RADIO MANUFACTURER'S SERVICE

Lesson Number Eight

NOISE ELIMINATION

Complete Data on . . .

- ALL TYPES OF INSTALLATIONS
- ALL MAKES OF RADIOS
- HOW TO GET BEST PERFORMANCE

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Prepared by

Philco Parts and Service Division

for Members of

Radio Manufacturer's Service

TO ALL R. M. S. MEMBERS:

This series of R. M. S. lessons is prepared jointly by Philco Radio Engineers and Philco Distributor Service Managers.

The distributors' service managers, all over the United States, write in weekly letters covering service conditions in their territories.

From these letters and reports the factory has first hand, personal contact with your service problems.

This information is supplemented by the factory's own field Service Engineers.

In this way we have accumulated the experience and problems encountered in making hundreds of thousands of installations.

The experience of over 12,000 R. M. S. members in making aerial installations under every possible condition have been gathered together for your guidance in this R. M. S. Lesson.

The growing importance of perfect aerial jobs gives you the opportunity to get "More Service Work and Make More Profits."

Chapter I

Introduction

Every wide-awake, progressive dealer and serviceman knows the importance of entirely satisfying every customer. The advertising value of the satisfied customer is an asset that will give good financial returns to any business concern. It is always easier to collect money from the customer who is convinced that value has been received. Keen competition has made customer satisfaction more important than ever before.

Securing Customer Satisfaction. In buying a radio set, the individual customer is purchasing entertainment. Since every individual is not always satisfied by the same type of program, the value of the radio set in the home depends upon the variety of programs that it can receive with satisfactory volume and tone. Customer satisfaction is bound to result if a large choice of program material is available with full clarity and tone and without static or interference noise.

Causes of Dissatisfaction. Static and interference noise have no entertainment value at any time, and disturbances of this kind will cause customer dissatisfaction. Such reception is unsatisfactory from the viewpoint of both the customer and the serviceman. Lost sales, unnecessary service calls and ill feeling are the natural results.

In most cases where the customer has made a strong complaint and no trouble has been located in the set, a noise-reducing aerial is installed, eliminating the trouble. While noise-reducing aerials greatly improve the operation of the set where interference is severe, they make a 100% improvement in the operation of any set in any location.

IT IS HIGHLY IMPORTANT THAT ALL DEALERS AND SERVICEMEN UNDERSTAND THAT NOISE-REDUCING AERIAL SYSTEMS ARE DESIGNED FOR THE HOME OF EVERY RADIO SET OWNER.

The cause of dissatisfaction in a large number of cases is due entirely to the manner in which the original installation is made. The set location, the neatness of the wiring, and the care taken in placing the aerial are just as important as the set itself in securing the customer's entire satisfaction.

Hundreds of customers, using poor aerials, put up with poor, noisy reception because they believe that better operation cannot be obtained. At the same time, the impression persists in their minds that advertising of ALL-WAVE, NOISE-FREE RECEPTION is either too enthusiastic or is plainly misleading. This is not so, but still it creates a serious obstacle in the path of the dealer selling radio equipment. One poor aerial installation may spoil a countless number of possible future sales. The dealer or serviceman who is smart enough to make the proper installation when making the sale will make more sales, and will not lose unnecessary time and expense trying to satisfy a customer made critical by noisy reception.

The radio sale of today includes the complete installation. Philco engineered installations are the answer to the problem of getting real performance in the home. The making of custom installations of every radio is becoming an absolute necessity. Here is a chance, never before available to trained servicemen, to do a profitable business obtaining aerial installations.

Active, aggressive servicemen who want opportunities should use this lesson carefully. Here are described the installations which will definitely produce the performance required by your customers and which will result in the customer's recommendation of your work to his friends and acquaintances.

It is the purpose of this book to explain the importance of the aerial in eliminating noise and the methods recommended for making correct installations of any radio set in any type or kind of home.

Chapter II

The Importance of the Aerial

The True Function of the Set

Radiophone transmission makes use of a high frequency wave to place programs on the air. In actual operation, the radio set amplifies the high frequency signals received by the aerial, and makes the program audible through the speaker. Practically, then, the radio set is an amplifier sensitive to all high frequency signals that are received and delivered to it by the aerial.

Why Noise Is Audible

Unfortunately, there are other high frequency impulses brought in by the ordinary aerial. These impulses are the electrical disturbances created by atmospheric conditions or by electrical equipment, and are of similar character to the high frequency output of a broadcasting station. The radio set, acting as a true amplifier, will step up both noise and signal impulses, delivering both to the speaker in the same proportions that they were at the antenna post of the set. Therefore, the only way to keep noise out of the speaker is to keep noise from entering the aerial.

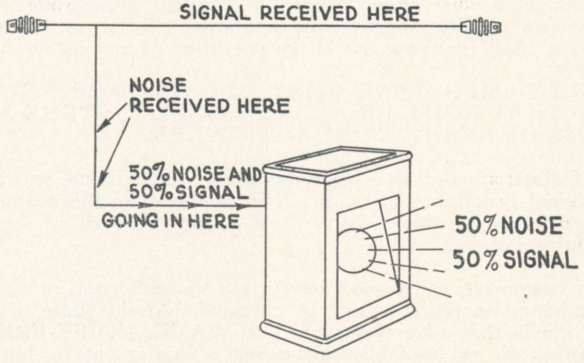
The Aerial Is the True Receiver

It has been shown that a set, taking all of its input from the aerial, will reproduce, in the same proportion, the noise and the signal delivered to it by the lead-in. This shows that the aerial is the true receiver of the system, and the set is acting as an amplifier.

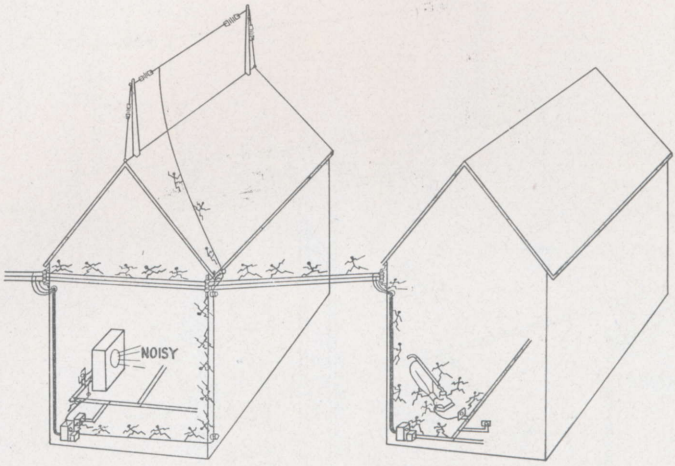
Increasing the power of the set will not alter this ratio, for both impulses are amplified alike. The only solution is elimination of the noise before it enters the radio set.

The Source of Electrical Interference

Every device that uses electricity for its operation is a possible source of high frequency disturbance. When a noise-producing device is operated from the same wires that supply the house with electricity, these same wires will act as an aerial for the noise. The noise received by direct radiation from the interfering device may be small, but the wires leading from it may carry a strong, objectionable, high-frequency impulse to any set that has its aerial or lead-in close to these wires. This interference, carried along the power lines of the home lighting circuits, produces an anvil chorus of hammering and banging unless some means is used to keep them out of the aerial and, thus, out of the set and its speaker. Refrigerators, oil burners, electric pumps, trolley systems, and hundreds of other pieces of electric equipment may send this interference over many miles of wire, causing noise and disturbances in radio sets located far from the original source of the trouble.



The Set Amplifies What the Aerial Receives



The Fields of Interference
Follow the Power Lines
NOTE.—Radio interference drawn as figures to show path into Radio Receiver.

The Location of the Noise Carrying Wires

Someone once said, "out of sight is out of mind." This can very well be said of wires in buildings. Since most wiring is hidden, little thought is given to the interference being carried by these power lines to every house connected to them.

Passing into the house, these same wires go to every outlet, every light, every switch, every extension, and every electrical device which they furnish with power. They run through the walls, the ceilings and the floors. The radio set, in its position within the house, is surrounded by these noise carrying wires.

The Objections to Indoor Aerials

Any aerial wire placed within a house will be within the intense noise field of the house wiring. For this reason alone, the reception of the indoor aerial will be very inferior to that of the outdoor type. In addition to this fact, the house wires surrounding the indoor aerial will partially shield it from radio signals. Placing the indoor aerial lower in the building will increase the noise pick-up and decrease the signal pick-up, but some people still believe the basement to be a good location. The indoor aerial would be ideal if noise alone was desired.

