

HAMMARLUND SHORT WAVE MANUAL

**THIRD
EDITION**

TEN CENTS THE COPY

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. . . This edition of the Hammarlund Short-Wave Manual, proofs of which you have sent me, looks excellent. It should be extremely interesting to anyone interested in building sets for short-wave work. Knowing, as I do the history of most of the set designs given and the manner in which they are described, I can heartily endorse them for the set builder.—*Laurence M. Cockaday, Editor, Radio News.*

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. . . After having been permitted to look over the proofs of the new 1936 Hammarlund Short Wave Manual, I certainly feel that the Hammarlund Manufacturing Company has outdone itself in giving the short wave experimenter and builder a Manual that is outstanding in all respects.

. . . It provides sufficient variety to suit all tastes and gives more than the usual amount of information so necessary to the earnest short wave constructor who can never get too much of such help. The new Manual should be treasured by all those who are fortunate enough to obtain one.—*Hugo Gernsback, Editor and Publisher of Radio Craft, Short Wave & Television, etc.*

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. . . Every well-known national radio magazine has contributed some worth-while contribution to the art in the form of a modern, simple short-wave receiver. The magazine technical staffs vie with each other for the honors. But in the Hammarlund Short Wave Manual you find the most important contributions from all of these radio magazine experts. Thus this Manual brings you, under one cover, the complete descriptions of everything that is best in short-wave receiver design. There is not a receiver description in this Manual which is not a top-notch.—*H. W. Dickow, Publisher of "The Radio Handbook."*

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The
Hammarlund 1936
Short Wave Manual

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THIRD EDITION

AN AUTHENTIC HIGH
FREQUENCY GUIDE
FOR THE AMATEUR,
EXPERIMENTER, AND
LISTENER-IN

THE HAMMARLUND MANUFACTURING CO., Inc.
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Introduction

IN this manual will be found the instructional details on what is, probably the most carefully selected and comprehensive group of inexpensive short-wave receiver designs ever published in a single volume.

The selections were made by the editors of five of the leading radio publications of the United States from among the most popular and efficient designs described in their publications during the past year or so. Then models of the receivers were constructed and put through their paces in the laboratory and "on the air" with the result that the thirteen designs presented here represent the cream of the hundreds offered to the home constructor during past months.

Inasmuch as the most popular designs are the more simple ones that combine low cost with efficiency, the receivers described here naturally fall in that class. The requirements of the constructor who is looking for more advanced design are not overlooked however. Then, too, while the demand is greatest for short-wave broadcast receivers, the special requirements of receivers for operation on the amateur bands have not by any means been neglected as is indicated by the fact that band-spread designs and even a 5-meter receiver have been included in this group.

Having arrived at the final selection of receivers, the next step was to turn the models over to the experimental laboratory for careful study to determine whether any of them could in any way be improved. The fact that several of them came out of this laboratory with improvements should not be taken as a reflection on the original designers or the publications in which the original descriptions appeared. The changes made mainly took the form of substitution of more modern tubes or more efficient coils, with some changes in associated parts to adapt them to these new units. In a few other instances changes which brought about a considerable improvement in efficiency at a slight increase in parts cost were considered justified and were therefore made.

In some respects reception of short-wave signals differs considerably from reception of signals on the broadcast band above 200 meters. Perhaps the most prominent difference is found in the astonishing distances that can be covered with even the most simple one or two

tube receivers. It is no particular feat, for instance, to hear the European stations and others from remote parts of the globe quite regularly with such receivers.

Such distance reception is not limited to the hours of darkness, as is DX reception on the broadcast band. In fact some of the most phenomenal reception is obtained in the daytime.

Generally speaking the larger the wavelength, the later in the day will best reception occur. The 16 meter broadcast stations, for instance, are best during the morning hours. Those operating on 19 meters come in well during the late morning and early afternoon hours. The 25 and 31 meter stations usually are heard with maximum volume during the late afternoon and early evening hours and those on 50 meters are best received after darkness has fallen.

The foregoing holds true with few exceptions in North America. One of these exceptions is reception from Australian stations. These operate around 31 meters, yet are heard best by Americans in the early morning before breakfast (at which time it is evening in Australia and New Zealand).

There are explanations for the conditions mentioned, some of them being rather involved. However, the important thing, from the standpoint of the short-wave listener, is that these conditions do exist. They mean that the old practice of sitting up all night for good DX reception is a thing of the past, and that practically any waking hour is a good one for foreign DX reception, on one wave-length or another in the short-wave range.

Tuning a short-wave receiver is a far more critical business than is the same operation on the broadcast band. This is not due to any electrical peculiarities inherent in the short waves and is best explained by an arithmetical example.

Assume that a receiver is capable of separating stations which are broadcasting at frequencies 10 kilocycles apart. In the broadcast band of 1500 to 550 kc. there would be room for 96 such station channels. If the tuning dial were properly marked off in 96 divisions therefore, a station would be heard at every division on this dial.

Now, going down to the short-waves, the tuning range of a single coil may be from 20 meters to 50 meters which means, in terms of frequencies, from 15,000 kc.

to 6,000 kc. Instead of providing for 96 channels there would be 900 such 10 kilocycle channels and with the same dial marking as mentioned above, there would be 10 channels to every division of the dial instead of only one. It therefore follows that in tuning the short-wave stations the adjustment of the dial has to be exact to a small fraction of a division. A high ration tuning dial is one way of accomplishing this.

Undoubtedly the most practical method is found in the use of some sort of band-spreading system. The most common of these is the one in which a small variable condenser is connected directly across the regular tuning condenser, the small condenser being employed for the exact tuning. Take as a specific example a short-wave receiver with a coil plugged in which covers the range of 20 to 50 meters mentioned above, and employing a tuning condenser of 140 mmfd. maximum capacity. Rotating his condenser through its entire capacity range tunes the receiver through a frequency range of 15,000 to 6000 kc., a span of 9000 kc. or 900 10-kc. channels. Now, suppose a shunt variable condenser of much smaller capacity is placed across this 140 mmfd. condenser. Swinging this small condenser through its entire range will result in a relatively small capacity variation and therefore a relatively small frequency range. With the selection of the proper small capacity, for instance, the frequency range with the smaller condenser may be only 1/10th as great as with the larger condenser and in such a case there would be only 90 channels within the range of this condenser, and tuning would become as non-critical as that in the average broadcast receiver.

When this system is employed no additional coils are required and the only extra cost is that of the small condenser. The large condenser is employed to tune the receiver into the particular band desired, say the 25 meter broadcast band. For instance, then the small condenser is employed to tune in the stations within that band. These stations will then be spread out over perhaps 15 or 20 degrees on the band-spread dial whereas they would fall within 1 or 2 degrees if tuned on the dial of the larger condenser alone.

Variable condensers, such as the Hammarlund Type MC-120B, are available which are especially intended for parallel band-spread use. These are made with the 2 condenser sections combined in a single unit but with separate shafts. These condensers are principally used in "ham" receivers.

For those who are interested in a more

detailed study than that presented here, an interesting discussion of band-spreading methods, analyzing the various methods in considerable detail, will be found in the October, 1934 issue of "Radio News."

There is a considerable difference in opinion as to what constitutes the most desirable type of receiver for short-wave work. There are many who prefer the



POPULAR JAPANESE SHORT WAVE TRANSMITTER

The station which is heard the world over and is the goal of listeners.

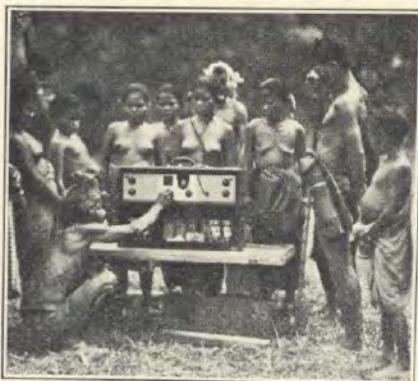
modern superheterodyne and a host that swear by the regenerative receiver.

There is much to be said for both types of receivers. Where a single receiver is required to cover both the short-wave and broadcast bands, the superheterodyne receiver undoubtedly has the edge because of its superior selectivity on the broadcast band. For purely short-wave work it can safely be said that either of these general types of receivers, if well designed and constructed, is capable of excellent service.

Among those who "build their own" the regenerative type of receiver is by far the most popular. It is less costly, easier to build, more easily understood by the novice and more economical in current consumption. Its selectivity may not equal that of a good superheterodyne, but it is selective enough for most purposes. Its sensitivity is as great as can be used in many locations—enabling it to bring in any signals that are above the local noise level of the average location.

