#309 Vol-17 No-23

EB. 25. 1928

LIST OF STATIONS

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RADIO WORLD
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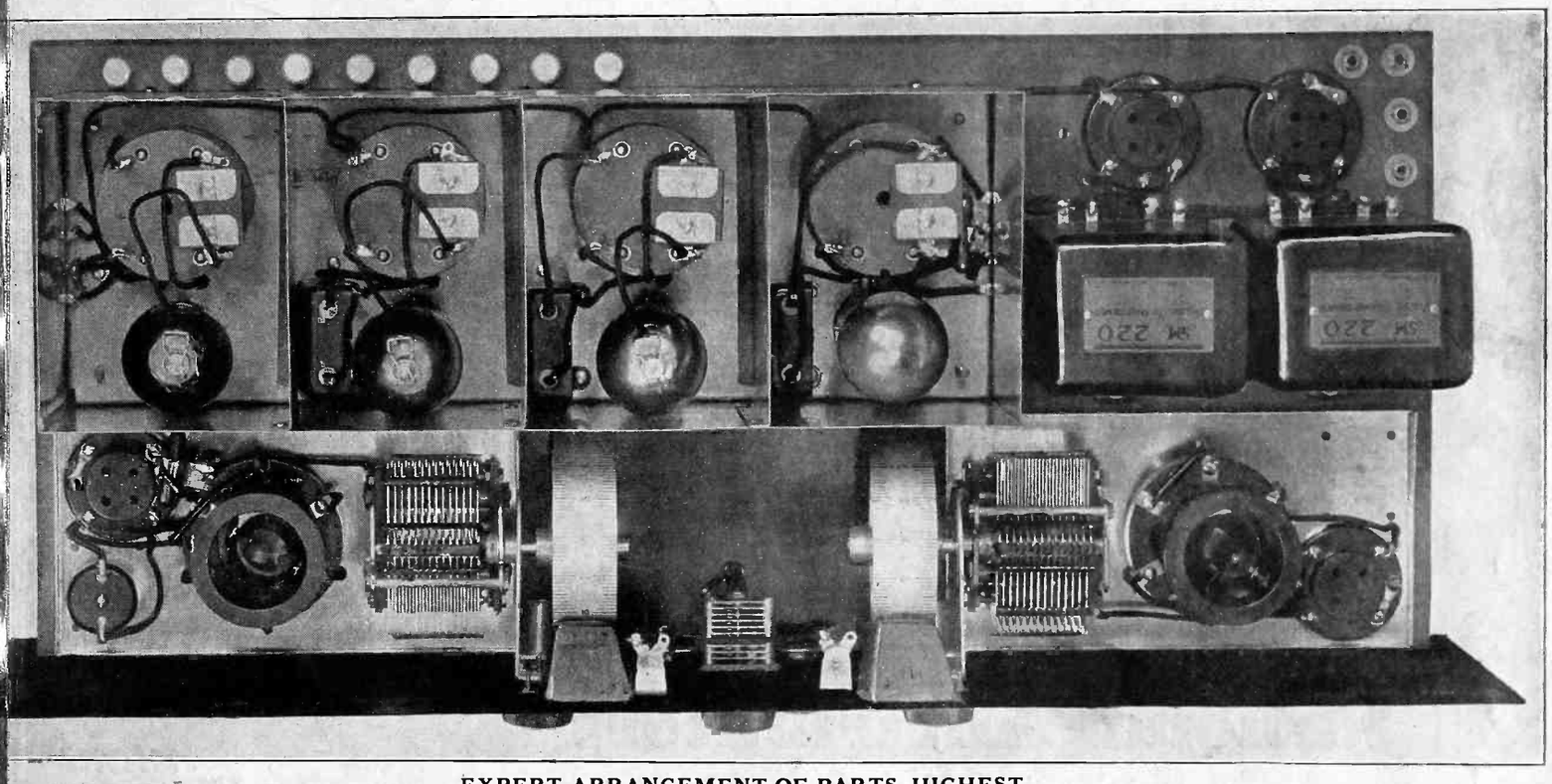
The First and Only National Radio Weekly

A DESK SET FOR EXECUTIVES

PARALLEL CONNECTION OF RECTIFIER TUBES

THE TYRMAN "70"

'HE SCREEN GRID MODEL LABORATORY SUPER-HETERODYNE



EXPERT ARRANGEMENT OF PARTS, HIGHEST EFFICIENCY IN WIRING BY THE NEATEST KNOWN METHOD, COMBINE WITH THE ELECTRICAL EXCELLENCE OF THE PARTS AND THE POWERFUL "KICK" OF THE SCREEN GRID TUBES TO MAKE THE LABORATORY SUPER A KNOCKOUT.

The Wiring of the AC Victoreen

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SM

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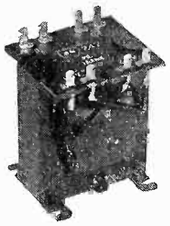
NOW Silver-Marshall offers for immediate delivery the famous 112 K.C. time signal amplifier catacomb improved and refined to take full advantage of the tremendous amplification possibilities of the new screen grid R.F. amplifier tubes. Every experienced fan and professional set builder knows the remarkable efficiency of the famous S-M 440 amplifier, with its high amplification, absolutely accurate peaking, and perfect uniformity, and the new 440-SG model of this famous unit, designed especially for screen grid tubes, is capable of providing **greater amplification than any other long-wave amplifier ever marketed.** The 222 type screen grid tubes are used in the three individually shielded low-loss R.F. amplifier stages, followed by a super-sensitive detector (UX-200A) in cushioned socket. The amplification is tremendous, the selectivity hair-splitting, yet tone is well-nigh perfect. The 440-SG amplifier catacomb is laboratory tuned and calibrated to exactly 112 K.C. and either two or three R.F. stages may be used at will. It is 15 inches long, 5 inches wide, and 5½ inches high, with removable cover, finished in beautifully burnished copper. It requires three 222, and one 22-A type tubes, 6 volts at .65 amperes, 135 volts B at only 6 milliamperes and 4½ volts of dry C battery for operation. Its current consumption is so low it may be operated on batteries, yet no finer amplifier can be had for use wherever a sharply tuned long wave amplifier is needed. Unconditionally guaranteed against mechanical and electrical defects, the 440-SG amplifier catacomb stands unequaled in the long wave amplifier field. Price $40.00, ready to use, less tubes.

All "A" Power for $5.00



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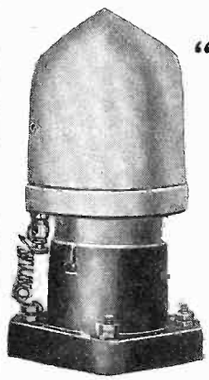

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Vol. XII. No. 23. Whole No. 309
FEBRUARY 25, 1928
15c per Copy. $6.00 per Year
[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under Act of March, 1879]

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.
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Silver Marshall

The Laboratory Super With Screen Grid Tubes

Covers All Wavelengths Between 30 and 3,000 Meters

By Ernest R. Pfaff

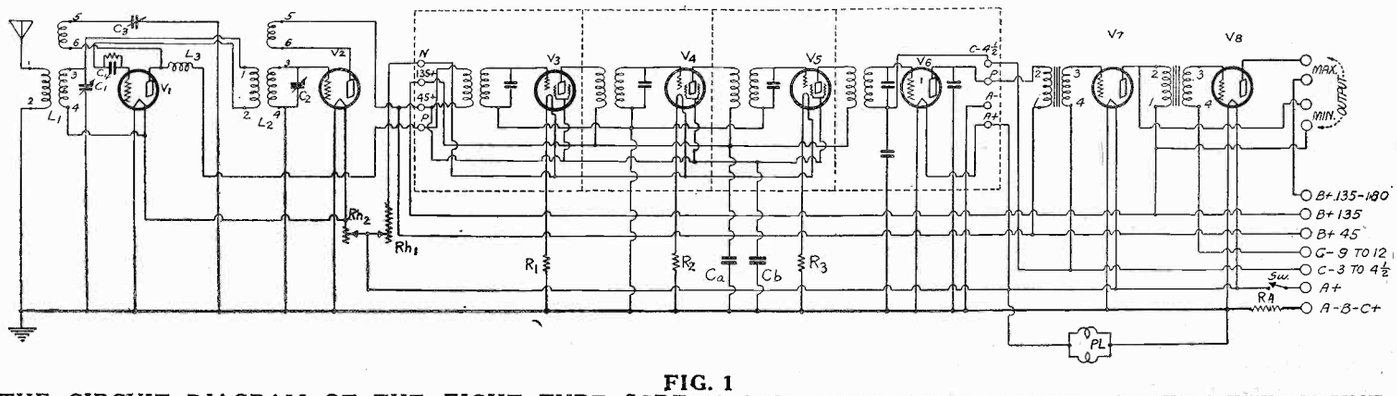


FIG. 1
THE CIRCUIT DIAGRAM OF THE EIGHT TUBE SCREEN GRID LABORATORY MODEL SUPER-HETERODYNE

SINCE the new screen grid tubes offer such abundant advantages of extremely greater sensitivity, and high amplification, consistent with stability, their inclusion in the three intermediate frequency stages of the Laboratory Super-Heterodyne makes one of the most remarkable receivers ever developed. To achieve this result the 440 SG intermediate amplifier must be used, for it is especially constructed for the Shielded Grid Tubes. Its frequency is 112 kc, the same frequency on which the time signals are sent from Arlington.

Specifically, the receiver is an eight-tube Super-Heterodyne employing three of the new screen grid tubes in the intermediate frequency amplifier, and having besides a mixor (consisting of first detector and oscillator) and two transformer coupled audio stages.

All possibility of anything less than peak performance in the hands of even the most inexperienced builder is precluded if instructions are carefully followed.

The real value of the screen grid tubes in this receiver can be realized best from the statement that the amplification factor in the three-stage 112 kc intermediate amplifier approaches 40 per stage, as compared with 20 per stage for the —018 type tubes. Thus the total amplification in the three stages of screen grid tubes is 64,000 as against 8,000 for the —01A tubes. The amplification at the intermediate frequency therefore is eight times greater.

Apparent Selectivity the Same

These values of amplification were obtained under conditions of equal apparent selectivity. It must not be forgotten that the need for selectivity increases much more rapidly than the amplification. Thus if the receiving range is doubled, possible interference is mulitplied by four, and the selectivity must be increased in the same proportion to maintain the same apparent selectivity.

This imposes a real task on the designer of a multi-tube screen grid receiver, since he must make sure that the selectivity is adequate at all times no matter how high the amplification may be.

In the screen grid Laboratory Super not only have the factors of increased amplification and increased selectivity been given careful consideration, but full regard has been paid to tone quality, so generally neglected, or, of necessity, slighted in Super-Heterodynes.

Through the use of an intermediate frequency of 112 kc, high amplifier selectivity has been obtained. Also, the cutting of side bands is brought entirely within the operator's control. Either he may have medium range, ultra-high quality reception or, by sacrificing tone slightly, he can boost the sensitivity to the point where stations not ordinarily heard come in with a loud roar.

Another advantageous feature of the 112 kc intermediate frequency is that, for all stations below 215 meters or above 455 meters, the receiver is a "one-spot" set. That is, stations outside of the 215-455 meter range are tuned in at but one point on the oscillator dial. Though stations between 215 and 455 meters can be tuned in at two points on the oscillator dial, the set is made "one-spot" for all stations outside that band.

A further advantage of the 112 kc intermediate frequency is that the two oscillator dial readings, for those stations that do come in at two points, are widely separated. Hence with the sharp, regenerative first detector the receiver is in operation practically "one-spot."

Regeneration in First Detector

Regeneration is used in the first detector and is controlled with a .000075 mfd. midget variable condenser. The use of regeneration at this point greatly in-

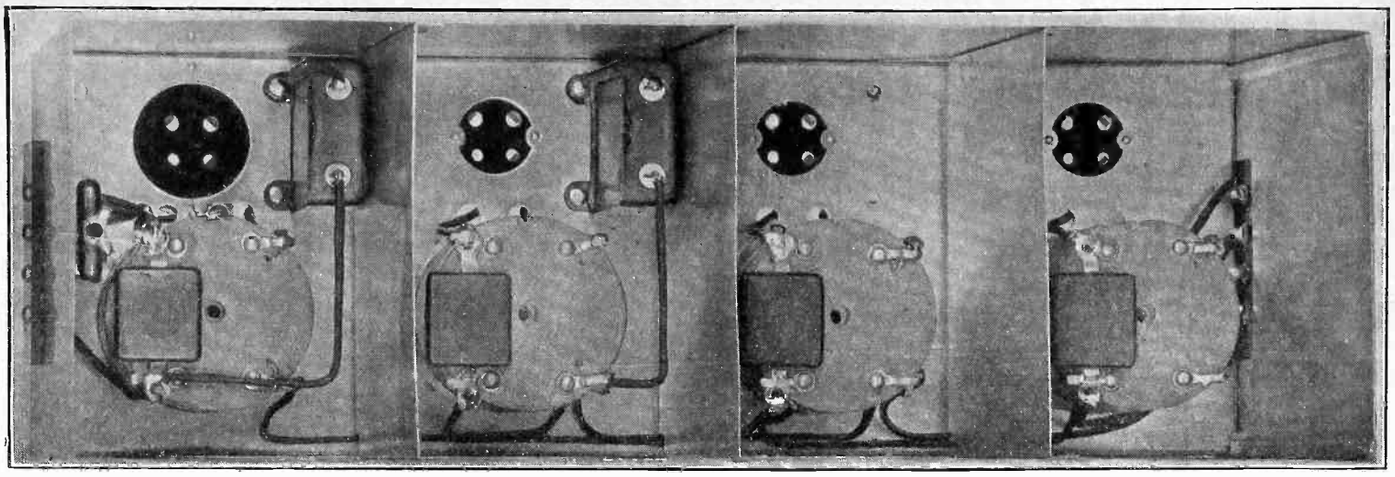


FIG. 2
INTERIOR VIEW OF THE 440 SG INTERMEDIATE FREQUENCY AMPLIFIER USED IN THE SCREEN GRID LABORATORY MODEL SUPER-HETERODYNE. NOTE THE FOUR FIXED FILTER CONDENSER ON TOP OF THE INTERMEDIATE COILS, AND THE LARGE BY-PASS CONDENSERS IN THE TWO RIGHT HAND COMPARTMENTS.

creases the sensitivity of the receiver and at the same time increases the selectivity in the required proportion. The knob for the midget condenser is placed on the panel and constitutes the major volume or sensitivity control. The detector tube and associated coils and condensers are placed in an aluminum compartment which is grounded.

Thus the detector and its circuit are well shielded from all disturbances, just as effective shielding is provided in the SG-440 amplifier.

The oscillator is similarly constructed and shielded but, of course, is so coupled that the circuit is in oscillation whenever the power is on.

Plug-in coils are used for both the antenna input transformer and the oscillator coil. The use of this system allows different sizes of standard oscillator and antenna coils to be plugged into the set, thus covering all waves from about 30 to 3,000 meters.

The Intermediate Amplifier

Following the first detector and the oscillator is the three tube long wave amplifier and one tube second detector (440 SG), for three screen grid tubes and one —01A type tube. There are four intermediate frequency, or 112 kc, couplers and other necessary parts. All the parts which comprise each stage are completely surrounded by a copper shield as shown by the dotted lines in the circuit diagram.

A two stage transformer coupled audio amplifier follows the intermediate amplifier. This is placed at the right of the intermediate amplifier and does not need shielding. This audio amplifier has a uniform response range between 30 and 5,000 cycles. Above the highest frequency it cuts off to keep down background noise and the all-too-prevalent heterodyne squeals which are caused by more than 600 broadcasting stations throughout the country.

Built on Sturdy Chassis

The entire set is mounted on a pierced steel chassis 10 inches wide, 1½ inches high, and 23 inches long, to which is attached a 7x24 inch metal panel carrying the control knobs. The actual controls are the vernier knobs actuating the two drum dials, an "On-Off" switch, a regeneration control (C3) for the first detector, a "Gain" control rheostat (Rh1), which regulates the volume for the three screen grid tubes, and a filament rheostat (Rh2) for the first detector and the oscillator.

In a number of tests the screen grid "Laboratory Model" receiver has been surpassing in DX ability, for it will reach out from Chicago on a small ten or twenty foot aerial and bring in with loudspeaker volume stations on the East and the West coasts that other receivers will not bring in at all.

LIST OF PARTS:

C1, C2—Two SM. 00035 mfd. variable condensers.
C3—One SM .000075 mfd. variable midget condenser.
C4—One Carter .00015 mfd. fixed condenser.
L1, L2—Two SM type 111A plug-in coils.
L3—One SM 2½ millihenry RF choke coil.
Rh1—One Carter 20-ohm rheostat.
Rh2—One Carter 6-ohm rheostat.
R4—One Carter .57 ohm fixed resistor.
V1, V6—Two CeCo type H detector tubes.
V2, V7—Two CeCo type F amplifier tubes.
V3, V4, V5—Three CeCo type RF22 screen grid tubes or UX222, CX322, Shieldplate 122.
V8—One Ceco power tube.
Sw.—One Carter battery switch.
S1, S2—Two SM aluminum shields 7¾x 3¾x5 inches.
S3—One SM 440 SG amplifier with shield.
Two SM Type 220 audio frequency transformers.
One 5 megohm grid leak.
Two SM drum dials, vernier action single type.
Two SM coil sockets, 6 contact type.
Four UX type tube sockets.
Four tip jacks.
One Van Doorn steel chassis.
One Van Doorn front panel, pierced and engraved.
Nine binding posts.
Connection wire.

One intermediate amplifier stage can be dropped from the eight tube circuit by simply pulling the grid lead from the left compartment of the amplifier (440 SG) over the shielding partition and clipping it to the top cap of the second tube (V4), the clip of which is not used at all in that case. With one tube dropped in this manner the circuit will still give results comparable to the results obtained with nine and ten tube Supers.

