

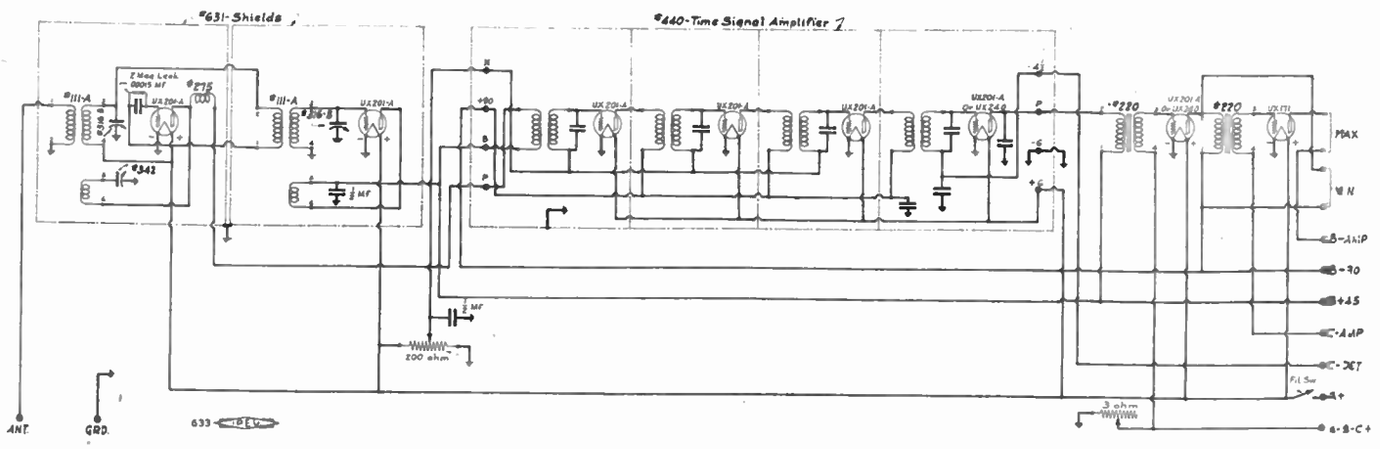
The Laboratory Super-Heterodyne may be operated from standard A, B, and C battery equipment, or it may be operated from light socket power equipment, either partially or wholly—using the standard CX301A, CX340, CX112, and CX371 tubes; either a 6 volt storage A battery with trickle charger (known, when both units are combined, as an "A Power Unit"), or from a direct true A power unit such as the new ABOX A supply. As there is considerable variation in B power units, a type employing a glow tube voltage regulator is recommended. Dry C batteries should be used. The receiver may be adapted for use with Sovereign, or other A. C. tubes.

Use of Output Transformer or Power Pack

It is highly desirable that an output transformer such as Silver-Marshall 221 or 222 be used between the receiver and the loud speaker. This unit has not been included in the set, since the ideal way to build it is to leave out the audio stages entirely and use, instead, a power pack such as the Unipac described elsewhere in this issue—a power amplifier and B supply combined. The first audio tube may be built into the Unipac as a CX326 tube with the first audio transformer in the set itself. In this case, the Unipac would serve beautifully as a phonograph amplifier with a record pick-up connected to the CX326 input tube's grid circuit, or as a two stage amplifier for the radio set with the secondary of the single audio transformer in the set connected to the Unipac in place of the record pick-up by means of a single phone cord.



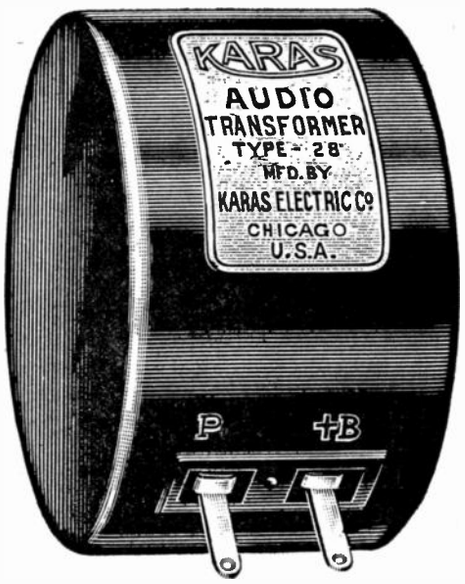
Cutting heavy sheet metal for shields, etc., is one of the most difficult jobs for the radio set builder. This work cannot be done successfully with shears, but the illustration shows how the job may be easily performed with a saw such as the F. P. M. holding the sheet metal between two boards. The cutting pattern is marked on the board facing the operator —or operatress.



Wiring Diagram of the Shielded All-Wavelength Superhetrodyne.

Memoranda

Radio Apparatus Line Has Interesting Items for 1927-28

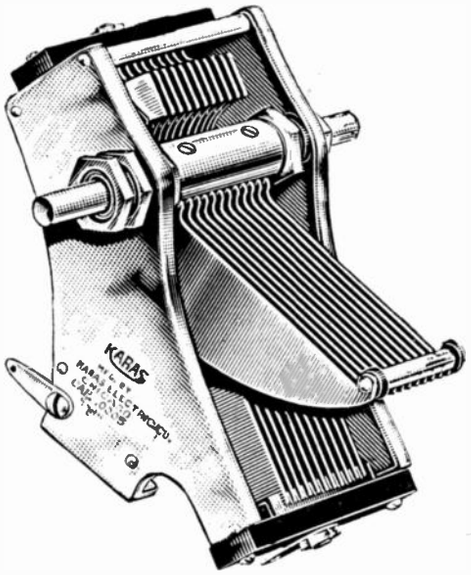


The Karas line of Radio Apparatus for the season 1927-28, offers a number of interesting new items that are in keeping with the high standards long ago established by this well known firm of precision instrument manufacturers. Among these items are the new Karas Type 28 Audio Frequency Transformer, the new Karas Output Filter, and the new Karas S. F. L. Removable Shaft Variable Condenser.

In designing the new Karas Type 28 Audio Transformer the Karas Engineers had in mind the need for compact set assembly, and the demand for full and complete amplification of the low notes as well as the high notes. They also sought a very much larger volume than most other transformers were able to deliver.

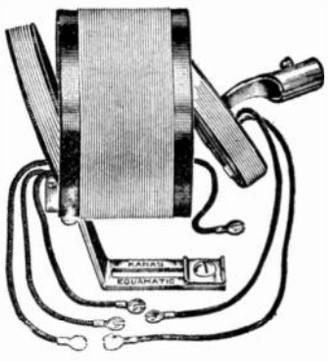
The Karas Type 28 has complete shielding, its all metal steel-clad case being a perfect shield in itself. This makes it possible to assemble a receiving set with the audio transformers in actual contact, if necessary to gain a compact assembly. Two Type 28 Transformers and a Karas Output Filter actually may be placed in the same space usually occupied by two ordinary large size audio transformers.

The spun-sealed case of the Type 28 is guaranteed not to leak insulating compound at any natural temperature. At the same time it protects the delicate windings within from any possible injury. Needless to say this case is absolutely waterproof.

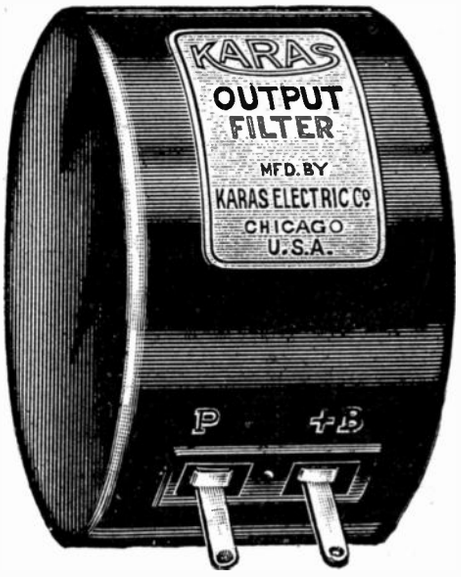


Extra long soldering lugs are used in the Type 28. In many instances these terminals are long enough to reach adjoining apparatus without the use of bus bar wiring.

A unique feature of these new transformers is their finish—brilliant black Duco—a heat-proof, moisture-resisting finish that is too well known to need special emphasis. Set builders will be quick to appreciate the compactness of these new transformers due to their cylindrical shape and the mounting on subpanel or baseboard.



The Karas 3-Circuit Tuner



Karas S. F. L. Removable Shaft Variable Condensers are made in three types, 11, 17 and 23, the capacities of these types being respectively .00025, .00037 and .0005 mfd.

The shafts of these new condensers are removable, so that dials may be mounted from either side of the condenser, or, if desired, an entirely new shaft may be inserted when it is necessary to mount condensers in tandem. Due to this removable shaft it is possible to single hole or base mount these condensers from either side, permitting the use of 0-100 or 100-0 dials, as desired.

Frames and plates are rigidly braced. They are made from a special hard-drawn brass.

The secret of Karas S. F. L. tuning lies in the special eccentric shape of the Karas Condenser plates, which distribute the stations at exactly 10 kilocycle separation on the dial, in accordance with government allocation of broadcasting channels. Every point of a 180 degree 100 division dial covering the 100 wavelengths between 200 and 600 meters thus indicates a separate station wavelength, a 1,000 kilocycle station coming in at 50 on the dial, and a 990 kilocycle station coming in at 51.

Frames are nickel plated and hand buffed. Binding posts and soldering lugs are provided at either end and on each side of the frame, affording convenience to the user.

A new item in the Karas line for 1927-28, is the Karas Output Filter. This development by the Karas Engineers was especially designed to entirely eliminate the harsh, undesirable chattering of the loud speaker due to execessive B battery voltage. In the output circuit it is the direct current component that is so largely responsible for this excessive noise in the loud speaker. The Karas Output Filter leaves only the a. c. component of the plate current— an essential to the proper operation of the speaker.

The Karas Output Filter contains an improved 100 henry choke and a large capacity paper condenser. These guarantee the performance of the filter under all conditions met with in a re-receiving set.

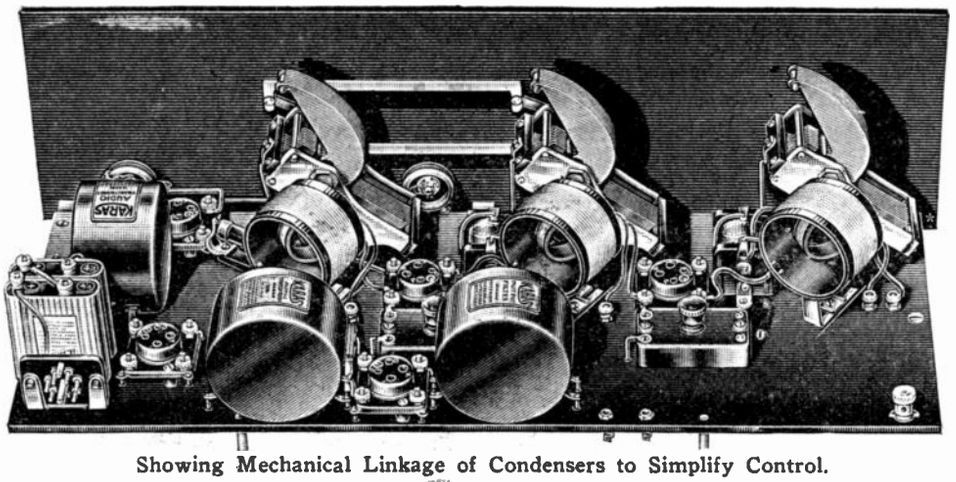
The shell of this filter is steel, spun-sealed and Duco-finished through which the terminals, plainly marked, are brought, the insulation being genuine Bakelite.

Karas Micrometric Dials turn with remarkable smoothness, have an extremely high gear ratio and no backlash. The gear train is as carefully cut as that in a high grade watch.

The vernier ratio is 63 to 1. This gives a fineness of tuning that is close to 1/1,000 of an inch, making it extremely easy to bring in hard to get stations.

Memoranda

New and Novel 2-Dial Set



Showing Mechanical Linkage of Condensers to Simplify Control.

In the new 1927-28 Karas 2-Dial Equamatic radio set builders will find a 5-tube tuned radio frequency receiving set embodying new applications of the Equamatic System of automatic energy transfer. This receiver will win a tribute from set builders for its power, selectivity and distance-getting qualities.

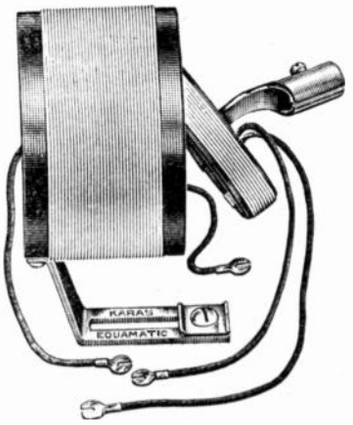
In the new Karas 2-Dial Equamatic all of the advantages of the 3-Dial Receiver of the past have been retained, and to these have been added the advantages of complete balance and neutralization. Extremely simple tuning is accomplished with the Karas 2-Dial Control System, by means of which two of the tuning condensers may be controlled through a single Karas Micrometric Vernier Dial.

Another advantage of the new 2-Dial Karas Equamatic is the fact that the subpanel or baseboard has been shortened to 24 inches, effecting a considerable economy of space and material.

The principle of the Karas Equamatic under the King patent application is too well known to need further elaboration. It depends upon the Karas Equamatic Inductance coils for its successful operation, these coils being designed to give a continuous and maximum transfer of energy between the primaries and secondaries at all wave length settings of the dials when the condenser dials are rotated. This is accomplished by mounting the primary coils on the extended shafts of the Karas S. F. L. Removable Shaft Variable Condensers, in such a manner that the degree of coupling between primary and secondary is constantly and automatically varied at exactly the rate necessary to maintain the radio frequency tubes at their highest practical maximum — just below the oscillation point.

Complete List of Parts for 2-Dial Equamatic

2 New Karas Type 28 Audio Transformers
1 New Karas Output Filter
3 New Karas Type 17 Variable Condensers
3 New Karas Equamatic Coils
2 New Karas Micrometric Dials 0-100
3 New Karas Subpanel Brackets
1 New Karas Control System Including Complete Hardware
2 Karas or Samson R.F. Chokes 100 Millihenry
1 Bakelite Front Panel Engraved (7"x24")
1 Bakelite Subpanel Drilled (9"x23")
1 Carter 10 Ohm Rheostat (gold arrow)
1 Carter 20 Ohm Rheostat (gold arrow)
1 Yaxley No. 69-B Interstage Switch (gold)
2 Carter Tip Jacks No. 10
1 Sangamo .00025 Fixed Condenser with clips
1 Amsco or other make Grid Leak 2 Meg.
2 Carter H-2 Resistors 2 Ohms
1 Yaxley Cable Plug
5 Benjamin Cushion Sockets
2 Samson Mica Neutralizing Condensers 0-.0007
2 .0001 Sangamo Fixed Condensers
1 .006 Sangamo Fixed Condensers
2 .001 Sangamo Fixed Condensers



Equamatic R. F. Transformer.

The Karas apparatus used in the new Karas 2-Dial Equamatic is interesting to note. The three condensers are the new Karas Type 17 Removable Shaft S. F. L. Condensers which the Karas engineers are featuring for 1927-28. Three of these condensers are used in the 2-Dial Equamatic. These are tuned by means of three Karas Micrometric Vernier Dials, which have a 63 to 1 gear ratio and permit a 1/1000th of an inch control of tuning. Mounted on the subpanel are three Karas Equamatic Inductance Coils, the primaries of which are mounted on the extended shafts of the Karas Condensers. Two new Karas Type 28 Impregnated Audio Frequency Amplifying Transformers are used in the 2-Dial Equamatic. These have spun-sealed steel-clad cases which give permanent protection to the delicate windings. A Karas Output filter also is used, the function of this new Karas Output filter being to prevent demagnetization of the loud speaker unit, and to sidetrack the direct current component of the plate current and eliminate all undesirable chattering of the loud speaker due to excessive B-Battery voltage. An important feature of the 2-Dial Equamatic assembly is the new 2-Dial Control System, which is furnished complete with three condenser shafts,

Partial List of Unions Whose Members Have Contributed $1.00 Per Year for Construction and Support of W. C. F. L.

Amalgamated Clothing Workers
Art Glass Workers No. 624
Bakers No. 2
Bakers No. 13
Bakers No. 62
Bookbinders No. 8
Boot & Shoe Workers No. 94
Bricklayers No. 21
Brick & Clay Workers (for all)
Bridge & Struc. Iron Workers No. 1
Broom Makers No. 29
Carpenters No. 1
Carpenters No. 10
Carpenters No. 13
Carpenters No. 62
Carpenters No. 80
Carpenters No. 141
Carpenters No. 416
Carpenters No. 434
Carpenters No. 1367
Cement Workers No. 76
Chicago Trades Union Label League
Cigar Makers No. 14
Cleaners & Dyers
Clerks Retail No. 195
Coopers No. 94
Diagnosticians
Distributors (circulars)
Egg Inspectors
Electrical Workers No. 9
Electrical Workers No. 713
Electrotypers No. 3
Electrical Workers No. 134
Engineers No. 143
Engineers No. 401
Engineers No. 464
Engineers No. 556
Engineers No. 587
Flat Janitors No. 1
Flat Janitors No. 30
Flint Glass Workers
Gardners 10615
Gas Fitters No. 250
Hatters Union No. 9
Health Officers
Lathers No. 74
Leather Workers District Council
Lithographers No. 4
Machinists No. 84
Machinists No. 113
Machinists No. 134
Machinists No. 199
Machinists No. 366
Machinists No. 390
Machinists No. 1528
Meat Cutters 546
Metal Polishers No. 6
Moving Picture No. 110
Municipal Mercantile Employees
Musicians No. 10
Painters No. 54
Painters No. 147
Painters No. 194

John Fitzpatrick, President Chicago Federation of Labor

Painters No. 275
Painters No. 396
Paper Makers
Plasterers, Journeymen No. 5
Portrait Artists
P. O. Clerks
Pressmen No. 3
Rope Splicers
Sheet Metal No. 115
Steam Fitters No. 597
Teachers, Fed. of Men
Teachers, Fed. of Women
Teamsters No. 703
Teamsters No. 705
Teamsters No. 706
Teamsters No. 712
Teamsters No. 721
Teamsters No. 727
Teamsters No. 734
Teamsters No. 742
Teamsters No. 753
Teamsters No. 754
Teamsters No. 772
Technical Engineers No. 14
Telegraphers, Western Brokers Div.
Tuck Pointers & F. C.
Typographical No. 9
Typographical No. 16
Typographical No. 330
Waitresses No. 484
Wall Paper Crafts No. 8
Watchmen, G. P. & C.

The Aero Seven Broadcast Receiver

Receiver Ideals in Theory and Practice

By Zeh Bouck

A GENERAL consensus sums up the characteristics of the ideal broadcast receiver, with logic and justice, as follows: First of all the number of tuning dials should be limited to unity. A single dial receiver is certainly most easily tuned, a simplicity that reflects the fact that radio has been graduated from the laboratory stage and has now become an instrument of pleasure, to be operated by the casual pass of the hand from an easy chair. Selectivity should be perfect. That is, it should tune neither too sharply nor too broadly. Either variation from the optimum is most undesirable. If a station tunes too broadly, interference will be experienced. One local station will often interfere with another, not to mention the impossibility of tuning through locals for distance when the lure of many miles impels. If a receiver tunes too sharply, side bands, frequencies which constitute the higher audio notes, will be cut off, with resulting distortion. The receiver is then said to have a high cut off. The effect is similar to certain types of poor audio amplifying transformers. The tone is drummy . . . muffled. It should be possible to control the selectivity of the receiver . . . from a comparatively insensitive state to the point where it readily detects relatively small impulses. In other words, the volume control should be confined to the radio frequency circuit. If a receiver operates at all times at maximum sensitivity, the noise level will always be at its highest point, regardless of whether

Zeh Bouck.

distant or local stations are being received. The extreme sensitivity required for the reception of DX necessarily sensitizes the receiver to extraneous and stray waves. Such sensitivity is quite unnecessary on local stations, where, aside from introducing disturbing noises, it generally results in overloading various tubes with resulting loss in quality.

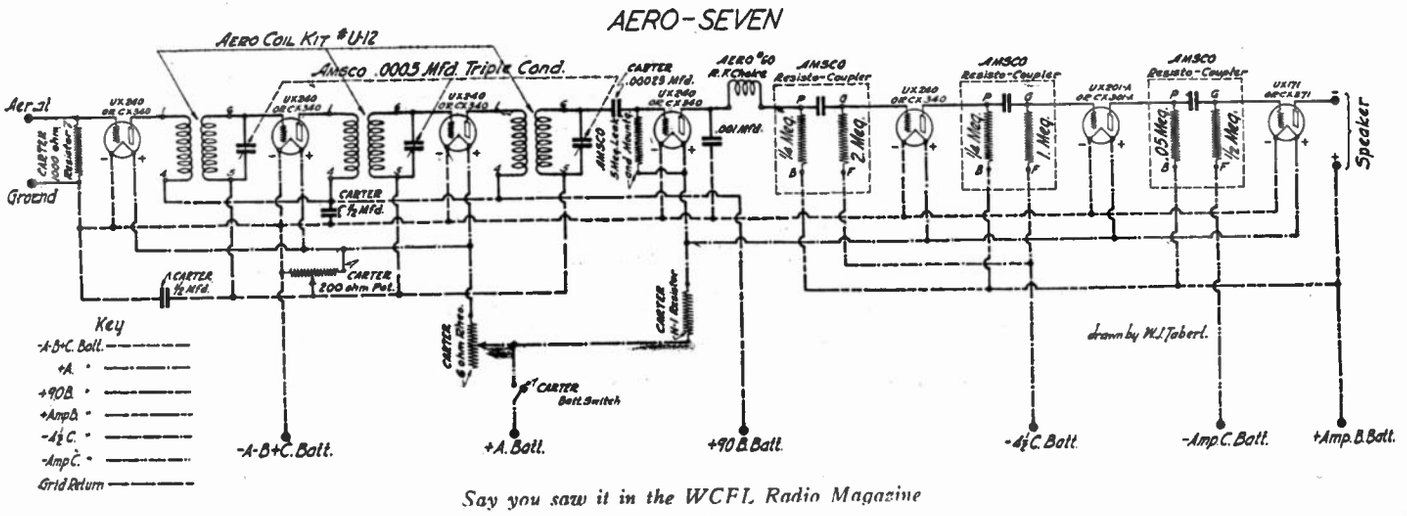
The volume or sensitivity control also should effect the desired control without broadening tuning to more than a negligible degree.

Assuming these various approaches to perfection in the radio frequency section of the receiver, an audio amplifier of comparable worth is essential to justify the electrical efficiency achieved.

The Aero-7

To call the Aero-7 "just another circuit" would do this receiver a gross injustice. As a matter of fact, it is not another circuit. It is a combination of well known circuits so modified that its action confirms very closely to the requirements for the ideal receiver outlined above.

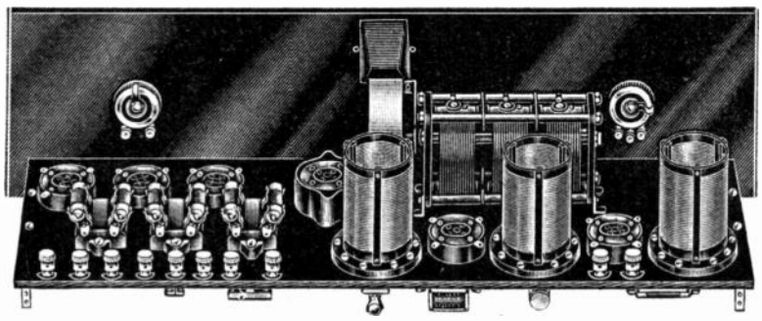
Single dial control, of several r.f. circuits, is achieved by well designed tandem tuning. The problem of simultaneous tuning has always been the alignment of the various circuits. For successful tandem tuning the inductive values and the capacitative values in each circuit must be accurately matched at all frequencies. It has been very difficult to do this for two reasons. It is a painstaking and highly scientific task to match all coils and condenser sections. Even with these



elements carefully checked, the capacitative and inductive effects of the proximity of parts and wiring introduce perplexing discrepancies. Also, the antenna coupling to the first r.f. tube often renders the tuning line of the first circuit inconsistent with that of succeeding circuits—an inconsistency which varies with the electrical characteristics of antennas.

Matching of Coils and Condensers:

The Aero coils are matched with a satisfactory degree of precision, immediately eliminating a possible factor for failure. The same may be said of the Amsco Triplet condenser. Each section of this condenser is equipped with a small equalizing or compenseating capacity which can be varied to compensate stray circuit capacities. Stray inductive effects are matched by careful layout and design of wiring. (It is, therefore, important that drilled panels be secured for this receiver, and the picture layout followed in every detail.)



Aero Seven Sub Panel

The effect of the antenna circuit on the first tuned circuit is eliminated in the Aero-7, by coupling the antenna to the first tube by means of a resistance connected between antenna and ground as shown in the schematic diagram. The first r.f. tube, therefore, acts as an untuned radio frequency amplifier.

The optimum value of selectivity has been attained in this receiver. The circuits cover, over a wide range of wave lengths, a frequency band closely approximating ten kilocycles—five kilocycles on each side of the fundamental frequency. This condition is achieved through careful coil design in combination with an efficient gain or sensitivity control.

Extreme sensitivity can be obtained with this receiver. The coils are characterized by low radio frequency resistances (genuinely scientific low loss construction) which results in a high amplification factor. Also, the design of the coils is such that there exists little inter-stage coupling. Amplification, therefore, approaches a true cascade effect, with high amplification and a thoroughly satisfactory degree of selectivity.

The potentiometer volume control is not included in the tuned oscillatory circuits. It therefore, has no effect on the damping of these circuits with resulting broadening of tuning. Whatever broadening exists is due to reduced regeneration, but never exceeds a highly satisfactory tuning characteristic.

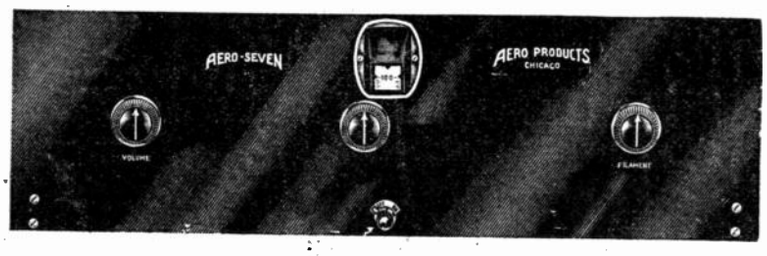
The Audio End:

Thus it is seen that the radio frequency section of the Aero-7 is so designed to provide a high degree of radio frequency efficiency compatible with perfect quality. The entire reproduction of the detector tube is preserved throughout the audio amplifier. Amplification is effected by means of resistance coupling, acknowledged by the majority of engineers to give the closest approach to distortionless amplification.

List of Parts:

The following is an exact list of parts used in the construction of this receiver. Considering the equalizing problems involved in tandem tuning arrangements, it is recommended that the amateur confine himself strictly to the recommended apparatus, even in such seemingly inconsequential parts as bypass condensers, rheostats and resistors.

1	Aero-Seven Foundation Unit	$12.00
1	Aero Choke Coil No. 60	1.50
1	Aero Kit of Coils U-12	12.00
1	Silver-Marshall Drum Dial	1.00
1	Carter "Imp" Battery Switch	.55
1	Carter "Imp" 200-ohm Potentiometer	.25
1	Carter "Imp" 6-ohm Rheostat	.00
1	Carter H-1000 Resistor	.30
1	Carter H-1 Resistor	.25
1	Carter .00025 Mfd. Condenser with Clips	.50
1	Carter .001 Mfd. Condenser	.50
2	One-half Mfd. bypass Condenser No. 205, 90c each	1.80
10	X-L Binding Posts, lettered—aerial, ground "A" battery plus, "A" battery minus, "B" batteries minus, "B" 90 volts, speaker positive, speaker minus, amplifier B-X	1.50
1	Amsco Floating socket	1.00
6	Amsco Plain Sockets, at 50c each	3.00
1	Amsco .0005 Mfd. Triplet Condenser, No. 1526	11.25
1	Amsco Grid-Gate Mounting	.30
1	Amsco 5 Meg. Grid-Gate	.50
1	Amsco Resistance coupled audio kit	7.00
	Wire, etc., Screw Assortment and Bus. Bar	.25
	Total	$59.55



Aero Seven Front Panel

Construction:

The actual building of the Aero-7 is best described in the detail photographs and in the instrument layout drawings. (Do not confuse the picture wiring diagram with the layout diagram. The picture wiring diagram spreads the parts in a manner to show

most clearly the connections between them, irrespective of the exact spacing of the parts or the exact directions taken by the wires.) Check your wiring against all illustrations and diagrams as the set nears completion.

The condenser is mounted so that the compensating condensers are up. That is, with the shaft extending to the right and the rotors opening in toward the front panel.

This receiver is not at all difficult to build—but any job worth doing is worth doing well.

Adjustment

There is only one set of adjustments to be made on this receiver, and these are effected when it is completely finished and wired to the usual power sources for reception. These are the compensating condensers on the Amsco triplet condenser. The condenser leaves the factory with the compensators screwed down tightly. Turn these two full turns counter-clockwise. (It is desirable, in making all adjustments on the compensators, to use a wooden screw driver. This will eliminate over-compensation due to body capacity effects. Any small stick can be shaved down into a satisfactory tool.) Tune in a station, preferably a local. Adjust the compensators, one at a time, by screwing in, until the station tunes the sharpest. Retune with the main dial following every adjustment of the compensators. Temporary adjustment of compensator can be effected by pushing it down slightly with the wooden adjusting tool, while the main dial is tuned. This will show immediately what particular compensator should be screwed down. That is all there is to it. Once adjusted, the condenser need never again be touched.

Tubes:

Either Cunningham or R.C.A. tubes should be used in the Aero-7. Note that Hi-Mu tubes are used in the first five sockets. The Aero coils are designed to take advantage of the high amplification constant of 30 which characterizes these tubes. Radio Frequency coils must be especially designed to do this. The second audio stage employs a 201-A tube to add additional stabilization to the amplifier, and to take care of unusual power surges. A 171 type power tube is used in the output stage to provide unusual volume without distortion. It is desirable, though not absolutely necessary, to couple this tube to the speaker through some output arrangement such as the Amsco Orthophone.

Operation:

The operation of the Aero-7, in virtue of our opening paragraph, is simplicity itself. It is merely a matter of turning the tuning dial to the selected station, and adjusting the volumn control to the desired point.

The receiver will operate from any antenna, short or long, indoor or outdoor, excepting a loop. It will operate from A, B and C batteries or eliminators, or any battery-eliminator combination.

Memoranda

Instructions for the Building and Operation of the Aero Short Wave Receiver and the Aero Short Wave Special

Two receivers for the amateur short waves are offered by the Aero Products, Inc. Both of these designs are built around the Aero Short Wave Coil Kit (LWT-125) which was so popular with amateurs and experimenters all over the world during the past season. This coil kit consists of three sturdily constructed coils of the air supported winding type, each having a grid and plate coil, and arranged to plug into a base mounting which is included in the kit. The detail of this includes a variable primary winding hinged to the plug base in such a way that a large range of coupling values is available. The range of the three coils as supplied is from 13 to 130 meters, but this range may be extended upward by the addition of two coils to 725 meters.

In order to facilitate the assembly of these coil kits into efficient receivers the Aero Products are supplying this season a foundation unit consisting of a finely finished and engraved Micarta panel and a specially prepared base-board. By the use of this foundation unit and the Aero coil kit it is possible to build either one of two very effective short wave designs. One of these, the Aero Short Wave Receiver, is equipped so as to be especially useful as a short wave telegraphic receiver. While this receiver is very capable in the reception of the ultra-low-wave broadcasting and re-broadcasting, fast becoming popular with all classes of listeners, a second receiver has been prepared that is more specially adapted to the reception of the low-wave voice and music broadcasts. This receiver is known as the Aero Short Wave Special Receiver. It is much the same as the Radio News Short Wave Special, detailed in that publication with slight modification from the receiver described.

Figures 1 and 2 show the front views of the Aero Short Wave and the Aero Special Receivers, respectively, and it will be noted that the front panel assemblies of both the receivers are identical. Both the plate and grid circuits are tuned by Amsco condensers operated by National dials, seen in the illustrations. At the extreme right is the Carter 25-ohm rheostat giving the control of the filament of the detector tube and below the battery switch of the same make. Thus in constructing either of the receivers illustrated the front panel assembly operations are the same. The .00014 (140 mmf) SFL type condenser is mounted at the left and the .00025 (250 mmf) SLC type at the right. The former is used to tune the grid circuit in each case and the latter controls the feedback of the circuit.

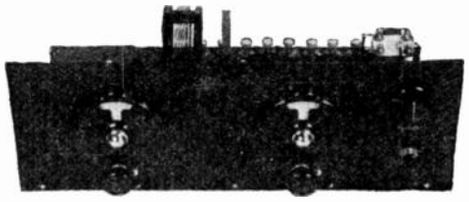


Fig. 1.
Front View of Aero Short Wave Receiver.

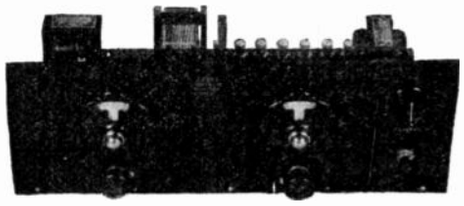


Fig. 2.
Front View of Aero Special Receiver.

The operations in completing a receiver of the Aero type will now be gone through and remarks on the Special set reserved for later.

As a first step, drill through wooden baseboard the hole for mounting the Aero Noskip No. 60 Choke coil (see layout sheet with foundation unit), and on the underneath side for a half-inch diameter clear out enough wood to allow the nut to repose and be flush with underneath baseboard surface. Remove only the outside nut on the choke coil for this purpose. Do not remove the inner nut which holds the engraved bakelite disc in place. The Aero Noskip No. 60 choke is made of very fine wire, of especial design, and we caution you against substituting other chokes in circuits where it is recommended. Furthermore, we caution you against tampering with it on the inside, because of the very fine wire. Each one is tested and is mechanically and electrically without defects. If, however, regardless of the above instructions, the choke is taken apart, be careful of the very fine wire in putting it together again. If, in the latter event, your set fails to function, you have broken the very fine wire in this choke. In which event, you should have it repaired or purchase a new one.

The base-board of the set should now be laid out in accordance with the drawing of Figure 3. A great deal of time and trouble may be saved in this operation by placing the board with the slot on the under side and trimming the drawing to size and fastening it with thumb tacks. Note that the drawing should be fastened in such a way that the binding posts are over the slot in the base. With the drawing in place it is a simple matter to locate the screw holes by punching through the paper with an awl or prick punch.

The paper should now be removed and the apparatus mounted with short wood screws in the manner indicated on the drawing. The appearance of the receiver should now be very much as shown in Figure 4. It will be noted that the Carter grid condenser and the Carter 2-ohm resistor are not mounted directly to the base but are screwed under the post of the respective sockets to which they attach in the circuit layout.

The receiver should now be wired in accordance with the diagram of Figure 5 taking care to keep all the grid and plate connection well in the clear and grouping the filament and battery connections as shown in the photo, Figure 4, as much as possible and lacing them into a secure cable with twine. All connections should be securely soldered, as loose connections that would cause only slight noises in the broadcast band are magnified ten-fold at the short waves.

After the connection of the receiver to the proper batteries, as shown in Figure 5, the receiver is ready for operation. Tuning to various waves is accomplished by the dial so marked while the regenerative or oscillating tendencies of the receiver are controlled by the right-hand dial. When receiving code signals it will be necessary to have the receiver in a continually oscillating state. Care should be taken, however, that the regeneration condenser is not advanced more than sufficient to allow stable oscillation, as this is the most sensitive adjustment of an oscillating receiver, as a rule.

It may be necessary to adjust the filament temperature of the detector when using different tubes as well as the resistance of the grid leak until the most sensitive adjustment is found. Several tubes should be tried until the one producing the strongest signals without extraneous hiss is found.

At certain points of the wave-band it may be found that the receiver will refuse to oscillate under any conditions of adjustment. In such cases the coupling of the antenna coil to the receiver should be reduced until the operation becomes normal. These points always occur at a fre-

quency where the reactance of the antenna and ground system is very low and changes in the antenna will, as a rule, only move these points to another setting of the wavelength dial.

It will be noted that this receiver employs transformers that are rather deficient in amplification of the low audio frequencies as compared to some of the modern flat characteristic types, and that no provision has been made for power tube operation. In fact none of the accouterments usually found in high quality broadcast reception are used. This was done in order to provide a type of audio amplifier that has proven more successful in telegraphic reception than an amplifier which is particularly suited to 'phone work. Telegraphic signals are heterodyned to essentially one audio frequency, which will usually be 300 to 1000 cycles per second. It is useless to amplify audio frequencies lying outside this band, as to do so is simply to admit more extraneous noises into the reception. With the transformers employed the audio characteristic is sufficiently good so that short wave broadcasting is perfectly intelligible but where the receiver is being built specifically for this purpose it is suggested that the Areo Short Wave Special form of this receiver will prove more desirable in producing tone quality in keeping with the modern broadcast set.

In this receiver a high grade audio transformer has been used as well as a power tube of the 171 type in the last stage of audio. As a further insurance of good quality a new form of detection described in a paper by E. T. Chaffee and G. H. Browning on "The Detection of Small 'Signals,'" which appeared in the February, 1927, issue of the proceedings of the Institute of Radio Engineers in employed. Any attempt at an abstract of this paper would be unnecessary and "out of order" for present purposes except to mention a striking conclusion reached by the authors with regard to the use of the grid leak and condensers which is commonly used in the type of receiver about to be described. Such a combination (condenser and leak in shunt) has such characteristics that a low impedance is presented to currents of radio frequency and a high impedance to currents of audio frequency and direct current.

As pointed out in the conclusions of the paper cited above, this is not the ideal type of impedance for detection purposes if highest quality of output is to be obtained from the detector. As stated by the authors an impedance should be employed which has not only a high impedance to audio frequency currents and a low impedance to radio frequencies but a very low resistance to direct currents and a low impedance to radio frequencies, but a very low resistance to direct currents as well. An impedance of this type is provided by a large iron cored inductance shunted by a small fixed condenser. In the receiver to be described this impedance is the secondary of a Thordarson 2-1

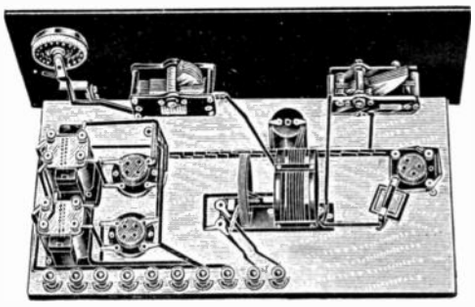


Fig. 4.
Back View of Aero Short Wave Receiver.

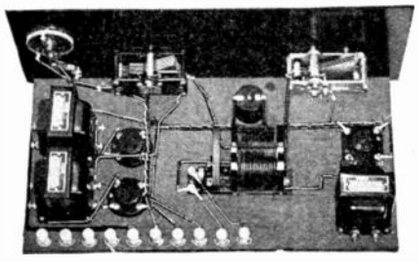


Fig. 8.
Back View of Aero Special Short Wave Receiver.

audio transformer shunted by a .0001 mfd. mica condenser. In this essential respect the Aero Short Wave Special Receiver differs from the many receivers for short waves described many times before in the popular press.

The construction of this receiver may proceed along the same lines as the previous one. Figure 8 shows the general apperance of the completed receiver.

In setting up the receiver for operation it should be noted that the detector and first stage of audio amplification require the use of 201-A tubes as in the regular type, while the last stage of audio is a 171 in this case.

In tuning the receiver it will be found that with many tubes it will be necessary to use 67½ volts on the plate of the detector tube in order to secure oscillation. A receiver of this type does not oscillate during the reception of radiophone signals. It will be found convenient to allow the receiver to oscillate while searching for such signals after which the regeneration control should be slightly retarded until the oscillation and the signal is tuned in clearly, with entire absence of heterodyne whistles.

Actual size blue prints and layout sheets of both the Aero Short Wave Receiver and the Aero Short Wave Special Receiver have been prepared, and both circuits and both layout sheets are packed FREE in the Aero foundation units, so that the home set builder can take his choice which to build, or later change over from one to the other. These foundation units contain a front panel deserving, from the standpoint of beauty, to grace any home, finely drilled and processed on Westinghouse Micarta. It is not our practice to sell the actual size blue prints or layout sheets, in as much as they are provided FREE with the Aero foundation units. The circuit presented herewith affords opportunity to view the prospect of the completed set. Dealers, however, for a cost of 50 cents, may procure a display set including both circuits and both layout sheets, and assist you thereby in determining which set you want to build.

List of Parts—Aero Short Wave Set

1 Aero Foundation Unit for Short Wave	$ 5.75
1 Aero Short Wave Tuner Kit LWT 125	12.50
1 Aero R. F. Choke Coil No. 60	1.50
2 National Style B Dials	5.00
1 Amsco .00014 Condenser	2.75
1 Amsco .00025 Condenser	3.00
1 Carter No. 2 Ir. Batt. Switch	.50
1 Carter Ir.-5 Im. Rheo	1.00
2 Silver-Marshall No. 511 Sockets	1.00
1 Benjamin Socket	.75
9 X-L Binding Posts; Lettered: Ant, Grd, A+, A Bat—, C Bat—, B 45+, B 90+, Speaker+, Speaker —	1.35
1 Carter .0001 mfd Condenser with Clips	.50
1 Carter H-2 ohm res	.25
1 Tobe 5-Meg. Tipon Grid Leak	.50
2 Thordarson 6-1 Audio Transformers	9.00
Screw Assortment and Bus Bar	.25

OPTIONAL:

1 Aero Int-4	125 to 250 meters	$4.00
1 Aero Int-5	235 to 550 meters	4.00
1 Aero Int-Zero	13 to 29.4 meters	4.00

BROKEN KIT PRICES

	List
One Int-1—Range 15 to 33.5 meters. Each	$4.00
One Int-2—Range 31.5 to 68 meters. Each	4.00
One Int-3—Range 57 to 133 meters. Each	4.00
One LWT Mounting Base. Each	3.00

List of Parts—Aero Short Wave Special

1 Aero Short Wave Foundation Unit	$ 5.75
1 Aero Short Wave LWT 125 Kit	12.50
1 Aero No. 60 Choke Coil	1.50
2 National Type B Dials	5.00
1 Amsco .00014 Condenser	2.75
1 Amsco .00025 Condenser	3.00
1 Carter 25-Ohm Rheostat	1.00
1 Carter Battery Switch	.50
1 Benjamin Socket	.75
2 Silver-Marshall No. 511 Sockets	1.00
3 Thordarson R200 Transformers (Audio)	24.00
10 X-L Binding Posts, Lettered: Ant., Grd., A+, A—, C—, 45B+, 90B+, B Amplifier+, Speaker+, Speaker —	1.50
1 Carter .0001 Mfd Condenser	.40
1 Carter H-2-2 ohm res	.25
Screw assortment and Bus Bar	.25
	$60.40

OPTIONAL

1 Radio Int-4, $4.00; 1 Aero Int-5.....$4.00
1 Aero Int-Zero..... 4.00

BROKEN KIT PRICES List

One Int-—Range 15 to 33.5 meters.
Each $4.00
One Int-2—Range 31.5 to 68 meters.
Each 4.00
One Int-3—Range 57 to 133 meters.
Each 4.00
One LWT Mounting Base. Each..... 3.00

Below—Layout and wiring diagrams of Aero and Aero Special Short Wave Receivers.

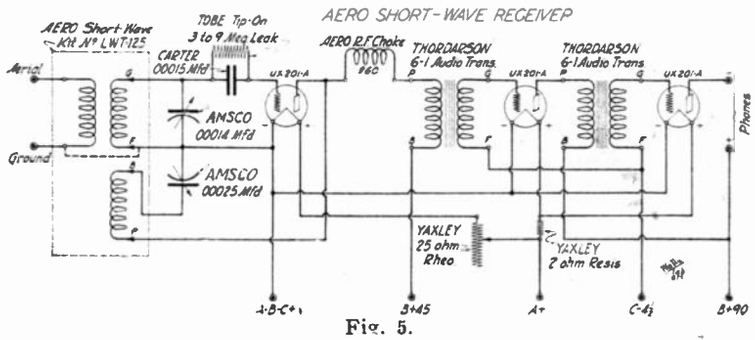
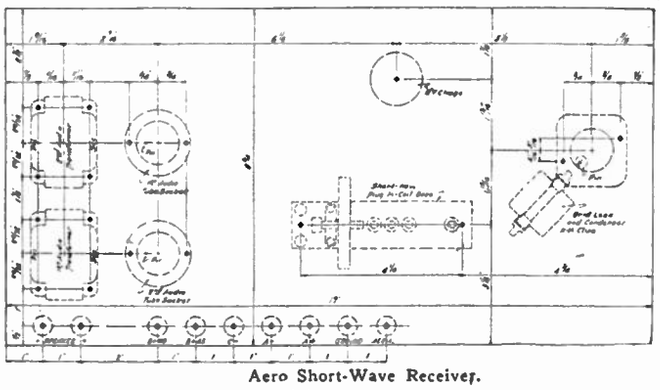
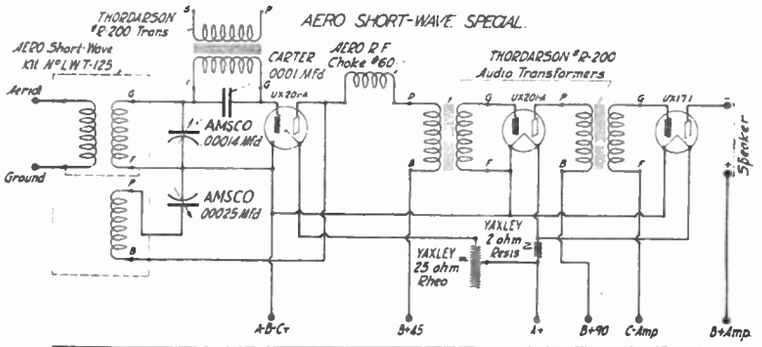


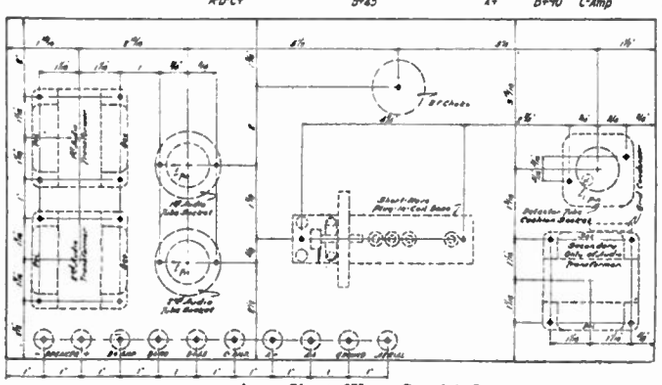
Fig. 5.



Aero Short-Wave Receiver.