No mention has been made of either straight tuned r. f. receivers, or those employing super-regeneration, because neither one of these rates serious consideration for general short-wave work between 15 meters and 200 meters.

Super-regeneration is without a rival for use in inexpensive receivers to operate on wavelengths below 10 meters because at these extreme frequencies neither tuned radio-frequency amplification nor normal regeneration are useful.



SHORT WAVE FANS IN JUNGLES OF MALACCA

A group of Jungle Dwarfs (the Sakai) tuning in on a short wave regenerative receiver brought to them by Frank Buck. The variable condensers, sockets, coils, etc. are all HAMMARLUND.

If the signal voltage of a distant station is only in the neighborhood of a few millionths of a volt (as is very often the case) at the antenna it is obvious that losses or inefficiency of any kind may make it quite impossible to hear that signal. Whether one's personal preference is for a superheterodyne or a regenerative receiver, therefore, the most important single factor in the success of the receiver, outside of the choice of a good design to follow, will be the care exercised in selecting the parts.

Some points of inefficiency are generally recognized. In the matter of insulation, for instance, the average short-wave enthusiast has learned that nothing short of the best is good enough. This explains the almost universal preference for Isolantite insulated tuning condensers and coil sockets. There are, however, other factors which are less often considered. Perhaps the most important of these is the plug-in coil.

A recent study of the low and medium-priced plug-in coils available on the open market showed them to have an average "Q" of approximately 100 (at 15 megacycles) whereas the "Q" of a perfect coil should approximate 200. Inasmuch as "Q" represents the efficiency of a coil in a tuned circuit, the implication of these figures is obvious. In actual practice, a "Q" of 200 is not obtainable in practical plug-in coils because of certain inherent losses introduced by the metal prongs of the coil form, or metal near the coil when in position in the receiver.

Hammarlund has made high-grade plug-in coils for years, but these have been beyond the purse of the average set builder. However, after a careful in-

vestigation, the conclusion was reached that plug-in coils of excellent characteristics could be produced to sell at a low price, especially as much of the research and development work involved in such an effort had already been accomplished in producing the coils employed in the Hammarlund "Pro" receivers. The design work was therefore started and the new coils are now on the market at the same price as ordinary coils. The forms employed in these new coils are moulded of XP-53, an exclusive Hammarlund product developed for this purpose. In this new insulating material the losses have been reduced to a point where it closely approaches the low-loss characteristics of the most expensive dielectric materials. Even the use of artificial coloring has been avoided, leaving the material a natural light tan. In production, these characteristics are scrupulously maintained and even improved by moulding the XP-53 in a groove ribbed shape to reduce the contact area between winding and form to a minimum.

As matters of utility and convenience, the coil forms are moulded with an inside shoulder which permits mounting the new Hammarlund type APC trimming condensers within the form, as illustrated below, where they are required for special band-spread or "fixed tune" purposes. A generous rim is provided at the top edge of the form, making it easy to grasp, and a removable wavelength index card is provided at the top of the form, on which the range of the coil is printed. Where forms alone are purchased, for winding coils at home, these index cards are left blank so that the builder can write in the range of the finished coil.

The development of the coil form was,



APC MIDGET IN XP-53 FORM
A cutaway view of the new XP-53 HAMMARLUND coil form with the popular air padding condenser, type APC, mounted on the special threaded shelf.



HAMMARLUND SHORT WAVE RADIO ON THE MORRISSEY

Oscar Hammarlund (left) at the controls of a Hammarlund "Pro" with Capt. Bob Bartlett looking on, on board the Morrissey, the North Pole schooner.

of course, only one step in the process of design. The design of the windings for the various frequency ranges represents the real achievement of the engineers. The first step in this work was to determine the most practical frequency ranges for each coil—not in an effort to cover as much of the short-wave band as possible with each coil but to determine the required range for each coil in its relationship to the important short-wave stations. It is a well established fact that the greatest short-wave tuning efficiency is obtained when the coil inductance is such that relatively little tuning capacity is required to tune the coil to the desired frequency. The problem, therefore, was to allocate the ranges so that as many as possible of the important frequency bands could be tuned at relatively low capacity values. The bands aimed at primarily were the 19, 25, 31 and 49 meter broadcast bands and the 20, 40, 80 and 160 meter amateur bands. In the final coils all of these are tuned with highly favorable capacity ratio. At the same time ample overlap is provided between ranges. The entire band from 17.5 meters up to, and including approximately, one third of the regular broadcast band is covered with a set of four coils, using a 140 mmf. Hammarlund condenser, as follows:

- Coil 1—17,100 kc. to 7,300 kc. (17.5 to 41 meters).
- Coil 2—9,200 kc. to 4,000 kc. (32.6 to 75 meters).
- Coil 3—4,500 kc. to 2,000 kc. (66.6 to 150 meters).
- Coil 4—2,200 kc. to 1,100 kc. (136 to 270 meters).

In addition to the above coils, a separate coil is available to cover the bal-

ance of the broadcast band. This coil has a range of 1,200 to 535 kc. or 250 to 560 meters. An additional coil is also available to cover the ultra high frequency range of 30,000 to 15,000 kc., or 10 to 20 meters.

It is well to point out here that the above frequency ranges were measured under actual operating conditions, with the coil plugged into a typical bandspread (parallel condenser) receiver and the antenna connected. If anything these ranges are conservative because the test receiver was completely shielded and the proximity of the shield walls would tend to reduce the coil ranges at the high-frequency ends. This is important because it means that the builder of a receiver can depend on these coils covering the ranges specified.

Having determined the approximate ranges for the coils, there were left the numerous other factors for study, such as the best form factor, the best wire sizes and spacing, the best positions for the coils on the forms and the spacing between windings. Most of these vary with frequency and therefore each individual coil represented a separate problem in itself.

Space does not permit going into more detail here but the final proof of the excellence of these coils is found in the fact that the "Q" (at 15 megacycles) was found to exceed 150. This is believed to be the highest value of efficiency obtainable in plug-in coils of conventional type.

Finally, the prong connection arrangement is worthy of mention. There have in the past been no standards as to which prong should be the control-grid connection, which the plate, etc., in any but 4-prong coils; and even in these the standard was not definite. Now, through the efforts of some of the manufacturers



REMOTE SHORT WAVE WORK

Sports and other remote broadcasts are sent to the main transmitter by portable short wave equipment as shown. Note the antenna—a loop of tubular copper



SHORT WAVING FROM AEROPLANES

A radio operator talking to his home office by way of short waves.

and of the magazine "Radio News" an attempt is being made to standardize these connections. The standards proposed to date have been adopted in these Hammarlund coils.

Proper attention and forethought in planning the layout and wiring is essential if a short-wave receiver is to prove efficient. This is particularly true of the parts involved in the tuned circuit of the detector (and the r. f. tube if one is used). The coil should be placed a distance at least equal to its radius from other parts such as the tuning condenser, tube shields, metal panels, metal chassis, etc. Otherwise such metal masses will seriously reduce the efficiency of the coil. The coil, the tube and the tuning condenser should, except for this limitation, be placed as close together as practical in order that all wiring of the grid and tuned circuits will be as short as possible. Then this wiring should be run in straight lines—avoiding right-angle bends, as one would the plague.

A metal panel or chassis should not be depended upon as a conductor for r. f. circuits. All r. f. connections should be made by means of wires, and these wires all connected together at one point of the metal chassis or panel.

One part of the average short-wave receiver that receives too little attention is the r. f. filter in the plate circuit of the detector. Unless a really good filter is used here the r. f. currents get into the headphones or into the audio amplifier where they tend to increase body capacity effects, cause instability and may even make it difficult to obtain proper regeneration. A filter consisting of two chokes connected in series and with

.00025 mfd. by-pass condensers, one connected from the junction of the two chokes to filament or ground, and the other from the B-plus end of the second choke to ground, will provide good results. The chokes required for such use may be of 1 or 2 millihenries inductance. The Hammarlund type (CH-X) are suitable, are easy to wire, and inexpensive.

There are several factors which contribute to smooth and effective regeneration. The antenna series condenser employed in most short-wave receivers has a material influence because it determines the degree of antenna coupling and therefore the amount of energy absorbed from the regenerative circuit by the antenna. The voltages (plate and screen) applied to the tube also influence regeneration, as does the plate by-pass capacity.

