INSTRUCTION BOOK

for Installing and Operating

FREED-EISEMANN RADIO RECEIVERS

Written and Compiled by

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FOREWORD

THE building of a Freed-Eisemann radio receiver is a complicated process. More than 300 parts are used in the receiver and each part must be tested before using and during construction. Special apparatus, much of which has been designed for the purpose, is employed in testing the individual parts. As the receiver progresses through the process of construction it is inspected at 17 different stages and then as a completed instrument. Any part that does not come up to standard is discarded.

In assembling the receiver only trained workmen are employed. Each unit carries an inspection tag so that it is possible to tell just who is responsible for the work on any part. This system of constant checking insures dependability of construction. After the receiver has received the stamp of approval it is packed in a heavy double air cushioned carton and is then ready to be shipped to you to furnish pleasure and entertainment.

In order to assist you in getting the greatest satisfaction and the best entertainment from your radio receiver, we have carefully compiled this Instruction Book for your use. Read it through at least once after your set is first installed, to be sure that you have not overlooked any of the suggestions which we offer for your guidance.

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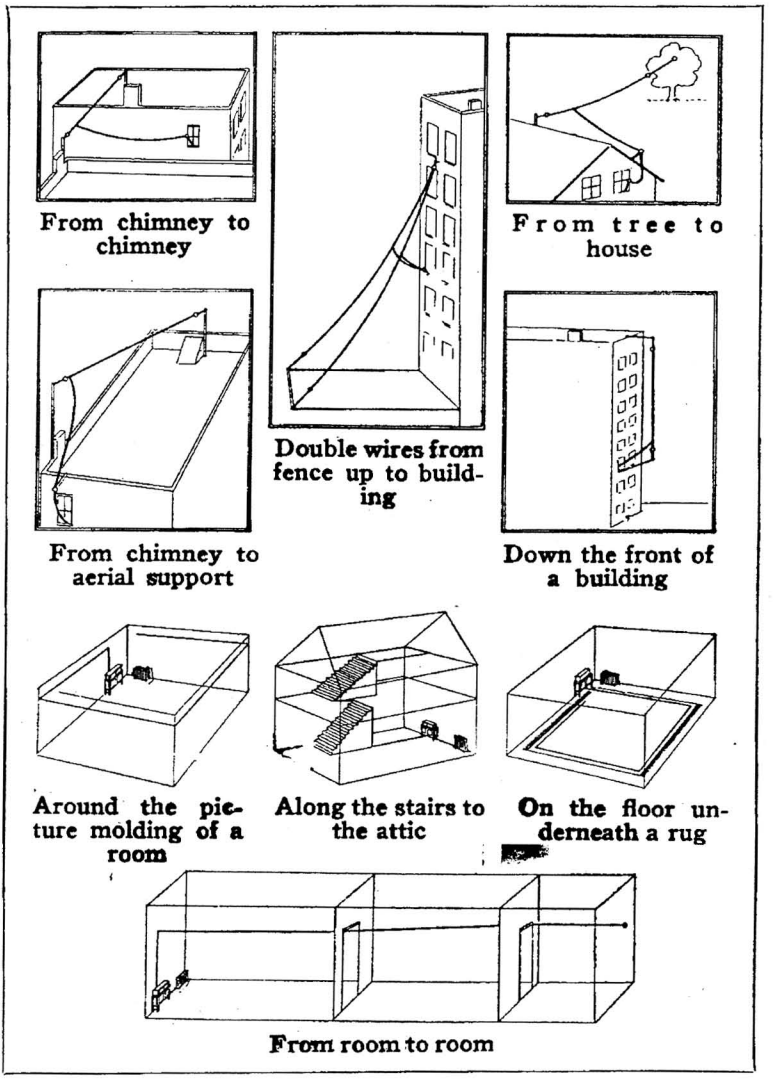


Antenna and Ground

Outdoor Antenna

THE following materials are required for a single wire outdoor antenna, such as is usually required for best results with Freed-Eisemann receivers:

1—70 to 100 feet of No. 14 B. & S. gauge hard-drawn copper wire, or stranded antenna wire. (7 strands No. 20 or No. 22 B. & S. gauge copper or phosphor bronze wire).

2—2 Porcelain insulators.

3—50 feet of lead-in wire (preferably insulated and not smaller than No. 16 B. & S. gauge).

4—1 approved lightning protector device.

5—1 lead-in porcelain tube or flexible copper strip.

6—25 feet of rubber covered wire for connections to set, batteries, etc. (Use for this purpose, preferably, No. 14 B. & S. gauge, single conductor lamp cord); do not use wire of smaller size than No. 18 B. & S. gauge.

7—1 Ground Clamp.

THE antenna is the hand that reaches out into the sky and captures the signals. It should therefore be as high as possible and clear of surrounding objects. It should preferably not be strung in a courtyard between two buildings. An antenna that is behind an apartment building or next to a wall will generally be shielded in certain directions and may not receive distant stations well from those directions.

The amount of actual current traveling in the wires of the antenna of a radio receiver is extremely small. The average radio fan listening to the crashing climaxes of a Symphony Orchestra does not realize that the source of all this tremendous sound is a tiny, infinitesimal current caught by his wires from the ocean of ether which acts as the connecting medium between his set and the broadcasting station.

The following precautions should be observed in putting up an antenna:--

(1) The ends of the antenna wires must be carefully insulated from the points of support to which the antenna is attached.

(2) The antenna should be kept at least 5 feet away from metal roofs and other grounded metal objects.

(3) The lead-in wire, which runs from the antenna down to the Radio Receiver, should be kept at least 3 feet away from the side of the building, and other grounded metal objects.

(4) The antenna and lead-in should not be put up parallel with telephone or power lines. This will reduce any possible induction noises.

(5) The connection between the antenna wires and the lead-in wire should be made very tightly. This connection should preferably be soldered; if this cannot be done conveniently, the connection should be covered with tape.

(6) If an antenna consisting of more than one wire is put up, the individual wires should be from 2 to 3 feet apart.

In general, the antenna should be put up as high and as far from grounded metal objects as possible.

If there are power-house lines, trolley wires, telephone or arc light wires in your vicinity, keep your antenna as far away from them as possible. Power-line and induction noises, as they are called, are the problems in reception which are most difficult to solve. When such conditions are unavoidable a considerable help will be to run the antenna at right angles to such wires. When the antenna and power wires run parallel for any appreciable length, unwanted induction noises may be picked up.

Have your antenna well insulated at its various points of support to prevent leakage to the building and thence to ground. If possible, see that the lead-in wire to the set and the wire on the roof are in one piece. If a joint is necessary, it should be well soldered or taped up to prevent corrosion, which may cause fluctuation in signal strength.

The lead-in should be run down to a point on the outside of the building to the window through which the lead-in enters the room.

The porcelain lead-in insulator should go through the wall or in the corner of the window sash. A flexible connecting strip is sometimes a little more convenient, and often it is satisfactory to bring the lead-in through an open window, being careful not to break the lead-in when window is closed.

Never let the antenna or ground lead run on top, or under, or alongside the receiver. Always run the antenna and ground leads directly to the rear and away from the receiver.

A lightning protector should be connected in accordance with the instructions which come with it.

Finally, it should be determined what length antenna is needed. Under ordinary circumstances 50 to 75 feet of outdoor antenna are all that is required for long distance reception, and usually neighboring broadcast stations can be brought in without any antenna connected to the receiver. With most sets, it is true that distance and volume are helped by a long antenna, although the receiver may tune broadly, while a short antenna, even though the signals sound weaker, will enable you to obtain mose selectivity in stations of nearly the same wave length.

If best results are not obtained immediately, it is well to put up a longer antenna, say up to 125 feet in length, if necessary.

The shorter the antenna the sharper will be the tuning of your receiver.

Indoor Antenna

A good indoor antenna consists of a considerable length of insulated wire running the length of several rooms, or a hallway. (Ordinary bell wire is satisfactory.) An indoor antenna will give satisfactory results for local reception.

The indoor antenna should be started in one room and run through several rooms, so that about 50 to 100 feet of wire is used.

Picture Molding Antenna: If the antenna for the receiver must be confined to one room as in a small apartment, satisfactory results may be obtained by using an antenna run around the picture molding at the top of the room, provided that the walls of the building are not metal lathed. Use No. 18 B. & S. gauge insulated wire. Connect one end of the wire to the short antenna binding post of the receiver and run the wire up to the picture molding. Use a glass push pin to hold the wire in place. The other end of the antenna wire, of course, should not be connected to anything metallic, and therefore should be perfectly insulated.

The Ground

In the home a good ground connection can be made to a radiator pipe, water pipe or gas pipe. Make your ground connection to a water pipe wherever possible. White lead is often used in joints of gas pipe and steam radiator pipes so that these may not make good ground connections.

The ground connection is very important and a good tight connection should be made by first scraping the paint off the pipe at the place of connection, until the bare metal shows. The ground clamp and ground wire should now be *securely* fastened and preferably soldered in place. Do not merely twist the wire about the pipe. Use a good ground clamp.

From the *ground* binding post, on the rear of the receiver, a wire should run *directly to the rear and away from the receiver to a ground connection.*

It is unnecessary ever to disconnect the ground wire. *Leave it permanently attached to the receiver.* Do not run the antenna and ground together as they come out of the receiver; and do not tape them together, but keep them apart at least 6 feet.

Battery Connections

A special folder giving specific instructions how to make battery connections to your type of Freed-Eisemann receiver, is included with every instruction book. Make sure that you get it, together with the radiolog on which to record the dial settings of the broadcast stations you receive. The folder covers completely all the information necessary for your type of receiver. This instruction book aims only to give general information about installing and operating any Freed-Eisemann receiver.