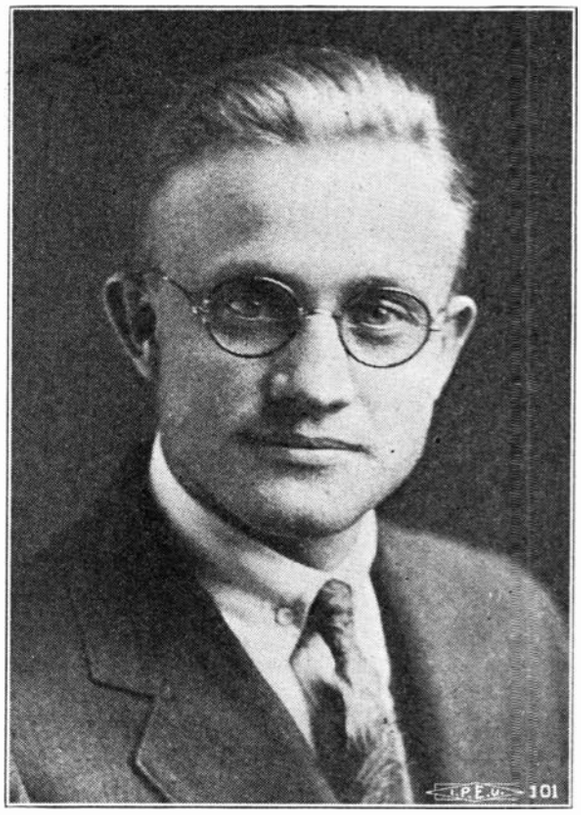
Fig. 3.
Baseboard Layout of Aero Short Wave Receiver.





Aero Short Wave Special Layout.

Baseboard Layout of Aero Short Wave Special.

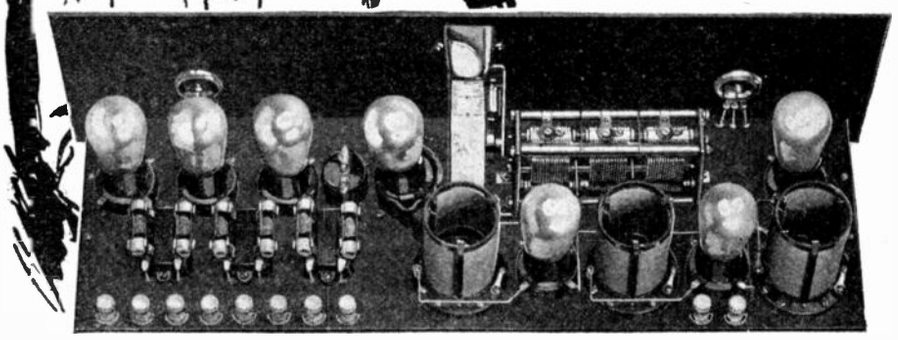


Virgil Schoenberg, Chief and Electrical Engineer and Constructor of Radio Station WCFL, the Voice of Labor. Member of Local No. 134 I. B. E. W.

Memoranda

AERO-SEVEN RECEIVER

10-Kilocycle Selectivity



Utilizing New 340 Tubes

Unique Features

The Aero-Seven Receiver, which is being featured in the prominent radio magazines and newspapers, is a new tried and tested tuned R. F. circuit, incorporating the most modern radio improvements at a popular price. It is a distinct innovation in a tuned R. F. receiver, utilizing three stages of R. F. and three stages of resistance-coupled audio. Circuit is built around the famous improved Aero Universal Coils, with improved Amsco S. L. tuning 3-gang condenser, S-M single-control drum dial and the tried and tested parts of other famous manufacturers. Such names as Carter, X-L, Westinghouse, Aero, Amsco and Silver-Marshall assure you of a circuit that is the final word in perfection.

Distinct features are: the new Hi-Mu tube at input and in R. F. stages, potentiometer control, higher amplification, 10-kilocycle selectivity and **true** single control.

The Aero-Seven has a broadcast range from below 200 meters to over 550 meters (1500-500 kc) and requires no shielding as with the small Aero coils, direct pick-up is negligible and coupling between coils is the very minimum. The coils are twice-matched at both high and low frequencies of the broadcast band, thus eliminating many difficulties in single dial control and overcoming one of the principle causes of disappointments.

The adjustable compensators on the Amsco condensers facilitate the equalization of circuits, solving the major problem of tandem tuning.

The extremely sharp selectivity of the Aero-Seven circuit is due to the low-resistance of the coils. The high voltage gain per stage, due to the extremely low loss construction, assures extreme distant reception and greatest volume and sensitivity is assured through the high efficiency of the coil windings.

New and Unique Hookup 3 Stages of Radio Frequency 3 Stages of Audio Amplification

The Aero-Seven has a new and unique hook-up that incorporates three stages of R. F. and three stages of Audio. There are two stages of tuned radio frequency and a special coupling stage, the secondary function of which is to prevent antenna detuning, thereby giving single control which is both theoretically and practically perfect. This independent antenna circuit is of a new and efficient design and employs a resistance connected between the antenna and ground inputting to the first grid circuit. Five CX340 tubes are used—3 in the R. F. circuit, one detector and one in the audio.

In the three audio stages, one 171 power tube is used, one 201A tube and the one CX340 tube in the input.

The circuit, therefore, is different from the usual 7-tube R. F. circuits, which variations contribute to its optimum selectivity, perfect quality and thrilling volume.

The combination of all the various parts, the matching of the Aero Universal Coils, together with the Amsco compensating 3-gang condenser, with true single control and potentiometer control, greatly simplifies operation and tuning, while adding efficiency to the circuit.

First Use of New CX340 Tubes—1-6/10 Times Better

Utilizing the new CX340 Cunningham tubes in place of the usual 201A, gives the Aero-Seven the distinction of being the first circuit using this superior method. CX340 tubes are 1-6/10 times more effective than 201A tubes, having a 5-volt filament and .25 amperes; plate, 180 volts maximum. In this receiver 90 volts is used constantly on the plate for the R. F. circuit, something seldom attempted but efficiently worked out here. It is a High Mu tube, having a high amplification factor (Mu-30) and is used both as a detector and as a radio and audio amplifier. The Aero-Seven is specially designed to operate with this new and better CX340 tube and the results secured will be a pleasing revelation to you. It is surprising what tone and volume is secured with a minimum use of current.

Resistance Coupled Audio Amplification

Resistance coupled audio amplification in the Aero-7 attains a quality of reproduction unapproachable in other systems. It preserves the extraordinary quality consistently achieved by Aero-7's 10-kilocycle selectivity.

10 Kilocycle Selectivity Now a Real Fact

Ten kilocycle selectivity is OPTIMUM Selectivity. It means a receiver that tunes sharply enough to eliminate interference and yet does not tune so sharply as to cause distortion. It is the ideal tuning characteristic. "Optimum tuning," says the engineer, when he means a perfect set.

Why bother with anything but the best? Why put up with anything but 10-kilocycle selectivity, as represented in the Aero-Seven circuit?

Due to the low-loss construction of the coils and condensers in the Aero-Seven and the great selectivity introduced into the circuit itself, you get selectivity so sharp that you cannot get two stations at one time under present broadcast regulations, at the same time providing adequate frequency margin to prevent high "cut off"—distortion.

Imagine what this means in perfect radio reception. Selectivity, the ability to tune in clearly, sharply, without fear of disturbance in getting the station you want whenever you want it—that's something every radio fan has long desired. It is an actuality in the Aero-Seven—a feature that is necessary in an up-to-date circuit—a feature that you get in the Aero-Seven when you build it.

New, Modern, Proved Features in Aero-Seven

10 Kilocycle selectivity.
Resistance coupled amplification.
Uses new CX340 tubes instead of 201A.
3 stages of R. F.
3 stages of audio amplification.
Volume maintained over entire broadcast range.
Extreme D-X reception.
Potentiometer control.
Silver-Marshall single drum dial.
True single control.
Aero Coils are twice matched at both high and low frequencies.
Amsco adjustable condensers.
Carter resistances.
Westinghouse Foundation Unit.
X-L Posts.
High quality parts throughout.
Range below 200 to above 550 meters (1,500-500 K€).
Low loss characteristics throughout.
Perfectly compensated—variation in antenna circuit doesn't affect it.
Wiring underneath sub-panel.
Simple construction.
Easy to build in quick time.
The most popular-priced 7-tube circuit.

See article in this issue

The Aero-Seven-tube Receiver assures you of the very latest in radio. It has everything—beautiful tone, 10 kilocycle selectivity—extreme long range and a volume at your command that can be raised to music-hall proportion or lowered to slumbering whispers. The particularly meritorious application of resistance coupling creates a most remarkable tone. It gives you a receiver that is in a class all its own—a real conqueror of space—a companion that you can depend upon absolutely in any emergency. It delivers quality that is quality, and yet its construction is so low in cost as to be almost unbelievable.

An Opportunity for Set Builders

The set builder will find the Aero-Seven a most profitable receiver to build. It is an extremely simple circuit—efficient, high grade and having a record of exceptional performance. It could hardly be duplicated in a factory-built set at double the cost.

You can make big money building this set for your friends and get a real "kick" out of it yourself.

Complete parts, drilled and engraved panels and foundation units are being distributed through the jobbing trade and are available at leading radio stores everywhere. If your dealer cannot supply you, order direct giving your dealer's name and we will see that you are supplied promptly.

A full-size working blueprint and booklet of assembly and operating instructions with complete data is furnished, which makes it both practical and easy to build this circuit quickly. Build yours early—get the jump on the other fellow.

Get the facts. Mail the coupon and 10c stamps for this valuable booklet. Send today—NOW!

Aero Products, Inc.
Dept. 409 1768 Wilson Ave., Chicago.

Dear Sirs: Enclosed find 10c for which please send me life-size blueprints, assembly diagrams, construction data and all the facts in building the new Aero-Seven Receiver.

Name .....

Address .....

Get the Facts—MAIL NOW→

AERO PRODUCTS, INC.
1768 Wilson Ave., Dept. 409 Chicago, U. S. A.

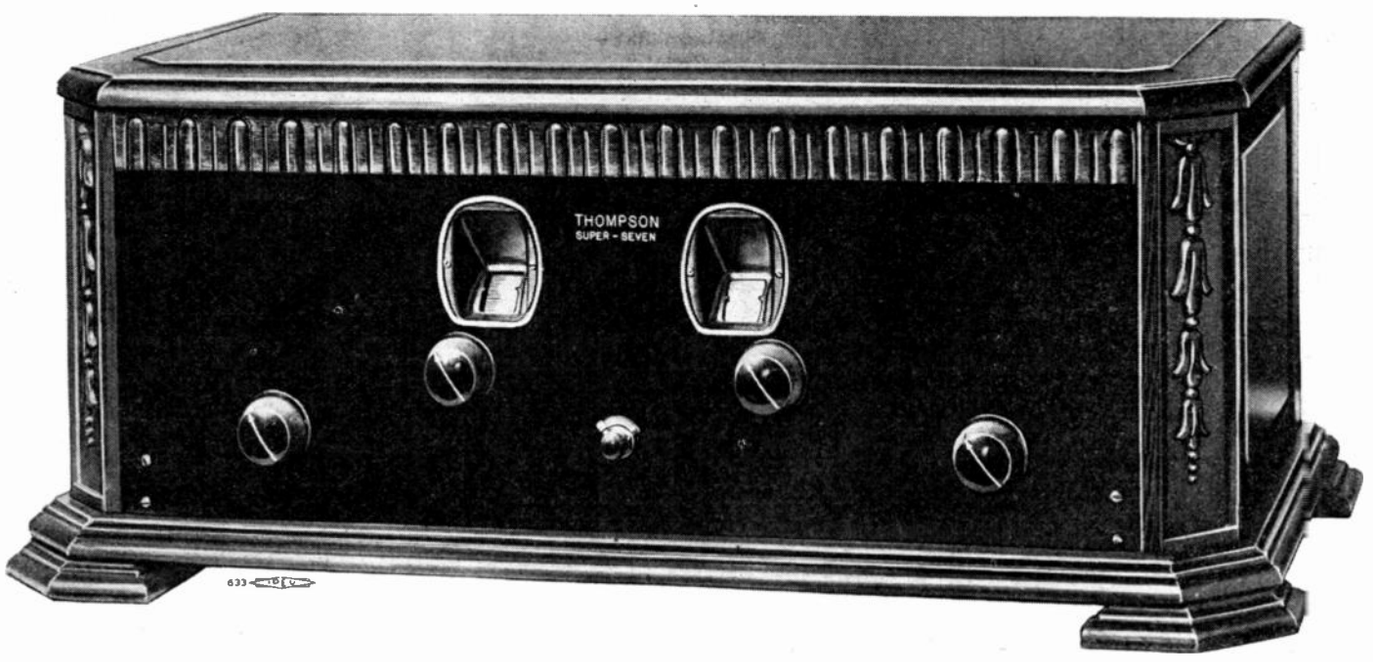
ASSOCIATED MANUFACTURERS—AMSCO, AERO, CARTER, WESTINGHOUSE-MICARTA, SILVER-MARSHALL, X-L.

Say you saw it in the WCFL Radio Magazine

The Thompson Super Seven

A Three Thousand Mile Superheterodyne Incorporating the Latest Ideas in Tonal Quality and Selectivity

By Sidney J. Thompson



OF ALL the Super Heterodynes that have appeared on the market within the last few years, very few have actually been within the reach of the average fan.

It seems that the general trend among designers of Supers has been slowly towards increasing the number of tubes and in doing so the average fan has found it increasingly difficult to build a good Super at a reasonable cost.

With the above thoughts in mind, the writer set about building a Super which would satisfy the very critical demands, and still be within the reach of the vast majority. Considerable experimental work was done and many different intermediate transformers tried. In an effort to reduce the cost as much as possible, a number of cheap long wave transformers were tested. The laboratory results were so utterly disgusting with them that they were promptly dropped. It finally appeared as if there was no other alternative, to produce a Super that could deliver the goods, but to proceed blindfolded insofar as cost was concerned, in which event, the main object would have been defeated.

As a last resort, several manufacturers of high grade products were called upon and the cooperation of their engineering staff requested. Then there began an elimination contest which was to result finally in the selection of a combination of quality parts to produce the desired results; namely, a low priced Super that could deliver the goods. The engineers were instructed to produce the finest reasonably priced Super Heterodyne that could be built with quality products.

In presenting for the first time the constructional details of the set, it is undoubtedly in order to express my appreciation to the following manufacturers whose utmost cooperation has been given.

Silver Marshall, Inc.
Camfield Radio Mfg. Co.
Ellis Electrical Laboratories.
The Halldorson Co.
Tobe Deutschman Co.
Westinghouse Micarta.
X-L Radio Laboratories.
Carter Manufacturing Co.
Aalco Radio Laboratories.
Arthur Lynch.

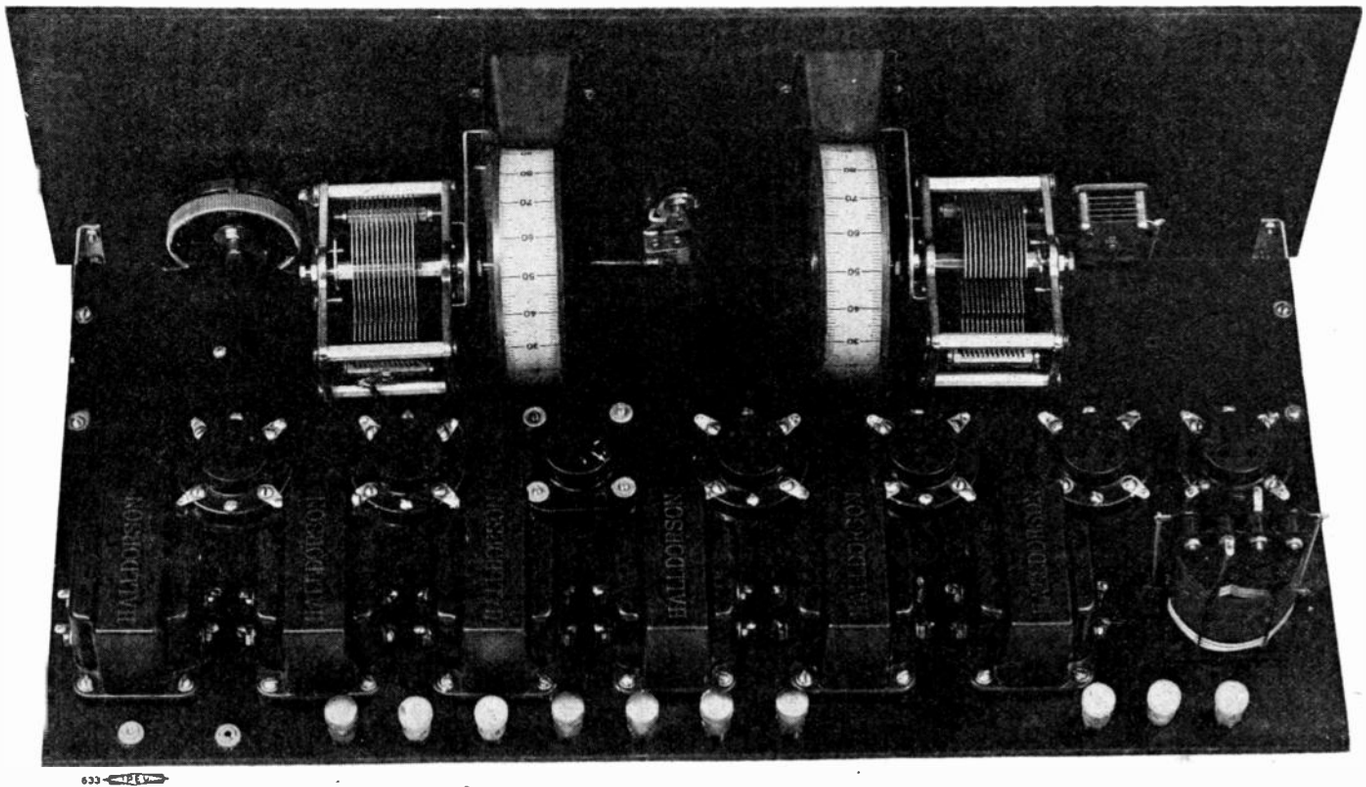
Engineers whose time is valuable and costly to the manufacturers have worked untiringly in the interests of the set builder and in presenting to the fans the result of more engineering ability in one set than has ever been incorporated in a single constructional article before. I feel that the home constructor, the professional set builder and experimenters are greatly indebted to the respective manufacturers. The fans may proceed on the construction of the receiver with the fullest assurance that their expectations of the set will be fulfilled. I am sure also, that any manufacturer who has cooperated in the development of this receiver will be only too glad to assist set builders in obtaining the same results that the laboratory set produced.

A complete summary of the experimental work and the time required in the development of the set would no doubt make a very interesting story, but as it would not serve any useful purpose in the construction of the Receiver, it will be omitted. Suffice it is to say that many engineering problems had to be overcome. Tonal quality and selectivity were the important features sought and there were many ways of obtaining both. Other Audio amplifying systems could very nicely have been used and would have produced excellent tone. In doing so, however, some other purpose of the set would necessarily have been defeated.

Tonal Quality and Overtones

Let us consider what is required to produce true rendition of the original broadcast. It is not a difficult matter to obtain excellent high note reproduction, likewise it is not difficult to obtain excellent low note reproduction.

Audio amplifying systems can be developed to accentuate either high or low



"The Works" of a Thompson Super Seven.

notes. In a great many cases it is more pleasing to accentuate, for instance, the low base notes. To some this accentuation gives a soft, deep tone that is rather pleasing. Other tastes for music frequently vary the other way, preference being given to accentuation of the higher notes. Obviously, neither one of these systems can produce perfect reproduction of the original broadcast and neither one would satisfy a trained musician.

It is surprising how few people enjoy listening to a woman over the radio and it is very rare when a soprano is reproduced without sounding squeaky. Not all of the blame for the disapproval of a woman's voice can be placed upon the shoulders of our fairer sex. In fact, the major portion of the blame belongs to the audio amplifying systems of radio sets in use today.

The perfect Audio system then would be one wherein the loud speaker and the Audio Transformers were so balanced that a flat amplification curve is obtained not for the Audio system alone nor for the loud speaker, but for the entire combination of receiving set and speaker.

The output from the loud speaker, should represent, in other words, a perfectly flat line giving even amplification throughout the entire audible range. This range should take in at least eight thousand cycles, for in many instances true amplification of frequencies of seven to eight thousand cycles are required. Should they be left out entirely, as is frequently the case, the result is powerful base note amplification, fair amplification of the middle register, but a suppression of the high notes with a corresponding disastrous loss in shadings and overtones of the voice.

Overtone amplification is obtained in but one manner. The ability of the Audio Transformers to produce an output energy which does not over accentuate nor suppress any frequencies. This allows full amplification of both high or low notes together with any given intermediate frequencies and the overtones are recreated. Only in this way is it possible to obtain perfect amplification accurately following the true shading of the artist's voice.

When an Audio amplifying system over amplifies some frequencies and suppresses others, the same effect will appear in the overtones where the rich, deep shadings and life of music are produced. If the amplifying system does not faithfully reproduce the weak, delicate shadings of the overtones they will become entirely unlike the original, for even the faintest trace of under or over amplification on a very delicate overtone gives a false reproduction of the most important element of music.

The system of amplification used in this receiver has been worked out according to the above theory. The overtones that distinguish the work of an amateur from that of our old masters have received the greatest consideration throughout the entire receiver and the result of this consideration is truly a revelation in the faithful reproduction of music thrilling both to the music lover and D. X. hound alike.

Precision Selectivity

The problem of selectivity alone is somewhat easily overcome, but to obtain selectivity, tonal quality and distance combined is a decidedly different problem. To obtain selectivity and still pass a wide enough frequency requires an extremely careful balancing of the component parts of the receiver. It is necessary, in order to retain amplification over the entire audible range that we have a band of at least ten kilo cycles in which to work. If we increase the selectivity beyond this point, we immediately enter the field of reproduction and begin to cut side bands of the music and bad distortion is the result.

The problem, therefore, is to get as close as possible to the point where we do not cut side bands. When this is done we have reached what might be called the peak of selectivity. We can go no further. This point can be only obtained by precision peaking of the filter transformer to cut off on either side of the ten kilo cycle band, five kilo cycles each side of the peak.

We continually see glowing reports of hair splitting selectivity, knife edge selectivity, and so forth, but to the seasoned engineer and I hope eventually to the fan and set builder all of these superlative adjectives mean but one thing—"hokum"—for the very simple reason that any Super can be designed so selective that a station cannot even get through.

Yes! Knife edge and hair splitting selectivity, but is it of any value to the fellow who wants to get stations with a smooth, comfortable ease without interference and maintain the finest tonal quality. This can only be done, not by freak-

ish transformers nor freakish methods of filtering, but by precision methods of calibrating as close to the ten kilo cycle band as precision apparatus will permit and then cutting the amplification off sharp. Here, then, is the engineers' answer to the problem of selectivity.

In the future, precision methods for obtaining selectivity in a circuit will be the governing factor in the selectivity of a Receiver and fans will do well to learn the truth now.

Sensitivity

Sensitivity is rather difficult to define. It might be likened to the acceleration of a motor car. Its chief requirement is that every part in the receiver operates at maximum efficiency. Coupled with this, of course, is the number of R. F. stages used. The number of stages, or the number of tubes as one might wish to look at it, is, however, rather poor guide to the sensitivity of a Receiver.

As an illustration of this, a set may be built using ten or twelve tubes, each tube operating perhaps only 50 percent efficient. The over all result in sensitiveness then would be little better than a five tube receiver. For this reason, it is far more important that the efficiency of each stage of amplification be taken into consideration more so than the number of tubes used in the receiver.

The machine described used only seven tubes, but the efficiency of every tube is as high as it is possible to attain.

The first step in the construction of the Receiver is a careful study of the circuit and baseboard layout. It will be noted that the arrangement of parts is such that all leads have been cut down to a minimum. By-pass condensers have been judiciously used in order to obtain maximum efficiency.

The Oscillator circuit is designed so that it will not unbalance the first detector tube on weak signals. Care should be taken to see that the rotor plates of the Oscillator Condenser are connected to the plate of the Oscillator tube and the stator to the grid, otherwise the Oscillator dial will be troubled with body capacity.

The use of the "C" battery has been very liberal, a C bias being used on the R.F. tubes in preference to the conventional lesser method of using a potentiometer. This method has been found more efficient in every way, and it reduces the "B" battery consumption of the set. There is one thing which will possibly strike the fan as being somewhat contrary to the trend of general design. It was mentioned earlier in this article that sensitivity of a Receiver is dependent on the efficiency of each R. F. stage. By using two long wave iron core transformers with a very high amplification factor the efficiency or amplification is brought up very high.

In order to obtain the desired selectivity with this system, the filter transformer is carefully designed and by precision methods its amplification cuts off very sharp on either side of a ten kilo cycle band.

Referring to figure in the sub panel layout plan, it will be seen that uniformity in design has been accomplished without sacrifice in the efficiency. In fact all leads have been thereby shortened.

Beginning from left to right, the tubes are arranged as follows:

First tube	Oscillator
Second tube	First Detector
Third tube	First R. F.
Fourth tube	Second R. F.
Fifth tube	Detector
Sixth tube	First Audio
Seventh tube	Second Audio

The control of volume and the sensitiveness of the receiver is handled through one rheostat in the filament circuit of the R. F. tubes only. This arrangement gives a smooth even variation of volume and also allows perfect control over any tendency of the R. F. tubes to oscillate.

For the sake of simplicity, binding posts were used throughout the Receiver. A Yaxley Cable and Plug could, however, be worked in very nicely and would no doubt improve the appearance somewhat. Though the machine has been designed primarily for loop operation, an antenna coupling coil may be inserted as shown on the diagram by the dotted line.

Obviously the distance getting ability is somewhat better when an antenna and ground are used, but this is partially offset by the fact that there is considerably less static disturbance with a loop and in a great many cases the same signal strength may be obtained with loop operation as with an outside aerial, most especially on distant stations. This is due to the fact that the loop being directional eliminates a great many squeals, howls and heterodyning which accompany the reception of distant stations and which an antenna would bring in above the signal strength of the station being received.

In assembling and wiring the Super, it is advisable to mount the parts on the sub-panel first leaving the front panel aside. It is suggested, also, that the Ellis Oscillator Coupler be mounted last.

The Ellis Coupler, by virtue of its low resistance space winding and high efficiency, is necessarily rather fragile and by mounting the unit last there would be no likelihood of damaging it.

The Receiver could be wired either with Belden Color Rubber Hookup wire or Acme Celatsite. In either case the different circuits can be wired with different colored wire. In wiring the set, green should be used for all grid wires, red for B plus leads, blue for A plus leads, and natural or yellow for all negative connections. This allows the connections to be checked rather easily, if necessary, after the Receiver is assembled.

U. X. 201A tubes or their equivalent should be used throughout the entire Receiver with the exception of the last Audio Stage, in which case it is recommended that a 171 power tube be used.

If the wiring has been carefully done, there is no reason why the set should not operate perfectly from the very start. It may be necessary to vary slightly the "C" batter voltage but it will be found in most cases, if the tubes used are O. K. that the three volt "C" bias for the radio frequency tubes as shown on the diagram will be correct.

Should a "B" battery eliminator be used, one of sufficient output should be obtained, capable of delivering at least one hundred and eighty volts at about forty mills, since this is what the Thompson Super Seven will draw when a 171 power tube is used on the last stage.

The fact that almost every tube in the Receiver is biased with a "C" battery reduces the battery current consumption considerably and practically prevents any danger of the set motor boating with a "B" Eliminator. Should this difficulty arise, as it might in the case of some eliminators with a high internal resistance, it can be eliminated by by-passing the output of the Eliminator with from two to ten Mfd. by-pass condensers.

An Eliminator that was found to work exceptionally well on the new Thompson Super Seven was the Silver Marshall Reservoir B. It delivers ample current and is silent in operation. A distinct advance forward has been made in the Silver Marshall Eliminator by the use of a glow tube to maintain the output voltage constant. The glow tube eliminates entirely the necessity for any variable adjustments, as it automatically delivers the correct voltage regardless of the current drawn by the Receiver.

Practically any high grade loud speaker will be found quite satisfactory. For those who prefer the Orthophonic type, the Temple Speaker cannot be mentioned too highly. Even the writer, who has always been an ardent booster for cones, isn't so sure that the Temple Orthophonic hasn't somewhat killed the solid belief in cone type speakers. However, a thoroughly high grade cone speaker is the "Baratone" eighteen or thirty-two inch. It is manufactured by the Baratone Mfg. Co., 844 W. Jackson Blvd., Chicago, and while comparatively unknown to the average fan, is nevertheless well worth hearing.

A six volt storage battery will be needed to light the filaments of the tubes. If a Trickle charger is to be used, a battery of eighty amperes capacity will be sufficient, otherwise, it would be advisable to get a little larger storage battery.

The Aalco adjustable loop is recommended where maximum distance is desired. However, either the Mathieson or the Bodine .0005 loops will cover the wavelength range nicely and give excellent results in every way.

The cabinet in which the set is pictured is the well known "Fritts." It needs no

introduction to set builders, it is known to all for its distinguished appearance.

Last but not least be sure you use good tubes—R. C. A. Cunningham or Sonatron tubes will do the work.

A set recently tested just north of Minneapolis has been receiving consistently P.W.X., Havana, Cuba; K.G.O., Oakland, California; K.F.I., Los Angeles; C.F.C.N., Calgary, Canada; C.J.C.A., Edmonton, Canada; W.B.Z.-W.E.A.F. and C.N.R.T., Toronto, Canada. All of these stations have been brought in with enough volume for the average home. It would, of course, be impossible here to give a complete "log" of the model sets located in Chicago and other parts of the country, but the above will act as a guide to what one may expect of the Receiver if carefully built.

The distance getting ability of any receiver depends on many conditions other than those having to do with the receiver itself.

Accessories, of course, should all be the best, if extreme D.X. reception is expected with regularity on the set.

List of Parts for the Thompson Super Seven

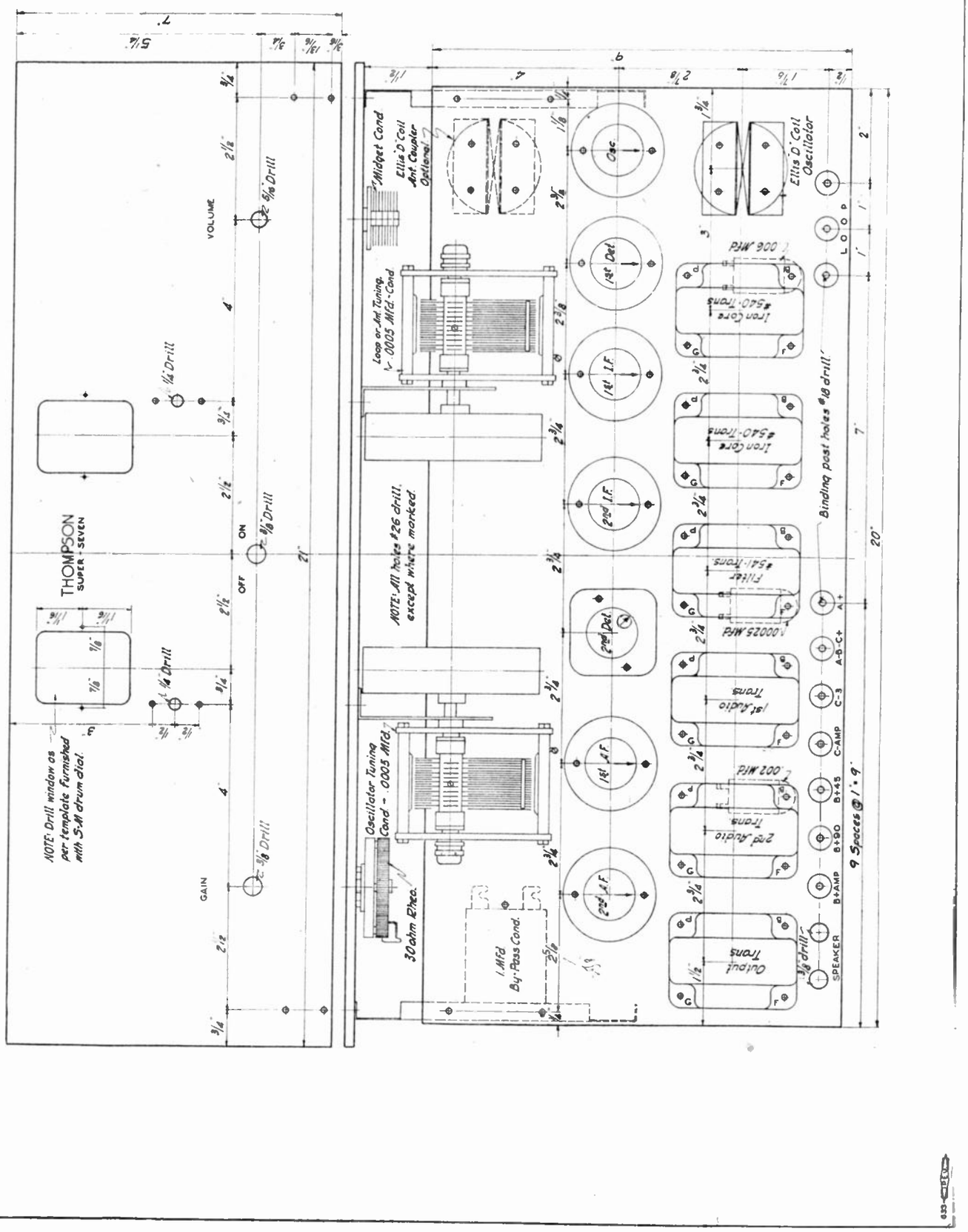
1	Silver Marshall No. 340 Midget Condenser	$ 1.50
6	Silver Marshall Tube Sockets, 50c each	3.00
2	Silver Marshall Drum Type Dials No. 805, $3.00 each	6.00
1	Pair Silver Marshall Brackets	.70
1	Carter Imp. Battery Switch	.65
2	Carter Imp. Jacks	.60
1	Carter H2 Resistance	.25
1	Carter H1½ Resistance	.25
1	Carter IR 30 Ohm Rheostat	1.35
1	Carter .006 Condenser	.85
1	Carter 110 1 mfd. Condenser	1.25
1	Carter .002 Condenser	.50
1	Carter .00025 Condenser	.40
1	Carter .001 Condenser	.50
2	Halldorson Precision Iron Core No. 540 Transformers, $6.00 each	12.00
1	Halldorson Precision No. 541 Filter Transformer	6.00
2	Halldorson Overtone Audio Transformers, $6.00 each	12.00
1	Halldorson Overtone Output Transformers	6.00
1	Micarta 7x21 Panel drilled and engraved	3.40
1	Micarta 9x20 sub panel drilled and engraved	4.95
1	Arthur Lynch 3 meg. gridleak	.50
1	Arthur Lynch Resistor Mounting	.35
2	Camfield .0005 mfd. Condensers, $6.00 each	12.00
10	X.L. Spring Binding Posts, 15c each	1.50
1	Ellis Oscillator Coupler	3.00
1	Benjamin Spring Socket	.75
	Total	$78.90

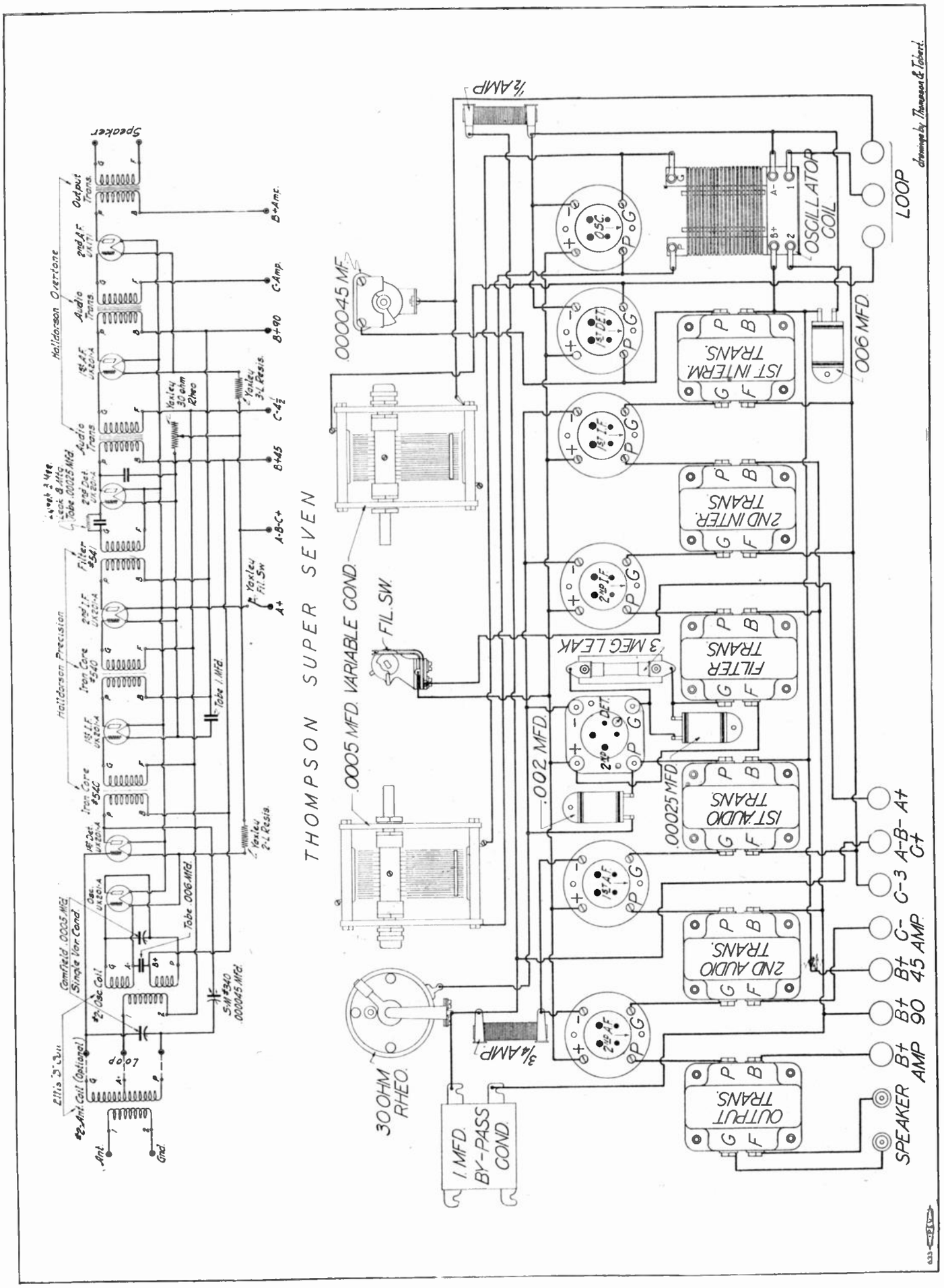
When aerial and ground operation is desired in preference to a loop, use—

1 No. 2 Ellis Antenna Coupler..... $3.00

(Circuits on following pages.)

Memoranda


THOMPSON
SUPER - SEVEN
VOLUME
GAIN
ON
OFF
NOTE: Drill window as per template furnished with S-M drum dial.
NOTE: All holes #26 drill. except where marked.
Midget Cond
Ellis D Coil Ant. Coupler Optional
Ellis D Coil Oscillator
Loop or Ant Tuning .0005 Mfd. Cond.
Oscillator Tuning Cond. - .0005 Mfd.
30 ohm Rheo.
1 Mfd By-Pass Cond.
Binding post holes #8 drill
9 Spaces @ 1" = 9"
Iron Core #540 Trans
Filter #541 Trans
1st Audio Trans
2nd Audio Trans
Output Trans
Osc
1st Det.
1st I.F.
2nd I.F.
2nd Det.
1st I.F.
2nd I.F.
.006 Mfd
.00025 Mfd
.002 Mfd
L O O P
A+
A-B-C+
C-3
C-AMP
B+45
B+90
B+AMP
SPEAKER


THOMPSON SUPER SEVEN
Speaker
Output Trans.
2nd A.F. UX171
Audio Trans.
1st A.F. UX120-A
2nd Det. UX120-A
Audio Trans.
Filter #541
2nd I.F. UX120-A
Iron Core #540
1st I.F. UX120-A
Iron Core #540
1st Det. UX120-A
Osc. UX120-A
Comfield .0005 Mfd. Single Vernier Cond.
Osc Coil
Ant Coil (Optional)
Ant.
Gnd.
Tube .006 Mfd.
Tube .1 Mfd.
Tube .006 Mfd.
Sw. #340 .000045 Mfd.
Yaxley 30 ohm Rheo
Yaxley 3/4 Resis.
Yaxley 2-1 Resis.
Yaxley Fil. Sw.
B+Amp.
C-Amp.
B+90
C-4½
B+45
A-B-C+
A+
Halldorson Overtone
Halldorson Precision
.000045 MF.
.0005 MFD. VARIABLE COND.
FIL. SW.
30 OHM RHEO.
1 MFD. BY-PASS COND.
¾ AMP
½ AMP
3 MEG LEAK
.002 MFD.
.00025 MFD.
.006 MFD.
OSCILLATOR COIL
LOOP
drawing by Thompson & Tobert
Osc.
1st Det.
2nd Det.
1st A.F.
2nd A.F.
1ST INTERM. TRANS.
2ND INTER. TRANS.
FILTER TRANS.
1ST AUDIO TRANS.
2ND AUDIO TRANS.
OUTPUT TRANS.
A- 1 B+ 2
P B G F
A-B- A+ C+
C-3
C- 45 AMP.
B+ 90
B+ AMP
SPEAKER

Group Filament Control for the Old Receiver

By Austin C. Lescarboura

SETS	TUBES USED	CURRENT CONSUMED	COMBINATION (Amperites)
3-tube set using	3—201-A	.75 amperes	1—No. 1-A 1—No. 112
	2—201-A 1—power tube	1.00 amperes	1—No. 112 1—No. 112
4-tube set using	4—201-A	1.00 amperes	1—No. 112 1—No. 112
	3—201-A 1—power tube	1.25 amperes	1—No. 3-A 1—No. 112
5-tube set using	5—201-A	1.25 amperes	1—No. 3-A 1—No. 112
	4—201-A 1—power tube	1.50 amperes	1—No. 4-A 1—No. 112
6-tube set using	6—201-A	1.50 amperes	1—No. 4-A 1—No. 112
	5—201-A 1—power tube	1.75 amperes	1—No. 4-A 1—No. 3-A
7-tube set using	7—201-A	1.75 amperes	1—No. 4-A 1—No. 3-A
	6—201-A 1—power tube	2.00 amperes	1—No. 4-A 1—No. 4-A

Automatic Filament Control Data for Three to Seven Tube Sets.

If there is one outsanding difference between the receiver of yesterday and that of today, it is in the matter of filament control. The old receiver has a plurality of rheostats, each of which must be carefully adjusted and readjusted from time to time if the tubes are to be operated at maximum efficiency and without danger of either excessive voltage or insufficient voltage to cause their early finish. Set designers, more and more, have come to appreciate the importance of using correct filament voltage as a means of distortionless reproduction quite as much as to insure maximum tube life.

Through a simple means of group control of all tube filaments, it now becomes possible to bring the old receiver up to date in the matter of filament control and, if desired, in the matter of distortionless volume control as well. Furthermore, the panel layout may be materially simplified, thus giving the set the appearance, as well as the workability, of a modern receiver .

The group control comprises a new device known as the Amperite Adapter, which consists of a base with ingenious clips to take two standard amperite units of proper value. The units snap in place and are thereby connected in parallel, with their combined regulating capacity placed in the minus "A" lead from battery to set. Various combinations of amperites may be used to take care of the filament control of any receiver, from the small three-tube set with standard ¼-ampere tubes throughout, to the seven-tube set with six ¼-ampere tubes and one ½-ampere power tube, as well as everything in between. Here are just a few combinations to take care of the requirements of several typical receivers:

The proper control at hand, the installation is a simple enough matter. No tools are required. No knowledge of radio technique is required. No internal changes or major operations are necessary. The amperite adapter is placed either inside the set cabinet or behind it, and screwed in place if desired. Again, the adapter may be placed near the battery if preferred. It is necessary, of course, to turn the rheostats of the set full on, so that their resistance is no longer effective. If the set is provided with fixed resistances or so-called ballasts, these should be short-circuited with a bit of bare wire twisted about the two clips or binding posts. The amperite adapter is now ready to control the receiver tubes automatically and no further attention need be given to the filament control problem, unless changes are made in the types of tubes used, and then only if the tubes happen to draw more or less current, in which event the amperite combination is changed to take care of the new requirements.

If the receiver is provided with rheostats, but not with a volume control, it is recommended that one of the rheostats be removed from the panel and in its place be installed a clarostat, tonatrol or other variable resistor capable of a resistance range of from virtually zero to several hundred thousand ohms. This variable resistor should be connected across the secondary of the first transformer, so as to serve as a distortionless volume control permitting the loud speaker rendition to be varied from a mere whisper to the full output by the mere twist of the knob of the variable resistor.

The simple change from rheostats or fixed resistances to the amperite adapter control will do much to modernize the old set. Not only will it simplify the operation of the receiver by dispensing with troublesome rheostats, but it will insure the proper operation of the tubes at all times. The tone quality will be improved because the proper emission will be maintained in all the tubes during their entire life, which is not the case when tubes are operated at above or below their rated voltage, causing paralysis and even early finish.

And so the old set, at a small expenditure of time, effort and money, can be modernized in a very simple and effective way.

Notes

Farmer-Labor Co-Operator's Department

Doings of the Producers on the Farm and Consumers in the City

(The purpose of this department is to publish general news of the co-operative movement, to promote and co-ordinate the activities of both the organized farmer and organized labor co-operatives. Farmers wishing to sell produce of any kind will be placed in communication with the best markets in which to sell; those co-operatives wishing to buy commodities will be informed of the best sources of supply.)

THE NATIONAL FARMERS' Union,—the exact title of which is the Farmers' Educational and Co-operative union of America,—bears the same relation to the organized farmers that the American Federation of Labor does to the organized workers. The first local was started by a group of Texas farmers whose leader was Newton Gresham, in the year 1902. They are now organized in twenty-eight states. A few of the strongest state unions are Iowa, Kansas, Nebraska, Minnesota, North and South Dakota, and Montana. In 1905, the Farmers' Union label was adopted, consisting of a plow, a hoe, and a rake. The Farmers' Union has always maintained a friendly attitude toward union labor.

The Iowa Farmers' Union

One of the strongest of the farmers' unions of the middle west is the Farmers' Union of Iowa. Mr. Milo Reno is State President and one of the outstanding figures of the organized farmers' movement in the corn belt states. He was one of the strongest and most consistent supporters of Senator Brookhart in his various campaigns.

