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The
WORLD'S
PREMIER
Custom-Built
RADIO

HAMMARLUND "HiQ-30" MANUAL

25¢

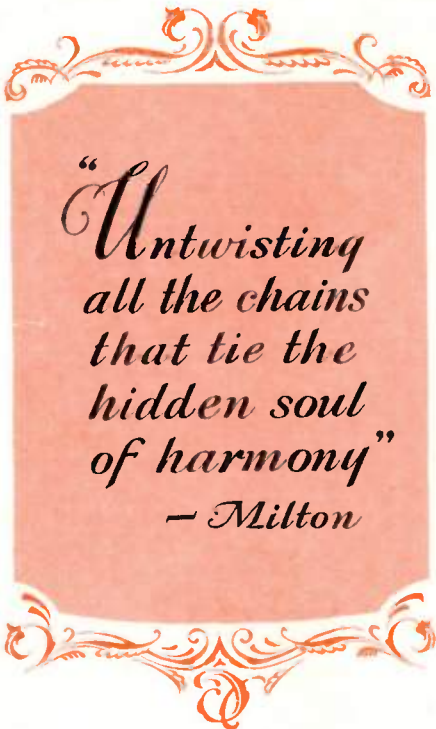


The **HAMMARLUND**
Custom-Built  **RECEIVER**

*A Masterpiece of
Radio Engineering*

MANUFACTURED BY

HAMMARLUND-ROBERTS, Inc.
424-438 W. 33rd Street, New York



*“Untwisting
all the chains
that tie the
hidden soul
of harmony”
— Milton*

Custom-Built *Means* BETTER BUILT

RALPH WALDO EMERSON is quoted as saying that "If one man builds a mousetrap better than another, though his shop be buried in a wilderness, the world will make a beaten path to his door."

The world little values nor long remembers commonplace things. They are here today and barely memories tomorrow.

Only genius counts—the genius to create, to develop and to produce something BETTER than has ever been done before.

Whether it be art or literature, method or machine, mousetrap or radio—there is always a place for the superlatively GOOD.

A little more than five years ago a group of distinguished engineers dreamed of a better radio receiver. Combining their experiences and looking ahead in the light of the best technical knowledge of the time, they created the first "HiQ" Radio.

It was so superior, so far in advance of any existing receiver, its fame spread almost overnight and thousands sought to copy it.

It was not a factory-made receiver because its refinements were such that no system of mass production could duplicate the skillful craftsmanship required to build it. This fact made it the ideal circuit for custom-radio builders to supply to their clients—and many a fine reputation and splendid profits were thus built up with it.

Since then, three other "HiQ" *Custom-Built* Receivers have been developed—each embodying the best features known at the time—each anticipating future improvements—each possessing that certain something which only the skilled hand, the human touch can give.

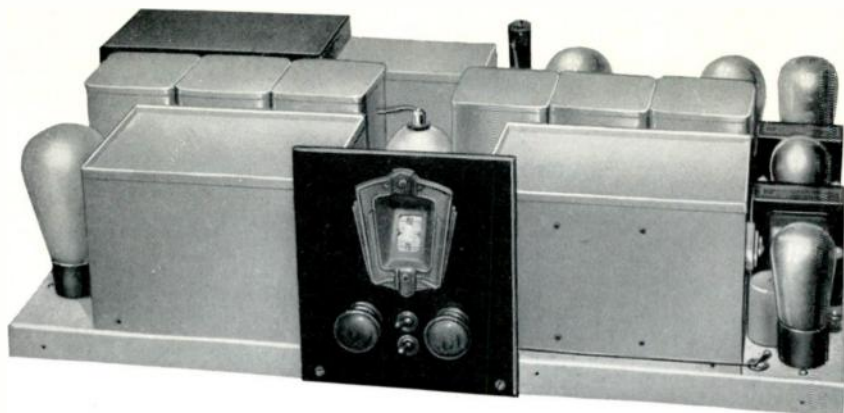
So great became the repute of these receivers for doing more than any receiver ever before was known to do, and doing it so much better, professional radio engineers built them for use in their own homes or for making comparative laboratory tests. Schools and colleges purchased the plans and built "HiQ" Receivers to demonstrate to their students the fine points of radio engineering. Hundreds of letters came from every country, telling of the amazing results obtained with "HiQ" Receivers on land and sea.

Distance never before dreamed of with a broadcast receiver—selectivity that abolished interference between stations—and all with a beauty of tone, charming to the musical ear.

With such a record to surpass, it would seem impossible to offer further improvements. And yet, the new Hammarlund "HiQ-30" so far exceeds the splendid performance of its predecessors, the difference can be described only by the word, *astounding*.

The reasons for this are easy to understand. In the first place, radio in general has advanced greatly. Today's tubes, coils and condensers are decidedly better than yesterday's. Speakers are sweeter, clearer and more powerful. The principles underlying

HAMMARLUND HiQ-30 MANUAL



Hammarlund HiQ-30 A.C. Receiver Chassis

shielding and filtering are better understood. Electrical interaction between circuits has been conquered; hum and distortion and raspy background noises have been subdued. Even cabinets are infinitely more beautiful than ever before.

So with such a general advance in radio science to work with, plus Hammarlund's unequalled experience in custom radio designing, it is claimed with the sincerest conviction, that the New Hammarlund "HiQ-30" is the World's Premier Custom-Built Radio.

It embodies every feature of proved worth, together with basic engineering principles and refinements of detail exclusive to Hammarlund design.

It will outperform any other receiver at any price and it costs less to build.

Complete Factory-Built Units

An outstanding principle of the "HiQ-30" is its UNIT CONSTRUCTION. Former "HiQ" models required the assembly of specified parts purchased at various dealers; then a considerable amount of wiring and testing had to be done. They were not difficult to build, it is true, but compare the inconvenience and time required with the great simplicity of the "HiQ-30" assembly.

Completely Assembled in Two Hours

The new "HiQ-30" contains only seven basic units, three of the most important of which are completely assembled, wired and tested in the Hammarlund laboratories and supplied to the radio builder ready to mount on the drilled metal chassis. They then need only to be connected together, which is accomplished with surprising speed, even by a novice.

Specially Designed Parts of Finest Quality

Furthermore, there is no shopping to do for parts—for Hammarlund now supplies all equipment packed in complete kit form for

easy construction and perfect operation of the "HiQ-30" Receiver.

Its parts are *especially designed* for the characteristics of the receiver, by Hammarlund and other makers of fine radio specialties such as Electrad, Amperite and Yaxley, whose reputation for quality is world-wide.

Uses a New Three-Stage Tuned Band-Pass Filter System

With a multiplicity of high-powered broadcasting stations on the air, it was evident to Hammarlund engineers more than a year ago that some practical system must be found to eliminate the cross-talk from unwanted stations while listening to one's favorite programs. So a new and unusual station filtering device was designed and given the descriptive title of "Band-Pass Filter," which means a filter which will pass only the wave-band to which you wish to tune it.

This filter was an original Hammarlund development and was used exclusively last season in the "HiQ-29" Master A.C. and D.C. models. It has been still further improved and is again an exclusive Hammarlund feature in the New "HiQ-30."

Picture to yourself how this remarkable device operates. Three special coils are tuned by three sections of a Hammarlund "Battle-ship" Condenser working simultaneously. Each coil and condenser section is individually shielded and then collectively shielded to shut out all possible interference. When a group of station signals, whose wave-lengths are near together, come in on the antenna, this filter pre-selects only the signal you want to hear and bars out all of the others, before any amplifying is done.

Practically any receiver can be built to tune so sharply that only one station at a time may be heard, but doing this by ordinary methods cuts off all except the extreme peak of the sound impulse and results in harshness and distortion of tone.

The Hammarlund Band-Filter, on the contrary, preserves the side bands containing the rich overtones of music which when heard through the speaker has all of the fullness and roundness of tone you would hear were the source of the music actually in the same room. In other words, the sound impulse curve is not peaked and then tapered off at the sides, but is squared off at the top and two electrical "walls" drop down on each side, completely enclosing the signal desired and barring all others.

These electrical "walls" are ten-kilocycles apart, which means that they can admit only the ten-kilocycle carrier wave of one broadcasting station at one time—no more, no less. If there is a station broadcasting within each ten-kilocycle limit, you will hear that station only, with nothing interfering from either side.

The result is that stations do not "swish" in as with ordinary receivers—they actually SNAP in. There is no gradual fading of one station into another as you turn the dial—no hearing two stations together, or perhaps three or four at once. When the side "wall"

is reached, the signal stops short and completely disappears. Turn the dial a fraction further and a new station clicks in sharp and clear.

The Hammarlund "HiQ-30" is the only receiver giving you this marvelous Tuned Band-Pass Filter. It is the only receiver which is entirely free from station interference in crowded districts near high-power broadcasting stations. That feature alone is priceless but costs you nothing extra, because the "HiQ-30" can be assembled by you or your local custom-radio builder at far less cost than any other receiver not having the advantage of the Tuned Band-Pass Filter.

Three-Stage Screen-Grid Tuned Radio Frequency Amplifier

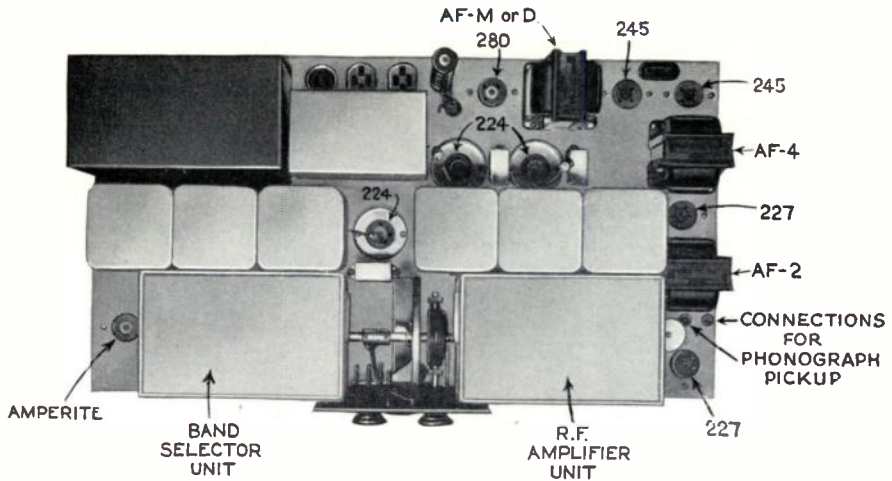
Next to Band-Filter Tuning, perhaps the greatest single advance in radio development is the Screen-Grid Tube. Everybody is talking about them. Nearly all radio manufacturers are featuring new receivers equipped for them—but bear this in mind—**NOT ALL RADIOS ARE NECESSARILY GOOD BECAUSE THEY USE SCREEN-GRID TUBES.** Here is a tube with a theoretical amplifying power *twenty* times as great as ordinary tubes. Not all of that enormous power can be used—perhaps it never will be—but the degree to which it can be used—the ability to make it perform at a practical maximum cannot be mastered overnight. Much experience, special technical knowledge and hard work are needed. So don't be misled by the Screen-Grid song everyone is singing so vociferously.

Hammarlund engineers conducted laboratory experiments with Screen-Grid circuits for more than two years. Only when they had mastered its peculiar powers was it offered to the public. That was last year in the famous Hammarlund "HiQ-29" Model. Thousands of these wonderful receivers operating in all parts of the world testify to Hammarlund thoroughness in design.

This season, in the New "HiQ-30" after further extensive research, a new type coil was developed especially for use with Screen-Grid tubes. A new filter system with new type polarized metal shielded chokes was incorporated. Each tube, each coil and each section of the Battleship tuning condenser is *individually* shielded—then the entire unit is enclosed in a metal compartment.

Such care and expense as only the custom-radio designer can afford to undertake has resulted in a "HiQ-30" Screen-Grid Amplifier that has almost inconceivable sensitivity and a range that is limited only by atmospheric conditions.

As a measure of its sensitivity, consider this extraordinary laboratory report: "The 'HiQ-30' has a sensitivity rating averaging well under one microvolt per meter." Compare this with the fact that average receivers require from ten to twenty microvolts of input per meter, before the engineering standard of output energy can be recorded—then you will realize the really great progress Hammarlund engineers have made. In simple language, this means that the "HiQ-30" is from ten to twenty times more powerful than the average commercial receiver.



*Top View of Hammarlund HiQ-30 A.C. Receiver Chassis
Showing Location of Various Units*

Truly the new custom-built "HiQ-30" is *the receiver of receivers* and will give you all you will ever ask of a radio in selective tuning—in distance getting—in brilliant tone quality.

More Power Than You Will Want to Use

Exceptional care has been taken to design a power amplifier for the "HiQ-30" capable of handling, without distortion, its enormous signal input. No stock equipment equal to such a task being available, special parts were designed throughout. The power transformer and filter chokes are built as a single unit in an enameled steel case with terminal leads at the bottom for sub-panel connection. Both the chokes and transformers have large cross-section cores of special laminations and large wire is used to permit continuous operation without overheating. The entire unit including an exceptionally generous seven-section filter condenser block is designed to provide a smooth, even voltage. A thoroughly efficient air-cooled voltage divider, especially designed by Electrad insures an accurate, stable voltage at each tap, precisely measured for the needs of each "HiQ-30" circuit.

The "HiQ-30" transformers are completely shielded and are ideally proportioned for fidelity of amplification over the entire musical scale. The deep-toned low notes come through with startling realism—not exaggerated at the sacrifice of the high notes, but exactly as you should and would hear them in the broadcasting studio. The radio frequency amplification of the "HiQ-30" is so high that the first-stage audio transformer can be of low-ratio to provide a gradual step-up entirely free from the raspy harshness so frequently heard in poorly designed receivers. Thus when fed into the push-pull output stage, using the new '45 type tubes, there is no overloading, even at the auditorium volume which the "HiQ-30" delivers without the least suggestion of distortion.

Both music and speech are sweet, clear and fully rounded with all overtones so necessary to good music.

The "HiQ-30" audio-amplifier will give delightful reproduction with any standard speaker. The output push-pull transformer used in the A.C. chassis is designed to work directly into the moving coil of the dynamic speaker and takes the place of the input transformer required by such speakers.

A special output transformer is supplied optionally for those who prefer to use the magnetic type of speaker.

All "HiQ-30" transformers have flexible leads at their base for sub-panel connection.

Unlimited Choice of Cabinets and Speakers

The "HiQ-30" chassis is standard size (7" x 12 $\frac{3}{4}$ " x 24") and fits, therefore, stock cabinets available at good radio stores.

This season, however, Hammarlund engineers, mindful of the unusual electrical features of the "HiQ-30", have especially selected two beautiful consoles embodying acoustical characteristics particularly desirable for the "HiQ-30." They are "The Blackstone"—a console and "The Windsor"—a radio-phonograph combination, both of which are illustrated and described in the gravure insert in the back of this manual.