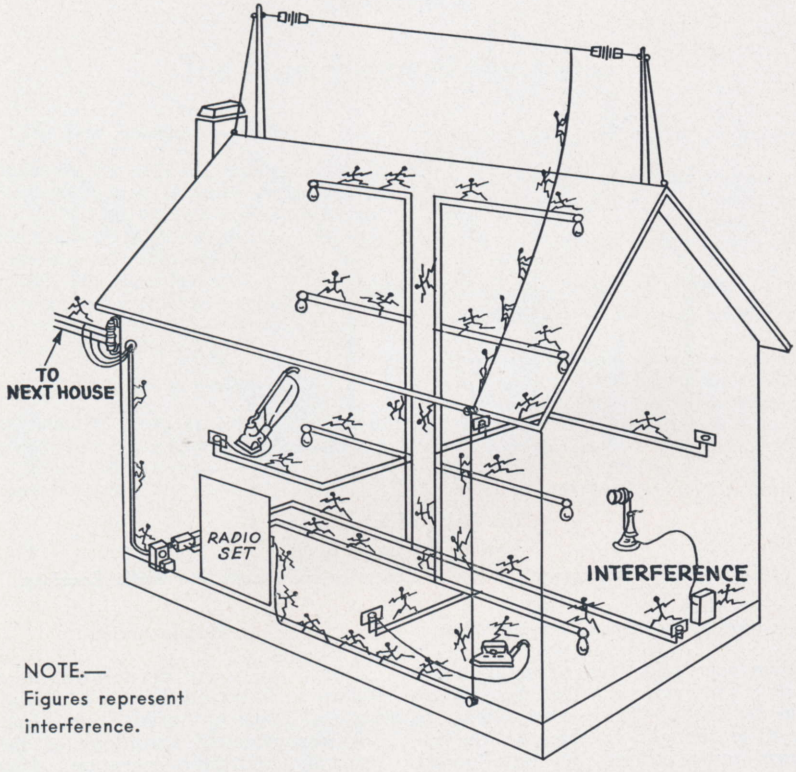
Plug-In Aerials

There are many devices on the market known as "Plug-In Aerials," "Aerial Eliminators," "Socket Aerials," etc., that generally depend upon variations of the same principle for their operation. Using the power supply wires of the house for an aerial, they are not only connected to the main source of interference in the home, but they may also constitute a fire hazard, if not correctly and carefully designed and installed.

The following quotation is from a report of the Philadelphia Radio Service Men's Association exposing the fraudulent claims in the advertising of one of these devices. It shows what this wide-awake, progressive organization of servicemen thinks about one device of this sort. We have deleted the names of the parties involved.

"**Item No. 1—Power Line Filter:** This unit is in no wise a Power Filter. To cover this feature they have a .25 mmfd. condenser connected directly across the A. C. line, thus merely bypassing whatever noise may be picked up from one side to the other.

"**Item No. 2—Aerial Filter:** It is in no sense of the word an Aerial Filter, as the aerial and ground connection shown on here are actually connected together.



The Network of Wiring in the Walls of the House

"Item No. 3—Voltage Regulator: It is in no sense of the word a Voltage Regulator since the male A. C. plug is directly connected to the female socket on the other end of the unit.

"Item No. 4—Prolongs Life of Tubes: Too ridiculous to comment on.

"Item No. 5—Aerial and Ground Eliminator: In no sense of the word an aerial and ground eliminator any more than any ordinary piece of wire would be.

"Item No. 6—Improves Clarity: Does not improve clarity.

"Item No. 7—Increases Volume on Most Sets: Impossible because aerial and ground posts as shown on unit are connected together so that if it were connected according to method shown in Figure "A," the aerial would merely pass through the binding posts by means of a direct connection.

"Item No. 8—Improves Tone Quality: Does not improve tone quality.

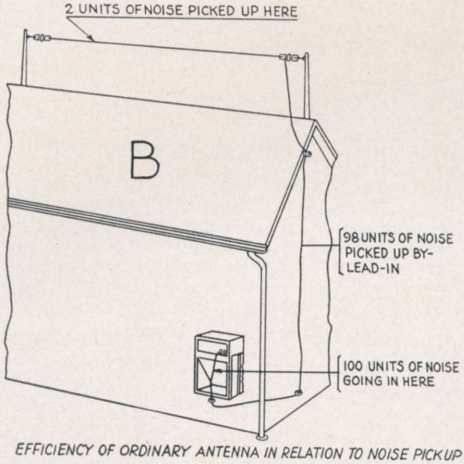
"Item No. 9—Increases Range on All Sets: Same answer as No. 7.

"Item No. 10—One Year, Unconditional Guarantee: Unquestionably true as there is nothing in the device to get out of order and judging from the general make-up they could replace one unit five times a year and still make a profit."

The Objections to Ordinary Aerials

The usual aerial consists of a suspended wire or group of wires, connected to the set by a single wire called a lead-in. This single wire lead-in is just as sensitive to high frequency signals as the aerial itself. Since the lead-in must come into the house and into the network of noise carrying wires of the house, the ordinary lead-in cannot possibly arrive at the antenna post of the set without having picked up some of this noise.

Whether the lead-in goes through the basement or around the baseboard, the



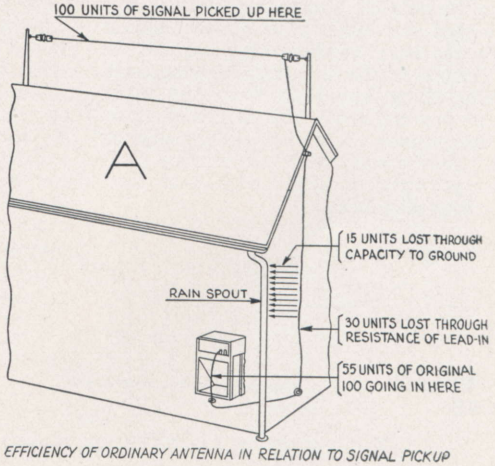
EFFICIENCY OF ORDINARY ANTENNA IN RELATION TO NOISE PICKUP

The Noise Pick-up of Ordinary Antenna & Lead-In

interference will get to it.

The ordinary lead-in is a high impedance wire carrying high frequency current from the aerial to the set. This type of line is subject to high loss, due to capacity effects with grounded objects, allowing the high frequency signals to leak away. The larger this condenser capacity, the higher the losses will be, yet some noise-eliminating aerials make use of a securely grounded shield placed around the lead-in, causing all except the strongest signals to be lost entirely. Such a system cannot give customer satisfaction.

Many customers attempt to get by with makeshift or otherwise inefficient aerial devices. The noise pick-up of a poor aerial exceeds the signal pick-up, particularly when the normal receiving range of the set is extended from the new obsolete standard of 100 miles to the present-day average of 5,000 miles. The best possible aerial, important as it is on nearby stations, becomes an absolute necessity over these distances.



EFFICIENCY OF ORDINARY ANTENNA IN RELATION TO SIGNAL PICKUP

The Signal Loss of Ordinary Antenna and Lead-In

Chapter III

How the Philco All-Wave Noise-Reducing Aerial Works

It is the purpose of the aerial to deliver to the set through the lead-in, a maximum amount of signal with a minimum amount of noise. The lead-in has, in the past, prevented servicemen from obtaining the desired low noise level due to the noise pick-up of this incoming wire. This fact made successful aerial installations a matter of chance, regardless of the time and care used by the serviceman. Now by means of a newly developed system, it is possible to do a good job quickly, and to secure *positive results* on *all bands of any all wave set.*

The Philco Transposed Lead-In System

Noise elimination has been made possible by changing the high impedance aerial and ground wires of the ordinary set to a low impedance twisted pair line specially designed to cancel out all noise pick-up. The twist of the cable greatly reduces its external magnetic field, cutting down on the ability of this line to pick up noise. However, any noise that is picked up by either one of the two wires will be equal to the noise picked up by the other, since they are closely twisted and are in the same relative position with respect to the field of noise. Arriving at the set transformer, the two equal noise impulses are opposed to each other, and mutually cancel out.

Previous Uses of Method

Early models of alternating current sets had twisted pair leads in all filament wiring to keep the hum of these lines out of the other circuits of the set. In telephone work the same thing has been done for many years to prevent cross talk in cabled lines. Time has proven the ability of this type of line to prevent static and interference pick-up, and yet carry a signal, with small loss, over a long distance.