Operating Your Receiver

ONE of the characteristics of a Freed-Eisemann receiver is its ability to build up from a very weak initial signal, one of considerable volume and clarity. A simple manipulation of the three dials on distant stations especially, is the means of obtaining this result. The procedure is as follows:

Set the second and third dials at the same reading, say 50°, varying the Antenna dial back and forth over the corresponding setting. If no broadcasting is heard at this setting, set the second and third dials at 48° and repeat the Antenna tuning operation. Continue this search, always commencing by setting the second and third dials every 2°, either up or down the scale, and then varying the Antenna dial. When a station is picked up, leave the Antenna dial at the point where the signal is loudest, then vary the second dial until the signal is still louder. Repeat this operation on the third dial. *Now for the important part.* After the three dials are in tune, *go back again to the Antenna dial* and repeat the whole operation, building the signal up on all the dials. Disregard the reading of the dial if necessary, when tuning in this manner. Use the ear entirely as the judge.

Then when the dials seem to be in tune turn down the Volume Control rheostat until the signal is just audible. *Then retune the three large dials.* This gives absolute maximum selectivity and best reproduction since it makes

certain that all three tuning circuits are exactly in resonance. Finally turn the Volume dial up to bring the signal to the desired loudness.

You cannot expect to hear a station when the dials are set at widely different readings, nor can you hope to tune in by using one dial only. The settings on the dials read very closely together since the condensers used on Freed-Eisemann receivers are very carefully matched. Due to slight differences in various installations, however, they are not likely to read exactly the same on all three dials. The greatest variation will probably be noticed on the first or antenna tuning dial.

It may be that on some setting of the three tuning dials a signal will be picked up very loud. This volume can be decreased by turning the Volume dial towards 0, until the required intensity is obtained. It is likewise possible to obtain good selectivity on a very loud signal by turning down the Volume dial until the speech or music is very soft; then, by carefully adjusting the three tuning dials the signal strength can be increased to sufficient volume. When signals come in from local stations too loud the volume can be cut down by turning Volume dial toward zero.

Reception

Reception From Distant Stations

WHEN using an indoor antenna or in picking-up a distant station, it is best to tune in using telephones instead of a loud speaker. After the broadcasting is tuned in, then plug in the loud speaker.

In receiving distant stations, it must be remembered that distant reception is seldom so clear as reception of local stations. The reason for this is the fact that the incoming wave is interfered with by all the static, spark transmission, transmitter heterodyne, and radiation from oscillating receivers which the wave may encounter en route from the distant broadcasting station to your set. The distortion of the incoming wave is also affected by disturbances caused by power lines and sparking motors.

Another reason for the fact that reception from distant stations is not always as clear as from local stations is the fact that when receiving distant stations the ratio of the amount of interference picked up to the amount of signal is greater than the ratio of the amount of interference as compared with the amount of signal picked up from local stations. On favorable evenings, when the amount of interference picked up is slight as compared with the amount of signal picked up, then reception will seem much clearer than on some other evenings when the amount of interference picked up is greater than the amount of signal.

Poor geographic location is sometimes responsible for poor reception. If your set happens to be installed in such a "dead spot" it is advisable to double or triple the length of your antenna, using as much as 150 to 200 feet, if possible, and also increase its height to determine whether or not this will improve poor reception due to your geographical situation.

Remember that there is a great difference between the distance which can be received during the day and during the night. The sunlight seems to have a peculiar effect on radio waves so that as much as three or five times greater distance can be received when it is dark than during the day time. Remember also that heat and humidity have adverse effect on radio waves. During the winter, on clear, cold nights, radio reception is at its best and great distance can be obtained, while during the summer on warm, humid days, you cannot expect to receive very far.

When the second and third dials are properly set for a given station, these settings do not vary when the set is moved to another location. That same station will be received on the same dial settings even though the set be moved to some other part of the country. However, the Antenna dial setting will vary according to the length and characteristics of the antenna, which may be erected at the new location of your set.

Do not think the test of this receiver for one or two nights will give you the measure of its efficiency. A little practice is needed in tuning to bring in distant stations. Turn the dials very slowly, so as not to pass by the point at which a station is in tune. Also remember that atmospheric and meteorological conditions, either at the location of the transmitting stations, or of your own vicinity, or somewhere between the transmitting station and your set, will affect the quality of reception. You will not know how well your receiver can act until you have used it for several weeks.

After you have become accustomed to operating the receiver, you will find that you can easily obtain very satisfactory results. It does not require a great deal of practice to bring in distant stations, but once you have gained familiarity in handling the receiver, it will be easier for you to get distance.

There is such a thing, however, as familiarity breeding contempt. Do not handle the receiver carelessly just because you feel that you are perfectly acquainted with it. For instance, do not turn the battery and volume dials up too high as this will shorten the life of the tubes, and do not try to get such great volume on your receiver as to spoil the quality of tone in the attempt to make the signals over loud.

Tune carefully and tune with the idea in mind that sweetness of tone and clearness of reproduction are more to be desired than mere loudness.

Broad Tuning

Broad tuning may be caused by two conditions:

1—*Broad tuning with very little amplification.* When this happens it is a positive sign that the storage battery is run down.

2—*Broad tuning with considerable amplification.* This is caused by the set picking up too much energy and is usually due to an antenna that is too long.

This phenomenon can, in most cases, be entirely obviated by cutting down the length of the aerial to about one-half its length, which will result in sharper tuning; thus, if a given station is heard, say within ten degrees on either side of its loudest point on the dial settings, shortening the aerial will cause it to be heard within two or three degrees of its loudest point. Thus, broadcasting stations can be effectively separated from one another.

Interference From Regenerative Receivers

Occasionally a loud whistle, changing in pitch from inaudibility to a disagreeable shrieking whistle may be heard on the receiver. This is not due to any oscillation *in the receiver,* but is due to a beat note produced between an incoming radio signal and a nearby oscillating regenerative receiver. This is a form of interference which no receiver made can eliminate. The elimination of this disturbance must be done at the place where it is produced, namely, in the regenerative receiver causing the trouble.

Freed-Eisemann receivers do not oscillate and do not radiate energy, and cannot possibly produce any whistles or howls, and any that may be heard are due, as above described, to neighboring oscillating receivers.

Reception Can Be No Better Than The Music And Speech Transmitted

Broadcasting stations vary in quality of the music and speech which they transmit. The arrangement of the transmitting apparatus in one station may be such that the transmitted wave tunes very sharply and that the music and speech which is radiated will be very free from side noises.

Another transmitting station may not sound so well and this may be due to the fact that there is transmitted together with what is actually spoken into the microphone, such side noises as generator hum from the transmitter, noises in the broadcasting studio, and noise due to imperfections in the transmitting apparatus. This is a common fault of certain stations.

The operation of the receiver should not be judged by comparing the reception of two different stations or the same station on two different nights because the quality of the transmission from any station may vary on different nights due to the above mentioned external disturbances which may be transmitted on one night and not on another.

Another thing to be borne in mind is the fact that every transmitting station transmits on a wave which has a certain degree of sharpness. In receiving the station the receiver will not tune any sharper than the sharpness of the transmitted wave. For that reason it will be noted that certain stations will appear to tune in more sharply than other stations.

Whistling Noise

Sometimes a *steady whistle* which does not change in pitch is heard in the receiver when tuning in for distant stations. This is not caused by any oscillation in the receiver, inasmuch as the set is absolutely free from oscillations, but is due to what is known as transmitter heterodyne. This is caused by two stations transmitting at frequencies which are almost the same, but which

have a difference in frequency corresponding to an audible note, so that it can be heard in the telephones or loud speaker. For example, if one station is sending at 360 meters, corresponding to 832,833 vibrations per second, and another station is sending at 361 meters, corresponding to 830,833 vibrations per second, the difference between the vibrations is 2000 per second, and as a result you will hear in your receiver this 2000 vibrations per second beat note. This phenomenon cannot be overcome at the receiving end, and at the present time there is no known method of eliminating this interference except by having the transmitting stations which are causing this beat note change their wave lengths until the difference in frequencies becomes so high as to be inaudible, say 15,000 vibrations per second.

This phenomenon of transmitter heterodyne is not very serious and the Department of Commerce is continually on the watch to see that the wave lengths used by the various stations are such that this interference is reduced to a minimum.

Static

When all three dials are in tune, that is, when the loudest signal is produced, the set is said to be in resonance. At this point, of course, loudest reception is obtained. If a crackling noise is heard, such as is most evident in summer time reception, this noise is due to static. A large amount of this static is eliminated by the receiver, however, a still greater amount may be eliminated by first bringing in the broadcasting as loud as possible and then turning the Antenna dial a little to the left simultaneously with turning the third dial a little to the right, weakening the signal somewhat. By bringing the circuits slightly out of tune, like this, the static will be practically eliminated. The incoming signal is usually strong enough to give satisfactory reception even though the circuit is placed slightly out of tune by rotating the dials as above in order to eliminate static.

Harmonics

When receiving a powerful nearby station, it will be found that the station may be received down towards the lower end of the dial in addition to the place on the dial where the station should come in. This is due to the fact that every broadcasting station not only radiates energy on one wave length, but radiates on a few other wave lengths, known as harmonics. This means that if the station which is sending on 400 meters happens to be close by, you are likely to receive that station on 400 meters—which is called the "Fundamental"—and on 200 meters—which is called the "Second Harmonic"—or on some other wave length which is some even submultiple of 400.

This form of radiation from a transmitter is unavoidable, but every broadcasting station tries to reduce the number of its harmonics as much as possible.

Harmonic reception occurs only from nearby broadcasting stations and is not the fault of the receiver.

If such harmonic reception interferes with reception of other stations, you should write to the broadcasting station producing such harmonics and notify them, as every broadcasting station takes pride in reducing any harmonics which there may be in its transmitted wave.