Components Used Standard

Even when two tubes are dropped in the same manner, that is, when using the circuit as a seven tube receiver, the circuit outperforms others with respect to selectivity, quality of tone and DX ability.

The parts used in the Screen Grid Laboratory Model are all standard, as will be seen in the list of parts, and thus no difficulty will be experienced in getting the parts, and what is equally important, replacement of parts in any case is an easy matter.

As will be seen on the circuit diagram, both the first detector and the oscillator circuits are inclosed with dotted lines, which represent shields. These are specially cut and shaped aluminum cans which fit over these tubes, coils and condensers. These shields are not absolutely necessary in all cases, but should always be used if there is one or more broadcasting stations close to the receiver or if it is to be used a great deal for tuning in extreme DX.

Ballast Used for Screen-Grid Tubes

A study of the circuit diagram of the intermediate amplifier will reveal various condensers and resistors. For example, there are three ballasts marked R1, R2 and R3. These are built into the 440 SG amplifier and are used to prevent excessive filament current on the screen grid tubes. The 20-ohm rheostat Rh1 is in series with all the screen-grid filaments and serves to control volume by cutting down the filament current below normal. The ballasts maintain normal circuit when the rheostat is set at zero. They are placed under the 440 SG baseboard.

There are also many condensers in the I.F amplifier which have not been given a special designation. These also are built into the amplifier. The condensers across the secondaries of the transformers can be seen on top of the transformers in Fig. 2. Two large by-pass condensers can also be seen in two of the compartments, and in the last to the right a small by-pass condenser which is connnected from the plate of the detector to the grounded shield.

A resistor R4 is connected in the negative lead of the A battery as a master ballast. It is wound with heavy resistance wire and has a resistance of .57 ohm.

The filament switch is placed in the positive leg of the A battery where it not only controls the filaments of the tubes but also the two dial lights.

(*Part II, conclusion, next week*)

Booklet On Resistance

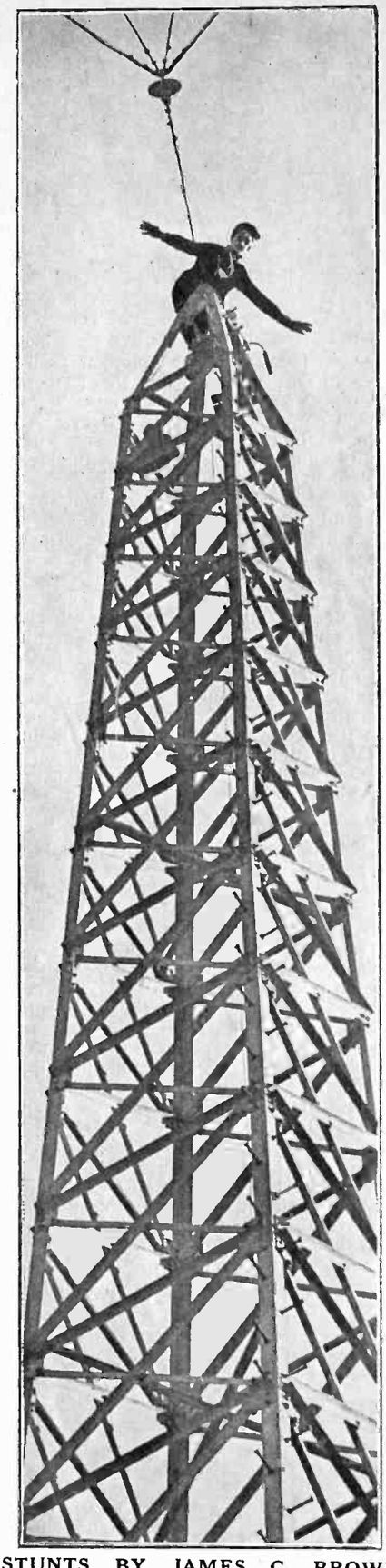
The American Mechanical Laboratories, 285 North Sixth Street, Brooklyn, N. Y., has just published a sixteen-page booklet entitled "Micrometric Resistance," and will send a copy to any inquirer mentioning RADIO WORLD. The booklet covers the use of precision resistors for improvement in radio receivers and greater efficiency and smoother operation in power packs and units, as well as giving in detail full information on all types of Clarostats now available.

The precision control of sensitivity. oscillation, tone, volume, regeneration, plate voltage, grid leakage, etc., are fully covered, assuring improvement in the usual radio sets. Line voltage is covered in a helpful manner for the numerous fans who have troubles in this important end of radio operation.—J. H. C.

METER BOARD IS A BILLIKEN

NATHAN GERBER, BOSTON RADIO ENGINEER, USING HIS NEW METER TESTBOARD THAT LOCATES ANY TROUBLE IN A RECEIVER.

HEAVENWARD



STUNTS BY JAMES C. BROWN, ATOP THE 200-FOOT-HIGH AERIAL TOWER OF KFI, LOS ANGELES, AMUSED A CROWD.

The Cheerful Outlook

RADIO reception is getting better all the time. This is not alone due to the great improvement that has been effected in the radio broadcasting art, but also to improved natural reception conditions. And these natural conditions are constantly becoming more favorable to the reception of bull fiddles, piccolos, and the esses and zees. Soon radio reproduction will be so good that present faultfinders will prefer radio to the original.

Just what are these natural conditions which are constantly on the upward grade? What are the natural forces that act to make the way of the radio waves easier every day.

For one thing there are the sun spot cycles. Whenever the sun shows its freckles there is a decided improvement generally in radio transmission and reception, so the wise men of the East say in their learned essays. But don't these sun spots recur periodically? If they do there can be no general improvement, but only a regular waxing and waning of the solar influence on radio waves.

Cooling Is Gradual

But what do these sun spots signify? Cooling of the sun at a more rapid rate than where the sun is white. The sun is cooling faster there because the sun spots are hotter than the white spots. That sounds absurd, does it not? It does, but not to the physicist who knows. So every time that the sun shows its spots it is just a little cooler than it was the previous time, and radio reception conditions just a little better. Even the newcomer in the radio reception frolic knows that the best chance he has for picking up distance stations is to angle for them on a cold, clear night. It is then that New York gets KFI and Los Angeles gets JOAK. days. Cold, clear weather is favorable to In the Winter, if ever, come perfect radio good reception.

There seems to be a discrepancy between the fact that radio reception is best when the weather is clear and cold and the alleged fact that it is best when the sun radiates heat most rapidly. Our purpose is not to start a controversy but merely to take the facts as they are or as they appear to be and see what they will lead to.

One thing is certain, and that is that the sun is cooling. Some day the sun will be as cold as an icicle. Then the earth will be colder than that. It will be so cold on this earth that no water vapor could remain in the air. Then every day and every night will be cold and clear, but dark for all that, since the sun will be too cold to shine.

That will be a radio fan's paradise. Every night will be good fr DX and every night will last 24 hours. There will be little or no static to mar the signals from the stations at the antipodes. The sun will be just one black spot, and if sun spots have anything to do with improving reception, conditions will be about as good as they can be.

When can this happy radio condition be expected? How long is "a little while" in this aging of the sun and its satellites? Perhaps a hundred billion years. Kelvin has estimated from the rate of the present cooling of the earth that 400,000,000 years have passed since the first solid crust formed on the surface of the earth. It was then red hot. It must have taken an equal length of time for the earth to cool from the white-blue hot temperature of the sun to a dull red heat. So it took nearly a billion years for the earth to cool from the temperature the sun now has to the temperature that the earth now has.

But the sun is much greater than the earth and cools proportionately at a much slower rate. So that our 100 billion year estimate was conservative. Be it accurate or not, it is a long time to wait for perfect radio reception conditions, and we might as well become reconciled to a little static now and then.

But, long before the sun will have assumed a pale red hue, life on earth will have become extinct and there will be no one interested in radio.

Movements of Watched from N

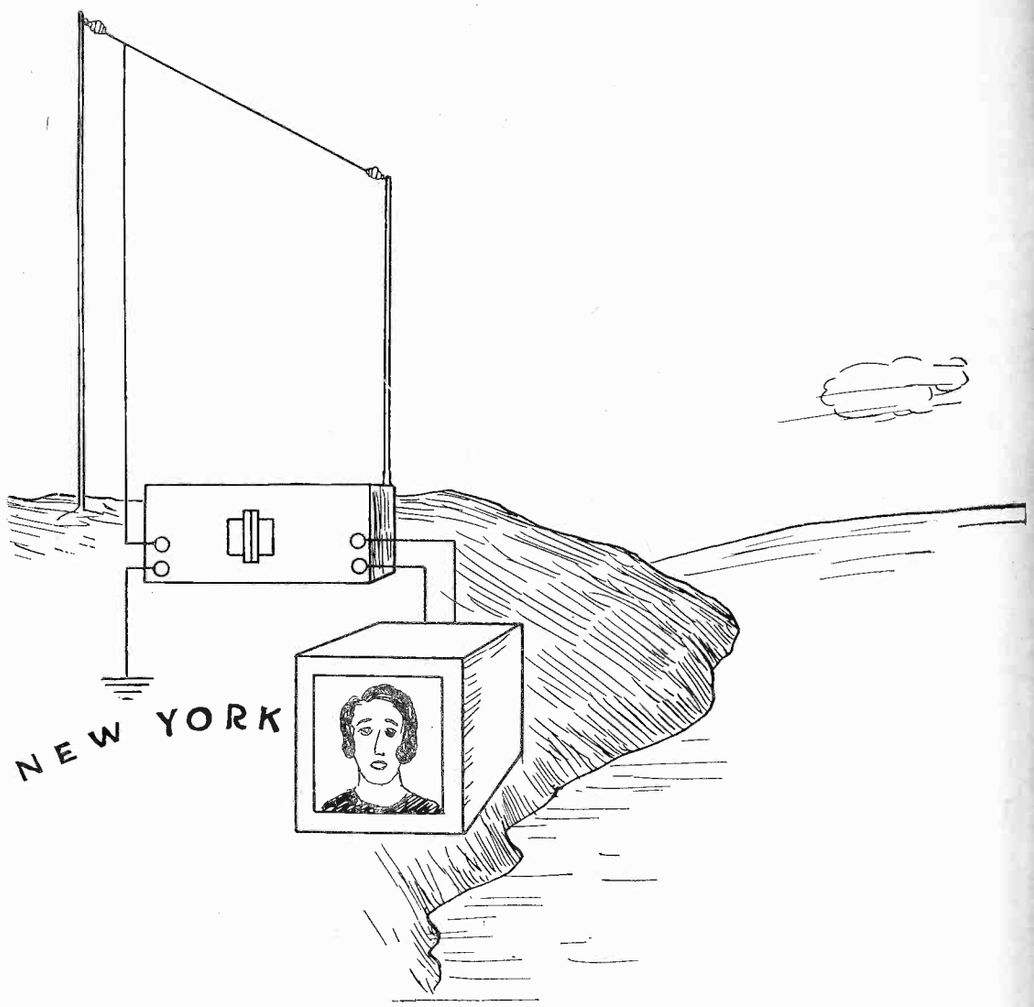
By Neal Fitzalan

Radio Vision Editor.

LOOKING in by radio will soon become an indoor sport as popular as listening in has been during the past seven years. Visual DX will soon fascinate the radio enthusiast just as auditory DX fascinates him now. Vision across the sea will soon become as commonplace as telephony across the sea.

These predictions are based on the successful results of television tests conducted recently by the Baird Television Development Company between London, England, and Hartsdale, a suburb of New York City. Tests between these points have been conducted secretly during a period of three months, but on a recent evening a public demonstration was first staged.

The demonstration, which lasted several hours, was a complete success. While the images which appeared on the televisor at the receiver were not perfect, due to lack of sufficient power to overcome static and code interference, they were recognizable.



Images Across the Sea.

The images received at Hartsdale were transmitted on short waves from the Longacre (London) laboratory of J. L. Baird, the inventor of the televisor and the system of television used. These waves were intercepted in the home of R. M. Hart, owner of short wave station 2CVJ, Hartsdale, and reconstructed into visual images corresponding to those transmitted.

The first image that appeared on the televisor was clear, but not recognizable. A radio report from London identified it as that of a ventriloquist's dummy. The object of using the dummy was to enable New York to tune in and synchronize properly.

Following the transmission of the dummy, Mr. Baird himself was requested, by Morse code from New York, to step before the transmitter and remain there for half an hour. He did so and while he was in the transmitting room he was requested to move nearer to and farther away from the transmitting window, and to move his head slowly from right to left. His movements were clearly seen in Hartsdale.

Following Mr. Baird, W. C. Fox, of the London Press Association, stepped into the transmitting room. His features were received in New York with little distortion and could easily be recognized.

First Woman Televised.

Mrs. Mia Howe, an American woman living in London, was the next to be televised. She was properly framed in the transmitting window with the aid of Mr. Baird, who directed her movements by talking through a speaking tube leading into the transmitting room.

Mrs. Howe's image was not received as distinctly as the images of others, according to a telephonic report from Hartsdale to London by Captain O. G. Hutchinson, managing director of the Baird company, because at the time interference conditions were especially bad. Nevertheless her image was seen in Hartsdale, and Mrs. Howe thus became the first woman ever to have been seen by radio across the ocean.

The Baird System.

The object to be transmitted by the Baird system of television is brilliantly floodlighted, and the scanning is done by mechanically directing the photo-sensitive cell to every point on the image in regular and rapid sequence.

In the present demonstration seventeen glaring incandescent lamps of 200 candle-

Magic Battery Fluid Mostly Corn Starch

Giving special emphasis to the ineffectiveness of battery "dopes" and patented mixtures which are alleged to "charge batteries, reduce internal resistance, remove sulphation, prevent freezing," the National Better Business Bureau has issued its annual report concerning its activities in the battery field.

After stating that the outstanding battery "dope" coming to the Bureau's attention during the year was composed essentially of corn starch, the report points out that the advertisers of battery compounds generally are not making the blanket claims for their product which was the custom several years ago. Many no longer claim that their compound will "charge batteries."

The report details at some length the co-operation which legitimate battery manufacturers have given the National Bureau. In connection with the advertising of so-called "eliminators" the work of the Bureau is of particular interest. Early in 1927, advertisers were offering products of varying construction without differentiating their merchandise from competitive units in any manner. It was the practice to describe these units as "A" and "B" "battery eliminators" and to point to the many disadvantages of batteries and battery operated radio sets.

In a recent survey fifty advertisers described their units in accordance with the Bureau's recommendations and only seven used the negative term "eliminator."

Woman in London w York by Television

power each were used to supply the requisite illumination. These lamps emitted a considerable amount of heat, which made a sitting for any length of time somewhat of an ordeal.

The scanning is accomplished by means of a large revolving wheel, which rotates at a considerable rate of speed. The light beams from the object, through the scanning wheel, is broken up into pulses of light by means of a slotted disc, which rotates at the rate of 2,000 revolutions per minute.

When these pulses of object-modulated light acts on the photo-electric cell an alternating electric current is generated, the frequency of which is determined by the number of light pulses that reach the cell per second. This alternating current is object-modulated.

Amplified at A. F.

The alternating current that emerges from the photo-electric cell is amplified by ordinary audio frequency amplifiers of high quality and then the amplified current is sent to the transmitting antenna at the radio station which hurls the radio waves across the ocean. The object-modulated A. C. that comes from the photo-electric cell is used to modulate the high radio frequency wave just as a voice frequency current is used to modulate the carrier wave of a broadcast station.

The radio transmitter used by Baird in his trans-oceanic test is located at Purley, near London. This station was operated with 2,000 watts of power and on short waves. One reason for the imperfect reception of the images at Hartsdale, was that the power of the transmitter was insufficient to cope with the atmospheric and code interference which prevailed at the time, particularly that caused by short wave code operators in Paris and Mexico City. This difficulty, however, can be remedied easily by increasing the power of the transmitter, Captain Hutchinson stated.

Captain Hutchinson predicted that before the end of the current year, two-way television service between New York and London will have been established.

The transmitter for such operation is now under construction in New York and as soon as it is completed it will be erected at a point near New York, probably at a convenient point on Long Island.

There seems to be a close similarity between the transmitter used by Dr. E. F. W. Alexanderson, of the General Electric Co., in his home radio television apparatus and that used by Mr. Baird.

Both apparently employ the same mechanical features in the scanning process, but they differ in the method of illumination of the object and in the placement of the photo-electric cell.

Dr. Alexanderson employs the system proposed by Dr. Frank Gray, and developed in the Bell laboratories.

The Gray system was discussed in the Feb. 4 issue of Radio World.

Method Unknown to Alexanderson

When Dr. E. F. W. Alexanderson lectured before the Institute of Radio Engineers, in New York City, last year, on a system of transmission and reception of visual motion that had been worked out at the General Electric plant at Schenectady, he was asked by one of his listeners what he thought of the system used by Baird, of Scotland, who was experimenting in London. Dr. Alexanderson replied that he had heard of the gentlemen but did not know what system he used.

Board Members Differ On Use of High Power

Washington.

Difference of opinion within the Federal Radio Commission itself as to the equitable distribution of high-power broadcasting stations in the United States was brought out during the Senate hearings on the confirmation of Commissioner Caldwell, Pickard and Lafount.

Commissioner Caldwell is of the opinion that there is room for a few more 50,000 watt stations, and perhaps a number of 100,000-watt stations, and that these stations, would enable listners to tune in without heterodyning and fading.

Commissioner Lafonnt, of Salt Lake City, who represents the Fifth Radio Zone of the Western States, told the Senate Interstate Commerce Committee that he opposes the use of any station of as high power as 50,000 watts, unless the arrangement is such that it does not operate on any channel used by the small Western stations. He said that he was dissatisfied with the present arrangement, because invariably the Eastern stations use higher power and cause most of the interference to the reception of the Western stations.

If some engineering plan can be evolved whereby 50,000-watt stations can operate simultaneously without causing interference, Commissioneer Lafount would consent and would then want some of them in the Western territory. But under the present set-up he would not permit any station to exceed 5 kilowatts.