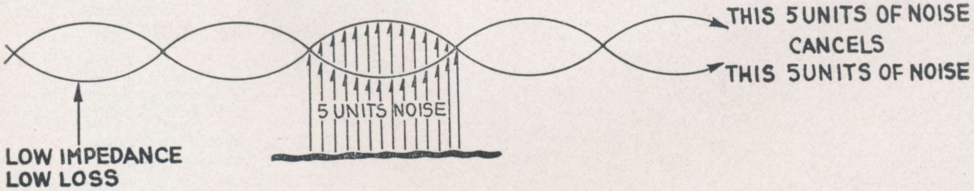
Balanced Impedance System

Increased transmission line efficiency may be obtained by reducing capacity and inductance losses. Since capacity may be used to overcome the effects of the inductance, the twin conductor of the Philco Transposed Lead-In is twisted in such a way as to make the capacity between the lines equal their inductance. Further losses are prevented by the low voltage, low impedance character of the signal passing through this line. THE NET RESULT IS TO REPRODUCE, AT THE TERMINALS OF THE SET, THE SAME CLEAR, UNDISTORTED SIGNALS THAT ARE PICKED UP BY THE AERIAL ITSELF, WITHOUT INTRODUCTION OF NOISE OR LOSS OF SIGNAL.

The Coupling Transformers

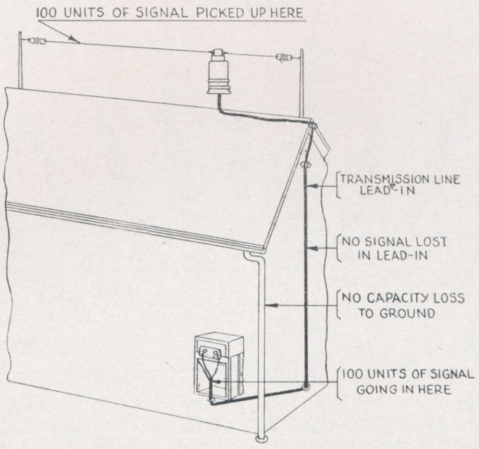
The coupling devices used to match impedances and to transfer signal energy to and from the transmission line are called the antenna and set transformers, respectively. The antenna transformer is suspended on the flat top portion of the aerial itself, where it concentrates the energy received by the aerial, and feeds it to the transmission line at low impedance. The parts used in this transformer are insulated to withstand the continuous application of 1,000 volts, preventing breakdown from static surges. The whole unit is thoroughly sealed against moisture and protected from the effects of weather.

The set transformer delivers to the set an exact duplicate of the signal received by the aerial, reversing the process which took place in the antenna transformer. For use on older model sets that mount this transformer externally, a switch is provided



THE LEAD-IN (NET RESULT – NO PICK-UP)

How the Lead-In Eliminates Noise

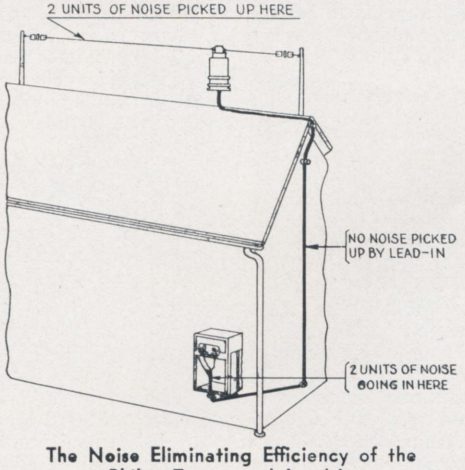


The Efficiency of the Philco Transposed Lead-In

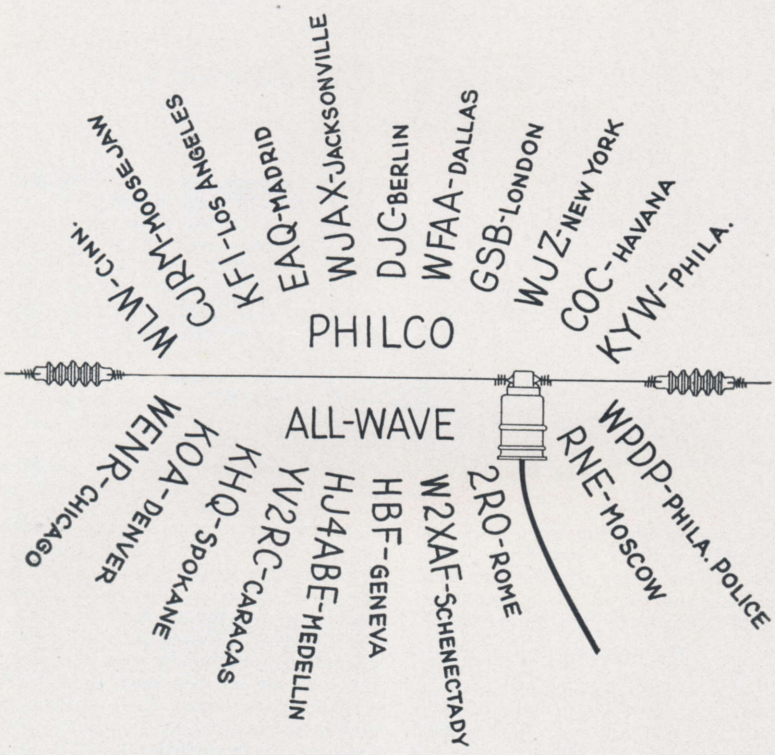
to correctly match the line impedance for both short and broadcast band waves. The new model sets have this transformer built into the chassis and the necessary matching is done automatically by the wave switch.

The Aerial

Those familiar with the transmission of radio signals know the importance of having an aerial correctly tuned. When used for receiving, maximum efficiency under given conditions will result when an aerial is tuned to the wavelength of the desired station. If only one station is desired, maximum efficiency can be obtained from a single flat top aerial of the proper length. But since practically every customer demands reception of a large number of stations having varied power and frequency, the modern aerial must work efficiently on every band of the modern all-wave set. In the Philco All-Wave Aerial the proper response is provided by use of different sections of the flat top, each broadly tuned to a definite frequency. Two of these resonant points are located in the short wave bands and one in the broadcast band. By combinations of aerial, transformer and lead-in, many other resonant points are provided. These are evenly spaced along the response curve, making it practically a straight line. In this way, the flat top portion of the



The Noise Eliminating Efficiency of the Philco Transposed Lead-In



Naturally Responds to ALL Frequencies (530 KC to 23 Megs.)

The Flat Top Responds Efficiently to All Waves

Philco All-Wave Aerial is made to respond efficiently to all signals on short wave or standard broadcast bands.

Mechanical Features

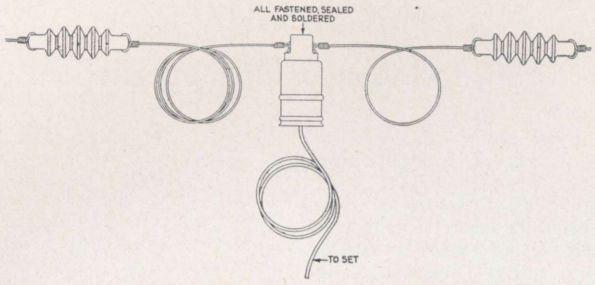
Many steps have been taken to preserve the features of the Philco All-Wave Antenna System over a long period of service. The wire used for the flat top is a heavy grade of high quality stranded copper wire ALREADY CUT TO THE PROPER DIMENSIONS AND SOLDERED TO THE ANTENNA TRANSFORMER. The lead-in is also fastened to the antenna transformer and the connections soldered. All that is required to install this aerial is support for the ends of the flat top. After fastening it to the lightning arrester, the lead-in is then carried into the set, and connected to the set terminal board (or set transformer). No ground is required for the set, no angles to measure, no spacers needed; in fact, an outside aerial could not be any easier to install.

The wire used for the lead-in is stranded, cotton and rubber covered, and then cabled in a braided material well impregnated against moisture. It is completely weatherproof.

This impregnation is of the same high quality as outside telephone lines, and frequent tests are made to insure the maintenance of this same high quality in every lot of this special lead-in wire.

Other Parts of the Kit

The flat top portion of the aerial is supplied with the 17 foot section cut to the proper length and the insulator correctly joined on to the wire. The 43 foot length is also soldered to the transformer and cut to the proper length for best results, but is left open to allow cutting to the maximum length allowed by the roof. The



The Simplicity of Making Installation

transmission lead-in is also soldered to the antenna transformer; an ample length (75 feet) is allowed. In addition, 2 well glazed porcelain insulators, 2 porcelain nail-on knobs, 1 porcelain tube and a special twin high quality lightning arrestor are supplied with the kit. Extreme care has been taken to make every part of this kit the highest quality that can be manufactured.

The Set Transformer, Philco Part No. 42-1095, is supplied as a separate part for installations on earlier Philco models or sets of other make.