Local Stations

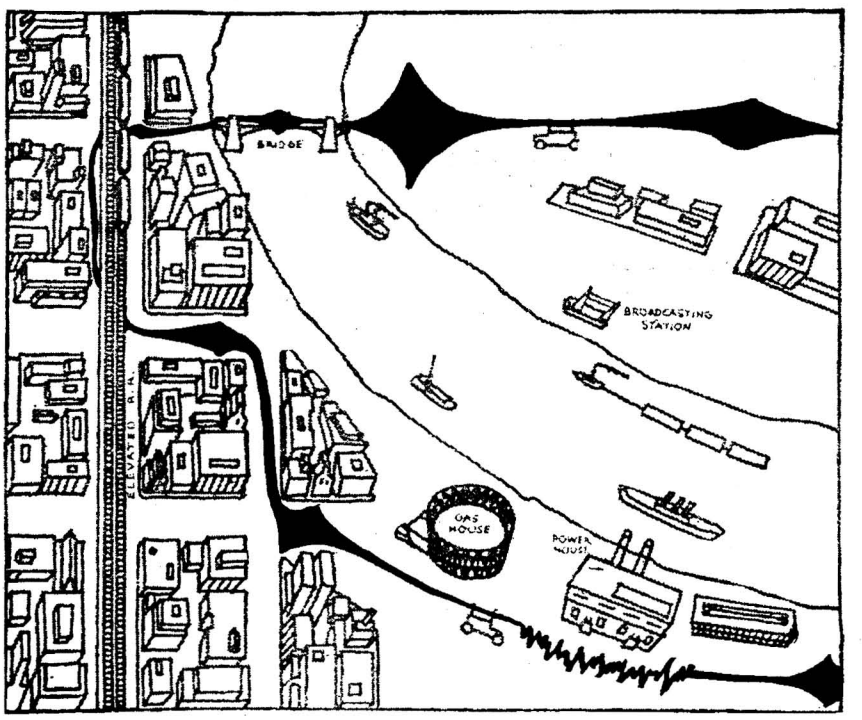
Occasionally, where a receiver is *very close* to a local station, difficulty may be had in working through said station.

This is more or less unavoidable, as a broadcasting station must be nearer to somebody than to somebody else. The best thing to do in such a case is to cut down the size of your antenna as much as possible so that the amount of energy picked up by the receiver is small. Many operators prefer to have a short indoor antenna for local reception and a good outdoor antenna for distant reception.

Loop Reception

Freed-Eisemann Receivers are not designed to operate with a loop, and it will be found that much better reception can always be obtained with the receiver using a short indoor antenna than with a loop.

However, if a loop is connected across the short antenna and ground binding posts on the set, and is kept 5 or 6 feet away from the set, good results may be obtained.



Absorption

The illustration shows the progress of a radio-equipped automobile from the open places and in the territory of private homes in the metropolitan district, to the zone of big buildings, power houses, and electric conduit lines.

Radio waves are absorbed by steel bridges and the breadth of the reception line in the photo is reduced to a minimum as the car passes over such a bridge.

The same result may be noted as the auto goes under the steel elevated railroad lines.

At street intersection radio signals are very much stronger, as in the middle of the street. The broader the street, the better the reception.

Passing the power house we see an apt illustration of "man-made static." Induction interference is marked. No radio reception is good when the antenna is located near power lines, but when the aerial is placed at right angles the obstacle is removed.

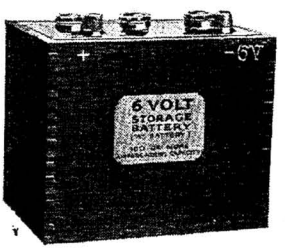
A rightly-placed antenna, high up, will work well, properly shielded, even in the district of steel and stone structures, but on lower floors an indoor wire may not be effective.

Caring For Your Receiver And Its Accessories

A RADIO RECEIVER, like an automobile, must have reasonable care in order to obtain best results. The special folder included with this instruction book tells you what accessories you need. Generally speaking, every Freed-Eisemann receiver requires the following operating units besides the aerial and ground:

1. Batteries
   - An "A" or filament battery
   - A "B" or plate battery
   - A "C" or negative grid bias battery
2. Vacuum tubes
3. A loud speaker, (head telephones are optional)

Care Of Batteries



"A" BATTERY: The "A" or filament battery is a battery which supplies current to light the filament of vacuum tubes. Some types of Freed-Eisemann receivers use storage "A" batteries, others use dry cells. In general, it may be said that the receivers using UV-201A tubes or C-301A tubes require storage "A" batteries to light the filament of the tubes, while receivers using UV-199 tubes use dry cell to supply the filament current to the vacuum tubes.

Storage "A" Battery: Storage "A" batteries are rated in ampere hours or the number of hours which the battery will last if discharged continuously at a 1 ampere rate. If a higher rate is used, the capacity will be slightly less than that given on the name plate. An "A" battery rated at 100 ampere hours will, therefore, provide current for five UV-201A tubes burning constantly for about 80 hours. All storage batteries lose a certain percentage of their charge on standing idle, and for this reason in normal radio service a 100 ampere hour battery when used on a Freed-Eisemann receiver will deliver about

65 hours of actual service at 3 hours per day, before the specific gravity falls to 1150 when the battery should be recharged. *It is wiser to recharge at* 1225. This eliminates any possibility of the battery failing during reception.

A new battery should be in a fully charged condition when received and should be ready for immediate service. It is quite possible, however, that it will not give its full capacity on the first discharge because of having been a few weeks in the dealer's stock. As soon as the specific gravity drops to 1150, the battery should be recharged. If you have no charging device, the battery should be charged at a competent storage battery service station.

When charging at home the following precautions should be observed:

Disconnect it from the set and place on charge with the plus terminal of the charger leading to the plus tap of the battery, and the minus of the charger to the minus tap of the "A" battery. The level of the acid in the battery should be one-quarter inch over the plates. If necessary, add sufficient distilled water to bring up the level of the solution. More than this amount of water is likely to cause overflowing toward the end of the charge when bubbling occurs. If any acid is spilled from the battery, it should be neutralized immediately with ammonia or baking soda solution. In order to estimate the approximate number of hours which the battery should be charged after being completely discharged, divide the ampere hour capacity of the battery by 3/4 of the charge rate indicated on the charger. For example 3/4 of 5 is approximately 4. 100 A.H. battery should, therefore, be charged by a 5 ampere charger in 100/4 = 25 hours. This is only an estimate which varies with different chargers and must be verified by a hydrometer reading. If the battery had been only half discharged and tests 1200, only 13-1/2 hours would be required by the same charger to bring the battery up to fully charge.

When the specific gravity reaches 1250 the acid level should again be looked at, and if necessary, sufficient distilled water added to bring the level to 1/4" above the separators as described above. The charging should then continue until the water has had a chance to mix thoroughly with the acid. This will have taken place when the hydrometer reads between 1250 and 1280. The battery is then ready for service, and should not require further attention until the gravity falls to 1150 again. Provided a charge rate no higher than that designated on the name plate is used, the vent caps may remain in place during the charge. If a higher rate is employed, the caps should be removed.

If you do not have a table or cabinet to conceal all the batteries, the batteries may be placed in the cellar and long leads run from them upstairs to the receiver. In this case the battery charger should also be located in the cellar which is very convenient. If it is inadvisable to do this, all the batteries may be placed in a wooden box and put in an inconspicuous part of the room. Never use a match, candle or other flame to examine a storage battery as the fumes of the acid are explosive. If you must examine it in a dark room use a flashlight or electric light.

Do not allow the battery to stand in a discharged condition. It should be charged at least every sixty days to keep it in good condition whether it is in service or not. If you plan to store your battery for more than two months, particularly during the winter, send it to a service station where it will be kept in charged condition.

Dry Cell "A" Battery: The Freed-Eisemann Receivers using dry cells as a source of current supply for the filaments of the vacuum tubes require six 1½-volt dry cells for best operation. The dry cells are to be connected as shown on the diagram mounted to the rear of each set. Dry cells require very little attention. When their combined voltage drops below 3 volts they must be replaced with new ones. Their average life is about six weeks for normal operation of a set although, of course, if the set is used a great deal, the dry cells will not last so long.

"B" BATTERY: The "B" batteries supplying the plate circuits of the vacuum tubes give the necessary energy to convert the received signals into music and speech for loud speaker operation, a very important element of the receiving set.

It is the power of the "B" battery that is converted into the music you hear. "B" batteries, as in fact all dry batteries, will lose their energy through standing even when not in use. Consequently if your "B" battery has been in use for a long time, even though much actual current has not been drawn from it, it is likely to have become considerably depleted.

"B" batteries for Freed-Eisemann receivers may be either of the large dry cell type or, if desired, of the storage battery type. The storage "B" battery lasts much longer than the dry "B" battery but requires more attention and must be recharged, of course, from time to time. Full instructions for taking care of it are supplied by the manufacturers of the battery. For general use, dry "B" batteries are recommended.

The largest heavy duty "B" battery, a 45-volt "B" battery should be used with Freed-Eisemann receivers. It is recommended that the following makes be used although there are other good "B" batteries on the market:

Burgess No. 2308
Ray-O-Vac No. 9303
Eveready No. 770 or No. 486

If small "B" batteries are used they are likely to run down quickly and become noisy.

Because of the fact that all Freed-Eisemann Receivers are multi-tube receivers, considerable plate current is required from "B" batteries. According to statistics furnished by battery manufacturers, about 100 to 125 hours of actual service can be expected from a good set of "B" batteries; in other words, if the receiver is used approximately 3 hours a day, at the end of 32 days the "B" battery voltage is likely to have dropped considerably. The voltage of each "B" battery should be 45 volts. When the voltage drops below 37 volts on the 45-volt tap, it is time to get new batteries or reception is likely to become noisy.

When purchasing new "B" batteries ask your dealer to test them with a voltmeter (*not an ammeter*) and see that the voltage of the new battery reads 45 volts or more. Never test the dry "B" battery with a lamp or ammeter, as it may injure the battery irreparably.

Short Circuiting the "B" Battery. It sometimes happens that the grid and plate of one of the vacuum tubes may lean over so as to touch each other, causing a short circuit in the "B" battery circuit. If this happens the tube is likely to burn out or else flare up very brilliantly and the filament will then break. The tube, of course, is no longer of any use. This phenomenon is accidental and should not be blamed on the set.