Commissioner Lafount points out that his zone comprises two-fifths of the area of the United States and 13,000,000 of the population. It has a total of 130 stations, with an aggregate power of 65,000 watts.

Rectifier Tubes in Parallel

Will Improve the Operation of An Eliminator

By Ernest Van Imbrie

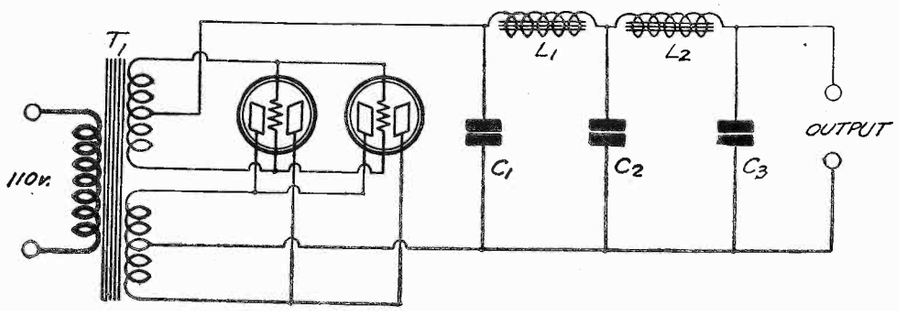


FIG. 1
THE CIRCUIT DIAGRAM OF A HEAVY-DUTY B BATTERY ELIMINATOR.

LIST OF PARTS

T1—One SM Type 329A power transformer.
L1, L2—One Thordarson double choke unit Type T-2099.
C1, C2, C3—One Tobe Model 764 B block (C1 is 2 mfd., C2 4 mfd. and C3 is 8 mfd.).
Two Benjamin UX sockets.
Two CeCo —80 type rectifier tubes.
Output—One Electrad Truvolt (Hi-Q type.)

RECTIFIER tubes are ordinarily rated at a certain number of milliamperes. Thus a common tube has a rating of 85 milliamperes. This does not mean that the tube cannot be made to deliver more current than 85 milliamperes. It means that no more can be drawn from the tube without decreasing the efficiency of the rectifier below a certain value, and without endangering the life of the tube. It is better to operate an 85 milliampere tube at 40 milliamperes than to operate it at its full rating.

Sometimes the receiver used requires so much current that the rectifier available does not efficiently deliver all that is necessary. The voltage across the output of the tube drops, due to internal resistance, to a point where the receiver gets a lower plate voltage than it should have.

This is not conducive to good results, and certainly not to long life of the rectifier tube.

Teaming Them Up

One method of avoiding this difficulty is to put a couple of identical tubes in parallel so that each of these tubes takes only half of the load. For example, if the receiver requires a plate current of 80 milliamperes, each of the parallel tubes would only have to deliver 40 milliamperes. The gain would be in the output voltage. The receiver may require a maximum plate voltage of 220 volts, but when a single tube is used and the current is 80 milliamperes the voltage may not be more than 180 volts. When a second tube is put in parallel with the first the voltage immediately jumps up to 220 or higher.

This change in the rectifier circuit will also have a salutary effect on the quality of the output of certain amplifiers. The resistance of the filter circuit and of the rectifier exerts a very strong influence on the behavior of the circuit, and usually induces misbehavior.

When the two rectifier tubes are in parallel the internal resistance of that part of the eliminator is just half of what it is with a single tube. The resistance of the rectifier is the major part of the total resistance of the eliminator, and hence by cutting it in half, the total resistance of the eliminator is very greatly reduced.

Equipment Needed

The two choke coils L1 and L2 in the filter circuit should be wound with heavy wire so that their direct current resistance is low. Coils of 30 henry inductance and a resistance of about 200 ohms can be procured. They are suitable and a couple of them should be employed in the filter.

The power transformer T1 should be conservatively rated or it will probably heat up too much when heavy current is drawn from it continuously. But there is no cause for worry on this score as long as the hand can be put on the transformer. A large transformer for a given voltage rating in general should be selected.

Resistor Strip Gets Hot

The resistance strip ordinarily used in the output has not been included in the diagram of this double rectifier eliminator. It is connected across the binding posts marked output. The placement of this strip is important because a great deal of heat is normally generated in it. If it is tubular it should be placed vertically so that air will circulate freely about it both inside and outside. There should be a draft through it.

But of greater importance is its placement with respect to the various condensers used in the eliminator. The condensers are filled with a wax which will soften or even melt when it is subjected to excessive temperatures. If the resistor strip is placed too close to the condensers the heat from the strip is likely to melt the wax, and this does the condensers no good at all. Provide an air space between the resistance strip and the condensers so that air can circulate between the two.

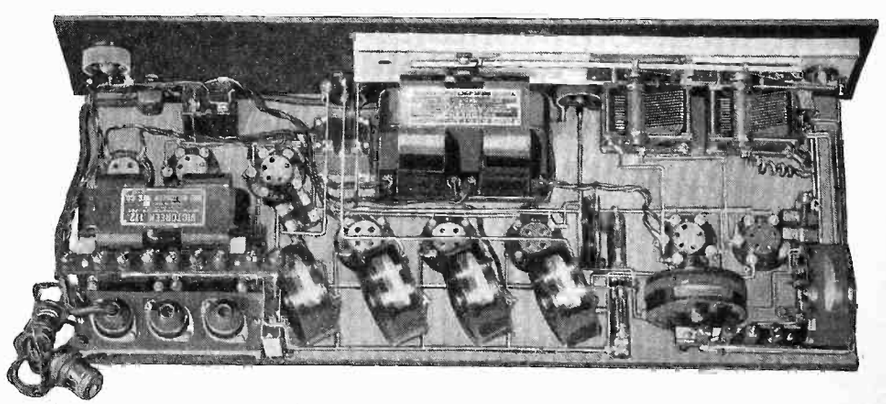
A considerable quantity of heat is also generated in the rectifier tubes. For this reason these tubes must also be kept away from the condensers.

Ventilation Necessary

It is of no avail to place the heat generating units of the eliminator so that the condensers and other parts will not be damaged by heat if the whole assembly is placed in a closed container not provided with adequate ventilation. If the heat generated cannot escape from the container the temperature of the air inside will rise so high as to damage the condensers or even the tubes and coils. There must be thorough ventilation.

If the container is made of wood very little heat will be conducted to the outside surface, and the heat inside will raise the temperature to a dangerous point. The same applies if the box is made of asbestos, or if it is asbestos lined. If the box is made of plain metal the heat will be conducted to the outside surface very easily and the temperature inside the box will not be so high. But even then it will be too high unless there is some special means of heat disposal other than conduction. There should be convection, that is, a draft of air, through the box. This may be provided by cutting holes in the sides near the bottom and in the top of the box, by putting a metallic screen in the back of the set in place of a solid wall, by leaving the top or the doors ajar, or by leaving the eliminator and filter in the open.

THE LATEST IN AC DESIGN



REAR VIEW OF THE NEW AC VICTOREEN, THE LATEST LABORATORY DEVELOPMENT OF JOHN A. VICTOREEN, GIFTED SCIENTIST. SEE ARTICLE ON OPPOSITE PAGE.

The AC Victoreen

How to Insure Perfect Results In Construction of this Receiver

[Part I of this article on the AC Victoreen was published last week. The following concludes the article.]

By Capt. Peter V. O'Rourke

IF you have followed the wiring directions your wiring will be correct. It is wise, however, where the possibility of blowing out eight tubes is concerned, to check up your connections against the instructions once more to make sure that you have made no mistakes, and insert but one tube at a time with power on.

Regeneration and the Victoreen

Regeneration may be incorporated into the Victoreen but the receiver is so sensitive and selective without regeneration that it has not been deemed advisable to incorporate it in this case.

The switch jack should be mounted with the frame towards the baseboard. In describing the wiring in detail, we will refer to the springs of the jack as follows: Number A spring is the first spring from the bottom; number B spring is the next; number C the next and so on to number F spring, which is the last spring in the pile and is at the top.

How to Tune the Receiver

The technique used in tuning this receiver is slightly different from that used with the DC set. Owing to the peculiar characteristics of the AC tubes it usually takes from 20 to 45 seconds before the tubes start to function; to speed up this operation is is advisable to turn on the one-half ohm rheostat, governing the intermediate tubes, to the limit, until you hear the familiar "live" sound in the speaker. When this starts, turn back the one-half ohm rheostat until the filaments of the —26 tubes are glowing at a dull red. Then adjust the 400 ohm potentiometer to the most sensitive point, as indicated by the sound coming from the speaker. You may then adjust the hum control knab, at the upper right corner of the panel to its neutral point.

You are now ready to tune in stations in the usual way with the master control. Each carrier fave will be indicated by a slight hiss. Stop in the center of this and then adjust the compensator knob and readjust the dial to its maximum volume point. You may then regulate the volume by adjusting the 400 ohm potentiometer and the half ohm rheostat. You will find that on strong and local signals the filaments of the —26 tubes will become invisible, even in a dark room. We advise always keeping the filaments of these tubes at the lowest working point, except on very weak signals, when it may be necessary to turn them on to full brilliancy.

Use of Loop

If type of loop other than those recommended by us is used, its inductance may be of such value that it cannot be properly tuned with a .0005 condenser.

This can be determined by the position of the compensator knob when tuning in a station of medium wave length. If this knob must be turned a considerable distance to the left of the center position (as indicated by the arrow) to bring in the signal to best advantage, the need for additional turns on the loop is indicated; if to the right, turns should be decreased.

The same result can be accomplished by shifting the rotor of the loop condenser one or more teeth on the gear rack in the direction in which the arrow on the compensator knob varies from the center position.

Volume Control

Control of volume is accomplished by means of the RF rheostat. The potentiometer should be set at that point which produces greatest signal strength and selectivity. Very seldom if ever should the potentiometer be operated on either extreme end, as a hum may be found when so operated. In general practice the set will operate most efficiency with the potentiometer arm near the center.

Antennas.

Any good box type loop is recommended which is large enough to give maximum pickup. The Vee coil-antenna is recommended as it meets the above requirements.

The use of the outside aerial is not recommended in very congested districts where a large number of stations are broadcasting. It is for use in such districts only in going after distance when the locals have shut down. You will find that the loop will give you all the distance reception you want with plenty of volume, and greater freedom from interference.

If you see an outside aerial be sure to make it no longer than about fifty feet including length of lead-in. A larger aerial will prove to be a collector of undesirable interference.

Hunting for Possible Trouble

One poor connection is enough to spoil an otherwise perfect set. Check each connection carefully to make sure all are good.

There should be little or no hum in this receiver. Any hum present is generally caused by the AC filament of the power tube in the power supply unit. In other words, this receiver should have very little more hum than is generally found on a DC operated set having a power tube operated with AC.

If any considerable rum is present it may be done to an open 30 ohm potentiometer, or a defective choke coil in the power supply, to the possibility that the power supply is closer to the audio end of the receiver than 18 inches.

If there is hum it is well to try a set of B batteries in place of the plate voltage supply to determine whether the source of the trouble is in the receiver or in the power supply. Similarly if a C battery eliminator is used a C battery should be substituted to see whether this eliminator is responsible.

Other causes of hum are insufficient C bias and a defective AC tube. To test whether the C bias is insufficient increase it and note whether the volume or the hum reduces. To test whether the trouble is due to a defective tube try a good tube in each of the sockets. The Ac tube will always hum slightly until it is warmed up.

Use By-pass Condenser

The .005 condenser across the primary of the first audio is important and under no circumstance can it be omitted, although slightly larger or smaller values may be used. A larger value produces a deeper tone which may be desirable on certain speakers. With the possible exception of this condenser the blueprint should be followed exactly.

It is always well to measure your normal AC line voltage, as, when writing to a manufacturer of power devices, the line voltage and frequency must be given accurately.

When the —27 tubes are first turned on the top portion of the heater element may light up brilliantly. This is not an indication of a defective tube but such tubes may become noisy with use. Should the set become noisy and it is suspected that the noise may be in the set, connect a wire across the loop terminals and throw switch to loop position. If noise is still present the noise originates in the radio set and may be localized by removing first the oscillator tube, then the first detector, then the first radio frequency, etc., until noise stops which will give you its approximate location.

Use Heavy Duty B Eliminator

We do not recommend the use of small types of B eliminators and only recommend a type of —10 power supply which has full wave rectification.

Should the intermediate amplifiers oscillate when the RF rheostat is on full the RF voltage is too high.

If the volume of the set is found to change occasionally while tuned in on a station, this is probably caused by a fluctuation in the line voltage.

Lack of control on the part of the 400 ohm potentiometer may be caused by its condenser being shortened. If this potentiometer should have an open circuit the RF transformers will receive no plate voltage and the RF circuit will be dead. Test for this by momentarily shorting all three terminals of the 400 ohm potentiometer.

Should it be found impossible to reduce the volume sufficiently by the RF rheostat either your line voltage exceeds 117 volts or the rheostat value is incorrect. Use the Victoreen ½ ohm nickel rheostat especially provided for this requirement.

A remarkable feature of this AC circuit is that the power consumption from the line including, A, B, and C units is less than 100 watts.

A Feast or a Famine Attends Shield Grid

One of the odd facts about the shielded grid tube is that it works wonderfully when it does work and when it doesn't work wonderfully it usually does not work at all. This is no shortcoming of the tube, but has to do principally with incorrect voltages and, in some especial instances, with faulty circuit design.

When the tube is used as a radio frequency amplifier, in shield grid fashion, with the G post of the socket connecting to B plus, the voltage must be correct in respect to the plate at the socket P post. Unless one knows in advance what the plate voltage will be he does not know what voltage the extra grid is to get. It is often some positive voltage between 16½ and 45, but if the plate voltage is higher than usual, the extra grid may get a higher B voltage than 45. Experimentally as much as 475 volts were tried on the G post. The tube got very hot and so did the metal shield. The current drawn was tremendous—enough to overheat an adjustable resistor built for radio power packs!

The positive B voltage when the tube is used in this fashion is not so critical as when the tube is used as a space charge detector. Here the second positive voltage does not go to the G post, but to the metal cap atop the tube, hence the circuit is not changed from normal detector operation, except to connect a clip to the cap and a wire flexible lead from the clip to a variable resistor of high range, say from 500 to 5,000,000 ohms or more. While 5,000,000 is plenty, if you have one of higher range you may use that. Connect one end to B plus power the highest B voltage you have, and the other end to the wire going to the tube cap.

The tube operates very poorly as a detector unless a bypass condenser, say, .001 mfd., is connected from plate to filament or from plate to A minus. It makes little practical difference whether the connection is made to filament or to A minus, but the filament connection is handier, since an F post of the socket is near the P post.

A short lead results.

How to Avoid Shorts In Using New Tubes

A point not previously brought out concerning the shielded grid tube is that if with other receiver tubes a hum is heard from B eliminator or last audio, the shielded grid tube, properly operated, will reduce the hum materially. While the shielded grid tube works without a metal shield covering it, include a shield, since hum is reduced in the instances cited above, and besides other forms of interference pickup are avoided.

Also ground the shield by connection to either filament post.

In making this connection remember that when the tube is used as a radio frequency amplifier, if the clip on the cap touches the metal shield a short of the input results. No signals are heard. So if you hear nothing look to this possible cause of trouble.

When the tube is used as a space charge detector, with top cap connected to B plus, then if the clip and shield touch, the B voltage may be directly applied to the filament, and this might ruin the tube. So be careful. It is almost impossible to cause such a short without gross carelessness, as the shields have hard rubber insulation that well protects the two circuits.

Repeat Tuning Often Aids Super-Heterodyne Reception

Nearly every Super-Heterodyne should have repeat points on the dial. That is, every station should come in on two different points on the oscillator dial. If it does not it simply means that one of the points have been shoved off the dial by making the intermediate frequency high. But all of the repeats can't be shoved off.

In most Super-Heterodynes each station comes in at more than two points. That, too, is normal operation, but this extra repetition can be avoided by proper design. The oscillator and the modulator should be loosely coupled, and the modulator should be preceded with a tuner which is selective at radio frequency. The multiplicity of repeats results from the demand for great sensitivity with the least possible equipment.

Station Elimination Opposed by Reader

EDITOR, RADIO WORLD:

I see no use of eliminating stations to clear up the broadcasting situation, except possibly around New York and Chicago. Stations elsewhere, I think, could practically all be used for daytime broadcasting but about half of them should be kept off the air between 7 and 11 at night. This plan would put no station out of business, would stop the interference at night and provide local programs during the day in sections where many small broadcasters now are using their stations only at night.

I see no reason for not extending the broadcast band down to 150 meters. Of course these bands are now assigned to someone else, but are they ever used? The folks occupying that territory since most of the amateurs have gone to the low waves are indeed few and far between.

J. E. SHANK,
Ledger-Dispatch, Norfolk, Va.

How the-22 Tube Improves Detection

An experimenter working the shielded grid tube will soon find that it has remarkable characteristics. One of these is super-sensitiveness as a detector.

But to get all the sensitiveness out of the tube it is necessary to comply with exacting requirements.

The efficiency of any tube largely depends on its amplification constant and on the high and low frequency impedances in its plate circuit. For high sensitivity the amplification constant must be high. That it is in the shield grid tube. The load impedance on the tube at radio frequency must be low. A by-pass condenser of .001 mfd. provides the necessary high frequency admittance. The low frequency impedance must be high.

For the highest sensitivity it is also necessary to adjust the various voltages very carefully. For example, the positive bias on the inner grid, when the tube is used as a space charge detector, is very critical. The fine variation necessary can be obtained with a high variable resistor.

It will be observed that all these conditions have been met in the Four Tube Shielded Grid Diamond. Condenser C6 supplies the high RF admittance, the resistance coupler, AF1, comprising R8, C8 and R9, supplies the high low frequency impedance, and R7 affords the necessary control for the inner grid potential.