Where "fringe howl" a terrific audio disturbance which occurs as the tube goes into or out of oscillation is experienced, the condition may sometimes be improved by the adjustments of the antenna or plate by-pass condensers. A more likely remedy, however, is to shunt the headphones or audio transformer primary (whichever is connected in the detector plate circuit) with a fixed resistor of 100,000 ohms or higher.

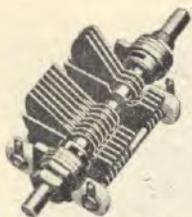
For simple regenerative receivers the antenna which will provide the best general results is the ordinary "L" type with a single lead-in wire. This antenna should be as high and long as practical, the lead-in should be kept clear of walls or other objects, the insulation should be good, and the antenna and lead-in should be one continuous length of wire without joints. If joints are necessary, they should be carefully soldered.

Special antenna systems have their advantages in many cases—but for the most part are not entirely practical for use with any type of receiver in which the antenna is capacity coupled direct to the grid circuit of the first tube as is the case in the great majority of regenerative receivers.



POLICE ON SHORT WAVES

The elaborate short wave arrangement of the Police Department of New York City.

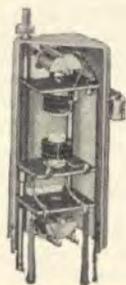


Band Spread Condenser

As explained on page 3, band spreading on short waves is a most effective feature. For this very important work, Hammarlund has produced the famous band spread condensers, a model of which is illustrated at the left. This model, known as the MC-120B is used in the A.R.R.L. "Ham" receiver described on page 26 of this manual. Its list price is \$3.00.

The tank section, or the larger capacity division of this condenser, may be set and locked at any desired capacity. This permits the tuning section to spread narrow frequency ranges over the entire dial regardless of the range of the band or the coils used.

Another important unit that Hammarlund has developed for short wave work is the new Hammarlund variable coupling air-tuned intermediate frequency transformer, shown here, below. These transformers are designed to permit continuous variation of the mutual inductance between primary and secondary throughout a wide range of values without otherwise effecting circuit constants. The approximate range of variation is from one-third critical coupling to over three times critical coupling. Both primary and secondary are thoroughly impregnated 3-pie Litz windings having the exceptionally high "Q" of 130 (power factor less than .008). The



Variable Coupling IFT

tuning condensers are the familiar and popular APC air dielectric type. The impregnated coils and low loss condensers result in a highly stable unit regardless of conditions of temperature or humidity. Both tuning adjustments are on one side of the aluminum shield which measures 2" x 2" x 5" high. Three of these units, known as the VT-465, are used in the 3-tube Pentode receiver described on page 22 of this manual. They list at \$5.50 each.

The popular APC air-padding condenser, which has so many important short wave applications is shown above. These ideal condensers maintain constant capacity under any conditions of temperature, humidity or vibration. One



Air Padding Condenser

of their ingenious features is the size. For instance the 100 mmf. units is only 1-7/32" x 15/16" x 1-1/2" high. The base is Isolantite of course, and the cadmium plated brass are soldered carefully to properly spaced soldered tie-bars. The sizes range from 25 mmf. to 100 mmf., the list price of the smallest one known as the APC-25, being only \$1.30 and the list price of the largest, the APC140, being only \$2.25.

Another important unit produced by Hammarlund for the short wave receiver is the midget type EC condenser which has so many uses. This is shown below. It is used for neutralizing, balancing and trimming. It is also excellent for adjusting multiple tune circuits or gang condenser units. It may be attached directly to the binding post of a socket or a condenser. The adjustment of the center screw provides a gradual capacity change over a wide range. The dielectric is mica, and the flexible plate is phosphor bronze. The base is bakelite, 1-1/4" x 11/16". The type EC-35, which has a range of from 3-35 mmf. lists at 40c.

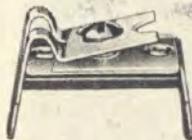


Type EC

A still tinier Hammarlund equalizing condenser is the type "MEX." It is so light in weight that it is self-supporting in wiring. In this type the base is Isolantite and only 5/8 x 3/4". The dielectric is mica and the spring plate of phosphor bronze. This model is made only in one size, having a range of from 3-30 mmf. Its list price is 30c.

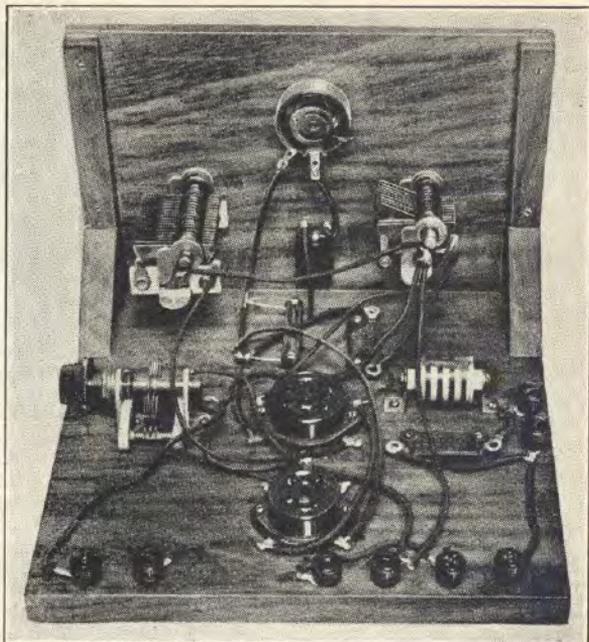
The Hammarlund aluminum tube shield also plays an important part in short wave receivers. The complete isolation afforded by this shield permits the use of the enormous amplification possibilities of the new tubes.

A special drawn-in neck completes the shielding between the control grid and the plate. A removable top is used to entirely shield the control grid cap. The body, cap and base are all made of heavy aluminum and designed for maximum cooling. Measures 45/8" high by 1 3/8" diameter, with standard mounting center of 1-27/32". The shield is known as the TS-50 and lists at \$4.00 each.



MEX

A Boy Scout's S. W. Receiver



THIS set was described in detail in "Radio News." This receiver was built by Scout Robert Crockett of Pelham, New York, and is a good example of a design which aims at a happy combination of efficiency and economy. It is assembled on a wood base and panel to avoid the expense of a metal chassis. Also, the dials used, cost but a few cents whereas dials of the vernier or drum types would add considerably to the overall cost. It will be noted, however, that the all important parts involved in the tuned circuits were selected with an eye for efficiency, as typified by the Hammarlund Isolantite insulated condensers.

The receiver employs relatively few parts and is a simple one to construct—easily within the ability of the novice who contemplates the construction of his first short-wave receiver. Further, it is one which, when completed, will give plenty of enjoyable reception. Scout Crockett has succeeded in tuning in some 300 short-wave stations with it.

No radical claims are made for the set

—such as loudspeaker operation, etc., but it will bring in the short-wave broadcast, amateur, police, aviation, television and commercial phone and telegraph stations with comfortable audibility. European short-wave broadcast stations are heard with plenty of volume for clear headphone reception.

One feature of this receiver which is out of the ordinary is the use of a midget air dielectric variable condenser (CI) in series with the antenna circuit. It has been a common practice to employ a "trimmer" condenser of the compression type for this purpose but, through the use of a variable air dielectric condenser here, readjustment is greatly simplified inasmuch as a screw driver is not required, and the variation in capacity is far smoother than is the case with the compression type condenser.

There is frequently a distinct advantage in being able to adjust the antenna series condenser readily. This condenser varies the degree of antenna coupling. Now, if the antenna is closely coupled to the detector circuit it tends to absorb energy and thus prevent oscillation, even when the regeneration control is well advanced. On the other hand, close antenna coupling results in more of the signal energy reaching the grid of the detector with correspondingly greater volume at the headphones. Against this is the fact that selectivity decreases as the coupling is increased. Now then,



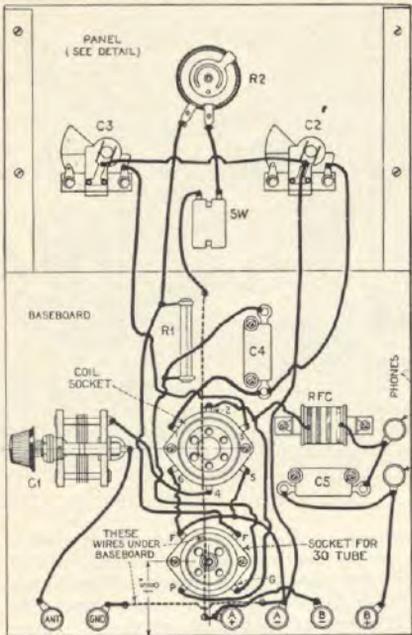


Fig. 1

the usual practice is to adjust the series condenser (the coupling) so that the detector can be made to oscillate readily throughout all ranges. The antenna absorption varies with frequency, however, so that when coupling is loosened to the degree required at frequencies where absorption is highest, it is likely to be found unnecessarily loose at other frequencies where antenna absorption is less.