If the voltages of your "B" battery drop below the voltages mentioned above, it is not satisfactory to add one new battery to your old set because while the voltage might be raised, a considerable amount of noise may result due to the other old battery having run down. When a battery starts to run down, the chemicals inside the battery begin to disintegrate and decompose, and this will cause considerable noise in the receiver.

The best way to test batteries is by means of a voltmeter, and for this purpose a Weston Model No. 301 voltmeter is recommended.

Always measure voltages while the set is in operation. *Never test voltages with an ammeter.* Be sure that you have a voltmeter.

Sometimes a dry battery becomes very noisy. This is due to the following causes:

A dry battery consists of a great number of individual cells. If one of these cells disintegrates, the voltage will fluctuate possibly over only a small margin, say from 45 to 43 volts, but the fluctuation in voltage, together with the accompanying disintegration, may cause considerable crackling in the set. This is ordinarily a very difficult thing to find, but can be very easily detected with an accurate voltmeter, such as mentioned above.

If the needle of the voltmeter flickers while the voltmeter is connected across the battery, it is a sign that the battery is defective, but if the voltage remains steady, then the battery is good.

If you have no voltmeter but suspect that your "B" battery is noisy after having used it for quite a while, take your head phones and place the terminals of the phones across the plus and minus leads of the "B" battery. There should be a sharp click when the terminals of the phones are applied to the battery terminals but after that there should be no noise. If you hear a rustling, crackling noise in the phones, the "B" battery, due to deterioration of one of its cells, has become noisy and should be replaced with a fresh one.

THE "C" BATTERY: The advantages of the "C" battery when used with a radio receiver are as follows:

1—If the vacuum tubes in the receiver are poor, the quality of speech and music received is likely to be bettered by the use of "C" batteries, and increased volume may be obtained. If the tubes used in the set are exceptionally good, the "C" battery is likely to make little difference.

2—However, the "C" battery will always lessen the current drain on the "B" batteries by about 40%, which will, of course, result in the "B" batteries lasting somewhat longer than ordinarily.

Type of Battery To Be Used: Use a three-cell, 4½-volt "C" battery. Use preferably National Carbon Company No. 771, or Burgess No. 2370, or Ray-O-Vac No. 231R, 4½-volt, "C" batteries.

The "C" battery must be connected, otherwise, the circuit will be open and the receiver will not operate. The "C" battery uses practically no current of its own but loses strength from standing and so should be replaced about every 2 or 3 months.

Vacuum Tubes

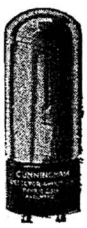
Be sure that only vacuum tubes made by reputable manufacturers are used. For Freed-Eisemann receivers which operate with storage batteries, either R.C.A. UV-201A or Cunningham C-301A tubes should be used. Do not use any other kind of tubes regardless of advice to the contrary. These tubes operate on 1/4 ampere each.

For Freed-Eisemann Receivers operating on dry cells, R.C.A. UV-199 or Cunningham C-299 tubes should be used.

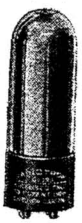
STORAGE BATTERY TUBES **DRY CELL TUBES**

Cunningham Type C-301A

R. C. A. Type UV-201A



Cunningham Type C-299



R. C. A. Type UV-199

The Battery rheostat on the receivers is designed to operate with these tubes. The position of the rheostat is not very critical so that the movement of the rheostat will not cause marked change in the volume of sound. Consequently the operation of the set is not critical.

Do not press down hard on the tubes when putting them in the sockets. Put them gently in the sockets with the pin on the side of the base of the tube dropping in the socket slot. Then turn the tube clockwise until the side pin engages the tube in a locked position.

Often the tubes will light up but fail to amplify or detect properly. If you suspect that a tube is not functioning as it should, take the whole set of tubes from the sockets and ask your dealer to test them for you. When purchasing tubes be sure the dealer tests them and have your dealer demonstrate with the receiver when you purchase it, the tubes which you are going to use in it.

Some tubes are better amplifiers for radio frequency than for audio frequency. Consequently it is advisable to try shifting the tubes around in each socket in the receiver to see in which position they operate best. When changing the position be sure to turn off the switch controlling the current so that the filaments are not jarred while lighted. Vacuum tube filaments while incandescent are very delicate and are more likely to break than when the tube is not lighted. If the plate should touch the grid it is likely to burn out all the tubes in the set. This is a very rare occurrence but it may happen if the tubes are changed around while they are lighted.

Non-Microphonic Detector Tubes: Freed-Eisemann receivers have shock-proof detector mountings but sometimes if a microphonic tube is placed in the detector socket the set will give out a very resonant sound when it is touched or shaken. Make sure that the tube used in the detector socket is not microphonic. It can be tested as follows:

When all the tubes are in place and lighted, and the loud speaker is connected up, then gently tap the tube in the detector socket with the finger and note the sound produced in the loud speaker. If it is a long, vibrant sound, the tube is not suitable as detector. If the sound produced in the loud speaker is only a short, quick sound that dies out immediately, the tube will be a good one to use as detector. It is advisable to try all the tubes so that the least microphonic one may be used for the detector. If a tube is very microphonic it will make peculiar ringing noises even when jarred so slightly as by a person walking across the room while the receiver is in operation.

Vacuum tubes are one of the most likely causes of trouble in radio receivers. If something goes wrong, it is well to look first to your tubes.

When To Discard Old Tubes

Formerly with the 200 and 201 types it was customary to consider the tube useful until its filament burned out. With the 201-A type the length of its useful life is largely dependent on the presence of a certain amount of specially prepared coating on the filament. This coating, consisting largely of thorium oxide, is responsible for the efficient emission of electrons that makes these tubes perform so well. This coating is gradually reduced by continuous use so that a tube will often give no outward indication of deterioration and yet become almost inoperative. For this reason it is good practice to keep an extra new tube on hand and to use it in comparison with those in the set about every two months. *Remember that the filament of a tube may continue to burn long after its active material is exhausted. Knowledge of this fact will enable the user to account for faulty operation and avoid much trouble.*

The Loud Speaker

The choice of a loud speaker is a very important item. Get the best one which you can afford. The best radio receiver in the world, if used with a poor loud speaker will give poor results. The output of a radio receiver may be absolutely perfect but if delivered through a loud speaker which does not reproduce the signals with equal perfection, fine quality of tone cannot be expected. Remember that Freed-Eisemann receivers are very powerful and deliver a lot of energy to the loud speaker. Consequently a loud speaker capable of handling this amount of power should be used with the set. We advise strongly that you have the loud speaker demonstrated with the receiver which you are buying, before you purchase the loud speaker. Give it a thorough test and make sure that it is satisfactory before buying.

A loud speaker is very similar to a telephone head piece in that it converts electrical energy into audible sound by means of a moving diaphragm. The horn does not produce any signals but merely amplifies the sound created by the moving diaphragm at its base. The greater the movement of the diaphragm the greater the sound. However, if the motion of the diaphragm is too great, the

diaphragm is likely to hit the pole shoes of the magnet which actuates it and so produce distortion. Too great a load on the loud speaker diaphragm will cause it to blast and make a harsh, rasping sound as the volume becomes too great.

Do not crowd too much power into your loud speaker. Not every speaker on the market can handle all the power which a Freed-Eisemann set is capable of delivering. Strong signals from local stations should, in most cases, be delivered to the loud speaker when the receiver is working at *medium* strength. If the reception on the loud speaker is noisy, test your set by plugging in with ear phones. If reception on the ear phones is clear, the fault is of course with the loud speaker and not with the set.

In order to bring in distant stations with maximum volume, it is well to tune in with the head phones and then, when greatest volume is obtained, plug in with the loud speaker. Be sure to remove the telephone from the jack when it is desired to have the loud speaker operate since both the telephone and loud speaker cannot operate at the same time.

When connecting the terminals of the loud speaker, try reversing the terminals. You will probably find that in one position the signal is clearer and louder than in the other. Once this is found, it will not be necessary to remove the terminals again from the plug.

If the loud speaker howls it is sometimes due to the fact that it is too near the receiver. It is preferable to place the loud speaker at one side of the receiver.

It is inadvisable to use a loud-speaking unit attached to the tone arm of a phonograph with a Freed-Eisemann receiver, since such a device is not suitable for taking the great amount of energy delivered by the receiver and the tone quality obtained by this method of reproduction is not satisfactory.

Four Points to Check Up

No. 1—A good ground is very essential for the proper operation of your Receiver. Try disconnecting the ground lead and if this has no appreciable effect on the signal, your ground is not a good one. Make sure that the pipe to which the ground wire is attached is scraped clean and that a good contact is made with the pipe and make sure you are using a pipe which is well connected to the ground.

No. 2—If your set stops suddenly, try tuning into another station. It may be that there is some trouble with the transmitting station. Sometimes when you turn your set on and can hear no stations at all, although your tubes and set seem to be functioning, there may be an S. O. S. on the air and consequently there will be no broadcasting. Call your local station on the telephone and ask them if that is the case.

No. 3—You will find that if you use the binding post marked "S. A." for the antenna connection, in almost every case the signal will be much louder than if you use the post marked "L. A." Wherever possible use the "S. A." binding post.

No. 4—Do not in any instance remove the leads from the "C" battery. The "C" battery is an essential part of the source of current supply and must be used to obtain satisfactory operation. Make sure that you read the instructions in your instruction folder and wiring card carefully so that you use the proper "C" battery voltage.

Don'ts

1—Don't use tubes of unknown make, but use only R.C.A. UV-201A or Cunningham C-301A tubes.

2—Don't use a UV-200 or a type C-300 tube for a detector. Use only a UV-201A or a type C-301A tube.

3—Don't mount the set on or near a radiator or other large metal object.

4—Don't forget that a good ground connection is an essential part of the installation.

5—Don't have the antenna lead or the ground lead run on top or around the set, but bring these two leads directly back and away from the receiver.

6—Don't change the tubes around while the rheostats are turned on. The filaments are very delicate and if they are jarred while burning may be broken.