The Advantages of the Philco All-Wave Aerial

The complete system, correctly installed, will provide world-wide reception for everybody. The reliability of the aerial, because of the high quality of the materials used, will assure customer satisfaction. The salesmen of all-wave sets will no longer make mental reservations when they tell customers about good foreign reception. Servicemen will find this installation work a profitable new source of income, because of the simplicity of the work required to erect this aerial. The neat appearance of the complete job will appeal to the customer. The serviceman will also appreciate the fact that the kit contains all necessary parts, including 75 feet of flexible lead-in and the lightning arrester, that the length of the lead-in can be altered as desired without affecting results, that NO SPECIAL ANGLES ARE REQUIRED, and that maximum efficiency with NOISE-ELIMINATION is obtainable on all frequencies from 150 to 23,000 kilocycles.

Many features have been added to the modern superheterodyne to increase customer satisfaction. Much greater range, more volume and better tone are a few of the advantages of the modern set, but the whole set becomes useless if noise prevents the enjoyment of these features. Customers are now demanding that noise be eliminated. The modern set will be equipped for operation with a noise-eliminating aerial and the dealer or serviceman that knows how to erect these aerials for best results will have an unexcelled opportunity to do more and better business than ever before.

Chapter IV

How to Make an Ideal Installation

In the past, the location of the radio set in the room was determined by the position of the nearest electrical outlet, and by the ease of installation of the lead-in. This was to some extent necessary because of the bad characteristics of ordinary lead-ins when in a field of noise. The use of the Philco System removes this limitation, allowing the owner to place the set for best tone and appearance. In cases where the owner is undecided in the choice of position, an ideal installation will be described, to aid the serviceman in recommending a definite location. Other types will be described in the following chapters.

The Ideal Installation

For the purpose of this illustration, a single house, with plenty of ground around it, will be used. The set is to be placed in the living room, first floor front. The room is rectangular and uses a single large rug for floor covering. (See Diagram No.).

Choosing a Location for the Set

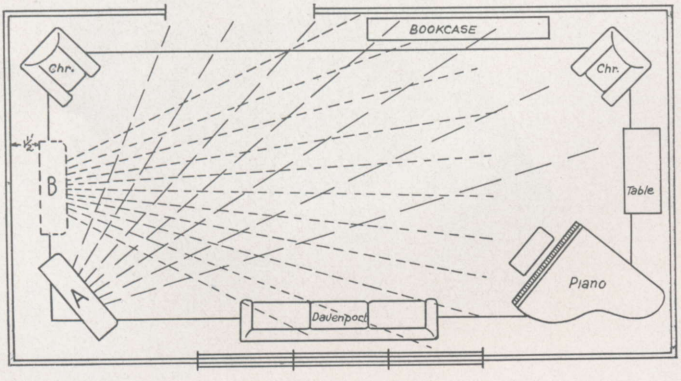
The position shown has been selected for tone and appearance. The speaker is best placed at one end of a rectangular room, keeping the listeners in a position to hear the sound waves directly, instead of by reflection from the walls. If in doubt about echoes disturbing the tone quality, try the simple test of having someone clap their hands together at those points selected for the speaker and listen for echoes in different parts of the room. It isn't necessary to be a sound engineer to make the best choice.

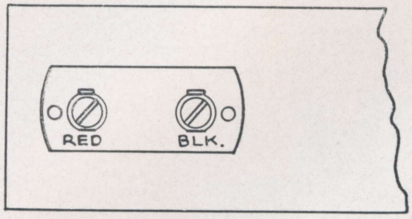
Do a Neat Job

After selling every customer on a noise-proof, high quality installation with each new set, put in good jobs. Attention to detail will result in greater customer satisfaction, which means fewer free service calls. Straight, neat wiring stapled down to cabinet or baseboard will leave the good impression that pays good dividend. There are generally three choices open to the serviceman in running remote control cables across the room. They may be placed under the rug, if one is used. In the absence of a full sized rug, the cable may be passed down through the flooring into the cellar and up on the other side of the room. Where it is impossible to use this method, the cable may be conducted around the room by fastening it to the baseboard with special fibre clamps (Philco Part Number 8201). In this case, it will be necessary to locate the speaker closer to the set to make the cable reach, or extend the cable by using extra lengths supplied on order.

Order of Installation

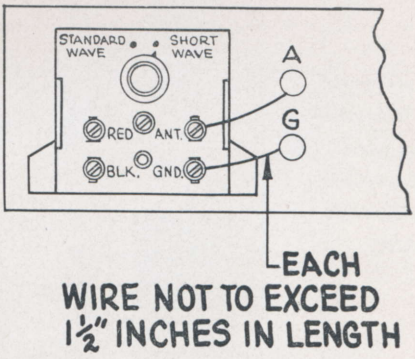
The proper way to install a set is the reverse of the usual procedure adopted by most servicemen. As has been suggested, locate the set first. On older model sets, the next step is to fasten the set transformer in place directly in back of the antenna and ground posts of the chassis so that the leads, now connected, are not longer than 1½". On new sets, the transformer is internally mounted and connected.





Philco ALL-WAVE AERIAL Terminal Panel on Chassis of All 1936 Philco All-Wave Receivers

Location of set transformer when used.



Locating the Noise

At this point two choices are open to the serviceman making the installation. The best method, to be used where practical, is that of fastening the red and black wires of the lead-in to their proper posts on the set first, and then, uncoiling the lead-in, pass the kit out the nearest window, and carry it up a ladder to the roof. The flat top portion of the aerial is then stretched out, using the maximum length available on the roof. By moving the stretched antenna from one portion of the roof to another, it is easy for someone listening in at the set to determine the degree of noise received in the various positions. Having determined the best position available, the supports are set up and the aerial permanently located. This method makes only one trip to the roof necessary and should be used if the location of the house indicates that reception would normally be noisy.

The other method is the one ordinarily followed, locating the flat-top in apparently the best position, and then fastening the lead-in on down to the set. Movement of the antenna may be accomplished by temporary suspension of it at different positions on the roof, while the output of the transmission line is connected to either a portable or the usual type of receiver.

CAUTION

NEVER RUN ANY WIRE, FORMING ANY PART OF THE AERIAL OR ITS SUPPORT, OVER OR UNDER ANY POWER LINE OR WIRE. This precaution should be observed on every installation. Carelessness in this matter has cost many radio sets; but, more important, the possibility of fire causing a house to burn down cannot be overlooked. Legal complications may result for the dealer or serviceman who disregards this warning.

POWER LINES ARE DANGEROUS AND AERIAL WIRES SHOULD NOT CROSS OVER OR UNDER THEM.

Hints on Locations

In ordinary type installations, it is common to run the lead-in from the nearest end of the aerial by the shortest path, into the set. While it will be hard at first, it is extremely important that all dealers and servicemen realize that now, having a lead-in in which length is unimportant, the aerial should be mounted as far from any source of noise as is physically possible.

The successful elimination of noise in every installation is dependent upon careful consideration of the noise-fields. It does not take an electrician to know that the ceiling lights of the top floor of a house must have their wires running directly beneath the roof. Since these wires are a source of noise, placing the flat top portion of the antenna within 10 feet of the roof makes the noise eliminating features of no avail. Many installations of this type have caused the dealer an untold amount of grief.

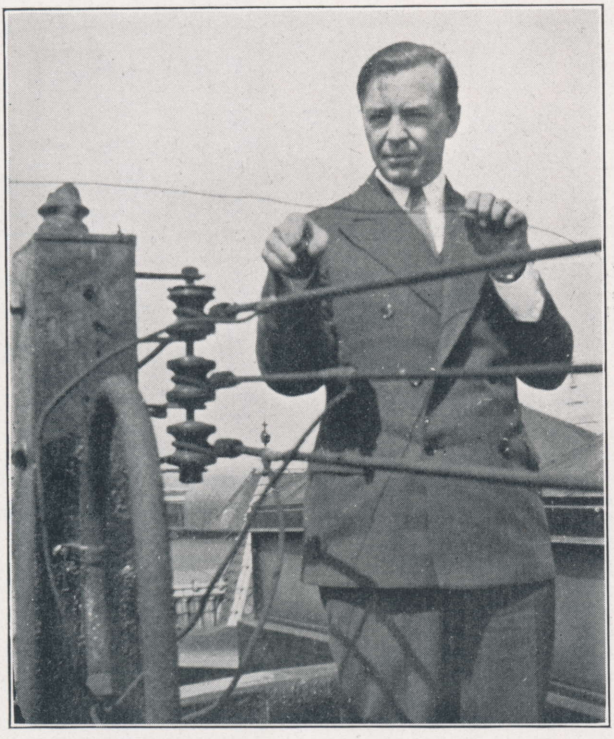
Effect of Distance from Source of Noise

Theoretically, the pick-up of an aerial varies inversely as the square of the distance from the source. This means that an aerial placed twice as far from a source of noise as another aerial will pick up only one-quarter of the noise received on the other. Thus, if an aerial 15 feet from a noise carrying wire picks up 100 units of noise, another aerial 30 feet from the same source of noise will only pick up approximately 10 units.