In addition, there are shown seven other exquisite cabinets, including a table-model, a second radio-phonograph combination and five unusually attractive consoles, each of which has the entire approval of Hammarlund engineers from the standpoint of mechanical dimensions and acoustical properties.

The period designs are authentic—the construction and finish are the very finest and the styles are sufficiently varied to suit different tastes and ideas of appropriateness for various sizes of rooms and home decorative plans. Also the prices (see page 48) are of a range to meet practically any requirement.

Automatic Line Voltage Regulation

Heretofore the problem of fluctuating line voltages has been a serious one in many communities owing to the varying loads, over which the power companies had no control, on the electric lines. The result in radio receivers was manifest in fading signals, sudden blasts of volume and uncertain tube life.

In the new "HiQ-30," voltage variations are automatically regulated by the Amperite Self Adjusting Line Voltage Control tube, connected in series with the supply line. Its use results in greatly improved tone of even intensity. Tube life is materially lengthened owing to their constant operation at rated voltages.

This is just one of the many "HiQ-30" refinements which prove the advantages of custom-designing—in leaving nothing undone which will add to the pleasure and satisfaction that comes from ownership of a perfect receiver.

Equipped With Permanent Phonograph Connection

Phonograph records reproduced through the marvelous "HiQ-30" power amplifier are so superior in volume and delightful in tone that Hammarlund engineers have provided for this feature as a permanent part of the chassis. A convenient switch on the front panel, instantly brings the phonograph connection into use and automatically disconnects the radio tuning section of the receiver.

The Best in Radio MUST Be Custom-Built

Thousands of homes where the finer things of life are appreciated, await this magnificent expression of radio perfection.

It is easy to build and superlative in results. The cost is infinitely lower than any receiver that even approaches it in any of the features that make radio worthwhile.

Make your choice of a receiver only after the most careful comparison—first, on tone quality, because tone is a paramount consideration in any musical instrument. Next—on its ability to reach out into space and bring into your home the program you want to hear, limited only by atmospheric conditions. Then—on selectivity, giving you one station at a time, sweet and clear, without interference of cross-talk buzzes, squeals and discords. Appearance comes next. And last—the reputation and experience of the manufacturer; his financial and moral responsibility that makes his guarantee mean something more than mere words and empty promises.

Measure the Hammarlund "HiQ-30" Custom-Built receiver by these standards and we are confident that no receiver of lesser merit can satisfy you.

Build the "HiQ-30" Yourself or Your Local Authorized Custom-Radio Builder Will Relieve You of Every Detail

Just a few hours of pleasant, interesting work in spare time, is all you need to make a complete assembly of the "HiQ-30" Receiver and *success is assured* because the most difficult units have already been constructed, wired and balanced at the Hammarlund laboratories.

But if you are among those who are tool-shy, to whom a screw-driver, pliers and a soldering iron are mysteries, don't let that deprive you of the finest radio of all time. Just entrust the work to your local Custom-Radio Builder. There is an authorized "HiQ-30" representative near you. We'll gladly give you his name and address. You may rely on his skill and responsibility.

A Final Word to Custom-Radio Builders

Remember, there is real money to be made in producing and installing custom receivers of "HiQ-30" quality.

If you are a professional radio man in good standing or an experienced fan who builds an occasional receiver for yourself or friends. *write to us*. We have a real business proposition to offer—a plan that will show you how to make money in custom-building with practical assistance that insures success.

PART No. 2

Theory

The outstanding feature of the HiQ-30 broadcast receiver is its novel frequency-selecting or tuning system which affords almost unbelievable selectivity with consequent freedom from interference. This quality is instantly apparent even when the receiver is operated in locations where the most adverse receiving conditions exist. It is felt, therefore, that a rather complete explanation of the principles involved in the design of the selecting system will prove of interest to the constructor.

Selectivity Is of Two Kinds

An analysis of the selectivity required of a modern high-gain receiver indicates the desirability of separating it into two classifications. For want of better terms one of these classifications will be called "wide" selectivity and the other "narrow" selectivity.

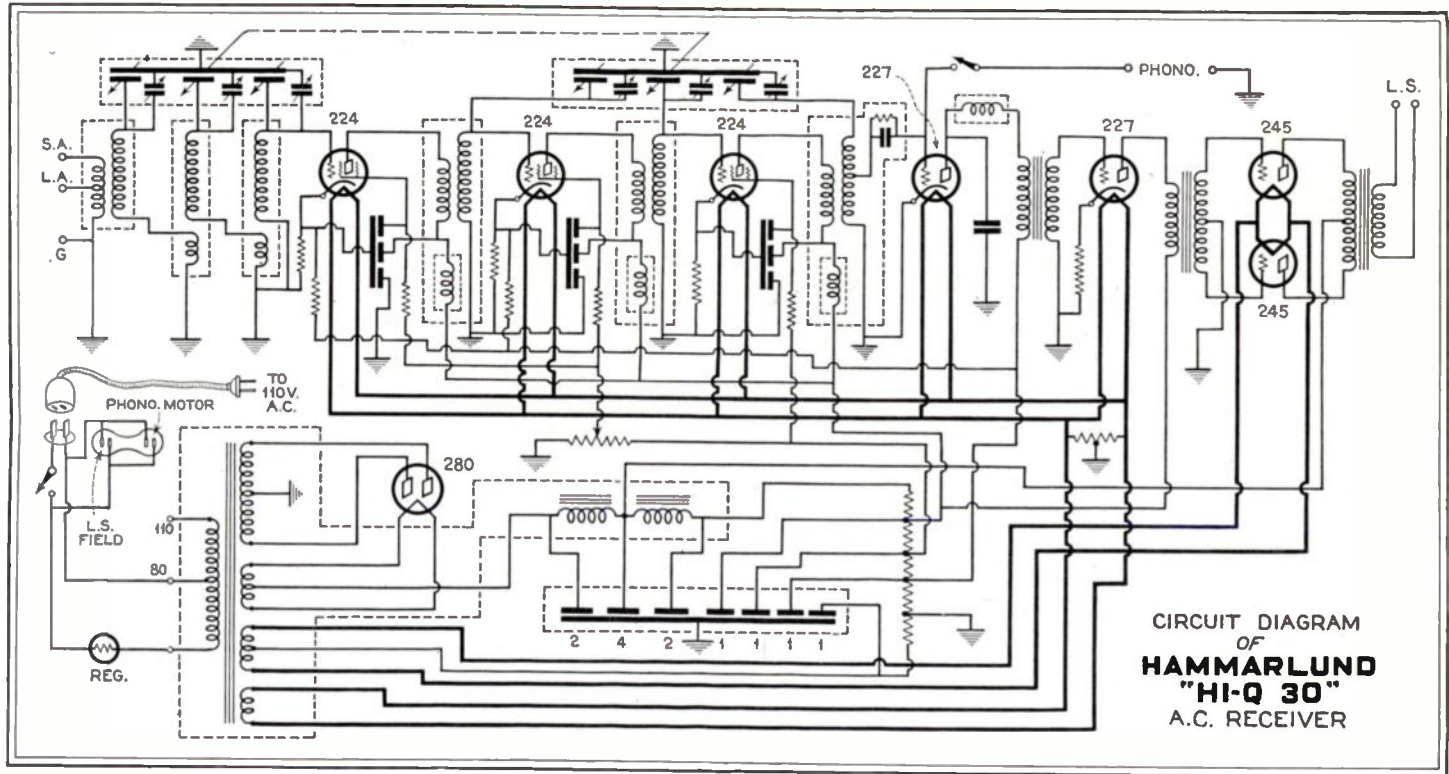
"Wide" selectivity may be defined as that kind of selectivity which enables the receiver to be satisfactorily operated only a few blocks away from a super-power broadcast transmitter without having the signals from that station pop in at unexpected dial settings and without hearing the nearby station's program as a background while listening to other stations several broadcast channels above or below its frequency.

Good "narrow" selectivity enables the operator to tune in a weak distant signal without interference from a relatively much more powerful station operating on a frequency only one channel above or below that of the desired station.

The Difference Between Apparent and Actual Selectivity

Many good receivers possessing a high degree of "narrow" selectivity are woefully deficient in the matter of "wide" selectivity. Many superheterodynes especially, having knife-like selectivity of the "narrow" types, prove totally unsatisfactory when operated in close proximity to one or more high-powered transmitters.

In view of the present trend toward higher transmitting power and high-percentage modulation, it is quite evident that a good "wide"-selectivity characteristic is becoming increasingly important. In addition, the "narrow"-selectivity requirements have also been increased by the gradual shift to higher gain radio-frequency amplifiers. While this connection may not be evident at the first glance, it is nevertheless a fact that the selectivity (both "wide" and "narrow") must be increased as the amplification is made greater if the receiver is not to *appear* unselective. While the *actual* selectivity of a receiver can be definitely determined in the laboratory without regard to its sensitivity (amplifying power), the receiver owner or experimenter judges it entirely by its *apparent* selectivity.



Schematic Diagram, Showing Circuit of HiQ-30 A.C. Receiver

As an illustration let us consider two receivers one of which has say three times as much amplification as the other. However, let both have the same *actual* selectivity. The response characteristics

of these two receivers are shown by curves A & B of Fig. 1. Let both receivers be accurately tuned to 600 K.C. with their volume controls turned to maximum. Assuming that no stations are on the air except one 580 K.C. station, no sound will be heard from the less sensitive set because it has not sufficient amplification to magnify the signal from the 580 K.C. station to the point where it becomes audible. On the other hand, the signals will be heard with the more sensitive receiver and inasmuch

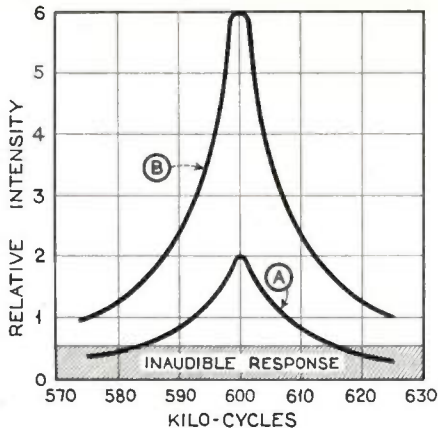


FIG. 1

as it is bringing in a 580 K.C. station while the dials are tuned to 600 K.C. it will invariably be declared the less selective receiver of the two, even though laboratory measurements show the "actual" selectivity of both to be identical. Since the "gain" or sensitivity of the HiQ-30 is a very high order, extreme measures have been taken to insure a degree of selectivity commensurate with the enormous amplification.

In general, it can be said that the selectivity of a receiver depends on the kind and number (and to a certain extent on the arrangement) of its tuned circuits. Also that the amount of its radio-frequency amplification depends on the kind and number of R.F. amplifier tubes employed. In practice, of course, these two statements do not hold true because the tube constants have an effect on the tuned circuits and the type of tuned circuit used has a marked effect on the amount of amplification secured from a given tube. In the following illustration, however, it will be assumed that these modifying factors have been taken into account.

Selectivity Difficulties in the Conventional Receiver

In the conventional radio receiver having three stages of radio-frequency amplification there are four tuned circuits. These consist of a tuned input circuit—often referred to as an antenna coupler—and three tuned inter-stage radio-frequency transformers. Since these four circuits are arranged in cascade, if they are all tuned to the same frequency, their selectivity is cumulative, and may be of a very high order if the individual circuits are of good design. For example let us assume that the four circuits are substantially alike and each has a selectivity factor of ten for a five per cent difference in frequency.

This means that if one of the circuits is tuned to resonance with a 1000 K.C. signal, an interfering 950 K.C. signal, of equal intensity, will produce only one-tenth as much voltage in the tuned circuit as the 1000 K.C. desired signal. The response characteristic for such a circuit is shown by curve No. 1 of Fig. 2. Let us assume such a four-circuit receiver to be tuned to 1000 K.C. and that there are two

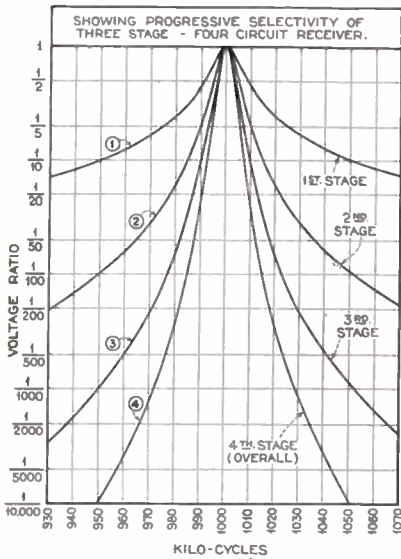


FIG. 2

signals of equal intensity induced in the antenna, one at a frequency of 1000 K.C. and the other at 950 K.C. After passing through the first tuned circuit, the interfering 950 K.C. signal will be only 1/10 as strong as the desired 1000 K.C. signal. After passing through the second circuit it will be only 1/100 as strong; after the third 1/1000 and after the fourth circuit only 1/10,000 as strong and consequently negligible. This cumulative selecting process is illustrated graphically in Fig. 2, where curve No. 1 represents the output of the first tuned circuit; curve No. 2 the output of the second circuit, etc. Curve No. 4 represents the output of the fourth and last tuned circuit and consequently indicates the *theoretical* overall selectivity of the receiver. However, if the

950 K.C. interfering signal were ten times as strong as the 1000 K.C. signal to begin with the final ratio would be 1/1000 instead of 1/10,000. If the 950 K.C. signal should be from a very powerful and nearby station it might quite easily induce a voltage in the receiving antenna one hundred times as great as that from the 1000 K.C. station to which the receiver is tuned. On the above basis, then, only 1/100 of the output of the fourth tuned circuit *should* be from the interfering station. Although it would depend on the relative modulation, type of program, etc., being transmitted, we will assume that this amount of interference would be just insufficient to be noticeable in the loud speaker output. It is interesting to note, however, the distinct difference between the case of equal signals in the antenna and the last mentioned case where the interfering signal is 100 times as strong in the antenna. In the case of equal antenna intensities the unwanted or interfering signal was always weaker than the 1000 K.C. signal as they were applied to the grid of each succeeding radio frequency amplifier tube. In the latter case the interfering 950 K.C. signal being 100 times as strong in the antenna is *10 times as strong* on the grid of the first R.F. tube, equal at the grid of the

second R.F. tube, and not until both signals have passed through the third tuned circuit and reached the grid of the third R.F. amplifier tube has the intensity of the interfering signal been reduced to 1/10 that of the desired 1000 K.C. signal. As stated previously the fourth tuned circuit and the detector *should* further attenuate the interference to the point where it would not be noticed, but unfortunately many times such is not the case, and the interfering signal comes through with disconcerting audibility, especially during pauses in the program of the desired station. That this is not a simple case of broad tuning or lack of selectivity is easily demonstrated. If the receiver is left tuned to the 1000 K.C. station until it signs off it will be found that the interference from the 950 K.C. station disappears instantly when the carrier of the 1000 K.C. station goes off the air. Also it is often quite possible to tune the receiver to say 980 K.C. (when there is no station operating on that frequency) without hearing a trace of the offending 950 K.C. station. In addition, very careful laboratory measurements made with the conventional artificial signal generator will indicate a degree of selectivity more than adequate to separate the two stations.