7—Don't recharge your storage battery while it is connected to the set. Always disconnect it before recharging.

8—Don't attempt to use a Western Electric Type 10A or Type 14A loud speaking telephone outfit with full audio amplification on your receiver. If you attempt to operate a 10A or 14A loud speaker from full amplification you will obtain a loud howl which will interfere with reception.

9—Don't use the same "B" batteries for the Western Electric Loud Speaker and the receiver. Use separate batteries.

10—Don't use a small loud speaker to get best results from your receiver. Freed-Eisemann receivers produce a tremendous amount of amplification and require a loud speaker capable of distributing a large amount of power.

11—Don't use small size "B" batteries as they run down quickly. Use the type recommended on the card on the back of the receiver.

12—Don't forget to change your dry "B" batteries about once every 5 or 6 weeks, or sooner if the voltage drops. You should test the voltage of your dry batteries with a voltmeter at the end of about 4 weeks of service to be sure that the voltages have not dropped so low that the batteries do not operate properly. A good set of dry "B" batteries will give about 100 hours of active service. Test your batteries with a high resistance voltmeter, while the filaments are lighted.

13—Don't place your loud speaker on top of the receiver. Always place it in back, or to the right of the receiver. Do not place a lamp or any metallic object of any kind on top or directly in back of the receiver.

14—Don't operate the receiver during a thunderstorm.

15—Don't place the receiver on a tapestry cover with metallic figures or trimmings on it; don't cover the receiver with any cloth having metal trimmings, or metal edging. Do not place the receiver on a piano.

16—Don't forget to connect the "C" battery in the circuit and make sure that the leads are not reversed.

Questions and Answers

Question No. 1—How should the antenna lead-in wire be connected?

ANS.—The wire leading from the antenna to the set should be run from the proper binding post away from the set, and in no case be permitted to lie on top of the set.

* * * *

Question No. 2—If my set loses selectivity, what can I do?

ANS.—Selectivity is affected by two things. First, the length of the antenna; and, second, the condition of the storage battery. To gain selectivity, shorten your antenna. If your set was properly selective and is no longer so, it means that your storage battery is run down.

* * * *

Question No. 3—Sometimes in receiving two stations near the same wave length, a steady whistling sound may be heard. What causes this?

ANS.—When two stations come in on wave lengths which are very close to each other, but which waves are separated by a frequency which is audible (from 20 to 15,000 vibrations a second), the telephone receiver responds to the beat note which is represented by the difference in frequency of the two stations. This note is called "transmitter heterodyne," and there is no way to eliminate such interference at the receiving station at the present time.

* * * *

Question No. 4—Is it possible to obtain equally good results with tubes operated by dry batteries for filament heating?

ANS.—Best results are obtained using a storage battery with tubes designed to operate with six volts on the filament. Standard tubes drawing one-fourth of one ampere will operate quite satisfactorily. We recommend UV-201A tubes or C-301A tubes.

* * * *

Question No. 5—Why does my set operate better on one night than on another?

ANS.—This is due to atmospheric condition. Sunlight is hindrance to long distance reception. Sunlight charges the tiny particles of dust with an electric charge which affects the incoming high frequency wave.

Question No. 6—How can I tell whether my set is noisy or whether my loud speaker is at fault?

ANS.—If your set is quiet with the ear phones, then noise on the loud speaker is not due to any fault with the set. The loud speaker is therefore defective.

* * * *

Question No. 7—Is there any way to cut out the crackle due to induction?

ANS.—Sometimes this noise may be avoided by turning your set at right angles to its former position. If it was set north and south, turn the set physically so that it lies east and west. Sometimes this will decrease induction from its source.

* * * *

Question No. 8—Is it possible that I may hear whistles in my set, which do not emanate from the set itself?

ANS.—Yes. If there is in your neighborhood a regenerative receiver which emits whistles while being tuned, those whistles are transmitted by the receiving antenna, and if they are close by to your set, you may hear such whistles, etc. It will be noted, however, that when the nearby operator stops tuning his regenerative receiver, these whistles will cease.

* * * *

Question No. 9—What may cause a steady buzz on the low wave lengths when all three circuits are in tune?

ANS.—This is probably due to induction from electric motors in your vicinity.

* * * *

Question No. 10—How can I stop a bell-like noise when I tap my set?

ANS.—Try a new detector tube.

* * * *

Question No. 11—How shall I test my battery?

ANS.—Batteries should not be tested while the filament is cold, as they frequently build up a voltage while idle, which may deceive the operator into thinking that the voltmeter test shows the batteries to be fully charged. Always test with a voltmeter both A and B batteries while the filament is lighted and all batteries connected to the set.

List of Broadcasting Stations

THE wave lengths of these stations may change slightly from day to day due to difference in broadcasting. Consequently if a distant station is logged at a certain setting of the dials, it is possible that at some future time, the dial settings may have to be changed slightly in order to bring the station in clearly. This is not due to any fault in the Receiver. Sometimes wave lengths are changed officially by the Government. In that case, of course, dial settings will be changed considerably.

UNITED STATES

Call Signal	*Location of Station*	*Wave Length*
AO6	Canton, O.	425
AT9	Fort Bragg, N. C.	435
AV7	St. Paul, Minn.	400
KDKA	E. Pittsburgh, Pa.	309.1
KDLR	Devils Lake, N. D.	231
KDYL	Salt Lake City, Utah	245.8
KDZB	Bakersfield, Cal.	209.7
KFAB	Lincoln, Nebr.	240
KFAD	Phoenix, Ariz.	273
KFAE	Pullman, Wash.	348.6
KFAF	Denver, Colo.	278
KFAJ	Boulder, Colo.	261
KFAN	Moscow, Idaho	231
KFAU	Boise, Idaho	275
KFAW	Santa Anna, Cal.	214.2
KFBB	Havre, Mont.	275
KFBG	Tacoma, Wash.	249
KFBL	Everett, Wash.	224
KFBU	Laramie, Wyo.	270
KFCB	Phoenix, Ariz.	238
KFCF	Walla Walla, Wash.	256
KFCY	Le Mars, Iowa	252
KFDD	Boise, Idaho	275
KFDH	Tucson, Ariz.	258
KFDJ	Corvallis, Ore.	254
KFDM	Beaumont, Tex.	315.6
KFDX	Shreveport, La.	250
KFDY	Brookings, S. D.	273
KFEC	Portland, Ore.	248
KFEL	Denver, Colo.	254
KFEQ	Oak, Nebr.	268
KFFP	Moberly, Mo.	266
KFFV	Lamoni, Iowa	250
KFGC	Baton Rouge, La.	268
KFGD	Chickasha, Okla.	252
KFGH	Stanford Univ., Calif	270.1
KFGX	Orange, Tex.	250
KFHA	Gunnison, Colo.	252
KFI	Los Angeles, Calif.	467
KFIF	Portland, Ore.	248
KFIO	Spokane, Wash.	266
KFIQ	Yakima, Wash.	256.3
KFIZ	Fond du Lac, Wis.	273
KFJF	Okla. City, Okla.	261
KFJM	Grand Forks, N. D.	278
KFJX	Cedar Falls, Iowa.	258
KFJY	Fort Dodge, Iowa.	246
KFKA	Greeley, Colo.	278
KFKB	Milford, Kan.	278
KFKQ	Conway, Ark.	250
KFKU	Lawrence, Kans.	275
KFKX	Hastings, Nebr.	288.3
KFLB	Menominee, Mich.	248
KFLR	Albuquerque, New Mexico	254
KFLV	Rockford, Ill.	229
KFLZ	Atlantic, Iowa	273
KFMB	Little Rock, Ark.	254
KFMQ	Fayetteville, Ark.	299.8
KFMR	Sioux City, Iowa	261
KFMT	Minneapolis, Minn.	263
KFMW	Houghton, Mich.	266
KFMX	Northfield, Minn.	336.9
KFNF	Shenendoah, Ia.	266
KFNJ	Warrensburg, Mo.	234
KFNL	Paso Robles, Cal.	240
KFOA	Seattle, Wash.	454.3
KFOC	Whittier, Calif.	236
KFON	Long Beach, Calif.	233
KFOO	Salt Lake City, Utah	241
KFOR	David City, Neb.	226
KFOT	Wichita, Kans.	231
KFOX	Omaha, Nebr.	248
KFOY	St. Paul, Minn.	252
KFPG	Los Angeles, Cal.	238
KFPR	Los Angeles, Cal.	231
KFPV	San Francisco, Cal.	246
KFPY	Spokane, Wash.	266
KFQA	St. Louis, Mo.	261
KFQB	Ft. Worth, Tex.	226
KFQC	Taft, Cal.	231
KFQH	Burlington, Cal.	220
KFQR	Okla. City, Okla.	209.7
KFQU	Holy City, Cal.	222
KFQW	No. Bend, Wash.	215.7
KFQZ	Hollywood, Cal.	226
KFRB	Beeville, Tex.	248
KFRC	San Francisco, Cal.	268
KFRM	Fort Still, Okla.	263
KFRU	Bristow, Okla.	394.5
KFRW	Olympia, Wash.	220
KFRY	State College, N. M.	266
KFSG	Los Angeles, Cal.	275
KFUJ	Breckenridge, Minn.	242
KFUM	Colo. Springs, Colo.	242
KFUO	St. Louis, Mo.	545.1
KFUP	Denver, Colo.	234
KFUR	Ogden, Utah.	224
KFUS	Oakland, Cal.	234
KFUT	Salt Lake City, Utah	261
KFUU	San Leandro, Cal.	224
KFVD	San Pedro, Cal.	205.4
KFVE	Univ. City, Mo.	240
KFVF	Hollywood, Cal.	208.2
KFVJ	San Jose, Cal.	226
KFVK	Sacramento, Cal.	248
KFVR	Denver, Col.	246
KFVS	Cape Girardeau, Mo.	224
KFVW	San Diego, Cal.	246
KFWA	Ogden, Utah.	261
KFWB	Hollywood, Cal.	252
KFWC	Upland, Cal.	211.1
KFWD	Arkadelphia, Ark.	266
KFWF	St. Louis, Mo.	214.2
KFWH	Chico, Cal.	254
KGB	Tacoma, Wash.	249.7
KGO	Oakland, Cal.	361.2
KGU	Honolulu, Hawaii.	270
KGW	Portland, Ore.	491.5
KHJ	Los Angeles, Cal.	405.2
KHQ	Seattle, Wash.	278
KIAF	Sihtipoc, Minn.	421
KJR	Seattle, Wash.	384.4
KJS	Los Angeles, Cal.	293.9
KLDS	Independence, Mo.	440.9
KLS	Oakland, Cal.	242
KLX	Oakland, Cal.	508.2
KLZ	Denver, Colo.	266
KMJ	Fresno, Cal.	234
KMO	Tacoma, Wash.	250
KNX	Hollywood, Cal.	336.9
KOA	Denver, Colo.	322.4
KOB	State College, N. M.	348.6
KOCH	Omaha, Neb.	258
KOP	Detroit, Mich.	278
KPO	San Francisco, Cal.	428.3
KPPC	Pasedena, Cal.	228.9
KPRC	Houston, Tex.	296.9
KQV	Pittsburgh, Pa.	275.2
KQW	San Jose, Cal.	226
KRE	Berkeley, Cal.	258
KSAC	Manhattan, Kan.	340.7
KSD	St. Louis, Mo.	545.1
KSL	Salt Lake City, Utah	299.8
KTCL	Seattle, Wash.	305.9
KTHS	Hot Springs, Ark.	374.8
KTW	Seattle, Wash.	454.3
KUO	San Francisco, Cal.	246
KUON	Missoula, Mont.	244