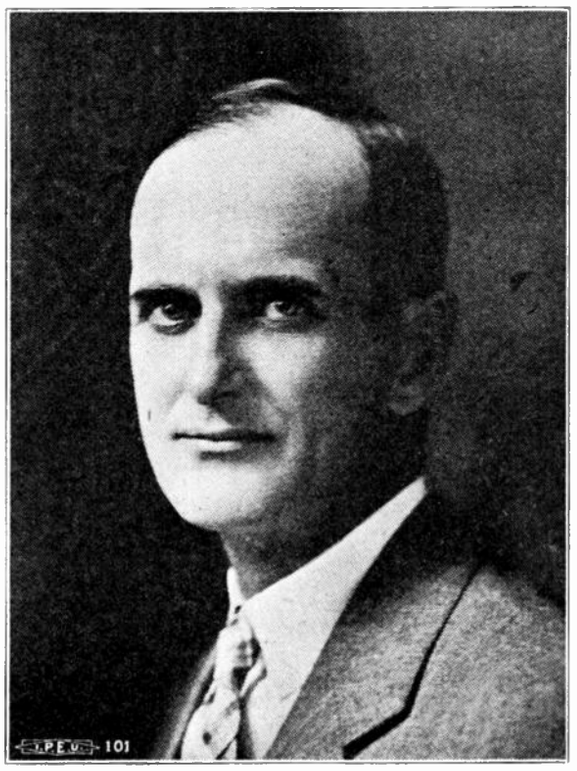
Frank E. Wheatcraft.

The work of the Iowa Farmers' Union is divided among several important departments, namely: the Legislative, the Live Stock Marketing, Life and Property Insurance, Wholesale Buying, and General Produce. The Live Stock Department is treated at greater length on another page.

The Legislative Department is on the job to watch state legislation.

The Life and Property Insurance Department, one of the fastest growing co-operative insurance organizations in the United States, not only insures the lives and property of its membership at more advantageous rates than the old line companies, but

Milo Reno, President of the Farmers' Union of Iowa and General Manager Farmers' Union Live Stock Commission of Chicago and St. Paul.



Underwood & Underwood.
C. W. White, General Manager of Wenatchee District Co-operative Association.

its funds are used in financing the farmers instead of being used by big business as are the funds of other insurance companies.

The Wholesale Buying Department, known as the Farmers' Union Service Association, operates a semi-wholesale business for the benefit of local unions and local associations. This department does a big car-lot business.

The Produce Department is now being organized to take care of all the marketing of all the produce of the members aside from the live stock. Some preliminary business has already been done in marketing eggs and poultry through the Farmer-Labor Exchange in Chicago.

Farmer-Labor Co-operation

One of the biggest problems of today, both locally, nationally and internationally, is the question, "How far can the co-operation of the forces of organized labor and organized farmers, both in the political and economic field, be carried?"

The men of vision in both the organized farm and labor movements have almost without exception, looked forward to the time when a more complete co-ordination between these forces would not only solve many of the immediate problems of these two great divisions of the masses, but would also be the greatest step towards ushering in the better social order that great social prophets have been heralding to a wearying and hoping world. On the other hand, the forces of reaction that are the chief beneficiaries of the present division of the forces of the producers—and the extreme radicals who pose as "wise ones," with a half digested philosophy that is a thin veneer for a little learning, (often a dangerous thing), are united in the statement that: "It is economically unsound to expect that anything less than a state of war can ever be the normal relations between producers and consumers, because, as they very learnedly tell us, it is the economic interest of the farmer as a producer, to get as high a price as he can for his product, and it is the economic interest of labor as consumers, to buy the same products cheaply as possible."

These stubborn things called facts, as well as the well grounded principles of scientific economics, however, in the opinion of the writer, will lead a well balanced mind to conclude that the real interests of both the Farmer and Labor is to unite in the task of eliminating the unnecessary parasitic middle man system that is preying upon both the producer and the consumer.

Just as the American Federation of Labor is divided into departments, such as the Railway Department, the Building Trades Department, Metal Trades Department, Printing Trades Department, so the Farmers' Union in the state of Washington has established a Grain Department, a Live Stock Department, a Fruit Department, etc. The members who raise apples, through their fruit department have organized the Wenatchee District Co-operative Association through which they market their apples. This co-operative association handled over 1,400 carloads of Jim Hill apples this season. Each car contains 756 boxes and each box averages more than 100 apples.

The Wenatchee District Co-operative Association, after paying all expenses, incurred in handling the apple crop, remits back to the farmers the full value of the apples sold. The Farmer-Labor Exchange, which acts as a clearing house between farmers' organizations and consumers, is co-operating with these apple farmers to market their crop.

The Central States Co-operative League represents the consumers co-operative stores movement in the middle west. A. W. Warriner is the Educational Director.

The League is affiliated with the International Co-operative Alliance through membership in the Co-operative League of the United States.

The first annual convention of the League will be held at Bloomington, Illinois, on May 22nd and 23rd.

"Instead of a battle and war of arms, the future will see a battle of economics, in which international co-operative organizations will combat international monopoly." — Huston Thompson, Chairman Federal Trade Commission, Washington, D. C.

European Cooperation

"The most inspiring thing that I saw in Europe is the way in which the co-operative organizations of producers and consumers have not only survived the decline of wreckage of their political governments, but in a majority of cases have increased greatly their power to protect the fundamental economic interests of their members.

"In all the European countries that I visited I found the co-operative movement a power for good, not only in its immediate purposes of saving money for its members and educating them in fundamental democracy, but in acting as a barrier against the development of the types of monopolies and combinations that have become so great a menace to representative government in the United States.

"Amid the chaos of political government in many parts of Europe, it was a great pleasure and an inspiration to see the stability of the type of economic government represented by the co-operatives.

"Lord Roseberry's description of the co-operative movement as a state within a state' conveys a vivid picture of the way in which millions of humble folks in Europe have applied the principles of self-government to the conduct of a large part of their economic relations."

Robert La Follette

Frank E. Wheatcraft, who has been heard on several occasions from WCFL the voice of organized Labor of Chicago, is business manager of a great co-operative livestock Sales Department owned and operated by the Farmers' Union at Chicago stockyards. Several hundred thousand livestock farmers in Illinois, Iowa, Wisconsin and other corn belt states own and operate this sales department on a co-operative basis. Cattle, hogs and sheep are sold on the open markets of the country, including Denver, Wichita, Omaha, Kansas City, St. Joseph, Sioux City, St. Louis, St. Paul and Chicago. The official name of the Sales Department is Farmers Union Live Stock Commission. The nine houses owned by Union Farmers have handled over $500,000,000.00 worth of stock since 1917 and returned more than $5,000,000.00 to patrons in the

form of patronage dividends. The Agency at Chicago stockyards which Mr. Wheatcraft manages was opened five years ago and has become a leader among 115 firms at the World's Largest Live Stock Market. Sales during 1926 exceeded sixteen million dollars and 1927 promises to be a banner year in the history of this great co-operative enterprise.

Milo Reno, President of the Iowa Farmers Union is General Manager of the business at Chicago and St. Paul stockyards. Mr. Reno is well known in organization work and has spoken from WCFL on several occasions. A Board of Directors representing several corn belt farm organizations supervises all operations of the Co-operative.

Mr Wheatcraft attributes the rapid growth of Farmers Union Live Stock Commission to the fact that farmers are receiving Cash Benefits in return for their loyalty and support as members of the Union and patrons of their own institutions. "Our people had to learn the same lesson that Organized Labor learned," he said. "If any man, or class of men, desires to maintain decent living standards and secure a fair share of the wealth which they create they must Control the Sale of their Labor or their Products at the Exchange Markets of the World."

Livestock

"Cooperative marketing will bring still larger cash returns to the farmer as the field is enlarged," Mr. Wheatcraft said. "Our Sales Department has now become the strongest and best organized agency in the United States. When you consider that the marketing movement is only nine years old and in this short time has practically delivered the death blow to the antiquated method of selling through stock-buyers and professional brokers or commission agents, you can appreciate the determination with which farmers have turned to the new method of marketing."

There is nothing mysterious or involved about the cooperative marketing of livestock. It simply means that the farmers who raise and feed Cattle, Hogs and Sheep for sale at public stockyards have organized to Control the Bargaining Process. This has been done by employing Salesmanship collectively rather than individually.

Labor did the same thing in the sale of its product, which of course is its time, skill and service. For centuries each and every laborer, artisan or tradesman competed against his fellows. Labor never emerged out of the blackness of despair and practical serfdom until Unions were formed to restrict competition and establish the principle of collective bargaining.

The Chicago organization of the Farmers' Union Live Stock Commission illustrates perfectly how the co-operative marketing program is being developed. This house was opened in 1922 when the Iowa Farmers Union took over the livestock commission business of the Equity Cooperative Exchange at Chicago and South St. Paul. Milo Reno, president of the Iowa Farmers Union induced Charles H. Watts, founder of the first co-operative Live Stock Sales Department to take charge at Chicago and develop a highly efficient organization of Salesmen for Union farmers at Chicago stockyards.

Mr. Watts being thoroughly familiar with the live stock business was able to secure high grade traders of long experience and proven ability to handle the selling end of the business. All employees of the Cooperative were employed at definite salaries, including the manager himself. The house was under direct supervision of a Board of Directors chosen from the farm organization. This Board represented more than 400,000 organized farmers.

Departments were established to handle each class of livestock at the market in the same way that privately owned commission firms handled stock. The Cattle Department was placed in charge of A. A. Holcomb, familiarly known to cattle men of the middle west as "Budd" Holcomb. He was raised on the ranges of the West and trained in sales and market practice over a period of seventeen years at Omaha, Kansas City, St. Joseph and Chicago markets. In organizing the sales force of the cattle department Mr. Holcomb secured men recognized as the best in the business. The cattle department of the Cooperative immediately appealed to stockgrowers in Iowa, Illinois and neighboring States. Consignments began to roll in and have increased each year with a constantly expanding roll of satisfied shippers as the result.

The Farmers Union Hog Department at Chicago is in charge of Edward Barnard. This department is the leader among all others in developing cooperative marketing. Over 24,000 carloads of hogs have been sold by the Farmers Union Live Stock Commission. On many occasions the cooperative firm receives the largest percentage of yard receipts at Chicago stockyards. They have two splendid hog alleys, well located to insure favorable sales and weights. Assisting Ed Barnard in the sale of hogs is another salesman of the finest type who happens to be Dean Barnard. Other members of the hog marketing organization at Chicago yards are E. K. Devine, R. W. Dancer, Lon W. Akhurst, James H. Kelly, and Andrew Cook.

The Story of "Jim Hill" Apples

The big deal by which the "Jim Hill" brand of "the world's finest apples" from Farmers' Union members from Wentatchee, Washington, will be marketed to the customers of Chicago under the union label has called attention to the pioneer activities of the Farmer-Labor Exchange in Chicago.

In November, 1922, Mr. G. A. Koger, one of the Non-Partisan League farmers from the state of Idaho, came to Chicago with a carload of Idaho Alfalfa honey belonging to himself and neighbors. The big spread between the price paid to the producers and the price that the consumers had to pay was so great that the ordinary consumer could not afford to buy honey.

To attempt a specific solution of this marketing problem, a committee composed of prominent labor men and organized farmers was formed under the name of the Farmer-Labor Exchange. It was decided to go directly to organized labor. Organized labor responded splendidly. The result has

A. A. Holcomb, Head Cattle Salesman. Farmers' Union Live Stock Commission.

been that seven carloads of this honey have been sold to the consumers in Chicago at a price that was a living wage to the farmers and a price that the consumers could afford to pay.

Publicity on Honey Deal

This was so remarkable a record that a story about the handling of this Idaho honey was sent out by the All-American Co-operative News Service of Cleveland, Ohio, to the farmer and labor press of the country. As a result of this publicity, the Exchange was requested to extend its service to many other farm organizations.

Carloads of Produce

The following list of carload shipments which have been received by the Exchange is an indication of the need of this kind of service:

40 carloads watermelons from Texas.

16 carloads vegetables from Texas.

12 carloads cabbage from Wisconsin.

20 carloads coal from Illinois.

8 carloads Irish potatoes from Oklahoma.

1 carload sweet potatoes from Arkansas.

8 carloads cantaloupes from Arkansas.

7 carloads honey from Idaho.

2 carloads grapefruit from Florida.

1 carload oranges from Florida.

6 carloads oranges from Florida.

Express and local freight and parcels post shipments of the following were also received:

Green peas, green peppers, eggplant, string beans, cucumbers, tomatoes, okra, etc., from Florida.

Eggs and poultry from Illinois and Iowa.

Veal from Wisconsin.

Maple syrup from Michigan and Indiana.

Apples from Michigan and Indiana.

Cane syrup and radishes from Arkansas.

Pecans from Texas.

Limburger cheese from Minnesota.

The following states have furnished

Ed. Barnard, Head Hog Salesman.

the greater percentage of this business, Illinois, Indiana, Michigan, Wisconsin, Minnesota, Idaho, Iowa, Missouri, Kansas, Arkansas, Texas, Florida.

Promote the Union Label

In addition to marketing produce for the farmers the Exchange has acted as buying agent for co-operative stores, buying clubs, trade unions, farmers' unions, etc. It is the policy in buying to give preference to co-operative wholesales, co-operative factories and concerns fair to union labor and the farmer. Among the merchandise bought in this way has been tea from the British Co-operative Wholesale (in co-operation with the Central States Co-operative Wholesale), gloves and cigars from co-operative factories owned by labor unions, and Union Label Goods of various kinds.

The organized farmers selling their produce through the Farmer-Labor Exchange to trade union consumers have appreciated this service so much that they have reciprocated by giving large orders for the famous Herrin union-mined, union-owned coal. The following quotation from *The Iowa Homestead* aptly describes the situation:

"Co-operation Brings Union Coal to Chicagoans"

"Coal mined by union men in pits owned by the Illinois Mine Workers' union is being distributed to organized consumers on farms and in the cities by the Farmer-Labor Exchange, 178 W. Washington St., Chicago. Lower prices for consumers and trade union conditions for producers are assured by this venture in direct marketing. Strangely enough, the war-scarred town of Herrin furnished the coal. The black diamonds come from that fateful strip mine where the efforts of a non-union operator to introduce low wage standards precipitated the riots of 1922. Finding it impossible to operate profitably with public sentiment ranged against him, the operator sold out and the Illinois United Mine Workers are now directly in charge of the property."

Dean Barnard, Hog Salesman. Farmers' Union Live Stock Commission.

Union Mined "Black Diamonds"

Besides marketing many carloads of this coal to union farmers and many thousands of tons to union consumers in Chicago, the campaign is on to supply trade union halls and labor temples with hundred per cent union mined coal, as fast as possible. The leading organizations in this drive are Carpenters Union No. 62, Bakers' Union No. 2, Carpenters' Union No. 181 and the Chicago Labor Temple.

Farmers' Union Butter

Several carloads of butter have been handled for the Kansas Farmers' Union Co-operative Creamery. This is one of the first centralized co-operative creameries in America. Plans are afoot to market this butter in Farmers' Union label cartons to the consumers of Chicago in the same manner as in the marketing of the "Jim Hill" union label brand of apples.

The Farmer-Labor Exchange is operated on the co-operative plan and whatever profits are made in its transactions belong to both the producers and the consumers in whose interests the Exchange is operated. The business policy is—contract no obligations that there are not funds in the bank to meet. Banking done with Chicago's only labor bank, which has extended its services to the Exchange on the basis of good sound banking.

The sales of farm produce are made through two channels:

A—Direct to consumers through co-operative stores, trade unions and buying clubs, among the teachers in the public schools, and employes in factories, banks, etc., on the basis of a saving to both the farmer and the consumer.

B—Sales on the regular produce market and to regular dealers on the basis of regular wholesale market prices as high on the average as when sold through commission men and with the assurance of an honest return to the farmer.

Co-operated for Success

The following is a list of a few of those organizations and individuals who have co-operated, either by actual transactions or in other ways, to make the Exchange a success:

Chicago's Labor Bank, The Amalgamated Trust & Savings Bank.

Milo Reno, president of Farmers' Union of Iowa.

John Fitzpatrick, president of Chicago Federation of Labor.

The Kansas Farmers' Union Co-operative Creamery.

The Farm Labor Union of America, Texarkana, Texas.

The Chicago Teachers' Union and Federations.

The Florida Farm Labor Union.

The Co-operative Trading Company, Waukegan, Ill.

The Minnesota Farmers' Union Exchange.

Thos. J. Lynch, Head Sheep Salesman. Farmers' Union Live Stock Commission.

The Honey Producers of Idaho.

Roseland Co-operative Store of Chicago.

The West Side Italian Co-operative of Chicago.

The Co-operative Central Exchange of Superior, Wisconsin.

Bennington Farm-Labor Union Clearing House, Bennington, Oklahoma.

Washington State Farmers' Union.

Wenatchee District Co-operative Association.

United States Department of Agriculture through its Market News Service and "Agriculture Co-operative" (weekly).

WCFL Brings Farm Producer and Worker Consumer Together

Since January 12th a constructive effort has been made to bring farm producer and worker consumer together with the aid of WCFL. The hour between 7:30 P. M. and 8 P. M. is set aside every Wednesday for this purpose. The speakers that have been on the program to date and the lecturers that will be heard in the future from WCFL are backed by the Farmer-Labor Exchange, of which Chas. F. Lowrie, a veteran in the labor movement, is the recognized head.

The Farmer-Labor Exchange handles the products of farm unions, co-operatives and the unionized Herrin coal mine.

Educational Program Offered

A truely instructive program was offered in the past from the broadcasting station of the Chicago Federation of Labor.

On January 12th, R. E. Kennedy, Secretary of the Illinois Farmers' Union, Pontiac, Ill., discussed "Cost of Production on the Farm."

On January 19th, Mr. Condon, of the Farmers' Union Livestock Commission, spoke about "Co-operative Livestock Marketing."

On January 26th, Mr. King supplemented the aforementioned discussion by speaking on "The Marketing of Livestock for the Iowa Farmers' Union."

On February 2nd, Secretary Wahlstrom of Roseland Co-operative Association spoke.

Feb. 9, F. E. Wheatcraft, Manager Farmers' Union Livestock Commission, Chicago.

Feb. 16th, Jacob Liukku, Manager Co-operative Trading Co., Waukegan, Ill.

Feb. 23, E. E. Kennedy, Secretary Illinois Farmers' Union.

March 6, Senator Smith W. Brookhart of Iowa.

March 9, C. F. Lowrie, Secretary Farmer-Labor Exchange, Chicago.

March 16, A. W. Warriner, Educational Director, Central States Co-operative League, Bloomington, Ill.

March 23, Mr. Edward Nordman, Commissioner Wisconsin Department Markets, Madison, Wis.

March 30, Dr. Geo. L. Kennedy, President Villa Grove, Ill., Co-operative Store.

April 6, E. N. Nockels, Secretary Chicago Federation of Labor.

April 13, George Keen, Editor Canadian Co-operator, and Secretary Co-operative Union of Canada.

April 20, President Milo Reno, of the Iowa Farmers' Union.

April 27, President John H. Walker, of the Illinois Federation of Labor.

Noted Speakers on Program

In addition, the following speakers have consented to speak at dates to be arranged later:

Governor A. G. Sorlie, of North Dakota.

Hon. Philip F. LaFolette, Madison, Wisconsin.

Dr. J. P. Warbasse, President The Co-operative League of the U. S. A.

Mr. Harry Fishwick, State President Illinois Miners' Union.

John Tromble, President Kansas Farmers' Union, Salina, Kansas.

Oscar Ameringer, Editor of the Illinois Miner.

Speculation vs. Co-operation

No story of cooperative marketing would be complete without drawing a contrast between the old and new conditions in the business. Twenty years ago the farmer had no voice in fixing prices. His stock was either sold to a scalper or stock buyer at home far below market prices or it was shipped to a broker or commission agent who had no connection with the production end of farming. This broker might resell to a speculator and become party to a chain of transactions by which the farmer was prevented from receiving anything like a profitable price. Great packing organizations employing expert stock buyers overshadowed the small brokers or commission men. Prices were subject to violent fluctuations. Evil practices of all kinds were alleged to exist at the public yards and the live stock industry was completely demoralized on the selling side. To the individual farmer it appeared a hopeless task to correct this situation.

With the advent of the Farmers' Union into the marketing field striking improvements were made at once. Through cooperative shipping the stranglehold of scalpers and country buyers was immediately broken. Today the farmer can receive full value for his animals whether he has one head or a thousand head. This change alone has caused untold millions of dollars to flow into the pockets of stock farmers in every section of the country.

Not satisfied with relieving country conditions, the Farmers Union entered the public markets. Speculators who had no real service to offer were driven out. Evil practices were rooted out and trade conditions placed under Government supervision. By offering the finest sales service at actual cost, the Farmers Union Live Stock Commission rapidly secured control of a great volume of product and within a few short years the farmers' selling agency was in position to match the Packers' Buying Agency. It is estimated that improvement in market practice alone has added fifty million dollars annually to livestock values at the public stockyards.

The future is in the farmers' hands. If livestock shipments can be concentrated under one control—the control of Farmers Union Live Stock Commission which is recognized as the official Sales Department—farm leaders anticipate that prices can be stepped up within a very short time to the basis of Cost of Production.

There is every reason to believe that meat processors are sympathetic with the live stock farmers situation. Packers handle meat and meat animal products as intermediary agencies who can pass them down at cost plus profit. If acquisition costs are increased by collective arrangement, this places all packers upon an equal footing with the public and will not react to the detriment of any meat processor.

Economists claim that the elimination of competitive trading structures and other items necessary to maintaining the old fashioned system of selling livestock would amount to millions of dollars a year. To illustrate this—the present sales cost of keeping thousands of small competitive commission firms or brokers is nearly a hundred millions of dollars a year. If al livestock were handled by Farmers Union Live Stock Commission this charge could easily be cut in half and possibly reduced to one-quarter its present amount. All along the line of shipping, handling, selling and distribution there are similar items waiting for organization and cooperation to bring order out of chaos.

Farmers who have stock to sell, regardless of affiliation with the organization may consign to the Cooperative Sales Department and secure the benefits of collective action.

Real One-Man Portable Is Here

By E. E. Plummer
Radio Editor, Herald and Examiner

To the radio listeners of the stone age the coming of the warm weather forebode the temporary demise of his best friend—the multi-control box from which, by dextrous manipulation, he was often able to unlock the combination long enough to hear the voice of a beautiful soprano.

But nowadays the demise is not so marked. Statistics prove the contention that modern receivers and up-to-date broadcasting have taken the edge off Summer much more effectively than the Volstead act has removed the edge from liquor.

Enter: A Portable Receiver

This Spring song is not purely in defense of warm weather radio, but has to do with a dandy little portable receiver. No, don't hold up your hands yet—this one *is* portable without the aid of hand truck and express wagon.

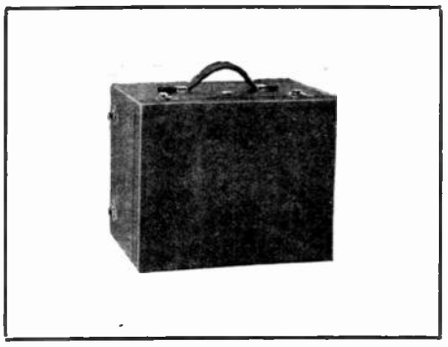
Inside the case of the Trav-Ler (pshaw! I've tcld you the name) is a very efficient five 199 tube receiver, loud speaker, and all the batteries. The set is one dial control and a small loop aerial picks up more broadcasters than you'll want to hear. The loop is built into the front of the case, and is removed and inserted in a receptacle in the top when in use.

Now is the time to be thinking over the portable set proposition.

When you're sitting on the bleachers, think how great it will be to hear the ball game broadcast and start an argument with the fellow sitting next to you, or how convenient it will be to know just what happened while waiting for the score board to catch up with the play. It might help even to teach the wife the fine points.

Let's not limit the portable to ball games, either. At the resort cottage, on automobile tours, boat or train trips—a good portable receiver has a place, a place that has not been filled before now because there were few one-man portables.

Trav-Ler Portable Opened and Ready for Operation.



This Radio Set Including Batteries Is All Contained in a Small Carrying Case.

Following the policyof reviewing the latest in radio receivers, we present herea description of a new addition to the line of portable sets which has found favor on many a dealer's counter.

Name and Maker: Trav-Ler Portable "5," made by the Trav-Ler Manufacturing Corporation.

Principal Features: Small size combined with light weight, giving ease of portability; sweet tone; strong volume; ample selectivity; good distance reach; one dial tuning, and low price.

Description: Circuit-Tuned loop aerial with two untuned radio frequency, detector and two audio frequency transformer coupled; number of tubes and type, five UX-109 or CX-299; antenna pickup, loop aerial 10 by 12½ inches square which is built into front cover of set, or aerial and ground may be used instead by employing Trav-Ler antenna coupler, an accessory sold by the makers; loud speaker, built-in horn type with Baldwin unit; number tuning controls, one only, with vernier refining knob; tube filament control—one rheostat for all five tubes; other variable controls, one a potentiometer volume control regulating grid bias on radio frequency tubes; on-off filament switch—yes, so arranged that portable case cannot be closed without turning off filaments, thus giving batteries; chassis, bakelite front and sub panel construction.

Cabinet Style: Portable case finished in black leatherette, size, when closed, 12½ inches long by 10 inches high by 8½ inches deep; weight, fully equipped with tubes and batteries, twenty-four pounds.

Guarantee: Set is guaranteed indefinitely against mechanical or electrical defects, and service is provided by manufacturer. Complete operating manual furnished purchaser, and wiring diagram is mounted in back cover of case.

Rectifying Replacement Elements for Chargers, Power Units and "A" Power Devices

The new Marathon rectifiers employ a novel principle of rectification, using a dry metallic disc rectifier which permits the present users of all electrolytic type chargers to change them into modern dry chargers at very low cost.

Users of the old type electrolytic chargers need not discard the complete unit, but may, at small expense, modernize their chargers by installing these new replacement units.

These new replacement rectifiers increase the charging rate of the old style chargers to which they are added, and eliminate entirely the danger of spilled acids or other liquids, and the necessity of frequently adding water, inspecting, etc. After once installed and connected, they will operate without attention. To install, remove electrolytic jar from the charger and substitute the new rectifying unit in its place. When the new unit will not fit into the place occupied by the jar, empty the jar of the liquids and all contents, and place the new unit on top of the jar. Connect the leads of the rectifying unit to the transformer and the battery.

Caution

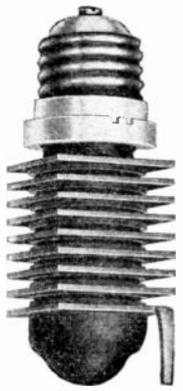
There are two distinct types of electrolytic chargers in general use and marketed under many trade names. They consist of those using a low secondary voltage and those using a high secondary voltage. The low voltage chargers have a secondary voltage of from 10-12 volts under load, and must be equipped with Type A-20 Replacement Rectifiers. The high voltage type chargers have a secondary voltage of from 15-16 volts under load, and should be equipped with Type A-40 Replacement Rectifiers.

These new Replacement Rectifiers are now available in the following types: Marathon Replacement Rectifier Type A-20—For replacing rectifying units of all trickle chargers, "A" Power devices, etc., of the electrolytic type which have a low secondary transformer voltage of from 10-12 volts under load. This type is a full wave rectifier and will increase the charging rate.

Marathon Replacement Rectifier Type A-40—For replacing rectifying units of trickle chargers, power units, "A" power devices of the electrolytic type, having a high secondary transformer voltage of from 10-12 volts under load. This type is single wave rectifier and will increase the former charging rate.

Marathon Rectifying Element Type "C"

This rectifying element is fitted with a standard screw base and is suitable for use in place of all 2 ampere bulb type charging devices using a transformer with



a secondary voltage of from 15-18 volts under load. To install, insert in the socket and screw in tight, placing clip connection to the top of the new element in the same manner as the tubes are connected. This element will furnish single wave rectification at a 2 ampere charging rate. Nothing to break or get out of order.

Alfred Marchev

Alfred Marchev, President of Temple, Inc., Chicago, manufacturers of Temple Speakers which are designed on the long compensated exponential air column type, has brought to the radio industry the fruits of a broad engineering technical training here and abroad. It seems to be very fitting that Mr. Marchev has been closely identified with the two major industries which have astonished the world in recent years—namely, aviation or aeronautics, and radio. Mr. Marchev was born in Zurich, Switzerland, and his early technical training was chiefly in experimental work, which ranged all the way from lighter-than-air balloons to flying machines and Zeppelins. Centered around an intense study of the physics of the air, he had rare opportunity of working with aeronautic engineers whose exploits during the World War were to lead to the remarkable developments which today we see in Trans-Atlantic flights, commercial aviation, etc. After spending a number of years in this work he came to America seeking broader experience and opportunity and became associated with the Thomas Morse Aircraft Corporation at Ithaca, N. Y. After spending a number of constructive years with this organization Mr. Marchev formed a private partnership under the name of Thomas & Marchev in order to perfect a line of automatic machinery which he had invented. At the conclusion of this work, he became engineer for the Ithaca Gun Company, following which he followed the advice of Horace Greely and came west, joining the Western Electric Co., Chicago, as a development engineer in charge of the engineering department. In these years, Mr. Marchev had made an intense study of radio from every angle and saw its immense possibilities for development. After four years with Western Electric he was a member of the Radio Division of the Chicago Signal Co., then manufacturing Temple Speakers, and remained with this Company until the organization of Temple, Inc., of which he is president. The success of this Company is well known in the radio industry and today it is recognized as a leader in speaker design. Associated with Mr. Marchev are F. W. Temple and Prof. P. G. Andre, who have made engineering their life work, and about whom we shall have more to say in a future issue.

Callies Laboratory Ensemble--Interchangeable Unit Construction Employed Throughout

Permits of Many Combinations—Super-Heterodyne or R. F. or Both—Interchangeable Intermediates

By Charles H. Callies

It is hard to say just where to begin with the description of the units that go to make up the ensemble about to be described. There are so many outstanding features which will undoubtedly be of particular interest to the advanced experimenter that it is hard to bring out the points in the order of their proper, relative importance.

The important points of this design and the reasons in back of them I am sure will be appreciated by the reader as he goes along, and I will also say in all sincerity that many of these features will be found in the advanced designs of 1928, which will be given prominence this fall. The ensemble is a proposition that no beginner should attempt, on the other hand the advanced experimenter will find no difficulty anywhere and will have at his disposal units that are really versatile in every sense of the word and which have possibilities that I do not think have been covered in anywhere near as complete a form before.

Units Absolutely Interchangeable

The Ensemble consists of six units:

No. 1—The loop or antenna stage
No. 2—The first R. F. stage
No. 3—The second R. F. stage
No. 4—Oscillator stage
No. 5—Intermediate stages
No. 6—The audio amplifier

The plug-in arrangement, about which more will be said later, permits the adding or taking away of units absolutely at will and so quickly that it can be done in less time than it takes to write about it. The entire ensemble is really an eleven-tube super-heterodyne. One tube is used in each of the first four stages, four in the fifth stage and three in the sixth or audio amplifier. Taking away one R. F. stage we have a straight super-heterodyne with but one stage of R. F. preceding it, taking away the first and second R. F. stages, we have a straight super-heterodyne. If we proceed along another line we can leave the first three units as they are removing the fourth and fifth—the oscillator and the intermediates—and we have a straight R. F. receiver.

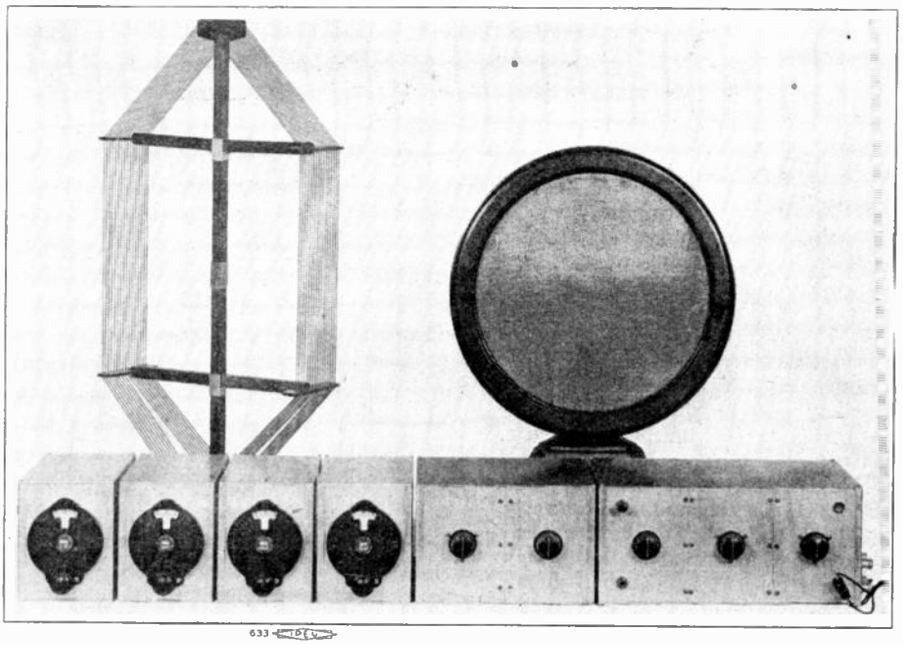
Any Number of Units May Be Tried Without Completely Rebuilding

Those who have been interested in super-heterodyne construction in particular will appreciate this paragraph. The constructor is able to try various combinations and various products without a complete tearing down of the receiver, for if, for instance, a different set of intermediates is to be tried it means simply the building of a new No. 5 unit. How many times has the average super-heterodyne enthusiast rebuilt his set simply to try new combinations in the intermediates to see whether or not they would function any better. In my particular case I have three separate and distinct No. 5 units, each having its own particular points of merit. In a super-heterodyne, for instance, we will find practically all of the circuits employing a standard loop or antenna stage. We will find that we have our own pet theories about audio and this stage will usually remain without a change regardless of the front end of the set. As for the oscillator stage there also are various different circuits that designers employ here, still the old tuned grid is applicable to all of the circuits and it has its own particular points of merit.

Charles H. Callies.

Receiver Completely Shielded

As will be seen from the illustrations, each unit is built in an aluminum can. In this construction I have employed the Alcoa cans of the Aluminum Company of America. These cans are 5″ wide 6″ high and 9″ deep and one can for each of the first four units will adequately take care of all of the parts that are required.



A complete view of the Ensemble with a Mathieson Loop and a Clarvox Speaker.

Two cans built together will take care of the average intermediate or No. 5 unit and the number of cans used in the audio amplifier will depend on the system that is employed by the constructor. In my case it is necessary to use three cans in a single construction for the audio amplifier on account of the power that I employed in the last stage. These shielding cans serve a two-fold purpose, first they give us the housing for each individual unit but more important, they give us the best kind of shielding between each and every stage. There is no possibility of pick up or coil interaction and extraneous noises in the ensemble, you might almost say are very noticeable by their absence.

No Panel Required

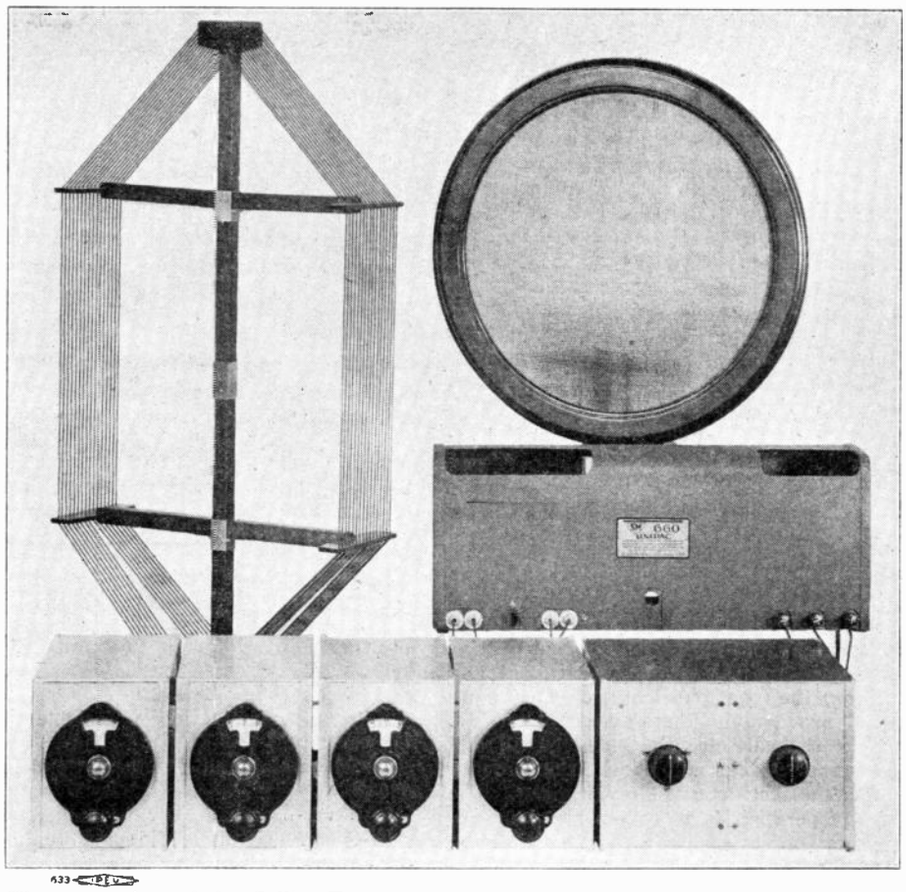
If the interchangeable feature is to be taken advantage of it is of course impossible to use a Bakelite or some other kind of fixed panel arrangement, consequently all of the controls are mounted directly on the shielding cans—insulating these controls from the aluminum in the case where it is necessary. This may seem to be a point against appearance but on the other hand the Alcoa cans are of such careful construction and design that they look very well, particularly if the constructor takes the pains to lacquer them in some pleasing fashion. The cans placed together in themselves look very attractive and if nothing else they look as if they meant business like a real honest-to-goodness receiver should. The first thought is, of course, efficiency and I will say that if any piece of receiving apparatus has ever delivered it, this ensemble surely has.

The Plug-in Arrangement

Across the bottom on both sides of each can are six outlets. This does not apply to the left hand side of unit No. 1 which has but three Carter tip jacks or to the right hand side of unit No. 6 or audio amplifier which carries a sufficient number of X-L binding posts to take care of our battery leads. Each of the other cans carry six Carter Tip Jacks on the left sides and the right hand sides carry six Carter Imp Plugs. A pattern or template must first be made of some metal so that it will be possible to drill these side pieces of aluminum exactly the same in each and every case for our tip jacks in one unit must exactly fit the Imp plug of the preceding unit anywhere and everywhere along the line to absolutely take care of the interchangeable feature of the ensemble. It is recommended that the template be drilled with very small holes and that our first holes in the aluminum cans or in the bakelite mounting strip also be of the same dimension. The holes can then be enlarged to take care of the plug or the jack as the case may be. On the left hand side of each unit the matter of insulating the jacks is taken care of with insulated washers—one extruded and one plain. They can be obtained with the Carter Tip Jack. The matter of insulating the plugs which appear on the right hand side of every unit except unit No. 6 is taken care of by mounting the plugs on a strip of bakelite ¾ x 8 inches and ⅛" in thickness. The holes in the aluminum on the right hand side must of course be slightly larger than the body of the plug to prevent short circuiting. The bakelite strip which carries our plugs must be drilled with the same template that is used in drilling our holes in the aluminum to insure an absolute fit when the units are assembled. On unit No. 6, instead of the right hand side terminals being imp plugs they are in this case X-L binding posts. These posts taking care of the leads that go to our batteries or eliminator. In my particular case on the right hand side of unit No. 6, I have two sets of bakelite strips each containing six binding posts, this, however, to enable me to take advantage of using batteries in certain portions of the set or the eliminator if I so desire. These binding post terminals can be arranged in any manner to suit the ideas of the builder. Plugs and jacks are arranged in the following order, reading from the front to the back:

No. 1—Negative A battery line.
No. 2—Positive A.
No. 3—The one which carries signal from one unit to the other.
No. 4—Marked "Variable"—used for "C" bias, etc.
No. 5—45 volt B.
No. 6—90 volt B.

This combination enables us to use 45 or 90 volts in any unit that we may desire and as higher voltages are required in the audio stages only it will take care of any kind of a circuit. Before leaving the subject of the tip jacks and plugs it should be said that in every case tip jacks No. 1 and also plug No. 1, which are the ones closest to the front, are not insulated the way the other five are but are in direct contact with the aluminum. These parts, of course, carry our negative A battery current, and plugs and jacks are used here merely to insure positive contact which we would not have if we depended only on slapping the various units together. Figs. 2 and 3 show the exact dimensions to be used in the construction of the ensemble as regards this plug-in feature.



The same view of the Callies Ensemble shown previously using a Mathiesen Loop but only the first five units and a Silver-Marshall Unipac for our audio amplifier and power supply. The speaker is a Claravox.

Step by Step Construction

In Fig. 1 is shown a wiring diagram of the entire ensemble. It would be well to treat each unit as a distinct and separate building operation and the wiring diagram has been drawn with this feature in view. This will enable the builder, if he so desires, to start building the set on the basis of a straight super-heterodyne, adding the two stages of R. F. later on. It will enable him to start with prac-

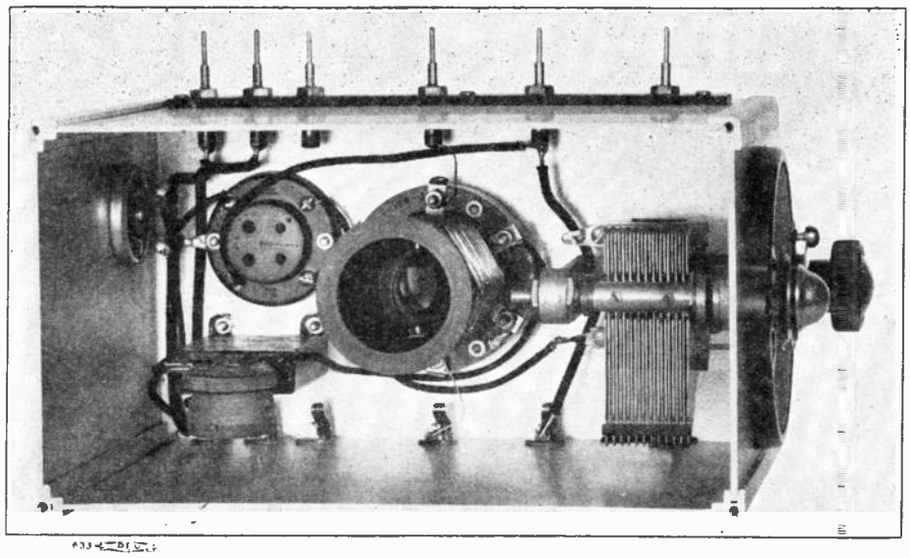
tically any unit and work up to the point which he desires. I have gone to considerable trouble in trying to make everything just as complete and fool-proof as possible simply for the love that I have for doing things nearly right and to avoid a lot of errors which otherwise might creep up. However, it is humanly impossible for me to show a picture diagram of every unit showing all mounting holes, etc., because the time involved in a thing of this kind is absolutely out of the question. The particular position which every unit occupies will depend on the products that the constructor uses and he will in every case, for the placement of these units, be called upon to use his own grey matter.

How to Proceed

Select the unit which is to be constructed first. Lay out all of the parts that require mounting on the piece of aluminum that serves as the bottom of the can and drill the necessary mounting holes. Be sure to allow for sufficient clearance for whatever happens to be mounted on the panel. Next drill and mount the front panel in accordance with the instructions that appear later on. Next in order are the sides. Drill and mount the jacks and plugs in accordance with the instructions already given. The next operation is to attach the four uprights—one at each corner—then slide the side pieces into position. Most of our wiring is now to be done. Regardless of whether or not the particular unit that we are working on carries, for instance, 45 volt current, nevertheless, a connection must be made between the 45 volt jack to the 45 volt plug (across the can) because some unit ahead will undoubtedly call for this current. These lead wires running across the assembly can be bent so that they will be toward the back and bottom of the can in an out of the way place. Of course either from the tip or plug ends we must also pick off all current which this particular unit demands. One other word before assembling the sides, and that is that it is wise to presolder both the jacks and the plugs because our final soldering operation will then be much easier. Then slide in the front and back piece—there are usually but one or two connections that are to be made to the units that are to be mounted in these places. Last of all attach the top and the job is complete. Needless to say, an insulated hook-up wire must be used practically everywhere (like the Kellogg fabric covered wire) so that all possibility of short circuits will be avoided. It is also a good plan to test all jacks, plugs and other parts with a voltmeter and "C" battery to be sure that no "shorts" are present.

Unit No. 1

As can be seen from the wiring diagram, unit No. 1 has been designed for loop reception but can be converted to antenna use with little trouble, however. This change will affect the first unit only.



A typical example of one of the units. This happens to be Unit No. 4 which is the oscillator. The details of the interior construction can easily be seen.

The parts called for in this unit are as follows:

1—Alcoa Stage Shield.
1—Hammarlund Midline Variable Condenser .0005.
1—Silver-Marshall Midget Condenser .000025.
1—Silver-Marshall 511 tube socket.
1—Carter 400 ohm Midget Potentiometer.
1—Carter 20 ohm Midget Rheostat.
1—Carter 1. bypass condenser.
3—Carter Tip Jacks with insulating washers.
6—Carter Imp Plugs.
1—¾ x 8 x ⅛ Bakelite Insulated strip on which the plugs are to be mounted.
1—National Vernier Dial.

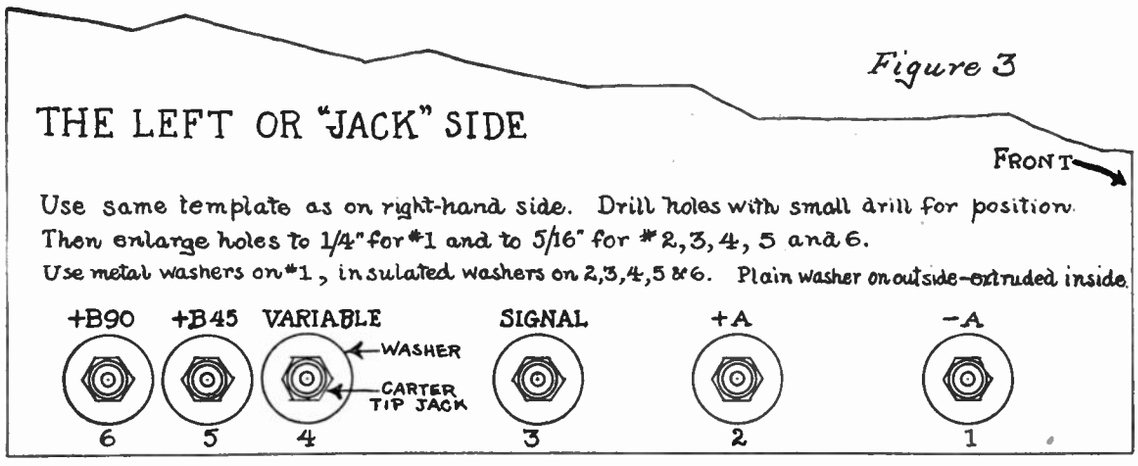
As this unit will always be the first one in the assembly it will differ from the others in the fact that on the left hand side it carries but three tip jacks—the loop terminals—and it also carries two controls on this left hand side. The two controls are a knob on the 400 ohm potentiometer and the knob controlling the regeneration which directly affects the Midget condenser. The matter of drilling the holes for the imp jacks and the plugs is quickly explained in the drawings (Figs. 2 and 3). The placement of the parts inside of the can is left to the constructor's own judgment, however, especially in Unit No. 1 there is plenty of room to spare, particularly if the unit is to be used with a loop as the diagram shows. Unit No. 1 also differs in one respect from all of the other units inasmuch as the variable condenser on the front panel is not mounted directly on the can. It is not grounded in the negative A line as the other condensers are, consequently some method of insulating must be employed here to accomplish this. The condenser is first mounted on a piece of ⅛" Bakelite, the mounting screw holes are countersunk, avoiding all possibility of contact with the can. This Bakelite strip was then attached to the front panel. The midget condenser mounted on the side must also be insulated and this can be done very easily through the use of extruded insulating washers. The potentiometer must also be insulated. The only part that is mounted on the rear of this unit No. 1 is our 20 ohm rheostat. This need not be insulated because one end of the rheostat is grounded, automatically forming our negative A connection. Be sure to pick out the right terminal on the lead going to the tube socket, for otherwise the tube will receive the full 6 volt load of our A battery This rheostat when once set to the proper voltage need never be touched. This covers all the important details of Unit No. 1.