The Cause of "Cross-Talk"

This particular kind of interference is often referred to as "riding in" or "cross-talk" and frequently occurs with sensitive and otherwise selective receivers. It can undoubtedly be explained by the fact that no vacuum tube is a perfect amplifier. That is to say all amplifier tubes have a slight rectifying action as well as amplifying action even when the grid, filament and plate voltage are exactly as specified by the manufacturer. This rectification, or more properly distortion, increases rapidly as the amplitude of the signal voltage impressed on the grid increases. In the case of a powerful nearby station the single tuned circuit preceding the first R.F. amplifier tube, even though tuned to a different station, permits a large voltage from the nearby station to reach the grid of the tube, along with the signal to which the receiver is tuned. Due to the slight distorting action of the first amplifier tube the weaker signal is slightly modulated by the stronger or interfering signal and the damage is done. No matter how great the number and selectivity of the remaining tuned circuits the interference will persist right through to the loudspeaker. On the other hand, if the selectivity of the first tuned circuit were sufficient to reduce the signal from the unwanted station to a relatively low value this modulation effect could not take place and the succeeding tuned circuits would then be able to further reduce the interference to the vanishing point. It is practically impossible to design a single tuned circuit possessing such a degree of selectivity. Even neglecting the damping effect of the antenna-ground circuit, a coil having a "Q"

of 200, that is $\frac{WL}{R} = 200$, which represents a very low loss coil

indeed, would only have a selectivity factor of 20, and the nearby 950 K.C. signal above referred to would still be five times as strong on the grid of the first amplifier tube as the 1000 K.C. signal to which the circuit is tuned.

Desirable to Separate the Functions of Selectivity and Amplification

Inasmuch as the *overall* selectivity of the hypothetical four-circuit receiver under discussion is quite high when no question of superimposed modulation is involved it is quite obvious that if all four tuned circuits were placed in cascade *ahead* of the first R.F. amplifier tube, the interfering 950 K.C. signal would be so reduced that "riding in" would be impossible. This amounts to separating the functions of selectivity and amplification—all the selecting is done first and then the desired signal (free from interference) is amplified to the desired degree and fed to the detector and so on to the loudspeaker. This is in marked contrast to the more common practice of selecting and amplifying simultaneously. The need for revising the old standards of receiver design is quite apparent in view of the changed conditions now prevalent in the field of radio broadcast reception. One important change is the widespread use of screen-grid tubes as radio-frequency amplifiers. Their tremendous amplifying power alone necessitates more careful receiver design if full advantage is to be taken of their possibilities, without running into new difficulties. Another important change is that of "high percentage" modulation. This, together with super-power, undoubtedly aggravates any tendency a receiver may have toward superimposing the modulation of such a station on the carrier of a distant station or weak local station to which it is tuned.

In view of the foregoing it is obviously desirable to place a large part of the frequency-selecting apparatus ahead of the radio-frequency amplifier of a modern receiver. The advisability of putting all of the selecting circuits ahead of an untuned amplifier was also considered and the idea rejected. The input and output capacities of the screen-grid tubes make the construction of an efficient aperiodic or untuned amplifier very difficult at broadcast frequencies. On the other hand, these capacities have no material effect in a tuned amplifier, and the additional selectivity provided by the tuned R.F. transformers is very effective *provided undesired signals have been sufficiently attenuated before reaching the first amplifier tube.*

The HiQ-30 Pre-Selects the Desired Signal

The HiQ-30 has a total of six tuned circuits, divided into two groups of three. The first group of three circuits constitutes a filter or pre-selecting unit which insures a remarkable degree of "wide" selectivity besides providing considerable "narrow" selectivity. This

unit is located between the antenna and the grid of the first radio-frequency amplifier tube. The second group of three tuned circuits consists of three interstage radio-frequency transformers. This second unit forms the radio-frequency amplifier and at the same time increases the "narrow" selectivity enormously. A further advantage possessed by the HiQ-30 frequency selecting system lies in the band-pass characteristic of the three circuit pre-selecting unit. Instead of having an overall response characteristic like curve No. 3 in Fig. 2, as might at first be supposed (assuming similar circuits) it has in reality a broad topped, steep sided characteristic more like curve A of Fig. 3. This is due to the peculiar behavior of tuned coupled circuits. When such circuits are suitably coupled, and each circuit is tuned to the same frequency, they react on each other in such a manner as to produce several distinct peaks or voltage maxima. When the amount of coupling between circuits is of the correct amount and the effective resistance of the tuned circuits is of the proper order, these peaks merge or blend together to form a substantially flat top as illustrated in curve A Fig. 3. The sides of the curve, however, are not materially affected and remain as steep as in curve 3 of Fig. 2. This results in a marked improvement in the fidelity of the loud speaker output with no loss of selectivity. The exact shape of the top of such a curve depends on the coupling between the individual circuits, the effective resistance of the circuits, and the frequency to which the unit is tuned. Fortunately, however, its exact shape is of no material importance it may be hollow in the middle, higher on one side than on the other, or very much rounded. So long as it has substantial *width*, the most critical listener will not be able to detect the irregularity, while even the most casual listener will detect the improvement over the sharply peaked tuning characteristic.

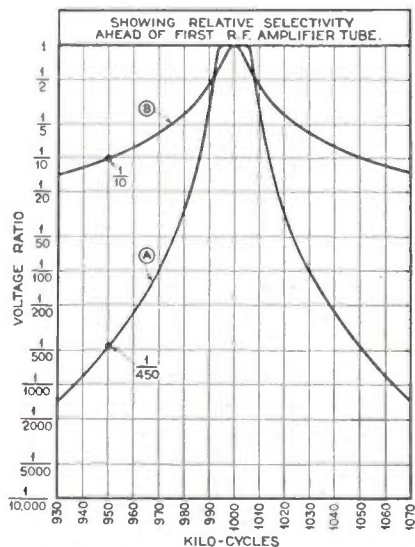


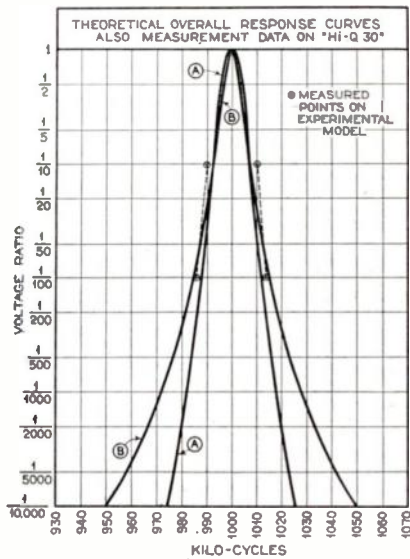
FIG. 3

Advantages of the HiQ-30 Flat-top, Straight-side Tuning Curve

Some of the advantages of the HiQ-30 frequency selecting system are illustrated in Figs. 3 and 4 where comparisons are drawn with the conventional four circuit receiver previously described. The

immense improvement in "wide" selectivity is clearly shown in Fig. 3 where curve A represents the selecting effect of the HiQ pre-selecting unit and curve B represents that of the first circuit of the four circuit receiver. In the case of the HiQ-30 an interfering signal of 950 K.C. would have to be 450 times as strong in the antenna in order to reach the grid of the first R.F. amplifier tube at the same amplitude as a 1000 K.C. signal whereas in the four circuit receiver it would only have to be 10 times as strong. As a more practical way of looking at it a 950 K.C. interfering signal of 450 times the intensity of the desired 1000 K.C. signal would be attenuated by the HiQ-30 pre-selecting unit to a one to one ratio by the time both had reached the grid of the first R.F. amplifier tube. After that it is a simple matter for the three remaining circuits to further attenuate it to a negligible value. In the other case, however, the interfering signal would still be 45 times as strong as the desired signal at the grid of the first tube. This condition would undoubtedly prove ideal for rectification and its resulting modulation, and even though the remaining selectivity were theoretically sufficient (which in this case it is not) the interference would undoubtedly be present in the output from the

loud speaker. This brings us to a consideration of Fig. 4 which represents the overall selectivity of both receivers; curve A is that of the HiQ-30, while curve B is that of the four circuit receiver. Curve A of Fig. 4 is made by combining the selectivity of the pre-selecting unit as shown in curve A of Fig. 3 with curve 3 of Fig. 2, since the last three circuits of both receivers are assumed to be identical. Curve B of Fig. 4 is merely a reproduction of curve 4 of Fig. 2. The superiority of curve A is quite apparent as would be expected in view of the fact that one receiver has six tuned circuits whereas the other has but four. What is not quite so apparent, however, is the improvement in the shape of the top of curve A, over that of curve B. It will be noticed that from



unity ratio down to 1/10 curve B is entirely inside curve A. From this it follows that the attenuation of the higher audio-frequency modulation (popularly known as side-band cutting) will be greater in the case of curve B than of curve A. Consequently the audio fidelity of receiver A will be better than that of receiver B. Below the 1/10 ratio curve A is inside of curve B and this indicates an increasing degree of selec-

tivity. To illustrate let us assume both sets tuned to a distant 1000 K.C. station having a field strength of ten microvolts per meter. Then an interfering signal at a frequency of 980 K.C. would have to be 1800 times as strong or 18000 micro-volts per meter, in order to produce a one to one interference ratio in the loud speaker of receiver A, while it would only have to be 270 times as strong or 2700 micro-volts per meter to produce an equal amount of interference in receiver B. When these voltage ratios are converted into power ratios they become simply amazing; in the case of receiver A the *power* of the interfering 980 K.C. signal must be over 3,000,000 times as great; in receiver B it must be 73,000 times as great.

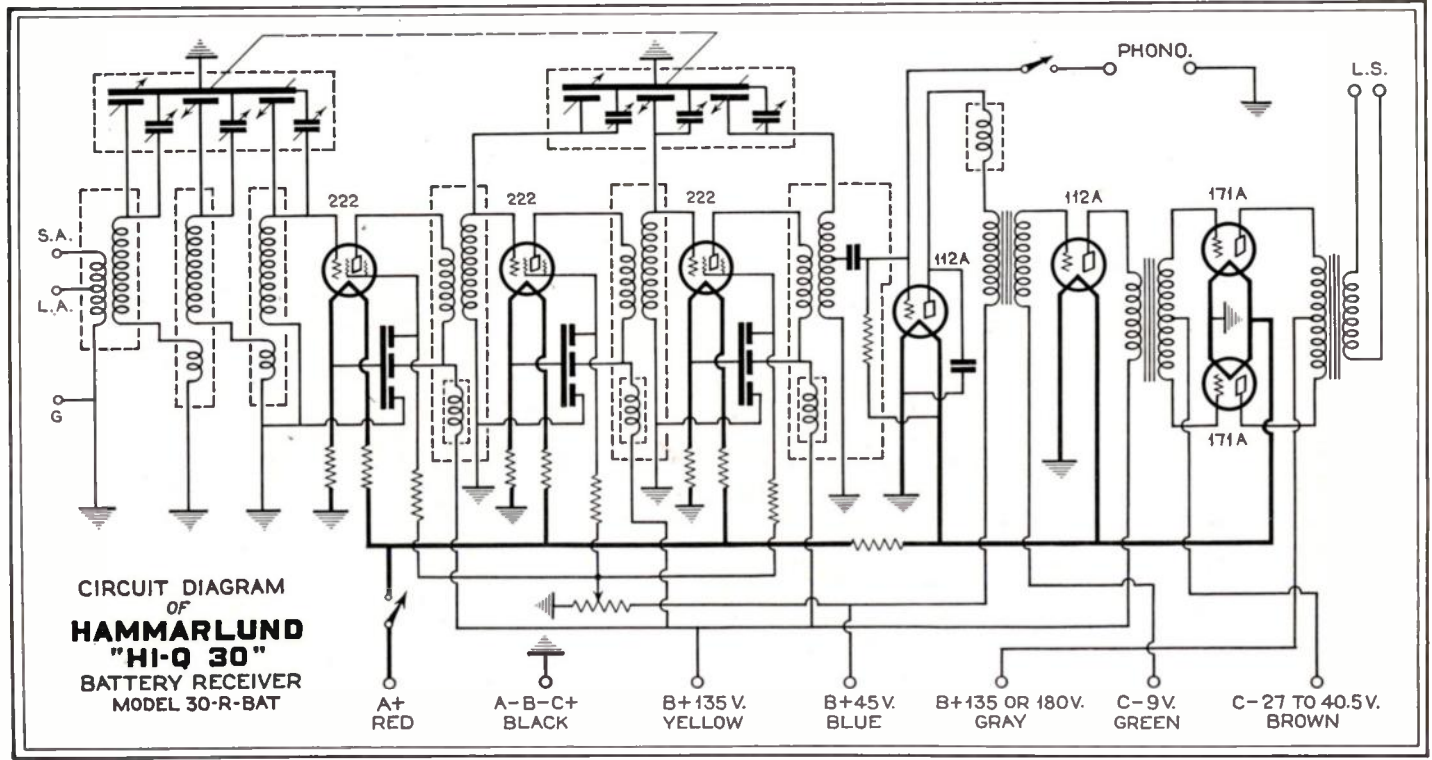
While the above has been largely a theoretical discussion of the selecting effect of various arrangements of tuned circuits, it is interesting to note the rather close agreement of the measured points plotted on Fig. 4. These four points were obtained in the course of some sensitivity measurements of one of the HiQ-30 models and represent the interfering effect of 10 times input and 100 times input. These measured points show a slightly wider band than the theoretical curve, but the slope of its sides is even steeper than predicted, indicating better audio fidelity (less side band cutting) and about equal selectivity.

The HiQ-30 Has Six Tuned Circuits, Controlled Simultaneously With One-Dial

As stated previously, the higher the sensitivity of a radio receiver, the greater its selectivity should be, especially when operated in congested locations. This follows naturally when it is considered that the ability to tune out a strong local station by a change of one or two degrees in the dial setting is of no particular benefit unless the receiver is sensitive enough to then bring in a weak distant signal with good volume. Conversely it is of no advantage to own a receiver of tremendous sensitivity unless it also possesses sufficient selectivity to tune out locals and other powerful signals in favor of the weak distant signal desired. The sensitivity of the HiQ-30 has been made very great by the use of three efficient stages of radio-frequency amplification using the A.C. screen-grid tubes. Inasmuch as the receiver is truly "one dial" control, the one-dial tuning all six circuits simultaneously, great care has been taken in the design and construction of the tuning inductances, in both the filter (pre-selecting) and amplifier units.

