APRIL 21
1928

BOARD'S NEW WAVE PLAN

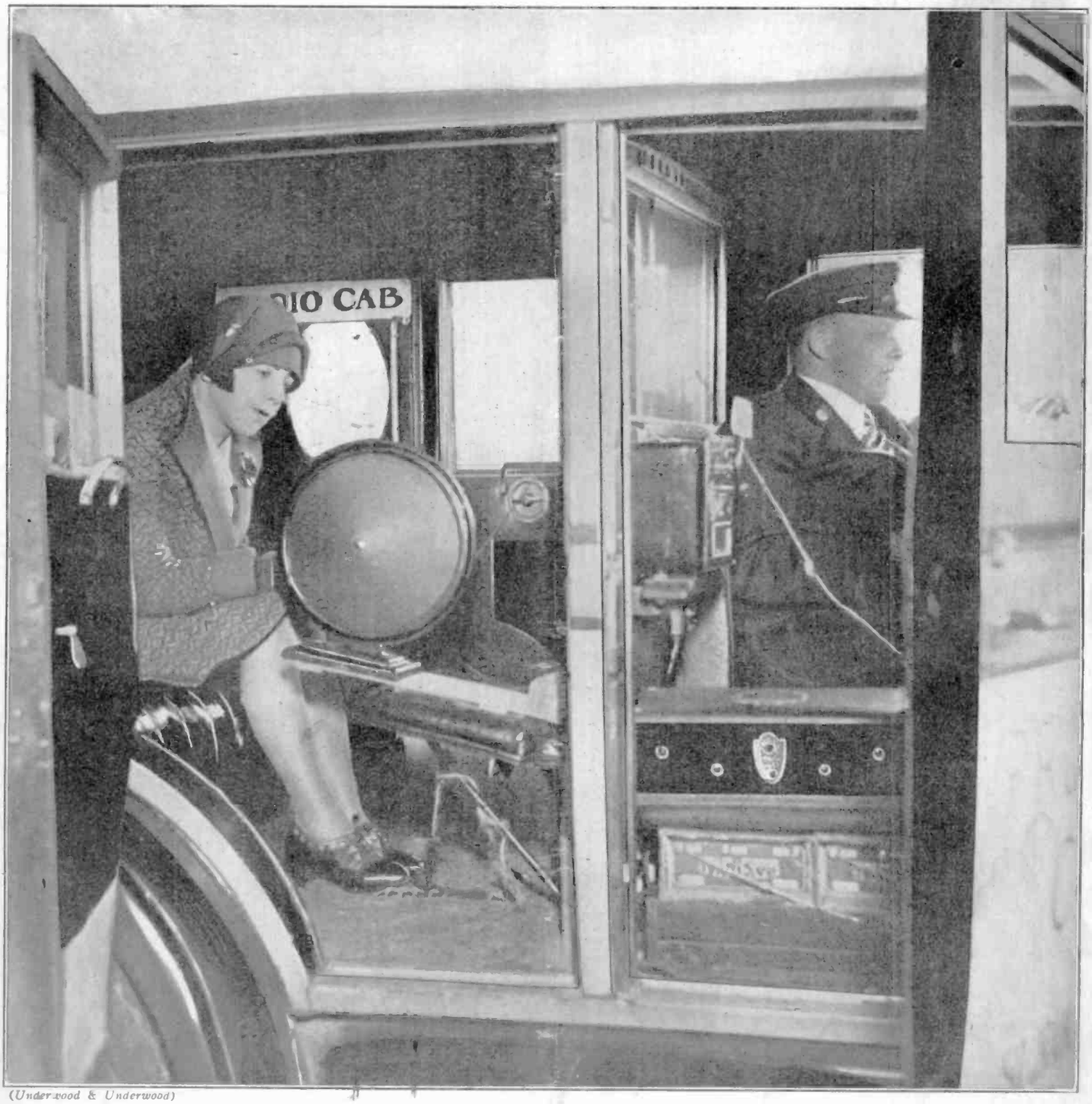
15
CENTS

RADIO WORLD
REG. U.S. PAT. OFF.
The First and Only National Radio Weekly

5-TUBE AC CIRCUIT
with Victoreen Equipment

POWER SUPPLY
for the New 50 Tube

NATIONAL SCREEN GRID 5
Construction Expertly Outlined



(Underwood & Underwood)

Chauffeurs find business better when taxis are radio equipped

www.americanradiohistory.com

A Scientific Trouble-Shooting Test Set

Consisting of Tube Checker That Reads Filament Voltage and Plate Current; Extra Meter Reads Plate Voltage, including B Eliminator Voltages.

Only $10.00

The best inexpensive combination for trouble-shooting is a Double R Tube Checker, comprising a 0-10 D.C. milliammeter, a 0-6 D.C. voltmeter, a switch, a rheostat and a socket. Add a high resistance voltmeter (0-300 v.). With these it is advisable to use a plug, so that all you need do is remove a tube from a receiver that you're testing, put the plug in the empty socket and the removed tube in the socket of the tester. You can immediately find open any short circuits, broken or flimsy connections, reversed connections, etc. The Double R Cord and Plug, the Double R Tube Checker, and 0-300 high resistance voltmeter constitute the Scientific Trouble-Shooting Test Set.

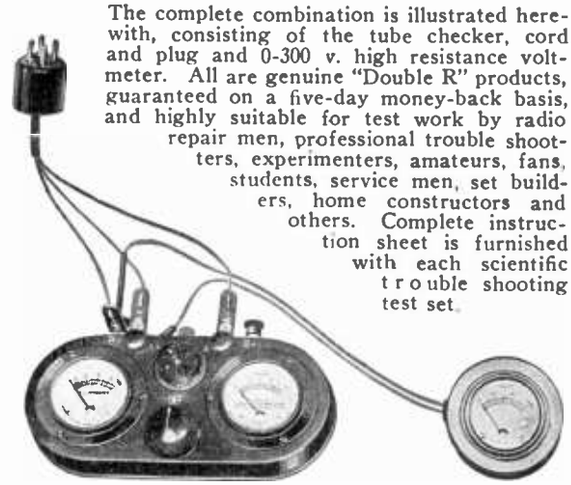
The Biggest Value That $10 Can Buy

No. 210 Tube Checker consists of 0-6 volts D.C. Voltmeter, 0-10 D.C. Milliammeter, Grid Bias Switch, Rheostat, Socket, Binding Posts (with instruction sheet) in handsome moire case....$6.50

The cord terminals of the plug leads correspond with the binding posts of the tube checker. Now connect the 6-300 volts high resistance voltmeter from A+ to B+ posts and you get all necessary readings. You can test plate voltage from B eliminators, or any other B supply, D.C. plate current and D.C. filament voltage, as well as the efficacy of the tube, by throwing the grid bias switch, for the plate current should change within given limits, depending on the type of tube.

No. 346—High resistance voltmeter, for reading any and all DC voltages, including B eliminators, up to 300 volts. Portable type, full nickel finish, long connecting cords and tips $4.50

No. 21—Cord and plug, with markers and lugs that fit tube checker binding posts..$1.85



The complete combination is illustrated herewith, consisting of the tube checker, cord and plug and 0-300 v. high resistance voltmeter. All are genuine "Double R" products, guaranteed on a five-day money-back basis, and highly suitable for test work by radio repair men, professional trouble shooters, experimenters, amateurs, fans, students, service men, set builders, home constructors and others. Complete instruction sheet is furnished with each scientific trouble shooting test set.

Service Men! Custom Set Builders! Experimenters! Students!

Equip your testing outfit with the indispensable combination that constitutes the Trouble Shooting Test Set and Time-Saver. You quickly locate trouble while others flounder about.

WHAT YOU GET

One No. 210 tube checker, with 0-6 voltmeter, 0-10 milliammeter, socket, rheostat, binding posts and bias switch, all built in; one No. 21 cord and plug, and one No. 346 high resistance 0-300 v. voltmeter.

FOR ONLY $10

If You Want Complete Test Set, as Above, But With 0-500 High Resistance Voltmeter, price is $11.

SEND NO MONEY!

Our Five-Day Money-Back Guaranty Fully Protects You!

Many professional and other radio technicians require a 0-500 high resistance voltmeter, as part of their scientific trouble-shooting test set, so that they can test ALL power pack B voltages. They do a great deal of work with high voltage power packs, especially where a —10 or —50 tube is used in the output of a receiver. For them the 0-500 v. high resistance voltmeter, No. 347, is just the thing to include in the test set, instead of the No. 346 high resistance 0-300 v. voltmeter. The combination may be obtained with the 0-500 v. voltmeter, instead of the 0-300 v. voltmeter, at only one dollar extra. The 0-500 v. meter is exactly the same as the 0-300 v. meter, except for difference in maximum voltage reading.

Guaranty Radio Goods Co.

145 West 45th Street, New York, N. Y.

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

Please send me at once, on a five-day money-back guaranty, one complete scientific trouble-shooting test set, consisting of one No. 21, one No. 210 and one No. 346, for which I will pay the postman $10, plus a few cents extra for postage.

☐ If 0-500 v. high resistance voltmeter No. 347 is preferred, put cross in square and pay $11, plus postage, instead of $10, plus postage.

NAME .....

ADDRESS .....

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

ALL METERS SOLD ON FIVE-DAY MONEY-BACK GUARANTY

www.americanradiohistory.com

"UNINTERRUPTED READER INTEREST"
EVERY WEEK — EVERY YEAR

RADIO WORLD

Vol. XIII. No. 5. Whole No. 317
APRIL 21, 1928
15c per Copy. $6.00 per Year
[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under Act of March 1879]

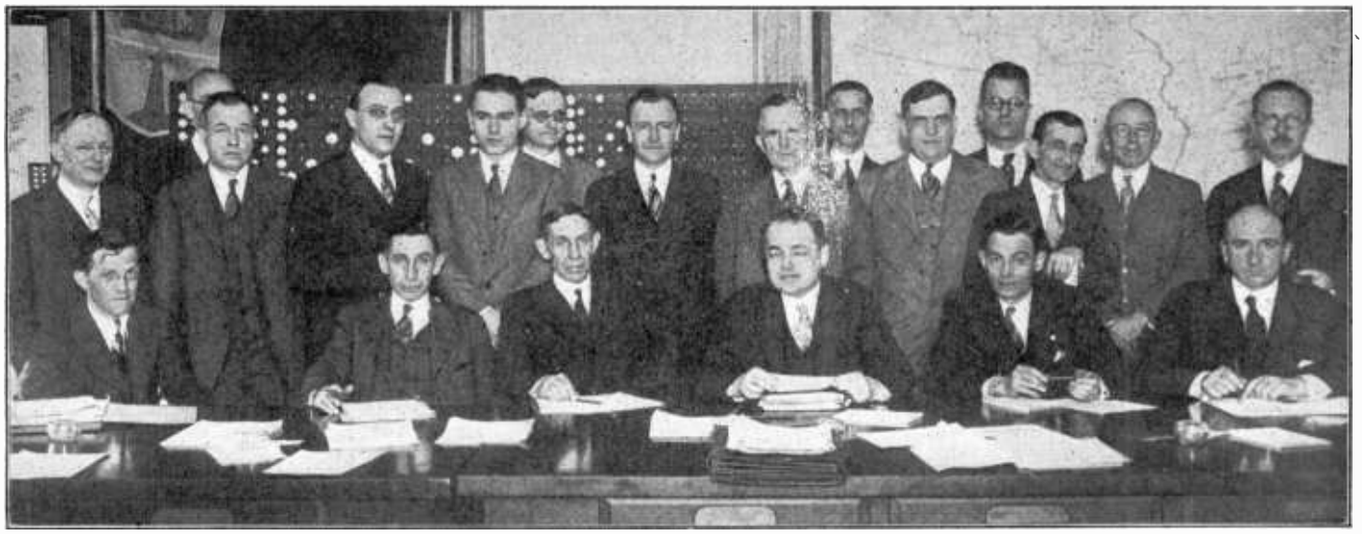
Technical Accuracy Second to None

A Weekly Paper Published by Hennessy Radio Publications Corporation, from Publication Office, 145 West 45th Street, New York, N. Y.

Phones: BRYant 0558 and 0559

Board's Wave Plan

Follows New Law Compelling Zonal Equalization



(Underwood & Underwood)

THE CONFEREES WHO HEARD THE COMMISSION'S PLAN OF WAVE ALLOCATION PRESENTED, AND GROUPS OF BROADCASTERS AND ENGINEERS WHO DISCUSSED THE PLAN. SEATED (LEFT TO RIGHT), SECRETARY BUTMAN AND COMMISSIONERS SYKES, ROBINSON (CHAIRMAN), CALDWELL, PICKARD, LAFONT. STANDING (EXTREME LEFT) IS R. H. MARRIOTT, CHAIRMAN OF THE SPECIAL COMMITTEE OF THE INSTITUTE OF RADIO ENGINEERS. AT EXTREME RIGHT (STANDING) IS JOHN V. L. HOGAN.

Washington.

A PLAN of allocating broadcast channels to the five radio zones and to the States within those zones in compliance with the "equal distribution" amendment of the radio law recently enacted was laid before the conference of radio engineers held with the Federal Radio Commission.

The Commission's plan proposes a national, regional and local classification of channels and sets forth two alternative projects for assigning stations to those channels, showing the allotments to be available to the zones and to the several States under each project. Stations would be grouped in three classes—C, B and A.

Full Text of Memorandum

The full text of the Commission's memorandum setting forth its plans follows:

Attached are two sample allocations giving assignments of broadcasting channels to zones and States. These allocations are intended to comply with the provisions of the Radio Act of 1927 as recently amended.

Both allocations are based upon a classification of broadcasting channels into three groups—national, regional and local. The channels of each of these groups are apportioned equally to the five zones and in each zone are apportioned to the States, as far as possible, in accordance with their population.

The power permitted for use by each assignment would on the average be as follows, subject to such modification as may be required or permitted by the terms of the Radio Act:

National channels, 20,000 watts; Regional channels, 500 watts; Local channels, 100 watts.

Classification of Channels

The two allocations, "Example A" and "Example B," differ primarily in the proportions by which the broadcasting spectrum is divided into the national and regional groups. The number of channels in each example assigned to each class is shown thus:

Cleared channels, one full-time assignment on each channel without duplication in any other part of the country: Example A, 50; Example B, 30.

Regional channels, each zone to have assignments on half of these channels: Example A, 36; Example B, 56.

Local channels, each zone to have five assignments on each of these channels: Example A, 4; Example B, 4.

Total number of channels (omitting six used by Canada): Example A, 90; Example B, 90

The C, B, A Classes

The number of stations or groups of stations which, under each of these plans, may be given full time assignments, is as follows:

Class C, for assignment to clear channels: Example A, 50; Example B, 30.

Class B, for assignment of regional channels: Example A, 90; Example B, 140.

Class A, for assignment to local channels: Example A, 100; Example B, 100.

Total number of full-time assignments for nighttime simultaneous operation: Example A, 240; Example B, 270.

The channels of each class are apportioned to the zones and States as follows:

Each zone is given an equal number of channels of each class. The number of assignments in each zone is 20 per cent. of the number of assignments in the country.

In Example A there are then allotted

www.americanradiohistory.com

Board's Statement Out Institute Raises

(Continued from page 3)

to each State the number of assignments of each class which corresponds to the proportion of its population of the zone.

By providing that each class of assignment carries with it a certain specification as to power, the proper distribution of channels to State carries with it a definite distribution of power to States. It is recognized that certain stations may not use the full power authorized for channels to which they are assigned.

This may make possible the temporary use of additional power on other channels where permissible from a radio interference standpoint.

Since each Class C channel is used exclusively by a single full-time assignment, there is no technical reason why this should be fixed at any limit below that which will be determined by economic considerations.

Tentative Limit 20,000 Watts

In order, however, to reach a definite value for the total power authorized for use on these channels, the power which may be used for each Class C assignment may be fixed tentatively at 20,000 watts.

This may be increased at a later time. thus increasing the general level of all Class C assignments in all zones.

The power designated for each Class B assignment is 500 watts. This will have to be reduced to 250 watts in the case of Class B stations assigned to Canadian shared channels when these stations are located within 250 miles of the Canadian border. The power of certain Class B stations may be increased to 1,000 watts, where these stations are located at points far removed geographically from other stations on the same channel.

The number of station assignments depends entirely on the amount of time division which is required.

Since the number of full-time channel assignments to zones has been made equal, the number of station assignments in the several zones will be equal if equal time divisions are required. If licenses granted to stations which share time are counted as fractional assignments, the sum of these fractional assignments would equal the number of full-time assignments.

Assignments to such stations as operate only during the daytime are not included in these allocations.

In order to determine whether a station or an applicant is eligible for consideration for a given class of assignment, is seems essential that certain requirements be adopted with which the stations of the several classes must comply.

These requirements should be most rigid in the case of Class B and Class C stations and should, even in the case of Class A stations, be such as to include only those stations whose operation is in the public interest.

These requirements may be primarily technical in their nature and thus subject to measurement by the field staff of the Radio Division of the Department of Commerce. To the technical requirements may, of course, be added other requirements based upon the public interest which the station is endeavoring to serve.

The technical requirements which may be specified include such points as accuracy of maintenance of frequency, freedom from undesired emissions, such as harmonics, amount of power used, and the percentage of undistorted modulation of emitted wave.

Consideration will need to be given to the numerical values which should be specified for each of these and similar characteristics in the case of stations of each of the several classes.

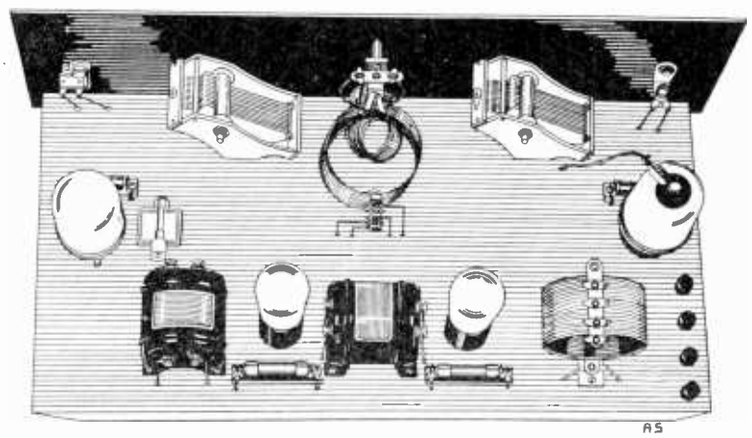
The examples of allocations attached hereto indicate the State to which each channel may be assigned, together with a designation of the class of the station. Assignments to the territorial possessions of the United States have not been included.

Use Population as Basis

The particular number of assignments to each State is dependent upon the population figures which are used.

These two examples differ slightly in this respect since Example A is based on the census of January 1, 1920, while Example B is based upon the official estimates made by the Bureau of the Census as of July 1, 1928.

LAYOUT OF SCREEN GRID DIAMOND



THIS SHOWS THE LAYOUT OF THE PARTS IN THE FOUR TUBE SCREEN GRID DIAMOND. THE BINDING POSTS IN THE LOWER RIGHT CORNER, READING UPWARD, ARE FOR THE PLATE OF THE LAST TUBE AND B+ POWER, RESPECTIVELY. THE OTHERS ARE FOR GROUND AND ANTENNA, READING UPWARD.

Changes in Proposed

Washington.

A plan for the allocation of wavelengths, time and power was submitted to a conference, called by the Federal Radio Commission, by R. H. Marriott, chairman of a special committee of the Institute of Radio Engineers. The plan, prepared by the Institute's Board of Direction, proposes some amendments to the Commissions' plan.

It is suggested that alphabetical classification of stations into three groups be reversed, so that the channels will be C, B and A in the order of interference, hence inverse order of importance of stations, with 250 watts maximum for Class A, 300 to 1,000 watts for Class B and 5,000 to 50,000 watts for Class C. The Board's plan makes the preferred channel class A, next B, next C.

The Institute opposed time division or sharing as uneconomical and favored its minimization. The number of channels per class was different from the Board's plan also.

Like the tentative draft of the alternative plans prepared by the Radio Commission as the basis for discussion at the conference, the plan of the Institute of Radio Engineers contemplates the classification of broadcast channels regionally.

Three Classifications Proposed

An aggregate of 340 full time assignments for the hours of darkness is proposed in the plan, with increased number of stations made possible during the day time and during the night time with time divisions. The nomenclature recommended for the different channels was Class A, B and C.