From this discussion it is seen that the adjustment of this condenser represents a compromise in most receivers where a permanent adjustment is maintained. However, with the type of condenser used in this "Scout" receiver, this can be readjusted to meet the variations in absorption at different frequencies. It can

also be adjusted to provide loose coupling and therefore higher selectivity if interference is encountered, or to provide closer coupling when tuning in extremely weak signals. In other words by varying this condenser as needed, the selectivity and sensitivity of the receiver are under more complete control of the operator and better reception is the result.

The front panel of the receiver is of 5/16 inch plywood with 1/4 inch plywood cleats screwed along the ends at the back for greater rigidity. The baseboard is of 3/8 inch hard wood. The front panel is attached to the baseboard by means of wood screws, or with wood plugs and glue; and is reinforced with two-inch triangular wood corner brackets, glued to panel and base at each end of the receiver.

Before mounting the front panel on the base it is well to drill the four holes required for mounting the panel controls, otherwise the drilling operation is likely to impose a strain on the panel. After the panel is drilled and is mounted on the baseboard, then all of the parts can be mounted in the positions indicated on the picture wiring diagram, Figure 1.

The batteries required consist of two No. 6 dry cells for the filament supply and one 45 volt battery of the type used in portable receivers, or two 22 1/2 volt C batteries. Large size B batteries are not required because the current drain of the single -30 tube is very small.

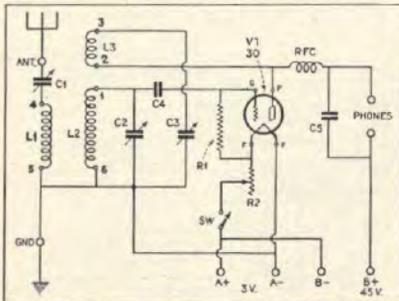
List of Parts

HAMMARLUND PRODUCTS

- C1—Midget variable condenser, type MC-35-S
- C2—Midget variable condenser, type MC-140-M
- C3—Midget variable condenser, type MC-250-M
- L1, L2, L3—Set of 6-prong plug-in coils, type SWK-6
- RFC—R.F. choke, type CH-B, 8 millihenries

MISCELLANEOUS

- C4—Aerovox or Cornell-Dubilier condenser, .0001 mfd.
- C5—Aerovox or Cornell-Dubilier condenser, .001 mfd.
- R1—I.R.C. metalized resistor, 3 megohms
- R2—Yaxley 30-ohm rheostat
- SW—Cutler-Hammer, s.p.s.t. toggle switch
- 1 Type -30 triode vacuum tube
- 1 Eby 4-prong socket, type 12 or Hammarlund Code S-4 Isolantite socket
- 1 Eby 6-prong socket, type 12 or Hammarlund Code S-6 Isolantite socket
- 8 Binding posts, suitably marked for connections as shown in Figure 1.



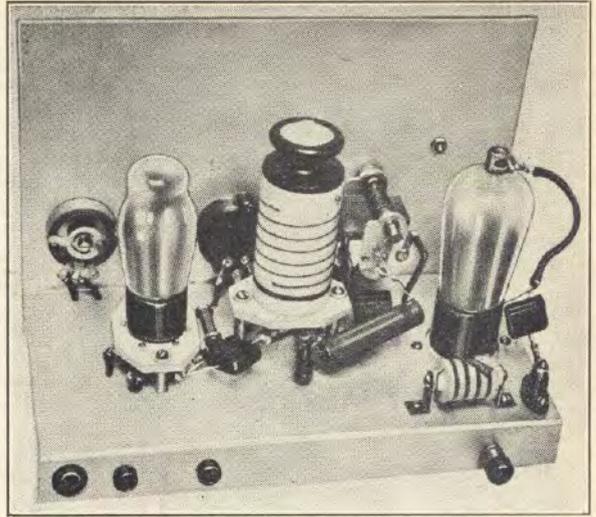
The Dragnet

(2 Tube S. W. Set)

DESIGNED by the technical staff of "Radio News," this receiver was originally described in that publication.

The "Dragnet" employs two of the latest types of 2-volt tubes and is designed to take full advantage of their superior features. Although only 2 tubes are employed, 3-tube results are obtained because the type -19 tube is a dual purpose type having two triode sections enclosed within one bulb. One of these triodes is used as a regenerative detector while the other provides one stage of audio-frequency amplification which aids materially in building weak signals up to good headphone volume. The other tube, a type -34 variable-mu pentode, is used in an untuned stage of radio-frequency amplification.

This r.f. stage serves a three-fold purpose. First, it provides an appreciable amount of r.f. amplification. It is a known fact that for maximum amplification from tubes of this type they must work into a high impedance load. The load which best satisfies this condition is a tuned circuit. It is this type of circuit, consisting of the coil L1 and condenser C2 that is employed in the "Dragnet". Also, under actual measurement it was found that the common practice of



using a resistor input did not produce nearly as good results as the choke, RFC, nor did chokes of lower inductance (millihenries) equal the one employed.

The second advantage of the r.f. stage is that it serves to completely isolate the antenna from the regenerative detector circuit and therefore eliminates absorption of regenerative energy by the antenna, thus making regeneration much more constant and easier to regulate.

The third advantage is that with this r.f. tube acting as a barrier, the r.f. energy generated by feed-back in the detector tube when in an oscillating condition or when on the edge of oscillation, cannot be radiated and cause interference in neighboring receivers. In other words, this receiver is strictly a "non-blooper".

The parts used throughout were selected for their high efficiency, a feature of the greatest importance, especially in the r.f. and detector circuits. Thus the coil and tube sockets are of Isolantite, as are also the forms upon which the plug-in-coils are wound, the insulation of the tuning condenser and the insulating

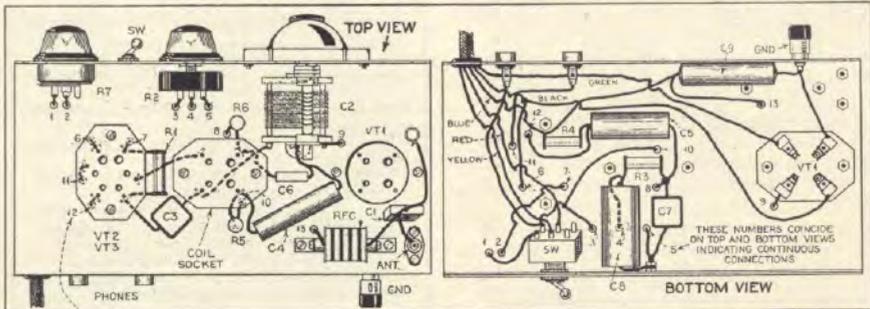
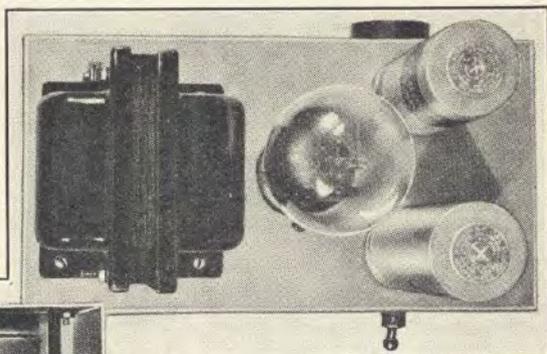
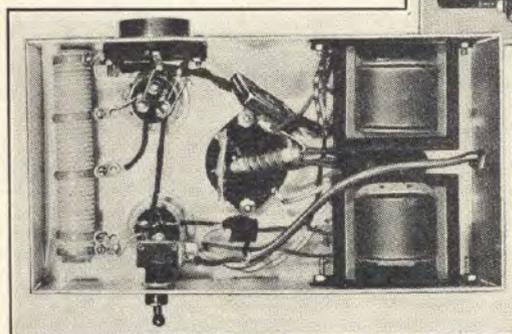


Fig. 1

A Power Pack

for

S. W. Receivers



THE power pack illustrated in the accompanying photographs and diagrams was originally described in "Radio News."