LIST OF BROADCASTING STATIONS—Continued

Call Signal	Location of Station	Wave Length
KWG	Stockton, Cal.	248
KWKH	Shreveport, La.	273
KWWG	Brownsville, Tex.	278
KYW	Chicago, Ill.	535.4
KZKZ	Manila, P. I.	272
KZM	Oakland, Cal.	242
KZRQ	Manila, P. I.	375
NAA	Radio, Va.	435
WAAB	New Orleans, La.	273
WAAC	New Orleans, La.	275
WAAF	Chicago, Ill.	278
WAAM	Newark, N. J.	263
WAAW	Omaha, Neb.	384.4
WABA	Lake Forest, Ill.	227
WABI	Bangor, Maine	240
WABM	Saginaw, Mich.	261
WABN	La Crosse, Wis.	244
WABO	Rochester, N. Y.	278
WABQ	Haverford, Pa.	261
WABR	Toledo, Ohio	263
WABU	Camden, N. J.	226
WABW	Wooster, Ohio	206.8
WABX	Mt. Clemens, Mich.	246
WABY	Philadelphia, Pa.	242
WABZ	New Orleans, La.	275
WADC	Akron, Ohio	258
WAFD	Port Huron, Mich.	256
WAHG	Richmond Hill, N. Y.	315.6
WAMD	Minneapolis, Minn.	243.8
WARC	Medford Hillside, Mass.	261
WBAA	W. Lafayette, Ind.	273
WBAK	Harrisburg, Pa.	276
WBAO	Decatur, Ill.	263
WBAP	Ft. Worth, Tex.	475.9
WBAR	Sisiht, Wis.	406
WBAV	Columbus, Ohio	293.9
WBAX	Wilkes-Barre, Pa.	356.4
WBBG	Mattapoisett, Mass.	248
WBBL	Richmond, Va.	229
WBBM	Chicago, Ill.	226
WBBP	Petosky, Mich.	238
WBBR	Staten Is., N. Y.	272.6
WBBS	New Orleans, La.	252
WBBW	Norfolk, Va.	222
WBBZ	Indianapolis, Ind.	338
WBCM	Chicago, Ill.	266
WBDC	Grand Rapids, Mich.	256
WBES	Takoma Park, Md.	222
WBOQ	Richmond Hill, N. Y.	236
WBR	Butler, Pa.	203
WBT	Charlotte, N. C.	275
WBZ	Springfield, Mass.	333.3
WCAC	Storrs, Conn.	275
WCAD	Canton, N. Y.	263
WCAE	Pittsburgh, Pa.	461.3
WCAG	New Orleans, La.	268
WCAH	Columbus, O.	266
WCAJ	Univ. Place, Neb.	254
WCAL	Northfield, Minn.	336.9
WCAO	Baltimore, Md.	275
WCAP	Washington, D. C.	468.5
WCAR	San Antonio, Tex.	263
WCAT	Rapid City, S. D.	240
WCAU	Philadelphia, Pa.	248
WCAX	Burlington, Vt.	252
WCAY	Milwaukee, Wis.	266
WCAZ	Carthage, Ill.	246
WCBA	Allentown, Pa.	254
WCBD	Zion, Ill.	345
WCBI	Bemis, Tenn.	240
WCBM	Baltimore, Md.	229
WCBQ	Nashville, Tenn.	242
WCBU	Arnold, Pa.	220
WCCO	Minneapolis, St. Paul, Minn.	416.4
WCEE	Elgin, Ill.	275.1
WCK	St. Louis, Mo.	273
WCM	Austin, Tex.	268
WCLS	Joliet, Ill.	214.2
WCSO	Springfield, O.	248
WCTS	Worcester, Mass.	268
WCUW	Worcester, Mass.	238
WCX	Detroit, Mich.	516.9
WDAE	Tampa, Fla.	273
WDAF	Kansas City, Mo.	365.6
WDAG	Amarillo, Tex.	263
WDAH	El Paso, Tex.	268
WDAY	Fargo, N. D.	244
WDBC	Lancaster, Pa.	258
WDBE	Atlanta, Ga.	278
WDBJ	Roanoke, Va.	229
WDBK	Cleveland, Ohio	227
WDBO	Winter Park, Fla.	240
WDBP	Superior, Wis.	242
WDBR	Boston, Mass.	261
WDBX	New York, N. Y.	233
WDBY	Chicago, Ill.	258
WDM	Washington, D. C.	270
WDOD	Chattanooga, Tenn.	256
WDRC	New Haven, Conn.	268
WDWF	Providence, R. I.	440.9
WDZ	Tuscola, Ill.	278
WEAA	Flint, Mich.	234
WEAF	New York, N. Y.	491.5
WEAH	Wichita, Kan.	268
WEAI	Ithaca, N. Y.	286
WEAJ	Vermilion, S. D.	278
WEAM	No. Plainfield, N. J.	261
WEAN	Providence, R. I.	270
WEAO	Columbus, Ohio	293.9
WEAR	Cleveland, O.	389.4
WEAU	Sioux City, Iowa	275
WEAY	Houston, Texas	270
WEBA	N. Brunswick, N. J.	233
WEBC	Superior, Wis.	242
WEBD	Anderson, Ind.	246
WEBE	Cambridge, Ohio	234
WEBH	Chicago, Ill.	370.2
WEBJ	New York, N. Y.	233
WEBK	Grand Rapids, Mich.	242
WEBM	Mobile, Ala.	226
WEBQ	Harrisburg, Ill.	226
WEBR	Buffalo, N. Y.	244
WEBW	Beloit, Wis.	268
WEBZ	Savannah, Ga.	263
WEEI	Boston, Mass.	475.9
WEMC	Berrien Springs, Mich.	285.5
WENR	Chicago, Ill.	266
WEW	St. Louis, Mo.	248
WFAA	Dallas, Tex.	475.9
WFAV	Lincoln, Neb.	275
WFBB	Eureka, Ill.	240
WFBC	Knoxville, Tenn.	250
WFBG	Altoona, Pa.	278
WFBH	New York, N. Y.	272.6
WFBI	Camden, N. J.	236
WFBJ	Collegeville, Minn.	236
WFBK	Hanover, N. H.	256
WFBL	Syracuse, N. Y.	252
WFBM	Indianapolis, Ind.	268
WFBQ	Raleigh, N. C.	252
WFBR	Baltimore, Md.	254
WFBY	Ft. Ben Harrison, Ind.	257
WFI	Philadelphia, Pa.	394.5
WFKB	Chicago, Ill.	217.3
WGAZ	So. Bend, Ind.	275
WGBA	Baltimore, Md.	254
WGBB	Freeport, N. Y.	244
WGBF	Evansville, Ind.	236
WGBM	Providence, R. I.	234
WGBQ	Menominee, Wis.	234
WGBS	New York N. Y.	315.6
WGBX	Orono, Me.	252
WGBY	New Lebanon, O.	250
WGCP	New York, N. Y.	252
WGES	Oak Park, Ill.	250
WGHP	Detroit, Mich.	270
WGMU	Richm'd Hill, N. Y.	236
WGM	Chicago, Ill.	270.2
WGR	Buffalo, N. Y.	319
WGST	Atlanta, Ga.	270
WGY	Schenectady, N. Y.	379.5
WHA	Madison, Wis.	535.4
WHAD	Milwaukee, Wis.	275
WHAG	Cincinnati, O.	233
WHAM	Rochester, N. Y.	278
WHAP	Brooklyn, N. Y.	240
WHIR	Atlantic City, N. J.	275
WHAS	Louisville, Ky.	399.8
WHAV	Wilmington, Del.	266
WHAZ	Troy, N. Y.	379.5
WHB	Kansas City, Mo.	365.6
WHBB	Stevens Point, Wis.	240
WHBF	Rock Island, Ill.	222
WHBH	Culver, Ind.	222.1
WHBI	Chesaning, Mich.	227
WHBL	Logansport, Ind.	215.7
WHBO	Pawtucket, R. I.	231
WHBP	Johnstown, Pa.	256
WHBW	Philadelphia, Pa.	215.7
WHBX	Punxsutawney, Pa.	212.6
WHBY	W. De Pere, Wis.	250
WHDI	Minneapolis, Minn.	278
WHEC	Rochester, N. Y.	258
WHK	Cleveland, O.	273
WHN	New York, N. Y.	360
WHL	Des Moines, Iowa	526