Unit No. 2

The parts required for this unit are as follows:

1—Alcoa Stage Shield.
1—Aero Universal Coil for .0005 condenser.
1—Hammarlund Midline Variable Condenser .0005.
1—Silver-Marshall 511 tube socket.
1—Silver-Marshall 276 choke coil.
1—Carter 20 ohm rheostat.
1—Carter 1. bypass condenser.
6—Carter tip jacks with insulated washers.
6—Carter Imp plugs with accompanying Bakelite insulating strip.
1—National Vernier Dial.

This unit contains 6 tip jacks on the left hand side, all but jack No. 1 being insulated. No. 1 jack is the negative A jack and is there for the sole purpose of insuring positive contact for this current. It will be noted that a choke coil is used in our battery lead to prevent R. F. impulses from entering our battery line. It will also be noted that the grid return of the Aero coil is brought back to the tip jack No. 4 which goes to the movable arm of the potentiometer in Unit No. 1 for the purpose of preventing oscillations. Nothing further need be



said about the construction of this unit. The variable condenser mounts directly on the aluminum, the rotor being grounded, and the rheostat mounts on the rear of the can exactly the same as in Unit No. 1.

Unit No. 3

The parts required in this unit are as follows:

1—Alcoa Stage Shield.
1—Aero Universal coil for .0005 condenser.
1—Hammarlund Midline Variable condenser .0005.
1—Silver-Marshall 511 tube socket.
1—Silver-Marshall 276 choke coil.
1—Carter 20 ohm rheostat.
1—Carter 1. bypass condenser.
6—Carter tip jacks with insulated washers.
6—Carter imp plugs with accompanying Bakelite insulated strip.
1—Carter .00025 grid condenser with grid leak clips.
1—2 meg. grid leak.
1—National Vernier Dial.

The construction of this unit is exactly the same as that of Unit No. 2 with the exception that a grid leak and condenser should be mounted in the grid circuit. Everything else is the same.

Unit No. 4

The parts employed in this unit are as follows:

1—Alcoa Stage Shield.
1—Hammarlund Midline Variable condenser .0005.
1—Silver-Marshall 515 coil socket.
1—Silver-Marshall 511 tube socket.
1—Silver-Marshall 111-A oscillator coil.
1—Silver-Marshall 276 choke coil.
1—Carter .5 bypass condenser.
1—Carter 20 ohm rheostat.
6—Carter plugs and jacks and insulating strip.
1—National Vernier Dial.

It will be noted in this circuit, which is the oscillator stage, that our pick up coil is in the plate circuit rather than in the grid circuit where it is usually found. However, this need not cause any alarm in the minds of the constructor and will work just as satisfactorily in the position shown as in any other. The oscillator consists of a tuned grid coil in order to do away with all body capacity. Again we find our radio impulses kept out of the battery line by the use of a choke coil. Other points of construction are similar to Units 1, 2 and 3. The key to the markings on the coil socket is:

1—Pick up coil.
2—Pick up coil.
3—Grid.
4—Negative A.
5—B battery.
6—Plate.

Unit No. 5

This is the stage that contains our intermediates and the second detector. The parts required here are as follows:

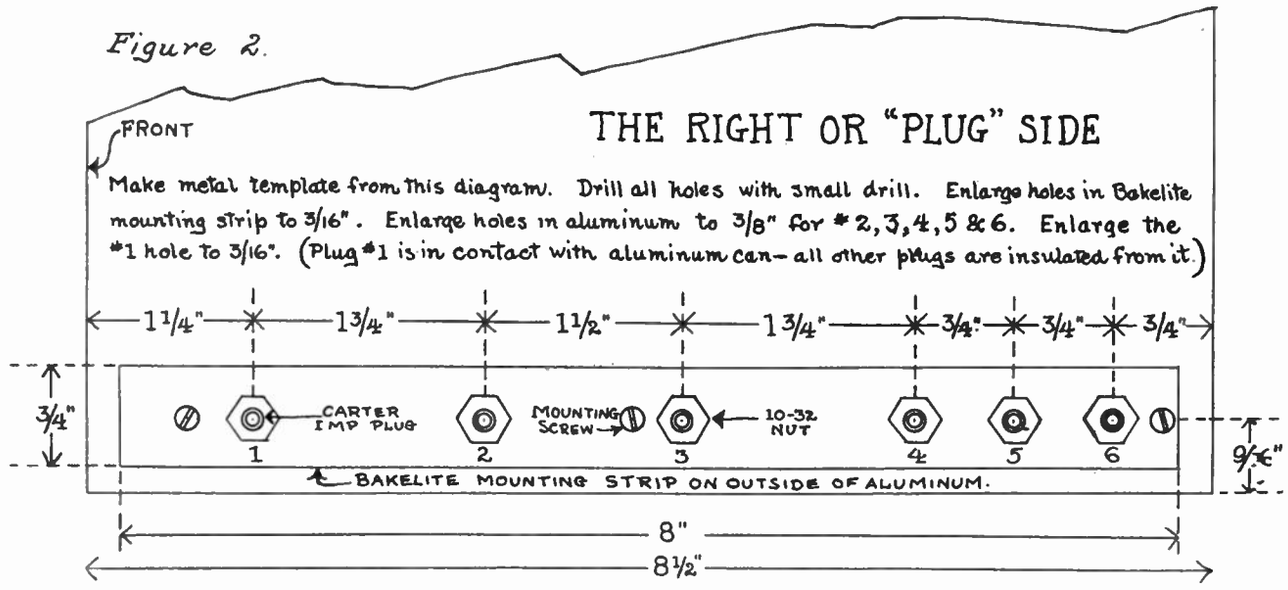
2—Alcoa Stage Shields.
3—Silver-Marshall 511 tube sockets.
1—Benjamin tube socket (spring type).
3—Silver-Marshall 210 long wave transformers.
1—Silver-Marshall 211 long wave filter.
1—Silver-Marshall 276 choke coil.
2—Carter 1. bypass condensers.
2—Carter .5 bypass condensers.
1—Carter 400 ohm potentiometer.
1—Carter 4 ohm rheostat.
1—Carter .005 bypass condenser.
1—C battery.
6—Carter tip jacks.
6—Carter imp plugs with accompanying insulating strip.

As will be seen from the wiring diagram, the first three long wave transformers are the 210 iron core transformers. The fourth one is the air core filter, the primary of which is tuned by condensers accompanying this filter. Oscillations in this intermediate are controlled by the potentiometer used in the customary manner. The first three coil sockets are Silver-Marshall 511 sockets. The last socket—the detector tube socket—is a Benjamin socket of the spring type which is used here to avoid the possibilities of microphonic noises entering into our signals. These units will fit very nicely into a compartment built of two Alcoa stage cans, the front panels being placed together. This will give us a can of the customary height and depth and with a width of 9½". Two pieces of aluminum must therefore be procured, 9½" x 9", or the tops and bottoms will have to be fastened together the same as the fronts and backs now are in our construction.

Our signal is rectified through the use of a C battery in our grid return rather than through the use of the customary grid leak and condenser. This is made entirely clear in the diagram. It might also be said that there will be adequate room in the compartment for the C battery which can be fastened in some manner by the constructor. All the currents are by-passed. On the front of this unit we have two controls, one is our potentiometer, the other is our rheostat, which controls the filament of all the tubes. The same thing applies here that applied in the other units as far as mounting is concerned. As we go along with this series of articles it is expected that several intermediate amplifiers will be described. The unit shown here consists of Silver-Marshall transformers. A little later on we will also show how other units can be used here and again is brought home one of the outstanding features of this ensemble that allows us to interchange one unit with another without any tearing down.

As shown in the list of parts five bypass condensers are required in this unit, four being of the regular bypass type, the other being of the size of a grid condenser. The condenser running from our 45 volt line to the negative A is of 1. capacity as is also our condenser between the 90 volt line and the negative A. The condenser across the C battery is of .5 capacity as is also the one between the variable lead going to the potentiometer and the negative A. The small .005 bypass condenser is placed between the negative filament line and the plate of our detector tube. In the plate of this detector tube going to our audio, we also find a choke coil. An important item in connection with the building of this intermediate amplifier is to keep the fields of the intermediate transformers away from the shielding, for otherwise it would

Figure 2.



tend to broaden this stage. Therefore, raise up these intermediate transformers by mounting them on spacer studs about an inch high.

Unit No. 6

This is our audio amplifier. Having spared no expense in the construction of the other five units of the set, we will carry along on the same lines and make this audio amplifier just as efficient as producers on the market will allow. We therefore employ push-pull amplification in the last stage in conjunction with a couple of 210 power tubes. Of course this amplifier must then be used with an eliminator that will not only light the filament of these power tubes but one that is built to deliver current to the entire receiver as well as 425 volts for the 210 tubes—also the necessary C bias for this last stage. The parts that are required are as follows:

2—Alcoa Stage Shields.
3—Silver-Marshall 511 tube sockets.
1—Silver-Marshall 220 audio transformer..
1—Silver-Marshall 230 push-pull input transformer.
1—Silver-Marshall 231 push-pull output transformer.
1—Carter 20 ohm rheostat.
1—Carter 500,000 Hi-ohm.
2—Carter short jacks.
12—X-L binding posts.
2—Insulating strips.
6—Carter tip jacks.
1—D.P.D.T. Carter horizontal jack switch.

On our front panel we can mount the hi-ohm volume control and the 20 ohm rheostat. The volume control which is placed in the secondary of the first audio transformer, of course, should be insulated with extruded washers. The 20 ohm rheostat on the filament of the 201-A tube can be mounted in the same manner as our other rheostats have been taken care of. On the right hand side of our audio amplifier unit we have two Bakelite strips each containing six binding posts and one strip taking care of the battery end of things, the other strip that portion going into the B eliminator.

The audio amplifier that is pictured in the photograph happens to be a little larger than is necessary. This is brought about, however, by the fact that it was constructed before the Silver-Marshall 230 and 231 push-pull transformers were on the market, consequently for the push-pull arrangement in this original model I had to employ two 220 audio transformers and two 221 output transformers in this last stage. My audio amplifier therefore carries five of these large transformers, one in the first stage and four in the second. With the advent of the Silver-Marshall Push-Pull Transformers, which work out exactly as the transformers that I have used, this number is brought down to three and consequently the unit can be built very easily in two shielding units. There is a third control on the front of my audio amplifier—this happens to be in one end of the filament line going to the power tubes which allows me to vary the filament voltage applied to these tubes. The original model, of course, was an experimental set and all sorts of power tube combinations were employed before the final decision was made that the 210 tubes were the best.

The fact that the 210 power tubes in the push-pull arrangement seem to deliver the best kind of a tone, need not keep anyone from building the audio amplifier with tubes of lower power. Two 171 power tubes in the last audio stage will work very nicely and, of course, will not require the tremendous voltages called for by the 210's.

Phonograph Amplifier

And that brings us to another important feature that has to do with the extreme versatility of the ensemble—and in this case with the audio amplifier in particular. Most all have admired the tone possibilities of the new electric phonograph reproducers—record amplifiers like the Orthophonic, Electrola and others. With the addition of a record pick up to our audio amplifier we have a record amplifier system that will not take a back seat to any of the products that the market affords. There are a number of record pick-ups on the market that can be obtained at a reasonable cost—the one that I am using and which I would not part with if I could not obtain another, is Phonovox unit—a product of the Pacent Radio Corporation, which retails for about $12.50.

As will be seen from the wiring diagram of the amplifier unit our signal is carried from the preceding unit to a double pole, double throw switch This switch in one position carries our radio signal to the plate terminal of the first audio transformer and carries our battery terminal of the same transformer to the 45 volt battery line. In the other position the switch carries both primary terminals of this transformer to the jack intended for phonograph reproduction. For phonograph record amplification, therefore, remove the audio amplifier unit from the Ensemble. Throw the switch so that the primary of the first audio transformer goes to the "pick-up" jack. Plug the terminals of the Phonovox pick-up into the pick-up jack and turn on the juice. Of course, our music will now be amplified in our speaker instead of in the sound chamber of the phonograph. I forgot to say that we must also "turn the crank" and get the record in motion.

I can become very enthusiastic, without even half trying, about the tone qualities of this audio unit. I will hold myself back, however, and simply say there is something in store for everyone who has not tried the Silver-Marshall audio amplifying units. They weigh better than four pounds each and every ounce seems to

have added its quota of real, honest-to-goodness performance.

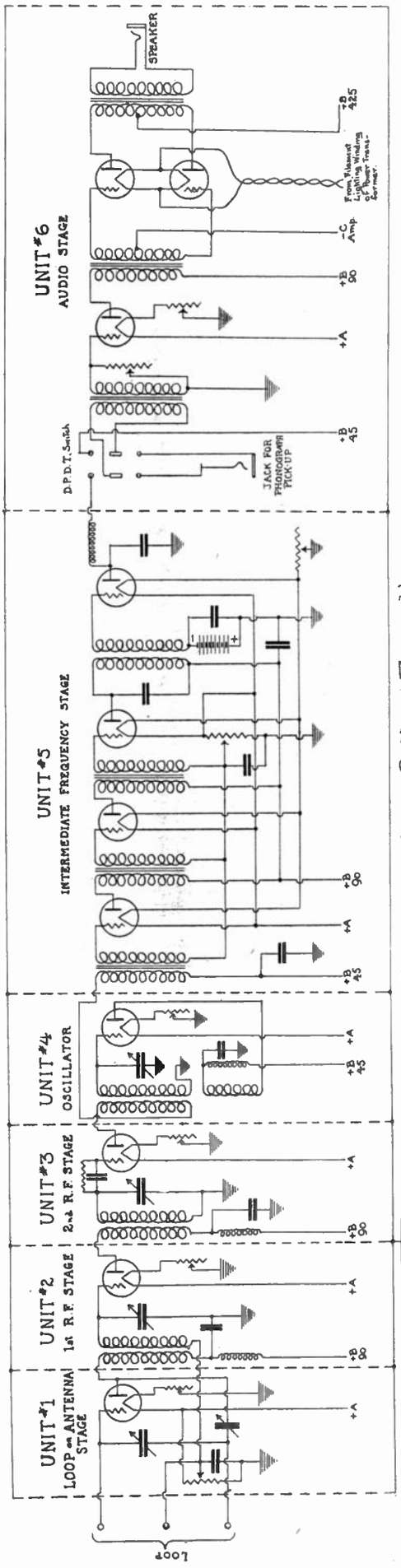
The Unipac

For those who wish to combine their audio amplifier with their power supply it is recommended that one of the Silver-Marshall Unipac kits be purchased. They will do away with the building of our audio amplifier as the Unipac employs practically every part called for in the audio stage that I have described and in addition it takes care of all our B voltages, our filament for the power stage and our C voltage required in the last stage. These Unipac kits may be obtained in almost any type for use with 210 tubes or 171 tubes. They also permit the attachment of the phonograph pick-up exactly as described previously. In building the Unipac, however, be sure to build it with two stages of audio the same as is required when reproducing records for ordinarily the Unipac carries only the last stage. All of this is made entirely clear in literature which I am sure Silver-Marshall will be glad to send to anyone who is interested.

Some Points on Tuning

Summer weather does not add any incentive nor does it add any inducements for a lot of DX hunting. Like everyone else I have been seeking the great outdoors on every possible occasion and in the past few weeks when the Ensemble has been in operation I have been satisfied with the locals. There is one thing about a set of this kind that must be remembered and that is that the set is so sensitive and selective that almost everything that is on the air is going to be heard. You'll tune into thunderstorms and other of nature's electrical displays just as easily as into a signal that originates a thousand and more miles away. The possibilities with the Ensemble are, however limited only by our thoroughness in tuning, by a careful logging of the dials and by the number of units that are used. I have been using the Ensemble since about the first of May and I never had any trouble getting at least two or three stations between WGN and WGES (at that time the old wavelength assignments were still in force) which were separated by about 50 K. C. KDKA always banged in like a local and not only that but it was almost an everyday occurrence to separate WSBT (The South Bend Tribune Station) from WABC in New York and both of these stations were operated on supposedly the same wavelength. A slight shift of the loop would tune one in and the other out and visa versa.

If the entire ensemble is constructed I suggest that for the first few evenings that the set be operated as a straight super (dropping units 2 and 3 of the Ensemble) so that a rough logging of the two dials may be obtained and so that the set may become familiar to us. Then add stage No. 3 which will make it at least 50% sharper. Finally add stage No. 2.



Wiring Diagram of the Callies Ensemble

Figure 1

The Accessories

In all of the work that I have done on this Ensemble I have used the Mathiesen Loop—the Baby Console model—and this has always delivered everything that could possibly be demanded of a loop aerial. It is sharp and directionable as need be and further it is small and delivers all the "kick" that is required. For my speaker, as is shown in the illustration, the Claravox speaker is used, and it has points of superiority which I have not up to this time found in other speakers and I do not hesitate to recommend this particular unit to anyone who is seeking the utmost in fine tone qualities.

The End

I have given the readers of this publication as clear a picture of the Callies Ensemble as it is possible for me to give. I have spoken in as straight-from-the-shoulder language and as sincerely as I know how. If there is anything that I have omitted, I will be glad to answer the questions. On the other hand, I am sure that the readers will appreciate that the rent is due once a month and that the kids need new shoes every once in a while, so unless it is very important I would rather have them save the postage stamp. I'm sure that you'll feel for me when I say that on some of my other constructional articles I had as many as twenty letters a day asking about "whether this would do just as well or if that would be all right." You know what I mean.

You can all expect further articles about different No. 5 units—the intermediates. This is now in work.

Memoranda

The St. James Super-Het

"Bottled" R. F. Transformers and the "U" Circuit Described

By Robert St. James

Editor's Note: Here is a lightweight super of great originality, designed by an engineer using accurate laboratory methods.

METHODS of testing intermediates as used in modern multi-tube receivers are varied. However, as is generally the case, the simpler the device, the more effective it is in results.

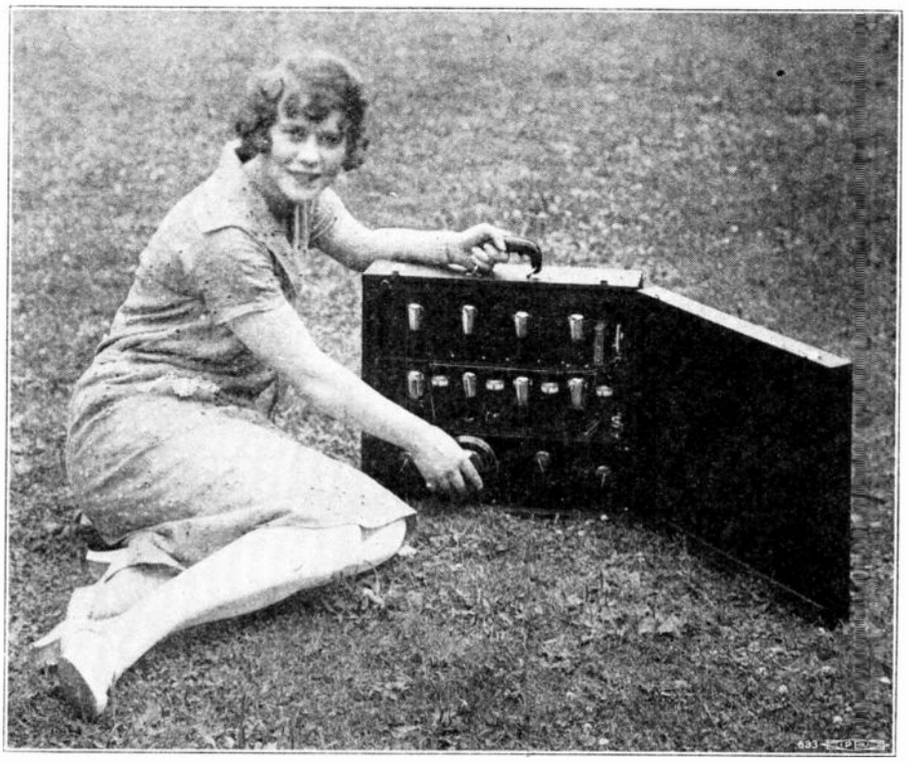
It is comparatively easy to tune a receiver of the single tube regenerative type to an incoming frequency, or to a frequency of constant value. Zero beat denotes that both circuits are in resonance and a slight change of the receiving circuit in either direction is evident as an audio signal covering a band of about 18 kilocylces (18,000 cycles).

By comparing the tone with a tuning fork vibrating at middle C on the piano and when the two tones are exactly alike we have a known frequency of 5 or about one-half k.c. A slight difference in the frequencies sets up a third audio beat which can be observed to change as the difference is varied.

If we keep below 500 cycles accurate variations can be detected and recorded between two frequencies.

The St. James Laboratories have developed a method of testing their intermediates using the principles described, and are able therefore to confine variations in the transformers to very small limits.

A standard oscillator operating at 240,000 cycles (the mean frequency used in the transformers) is coupled loosely with the transformer to be tested and the resultant beat difference is fed through an amplifying system to a loud speaker. This circuit is so planned that the output can also be diverted to a miliameter to denote its amplification factor when in resonance. The latter is to act as a double check on the transformers, and will show a defect that might be passed in the beat method. One or two shorted turns with a slight average in turns would give a proper beat, but when tested for amplification would show quite low.



The fair sex favors portables such as the St. James; equally useful on picnics, beach parties and in the home. Efficiency is not sacrificed by St. James as a result of this extreme compactness.

Placed across the terminals of the standard oscillator, is a very small variable capacity on which frequency variations are controlled, covering a band of fifty cycles (the limits which are fixed for maximum variations). The transformer to be tested is placed in position, four mercury cups insuring a quick and positive contact at all terminals and the small condenser is then adjusted zero beat; sub standards each of which bears a letter and is 30 cycles different from the one below and above it, replace the transformer under test. When exactly the same variation as measured in tone occurs, the transformer is then classified acording to that letter. Four such comprise a set, and after complete test are packed in a sealed container.

To insure continued matching the St. James transformers are *first* thoroughly dehydrated by means of a vacuum treatment to remove all moisture from coils and interior of the vessel enclosing them and then sealed off from atmosphere. They will then retain their uniform characteristics for an indefinite period.

All inductances are less than one inch in diameter, which tends to reduce the external field, preventing interaction of unwanted nature and being fairly immune to disturbances which would affect larger and more exposed surfaces. These advantages

will be emphasized in the U circuit, a recent development of the St. James Laboratories, and enable them to be used most effectively.

In order to appreciate what is happening in our receiver, its comparison to the action of light with a camera will give us a mind picture that presents it quite simply.

A camera with a leaky bellows or plate holder, would produce a picture fogged and indefinite and our radio set if it allowed signals and disturbances to affect it excepting through the proper channels such as loop or antenna would present much the same kind of difficulty in the reception obtained.

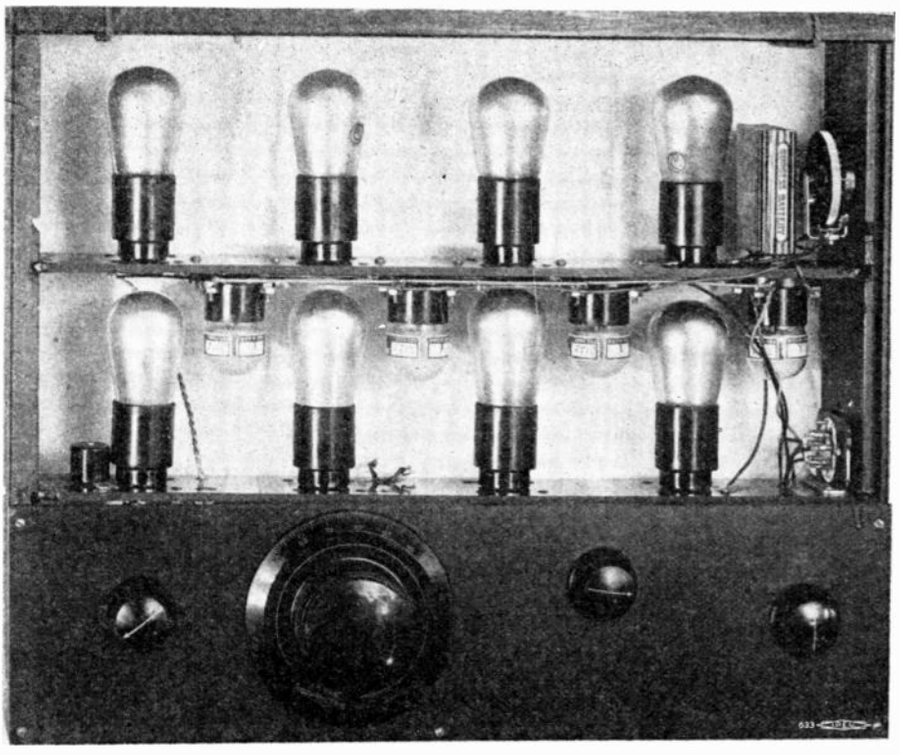
We should so construct our set that it would reject all electrical effects excepting through our collector.

Shielding will not do it, the most we can say for that method is that interaction is reduced considerably. The proper method would be to remove the source of such effects, and in the description to follow you will see that has been accomplished in a very novel and simple manner.

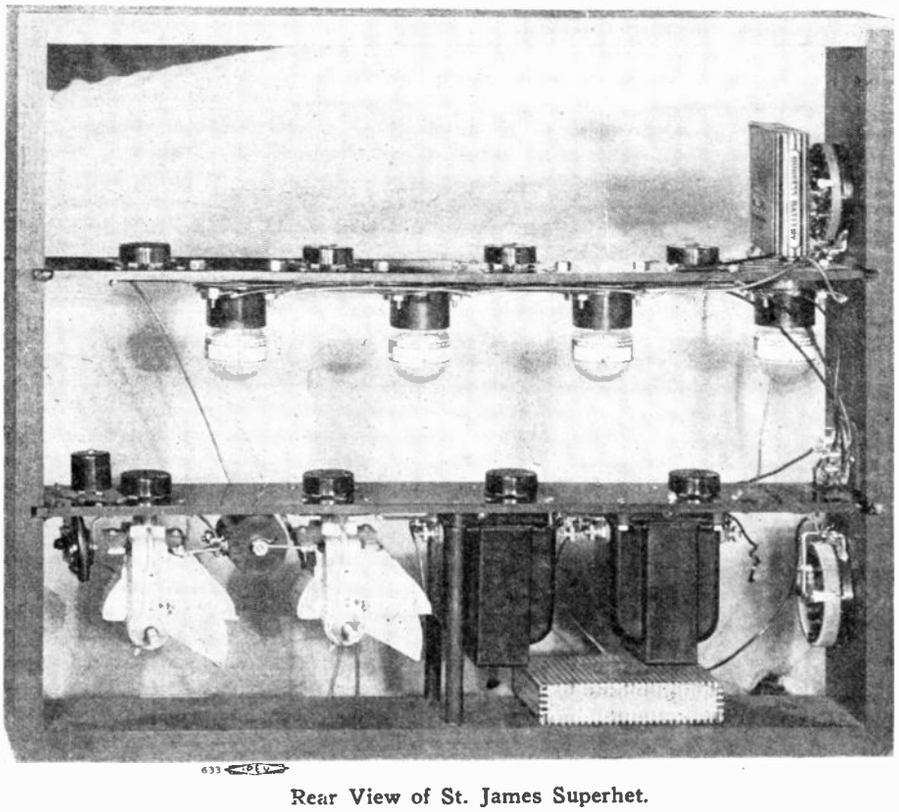
A loop collector has about 90 feet of wire on the average, and supplies sufficient energy to receive signals at considerable distances. The conventionally wired set has from 30 to 50 feet of wire connecting the various units together. The loop is tuned quite sharply to a rather narrow band, but the exposed wiring of the set is critical to all effects, especially those in the vicinity of the receiver. When this exposed wire represents approximately 50 percent of that of the loop, we have a condition much the same as we did with the leaky camera resulting in reception that could hardly be termed perfect.

The St. James upright "Eight" using the U circuit presents the first real solution of the objective, to have a sensitive balanced and highly efficient receiver which will pass our signal cleanly unaccompanied by disturbances to our speaker.

The chassis is so laid out that but ten feet of wire is required to form all connections. This wiring is divided into two legs, one in opposition to the other, so that the slight disturbances picked up on one side is balanced out by the other. This would be much the same as a column of water in a pipe. A pressure would be noted throughout, and to balance out this pressure the addition of another column forming a U would equalize and neutralize any flow that would happen in the single pipe.



Front View of St. James Superhet.



Rear View of St. James Superhet.

Balsa Radio Reproducer

The Lightest Wood on Earth Proves to Be Ideal Material for Home Built as Well as Factory Made Loud Speakers—"Speaking Screen" the Latest Sensation in Radio

By Arthur H. Lynch

Away back in the days of the Spanish Main, European explorers in search of treasure, happened upon a group of Panamanian Indians paddling a huge raft. They were indeed bewildered on seeing two of the Indians raise the raft from the water and carry it up on the beach. What manner of men are these, they thought as they watched the two natives carry the raft without difficulty, which they believed, judging from its size, would require at least ten or twelve of their own men to carry.

Putting a small boat ashore, they made friends with natives and by sign language, made inquiries concerning the raft, to which the Indians had given the name, Balsa, which by the way is also the Spanish name for raft. They were dumbfounded to find that this raft was particularly light. On making further investigation, they found that the raft was made from logs, cut from trees which were rather common in that territory.

Common to Tropical Jungles

These explorers then called the tree from which this wood is obtained, the balsa tree. The botanical name of this particular species of tree, is the ochromo lagopus. This tree is common in tropical jungles. In appearance, it resembles the North American cotton-wood, the bark being fairly smooth. The cut wood has something of the appearance of clear white pine or basswood and has a smooth velvety feeling to the touch. Balsa is, so far as is known, the lightest wood that grows. The commercial product averages from six to seven pounds per cubic foot. This is approximately one-half the weight of good cork. This lightness is the result of a peculiar cellulose structure which differs from that of nearly every other wood. In ordinary woods the thickness of the cell walls generally forms a considerable part of their diameter but in balsa, the cell walls are extremely thin and there is practically no lignification. This structural arrangement confines within its barrel-shaped cells, a considerable quantity of dead non-circulatory air which represents 92% of the total volume.

Commercial Application of Balsa

The commercial applications of a wood of this character were soon recognized, and it was not long before rafts, boats and life-saving equipment of various kinds were made of this remarkable wood.

During the World War, thousands upon thousands of mines were floated in the mined areas in the sea, by means of balsa wood floats. Practically every modern aeroplane manufactured in the United States and foreign countries, has balsa wood stream lining in the wings. Balsa wood is also used for the struts and as a filler in the fuselage because of its extremely lightweight and comparatively great strength.

The famous Ryan monoplane, Spirit of St. Louis, flown by Captain Lindbergh on its record breaking flight from New York to Paris, had lata balsa built in at various vita locations.

The Bellanca plane, Columbia, which was flown by Chamberlain, and Commander Byrd's America, now so much in the public eye, are equipped with generous quantities of lata balsa wood.

All the lives on the transport President Lincoln, which was torpedoed by a German submarine, were saved by means of trusty balsa wood rafts which were immediately thrown into the water when there was no time to launch the life boats. These are but a few of the ways in which balsa has distinguished itself.

Fig. 2. The front of the Lata Balsa Reproducer is here covered with an attractively colored chintz. The reproducer made up in this fashion makes an ideal wall decoration. The chintz does not touch the diaphragm and is light enough so as not to interfere with the performance of the reproducer.

Varying Degrees of Lightness Found in Balsa Wood

Just as is true with almost every other wood, and just as we find in the construction of the human body itself, there is a very great variation in texture in balsa wood. This variation in texture brings about a change of weight. For each particular weight and texture of balsa wood, certain commercial applications have been found. For instance, balsa wood of varying degree of density and weigh is now in common use in electric refrigerators, refrigerator trucks and refrigerator railroad car bodies, shipping containers, cold storage plants, building installation, various types of incubators. Balsa wood is also used as foundation pads for machinery, to absorb the vibration from prime movers and thereby eliminate the noise that they would ordinarily produce. It is used for bath room floors and walls, it is also used for surf boards, aquaplanes, life rafts, bathing floats, life preservers, mine buoys and for a number of purposes, including rifle cases and decoys by sportsmen.

And Now Balsa For Radio Reproduction

For a number of years scientists and others interested in the production of musical instruments and other sound producing devices, have realized that the production of a true sound, depends to a very great extent upon the true vibration of the sound producing device which agitates the air around it. It has been found that any material which is subjected to a vibrating force, will create a corresponding sound. Some materials, however, such as the

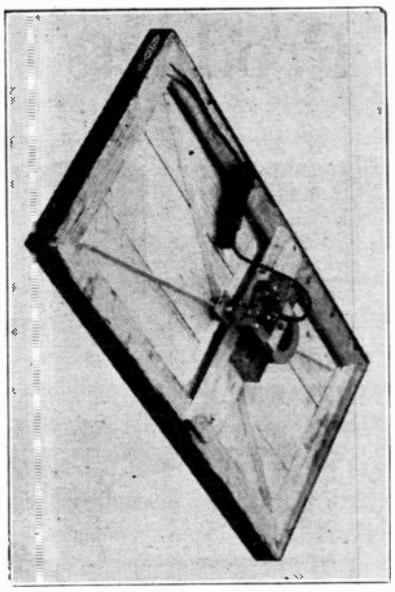


Fig. 1. The home-constructed Lata Balsa Reproducer of the approved type. Three wide strips of Lata Balsa wood which is cut very thin are placed within the frame. To one surface of these three pieces, Lata Balsa fins are attached as shown in the accompanying sketch. Where the fins converge in the centre, a small metal clutch is attached and this clutch in turn makes the connection between the centre of the diaphragm itself and the driving piston of the reproducer unit. The reproducer unit is mounted on a wooden support which extends directly across the rear of the frame from one side to the other.

various metals, respond to one frequency more readily than to all other frequencies. A specific instance of this nature is the tuning fork. Tuning forks are designed to vibrate at a single fixed frequency.

Metal diaphrams used as sound producing elements, either in telephone receivers or in loud speakers, share this characteristic of the tuning fork, to a greater or less degree, depending upon the diameter of the diaphragm itself, the thickness of the diaphragm and the material of which the diaphragm is made.

The Ideal Reproducer

Engineers have discovered that a particular weight of balsa wood, constructed in the form of a diaphragm and driven by a pin at its center, comes nearest to approaching the ideal reproducer of any system yet developed.

Balsa wood for this particular purpose is now being prepared in comparatively limited quantities by a secret process. This particular type of balsa wood is being introduced to the radio and phonograph field under the name of Lata Balsa wood. The word, Lata Balsa, is used to distinguish this type of wood from the other grades of balsa wood, which, though suitable for some of the commercial purposes outlined above, are not at all suitable for radio reproducers.

The prime factor and most remarkable characteristic of Lata Balsa wood, is the fact that the natural period of vibration is negligible. Therefore, a diaphragm made of this material will respond only to the vibration delivered to it by the driving pin of the electric magnetic device commonly known as the reproducer unit.

Technically, Lata Balsa wood is known as dead material. A properly designed lata balsa wood diaphragm, driven by a sensitive reproducer unit, will respond faithfully to frequencies as low as 14 cycles. It will also respond to frequencies so high that it is beyond the human ear to detect them. From the standpoint of acoustic engineering, the possibilities of a reproducer of this character may be immediately recognized.

Building the Lata Balsa Reproducer

The simplest and what seems to be the most popular method of building the Lata Balsa wood diaphragm, is illustrated in Fig. 1. The size of the supporting frame may be varied to suit the desire of the builder.

Frames of three different sizes with the necessary balsa wood for making the diaphragm to fit, are now available and they will be found to fill any ordinary requirements. The medium size, namely 36x21 in. is the most popular.

Three rather wide strips of Lata Balsa wood, which is cut very thin, are placed within the frame. To one surface of these three pieces, Lata Balsa pins are attached as shown in the accompanying sketch. Where the pins converge in the center, a small metal clutch is attached and this clutch in turn makes the connection between the center of the diaphragm and the driving piston of the reproducer unit. The reproducer unit is mounted on a wooden support which extends directly across the rear of the frame from one side to the other.

Because of its shape and because it is flat, the Lata Balsa reproducer lends itself very well to the production of an artistic piece of furniture, as well as a really good reproducer. Light printed cloth material may be applied to the outside edges of the frame and kept away from the diaphragm as shown in one of the accompanying photos. Almost any design may be used and in this way the Lata Balsa reproducer may well express the individuality of the builder.

Reproducer Not Entire Story

The reader of a descriptive article of this character, sometimes makes the mistake of asuming that the wonderful depth of tone it is possible to produce with the Lata Balsa reproducer, is made possible merely by attaching the reproducer to any radio receiver. This is not true. One of the best reproducers available to the public before the Lata Balsa reproducer came into being, was the Western Electric Cone. Properly operated, this cone can be made to reproduce music and speech with remarkable fidelity. However, when this cone was first introduced, it was found that it would not perform in a satisfactory manner on more than about 15 per cent of the radio receivers then in existence. Many people assumed that the difficulty was with the speaker instead of tracing it back to the audio amplifier on the receiver where the trouble actually did lie.

This is true even to a more marked degree when the Lata Balsa reproducer is used. In order to have the beautiful music which is made possible by the use of the Lata Balsa reproducer, it is necessary that the reproducer be fed by a radio receiver having an audio amplifier which is capable of reproducing the low as well as the high notes without distortion.

Radio and acoustic experts agree, that one of the simplest, cheapest and best types of audio amplifiers is made by the application of a resistance coupling. This is particularly true when the new high mu tubes are used and a power tube is used in the last stage. The application of a resistance coupled amplifier to already existing radio receivers, is a rather simple procedure and the results obtained more than warrant the slight expense involved.

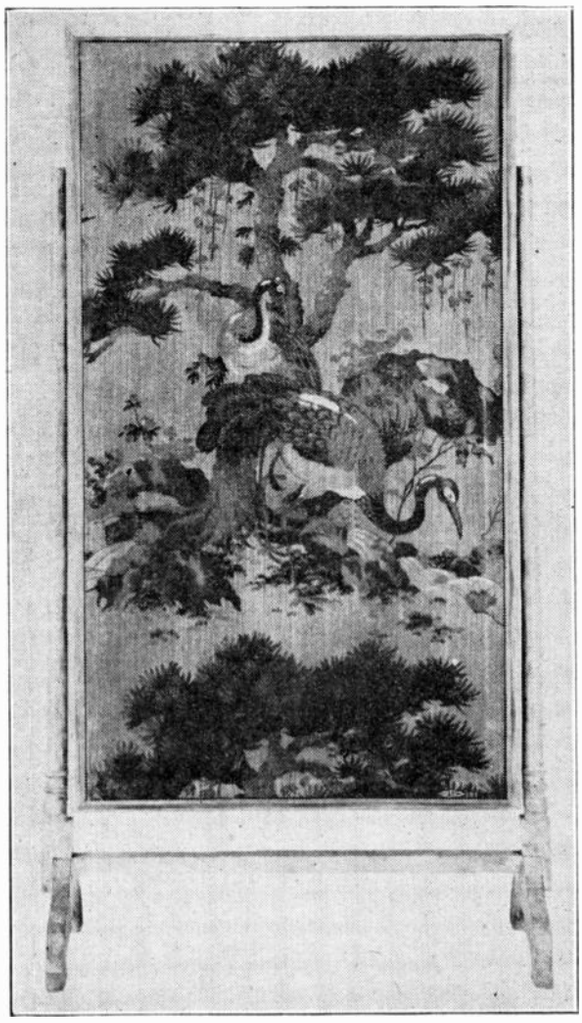
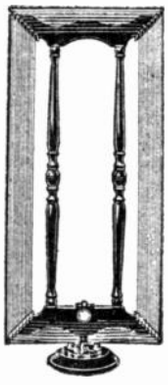


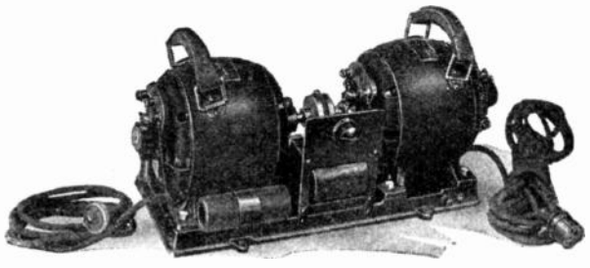
Fig. 3. Another attractively covered Lata Balsa Reproducer mounted on an easel. Designs of many kinds may be had and the individuality of the constructor expressed by the particular covering employed.

Bodine DeLuxe Loop



The engineers of the Bodine Electric Company, Chicago, have concentrated their attention on the building of an improved loop which combines beauty and efficiency. They have called their new loop the Bodine DeLuxe Loop, and its outstanding beauty certainly merits the name.

The frame is of hand-rubbed, selected American Walnut and harmonizes with the most artistically decorated room. The signal pick-up ability of the DeLuxe Loop is remarkable. It has given excellent results on Victoreen, Nine-in-Line, Best, Madison-Moore, Scott, Eight-in-Line, and many other popular super-heterodynes.



A New Radio Motor Generator Set

The Bodine Electric Company, Chicago, Illinois, have developed a radio motor generator set for operation of alternating current radio on direct current supply. The unit is noiseless in operation and overcomes the disturbances common to ordinary D. C. to A. C. conversion equipment. It has an efficient filter system which eliminates disagreeable noises and furnishes a pure 60 cycle alternating current amplification for any radio set. Extension cords are provided for plugging the motor direct to D. C. lighting sockets.

The Improved Aristocrat

A Real Receiver at a Modest Price

By Arthur Lynch

A real radio receiver usually costs real money and plenty of it. This is true whether the receiver is made at home or purchased complete. It is a safe general rule to figure on getting just about as much satisfaction from a receiver as you are willing to pay for it. The price of good receivers and good kits has increased rather than decreased for the past few years. Radio engineering has progressed and the developments have, as a rule, been accompanied by a greatly increased cost and a corresponding increase in the work involved in applying the improvements.

Sound engineering, however, need not be entirely based upon luxury. We find that in other fields of endeavor improved performance is many times accompanied by price reductions. This is particularly true in the automotive field. We can buy a smoother riding car, with a better motor, which is more economical on gasoline and tires and requires less repairing for a lot less money than we could a few years ago. This has not been true, up to now, in the radio field.

It is very true that we have been able to purchase cheap receivers and cheap kits, but their performance has been of an inferior nature.

The author has, for a long time, insisted that it is possible to produce the necessary material for a more than ordinarily good receiver, employing real engineering, so that the material necessary for building it could be purchased at retail—and not cut price either—for between $25.00 and $35.00. The notion was that the material would be of the highest grade and still be available to the man of limited financial resources.

The proposition was put to several of the more responsible manufacturers. They all agreed that it was a fine idea but most of them took it with a grain of salt. We got busy and designed the receiver to be described here, hooked it up in the office, put it in a swell console and invited the same fellows to come in and hear it. Before telling them it was our 25-35 baby we asked how they liked the way it tuned and how they liked the tone quality. They agreed without a single dissenting voice that it was the bee's knees. They then began to ask questions. They were not convinced that we were not spoofing until we yanked the chassis out of the console and showed them how it was done. Then they all agreed it was a knock-out and they all wanted to play ball along with us in putting the idea across. There aren't any fly-by-night concerns among them, either. They represent the cream of the business—folks who have made real records for themselves by giving a dollar's worth for a dollar.

How It Was Done

You, like our manufacturer friends, may want to know how it was done. Here is the answer:

A few years ago the author designed a receiver which was known as the "Aristocrat." It was very popular and folks who built it still talk about it. It was described in Radio Broadcast month after month and became one of the most satisfactory receivers ever described in that magazine.

Arthur H. Lynch, author of the accompanying article is a young man of very wide radio experience. For many years he was a commercial operator. At one time he was employed by the New York Times at its trans-Atlantic receiving station, which was installed by your editor and of which he was in charge. Later he was Assistant Advertising Director of Publicity of the Radio Corporation of America. He resigned this post to become Editor of Radio Broadcast Magazine, which he handled in most able fashion for four years. In less than two years he has come to the front as one of the country's ablest radio manufacturers and merchants.

Mr. Lynch has many friends among the manufacturers and publications because he is always willing to give and take advice—witness the important personages lined up behind him in this enterprise. It is a pleasure to present this informative article to you.

THE EDITOR.

Here, thought we, is a receiver already recognized as a good one—a receiver which, for sensitivity, selectivity, ease of operation and tone quality is hard to beat, at any price. True, it was not the easiest receiver in the world to build—nor by any means the most difficult. Even though it was a mighty fine receiver and every effort had been made to hold the price down, it would cost a little more than $60.00 to purchase the parts.

How, then, could we simplify the construction and bring down the cost? "A rather large order," you'll say. And we agree.

Well, we realized that a sub-panel was necessary for mounting some of the parts. We decided to have a manufacturer turn out the sub-panel with all the parts on it. That cut the cost way down and cut the work for the home constructor down to a minimum. A glance at the accompanying illustrations will prove this point. At the same time these advantages were realized other engineering features of merit were utilized and the sum total result is a unit which will be known from now on as a "deck."

But, before saying any more about the decks, you may want to know the names of the companies interested in this project—companies which indicate by their willingness to cooperate, that they too are interested in providing good radio entertainment without gouging the public. They include the Aero Products Co., Ambassador Sales Co., Amsco, Arthur H. Lynch, Inc., Balsa Wood Reproducer Corp., C. E. Manufacturing Co., Cogswell Mfg. Co., H. H. Eby Mfg. Co., Electrad, Inc., F. W. Sickles Co., General Radio Co., Hammarlund Mfg. Co., National Company, Precision Coil Co., Samson Electric Co., Silver-Marshall, Inc., Westinghouse Elec. & Mfg. Co., Wireless Radio Corp., X-L Laboratories. And it is very likely that this list will soon be increased to include the names of several more similarly high-grade houses.