Accurately Matched Coils and Condensers

The filter tuning coils and the radio-frequency transformer secondaries are wound on threaded bakelite forms and the six coils of each receiver are matched to each other with an accuracy of better than $\frac{1}{4}\%$. The two triple-gang tuning condensers are also accurately



Schematic Diagram Showing Circuit of HiQ-30 Battery Operated Receiver

matched with each other in addition to having their individual sections matched. This matching is important for both selectivity and sensitivity. Since the distributed capacities of the six tuned circuits differ widely from each other, a supplementary adjustable capacity is connected across each main tuning condenser. These supplementary capacities are adjusted so as to bring the minimum or inherent capacities of the individual circuits to exactly the same value. Thereafter, since the inductances and individual tuning condenser sections are matched, the six circuits will be found to track throughout their entire tuning range.

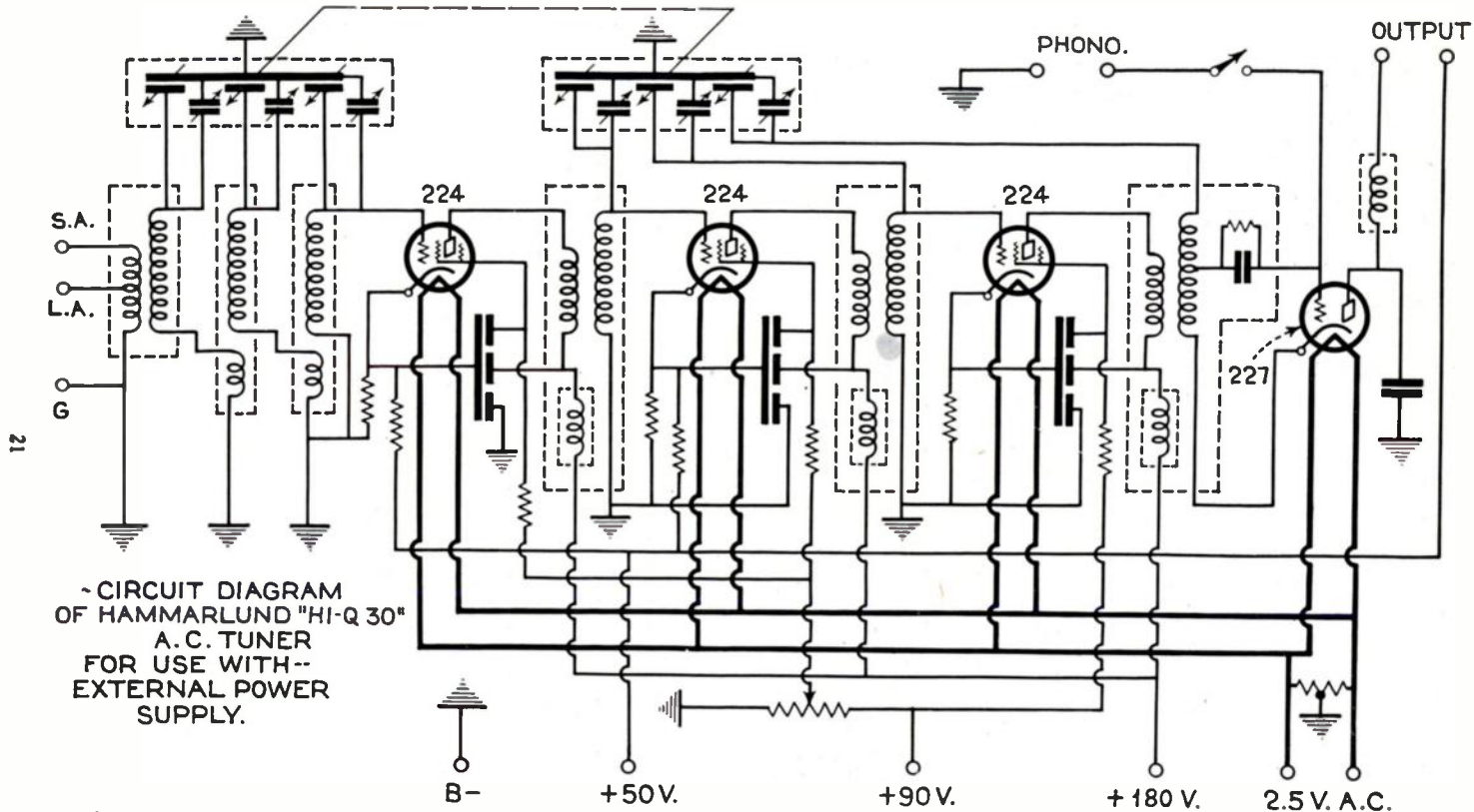
The radio-frequency transformers have high inductance primaries closely coupled to space wound secondaries thus insuring a high impedance load in the plate circuits of the screen-grid radio frequency amplifier tubes. This insures a high R.F. gain over the whole broadcast frequency band. Although the amplification of these R.F. transformers increases rapidly with frequency no steps were taken to prevent this condition, since it is a simple matter to control the amplification at any wavelength by properly adjusting the volume control. Under test a sample receiver had a measured sensitivity of $4\frac{1}{2}$ micro-volts per meter at the extreme lower end of the broadcast spectrum (550 K.C.) and this increased to 1 micro-volt at about 750 K.C. Above 750 K.C. the sensitivity increased still more, but could not be measured owing to the fact that the measuring equipment used was not calibrated above that point.

All Circuits Are Individually and Collectively Shielded

This tremendous R.F. gain makes complete shielding absolutely necessary and accordingly this phase of the HiQ-30 design has received especially careful attention. The filter coils and R.F. transformers are shielded in individual copper cans (tinned on the outside) with soldered tops and bottoms. Each triple-gang tuning condenser is also shielded in an aluminum can and in the case of the second triple condenser, which tunes the three R.F. transformers, the shielding is carried still further, partitions being placed in this can to isolate each of the three condenser sections from the others. The screen grid tubes are enclosed in specially designed two-piece aluminum shields which are removable to facilitate changing or inspecting tubes. The radio frequency chokes used as isolating impedances in the plate circuits of the screen grid tubes are mounted in the copper shields housing the radio-frequency transformers, but are shielded from same by their own aluminum cases. The R.F. choke coil used in the plate circuit of the detector is also shielded, since any feedback of R.F. energy from this point to the input of the receiver would be very undesirable.

A Super-sensitive Detector Circuit

The standard grid-leak, grid condenser detector has been used with slight modifications. As will be noticed in the circuit diagram,



HiQ-30 A.C. Tuner without power supply, showing R.F. Circuit only. This diagram is shown only to more graphically illustrate the features of the HiQ-30 tuning circuit. Due to the difficulties of adapting to ordinary power supplies, this model is of little use except for laboratories desiring it for experimental purposes.

the lead to the grid condenser and leak is tapped off the secondary of the third R.F. transformer at a point roughly two-thirds from the filament end. By this scheme the damping effect on the tuned circuit caused by the low input resistance of the detector tube, is reduced by more than half, thereby materially improving the selectivity of the circuit. At the same time greater voltages are built up in the circuit by reason of the reduced damping; therefore the voltage actually impressed on the detector grid is not reduced. Another quite important advantage of the tap is the reduction of the effective input capacity of the detector. While the input capacity of the tube is not actually reduced, its *effect on the tuned circuit* is reduced by over fifty per cent, thereby permitting the use of an equalizing capacity across this circuit as well as the others. The combination of .00025 grid condenser and one meg-ohm grid leak introduces practically no distortion in the audio frequency range.

Low Ratio Audio Transformers Prevent Distortion

The total amount of audio amplification is comparatively low, even though two stages are used. This enables the use of low ratio A.F. transformers with large primaries insuring good low note reproduction. The low overall A.F. amplification makes audio regeneration virtually impossible, besides reducing microphonic troubles to a minimum, and in addition reduces to a truly negligible amount the annoying A.C. hum generally associated with A.C. receivers. On the other hand the audio gain is sufficient to insure maximum input to the push-pull power tubes long before the detector tube is overloaded. The first stage transformer has a ratio of one and one-half to one and the push-pull input has a ratio of two to one. To obviate any possible distortion in the first stage A.F. amplifier tube it is operated at the maximum plate voltage of 180, with a suitable grid bias maintained by the voltage drop caused by the flow of its plate current through a 2000 ohm biasing resistor.

Push-Pull 45 Power Output

The two 245 type power tubes used in the output stage are connected in push-pull. This last or output stage provides a reserve of power sufficient to supply almost any degree of volume desired, and in addition insures full rounded tone even at low volume levels. Two different output transformers are available, depending on the operating conditions to be met. One of these transformers (AF-M) is designed to match the output impedance of the 245 tubes to the ordinary magnetic type loud speaker, also to dynamic speakers with built in input transformers. The other (AF-D) is designed to match the tube impedance directly to the moving coil of a dynamic speaker having an input impedance of the order of ten ohms.

A Specially-Designed Power-Pack

The power supply apparatus, consisting of the power transformer, filter chokes, filter condenser and voltage divider were designed especially for the HiQ-30. The power transformer and two filter chokes are housed in a steel compound-filled case. The power transformer has a 110 volt primary tapped at 80 volts. This tap permits the use of a regulator tube to control the line voltage fluctuations met with in most localities. The several secondaries are designed to furnish the exact voltages required for this particular receiver. While the 245 filaments are rated at $2\frac{1}{2}$ volts the same as the 224 and 227 tubes, a separate $2\frac{1}{2}$ volt secondary is provided for them in order to obviate any possibility of coupling between the output and input circuits of the receiver. The first filter choke is a heavy duty affair designed to pass the entire output of the rectifier tube, which is of the full wave 280 type. Under operating conditions the current through this choke is 100 milliamperes. At the output end of this choke the current divides; 60 mils going directly to the plate of the 245 power tubes and 40 mils flowing through the second filter choke to the voltage divider. This second filter choke has a higher inductance than the first and consequently greater filtering efficiency. Taking off the plate supply for the power tubes at the end of the first choke results in a further isolation of the output circuit from the remainder of the receiver. The current through the voltage divider has been made high to secure better regulation on the lower plate voltages under operating conditions, since a variation in the setting of the volume control causes a variation in the plate current drawn by the screen grid amplifier tubes. The lower section of the voltage divider (850 ohms) carries the plate current of the two power tubes back to the negative of the "B" supply; thus automatically furnishing the grid bias for those tubes.

The filter condensers and voltage tap by-pass condensers, 12 microfarads in all, are housed in a single case for convenience in mounting and wiring. A large safety factor has been allowed in the specifications of these condensers to insure against breakdown. The three main filter sections, 2, 4 and 2 mfd. are conservatively rated for continuous operation at D.C. voltages of 600, 500, and 400, respectively. The 1 mfd. section across the 180 volt tap is rated at 400 volts and the 90 volt by-pass section at 300 volts. The two remaining 1 mfd. sections are connected as by-passes across the 50 volt detector tap and the power tube grid biasing resistor are both rated at 200 volts.

Although the foregoing description covers the completely A.C. operated model including the audio amplifying system, the receiver can be used as a tuner in conjunction with any high grade power amplifier which may be available. A battery-operated model has also been designed the characteristics of which do not differ greatly from those of the A.C. model.

PART No. 3

Apparatus

Let us assume that a man has just purchased an automobile for which he has paid in the neighborhood of a thousand dollars. He will tell his friends how fast it will travel, the number of cylinders, how economical it is, its riding qualities and a hundred other little details.

Now let this man become the owner of a car, which has been custom-built and for which he has paid a sum several times greater than he did for the other. What will he tell his friends about the new car? All that he told them before—true enough, but—he will go into details about which he never thought in connection with the first automobile. He will explain how the riding qualities far excel those of the other car and why they do; the engine will have a longer life at a lower cost because of the quality of the materials and workmanship; he will tell how the upkeep per mile over a period of years will be lower than formerly—in short, he takes a far greater pleasure in owning the second car because he is conscious of finer quality of material and workmanship. And does he think of price? Not if he knows the true excellence of his purchase.

The same reasoning may be applied to the ownership of a radio receiver. In general there are but two kinds of radios. One will do no more or less than thousands of other sets turned out in the same factory. The other is a superior product, painstakingly planned and custom-built to the highest standards of excellence. It is worth more because it gives more and means more to its owner. It is a musical instrument in its truest sense—not a music box.

For several years radio receivers have been undergoing great changes—circuits have been refined; the components of receivers have been improved; cabinets have become something more than merely containers—radio as an art has made tremendous advances. And just as with any other art, human skill supersedes all else. Machines can never create a masterpiece—brawn can never take the place of brain.

Since the dawn of better receivers, "Custom Built" and "Hammarlund-Roberts" have been synonymous. Each year a custom-built receiver bearing this mark of distinction has captivated music lovers and each year has always maintained its leadership. Why? First, a superior circuit, then quality of its parts.

Heretofore Hammarlund-Roberts receivers have been constructed from material furnished by a number of manufacturers, the foremost in their respective lines. This year, for the new Hammarlund "HiQ-30," an even higher degree of standardization has been perfected. In order to assure apparatus of uniform high quality exactly matched of the requirements of the circuit, special parts have been designed

and are manufactured under the supervision of Hammarlund engineers. New methods of construction and assembly have been developed, so accurate that when the "HiQ-30" is sold an unconditional guarantee accompanies it.

Hammarlund Three-Stage Band Filter Unit



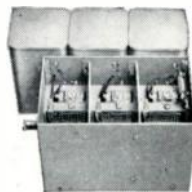
Hammarlund Three-Stage
Band Filter Unit
Bottom View

Let us consider the various components of the set. First the three-stage band-filter unit. This unit which is located at the left of the dial (See Page 7), consists of a matched triple "Battleship" shielded condenser and the necessary inductances. Three filter coils or inductances are placed in individual copper shields, their arrangement being indicated by the dotted lines in the circuit diagram. Heretofore, it might be mentioned, the manufacturer of custom-built radio receivers has left it to the constructor to do all the wiring himself. As nobody is infallible certain errors in wiring many times gave rise to difficulties in making the set perform properly. Wiring in the "HiQ-30" is done as far as possible at the factory. In the band filter unit all internal wiring of the parts is completed; there are only three wires that the constructor must solder and these are brought out from the under side of the chassis.

The matched triple "Battleship" condenser is mounted in an aluminum shield and all units are connected to their respective inductances. The unit is then given a thorough test and the tops of the coil shields soldered in place. In other words, the unit is delivered to the constructor already assembled, adjusted and tested so that there is no chance of error.

Hammarlund Screen Grid Amplifier Unit

The three-stage screen-grid radio-frequency amplifier unit is assembled at the factory in the same manner. The three shields contain the radio-frequency transformers and their attendant R.F. choke coils. Each radio-frequency choke is individually shielded in a separate aluminum shield before mounting inside the shield cans. These parts are of course, adjusted and tested before the tops of the shields are soldered in place. A matched special triple condenser in an aluminum shield with each section in individually shielded compartments forms part of the completed unit. The entire unit is assembled, wired, adjusted and tested at the factory before shipment.