Effect of Direction from Source of Noise

The direction of the aerial is also important. Pick-up will be greatest from the

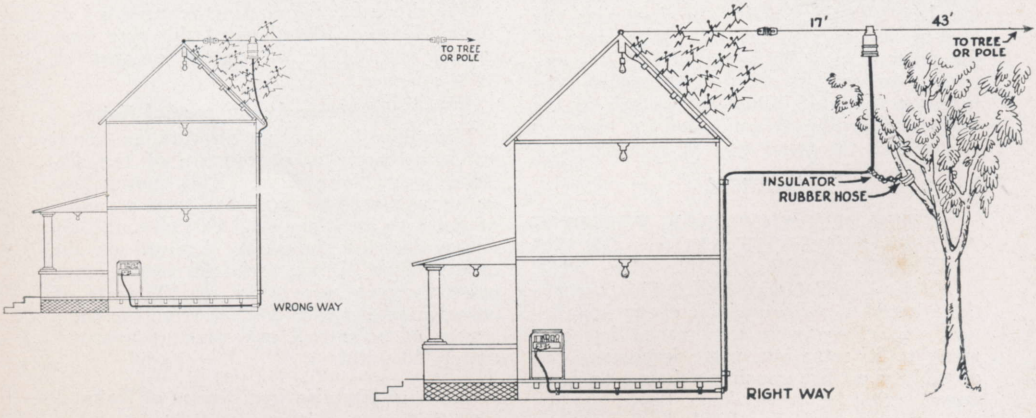
A Serviceman Was Careless— This Aerial Crossed Over the POWER LINES



Result: FIRE!— Customer's Home Badly Damaged

direction at right angles to the length of the flat top wire. This means that wires run parallel with the aerial will transfer more noise to the aerial than wires run at right angles. It also means that interference under or over the aerial may have a strong effect upon the flat top.

This directional effect may be used to advantage where the interference is coming from a definite source, turning the aerial so that minimum pick-up of the noise will result.



Right and Wrong Ways of Installing Flat Top
Always Place Aerial Completely Out of Interference Field

Right and Wrong Positions

Having outlined the precautions to be observed in placing the flat top, reference should now be made to the diagram of the correct and incorrect installation on an ideal home as shown on page 16.
If the aerial is installed as shown in the incorrect diagram, the customer will be justified in stating that he has an all-wave set with a noise-eliminating, all-wave aerial and still has not obtained satisfactory results. The serviceman will be obliged to repair the set time after time being unable to find anything wrong, and the customer will still be dissatisfied. The correct installation will give 100% better performance, removing the expense of these service calls.

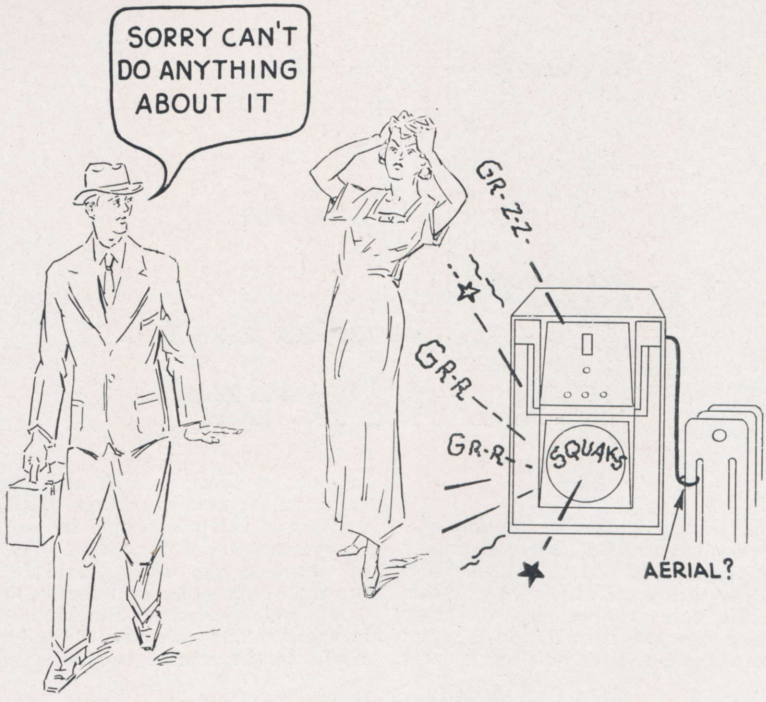
Supporting the Aerial

Poles of metal or wood may be used to support the aerial, in the absence of natural or other supports. Each method of fastening requires special attention and each will be taken up separately.

Metal Poles

The use of metal poles is generally desirable because of their durability and strength. These advantages may outweigh the disadvantages of weight and conductivity if certain precautions are observed. An awning eye placed at the top of the pole will prevent rain from entering and rusting it from the inside. This will also make a very convenient method of fastening all wires. The base of the pole should rest upon a square block of wood, one foot square and at least one inch thick, preferably two. A hole drilled part way into the center of the wood will provide protection against slipping, and make flanges unnecessary.

Another point to observe is in the placing of the wooden base on the roof. A flat block of this type will allow water to accumulate under it without providing proper ventilation. This constant presence of moisture will in time rot not only the block; but, more serious, it will decay this portion of the roof. Strips of ordinary builders' lath nailed to the under side of the block, and spaced an inch or so apart will effectively prevent the collection of excessive

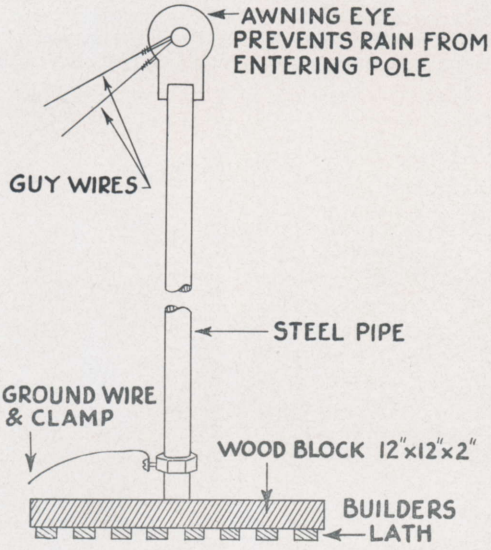


But—now he can!

moisture.

Finally, metal poles should be grounded to eliminate the lightning hazard. Connection may be made to any ground found upon the roof.

not use nails driven into wooden poles for fastening of any wiring. Nails will rust through shortly, and the guy wires will break away. Always wrap a guy wire completely around the pole two or three times

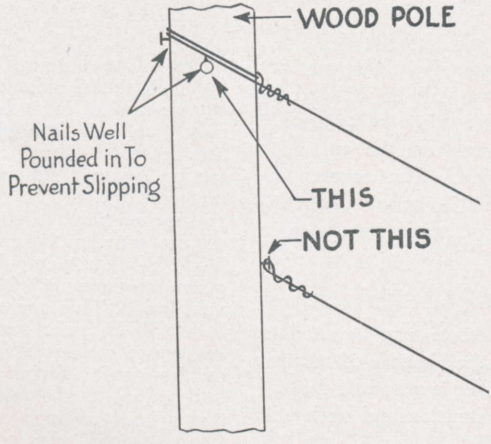


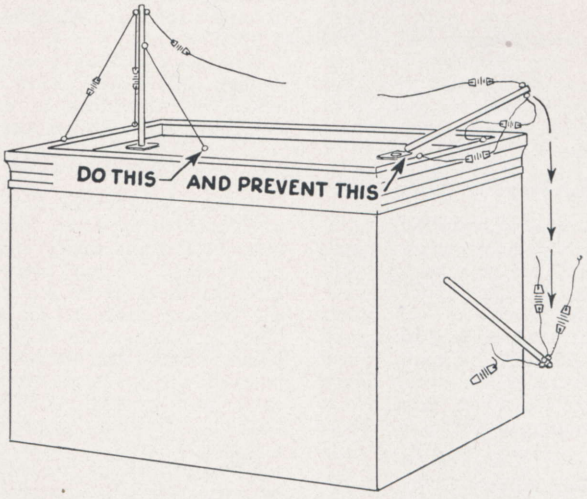
Wooden Poles

The type of wood selected for pole material is very important. Pine and similar soft woods are not good; but hickory will be found excellently suited for the purpose. Be sure the pole is of sufficient size in cross-section so that it will not sag and become an eyesore to the home owner. Do

to gain an effective hold, and then a few nails may be used to prevent slipping. The support of the pole should be the same as that recommended for metal. The method of fastening guy wires should be used at the top of the pole for tying on the aerial.