Many present day power packs prove entirely suitable for use with non-regenerative receivers, or with receivers designed for the broadcast band only. But when used with short-wave regenerative receivers these units' hum is so troublesome in many instances as to seriously mar reception. This is particularly true if the receiver is maintained in an oscillation condition for reception of c. w. signals.

Such trouble is usually traceable to the inclusion of an inadequate filter in the power supply unit. It may be due to skimping on capacity, or to the use of only one choke, or perhaps 2 chokes having insufficient inductance.

Another common source of trouble is found in unstable operation of the receiver, particularly if it is one employing a tuned r.f. stage ahead of the regenerative detector. Such instability is often due directly to inadequate by-pass capacities across the various voltage taps in the power pack.

Both of these types of troubles are effectively eliminated in the unit described here. Two sizable chokes are included in the filter, and a total of 16 mfd. for the filter capacity. In addition, a capacity of 4 mfd. is provided across each of the output voltage taps. The high voltage to the filter is obtained through a center-tapped resistor connected across the rectifier filament to further aid in hum reduction.

The filter circuit employed makes use of the choke input method. This arrangement has several distinct advantages over the capacity input type of filter. Most important is the better voltage regulation obtained. This is especially important in short-wave receivers which employ an r.f. stage and control the sensitivity by varying the cathode or grid bias. Such control varies the plate current of the r.f. tube and as a result, unless good power supply regulation is obtained, the plate voltage applied to the other tubes will vary. This is one reason why in such receivers reducing the sensitivity of the r.f. stage may cause the detector to spill over into an oscillating state.

Another common source of trouble is found in unstable operation of the receiver, particularly if it is one employing a tuned r. f. stage ahead of the regenerative detector. Such instability is often due directly to inadequate by-pass capacities across the various voltage taps in the power pack.

A third, and perhaps somewhat left-handed advantage of this system is that the d.c. output voltage obtained with choke input is considerably lower than that obtainable with capacity input. This is really an advantage because while few short-wave receivers employ more than 200 volts on the plates it is difficult to obtain power transformers which will provide such low voltage. The normal and least expensive power transformers provide an a.c. voltage of 300-350 each side of the center. When a condenser input filter is used with these, at normal drains, the d.c. voltage output is usually in excess of 300 volts—a value quite excessive for most short-wave receivers. Thus the use of the choke input permits employment of the least expensive type of standard power transformer.

The power pack described here provides 220 volts d.c. at a current drain of 25 milliamperes. In addition it includes a 6-volt filament winding rated at 1.5 amperes which will supply the filaments of up to 5 tubes of the 6-volt type. In the particular model shown here the voltage divider is provided with 3 adjustable taps, thus supplying the high voltage and two intermediate values, all variable.

Another feature of this power pack which should not be overlooked is the r.f. filter consisting of the r.f. choke RFC, and the mica condenser C6 which has a capacity of .006 mfd. The purpose of this filter is to avoid the tunable hum sometimes so troublesome in short-wave sets.

Now, the center taps of the high-voltage secondary and the 6-volt filament winding of the transformer are grounded to the chassis at one of the mounting screws of the input choke, CH1.

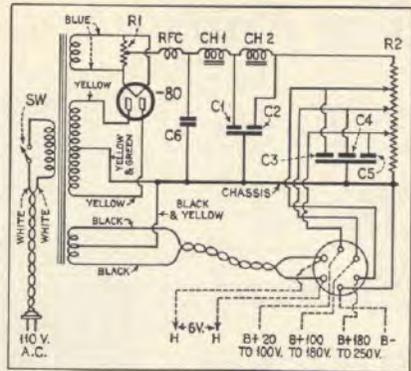


Fig. 2

This power pack should prove highly satisfactory for use as a B supply unit for any short-wave receiver which requires 90 volts or more on the plates. If the voltage required is less than the normal output of the power pack it is obtained from the top tap of the divider, adjusting this tap to the exact value desired. If the receiver has heater type 6-volt tubes their filament supply can be taken from the power pack also, after first being sure that the filament wiring in the receiver is not connected to any of the other wiring. Also, it will probably be found desirable to rewire the filaments with twisted pair if the filament wiring was not originally of this type.

The plate supply voltage obtained from this power pack is almost absolutely free from hum. In tests made with a 3-tube r.f. regenerative receiver not the slightest trace of hum could be heard, even when operating at 20 megacycles.

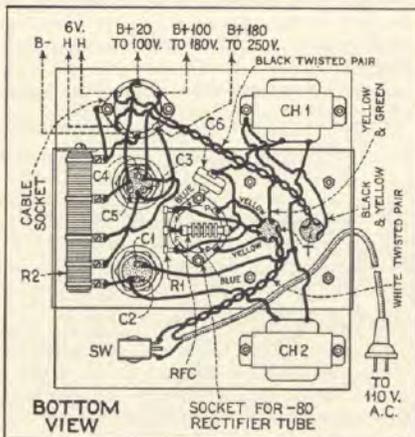


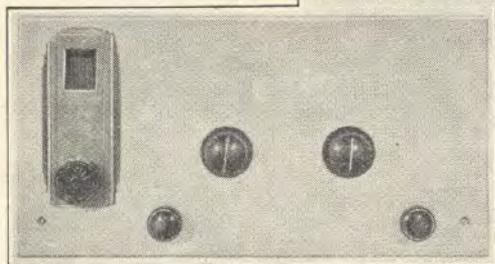
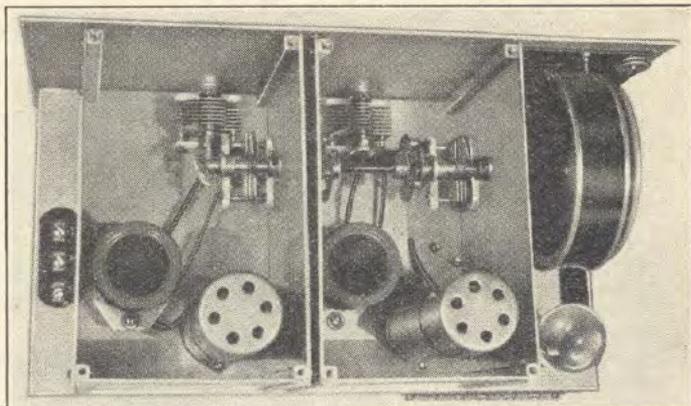
Fig. 1

List of Parts

- C1, C2—Aerovox or Cornell electrolytic condensers, 2-sections, 3-8 mfd., 450 volts, d.c.
- C3, C4, C5—Aerovox or Cornell electrolytic condensers, 3-section, 4-4-4 mfd., 450 volts, d.c.
- C6—Aerovox mica condenser, .006 mfd.
- CH1, CH2—Thordarson chokes, type T-4502
- RFC—Hammarlund type CH-X r.f. choke
- R1—Electrad 30 ohm center-tapped filament resistor
- R2—Electrad Truvolt voltage divider, type C-200, 20,000 ohms, 50 watts, with 3 adjustable intermediate taps
- 1 Eby 4-prong tube socket, type 12
- 1 Eby 6-prong tube socket, type 12
- 1 Eby 6-prong cable plug, male
- 1 Six-conductor cable (of required length)
- SW—Toggle switch, s.p.s.t.
- T—Thordarson power transformer, type T-5472
- 1 Type -80 rectifier tube
- 1 Six foot line cord with plug
- 1 Rubber grommet, 1/2 inch (for power cord hole in chassis)
- 1 Aluminum or steel chassis

The Radio Amateur's Handbook

3-Tube Band- Spread A C Set



SOONER or later most owners of regenerative receivers feel the urge to try the use of radio-frequency amplification ahead of the regenerative detector. In the days when only triode tubes were available the complications in this were severe and at best very little amplification was obtained in the r.f. stage. With the introduction and popularization of screen-grid tubes and r.f. pentodes, however, the picture has changed completely with the result that a well designed r.f. stage adds tremendously to the sensitivity and general behavior of the regenerative receiver.

The receiver illustrated here represents a good example of such a set. It is a model constructed after the description which appeared in "The Radio Amateur's Handbook," tenth edition.

In the construction of this model there was some variation from the original, mainly in the method of obtaining regeneration. The original had the tickler in the cathode circuit and standard plug-in coils are not well suited to this arrangement. In the model described here, therefore, the circuit was changed to include the tickler in the plate circuit. No change was made in the method of controlling regeneration—a potentiometer to vary the voltage applied to the screen grid.