Hammarlund Screen Grid
Amplifier Unit

Hammarlund Shielded Polarized R.F. Choke Coil



Hammarlund Shielded
Polarized R.F. Choke Coil

The radio-frequency choke coils have been specially developed for modern high-gain receivers using the screen-grid type of tube. Because of polarization and shielding there is no external field to cause circuit instability or feed-back. High inductance, low distributed capacity and compactness are other design features that make these chokes extremely efficient.

Hammarlund Screen Grid Tube Shield

The aluminum tube shields used in the HiQ-30 completely shield both tube and socket, thus insuring full amplifying properties. The outlet of the control grid at the top of the shield is protected with a soft rubber grommet against accidental short circuits.



Hammarlund Screen Grid
Tube Shield

Hammarlund Audio Transformers (Including Push-Pull)

It may be truly said that no radio receiver is better than its audio-frequency amplifier. If the characteristic curves of the transformers are not of the proper shape it is impossible to obtain uniform amplification over the whole range of frequencies needed for high quality reproduction.



Hammarlund Audio
Transformers
(Including Push-Pull)

The audio transformers used in the HiQ-30 were specially designed for this set. The one employed between the two 227 tubes (the first stage) has a voltage amplification ratio of $1\frac{1}{2}$ to 1. The impedance of the primary is very high in order that the lower frequencies will have their true values. The response curve has a sharp drop at the high frequency end just below those frequencies classed as "noise." The core is of large cross section and built up of specially treated laminations, permitting high primary currents without danger of saturation. The coils and core are completely shielded in an enameled steel case and pigtail leads are provided for connecting under the chassis.

The pushpull input and output transformers are also specially designed. With the added power delivered by the two 245 tubes, it is essential that a great deal of attention be paid to this part of the amplifier. The design, quality of materials, and workmanship of these transformers leave nothing to be desired.

The balance input transformer has a substantial core that permits a high plate voltage to be used on the 227 tube in the first stage of the amplifier without ill effects on the response curve. The high inductance of the primary coil provides for excellent low-frequency amplification and the cut-off of high-frequency noises.

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The push-pull output transformers are made in two types with secondary impedances that will match as nearly as possible either a magnetic or dynamic type loud speaker. The windings and core are so designed that they will stand up under the normal high voltages necessary for successful operation of this type of transformer.

Hammarlund Push-Pull Power Supply Unit

If alternating current is used to provide power for a receiver it is essential that the filter condensers, chokes, resistors and transformer be of the best grade.

The power transformer and the two chokes are used in the HiQ-30 A.C. model built as a single unit in an enameled steel case, having pig-tail leads at the bottom. The primary of the power transformer is tapped at 80 volts so that a voltage-regulating device may be employed. The ratings of the secondaries are as follows: 750-volt, 100 milliampere, center tapped; 5 volts, 2 amperes center-tapped for the filament of the 280-type rectifier tube; $2\frac{1}{2}$ volts, 3 amperes center tapped for the filaments of the 245 tubes; and $2\frac{1}{2}$ volts 9 amperes for the heaters of the other five tubes in the set. The filter chokes have a rating of 30 henries at 100 milliamps and 30 henries at 40 milliamps respectively.

The cores of the chokes and power transformer are of large cross sections and are made up of special laminations so that together with the large wire used, there will be no danger of overheating under normal operating conditions. This unit is tested before assembly and is guaranteed to give a smooth d. c. output when used with the Hammarlund 2-4-2 mf. condenser bank.



Hammarlund Push-Pull
Power Supply Unit



HiQ-30 Filter Condenser
Block

HiQ-30 Filter Condenser Block

The Hammarlund Condenser Block contains all the necessary filter and by-pass condensers required for the power supply. In accordance with all the other units of the HiQ-30, the leads from the condensers are brought out at the bottom of the case, so that they may be connected beneath the chassis, where all the wiring of the set is done. The values are: 2 mf. at 600 v.; 4 mf. and 2 mf. at 500 and 400 volts respectively; four 1 mf. at 300, 400, 200 and 200 volts. These voltage ratings are high to take care of any excessive peak voltages.

HiQ-30 Voltage Divider

The voltage divider, having monel-metal clips for connecting, has a resistance of 9850 ohms. It is wire-wound, has a rating of 30 watts, and is wound on a $\frac{3}{4}$ -inch vitreous tube 5 inches in length. The tapped sections are of 850, 2500, 1500, 3000 and 2000 ohms.



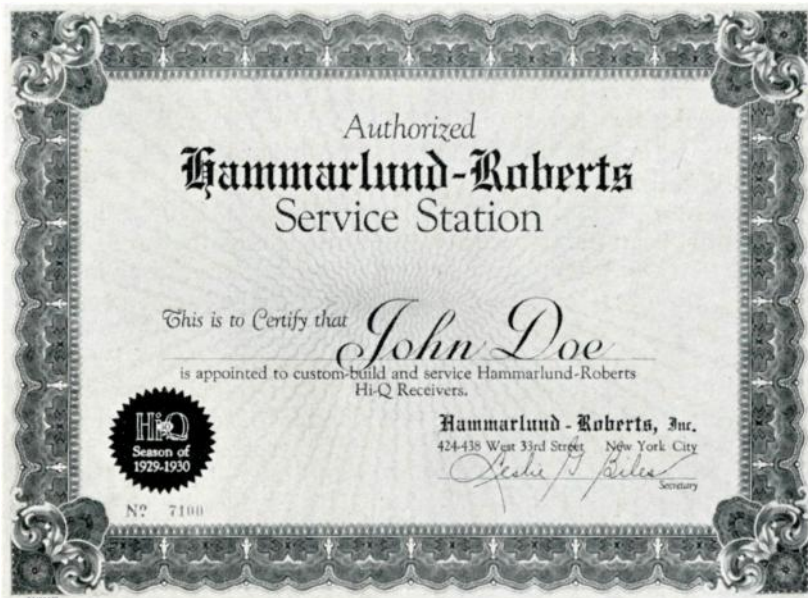
HiQ-30 Voltage Divider

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PART No. 4

Testing and Service

It has been mentioned previously that all the units and parts of any model of the HiQ-30 have been tested thoroughly before they are shipped from the factory. Yet in order to be certain that they are in perfect condition before installation, it is best to test them, as they might have been damaged in transit.



It always has been the policy of Hammarlund-Roberts, Inc., to appoint qualified radio experts to install, demonstrate and service the HiQ receivers. Only such men who were able to demonstrate their ability and knowledge were authorized to represent the organization in the field; and such representatives were issued a Certificate of Authorization, which is reproduced on this page. There are at the present time some 6500 Hammarlund-Roberts Service Stations, so there is doubtless a man in your community who is capable of answering any questions that might arise about your HiQ set. If you don't know him, write us for his name and address.

Answering questions is a service that is entirely free to owners or prospective owners of HiQ receivers. This service corps has been established to serve the best interests of all who want to learn what a remarkable receiver the HiQ-30 really is. It is suggested that you get in touch with your nearest Service Station and get the facts.

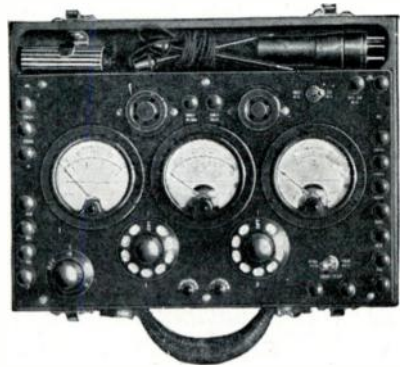
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Then in the matter of testing, locating troubles, or any other servicing that might arise, it is well to go to a man who is thoroughly familiar with the various ins and outs of the particular receiver in which you are interested. You will find the man at the Authorized Service Station can help you out of your difficulty and at a reasonable charge.

All too often "faults" have been discovered by so-called radio experts where they did not exist in sets, mainly to impress the owner with the vast knowledge possessed by the "expert." And the time and money wasted by the owner are absolutely unnecessary.

If you wish advice, information or work done on your set, go to a Hammarlund-Roberts Service Station. Remember a radio set—no matter how fool-proof it may be when it leaves the factory—is a precision instrument and should be treated accordingly. You would not take an expensive watch for repair to a man who claims to be a watchmaker, just because he has a few tools and knows a mainspring when he sees one. You take it to an expert, in every sense of the word. Parts of a radio receiver are every bit as delicate as the works of a watch—for example, the fine adjustments necessary for absolute synchronization of tuning circuits or repairs to the hair-like wire in the windings of your loud speaker. Is that anything for a blacksmith to repair?

The new HiQ-30 is a receiver built and packed in such a manner at the factory that very little can go wrong with it in transit. But sometimes that little may be too much. It is wise to have set looked over by someone competent if it does not function as it should.



WESTON MODEL 547
Radio Set Tester

Recommended for testing HiQ-30
A.C. and D.C. Receivers and Tuners

This checking-up process is facilitated by the use of a Weston Set Tester and the HiQ service man is familiar with its operation. There is practically no trouble that can occur in a radio receiver that can not be speedily discovered with one of these instruments and usually the difficulty is found to be minor—quickly and economically corrected.

PART No. 5

The Radio-Phonograph Combination

The ideal combination for music in the home is a phonograph and a radio receiver. Even though it is generally possible to get almost any type of radio program that is desired at nearly any time of the day, yet the radio receiver is always limited to the selections played at the broadcast stations. With the aid of a phonograph and electric pick-up one's favorite music may be played at any time.

There is a dance for instance. In the earlier hours of the evening the programs are of a more general nature. Usually dance music follows later. A phonograph at this time is especially handy.

The modern phonograph has borrowed most of its equipment from the radio field, as witness the audio-frequency amplifiers and loud speakers used in the most up-to-date models. Manufacturers of talking machines have discovered that the radio engineer knew much more about sound reproduction than they did, and so today we have at our command as efficient reproduction from phonograph discs as we have from broadcast stations. And, it might be added, sometimes the phonograph excels the radio for atmospheric and interference are, of course, eliminated.

In the combination models of the HiQ-30 the installation of the phonographic apparatus is quite simple. All the necessary apparatus fits perfectly into the cabinet, all cuts and holes have been made ready for installation of the parts. The connecting of the magnetic pick-up device into the radio circuit is accomplished by simply inserting the two plug-in tips of the leads into two pin jacks in the set chassis.

The switching arrangement of a phonograph pick-up for radio receivers has been the cause of many sleepless nights for engineers. Generally the detector tube was not in a position near the front of the set and as long grid leads are not good practice, the control switches have been on the back of cabinets, on the sides or any place on the panel.

It will be noticed that the HiQ-30 phonograph control is over the "On-Off" switch on the panel. This control is connected mechanically to a similar switch located on the grid terminal of the detector tube. In this way long leads are eliminated and the control switch is conveniently located. This is a feature found only in the HiQ-30.

On the rear of the chassis is a duplex receptacle for the 110-volt A.C. line for operating the phonograph motor and energizing the field coils of an A.C. dynamic type loud speaker, if one is used. The electric turntable motor of the phonograph is turned on and off by a switch conveniently near it. Three needle cups are also provided.

As mentioned elsewhere, the volume of the radio receiver is controlled by the variable resistor in the screen grid circuits of the R.F. tubes. This must be turned to minimum when the phonograph is in operation.

The volume delivered by the pick-up is controlled by the volume control supplied with the pick-up and is mounted near the turntable.

PART 6

Accessories

Since the early days of radio broadcasting, one of the most difficult problems facing radio and sound engineers has been the realistic transformation of electrical impulses from a radio receiver into sound waves.

The radio buying public quickly became dissatisfied with the uncomfortable head-phones and the raucous tone of the early "horn" type speakers. They demanded greater tone fidelity and volume.

Also many of the newer radio buyers who bought their receivers for entertainment demanded a degree of perfection comparable to the actual presence of the artists, or reproduction at least equal to that of the phonograph.

Today, in the modern dynamic type reproducer, perfection is indeed a reality, particularly when the reproducer is accurately matched to the exact output characteristics of the receiver.

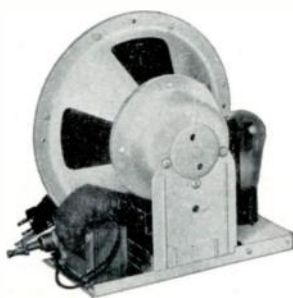
The *Custom-Built* HiQ-30 A.C. Receiver is a striking example of perfect harmony between receiver and reproducer.

The *New* Hammarlund D-10 Dynamic Speaker has been especially designed for the HiQ-30 A.C. Receiver and is manufactured under most rigid precision standards.

From a gentle whisper, to the full extent of its stupendous volume, every note in the audible tone range is delivered with an absolute realism that is amazing. Nothing is added, nothing is taken away from the crystal-clear output of the HiQ-30.

The Hammarlund D-10 Dynamic Speaker is entirely free from hum due to the use of full-wave rectification, a specially designed A.C. bucking coil and its own power supply transformer built into the speaker chassis, which supplies filament voltage for the 280 type rectifying tube used, and power to energize the field coil.

A new "spider" type centering spring keeps the cone and voice coil always in proper position.



The New
Hammarlund D-10
Dynamic Speaker

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The Hammarlund D-10 Dynamic Speaker is regularly supplied without an input transformer. Hammarlund Push-Pull Output Transformer "AF-D" should be used in the HiQ-30. Connections from the "AF-D" Transformer are made directly into the moving coil of the Speaker. This moving, or "voice" coil has an impedance of approximately 8 ohms at 1000 cycles.

On special order, the Hammarlund D-10 Dynamic Speaker can be furnished with an input transformer. In this case Hammarlund Push-Pull Output Transformer "AF-M" should be used in the receiver.

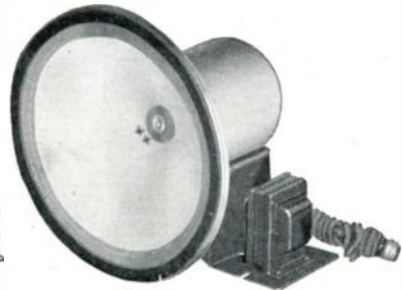
Certain other dynamic speakers have characteristics ideally suited to the output of the HiQ-30. After careful tests, the following speakers are especially recommended:



The Rola



The Jensen



The Wright de Coster

NOTE—These speakers are regularly stocked and sold by Hammarlund-Roberts, Inc. Unless specially ordered they are supplied without input transformers—Hammarlund Push-Pull Output Transformer "AF-D" on the HiQ-30 being connected directly into the moving coil of the speaker. If the speakers are ordered with input transformers, use Hammarlund "AF-M" Transformer in the receiver.