But to get back to the deck. It is a sub-panel of Westinghouse Micarta with everything necessary for making a five tube receiver mounted right on it—except the tuning elements. There are five of the latest type Eby sockets; all the coupling condensers and resistors for the latest type resistance amplifier held in place by a new type of clip which insures perfect contact. The resistors being of the now-famous metallized type, made with special ends to fit the new sure-grip clips. The fixed condensers are of an entirely new type and are encased in glass tubes. They, too, are provided with metal caps similar to the resistors and, as may be seen from the accompanying illustrations, fit directly into sure-grip clips. The by-pass condensers for the input of the audio amplifier is of the same type and is also mounted on the deck. The grid condenser mounting is a real inovation. The clips for the grid condensers are made double and an additional sure-grip clip is provided so that the grid leak may be placed either directly across the grid condenser, as is the custom with the ordinary type of detector tube, or, the grid leak may be connected directly back to the filament circuit by using the additional clip. The latter arrangement is for use with gassy detector tubes, such as the Radiotron 200A and Cunningham 300A.

Holes are provided in the deck for ten binding posts. The posts, however, are not part of the deck equipment because some constructors will wish to use a cable for the battery connections.

Every improvement which this season is

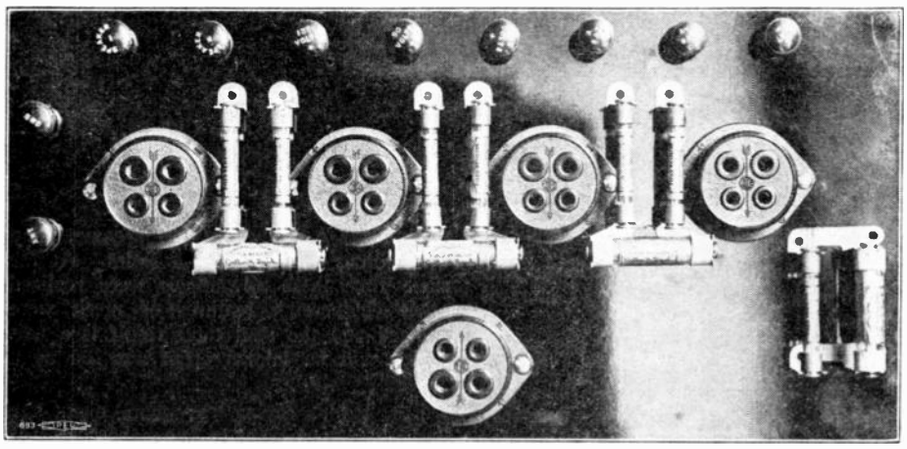


Fig. 1. Top view of the Lynch 5 tube deck. Note the special sockets, special resistors and condensers held securely in place by the new, patented, sure-grip mounts. The binding posts are shown here to illustrate the appearance of the deck when they are employed.

likely to unfold may be applied to the circuits with which the deck may be used, by making a few simple changes in the wiring. All of these additional uses will be described as they prove to be practical. For the time being we will be satisfied with a most satisfactory receiver at a very low first as well as very low upkeep cost.

The Circuit

The new deck may, as we have mentioned, be used with any one of a whole group of circuits and will, regardless of the circuit employed, deliver very much better than average tone quality because of the resistance coupled amplifier which it has been made to include. Radio engineers who are open-minded about audio amplification agree that there is no better method of obtaining good tone quality at any cost and there is certainly no means of obtaining the same quality at anything like the same cost.

For the particular application of the deck about which this article is written, we have chosen the famous Aristocrat circuit. This circuit is the result of the application of some of the best work of Armstrong, Roberts, Hazletine, Rice and other recognized authorities. Their work has been combined into a receiver which embodies the advantages of each without involving the disadvantages which any of them would bring about if used alone.

Technically the circuit is known as a stage of tuned, neutralized radio frequency amplification coupled to a regenerative detector which is in turn followed by a three stage resistance-coupled audio amplifier.

This sounds very involved and it does include some of the soundest radio engineering. However, a glance at some of the illustrations will show how simple all of this engineering is, when reduced to practice. The net result is much simpler to achieve than most other circuits, regardless of the engineering involved.

Nor is there anything tricky about the circuit. It is similar in principle to the circuits which have consistently gained in favor for the past few years. These circuits include the Roberts, the Universal, the Browning-Drake, the Teledyne, the Diamond of the Air, the Hammarlund-Roberts. Most of the improvements over the Aristocrat of three years ago are found in the mechanical changes in the layout which simplify the construction and operation.

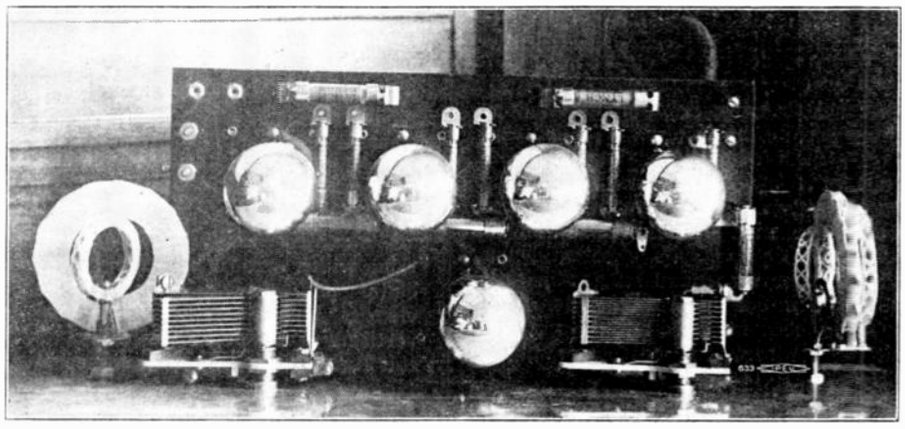


Fig. 3. Illustrates the simplicity of wiring of the Improved Aristocrat when a metal panel and the new deck are used. In this instance Sickles coils have been used in conjunction with Cogswell condensers. Note the additional plate on the left of the left-hand condenser. This forms the neutralizing condenser and it is adjusted by turning the small screw which is visible in the illustration.

Many Fingers in the Pie

The present author has been very fortunate in having the whole-hearted cooperation of some of the best brains in the industry in producing this design.

For instance, the sure-grip clips which hold the resistors and the coupling condensers for the resistance amplifier are the work of Arthur Dorsey who holds a patent covering their use. Mr. Dorsey is the designer of many of the vernier dials which have been most popular for the past few years.

H. H. Eby, the binding post and socket manufacturer, has provided special prongs on his new type sockets for the deck which couple to the resistor clips by eyelets and thus reduce the wiring to a minimum.

F. W. Sickles, the man famous for the diamond weave coil suggested the use of a rotating primary for the antenna coupler. This makes it possible to get any degree of selectivity desired and almost any volume without using an antenna switch, which was the arrangement on the former Aristocrat. Incidentally this improvement makes the operation of the receiver simpler, makes it easier to assemble and reduces the cost. All of the coil manufacturers to whose attention this suggestion has been called have agreed to make their antenna couplers with rotary primaries from now on.

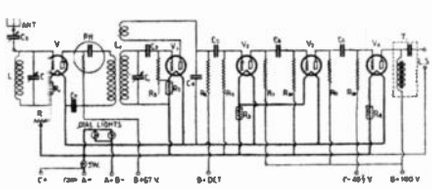
Mr. Cogswell, of the condenser manufacturing company bearing his name, has developed a very unique neutralizing condenser which is made part of the antenna tuning condenser and thus aids in simplifying the receiver as well as keeping the cost down.

Lloyd Hammarlund showed us a similar way of applying one of his neutralizing condensers to one of his standard condensers, which effects a similar saving in time and money.

James Millen, who has become famous in a very short time for his very intelligent and very practical applications of sound radio engineering, especilly in the application of electric light current to receivers, has had a hand in the design from the beginning which, by the way, was many months ago. To attempt to describe all of his contributions to the completed job would require more space than there is available here.

Seymour Wolmner, of the Wireless Radio Corp., has produced a special metal panel with the holes already made in it for the various dials and fittings. By the use of his panel and vernier dials, which are mounted directly on the panel, the cost is further reduced, the building simplified and the appearance greatly improved. The illuminated vernier dials which are made part of his panel also form the supports for holding the deck without any brackets being necessary.

Ernest Kauer and Roger Williams, Chief Engineer and Laboratory Director, respectively, of the C. E. Mfg. Co., makers of CeCo tubes, have been very generous in supplying the author with valuable tube data which enabled him to make suggestions for improving the performance of the receiver by using special tubes.



Use of Phasatrol for Neutralization and Midget Condenser for Antenna Tuning.

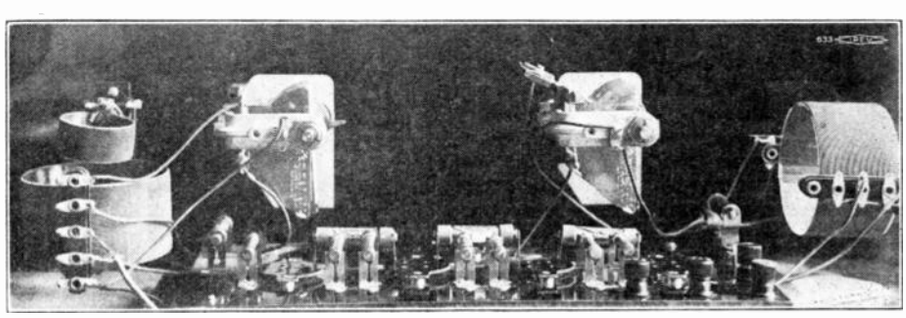


Fig. 5. In this receiver a Westinghouse Micarta Panel 7x21 inches is used. Hammarlund coils and condensers are used here to good advantage. All of the parts necessary for building this model may be had for a little less than $35.

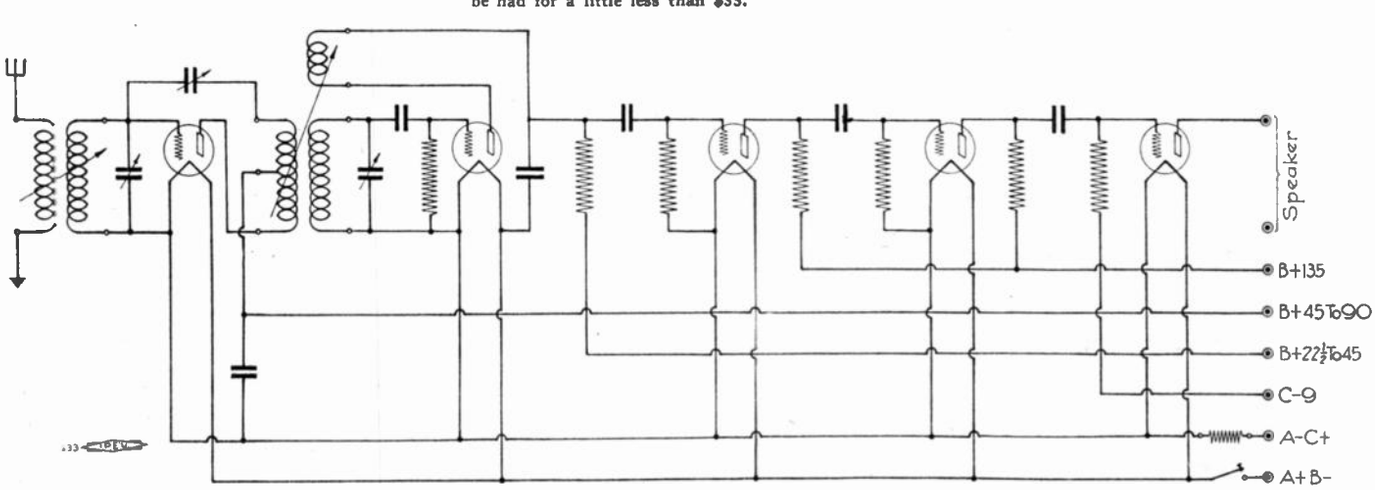


Fig. 6. This is the regular Improved Aristocrat Circuit. In this instance the Roberts system of neutralizing is employed. The split primary system is used in this instance. This is the circuit employed in the receiver illustrated in Fig. 3. Such coils as the Sickles, Hammarlund, Ambassador, Uncle Sam, all of which may be obtained with dual primaries may be used in this circuit.

1921 Dreams — 1927 Achievements

The Romantic Past and the Hustling Present of Chicago's Oldest Radio Store

As far as the affairs of the world in general are concerned, 1921 is merely yesterday. But to speak of the year 1921, in connection with the world of radio, is to hark back to the beginning of time. Very few of the people who form a part of the great radio industry of today can date their "radio past" back that far. For radio was merely a dream of the future for most of us at that time. Take the case of Lou M. Strauss. Now, as president of the Newark Electric Company, radio means almost everything to him, whereas back in '21—well, that brings us to our story.

Behind the counter of his little cigar and novelty shop out on West Madison Street, Lou Strauss used to listen to his friends and customers discussing the news and the fads of the day. Lou was a good listener, and he could talk to all of them along the lines that interested them most. Except in the case of that man Smith. . . .

Smith, to give him a conveniently indefinite name, had always appealed to Lou as a good sort—just a regular fellow. But lately it seemed that he'd gone off his keel somehow. He no longer evinced any interest in discussions concerning Jack Dempsey, or Babe Ruth, or Earl Sande—and he would persist in dragging into the conversation a lot of meaningless chatter about "variometers and couplers," "ohms and amperes," "static and antennae." The rest of the boys just put him down as a "Nut" and let it go at that. Lou was almost inclined to do the same—except that he was curious to find out more about this strange hobby that could change such a bright likeable chap into a one-track mind and a dreamer.

So, one Friday night when Lou was closing up the shop just as Smith came along with a particularly wild yarn about "a symphony orchestra coming in tonight over the air from Pittsburgh," Lous was ready to investigate this queer business of radio at first-hand. For once, he didn't laugh down the invitation that Smith had so often made around the store, "to come out and see for yourself." He went along—prepared for a big laugh, perhaps—but at any rate he went.

When the miracle actually came off according to schedule, and the strains of violins and wood-winds came in with uncanny clarity, "clear from Pittsburgh," Lou stayed to marvel, and came away with a dream of a new busines future.

In the case of Lou Strauss, to dream meant to act, and he lost no time in setting out toward his new goal. Of course, you can imagine that it was no cinch to convince a wife, possessed of logic and common sense, that it was anything but utter tomfoolery to give up a thriving little business in cigars and novelties to embark in a business in an unknown something called "radio." Something she'd never heard of, and something that Lou himself was so hazy about that he couldn't explain.

But Lou had his dream.

Saturday morning the boys on Madison Street exchanged blank looks when they saw the tobacconist's stock moving out, and on Sunday the blank looks turned into broad grins as they saw the signs go up announcing the Radio Service Company. But they—and perhaps Lou himself—received a big surprise when Monday morning saw a brisk business going on in those "variometers and couplers" that so few people seemed to understand—and such an astonishingly large number of people seemed to want! It was Lou's turn to grin—and has been ever since.

In that early day there was but one radio manufacturing company in Chicago, and there was no established radio station. But there was nevertheless, a big demand for radio parts, as Lou had been astute enough to foresee. And he simply made it his job to keep a jump-and-a-half ahead of that demand. Night would find Lou at the manufacturer's factory, buying all the "variometers and couplers" he could lay his hands on. And morning would find him selling them as fast as he could load them onto his counter.

Everybody seemed to be possessed of a mania to build a set—and Lou seemed to be the only one able to help out. Of course, at that time Lou himself couldn't have built a set if he'd tried. But Lou had a complete catalogue of radio parts—which was something nobody else seemed to have—and he had a motto: "If we haven't got it, we'll get it." And he made good.

Sometimes, in those first days, it was up to the customers themselves to identify parts of Lou's fast-growing stock. "If you know it when you see it, and you know what it's for after you get it, why you'll probably be able to find it here."

Those were the days.

Of course, other radio stores began to dot the Loop district. But still Lou made it his business to keep a jump-and-a-half ahead of the demand. For example, there came the story of some new wrinkle called a "vacuum tube." Everybody wanted them—and it seemed that nobody had them. So Lou was hot on the trail.

It was no more than a vague rumor that had somehow come to the ears of his fellow radio-enthusiast, Smith. "Somebody in Detroit's got a stock of tubes." As fast as a train could get him there. Lou was after those tubes. And he got them—50 of them, at a price of $6.50 each. Back to the Loop again, and he found that "somebody on the South Side" was rumored to have obtained a couple of hundred tubes. He cornered those too, at the same price of $6.50.

And next day, while everybody was still wondering where they could get hold of vacuum tubes, Lou had 'em. More than that, he ran a sale on them, retailing them at $6.50 each, the exact price he had paid. It was a city-wide sensation among the radio amateurs of the day, and the seven hundred tubes were gone before the day was half over.

Of course, he could have charged more for them. He could have sold them at almost any price. Foolish. Not at all, in fact we have right there the key to the subsequent success of Lou Strauss' business.

For this is a business that has been built up on *merchandise*, not on *prices* And Lou M. Strauss realized, from the very dawn of radio, that a success in the radio parts business depended more upon the completeness of his store's stock, than upon the prices charged. Time has proved the correctness of his theory, for while many radio stores have come and gone in the past six years, Lou Strauss business has continued to grow, until the point has been reached where his stock is the most complete in the United States, and his customers can be counted in all parts of the country.

Times have changed, in a vast degree since the early days of the Radio Service Company. For a time radio business centered in parts, rather than in complete ready-built sets. And radio parts stores seemed to spring up on every street corner. Soon there were "Radio Service Companies" by the score, and the Lou M Strauss organization had lost its identity though not its established trade. So it was time to find a new name.

Lou called up the sign painter, but he wasted no great thought on the subject of the new firm name. Lou was too busy keeping up with the new developments of the industry, for, to his mind "The name on the sign isn't the important thing, it's the merchandise behind the sign that counts." But there was the sign painter, ready for work, and a new

name was required. Lou paused in his perusal of radio journals and catalogues—

"Well, let's see, what'll we call it? Hmm, that was a nice program I heard over (?) last night, from Newark, N. J. Newark—there's the name." And so the Newark Electric Company was born, as the succesor of the Radio Service Company.

So the name was changed, and the store meanwhile had been moved, in answer to the need for larger quarters, to its present location at 226 West Madison Avenue, but these things, after all, were of minor importance. The big change is best represented by the change which was made in the motto at that time. There was no longer any need for Lou to say, "If we haven't got it, we'll get it," for he had long since seen to it that, whatever it was, he had it. So the store justified the new motto: "Everything in Radio."

Came hard times for the radio parts business. The ready-made sets began to sweep the market, and the boys along Madison Street perhaps began to think that the end was in sight for the Newark Electric Company, as it was for so many of the stores catering to the demand for custom-made radio sets. But Lou was still serene—and the great decline of the radio parts business did not suffice to erase his smile.

For it was "still Lou's turn to grin." Though the general trade in radio parts fell off, Lou's business began to grow all the faster. And Lou knew why. Let him tell you in his own words:

"There was a time when the custom tailors clothed the country, and the 'hand-me-down,' or ready-made suit, was a laughing stock. You know how that has changed. You know how many tailoring establishments have gone out of business as the great clothing manufacturers have come up. But you also know that there is still a call for custom-tailored clothing, and there are custom tailors who are better off today than ever before. Well, it's the same way with the radio game. There will always be a big demand for radio sets that are 'tailored to your individual needs' just as there will remain a demand for tailored-to-your-measure clothing. And those who can supply the larger variety of essentials required to insure radio sets of the custom kind that are actually an improvement over the average, will find their niche in the radio industry."

And as he puffed his cigar, in contemplation of the paintings on his wall of Steinmetz, Marconi, and DeForest, it almost looked as if those great worthies were nodding back to him in complete agreement.

Whatever you want in the way of radio, you'll find it when you go to see Lou Strauss. If it's a part, it's here in stock, or will be obtained by the fastest possible means. It it's advice on matters pertaining to success in radio-set building, you'll get that, too. For Lou Strauss aims to maintain a service, for the radio amateurs of the country, rather than a mere bazaar.

Readers of this magazine are already familiar with the fact that Station WCFL, in seeking to give the ultimate in radio service through the WCFL Listeners' Co-operative Association, could do no better than turn over all of the Association's needs to Lou M. Strauss and the Newark Electric Company. So we, too, are profiting today from the fact that in those far-off days of 1921 Lou M. Strauss had a crazy dream that caused broad grins along West Madison Street.

The days of Lou's dreams are by no means over, either. For he is still dreaming of the future of radio, and thinking of the hosts of youngsters over the country who are radio amateurs, and in whose hands, he realizes, the future progress of radio lies. And, in his dreams of that future, he still sees to it that his own service shall lie in keeping "a jump-and-a-half ahead of the demand."

So it is, that on September 22, when all the boys of the old days on West Madison Street are swarming to the Tunney-Dempsey fight, Lou finds himself far away. Not that he wouldn't like to be there, for he's still a regular fellow. But there's the Radio World's Fair on in New York, and Lou still has his dream . . . and he's determined to see to it that in living up to those dreams of 1921, he keeps abreast of the latest radio developments, and holds his enviable position of maintaining the most complete radio stock in the United States.

The Loud Speaker Comparator

By Garet Denis
Development Engineer, Temple, Inc.

Within recent years many milestones of progress have been passed in the onward rush of the radio manufacturer and layman in search of an idea. This tremendous growth of the radio industry has caused the most intensive development of practically every device pertaining to the improvement of radio, and more particularly to the equipment which is responsible for the improvement of quality of reproduction. Prospects of improved air conditions along with the outstanding achievements of loud speakers and audio frequency amplifiers gives the manufacturer the feeling that the public will appreciate the efforts he is making for better radio.

Because of the great improvements which have been made in quality of reproduction, it is apparent that this improved radio will enjoy a well earned popularity this coming season.

With the rapid improvement of speakers there comes the demand for some method of quickly demonstrating the merits of one speaker or amplifier over another to the public and in this way settling any controversy or doubt as to the relative performance in the observer's mind. It often happens that a dealer in making a demonstration to a prospective customer has been asked to switch the set from one speaker to another so that the customer might compare the volume and quality of response on a particular piece of music, but before the change could be made the selection was either finished or it changed so that the customer received an erroneous impression of the speaker.

Many types of switches with jacks have been assembled by ingenious dealers to facilitate making comparative demonstrations of speakers. Most of these devices have been more or less crude, but, nevertheless, they answered the problem. In laboratories where it is imperative that an unbiased opinion of the merits and faults of the speaker be known, switches have been made from the early days, which will allow a rapid change over from one circuit to the next.

A shown in the figure, a compact and new design of such a switch has been developed which incorporates every desirable feature in such a simple apparatus and which is available to the dealer and layman as well as to the laboratory. It consists of a bakelite turret, moulded in the form of a hollow truncated cone. Around the base of this cone five pin jacks are mounted, all of which are electrically connected together on the inside of the cone form, and form the common lead to five speaker circuits. Directly above each of these pin jacks five more jacks are mounted in such a way so as to allow the switch arm to make individual contact with the terminal of each one of them.

The switch arm is mounted on a shaft which extends through the flat top of the truncated cone. A ball bearing is placed in the cap nut which holds the switch arm on the shaft and the bakelite turret is notched so that when the switch is turned from one jack to the next it drops into position with a snap and in such a way so as to make definite and positive electrical contact. The switch arm is insulated from the metal name plate It passes from one to another one of five speakers almost instantaneously which allows the same tones to be heard in each of the speakers. From this a critical comparison can be made and definite conclusions as to respective merits of each speaker can be obtained very easily.

Radio Tubes — Their Use and Abuse

By R. M. Wise

The steady growth in the number of "Special Purpose" radio tubes, combined with progress in receiver and reproducer design, has made possible marked improvement in tone quality of reproduced broadcast music and speech. Nearly all of these special tubes can be utilized to advantage in older types of receivers, especially if a few necessary precautions are observed. In the following paragraphs comments and suggestions regarding the proper use of special tube types are given, together with a discussion of some of the more common forms of abuse to which the better known and older tube types are more or less frequently subjected.

The "power amplifier" types of loud speaker supply tubes have been available for two years and their use is generally well understood.

The two types best adapted for medium "B" voltages are the CX-112 and CX-371. The CX-112, introduced first, came into immediate favor, and for a time was more popular than the CX-371. This initial preference for the CX-112 was due to several factors, the most important ones being, first, the fact that the voltages required by this type were identical with those required by type CX-301A, and the tube could be substituted without battery changes. Secondly, the horn type speaker, more sensitive than the cone speaker, was still popular and there was less necessity for the greater power output given by the CX-371. A third factor was the misapprehension about battery voltages, many not realizing that although the CX-371 could be used at the maximum voltage of 180 volts, the quality of reproduction was equally good at 135 volts, and the volume ample for average home service.

During the current season the position of the two tubes is rapidly being reversed, the CX-371 assuming the leadership, partly because of the large number of new receivers in which the tube is used, and partly because of a better popular understanding of the correct way of using the CX-371. As improvements in audio amplification and in speaker design are made the advantage of using type CX-371 became increasingly apparent. The higher frequencies are usually reproduced satisfactorily by any type of output tube, but to secure full undistorted reproduction of low frequencies, or the bass notes, a tube having low internal resistance is required, and the user who has tried the CX-371 will not be satisfied with other tubes unless he goes to the high voltage type (such as the CX-310).

In installing the CX-371, the first precaution with which the user had to become familiar was the use of a high grid biasing or "C" battery voltage—from 16½ to 40½ volts in the case of CX-371. With the general purpose tubes which the power tubes replaced, the use of a "C" battery was to a large extent optional with the user, although the fact that better quality was obtained with this battery was generally recognized.

With type CX-371 the "C" battery is not optional, but quite necessary for satisfactory tone quality and volume, to say nothing of the fact that continued use without the proper "C" voltage will overheat and damage the tube. The normal plate current with bias is 20 milliamperes at the maximum plate voltage, 180 volts. Without bias the current may rise as high as 100 m.a., dissipating so much heat in the tube that the plate will be heated to redness. Another precaution which must be observed when the CX-371 is supplied with "B" voltage from a socket power device is that the voltage, if adjustable, is not raised above the proper value for the "C" voltage provided. Some of these devices are capable of furnishing a voltage on the order of 200 to 300 volts, and if the knob controlling this voltage is adjusted by ear until the reproduction sounds best, it will nearly always be raised above the proper value, simply because an overflow of this kind reduces the internal resistance of the tube and so improves the performance to some extent, although deterioration of the tube soon begins and then the performance is rapidly impaired. Correct operation of the tube may be obtained from socket-power devices by observing any one of these precautions:

(1) Select a device equipped with a "glow tube," or voltage regulator tube such as type CX-374.

(2) Measure the plate current supplied to the last tube with a milliammeter, or—

(3) Measure the voltage applied with a high resistance voltmeter (suitable meters having a resistance of 1,000 ohms per volt are available).

One of the latter two measurements should be made by a service man at the time the set is installed, and then care taken never to exceed the setting found to be proper on this test, by turning the control knob to a higher setting.

With "B" batteries the maximum voltage obtainable is fixed, and it is only necessary to see that the proper "C" voltage is provided. Care must be taken to see that the "C" battery is not reversed, and that it is tested each time the "B" batteries are renewed. When the voltage has dropped to 17 volts per section from the initial voltage of 22½ volts the battery should be replaced. When there is a doubt as to the condition of this battery the safe plan is to renew it, for a run down "C" battery will greatly increase the current drain on the more expensive "B" batteries. If the audio transformer secondary is defective and becomes open circuited, or there is an open connection elsewhere in the grid circuit, the tube will lose its bias, the first indication of which will be greatly reduced volume together with distorted reproduction. The second indication is extreme heating of the power tube, which in normal operation becomes moderately warm at 135 volts and fairly hot at 180 volts. With such indications the set should be turned off and the trouble located before any attempt is made to continue operation.

Another special tube type which must be correctly used in order that best results may be secured is the special detector, type CX-300A. This is an alkali vapor detector tube, and is far superior to type CX-301A in detector sensitivity, due to the action of the vapor in the tube. This type cannot be designed so that the slight hiss characteristic of gas content detectors is entirely eliminated and where very high audio amplification is used, as with three stages of transformer coupled amplification, or even two stages of 6.1 or higher ratio transformers, the noise will become appreciable. Also, several of the good grades of audio transformers of current design have a resonance peak at the higher frequencies, which has a bad tendency to accentuate any hiss present. If the following combination is used, exceptionally good results are possible with the CX-300A:

(1) CX-300A detector, CX-301A first audio, CX-371 output tube, transformer ratio not higher than 4:1 (see following paragraph).

(2) CX-300A detector, CX-340 first audio, CX-371 or CX-112 output tube. Used with resistance coupling (see comments on CX-340 below:).

In connection with the combination (1) above, it is noted that transformers having a ratio not higher than 4:1 be used. It is also good practice to shunt the secondary of the transformer with a .5 megohm grid leak, as this will eliminate over-amplification of the higher frequencies, which is objectionable with the CX-300A. Another fact not generally appreciated is that the tube hiss is greatly reduced when a moderately strong carrier is tuned in. This may be tested experimentally during an intermission in the program from a broadcasting station by turning the volume control to a very low setting, and then back to normal, or by detuning one of the dials momentarily. It will be found that the hiss practically disappears as the carrier wave is tuned in, thus proving that the tube noise is not "drowned out by the music," as some listeners have supposed, but actually disappears.

The CX-340 is another special purpose tube of particular interest to experimenters who prefer resistance coupled amplification. This type of amplifier has the advantage over transformer coupled amplifiers in that the resistance units are less expensive, less bulky and very much lighter than trans-

formers providing equivalent quality of reproduction. The frequency characteristic can be made as flat as desired at the low frequency and, as the blocking condensers may be increased in size if desired, .006 mf., in combination with a 2 megohm grid leak will allow frequencies down to 30 cycles to be amplified without appreciable attenuation. It is often undesirable to have the amplifier efficient at frequencies below 30 cycles because the bypass condensers used in power supply devices introduce considerable reactance at very low frequencies, and may result in sufficient common coupling to cause an audio oscillation, or "motor-boating." The .01 megohm grid leak in the common lead to the detector, and first audio amplifier, shunted by 2 mf. condensers, Fig. 1, will secure a sharp cutoff of frequencies below the audible range and will prevent "motor-boating" with all of the better types of socket power devices, without in any way affecting the performance of the amplifier at higher frequencies. With "B" batteries and with the highest grade of "B" supply devices, the resistance may be reduced to .05 or .025 megohms. This method, on which patents are pending, is unlike other systems in which the performance of the amplifier at higher frequencies is impaired to prevent coupling at very low frequencies.

When the CX-300A is used in the detector socket, only two audio stages should be used, as three stages, with type CX-340 in the first and second audio socket, will result in excessive audio amplification. When type CX-301A is used, three stages may be used. In either the latter case, or when used with CX-340, the increased detector sensitivity of the CX-300A is of advantage, and the combination will bring out the best of each tube type.

When the CX-340 is substituted for type CX-301A in a resistance coupled amplifier several changes in constants are necessary, and the improved performance on low frequencies may cause trouble.

General Purpose Types:

During the past seasons the familiar types of radio tubes have played the role of "Jack of all Trades," and as a result have frequently been placed in service under conditions never intended or contemplated by the manufacturer. The manner in which the better grades of tubes have survived under severe "overloads" is a gratifying proof of the quality of the product.

What constitutes a severe "overload" on a tube? It might be imagined by the uninitiated that the last tube in a receiver tuned in on a strong local station, and with the volume turned up beyond the point where the music sounds clear, would fall under this classification, but this is not the case. This is a form of overloading, but one which only results in distorted music, and in general the tube is not affected at all, the only exception being cases where the distortion is so severe as to raise the average value of plate current to a high value. A severe overload occurs when the manufacturers' specifications on filament and plate voltage are disregarded, and higher voltages used.

In some cases the tube has been so consistently overloaded that many experimenters assume that the voltages generally used are the recommended values. One of the popular tube types affords a good illustration of this condition. The voltages recommended for type CX-301A are a filament voltage of 5.0 volts, and plate voltages of 90 to 135 volts with the grid bias specified as —4.5 and —9.0 volts, respectively. If the grid bias of 4.5 volts recommended at 90 volts is omitted it is equivalent to adding about 35 volts to the plate voltage, or in other words, is equivalent to operation of the tube at 125 volts with —4.5 volts bias. The overload is of course correspondingly more severe if the plate voltage is raised. This is clearly shown in the table, Figure 3.

It happens that Type CX-301A is designed with such a wide margin of safety that the tube is well capable of withstanding the 58 per cent overload which occurs when 90 volts plate is supplied to the tube without grid bias as shown in Line 3 of the table, Figure 3. Life tests have shown that the tube will give normal service under such conditions. If, however, the tube is in a set which is being operated from a "B" power device and the voltage from this device is raised above 90 volts, the overload may become severe enough to affect the tube life, particularly if at the same time the rheostat is turned above the 5 volt setting.

The fact that normal operation can be obtained under the above conditions with type CX-301A tube, has led many experimenters to use the dry cell types under the same conditions. With these tubes the overload capacity is less, due to the fact that the filament must be designed to secure very high economy of operation from dry cells. Operation of these tubes at 90 volts plate and with zero grid bias does not represent a satisfactory operating condition, the overload being approximately the same as with type CX-301A, or about 50 per cent. Satisfactory service will be consistently obtained from these tubes only when they are operated at 67½ volts plate and zero grid bias, or at 90 volts plate and with the recommended voltage of 4½ volts grid.

When power for the set is being derived from a socket power device and the adjustments are made by ear, that is, the voltages are varying until the reception sounds best, often leads to the use of voltages which are too high. Instances of this are frequently found in service; a typical example being a set which was recently checked up by a service man. In this installation a storage battery and trickle charger supplied the "A" current, while the "B" power was derived from a unit in which all voltages were adjustable by means of control knobs on the units. The user had planned to operate the output tube at 135 volts plate and had provided a "C" battery of —9 volts. A check up on the voltages applied to the power tube showed that the filament was being operated at 5.4 volts and that the plate voltage was 165 volts. The combined overload had proven too severe for the tube to withstand over a long period of time, and yet this was the setting at which the reception was best. Correction of these voltages resulted in satisfactory service being obtained from the output tube.

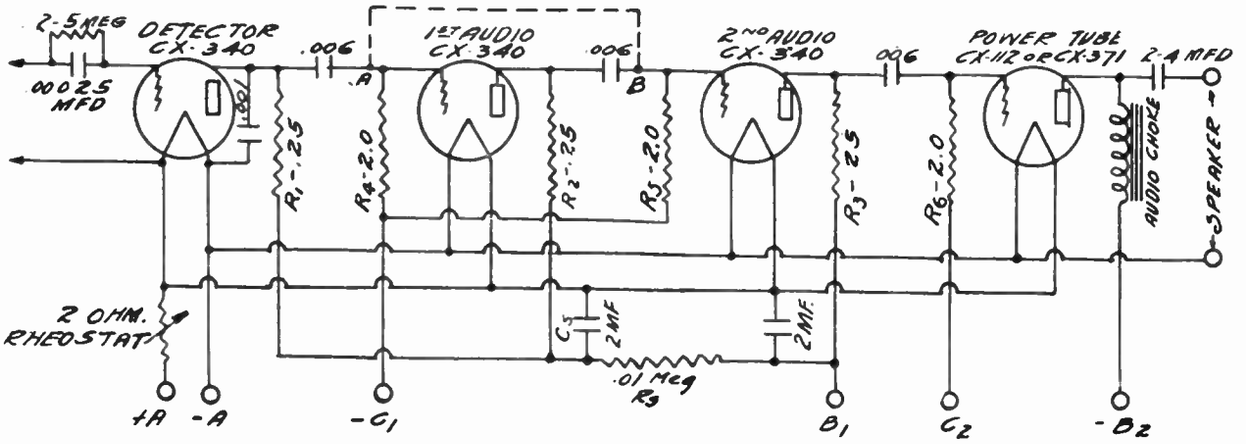
TYPE CX-301A

	Plate Volts	Grid Volts	Plate Current M. A.	"B" Power Consumed in the Tube Milli Watts	Extent of Overload
1	90	4.5	2.0	180	Below Maximum
2	135	9.0	2.5	340	Normal Maximum
3	90	0	6.0	540	58%
4	120	0	9.8	1170	240%
5	135	0	12.0	1620	380%

Figure 3

Memoranda

CUNNINGHAM CX-340



TYPICAL AUDIO CIRCUIT FOR THE CX-340 - HIGH MU TUBE

IF EXTREME VOLUME IS NOT ESSENTIAL, ONE AUDIO STAGE MAY BE OMITTED, CONNECTING POINT A TO POINT B. AND REMOVING RESISTORS R_2 & R_4
STABILIZING RESISTOR R_5 AND CONDENSER C_5 PERMIT SATISFACTORY OPERATION WITH EITHER B BATTERIES OR B ELIMINATOR.

PLATE AND GRID VOLTAGE VALUES.

IMPEDANCE COUPLED (DETECTOR, 1ST & 2ND AUDIO) CX-340

B1	C1
180	4.5
157	3.0 - 4.5
135	3.0
90	1.5

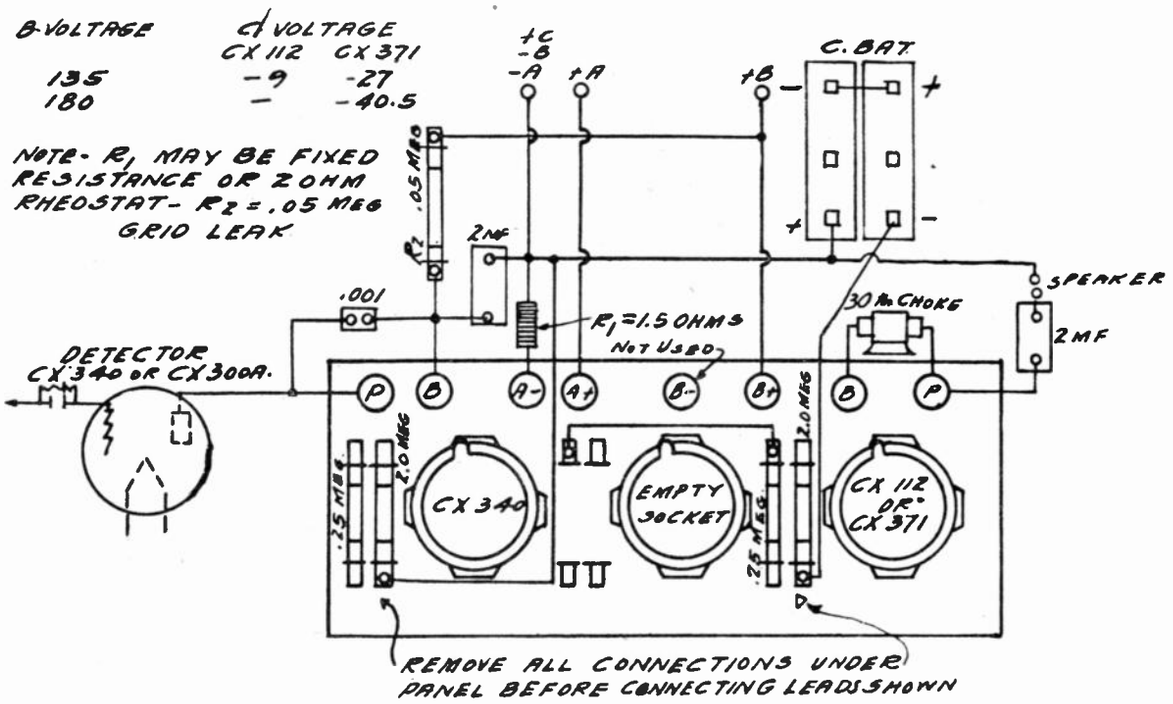
RESISTANCE COUPLED (DETECTOR, 1ST & 2ND AUDIO) CX-340

B1	C1
180	3.0
157	1.5
135	1.0 - 1.5

POWER TUBE

CX-371 B2	CX-371 C2	CX-112 B2	CX-112 C2
180	40.5	157	10.5
157	33.0	135	9.0
135	27.0	90	6.0
90	16.5		

FIG. 1



TYPICAL RESISTANCE COUPLED AMPLIFIER REWIRED FOR CX-340 TUBE.

FIG. 2

3-Foot Cone Speaker Construction Simplified

Pioneer Designer of "Build-Your-Own" 3-Foot Cone Speaker Now Has Method for Assembling Parts Flat

By W. H. Sinclair

A little less than a year ago the idea of building your own three-foot cone speaker was conceived and presented to the radio constructors of this country. In about ten months more than 100,000 three-foot cone speakers have been built by home constructors. And the building of these large size speakers apparently has just begun.

Last year's way of building a three-foot double cone speaker is as antiquated as horse cars—as passé as last year's women styles.

A new, better and easier way has been devised to build cones—a way which requires absolutely no skill and which will enable the most inexperienced to build a perfect cone. It makes no difference if you've never built anything before, if you can chauffeur a pair of shears along a plainly marked line, pour some cement where you're told to place it and put adhesive tape where you're directed to stick it, you can build a three-foot double cone speaker which will afford you a lot of pleasure in assembling and a lot more in reproduction.

It is fitting that this advance in the assembling of a three-foot double cone speaker should be credited to the pioneer and original designer of the "build-your-own" three-foot double cone speaker—G. R. Penn.

The G. R. P. three-foot double cone speaker, as Mr. Penn's speaker is known this year, is assembled FLAT!

Sounds impossible.

I thought so, too, until I saw it. And then I wondered why the idea hadn't occurred to someone before.

Everything is accurately marked.

With a pair of shears cut out the back cone along the solidly printed lines. Then lay the front cone sheet with decorated side face down. Cut out the wedge shaped piece from the front cone along the printed lines. Place the cut out sheet for the back cone on the sheet for the front cone so that it fits with the dotted line on the back of the front cone and so that the tips of the lettered arrows meet exactly.

Place heavy books, flat irons or other weights to hold the Back Cone in position. From a spout can direct a thin stream of Special Cone Speaker Ambroid Cement around the circumference of the Back Cone running your finger along the edge of the Back Cone so as to prevent the Ambroid from seeping between

You then cement the Back Ring to the Back Cone in a place accurately marked for it; cut away the excess Fonotex from the Front Cone along the marked line. Place weights on it and let it dry. Next you fasten an ingenious draw bolt which comes with the kit, to the Back Ring with bolts. The holes have already been drilled so that you cannot misplace the parts.

Join the Back Cone by closing the Draw Bolt, close the seam with adhesive tape provided with the kit; make a small reinforcing cone for inside the marked tip of the large cone; place the apex discs in position; mount your unit; adjust it and your G. R. P. three-foot Double Cone Speaker is ready for reception.

The next evening, or the same evening if you prefer, you can bind the edge of the cone with the braid provided for that purpose.

Time for building, outside of applying the edging braid, is about one hour.

The G. R. P. Cone Speaker Unit is a well designed, sturdily-built piece of mechanism and created to reproduce all frequencies without distortion.

It is a four-pole unit with two separate adjustments. One is to adjust the unit to sets with strong or weak outputs; the other adjustment is a finer adjustment and instantly made according to the output of the particular set with which the speaker is used. This adjustment can be made while the speaker is playing and without removing the unit from the speaker. The magnet is chromium plated to prevent rust.

The reason for a three-foot cone speaker is based on the fact that this size, when actuated by a really good unit, is capable of reproducing all the requencies within the range of average human audibility. The low tones are accurately reproduced while the very high notes are mellowed and sweetened.

It is a fact that a three-foot cone will resonate at lower frequencies than a smaller one just as a large pipe in an organ produces a lower tone than a small pipe.

The reason for the three-foot cone's ability to reproduce high notes lies in the fact that in its makeup is every size cone up to three feet. The high frequencies are reproduced near the apex; and as the tones lower more of the three-foot cone's resonating surface is

"Double or single, which shall I build? Nearly everyone thinking of building his own three-foot cone speaker has asked himself this question.

It seems as if the preference of musically trained people is for double cone speakers. The back cone seems to add a depth to the tone to round it out and to "purify" it, if you get what I mean.

To my ear and to that of many others the reproduction of a single cone sounds "thin" and lacking in depth. It appears to lack the musical timbre of a double cone, which I consider essential to enjoyment of musical programs.

The better the set the more marked is the improvement in reproduction through a three-foot cone. And now that they are so easily assembled anyone may have one.

Parts in Kit.

1 Sheet Decorated and Marked Fonotex for Front Cone.
1 Sheet Marked Fonotex for Back Cone.
1 G. R. P. Cone Speaker Unit with 3 feet cord.
1 G. R. P. Back Ring (pat.pend.).
1 Set G. R. P. Unit Mountings.
1 Special Back Ring Bolt
1 Can Special Cone Speaker Ambroid Cement.
1 G. R. P. Apex Assembly.
1 Strip Adhesive.
3 Yards Edging Braid.

Screw eye, rubber bumpers, bolts, nuts, washers. Illustrated Assembling Directions.

Price $13.50

Kit for Single Cone, $10.50

Note—This includes all parts needed.

Welty Set Easiest of All to Build ---Ready Wired,---

Panel, Ready Mounted Condensers and Rheostats Enable Amateur to Build Set Like an Expert (You Can't Make a Mistake)

Radio set builders often judge the desirability of a new circuit construction by the number of pages and diagrams required to tell how the thing is to be put together.

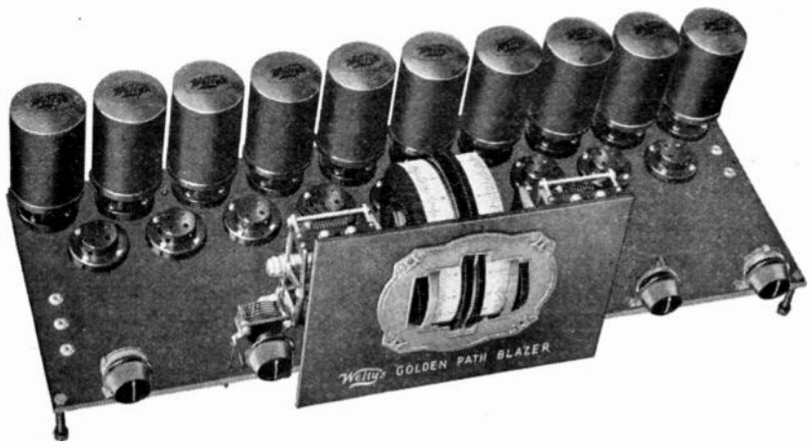
From this standpoint it is a pleasure and an economy in paper and ink to explain the construction of the Welty Radio set so designed that the builder cannot make a mistake.

"Canned" plug-in coils and transformers plus a ready-wired chassis, if so ordered, leave very little for the builder of a Welty set to do after he has mounted the front panel on the chassis other than plug in the tubes and the "cans" in the proper sockets and hook up the batteries.

The advantage of this highly simplified arrangement will be plain to all, particularly those readers who like the writer have spent many hours struggling with wiring diagrams right and wrong. Manufacturers of radio parts are doing all they can to minimize work for the set builder, providing drilled and engraved panels and subpanels, etc., and the Welty ready wired chassis and plug in coils are simply a logical conclusion in this development.

The Welty shielded coil units are of standardized size for T. R. F., long wave and audio frequency adapted to plug in a regular socket. Mechanical protection as well as electrical shielding is provided by the copper cans. The long wave or intermediate frequency coils are peaked at 1300 meters and accuracy of matching is assured by employment of the vacuum tube voltmeter method with supplemental check. The Welty shielded intermediate Transformers are strictly a laboratory job.