Referring to the schematic circuit of Figure 2, it will be seen that the r.f. stage is quite conventional in every respect. It uses a -58 r.f. pentode, self biased.

The single audio stage is impedance coupled to the detector circuit. It employs a type -56 tube which is also self biased.

It is important that means for con-

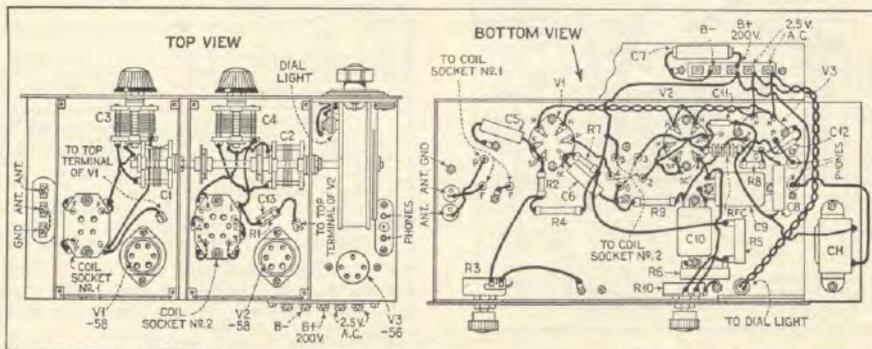


Fig. 1

trolling the gain of the r.f. stage be provided on the front panel of such a receiver as this. Otherwise even moderately strong signals will overload the detector. If the regeneration control alone were depended upon for this purpose the results would be highly unsatisfactory because in addition to detector overloading, there would be a distinct loss of selectivity when regeneration is retarded to reduce the volume. On the other hand, by controlling the gain of the r.f. stage, the input to the detector can be held down to a low level, full regeneration employed and thus maximum selectivity obtained.

The band-spread system employed provides continuous band-spreading by means of a small condenser shunted across the tank tuning condenser of each stage. These tank condensers are controlled by individual knobs. These may be seen as the two top control knobs in one of the accompanying photographs. The small band-spread condensers, however, are ganged for control by the single main tuning control at the left end of the receiver.

Not only does this system provide a very helpful degree of band spreading at any and all points throughout the range of the receiver, but it also provides single dial control within any band which has been selected by means of the tank condensers. Thus when the broadcast listener has tuned the tanks to resonance in the 25-meter broadcast band, for instance, he proceeds to tune in the individual stations in that band with the single main control, much in the same manner as he would tune in broadcast band stations on a modern broadcast receiver. The circuits will be found to track fairly well throughout the full rotation of the band spread dial, although some readjustment of the r.f. tank condenser will be required.

The model receiver shown here was built for use with Hammarlund standard plug-in coils and with the tuning capacities used, will cover the short-wave range from 19 to well over 200 meters, with adequate overlap, using 4 pairs of these coils.

The secret of using a tuned r.f. stage successfully, ahead of a regenerative detector, lies in providing thorough shielding. If shielding is inadequate there will be interaction between the two circuits to the extent that the tuning of one will react on the other and regeneration will be difficult to control.

This receiver is intended for operation from an a.c. power supply unit which will supply approximately 200 volts d.c. for the plates and 2½ volts for the heaters. Should it be desired to employ

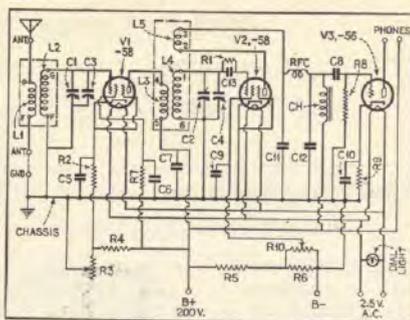


Fig. 2

B batteries, the voltage divider consisting of R5 and R6 may be eliminated and the "high" end of the potentiometer brought out to the 45-volt tap on the B battery.

The chassis is made from a sheet of 16-gauge aluminum, 17 inches by 11 inches. The edges are bent down 2 inches all around, making the deck dimensions 13 inches by 7 inches. The front panel is 13½ inches long by 7 inches high. The shield cans each measure 7 inches long, 4¾ inches wide and 4¾ inches high.

List of Parts

HAMMARLUND PRODUCTS

- C1, C2—Midget variable condensers, type MC-20-S
- C3, C4—Midget variable condensers, type MC-140-M
- L1, L2—Kit of 4-prong plug-in coils, type SWK-4
- L3, L4, L5—Kit of 6-prong plug-in coils, type SWK-6
- RFC—R.F. choke, type CH-X
- 1 Isolantite socket, 4-prong, type S-4
- 1 Isolantite socket, 6-prong, type S-6
- 2 Tube shields, type TS-50
- 2 Flexible couplings, type FC

MISCELLANEOUS

- C5, C6, C8—Cornell-Dubilier .01 mfd., 200v.
- C7—Cornell-Dubilier .1 mfd., 400v.
- C9, C10—Cornell-Dubilier type HC-227 1.0 mfd., 160v.
- C11, C12, C13—Cornell-Dubilier .00025 mfd.
- CH—Thordarson audio choke, type T-2927
- R1—I.R.C. resistor, 5 megohms
- R2—I.R.C. resistor, 250 ohms, 1 watt
- R3—Electrad potentiometer, 10,000 ohms
- R4—I.R.C. resistor, 50,000 ohms, 1 watt
- R5—Electrad wire wound resistor, 15,000 ohms, 5 watts
- R6—Electrad wire wound resistor, 5000 ohms, 5 watts
- R7—I.R.C. resistor, 100,000 ohms, ½ watt
- R8—I.R.C. resistor, 5 megohms ½ watt
- R9—I.R.C. resistor, 2000 ohms, 1 watt
- R10—Yaxley potentiometer, 50,000 ohms
- 1 National illuminated drum dial, type H
- 2 Eby laminated wafer sockets, 6-prong
- 1 Eby laminated wafer socket, 5-prong
- 1 Eby strip, 5-gang (screw terminals)
- 1 Eby strip, 3-gang (screw terminals)
- 1 Eby strip, 2-gang (tip jack terminals)
- 1 Aluminum chassis and 2 aluminum shield cans (see text).

*All metalized type.

Send for Catalog for Complete Information on all HAMMARLUND products

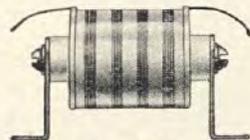
For Better Radio Hammarlund PRECISION PRODUCTS

Manufactured by HAMMARLUND MANUFACTURING CO., Inc., 424-438 West 33rd Street, New York

All prices shown here are list prices of parts used in sets described in this manual.

HAMMARLUND Standard and Midget Isolantite R. F. Chokes

The Standard Choke is particularly designed for short wave, and ultra short wave receivers and transmitters but is equally effective within broadcast band. Compactness permits mounting in isolated positions well removed from stray RF fields. Four windings, moisture proofed, and carried on Isolantite spool. Protected by radio frequency lacquer and cellophane covering. Inductance—8 mh; DC resistance—70 ohms; distributed capacity—3 mmf; 125 milliamperes. Choke is 1 3/8" x 7/8".



Type CH-B

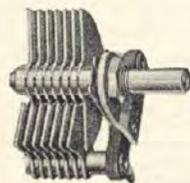
Code CHB\$1.10

The Midget Choke is invaluable for use where space is at a premium. Its tiny size, and lightness permits it to be supported by its own leads. Five universal wound pies mounted on a 3/4" Isolantite core, with coils impregnated to insure ruggedness and minimize atmospheric effects. Tinned copper wire leads, secured to Isolantite core with metal end caps. Length across caps—1 1/2". Diameter—1/2". Inductance—2.1 mh; DC resistance—35 ohms; capacity 1 mmf. 125 milliamperes.



Type CHX\$.60

HAMMARLUND Star Midget Condensers

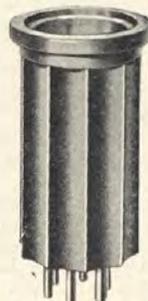


Star Midget

A very popular low priced midget for set builders, experimenters and laboratories. There are types for receiving, and transmitting, for short wave tuning, regeneration, antenna coupling, verniers, etc. Light in weight, strong and compact in construction, smooth as velvet in operation. Low minimum capacity, low loss natural Bakelite insulation, non-corrosive aluminum plates. Easy single hole mounting, 1/4" shaft, 5/16" bushing, 1" bakelite knob. Size 1-9/16" wide by 1 3/4" high. Depth behind the panel from 11/16" to 1 1/2" depending on capacity. Available in sizes from 15 mmf. to 140 mmf.