Four wavelengths would be assigned to Class A with an aggregate of 50 stations to each, or 200 in all, the power to be used not exceeding 250 watts. Thirty-six channels would be set aside for Class B, with 2½ assignments on each or 90 stations in all, and with power ranging from 300 to 1,000 watts for each station so classified. Then there would be 50 Class C channels with only one assignment on each, the power ranging from 5,000 to 50,000 watts.

Class A channels would be the "na-

www.americanradiohistory.com

lines New Wave Plan—Some Objections

They may nevertheless serve satisfactorily as a basis for study.

The determination of which particular stations or group of stations shall have the assignments made to the several States, in either of the attached allocations, is a matter for decision by the Commission.

Advises Study

The relations between frequency separation, geographical separation and power given in the basic allocation which is finally adopted should be studied with care to make sure that they provide such freedom from interference as is consistent with a maximum of broadcasting service.

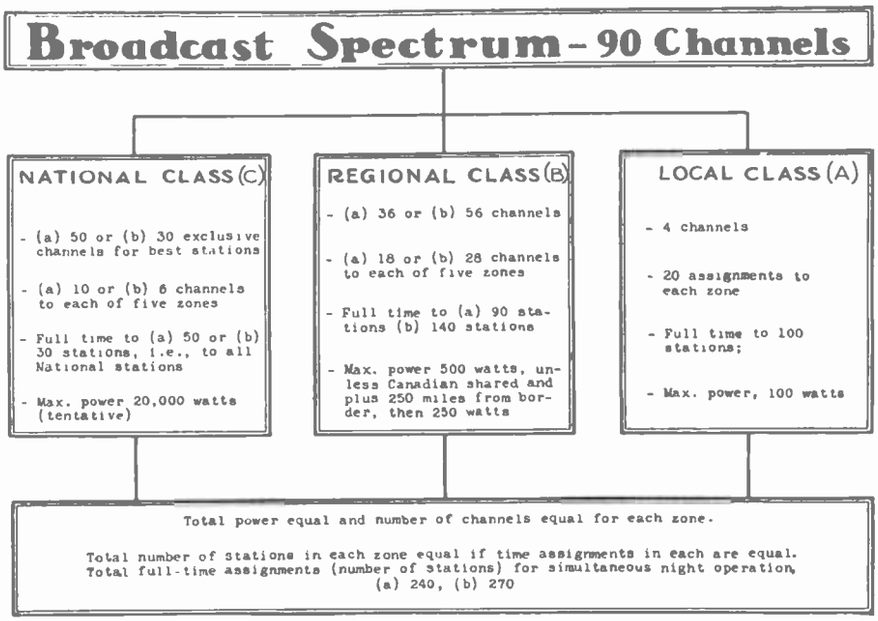


CHART OF THE COMMISSION'S NEW WAVE PLAN

The Commission would divide stations into three classes—National (Class C), Regional (Class B) and Local (Class A), in the general order of the public interest in and importance of the stations. Alternative proposals are made for Classes C and B, and these alternatives are designated (a) and (b). Both plans are for night operation, since the heart of the problem is the distribution of power, time and waves for night transmission.

Wave Plan by Institute

tional" channels, although they would not always be heard nationally, Mr. Marriott explained. With 50 stations placed on such cleared channels, there might be one assignment to each State under the law, he suggested.

The chairman of the conference was Dr. J. H. Dellinger, of the Bureau of Standards. He called upon various persons attending to state their views regarding the situation. Among those present were members of the House Committee on Marine and Fisheries, including the chairman, Representative White (Rep.), of Lewiston, Me.

Mr. White was asked his construction of the equalization amendment of the radio law recently enacted by Congress. He asserted that he construed it to mean that Congress desires the Radio Commission to make as nearly as possible an equal allocation of the number of stations within the several zones. It was the intent of Congress also, said Mr. White, that each zone shall receive the same number of wavelengths, the same amount of aggregate power and the same number of broadcasting hours.

Judge E. O. Sykes, member of the Commission from the third zone (Southern States) asserted that "unquestionably the acts of Congress gives us the authority to limit the number of stations."

That the interests of the listeners must prevail as against those of broadcasting stations, was asserted by John V. L. Hogan, New York consulting radio engineer. Mr. Hogan said that in his opinion the Commission must get rid of the idea of permitting a maximum number of stations, because "listeners will be best served by having a maximum number of cleared channels with reasonable power to use on such channels."

Capt. S. C. Hooper, of the Navy, pointed out the importance of requiring strict adherence to frequencies, and stated that the International Radiotelegraph Convention binds all its signatory nations to holding their transmitters to assigned frequencies and prevent interference and to use the most modern equipment.

When Commissioner Lafount suggested increasing twofold the number of stations to be placed on the B channels, raising the number contemplated by the Institute report from 90 to 180, C. W. Horn, of the Institute committee stated this would result in a reduction of the service range of B stations and would increase the number of listeners with "dead spots" on their dials.

Besides the full membership of the Commission, those attending the morning sessions of the conference were: Mr. Marriott, Dr. Dellinger, C. W. Horn and L. E. Whittemore, representing the I. R. E; W. D. Terrell and W. E. Downey, of the Radio Division, Department of Commerce; C B. Jolliffe, Bureau of Standards; Capt. Guy Hill, U. S. Army Signal Corps; Capt. S. C. Hooper, U. S. Navy Bureau of Engineering; Frank Scott, counsel for the National Association of Broadcasters; L. S. Baker, secretary of the National Association of Broadcasters; R. S. McBride, American Engineering Council; F. D. Guthrie and Charles Ford, Radio Corporation of America; Oswald Schuette, Radio Protective Association; Lewis M. Hull, Radio Manufacturers' Association; Louis B. F. Raycroft, National Electrical Manufacturers' Association; John M. Clayton, Institute of Radio Engineers; Roland F. de Fere, Washington, D. C.; H. A. Bellows, Station WCCO, Minneapolis, Miss.; W. G. Damm and L. G. Caldwell, Station WTMJ, Milwaukee, Wis.; Dr. Frank W. Elliott, Station WOC, Davenport, Iowa, and William Hedges, Station WMAQ, Chicago, Ill.

Members of Congress who attended the conference were Representatives White, Clancy (Rep.), of Detroit, Mich.; Free (Rep.), of San Jose, Calif.; Lehlbach (Rep.), of Newark, N. J., and Bland (Dem.), of Newport News, Va.

Asserting that the set-ups presented by the engineers were based on theoretical rather than practical conditions, spokesmen for the National Association of Broadcasters, The Radio Manufacturers and the Federated Radio Dealers Association, asked for an opportunity to present a plan of their own which they said would be formulated to recognize "the necessities of the case."

Those who spoke were Frank Scott, counsel for the three associations; H. A. Bellows, former member of the Radio Commission, their legislative adviser, and L. F. Lacroft, of the National Association of Electrical Manufacturers. It was agreed by the Commission to hold another hearing on Monday, April 23, at which representatives of the broadcasters, manufacturers and distributors would present their plan.

Full Text of Institute's Report

Following is the full text of the plan of the Institute of Radio Engineers for wave, time and power allocation, as submitted to the Federal Radio Commission's conference:

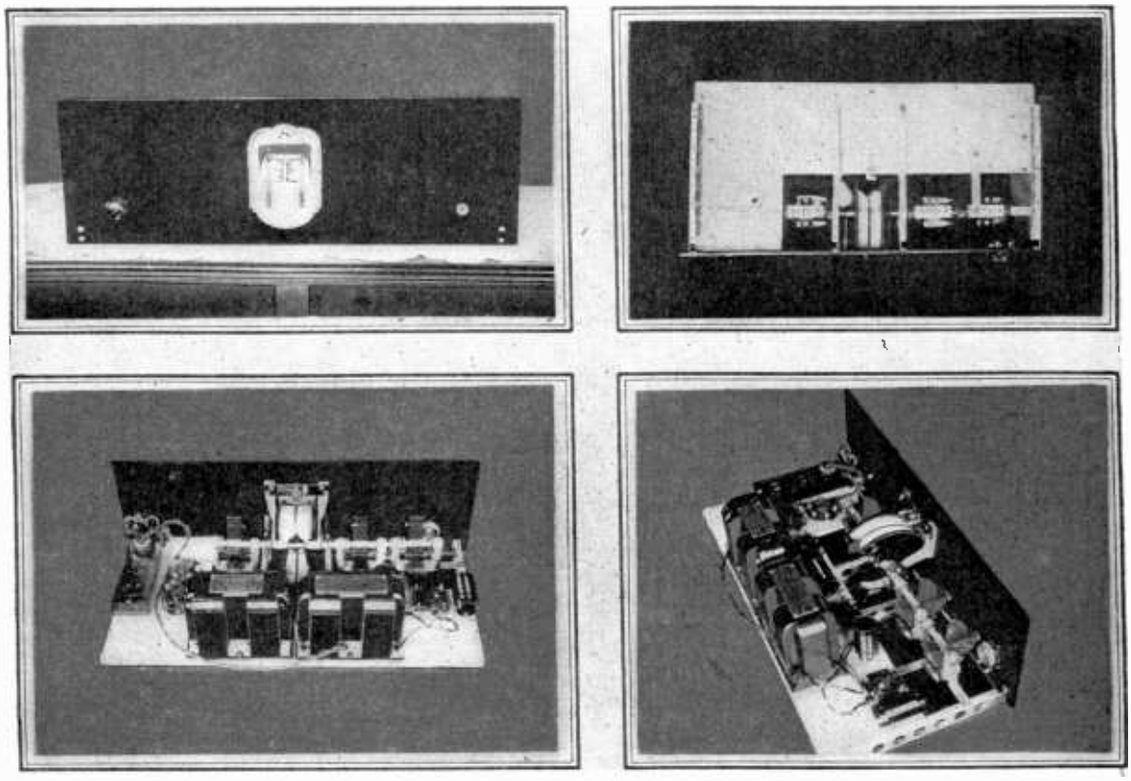
The following suggestions cover the present state of the art and are intended to apply to transmission during hours of darkness throughout the entire year. Daylight ranges are less, and more duplica-

(Continued on page 19)

www.americanradiohistory.com

Correct Bias Makes A

By Capt. Peter
Contributing



LOCALIZED TUNING OF THE AC SET RESULTS FROM GAUGING TWO OF THE TUNING CONDENSERS AND USE OF THE HAMMARLUND DRUM DIAL (TOP LEFT). THE BASEBOARD IS CUT OUT AS SHOWN (TOP RIGHT) TO PERMIT LEEWAY FOR DRUM AND CONDENSERS. BOTTOM VIEW IS SHOWN. THE FILAMENT TRANSFORMER IS AT RIGHT, THE AUDIO UNIT AT LEFT, IN LOWER LEFT PHOTOGRAPH. AN ANGLE VIEW IS DEPICTED IN LOWER RIGHT.

CONVENIENCE of operation is the keynote in this AC receiver. The tuning controls are all centralized in the middle of the panel and so placed that three tuned circuits can be tuned simultaneously with a single finger. Power controls are localized at another point on the panel so that all currents are turned on and off with a single switch.

No trimmer condensers are necessary to compensate for poorly balanced tuned circuits. No relays are necessary to open one circuit when another is opened or to close it when the first is closed. There are no relays in the circuit to get out of order. There are no open high voltage wires to menace the safety of the home and to violate the Underwriters' rules.

The tuning condensers are all controlled with a Hammarlund drum dial and are coupled with the Hammarlund system of ganging. This enables the operator to tune the three condensers simultaneously for tuning and to tune one of them singly for best volume on DX. These operations can be performed with a single hand. Two of the tuning condensers are mounted rigidly on the shaft so that they are tuned together but the third is independently variable. This variability is sufficient to effect the sharpest tuning necessary.

The three RF transformers L1L2, L3L4 and L5L6, are of the small type, using enamel covered wire, and are obtainable at radio stores. They are small in size yet exceptionally effective. Their small diameter insures a low distributed capacity and a minimum of electric coupling between them. The right angular placement of the coils insures practically zero magnetic coupling. This is further aided by the small diameters of the coils and the wide separation of those coils. Hence the circuit is stable in operation even for the shortest wavelengths in the tuning range.

If oscillation occurs, grid suppressors may be used.

The coils are designed for a capacity of .00035 mfd. and consequently the Hammarlund Midline tuning condensers C1, C2 and C3, are of that capacity.

The tubes used in the circuit are all designed for AC operation. The two RF amplifiers and the first audio amplifier are of the —26 type. The detector is of the —27 or heater type, and the power tube is of the 112A type. The 112A tube, being a "dull emitter," is particularly suitable for AC operation, although its filament voltage is as high as 5 volts.

The filament voltages are supplied by a Victoreen 326 filament transformer which affords adequate current at 1½, 2½ and 5 volts. The 5 volt winding is accurately center tapped, which insures freedom from AC hum in the power tube. The 2½ volt winding is also center tapped, but this is only used to make the heater circuit positive with respect to the cathode, and not for any balance.

The 1½ volt winding is not center tapped because the potentiometer method is more effective in balancing the filament circuit for the elimination of hum in the two RF and

107 Stations Send U. S. Market Reports

Washington.

One hundred and seven radio stations throughout the United States now are broadcasting the farm market reports issued by the Bureau of Agricultural Economics, United States Department of Agriculture. The market news programs of these stations range from reports on a few agricultural commodities at local markets to complete statements on prices, shipments and trade conditions for all farm products in leading consuming centers.

The radio market news service was begun experimentally in 1921, when three radio stations co-operated in broadcasting the reports. A year later sixty-five radio stations were flashing out the market messages, following which there was a rapid expansion of the service to its present nation-wide scope.

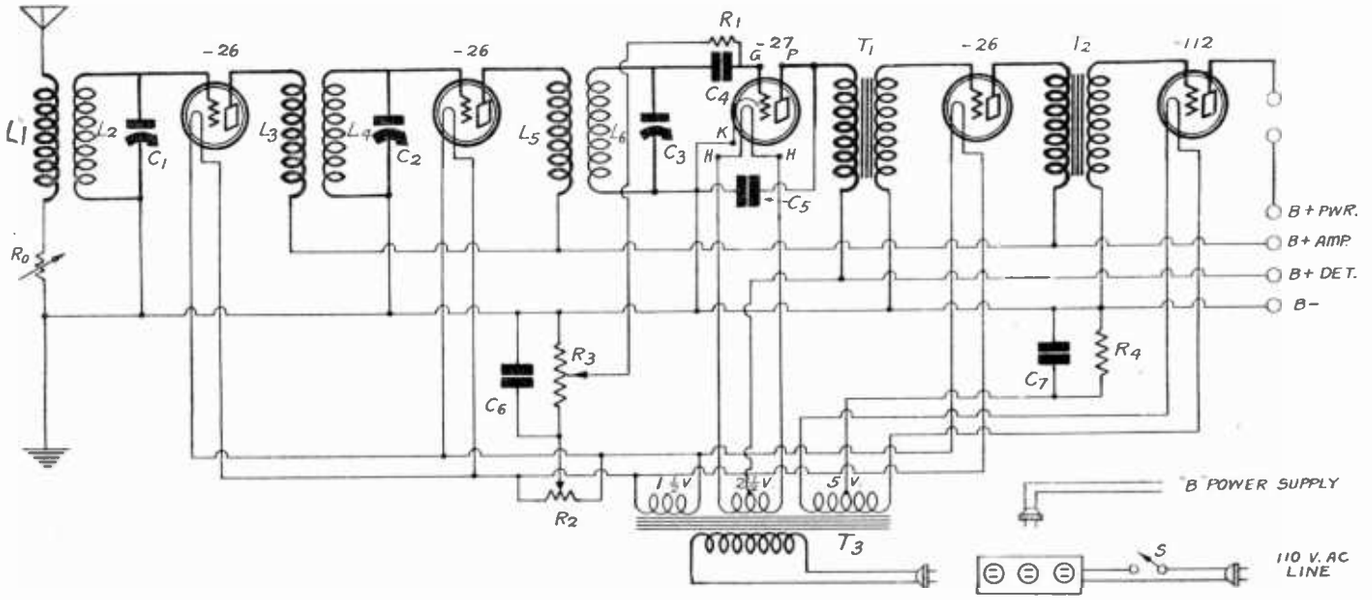
Arrangements have been made in each city where Government market news work is conducted for one or more stations to broadcast information supplied by the branch offices of the Bureau of Agricultural Economics. There are 38 of these field offices in 22 states, connected by a leased telegraph wire system of 7,800 miles for the rapid interchange of reports on market conditions.

www.americanradiohistory.com

C Set Work Splendidly

V. O'Rourke

Editor



first AF stages. This potentiometer is designated by R2 and is an Electrad 20 ohm center tapped fixed resistor.

The grid bias for the three —26 type amplifier tubes is obtained from the voltage drop in resistor R3 placed in series with the lead to the center tapped resistor R2. The value of R3 should be 400 ohms and it should have a current carrying capacity of at least 20 milliamperes. A Frost potentiometer of that value is suitable.

The grid of the —27 type detector is given a positive bias with respect to the cathode by connecting the low end of the grid leak R1 to the slider on the potentiometer R3. The position of the slider should be adjusted experimently to the point which gives greatest detecting efficiency, that is, loudest volume.

The grid bias for the power tube is obtained from the drop in resistor R4 placed in the lead to the center tap of the 5 volt winding on the Victoreen filament transformer. The value of R4 should be about 1,200 ohms, but either a 1,000 or a 1,500 ohm fixed resistor such as Electrad Truvolt, may be used.

The by-pass condenser C5 in the plate circuit of the detector should have a value of .0005 mfd. The condenser C6 across R3 and condenser C7 across R4 each should have a value of 4 mfd or higher. These condensers may be of low voltage rating such as the Tobe 304.

Condenser C4 in the detector should have a value of .00025 mfd. and it should be of the moulded mica type such as the Carter.

The volume is controlled by means of a variable resistor R0 placed in series with the antenna circuit. It should have a range of from zero to 10,000 ohms, such as the Electrad Type G high variable resistor.

The audio frequency amplifier is coupled with a Victoreen 112 audio transformer unit, which is capable of faithful amplification over the entire essential tonal range. It is well shielded from electric coupling so that high frequency audio oscillator is precluded.

LIST OF PARTS

L1L2, L3L4, L5L6—Three RF transformers for .00035 mfd. tuning.
T1, T2—One Victoreen Type 112 audio transformer unit
T3—One Victoreen Type 326 filament transformer
C1, C2, C3—Three Hammerlund .00035 mfd. Midline condensers
C4—One Carter .00025 mfd. moulded condenser (without clips).
C5—One Carter .0005 mfd. moulded condenser
C6, C7—Two Tobe type 304 4 mfd. by-pass condensers
R0—One Electrad type G variable resistance (0-10,000 ohms)
R1—One Lynch 2 megohm grid leak
R2—One 20 ohm Electrad center tapped resistor
R3—One Frost 400 ohm potentiomenter
R4—One Electrad 1,000 or 1,500 ohm resistor (Truvolt)
Eight Eby binding pists
One Lynch single mounting
One Hammarlund double drum dial
One Hammarlund flexible coupling (for condensers C2 and C3)
One Victoreen type 333 three-socket outlet block and switch
Four Benjamin four prong sockets
One Benjamin type —27 socket (five prong)
Four Benjamin sub-panel brackets
One 7x24 inch bakelite panel
One 8x23 inch ply-wood baseboard, cut to conform to drum and condensers.

Better Grade Speakers Require Good Audio

Public demand has forced the improvement of loudspeakers with very successful results. The public, however, has continually overlooked the fact that loudspeaker design improvements display an influence upon the required design of associated receiver audio amplifiers.

"The person purchasing a new loudspeaker, one of improved design, does so simply because he desires improved quality of reproduction," says E. E. Hiler, inventor of the tuned double impedance system of audio frequency amplification. "Unfortunately, however, this is not always obtained, in fact, in many instances, the better speaker produces inferior results."

"This to the owner is an enigma and very disappointing.

"The fault and solution are found in the audio amplifier. In the case mentioned, the operating characteristics of the receiver audio amplifier were better suited to the first speaker. The improvement in speaker design is found in the increase in frequency range and more uniform response.

"The better the speaker, the more uniform must be the frequency response characteristic of the receiver audio amplifier. The time will eventually arrive when every receiver will utilize a flat characteristic audio amplifier and a full sideband characteristic radio frequency amplifier. Then all good loudspeakers will function satisfactorily with all receivers.