The Welty units are adapted to the construction of straight tuned radio frequency sets of from five tubes up, superheterodyne ensembles and combined T. R. F.-superhets or what have you. The audio amplifier units are of the "Aphonic" type combining the principles of impedance, resistance and transformer action The last unit in each train is an output filter which adds to tonal quality and protects the loud speaker unit.



Welty units plugged into ready wired subpanel make a very simple and neat nine tube superheterodyne.

All inductances and transformers are built in uniform copper containers, which act as electrical shield and mechanical protection combined.

Welty units employed in a standard five tube circuit with drum control condensers.

The Latest Development in Socket-Power Units

AN ACHIEVEMENT in this season's new radio developments is the "Bone-Dri" A socket-power units and "Bone-Dri" chargers released recently by the Webster Company, Chicago. The 3,500,000 radio receivers with four tubes or more at present in use in homes electric lighted, can now be provided with all the economies and improved reception offered by light socket-power without any revolutionary rebuilding of the sets. Simply discard the storage battery and charger and the B batteries—the parts that give the most trouble and expense—and put in a "Bone-Dri" AB unit.

Buyers of new sets can avoid costly experiments with so-called "revolutionary" equipment—not yet time-tried—by selecting standard equipment which has proven efficient and dependable and equip it with "Bone-Dri" socket-power and have the most up-to-the-minute receiver.

The remarkable compactness and great efficiency of the Webster "Bone-Dri" units is made possible by the unique construction of the Raytheon A rectifier and the "Bone-Dri" filtering equipment.

The entire original method of rectification in the Raytheon Cartridge is through two metallic conductors so arranged, with a non-conducting substance, that the resistance to the flow of current in one direction is practically nil, while it is extremely high in the reverse direction, producing a pulsating direct current. Extensive test of the Raytheon A Cartridges shows that their normal life may be placed at 750 hours, or more than a year of usual service. There is no glass bulb or filament to break—a great saving in replacement cost. No filament to light—a substantial saving on the electric (light) bills. The unit is so constructed that the Raytheon A cartridge can be readily replaced.

The "Bone-Dri" filter, it is said, consists of a perfectly dry mineral compound, which, when properly connected with specially designed chokes, smoothes out the pulsating direct current delivered from the rectifier, and "filters" from the loud speaker all AC hum and rectification noises. Continued forced life tests, it is claimed, of this material, over a period equal to several years' normal usage, resulted in no signs of depreciation. The filter, however, is so designed that it readily may be replaced at the manufacturer's list cost of $3.00 for the No. 7 or $4.00 for the No. 10 units.

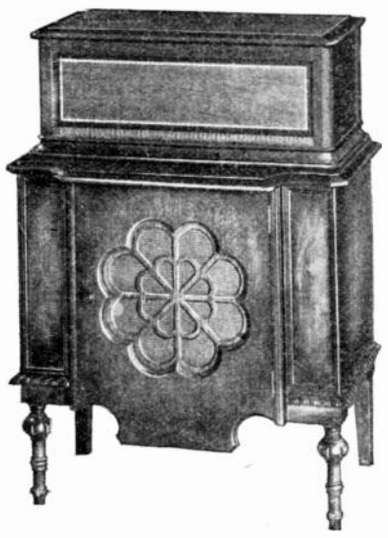
Raytheon Cartridge Socket Power Unit.

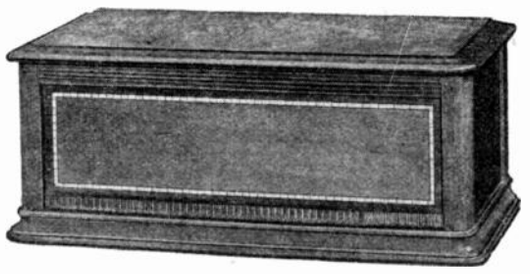
This combination provides an A socket-power that requires no watering—no acid to spill and spoil the furnishings—no noisy vibrating parts—no glass tube or filament to break—no fumes to corrode parts near it—and no more battery trouble—just connect it to the light socket and get ample quiet A current for any set—full power always ready.

"Bone-Dri" AB-10 model supplies up to 2½ amperes at 5½ to 6 volts smooth, quiet, direct current for filament lighting for receivers up to 10 tubes—one of which may be a power tube. This unit has 3 voltages with variable controls for B values. The detector supply may be varied from 10 to 75 volts, the intermediate amplifier supply from 20 to 125 volts, and the power tube supply from 125 to 180 volts.

New Cabinets Add to Attractiveness of Radio in the Home

Ehlert Cabinets Recommended by "NINE-IN-LINE," Thompson, Scott and Other Parts Manufacturers





The Table Cabinet has Butt Walnut top, all visible parts, including base moulding and posts, of genuine Black Walnut. The tops, sides and fronts of the Speaker Console are genuine Walnut Veneer. Finish rich golden nut-brown walnut, water stain, filled, 3 coats of genuine lacquer, hand rubbed and hand polished to a beautiful satin smooth finish. 15 operations to produce the finish alone.

These Cabinets are made in Black Walnut. Have slide-in grooves, piano hinges, and lid holders. Are made to take panel 7 inches high, will take panels 8 inches by simply removing upper panel strip.

These Cabinets go thru 15 operations in the finishing alone. They are water stained, filled, have 3 coats of genuine lacquer, are hand rubbed and polished to a satin smoothness.

10-inch Depth Cabinets

For panel	Inside Depth
7x18	10 inches
7x21	10 inches
7x24	10 inches
7x26	10 inches
7x28	10 inches
7x30	10 inches

12-inch Depth Cabinets

For panel	Inside Depth
7x18	12 inches
7x21	12 inches
7x24	12 inches
7x26	12 inches
7x28	12 inches
7x30	12 inches

A Note on Loudspeaker Design

The ideal diaphragm material for a loud speaker would combine extreme lightness, strength and rigidity and "non resonance" by which is meant freedom from vibration at any particular sound frequency. The worst possible vibrating element considered from the standpoint of resonance would have some of the qualities of a tuning fork which responds most decidedly to a certain musical note depending on its length and stiffness. Such a diphragm would wreck a musical program in its attempts at reproducing the music by bringing forth a certain frequency and its harmonics with a terrible blast and barely responding to frequencies of sound with which it could not resonate.

Balsa wood, a very light and porous material, when cut in very thin sheets, has been found nearly ideal as a loudspeaker diaphragm material. Certain rather thick papers and cardboards, having an unpolished surface have been found excellent and more easily adapted to the cone form which is most desired by builders.

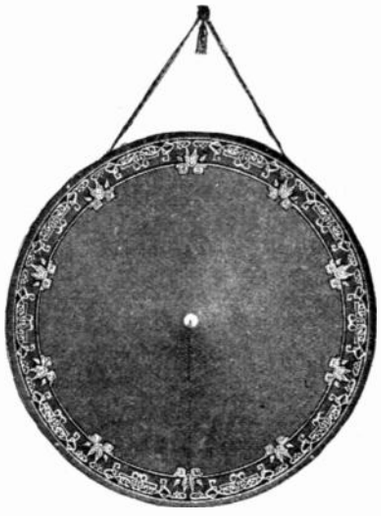
The problem of designing microphone diaphragms is similar to loud speakers and the "non-resonant" quality has been achieved in an interesting way. In radio microphones the diaphragm made of thin steel or aluminum alloy is stretched mechanically until its period of resonance or natural vibrating point is at a frequency well above the range of audible sound. As a matter of fact the thin metallic disks are stretched until they respond to a sound frequency of 20,000 whereas the highest audible musical note such as the highest soprano is about 15,000 cycles or vibrations per second.

Some radio listeners are under the impression that singers and speakers before the microphone use a loud tone of voice and sometimes wonder how the announcer is able to stand up under the strain of a long program without entirely losing the power of speech. As a matter of fact the skilled professional announcer speaks in a very low tone, barely audible ten feet from the microphone thereby avoiding strain to the vocal organs and usually enabling him to drop his register to a deep bass even though his normal voice may be quite high in pitch. Lack of volume in the voice is compensated by amplification controlled by the radio operator and in fact it makes very little difference whether the speaker whispers or shouts into the microphone for the control operator will operate his "gain control" up or down as the case may be and control the voice input electrically at a suitable value for the most efficient operation of the transmitter. Occasionally a singer or speaker takes the control operator unawares and overloads the set, whereupon the automatic circuit breaker operates to save the transmitter from destruction and there is a pause of a minute or so in the program while the broadcast station is "off the air" recovering from the shock.

Memoranda

A Three Foot Cone Loudspeaker

For Ten Dollars



Ensco 36 Inch Loudspeaker for Wall Mounting.

Since the first appearance of the large Western Electric cone loud speakers it has been the ambition of every radio fan to own a reproducer of this sort capable of responding to the low as well as the high notes in music.

The public was quick to grasp the idea that only a large cone or a large horn could respond naturally to the low notes or slow vibrations of music and that greater volume was also attained by increasing the size of the reproducer, but difficulties in manufacturing and shipping these large fragile affairs kept the price well up towards $100 until the "knock-down" designers entered the field and built the thing in pieces to be put together by the radio fan himself.

Perhaps the best known kit of parts for building a big cone is turned out by the Engineers Service Company of New York and Chicago, and reaches the customer all securely packed in a heavy cardboard tube about three feet long and four inches in diameter.

The customer removes the wrapper and finds that the tube contains a large square of Fonotex conveniently marked out for building the cone; an electro-magnetic unit to vibrate the cone and an easily assembled wooden frame to mount the cone and unit. Since full directions for the construction of the whole outfit are enclosed I will not take space here to tell how it is done but will assure the reader that the "Ensco" loud speaker can be put together with the aid of a pair of scissors and a tube of glue in less than a half an hour.

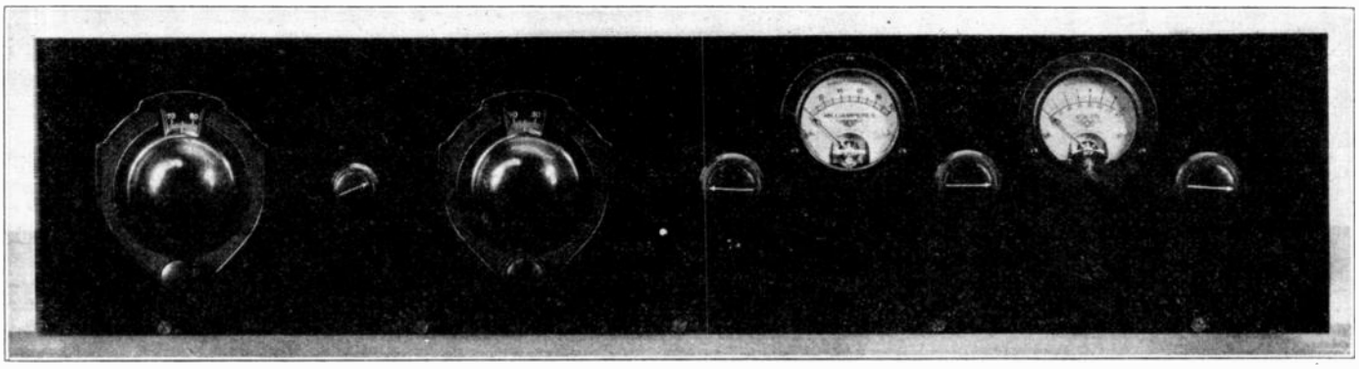
Examination of the vibrating part of the Ensco loud speaker unit reveals the fact that it is nothing if not rugged and stiff in construction. Instead of actuating the cone by a delicate lever movement the Ensco armature drives the cone direct, which takes considerable power but the results seem worth while. The idea behind the Ensco loud speaker unit appears to be somewhat similar to the thought which inspired the designer of the Western Electric broadcast microphone. In loud speaker diaphragms as well as reproducer unit armatures and microphone diaphragms a problem is always encountered which causes engineers to tear their hair and talk in their sleep. If the vibrating element is sensitive and flexible it is sure to have a vibratory period somewhere in the musical scale which will cause it to over-emphasize particular sounds and this "loud spot" produces a tremendous volume of sound out of all proportion to the rest of the musical range. If music were limited to one octave or less a sensitive loud speaker working at or near the fundamental of the vibrating element would be O. K. but broadcast reception demands uniform response over a great range of frequencies and this requirement sounded the doom of the early "sensitive" loud speaker units. It may be possible to build a sensitive loud speaker unit sufficiently "damped" to prevent "blasting," but the Ensco unit evidently operates on the reasonable conclusion that a modern radio set has a sufficiently high power level at all times to vibrate a very rugged and substantial armature and that such a construction is necessary anyway to prevent "chattering" on overload.

Stated in simple terms the Ensco loud speaker is "stiff" but this is no disgrace, and we find a good parallel, as I pointed out before, in the Western Electric microphone, the only difference being that in the case of the microphone the insensitiveness is compensated by audio amplification of the electrical output while in the Ensco unit the electrical input or plate voltage and current must be high. With plenty of plate voltage (135 volts or more) the Ensco loud speaker gives a very excellent performance, and since power tubes require at least this voltage and power tubes are another necessary factor in successful radio reception, the Ensco device lines up nicely with other modern radio units and specifications—besides the whole outfit only costs $10, which puts it in a class by itself for high class radio reproduction at a low price.

Fourteen Tubes and How

A Description of the Robertson-Davis Hot Spot Fourteen Receiver

By Merwyn Heald, B. S., E. E.



The performance and excellence of the MELO-HEALD ELEVEN is already a matter of history and may be taken as a standard upon which to compare the performance of the "HOT SPOT" 14.

"HOT SPOT" 14 is as easily handled, has more range, has equal volume, and in addition to this, it has the property of not having stations appear at more than one position on the oscillator dial. A thermometer reads a given temperature at only one place. The "HOT SPOT" 14 reads a given station at only one place.

This is accomplished by the use of high intermediate frequency in the intermediate amplifiers. That this high intermediate frequency has been utilized with no sacrifice of stability, quality, range or volume, speaks exceptionally well for the designers of these transformers.

This set was designed primarily to meet the very exacting conditions in the metropolitan areas, where the number of high-powered local stations form a complete barrier to out of town reception for most receivers. At the same time it is not excluded from performing in a highly satisfactory manner in the rural districts, for it is well known that a receiver which has sufficient power and selectivity to perform satisfactorily in congested districts, is more than satisfactory in out-lying territories. In Chicago, this receiver has proved time and time again that it is competent to receive from 15 to 30 out of town stations any night of the week and any week of the year. Using this receiver in the heart of Chicago, in the middle of the summer, we have logged as high as twenty out of town stations, right through the high powered locals.

The desirability of a regenerative loop is conceded, and this method of pick-up is used on the "HOT SPOT" 14. It is essential that the loop be maintained in a sensitive condition by means of regeneration. It is equally as essential that the loop does not oscillate, for the reason that loop oscillation is the source of many objectionable effects, such as, whistles, reradiation, spurious appearance of local stations, and poor quality.

In superheterodynes employing a comparatively low intermediate frequency, all that prevents a station from appearing in two or more places on the oscillator dial, is the exclusion property of the loop. The loop becomes more exclusive as its frequency is farther and farther removed from the frequency of the oscillator, that is, as the intermediate frequency is increased.

A very good example of this is, that it has been observed, when operating this receiver in a locality which is virtually under the antenna of a high powered local station, it is impossible to receive that station on anything but its fundamental unless the loop condenser be set with great precision on that station's frequency. When this setting is performed with great exactitude, it is then possible to receive the *station's second harmonic*. However, if the loop condenser is displaced even a slight amount from its full resonance setting, the second harmonic from the station cannot be heard.

It was found in the MELO-HEALD ELEVEN that the removal of the pick-up coil from inductive relationship to the plate coil of the oscillator, by means of a link system, showed a great improvement in the appearance of harmonics from the local oscillator. This improvement was so marked that harmonic oscillations from the local driver has never caused the slightest trouble in the mixing system of the ELEVEN. In addition to this, it was found that a wave form resulting from a link mixing system of this nature, was of such excellence that it was handled to the best advantage by the intermediate amplifiers.

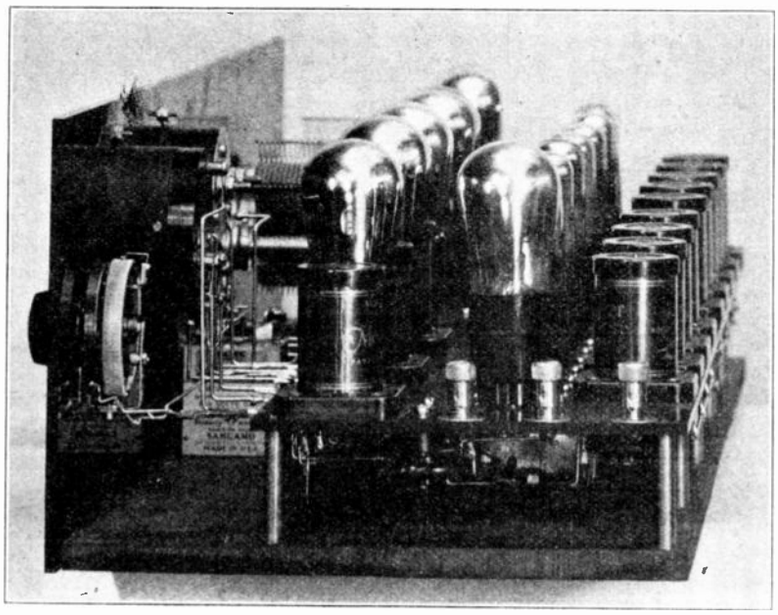
The same system of oscillating and mixing that was so successfully used in the MELO-HEALD ELEVEN has been employed in the "HOT SPOT" 14. In addition to this the oscillation system was so designed that its output increases as the frequency decreases. It is known that broadcasting stations operating at a high frequency are received with more reliability than those operating at a low frequency, that is, a station operating at 1,500 kilocycles would be more dependable than one operating at 600 kilocycles. To compensate somewhat for this variation, the output of the oscillator was inverted from this order, so that when it is oscillating to heterodyne with a 1,500 kilocycle station, its output is less than when it is operating to heterodyne with a 600 kilocycle station.

For the oscillator, the two detectors and the audio amplifiers 5 volt tubes are used, and for the intermediate frequency amplifier 199 tubes. This is a great saver of filament current and the total plate drain is approximately 35 mills.

The filaments of the A tubes are controlled by a semi-fixed resistance which can be adjusted for best operation and then left in that position. The same system of filament control is used on the second detector and three stages of audio. The only adjustment of filament voltage that need be used in the set's operation, is the filament voltage on the intermediate amplifiers, which is controlled by the panel rheostat.

In order to avoid burning the 199 tubes at too high a temperature, a fixed four ohm resistance is placed in the lead. This never allows the voltage to exceed 3.5 volts. For DX work the tubes should be normally operated at 3 volts. For local stations or extreme selectivity satisfactory results will be obtained by burning the tubes below normal. A combination voltmeter is used, reading either plate voltage in the amplifier circuit or filament voltage on the 199 tubes, at the throw of a switch. Watch this meter closely, for it will tell whether or not your set is being supplied with the correct voltages, and prevents overloading.

The other meter is a milliameter. The set should ordinarily not draw more than forty mils, but to provide for power tubes a meter reading up to one hundred is recommended. The three ohm rheostat on the panel controls the 199 tubes, the two semi-fixed resistances mounted on the baseboard control the 201A tubes. The six ohm resistance governs the current supplied the



Rear Side View.

oscillator and first detector, while the three ohm regulates the second detector and the three audio amplifiers.

One precaution to be observed very closely is to never remove or place in the sockets any of the 199 tubes while the current is turned on. They are controlled in parallel. If only one is in the socket, the current intended for eight tubes will pass through it, and quite likely it will be decidedly worthless in less time than it takes to tell of the decease.

The design of the intermediate frequency transformers, MELOCOUPLERS, was influenced by the following conditions:

While it was permitted that each stage might have a lower amplification than each stage of the conventional three or four stage intermediate amplifier, at present common among superheterodynes, it was imperative that the overall amplification be far in excess of the overall amplification of the ordinary intermediate amplifier. This meant that stability must be maintained in order that the grid be sufficiently negative, with respect to the filament, so that the shunting resistance caused by plate action of the grid would cause little or no broadening of the resonance curve of the secondary of the intermediate transformer. That this has been accomplished is proved by the fact that it is possible to carry the potentiometer arm on the negative side of the zero (or midpoint).

The intermediate amplifier must be very selective. It is known that the greater the number of intermediate stages, the broader the resonance curve of the combination. Consequently, each transformer, that is to be used in an intermediate amplifier of a large number of stages, must have a much sharper resonance curve than the resonance curve that would be permitted in a transformer to be used in three or four stages. Again, that this has been accomplished is proved by the fact that we are consistently separating distant stations and high powered local stations located within a short distance of the location of our receiver, differing by ten kilocycles, and that a separation of even less than this difference is accomplished when the receiver is sufficiently far removed from the interfering station so that it is not unduly influenced.

It is quite possible for distortion to appear in the intermediate amplifier, therefore, for pleasing reception it is necessary that the intermediate transformers be so designed that they will not distort the audio frequency modulation passing through them on the carrier frequency. Again, that this has been done is proved by the fact that this receiver, when used in connection with our MELOFORMER for audio frequency amplification, has a tonal quality that is yet to be excelled.

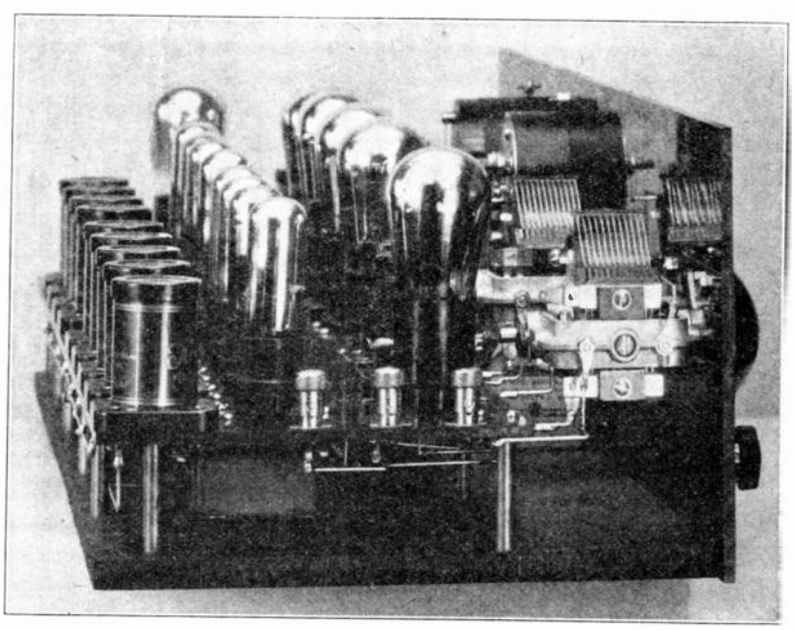
In order that these various qualifications for a desirable intermediate amplifier be obtained, it was necessary that the conditions in each stage be studied carefully and handled accordingly. That a transformer could be designed to operate successfully in the first stage and be used in the last stage, was impossible. It was necessary to study conditions in each individual stage and meet them accordingly.

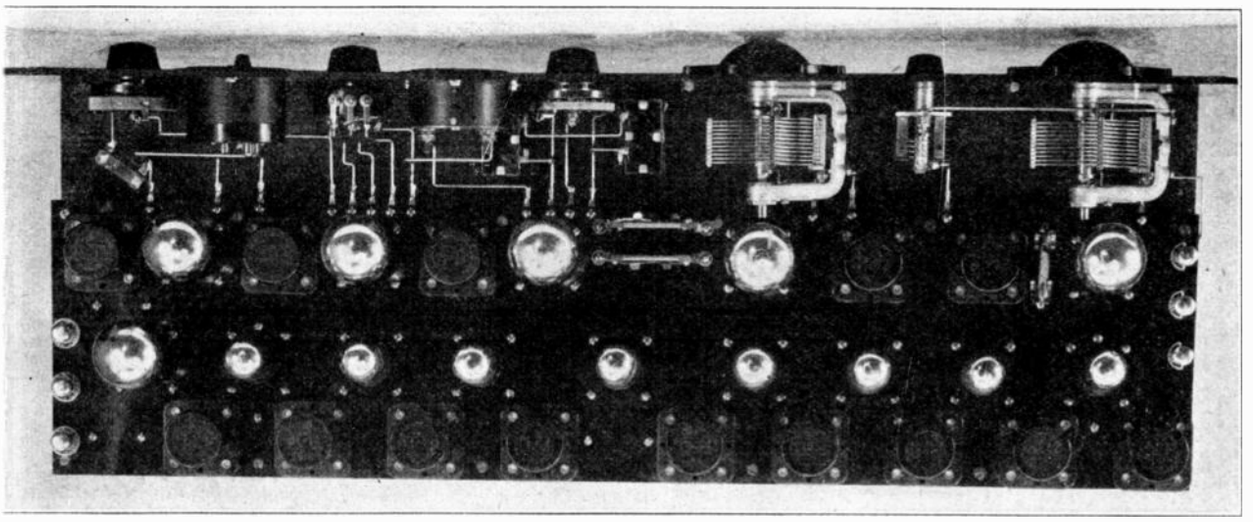
While grid detection is used in the first detector tube to increase sensitivity (in view of the fact that this is what might be termed the "threshhold" of the receiver), for the second detector tube, plate detection is used, so that distortion, which is often caused by grid detection, may be entirely eliminated in passing the signal from the intermediate amplifier to the audio amplifier.

For the past five years the Robertson Davis Company have manufactured an audio frequency transformer which is revolutionary in its design. It is a transformer constructed without the use of laminations, although in effect the special alloy used in its solid construction is such as to give the benefits of laminations without giving the undesirable qualities. Three stages of MELOFORMER audio frequency amplification are used in the "HOT SPOT" 14, with absolutely no sacrifice of quality. It is unnecessary to resort to any so-called "doctoring" methods in order to receive pleasing music from the loud speaker.

The volume control used is a 200,000 ohm potentiometer, placed across the secondary of the second audio frequency transformer. It is entirely unnecessary when more volume is needed on a distant station to jack into an additional stage. It is only necessary to increase the volume by means of this potentiometer.

On this potentiometer is mounted a filament switch. It might just as well be on the rheostat, as both have to be turned to bring the set to the point of maximum sensitivity, the advantage being that with the rheostat it is often desirable to bring the filaments to the correct temperature once and then leave them there, while the potentiometer is changed from station to station.





Top View of Set.

For that reason we chose this unique method of filament control.

No provision has been made for the use of the loud speaker in any stage but the last, for the reason that the increased cost of operation of this system is more than overbalanced by its flexibility of control.

This is advantageous because any change in the operating characteristics of the audio frequency amplifier is reflected on the operating characteristics of the intermediate amplifier, and when once this amplifier has been brought to the condition of extreme sensitivity, it is not desirable to affect it by any change in the audio frequency. It is not thought advisable to use a higher resistance than 200,000 ohms for this potentiometer, for the reason this would introduce too high a resistance in the grid return of the second audio frequency tube when it is being operated near the half resistance point.

It is nothing less than marvelous that a receiver capable of such tremendous amplification can be operated on two amperes of "A" current and 35 milliamperes of "B" battery current. However, this can be done with the "HOT SPOT" 14. Of course, if a power tube with a large plate voltage is used in the third stage of audio, or if more than the recommended 45 volts is used on the intermediates, it is possible that the "B" battery current will increase, but with the exception of the desire for excessive volume, it is absolutely unnecessary to resort to these extremes, and the receiver can be very satisfactorily operated under the above conditions.

While this receiver has tremendous power, it is not critical, providing a few precautions are observed. It is absolutely imperative that the intermediates be constructed symmetrically, and that in no instance shall they be closer together than 2⅞ inches center to center. It is also imperative that the fixed condensers be located outside of the field of the transformers and that no wires run within these fields. An inspection of the accompanying cuts will show that these items have been observed in the construction of the model receiver.

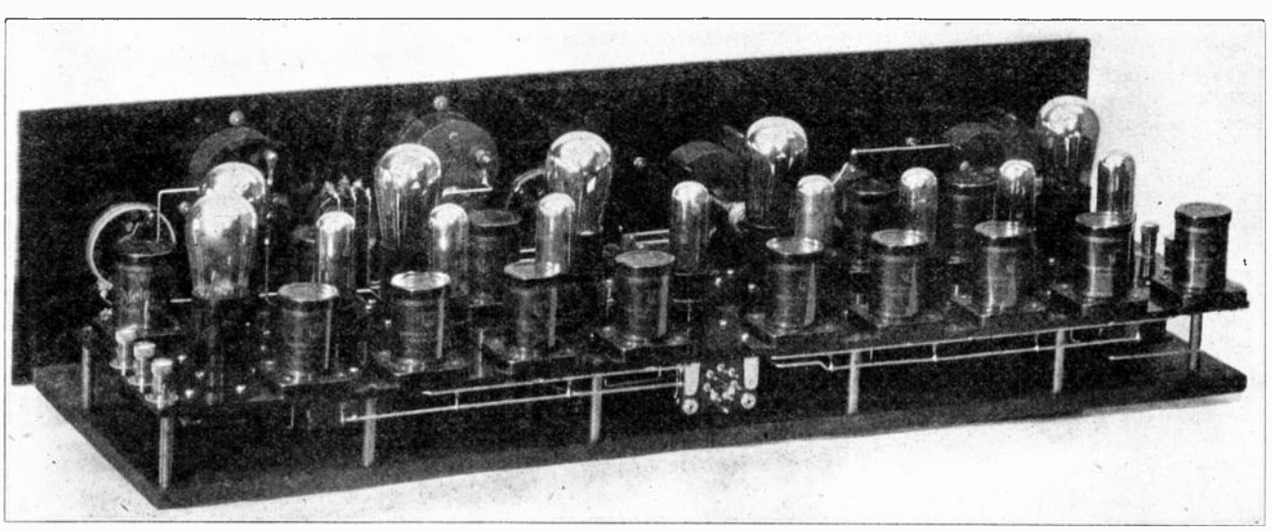
It is essential that no defective apparatus be used in this receiver to have it perform satisfactorily. This is especially true of the fixed condensers. A defective fixed condenser can ruin the operation of the "HOT SPOT" 14.

There should be no difficulty in constructing the "HOT SPOT" 14 exactly as the accompanying cuts show it, but in case more technical information is desired, it can be obtained by writing direct to the manufacturers of the MELOFORMER and MELO-COUPLER.

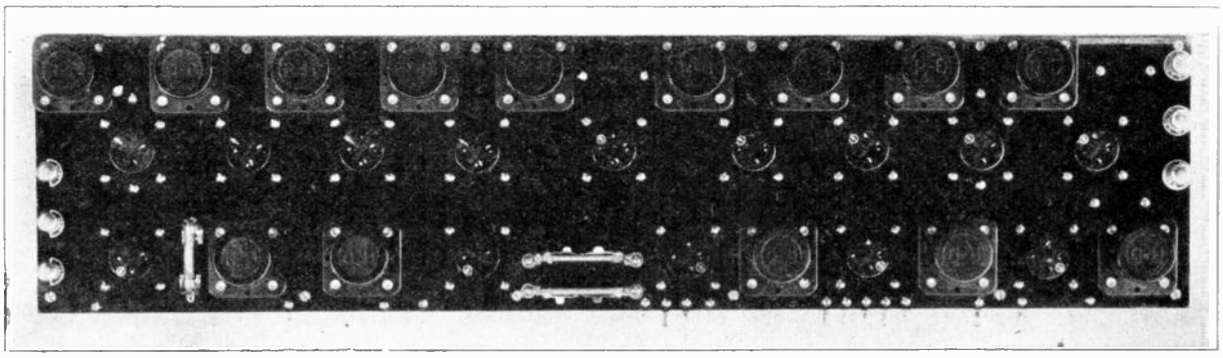
Soldering is an art not fully appreciated by the layman. Because solder adheres to a joint does not mean that the joint is soldered. With a set of this size, one may readily appreciate what it means to have a faulty joint and not be able to find it. Be sure your solder is uniting the joint, not merely coating it.

Volumes have been written on why rosin should be used as a flux, but still it is shunned like the smallpox. If you positively have to use acid, equip yourself with a bottle of alcohol and a No. 6 water color brush. Swab each joint after soldering, and then wipe dry with a rag.

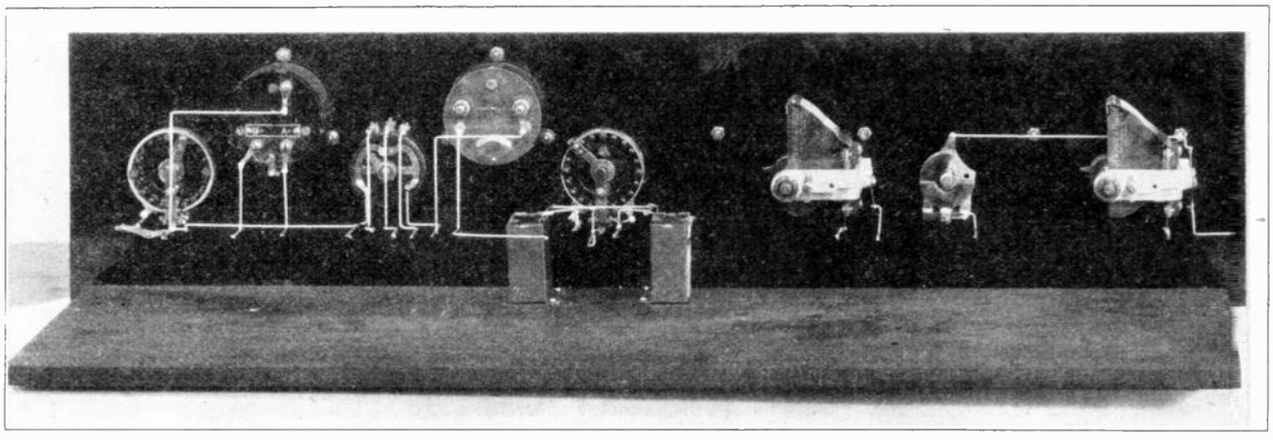
The accessories to be used with this receiver should be chosen with the fact in



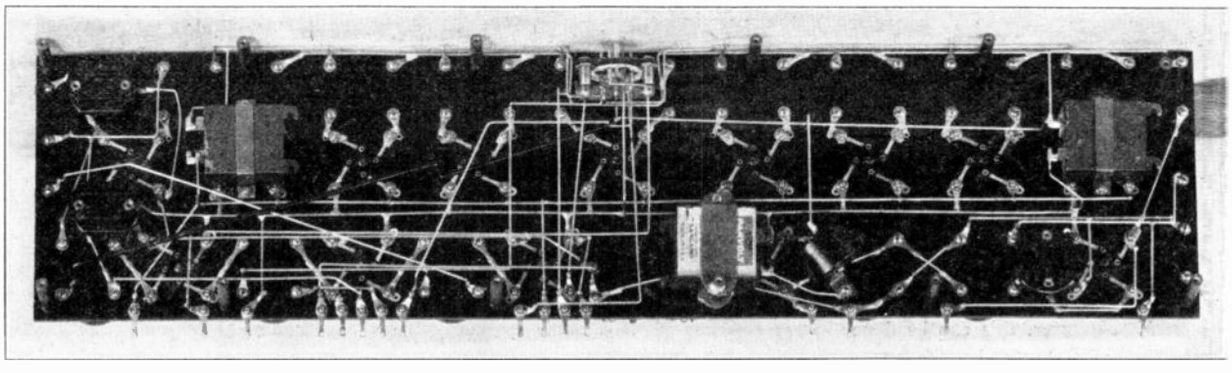
Rear View of Set.



Top View of Subpanel.



Rear View of Panel.



Bottom View of Subpanel.

mind that they are to be used with a receiver that is unequalled in power and sensitivity and hence should be of the best possible quality. This selection should not be difficult because there are a large number of accessory manufacturers that are making merchandise of a high standard.

PARTS WITH WHICH TO BUILD THE FAMOUS "HOT SPOT" 14

1 420 Cer'fi'd Robertson-Davis Melocoup.
1 460 Cer'fi'd Robertson-Davis Melocoup.
1 461 Cer'fi'd Robertson-Davis Melocoup.
1 462 Cer'fi'd Robertson-Davis Melocoup.
1 463 Cer'fi'd Robertson-Davis Melocoup.
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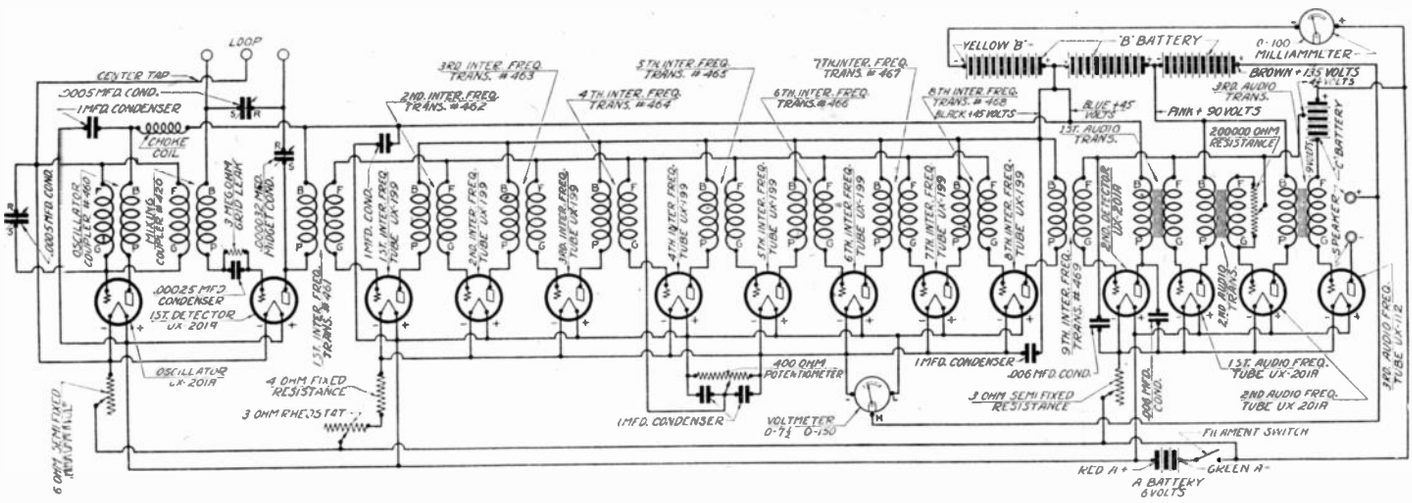
1 467 Cer'fi'd Robertson-Davis Melocoup.
1 468 Cer'fi'd Robertson-Davis Melocoup.
1 469 Cer'fi'd Robertson-Davis Melocoup.
3 Certified Robertson-Davis Multistage Meloformers.
1 Certified Robertson-Davis Melochoke.
14 Spring Sockets.
1 Cable Plug (Jones or Yaxley).
3 Loop Binding Posts (X. L.).
3 "C" Battery Binding Posts (X. L.).
2 Speaker Binding Posts (X. L.).
2 .006 Sangamo Fixed Condensers.
1 .00025 Sangamo Fixed Condenser with Clips.
1 4 Megohm Grid Leak (Metalized).
1 4 Ohm Fixed Resistance (Yaxley).
1 3 Ohm Semi-fixed Resistance; Double Arm. Base Mtg. (Yaxley).*
1 6 Ohm Semi-fixed Resistance; Double Arm. Base Mtg. (Yaxley).*
5 1 Mfd. Sangamo Fixed Condensers.
2 Bakelite Strips for Mounting.

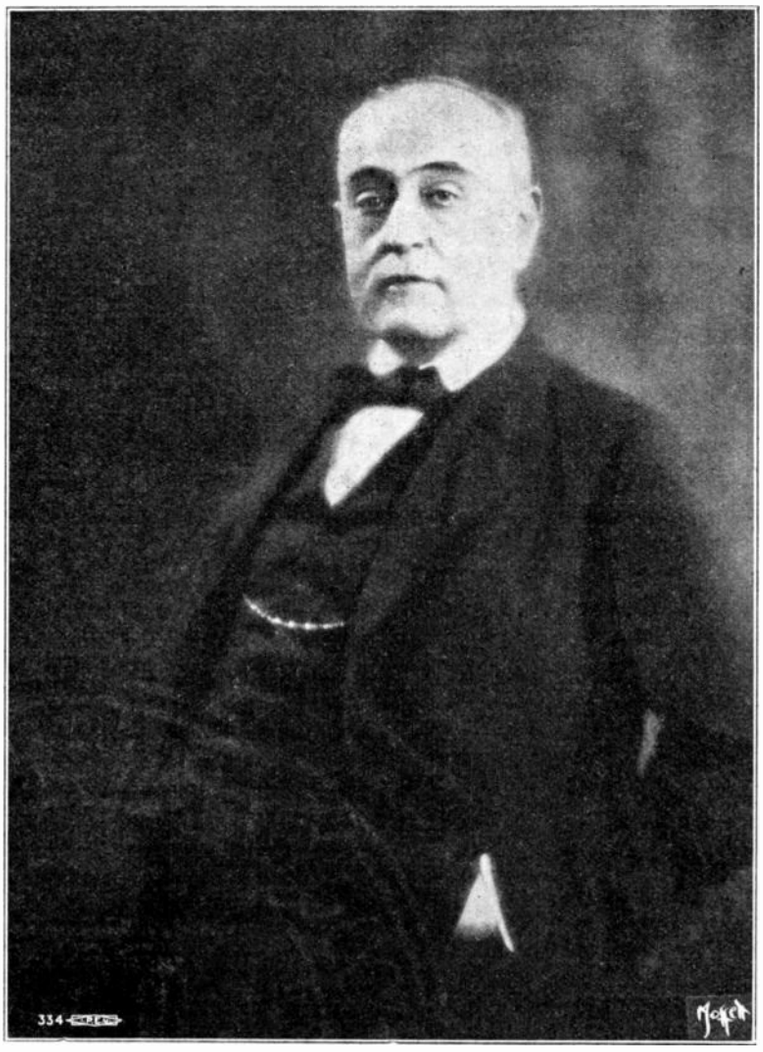
*Or Rheostats Mtd. Inside Set (2).

(1) Loop Binding Posts.
(2) Speaker and "C" Battery Binding Posts.
2 Hammerlund Midline .0005 Variable Condenser.
2 Kurz-Kasch Vernier Dials.
1 Hammerlund Midget .000032 (Split plate).
1 400 Ohm Yaxley Potentiometer.
1 200,000 Ohm Potentiometer, Volume Control (Frost or C. R. L.)
1 3 Ohm Rheostat (Yaxley).
Either Modulator or Rheostat should be provided with Filament Switch
1 Voltmeter 0-7½-150 (Jewel or Weston).
1 7x30-inch Panel.
1 10x29-inch Baseboard.
Hardware and Bus Bar.
1 0-100 Milliameter (Optional).
8 UX-199 Tubes.
5 UX-201A Tubes.
1 UX-171 Tube.



—Schematic wiring diagram for the advanced experimenter

Data and Memoranda



Edward N. Nockels, Secretary of Chicago Federation of Labor.

Important Notice

SUBSCRIPTION to WCFL Radio Magazine includes membership in the Co-Operative Farmer-Labor Radio Listeners' Association, maintained by the Chicago Federation of Labor in conjunction with its broadcast station, WCFL.

Members of the Association are entitled to a special discount on all radio apparatus described in our catalog, which is mailed to members together with their membership card and certificate of membership when they subscribe for WCFL Magazine.

Orders for radio sets and parts should be mailed to WCFL Radio Magazine, 623 South Wabash Avenue, Chicago, enclosing postoffice money order for the required amount. Shipment of the order, service and further detailed information will be obtained from the Newark Electric Company, 226 West Madison Street, Chicago, exclusive distributors for the Co-Operative Farmer-Labor Radio Listeners' Association.

All radio apparatus advertised and described in WCFL radio Magazine may be obtained at a discount by subscribers, who are also automatically members of the Co-Operative Association.

The subscription price to WCFL Radio Magazine is $1.25 per year or thirty-five cents per copy, issued quarterly. The yearly saving to each member of the Association purchasing radio apparatus should be from five to ten times the nominal cost of membership in the Association, including subscription to WCFL Magazine.

Let's Develop Our Radio Manners

By Charles Golenpaul
American Mechanical Laboratories

More crimes have been committed against society by misapplied radio than by any other agency intended primarily for the public good. Radio reception, unfortunately, is only too often permitted to blast conversations to pieces, to disturb neighbors, to disrupt marital relations, and so on, for the reason that few seem to posses the necessary appreciation of radio ethics, and still fewer have the proper means of putting such ethics into practice.

Radio reception should be fitted to the circumstances. Thus if the radio program is the main entertainment for the moment, and if there is no chance of disturbing your neighbors against their will, then by all means use the full volume. On the other hand, if the radio program is in the nature of a pleasing background of music for the dinner conversation, bridge game, reading, or restful period, then please remember to keep the volume level down to proper proportions.

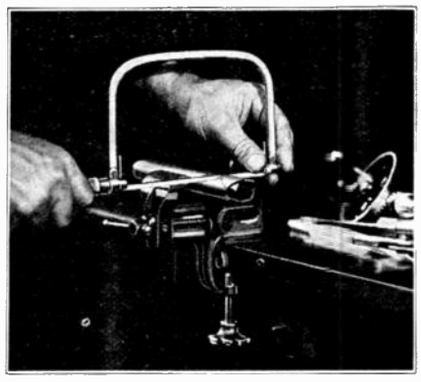
Perhaps the main reason why so many radio enthusiasts operate their radio set at full blast, no matter what the circumstances, thereby causing hardship and hard feeling, is that they fear the loss of tone quality by the reduction of volume. Others, contrariwise, may fear to turn up the volume because of the sharpness of the rendition, now made prominent. Frankly, excessively low volume, which causes the listener to strain his hearing power, consciously or otherwise, is just as irritating as excessive volume. A happy medium must be struck.

It is good practice to provide the loud speaker with a tone as well as a volume control, so that we may practice radio manners at all times without sacrificing radio results. The tone control consists of a low-capacity fixed condenser, of the mica type, which is shunted across the loudspeaker for the purpose of taking off the sharp edge which is annoying when full volume is employed. Each loudspeaker and its amplifier will require a different value for the best results, and personal tastes also differ as to the amount of "muting" or mellowness required. However, as a starting point it is recommended that capacities of from .005 to .03 mfd. be tried.

So much for the tone control, which is essential since increased sharpness is desirable when the volume is turned low in order to provide sufficient detail for the rendition, and less sharpness when the volume is turned up full. Incidentally, the shunted condenser also serves to reduce static interference in the summer.

As for the volume control, the best practice is to shunt a variable high resistance across the loud speaker leads or wiring, with the adjustment knob conveniently placed so that it may be manipulated without having to walk to the distant receiving set. One ingenious plan is to use a universal range Clarastat, with a double-conductor flexible cord, so that the adjustment may be made from the easy chair, davenport, or other part of the room. Again, the Clarostat may be placed on the wall, convenient to the listeners. Still again, several control units may be employed in various parts of the home, all shunted across the loud speaker leads. The tone control, comprising one or more condensers with a suitable switching device to cut the capacity in or out, may be placed alongside the variable resistor, with the arrangement left to the ingenuity of the radio enthusiast.

At any rate, loud speaker control permits of exercising the utmost radio manners at all times.