Code SM-25 (25 mmf.)\$.85
Code SM-100 (100 mmf.) 1.00
Code SM-140 (140 mmf.) 1.25

New HAMMARLUND Low Loss Coil Forms and Short Wave Plug-in-Coils



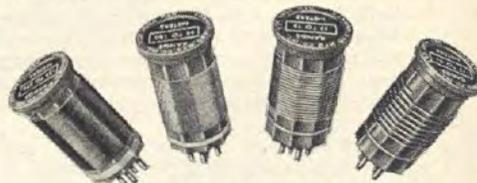
Type SWF

These attractively priced coil forms are made of XP-53 dielectric, a remarkable new loss insulating material. Rugged, durable and most important, extremely effective, for XP-53 losses are extremely low. Its amber color is natural... no artificial coloring to cause losses. The coil proportions provide most practical form factor. The forms are groove-ribbed for air spacing of windings. There are also flange grips, and neat meter index inserts, for wavelength indications. Another clever feature of the form is a threaded shelf, molded inside, to permit the mounting of a trimming or padding condenser for tuning the coil to a fixed frequency or for band spread arrangement.

Code SWF-4 (4 prong)\$.35
Code SWF-5 (5 prong)35
Code SWF-6 (6 prong)40

Hammarlund Short Wave Plug In Coils provide maximum signal strength, and greatest selectivity on all bands. Extensive laboratory work results in practically perfect design of primary, secondary tickler, coupling and overlap.

Wound on low loss XP-53 dielectric Hammarlund plug in forms. Secondaries of the 17 to 41 meter and 33 to 75 meter coils are of heavy silver plated wire to reduce skin resistance losses to a minimum. The secondaries of the other coils are of silk covered copper wire. The 270 to 560 meter coil is of bank-wound litz.



SWK Set of Coils

No. 40 coil (wound coil, 4 prongs, 10-20 meters) \$1.00
No. 41 coil (wound coil, 4 prongs, 17-41 meters) 1.00
No. 42 coil (wound coil, 4 prongs, 33-75 meters) 1.00
No. 43 coil (wound coil, 4 prongs, 66-150 meters) .75
No. 44 coil (wound coil, 4 prongs, 135-270 meters) .75
BCC-4 (wound coil, 4 prongs 250-560 meters) 1.25
No. 60 coil (wound coil, 6 prongs, 10-20 meters) 1.25
No. 61 coil (wound coil, 6 prongs, 17-41 meters) 1.25
No. 62 coil (wound coil, 6 prongs, 33-75 meters) 1.25
No. 63 coil (wound coil, 6 prongs, 66-150 meters) 1.00
No. 64 coil (wound coil, 6 prongs, 135-270 meters) 1.00
BCC-6 (wound coil, 6 prongs, 250-560 meters) 1.50
SWK-4 (kit—4, four-prong coils 17-270 meters) 3.00
SWK-6 (kit—4, six-prong coils 17-270 meters) 3.75

HAMMARLUND Isolantite Coil Forms and Sockets

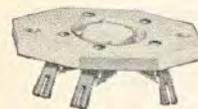
These coil forms are of extruded Isolantite. Their low losses and effective stability guarantees efficient high frequency results under all conditions.

Equipped with convenient black enameled wooden handle with a flat top, in which is a removable paper disc for writing in frequencies. A celluloid disc protects the paper, a spring ring holding the disc in place. Surface is "non-skid," eliminating troubles encountered in winding on slippery surfaces. The numerous holes provided in the form, make drilling unnecessary. The form is 1 1/2" in diameter and 2 1/2" long exclusive of knob and prongs. Made in 4, 5 and 6 prong types to fit standard sockets.



Type CF

Code CF-4 (4 prong)\$1.00
Code CF-5 (5 prong) 1.00
Code CF-6 (6 prong) 1.00



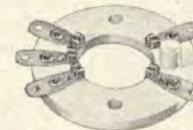
Low loss sockets are just as important as low loss coils or condensers. In the Hammarlund Isolantite sockets, low loss is combined with low cost.

Constant resistivity and perfect contact eliminates noise.

The sockets have glazed tops and sides. The side gripping contacts are rust proof. They can be used for sub-panel or base mounting. Made in four, five, six, seven and eight prong styles. They are all 2 1/4" long, and 1 5/8" wide, with standard mounting centers of 1-27/32".

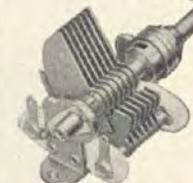
Code S-4 (4 prongs)\$.60
Code S-5 (5 prongs)60
Code S-6 (6 prongs)60
Code S-7 (large base, 7 prongs)60
Code S-7-B (small base, 7 prongs)60
Code S-8 (8 prongs)75

Acorn socket at right. Isolantite. For new high frequency acorn tubes—954 to 955. 1 7/8" diameter. Five double grip silver plated phosphor bronze prongs, eyeletted and lipped to base. Guaranteed perfect contact. Has alignment plug. Top, sides, and plug glazed.



Code S-900\$1.50

Improved HAMMARLUND Midget Condensers

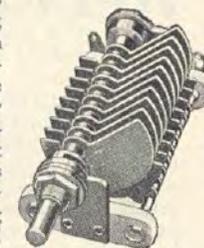


Type MC

The marked efficiency of Hammarlund condensers at ultra high frequencies has been attained by extensive research in materials and design, constant experimentation and careful workmanship, plus years of experience.

Isolantite insulation reduces dielectric losses to a minimum, assuring maximum and uniform efficiency under all conditions of temperature and humidity. Strictly noise-free operation is insured with a new, split type rear bearing, plus a new noiseless silver plated Beryllium wiping contact. Cadmium plated non-corrosive, soldered brass plates eliminate vibration. Shaft 1/4" in diameter, extending 5/16" beyond rear frame to facilitate ganging. Individually tested for breakdown on 500 volts A.C. Available from 20 mmf. to 325 mmf.

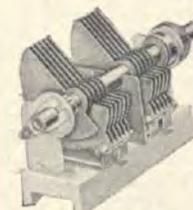
Code MC-140-M\$2.50
Code MC-100-M 2.25
Code MC-35-S 1.50



Double Spaced

The Double Spaced Midgets have wide spacing, special bearings, and Isolantite, making them particularly suitable for ultra short wave receivers and transmitters. Midline or semi-circular plates in 20, 35 and 50 mmf. sizes.

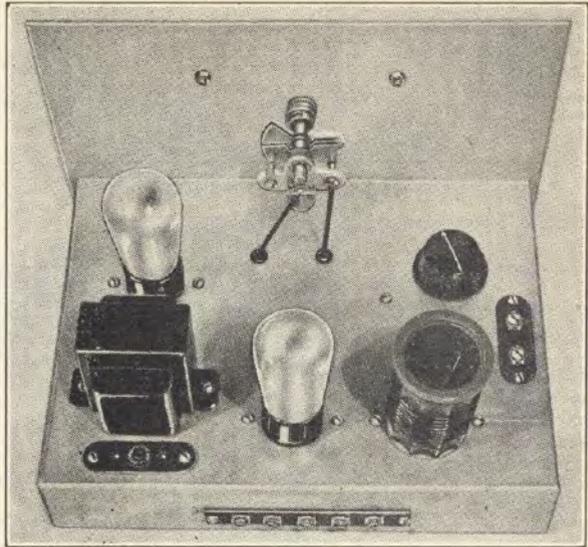
HAMMARLUND Split Stator Midget Condensers



Dual Midget

Like Hammarlund Single Midget Condensers, these duals incorporate in their design every requirement of a high quality small size two gang condenser. Their rigidity, low losses and careful construction affords greatest electrical and mechanical efficiency in all types of short wave receivers, using two gang tuning condensers. The entire condenser is built on a strong Isolantite base, including a shield plate between the stators. Other specifications are the same as for the singles. Made for single hole panel mounting. Overall length behind the panel—3 1/4".

The Doerle Two- Tube Receiver



MR. WALTER C. DOERLE is well-known for his various short-wave receiver designs and the receiver described here has been justly popular with short-wave enthusiasts. Basically it is not unusual in the circuit employed. However, careful consideration of design details has resulted in this particular Doerle receiver being especially popular since it was first described in the magazine "Radio."