RESULTS EDITOR:

Built the Four Tube Shielded Grid Diamond of the Air from details in your Feb. 4 issue, and it is a knockout. New York and Chicago stations come in with great volume. The set tunes very sharp. My 222 tube proved out to be non-microphonic, and I had no interaction troubles, with or without shielding.

The stage of radio frequency using the new efficient tube is sensitive to a superlative degree. I even brought in KFI, Los Angeles, on ground and three foot lead-in wire alone, with sufficient volume to hear announcing and program on loudspeaker. Music filled the room on a ten-foot indoor aerial.

My set worked best with the voltages recommended on the carton of the tube, 3.3 on filament, 135 plate, and 45 on the shield plate. It also worked very well on 90 plate and 22½ shield plate. My set is perfectly stable even with the shield off the tube.

ARTHUR SMITH,
1107 Franklin St., Tampa, Fla.

* * *

(*Telegram*)

RESULTS EDITOR:

DIAMOND SHIELDED GRID WONDERFUL GIVE US MORE SHIELDED GRID CIRCUITS.

DR. L. M. CHAPIN,
HIBBING, MINN.

Sectional Feeling Runs High

SECTIONALISM is making itself felt more than ever in the discussions of solutions of the assignment of wavelengths and time on the air to broadcasting stations.

The South complains it has insufficient total power and stations, while the Mid-West complains that simultaneous broadcasting by stations on the same wave, although on opposite coast points, interferes badly with reception of nearer stations on frequencies close by.

The large cities feel that so many stations in their midst hamper or prevent distant reception until the locals have signed off.

Again, many persons in scattered parts of the country complain that broadcasting of a given program by chain stations so greatly restricts the choice of programs as to deny full satisfaction.

So one hears the argument of one part of the country, and again a different argument from another part of the country, yet the situation is far better than it was before the Federal Radio Commission took it in hand.

After the Commission has gained a new lease of life by Congressional enactment it is almost certain to make reassignments, so that many of the just complaints will be heeded.

Contradictory demands and both natural and administrative limitations have made the Commission's task extraordinarily hard. Patience has paid big dividends in the past and promises to pay bigger ones in the future, regardless of the increased rediscount rate of the Federal Reserve Bank.

THE WAVE DEBATE

EDITOR, RADIO WORLD:

Out here in the Midwest with our powerful sets stations allocated near each other's wavelengths, although geographically far apart, mean nothing as far as clearing the air is concerned.

There are too many stations on the air and too many stations trying to pound through their programs of very inferior quality. The chain programs are the best and out here everyone is for programs rendered by the best artists.

We appreciate very much what the Radio Commission is accomplishing and if at any time some of its members could make it convenient to visit this district and see, or rather hear themselves just the chaotic condition of our radio reception, I personally will be very glad to entertain them.

The situation out here is intolerable. Nothing but heterodyning, blanketing and interference.

As an example, last Sunday to obtain the Atwater Kent program I had to use nine chain stations and then could not obtain clear reception. Also WOC interferes with WDAF and some Chicago stations. WGN, WOS and KHJ interfere badly. KFI is blanketed, WHO also, KYW likewise, KSD and WFAA badly mixed up, KFNF a confounded nuisance except to a few farmers. WCCO impossible to receive for heterodyning, WLW likewise, WSM badly mixed up. WOW and WBAP blanket each other and also WOAI; KWKH a nuisance. KDKA, KVOO, WLS and KFAB all badly mixed up. So you see that all or nearly all of these stations constituting the chain are almost impossible to receive satisfactorily.

I personally would be very glad to do anything possible to better conditions out here. The situation is seriously affecting the radio business in general.

I believe it is wrong to allocate wavelengths from Washington and I believe that one of the Federal Radio Commission's engineers located in the Middle West soon would find out for himself just what we listeners are putting up with. It is a shame that the National Broadcasting Company's splendid programs which cost so much money cannot be received out here as a music-loving community desires.

I have one of the largest sets in the West, with Edinborough and London to my credit, so am not writing of experiences from a cheap set, but from experience obtained from one of the best sets obtainable.

If there is anything we can do let us buckle down to it and clear up this chaos.

We all appreciate the situation confronting the Commission and we realize that the Commission is doing all possible to improve conditions, but it does seem to us that the only cure is to chop off some three or four hundred stations.

Geographic separation of stations on or near the same wavelength will never clear the air and I doubt very much if putting all chain stations on the same wavelength, as some noisy ones demand, would cure the trouble.

FELIX L. CADOU,
Kansas Power Co., Liberal, Kans.

* * *

EDITOR, RADIO WORLD:

I have heard a lot of the Federal Radio Commission picking some of the stations off the air, but not one word about the National Broadcasting Company taking up all of the dial. Here on the Pacific Coast we get the same thing on seven positions on the dial. If the program were broadcast from one station like KPO, San Francisco, it could be picked up all over the coast with any old set. I do not see where the Board has done a thing except favor the N. B. C.

The Board should cut the power of some of the chain stations.

H. C. SANFORD,
629 Jamison Avenue,
Sedro Woolley, Wash.

Something Up Sleeve, McCord Tells Builders

By Robert H. W. McCord

SINCE RADIO WORLD published an article of mine in the February 11 issue, to which I attached a coupon prospective members of a custom set builders club were to fill out, I have received almost enough replies to convince me that such a club should be started. I say "almost," because unless hundreds of custom set builders favor such a club, and are willing to make it something of real value, there is no use starting it. So far not quite a hundred replies have been received.

I have been questioning parts manufacturers, and they strongly favor the plan and offer assistance. All of us professional set builders know that such assistance from manufacturers must be of a very material nature. While I am not promising anything, I have something up my sleeve, and bona fide signing of this week's coupon is likely to draw it out.

It is a lot of work (for me) to start such a club, but I'm willing. If you professional set builders will get these filled-in coupons back to me fast enough I'll become positively convinced, will get started at once, and will open your eyes with the exposition of advantages that will accrue. We'll have a real club or none—genuine, material assistance, exclusive inside information and money-making plans.

You fellows ring the bell by putting your John Hancock where it belongs. Thanks.

Some of the new indorsers follow:

Nelson F. Colvin, 2018 Greenup St., Covington, Ky.; Wm. H. Walters, 619 N. Albyn St., Carbondale, Ill.; Russell G. Hanna, Beardsley, Minn.; Frank F. Mann, 28 Wachusett St., Worcester, Mass.; C. B. Woodruff, 53 Atkinson St., Rochester, N. Y.; Harold R. Wiggins, 2141 Sedgwick St., Chicago, Ill.; Russell H. Slimm, 570 Auburn St., Camden, N. J.; Geneveux Service Co., 12 Levoy St., Lowell, Mass.; Chas. F. Hoschke, 20 Heyward St., Brooklyn, N. Y.; Louis Kern, 1603 Baywood Ave., Toledo, Ohio; A. T. Armstead, 2645 Bellevue Ave., Cincinnati, Ohio; F. B. Wheeler, 4430 Walker Ave., Houston, Texas; John J. Meehan, 2446 N. Bancroft St., Philadelphia, Pa.; E. J. Taylor, 690 West 37th St., Des Moines, Iowa; G. W. Newton, R. F. D. 2, Box B, Alexandria, La.; E. Wm. Fries, 16 N. 56th St., Philadelphia, Pa.; Arthur C. Smith, 209 Sixth St., N. W., Charlottesville, Va.; Frank J. Jilek, 4800 Sixth Ave., So., St. Petersburg, Fla.; Ray Laker, Box 163, Ottawa, Ont., Canada; Francis J. McCormack, 291 Martense St., Brooklyn, N. Y.; Charles Pautello, 551 West 204th St., New York City; E. Paetzold, 36 6th St., Weehawken, N. J.; Joseph A. Vieiva, 119 Wolfe St., San Francisco, Calif.; I. R. Horn, 202 N. 15th St., East Orange, N. J.; William A. Harding, 2013 N. 29th St., Philadelphia, Pa.; Clay D. Woodcock, 506 Edgewood Ave., Trafford, Pa.; Charles Rehn, Jr., 4046 25th St., San Francisco, Calif.; Edwin W. Melvin, 308 S. Union Ave., Havre de Grace, Md.; Alf. Candy, 33 Chester Ave., Toronto 6, Ont., Canada; Arthur G. Whelpley, 77 Arsdale Terrace, East Orange, N. J.; D. A. Johnston, Box 206, New Britain, Conn.; Harry L. Brown, 1450 Fulton St., Brooklyn, N. Y.; Roy E. Guard, Falls Church, Va.; S. H. Anderson, Box 471, Pleasantville, N. Y. (Westchester County); Thomas F. Meagher, 7765 75th St., Glendale, L. I.; Adrian Pellenc, 35 Purdy St., Princess Bay, Staten Island, N. Y.; A. I. Sadick, 1090 Simpson St., Bronx, N. Y.; R. N. Bell, 8630 So. Vermont, Los Angeles, Calif.; J. K. Brintzenhoff, 110 South 6th St., Reading, Pa.; Thomas A. Walsh, 594 E. 143rd St., Bronx, New York City; R. H. Pepper, 1963 Laveer St., Philadelphia, Pa.; Clyde Christy, 33 St. Mary's Ave., Port Richmond, S. I., N Y.; Henry C. Gancel, 550 Riverside Drive, New York City; Geo. M. Binger, c/o the Wm. H. Block Co., Indianapolis, Ind.; Marvin C. Williams, Box 353, Rantoul, Illinois; Alfred E. Ritter, 476 East 15th St., Brooklyn, N. Y.; Arthur Bosch, 1090 E. 36th St., Brooklyn, N. Y.; W. J. Stevens, 1017 Peniston St., New Orleans, La.; Theodore Hummer, 46 Christopher St., Montclair, N. J.; Theo. W. Hippe, 261 Jackson St., Bristol, Pa.; J. G. Klenk, 3650 N. 7th St., Philadelphia, Pa.; W. Lewis Armentrout, Winterthur, Delaware; H. G. Rydholm, 321 Main St., Sauk Centre, Minn.; J. Allen King, 213 Jackson St., Topeka, Kans.; H. L. Thomas, Box 201, Asheville, N. C.; I. J. Bedell, 182 Myrtle Ave., Jersey City, N. J.

Robert H. W. McCord,
c/o RADIO WORLD,
145 West 45th Street, N. Y. City.

I am a custom set builder and would like to join you in the formation of a national organization of custom set builders. Please list my name and address. I am one of the indorsers. This does not obligate me in any way.

NAME .....

ADDRESS .....

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

Two Dials, DX and Tone Thrill Set Builders

Two things conflict in radio construction—utter convenience and maximum efficiency. In many factory-made sets the compromise leans heavily toward convenience, while in a custom built or home-constructed receiver efficiency reaches much higher planes with less than proportionate sacrifice of convenience. But with the build-your own devotees the single dial set therefore is not so popular, because much greater sensitivity is obtainable by using two dials, and the home constructors are a DX crowd, as well as a tone quality aggregation.

Music Taste Changes from Bananas to Bach

Pittsburgh.

From "Yes We Have No Bananas" to Bach's "Air on the G String." From "red-hot" syncopation to the dignity of the classics.

That, according to Victor Saudek, conductor of KDKA's Little Symphony Orchestra, has been the evolution of musical taste among radio listeners since broadcasting became an established institution a little more than seven years ago. And there is no one, perhaps, whose opinion on such matters is entitled to more respect than is Mr. Saudek's for he, as head of the first orchestra ever organized exclusively for radio broadcasting, has been presenting concerts over the air nightly for more than five years, and for the same length of time has been receiving a daily flood of mail expressing the likes and dislikes of his audience.

Early Fans Demanded Jazz

When dinner concerts by the Little Symphony first became a regular KDKA feature, Saudek says he and his fellow musicians became the target for a volley of caustic correspondence. "If you want anybody to listen to you, lay off the high-brow bunk," a typical letter said. "Give us something peppy, like 'Red Hot Mamma,'" said another.

After a few months, however, a majority of the fans asked for folk songs. The Stephen C. Foster melodies and love ballads were requested more frequently than any other. "When You and I Were Young, Maggie," was one of the favorites. Another was "Silver Threads Among the Gold."

Light opera, notably Victor Herbert's works, next came into favor with the listeners. Saudek began to receive hundreds of letters requesting selections from "The Red Mill," "Sari," "The Chocolate Soldier," and the entire list of Gilbert and Sullivan works.

Classics Wanted Now

It was about three years ago when an overwhelming sentiment in favor of "standard" music made itself manifest. For a period of many months selections such as "The Overture to Poet and "Peasant" and "The Overture to William Tell" lead in popularity.

For the past year or more Saudek's programs have been made up almost exclusively of so-called semi-classical and classical music, and he says there is no doubt that this is the type of music his listeners now want. Every mail, he says, brings letters begging him not to cheapen his programs—a distinct contrast to the general attitude of five years ago. The most frequent requests are for the various classical serenades, minuets, intermezzoes and ballets, and also for classical bits from popular symphonies of Haydn, Schubert and Mozart.

Modern Airs Unpopular

"The elevation of public taste within five years has been astounding," Saudek declares, "but the radio audience is not yet prepared for the richest musical literature, such as complete symphonies by Beethoven and Brahms.

"Nor is the public yet ready to hear modern music, from the pens of such composers as Ravel, Stravinsky, Honegger, Milhaud, DiFella, Schoenberg and Bela Bartok. It is sad but true that if we were to feature such works our audiences would be decimated in short order."

Not Up to Snuff, Expert Says of Announcers

The experimenters whose work is going to make the radio a significant part of modern civilization are at work not alone in engineering laboratories, but in the offices where material is being prepared for radio transmission and before the microphones of the nation's radio stations, in the opinion of Morse Salisbury, new chief of Radio Service for the United States Department of Agriculture.

"The engineers have made marvelous progress in perfecting the radio as a rapid means of communication," Salisbury commented. "The radio writers and announcers have barely kept pace with them in adapting this new instrument to the educational needs of listeners.

Unlocks Lore of the Mind

"I welcome the opportunity to take part in the Department of Agriculture's large-scale experiment in making knowledge stored up in laboratories, libraries, and minds of the nation's agricultural scientists readily and quickly available to the men and women who can put it to use in their daily lives."

The new chief of Radio Service observed that the pioneer work of Sam Pickard, his predecessor, who established the Radio Service in 1926, has established the fact that farmers and home-makers want and make use of radio information on the work of the Department of Agriculture.

To the question in the service's 1927 survey of use of farm radio sets, "If you had to give up one or the other, which would you prefer to have left, music or talk?" 2,358 representative farmers replied "Talk" and 1,538 answered "Music," Salisbury recalled. He pointed also to the fact that some 10,000 queries each month from radio listeners follow the broadcasting of the Housekeepers' Chats, one of the 11 features supplied radio stations by the service.

Effective Means of Education

"There is now no doubt," he added, "that radio is a most effective means of education. Just how best to use it has to be found by experiment.

The radio service has the exceptional opportunity of using the experience of 127 stations broadcasting its releases this year. and some 5,000,000 or more listeners receiving these broadcasts daily in finding the technique of giving information and instruction by radio."

The service will begin February 22, a new series of talks on cooperative marketing. Salisbury announced. These will be broadcast from 50 stations throughout the country for a period of 10 weeks.

Fears Independent Stations Will Suffer

I cannot agree entirely with H. L. Kenney of Kansas City that a large number of broadcasting stations should be deleted. If this is done all the little independent stations will be removed from the air first, leaving the field to the powerful chain stations. With these stations monopolizing the broadcast spectrum it would be useless to construct sets to receive more than one channel, for the same program would be received all over the tuning dials. This lack of variety would become monotonous.

The class of programs now put out by the chain stations gets tiresome, and I for one will junk my receiver if I am forced to choose between these programs or none.

If they will broadcast the chain programs on a single wave and allow the crowded stations below 300 meters to spread out, it would be necessary only to delete a few stations where congestion is greatest. We should then have good, clear reception throughout the spectrum and a variety of programs to satisfy all.

The Federal Radio Commission has created chaos below 300 meters by forcing so many stations to operate in this band. There is hardly a channel on which from three to five stations are not mutually squealing all the time.

It seems to me that the Commission has shown favoritism in granting clear channels to the big electrical concerns, many of which do not broadcast programs which are enjoyed by many persons west of the Mississippi River and not many more east of the river.

We do like to hear the World's Series games and occasionally a program of different type broadcast by the big chains, but 90 per cent of our radio entertainment is derived from the little independent stations, the power of which has been reduced so that it is now difficult to pick them up.

Here is hoping that the little ones stay.

CLARENCE A. BRADT,
Columbine, Colo.

* * *

EDITOR, RADIO WORLD:

When my copy of RADIO WORLD arrived I found that Tim Turkey had added a word to his former article on the broadcasting of boxing contests.

I agree with him heartily. As long as men have red blood in their veins just so long will they be interested in physical contests, and it will be a sad day for the human race, if the day ever comes, when its interest in these affairs wanes.

Of course we will always have with us those who criticize as brutal, disgusting, etc., almost any physical contest, and anyhow is fighting any more so than football? Besides there only two instead of twenty-two engaged in it.

Did you ever notice, too, that those nominally opposed to boxing always listen in if they have a chance? As if to appear consistent they go into another room, but always remain within earshot of the set.

(DR.) GEO. H. LEGGETT,
133 West 123rd Street,
New York City.

Six Hotels Equipped With Radio in Rooms

The six Statler hotels in New York, Boston, Cleveland, Detroit, Buffalo and St. Louis were linked with WEAF and sixteen other stations on Feb. 8 between 8 and 9 p.m. Eastern Standard Time to present the joint broadcast by six musical organizations celebrating the inauguration of radio programs in all the rooms of the hotels as part service to the guests. The six orchestras took turns entertaining the radio audience.

Self-Interest Arises In Wave Discussion

EDITOR RADIO WORLD:

I have just read the letters from Louis T. Thoma and R. E. Brown in the January 28 issue of RADIO WORLD. I would like to ask these gentlemen a few questions.