"A series of laboratory experiments with various speakers of present and older vintage, operated in conjunction with a tuned double impedance audio amplifier, arranged to have a flat characteristic by increasing the value of the coupling condenser, showed that the improved speakers of this day make available more uniform frequency response.

"The amplitude of the peaks and the depth of the depressions found in the characteristic curve have been reduced.

"The length of the operating spectrum has also been greatly increased, although the full low frequency response is still lacking. The tests conclusively demonstrated that the better the speaker design, the more uniform its response and the greater the need for a flat characteristic audio amplifier."

www.americanradiohistory.com

Tap Off for Shorter Waves

By J. A. Fair

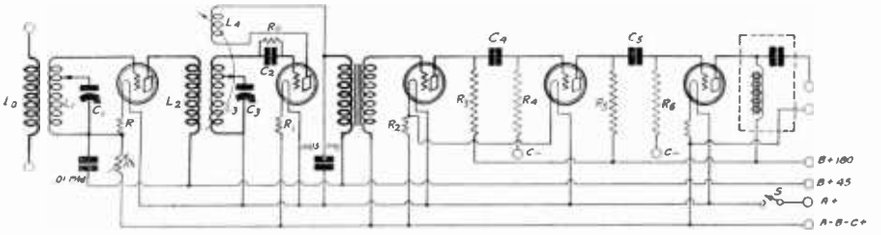


FIG. 1

THE DIAMOND OF THE AIR CAN BE CHANGED EASILY SO THAT THE SHORT WAVE STATIONS IN THE BROADCAST BAND WILL BE SPREAD OUT OVER THE ENTIRE DIAL BY CONNECTING THE TUNING CONDENSERS ACROSS ONLY A PORTION OF THE TUNING COILS.

Usual broadcast tuner may be tapped so as to reach down to 65 Meters—Where to locate the Tap—How Plan Works in the Five Standard Tube Diamond

MOST tuning condensers used in receivers are so constructed that the short wave stations are crowded on the lower ends of the dials. This crowding, of course, has nothing to do with lack of selectivity, but is purely a mechanical effect. Nevertheless it is at times annoying to have so many stations come in within a few divisions. Exact tuning is difficult. For that reason fans have suggested that the circuit be changed so that the short waves will be spread over a greater part of the dials. This change is very easily made.

The position on a dial at which any given station comes in depends on how much inductance is connected across the condenser controlled by that dial. And the inductance depends on the number of turns on the coil. Hence all that is necessary to bring the short wave stations farther up, and thus to spread them out, is to remove some of the turns from the coil. If it is desired to bring in a station operating on 1,000,000 cycles where ordinarily a station operating on 550 kc comes in, the number of turns required is about 55 per cent. of the total number of turns. Thus if there are 60 turns on the coil, 45 per cent., or 27 turns, should be removed, leaving 33 turns.

Secondary Is Tapped

But if 45 per cent. of the turns are removed from the tuning coils the receiver will no longer tune in any stations operating on frequencies lower than 1,000,000 cycles. Since most of the larger stations are operating on frequencies lower than 1,000,000 cycles, the removal of the turns is not desirable. Moreover, it is not necessary.

Instead of removing turns a tap may be brought out at a suitable point on the secondary and the grid side of the tuning condenser connected to that. The tuning condenser will then tune only a portion of the secondary coil. The extra turns are not wasted, for they aid in stepping up the signal voltage whether they are included in the tuned circuit or not.

When this method of tapping is employed to s pread out the short wave stations the lead from the tuning condenser should be provided with a clip so that the circuit may be changed quickly from one range to the other. It is not advisable to bring a switch out on the panel for this changeover because the high potential lead then would be long.

Five Tube Diamond Illustrated

Fig. 1 shows a circuit which is essential the Five Tube Diamond of the Air (not screen grid model) with switches provided on both the secondaries. The clips at the ends of the leads from the tuning condensers are indicated by arrows pointing to the turns of the tuning coils. Other circuits may be treated in the same manner, provided that access can be had to the turns on the coil without damaging the windings.

The turn selected for tapping should be pried away a little from the others. A strip of tape or fiber should then be put under it to protect the other turns. Then the insulation may be removed from a point on the selected turn and a short piece of wire soldered to it. This constitutes the tap to which the clip is connected.

The same system of tapping may be used on the screen grid model Diamond. In either instance you will be able to tune down to about 65 meters.

What Range Is Essential for Audio?

By Roger St. Yves

What is the essential frequency range in audio amplification? Do the frequencies above 5000 cycles contribute anything? Do those below 100 cycles? How far up and down should the straight characteristic of a transformer extend?

In a good transformer it is not necessary nor even desirable that the straight line characteristic extend down to the very lowest audible notes nor up to the very highest. It is sufficient if the curve is straight over the essential part of the audible scale.

And that raises the question as to what range in the audible scale is essential. There is a wide divergence of opinion on that point in radio circles, but all those who understand the subject thoroughly in all its phases are in close agreement. When they do differ it is in method rather than in results.

One essential region of the scale is that between 5,000 and 10,000 cycles. This region is often disregarded by designers of equipment on the ground that it lies above the musical range. That is true, but it is not necessarily true that the higher musical frequencies can be reproduced realistically if those high audio frequencies are missing. The frequencies up to 10,000 are needed to give timbre to the higher notes used in music.

One reason given for suppressing the frequencies in the 5,000 to 10,000 range is that it is not necessary to reproduce them to make vocal speech intelligible. But is intelligibility a sufficient criterion?

If speech is to be reproduced naturally all the frequencies up to 10,000 ought to be reproduced fully. The ease of intelligibility depends on the audio frequencies lying above 5,000 cycles.

As a selective radio frequency tuner suppresses the higher audio frequencies it is all the more necessary to insure against further suppression of these frequencies in the audio amplifying system. Audio transformers can do justice to the frequencies between 5,000 and 10,000 cycles.

Neither must the base notes be neglected, for they give the signal its richness and fullness. Yet the bass notes must not be accentuated to the extent of making the signal boomy and hollow sounding, an error which is now often committed in the name of perfect quality.

The designer must ever keep in mind that the radio frequency tuner favors the bass notes and that the audio amplifier must be chosen so as to offset this inequality. This means that the characteristic of the transformer should not be straight down to the lower limit of audibility but should gradually bend downward. This is no excuse for a bad transformer, for the transformer must show a fair amplification as low as 40 cycles. A poor transformer shows a voltage loss below 100 cycles.

There is still another reason why the audio frequency amplifier should not show full efficiency below about 30 cycles, and why it should actually show a voltage loss below 10 or 15 cycles.

An amplifier which is fully effective down to these low frequencies usually motorboats viciously when connected to a B battery eliminator.

By-pass condensers are not practical for stopping this disturbance because of the low frequency of the motorboating.

In nearly all cases it is necessary to introduce some device which will cut down the amplification of the circuit at the troublesome frequencies to stop the disturbance.

This only happens where the amplification is excessive below the audible limit.

www.americanradiohistory.com

Hints on Metal Subpanels

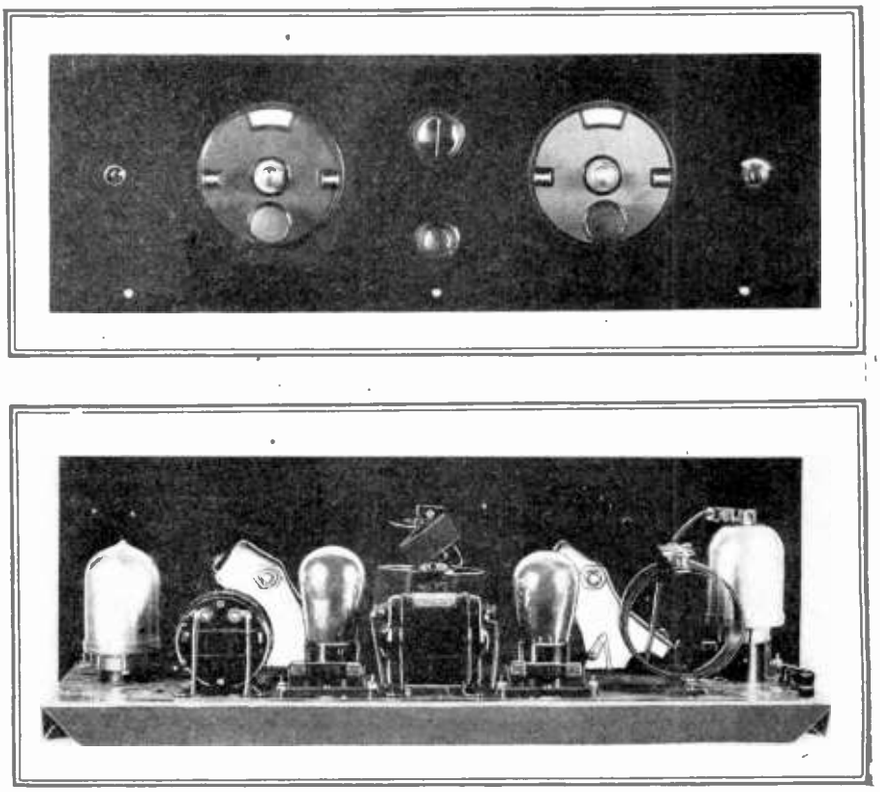
By H. B. Herman

IN construction of a receiver such as the Screen Grid Diamond of the Air, the four tube model of which is illustrated, an aluminum subpanel assures physical rigidity and neat appearance, since the subpanel is already drilled with holes to accommodate the specified parts, including the wires leading to and from them.

A few special instructions will make the work easier and better.

The aluminum subpanel may be connected to minus A, which may be grounded, and the subpanel is used wherever a tap is to be taken off the minus A lead.

As is well known, you can not solder to aluminum. But you can drive screws through holes in the aluminum and as these screws, as well as their bolts or nuts, are brass, even if nickeled, or are iron, you can solder to the screw or nut.



FRONT AND REAR VIEWS

Use of Insulating Washers

In the particular subpanel that is standard for the Screen Grid Diamond, insulating washers are affixed on top by the manufacturer, so that the Karas condensers, for instance, will not necessarily make electric contact with the subpanel.

The reason is that one condenser frame or rotor goes to A plus and the other to A minus, and a short would result.

By omitting a round insulating washer from the under side of the subpanel, in making the connection for the RF condenser, a way is thus provided for grounding A subpanel and making it A minus besides. For instance, the rotor or frame of the RF condenser is connected to A minus and to ground, and when that frame is screwed down on the subpanel and the tail of the screw is NOT specially insulated with any of the insulating washers furnished with the subpanel, then the subpanel and the rotor become connected to the same line.

Detector to A Plus

So, where the other or detector tuning condenser is NOT to be connected to minus A, but to plus A, the precaution must be taken to use an insulating washer on the under side of the subpanel. The upper part or top elevation of the subpanel has washers permanently affixed, and these are left in place in both instances.

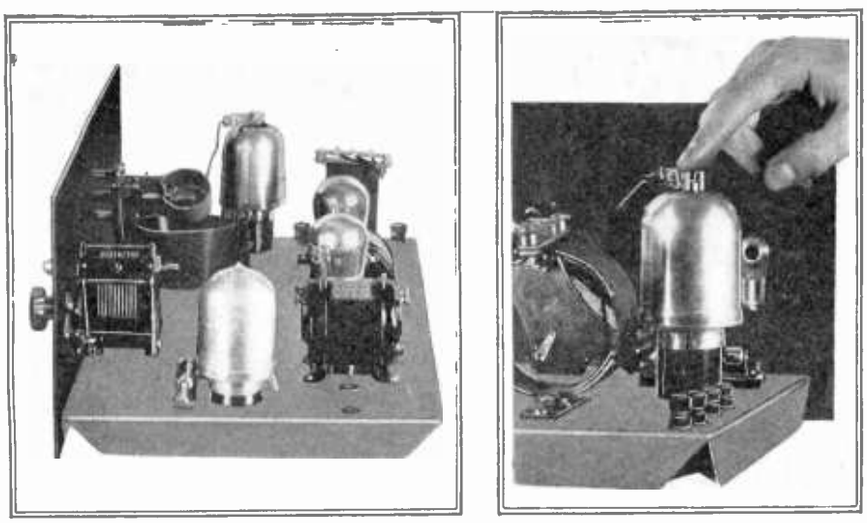
Whenever constructing a set, where a drilled panel or subpanel is being used, do not immediately fasten tightly each bolt and nut, but insert the machine screws and loosely affix the nut, without driving it home.

Give Yourself a Chance

When you create this flexible condition you will find yourself enjoying the extra tolerance, and screws will fit nicely into other holes, which you otherwise might have to force in.

Strive for Alignment

In other words, the drilling contemplated the construction as a whole, yet it will happen that constructors finally fasten a screw and nut before all the parts are assembled in place, and think the holes are not in quite the right place, because the hard-and-fast work already done throws some section of the surface out of perfect alignment with a hole in a part that should fit just as snugly as any other thing in the assembly.



HOW THE RECEIVER LOOKS, AFTER CONSTRUCTION, WITH A VAC-SHIELD ON THE 22 TUBE AND ANOTHER ON THE SPECIAL DETECTOR. ALL THE SPECIFIED PARTS FIT ON THE DRILLED ALUMINUM SUBPANEL. AT RIGHT, FINGER POINTS TO THE CLIP CONNECTED TO THE CAP OF THE TUBE. THIS CAP PROTRUDES THROUGH THE VAC-SHIELD.

Quarterly Survey of Stocks Completed

Washington

Tabulation of the number of radio sets sold in the United States last year will be a new feature of the next quarterly survey of stocks in the hands of radio dealers and jobbers has been conducted by the Electrical Division in co-operation with the Radio Division of the National Electrical Manufacturers' Association, the Department of Commerce announced. The statement in full text follows:

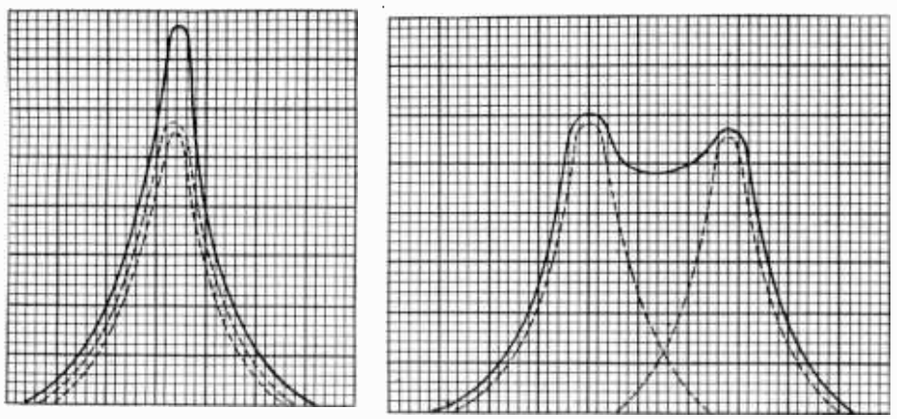
"Questionnaires are being mailed out to approximately 33,000 radio dealers and 1,000 jobbers in this country. In addition to stocks on hand the information requested will indicate the number of battery-operated and AC radio sets sold by each dealer and jobber during the year 1927.

"The two previous surveys of stocks held by dealers and jobbers averaged about a 25 per cent return for both classes. The return from jobbers alone was about 40 per cent."

www.americanradiohistory.com

The National Screen Takes the

By James



A B

AT LEFT IS THE RESULT OBTAINED BY MATCHING CIRCUITS. AT RIGHT THE REASON FOR BROAD TUNING IS SHOWN.

Facts About the National SG Five

Sensitivity and selectivity sufficient to bring in distant stations when locals are on, when using 4 or 5 ft. wires as an antenna. Longer antenna not required for any kind of reception. Piano hinge on back of cabinet serves as antenna for local and semi-distant reception. Selectivity such that WJZ can be received in Boston through WNAC which is separated by only 10 kc.

No shielding nor neutralizing required. Operation far more stable than former Browning-Drakes using old type tube.

Uses high impedance slotwound primary type of transformer for coupling the shield grid stage to the regenerative detector.

Proper location of coils assured by employing National kit, in which coils, condensers and and dial are mounted as a unit.

Antenna variometer or inductive trimmer does away with need for ordinary trimmer condenser.

Due to stability of the RF amplifier, maximum detector regeneration may be obtained without danger of RF tube oscillating.

Squeal method of tuning may be used on distant stations without causing interference with neighboring receiving sets.

The set is exceedingly simple to construct, due to lack of shielding and neutralizing.

PART II

ONE of the features of the National Screen Grid Five Receiver is the ease with which it may be operated.

Even when the detector regeneration is increased to the maximum, the set does not lose its stability and the radio frequency tube does not oscillate. Also, for local and even semi-distant reception, the single tuning control is all that need generally be used. For extreme distance, however, it will be found of advantage to employ both the tickler and inductive trimmer.

Very excellent performance may readily be obtained with a 3 or 4 ft. wire connected directly to the control grid of the UX222 tube as an antenna. (The cap on the tube is the control grid connection). In fact, such an antenna is to be recommended for use wherever extreme selectivity is desired.

How to Connect Antenna

Where the set is not located very close to any broadcasting stations, however, a 20 or 25 ft. indoor antenna may be used, if preferred. Such an antenna should be connected directly to the tap on the antenna coil. Where the conventional 50 to 60 ft. outdoor antenna is used, an antenna series condenser of about .0001 mfd. must be employed.

Such an antenna will be found of considerable aid in increasing the range and volume of the receiver on distant stations in any locations where local interference power leaks and other sources of noise are not bothersome.

When the receiver is first put into operation, the inductive trimmer should be set in mid position, the set screws on the tuning condensers loosened and then some local station carefully tuned in by moving the two tuning condensers separately. This process is necessary to get the two circuits in step. The set screws are then tightened, and any slight variations on other stations being compensated for by means of the trimmer.

Properly Match Circuits

If the two circuits are not properly lined up, broad tuning, i. e., lack of selectivity, is certain to result. The reason is self-evident from Fig. 1, which shows the resonance curves of both tuned circuits as well as the combined curve for the entire amplifier when the two circuits are properly lined up, as at A, and when they are not, as at B. Moreover, whenever a station seems to come in at two slightly different dial settings, we have the condition illustrated at B in Fig. 2, and a slight simultaneous readjustment of the trimmer and the tuning dial will correct matters.

In tuning for distant stations, the use of regeneration in the detector circuit will be found of great assistance. As a result of the use of the screen grid tube in the RF stage, the detector may, if desired, be permitted to oscillate and stations picked up by their carrier wave, without annoying the neighbors.

Experiment With Leaks

To obtain smooth regeneration, it is advisable to try several different values of grid leaks and also different values of detector plate voltage. While almost any type of tube may be employed as a detector, the 112A will generally be found to be preferable to the 200A or the 201A. While a good 200A is more sensitive than a 112A, there seems to be quite a number of these tubes that are "not so good." Then, again they have the very serious drawback of being noisy and of causing many receivers to motorboat. The 112A is very much less microphonic and, in almost every other way, a better tube for general use than the less expensive 201A.

Operating Data

Some of the 222s are inclined to be rather microphonic and thus cause trouble when the loudspeaker is placed quite close to the set. This difficulty is generally encountered only when the volume control rheostat is in approximately mid-position.

A slight readjustment of the rheostat in most instances will correct the trouble, unless the tube is a poor one.

Generally about 45 volts on the screen grid and 135 on the plate of the 222 will give very satisfactory results.

The screen grid voltage should be approximately 45 when using 135 volts on the plate of RF tube. This voltage is not critical, however, and variations of a few volts in either direction do not make an appreciable difference in performance.

Transformer Coupling Fine

Contrary to the general impression, it is not essential to employ a tuned plate impedance in connection with the new screen grid tube when it is used as a radio frequency amplifier.

In fact, much more stable and otherwise satisfactory results are obtainable if a correctly designed radio frequency transformer having a very high primary impedance is employed.

When one of the new tubes is used with such an RF transformer, in connection with the Browning-Drake circuit, not only is the sensitivity or distance getting ability of the receiver improved to a marked degree, but also, the necessity for neutralization and any tendency toward undesired oscillation of the radio frequency stage are completely eliminated. Obviously

www.americanradiohistory.com

Grid Five Easily Hurdles

Millen

LIST OF PARTS

L1, L2L3L4, C1, C2, PL—One National Single Dial Tuning Unit BD No. 222 with No. 28 Illuminator (unit consists of drum dial, antenna and detector coils, two knobs, two tuning condensers, mounted on frame).