LIST OF BROADCASTING STATIONS—Continued

Call Signal	Location of Station	Wave Length
WHT	Dearfield, Ill.	238-399.8
WIAD	Philadelphia, Pa.	250
WIAK	Omaha, Neb.	278
WIAS	Burlington, Iowa	254
WIBA	Madison, Wis.	236
WIBC	St. Petersburg, Fla.	222
WIBD	Joliet, Ill.	200
WIBF	Wheatland, Wis.	231
WIBG	Elkins Park, Pa.	222
WIBJ	Chicago, Ill.	215.7
WIBK	Toledo, O.	205.4
WIBL	Chicago, Ill.	215.7
WIBO	Chicago, Ill.	226
WIL	St. Louis, Mo.	273
WIP	Philadelphia, Pa.	508.2
WJAD	Waco, Tex.	352.7
WJAG	Norfolk, Neb.	276
WJAK	Greentown, Ind.	254
WJAM	Cedar Rapids, Iowa.	268
WJAR	Providence, R. I.	305.9
WJAS	Pittsburgh, Pa.	275
WJAZ	Chicago, Ill.	268
WJBC	La Salle, Ill.	234
WJBD	Ashland, Wis.	233
WJJD	Mooseheart, Ill.	302.8
WJY	New York N. Y.	405.2
WJZ	New York, N. Y.	454.3
WKAA	Cedar Rapids, Iowa.	278
WKAP	Cranston, R. I.	234
WKAQ	San Juan, Porto Rico.	340.7
WKAR	East Lansing, Mich.	285.5
WKAV	Laconia, N. H.	209.7
WKBG	Chicago, Ill.	215.7
WKRC	Cincinnati, Ohio,	422.3-325.9
WKY	Okla. City, Okla.	275
WLAL	Tulsa, Okla.	275
WLB	Minneapolis, Minn.	278
WLBL	Stevens Point, Wis.	278
WLIT	Philadelphia, Pa.	394.5
WLS	Chicago, Ill.	344.6
WLW	Cincinnati, Ohio.	422.3
WMAC	Cazenovia, N. Y.	275
WMAF	S. Dartmouth, Mass.	360
WMAK	Lockport, N. Y.	266
WMAN	Columbus, Ohio.	278
WMAQ	Chicago, Ill.	447.5
WMAY	St. Louis, Mo.	247
WMAZ	Macon, Ga.	261
WMBB	Chicago, Ill.	250
WMBF	Miami Beach, Fla.	384.4
WMC	Memphis, Tenn.	499.7
WMCA	New York, N. Y.	340.7
WNAB	Boston, Mass.	250
WNAC	Boston, Mass.	280.2
WNAD	Norman, Okla.	254
WNAL	Omaha, Neb.	258
WNAT	Philadelphia, Pa.	250
WNAV	Knoxville, Tenn.	233
WNAX	Yankton, S. D.	244
WNJ	Newark, N. J.	252
WNYC	New York, N. Y.	526
WOAC	Lima, Ohio.	261
WOAI	San Antonio, Tex.	394.5
WOAN	Lawrenceburg, Tenn.	282.8
WOAW	Omaha, Neb.	526
WOAX	Trenton, N. J.	240
WOC	Davenport, Iowa.	483.6
WODA	Paterson, N. J.	202.6
WOI	Ames, Iowa.	270
WOK	Homewood, Ill.	217.3
WOO	Philadelphia, Pa.	508.2
WOQ	Kansas City, Mo.	278
WOR	Newark, N. J.	405.2
WORD	Batavia, Ill.	275
WOS	Jefferson City, Mo.	440.9
WOWL	New Orleans, La.	270
WOWO	Fort Wayne, Ind.	227
WPAK	Fargo, N. D.	275
WPAZ	Charleston, W. Va.	268
WPG	Atlantic City, N. J.	299.8
WPSC	State College, Pa.	261
WQAA	Parkersburg, Pa.	220
WQAC	Amarillo, Tex.	234
WQAE	Springfield, Vt.	246
WQAM	Miami, Fla.	268
WQAN	Scranton, Pa.	250
WQAO	New York, N. Y.	360
WQAS	Lowell, Mass.	252
WQJ	Chicago, Ill.	447.5
WRAA	Houston, Tex.	256
WRAF	La Porte, Ind.	224
WRAK	Escanaba, Mich.	256
WRAM	Galesburg, Ill.	244
WRAV	Yellow Spgs., Iowa.	263
WRAX	Gloucester City, N. J.	250
WRBC	Valparaiso, Ind.	278
WRC	Washington, D. C.	468.5
WREO	Lansing, Mich.	285.5
WRHF	Washington, D. C.	256
WRK	Hamilton, Ohio.	270
WRM	Urbana, Ill.	273
WRNY	New York, N. Y.	258.5
WRI	Dallas, Tex.	350
WRW	Tarrytown, N. Y.	272.6
WSAB	Cape Girardeau, Mo.	275
WSAC	Clemson College, S. C.	336.9
WSAD	Providence, R. I.	256
WSAG	St. Petersburg, Fla.	266
WSAI	Mason, Ohio.	325.9
WSAJ	Grove City, Pa.	229
WSAM	Allentown, Pa.	229
WSAR	Fall River, Mass.	254
WSAZ	Pomeroy, Ohio.	244
WSB	Atlanta, Ga.	428.3
WSDA	New York, N. Y.	263
WSKC	Bay City, Mich.	261
WSMB	New Orleans, La.	319
WSMK	Dayton, Ohio.	275
WSOE	Milwaukee, Wis.	246
WSRO	Hamilton, Ohio.	252
WSUI	Iowa City, Iowa.	483.6
WSY	Auburn, Ala.	250
WTAB	Fall River, Mass.	266
WTAC	Johnstown, Pa.	267.8
WTAM	Cleveland, Ohio.	389.4
WTAP	Cambridge, Ill.	242
WTAQ	Osseo, Wis.	254
WTAR	Norfolk, Va.	261
WTAS	Elgin, Ill.	302.8
WTAT	Boston, Mass.	244
WTAW	College Sta., Tex.	270
WTAX	Streator, Ill.	231
WTG	Manhattan, Kan.	278
WTHS	Flint, Mich.	218.8
WTIC	Hartford, Conn.	348.6
WWAD	Philadelphia, Pa.	250
WWAE	Plainfield, Ill.	242
WWAO	Houghton, Mich.	263
WWI	Dearborn, Mich.	266
WWJ	Detroit, Mich.	352
WWL	New Orleans, La.	275

ARGENTINA

LOR	Buenos Aires.	350
LOV	Buenos Aires.	350
LOW	Buenos Aires.	325
LOX	Buenos Aires.	375
TCR	Buenos Aires.	325-300

AUSTRALIA

2BL	Sydney	350
2FC	Sydney	1100
3AR	Melbourne	480
5CL	Adelaide	875
6WF	Pert	1250

AUSTRIA

Graz	404
Vienna	530

BELGIUM

SRB	Brussels	265

BRAZIL

SPE	Rio de Janero	250

CANADA

CFAC	Calgary, Alta.	434.5
CFCA	Toronto, Ont.	356.9
CFCF	Montreal, P. Q.	410.7
CFCH	Iroquois Falls, Ont.	499.7
CFCK	Edmonton, Alta.	516.9

CANADA (Continued)

Call Signal	Location of Station	Wave Length
CFCN	Calgary, Alta.	434.5
CFCR	Sudbury, Ont.	410
CFCT	Victoria, B. C.	329.5
CFCU	Hamilton, Ont.	340.7
CFHC	Calgary, Alta.	434.5
CFKC	Thorold, Ont.	248
CFQC	Saskatoon, Sask.	329.5
CFRC	Kingston, Ont.	450
CFXC	New Westminster, B. C.	291.1
CFYC	Vancouver, B. C.	410.7
CHBC	Calgary, Alta.	434.5
CHCM	Calgary, Alta.	434.5
CHCS	Hamilton, Ont.	340.7
CHIC	Toronto	356.9
CHNC	Toronto	356.9
CHUC	Saskatoon, Sask.	329.5
CHXC	Ottawa, Ont.	434.5
CHYC	Montreal, Que.	410.96
CJCA	Edmonton, Alta.	516.9
CJGC	London, Ont.	329.5
CKAC	Montreal, Que.	410.7
CKCD	Vancouver, B. C.	397
CKCK	Regina, Sask.	476
CKCO	Ottawa, Ont.	434.5
CKCX	Calgary, Alta.	434.5
CKFC	Vancouver, B. C.	410.7
CKLC	Calgary, Alta.	434.5
CKNC	Toronto, Ont.	356.9
CKOC	Hamilton, Ont.	340.7
CKY	Winnipeg, Man.	384.4
CNRA	Moncton, N. B.	312.3
CNRC	Calgary, Alta.	434.5
CNRE	Edmonton, Alta.	516.9
CNRM	Montreal, Que.	410.7
CNRO	Ottawa,	434.5
CNRR	Regina, Sask.	476
CNRS	Saskatoon, Sask.	329.5
CNRT	Toronto, Ont.	356.9
CNRV	Vancouver, B. C.	410.7
CNRW	Winnipeg, Man.	384.4

CUBA

PWX	Havana	400
Q2LC	Havana	250
2BY	Havana	320
2HP	Havana	295
20K	Havana	360
20L	Havana	300
2WW	Havana	210
6BY	Cienfuegos	300
6EV	Cabarien	250
6KJ	Tuinucu	275
6KW	Tuinucu	332
7SR	Camaguey	295
8BY	Santiago	250
8CX	Santiago	245
8DW	Santiago	275
8EV	Santiago	180
8GT	Santiago	260

FRANCE

Toulouse	300
Lyons	280-470

GERMANY

Hamburg	395
Muenster	410
Breslau	418
Berlin (Vox Hans)	505
Berlin (Witzeben)	500
Stuttgart	443
Leipzig	454
Koenigsberg	463
Frankfurt-on-Main	470
Munich	485