With the HiQ-30 Battery Operated Receiver, Hammarlund engineers recommend the Jensen D.C. Dynamic, and the Farrand Inductor Dynamic, either of which will give superb full-range reproduction.

NOTE—For use with the Farrand Inductor Dynamic, specify the Hammarlund Push-Pull Output Transformer "AF-M."

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The Bodine Electric Turntable, which has been selected for use with the HiQ-30, is ideal, as the motor driving the turntable is of the induction type, which has no commutator or brushes to cause sparking with any resultant interference. The motor is designed for operation from the 110-115 volt, 60-cycle a-c. house lines.



Bodine Electric Turntable

The speed reducing mechanism of the worm-gear type is employed and entirely enclosed, which, with the absence of belts or external gearings, insures smooth and quiet operation, as the motor itself is silent. A governor operated by a knob is also provided, making possible very accurate control of the turntable's speed.

The special mounting of the turntable plate and motor on an ingenious spring support eliminates any possibility of vibration being transmitted to the vacuum tubes, resulting in microphonic noises.

In order to get first-class reproduction from a phonograph it is necessary to have an electrical pick-up which is capable of transforming the mechanical energy transmitted to it by the needle running along in the record's groove into electrical energy with a minimum of loss and distortion. It should be remembered that the process in a pick-up device is exactly the opposite from that which occurs in a loud speaker.

In the latter the electrical energy from the output of the audio-frequency amplifier excites the unit's coil and this in turn causes the diaphragm to vibrate setting up sound waves in the air. In the case of the pick-up the needle is caused to vibrate by the variations in the groove of the record and the armature attached to the needle is made to vibrate in exactly the same way. This vibrating of the armature induces minute electrical currents in the unit's coils and these currents are fed to an audio-frequency amplifier, where they are magnified and so go to the loud speaker.



Audak Phono Pickup
(Special HiQ-30 Model)

Therefore, if we wish to get all the fine shades of recording that have been impressed upon the disc, it is imperative that we have a pick-up device that will transfer one type of energy into another with maximum efficiency. Such a pick-up is the Audak. The frequency-response curve of this instrument shows that it has the necessary characteristics for the reproduction of all audible frequencies, which is ample for the finest electrical recording.

PART No. 7

SOUND INSTALLATIONS

A Lucrative Field for the Custom Builder

The modern trend in apartment house and hotel design, and operation of amusement parks, dance halls, swimming pools and skating rinks has opened a lucrative field to the custom set builder.

Radio as a medium of entertainment has been accepted by the multitude for several years past. Now, it is being recognized by Corporations as a source of music and entertainment. Multiple sound installations in apartment houses are daily increasing in popularity. Disfigurement of an apartment dwelling by a large number of outdoor aerials has been prohibited. The modern building constructor makes provision for several major installations operated by the Corporation and supplying entertainment to the tenants. The modern hotel owner realizes that the lonely traveler misses his radio and arranges a major installation with loud speakers or headsets in each room. The owner of a skating rink realizes that radio as a means of musical entertainment is better than the old steam calliope and more economical than an orchestra. The amusement park owner, the operator of a swimming pool—the restaurateur—all are firmly convinced of the innumerable advantages of a high quality radio installation. The custom set builder is the logical man to make such installations.

The new HiQ-30 A.C. tuner operated in conjunction with several high calibre speech amplifiers offers the ideal combination for such work. Many such installations are now in use. We need not stress the design of the Hammarlund-Roberts 1930 HiQ-30 receiver. You are already familiar with its marvelous performance. We take this opportunity to suggest it as the ideal sound installation for apartment houses, hotels, restaurants, skating rinks, etc., wherever a radio receiver is to feed a number of loud speakers.

Since the HiQ receiver is complete in itself and is designed for a home, its audio amplifying system is not employed. The units selected for use with external power amplifiers are just the band-filter, screen grid tuner and detector. Recognizing that the design of the power supply employed with a tuner-detector unit is of paramount importance we have arranged correct power supply for the radio frequency and detector tubes. The power amplifiers suggested for use with the HiQ-30 A.C. screen grid tuner-detector are the Amertran and the Samson Pam units.

The Amertran amplifier system consists of two sections, the 21-D power box and the 2 AP amplifier. The descriptions of the units follow. Particular reference is made to the effect that voltages available from the Amertran power box are employed only with the 2 AP amplifier and not for the tubes in the tuner-detector unit.

AmerTran Hi-Power Box

Type 21-D

The Amertran Hi-Power Box is an unusually flexible high power ABC Eliminator which operates directly from the 110 volt, 50 or 60 cycle house lighting circuit. It converts the A.C. house current into direct current for "B" voltages up to 450 volts, "C" bias voltages for all tubes, and A.C. filament voltages for all A.C. and power tubes.



Amer-Tran Hi Power Box
Type 21-D

The unit delivers a plate voltage of 450 volts for two 210 or one 250 power tube, and adjustable intermediate voltages for R.F., detector and first audio. The R.F. and detector voltages are not used with the HiQ-30 A.C. tuner. Plate currents are 55 M.A. for power tubes and 25 M.A. for other tubes. Filament A.C. Voltages provided are $7\frac{1}{2}$ v. for one 281 rectifying tube; $7\frac{1}{2}$ v. for two 210 or one 250 tube; $2\frac{1}{2}$ v. for five 227 tubes, and $1\frac{1}{2}$ v. for five 226 tubes. "C" Bias Voltages are adjustable for all tubes.

The Hi-Power Box is enclosed in a strong metal container. All parts, including the control panel, are firmly secured to the metal base so that the cover may be removed without disturbing wiring or parts. The control panel on the front of the chassis contains the following adjustments: (1) Main line "on and off" switch; (2) Four point primary tap switch for 100, 110, 115 and 120 volts; (3) Adjustment for R.F. and A.F. plate voltages; (4) Rheostat for controlling detector plate voltage; (5) Bias adjustment for R.F., Det., 1st A.F., and output tube bias; (6) Jacks for measuring plate current of power tube, R.F., 1st A.F. and sub-total; (7) Binding posts for B plus, R.F., C— Det., C— R.F., -FILT (minus side of filter circuit) Cathode or A—, $2\frac{1}{2}$ v. for heater for 227 tubes, $1\frac{1}{2}$ v. for filament of 226 tubes, and one binding post attached to the base for grounding the chassis.

An opening in the box gives access to a Yaxley receptacle which contains all other necessary connections. The Amertran 2-AP Power Amplifier is provided with a cable and plug to fit this receptacle. Arrangements are such as to permit ease of all connections and adjustments after installation.

AmerTran Push-Pull Amplifier Type 2-AP



Amer-Tran Push Pull Amplifier
Type 2-AP

The Amertran Amplifier Type 2-AP is a high quality two stage transformer coupled audio amplifier with a push-pull power stage. It is designed for A.C. operation with a 227 tube in the first stage followed by power tubes in the push-pull stage, and is intended to be connected to the detector of any good receiver and operated from an A.C. power supply system, such as the Amertran Type 21-D. The output from this amplifier with UX-210 tubes in the power stage is sufficient to fill a medium size dance hall, auditorium, theatre, or church.

The Type 2-AP audio amplifier consists of a first stage Amertran De Luxe transformer followed by a 227 amplifying tube. This is followed by an Amertran Type 151 input push-pull transformer, which feeds into two power tubes. The output transformer determines the type number of the amplifier and depends upon the combination of power tubes and speaker desired.

Power Tubes	Speaker	Output Transformer	Amplifier Type No.
210	Magnetic	152	2 AP-5
210	Dynamic	200	2 AP-2
245	Magnetic	442	2 AP-7
245	Dynamic	443	2 AP-6

The amplifier is housed in a finished metal case having openings for the necessary tubes. On the input end are binding posts for the plate of the detector tube and for the cathode or filament terminal of this tube. On the output end are binding posts for connection to the speaker. A cable contains all wires for the power supply system. Seven wires terminate in a Yaxley plug which nests in the receptacle in the 21-D Power Box. Two extra wires are provided for connection to the 2½ volt filament lead binding posts on the Power Box.

The amplifier can be used with a custom built power box.

Samson Pam Amplifiers

The Samson Pam amplifiers suitable for use with HiQ-30 are two in number. In contrast to the Amertran units, these are complete in themselves, each amplifier being individual. The power supply for the amplifiers is located within its own confines and voltages for other loads are not available. Two separate types of Pam amplifiers are suitable for use with the Hammarlund-Roberts HiQ-30. These are the Pam 9, and Pam 19. The selection is governed by the existing power requirements.

Samson Pam Amplifier No. 9

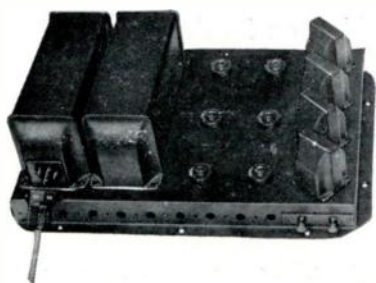
The Pam 9 is a two-stage transformer coupled audio amplifier consisting of a single 227 feeding into a push-pull 250 stage, employing two 250 type tubes. The power supply is a full-wave rectifying system utilizing two 281 type tubes. The unit is entirely self-contained and is equipped with input and output binding posts.

The power output of the system with .5 volt input into the amplifier is 15 watts when feeding into an impedance of 4000 ohms. The input impedance of the amplifier is 5000 ohms. The primary winding of the power transformer is equipped with taps so that the range of line voltage is from 100 to 130 volts.



Samson Pam Amplifier No. 9

Samson Pam Amplifier No. 19



Samson Pam Amplifier No. 19

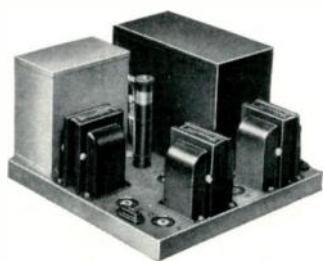
The Pam 19 is a three stage amplifier of resistance-transformer coupled type, employing two stages with 227 type tubes and an output power stage with two 250 tubes. The power supply system utilizes two 281s connected in full wave fashion. This amplifier like the Pam 9 is self-contained and supplies power for the tubes in the amplifier but not for the tubes in the tuner unit. The amplifying power of this amplifier is 68 DB. This amplifier like the other affords a maximum undistorted output of 15 watts feeding into a 4000 ohm load, but the required input voltage to the Pam 19 is only .2 volt.

HAMMARLUND HiQ-30 MANUAL

The input impedance is 5000 ohms. The amplifier is furnished with input and output binding posts.

In the event that dynamic speakers are to be used with either of these amplifiers, field current must be secured from the A.C. line, since it is not available in the amplifier. Both units are designed for operation on A.C. systems. The Pam 19 like the Pam 9 is equipped with a tapped primary power input so that it is suitable for use on all line voltages from 100 to 130.

Hammarlund A.C. Push Pull Power Amplifier



Hammarlund A.C. Push Pull
Power Amplifier

The Hammarlund PA-245 Power Amplifier is especially recommended for use with the HiQ-29 A.C. receivers and tuners, or other receivers or tuners having self-contained power supply. It is also the ideal power amplifier for use in electrifying phonographs due to its superb tone, volume and compact construction.

It operates directly from the A.C. current supply and is capable of delivering 5200 milliwatts of undistorted volume.

The PA-245 employs a '27 type tube in the first stage, two '45 type tubes in the balanced push-pull output, and an Ameperte Self-Adjusting Voltage Regulator to assure constant voltages, uniform volume and longer tube life.

Power chokes, filter chokes, filter and by-pass condensers, audio transformers, and other units are all special Hammarlund parts of highest quality.

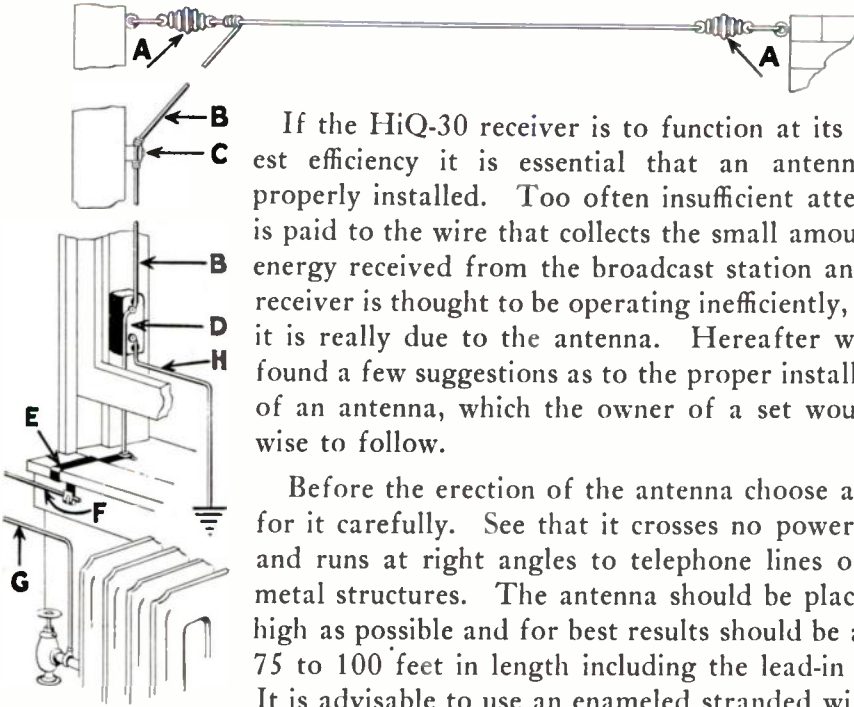
The complete amplifier can be assembled on its drilled cadmium-plated chassis and wired, ready to operate, in two hours. All instruments have pigtail leads so that no wiring appears above the chassis. Necessary hardware and cord for light-socket connection included.

NOTICE

Full information regarding special sound installations for theatres, auditoriums, talking motion pictures, parks, portable public address systems, and details concerning special audio amplifying systems or power amplifiers will be gladly furnished on request to the engineering department of AMERICAN TRANSFORMER CO., 178 Emmet St., Newark, N. J., or SAMSON ELECTRIC CO., Canton, Mass.

PART No. 8

Antenna and Installation



If the HiQ-30 receiver is to function at its highest efficiency it is essential that an antenna be properly installed. Too often insufficient attention is paid to the wire that collects the small amount of energy received from the broadcast station and the receiver is thought to be operating inefficiently, when it is really due to the antenna. Hereafter will be found a few suggestions as to the proper installation of an antenna, which the owner of a set would be wise to follow.

Before the erection of the antenna choose a span for it carefully. See that it crosses no power lines and runs at right angles to telephone lines or any metal structures. The antenna should be placed as high as possible and for best results should be about 75 to 100 feet in length including the lead-in wire. It is advisable to use an enameled stranded wire, as this will not corrode as quickly as bare wire.