AF1—One National First Stage Impedaformer.

AF2—One National Second Stage Impedaformer.

AF3—One National Third Stage Impedaformer.

TF—One National Tone Filter.

C, OC—Two Aerovox .0001 mfd. moulded mica condensers.

C3—One Aerovox .00025 mfd. moulded mica condenser.

C6—One Aerovox .001 mfd. moulded mica condenser.

C4, C5—Two Tone .5 mfd. bypass condensers.

1, 2, 3, 4, 5—Five General Radio sockets.

S—One Yaxley Switch.

R2—One Carter 20 ohm Rheostat.

L5, L6—Two National RF chokes, with two Lynch Equalizer mountings.

R3—One Lynch 2 meg. grid leak with single mounting.

R4—One Lynch No. 4/5 Filament Equalizor with single mounting.

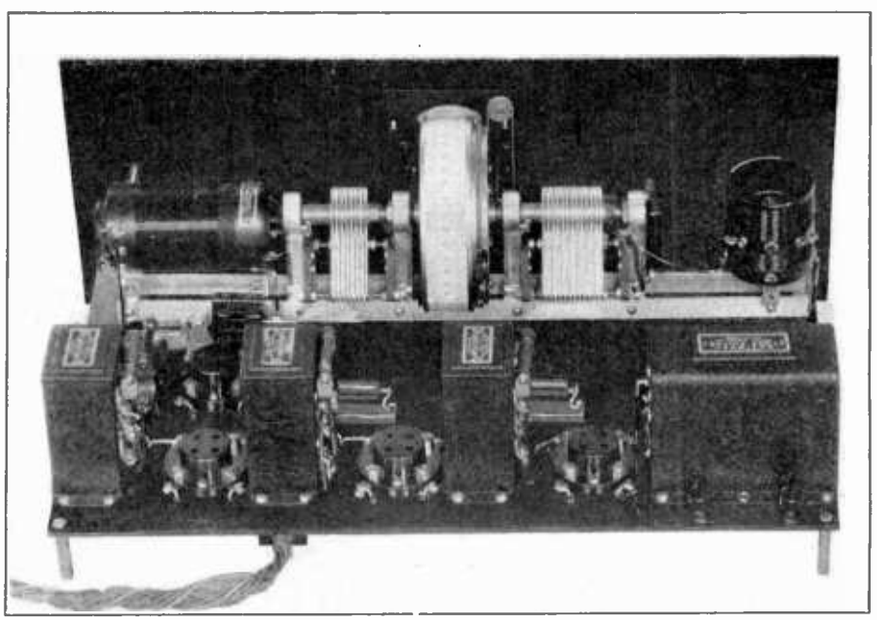
R1—One Lynch 15 ohm Filament Equalizor with single mounting.

One—Bakelite front panel, 7 x 18 inches.

One—Bakelite subpanel, 10 x 17 inches.

Two extra knobs to match those on coil shafts, and to be affixed to rheostat and switch shafts.

One fuse clip or No. 45 Universal Peewee clip for cap of 222 tube.



REAR VIEW OF THE RECEIVER

this condition results in better tone quality as the regeneration in the detector circuit may readily be controlled without effecting the stability of the radio frequency stage.

Another important result of the use of the special National Browning-Drake high impedance slot wound primary transformer in place of the tuned plate system is the elimination of the necessity for shielding, when due care is given to the proper location of the coils and condensers.

When to Use 112A

This condition exists in the case of the National No. 222 B-D Tuning Unit, which is specified in connection with the National Shield Screen Five.

In the first audio stage an UX-201A should be used, while in the second stage either an UX-201A or a high mu tube may be employed, depending upon the volume desired. An UX-171A is recommended for the last stage unless there are no local stations, in which event the use of the 112A with proper C bias, will result in increased volume.

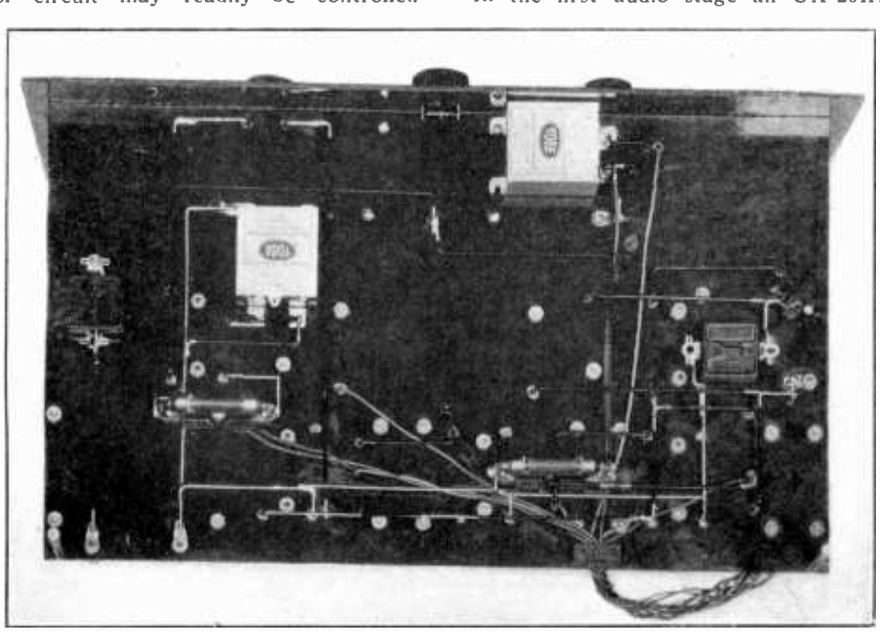
The grid bias for the 171A tube with 180 volts on the plate should be 45 volts. If the 112A tube is used with the same plate voltage a grid bias of 12 volts should be employed. On the 112A it is preferable to use 135 plate volts with about 9 volts negative grid bias.

Data on Impedaformers

The first Impedaformer AF1 has inbuilt a radio frequency choke coil for the suppression of radio frequency currents, as can be seen from the circuit diagram. Ordinarily this choke would be sufficient when working in conjunction with condenser C6, but for this screen grid circuit it has been found advisable to add another radio frequency choke outside AF1. This extra coil is labeled L6 on the circuit diagram.

With this external coil connected the filtering of the RF currents from the audio amplifier is very thorough.

It is the distributed capacity of the Impedaformer AF choke which makes L6 so effective. The only RF voltage transmitted to the AF circuit is the voltage drop in the distributed capacity. Since the impedance of this capacity to radio frequencies is very much smaller than the impedance of the choke coil L6 nearly the entire drop will occur across the coil.



VIEW OF SUBPANEL BOTTOM

[The author kindly volunteered to send a blueprint of the National Screen Grid Five to any reader who so requests. Address him: James Millen, c/o RADIO WORLD, *145 West 45th Street, New York, N. Y.]*

www.americanradiohistory.com

A Power Amplifier

By A. R.

Service Department,

IT has been generally conceded that the greater the amount of energy or power supplied to the speaker by the last audio stage tube, the better the quality. This, of course, is assuming that all other considerations are equal.

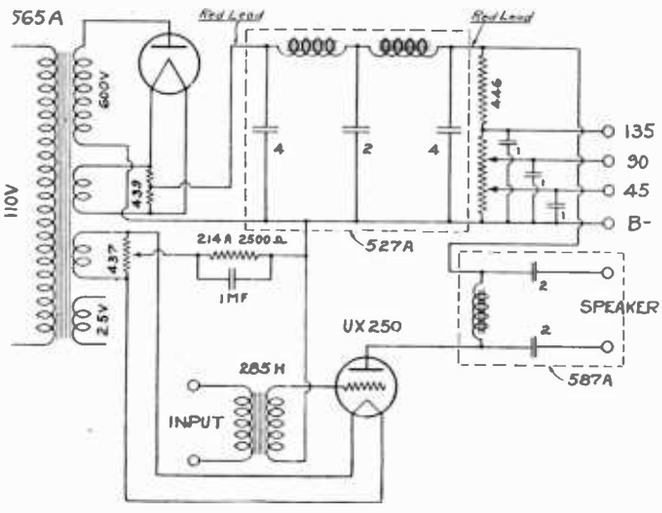
Good Tone

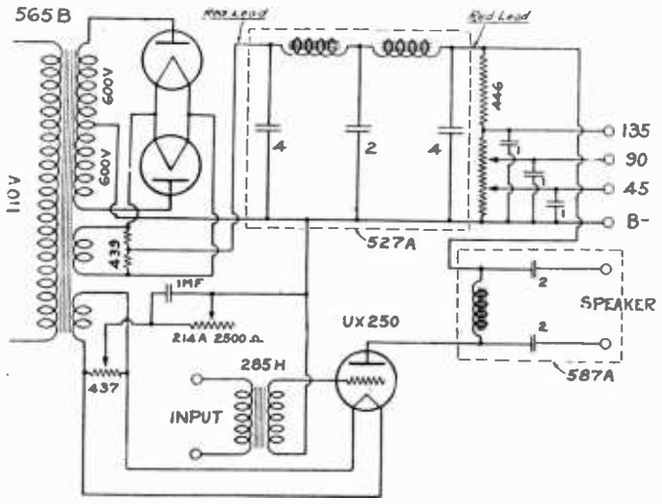
The desire for good tone quality with reasonable volume is of paramount importance to the majority of listeners. To this end power tubes such as the —71 and the —10 type have played an important part. The type —71 power tube is especially desirable for average home use as it does not require the high plate voltage of the —10 type and at the same time provides the speaker with ample volume. The type —10 tube is a logical choice for those who have demanded more volume than the —71 type of tube is capable of delivering.

More Power

Power and more power has been this season's cry in regard to audio units.

Realizing this demand for great volume together with good quality the Radio Corporation of America has recently announced a new power amplifier tube to be known as their UX 250 (Cunningham CX 350). The various characteristics of this tube are listed at the bottom of this column.





FIGS. 1 (TOP) AND 2.

Filament of —50 Tube

The filament rating is 1.25 amperes at 7.5 volts, which is the same as that for a —10 tube. The material used for the filament, however, is the coated ribbon type similar to that used in the —81 rectifier tube.

The filament operates at a dull red heat and the low operating temperature and increased size of this filament results in minimum ripple voltage or hum when operated from an AC source. The—50 is of the low-mu type, the amplification factor being 3.8.

Not Absolutely Interchangeable

The coated filament is not affected by traces of gas and a slight blue glow will not impair or affect the performance of the tube provided the resistance in the grid circuit is kept low, preferably not over 10,000 ohms, to avoid a decrease in bias which may result from the flow of gas current to the grid.

A low-resistance output choke with a condenser, or a transformer capable of handling the heavy plate current of the —50 without saturation of the core or overheating of the windings, must be provided for this tube to prevent excessive voltage drop in the plate circuit and to protect the loudspeaker windings.

From a casual glance it might seem that this tube is interchangeable with the —10. This is true to a certain extent but as the plate current required is about three times that of either the —10 or the —71 tube, special considerations must be taken into account in the filter and the tube output systems to prevent saturation.

The rectifying transformer, at the same time, should be designed to furnish the requisite requirements of voltage and current for this tube with a good margin of safety.

To obtain the necessary voltage to operate the —50 under load at its maximum plate voltage the rectifying transformer should have a high voltage secondary of at least 600 volts.

CHARACTERISTIC OF THE —50 TUBE

Plate voltage	250	300	350	400	450
Neg. Grid Bias voltage.	45	54	63	70	84
Plate Current (milliamperes)	28	35	45	55	55
Plate Resistance (ohms)	2100	2000	1900	1800	1800
Voltage Amp. Factor..	3.8	3.8	3.8	3.8	3.8
Max. Undistorted Output (milliwatts)	900	1500	2350	3250	4650

Description of Parts

The new General Radio transformers, known as the Type 565-A and Type 565-B, are intended for use in half and full wave rectifying systems respectively, employing either one or two UX 281 rectifier tubes or equivalent.

The Type 565-A transformer consists of one high voltage secondary of 600 volts and two low voltage secondaries of 7.5 volts each for the filaments of the rectifier and power amplifier tubes. There is also another low voltage secondary of 2.5 volts which is primarily intended for use in conjunction with the 226 or 227 types of tubes when this unit is used in a complete two or three stage amplifier.

The Type of 565-B full wave transformer is identical in size and appearance with the Type 565-A and consists of two 600-volt high-voltage secondaries together with two low-voltage secondaries of 7.5 volts each.

The Type 527-A rectifier filter incorporates two heavy duty chokes, each having an inductance of 15 henries, and a condenser assembly of 4-2-4 mfd.

Gap Prevents Saturation

Both the Type 565-A and 565-B transformers are rated at 200 watts. To eliminate any danger due to short circuits all connections to the instrument are brought out in the form of rubber-covered leads of various colors which are plainly indicated on the name plate.

The connections to the Type 527-A Rectifier Filter are also leads and it is very important that the red lead be used in the high voltage side of the rectifier system.

The direct current resistance of the chokes used in the Type 527-A Rectifier Filter is 175 ohms each. These chokes are made with butt joints and have a .003 inch air gap in order to prevent saturation at high values of plate current.

One of the most common causes of distortion in the tube itself is that resulting from the flow of grid current. The amount of signal voltage that may safely be impressed upon the grid of the tube without causing grid current to flow is fairly well indicated by the grid bias voltage; actually it is half the square root of two, or .707 times the grid bias voltage.

Question of Power

At the same time that we are interested in preventing the tube from distorting we are also desirous of obtaining the maximum power output that the tube is capable of delivering.

The power output of a tube, however, is proportional to the square of the input voltage.

For instance, if we had a theoretical tube that was designed to give a one-watt power output with a ten-volt grid swing, and only five volts were available on the grid of this tube, a quarter of a watt power output would result. This brings us to another consideration of the new —50 power amplifier tube. A study of its characteristics shows that at its maximum plate voltage the signal input voltage necessery to obtain the 4,650 milliwatt power output is 58.8 volts R. M. S. (.7 times the grid bias voltage) compared to 24.5 volts R. M. S. for maximum output of the —10 tube and 28 volts R. M. S. for the —71 tube.

Now if we had only enough signal voltage to operate a —10 tube at its maximum power output available on the grid of the —50 tube, a little figuring with pencil and paper would readily show that the output available under this condition would be about that of the —71 type of tube.

All this means that sufficient voltage

www.americanradiohistory.com

for the New -50 Tube

Wilson
General Radio Co.

LIST OF PARTS

One General Radio Type 565-A Transformer.
One General Radio Type 527-A Rectifier Filter (chokes and condensers).
One General Radio Type 587-A Speaker Filter.
Two General Radio Type 349 Sockets.
One General Radio Type 439 Center Tapped Resistance.
One General Radio Type 437 Adjustable Center Tapped Resistance.
One General Radio Type 285-H Audio Transformer.
Two General Radio Type 446 Voltage Dividers.
One General Radio Type 214-A—2,500 ohm Resistor.
One Base Board 14"x16".
One BP Strip, 4 Binding Posts.
One Snap Switch, Cord and Plug.
Four 1 Mfd. Condensers (Four tube 1 mfd. bypass condensers.)

amplification must be employed between the detector and the grid of the —50 tube if its greatest power output is to be realized.

It is well, though, in normal service, to operate the last audio stage tube below full capacity, leaving a large reserve of volume available, a condition favorable to best quality of reproduction.

The —50 tube is not particularly suited for use in a push-pull output system on account of the extremely high signal voltage necessary to operate it at anywhere near its maximum output.

The push-pull method of connecting two tubes necessitates twice as much signal input voltage as a single tube to secure the maximum power output.

This means that a voltage amplifier of high gain must be employed between the output of the detector tube and the two —50's. This is not particularly recommended since an amplifier of this sort is rather unstable.

Parallel Connection

If more power is desired than a single tube is capable of producing, two —50's may be connected in parallel with the result that the power output will be doubled with the same input voltage as is necessary for the operation of a single tube.

To obtain a maximum transfer of undistorted energy it has been determined empirically that the load resistance should be equal to twice that of the plate resistance of the tube.

The DC resistance of the windings of an average loudspeaker is of the order of 1,000 ohms. This is the resistance offered to the flow of the plate current from the plate supply when the speaker is used without an output transformer or equivalent.

The resistance offered by the speaker to the signal voltage generated by the output tube is very much higher than the DC resistance of the windings, especially at the higher audio frequencies. This resistance is termed the impedance of the speaker and it is the combined effect of the resistance and the reactance of the unit.

Speaker Impedance

The average impedance of present-day speakers, such as a Western Electric, is approximately 4,000 ohms. Because of this fact and the low plate impedance of the —50 tube it is not necessary to use an impedance adjusting device such as an output transformer.

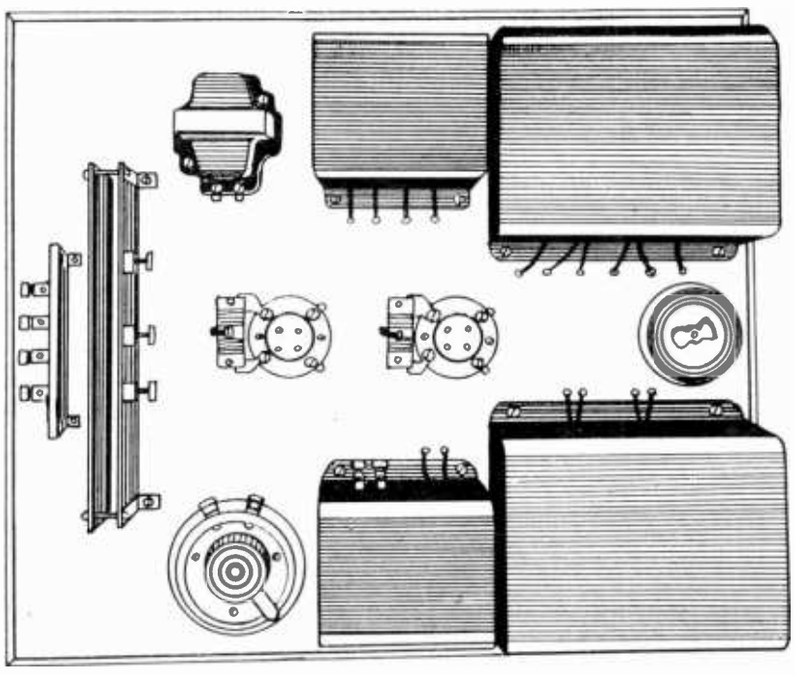
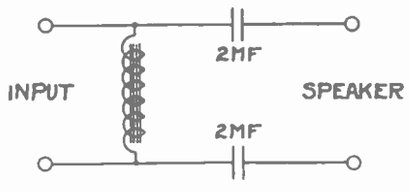


FIG. 3
VIEW OF AMPLIFIER FROM TOP

However, some method of coupling must be used between the output of this tube and the speaker to prevent the high plate current from eventually burning out the speaker windings. For this purpose the Type 587-A speaker filter was designed, and it thoroughly insulates the speaker from both the high voltage and direct current of the tube.

This device consists of a heavy duty choke similar in construction to the chokes used in the Type 587-A Rectifier Filter but having a direct current resistance of 250 ohms. Two 2 mfd. condensers are also used. The wiring diagram of this instrument is shown below:



Figs. 1 and 2 show respectively the schematic wiring diagram of a single stage power amplifier combined with a plate supply unit utilizing half and full wave rectifying systems respectively, while Fig. 3 shows an experimental model of a complete amplifier. As mentioned before, this amplifier should be preceded by a voltage amplifier of sufficient voltage gain, such as two stages of double impedance employing 112, in order to operate the —50 tube properly. To obtain as large a voltage gain as possible in the power amplifier an audio transformer having a ratio of 1 to 6 has been employed.

From a frequency standpoint the use of a high ratio transformer is perfectly permissible in this case as it is working out of a relatively low impedance tube. In order to keep this impedance as low as possible it is recommended that the 112 type of tube be employed in the preceding stage.

Resistor Bias

Two of the General Radio Type 446 voltage dividers connected in series are used as the output potentiometer device to supply the correct plate potentials for a radio receiver.

It is desirable that the bias required by the tube be supplied from the voltage drop across a resistance in series with the B return as shown in Figs. 1 and 2.

It will be found that this connection compensates almost completely for changes in plate voltage which may occur as a result of line voltage variation, since an increase in plate voltage causes a small increase in plate current, which in turn raises the applied C bias sufficiently to compensate for the new value of plate voltage, thus maintaining the proper operating condition at all times.