Cutting thin metal and bakelite or fiber tubing without the aid of a lathe is undoubtedly the hardest of all jobs for the amateur mechanic. The illustration shows how this work may be done with an "all purpose" saw such as the F. P. M. If a wooden dog of the correct size to fit inside the tube is used there will be less danger of crushing the tube in the vice and the cut will be more accurate

High Voltage "B" Eliminator Power Amplifier

425 Volts Used on Plate With New Carter Combination

Although "distance" and "selectivity" are naturally desirable qualities for a radio receiver, the modern radio listener is primarily interested in obtaining realistic tone quality.

The use of a good power amplifier will materially improve the tone quality of almost any set. The type 310 power tube has the largest handling capacity of any tube now being used. When it is used in a suitable amplifying circuit it will give excellent results for either home or large auditorium.

Many of these amplifiers are now in use, but a great many of them have been giving poor results because improper plate and grid voltages were used. In fact, a type 310 tube operating with a 350 volt plate potential will only have an undistorted output capacity slightly greater than a 371 type tube. If, however, the plate potential is increased to 425 volts, the maximum undistorted output will be almost doubled, or 1540 milliwatts.

One may ask, "Why have such a large output capacity when only moderate volume is desired?" The answer is—it takes four times greater handling capacity to reproduce a 30 cycle note without distortion than it does to reproduce a 1,000 cycle note with the same intensity. It is easy to perceive that—in a set without a power tube—we could have undistorted reproduction of the higher notes while the lower tones would be badly distorted and the timbre and realism would be lost.

The "B" eliminator power amplifier combination to be described in this article uses a 316-B rectifier tube which has a capacity of 65 mills. This is sufficient to supply both the power amplifier and the average radio set. The plate voltage applied to the type 310 power tube is 425 which, as stated before, permits the tube to deliver its maximum undistorted output. The 7½ volt A. C. current for both tubes (the 316B and 310) is supplied by separate windings on the power transformer. The choke coils for filtering the rectified current are housed in the same case with the transformer to give a neater appearance and simplify wiring.

Since this device may also be used as a "B" eliminator, a "voltage divider" is necessary to reduce the 425 volt output to the values required by the radio receiver. This voltage control kit is very unique inasmuch as it consists of 3 wire wound resistors equipped with sliders that act as voltage taps. These sliders may be varied to give any desired "B" or "C" voltage. No regulator tube is required because the resistors are wire-wound and after the adjustment is made, the voltages will always remain fixed. The large current capacity of the tube and transformer also improves the regulation of the eliminator and keeps the voltage constant in spite of rather severe changes in load. The total resistance of the wire-wound strips is but 14,000 ohms—this is bridged across the entire voltage output and the sliders adjusted until the voltage is obtained that operates the set most satisfactorily. It will be found that the resistance in series with the 90 volt tap will only be about 6000 ohms or less about one-half that of the customary type. This low resistance in series with the load will also reduce voltage fluctuation with change of load and materially improve the tone quality of a receiver.

A. J. Carter, pioneer Chicago raido manufacturer and guiding spirit in promoting co-operation and standardization in the production and distribution of radio apparatus.

The condenser block used in this circuit is especially designed for this new voltage control described in the above paragraph. Every "B" and "C" voltage is by-passed so there will be no tendency toward "motor-boating." The filter condensers in the block have a continuous D. C. working voltage of 600 volts, thereby overcoming the hazard of breakdown. Input circuit to the amplifier uses a high grade audio transformer, the primary of which is connected to tip jacks for convenience in connection to the radio set.

The output of the amplifier is fed through the customary condenser—choke system using a 30 henry choke coil and a 600 volt 2 MFD. condenser. This will keep the plate current of the type 310 tube out of the speaker and protect the speaker unit.

List of Parts

1 Carter C-600 Condenser Block.
1 Carter No. 620 Condenser.
1 Carter No. 2313 Voltage Control Kit.
1 Carter P-3800-60 Voltage Control Multiplier.
4 Carter No. 10 Tip Jacks.
1 Thordarson R-210 Power Compact.
1 Thordarson R-200 Audio Transformer.
1 Thordarson R-196 Choke Coil.
7 Eby Binding Posts.
2 Silver-Marshall Sockets.
1 Cunningham Type 310 Tubes.
1 Cunningham Type 316-B Tube.

Construction

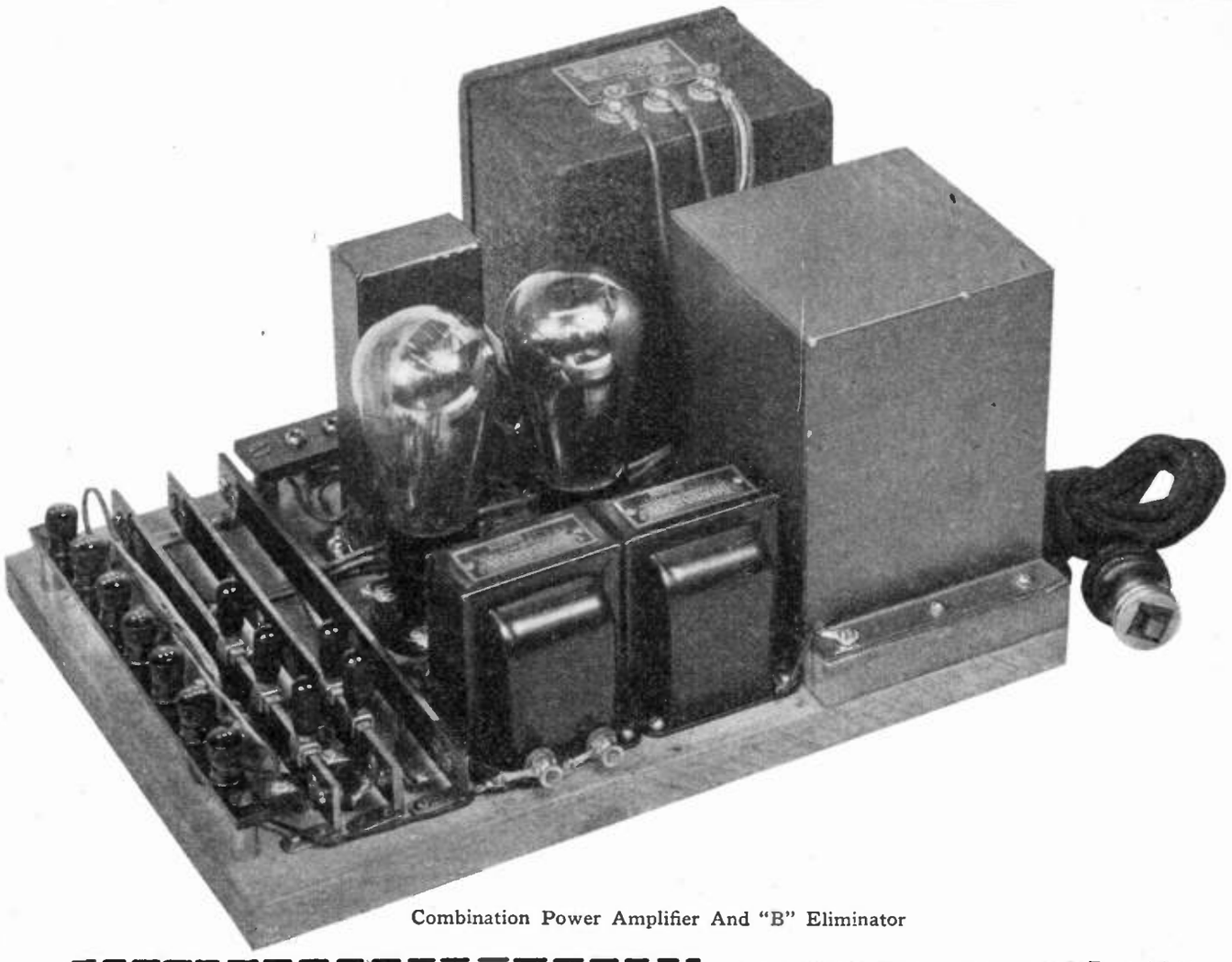
The construction of this eliminator is very simple, since there are relatively few parts. All of the parts are mounted on a wooden base board with wood screws. The small bakelite terminal strips for the Tip Jacks and Binding Posts may be supported from the base board by a few metal washers.

In wiring this device it is suggested that soldering lugs be used under all screw terminals and flexible rubber-covered wire used for all connections.

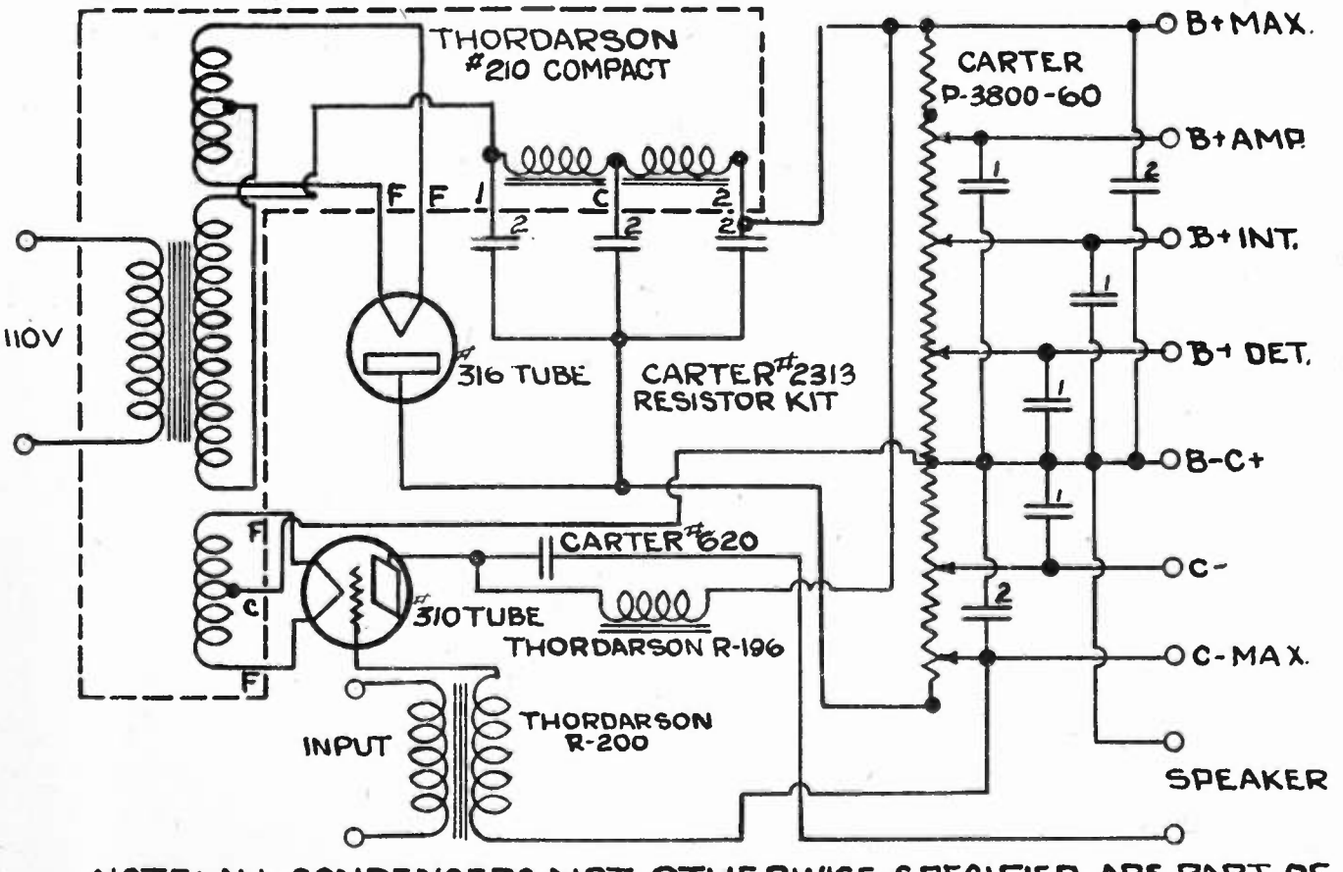
Operation

The voltage delivered by this device is very high and it should be handled accordingly. It is best not to handle the eliminator while the power is turned on.

MEMORANDA



Combination Power Amplifier And "B" Eliminator



NOTE: ALL CONDENSERS NOT OTHERWISE SPECIFIED ARE PART OF CARTER #C-600 BLOCK

Official U. S. Federal Radio Commission's List of Broadcast Stations and Wavelengths

(DEP'T OF COMMERCE)

CALL	STATION AND OWNER	POWER WATTS	KCYS.	MTRS.
KDKA	E. Pittsburgh, Pa., Westinghouse E. & M. Co.	30KW	950	315.6
KDLR	Devils Lake, N. D., Radio Electric Co.	15	1300	230.6
KDYL	Salt Lake City, Utah, Intermountain Brdcstg. Corp.	100	1160	258.5
KELW	Burbank, Calif., Earl L. White. Divides time with KPPC.	250	1310	228.9
KEX	Portland, Ort., Western Broadcasting Co.	2500	1250	239.9
KFAB	Lincoln, Neb., Neb. Buick Auto Co.	2000	970	309.1
		5000	6 to 7 P.M.	
KFAD	Phoenix, Arizona, Electrical Equipment Co.	500	1100	272.6
KFAU	Boise, Idaho, Independent School Dist.	2000	1050	285.5
		4000	6 A.M. to 6 P.M.	
KFBB	Havre, Montana, F. Buttrey Co.	50	1090	275.1
KFBC	San Diego, California, Dr. Arthur	100	1210	247.8
KFBK	Sacramento, Calif., Kimball-Upson Co. (W. Yale)	100	560	535.4
KFBL	Everett, Washington, Leese Bros.	50	1340	223.7
KFBU	Laramie, Wyoming, Bishop N. S. Thomas.	500	700	428.3
KFCB	Phoenix, Arizona, Nielsen Radio Supply Co.	125	1230	243.8
KFCR	Santa Barbara, Calif., Santa Barbara Brdcstg. Co.	50	1420	211.1
KFDM	Beaumont, Texas, Magnolia Petroleum Co.	500	800	374.8
KFDX	Shreveport, La., First Baptist Church.	250	1270	236.1
KFDY	Brookings, S. D., S. D. State College. Divides time with KMA.	500	760	394.5
KFDZ	Minneapolis, Minn., Harry O. Iverson	10	1390	215.7
KFEC	Portland, Oregon, Meier & Frank Co. (KFIF)	50	1400	214.2
KFEL	Denver, Colorado, Eugene P. O'Fallon, Inc.	250	1210	247.8
KFEQ	St. Joseph, Missouri, Scroggin & Co. Bank.	1000	1300	230.6
KFEY	Kellogg, Idaho, Union High School	10	1290	232.4
KFGQ	Boone, Iowa, Boone Biblical College.	10	1430	209.7
KFH	Wichita, Kansas, Hotel Lassen.	500	1220	245.8
KFHA	Gunnison, Colorado, West. St. Col. of Col.	50	1180	254.1
KFHL	Oskaloosa, Iowa, Penn College.	10	1410	212.6
KFI	Los Angeles, California, Earle C. Anthony, Inc.	5000	640	468.5
KFIF	Portland, Oregon, Benson Poly. Inst. (KFEC)	50	1400	214.2
KFIO	Spokane, Washington, North Central H. S. (KEPY)	100	1220	245.8
KFIQ	Yakima, Washington, Dr. I. M. Miller.	100	1440	208.2
KFIU	Juneau, Alaska, Alaska Elec. Lt. & Pr. Co.	10	1330	225.4
KFIZ	Fond du Lac, Wis., Fond du Lac Commonwealth Reporter	100	1120	267.7
KFJB	Marshalltown, Iowa, Marshall Electric Co.	100	1210	247.8
KFJF	Oklahoma City, Oklahoma, Nat'l Radio Mfg. Co.	750	1100	272.6
		1000	6 A.M. to 6 P.M.	
KFJI	Astoria, Oregon, E. E. Marsh (KMED)	15	1200	249.9
KFJM	Grand Forks, N. Dak., University of N. Dak.	100	900	333.1
KFJR	Portland, Oregon, Ashley C. Dixon & Son (KTBR)	100	1060	282.8
KFJY	Fort Dodge, Iowa, C. S. Tunwall (KFMR)	100	680	440.9
KFJZ	Fort Worth, Texas, W. E. Branch.	50	1200	249.9
KFKA	Greeley, Colorado, Colo. St. Teachers Col.	200	750	399.8
KFKB	Milford, Kansas, Dr. J. R. Brinkley	1500	1240	241.8
		2500	7 A.M. to 7 P.M.	
KFKU	Lawrence, Kansas, University of Kan. (WREN)	500	1180	254.1
KFKX	Hastings, Neb., Westinghouse E. & M. Co. (KYW)	2500	570	526.0
KFKZ	Kirksville, Mo., Northeast Mo. St. Teachers Col.	15	1330	225.4
KFLV	Rockford, Illinois, Swedish Evan. Mission Church.	100	1120	267.7
KFLX	Galveston, Tex., George Roy Clough.	100	1110	270.1
KFMR	Sioux City, Iowa, Morningside College (KFJY)	100	680	440.9
KFMX	Northfield, Minnesota, Carleton College (WCAL)	500	1270	236.1
KFNF	Shenandoah, Iowa, Henry Field Seed Co.	2000	650	461.3
			6 to 7 P.M. only	
KFOA	Seattle, Washington, Rhodes Department Store.	1000	670	447.5
KFON	Long Beach, California, Nichols & Warinner, Inc.	500	1240	241.8
KFOR	Lincoln, Nebraska, Howard Shuman.	100	1380	217.3
KFOX	Omaha, Nebraska, Bd. of Educ. (KOCH-WNAL)	100	1160	258.5
KFOY	St. Paul, Minnesota, Maurice Gordon Goldberg.	250	1050	285.5
KFPL	Dublin, Texas, C. C. Baxter.	15	1090	275.1
KFPM	Greenville, Texas, The New Furniture Co.	15	1300	230.6
KFPR	Los Angeles, Calif., L. A. Co. For. Dept. (KFQZ)	250	1290	232.4
KFPW	Cartersville, Missouri, Rev. Lannie W. Stewart.	50	1140	263.0
KFPY	Spokane, Washington, Symons Invest. Co. (KFIO)	250	1220	245.8
KFQA	St. Louis, Missouri, The Principia.	50	930	322.4
KFQB	Ft. Worth, Texas, Lone Star Broadcast Co.	1000	1150	260.7
KFQD	Anchorage, Alaska, Anchorage Radio Club.	100	870	344.6
KFQU	Holy City, California, W. E. Riker.	100	1200	249.9
KFQW	Seattle, Washington, Carl F. Knierim.	100	1380	217.3
KFQZ	Hollywood, California, Taft Radio & Brdcstg. Co., Inc. (KFPR)	100	1290	232.4
KFRC	San Francisco, California, Don Lee, Inc.	1000	660	454.3
KFRU	Columbia, Missouri, Stephens College.	500	1200	249.9
KFSD	San Diego, California, Airfan Radio Corp.	500	680	440.9
KFSG	Los Angeles, California, Echo Park Evan. Assn.	500	1090	275.1
KFUL	Galveston, Texas, Thomas Goggan & Bros.	500	1160	258.5
KFUM	Colorado Springs, Colo., W. D. Corley.	100	1270	236.1
KFUO	St. Louis, Mo., Concordia Theolog. Sem. (KSD)	500	550	545.1
KFUP	Denver, Colorado, Fitzsimmons General Hosp.	100	1320	227.1
KFUR	Ogden, Utah, Peery Building Co.	50	1330	225.4
KFUS	Oakland, California, Dr. L. L. Sherman (KRE)	50	1170	256.3
KFUT	Salt Lake City, Utah, University of Utah.	50	600	499.7
KFVD	Venice, Calif., W. J. & C. I. McWhinnie (KGFJ)	250	1440	208.2
KFVE	St. Louis, Mo., Greater St. Louis Brdcstg. Corp.	1000	1280	234.2
		2000	6 A.M. to 6 P.M.	
KFVG	Independence, Kansas, First Meth. Epis. Church.	50	1330	225.4
KFVI	Houston, Texas, Hdq. Troop, 56th Cavalry.	50	1260	238.0
KFVN	Fairmont, Minn., Carl E. Bagley.	100	1310	228.9
KFVS	Cape Girdardeau, Mo., Hirsch Battery & Radio Co.	50	1340	223.7
KFWB	Los Angeles, Calif., Warner Bros. Brdcstg. Corp.	500	830	361.2
KFWC	San Bernardino, Calif., Lawrence E. Wall.	100	1350	222.1
KFWF	St. Louis, Mo., St. Louis Truth Center, Inc.	250	1400	214.2
KFWH	Eureka, California, F. Wellington Morse.	100	1180	254.1
KFWI	San Francisco, Calif., Radio Entertainments, Inc.	500	1120	267.7

CALL	STATION AND OWNER	POWER WATTS	KCYS.	MTRS.
KFWM	Oakland, California, Oakland Educational Soc	500	1270	236.1
		1000	6 A.M. to 6 P.M.	
KFWO	Avalon, Calif., Lawrence Mott	250	1000	000.0
KFAD	Jerome, Idaho, Service Radio Co	15	1470	204.0
KFXF	Denver, Colo., Pikes Peak Brdcstg. Co., Inc	500	1060	282.8
KFXH	El Paso, Tex., W. S. Bledsoe	100	1240	241.8
KFXJ	Edgewater, Colo., R. G. Howell	15	1390	215.7
KFXR	Oklahoma City, Okla., Exchange Ave. Baptist Ch	50	1340	223.7
KFXY	Flagstaff, Ariz., Mary M. Costigan	25	1460	205.4
KFYF	Oxnard, Calif., Carl's Radio Den	25	1260	238.0
KFYR	Bismarck, N. Dak., Hoskins-Meyer	250	1250	239.9
		500	6 A.M. to 6 P.M.	
KGA	Spokane, Wash., Northwest Radio Service Co	2000	1150	260.7
KGAR	Tucson, Ariz., Citzens Publishing Co	100	1280	234.2
KGBS	Seattle, Wash., Arthur C. Dailey	100	1480	202.6
KGBU	Ketchikan, Alaska, Alaska Radio & Service Co	500	1310	228.9
KGBX	St. Joseph, Mo., Foster-Hall Tire Co	100	1040	288.3
KGBY	Columbus, Neb., Thelen & Taddiken	50	1480	202.6
KGBZ	York, Neb., Federal Live Stock Remedy Co	100	1410	212.6
KGCA	Decorah, Iowa, Charles W. Greenley (KWLC)	10	1210	247.8
KGCB	Oklahoma, Okla., Wallace Radio Inst. (KGFG)	50	1390	215.7
KGCH	Wayne, Neb., S. A. Lutgen, M. D.	250	1020	293.9
KGCI	San Antonio, Tex., Liberto Radio Sales (KGRC)	15	1360	220.4
KGCL	Seattle, Wash., Archie Taft & Louis Wasmer (KPCB)	50	1300	230.6
KGCN	Concordia, Kan., Concordia Brdcstg. Co	50	1440	208.2
KGCR	Brookings, S. Dak., Cutler's Radio Brdcstg. Service, Inc.	15	1440	208.2
KGDW	Humboldt Neb., Frank J. Rist	100	1450	206.8
KGCX	Vida, Mont., First State Bank of Vida	10	1230	243.8
KGDA	Dell Rapids, S. Dak., Home Auto Co. (6 to 6)	15	1180	254.1
KGDE	Barrett, Minn., Jaren Drug Co	50	1460	205.4
KGDJ	Cresco, Iowa, R. R. Rathert	10	1480	202.6
KGDM	Stockton, Calif., E. F. Peffer	10	1380	217.3
KGDP	Pueblo, Colo., Boy Scouts of America	10	1340	223.7
KGDR	San Antono, Tex., Joe B. McShane	15	1480	202.6
KGDW	Humboldt, Neb., Frank J. Rist	100	1450	206.8
KGDX	Shreveport, La., William E. Antony (KGGH)	250	1410	212.6
KGDY	Oldham, S. Dak., J. Albert Loesch	15	1450	206.8
KGEF	Los Angeles, Calif., Trinity Methodist Church	500	1140	263.0
KGEH	Eugene, Ore., Eugene Broadcast Station	50	1490	201.2
KGEK	Yuma, Colo., Beehler Elec. Equip. Co. (6 to 7 only)	10	1140	263.0
KGEN	El Centro, Calif., E. R. Irey & F. M. Bowles	15	1330	225.4
KGEO	Grand Island, Neb., Hotel Yancey	100	1460	205.4
KGEQ	Minneapolis, Minn., Fred W. Herrmann	50	1480	202.6
KGER	Long Beach, Calif., C. Merwin Dobyns (KRLO)	100	1390	215.7
KGES	Central City, Neb., Central Broadcast Co	10	1470	204.0
KGEU	Lower Lake, Calif., L. W. Clement	50	1320	227.1
KGEW	Fort Morgan, Colo., City of Ft. Morgan	10	1370	218.8
KGEY	Denver, Colo., J. W. Dietz	15	1490	201.2
KGEZ	Kalispell, Mont., Flathead Brdcstg. Assn	100	1460	205.4
KGFB	Iowa City, Iowa, Albert C. Dunkel	10	1340	223.7
KGFF	Alva, Okla., Earl E. Hampshire	25	1460	205.4
KGFG	Oklahoma City, Okla., Full Gospel Church (KGCB)	50	1390	215.7
KGFH	La Crescenta, Calif., Frederick Robinson (KMIC)	250	1340	223.7
KGFI	San Aneglo, Tex., M. L. Eaves	15	1360	220.4
KGFJ	Los Angeles, Calif., Ben S. McGlashan (KFVD)	100	1440	208.2
KGFK	Hallock, Minn., Kittson County Enterprise	50	1340	223.7
KGFL	Trinidad, Colo., N. L. Cotter	50	1350	222.1
KGFM	Yuba City, Calif., George W. Johnson	15	1420	211.1
KGFN	Aneta, N. Dak., Henry Haraldson & Carl Thingstad	15	1500	199.9
KGFO	Portable, Brant Radio Power Co	100	1470	204.0
KGFP	Mitchell, S. Dak., Mitchell Broadcast Co	10	1410	212.6
KGFW	Ravenna, Neb., Otto F. Sothman	10	1000	299.8
KGFX	Pierre, S. Dak., Dana McNeil (6 to 7 only)	200	1180	254.1
KGGF	Picher, Okla., Dr. D. L. Connell	100	1450	206.8
KGGH	Cedar Grove, La., Bates Radio & Elec. Co. (KGDX)	50	1410	212.6
KGO	Oakland, Calif., General Electric Co	5000	780	384.4
KGRC	San Antonio, Tex., Gene Roth & Co. (KGCI)	50	1360	220.4
KGRS	Amarillo, Tex., Gish Radio Service	150	1230	243.8
KGTT	San Francisco, Calif., Glad Tidings Temple and Bible Institute	50	1450	206.8
KGU	Honolulu, Hawaii, Marion A. Mulrony	600	1110	270.1
KGW	Portland, Ore., Oregonian Pub. Co	1000	610	491.5
KGY	Lacey, Wash., St. Martins College	50	1230	243.8
KHJ	Los Angeles, Calif., Times Mirror Co	500	740	405.2
KHQ	Spokane, Wash., Louis Wasmer, Inc	1000	810	370.2
KICK	Atlantic, Iowa, Atlantic Automobile Co	100	650	461.3
KJBS	San Francisco, Calif., Julius Brunton & Sons Co	50	1360	220.4
KJR	Seattle, Wash., Northwest Radio Service Co	2500	860	348.6
KKP	Seattle, Wash., City of Seattle, Harbor Dept	15	1130	265.3
KLCN	Blytheville, Ark., Daily Courier News (6 to 6 only)	50	1050	285.5
KLDS	Independence, Mo., Reorganized Church of Jesus Christ of Latter Day Saints	1500	1110	270.1
KLIT	Portland, Ore., Lewis Irvine Thompson	10	1450	206.8
KLS	Oakland, Calif., Warner Bros. (KZM)	250	1220	245.8
KLX	Oakland, Calif., Tribune Pub. Co	500	590	508.2
KLZ	Denver, Colo., Reynolds Radio Co., Inc	250	1120	267.7
KMA	Shenandoah, Iowa, May Seed & Nursery (KWKH-KFDY)	1000	760	394.5
KMED	Medford, Ore., W. J. Virgin (KFJI)	50	1200	249.9
KMIC	Inglewood, Calif., James R. Fouch (KGFH)	250	1340	223.7
KMJ	Fresno, Calif., The Fresno Bee	50	820	365.6
KMMJ	Clay Center, Neb., The M. M. Johnson Co. (WCAJ)	500	790	379.5
KMO	Tacoma, Wash., K M .O, Inc.	250	1180	254.1
KMOX	St. Louis, Mo., Voice of St. Louis	5000	1000	299.8
KMTR	Hollywood, Calif., KMTR Radio Corp	500	570	526.0
KNRC	Santa Monica, Calif., Clarence B. Juneau	500	800	374.8
KNX	Los Angeles, Calif., L. A. Express Pub. Co	500	890	336.9
KOA	Denver, Colo., General Electric Co	5000	920	325.9
		10000	6 to 7 P. M.	
KOAC	Corvallis, Ore., Ore. St. Ag'cul'al Col	500	1110	270.1
KOB	State College, N. Mex., N. Mex. College (KWSC-KTW)	5000	760	294.5
KOCH	Omaha, Neb., Central Radio Sch. (WNAL-KFOX)	250	1160	258.5
KOCW	Chickasha, Okla., Okla. Col. for Women	250	1190	252.0
KOIL	Council Bluffs, Iowa, Mona Motor Oil Co	2000	1080	277.6
		4000	7 A.M. to 7 P.M.	

CALL	STATION AND OWNER	POWER WATTS	KCYS.	MTRS.
KOIN	Portland, Ore., K O I N, Inc	1000	940	319.0
KOLO	Durango, Colo., Gerald K. Hunter	5	1500	199.9
KOMO	Seattle, Wash., Fisher's Blend Station, Inc	1000	980	305.9
KOW	Denver, Colo., Olinger Corp Broadcasting	250	630	475.9
KOWW	Walla Walla, Wash., Frank A. Moore, Inc	500	1000	299.8
KPCB	Seattle, Wash., Pac. Coast Biscuit Co. (KGCL)	50	1300	230.6
KPJM	Prescott, Ariz., Frank Wilburn	15	1400	214.2
KPLA	Los Angeles, Calif., Pacific Development Radio Co	500	1190	252.0
KPNP	Muscatine, Iowa, Central Radio Co	100	1420	211.1
KPO	San Francisco, Calif., Hales Bros. & The Chronicle	1000	710	422.3
KPPC	Pasadena, Calif., Pasadena Pres. Ch. (KELW)	50	1310	228.9
KPRC	Houston, Tex., Houston Printing Co	500	1020	293.9
KPSN	Pasadena, Calif., Pasadena Star-News Pub. Co	1000	950	315.6
KQV	Pittsburgh, Pa., Doubleday-Hill Elec. Co. (WJAS)	500	1110	270.1
KQW	San Jose, Calif., First Baptist Church	500	1010	296.9
KRAC	Shreveport, La., Caddo Radio Club	50	1360	220.4
KRE	Berkeley, Calif., First Cong. Church (KFUS)	100	1170	256.3
KRLD	Dallas, Tex., K R L D, Inc.	500	650	461.3
KRLO	Los Angeles, Calif., Freeman Lang & A. B. Scott (KGER)	250	1390	215.7
KRSC	Seattle, Wash., Radio Sales Corporation	50	1420	211.1
KSAC	Manhattan, Kan., Kansas State Agri. College	500	900	333.1
KSBA	Shreveport, La., W. G. Patterson	1000	1120	267.7
KSCJ	Sioux City, Iowa, Perkins Bros. Co. (KWUC)	500	1230	243.8
KSD	St. Louis, Mo., Pulitzer Pub. Co. (KFUO)	500	550	545.1
KSEI	Pocatello, Idaho, KSEI Brdcstg. Assn	250	900	333.1
KSL	Salt Lake City, Utah, Radio Service Corp. of Utah	1000	990	302.8
KSMR	Santa Maria, Calif., Santa Maria Valley R. R. Co	100	1100	272.6
KSO	Clarinda, Iowa, Berry Seed Co	500	1320	227.1
KSOO	Sioux Falls, S. Dak., Sioux Falls Broadcast Assn	250	1430	209.7
KTAB	Oakland, Calif., Associated Broadcasters	500	1070	280.2
KTAP	San Antonio, Tex., Robert B. Bridge	20	1310	228.9
KTBI	Los Angeles, Calif., Bible Inst. of Los Angeles, Inc.	500	1040	288.3
KTBR	Portland, Ore., M. E. Brown (KFJR)	50	1060	282.8
KTCL	Seattle, Wash., American Radio Tel. Co	500	1080	277.6
KTHS	Hot Springs, Ark., Arlington Hotel Co	1000	780	384.4
KTNT	Muscatine, Iowa, Norman Baker	3500	1170	256.3
		5000	6 A.M. to 6 P.M.	
KTSA	San Antonio, Tex., Alamo Broadcast Co	2000	1130	265.3
KTUE	Houston, Tex., Uhalt Electric	5	1410	212.6
KTW	Seattle, Wash., First Pres. Ch. (KWSC-KOB)	1000	760	394.5
KUJ	Seattle, Wash., Puget Sound Radio Broadcasting Co., Inc.	10	1500	199.9
KUOA	Fayetteville, Ark., University of Arkansas	500	1010	296.9
KUOM	Missoula, Mont., State Univ. of Montana	500	800	374.8
KUSD	Vermillion, S. Dak., University of South Dakota	250	620	483.6
KUT	Austin, Tex., University of Texas	500	1290	232.4
KVI	Tacoma, Wash., Puget Sound Radio Broadcstg. Co.	50	1280	234.2
KVOO	Bristow, Okla., Southwestern Sales Corp	1000	860	348.6
KVOS	Seattle, Wash., L. Kessler	50	1430	209.7
KWBS	Portland, Ore., Schaefer-Radio Co	15	1500	100.0
KWCR	Cedar Rapids, Iowa, H. F. Paar (WJAM)	250	780	384.4
KWG	Stockton, Calif., Portable Wireless Tel. Co	50	870	344.6
KWJJ	Portland, Ore., Wilbur Jerman	50	1010	296.9
KWKC	Kansas City, Mo., Wilson Duncan Brdcstg. Co	100	1350	222.1
KWKH	Shreveport, La., W. K. Henderson (KMA)	1000	760	394.5
KWLC	Decorah, Iowa, Luther College (KGCA)	50	1210	247.8
KWSC	Pullman, Wash., State Col. of Wash. (KTW-KOB)	500	760	394.5
KWTC	Santa Ana, Calif., Dr. John Wesley Hancock	5	850	352.7
KWUC	Le Mars, Iowa, Western Union College (KSCJ)	1500	1230	243.8
KWWG	Brownsville, Tex., Chamber of Commerce	500	1080	277.6
KXL	Portland, Ore., K X L Broadcasters	50	1360	220.4
KXRO	Aberdeen, Wash., K X R O, Incorporated	50	1320	227.1
KYA	San Francisco, Calif., Pacific Broadcasting Corp	500	970	309.1
KYW	Chicago, Ill., Westinghouse E. & M. Co. (KFKX)	2500	570	526.0
KZM	Oakland, Calif., Preston D. Allen (KLS)	100	1220	245.8
WAAD	Cincinnati, Ohio, Ohio Mechanics Inst	25	1120	267.7
WAAF	Chicago, Ill., Drovers Journal Pub. Co. (WBBM-WJBT)	500	770	389.4
WAAM	Newark, N. J., WAAM, Inc. (WGBS)	500	860	348.6
WAAT	Jersey City, N. J., Bremer Broadcasting Corp. (WGBB-WEVD)	300	1220	245.8
WAAW	Omaha, Neb., Omaha Grain Exchange (6 to 7 only)	500	860	348.6
WABC	Richmond Hill, N. Y., Atlantic Broadcasting Corp. (WBOQ)	2500	920	325.9
WABF	Kingston, Pa., Markle Broadcstg. Corp	250	1460	205.4
WABI	Bangor, Me., First Universalist Church	100	770	389.4
WABO-WHEC	Rochester, N. Y., Lake Avenue Memorial Baptist Church & Society (WHEC)	100	1290	232.4
WABQ	Philadelphia, Pa., Keystone Brdcstg. Co., Inc	500	1150	260.7
WABR	Toledo, Ohio, Scott High School (WTAL)	50	1070	280.2
WABW	Wooster, Ohio, College of Wooster	50	1210	247.8
WABY	Philadelphia, Pa., John Magaldi, Jr. (WFKD)	50	1210	247.8
WABZ	New Orleans, La., Coliseum Place Baptist Church	50	1210	247.8
WADC	Akron, Ohio, Allen T. Simmons	500	1010	296.9
WAFD	Detroit, Mich., Albert B. Parfet Co. (WRAV)	100	880	340.7
WAGM	Royal Oak, Mich., Robert L. Miller	50	1330	225.4
WAGS	Lexington, Mass., J. Smith Dodge, Inc	5	1390	215.7
WAIT	Taunton, Mass., A. H. Waite & Co., Inc	10	1400	214.2
WAIU	Columbus, Ohio, American Ins. Union (WEAO)	5000	1060	282.8
WALK	Willow Grove, Pa., Albert A. Walker	50	1490	201.2
WAMD	Minneapolis, Minn., Radisson Radio Corp. & Stanley E. Hubbard	500	1330	225.4
WAPI	Auburn, Ala., Alabama Polytechnic Inst	1000	920	325.9
WARS	Brooklyn, N. Y., Amateur Radio Specialty Co. (WSDA-WBBC)	500	1320	227.1
WASH	Grand Rapids, Mich., Baxter Laundries, Inc	250	1170	256.3
WATT	Portable, Edison Elec. Illum. Co	100	1490	201.2
WBAA	Lafayette, Ind., Purdue University (WRM)	500	1100	272.6
WBAK	Harrisburg, Pa., Penna. State Police (WPSC)	500	1000	299.8
WBAL	Baltimore, Md., Cons. Gas, Elec. Lt. & Power Co	5000	1050	285.5
WBAO	Decatur, Ill., James Millikin University	100	1120	267.7
WBAP	Ft. Worth, Tex., Carter Publications, Inc. (WFAA)	1500	600	499.7
WBAW	Nashville, Tenn., Waldrum Drug Co	100	1210	247.8
WBAX	Wilkes-Barre, Pa., John H. Stenger, Jr. (WBRE)	100	1200	249.9
WBBC	Brooklyn, N. Y., Brooklyn Broadcasting Corp. (WARS-WSDA)	500	1320	227.1
WBBL	Richmond, Va., Grace Covenant Pres. Ch	100	1210	247.8

CALL	STATION AND OWNER	POWER WATTS	KCYS.	MTRS.
WBBM	Chicago, Ill., Atlas Inv. Co. (WJBT-WAAF)	1000	770	389.4
WBBP	Petoskey, Mich., Petoskey High School	100	1250	239.9
WBBR	Rossville, N. Y., Peoples Pulpit Association (WEBJ-WLTH)	1000	1170	256.3
WBBW	Norfolk, Va., Ruffner Junior High School	50	1270	236.1
WBBY	Charleston, S. C., Washington Light Infantry	75	600	499.7
WBBZ	Portable, C. L. Carrell	100	1470	204.0
WBCN	Chicago, Ill., Great Lakes Radio Broadcasting Corp. (WENR)	250	1040	288.3
WBES	Takoma Park, Md., Bliss Electrical School	100	1010	296.9
WBET	Boston, Mass., Boston Transcript Co. (WSSH)	500	1040	288.3
WBIS	Boston, Mass., The Shepard Stores (6 to 6) only	100	990	302.8
WBKN	Brooklyn, N. Y., Arthur Faske (WBMS-WIBI-WWRL)	100	1120	267.7
WBMH	Detroit, Mich., Braun's Music House	100	1420	211.1
WBMS	Union City, N. J., Geo. J. Schowerer (WBKN-WIBI-WWRL)	100	1120	267.7
WBNY	New York, N. Y., Baruchrome Corp. (WHAP-WMSG)	500	1270	236.1
WBOQ	Richmond Hill, N. Y., Atlantic Broadcasting Corp. (WABC)	500	920	325.9
WBRC	Birmingham, Ala., Birmingham Broadcasting Co	250	1230	243.8
WBRE	Wilkes-Barre, Pa., Louis G. Baltiomre (WBAX)	100	1200	249.9
WBRL	Tilton, N. H., Booth Radio Laboratories	500	1290	232.4
WBRS	Brooklyn, N. Y., North American Broadcasting Corp. (WCDA-WRST)	100	1420	211.1
WBSO	Wellesley Hills, Mass., Babson's Statistical Organization, Inc.	100	780	384.4
WBT	Charlotte, N. C., C. C. Coddington	500	1160	258.5
		1000	7 A.M. to 7 P.M.	
WBZ	E. Springfield, Mass., Westinghouse E. & M. Co	15000	900	333.1
WBZA	Boston, Mass., Westinghouse E. & M. Co	500	900	333.1
WCAC	Mansfield, Conn., Conn. Agri. College (WTIC)	500	560	535.4
WCAD	Canton, N. Y., St. Lawrence University	500	820	365.6
		1000	6 A.M. to 6 P.M.	
WCAE	Pittsburgh, Pa., Kaufman & Baer Co	500	580	516.9
WCAH	Columbus, Ohio, C. A. Entrekin	250	560	535.4
WCAJ	Lincoln, Neb., Nebraska Wesleyan Univ. (KMMJ)	500	790	379.5
WCAL	Northfield, Minn., St. Olaf College (KFMX)	500	1270	236.1
WCAM	Camden, N. J., City of Camden	500	1340	223.7
WCAO	Baltimore, Md., Monumental Radio, Inc. (WCBM)	250	780	384.4
WCAT	Rapid City, S. Dak., S. Dak. State Sch. of Mines	100	1210	247.8
WCAU	Philadelphia, Pa., Universal Brdcstg. Co	500	890	336.9
WCAX	Burlington, Vt., University of Vermont	100	1180	254.1
WCAZ	Carthage, Ill., Carthage College	50	880	340.7
WCBA	Allentown, Pa., Chas. W. Heimbach & B. Bryan Musselman (WSAN)	100	1350	222.1
WCBD	Zion, Ill., Wilbur Glenn Voliva (WLS)	5000	870	344.6
WCBE	New Orleans, La., Uhalt Radio	5	1320	227.1
WCBH	Oxford, Miss., University of Mississippi	100	1240	241.8
WCBM	Baltimore, Md., Hotel Chateau (WCAO)	100	780	384.4
WCBR	Portable, Charles H. Messter	100	1490	201.2
WCBS	Springfield, Ill., Harold L. Dewing & Chas. Messter	250	1430	209.7
WCCO	Minneapolis, Minn., Washburn Crosby Co	5000	740	405.2
		7500	6 A.M. to 6 P.M.	
WCDA	Cliffside, N. J., Italian Educational Broadcasting Co. (WBRS-WRST)	250	1420	211.1
WCFL	Chicago, Ill., Chicago Federation of Labor (WEMC-WLTS)	1500	620	483.6
WCGU	Coney Island, N. Y., Chas. G. Unger (WKBQ and WKBO)	500	1370	218.8
WCLO	Camp Lake, Wis., C. E. Whitmore (WWAE) (WJBC)	100	1320	227.1
WCLS	Joliet, Ill., M. A. Felman Co. (WKBB)	150	1390	215.7
WCMA	Culver, Ind., Culver Military Academy	250	1160	258.5
WCOA	Pensacola, Fla., City of Pensacola	500	1200	249.9
WCOC	Columbus, Miss., Crystal Oil Co	250	1300	230.6
WCOM	Manchester, N. H., City of Manchester	100	1260	238.0
WCOT	Providence, R. I., Jacob Conn	50	1330	225.4
WCRW	Chicago, Ill., Clinton R. White (WFKB-WPCC)	500	1340	223.7
WCSH	Portland, Me., Congress Square Hotel Co	500	830	361.2
WCSO	Springfield, Ohio, Wittenberg College	500	1170	256.3
WCWK	Ft. Wayne, Ind., Chester W. Keen (WOWO)	500	1310	228.9
WCWS	Danbury, Conn., Danbury Brdcstg. Station (WICC)	100	1400	214.2
WCX-WJR	See WJR-WCX			
WDAD-WLAC	Nashville, Tenn., Dad's Auto Accessories, Inc. & Life & Casualty	1000	1330	225.4
WDAE	Tampa, Fla., Tampa Publishing Co	500	1120	267.7
WDAF	Kansas City, Mo., Kansas City Star Co	1000	810	370.2
WDAG	Amarillo, Tex., J. Laurance Martin	250	1140	263.0
WDAH	El Paso, Tex., Trinity Methodist Church	100	1280	234.2
WDAY	Fargo, N. Dak., Radio Equipment Corp	250	830	361.2
WDBJ	Roanoke, Va., Richardson-Wayland Elec. Corp	250	1300	230.6
WDBK	Cleveland, Ohio, WDBK Brdcstg. Station Co., Inc. (WJAY)	250	1320	227.1
WDBO	Orlando, Fla., Rollins College, Inc	500	1040	288.3
		1000	6 A.M. to 6 P.M.	
WDEL	Wilmington, Del., Wilmington Elec. Spec. Co., Inc.	100	1130	265.3
WDGY	Minneapolis, Minn., Dr. Geo. W. Young (WRHM)	500	1150	260.7
WDOD	Chattanooga, Tenn., Chattanooga Radio Co., Inc	500	1220	245.8
WDRC	New Haven, Conn., Doolittle Radio Corp	500	1060	282.8
WDWF-WLSI	Cranston, R. I., Dutee W. Flint & The Lincoln Studios, Inc.	500	800	374.8
WDWM	Asbury Park, N. J., Radio Industries Broadcast Co	500	830	361.2
WDZ	Tuscola, Ill., James L. Bush (6 to 6 only)	100	1080	277.6
WEAF	New York, N. Y., National Brdcstg. Co., Inc	50000	610	491.5
WEAI	Ithaca, N. Y., Cornell University	250	620	483.6
WEAM	N. Plainfield, N. J., Borough of Nor. Plainfield (WOAX)	250	1250	239.9
WEAN	Providence, R. I., The Shepard Co	500	940	319.0
WEAO	Columbus, Ohio, State University (WAIU)	750	1060	282.8
WEAR	Cleveland, Ohio, Willard Storage Battery Co. (WTAM)	1000	750	399.8
WEBC	Superior, Wis., Head of The Lakes Broadcasting Co.	250	1240	241.8
WEBE	Cambridge, Ohio, Roy W. Waller	10	1210	247.8
WEBH	Chicago, Ill., Edgewater Beach Hotel Co. (WJJD)	2000	820	365.6
WEBJ	New York, N. Y., Third Avenue Railway Co. (WBBR-WLTH)	500	1170	256.3