Due allowance should be made in the length of wire used for strains from storms, etc., if firm supports, such as masts, trunks of trees, etc., are not employed. Referring to Figure, three feet should be allowed between the insulator and the support, as indicated at A. It is recommended that glass insulators be used, as this type will permit the moisture to drip off readily. It is also recommended that the lead-in wire be a part of the antenna wire itself, thus eliminating splicing and making it easy to locate a possible break. (See B). This lead-in wire must be insulated from the building by stand-off insulators, C, otherwise the weak currents will leak off to ground.

In order to have the installation of the antenna conform with the rules of the National Board of Fire Underwriters, it is essential that a lightning arrester, approved by the Board, be placed in the lead-in line, as shown at D. The second post of the arrester is connected to

a metal post in the ground or an outside water-pipe. The omission of a lightning arrester may invalidate a fire insurance policy; so to be on the safe side, install one.

The lead-in wire is connected to a lead-in strip, see E, allowing the outside end to be lower than where it enters the building so that water may drip off. The wire, F, may be rubber-covered, this leading to the antenna binding-post on the set. The ground binding-post of the set may be connected to a water pipe or a radiator (the former being preferable) by means of a ground clamp, G, using rubber-covered wire. The wire for the outside ground lead, H, should be rubber-covered and insulated from the building by stand-off insulators. In making connections with enamel wire, be sure that the wire is scraped clean of enamel at the joints. It is wise to solder all connections, except that of the inside ground wire, where a pipe clamp is used. If soldering is impossible wrap the joints firmly together and over the connection wrap sufficient tinfoil to cover. Over the whole joint wrap some tape, covering the tinfoil.

If an indoor antenna is employed, it may be run around the picture molding near the ceiling and a wire run down to the set. Or if it be more desirable the wire can be run around the baseboard of the room, and held in place, in either case, by means of insulated staples.

The HiQ-30 receiver is so sensitive that satisfactory local and short-distance reception can be obtained by using a copper screen as an antenna. This screen is made like an ordinary window screen, held by a wooden frame that will fit across the back of a console cabinet. Two screws, one at the top and the other at the bottom will be sufficient to support the screen. Solder one end of the lead-in wire to the nearest corner of the copper mesh and attach the other end to the antenna binding post of the receiver. No lightning arrester is required when using the screen or any other indoor antenna. The usual ground connection, however, should be retained.

House Wiring for Radio

In keeping with the rapid advance of radio equipment, outlets for radio use have been developed, so that instead of a mass of unsightly wires, wall outlets can be used of the same general types as used for the electric-light lines in a house. As the illustrations show these may be had for loud speaker outlets, 110-volt power lines, antenna and ground connections, volume controls, etc.

HAMMARLUND HiQ-30 MANUAL

These outlets, which are made by the Yaxley Mfg. Co., consist of two parts: the wall plate and the device which it conceals, which may be one or more jacks, a switch, a volume control, etc. The accessory is usually mounted on a supporting strap by means of which it is attached to the switch or outlet box. If this be omitted the strap may be fastened to the plaster laths or studding by means of two wood screws. The wall plate is attached to the strap by two screws.



No. 238

For Loud Speaker and
Antenna and Ground
Connections



No. 241

Two-gang plate for A.
C. (duplex receptacle),
and aerial and ground



No. 350

For Loud Speaker, An-
tenna and Ground, and
Battery Connections

The wall plates are regularly furnished in brushed brass or Bake-lite, but may be obtained in special finishes if desired.

Not only do these outlets remove unsightly wiring, but their use enables a house to be so wired that with a minimum of bother programs can be heard in any room or on a porch and the receiver can be controlled from remote points.

Some of us may have become so engrossed in our work of building sets that we have overlooked the modern necessity for radio wired homes. Radio outlets certainly make the use of radio more convenient and enjoyable. Therefore the subject is worthy of consideration by both the radio owner and the custom-radio builder.

NOTICE

Special information, and interesting literature concerning house-wiring for radio will be cheerfully furnished upon request to YAXLEY MFG. CO., Chicago, Illinois.

HAMMARLUND HiQ-30 MANUAL

"HiQ-30" A.C. RECEIVER

Contains all parts (less tubes) for completing the nationally advertised "HiQ-30" A.C. Receiver chassis — "The World's Premier Custom Built Receiver." *Complete units*, each unit assembled, wired and rigidly tested before leaving the factory. The "HiQ-30" is unqualifiedly guaranteed for distance, selectivity, volume and tone. *Complete instructions for assembling and operating packed with each kit.* Parts can be ordered separately from the following schedule.

Complete Parts, Code 30-R-AC	\$162.50
1—Hammarlund No. BS-3 Three Stage Band Filter Unit.....	\$27.00
1—Hammarlund No. RF-3 Three Stage Screen Grid Amplifier Unit.....	35.00
1—Hammarlund No. SD Knob Control Drum Dial.....	4.00
1—Hammarlund No. SPC Shielded Polarized R.F. Choke.....	1.50
1—Hammarlund No. AF-2 First Stage Audio Transformer.....	8.00
1—Hammarlund No. AF-4 Push Pull Input Transformer.....	8.00
1—Hammarlund No. AFM Push Pull Output Transformer.....	8.00
1—Hammarlund No. PS-45 Power Supply Unit for Push Pull '45s.....	24.00
3—Hammarlund No. TS Screen Grid Tube Shields @ 60c ea.....	1.80
1—Aerovox No. CHQ-30 Filter Condenser Block.....	16.50
3—Aerovox No. BP-3 Triple By-Pass Condensers @ \$1.60 ea.....	4.80
1—Yaxley No. 810-C Center Tapped 10 ohm Resistor.....	.30
1 pr. Yaxley No. 422 Insulated Phono Tip Jacks.....	.25
1—Yaxley No. 401-S Speaker Twin Tip Jack.....	.25
1—Electrad No. RHQ-30 Voltage Divider.....	2.50
1—Electrad No. 3 Flexible Grid Resistor, 800 ohms.....	.35
1—Electrad No. 3 Flexible Grid Resistor, 2000 ohms.....	.40
2—Electrad No. 3 Flexible Grid Resistors, 400 ohms @ 35c ea.....	.70
3—Electrad No. 3 Flexible Filter Resistors, 5000 ohms @ 40c ea.....	1.20
1—Electrad Royalty Volume Control Potentiometer, 25,000 ohms, special taper.....	2.00
1—Eby No. 6-11 Two Prong Tube Socket marked "Amperite".....	.25
1—Eby No. 6-11 Four Prong Tube Socket marked 280.....	.30
2—Eby No. 6-11 Four Prong Tube Sockets marked 245 @ 30c ea.....	.60
2—Eby No. 6-11 Five Prong Tube Sockets marked 227 @ 35c ea.....	.70
3—Eby No. 6-11 Five Prong Tube Sockets marked 224 @ 35c ea.....	1.05
1—Eby Triple Binding Post Strip.....	.60
1—Hart & Hegeman No. 20510 Phono Toggle Switch.....	.60
1—Hart & Hegeman No. 20510 Line Toggle Switch.....	.60
1—Sangamo "Illini" Mica Fixed Condenser, .001 mfd.....	.45
1—Beaver-Arrow Handle Cap, Cord Connector and Silk Cord.....	1.25
1—Beaver No. L-14 Duplex Receptacle.....	.70
1—Arrow No. 8339 Plug Type Midget Receptacle.....	.35
1—HiQ-30 Foundation Unit Code QFU-30 (containing diagrams, illustrations, and complete assembling, wiring and operating instructions, drilled steel chassis, Bakelite panel, condenser shaft coupling, walnut knobs, rubber grommets, fixed resistance units, nuts, bolts and screws, washers, solder, and all special hardware for constructing the HiQ-30 Receiver).....	8.50
Total List Price.....	\$162.50

Parts may be ordered separately from the above schedule.

HAMMARLUND HiQ-30 MANUAL

"HiQ-30" BATTERY RECEIVER

Complete parts for constructing the famous "HiQ-30" Phono-Radio Receiver for battery operation. Assembling and operating instructions packed with each Unit. Parts may be ordered separately from the following schedule.

Complete Parts Code 30-R-BAT	\$119.15
1—Hammarlund No. BS-3 Three Stage Band Filter Unit.....	\$27.00
1—Hammarlund No. RF-3 Three Stage Screen Grid Amplifier Unit.....	35.00
1—Hammarlund No. SD Knob Control Drum Dial.....	4.00
1—Hammarlund No. SPC Shielded Polarized R.F. Choke.....	1.50
1—Hammarlund No. AF-2 First Stage Audio Transformer.....	8.00
1—Hammarlund No. AF-4 Push Pull Input Transformer.....	8.00
1—Hammarlund No. AFM Push Pull Output Transformer.....	8.00
3—Hammarlund No. TS Screen Grid Tube Shields @ 60c ea.....	1.80
3—Aerovox No. BP-3 Triple By-Pass Condensers @ \$1.60 ea.....	4.80
1 pr. Yaxley No. 422 Insulated Phono Tip Jacks.....	.25
1—Yaxley No. 401-S Speaker Twin Tip Jack.....	.25
1—Yaxley No. 669 Cord Connector and Cable.....	3.25
2—Yaxley No. 415 Pup. Plugs @ 10c ea.....	.20
6—Yaxley No. 810 Resistors, 10 ohms, @ 15c ea.....	.90
1—Yaxley No. 8008 Resistor, .8 ohms.....	.15
3—Electrad No. 3 Flexible Filter Resistors, 5000 ohms @ 40c ea.....	1.20
1—Electrad Royalty Volume Control Potentiometer, 25,000 ohms, special taper.....	2.00
2—Eby No. 6-11 Four Prong Tube Sockets marked 171-A @ 30c ea.....	.60
2—Eby No. 6-11 Four Prong Tube Sockets marked 112A @ 30c ea.....	.60
3—Eby No. 6-11 Four Prong Tube Sockets marked 222 @ 30c ea.....	.90
1—Eby Triple Binding Post Strip.....	.60
1—Hart & Hegeman No. 20510 Phono Toggle Switch.....	.60
1—Hart & Hegeman No. 20510 Line Toggle Switch.....	.60
1—Sangamo "Illini" Mica Fixed Condenser, .001 mfd.....	.45
1—HiQ-30 Foundation Unit Code QFU-30 (containing diagrams, illustrations, and complete assembling, wiring and operating instructions, drilled steel chassis, Bakelite panel, condenser shaft coupling, walnut knobs, rubber grommets, fixed resistance units, nuts, bolts and screws, washers, solder, and all special hardware for constructing the HiQ-30 Receiver).....	8.50
	<hr/>
	\$119.15

Parts may be ordered separately from the above schedule.

HAMMARLUND HiQ-30 MANUAL

"HiQ-30" TUNERS

Complete parts for constructing the tuning units, including power supply and detector, of the "HiQ-30" A.C. or Battery Operated Receivers. The A.C. Tuner has self-contained power supply. Either Tuner can be coupled with any standard audio power amplifier having self-contained power supply. Built of completely assembled wired and tested Hammarlund HiQ-30 units. Full assembling and operating instructions packed with each Tuner.

A.C. TUNER

Complete Parts	
Code 30-T-AC	\$138.65
1—Hammarlund No. BS-3 Three Stage Band Filter Unit	\$27.00
1—Hammarlund No. RF-3 Three Stage Screen Grid Amplifier Unit.....	35.00
1—Hammarlund No. SD Knob Control Drum Dial	4.00
1—Hammarlund No. SPC Shielded Polarized R.F. Choke	1.50
1—Hammarlund No. PS-45 Power Supply Unit for Push Pull '45s.....	24.00
3—Hammarlund No. TS Screen Grid Tube Shields @ 60c ea.....	1.80
1—Aerovox No. CHQ-30 Filter Condenser Block	16.50
3—Aerovox No. BP-3 Triple By-Pass Condensers @ \$1.60 ea.....	4.80
1—Yaxley No. 810-C Center Tapped 10 ohm Resistor .....	.30
1 pr. Yaxley No. 422 Insulated Phono Tip Jacks .....	.25
1—Yaxley No. 401-S Speaker Twin Tip Jack .....	.25
1—Electrad No. RHQ-30 Voltage Divider	2.50
1—Electrad No. BHQ-30 Bleeder Resistor	1.50
3—Electrad No. 3 Flexible Filter Resistors, 5000 ohms @ 40c ea.....	1.20
1—Electrad No. 3 Flexible Grid Resistor, 800 ohms.....	.35
2—Electrad No. 3 Flexible Grid Resistors, 400 ohms @ 35c ea.....	.70
1—Electrad Royalty Volume Control Potentiometer, 25,000 ohms, special taper	2.00
1—Eby No. 6-11 Two Prong Tube Socket marked "Amperite" .....	.25
1—Eby No. 6-11 Four Prong Tube Socket marked 280 .....	.30
1—Eby No. 6-11 Five Prong Tube Socket marked 227 @ 35c ea.....	.35
3—Eby No. 6-11 Five Prong Tube Socket marked 224 @ 35c ea.....	1.05
1—Eby Triple Binding Post Strip.....	.60
1—Hart & Hegeman No. 20510 Phono Toggle Switch .....	.60
1—Hart & Hegeman No. 20510 Line Toggle Switch .....	.60
1—Sangamo "Illini" Mica Fixed Condenser, .001 mfd.....	.45
1—Beaver-Arrow Handle Cap, Cord Connector and Silk Cord	1.25
1—Beaver No. L-14 Duplex Receptacle.....	.70
1—Arrow No. 8339 Plug Type Midget Receptacle .....	.35
1—HiQ-30 Foundation Unit Code QFU-30 (containing diagrams, illustrations, and complete assembling, wiring and operating instructions, drilled steel chassis, Bakelite panel, condenser shaft coupling, walnut knobs, rubber grommets, fixed resistance units, nuts, bolts and screws, washers, solder, and all special hardware for constructing the HiQ-30 Receiver).....	8.50
	\$138.65

BATTERY TUNER

Complete Parts	
Code 30-T-BAT	\$93.80
1—Hammarlund No. BS-3 Three Stage Band Filter Unit.....	\$27.00
1—Hammarlund No. RF-3 Three Stage Screen Grid Amplifier Unit.....	35.00
1—Hammarlund No. SD Knob Control Drum Dial	4.00
1—Hammarlund No. SPC Shielded Polarized R.F. Choke	1.50
3—Hammarlund No. TS Screen Grid Tube Shields @ 60c ea.....	1.80
3—Aerovox No. BP-3 Triple By-Pass Condensers @ \$1.60 ea.....	4.80
1 pr. Yaxley No. 422 Insulated Phono Tip Jacks .....	.25
1—Yaxley No. 401-S Speaker Twin Tip Jack .....	.25
1—Yaxley No. 660 Cord Connector and Cable	3.00
6—Yaxley No. 810 Resistors, 10 ohms, @ 15c ea.....	.90
1—Yaxley No. 80325 Resistors, 3¼ ohms @ 15c.....	.15
3—Electrad No. 3 Flexible Filter Resistors, 5000 ohms @ 40c ea.....	1.20
1—Electrad Royalty Volume Control Potentiometer, 25,000 ohms, special taper	2.00
1—Eby No. 6-11 Four Prong Tube Socket marked 112A .....	.30
3—Eby No. 6-11 Four Prong Tube Socket marked 222 @ 30c ea.....	.90
1—Eby Triple Binding Post Strip.....	.60
1—Hart & Hegeman No. 20510 Phono Toggle Switch .....	.60
1—Hart & Hegeman No. 20510 Line Toggle Switch .....	.60
1—Sangamo "Illini" Mica Fixed Condenser, .001 mfd.....	.45
1—HiQ-30 Foundation Unit Code QFU-30 (containing diagrams, illustrations, and complete assembling, wiring and operating instructions, drilled steel chassis, Bakelite panel, condenser shaft coupling, walnut knobs, rubber grommets, fixed resistance units, nuts, bolts and screws, washers, solder, and all special hardware for constructing the HiQ-30 Receiver).....	8.50
	\$93.80

Parts may be ordered separately from the above schedule.