Do you think that because you live in the center of the American Radio Universe that you only should be taken into consideration by the Radio Commission?

How about some of the rest of us who live in the other three-quarters of the United States?

West of the Missouri-Mississippi lies almost two-thirds of the territory and this region has only about one-third of the radio stations. The South is no better served. In fact the North-Central and the North-Atlantic States have about three-fifths of the stations, and these occupy about one-fourth of the territory.

Do not misunderstand me. I am not complaining that the better stations are in the favored territory. That is as it should be because the best talent is available there as well as the greatest number of listeners. Neither do I plead for more stations in the West and the South.

We have about 100 stations in our territory, most of which have only a local audience, but fill a vital need.

My complaint is that we cannot receive any but the strictly local stations without interference from stations in the East. It is impossible, for example, to tune in our best stations in Portland and Seattle, located about 300 miles away, without interference rendering the signals unintelligible. This is due to crosstalk and heterodyning between stations which the Radio Commission assigned to the same channels.

A survey of reception conditions in the West will show that there is hardly a single station of the better class which can be received without such interference. And this is not the fault of my receiver, for when there is no interference it will bring in regularly and clearly such stations as WJAM, WLW, WDAF, KWKH and WBBM.

There are too many stations like KMA continuously crowing about shoes, dress goods, fertilizers, hog feed and divers other types of merchandise. Why should this thing be permitted? Why should one station be permitted to use one of the precious wave channels for the selfish purposes of its owner when many others who are anxious to serve the public are refused licenses for lack of channels?

I agree with Senator Dill of this State when he says that the Radio Commission has no backbone. Everybody expected some relief when the Commission began to function, but as far as the West is concerned radio conditions are far worse this winter than a year ago.

R. T. COASTER,
Opportunity, Wash.

U.S.-Holland 'Phone

Radio telephone service between the United States and the Netherlands was opened recently at 7:30 in the morning when Victor Damme, director general of the Netherlands, exchanged greetings with J. H. Van Royen, Netherlands Ambassador in Washington, and also with Secretary of State Frank B. Kellogg.

The radio connection between the United States and the Netherlands is established through London, the conversations passing from England to the continent through the submarine cables.

A call was put through in the morning by William Westerman, president of the American Chamber of Commerce in Amsterdam, for Willis H. Booth, president of the New York Netherlands Chamber of Commerce and vice-president of the Guaranty Trust Company. They exchanged formal greetings and hopes for the prosperity of the new serv-

Why You Should Use Shielded Grid Tubes

The ease with which a shielded grid tube may be included in a circuit of this type, plus the undoubted value of such inclusion, presents an opportunity to the home constructor and custom set builder that is irresistibly alluring.

Moreover, here is the very latest thing in tubes, and abundantly worth while, just awaiting your trial. And there need be no doubt concerning the outstanding success of such trial, for although the tube has its own compendium of mysteries, its use in the simplest circuit to which it is adaptable has stood the acid test.

When distant stations otherwise none too plainly heard come rolling in with volume called "as loud as any local," without disturbing the ease of tuning or sacrificing selectivity, one realizes that he has something that is well worth while.

Dangers Averted

The shielded grid tube has a certain flexibility that enables one to utilize the tube in a most simple manner, and as results fully warrant the choice, the tube was selected as an input amplifier without plate tuning. In this way the amplification at radio frequencies is kept to within practical limits and self-oscillation in that stage is not encountered. When the highest amplification of which the tube is possible in radio or audio circuits is used there may be trouble, especially self-oscillation, but in the circuit as outlined the danger factor was wholly circumvented.

The tube, used as a shielded plate tube, to give this use an accurate name, is simply connected in circuit as follows: the grid post of the socket goes to B plus; the cap at top of the tube goes to the grid end of the antenna coil secondary and to the stator plates of the first tuning condenser, C1, a clip being used. The rest of the connections are made in orthodox style. As a six volt source of A supply will naturally be used, some means must be provided for dropping the voltage to 3.3 and maintaining the current drain at .132 ampere. Although the tube is a newcomer in the market, a suitable Amperite already has appeared. It is No. 622, and it fulfills the requirements excellently.

The B voltage to be applied to the G post of the first socket—that is, to the shield plate—is something you must determine for yourself. Likely it will be less than 45 volts, but you can solve the problem nicely by test. If you use B batteries, there are sufficient taps to enable you to decide the question quickly. If you use a B eliminator you can connect B plus detector, if variable, to the common B lead of the RF and first audio, and use the B plus amp. voltage, if variable, to give you the desired voltage. Or you may team up the three-tube plate return connection to B plus amp. on the eliminator and use the B plus detector variable for obtaining the correct positive voltage for the shield plate. This method works out well if you have only one variable B voltage on your eliminator—the tap usually providing the B plus det. voltage. However, if you can separate the B voltages, do so.

Now, you have probably heard, and if not you will read on the circular enclosed in the carton with the shielded grid tube, that the filament voltage is not critical. That assertion is bolstered up by the fact that such a highly scientific organization as Radiall Co. makes an Amperite for correct filament voltage and regulated current for the tube when the tube is used on an original six volt source. So if there were critical points about the filament voltage and current these two organizations—tube manufacturer and Amperite manufacturer—would not be taking the position they do.

Not Critical

The current and voltage of the filament are not critical, but one must be sure to get the right B voltage on the shield plate (G post of socket), for unless that is done not only is the filament voltage critical but reception becomes erratic and maybe is rendered impossible. However, all you need do is get that very important positive shield plate potential correct. It is well to bear this firmly in mind, for after you build the set, if you did not know this trivial kink, you might feel that somebody in whom you had unlimited confidence had played fast and loose with your credulity.

The other outstanding consideration is that for full gain it is necessary to use the entire primary winding of the Hammarlund three circuit coil L3. This is done by making the regular plate connection of the RF tube to one extreme lug on the back of the coil, while the other extreme lug will be joined to the B plus voltage. As high a plate load impedance as the coil affords is desirable for maximum transfer of voltage, since the plate impedance of the shielded grid tube is abnormally high, even under the operating conditions invoked in the present circuit.

And while this high gain is safeguarded as outlined, the opposite course, that of using less than the full number of turns of the aperiodic winding in the antenna circuit, may well be followed, otherwise the signal energy introduced into the first tube may be altogether too large to prevent serious overloading of the detector.

DX Reception Is Used for Program Repetition

The distance ability of some radio sets often is the cause of coincidence. Many Middle West fans at the close of a particularly likeable program, sponsored by a national advertiser, start angling for a Western station to hear the program again. This is possible because of the difference in time.

G. Edward Elwell, of Bloomsbury, Pa., tells of an interesting coincidence in a letter to KFI, Los Angeles. He states that he tuned in KFI, recently, during the broadcast of selections from what he knew was a Victor Herbert opera. He missed the opening announcement, and because it had been some time since he had last heard the particular selections, he was unable to recall the name. The next day at noon he tuned in WJZ, New York, and heard the identical selections, which proved to be from "It Happened in Nordland."

Desk Set for the Busy But Willing Executive

By Herbert E. Hayden

(Photographs by the Author)

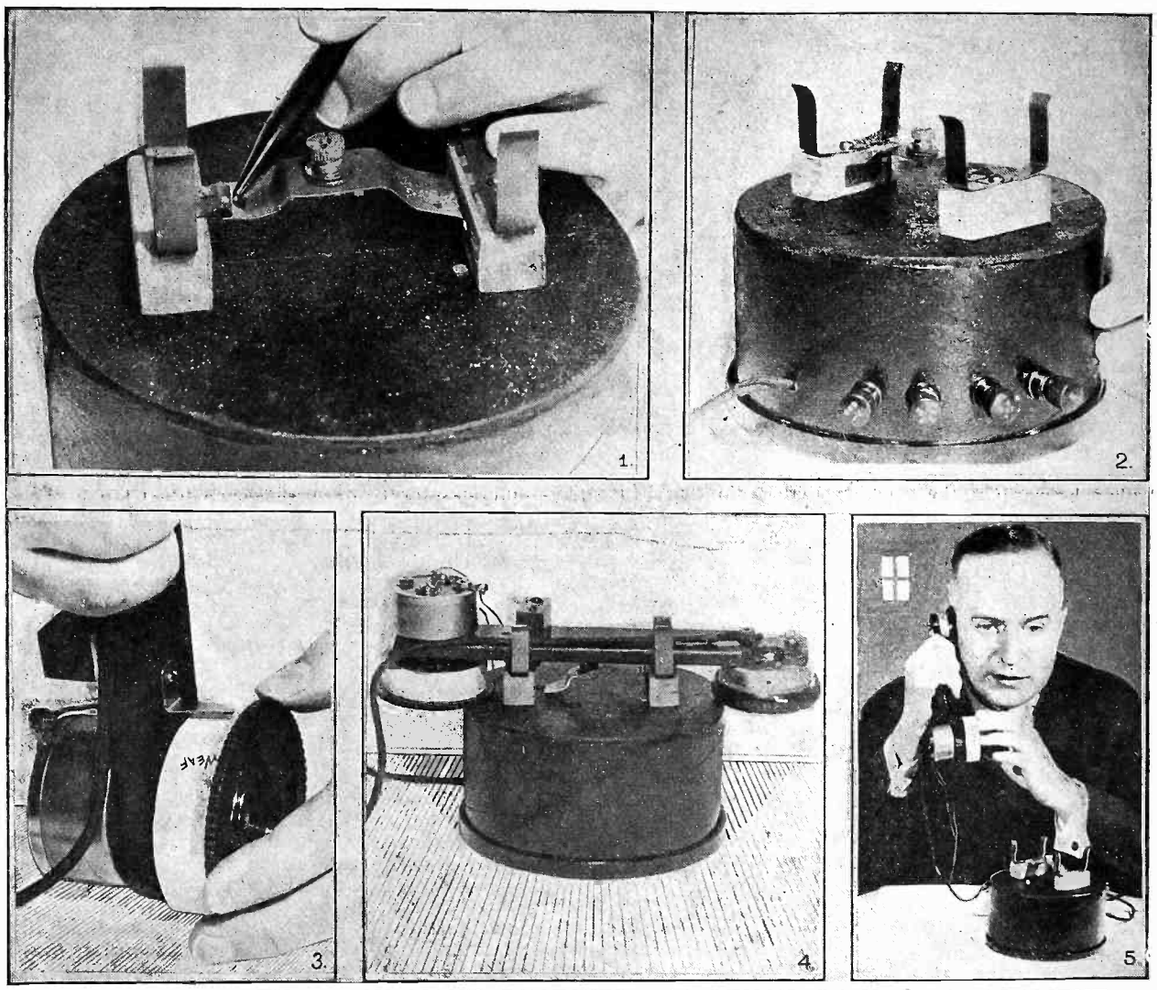
MANY important events of wide public interest take place during business hours, say from 10 in the morning to 5 in the afternoon. Business men would like to attend some of these, but duty keeps them in their offices.

How many would not desert the office for the baseball park during a world series game?

How many would not like to participate in the welcome of a national hero returning from the fields of his conquests?

How many would not like to hear the President of the United States in person deliver his message to Congress or to the people directly? There are few that would not?

But few executives can take the time during business hours and still attend to their work properly. They either have to sacrifice the interest of the business or the pleasure of participating in important happenings. But certain compromises are possible.



FIVE VIEWS OF THE BUSY MAN'S RECEIVER: (1) PENCIL POINTS TO FILAMENT SWITCH WHICH IS SO ARRANGED THAT RECEIVER IS TURNED ON WHEN HEAD SET IS TAKEN OFF THE SUPPORTS. (2) BATTERY LEADS ARE CONNECTED TO BINDING POSTS ON THE SIDE OF THE BOX. (3) ONE END OF HEAD SET CARRYING THE TUNING CONDENSER AT THE REAR AND THE CONTROL AND DIAL IN FRONT. (4) COMPLETE RECEIVER IN NON-OPERATING POSITION SHOWING EARPIECE AT ONE END OF HEAD SET AND THE TUNING GEAR AT THE OTHER. (5) THE RECEIVING SET IN USE BY A BUSY EXECUTIVE.

The more important political, scientific and sporting events are broadcast by one or more stations, so that anyone equipped with a radio set can participate in this manner, provided that time is available and other circumstances permit.

But that leaves the business man about where he was before. Most offices are not equipped with radio receivers, and if they were they could not be used with a loudspeaker for the noise from it would not only distract the busy executive but also many of his sub-ordinates.

A loudspeaker in a busy office during a world series game would demoralize the whole force and turn the office into a gallery.

But this objection is not applicable to a small portable set with which the executive can listen in alone without disturbing any one else. He can even continue with his own work and yet get enough of the report of the happenings to know what is going on.

Unique Set

A unique receiver was built for an executive interested principally in stock quotations. The receiver is illustrated in Figs. 1 to 5. The circuit diagram is Fig. 6.

As can be seen from Fig. 6 the circuit embodies the principle of the ultra-audion, an arrangement known for its high sensitivity and simplicity. There is a single RF transformer, L1 and L2. Its primary is connected either to a small indoor antenna or to a light socket antenna, depending on the surroundings. The secondary is tuned with a small variable condenser of .0005 mfd. capacity.

A condenser C1 of .00025 mfd. connected between the tuned circuit and the grid serves as detecting condenser. The grid leak R1 necessary to make the detector sensitive is connected between the grid and the positive end of the A battery. Its resistance is 3 megohms.

A third condenser C3 is connected between the plate and the tuned circuit for the purpose of isolating the tuned circuit from the plate voltage and to limit the regeneration. This condenser should have a capacity of about 100 mmfd. and it may be a variable condenser of the compression type. Whether a fixed or a variable condenser is used it must be physically small as well as electrically.

Stage of AF

One stage of AF is used to boost the volume and thus to make the range of the receiver many times greater than what it would be with a single tube. The transformer T1 use should be small so

(*Continued on page 20*)

Radio University

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When writing for information give your Radio University subscription number.

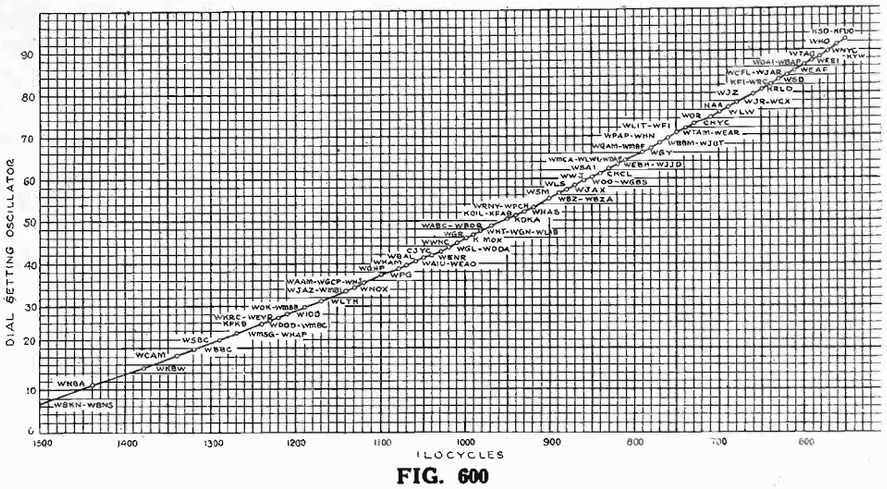

FIG. 600

REGARDING THE ADAMS 1-2-3 receiver (7 tubes) described in the February 11 issue, please show tuning curve of oscillator to aid me in locating DX stations.

H. W. FREMONT,
Dubuque, Ia.

Fig. 600 shows such a curve.

* * *

WILL YOU kindly explain the meaning of the following radio terms: A "getter," Heaviside layer, refraction, space charge, shield grid, radiation resistance?—FRANKLIN PIERCE, Philadelphia, Pa.

A "getter" is a substance placed in a vacuum tube during manufacture for the purpose of "getting" the last trace of gas after the pumps have done their work. It is usually a metal like magnesium. The Heaviside layer is a layer of rarefied air in which there are free electrons. It is about 200 miles up. but varies from time to time. Refraction means bending of the direction of a wave motion when the wave goes from one medium to another. Examples are a light ray bending on entering water, light bending on entering glass, electric waves on entering the Heaviside layer. Space charge is the electrification in the space between the filament and the plate due to the presence of electrons or positive ions. A shield grid is a grid plate put between the plate and the ordinary grid for shielding the control grid from fluctuations in the plate voltage. Radiation resistance is the resistance of an antenna due to the radiation of electric power into space. It is analogous to the motional resistance of a telephone, which is due to the radiation of sound from the loudspeaker.

* * *

THERE IS a terrific howl in my receiver which I have been unable to remove. I have changed tubes, speaker, resistors, grid condensers and eliminator, but the howl continues. The howl starts slowly and then grows so strong that no signal can be heard. What can I do to stop it?

(2)—I have a shield grid tube and want to connect it ahead of my receiver. Can I connect it across the 6-volt A battery if I put a rheostat in series with the filament?—LLOYD DAVIS, Memphis, Tenn.

(1)—The howl is due to a microphonic tube, perhaps the detector. Protect it from the sound of the loudspeaker. Put a Vac Shield or lead weight on the delicate tube. You can find the frail tube by tapping it gently. There will be a ring of about the same frequency as the howl.

(2)—You can if you use a rheostat of at least 25 ohms.. The voltage of the tube is 3.3 volts and the current is 132 milliamperes (.132 amp.). Hence when the battery voltage is 6.4 volts, as it may be, the required resistance is close to 25 ohms.

* * *

I HAVE a 5-tube Diamond of the Air and it gives me excellent quality and sufficient volume for all ordinary purposes. But it is not loud enough to dance by when dance music is playing. Can I add another resistance coupled stage to make it loud enough?

(2)—Would it be better to use a transformer stage?

(3)—Can you suggest any better arrangement?—LESTER HIGGINS, Lincoln, Neb.

(1)—It is not advisable to add another stage because the circuit would not be stable.

(2)—Yes, it would be better, but still it may make the set unstable.