CALL	STATION AND OWNER	POWER WATTS	KCYS.	MTRS.
WEBQ	Harrisburg, Ill., Tate Radio Company	15	1340	223.7
WEBR	Buffalo, N. Y., H. H. Howell	200	1240	241.8
WEBW	Beloit, Wis., Beloit College	500	1160	258.5
WEDC	Chicago, Ill., Emil Denemark (WGES)	500	1240	241.8
WEEI	Boston, Mass., Edison Electric Illuminating	500	670	447.5
WEHS	Evanston, Ill., Victor C. Carlson	100	1390	215.7
WEMC	Berrien Sprgs., Mich., Emmanuel Missionary College (WCFL-WLTS)	1000	620	483.6
WENR	Chicago, Ill., Great Lakes Brdcstng. Co. (WBCN)	500	1040	288,3
WEPS	Gloucester, Mass., Matheson Radio Co., Inc.	100	1010	296.9
WEW	St. Louis, Mo., St. Louis University (6 to 8 only)	1000	850	352.7
WEVD	Woodhaven, N. Y., Debs Memorial Radio Fund (WAAT-WGBB)	500	1220	245.8
WFAA	Dallas, Tex., Dallas Morning News (WBAP)	500	600	499.7
WFAM	St. Cloud, Minn., Times Pub. Co., Inc.	10	1190	252.0
WFBC	Knoxville, Tenn., First Baptist Church	50	1280	234.2
WFBE	Cincinnati, Ohio, Garfield Place Hotel Co.	250	1220	245.8
WFBG	Altoona, Pa., Wm. F. Gable Company	100	1070	280.2
WFBJ	Collegeville, Minn., St. John's University	100	1100	272.6
WFBL	Syracuse, N. Y., The Onondaga Co., Inc.	750	1160	258.5
WFBM	Indianapolis, Ind., Indianapolis Power & Light Co.	250	1330	225.4
WFBR	Baltimore, Md., Fifth Infantry, Maryland National Guard	100	1330	225.4
WFBZ	Galesburg, Ill., Knox College (WRAM)	50	1210	247.8
WFCI	Pawtucket, R. I., Frank Crook, Inc. (WNBX)	100	1240	241.8
WFDF	Flint, Mich., Frank D. Fallain	100	860	348.6
WFI	Philadelphia, Pa., Strawbridge & Clothier (WLIT)	500	740	405.2
WFIW	Hopkinsville, Ky., The Acme Mills, Inc.	500	1070	280.2
		1000	6 A.M. to 6 P.M.	
WFKB	Chicago, Ill., Francis K. Bridgman, Inc. (WCRW-WPCC)	500	1340	223.7
WFKD	Frankford, Pa., Foulkrod Radio Eng. Co. (WABY)	50	1210	247.8
WFLA	Clearwater, Fla., Clearwater Chamber of Commerce	500	820	365.6
WGAL	Lancaster, Pa., Lancaster Electric Supply & Constr. Co. (WKJC)	15	1190	252.0
WGBB	Freeport, N. Y., Harry H. Carmon (WAAT-WEVD)	400	1220	245.8
WGBC	Memphis, Tenn., First Baptist Church	15	1080	277.6
WGBF	Evansville, Ind., Finke Furniture Co.	250	1270	236.1
WGBI	Scranton, Pa., Scranton Broadcasters, Inc. (WQAN)	250	1300	230.6
WGBS	Astoria (L. I.), N. Y., Gimbel Bros., Inc. (WAAM)	500	860	348.6
WGCP	Newark, N. J., May Radio Broadcast Corp. (WNJ)	500	1070	280.2
WGES	Chicago, Ill., Oak Leaves Brdcstg. Corp. (WEDC)	500	1240	241.8
WGHP	Mt. Clemens, Mich., Geo. Harrison Phelps, Inc.	750	940	319.0
WGL	New York, N. Y., International Broadcasting Corp. (WODA)	500	1020	293.9
		1000	7 A.M. to 1 P.M.	
WGM	Jeannette, Pa., Verne & Elton Spencer	50	1440	208.2
WGMU	Portable, Atlantic Broadcasting Corp. (WRMU)	100	1490	201.2
WGN-WLIB	Chicago, Ill., Tribune Co. & Liberty Weekly, Inc.	500	980	305.9
WGR	Buffalo, N. Y., Federal Radio Corporation	750	990	302.8
WGST	Atlanta, Ga., Georgia Sch. of Technology (WMAZ)	500	1110	270.1
WGWB	Milwaukee, Wis., Radiocast Corp. of Wisconsin	500	1870	318.8
WGY	S. Schenectady, N. Y., General Elec. Co. (WHAZ)	30KW	790	379.5
WHA	Madison, Wis., University of Wisconsin (WLBL)	750	940	319.0
WHAD	Milwaukee, Wis., Marquette University (WTMJ)	500	1020	293.9
WHAM	Rochester, N. Y., Stromberg-Carlson Telephone Mfg. Co.	5000	1080	277.6
WHAP	New York, N. Y., Defenders of Truth Society (WMSG-WBNY)	1000	1270	236.1
WHAR	Atlantic City, N. J., Cook's Sons, Inc. (WPG)	1000	1100	272.6
WHAS	Louisville, Ky., The Courier Journal Co. & The Louisville Times Co.	500	650	461.3
WHAZ	Troy, N. Y., Rensselaer Poly. Inst. (WGY)	500	790	379.5
WHB	Kansas City, Mo., Sweeney Automobile School Co. (WOQ)	500	890	336.9
WHBA	Oil City, Pa., C. C. Shaffer	10	1150	260.7
WHBC	Canton, Ohio, St. John's Catholic Church	10	1270	236.1
WHBD	Bellefontaine, Ohio, Chamber of Commerce	100	1350	222.1
WHBF	Rock Island, Ill., Beardsley Specialty Co.	100	1350	222.1
WHBL	Portable, C. L. Carrell	100	1470	204.0
WHBM	Portable, C. L. Carrell	100	1490	201.2
WHBN	Gainesville, Fla., University of Florida	10	1010	296.9
WHBP	Johnston, Pa., Johnston Automobile Co.	250	1310	228.9
		500	6 A.M. to 6 P.M.	
WHBQ	Memphis, Tenn., Brdcstg. Station WHBQ, Inc.	100	1290	232.4
WHBU	Anderson, Ind., Citizens Bank	15	1360	220.4
WHBW	Philadelphia, Pa., D. R. Kienzle	100	1360	220.4
WHBY	West De Pere, Wis., St. Norbert's College	50	1200	249.9
WHDI	Minneapolis, Minn., William Hood Dunwoody Industrial Inst. (WLB)	500	1220	245.8
WHEC-WABO	Rochester, N. Y., Hickson Electric Co., Inc.	100	1180	277.6
WHFC	Chicago, Ill., Woodson & Wilson, Inc.	200	1390	215.7
WHK	Cleveland, Ohio, Radio Air Service Corp.	500	1130	265.3
		1000	6 A.M. to 6 P.M.	
WHN	New York, N. Y., George Schubel (WQAO-WPAP)	500	760	394.5
WHO	Des Moines, Iowa, Bankers Life Co.	5000	560	535.4
WHPP	New York, N. Y., Bronx Brdcstg. Corp. (WMRJ-WTRL)	10	1450	206.8
WHT	Chicago, Ill., Radiophone Brdcstg. Corp. (WIBO)	5000	720	416.4
WIAD	Philadelphia, Pa., Howard R. Miller, (WNAT)	100	1040	288.3
WIAS	Burlington, Iowa, Home Electric Co.	100	630	475.9
WIBA	Madison, Wis., Capital Times-Strand Theater Station	100	1250	239.9
WIBG	Elkins Park, Pa., St. Pauls P. E. Church (6 to 6 Sunday)	50	680	440.9
WIBI	Flushing, N. Y., Fred. B. Zittell, Jr. (WBKN-WBMS-WWRL)	100	1120	267.7
WIBJ	Portable, C. L. Carrell	100	1490	201.2
WIBM	Portable, C. L. Carrell	100	1490	201.2
WIBO	Chicago, Ill., WIBO Broadcasters, Inc. (WHT)	500	720	416.4
WIBR	Steubenville, Ohio, Thurman A. Owings	50	1200	249.9
WIBS	Elizabeth, N. J., Lt. Thos. F. Hunter (WLBX-WMBQ)	150	1470	204.0
WIBU	Poynette, Wis., Wisconsin State Journal Co.	20	1380	217.3
WIBW	Portable, C. L. Carrell	100	1470	204.0
WIBX	Utica, N. Y., WIBX, Incorporated	150	1260	238.0
WIRZ	Montgomery, Ala., Alexander D. Trum	15	1300	230.6
WICC	Bridgeport, Conn., Bridgeport Brdcstg. Station, Inc. (WCWS)	250	1400	214.2
WIL	St. Louis, Mo., Benson Radio Brdcstg. Co.	250	1160	258.5
WIOD	Miami Beach, Fla., Carl G. Fisher Co.	1000	1210	247.8

CALL	STATION AND OWNER	POWER WATTS	KCYS.	MTRS.
WIP	Philadelphia, Pa., Gimbel Bros., Inc. (WOO)	500	590	508.2
WJAD	Waco, Tex., Frank P. Jackson	500	670	447.5
WJAG	Norfolk, Neb., Norfolk Daily News	250	1050	285.5
		500	7 A.M. to 7 P.M.	
WJAK	Kokomo, Ind., J. A. Kautz	50	1280	234.2
WJAM	Cedar Rapids, Iowa, D. M. Perham (KWCR)	100	780	384.4
WJAR	Providence, R. I., The Outlet Company	500	620	483.6
WJAS	Pittsburgh, Pa., Pittsburgh Radio Supply House (KQV)	500	1110	270.1
WJAX	Jacksonville, Fla., City of Jacksonville	1000	890	336.9
WJAY	Cleveland, Ohio, Cleveland Radio Broadcasting Corp. (WDBK)	500	1320	227.1
WJAZ	Mt. Prospect, Ill., Zenith Radio Corp. (WMBI)	5000	1140	263.0
WJBA	Joliet, Ill., D. H. Lentz, Jr.	50	930	322.4
WJBB	Tampa, Fla., Financial Journal, Inc.	250	870	344.6
WJBC	La Salle, Ill., Hummer Furniture Co. (WWAE-WCLO)	100	1320	227.1
WJBI	Red Bank, N. J., Robert S. Johnson	150	1140	263.0
WJBK	Ypsilanti, Mich., Ernest F. Goodwin	15	1360	220.4
WJBL	Decatur, Ill., Wm. Gushard Dry Goods Co	250	1410	212.6
WJBO	New Orleans, La., Valdemar Jensen	100	1140	263.0
WJBR	Omro, Wis., Gensch & Stearns	100	1320	227.1
WJBT	Chicago, Ill., J. S. Boyd, Inc. (WBBM-WAAF)	500	770	389.4
WJBU	Lewisburg, Pa., Bucknell University	100	1400	214.2
WJBW	New Orleans, La., Charles C. Carlson, Jr.	30	1260	238.0
WJBY	Gadsden, Ala., Electric Construction Co.	50	1280	234.2
WJBZ	Chicago Heights, Ill., Roland G. Palmer & Antony Coppotelli	100	1440	208.2
WJJD	Mooseheart, Ill., Supreme Lodge of the World, Loyal Order of Moose (WEBH)	1000	820	365.6
WJKS	Gary, Ind., Johnson-Kennedy Radio Corp. (WSBC)	500	1290	232.4
WJPW	Ashtabula, Ohio, J. P. Wilson	30	1440	208.2
WJR-WCX	Pontiac, Mich., WJR Inc. & Detroit Free Press	5000	680	440.9
WJZ	Bound Brook, N. J., Radio Corp. of America	30	660	454.3
WKAQ	San Juan, P. R., Radio Corp. of Porto Rico	500	880	340.7
WKAR	East Lansing, Mich., Michigan State College	500	1050	285.5
		1000	7 A.M. to 7 P.M.	
WKAV	Laconia, N. H., Laconia Radio Club	50	1340	223.7
WKBB	Joliet, Ill., Sanders Bros. (WCLS)	150	1390	215.7
WKBC	Birmingham, Ala., H. L. Ansley	10	1370	218.8
WKBE	Webster, Mass., K. & B. Electric Co.	100	1310	228.9
WKBF	Indianapolis, Ind., Noble Butler Watson	250	1190	252.0
WKBG	Portable, C. L. Carrell	100	1490	201.2
WKBH	La Crosse, Wis., Callaway Music Co.	500	1360	220.4
WKBI	Chicago, Ill., Fred L. Schoenwolf	50	930	322.4
WKBL	Monroe, Mich., Monrona Radio Mfg. Co.	15	1460	205.4
WKBM	Newburgh, N. Y., John Wilbur Jones	100	1440	208.2
WKBN	Youngstown, Ohio, W. P. Williamson, Jr. (WMBW)	50	1400	214.2
WKBO	Jersey City, N. J., Camith Corp. (WKBQ-WCGU)	500	1370	218.8
WKBP	Battle Creek, Mich., Enquirer-News Co.	50	1410	212.6
WKBQ	New York, N. Y., Starlight Amusement Park (WKBO-WCGU)	500	1370	218.8
WKBS	Galesburg, Ill., Permil N. Nelson (WLBO)	100	1380	217.3
WKBT	New Orleans, La., First Baptist Church	50	1190	252.0
WKBU	Portable, Harry K. Armstrong	50	1470	204.0
WKBV	Brookville, Ind., Knox Battery & Elec. Co.	100	1380	217.3
WKBW	Buffalo, N. Y., Churchill Evangelistic Assn., Inc.	500	1380	217.3
WKBZ	Ludington, Mich., K. L. Ashbacker	15	1500	199.9
WKDR	S. Kenosha, Wis., Edward A. Dato	15	930	322.4
WKEN	Kenmore, N. Y., Radio Station WKEN, Inc.	250	1470	204.0
WKJC	Lancaster, Pa., Kirk Johnson & Co. (WGAL)	50	1190	252.0
WKRC	Cincinnati, Ohio, Kodel Radio Corp.	500	900	333.1
WKY	Oklahoma City, Okla., WKY Radiophone Co.	150	1040	288.3
WLAC-WDAD	See WDAD-WLAC			
WLAP	Louisville, Ky., L. W. Benedict	30	1120	267.7
		100	6 A.M. to 6 P.M.	
WLB	Minneapolis, Minn., Univ. of Minnesota (WHDI)	500	1220	245.8
WLBC	Muncie, Ind., Donald A. Burton	50	1430	209.7
WLBF	Kansas City, Mo., Everett L. Dillard	50	1430	209.7
WLBG	Petersburg, Va., Robert Allen Gamble	100	1400	214.2
WLBH	Farmingdale, N. Y., Joseph J. Lombardi	30	1290	232.4
WLBI	Wenona, Ill., Wenona Legion Broadcasters, Inc.	250	1260	238.0
WLBL	Stevens Pt., Wis., Wisconsin Dept. of Markets (WHA)	1000	940	319.0
WLBM	Boston, Mass., Browning-Drake Corp.	50	1300	230.6
WLBN	Portable, William E. Hiler	50	1470	204.0
WLBO	Galesburg, Ill., Fred. A. Trebbe, Jr. (WKBS)	100	1380	217.3
WLBQ	Atwood, Ill., E. Dale Trout	25	1480	202.6
WLBR	Belvidere, Ill., Alford Radio Co.	15	930	322.4
WLBT	Crown Point, Ind., Harold Wendell	50	930	322.4
WLBV	Mansfield, Ohio, Mansfield Brdcstg. Assn.	50	1450	206.8
WLBW	Oil City, Pa., Petroleum Telephone Co.	500	1020	293.9
WLBX	L. I. City, N. Y., John N. Brahy (WIBS-WMBQ)	250	1470	204.0
WLBY	Iron Mountain, Mich., Aimone Electric	50	1430	209.7
WLBZ	Dover-Foxcroft, Me., Thompson L. Guernsey	250	1440	208.2
WLCI	Ithaca, N. Y., Lutheran Assn. of Ithaca	50	1210	247.8
WLIB-WGN	Elgin, Ill., Liberty Weekly, Inc. & The Tribune Co.	15KW	980	305.9
WLIT	Philadelphia, Pa., Lit Brothers (WFI)	500	740	405.2
WLS	Chicago, Ill., Sears, Roebuck & Co. (WCBD)	5000	870	344.6
WLSI-WDWF	See WDWF-WLSI			
WLTH	Brooklyn, N. Y., The Voice of Brooklyn (WBBR-WEBJ)	250	1170	256.3
WLTS	Chicago, Ill., Lane Technical H. S. (WEMC-WCFL)	100	620	483.6
WLW	Harrison, Ohio, Crosley Radio Corp.	5000	700	428.3
WLW	Cincinnati, Ohio, Crosley Radio Corp.	500	700	428.3
WLWL	New York, N. Y., Missionary Society of St. Paul the Apostle (WMCA)	1000	810	370.2
WMAC	Casenovia, N. Y., Clive B. Meredith (WSYR)	500	1330	225.4
WMAF	S. Dartmouth, Mass., Round Hills Radio Corp.	500	700	428.3
WMAK	Lockport, N. Y., Norton Laboratories, Inc.	750	550	545.1
WMAL	Washington, D. C., M. A. Leese Co.	100	990	302.8
WMAN	Columbus, Ohio, W. E. Ileskitt	50	1280	234.2
WMAQ	Chicago, Ill., Chicago Daily News, Inc. (WQJ)	1000	670	447.5
WMAY	St. Louis, Mo., Kingshighway Pres. Church	100	1210	247.8
WMAZ	Macon, Ga., Mercer University (WGST)	500	1110	270.1
WMBA	Portable, LeRoy Joseph Beebe	100	1470	204.0
WMBB	Chicago, Ill., American Band & Mtg. Co. (WOK)	500	1190	252.0
WMBC	Detroit, Mich., Michigan Brdcstg. Co., Inc.	100	1230	243.8
WMBD	Peoria Hts., Ill., Peoria Heights Radio Lab.	250	1460	205.4

CALL	STATION AND OWNER	POWER WATTS	KCYS.	MTRS.
WMBE	St. Paul, Minn., Dr. C. S. Stevens	10	1440	208.2
WMBF	Miami Beach, Fla., Fleetwood Hotel Corp	500	780	384.4
WMBG	Richmond, Va., Havens & Martin	15	1360	220.4
WMBH	Joplin, Mo., Edwin Dudley Aber	100	1470	204.0
WMBI	Chicago, Ill., Moody Bible Institute (WJAZ)	500	1140	263.0
WMBJ	Monessen, Pa., Star Theatre	50	1290	232.4
WMBL	Lakeland, Fla., Benford's Radio Studios	50	1310	228.9
WMBM	Memphis, Tenn., Seventh Day Adventist Church	10	1430	209.7
WMBO	Auburn, N. Y., Radio Service Laboratories	100	1360	220.4
WMBQ	Brooklyn, N. Y., Paul J. Gollhofer (WIBS-WLBX)	100	1470	204.0
WMBR	Tampa, Fla., F. J. Reynolds	100	1190	252.0
WMBS	Harrisburg, Pa., Mack's Battery Co	250	1280	234.2
WMBU	Pittsburgh, Pa., Paul J. Miller	50	1380	217.3
WMBW	Youngstown, Ohio, Youngstown Brdcstg. Co., Inc. (WKBN)	50	1400	214.2
WMBY	Bloomington, Ill., Robert A. Isaacs (WNBL)	15	1500	199.9
WMC	Memphis, Tenn., Memphis Commercial Appeal, Inc.	500	580	516.9
WMCA	Hoboken, N. J., Greeley Square Hotel Co. (WLWL)	500	810	370.2
WMES	Boston, Mass., Massachusetts Educ. Society	100	1420	211.1
WMPC	Lapeer, Mich., First Methodist Protestant Church	30	1280	234.2
WMRJ	Jamaica, N. Y., Peter J. Prinz (WHPP-WTRL)	10	1450	206.8
WMSG	New York, N. Y., Madison Square Garden Broadcast Corp. (WBNY-WHAP)	500	1270	236.1
WNAC	Boston, Mass., The Shepard Stores	500	850	352.7
WNAD	Norman, Okla., University of Oklahoma	500	1250	239.9
WNAL	Omaha, Neb., R. J.Rockwell (KFOX-KOCH)	250	1160	258.5
WNAT	Philadelphia, Pa., Lennig Bros. Co. (WIAD)	100	1040	288.3
WNAX	Yankton, S. Dak., Gurney Seed & Nursery Co. & Dakota Radio App. Co.	250	990	302.8
WNBA	Forest Park, Ill., Michael T. Rafferty	200	1440	208.2
WNBF	Endicott, N. Y., Howitt-Wood Radio Co	50	1450	206.8
WNBH	New Bedford, Mass., New Bedford Brdcstg. Co	250	1150	260.7
WNBJ	Knoxville, Tenn., Lonsdale Baptist Church	50	1450	206.8
WNBL	Bloomington, Ill., Harvey R. Storm (WMBY)	15	1500	199.9
WNBO	Washington, Pa., John Brownlee Spriggs	15	1420	202.6
WNBQ	Rochester, N. Y., Gordon B. Brown	15	1480	202.6
WNBR	Memphis, Tenn., John Ulrich	20	1310	228.9
WNBX	Springfield, Vt., First Congregational Church Corp. (WFCI)	10	1240	241.8
WNJ	Newark, N. J., Herman Lubinsky (WGCP)	500	1070	280.2
WNOX	Knoxville, Tenn., Peoples Tel. & Telg. Co	1000	1130	265.3
WNRC	Greensboro, N. C., Wayne M. Nelson	500	1340	223.7
WNYC	New York, N. Y., Dept. of Plant & Structures	500	570	526.0
WOAI	San Antonia, Tex., Southern Equipment Co	5000	990	302.8
WOAN	Lawrenceburg, Tenn., Church of the Nazarene & Vaughan School of Music	250	1050	285.5
WOAX	Trenton, N. J., Franklyn J. Wolff (WEAM)	500	1250	239.9
WOBR	Portable, Harl Smith	10	1470	204.0
WOC	Davenport, Iowa, Palmer School of Chiropractic	5000	850	352.7
WOCL	Jamestown, N. Y., A. E. Newton	25	1340	223.7
WODA	Paterson, N. J., Richard E. O'Dea (WGL)	1000	1020	293.9
WOI	Ames, Iowa, Iowa State College	2500	1130	265.3
		5000	6 to 6	
WOK	Homewood, Ill., Trianon, Inc. (WMBB)	5000	1190	252.0
WOKO	Peekskill, N. Y., Harold E. Smith	250	1390	215.7
WOKT	Rochester, N. Y., Titus-Ets Corporation	500	1430	209.7
WOMT	Manitowoc, Wis., Mikadow Theatre	50	1350	222.1
WOO	Philadelphia, Pa., John Wanamaker (WIP)	500	590	508.2
WOOD	Grand Rapids, Mich., Walter B. Stiles, Inc	500	1150	260.7
WOQ	Kansas City, Mo., Unity School of Christianity (WHB)	250	890	336.9
		500	6 A.M. to 6 P.M.	
WOR	Newark, N. J., L. Bamberger & Co	500	710	422.3
WORD	Batavia, Ill., Peoples Pulpit Assn. (WTAS)	5000	1090	275.1
WOS	Jefferson City, Mo., State Marketing Bureau	500	640	468.5
WOW	Omaha, Neb., Woodmen of the World Life Ins. Assn.	1000	590	508.2
WOWO	Ft. Wayne, Ind., Main Auto Sup. Co. (WCWK)	1000	1310	228.9
WPAP-WQAO	See WQAO-WPAP			
WPCC	Chicago, Ill., North Shore Cong. Church (WCRW-WFKB)	500	1340	223.7
WPCH	Brooklyn, N. Y., Concourse Radio Corp. (WRNY)	500	970	309.1
WPEP	Waukegan, Ill., Maurice Mayer	250	1390	215.7
WPG	Atlantic City, N. J., Municipality of Atlantic City (WHAR)	5000	1100	272.6
WPRC	Harrisburg, Pa., Wilson Printing & Radio Co	100	1430	209.7
WPSC	State College, Pa., Penna. State College (WBAK)	500	1000	299.8
WPSW	Philadelphia, Pa., Phila. School of Wireless Telegraphy	50	1480	202.6
WQAA	Parkersburg, Pa., Horace A. Beale, Jr	500	1390	215.7
WQAM	Miami, Fla., Electrical Equiment Co	750	930	322.4
WQAN	Scranton, Pa., Scranton Times (WGBI)	250	1300	230.6
WQAO-WPAP	Cliffside, N. J., Calvary Baptist Church (WHN)	500	760	394.5
WQJ	Chicago, Ill., Calumet Brdcstg. Co. (WMAQ)	500	670	447.5
WRAF	La Porte, Ind., The Radio Club, Inc	100	1440	208.2
WRAH	Providence, R. I., Stanley N. Read	250	1500	199.9
WRAK	Escanaba, Mich., Economy Light Co	50	1060	282.8
WRAM	Galesburg, Ill., Lombard College (WFBZ)	50	1210	247.8
WRAV	Yellow Springs, Ohio, Antioch College (WAFD)	100	880	340.7
WRAW	Reading, Pa., Avenue Radio & Elec. Shop	100	1260	238.0
WRAX*	Philadelphia, Pa., Berachah Church, Inc	250	1410	212.6
WRBC	Valparaiso, Ind., Immanuel Lutheran Church	250	1260	238.0
WRC	Washington, D. C., Radio Corp. of America	500	640	468.5
WRCO	Raleigh, N. C., Wynne Radio Co	250	1380	217.3
WRCV	Norfolk, Va., Radio Corp. of Virginia	100	1430	209.7
WREC	Memphis, Tenn., WREC, Incorporated	50	1180	254.1
WREN	Lawrence, Kan., Jenny Wren Co. (KFKU)	750	1180	254.1
WREO	Lansing, Mich., Reo Motor Car Co	500	1300	230.6
WRES	Quincy, Mass., Harry Leonard Sawyer	50	1380	217.3
WRHF	Washington, D. C., Washintgon Radio Hospital Fund (6 to 7 only)	150	930	322.4
WRHM	Fridley, Minn., Rosedale Hosp. Co., Inc. (WDGY)	1000	1150	260.7
WRK	Hamilton, Ohio, S. W. Doron & John C. Slade	100	1460	205.4
WRM	Urbana, Ill., University of Illinois (WBAA)	500	1100	272.6
		1000	6 A.M. to 6 P.M.	
WRMU	Portable, Atlantic Broadcasting Corp. (WGMU)	100	1490	201.2
WRNY	Coytesville, N. J., Experimenter Pub. Co (WPCH)	500	970	309.1
WRPI	Terre Haute, Ind., Rose Polytechnic Inst. Broadcasting Assn.	100	1440	208.2
WRR	Dallas, Tex., City of Dallas	500	850	352.7

CALL	STATION AND OWNER	POWER WATTS	KCYS.	MTRS.
WRRS	Racine, Wis., Racine Broadcasting Corp.	50	930	322.4
WRSC	Chelsea, Mass., William S. Pote	15	1460	205.4
WRST	Bay Shore, N. Y., Radiotel Mfg. Co., Inc. (WBRS-WCDA)	250	1420	211.1
WRVA	Richmond, Va., Larus & Bro. Co., Inc.	1000	1180	254.1
WSAI	Cincinnati, Ohio, U. S. Playing Card Co.	5000	830	361.2
WSAJ	Grove City, Pa., Grove City College	250	1340	223.7
WSAN	Allentown, Pa., Allentown Call Pub. Co., Inc. (WCBA)	100	1350	222.1
WSAR	Portsmouth, R. I., Doughty & Welch Electrical Co., Inc.	100	1190	252.0
WSAX	Chicago, Ill., Zenith Raido Corp.	100	1470	204.0
WSAZ	Huntington, W. Va., McKellar Electric Co.	100	1240	241.8
WSB	Atlanta, Ga., Atlanta Journal Co.	1000	630	475.9
WSBC	Chicago, Ill., World Battery Co., Inc. (WJKS)	500	1290	232.4
WSBF	St. Louis, Mo., Mississippi Valley Broadcasting Co.	250	680	440.9
WSBT	South Bend, Ind., South Bend Tribune	500	1260	238.0
WSDA	New York, N. Y., The City Temple (WARS-WBBC)	250	1320	227.1
WSEA	Virginia Beach, Va., Virginia Beach Broadcasting Co., Inc.	500	1140	263.0
WSIX	Springfield, Tenn., 638 Tire & Vulcanizing Co.	150	1410	212.6
WSKC	Bay City, Mich., World's Star Knitting Co.	250	610	491.5
WSM	Nashville, Tenn., Nat'l Life & Accident Ins. Co., Inc.	5000	880	340.7
WSMB	New Orleans, La., Saenger Theatres, Inc. & Maison Blanche Co.	500	930	322.4
WSMK	Dayton, Ohio, Stanley M. Krohn, Jr.	200	1010	296.9
WSOE	Milwaukee, Wis., School of Engin'ring of Milwaukee	500	1110	270.1
WSRO	Middletown, Ohio, Harry W. Fahrlander	100	780	384.4
WSSH*	Boston, Mass., Tremont Temple Baptist Church (WBET)	100	1040	288.3
WSUI	Iowa City, Iowa, State University of Iowa	500	710	422.3
WSVS	Buffalo, N. Y., Seneca Vocational School	50	1460	205.4
WSYR	Syracuse, N. Y., Clive B. Meredith (WMAC)	500	1330	225.4
WTAD	Quincy, Ill., Illinois Stock Medicine Broadcasting Corp.	250	1270	236.1
WTAG	Worcester, Mass., Worcester Telegram Pub. Co., Inc.	500	580	516.9
WTAL	Toledo, Ohio, Toledo Broadcasting Co. (WABR)	100	1070	280.2
WTAM	Cleveland, O., Willard Storage Bat. Co. (WEAR)	3500	750	399.8
		5000	6 A.M. to 6 P.M.	
WTAQ	Eau Claire, Wis., C. S. Van Gorden	500	1180	254.1
WTAR	Norfolk, Va., Reliance Electric Co., Inc.	500	1270	236.1
WTAS	Elgin, Ill., Illinois Broadcasting Corp. (WORD)	3500	1090	275.1
WTAW	College Station, Tex., Agri. & Mech. Col. of Texas.	500	970	309.1
WTAX	Streator, Ill., Williams Hardware Co.	50	930	322.4
WTAZ	Lambertville, N. J., Thomas J. McGuire	15	1360	220.4
WTHO	Detroit, Mich., W. J. Thomas Broadcasting Co.	250	1370	218.8
WTIC	Hartford, Conn., Travelers Insurance Co. (WCAC)	500	560	535.4
WTMJ	Brookfield, Wis., Milwaukee Journal (WHAD)	1000	1020	293.9
WTFF	Mt. Vernon Hills, Va., Independent Pub. Co.	50	1470	204.0
WTRL	Midland Park, N. J., Technical Radio Laboratory (WMRJ-WHPP)	15	1450	206.8
WWAE*	Chicago, Ill., Dr. Geo. F. Courrier (WCLO-WJBC)	500	1320	227.1
WWJ	Detroit, Mich., The Detroit News	1000	800	374.8
WWL	New Orleans, La., Loyola University	100	1090	275.1
WWNC	Asheville, N. C., Chamber of Commerce	1000	1010	296.9
WWRL	Woodside, N. Y., Wm. H. Reuman (WBKN-WBMS-WIBI)	100	1120	267.7
WWVA	Wheeling, W. Va., John C. Stroebel, Jr.	100	770	389.4

*WWAE shares time with WCLO and WJBC on 1320 Kil.

*WSSH shares time with WBET effective Aug. 15th. Authorized to operate on 1040 Kcys.

Broadcasting Stations of 100 Watt Power and Over Arranged by Kilocycles

550—KFUO
KSD
WMAK
560—KFBK
WCAC
WCAH
WHO
WTIC
570—KFKX
KMTR
KYW
WNYC
580—WCAE
CHCY
CJCA
CNRE
WTAG
590—KLX
WIP
WOO
WOW
600—CFCH
WBAP
WFAA
610—KGW
WEAF
WSKC
620—KUSD
WEMC
WCFL
WEAI
WJAR
WLTS
WEMC
630—CJCW
KOW
WIAS
WSB
640—KFI
WOS
WRC
650—KICK
KFNF
KRLD
WHAS
660—KFRC
WJZ
670—WEEI
WJAD
WMAQ
WQJ
680—KFMR
KFJY
KFSD
WCX
WJR
WSBF
690—CFAC
CFCN
CHXC
CJCJ
CKCO
CNRC
CNRO
700—KFBU
WLW
WMAF
710—KPO
WOR
WSUI
720—WHT
WIBO
730—CFCF
CFYC
CKAC
CKCD
CNRM
740—KHJ
WCCO
WFI
WLIT
750—CYJ
KFKA
PWX
WEAR
WTAM
760—KFDY
KOB
KTW
KMA
KWKH
KWSC
WHN
WPAP
770—WAAF
WABI
WBBM
WJBT
WWVA
780—CKY
CNRW
KGO
KTHS
KWCR
WBSO
WCAO
WCBM
WJAM
WMBF
WSRO
790—KMMJ
WGY
WCAJ
WHAZ
800—KFDM
KNRC
KUOM
WDWF
WLBI
WWJ
810—KHQ
WDAF
WLWL
WMCA
820—WCAD
WEBH
WFLA
WJJD
830—KFWB
WCSH
WDAY
WDWM
WSAI
840—CFCA
CHIC
CHNC
CJBC
CJSC
CKCL
CKLC
CKNC
CNRT
850—WEW
WNAC
WOC
860—KJR
KVOO
WAAM
WAAW
WFDF
WGBS
870—KFQD
WCBD
WJBB
WLS
880—6KW
WAVD
WKAQ
WRAV
WSM
890—KNX
WCAU
WHB
WJAX
WOQ
900—KFJM
KSAC
KSEI
WBZ
WBZA
WKRC
910—CFCT
CFQC
CHUC
CJGC
CJWC
CKCW
CNRS
920—KOA
WABC
WAPI
WBOO
930—CHNS
CNRA
WQAM
WSMB
WQAN
940—KOIN
WEAN
WGHP
WHA
WLBL
950—KDKA
KPSN
960—CKCK
CNRR
970—KFAB
KYA
WPCH
WRNY
WTAW
980—KOMO
WGN
WLIB
990—KSL
WGR
WMAL
WNAX
WOAI
1000—KMOX
KFWO
KOWW
WBAK
WPSC
1010—KQW
KUOA
WBES
WEPS
WSMK
WWNC
1020—KGCH
KPRC
WGL
WHAD
WLBW
WODA
WTMJ
1030—CFRB
CJBC
CJYC
CKCX
CKSM
CNRV
1040—KGBX
KTBI
WBCN
WBET
WDBO
WDNR
WKY
WNAT
WSSH
1050—KFAU
KFOY
WBAL
WJAG
WKAR
WOAN
1060—KFXF
WAIU
WDRC
WEAO
KFJR
1070—WFBG
WNJ
WTAL
1080—KOIL
KTCL
KWWG
WDZ
WHAM
1090—KFSG
WORD
WTAS
WWL
1100—KFJF
KSMR
WBAA
WFBJ
WHAR
WPG
WRM
1110—KFLX
KGU
KLDS
KOAC
KQV
WGST
WJAS
WMAZ
WSOE
1120—CFRC
KFIZ
KFLV
WBAO
WBKN
WBMS
WDAE
KFWI
WIBI
KLZ
KSBA
WWRL
1130—WDEL
WHK
WNOX
WOI
1140—KGEF
WDAG
WJAZ
WJBI
WIBO
WMBI
WSEA
1150—KFQB
KGA
WABQ
WDGY
WNBH
WOOD
WRHM
1160—KDYL
KFOX
KFUL
WBT
WCMA
WEBW
WFBL
WIL
WNAL
KOCH
1170—KRE
KTNT
WASH
WBBR
WCSO
WEBJ
1180—KFKU
KFWH
KMO
WCAX
WHEC
WREN
WRVA
WTAQ
1190—KOCW
WKBF
WMBB
WMBR
WOK
WSAR
1200—KFQU
KFRU
WBAX
WBRE
WCOA
1210—KFBC
KFEL
WBAW
WBBL
WCAT
WIOD
WMAY
1220—KFH
KFIO
KFPY
KLS
KZM
WATT
WDOD
WFBE
WGBB
WHDI
WLB
1230—KFCB
KGRS
KSCJ
KWUC
WBRC
WMBC
1240—KFKB
KFON
KFXH
WCBH
WEBC
WEBR
WEDC
WGES
WSAZ
1250—KEX
WADC
WBBP
WEAM
KFYR
WIBA
WNAD
WOAX
1260—WCOM
WIBX
WLBI
WRAW
WRBC
WSBT
1270—KFDX
KFMX
KFWX
KFUM
WBNY
WCAL
WGBF
WHAP
WMSG
WTAD
WTAR
1280—KFVE
KGAR
WDAH
WJAK
WMBS
1290—KFPR
KFQZ
KUT
WABO
WBRL
WHBO
WSBC
1300—WCOC
WDBJ
WGBI
WREO
1310—KELW
KFVN
KGBU
WCWK
WHBP
WKBE
WOWO
1320—KFUP
KSO
WARS
WBBC
WCLO
WDBK
WJAY
WJBC
WJBR
WSDA
WWAE
1330—WAMD
WCOT
WDAD
WFBM
WFBR
WLAC
WMAC
WSYR
1340—KGFH
KMIC
WCAM
WCRW
WFKB
WSAJ
WPCC
1350—KFWC
KWKC
WCBA
WHBD
WHBF
WSAN
1360—WKBH
WMBO
1370—WCGU
WGWB
WKBO
WKBQ
WTHO
1380—KFOR
KFQW
WKBS
WKBV
WKBW
WLBO
WRCO
1390—KGER
KRLO
WCLS
WEHS
WHFC
WKBB
WOKO
WPEP
WQAA
1400—KFWF
WCWS
WICC
WJBU
WLBG
1410—KGBZ
KGDX
WJBL
WRAX
WSIX
1420—KPNP
WBMH
WBRS
WCDA
WMES
WRST
1430—KSOO
WCBS
WOKT
WPRC
WRCV
1440—KFIQ
KFVD
KGCU
KGFJ
WJBZ
WKBM
WLBZ
WNBA
WRAF
WRPI
1450—KGDW
1460—KGEO
KGEZ
WABF
WMBD
WRK
1470—KGFO
WBBZ
WHBL
WIBS
WIBW
WKEN
WLBX
WMBA
WMBH
WMAQ
WSAX
1480—KGBS
WPSW
1490—WCBR
WGMU
WHBM
WIBJ
WIBM
WKBG
WRMU
1500—WRAH

The

TEMPLE
AIR COLUMN
SPEAKER

has given the world a new appreciation of radio

Marvelous tone quality—the sensation of every radio show in the country—the TEMPLE AIR COLUMN SPEAKER brings new delights in radio. Finer reception than you ever dreamed was possible. Here is a speaker that is sweeping the radio world. To hear a TEMPLE is to want one immediately.

NOT A CONE

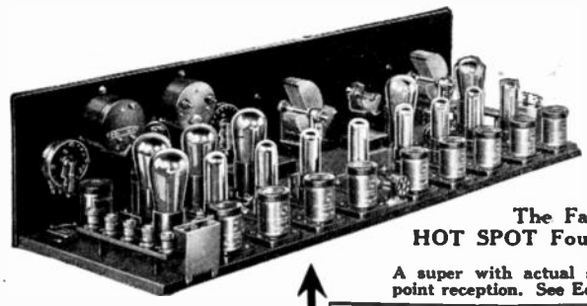
"Long exponential air column type"

Developed on a principle that is scientifically correct and acoustically perfect; the TEMPLE will surprise you with its beauty of tone—its clearness and quality. Your dealer will be glad to demonstrate it on the TEMPLE COMPARATOR, which tells the truth about speakers. Close your eyes—you will pick the TEMPLE every time. Demonstrated and sold by leading dealers everywhere.

Console Cabinet Model No. 65—priced at $65.00; *west of Rockies,* $75.00.
Drum Type Model No. 13, 13-inch—priced at $29.00; *west of Rockies,* $32.00.
Drum Type Model No. 18, 18-inch—priced at $48.50; *west of Rockies,* $55.00.

TEMPLE, Inc.
213 S. Peoria St.
Chicago
Leaders in Speaker Design

Radio is at its best with
The famous* HOT SHOT *Fourteen
OR
THE FAMOUS *Melo-Heald* ELEVEN
to bring the programs in

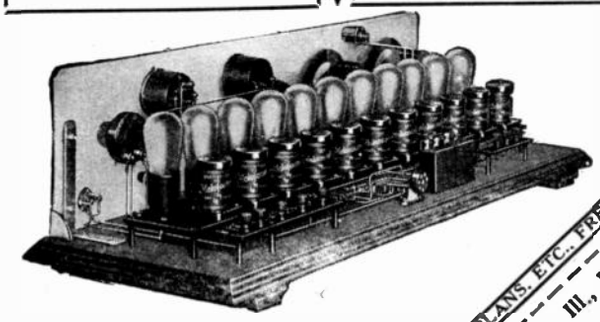


The Famous HOT SPOT Fourteen

A super with actual single-point reception. See Editorial

Certified Meloformers make three stages of ideal audio possible, and also render beautiful reproduction without slightest distortion on as high as **four stages. Meloformers** can be used for **audio in any circuit, as well as** those described on this page, etc. Specifications:—Mfrs., Robertson-Davis Co., Inc., Chicago; H., 2¼ in. O. A.; Base, 2 in. sq.; Top, 1⅜ in. dia.

Certified Melocouplers are guaranteed **radio frequency** transformers for specific service in high-powered **Fourteen** and **Eleven-Tube Circuits. Each** is built with an **air-core,** peaked wound and tested at the same point of efficiency; making kits **unnecessary.** Specifications;—Mfr., Robertson-Davis Co., Inc., Chicago; H., 2¼ in. O. A.; Base, 2 in. sq.; Top, 1⅜ in. dia.



THE FAMOUS *Melo-Heald* ELEVEN

A powerful, clear, melodious super for the fan who wants the best, but does not require the maximum sharpness and efficiency of the famous HOT SPOT Fourteen. Spring issue of Citizen's Radio Call Book contains detailed description.

FREE. Schematic diagrams, plans and instructions for building either receiver sent Free on request. Use coupon.

FILL IN AND MAIL TODAY FOR FURTHER CONSTRUCTION PLANS, ETC., FREE

Robertson-Davis Co., Inc. 412 Orleans St., Dept. WC-1, Chicago, Ill., U. S. A.

Gentlemen: Without charge or obligation, please send me Plans and Specifications for construction of receiver designed by Merwyn Heald and described in the WCFL Radio Magazine. Also, send further particulars regarding Certified Meloformers and Melocouplers manufactured by you and used in designing Mr. Heald's sets. (Check receiver you are interested in.)

I am interested in The Famous HOT SPOT Fourteen ☐
I am interested in The Famous Melo-Heald Eleven..... ☐

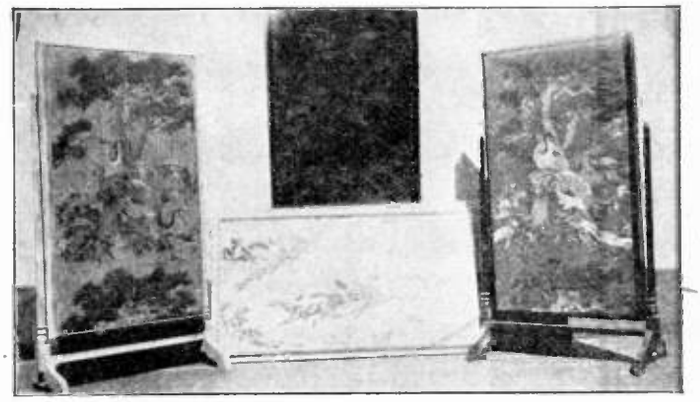
Name .....
(WRITE OR PRINT CLEARLY)
Address .....
City wc-9

Superior Tone Quality

plus

Artistic Appearance

To duplicate this attractive reproducer is a simple job with the Lata Balsa Reproducer Kit



IMPROVEMENT in reproduction is the outstanding radio achievement of the past year. Engineering methods developed for radio have given a new lease on life to the phonograph industry.

The audible range of radio receivers and phonographs has been greatly extended by the intelligent application of sound engineering fundamentals gleaned from research in the electrical and acoustical field.

Radio and Phonograph engineers have recognized in Lata Balsa—the marvelous, tropical wood with no inherent acoustic resonance points—the ideal diaphragm, and have begun to apply it to sound reproducers of more than ordinary excellence. Lata Balsa is rapidly gaining favor in both fields.

A good loud speaker must be fed by a good audio amplifier. Radio engineers agree that there is no means of providing tone fidelity to compare with resistance coupling.

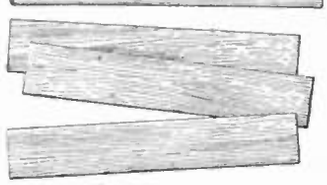
Resistance coupling and its manifold applications have been the work of the Engineering Department of Arthur H. Lynch, Inc., for a long period. In their search for a reproducer which would demonstrate its superiority in a conclusive manner they have made exhaustive tests on the Lata Balsa Reproducer and find the combination to be ideal.

Everything necessary for the building of a modern three-stage resistance coupled amplifier.....$9.00

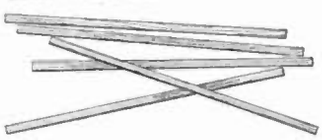
Musicians, Music Lovers and Acoustic Experts agree with them. Artists and artistically inclined housewives recognize in the decorated Lata Balsa Reproducer, which may be made into a firescreen or wall decoration, a relief from the unsightly appearance of the old fashioned "loud speaker."

These scientific wonders are now available to every man and woman at but slight cost. They are easy to apply to any receiver either old or new.

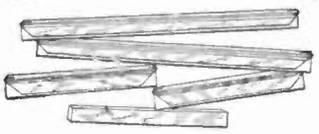
Lata Balsa Kit containing following items:



Wide Lata Balsa strips.

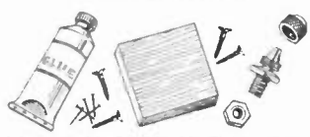


Thin strips or fin of Lata Balsa.

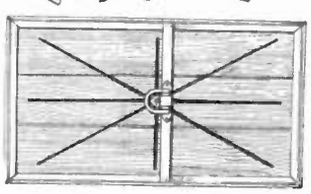


4 Hardwood pieces for frame. 1 hardwood piece for mounting electro-crisen unit.

Showing how to put bushing into square block of wood.



Glue, Brads, Screws, square piece of wood for holding bushing.



Reverse side of Lata Balsa Reproducer showing parts put together.

The Lata Balsa Kit as it comes to you

The complete Lata Balsa Reproducer Kit which you may assemble in a few minutes into a wonderful reproducer of tone quality and an artistic piece of furniture—
13-in. x 24-in., $8.00 21-in. x 36-in., $10.00
Lata Balsa Balanced Armature Reproducer Unit designed especially for use with Lata Balsa Reproducer Unit....$8.00

If Your Dealers Cannot Supply You

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Sole Sales Representatives

ARTHUR H. LYNCH, Inc.
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At 57th Street, New York City

Gentlemen:

Please send me the items checked, for which I enclose my money order or cash.

Lata Balsa Reproducer Kit, 13 x 24	$ 8.00
" " " " 21 x 36	10.00
" " " Unit	8.00
Lynch Resistance-Coupled Amplifier Kit	9.00

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Address.....

City-State.....

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NEW YORK CITY