Movable Arm

If a decrease in voltage occurs, such as would be caused by a sudden drain upon the plate supply, the reverse action would take place. The movable arm of the Type 214-A—2,500-ohm resistor used to get the proper bias voltage should be set so as to use approximately 3-5 of the total resistance, since a resistance of 1,500 ohms is about right to give the proper bias for the US 250 tube.

In both Figs. 1 and 2 it was thought advisable to use an adjustable center tapped resistance across the filament of the power amplifier tube and adjust it under actual operating condition for minimum hum.

The experimental model makes use of the half-wave rectifying system. If a full-wave system is desired the Type 565-B transformer should be substituted for the Type 565-A Transformer and another socket should be added for the additional rectifier tube. All other parts, however, remain the same.

www.americanradiohistory.com

A Solution of Screen

By J. E. Anderson

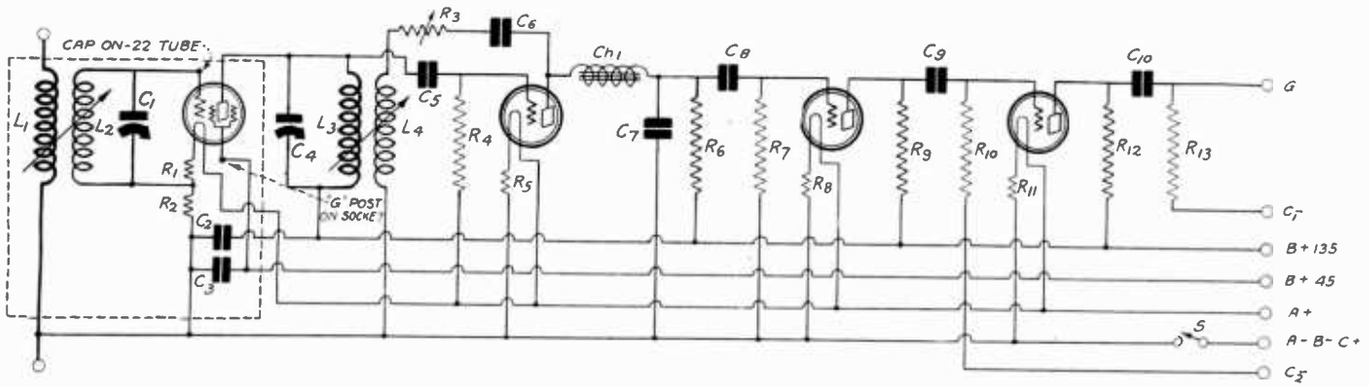


FIG. 1

THE CIRCUIT DIAGRAM OF A RECEIVER COMBINING SELECTIVITY, SENSITIVITY, FIDELITY AND SCREEN GRID OPERATION.

THE screen grid tube has aroused public interest more than any other recent radio development. Why? Because it has two outstanding properties. One of these is that the capacity between the plate and the control grid is practically nil. The other is that its amplification constant is enormously high.

The extremely small capacity between the electrodes makes it possible to tune the plate circuit, or to couple a tuned circuit very close to the plate circuit, without danger of oscillation. The high amplification constant promises great sensitivity and distance getting ability. Both of these are highly desirable characteristics.

But some fans have learned that a high amplification factor and a high amplification are not the same. The high amplification factor is simply potential amplification, not necessarily actual. To make it a fact it is necessary to design the circuit so as to take advantage of the possible high gain factor. Mere substitution of the screen grid tube for another may result in loss of amplification.

Amplification or Selectivity

Other fans who have obtained the high amplification of which the tube is capable have discovered that the selectivity of the circuit is almost gone. Again the disappointment is due to faulty design of the circuit.

But it is a problem of utmost simplicity to make the tube amplify enormously without sacrificing the selectivity. In fact, it is easy to make the tube amplify so much that it becomes difficult to handle all the volume. But that, too, is a problem in design.

Let us see how it is possible to design a circuit so that the tube will do its stuff and still retain the required selectivity.

Loading the Tube

There is no secret involved. It is just a matter of doing the obvious. The makers of the tube inform us that the screen grid tube has a very high AC output resistance. And from general tube theory we know that if we want a high voltage amplification out of a tube the load impedance connected to the tube must be high in comparison with the AC output resistance.

In all cases where the screen grid tube has not delivered the promised amplification the reason has been that this simple condition has not been met. Not only has the load impedance not been large compared with the AC output impedance of the tube, but it has been negligibly small compared with it. Lack of amplification inevitably follows such design.

The necessary high impedance in the plate circuit can be obtained in one of several ways. A high coupling resistor as in resistance coupled amplification is one way, a high value radio frequency choke is another, a radio frequency transformer with many turns on the primary connected to the screen grid tube is still another, and a parallel tuned circuit is still another. Whichever is used, the impedance connected in the plate circuit must be large as compared with the AC plate impedance of the tube, which is given as 850,000 ohms.

Resistance Load

If resistance coupling is chosen the value of the effective coupling resistance should be at least one megohm. If a higher value is chosen the voltage amplification will be higher.

But there are many objections to the use of resistance coupling. In the first place, no selectivity is possible. In the second place a higher than the rated plate voltage should be used.

And in the third place it is very difficult if not impossible to make the effective load resistance high compared with 850,000 ohms, because the grid leak and the input resistance of the following tube are connected in parallel with the coupling resistance and the total effective resistance is much less than the lowest resistance of these. When grid detection is used the grid to filament resistance of the detector is not high. We dismiss the resistance AF method of coupling as not suited to our purpose.

Impedance Coupling

The situation is not much better when a radio frequency choke coil is used. The grid to filament resistance of the detector may still be the the lowest impedance of the three connected in parallel. And no selectivity can be gained in this type of coupling, either. Hence we pass to the next.

When a radio frequency transformer is used as the coupler following a screen grid tube the situation is much better. But to get much amplification from the tube the number of turns on the primary of the transformer must be high. It may be necessary to use as many turns on the primary as on the secondary, and then in addition to use a small tuning condenser, enabling the use of many turns on the secondary. That brings the amplification of the tube up to a high value, not to the value indicated by the high amplification constant of the tube, but to a value high enough for all practical purposes. In fact it may be too high.

A compromise is necessary by using fewer turns on the primary and sacrifice of some amplification. This sacrifice is in the interest of selectivity and stability.

Tuned Impedance Method

While the transformer method is good

LIST OF PARTS

For the receiver.

L1, L2—Two General Radio Type 268 variocouplers.
C1, C4—Two Karas .00025 mfd. tuning condensers.
C2, C3—Two Polymet .001 mfd. condensers, or a .1 mfd. Polymet midtapped buffer condenser.
C5—One Polymet .00025 mfd. grid condenser.
C6—One Polymet .001 mfd. mica dielectric condenser.
C7—One Polymet .0005 mfd. mica dielectric condenser.
C8, C9, C10—Three Polymet .01 mfd. mica dielectric condensers.
Ch1—One General Radio 65 millihenry radio frequency choke.
R1—One Lynch Type 15 Equalizor.
R2—One Lynch Type 5 Equalizor.
R3—One Volume Control Clarostat.
R4—One Lynch 2 megohm grid leak.
R5, R8, R11—Three Lynch Type 4 Equalizors.
R6, R9, R12—Three Lynch .25 megohm coupling resistors.
R7, R10, R13—Three Lynch 2 megohm grid leaks.
S—One Carter filament switch.
Two knobs for rotors of vario couplers.
Four standard Benjamin sockets.
Five single Lynch equalizor mountings.
Seven Lynch resistor mountings, single.
Two Karas Micrometric dials.
One Vac-Shield.
A quantity of copper shielding 1/16 inch thick.
Nine Eby binding posts.
One 7 x 18 Bakelite panel.
One 7 x 17 Bakelite sub-panel.
Two Benjamin sub-panel brackets.

www.americanradiohistory.com

Grid Circuit Problems

Technical Editor

both as to voltage amplification and selectivity, we have chosen the tuned impedance method in the circuit described here. The complaint against this method is that it does not yield any selectivity. Ordinarily it is almost as broad as resistance or choke coil coupling. We must overcome this objection.

A parallel tuned impedance is a pure resistance in effect at the resonant frequency. But the effective resistance is very high. It is that fact which makes the amplification by this method so high. The more selective this parallel tuned circuit is, the higher the effective resistance and the higher the amplification.

Hence we want to make the effective selectivity of the tuned circuit as high as possible. Then we will gain both amplification and selectivity at the same time. How is it done?

Why Circuit Is Broad

When a parallel tuned circuit is connected in the plate circuit of a screen grid tube and to the grid circuit of a detector it seems to lose all its selectivity. Hence the tuning becomes broad and the selectivity very low. Why is that?

Because several resistances are connected in parallel with the tuned circuit, as was the case with resistance and impedance coupling. There are the plate resistance of the screen grid tube, the grid leak resistance and the grid filament resistance of the detector.

When many resistances are connected in paralel with a tuned circuit, even when each one of these is high, the total effective series resistance of the tuned circuit is high. The lower the resistance across the tuned circuit, the higher is the series resistance of that circuit, and it is the series resistance which determines the selectivity. It must be low for high selectivity as well as for high amplification.

It is important to distinguish carefully between the series resistance of a tuned circuit and the parallel resistance of the same circuit. The parallel resistance is measured across the tuning condenser and the inductance coil. The series resistance is measured in series with the two. When one is high the other is low, and vice versa. In each case the circuit is tuned to the frequency of measurement.

The Problem

The problem is to decrease the series resistance of the tuned circuit to increase as much as possible the parallel resistance. And there is only one practical way of doing it, and that is by regeneration. A tickler coil of generous proportions is coupled to the tuning coil, and the amount of feedback is adjusted until the effective resistance in the tuned circuit has been decreased to the required degree.

When the circuit breaks into oscillation the resistance has been reduced to zero. Just before that the amplification obtained from the screen grid tube is greatest, the selectivity is the highest and the detector is also the most effective. There is an all-around gain.

Now refer to the circuit diagram in Fig. 1. This involves all the principles discussed above. L3C4 is the tuned circuit in which the effective resistance is reduced to the vanishing point by the tickler coil L4. The amount of energy fed back to the tuned circuit can be adjusted with either the variable resistor R3 or with the tickler rotor. Only one of these variables need be put on the panel, preferably the tickler.

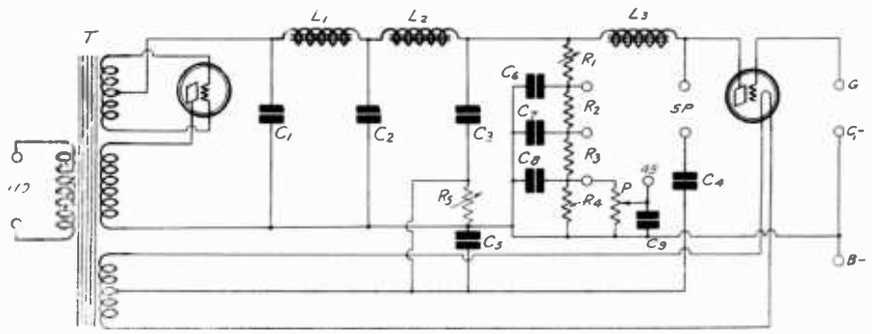


FIG. 2

THE SCHEMATIC DIAGRAM OF A POWER SUPPLY UNIT AND POWER AMPLIFIER ESPECIALLY DESIGNED TO MATCH THE RECEIVER OUTLINED IN FIG. 1. FIDELITY AND POWER CHARACTERIZE THIS AMPLIFIER

The selectivity of this circuit depends almost entirely on the setting of the tickler, as does the amplification. When the tickler is set so that the feedback is zero the volume is low and the selectivity negligible. And when the tickler is set so that the feedback nearly makes the circuit oscillate, both the sensitivity and the selectivity are very great.

Arrangement of Tickler Circuit

One side of the tickler coil is grounded so as to reduce any body capacity effects. The variable resistor is used as a rough adjustment of the current fed back and to make the tickler less critical. The condenser C6 is used to prevent any direct current from passing through the tickler, as well as to prevent the higher audio frequencies from escaping through the tickler circuit. Since this is one of the objects of the condenser its value should not be over .001 mfd. A condenser of .0005 mfd. will serve well.

The adjustment of the variable resistor depends on the type of detector tube that is used, on the value of the grid leak R4, on the grid, plate and filament voltages used on the detector tube and on the number of turns on the tickler. But it is not at all critical, since the tickler has a wide range.

With a -40 tube for detector, a condenser (C6) of .0005 mfd., a grid leak of 2 megohms and a tickler having about half as many turns as the tuning coil the value of R3 that seemed to give best results was 12,000 ohms.

Variocoupler Used

Coil L3 was the secondary of a variocoupler designed for a condensor of .00025 mfd. Hence C4 had that value. L4 was the rotor winding of that variocoupler.

The first tuned circuit, L1L2, C1 was identical with the second, except so far as differences were introduced by the stray values of inductance, capacity and resistance.

These tuned circuits are alike in construction. The condensers can be ganged because the setting of C4 depends to a considerable extent on the setting of the tickler circuit. The closer the coupling between L3 and L4, and the lower the value of R3, the higher is the apparent inductance of L3. Hence the tickling has a compensatory effect.

Stray Coupling Reduced

As a means of reducing stray coupling between the tuned circuits condensers C2 and C3 are used. They should be connected so that the leads are as short as practical in order that their effects be greatest. Each may have a value of .001 mfd. or larger. A buffer condenser having two .1 sections is also suitable, the middle tap being connected to ground.

A dotted square is shown around the first tuner and the screen grid tube. This is a shield to prevent capacity and inductive feed back through the air, particularly to protect the first tuner from the field of the second. This shield is quite necessary if the circuit is to be operated anywhere near its maximum sensitivity. And it is not sufficient to have a shield of thin metal. Copper sheeting at least 1-16 inch should be used.

It is also advisable to run the plate lead from the screen grid tube out of the shield by the shortest possible route, or else use shielded wire. The same applies to the lead running to the outer grid, although this is not quite so important.

Antenna Lead-In Shielded

It is also a good idea to shield the antenna lead-in near the set from the second tuner. This may require that the second tuner and the detector be included in a shield similar to that around the first tuner. The shielding should be grounded.

The resistors R1 and R2 have a total of

(Concluded on next page)

LIST OF PARTS

For the power supply and amplifier

T—One S-M 327 power transformer.
L1, L2—One S-M 331 Unichoke.
L3—One S-M 331 Unichoke or S-M 244 choke.
C1, C2—Two Tobe 2 mfd. 1,000 volt condensers, Type 602.
C3, C4—Two Tobe 4 mfd. condensers or larger of 1,000 volt rating, Type 604.
C5—Two Tobe 4 mfd. Type 204 condensers.
C6, C7, C8—Three Tobe 2 mfd. Type 302 condensers.
C9—One Tobe 1 mfd. Type 201 condenser.
P, R1—Two Centralab 25,000 ohm HP-025 heavy duty potentiometers.
R2, R3—Two Centralab 2000 ohm F-2000.
R4—One Centralab 3464 ohm FT-3464 fixed resistor.
R5—One Centralab 2,000 ohm Type PF-2000 potentiometer
Eight Eby binding posts.
Two Benjamin sockets.
One 7 x 18 sub-panel, wood or Bakelite.

www.americanradiohistory.com

(*Concluded from preceding page*)

20 ohms and are proportional so that R1 is 15 ohms and R2 5 ohms. The grid return is connected to the tap and this automatically gives the correct grid bias to the control grid on the screen grid tube. A six volt filament voltage source is assumed.

Resistors R5, R8 and R11 are suitable Amperites. If the detector and the two audio tubes of the -40 high mu type No. 1A Amperites are used.

Grid Circuit Detection

Grid circuit detection is used because this is more sensitive than plate circuit detection. 65 should be .00025 mfd. and R4 should be 2 megohms or more.

It may be that plate circuit detection is desired, since that will stand a greater input without overloading the detector. When that is used C5 may be increased to .001 mfd. The low end of R4 should then be connected to a suitable negative potential instead of to the positive end of the filament. The bias should be from 0 to 3 volts for plate voltages under 100 volts. Try different bias voltages.

Ch1 has a two-fold purpose. It forces the radio frequency currents in the plate circuit of the detector through the tickler circuit and it keeps them out of the audio amplifier it may be a 65 millihenry radio frequency choke coil. C7 is a .0005 mfd. condenser which aids the coil to function properly. It also serves to keep a certain amount of high frequency noise out of the loudspeaker.

Standard Audio Amplified

The audio amplifier used is a standard resistance coupled circuit, except that the last tube has been omitted. The stopping condensers C8, C9 and C10 may each have a value of .01 mfd. and they should be of the mica dielectric type. R6, R9 and R12 should be 250,000 ohms coupling resistors. R7, R10 and R13 may be tentatively put at 2 megohms each.

These values should be used unless motorboating results from the use of a poor B battery eliminator. If motorboating starts in the circuit R13 may be reduced considerably, say down to 100,000 ohms. Or in very bad cases of motorboating the secondary of an old audio transformer may have to be connected across the resistor. Motorboating will only occur when an unsuitable eliminator is used to drive the circuit. In most cases it can be stopped by the methods suggested above.

Grid bias detector affords another remedy for motorboating. Reduce the negative grid bias, for when it is too high there is more amplification than rectification, and this not only gives weak response, but is conductive to motorboating.

Problem of Volume Control

There is sensitivity in this receiver to throw away. The problem is not to bring in the signals from distant stations but to keep those of the locals from shaking the house down.

There is only one volume control shown in the circuit diagram. Another may be necessary in some locations. The controls shown is the variable coupling between the antenna coil and the first tuning coil. This may be turned so that no energy can pass from the antenna to the secondary, at least by induction. But there are other sources of pick-up which will give rise to a considerable volume, and this also must be kept within reasonable bounds. These stray sources may be kept sown by by-passing the leads to the batteries near the set and by shielding the entire receiver if necessary.

Power Tube External

In most cases an outdoor antenna will pick up too much. A small indoor antenna will be enough in nearly all cases. Even then in extreme cases a 30 to 60 ohm rheostat may have to be put in the positive leg of the filament of screen grid tube to control the volume.

The power tube has been omitted from the circuit diagram because it is assumed that this will be incorporated in the power supply unit. Binding posts have been provided for making the connections between the power tube and the output of the resistance coupled amplifier. G is connected to the grid of the power tube and C1- to the corresponding terminal on the power supply diagram, Fig. 2. This is the same as B- on the power pack.

B- on the circuit diagram is to be connected to the B- post on the power supply diagram. The C plus on Fig. 1 refers only to the grid bias battery for the last tube shown in that diagram. The negative of this battery is connected to C2-. The value of this bias would depend on the type of tube used. If a high mu tube it should be from 3 to 4½ volts. If a general purpose tube is used it should be from 4½ to 7½ volts.

The power tube incorporated in the power supply should be one of the -50 type, which will give an undistored output of nearly 5 watts. This is recommended because it is able to handle the high quality output of the resistance coupled amplifier without introducing any distortion.

High plate voltage is necessary to operate this tube to the best advantage, and therefore the power supply is designed so that it will deliver the necessary voltage and current.

The power transformer T should have two 7½ volts windings, one for the filament of the rectifier and another for that of the power tube. It should have also a high voltage winding for the plate of the half wave rectifier. A transformer such as the S-M 327 is suitable if the entire high voltage winding is used on the -81 type rectifier, or the S-M 328 may be used if it is desired to use full wave rectification and two -81 type tubes. Either of these transformers has two 7½ volts windings with adequate current carrying capacity.

The two choke coils L1 and L2 may be combined into a single unit such as the 331 Unichoke, which is an especially effective ripple remover, or any two heavy duty, 30 henry choke coils may be used. The rating of these chokes should be at least 125 milliamperes for continuous duty.

The loudspeaker output choke L3 should be a high inductance choke which will carry enough current for the -50 amplifier tube. That is, it should carry at least 60 milliamperes and the inductance should be high at that current value. About 30 henrys is a suitable inductance, but higher values may be used. Coils like the S-M 331 Unichoke or the S-M 244 are suitable for this purpose.

C1 should be at least 2mfd. C2 may have the same value. C3 should not be less than 4 mfd., and the larger the capacity of this condenser is the better the power pack will work. C4 also should be 4 mfd. or larger.