(3)—Add a —10 type power tube with high plate voltage and omit the last tube in the set. This makes the number of stages the same but the amplification and output much greater.

* * *

I BUILT two 5-tube Diamond of the Air receivers, one for myself and one for a friend of mine. The two are exactly alike. My friend's receiver works perfectly and gives wonderful quality and gets all the stations he wants. My set, on the other hand, stutters and I can't get anything satisfactorily. What is the reason?

(2)—We have interchanged the tubes. His tubes do not work in my set and my tubes work in his set, so the trouble is not with the tubes. Could it be with the loudspeaker? We use different types.—ELBERT GRAYSON, New York, N. Y.

(1)—Your receiver motorboats while your friend's receiver does not.

(2)—The speakers may have a certain effect on the trouble but the probability is that your set will stutter with either speaker. The trouble is caused by your eliminator. Try your friend's eliminator on your set and note the difference. Connect a choke coil across one of the amplifier grid leaks, the secondary of an old transformer, for example, to cure your trouble when you use your own eliminator.

* * *

WHAT ARE the values of resistances R2, R3 and R4 in the eliminator shown in Fig. 2, page 4, Jan. 21, issue of RADIO WORLD?

(2)—I have a resistor strip with a total of 13,000 ohms and tapped so that the two end sections are 2,000 ohms each and the three middle sections are 3,000 ohms each. It was designed for a 171 power pack. Can this be used in the eliminator referred to in question 1?

(3)—The drawing is marked 180 volts at the highest tap but when I put a high resistance voltmeter across zero and 180 I get over 220 volts. What can I do to bring the voltage down to 180 volts?

(4)—Can the hook-up referred to in Question 1 be used with a Raytheon or similar rectifier?—EDWARD JOHNSON, El Paso, Texas.

(1)—They may be 3,000 ohms each.

(2)—Yes.

(3)—Do nothing; it should measure 220. What you measure is the plate voltage of 180 volts plus the grid voltage of 40 volts.

(4)—Yes.

* * *

A MOST PECULIAR phenomenon has developed in my receiver. Up to the other day it worked fine, but now the first radio frequency stage does not tune, although I get weak reception. Here is the phenomenon: Although the first RF tube lights the dial may be turned without affecting the signal, except at the former tuning-in point for any station, and at this point the dial now tunes the station OUT! My wife thinks this is weird. I took out the first RF tube and the set worked in the same freakish way. Do you suppose my antenna has grown old and needs replacement? What is the cause of and remedy for my trouble?

B. JUDSON MARSH,
Owensboro, Ky.

The RF socket is defective. Either plate or grid spring does not contact.

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Have your name entered on our subscription and University lists by special numbers. Put this number on the outside of the forwarding envelope (not the enclosed return envelope) and also put at the head of your queries. If already a subscriber, send $6 for renewal from close of present subscription and your name will be entered in Radio University. No other premium given with this offer.

[In sending in your queries to the University Department please paragraph them so that the reply can be written under or alongside of each query. Write on one side of sheet only. Always give your university number.]

RADIO WORLD, 145 West 45th Street, New York City.
Enclosed find $6.00 for RADIO WORLD for one year (52 nos.) and also enter my name on the list of members of RADIO WORLD'S University Club, which gives me free information in your Radio University Department for 52 ensuing weeks, and send me my number indicating membership.

Name .....

Street .....

City and State .....

LIST OF STATIONS

550 kc.—545.1 m.

KSD, St. Louis, Mo.
KFUO, St. Louis, Mo.
WMAK, Lockport, N. Y.
WPTF, Raleigh, N. C.
WFAA, Dallas, Texas
WDAY, Fargo, N. D.
KFDY, Brookings, S. D.

560 kc.—535.4 m.

WCAC, Mansfield, Conn.
WHO, Des Moines, Iowa.
KFBK, Sacramento, Cal.
WTIC, Hartford, Conn.

570 kc.—526.0 m.

WNYC, New York City.
KFKX, Chicago, Ill.
KYW, Chicago, Ill.
KMTR, Los Angeles, Cal.

580 kc.—516.9 m.
(Canadian Shared)

WMC, Memphis, Tenn.
WWVA, Wheeling, W. Va.
WFLA-WSUN, Clearwater, Fla.
WTAG, Worcester, Mass.

590 kc.—508.2 m.

WOW, Omaha, Nebr.
KLX, Oakland, Cal.
WEEI, Boston, Mass.

600 kc.—499.7 m.

WBAP, Fort Worth, Texas.
WOAI, San Antonio, Texas.

610 kc.—491.5 m.

KGW, Portland, Ore.
WEAF—One transmitter at Bellmore, N. Y.
WEAF—One transmitter at New York City.

620 kc.—483.6 m.

WJAR, Providence, R. I.
WCFL, Chicago, Ill
WLTS, Chicago, Ill.
WEMC, Berrien Springs, Mich.
KUSD, Vermilion, S. D.
WTAW, College Station, Tex.
KFDM, Beaumont, Tex.
KFBU, Laramie, Wyoming.

630 kc.—475.9 m.
(Canadian Shared)

WSB, Atlanta, Ga.
WSUI, Iowa City, Iowa.

640 kc.—468.5 m.

WRC, Washington, D. C.
KFI, Los Angeles, Cal.

650 kc.—461.3 m.

WNAC-WBIS, Boston, Mass.
KRLD, Dallas, Tex.
KFNF, Shenandoah, Ia.
WCAE, Pittsburgh, Pa.
WRR, Dallas, Tex.
KUOM, Missoula, Mont.

660 kc.—454.3 m.

WJZ, Bound Brook, N. J.
KFRC, San Francisco, Cal.

670 kc.—447.5 m.

WMAQ, Chicago, Ill.
WQJ, Chicago, Ill.
KFOA, Seattle, Wash.

680 kc.—440.9 m.

WJR-WCX, Pontiac, Mich.
WIBG, Elkins Pk., Pa.
KFSD, San Diego, Cal.
WAAW, Omaha, Nebr.

700 kc.—428.3 m.

WLW—One transmitter at Harrison, N. J.
WLW—One transmitter at Cincinnati, Ohio.
WMAF, So. Dartmouth, Mass

710 kc.—422.3 m.

WOR, Newark, N. J.
KPO, San Francisco, Cal.
WOS, Jefferson City, Mo.

720 kc.—416.4 m.

WGN-WLIB, Chicago, Ill.
WLIB-WGN, Near Elgin, Ill.
KHJ, Los Angeles, Cal.

740 kc.—405.2 m.

WLIT, Philadelphia, Pa.
WFI, Philadelphia, Pa.
WCCO, Minneapolis, Minn.

750 kc.—399.8 m.

WEAR, Cleveland, Ohio.
WTAM, Cleveland, Ohio.
WSBT, South Bend, Ind.

760 kc.—394.5 m.

KMA, Shenandoah, Iowa.
WHN, New York City.
WQAO-WPAP, Cliffside, N. J.
KTW, Seattle, Wash.
KWSC, Pullman, Wash.
KWKH, Shreveport, La.
KOB, State College, N. M.

770 kc.—389.4 m.

WBBM, Glenview, Ill.
WAAF, Chicago, Ill.
WJBT, Chicago, Ill.
WABI, Bangor, Me.

780 kc.—384.4 m.
(Canadian Shared)

WQAM, Miami, Fla.
WMBF, Miami Beach, Fla.
KGO, Oakland, Cal.
WBSO, Wellesley Hills, Mass
KTHS, Hot Springs, Ark.

790 kc.—379.5 m.

WCAJ, Lincoln, Neb.
WGY, So. Schenectady, N. Y.

800 kc.—374.8 m.

KNRC, Santa Monica, Cal.
WOC, Davenport, Ia.

810 kc.—370.2 m.

WDAF, Kansas City, Mo.
KHQ, Spokane, Wash.
WLWL, Kearney, N. J.
WMCA, Hoboken, N. J.

820 kc.—365.6 m.

WEBH, Chicago, Ill.
WJJD, Mooseheart, Ill.
KMJ, Fresno, Cal.
WCSH, Portland, Me.

830 kc.—361.2 m.

WSAI, Cincinnati, Ohio.
KFWB, Los Angeles, Cal.

850 kc.—352.7 m.

WWJ, Detroit, Mich.
WEW, St. Louis, Mo.

860 kc.—348.6 m.

WOO, Philadelphia, Pa.
WGBS, Astoria, Long Island, N. Y.
WIP, Philadelphia, Pa.
KVOO, Bristow, Okla.
KJR, Seattle, Wash.
KXA, Seattle, Wash.

870 kc.—344.6 m.

WLS, Chicago, Ill.
WCBD, Zion, Ill.
KWG, Stockton, Cal.
KFQD, Anchorage, Alaska.

880 kc.—340.7 m.
(Canadian Shared)

WAPI, Auburn, Ala.
WJAX, Jacksonville, Fla.
WHB, Kansas City, Mo.
WOQ, Kansas City, Mo.

890 kc.—836.9 m.
(Canadian Shared)

WSM, Nashville, Tenn.
KNX, Los Angeles, Cal.

900 kc.—333.1 m.

KFQB, Fort Worth, Texas.
WJAD, Waco, Texas.
WBZ, East Springfield, Mass.
WBZA, Boston, Mass.
KSAC, Manhattan, Kan.
KFJM, Grand Forks, N. D.
KSEI, Pocatello, Idaho.
WHA, Madison, Wis.
WLBL, Stevens Point, Wis.

920 kc.—325.9 m.

KOA, Denver, Colo.
WRNY, Coytesville, N. Y.
WPCH, Hoboken, N. J.

930 kc.—322.4 m.
(Canadian Shared)

WRHF, Washington, D. C.
WHAS, Louisville, Ky.
KICK, Atlantic, Iowa.
WIAS, Ottumwa, Iowa.
WKA, San Juan, Porto Rico.

940 kc.—319.0 m.

KOIL, Council Bluffs, Ia.
KFAB, Lincoln, Nebr.
KOIN, Portland, Ore.

950 kc.—315.6 m.

KDKA, Pittsburgh, Pa.
KPSN, Pasadena, Cal.

970 kc.—309.1 m.

KYA, San Francisco, Calif.
WABC, Richmond Hill, N. Y.
WBOQ, Richmond Hill, N. Y.

980 kc.—305.9 m.

WHT, Chicago, Ill.
WIBO, Desplaines, Ill.
WHAZ, Troy, N. Y.
KOMO, Seattle, Wash.

990 kc.—302.8 m.

WGR, Buffalo, N. Y.
KSL, Salt Lake City, Utah.

1000 kc.—299.8 m.

KFWO, Avalon, Cal.
KMOX, St. Louis, Mo.
WPSC, State College, Pa.
WBAK, Harrisburg, Pa.

1010 kc.—296.9 m.
(Canadian Shared)

WWMC, Asheville, N. C.
KUOA, Fayetteville, Ark.
WEPS, Gloucester, Mass.
WSHK, Dayton, Ohio.
KQW, San Jose, Cal.
WDEL, Wilmington, Del.
KGFW, Ravenna, Nebr.
WSMB, New Orleans, La.
KLZ, Denver, Colo.

1020 kc.—293.9 m.

WODA, Paterson, N. J.
WTMJ, Milwaukee, Wisc.
KPRC, Houston, Texas.
WLBW, Oil City, Pa.
KGCH, Wayne, Nebr.
WGL, Secaucus, N. J.
KGDW, Humbolt, Nebr.
KGEZ, Kalispell, Mont.

1040 kc.—288.3 m.

WDBO, Orlando, Fla.
WENR, Chicago, Ill.
WBCN, Chicago, Ill.
KTBI, Los Angeles, Cal.
WNAT, Philadelphia, Pa.
KGBX, St. Joseph, Mo.
WKY, Oklahoma City, Okla.
WSSH, Boston, Mass.
WBET, Boston, Mass.
WIAD, Philadelphia, Pa.

1050 kc.—285.5 m.

WBAL, Baltimore, Md.
KFAU, Boise, Idaho.
WJAG, Norfolk, Nebr.
KLCN, Blytheville, Ark.
KMMJ, Clay Center, Nebr.
WCAL, Northfield, Minn.
WDGY, Minneapolis, Minn.

1060 kc.—282.8 m.

WAIU, Columbus, Ohio.
KFXF, Denver, Colo.
KFJR, Portland, Ore.
KTBR, Portland, Ore.
WRAK, Escanaba, Mich.
WEAO, Columbus, Ohio.

WDRC, New Haven, Conn.
KFUM, Colorado Springs, Colo.

1070 kc.—280.2 m.

WHAM, Rochester, N. Y.
KTAB, Oakland, Cal.

1080 kc.—277.6 m.

WGHP, Mt. Clemens, Mich.
WKAR, E. Lansing, Mich.
KWWG, Brownsville, Texas.
WDZ, Tuscola, Ill.
WNAX, Yankton, S. Dak.

1090 kc.—275.1 m.

WEAN, Providence, R. I.
WTAS, Elgin, Ill.
KFSG, Los Angeles, Cal.
KFPL, Dublin, Texas.
KFBB, Havre, Mont.
WFBM, Indianapolis, Ind.

1100 kc.—272.6 m.

WHAR, Atlantic City, N. J.
WPG, Atlantic City, N. J.
WRM, Urbana, Ill.
WBAA, La Fayette, Ind.
KFJF, Oklahoma City, Okla.
KFAD, Phoenix, Ariz.
WFBJ, Collegeville, Minn.
KSMR, Santa Maria, Cal.
WFDF, Flint, Mich.
WSKC, Bay City, Mich.

1110 kc.—270.1 m.

KLDS, Independence, Mo.
WJAS, Pittsburgh, Pa.
KQV, Pittsburgh, Pa.
WGST, Atlanta, Ga.
WMAZ, Macon, Ga.
WSOE, Milwaukee, Wisc.
KOAC, Corvallis, Oreg.
KFLX, Galveston, Texas.
KGU, Honolulu, Hawaii.
WHAD, Milwaukee, Wisc.

1120 kc.—267.7 m.
(Canadian Shared)

WBAO, Decatur, Ill.
WDAE, Tampa, Fla.
KSBA, Shreveport, La.
KFLV, Rockford, Ill.
WAAM, Newark, N. J.
WNJ, Newark, N. J.
WGCP, Newark, N. J.
WLAP, Louisville, Ky.
KFWI, San Francisco, Cal.
KFIZ, Fond du Lac, Wisc.
WOBU, Charleston, W. Va.
WFPG, Altoona, Pa.

1130 kc.—265.3 m.

WNOX, Knoxville, Tenn.
WOI, Ames, Iowa.
WHK, Cleveland, Ohio.
KTSA, San Antonio, Texas.
KKP, Seattle, Wash.
WBES, Takoma Park, Md.
WICC, Easton, Conn.
WCWS, Danbury, Conn.

1140 kc.—263.0 m.

WSEA, Virginia Beach, Va.
WJAZ, Mt. Prospect, Ill.
WMBI, Chicago, Ill.
WDAG, Amarillo, Texas.
KGHP, Hardin, Mont.
KGEF, Los Angeles, Cal.
WJBO, New Orleans, La.

KFPW, Carterville, Mo.
KGEK, Yuma, Colo.
WJBI, Red Bank, N. J.
WEAM, N. Plainfield, N. J.

1150 kc.—260.7 m.

WCMA, Culver, Ind.
WDWF-WLSI, New Bedford, Mass.
WRHM, Fridley, Minn.
WOOD, Grand Rapids, Mich
KGA, Spokane, Wash.
WHBA, Oil City, Pa.
WCAU, Philadelphia, Pa.
WFIW, Hopkinsville, Ky.

1160 kc.—258.5 m.

WFBL, Syracuse, N. Y.
WEBW, Beloit, Wisc.
WNAL, Omaha, Nebr.
KOCH, Omaah, Nebr.
KFOX, Omaha, Nebr.
KFUL, Galveston, Texas.
KYDL, Salt Lake City, tah.
WIL, St. Louis, Mo.
WBT, Charlotte, N. C.
WSBF, St. Louis, Mo.

1170 kc.—256.3 m.

KTNT, Muscatine, Iowa.
WCSO, Springfield, Ohio.
KRE, Berkeley, Cal.
KFUS, Oakland, Cal.
WBER, Rossville, N. Y.
WASH, Grand Rapids, Mich.
WEBJ, New York City.
WLTH, Brooklyn, N. Y.

1180 kc.—254.1 m.

KGFX, Pierre, S. Dak.
WRVA, Richmond, Va.
WREN, Lawrence, Kans.
KFKU, Lawrence, Kan.
KMO, Tacoma, Wash.
WTAQ, Eau Claire, Wis.
WCAX, Burlington, Vt.
KFHA, Gunnison, Colo.
KGDA, Doll Rapids, S. Dak.
WHEC-WABQ, Rochester, N. Y.

1190 kc.—252.0 m.

WORD, Batavia, Ill.
KPLA, Los Angeles, Cal.
WMBB-WOK, Homewood, Ill
WSAR, Fall River, Mass.
WKJC, Lancaster, Pa.
WGAL, Lancaster, Pa.
WKBF, Indianapolis, Ind.
WMBR, Tampa, Fla.
WKBT, New Orleans, La.
WFOM, St. Cloud, Minn.
KOCW, Chickasha, Okla.

1200 kc.—249.9 m.
(Canadian Shared)

KFKA, Greeley, Colo.
WBAX, Wilkes-Barre, Pa.
WBRE, Wilkes-Barre, Pa.
KFRU, Columbia, Mo.
WCOA, Pensacola, Fla.
KFQU, Holy City, Cal.
KFJI, Astoria, Oreg.
WIBR, Steubenville, Ohio.
KFJZ, Ft. Worth, Tex.
WHBY, West de Pere, Wisc.
KMED, Medford, Oreg.
KFYR, Bismarck, N. D.
WCAZ, Carthage, Ill.
WBBY, Charleston, S. C.
KFUT, Salt Lake City, Utah.
WSAZ, Huntington, W. Va.
WREC, Memphis, Tenn.
WSIX, Springfield, Tenn.