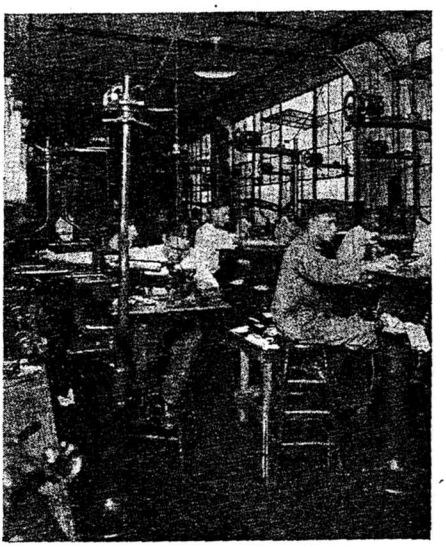
GREAT BRITAIN

2BD	Aberdeen, Scot.	495
2BE	Belfast, Ireland	439
2DE	Dundee, Scot.	331
2EH	Edinburgh, Scot.	326
2LO	London, Eng.	361
2LS	Leeds, Bradford, Eng.	310-346
2ZY	Manchester, Eng.	375
5IT	Birmingham, Eng.	475
5NG	Nottingham, Eng.	326
5NO	Newcastle, Eng.	403
5PY	Plymouth, Eng.	335
5SC	Glasgow, Scot.	420
5WA	Cardiff, Wales	351
5XX	Chelmsford	160
6BM	Bournemouth, Eng.	385
6FL	Sheffield, Eng.	301
6KH	Hull, Eng.	335
6LV	Liverpool, Eng.	315
6ST	Stoke-on-Trent, Eng.	306

MEXICO

CYA	Mexico City	185
CYB	Mexico City	380
CYF	Oaxaca, Oax.	260
CYH	Mexico City	340
CYL	Mexico City	480
CYS	Monterey	310
CYX	Mexico City	333
CYZ	Mexico City	400
CZA	Mexico City	500
CZF	Chihauhau City	325

Building Freed-Eisemann Radio Receivers



Electrically operated Engraving machines automatically engrave the panels.

THE story of Freed-Eisemann portrays one of the real romances of the Radio Industry. Now regarded as one of the foremost in the field, this concern had its origin in a rather humble way during the early days of broadcasting. The first Freed-Eisemann product was a crystal receiver whose modest success inspired the subsequent step toward the manufacture of the more recent invention, the multiple tube receiver.

This was undoubtedly the logical step for Freed-Eisemann to take. Heading the organization is Mr. J. D. R. Freed who is not only president, but fittingly serves as the Chief Engineer by virtue of his exceptional experience as a Radio Engineer, with a reputation earned by his service to the Government during the war. His pathfinder work in Radio has since marked him as one of the foremost authorities in Radio Science.

The company showed its broad scientific vision by soon acquiring a license under the Hazeltine patents, introducing the famous Neutrodyne Receiver. In addition, Freed-Eisemann Radio Receivers became famous for their unexcelled workmanship and handsome appearance.

The rapid growth of this concern necessitated the acquisition of new quarters for increased production. It moved to the Sperry Bldg., Manhattan Bridge Plaza, Brooklyn, occupying a series of floors totaling about 60,000 square feet.

Here is to be found one of the finest Radio manufacturing plants in the world, including a Research laboratory whose equipment consists of every known form of experimental Radio apparatus. A large staff of radio and electrical engineers is employed under the direct supervision of Mr. J. D. R. Freed, devoting their entire time and effort to the advancement of Radio.

The plant is scientifically arranged for

These huge machines punch the Bakelite tubes for radio frequency transformers.

The Bakelite tubes are turned by a motor while a threaded arm guides the coil winding, insuring correct spacing.

efficient service in each of its many departments. Facilities are provided for testing every bit of material used in the receivers and then is supplemented by a divisional test during the various stages of manufacture. Nothing is left undone. Time is sacrificed for the sake of perfection in workmanship. It is most admirable to note in this day of hurried commercialism, the particular care taken with every minute detail up to the point of shipment in air cushioned cases.

To follow the progress of a Radio set, through its various stages of manufacture, one should start at the Stock Room. Here every part received is inspected, and any unsuitable materials immediately thrown out. Adequate stocks of all requisite parts are maintained, and as the quantity used is most substantial the stock room seems to contain enormous supplies. One of the floors in this building is used largely as storage space for reserve materials.

In the factory—the first point of observation is, naturally, the row of huge presses fitted with steel dies for punching coils and panels. Passing on beyond this point into the center of the department to watch the coil winding, one is immediately impressed with the characteristic thoroughness of the entire organization. The wire cutting department comes next; and here all wires used are cut to proper lengths by extremely dexterous workers, assorted and designated for the various uses.

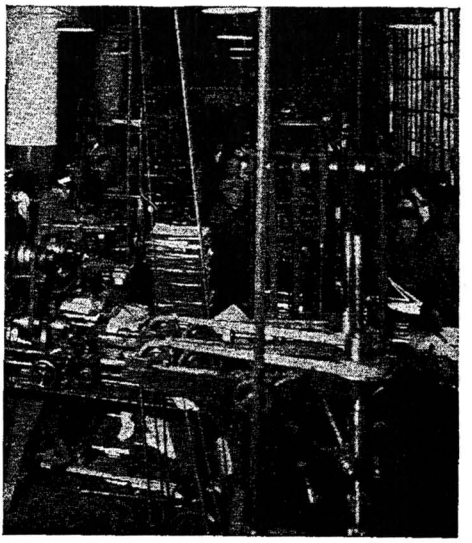
Of all the processes of manufacture there is none more interesting than panel engraving. This is accomplished through a series of steps, each machine doing an individual portion of the work until the entire panel is engraved. It is astonishing to watch machinery do such delicate work.

The actual assembly of sets begins in the next department. Here long benches are arranged, and from bare panels to finished Receiver the work progresses in successive stages, every operator having his particular bit of wiring or assembling to do.

Before the sets are installed in cabinets, they are tested and arranged in racks. After the workroom examination they are sent to a test room, where more rigid inspection is made.

Having passed this inspection, the sets are installed in cabinets

Wiring Racks—The panel, after having the various parts assembled on it, is mounted on a movable rack. The connections are then wired with square bus wiring and firmly soldered.



The corner of the machine shop used for the construction of experimental apparatus.

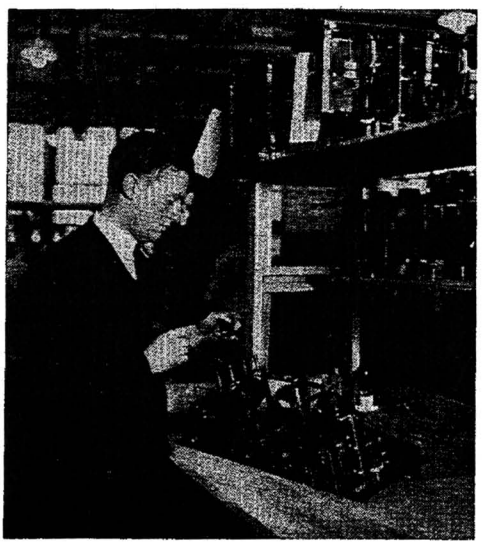
and are again tested before packing. The packing is carefully done, in order that even the most sensitive parts may not be disturbed, and that cabinets not marred.

An inspection ticket is attached to each receiver the moment it is started in assembly, and as each step is finished, the workman signs his name.

No less than seventeen tests are given each receiver before it begins bringing in DX for the fan whose home it finally adorns. That is why music reproduced by the Freed-Eisemann Receiver is real music, just as it is rendered by the masters appearing before the microphone and engendering, with the cooperation of radio throughout the length and breadth of the land, deeper love for the best that the world of music provides.

Mr. Joseph D. R. Freed, Mr. Alexander Eisemann and Mr. Arthur Freed, the executives of the company, feel personally responsible to you for the performance of every Freed-Eisemann Radio Receiver. They have inspired every man in their great plant with the same uncompromising vigilance, the same devotion to an ideal; "The Receiver Built With A Conscience."

You will know at the first turn of the dials, at the first strain of music, that your Freed-Eisemann was built by clever, trained, unhurried hands, to give you pleasure—now and for years to come.



Electrical Testing—After being wired the receiver is tested electrically at every connection to make certain that it is wired properly.

Some Facts About Freed-Eisemann

The Largest Neutrodyne Manufacturers in the World — The official figures show that in 1924 Freed-Eisemann Radio Corporation did more than half as much business as all the other thirteen licensed Neutrodyne manufacturers combined.

$10,000,000 worth in use — The fact that there are so many Freed-Eisemann Receivers already in use is proof of the great public acceptance of this one make.

Selected to Build Special Sets for the U. S. Army — Freed-Eisemann was selected to build the special sets for the United States Army which had to meet exacting requirements in cutting out all broadcasting and receiving only special wave lengths used by the great chain of forts maintained by the U. S. Government.

On the President's Yacht — The President's official yacht, the Mayflower, carries a Freed-Eisemann Radio Receiver which was selected by Government experts after rigid tests and purchased by the Government for use on the President's yacht.

Trans-Atlantic Cup Winner — Last November Mrs. Edna M. Smith of Springfield Gardens, L. I., heard Madrid, Spain, and England broadcasting on her Freed-Eisemann receiver and won the Trans-Atlantic cup offered for first reception on Freed-Eisemann Receivers.

A Nation-Wide Test Before Production — Before Freed-Eisemann brings out a new set, samples are sent to practically every state in the Union so that the new receivers may operate under special conditions which exist in various localities. Last summer a new model was sent completely around the United States receiving broadcasting under the most difficult conditions—in moving trains and automobiles.

Research — The Freed-Eisemann Radio Corporation maintains a large research department in which new developments in Radio are constantly being tested and tried. Thus you may be sure that Freed-Eisemann will at no time bring out anything that is not exactly right.

Memorandum

Memorandum