C5 should preferably be 8 mfd. or larger. But this condenser need not be rated to withstand as high voltage as the others since the highest voltage across it will never exceed 100 volts. Therefore money may be saved by using a condenser rated at 200 or 300 volts although the total capacity of it is 8 mfd. or more.

The voltage across C9 will never exceed 50 volts, hence that too may be one of low rating. Further, since its purpose is to by-pass radio frequency currents, 1 mfd. is ample.

When this power supply is used for the receiver shown at Fig. 1 only one of the voltage taps between 45 and the highest voltage will be used. Therefore C6 and C7 both may be connected to the tap used. thus taking advantage of the combined capacity. They should be connected to the tap which gives 135 volts. But if other voltages are desired the connection should be made as shown. Each of condensers C6, C7 and C8 should be a 2 mfd., although 1 mfd. will serve.

Note that the loudspeaker SP returns through condenser C4 to the midtap of the filament winding. This connection is used instead of one of the usual connections because it improves the operation of the circuit and minimizes distortion. It reduces the tendency of the circuit to motorboat on low frequencies and at the same time prevents the suppression of the low notes by resistor R5.

P is a 25,000 ohm potentiometer used for obtaining the correct voltage for the outer gird on the screen grid tube. Any voltage from zero to about 50 may be obtained, and 45 volts is about the correct value. P is connected in parallel with a fixed resistor of 3,464 ohms R4. The total resistance of these two resistors in parrellel is about 3,000 ohms. Centralab HP-025 potentiometer and FT-3464 resistor are suitable.

Each of R2 and R3 may be a 2,000 ohm fixed resistor such as Centralab F-2000.

R1 is made variable so that the intermediate voltages can be adjusted. A variable resistor having a range of 25,000 ohms is recommended, such as the Centralab HP-025 potentiometer. It should be used as a rheostat.

The grid bias for the power tube is derived from the voltage drop in R5, which should be a variable resistor having a total resistance of 2,000 ohms. The proper resistance to use with a -50 type tube depends somewhat on the plate voltage used but varies between 1200 and 1800 ohms. The higher plate voltages require the lower resistance value. For this circuit a value of about 1500 ohms is suitable, that is, ¾ of the 2,000 ohms resistor. A Centralab PF-2000 potentiometer used as a rheostat may be used.

Line Compensation Necessary AC Factor

The problem of compensating for line-voltage fluctuations is one now receiving careful consideration. In many cases the power transformer is provided with several primary taps, so as to make the necessary allowance for different line voltages. However, since it is inconvenient to change connections, some variable resistance means must be employed in the primary or input circuit.

A simple solution is a suitable variable resistor in the input or primary circuit. The resistance value must total several hundred ohms, in order to have a regulating effect in connection with the usual electrified receiver or radio power unit. When such primary resistance is employed, the lowest voltage tap on the transformer primary should be utilized, with the series resistance serving to reduce the input voltage to the desired point. The power clarostat with a 25-500 ohm range, provides a satisfactory line-voltage control when arranged as shown in the accompanying diagram.

Aside from compensating for line-voltage fluctuations, the primary resistance also serves as a group control for the radio receiver and amplifier. Instead of having to raise or lower the voltages of individual circuits supplied by socket power, it becomes possible to raise or lower all voltages in a single group. This is highly desirable, especially where circuits have been carefuly balanced and must be maintained in step.

www.americanradiohistory.com

Short Wave Range Great

By J. E. Anderson

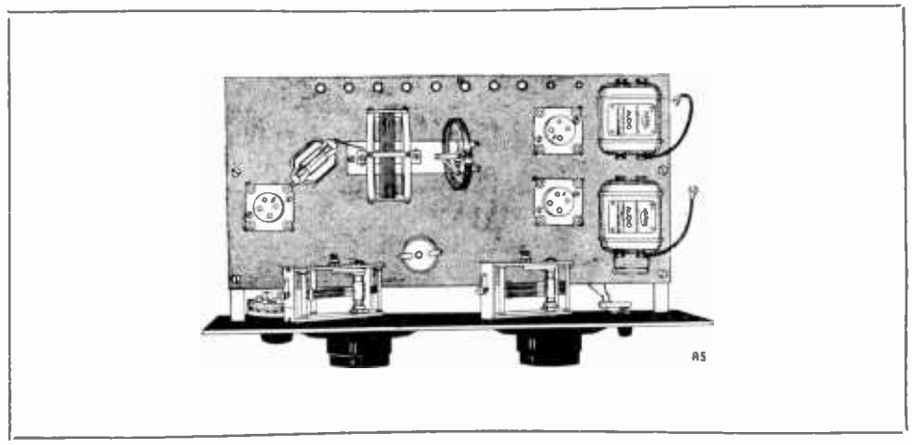
Technical Editor

THE Karas short wave set described in the March 31st, April 7th and 14th issues of RADIO WORLD was intended for great volume with good quality and therefore the second tube was a 112A and the third a —71A type tubes. But many prospective builders of the receiver have asked whether it is practical to use —01A type tubes throughout, as they are satisfied with moderate volume.

What changes are necessary in the circuit to adapt it to the use of —01A tubes throughout?

There are only a few minor changes necessary to effect the adaptation, and these concern the plate and grid voltages.

No change is necessary in the filament circuit, because the —01A tube takes the same filament current as the 112A and the —71A type tubes. The No. 112 Amperite designated R2 in the circuit diagram can be retained.



THE KARAS SHORT WAVE RECEIVER.

Plate Voltages Necessary

The plate voltage provided for the 112A tube in the original circuit was 90 volts. That voltage is also correct for a —01A tube, so no change is necessary there. But 180 volts provided for the —71A tube is too much for the —01A tube. The voltage should not be greater than 135 volts, and even 90 volts would be enough, provided that only a moderate loudspeaker volume was desired.

The grid bias required for the second tube (first audio) need not be changed, since the plate voltage remains the same and the amplification constant of the —01A is about the same as that of the 112A tube. The bias provided is 4½ and that is right.

But the grid bias intended for a power tube should be decreased for the —01A, since the plate voltage has been reduced considerably and also since the amplification constant of the —01A is much higher than that of the —71A tube. With 135 volts on the plate of the —01A tube the bias should be 7½ to 9 volts.

Output Filter Unnecessary

While no output filter is shown in the circuit diagram it was stated in the original article that one should be used when the last tube is a —71A and the plate voltage is 180 volts.

But when a —01A tube is used in the last stage with a plate voltage of 135 or less no output filter is necessary. In fact, it is better to omit it in that case, unless a suitable output transformer is used to match the impedance of the last tube to that of the speaker used. For most speakers not even an output transformer is necessary.

What range can be expected from a short wave set like the Karas? That question has been raised by many who are interested in the receiver. There is no definite answer to that because the question is entirely too indefinite. There are six coils in the set and there are six corresponding wavelength ranges. And in a general way there are also six corresponding reception ranges to be expected.

In addition to this, the reception range depends on the time of the day, and that dependence varies with the wavelength range. The daytime expectancy is not the same for 20 meters as it is for 40, nor 80, nor 200, nor 700 meters.

In the broadcast range the same reception range can be expected as for a similar receiver designed especially for broadcast reception. For the short wave ranges almost any reception range can be expected. Reception half way around the earth has been recorded on short waves. That of course does not mean that any given short wave station located from 5,000 to 12,000 miles away can be received at any time. It means that any station located at a great distance is as likely to pop in as one located closer.

Stations Nearby Far Away

The behavior of a short wave set appears to be very freakish, but experience with such a receiver will reduce the freakishness to regularity. That is, it will teach the operator when distant stations can be expected and on what wavelength range they can be expected at certain times of the day.

One of the short wave ranges stations within 500 miles usually cannot be expected unless they are closer than 10 to 50 miles. In fact it seems that stations actually far away are in the back yard and that stations around the corner are on the other side of the earth. It is this uncertainty about short waves which puts the greatest thrill into the work. And the uncertainty will last as long as the operator of the receiver is unfamiliar with the vagaries of short waves.

Many European stations are now operating on beam radio. Those operators of short wave sets located outside of the beams cannot expect to pick up the signals. But those who are inside the beam can pick them up easily with a short wave set.

Besides the beam telephone and telegraph stations there are many other short wave stations which are at the disposal of operators of a receiver capable of covering as wide a range as that of the Karas receiver.

To those interested in constructing the Karas Short Wave Set, which uses three tubes, with plug-in coils for the detector circuit, a complimentary blueprint will be sent on request. Address J. E. Anderson, Technical Editor, Radio World, 145 West 45th Street, New York, N. Y.

High Current Chokes Need Special Design

By John F. Rider

The development of high current A, B, C power packs and B eliminators for use with 400 mil rectifying tubes and full wave rectifying systems utilizing type 281 tubes, makes necessary certain design considerations which were not so important with the now obsolete 50 and 60 mil rectifying tubes.

These considerations either "make" or "break" a choke, that is to say, it is the difference between a good and a bad choke. "The average person," says an engineer of a transformer manufacturer, "interested in radio, is familiar with a filter choke as being a winding on a steel core, the core being in the form of a square. This assumption is correct, but for one point, the airgap in the core. The function of the airgap is to prevent the saturation of the core by the magnetic flux created by the direct current flow through the choke windings. An excessive gap will reduce the required inductance of the choke and an insufficient gap will reduce the filtering action of the choke by causing saturation and harmonics.

"With small values of DC flow, this gap is not of great importance, since the amount of core used in the average choke is usually sufficient to perform satisfactorily with the small value DC in the windings. But when 100, 200 or 400 mils are flowing through the windings, it is extremely important that the correct airgap be incorporated in the electrical design. The result of an insufficient airgap and excessive current flow is a 'hum' in the eliminator output due to reduced action of the filter system and consequently greater AC ripple in the voltage fed to the plates of the tubes. One can readily comprehend that real scientific design is necessary to produce an efficient 100, 200 or 400 milliampere choke."

It is important to have good chokes.

www.americanradiohistory.com

A THOUGHT FOR THE WEEK

IF the Federal Radio Commission will so distribute power, wavelengths and time on the air, to enable all of us to get the stations we want, without interference, we'll buy five roses and appoint General Harbord to pin one on the manly breast of each commissioner.

RADIO WORLD

The First and Only National Radio Weekly

Radio World's Slogan: "A radio set for every home."

TELEPHONES: BRYANT 0558, 0559
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
FROM PUBLICATION OFFICE
HENNESSY RADIO PUBLICATIONS CORPORATION
145 WEST 45TH STREET, NEW YORK, N. Y.
(Just east of Broadway)
ROLAND BURKE HENNESSY, President
M. B. HENNESSY, Vice-President
HERMAN BERNARD, Secretary
Chicago: 55 West Jackson Blvd.
Kansas City, Mo.; E. A. Samuelson, 300 Coca Cola Bldg.
Los Angeles: Lloyd Chappel, 611 S. Coronado St.
European Representatives: The International News Co.
Breams Bldgs., Chancery Lane, London, Eng.
Paris, France: Brentano's, 8 Avenue de l'Opera

EDITOR, Roland Burke Hennessy
MANAGING EDITOR, Herman Bernard
TECHNICAL EDITOR, J. E. Anderson
ART EDITOR, Anthony Sodaro
CONTRIBUTING EDITORS:
James H. Carroll, John Murray Barron and
Capt. Peter V. O'Rourke

SUBSCRIPTION RATES

Fifteen cents a copy.. $6.00 a year. $3.00 for six months. $1.50 for three months. Add $1.00 a year extra for foreign postage Canada, 50 cents.

Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order, is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address; also state whether subscription is new or a renewal

ADVERTISING RATES

General Advertising

1 Page, 7½" x 11"	462 lines	$300.00
½ Page, 7½" x 5½"	231 lines	150.00
½ Page, 3½" D. C.	231 lines	150.00
¼ Page, 4½" D. C.	115 lines	75.00
¼ Page, 4½" S. C.	57 lines	37.50
1 Column, 2¼" x 11"	154 lines	100.00
1 Inch		10.00
Per Agate Line		.75

Time Discount

52 consecutive issues	20%
26 times consecutively or E. O. W. one year	15%
13 times consecutively or E. O. W.	12½%
4 consecutive issues	10%

WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum 10 words. Cash with order. Business Opportunities, ten cents per word. $1.00 minimum.

Entered as second-class matter March 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Proposed Wavelengths For Army and Navy Asked

Washington.

The Secretary of Commerce, Herbert Hoover, stated that he had approved the report of the Inter-Departmental Radio Advisory Committee, which has been transmitted to President Coolidge, making certain recommendations relative to short wavelengths for the Government, including the Army and Navy.

The Radio Act of 1927 contained a provision to the effect that the President shall allocate to the Army and Navy and the various Government agencies, wavelengths for their use.

Set-Builders' Club "for Experts Only"

THOSE who have filled out and sent in questionnaires, like the one reprinted herewith in an attempt to get a custom set-builders club started, want the membership requirements to be such that the good name of the club will not be imperilled by poor workmanship of any member.

All hands seem to agree that all ranking members should possess skill at custom set building, although some propose that the memberships be in two or more classes, so that a Grade A member would be an expert, a Grade B member one now acquiring the knowledge and experience that spell expertness, and a Grade C member a novice desirous of moving up in the ranks.

Those proposing such gradation are comparatively few. The overwhelming sentiment is for one class only—a duly qualified expert.

Dues Favored

In line with this, many suggest that, once a person is admitted to membership, he be given a membership card and also an engraved membership certificate, like a diploma, well worth framing.

All who have mentioned dues favor such an idea, the general trend being toward $5 to $10 a year. One suggestion was that dues be $10 a year, made in two payments, one at the beginning, the other at the end of the radio season.

Healthy warnings have been received, as well. One writer wanted all precautions taken that the club would give members their full money's worth, in service and data, and that the movement should not degenerate into some mere outlet for favored manufacturers or become the medium for attaining some other selfish motive.

Best Intentions Prevail

It is well to receive such warning, as it shows real thought. On the other hand, the only object all along has been to unite custom set builders for their own benefit and protection, and to give them the driving strength of organized effort.

One of the subjects often discussed in letters I receive is discounts. Quite a few have written that they buy parts from catalogue houses and would like to have the club furnish the parts, if prompt deliveries could be assured.

An analysis is being made of the various kinds of service the club could render to its members, and this will be published soon. Also candidates' examination papers are being prepared, as well as proposed membership blanks.—McCord.

TUBE BOOK OFFERED

"How to Take Care of Your Radio Tubes," a very complete booklet giving much valuable information, is now off the press and may be obtained by readers of RADIO WORLD by addressing Sonatron Tube Company, 108 W. Lake St., Chicago, Ill.

Cut out, fill out and mail questionnaire to Radio World, 145 West 45th Street, New York, N. Y., Attention Mr. McCord.

(1) Your name .....
Address .....
City .....State .....
(2) How old are you? .....
(3) Are you a citizen of the United States?....
(4) If not, of what country? .....
(5) Do you make custom radio sets as your exclusive means of livelihood? .....
(6) If not, do you make custom radio sets for hire as a side line? .....
(7) How long have you been making custom radio sets?..... .....
(8) How many have you made?.....
(9) If you do not make them for pay, do you make them for others without charge for labor? .....
(10) Do you make radio sets exclusively for your own use and enjoyment?.....
(11 From whom do you buy your parts?.....
.....
(12 Are you an annual mail subscriber for any radio magazines? .....
(13) If so, state which.....
(14) If not, do you regularly buy radio magazines at news-stands? .....
(15) If so, state which.....
(16) How did you obtain your radio knowledge?
.....
(17) How much did you spend last year (1927) on parts? .....
(18) From what institutions of learning were you graduated? Include public school, high school, college, with addresses
.....
.....
(19) Do you favor incorporation of the prospective custom set builders club? .....
(20) Do you favor co-operative buying by the club for its members? .....
(21) Do you favor local branches of such a club, in addition to the central organization?...
(22) What dues, if any, do you think should be charged? .....
(23) Do you favor the club maintaining a central laboratory for the benefit of its members?
.....
(24) And sending out confidential circuits, tube and other data, including blueprints?.....
(25) What circuits, if any, have you specialized in? .....
(26) How many customers have you? .....
(27) Do you sell factory-made sets? .....
(28) If so, state which .....
(29) Do you service sets other than those of your manufacture? .....
(30) Do you accept time payments for sets you make? .....
(31) If so, does anybody discount this paper for you? .....
(32) What is your gross income per year from custom set building? .....
(33) Net income from same? .....
(34) Give two references as to your character.
Name of reference.....
Address .....
Name of reference.....
Address .....
(35) Is your set building business in your home?
.....or have you a separate place of business?.....
(36) What name do you prefer for organization?
.....

www.americanradiohistory.com

CLUB ENTHUSIASTS

Here are a few more names of persons who signified they are interested in joining the proposed custom set builders club:

M. S. Buyser, 727 53rd St., Brooklyn, N. Y.
L. L. Lowe, 3312 Taylor St., East Chattanooga, Tenn.
Fred W. Pace, 3931 3rd Ave., Detroit, Mich.
William Claffy, 2624 North Jessup St., Philadelphia, Pa.
Chandler L. Kletz, 313 Easy St., McComb, Miss.
C. C. Easley, 3711 Fillmore St., San Francisco, Calif.
D. D. Austin, 821 Elm St., Albany, Oregon
B. L. Helfer, 199 15th, Wheeling, W. Va.
Albert L. Lee, 512 Jersey St., New Brighton, S. I., N. Y.
John De Castro, 53 W. 114th St., New York City
John F. Barry, Box 18 377 Main St., White Plains, N. Y.
J. C. Levering, 321 Madison St., Frederic, Md.
Fred J. Haskell, 113 So. Park Ave., Waukegan, Ill.
Louis Loerzel, 135 Davies Ave., Dumont, N. J.
Alonzo B. Coles. 141 W. 98th St., New York City
H. A. Sadler, 14416 Troester Ave., Detroit, Mich.
H. L. Wilson, 239 Goodman St., Cincinnati, Ohio.
Edgar Uhrig, 30 Church St., Keyport, N. J.
Roy S. Merrill, Morgan Hill, Calif.
G. M. DeRose, Box 1116, Roseburg. Oregon
J. S. Eagler, 159 Pennebaker Ave., Lewistown, Pa.
Joseph Hunter, 143 Carolina Ave., Irvington, N. J.
Frank Schorn, 172 South St., Jersey City, N. J.
Basil F. Ramey, 2266 E. 103rd St., Cleveland, Ohio
W. H. Farrin, 701 Somerville Ave., Somerville, Mass.
W. B. Bolton, 154 Westmoreland St., Riverside, Calif.
W. F. Purnell, 1512 W. 22nd St.. Oklamoha City, Okla.
R. A. Holmes, 5802 36th Ave., Kenosha, Wis.
Frank Gossett, 524½ So. Main St., Independence, Mo.
George J. Sanborn, 38 Fred St., Lowell, Mass.
F. H. Webster, Marvell, Arkansas.
Chester A. Lane, 1407 9th St., Altoona, Pa.
Howard L. Pelham, 12 Pleasant St., New Haven. Conn.
George E. Mutterer, 261 Webster Ave., Jersey City, N. J.
William Beckett. 403 Elm St., Camden, N. J.
C. M. Rogers, 1216 Maywood Ave., Peoria. Ill.
L. A. Roberts, Brewerton Rd., Syracuse, N. Y.
Wm. D. Belyea, 119 Endicott St., Lowell, Mass.
Paul E. Roberts, 320 Varnum Ave., Lowell, Mass.
Isaac N. Woodward, 408 W. Somerville Ave., Philadelphia, Pa.
Ben Rose, 725 Guarantee Title Bldg., Cleveland, Ohio.
Joseph D. Copeland, 85 Main St., S. Portland, Maine.
E. J. Boyd, Box 137, Beaver Falls, Penn.
John J. Haas, 3522 Vliet St., Milwaukee, Wis.
A. W. Oelmann, Jr., 1825 Poplar Grove St., Baltimore, Md.
Morgan J. O'Leary, 232 Sherman Ave., New York City.
Horace V. Houyoux, Franklin. New Jersey.
James E. Brown, 302 N. 35th St., Louisville, Ky.
C. W. Lau, Box 249, Winter Garden, Fla.
Jack Hultgreen, 4123 W. North Ave., Chicago, Ill.
Louis J. Vernees, 384 13th St., Brooklyn, N. Y.
Chas. E. Dutton, Arkansas Pass, Texas.
A. J. Mossop, Dalton, Ohio.
C. J. Gerlach. 410 Heath St., Logansport, Ind.
H. M. Johnson, 12 Great Lakes Ave., W., River Rouge, Mich.
A. E. Stewart. 205 Monroe St.. Clebourine, Texas.
J. R. Chandler, Arcade Box 1004, Los Angeles, Calif.
C. E. Dicks, Hinckley, Minn.
J. L. Bohon, R. 7, Sedalice, Mo.
H. Hanson. Vermillear, S. Dak.
Edgar A. Keller, 322 Austin St.. Toledo, Ohio.
Noel J. Lawson, 1202 Third Ave.. S. W., Aberdeen, S. Dak.
Earl Smith, 116 Lisbon Ave., Buffalo, N. Y.
Chas. E. Hayden, 44 Carmichael, Amsterdam, N. Y.
Henry C. Jensen, 249 Robbins St., Waltham, Mass.
D. E. Lake, 254 Catawissa Ave., Sunbury, Pa.
John W. Rodgers, 3718 Kate Ave., Baltimore. Md.
D. D. Bartholomew, 221 S. Third Ave., Bozeman, Mont.
K. C. Rogers, Jr., 1035 Broadway, Beaumont, Texas.
L. E. Johnson, 307 S. 6th St.. Steubenville, Ohio.
Lawrence Chaput. 431 S. Main St., Springfield, Mass.
Earl L. Burt, Box 12, Russell, Minn.
B. C. Eddy, Soldiers Home, c-o Treasury Office, Calif.
M. S. Buyser, 727 53rd St., Brooklyn, N. Y.
William J. Snerl, 9205 Brush Place, Rockaway Beach, N. Y.
Edwin W. Melvin, Havre De Grace, Md.
Oliver E. Willis, 227 Audubon Ave., New York City.
L. R. Price, 408 10th Ave., Haddon Heights, N. J.
Carl C. Johnson, Fort Myers, Florida.
Hugh Orr, 39 Highland Terrace, Brockton, Mass.
David S. Jackson. 107 Plane St., Newark, N. J.
Elgin Aubrey, 590 Danforth Ave., Toronto, Ont., Canada.
Wm. G Cave, Jr., 2704 Pacific Ave., Wildwood, New Jersey.
Edward Evans, 3230 Broadway, New York, N. Y.
Edward L. Becker, 206 Broadway, Blue Island, Ill.
Chas. W. Secord, 1699 69th Avenue Place, Oakland. Calif.
Earl C. Abbot, 187 Brown St., Waltham, Mass.
H. E. Thomas, 4245 Hollis St., Emeryvile, Calif.