1210 kc.—247.8 m.
(Canadian Shared)

WFKD, Frankford, Pa.
WABW, Wooster, Ohio.
WABY, Philadelphia, Pa.
WCAT, Rapid City, S. Dak.
WIOD, Miami Beach, Fla.
KFEL, Denver, Colo.
KFBC, San Diego, Cal.
WEBE, Cambridge, Ohio.
KFJB, Marshalltown, Iowa.
KGCA, Decorah, Iowa.
WLCI, Ithaca, N. Y.
WRAM, Galesburg, Ill.
WFBZ, Galesburg, Ill.
KWLC, Decorah, Iowa.
KOW, Denver, Colo.
WKDR, Kenosha, Wisc.
WLBT, Crown Point, Ind.
WJBA, Joliet, Ill.
WTAX, Streator, Ill.
WRRS, Racine, Wisc.
WLBR, Belvedere, Ill.
WNBH, New Bedford, Mass.

1220 kc.—245.8 m.

WGBB, Freeport, N. Y.
WAAT, Jersey City, N. J.
WEVD, Woodhaven, N. Y.
WHDI, Minneapolis, Minn.
WLB, Minneapolis, Minn.
KFH, Wichita, Kans.
KZM, Oakland, Cal.
KLS, Oakland, Cal.
WFBE, Cincinnati, Ohio.
KFPY, Spokane, Wash.
KFIO, Spokane, Wash.
WKRC, Cincinnati, Ohio.
WWL, New Orleans, La.

1230 kc.—243.8 m.

KWUC, LeMars, Iowa.
KSCJ, Sioux City, Iowa.
KGY, Lacey, Wash.
KGRS, Amarillo, Tex.
KFCB, Phoenix, Ariz.
KGCX, Vida, Mont.
WMBC, Detroit, Mich.
WFBR, Baltimore, Md.
WDOD, Chattanooga, Tenn.
WCAD, Canton, N. Y.
WCAO, Baltimore, Md.

1240 kc.—241.8 m.

WFCI, Pawtucket, R. I.
KFKB, Milford, Kans.
WEDC, Chicago, Ill.
WGES, Chicago, Ill.
KFON, Long Beach, Cal.
WEBR, Buffalo, N. Y.
WEBC, Superior, Wis.
WNBX, Springfield, Vt.
WMAL, Washington, D. C.
WBRC, Birmingham, Ala.

1250 kc.—239.9 m.

WOAN, Lawrenceburg, Tenn.
WJAM, Cedar Rapids, Ia.
KWCR, Cedar Rapids, Ia.
WNAD, Norman, Okla.
KEX, Portland, Oreg.
WIBA, Madison, Wis.
KGCU, Mandan, N. Dak.
WBBP, Petosky, Mich.
WOAX, Trenton, N. J.
WCAP, Asbury Park, N. J.
WTAL, Toledo, Ohio.
WBAW, Nashville, Tenn.

1260 kc.—238.0 m.

WRAW, Reading, Pa.
WLBI, Wenona, Ill.
WRBC, Valparaiso, Ind.
WJBW, New Orleans, La.
KFVI, Houston, Texas.

WIBX, Utica, N. Y.
WJBB, Sarasota, Fla.
WQBA, Tampa, Fla.
WABZ, New Orleans, La.
WADC, Akron, Ohio.

1270 kc.—236.1 m.

KHMC, Harlingen, Tex.
KFDX, Shreveport, La.
WGBF, Evansville, Ind.
KFMX, Northfield, Minn.
KFWM, Oakland, Cal.
WHAP, Carlstadt, N. J.
WPUB, New York City.
WTAR-WSUF, Norfolk, Va.
WBBW, Norfolk, Va.
WTAD, Quincy,, Ill.
WBNY, New York City.
WSRO, Middletown, Ohio.
WHBC, Canton, Ohio.

1280 kc.—234.2 m.

WMAY, St. Louis, Mo.
KWK, St. Louis, Mo.
KFQA, St. Louis, Mo.
WMBS, Lemoyne, Pa.
KVI, Tacoma, Wash.
WMPC, Lapeer, Mich.
WMAN, Columbus, Ohio.
WJBY, Gadsden, Ala.
KGAR, Tuscon, Ariz.
WJAK, Kokomo, Ind.
WFBC, Knoxville, Tenn.
WDAH, El Paso, Texas.
WCAH, Columbus, Ohio.
WBBL, Richmond, Va.

1290 kc.—232.4 m.

WNBZ, Saranac Lake, N. Y.
WJKS, Gary, Ind.
WSBC, Chicago, Ill.
WBRL, Tilton, N. H.
KUT, Austin, Tex.
KFQZ, Hollywood, Cal.
KFPR, Los Angeles, Cal.
WMBJ, Monessen, Pa.
WHBQ, Memphis, Tenn.
KFEY, Kellogg, Idaho.
WLBH, Farmingdale, N. Y.
KFMR, Sioux City, Ia.
KFJY, Ft. Dodge, Ia.

1300 kc.—230.6 m.

KFEQ, St. Joseph, Mo.
KGCL, Seattle, Wash.
KPCB, Seattle, Wash.
WQAN, Scranton, Pa.
WGBI, Scranton, Pa.
KFPM, Greenville, Tex.
WDBJ, Roanoke, Va.
WCOC, Columbus, Miss.
WIBZ, Montgomery, Ala.
KDLR, Devils Lake, N. Dak.
WLBM, Boston, Mass.
WAFD, Detroit, Mich.
WAAD, Cincinnati, Ohio.

1310 kc.—228.9 m.

WOWO, Ft. Wayne, Ind.
WMBL, Lakeland, Fla.
KWJJ, Portland, Oreg.
WKBE, Webster, Mass.
KTAP, San Antonio, Tex.
WHBP, Johnstown, Pa.
WNBR, Memphis, Tenn.
KGBU, Ketchiken, Alaska.
KELW, Burbank, Cal.
KPPC, Pasadena, Cal.
WGBC, Memphis, Tenn.

1320 kc.—227.1 m.

WWAE, Chicago, Ill.
KSO, Clarinda, Iowa.
WCLO, Camp Lake, Wis.
WJBC, La Salle, Ill.

KGEU, Lower Lake, Cal.
WARS-WSDA, Brooklyn, N. Y.
WJAY, Cleveland, Ohio.
WBBC, Brooklyn, N. Y.
WFJC, Akron, Ohio.
WCBE, New Orleans, La.
KFUP, Denver, Colo.
WAIZ, Appleton, Wis.
KXRO, Aberdeen, Wash.
WTHS, Atlanta, Georgia.
KGHB, Honolulu, T. H.

1330 kc.—225.4 m.

WSYR, Syracuse, N. Y.
WMAC, Casenovia, N. Y.
WLAC-WDAD, Nashville, Tenn.
KFIU, Juneau, Alaska
WCOT, Olneyville, R. I.
WAGM, Royal Oak, Mich.
KFVG, Independence, Kans.
KGEN, El Centro, Cal.
KFKZ, Kirksville, Mo.
KFUR, Ogden, Utah.
WCBM, Baltimore, Md.

1340 kc.—223.7 m.

WFAN, Philadelphia, Pa.
KFXR, Oklahoma City, Okla.
WCAM, Camden, N. J.
WFKB, Chicago, Ill.
WCRW, Chicago, Ill.
KGFH, La Crescenta, Cal.
KMIC, Inglewood, Cal.
KFBL, Everett, Wash.
WKAV, Laconia, N. H.
WSAJ, Grove City, Pa.
KGFB, Iowa City, Ia.
KGDP, Pueblo, Colo.
WNRC, Greensboro, N. C.
KGFK, Hallock, Minn.
WEBQ, Harrisburg, Ill.
KFVS, Cape Girardeau, Mo.
WOCL, Jamestown, N. Y.
WPCC, Chicago, Ill.

1350 kc.—221.1 m.

KFWC, San Bernardino, Cal
WSAN, Allentown, Pa.
WCBA, Allentown, Pa.
WHBD, Bellefontaine, Ohio.
WHBF, Rock Island, Ill.
KWKC, Kansas City, Mo.
WOMT, Manitowoc, Wis.
KGFL, Raton, N. Mex.
KWTC, Santa Ana, Cal.
KGBY, Columbus, Nebr.
WAMD, Minneapolis, Minn.
KFOY, St. Paul, Minn.

1360 kc.—220.4 m.

KGCI, San Antonio, Tex.
KGRC, San Antonio, Tex.
WKBH, La Crosse, Wis.
KXL, Portland, Ore.
WTAZ, Richmond, Va.
WHBW, Philadelphia, Pa.
WJBK, Ypsilanti, Mich.
WHBU, Anderson, Ind.
KRAC, Shreveport, La.
WMBO, Auburn, N. Y.
KGFI, San Angelo, Tex.
KJBS, San Francisco, Cal.
WMBG, Richmond, Va.

1370 kc.—218.8 m.

WGWB, Milwaukee, Wis.
WKBQ, New York City.
WKBO, Jersey City, N. J.
WCGU, Sea Gate, Coney Island, N. Y.
KGEW, Ft. Morgan, Colo.
WKBC, Birmingham, Ala.
WLBQ, Atwood, Ill.

(Concluded on next page)

SIXTH YEAR

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
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RADIO VISION EDITOR, Neal Fitzalan
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.

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.

Judson Starts Bureau For Fine Music On Air

Arthur Judson, 113 West Fifty-seventh Street, N. Y. City, producer, and manager of operatic and concert artists, such as Chaliapin, Martinelli, Braslau and many others, as well as such orchestras as the New York Philharmonic and Philadelphia Orchestras, has taken broadcasting so seriously as to organize his own bureau for the presentation of radio programs.

Three years ago Judson began his research into the radio situation. An organization has been built, in the ranks of which are to be found some of the greatest of the musical talent of the world, and in the production department are musical, radio, literary and production minds that stand out as leaders in their particular specialties. It was not until last fall that the Judson Radio Program Corporation made its bow before the microphone. At that time, it assumed the responsibility of producing all radio presentations for the Columbia Broadcasting System and in the five months that have elapsed, the wisdom of laying a firm foundation upon which to build the organization has become apparent.

Recently is was announced that the activities of the Judson Radio Program Corporation would no longer be confined to the production of one network, but would be liberated to spread the productions to any station or network of stations desiring to avail themselves of the service.

Judson is a native of Dayton, Ohio, where he began his career as a violinist. He later migrated to New York, where he dropped active participation in the artistic side of music and began work in the executive angle of the field by associating himself with a musical publication. Shortly afterwards, he became affiliated with the New York Philharmonic and Philadelphia Orchestras, finally becoming the manager of these organizations.

Among the stars of opera and concert fame from which the Judson Radio Program Corporation may draw for some of its talent in building radio programs are the following: Sopranos—Mabel Garrison, Hulda Lashanska, Louise Lerch, Nina Morgana and Eide Norena; Contraltos—Sophie Braslau, Maria Olszewska and Sigrid Onegin; Tenors—Giovanni Martinelli, Frederick Jagel; Baritones—Herbert Heyner and Heinrich Schlusnus; Basso—Fedor Chaliapin; Pianists—Alfred Cortot, Rudolph Ganz, Gitta Gradova, Valdimir Horowitz, Guiomar Novaes, Paul Wittgenstein; Violinists—Cecilia Hanson, Ruth Breton, Francis McMillan, Joseph Szigeti and Efrem Zimbalist; Cellist—Hans Kindler; Harpist—Carlos Salzedo; Orchestras and Instrumental Combinations drawn from the ranks of the New York Philharmonic Orchestra, the Philadelphia Orchestra and the Cincinnati Symphony Orchestra.

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1380 kc.—217.3 m.

WKBW, Buffalo, N. Y.
KGDM, Stockton, Cal.
KFQW, Seattle, Wash.
WRES, Quincy, Mass.
WKBV, Brookville, Ind.
WKBS, Galesburg, Ill.
WLBO, Galesburg, Ill.
KFOR, Lincoln, Nebr.
WIBU, Poynette, Wis.

1390 kc.—215.7 m.

WKBB, Joliet, Ill.
WCLS, Joliet, Ill.
WEHS, Evanston, Ill.
WHFC, Chicago, Ill.
WPEP, Waukegan, Ill.
KGER, Long Beach, Calif.
KRLO, Los Angeles, Calif.
WQAA, Parkesburg, Pa.
KFDZ, Minneapolis, Minn.
KGCB, Oklahoma City, Okla.
KGFG, Oklahoma City, Okla
KFXJ, Edgewater, Colo.
WOKO, Peekskill, N. Y.
WLEX, Lexington, Mass.
WKBI, Chicago, Ill.

1400 kc.—214.2 m.

KFIF, Portland, Ore.
KFEC, Portland, Ore.
WAIT, Taunton, Mass.
WKBN, Youngstown, Ohio.
WMBW, Youngstown, Ohio.
WLBG, Petersburg, Va.
KFWF, St. Louis, Mo.
WJBU, Lewisburgh, Pa.
KPJM, Prescott, Ariz.
WCWK, Ft. Wayne, Ind.

1410 kc.—212.6 m.

WRAX, Philadelphia, Pa.
KGBZ, York, Nebr.
KTUE, Houston, Texas.
WJBL, Decatur, Ill.
WKBP, Battle Creek, Mich.
KFHL, Oskaloosa, Ia.
KGFP, Mitchell, S. D.
KGDX, Shreveport, La.
KGGH, Cedar Grove, La.

1420 kc.—211.1 m.

KRSC, Seattle, Wash.
WCDA-WBRS, Cliffside, N. J
WRST, Bay Shore, N. Y.
WNBO, Washington, Pa.
WMES, Boston, Mass.
WLOE, Chelsea, Mass.
WBMH, Detroit, Mich.
KPNP, Muscatine, Ia.
KFCR, Santa Barbara, Calif.
KGFM, Yuba City, Calif.
KFYO, Breckenridge, Texas.

1430 kc.—209.7 m.

KGHC, Slayton, Minn.
WOKT, Rochester, N. Y.
KVOS, Bellingham, Wash.
WPRC, Harrisburg, Pa.
WRCV, Norfolk, Va.
WLBC, Muncie, Ind.
WMBM, Memphis, Tenn.
WLBF, Kansas City, Mo.
WCBS, Springfield, Ill.
KSOO, Sioux Falls, S. D.
WLBY, Iron Mountain, Mich
KFGQ, Boone, Iowa.
WTFI, Toccoa, Ga.
KGHF, Pueblo, Colo.

1440 kc.—208.2 m.

WRAF, La Porte, Ind.
WJBZ, Chicago Heights, Ill.
WNBA, Forest Park, Ill.
KFVD, Venice, Calif.
KGFJ, Los Angeles, Calif.
WGM, Jeannette, Pa.
WJPW, Ashtabula, Ohio.
WMBE, St. Paul, Minn.
WLBZ, Dover-Foxcroft, Me.
WRPI, Terre Haute, Ind.
KGCN, Concordia, Kans.
KGCR, Brookings, S. D.

1450 kc.—206.8 m.

WPSW, Philadelphia, Pa.
KGTT, San Francisco, Calif.
KLIT, Portland, Oreg.
WMRJ, Jamaica, N. J.
WTRL, Midland Park, N. J.
WHPP, Bronx, N. Y.
WLBV, Mansfield, Ohio.
WNBJ, Knoxville, Tenn.
WNBF, Endicott, N. Y.
KGDY, Oldham, S. D.
KGGF, Picher, Okla.
KGDR, San Antonio, Tex.

1460 kc.—205.4 m.

WNBQ, Rochester, N. Y.
WKBL, Monroe, Mich.
WMBD, Peoria Heights, Ill.
WABF, Kingston, Pa.
KGEO, Grand Island, Nebr.
KFXY, Flagstaff, Ariz.
KGDE, Barrett, Minn.
KGFF, Alva, Okla.
WRK, Hamilton, Ohio.
WOBT, Union City, Tenn.

1470 kc.—204.0 m.

KFXD, Jerome, Idaho.
WLBN, Chicago, Ill.
WSAX, Chicago, Ill.
WMBA (Portable), Newport, R. I.
WBBZ (Portable), Chicago, Ill.
KGEQ, Minneapolis, Minn.
WHBL (Portable), Chicago, Ill.
WIBW (Portable), Chicago, Ill.
WMBH, Joplin, Missouri.
WIBS, Elizabeth, N. J.
WMBQ, Brooklyn, N. Y.
WLBX, Long Island, City, N. Y.
KGFO (Portable), Terre Haute, Ind.
KGES, Central City, Nebr.
WKEN, Buffalo (Kenmore, (N. Y.).
WOBR (Portable), Shelby, Ohio.
KGGM (Portable), Inglewood, Calif.
WSVS, Buffalo, N. Y.
KHAC (Portable on Aeroplane).

1480 kc.—202.6 m.

WTFF, Mt. Vernon Hills, Va.
KVL, Seattle, Wash.
WHBN, Gainesville, Fla.

1490 kc.—201.6 m.

WCBR (Portable), Providence, R. I.
WHBM (Portable, Chicago, Ill.
WIBJ (Portable), Chicago, Ill.
WIBM (Portable), Chicago, Ill.
WKBG (Portable), Chicago, Chicago, Ill.
WGMU (Portable), New York City.
WRMU (Portable), New York City.
KGEY, Denver, Colo.
WATT (Portable), Boston, Mass.
WALK, Willow Grove, Pa.
KGEH, Eugene, Ore.

1500 kc.—199.9 m.

KWBS, Portland, Ore.
KUJ, Seattle, Wash.
WNBL, Bloomington, Ill.
WKBZ, Ludington, Mich.
KGFN, Aneta, N. D.
WRAH, Providence, R. I.
WBMS, Union City, N. J.
WNBW, Carbondale, Pa.
WGOP, Flushing, N. Y.
WWRL, Woodside, N. Y.
WBKN, Brooklyn, N. Y.