HAMMARLUND HiQ-30 MANUAL

PRICE LIST *of* ACCESSORIES

Speakers, Amplifiers, Phono Motors, Pickups, Tubes, Etc.

Dynamic Speakers

Without Input Transformers, to work with Hammarlund AFD output transformers.

HAMMARLUND D-10	\$35.00	JENSEN AUDITORIUM	70.00
(Without 380 Rectifier Tube)		ROLA CONCERT	39.00
		ROLA AUDITORIUM	55.00
JENSEN CONCERT	35.00	WRIGHT DE COSTER.....	68.50
		BEST THEATRE DYNAMIC	95.00
		(Home Model)	

NOTICE

The AF-M Output Push-Pull Audio Transformer should be used with all magnetic speakers and all dynamic speakers, except such dynamic speakers specially ordered without the input transformers regularly furnished.

The AF-D Output Push-Pull Audio Transformer is designed to work directly into the moving coil of dynamic speakers having an impedance of approximately 10 ohms.

If the output transformer furnished with your kit is not of the desired type, Hammarlund-Roberts will gladly exchange it if returned in good condition with postage to cover return shipment.

Radio Phonograph Accessories

BODINE MOTOR AND TURNTABLE.....	\$35.00
AUDAK PHONO PICKUP, <i>Special HiQ-30 Model</i>	21.00
AUDAK PHONO PICKUP VOLUME CONTROL.....	2.50

Cunningham Tubes

C-327	\$2.50	C-324	\$4.00	CX-380.....	\$3.00	CX-345	\$ 3.50
CX-112A.....	2.25	CX-322	4.50	CX-381	7.25	CX-350	11.00

Arcturus Tubes

127.....	\$2.50	124.....	\$4.00	180.....	\$3.00	145.....	\$3.50
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All tubes are individually tested, and push-pull tubes sold only in matched pairs.

HAMMARLUND HiQ-30 MANUAL

Amperite

No. 11-20 Self-Adjusting Line Voltage Regulator Tube.....\$3.50

Amertran Power Amplifiers

AMERTRAN HIPOWER BOX No. 21D..... 130.00
AMERTRAN TWO STAGE PUSH PULL AMPLIFIER No. 2AP..... 80.00
(Less Tubes)

Amertran Concert Hall Amplifiers

Panel Type, 3 Stage, Push Pull 245 Amplifiers
with A.C. Power Supply.....\$600.00
Panel Type, 3 Stage, Push Pull 226 and Push
Pull 250 with A.C. Power Supply.....1200.00
(Less Tubes)

Samson Pam Amplifiers

SAMSON PAM 9—250 Push Pull Power Amplifier.....\$137.50
SAMSON PAM 19—227 and 250 Push Pull Power Amplifier 130.00
(Less Tubes)

Hammarlund A.C. Push Pull Power Amplifier

Code No. PA245, Complete parts, less tubes..... 77.60

Set Testing Apparatus

Weston Model 547 Radio Set Tester.....\$125.00

Complete information and descriptive literature concerning any listed accessory will be supplied on request to either Hammarlund-Roberts, Inc., or the manufacturers.

Note

PLEASE MAIL COUPON
AT THE BOTTOM
OF THIS PAGE

HAMMARLUND-ROBERTS, INC.,
424-438 West 33rd Street,
New York, N. Y.

- Please advise me of name of nearest Hammarlund-Roberts Custom-Set builder who will demonstrate the HiQ-30.
- Please send me news of latest scientific developments in radio broadcast receiver theory and construction. (Reports mailed at irregular intervals whenever developments warrant.)
- I am interested in the Hammarlund-Roberts Special Custom-Radio Builders Proposition.
- Please send me literature covering all Hammarlund Products.
- I acknowledge receipt of the HiQ-30 Manual.

Name

Address

City State

HAMMARLUND HiQ-30 MANUAL

HiQ-30 CABINETS

Open up Gravure Insert (opposite) for illustrations and specifications of the 9 beautiful, specially selected HiQ-30 cabinets.

OXFORD	\$ 28.50, F.O.B. Racine, Wis.
STRATFORD	55.00, F.O.B. New York City.
RALEIGH	75.00, F.O.B. Bay City, Mich.
ARDEN	96.50, F.O.B. Bay City, Mich.
CAMBRIDGE	98.00, F.O.B. Racine, Wis.
YORKSHIRE	75.00, (With Motor and Pickup.....\$143.00), F.O.B. Racine, Wis.
BLACKSTONE	150.00, F.O.B. Saginaw.
WINDSOR	175.00, (With Bodine Motor, Audak Pickup, Volume Control and Needle Cups..... 233.50), F.O.B. Saginaw.
MILAN	600.00, F.O.B. Bay City, Mich.



Special
"HiQ-30"
CABINETS



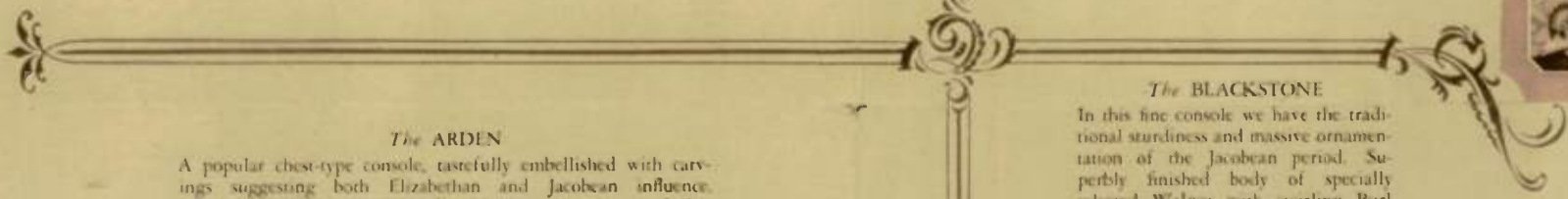
The MILAN
 A magnificent period console exquisitely decorated with hand-carvings of the Italian Renaissance. Truly representative of the finest cabinet craftsmanship and worthy of the most exclusive environment. Doors of choicest Butt Walnut with overlays of Carpathian Elm and Maidou Burl. 49½" high, 37½" wide, 16¼" deep.



The RALEIGH
 An Elizabethan period console with dignity suitable to any home furnishing scheme. Front panels of half-diamond matched Oriental Walnut with Satinwood overlays. Sliding doors of two-piece matched Butt Walnut; non-rattle construction. 43" high, 27" wide, 16" deep.

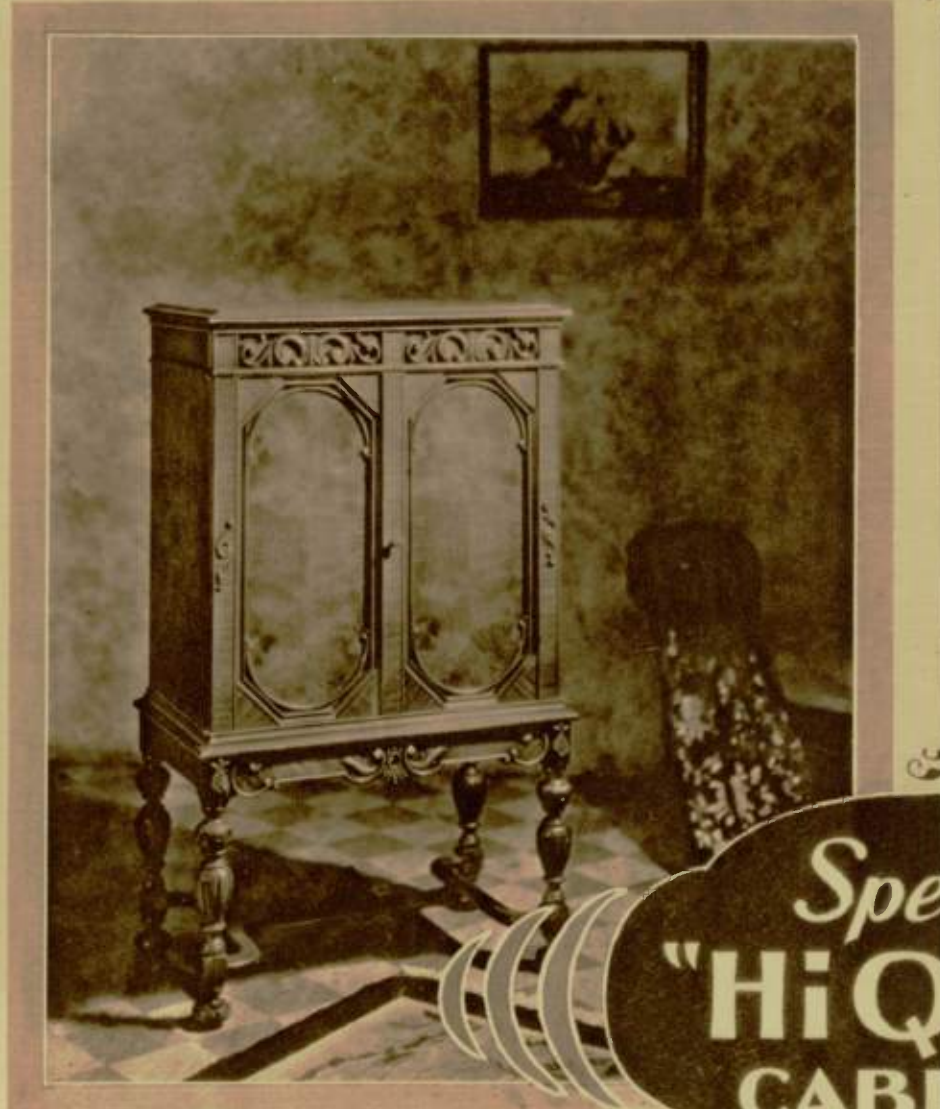


The BLACKSTONE
 In this fine console we have the traditional sturdiness and massive ornamentation of the Jacobean period. Superbly finished body of specially selected Walnut with swirling Burl Walnut grain in a lighter tone on the doors. Especially approved by Harward acoustical experts. 49½" high, 29" wide, 18" deep.



The ARDEN
 A popular chest-type console, tastefully embellished with carvings suggesting both Elizabethan and Jacobean influence. Matched Butt-Walnut plywood, with decorative inlays of Elm and Saffin wood. Recommended for battery-operated chassis. Ample room for all batteries. 43" high, 32" wide, 16" deep.

The O...
 A superior table cabinet for use where floor space is limited. In A.C. or D.C. chassis. Has recessed front-panel and diagonal piano hinge. 10½" high, 29"



Spe
"HiQ"
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The CAMBRIDGE

A charming and practical Georgian combination of library desk and radio. Two-toned Walnut body with Burl and Satinwood overlays. Radio panel of natural Mahogany. Stationery compartments on each side of the speaker. The desk is part of the drawer. 52 1/4" high, 28 1/4" wide, 18" deep.



The WINDSOR

This rugged cabinet of Tudor design is the special choice of Hammarlund engineers for the "HiQ. 50" Radio-Phonograph combination. Contains record compartment and ample space for all mechanism. Oriental Walnut body with lighter toned side panels and Burl Walnut sliding doors. Richly carved and beautifully finished. 49 1/2" high, 32" wide, 20" deep.



FORD
 those who value portability, or
 encloses the complete "HiQ. 50"
 hand-rubbed, solid Walnut, with
 all carved corners. Full-length
 wide, 16" deep.

The STRATFORD

This classic console will appeal to lovers of the simple lines characteristic of modern furniture. Solid hand-rubbed Oriental walnut with diamond-matched sliding doors, fluted side panels and spindle turned legs reminiscent of the Jacobean period. 51 1/2" high, 28 1/4" wide, 20" deep.

The YORKSHIRE

One of the two beautiful "HiQ. 50" Radio-Phonograph combinations of Elizabethan design. Perfectly matched two-toned Walnut with quartered Burl and Satinwood overlays, richly hand-rubbed. Has sliding doors and is equipped with a phonograph motor board and record compartment. 48 1/2" high, 27" wide, 17" deep.



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CABINETS

*Masterpieces of the woodworkers' art,
especially selected for beauty of design,
fine craftsmanship and acoustical quality*

OBVIOUSLY, a handsome cabinet cannot help a poor radio to perform. But it cannot be denied that a good radio *deserves* the best of cabinets.

Then, radio becomes something more than merely a source of entertainment. It becomes furniture—a vital part of the decorative setting of one's household—a feast for the eyes as well as the ears.

Special selection of the cabinets shown in this insert was based primarily on acoustical properties, because radio cabinet construction has a great deal to do with the tone obtainable from modern high-power dynamic speakers. *Realism*, free from hollow "barrel" effects is essential.

Next in importance is sturdy construction. This, too, not only affects tone, but lasting qualities as well.

All of these features, as well as superb beauty will be found in the nine special "HiQ-30" Cabinets described here. They include six charming consoles, a table model and two radio-phonograph combinations which will meet the requirements of the most exacting taste as well as limitations in price. Two of this splendid cabinet group—The "Blackstone" and The "Windsor" are particularly distinguished by being the personal selections of Hammarlund engineers on account of their *ideal* adaptability to the tone characteristics of the "HiQ-30" Receiver.

See Page 48 of the "HiQ-30" Manual
for prices and other details.

(Illustrations Inside)

RADIO, like motor cars, has reached the stage in its development where *appearance* counts for a great deal more than ever before.

With this in mind, Hammarlund has given close attention this season to providing cabinets of a quality appropriate for housing the finest radio mechanism ever offered to the public.

Nine beautiful specially selected "HiQ-30" Cabinets are pictured and described in this insert.

The standard size (7" x 12 $\frac{3}{4}$ " x 24") of the "HiQ-30" chassis permits, however, unrestricted choice of stock cabinets.

HAMMARLUND-ROBERTS, INC., 424-438 West 33rd Street, New York



CABINETS

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