A simple precaution should be observed in erecting any pole near the edge of the roof. In the case of two poles supporting

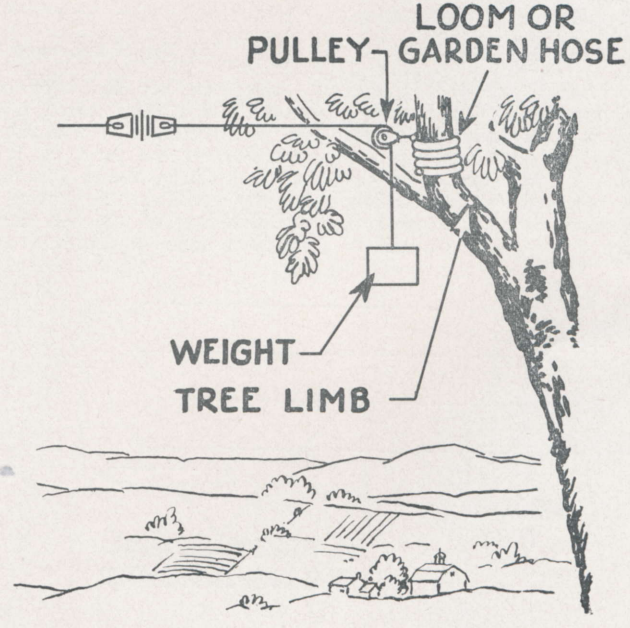




an aerial between them, it is wise to place a guy wire in such a position that breakage of the aerial will not allow the poles to fall backward off of the roof.

Natural Supports

Under this heading, the most common natural support used is the tree. If it is undesirable to use a pulley with a weight to provide tension for the aerial, select a strong yet pliable limb for the fastening of the aerial. The pliable limb will give as the tree sways and provide the desired spring action. Never allow any active portion of the aerial to be within the shielding effect of the tree. This means that the



tree should be cleared by five feet minimum. It will be well to again caution against the use of nails because they will rust through and also may kill the tree. For further protection of the tree, use electrical house wiring loom or sections of garden hose slipped over wires, looped around limbs of trees.

Other Supports

In those cases where support may be obtained by fastening to a cornice, gable or other projection, be sure to keep the aerial at a sufficient distance from the object to prevent interference or absorption. In the case of the peak of a gabled roof, keep in mind the 10 foot minimum to any electric light wire under the roof. Metal roofs will generally act as grounds or shields, and proximity to them should be avoided.

Guy Wires

All guy wires should be broken up by insulators so that no portion of them is longer than 8 feet. In the case of any support wire over 8 feet long, it will be necessary to put in at least one insulator. This is to prevent the guy wire from acting as an aerial at a frequency close to that which is being used. All other leads come into the same classification and should be broken up by insulators in the same manner. This is important and should be observed without fail in every installation.

How to Fasten Guy Wires

In fastening to brick, a star drill is used to make a hole about ½ to ¾" in diameter in the brick. This is filled tightly by means of a wooden plug or lead insert made for this purpose. A screw-eye or stand-off insulator, as required, is then tightly screwed into the wooden plug. Where it is *necessary* to place a screw-eye or nail in the roof, fill around the eye with a good grade of roofer's sealing compound to stop a possible leak.

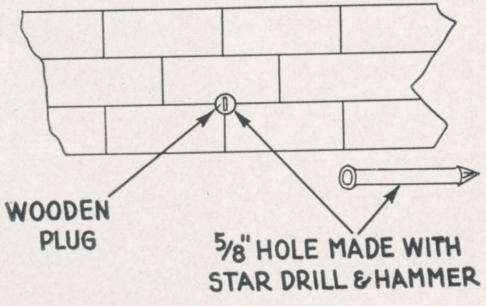
Chimnels do not generally extend far enough above the roof to support the aerial, but they may be used as an additional guy to hold the pole.

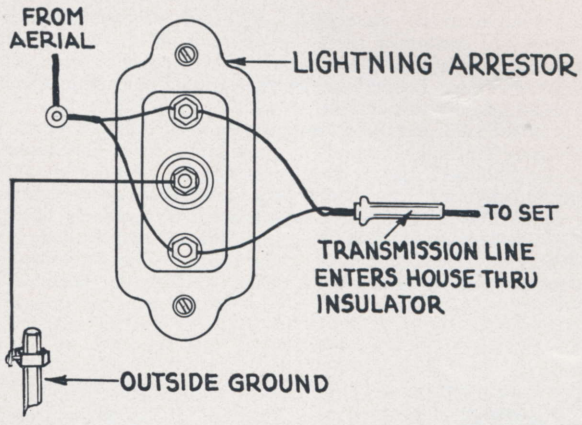
Completing the Job

Having located the flat top, the lead-in is carried away from this portion of the antenna at right angles to it for a distance of 10 feet. It may then go in whatever direction is required for it to terminate at the binding posts of the set transformer. The lightning arrestor is placed at the point of entry into the building. The center post of the arrestor should be connected to a good ground OUTSIDE OF THE BUILDING. This is required by the Underwriters' laws in most states. Carrying the lead-in through the wall of the building by means of the porcelain tube supplied with the kit, the twisted pair is run through the house by whatever path affords the best appearance. Magnetic fields or other wiring of any kind do not have to be taken into consideration when locating this wiring, but precaution should be observed to prevent short circuits occurring or wear cutting through the wire. Ordinary insulated staples may be used to fasten it down to rafter or finished woodwork. These staples are inexpensive and should be used freely to provide a neat installation.

The Use of a Ground Wire

After the set has been completely installed and is being tested, it is well to find out if a ground wire will aid or impair the reception of the aerial as it is. In some cases, it will be found that the ground will aid the aerial in eliminating noise due to the shielding of the set, carrying all extraneous noise in the field around the set

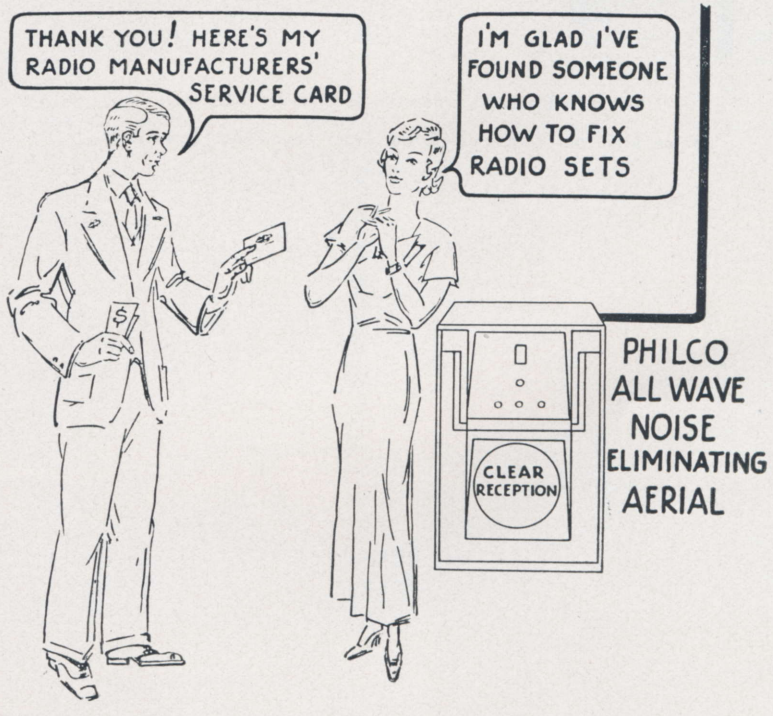




to the ground. In other cases, it will be found that no difference results. This will be noticed generally when one side of the 110 volt line is grounded, and the chassis of the set is being grounded through the line filter condensers. In still other cases, connecting this lead to the ground post will impair the reception. This occurs when the conditions surrounding the aerial and its lead-in are such that connecting a ground to the chassis alters the responsive points of the aerial and reduces its effectiveness. These cases are rare, but when it occurs, leave the ground off.

The Demonstration

In demonstrating the results of the work which you have, as a serviceman, installed for the customer, keep in mind the fact that the customer will judge the entire job by what is heard when the set is first turned



on. A thorough demonstration, starting with the local stations and gradually picking up more distant transmitters, is generally the best procedure. The customer will be very favorably impressed by the demonstration, particularly if the section is known to be noisy; but, in those cases where good reception is ordinarily obtained, the customer will be astonished by the ease with which foreign reception is accomplished. Care in carrying out the details which have been mentioned will raise the quality of the work which you, as a serviceman, will turn out.