WRIT STOPS R. C. A. BAN ON OTHERS' TUBES

Wilmington, Del.

Judge Hugh M. Morris, in the Federal District Court, granted a temporary injunction to the DeForest Radio Company and four other independent tube manufacturers, restraining the Radio Corporation of America from enforcing clause 9 in its tuned radio frequency license contract with set manufacturers, which clause requires the set manufacturers to equip the sets only with R. C. A. tubes to make the sets "initially operative."

The pdaintiffs asked for the preliminary injunction on the ground that clause 9, in practice, violated the Sherman and Clayton laws, which affect monopolies in restraint of trade.

The Sole Seller.

Judge Morris set forth that the R. C. A. was "the sole seller of the radio tubes made by General Electric Co. and Westinghouse Electric & Manufacturing Co." He added that the license, granted by the R. C. A. and associated companies to twenty-five set manufacturers, contained clause 9, which the plaintiffs alleged unlawfully injured their business by compelling set manufacturers so licensed to refrain from using tubes of other manufacture for making the sets "initially operative."

Quotes Law.

He quoted from the third section of the Clayton act:

"It shal be unlawful * * * to lease or make a sale or contract for sale of goods, * * * whether patented or unpatented, * * * on the condition, agreement or understanding that the lessee or purchaser thereof shall not use or deal in the goods, * * * of a competitor or competitors of the lessor or seller, where the effect of such lease, sale, or contract for sale or such condition, agreement or understanding may be to substantially lessen competition or tend to create a monopoly in any line of commerce." (38 Stat. 731.)

The Court continued:

"Plaintiffs' affidavits declare that the defendant and the twenty-five licensees combined do approximately ninety-five per centum of the total business done in radio receiving sets. Defendant's affidavits state that such business does not exceed seventy per centum of the total.

"Plaintiffs' primary contention that Paragraph 9 of the contracts is a violation of Section 3 of the Clayton Act depends for its soundness upon the integrity of the three subordinate propositions that (1) there is a contract for the sale of goods (2) on the condition that the purchaser shall not use or deal in the goods of a competitor or competitors of the seller and (3) that the effect of such contract for sale or such condition is 'to substantially lessen competition or tend to create a monopoly in radio tubes.

"The plaintiff finds in paragraph 9 an express contract for the sale of goods—radio tubes—and asserts that whatever may be the remaining provisions embodied in the same instrument of writing they are powerless to take the sale contract outside the field of operation of the Clayton Act.

"The defendant, on the other hand, pronounces the contract a license agreement and the provisions in paragraph 9 touches the purchase and sale of tubes, lawful covenants, restrictions, or conditions of such license."

Practical Effect Illegal.

After reviewing the legal points raised by both sides, the court held that the practical effect of clause 9 constituted a violation of the law, particularly since the set manufacturers, to play safe, would respect even patents of doubtful integrity that the defendant claimed to possess in clear title.

The court declared that a contract for the sale of goods, as in this case, might easily be in violation of the anti-monopoly laws, and that even undisputed ownership of a patent did not carry with it freedom to impose unlimited restrictions, since the Clayton Act, particularly was a definite limitation even upon patent rights.

The list of plaintiffs follows:

Arthur D. Lord, Receiver in Equity for the DeForest Radio Company, Northern Manufacturing Company, United Radio & Electric Corporation, Televocal Corporation, and Harry Chirelstein, doing business under the name and style of Sonatron Tube Corporation.

Trust Uses Its Patents as Bludgeon, Senators Hear

Washington.

Alleged oppressive tactics on the part of a "radio trust" in an effort to restrain competition and to absorb or drive out of business, small independent units in the radio industry, were recited before the Senate Committee on Patents by witnesses for the Radio Protective Association, of Chicago.

Headed by their counsel, Ernest Reichman, of Chicago, the Association's witnesses concluded their testimony in support of the bill (S. 2783) introduced by Senator Dill (Dem.), of Washington, providing for forfeiture of patent rights in cases of conviction under laws prohibiting monopoly. The hearings were adjourned until the Radio Corporation of America could present its side.

Industrial Monopoly Charged.

The arguments of the Radio Protective Association, in general, were directed against patent grouping by the Radio Corporation of America, with an alleged consequent monopolization of the radio trade, particularly in vacuum tubes.

In an oral statement, the general attorney for the Radio Corporation, Manton Davis, outlined the line of defense to be offered.

"The agreements here critized," said he, "were created by independent groups. There was no possibility of a radio industry until the cross-licensing of patents permitted the lawful making of radio apparatus. Far from these devices restraining trade, they took the restraints off that made it possible."

Arthur D. Lord, receiver in equity for the DeForest Radio Co., Newark, N. J., testified that litigation largely directed against this concern required an expenditure of $342,000 to protect its rights. Patents held by the Radio Corporation, he asserted, were mostly on refinements, and "are being used as a bludgeon over the independents."

Charges Pressure.

"No fundamental patents are held by the Radio Corporation that have to do with the audion tube, which was invented in 1906 by Lee DeForest," he said. "There is no patent in existence today on the tube itself; all patents have run out. The great array the Radio Corporation of America displays is simply refinements on construction."

Pressure brought to bear against the DeForest Company, Mr. Lord claimed, forced it to cease operations. He charg.d the Radio Corporation with having put the DeForest plant under a system of espionage, stationing spies within it.

His argument was directed principally against the patent license agreements, whereby manufacturers licensed to use R. C. A. patents, are required to equip their radio receiving set only with tubes distributed by the R. C. A. He said that 95 per cent of the sets sold today are so limited.

How Business Fell Off.

So acute had become the situation—the DeForest concern's bona fide distributors having dwindled from 166 a year ago to only 12 last February 1—that relief had to be sought in the courts, Mr. Lord stated.

On February 6, he declared, Judge Hugh M. Morris, in the United States District Court at Wilmington, directed a permanent injunction against the enforcement of "Clause 9" of the patent license agreements of the Radio Corporation. This clause relates specifically to the equipment of licensed radio sets with particular kinds of tubes.

George M. Salkeld, representing the Televocal Company, of New York, and the Independent Tube Company, made a short statement, to the effect that the latter concern had sold its entire output of tubes up to the time of the Chicago Radio Show. It had a plant operating with 100 employes, he said. When the R. C. A. entered into its patent license agreements with 25 independent manufacturers, who agreed to Clause 9, the business was cut down to a fraction of its former size, he said.

Woman Executive Heard

Mrs. C. E. Quinn, of Cleveland, vice-president and general manager of the Specialty Appliance Co., makers of rectifier tubes, testified that she was a former employe of the General Electric Company. She cited instances of the General Electric's absorption of patents, and litigations against small concerns manufacturing incandescent lamps in alleged violation of those patents.

Mrs. Quinn charged the Patent Office with favoring the General Electric Company in granting the patents, stating that in some instances patents were granted on identical devices previously patented.

Her own efforts to establish an independent business, she testified, have been repeatedly balked by the General Electric Company, which she claimed "forced" her out of the lamp business and is now, by pending litigation, seeking to force her out of the rectifier-tube manufacturing business.

The Voice of Labor.

The secretary of the Chicago Federation of Labor, Edward E. Nockels, who is also general manager of WCFL, Chicago, told the committee that concentration of patents "defeated the Constitutional purpose of the patent laws."

An investigation will reveal patent discriminations, he said, leading to the conclusion that an effort is being made to monopolize the radio industry.

The Tyrman 70 Amplimax

By Brunsten Brunn

(*Parts I, II and III were published February* 4, 11 *and* 18. *Part IV, the conclusion, follows.*)

WHEN two different frequencies are impressed on the grid of a vacuum tube at the same time, the plate current in that tube will contain many different frequencies, all related in a definite way to the two input frequencies.

In the first place the output will contain the two frequencies put in. Then it will have a frequency which is the difference between the two input frequencies, and again it will have a frequency which is the sum of the two input frequencies. The output current will also have all the harmonics of both the input frequencies, and innumerable combination frequencies from the harmonics.

In ordinary broadcasting the carrier frequency is one of the input frequencies and the signal is the other frequency. These two frequencies appear in the plate current of all the tubes, but particularly in that of the detector tube. The sum and the difference frequencies also appear, and these are the side bands, or rather the side frequencies. The difference frequency is the lower side frequency and the summation frequency is the upper side frequency.

When Difference is Great

In broadcasting the signal frequency is low and the carrier is high. In that case there is a small difference between the lower and the upper side frequencies. For example, let the carrier frequency be 1,000,000 cycles and the signal frequency 100 cycles. The lower side frequency will then be 999,900 cycles and the upper will be 1,000,100 cycles.

In a Super-Heterodyne, like the Tyrman "70" Amplimax, the difference between the carrier and the carried frequencies is small, and in that case the difference between the lower and the upper side frequencies is great.

For example, let the intermediate frequency of the circuit be 340,000 cycles and let the signal frequency be 1,000,000 cycles. The local frequency, which now becomes the carrier, so far as the receiver is concerned, may be set at 1,340,000 cycles. The difference is 340,000 cycles, which is the lower side frequency. The sum is 2,340,000 cycles, which is the upper side frequency.

Summation Frequency Real

The summation frequency is as real as the difference frequency and it could be used in a receiver by tuning the intermediate frequency filter to that instead of to the difference frequency, but that is not the more efficient way, and the Tyrman is designed on efficiency lines.

It is not necessary that one of the frequencies which enter into this combination be generated in the receiver. It may be generated anywhere, yet it will be effective provided that it is strong enough when it reaches the receiver. Suppose there are two strong broadcasting stations in one city. Let the frequency of one be 600 kc and that of the other 700 kc. Suppose that the 600 kc is modulated with a desirable program and that the 700 is radiating a steady unmodulated carrier. Here we have the conditions for either a difference frequency receiver or a summation frequency receiver in which the 700 kc station is acting as the local oscillator.

If the intermediate filter is tuned to 100,000 cycles the 600 kc station can be received as long as the 700 kc carrier also reaches the receiver. If the intermediate filter is tuned to 1,300 kc, that is to the sum of 700 and 600, the 600 kc station can be received by the summation frequency method. The pre-detector tuner in this case would have to be tuned so that both the 600 and the 700 kc frequencies could reach the modulator.

Phantom Stations

If both the 700 and the 600 kc waves are modulated, the signals from both will be heard in the receiver which is tuned to 1,300 kc in the intermediate channel. This condition is very common in radio broadcast reception and gives rise to much interference.

Ordinary radio receivers are not exempt, though they do not have a summation frequency amplifier.

If an ordinary receiver be tuned accurately to a low wave, or high frequency, which happens to be the summation frequency of two high wave powerful stations, both of these stations will be heard. The apparent station giving rise to this dual reception is called a phantom station. The real location of the cause is in the curvature of the grid voltage plate current characteristic of the tubes in the set. Perhaps the first tube is chiefly responsible.

Combination Heterodyning

There may be many such phantom stations effective at the same time, particularly in districts where broadcast stations are concentrated. Although the stations are phantom the frequencies are not. They are as real as the frequencies radiated from the antennas of the broadcast stations. And they will interact in the receiver and produce other frequencies, some of which may be audible squeals.

Much of the background of indefinable squeals, growls and rumbles heard in a radio receiver are due to these beat and summation frequencies.

They are called combination heterodynes because they are produced by the combination of the two frequencies, either or both of which may have been produced by the combination of other two frequencies.

The harmonics of the fundamental carriers play a very important part in this combination.

Repeats Not Phantom

The fact that a close and high power station can be received at several points on the dials is not always an indication that a phantom station is at work. Some of the better stations can be received on the first three harmonics on an average tuner, and these harmonics would exist if there were no other station broadcasting. KSD with a frequency of 550 kc may be received by tuning to 1,100 kc and to 1,650 kc. The second harmonic is thus well in the broadcast range while the third is just above, but within the range of many tuners.

Stations as far up the scale as 750 kc may have at least one repeat on a TRF set, since the second harmonic of 750 is 1,500 kc.

Reception on one of the harmonics is usually clear and free from interference whereas the reception on a phantom is rarely clear. The harmonic reception is clear unless another station happens to be fundamentally operated on that harmonic. The phantom reception is not clear except when one of the transmitting stations involved is radiating an unmodulated wave.

Riding Through

Sometimes it has been observed that one station will be heard when the receiver is tuned to another station. For

(*Concluded on next page*)

A Set For Your Desk

(*Concluded from page* 14)

that it will not add unduly to the total weight of the assembly.

The two tubes employed in the circuit are of the —99 type. The filament voltage required is therefore 4.5 volts with a No. 120 amperite A to cut the current down to the proper value. The plate voltage need not exceed 45 volts, and as the current drain is low, a single small 45 volt block will be necessary.

Fig. 1 shows a close-up view of the top of the receiver when the headset has been removed. The top of the circular box is cut out of heavy cardboard. Attached to this circular top are two rectangular blocks of wood on which rest two U-shaped pieces of brass. These are designed to hold the headset as shown in Fig. 4. Fig. 2 shows more clearly the construction and mounting of the U pieces.

Between the two wood blocks in the center of the circular top is the filament switch S, which is so arranged that the circuit is broken when the headset is put in place and opened the instant the headset is removed. The pencil points to the contact points on the switch. The thumbnut visible directly under the operator's middle finger is the push button, so to speak, which opens the circuit when the handle of the headset presses down on it.

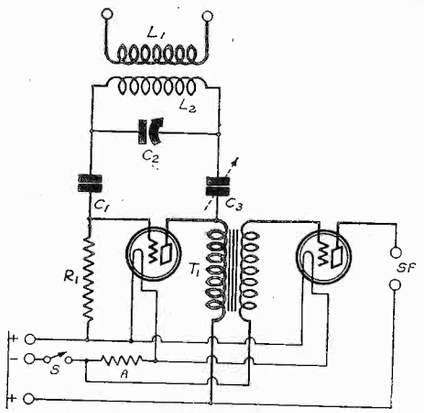

FIG. 6
THE CIRCUIT DIAGRAM OF THE ULTRAUDION TWO RECEIVER DESIGNED FOR A BUSY EXECUTIVE AND BASEBALL DEVOTEE.

PHONE OPENS, BERLIN TO U. S.

Radio telephone service between the United States and Berlin was inaugurated recently, when Secretary of State Kellogg, and Chancellor Marx, of Germany, exchanged felicitations by telephone.

Next Week!
The H. B. H.
Airplane Cloth
Speaker

(Concluded from preceding page)

example, WJZ may be heard when the receiver is tuned to WEAF. The interference tunes in and out with the desired frequency.

This behavior in a circuit is certainly not according the rule.

Why is it that the interfering signal gets through to the loudspeaker when the circuit is tuned to another frequency, and why does not the interfering signal stay in when the desired station is tuned out?

It is obviously not a case of lack of selectivity.

The phenomenon has been given the name of "riding through," which signifies that the interfering signal rides through the tuned circuit on the carrier of the desired frequency. This is nothing new. It is just a case of modulation. The carrier of the desired station is modulated by the signal of the interfering station, probably in the first tube, and then it rides through the tuner just like the modulation frequencies on the desired signal itself.

This phenomenon often occurs when the radio frequency or detector tubes pick up a low frequency hum, as in AC sets.

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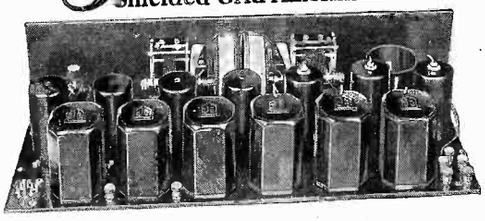

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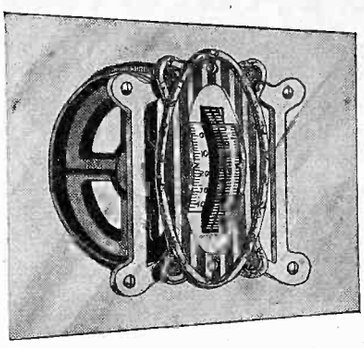

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The new shielded grid tube is used as the radio frequency amplifier. That is why the amplification is boosted forty times over and above what it would be if an —01A tube were used instead.

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 Four-Tube Shielded Grid Diamond uses two of the shielded grid tubes, the other tubes being one 01A and one 112, or equivalent, or a special detector tube may be used, one —01A for first audio and the power tube in the last stage.

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

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Chas. P. Poitras, 33 Notre Dame Ave., Hicksville, L. I., N. Y.
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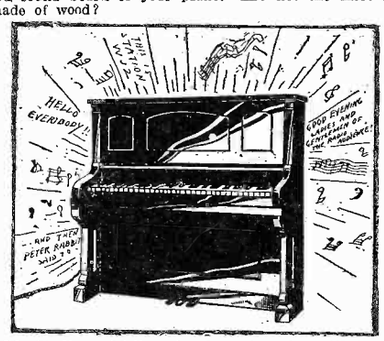

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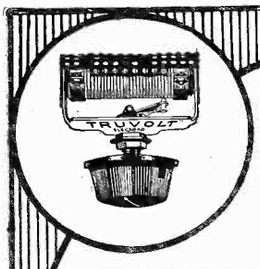

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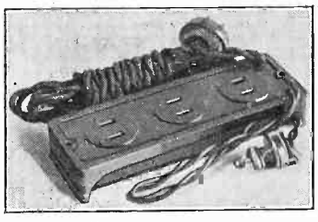
Victoreen "326" Filament Transformer



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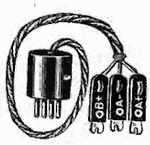
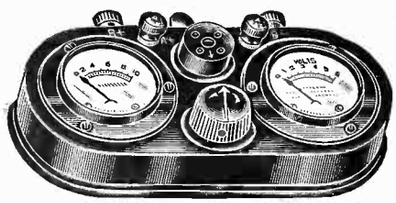
The Double R Cord and Plug, and the Double R Tube hecker are shown herewith.



No. 21 Cord and Plug.....$1.85



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The cord terminals of the plug leads correspond with the binding posts of the tube checker.

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