Radio Engineers Submit Wave Plan

(*Concluded from page* 5)

tion in daytime in frequency allocation may be permissible.

It is suggested that the nomenclature as proposed by the Commission regarding national, regional and local classifications of channels and stations be changed to the former Department of Commerce nomenclature, which referred to the channels and stations of these types as Classes C. B and A, respectively, since the names are substantially descriptive of the interfering effect of the stations and may therefore be misleading.

Interconnection Necessary

In the matter of normal power for each class of station, it is the (Institute) Board of Direction's suggestion that it is to be noted that, in order to cover large areas of the United States, with particular reference to rural districts, it is necessary to interconnect very large groups of powerful stations, including even Class C stations.

Normal power of Class A stations should not exceed 250 watts. The normal power of Class B stations should be from 300 to 1,000 watts inclusive. The normal power of Class C stations should be from 5,000 to 50,000 watts, with a provision that as soon as practicable these limits be raised (in the Class C rating), with due regard to limitations imposed by local interference and interference with neighboring channels in then current receivers.

The Three Classes

It is suggested that in each class the following number of channels may be used and the following time divisions should be required:

Class A. Number of channels, 4; number of assignments per channel, 50; number of full-time assignments, 200.

Class B. Number of channels, 36; number of assignments per channel, 2½; number of full-time assignments, 90.

Class C. Number of channels, 50; number of assignments per channel, 1; number of full-time assignments, 50.

Time division is undesirable in that it increases the cost of operation. For this reason it is felt it should be minimized to the greatest extent compatible with other requirements.

Technical Requirements

The Board suggests that stations of each class should be required to meet the following technical requirements:

Maintenance of frequency. The present requirements of 500 cycles if adhered to is sufficient to prevent station from wandering outside their channel assignments.

The way in which further improvement in frequency control can be of benefit is in the elimination of beat note interference between stations simultaneously occupying the same channel. To do this requires a frequency stability of the order of plus or minus 25 cycles.

Synchronization on Way

It may reasonably be anticipated that technical methods for obtaining such stability will be available in about two or three years or perhaps less. It is suggested that when such equipment becomes readily and commercially available the requirement be made plus or minus 30 cycles.

It is doubtful that any requirement between this value and the present value would be of sufficient beneficial effect to warrant its use as an interim measure.

Harmonics should be eliminated in so far as the state of the art permits.

It is of best interest to the broadcaster to use the highest degree of modulation consistent with good quality.

Literature Wanted

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

RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature.

Name .....

Address .....

City or town .....

State .....

Radio Hospital, 1337 Aisquith St., Baltimore, Md.
Rolf Sundby, Rio, Wis.
Richard Schumeyer, 69-13 44th Ave., Winfield, L. I., N. Y.
R. Williams, 9 Ardsley Rd., Glen Ridge, N. J.
R. F. Lambert Co., 1524 Clairmont Ave., Detroit, Mich.
I. E. Sweazey, 31 Mariners Place, Plainfield, N. J.
Lew Alberts, 87 Sands St., Brooklyn, N. Y.
Ira E. La Londe, 318 Murray Ave., Va. Highlands, Alexandria, Va.
Lawrence Fludd, 39 E. 2nd St., Chester, Pa.
Barnet Lieberman, 167 17th St., Brooklyn, N. Y.
W. J. Sanchez, 1318 N. Lopez St., New Orleans, La.
Frederick L. Norton, 42 Kirkham Ave., East Haven, Conn. P. O. Box 6
Edward Biehl, 7131 Schoyer Ave., Swissvale, Pa.
True Fit Optical Co., 325 Eagle Building, Spokane, Wash.
Fred W. Pace, 3931 3rd, Detroit, Mich.
Hiland Radio Co., 1034 Blendan Place, St. Louis, Mo.
Benjamin Smitt, 57 Prospect St., New Bedford, Mass.
Albert B. Oden, 618½ Gaines, Davenport, Iowa.
Thos. Teigen, 309 6th St. N. W., Minot, N. D.
H. S. Miller, P. O. Box 235, Spindale, N. C.
William Benner, 62 Rosary Ave., Lackawanna, N. Y.
E. J. Smalley, RD 50, New Canaan, Conn.
Wilbur Gumtow, 1001 27th Ave., Milwaukee, Wisc.
Gilbert Schmidt, 924 67th Ave., West Allis, Wisc.
H. B. Couch, 109 West Sixth Ave., Topeka, Kansas.
Bernard Holeney, 476 Berkeley Rd., Columbus, Ohio.
L. Stasko, 33 Union St., Ecorse, Mich.
Anthony DelleRose, 2132 So. Beechwood St., Philadelphia, Pa.
George T. Kitson, 230 Crowley Ave., Buffalo, N. Y.
Geo. E. Rawson, 3068 S. 34th St., Omaha, Nebraska.
Don Rosenbalm, 411 Kickapoo St., Hiawatha, Kansas.
M. C. McKay, 434 29th Ave., San Francisco, Calif.
N. A. Miller, Home Radio Shop, Huron, S. D.
A. P. Coffrin, 814 So. 55th St., Philadelphia, Pa.
P. S. Fancher, 6115 Trumbull Ave., Detroit, Mich.
M. B. Lamont, R. D. No. 6, Warren, Ohio.
Harry Kirmond, Empire Building, Marysville, Calif.
Julio E. Gianella, P. O. Box 1127, Lima, Peru, S. A.
Wm. D. Kelly. 303 E. 28th St., Baltimore, Maryland.
A. D. Moore, 428 Oakview Road, Decatur, Ga.
Wm. O'Brien, 933 Willow Ave., Hoboken, N. J.
W. L. Patterson, Box 115, Brookhaven, Ga.
But. Williams, 329 42nd St., Brooklyn, N. Y.
Elton Anderson, 1016 E. 11th St., Erie, Pa.
Wm. E. Elkins Box 204, Balboa Beach, Calif.
W. W. Warren, 45 Wells St., Hartford, Conn.

I. E. Robinson Elected Commission's Chairman

Washington.

The Federal Radio Commission selected Ira E. Robinson, of Grafton, W. Va., recently appointed by President Coolidge to be a member of the Commission, as chairman of that body.

He succeeds E. O. Sykes, of Mississippi, who has been acting chairman since the death of Rear Admiral W. H. G. Bullard, and who will now continue as vice-chairman.

www.americanradiohistory.com

KARAS 3 TUBE SHORT WAVE KIT!

—it's a marvel!

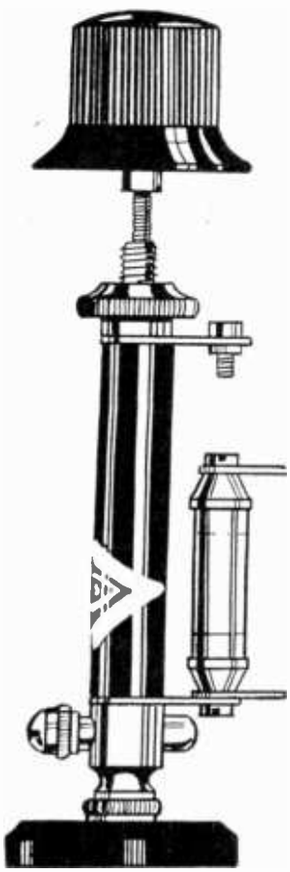
Reached half way round the world! Uses famous Karas Micrometric dials and Karas Orthometric variable condensers! Gets marvelous results! Get the complete kit at your dealers or write us direct.

Cost of Complete Kit, $58.95

KARAS ELECTRIC CO.
4039 DC, N. Rockwell St., Chicago

BRETWOOD

Variable Grid Leak
De Luxe Model



BETTER BY FAR, than any fixed leak in the detector circuit is the Bretwood Variable Grid Leak.

DON'T SEND A SOLITARY CENT!

The Bretwood Leak may be baseboard or panel mounted. Works the same in any position. No fluid used.

Guaranty Radio Goods Co.,
145 West 45th Street, N. Y. City

Please mail me at once one New and Improved 1928 Model De Luxe Bretwood Variable Grid Leak with one Bretwood Bullet Condenser attached, for which I will pay the postman $2.25 on receipt. Both must be the genuine Bretwood articles, imported from England.

Name .....

Street Address .....

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

RECENT ISSUES of Radio World, 15c each. Be sure to give date of issue when writing. Radio World, 145 West 45th Street, New York City.

Radio University

I HAVE a 2 ampere Tungar battery charger. I have tried to use this directly as a filament current supply but found that the circuit hums a great deal. Is there a filter available which can be used to take out the hum?

(2)—Please outline the requirements of such a filter if one is practical.

(3)—I have built a five tube screen grid Diamond of the Air. Will the Tungar rectifier supply enough filtered filament current for this circuit?

FRITZ SCHWARTZ,
St. Louis, Mo.

(1)—Yes, there is a filter suitable for this purpose.

(2)—An electrolytic condenser having a capacity of about 3,500 mfd. and a choke coil wound with heavy wire will be required. The wire should be about No. 18 DCC and the inductance of the choke about 5 henrys at full load. The coil should have a large core of silicon steel.

(3)—Yes.

THE AEROVOX "Research Worker"

is a free monthly folder which will keep you abreast of the latest developments in Radio.

Your name will be placed on the mailing list on request.

AEROVOX WIRELESS CORP.
72 Washington Street Brooklyn, N. Y.

You Need

"Vac-Shield"

for the New 222 Shield Grid Tube to Stabilize Your Set

THE invention of these **non-magnetic** shields for Type 201-A or the new Type 222 Tubes prevents inter-stage coupling and electro-static effects, overcoming stray capacities that make tuning of distant stations so difficult. Just the thing to stabilize short-wave set, too.

Attached in a minute. Order today by mail, C. O. D., $1.00

ORANGE RESEARCH LABORATORIES
247-249 McKinley Avenue
East Orange, N. J.

WHAT IS THE BEST intermediate frequency for a Super-Heterodyne receiver?

(2)—I have an 8-tube Super which gives good satisfaction as to sensitivity but it is not selective enough. It squeals a great deal and sometimes it brings in two stations at the same time. What is the cause and what can be done to remedy the trouble?

(3)—Is it practical to make a one-dial Super? If so, how can it be done?

(4)—Will you please recommend a B battery eliminator which will drive an 8-tube Super properly?

THOMAS McRAE,
Boston, Mass.

(1)—There is no best frequency for the intermediate amplifier. But it should be higher than 45 kc and not higher than about 200 kc.

(2)—The cause of the squealing is the reception of two stations at the same time due to inadequate tuning before the first detector. Another RF tube and another sharp tuner will abate the squealing nuisance.

(3)—It is not practical.

(4)—Any B battery eliminator which will deliver 60 milliamperes or more and at the same time will maintain the specified voltages on the plates of all the tubes in the circuit.

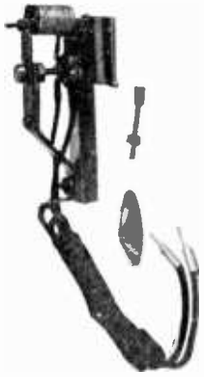
* * *

I HAVE NOTICED in some circuits that the by-pass condenser in the plate

ENSCO WINNERS

BEST FOR YOUR

AIRPLANE SPEAKER



THE FAMOUS
ENSCO DIRECT DRIVE UNIT $9.00

Real Low Notes—not artificial echoes. No hollow tones—but actual reproduction. Matches all power tubes—stands highest power. Sold on money-back guarantee—Easy to mount, space saving. Thumb-lever adjustment. Order at once!

RADIO'S GREATEST TRIUMPH ENSCO PIANO UNIT

Makes the finest loud speaker of your piano—Attached instantly. Does not show or mar thumb-lever adjustment. **$10.**

Money Back on either Unit if you are not satisfied that tone is finest you ever heard.

On demonstration at all ENSCO Studios. Mail and telegraph orders filled. Make checks and money-orders payable to Engineers Service Co. Order at once from nearest office. Approved by RADIO WORLD Labs.

ENGINEERS' SERVICE CO.
28 E. Jackson Blvd., Chicago, Ill.
Main Office: 25 Church Street, New York City

FILL OUT AND MAIL NOW
SUBSCRIPTION BLANK

RADIO WORLD

RADIO WORLD *145 West 45th Street, New York City (Just East of Broadway)*

Please send me RADIO WORLD for .....months, for which please find enclosed .....

SUBSCRIPTION RATES:
Single Copy .....$ .15
Three Months 1.50
Six Months 3.00
One Year, 52 Issues..... 6.00
Add $1.00 a Year for Foreign Postage; 50c for Canadian Postage.

www.americanradiohistory.com

circuit of the detector is connected from the plate to ground, in others from the low potential side of the tickler to ground and in still others directly across the first audio frequency transformer. Which is the best method?

(2)—What size should the by-pass condenser be in an ordinary broadcast receiver? Values recommended vary from .0001 to .005 mfd. in different circuits.

OMER DAHLIN,
Minneapolis, Minn.

(1)—The best position for the by-pass condenser is from the low potential side of the tickler coil to ground. It should never be connected from the plate of the detector to ground unless there is no tickler in the detector. Across the primary of the audio frequency transformer is a fair position, but it is better to connect the low side to ground than to plus 45 volts.

(2)—The most satisfactory size as a rule is .0005 mfd. A .001 mfd. or larger will give somewhat greater volume but it will also suppress the higher audio notes. A .005 mfd. is much too large and a .0001 mfd. is much too small.

* * *

I HAVE BUILT a Super-Heterodyne but I am not getting the results that I expected. The set is noisy and the sensitivity is very poor. I am using a B battery eliminator and I know that is O.K., for it worked fine on a four tube Diamond of the Air. Can you tell me what is wrong with the set?

MANUEL HERNANDEZ,
Oakland, Calif.

The B battery eliminator is at fault. It may be all right for the four tube Diamond but it does not deliver enough current for the other. Get an eliminator which will deliver at least 60 milliamperes at the voltages required for the Super-Heterodyne.

NATIONAL

Single Dial Tuning-Unit—Type 222

Made expressly for experimentation with the new 4 electrode UX 222 tube. The newly designed transformer and variable induction antenna coil, NATIONAL Equitune Condensers and New NATIONAL Velvet Vernier Type F Single Drum Dial are mounted on rigid light aluminum girders that preserve the alignment. The unit is very easy to install and to use.

Volney D. Hurd, of the Christian Science Monitor, reports that on a test of this Type 222 Tuning Unit, at Malden, Mass., **Chicago stations came in like locals on a 5-foot antenna.** This means a DX-getting rating, under favorable conditions, of 200 miles per foot of antenna.
List Price, Type 222, $25.00
Two other types available.
Send for Bulletin 121-W.

NATIONAL TUNING UNITS STANDARD WITH THE EXPERIMENTER SINCE 1924

NATIONAL COMPANY, INC. : MALDEN, MASS.
W. A. READY, Pres. Sherman, Abbot, Jackson Streets

BIG DISCOUNTS TO SET BUILDERS

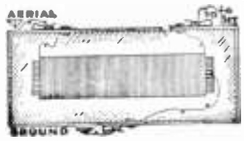
LIFETIME OPPORTUNITY for Making Money! Get our new big catalog; see the bargains in standard radio parts, sets, kits at rockbottom wholesale prices. Huge stocks ready for quick shipment. Big profits for you. Wonderful special offers. Write for FREE copy. Barawik Co., Dept. 904, Chicago

LYNCH

Resistors for receiving, transmitting, and power supply work.
ARTHUR H. LYNCH, Inc.
1775 Broadway N. Y. C

OLD MAN STATIC "KILLED" AT LAST

Kilostat is a new unit that "traps" the crash and howls of static and "grounds" it outside your set. Improves tone and selectivity, too.



Connect Kilostat to your aerial and "tune out" disturbing elements. Easily attached to any set. Any radio fan can now obtain this marvelous unit for only one dollar, on 10-days' trial. Send name to 20th Century Radio Co., 1108 Coca Cola Bldg., Kansas City, Mo., and Kilostat will be sent by c.o.d. mail. Dollar returned if it does not improve reception fifty per cent So write today.

Subscribers: Look at the Expiration Date on Your Wrapper

We do not like to take your name from our subscription list without specific instruction to do so because many of our readers wish to keep a complete file of the paper.

Please, therefore, look at the subscription date stamped on your last wrapper, and if that date is earlier than the issue contained in the wrapper, please send check to cover your renewal.

In this way you will get your copies without interruption.

Subscription Dept., RADIO WORLD, 145 West 45th Street, New York City.

WAVE TRAP, $1.50

Genuine Moulded Bakelite Casing, panel or sub-panel mounting option, or placement atop of cabinet, mark this new model wave trap that cuts out interference. Send check, P. O. money order, or postage stamps.

Five-day money-back guaranty
Guaranty Radio Goods Co.
145 West 45th St., N. Y. City

Quick Action Classified Ads

Radio World's Speedy Medium for Enterprise and Sales

10 cents a word — 10 words minimum — Cash with Order

MEN—BIG PAY working romantic South America. Fare, expenses paid. South American Service Bureau, 14,600 Alma, Detroit, Mich.

EVERY FRIDAY at 5.40 P. M. (Eastern Standard Time) Herman Bernard, managing editor of Radio World, broadcasts from WGBS, the Gimbel Bros. station in New York, discussing radio topics.

GUARANTEED Safety Razor, with strop, in neat, strong carrying case, 25 cents. First-class, new. Send coin, M. O. or stamps.—P. Cohen, 236 Varet Street, Brooklyn, N. Y.

NEW SHIELDED GRID TUBES for Diamond, S-M Six or Laboratory Super, Tyrman 70. Price $5 each. Philip Cohen, 236 Varet St., Brooklyn, N. Y.

MAGNAVOX M7 cone speaker, List $15, A1 condition, used two weeks. Fine tone. Price, including baffle, $9. Send M. O. on 5-day money back guarantee. I. Andersen, 118 Goodrich St., Astoria, N. Y. City.