A good demonstration backed up by good work will soon become the thought associated with your name when people think of you as a serviceman, and the advertising that they will give you in return for every good job is bound to increase your business. Such advertising is extremely valuable and can not be paid for in any other way than by doing the type of work which has been outlined here. Keep the quality of YOUR installations at the same high quality of the units which are sold to you in the Philco All-wave Aerial Kit.

Use This Envelope Stuffer to Get Aerial Customers

Price $1.00 per Thousand—Order From Your Philco Distributor

Chapter V
Special Problems of Small Homes and Apartment Houses

In giving the serviceman an example of an ideal installation, it was realized that few, if any, of the actual installations made will be so easy to work out. The purpose of the illustration was to prove to every dealer and serviceman that, even in the most ideal situation, the use of the Philco All-wave, Noise-Eliminating Aerial will be of positive benefit to the user. In this, and other chapters, some of the more difficult situations will be discussed.

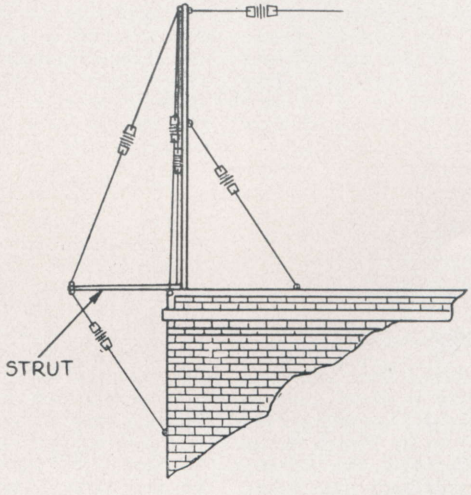
The Small House

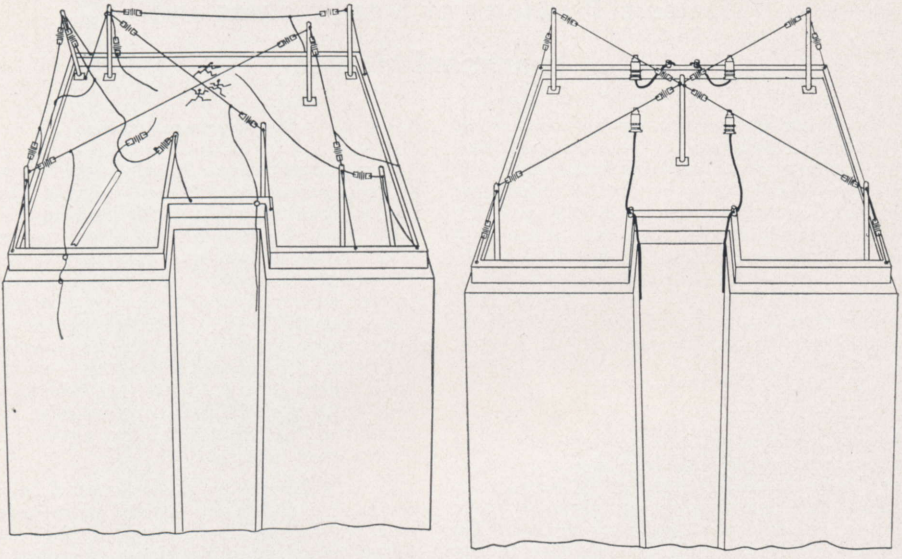
Locating a flat top aerial on a small house has always been a problem. Since the requirements of the All-wave Aerial are only 34 to 60 feet, it is possible to locate this aerial on a roof or in a space too short for most ordinary aerials. On those few homes that do not provide any straight path of this length, it may be necessary to devise unusual methods of support. One way to secure the necessary length for the flat top is to provide a large difference between the height of the two poles used. This is impractical in cases where the tall pole cannot be well supported. Poles may be mounted on the edge of the roof, if struts are used to support the guy wires.

The Apartment House

Most apartment house owners have voiced objections against aerials being placed upon the roofs of the buildings. This is in part due to the complete disregard which some people have had for the property of these owners. By allowing anyone to put an aerial upon the roof, the result has generally been a network of wires so crisscrossed that no one in the apartment has been able to get even fair reception. With this picture of twisted wiring and bent poles in mind, most owners have flatly prohibited the erection of any aerial whatsoever upon the roof.

How different the picture would be if a series of aerials were erected in an orderly manner, for best efficiency of the whole group and best appearance as paramount considerations. In such an installation, the objectionable features have been removed from the owner's viewpoint and the desirable features have been retained for the occupants of the building. On most apartment houses, it is generally possible to secure a large space for the placement of aerials radially around a pole somewhere in the center of the roof. The other ends of these aerials may be suspended from





Comparison of the Old Way and the New Philco Engineered Installation

projections above the roof sufficiently high for the purpose or by means of other poles. In any case, the number of aerials that can be placed around the circle will depend upon the distance that the roof allows them to be placed from the central pole, keeping in mind the fact that each will have a tendency to partially shield those next to it. Always place the 17 foot section on the outside of the circle. In the case of four aerials coming from the central pole, they may be placed within three feet of the support. This distance will necessarily vary with the number of aerials so placed.

Should the radial arrangement be impractical, a series of antennas, placed side by side allowing 10 feet between each, would answer the purpose. The same rules governing other installations holds for this condition. Place the 17 foot sections alternately in each aerial.

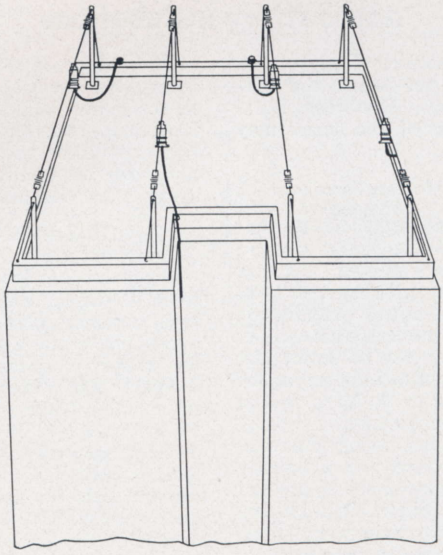
Effect of Other Aerials

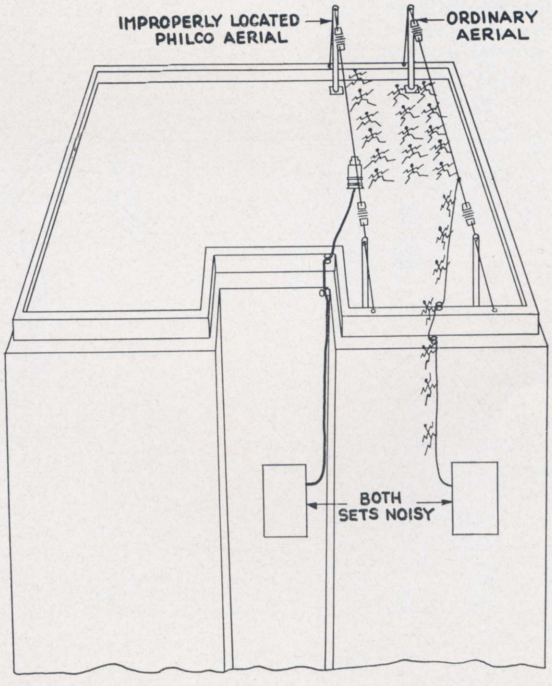
It must be remembered that any ordinary type of aerial that is placed close to a Philco All-Wave Noise-Eliminating Aerial will induce noise into the Philco Aerial. This is due to the fact that the ordinary lead-in will carry signals both ways taking the noises from the floors below the roof and carrying them up into the aerial where they will be radiated into the flat top of the all-wave aerial. This fact is mentioned in connection with apartment house installations because it will be most frequently encountered in systems of this type, but it will hold true for every case where an ordinary aerial is side by side with one of the noise-eliminating type. Ten feet or more space is required to prevent this form of trouble. It is permissible, however, to run the noise-proof lead-ins of two aerials side by side.

Settling the Apartment House Problems

Here is an opportunity for the dealer or the serviceman who is ambitious, to satisfy a large number of customers by selling an apartment house owner on this answer to his problem. Any such owner is continually beset by requests for permission to put up aerials; and, if tactfully approached, will welcome the freedom from unsightly arrangements which this plan offers. A good business may be built up on this item alone if a sufficient number of occupants of each apartment will agree to pay their portion of the costs. Another method of doing

business in this situation is to sell the apartment house owner the entire installation so that he may rent the use of the aerial to the occupants of the various apartments.





Avoid Other Aerials

Chapter VI

Overcoming the Problems of D. C., Farm Lighting, and Battery Installations

In many homes, the source of power for operation of the radio set is not the conventional 110 or 220 volts alternating current, and the installation of the aerial may vary accordingly.

Proper Installation for Battery Receivers

As has been shown in Chapter II, the flat top portion of the All-Wave Aerial is more efficient than the ordinary aerial. Because of the fact that this antenna system puts more signal strength into the primary of the 1st R. F. coil of the set, less power will be required by the set to make the signal audible. This results in a saving of battery consumption due to A. V. C. action cutting down receiver sensitivity.

In ordinary installations, using the conventional aerial and ground for a battery set, a good ground is extremely important and must be obtained. Since most battery sets are located on farms, where no other power is available, it is often necessary to spend much time in securing a tight ground connection. Think of the time that could have been saved on many of these installations, using a Philco All-Wave Aerial System, in which no ground is required for the set.

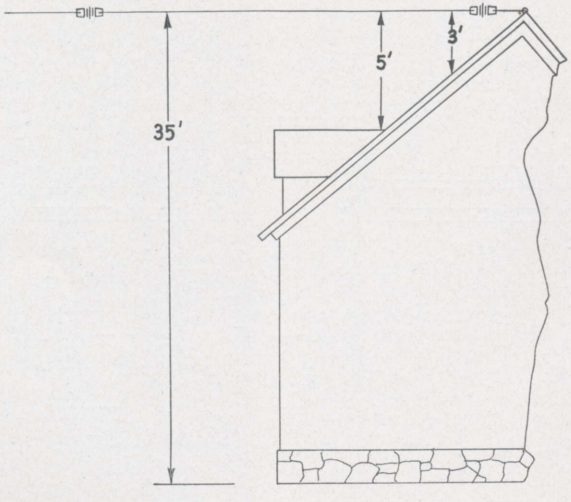
The height of the aerial is the important point when erecting the all-wave system for these homes. Get it as high as possible, considering the effective height as the distance from the roof, or the ground, as the case may be. The rest of the installation is made as outlined in Chapter IV.

110 Volt D. C. Operated Sets

Many of the older style 110 volt D. C., or A. C.-D. C. sets, do not use the chassis as a common ground wire, and it will be necessary to use a small condenser to make the proper connections for the set transformer. The antenna wire is put in place as usual. Using a .01 Mfd. condenser, Philco part No. 30-4051, with pigtail leads, connect one end to "gnd." on the set transformer and the other end to the most convenient bolt on the chassis. (See cut on next page.) The system is not grounded, except at the lightning arrestor. The modern set will be connected as usual with the transmission line on the terminal board.

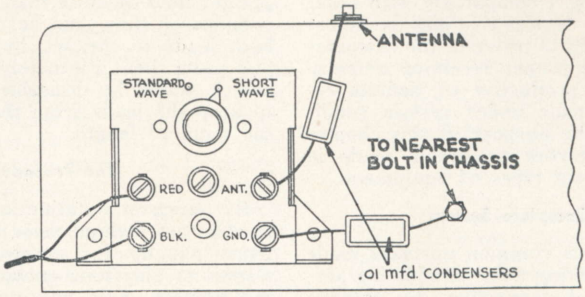
32 Volt Farm Lighting Systems

The suppression of farm lighting plant interference depends a great deal upon the



Effective Height

correct installation of the noise eliminating aerial system. Cases have been known where it was necessary to place the flat top portion as much as 400 feet from the set in order to get away from the interference radiated by the power wires from the lighting plant. This distance may be cut down by placing a Philco Model 0100 Line Filter at the generator connections, preventing the power wires from acting as a radiator for the interference. Philco Service Bulletin No. 189-A explains the method used and how to install the necessary filters and condensers for this purpose.



.01 mfd. Condensers Are Philco Part No. 30-4051

Chapter VII

Testing the Installation

Ample proof of the superiority of all-wave noise-eliminating aerial systems may be had by making a comparison with other types of pick-up devices. It may be necessary in some cases to prove to the customer the value of the proper receiving antenna. The test, to be productive of definite results, must be made under certain conditions, and it is the purpose of this chapter to explain the errors commonly made in comparing different types of equipment.

Use Complete System

One of the most common mistakes made by servicemen testing noise-eliminating aerials is that of disconnecting the antenna transformer and using the lead-in as an aerial. With the antenna transformer disconnected, the twin leads of the twisted pair are no longer a transmission line closed at both ends, but become two separate wires of high impedance and the capacity between them causes losses and allows some pick-up. For correct operation, the system must be complete with antenna, transformer, aerial wires, and lead-in properly installed. The aerials used in comparison should be placed 12 to 15 feet apart, parallel with each other, and of the same height and length. By placing them so, the conditions imposed upon them are as nearly equal as it is possible to make them. Considering the sources of noise, care should be taken that neither one is placed in a greater field of noise than the other. Direct comparison may then be made by bringing both leads to the set, by different routes, and using them alternately. A quick throw switch would be desirable if care is taken to keep the leads from the transformer of the required length.

The Procedure

By tuning in a station known to be fairly hard to get without noise and using the antenna put up for comparison, allow the station to play long enough to get used to the volume, tone and noise level of the set. Now, switch over to the noise-eliminating aerial and be the judge for yourself and allow the customer to hear the difference.

A number of aerials may be tried in this manner, and a very convincing demonstration made for display purposes in a store if so desired. Even in a "quiet" location, the difference will be readily observed and appreciated. If the set used in this test has automatic volume control, it would be well to short out the A. V. C. action during one test to illustrate the greater efficiency of the all-wave aerial. In most cases, a manual control will not have to be advanced as far as is necessary for other aerials.

Chapter VIII

Summary

In giving the serviceman and the dealer complete information on the correct procedure to be used in installing any and every radio set regardless of location or type of home, certain explanations of theory are necessary. In order to make practical use of the information so supplied, it is necessary to condense the material to outline form. After having read over and studied the explanations in the foregoing chapters, the following outline will be sufficient memorandum of all essential details as each new set is installed with its accompanying noise-eliminating, high efficiency aerial. It is suggested that this outline be typed separately and used as reference on every job.

How to Put Up an All-Wave, Noise-Eliminating Aerial

I—Locate the Set
- A—For best tone
  - 1—At one end of long room
  - 2—In corner of square room
  - 3—Away from pianos or other stringed musical instruments
  - 4—Check window panes and other objects to prevent rattling.
  - 5—Use hand clapping test, if in doubt, about echoes
- B—For best appearance
  - 1—All wiring concealed
  - 2—If exposed, use wire of same color as background
  - 3—Staple all wires
  - 4—Place remainder, if any, of remote control cables in space allotted for same

II—Install lead-in
- A—Older model sets
  - 1—Install set transformer so that antenna and ground ("Ant." and "Gnd.") leads are not longer than 1 ½".
- B—Newer model sets
  - 1—Bare end of transmission line and connect to proper terminals on set chassis

III—Test proposed aerial location
- A—Carry aerial to roof coiled up (see Chapter IV, Page 3)
  - 1—Out nearest window
  - 2—Up ladder to roof
- B—Stretch out flat top portion of aerial
- C—Erect supports temporarily and fasten up aerial
  - 1—Coil up remainder of 43 foot section. Do not cut.
- D—Test for noise in set
  - 1—If noisy, try other locations
    - a—17 foot section farthest from noise, or at highest point of aerial
    - b—change direction of aerial to eliminate interference
- E—AVOID POWER LINES
  - 1—Do not cross over or under them

IV—Supporting the Aerial
- A—Metal poles
  - 1—Cap pole with awning eye
  - 2—Use wooden block 1 foot square and 2 inches thick as base
  - 3—Use wood strips under block to prevent rotting
  - 4—Ground poles
- B—Wooden poles
  - 1—Avoid soft woods
  - 2—Avoid use of thin poles
  - 3—Do not use nails to hold wires (wrap them around pole)
  - *Warning*: Guy wire all poles in all directions
- C—Natural Supports
  - 1—Trees
    - a—Allow for natural swing of trees
    - b—Use no nails
    - c—Cushion wires with garden hose
    - d—Keep aerial away from tree
- D—Other supports
  - 1—Allow space to prevent interference or absorption
- E—Guy wires
  - 1—Use copper wire
  - 2—Insert insulators at least every 8 feet
  - 3—Use screw eyes to hold guy wires
    - a—Use sealing compound when placed in roof
  - 4—Avoid chimneys except to support guy wires

V—Completing the job

A—Carrying lead-in at right angles to aerial, at least for 10 feet

B—"Knob-On" lead-in, down side of house

C—Connect lightning arrestor at point of entry

1—Use outside ground

D—Insert porcelain tube in 5/8" hole drilled through wall of building

E—Staple lead-in inside house

VI—Demonstrate operation of set

A—Start with local stations

B—Explain operation of all dials (include set transformer when used)

C—Leave Radio Manufacturers' Service card in back of set