BE THE LICENSED RADIO DOCTOR in your community. $7-$10 spare time evenings. Our co-operative plan secures all the work you want. Secure franchised territory now. Write for booklet. **Co-operative Radio Doctors, Dept. W, 131 Essex St., Salem. Mass.**

THE A C KARAS EQUAMATIC—Full description, analytical article, in Feb. 11th and 18th issues. Send 30c for these isues and get free blueprint. Radio World, 145 West 45th St., N. Y. City.

RADIO SETS built to order. Sets repaired. Superhets a specialty. Sweeney Radio Shop, Dept. RW, Pearsall, Texas.

LARGE MANUFACTURER of popular priced Radio Cabinets wants representatives selling radio dealers. Models listing at $13 and up. Well made in large modern plant. Quantity sellers. Straight commission basis. For full details, address Drawer RW 10, Boonville, N. Y.

CUSTOM SETS BUILT. Sets repaired at a reasonable cost. Kits assembled. Rufus Jones, Jr., 1525 No. 15th Street, Birmingham, Alabama.

"RADIO THEORY AND OPERATING," by Mary Texanna Loomis, member Institute of Radio Engineers, Lecturer on radio, Loomis Radio College. Thorough text and reference book; 886 pages, 700 illustrations. Price $3.50, postage paid. Used by Radio Schools, Technical Colleges, Universities, Dept. of Commerce, Gov't Schools and Engineers. At bookdealers, or sent on receipt check or money order. Loomis Publishing Company, Dept. RW, 405 9th St., Washington, D. C.

GUARANTEED Safety Razor, with strop, in neat, strong carrying case, 25 cents. First-class, new. Send coin, M. O. or stamps.—P. Cohen, 236 Varet Street, Brooklyn, N. Y.

RECENT ISSUES of Radio World, 15c each. Be sure to give date of issue when writing. Radio World, 145 West 45th Street, New York City.

www.americanradiohistory.com

"DOUBLE R" METERS

Our Complete Catalogue of Meters is Contained in This Advertisement

POCKET AMMETER

No. 1—For testing dry cells, 0-40 ampere DC scale pocket meter $1.50

POCKET AND PORTABLE VOLTMETERS

No. 8—For testing A batteries, dry or storage, 0-8 volts DC scale.....$1.65
No. 10—For testing A batteries, dry or storage, 0-10 volts DC scale..... 1.65
No. 13—For testing A batteries, dry or storage, 0-16 volts DC scale..... 1.65
No. 50—For testing B batteries, dry or storage, but not for B eliminators, 0-50 volts DC scale 1.65
No. 39—For testing B batteries, dry or storage, but not for B eliminators, 0-100 volts DC scale 1.85
No. 40—For testing A and B batteries, dry or storage, but not for B eliminators; double reading, 0-8 volts and 0-100 volts DC scale.. 2.25
No. 42—For testing B batteries, dry or storage, but not for B eliminators; 0-150 volts DC scale 2.00
No. 346—For testing B voltages, including eliminators. High ressitance water 0-300 volts DC scale 4.50
No. 347—Same as No. 346, except that scale is 0.500 volts 5.50
No. 348—For testing AC current supply line, portable, 0-150 volts 4.50

VOLTAMMETERS

No. 18—For testing amperage of dry cell A batteries and voltage of dry or storage A batteries, double reading, 0-8 volts, and 0-40 amperes DC.....$1.85
No. 35—For testing amperage of dry cell A batteries and voltage of B batteries (not B eliminators); double reading, 0-50 volts, 0-40 amperes DC .....—..... 2.00

PANEL VOLTMETERS

No. 335—For reading DC voltages, 0-8 volts..$1.65
No. 310—For reading DC voltages, 0-10 volts.. 1.65
No. 316—For reading DC voltages, 0-16 volts.. 1.65
No. 326—For reading DC voltages, 0-6 volts.. 1.65
No. 337—For reading DC voltages, 0-50 volts.. 1.65
No. 339—For reading DC voltages, 0-100 volts.. 1.75
No. 342—For reading DC voltages, 0-150 volts.. 1.75
No. 340—For reading DC voltages, double reading, 0-8 volts, 0-100 volts..... 2.25

(Panel meters take 2 5/64" hole)

PANEL AC VOLTMETERS

No. 351—For reading 0-15 volts AC.....$2.25
No. 352—For reading 0-10 volts AC..... 2.25
No. 353—For reading 0-6 volts AC..... 2.25
(See No. 348 under "Pocket and Portable Voltmeters.")

PANEL MILLIAMMETERS

No. 311—For reading 0-10 milliamperes DC..$1.95
No. 325—For reading 0-25 milliamperes DC.. 1.85
No. 350—For reading 0-50 milliamperes DC.. 1.65
No. 390—For reading 0-100 milliamperes DC.. 1.65
No. 399—For reading 0-300 milliamperes DC.. 1.65
No. 394—For reading 0-400 milliamperes DC.. 1.65

DC PIN JACK VOLTMETERS

No. 306—For Radiolas No. 25 and 28, 0-6 volts DC $2.50
No. 308—For No. 20 Radiola, 0-6 volts DC.. 2.50
No. 307—Desk type voltmeter with cord, 0-6 volts DC 2.50

6-VOLT A BATTERY CHARGE TESTER

No. 23—For showing when 6-volt A battery needs charging and when to stop charging; shows condition of battery at all times....$1.85

PANEL AMMETER

No. 338—For reading amperage, 0-10 amperes DC $1.65

SEND NO MONEY!

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

Please send at once your meters, catalogue numbers:

....

for which I will pay postman advertised price plus few cents postage.

Name .....

Address .....

City..... State.....RW-B28

ALL METERS SOLD ON FIVE-DAY MONEY-BACK GUARANTY

The Radio Trade

Propson New Chief of Crosley Advertising

Carl F. Propson, of Rochester, New York, has been appointed advertising manager for the Crosley Radio Corporation.

For the last six years Mr. Propson was director of advertising and sales promotion for the Bausch & Lomb Optical Company, at Rochester, and previously was export advertising manager for E. I. du Pont de Nemours & Co., Inc., of Wilmington, Del.

During the World War Mr. Propson was captain of Company I, Massachusetts 18th Infantry. This year he was elected President of the Rochester Chapter, Sons of the American Revolution.

STANDARD

CLAROSTAT

The "Standard" by which all other variable resistors are judged.

FREE *Useful, instructive literature. Ask your dealer or write us direct.*

American Mechanical Labs.
285 North 6th Street, Brooklyn

VICTOREEN

PARTS STANDARD FOR AC CIRCUITS

Victoreen "326" Filament Transformer

Victoreen "326" Filament Transformer
Supplies current to the AC tubes at their rated voltages. Capacity 8 UY 327 or UX 326 and 2 half ampere 5 volt power tubes. Price $22.00.

Victoreen "333" Switch and Plug Unit
Eliminate AC wiring connections by providing 3 receptacles into which the power leads for the A, B and C connections may be plugged. This unit is placed in a set and all AC devices are controlled by the panel switch furnished with it. Price $4.75.

Victoreen "112" Audio Unit
Produces a tone quality and faithfulness little short of marvelous. Two stages in the one case. It is designed to handle up to 475 volts of B supply in the last stage, using a UX 210 tube, and 180 volts in the first stage using a UY 327 tube. Price $22.00.

THE GEORGE W. WALKER CO.
Merchandisers of Victoreen Radio Products
2825 Chester Avenue, Cleveland, Ohio

Big 30 inch Cone Speaker —Build it yourself and Make Money!

Here it is at last! A real 30-inch power cone for only $6.50. The new Excelocone is unlike other impractical knocked-down cones on the market. Easy to build. Everything furnished and cut to exact dimensions. Simple illustrated instructions furnished impossible to go wrong. Beautiful clear and natural tone. Gets all the notes from highest piccolo note (frequency 4,096 per second) to the lowest bass tuba note (frequency 36 per second) without squeal, rattle, rumble or distortion. Cone handsomely lithographed in old rose and black harmonizing colors; base in beautiful brown frostene lacquer. Has sold in stores for $32.50 assembled. Build it yourself and sell it to your friends.

Thousands of satisfied users. Send no money. Shipped C.O.D., plus express company charge. Indicate size and model desired.

30" Cone, Pedestal Type	$7.50
30" Cone, Wall Type	6.50
22" Cone, Pedestal Type	7.25
22" Cone, Wall Type	6.00

MONMOUTH PRODUCTS COMPANY
887 E. 72nd St. Cleveland, Ohio

Super-Silver Unit Has Anti-Rattler

With the advent of the cloth diaphragm speaker, somewhat of a revolution was wrought in the speaker field and many preconceived ideas of tone quality were upset. Fans everywhere took to the airplane speaker, which is now popular all over the country. A group of engineers has developed a unit, the Super-Silver, with characteristics particularly suited to cloth speakers and which also gives fine results with any type of cone. A feature is a short piece of gum rubber on the driving pin that stops whipping or side motion and prevents rattling with high power. The unit is extraordinarily rugged with an extra large permanent magnet which insures long life. Full information will be furnished on request by Newbrook Radio Sales Co., Room 1111, 8-10 Murray Street, New York City. Mention RADIO WORLD.

NEW EDITION, "BETTER TUNING"

"Better Tuning," the very latest issue of this interesting and valuable data booklet, is now ready for distribution to radio fans who will mention RADIO WORLD. Address Bremer-Tully Co., 532 S. Canal St., Chicago, Ill.

NEW INCORPJORATIONS

Mamaroneck Radio Shop, Mamaroneck, N. Y. Atty., J. S. Rosenthall, 220 5th Ave., New York, N. Y.

THE VERY UNIT FOR EXPONENTIAL HORNS

This purchase direct from the manufacturers permits us to offer this well known excellent unit at the special price of $3.00. Satisfaction guaranteed. Money refunded if requested after a 5-day trial. Take advantage of this offer, send in your $3.00 and receive a good unit for very little money. $3.00

Berkman Unit, Salt Lake City, Utah
Double Magnet Moving Armature
List Price, $9.00

Suitable for the Exponential or the usual cabinet horn.

Tested and Approved by Radio World Laboratories

N. Y. C. RADIO SALES CO.
2230 OCEAN AVENUE. BROOKLYN, N. Y.

BLUEPRINT
and Instruction Sheet
for the Silver-Marshall
Shielded Grid Six

The New Receiver Utilizing the New Shielded Grid Tubes with Their Powerful Kick. 25 Cents

Guaranty Radio Goods Co.
145 WEST 45TH STREET
NEW YORK CITY

EVERY FRIDAY at 5.40 P. M. (Eastern Standard Time) Herman Bernard, managing editor of Radio World, broadcasts from WGBS, the Gimbel Bros. station in New York, discussing radio topics.

www.americanradiohistory.com

Field for AC Set-up

According to the Federal Radio Commission, there are approximately 7,500,000 radio receivers in operation in this country. This includes radio receivers of every possible type from the single crystal to the eight, nine and ten tubers.

The above figure, in the opinion of Hugh H. Eby of the H. H. Eby Mfg., Co., when compared to the number of electrically wired homes, which total approximately 9,250,000, shows plenty of room for expansion in the sale of AC adapter harnesses. The number of AC electric radio receivers included in the 7,500,000 is hard to say, but a safe estimate would be 500,000.

Horn Unit Selling Fast

That many fans favor the exponential type speaker is evidenced by the fact that the N. Y. C. Radio Sales Co., 2230 Ocean Avenue, Brooklyn, N. Y., reports that the entire lot of double magnet, moving armature, Borkman units, recently advertised, have been sold out. The company got a fresh shipment of the same high quality. They are particularly pleased over the fact that not one unit has been returned, nor one complaint received. On the other hand, many letters of praise regarding the unusually fine quality of this unit have been sent them and many customers have re-ordered, Any information regarding this fine unit will be cheerfully furnished by this concern.

TABLE TYPE CLAROSTAT

Adds the final touch to your receiver. Ideal control for volume and tone.

Free! *Ask your dealer for copy of "Radio Etiquette" or write us direct.*

American Mechanical Labs.
285 North 6th St. Brooklyn, N. Y.

Don't Waste Your Money

Buy radio tubes as you do other commodities—on a basis of *value*.

You want clear reception, full volume, natural tone. These CeCo tubes will give and IN ADDITION an extraordinary long life of steady, unfailing performance.

CeCo is the scientifically engineered tube—the laboratory-tested tube, the tube endorsed by great radio authorities.

CeCo makes any good receiver BETTER.

Ask your dealer to help you choose the types of CeCo best suited to your set.

C. E. MFG. CO., INC.
Providence, R. I. U. S. A.

CeCo RADIO TUBES

MEMBERS OF THE TRADE—Write for proposition on blueprints of 4-tube Diamond (standard tubes), 5-tube Diamond (standard tubes), and 4-tube Shield Grid Diamond (one SG tube). Guaranty Radio Goods Co., 145 W. 45th St., N. Y. City.

EVERY FRIDAY at 5.40 P. M. (Eastern Standard Time) Herman Bernard, managing editor of Radio World, broadcasts from WGBS, the Gimbel Bros. station in New York, discussing radio topics.

FORTY TIMES as Much Amplification!

The New Shielded Grid

4-TUBE DIAMOND OF THE AIR

Designed by H. B. HERMAN and described by him in the February 4 11 and 18 issues of RADIO WORLD.

The favorite four-tube design, simple as can be, takes a great step forward, so that home constructors of radio receivers, and custom set builders, can build a distance-getting and voluminous set, the parts for which list remarkably low.

The new shielded grid tube is used as the radio frequency amplifier. That is why the amplification is boosted forty times over and above what it would be if an —01A tube were used instead.

Such simplicity of construction marks the receiver that it can be completely wired, skillfully and painstakingly, in two and a half hours.

All you have to do is to follow the official blueprint, and lo! a new world of radio achievement is before you! Distant stations that four-tube sets otherwise miss come in, and come in strong. No tuning difficulty is occasioned by the introduction of this new, extra powerful, startling tube, but, in fact, the tuning is simplified, because the signal strength is so much greater.

When you work from the official wiring diagram you find everything so delightfully simple that you marvel at the speed at which you get the entire receiver masterfully finished. And then when you tune in—more marvels! 'Way, 'way up, somewhere around the clouds, instead of only roof high, will you find the amplification!

You'll be overjoyed. But you should place every part in exactly the right position. Stick to the constants given, and, above all, wire according to the blueprint!

Front Panel, Subpanel and Wiring Clearly Shown

When you work from this blueprint you find that every part is shown in correct position and every wire is shown going to its correct destination by the ACTUAL ROUTE taken in the practical wiring itself. Mr. Herman's personal set was used as the model. This is a matter-of-fact blueprint, with solid black lines showing wiring that is above the subpanel, and dotted lines that show how some of the wiring is done underneath.

Everything is actual size.

Not only is the actual size of the panel holes and instruments given, but the dimensions are given numerically. Besides, it is one of those delightful blueprints that novice and professional admire so much—one of those oh-so-clear and can't-go-wrong blueprints.

Be one of the first to send for this new blueprint, by all means, and build yourself this outstanding four-tube receiver, with its easy control, fine volume, tone quality, selectivity and utter economy. It gives more than you ever expected you could get on four tubes—and the parts are well within the range of anybody's purse.

The circuit consists of a stage of tuned RF shielded grid tube amplification, a regenerative detector, and two transformer coupled audio stages.

What a receiver!

$1.00 for 27" x 27" Blueprint,

Send your order today!

.....

RADIO WORLD,
145 West 45th St., N. Y. City.
Enclosed please find:

☐ $1.00, for which send me at once one official blueprint of the Four-Tube Shielded Grid Diamond of the Air, as designed by H. B. Herman, and described by him in the February 4, 11 and 18 issues of Radio World.

45 cents extra for Feb. 4th, 11th, 18th issues.

NAME .....

ADDRESS .....

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

Take Your Choice of 7 Other Publications

For NEW RADIO WORLD Subscribers Ordering NOW

Radio World has made arrangements

—To offer a year's subscription for any one of the following publications with one year's subscription for RADIO WORLD—

RADIO NEWS or POULAR RADIO or SCIENCE AND INVENTION or BOYS' LIFE or RADIO DEALER or RADIO (San Francisco) or RADIO AGE.

This is the way to get two publications

—for the price of one:
—Send $8.00 today for RADIO WORLD
—for one year (regular price
—for 52 numbers)
—and select any one of the other
—nine publications for twelve months.

—Add $1.00 a year extra for
—Canadian or Foreign Postage
—Present RADIO WORLD subscribers
—can take advantage of this offer by
—extending subscriptions one year
—if they send renewals NOW!

Radio World's Special Two-for-Price-of-One Subscription Blank.

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

Enclosed find $8.00 for which send me RADIO WORLD for twelve months (52 numbers), beginning ..... and also without additional cost, Popular Radio, or Radio News, or Science and Invention, or Radio Dealer, or Radio (San Francisco), or Radio Age, or Boys' Life (or $10.00 for a two-year subscription to one address). No other premium wtih this offer.

Indicate if renewal.

Offer Good Until

May 15, 1928

Name .....

Street Address .....

City and State .....

www.americanradiohistory.com

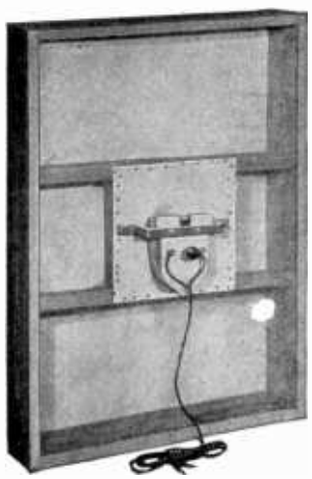
HBH

Airplane Cloth Speaker Kit

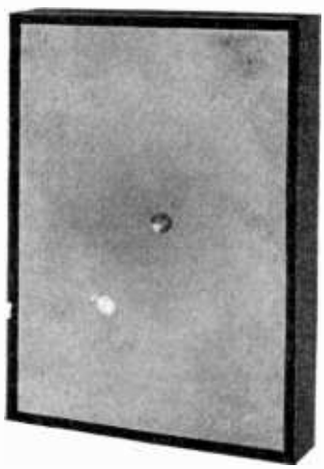
Special size 16½" x 22½", (Cat. 1086) Price, Including Unit

$7.00

Kit Consists of airplane cloth, frame, moulding, unit, stiffening fluid, apex, crossarm, bracket, long cord, apex, hardware and instruction sheet.



Rear View of the HBH Airplane Cloth Speaker Size, 16½x22½ Inches



Front View of the HBH Airplane Cloth Speaker Size, 16½x22½ Inches

An Opportunity is presented to you to obtain a kit of this special but attractive size, 16½x22½", because a manufacturer accumulated an extraordinarily large stock of them.

For $1 Extra We Build It for You!

If you do not want to build the speaker yourself, at $1 extra cost you can quickly receive the factory-built speaker in your home, all ready to play. Size 16½x22½" (Cat. 1086B).... **$8.00**

Buy a Kit and Build Speaker Yourself at These Prices

Complete Kit, 18x24", Cat. No. 1109.....$10
Complete Kit, 24x36", Cat. No. 1110.....$12
Complete Kit, 36x36", Cat. No. 1111.....$14

Buy a Factory-Made Speaker, Ready to Play, at These Prices

18x24", Cat. No. 1088.....$11
24x36", Cat. No. 1090.....$14
36x36", Cat. No. 1091.....$16

CHOOSE WHAT YOU WANT, BUT SEND NO MONEY!

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

Ship me the following items as advertised in Radio World:

Cat. No.....Cat. No.....Cat. No.....

Cat. No.....Cat. No.....Cat. No.....

for which I will pay postman advertised price plus few cents extra for postage.

Name .....

Address .....

City .....**State** .....

Five-Day Money-Back Guaranty

LOUD UNIT

Powerful unit, excellent for any cone or similar type speaker, standard for HBH speaker; very loud. Cat. No. 1098, $3.75.

The unit is the Powertone model, which provides high degree of volume and is very sensitive. Stands great strain. Used successfully in all radio receivers, including power pack installations up to 550 volts on the plate. Up to 135 volts DC may be passed through coils of unit without damage. For higher voltages filtered output is recommended, but unit has long stood up to 180 v. unfiltered. **Unit, Cat. No. 1098, $3.75**

Unit mounting bracket, Cat. No. 1113..... 35c. Apex. Cat. No. 1107, 25c.

GENUINE "DOPE"

Genuine HBH Stiffening Fluid, secret compound, with superlative effect on tone quality. Large sized can, enough for three coats. Cat. No. 1097, $1.50.

www.americanradiohistory.com