Analysis of the detailed schematic circuit diagram in Figure 2 shows the standard tickler method of obtaining regeneration, and a capacity-coupled antenna circuit. Band-spread tuning is provided by means of a small variable condenser, C1, shunted across the larger tuning capacity, C2.

The condenser C2 is used for tuning to the desired range, then the smaller

condenser will spread the stations in this range over a wide area on the main tuning dial. Inasmuch as the smaller condenser is utilized for all exact tuning, it is controlled by the large dial in the center. The "rough tuning" condenser, C2 requires less critical adjustment, and may therefore be controlled by a small knob, as shown at the lower right corner of the front panel. Some builders prefer to have the large condenser controlled by the main dial and to use the smaller condenser more in the nature of a trimmer. Where this system is preferred it is only necessary to transpose the positions of the 2 condensers on the panel, the wiring of the receiver remaining the same as shown in the picture wiring diagram.

Regeneration is controlled by means of the potentiometer, R2, A .25 mfd.

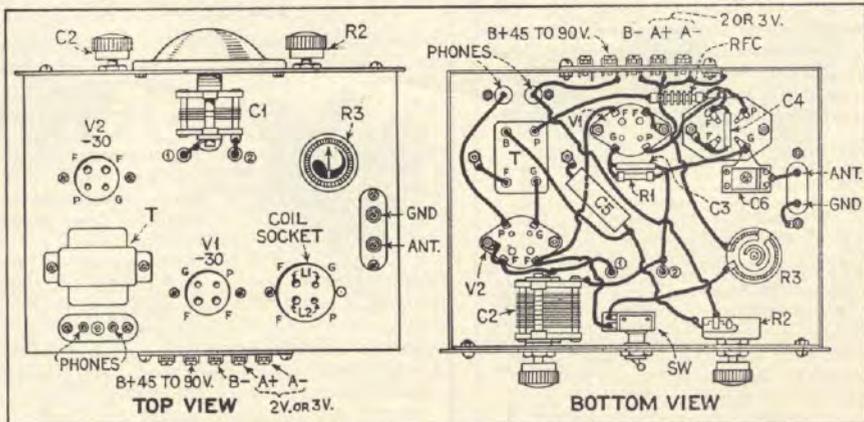


Fig. 1

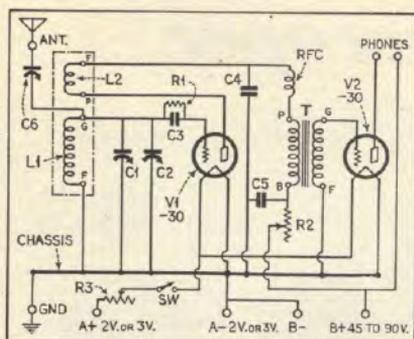


Fig. 2

by-pass condenser, C5, is connected across this potentiometer to ground—its purpose being partly to by-pass any noise that may develop in the potentiometer. The condenser C4 is the normal plate by-pass condenser completing the r.f. plate circuit to ground, thus by-passing the primary of the audio frequency transformer.

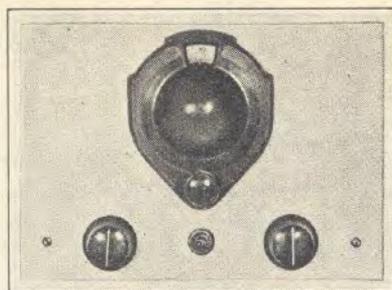
A type -30 tube is employed for the regenerative detector and another for the single audio stage. Two $1\frac{1}{2}$ volt dry cells are used for the filament supply and are controlled by a rheostat which is mounted back on the chassis, as it requires only occasional adjustment.

Hammarlund plug-in coils of the 4-prong, 2-circuit type are used.

The chassis consists of a piece of 16-gauge aluminum, $13\frac{1}{2}$ inches long by 11 inches wide with the four corners cut out and the four sides bent down to form walls 2 inches high, leaving a deck space $9\frac{1}{2}$ inches long by 7 inches deep. The front panel, also of 16-gauge aluminum, is 10 inches long by 7 inches high.

It will be noted in Figure 1 and in the photograph that there are five terminals shown on the battery terminal strip. Only four of these are used and a 4-gang strip will therefore be satisfactory.

To tune, first find proper adjustment for the antenna condenser, C-6, by advancing the regeneration control until the circuit breaks into oscillation, then tuning throughout the range with condenser C2. If it cannot be made to oscillate throughout this range, decrease the capacity of the condenser, C6, until it is found possible to maintain oscillation throughout the entire tuning range. If, on the other hand, too much regeneration is obtained, then increase the capacity of C6.



Panel View

Once the proper control of regeneration has been obtained, the tuning and operation of this receiver will be found extremely simple. The condenser C1 will aid materially in tuning in all the stations to exact resonance, or in spreading the stations out on the dial, when tuning in, on the more congested bands.

The antenna for this receiver should be a comparatively short one, about 50 feet, exclusive of course, of the lead in.

For increased amplification for loud speaker reproduction, an additional stage of audio amplification can be added, using the same circuit principle, indicated in Figs. 1 and 2. Use however, a separate chassis for this stage, since crowding of this additional material on the chassis, will mar the effectiveness of the receiver.

List of Parts

HAMMARLUND PRODUCTS

- C1—Midget variable condenser, type MC-35-S
- C2—Midget variable condenser, type MC-140-M
- C6—Equalizer condenser, type EC-35
- RFC—R.F. choke, type CH-X
- 1 Set of 4 prong plug-in coils, type SWK-4
- 1 4-prong Isolantite socket type S4

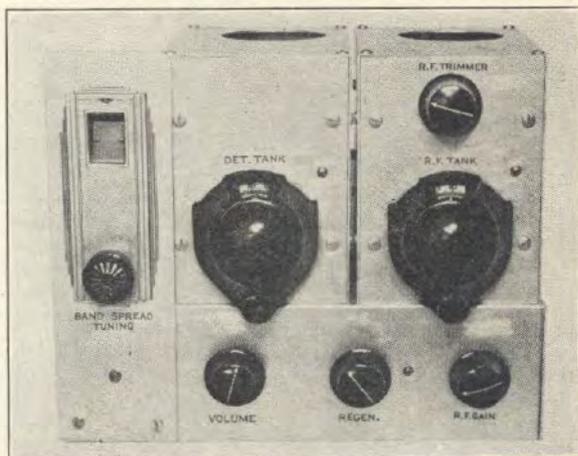
MISCELLANEOUS

- C3, C4—Cornell Dubilier mica condenser, .00025 mfd.
- C5—Cornell Dubilier pigtail by-pass condenser, .25 mfd.
- R1—I.R.C. resistor, 1.5 megohms
- R2—Electrad, type R1-205 potentiometer, 50,000 ohms
- R3—Electrad, type R1-204, 10 ohms rheostat
- SW—Toggle switch, s.p.s.t.
- T—Thordarson type T5736 a.f. transformer
- 2 Eby 4-prong sockets, wafer type, or Hammarlund Code S-4 Isolantite sockets
- 1 Kurz-Kirsch vernier dial (large)
- 1 Aluminum Doerle panel and chassis
- 1 Eby 2-gang terminal strip (tip Jack terminals)
- 1 Eby 2-gang terminal strip (screw terminals)
- 1 Eby 4-gang terminal strip (screw terminals)

The "Skyscraper"

3-Tube T. R. F. Set

An effective short-wave receiver equally well adapted to broadcast or amateur service.



THIS three tube tuned r.f. receiver originally appeared in Radio News—the second of the Radio News laboratory receivers. Following are some of its unusual features:

1. Continuous band spreading.
2. Extreme sensitivity.
3. Two tuned circuits for selectivity.
4. Battery or power pack operation.
5. Flexible control of sensitivity and volume.
6. Complete freedom from r.f.-detector interlocking.
7. Single dial band-spread tuning.
8. Most favorable L/C ratios for all important bands.
9. Covers from 15 meters to 560 meters continuously.
10. Ample output for loudspeaker operation. Outputs for headphones, magnetic speakers or dynamic speakers.
11. No body capacity.

12. Complete freedom from hum when a.c. operated.

The advantages of a really good stage of r.f. amplification, ahead of a regenerative detector, are not fully appreciated by the average shortwave constructor, as indicated previously. The outstanding ability of the several available commercial receivers is widely recognized but as a rule the home constructor has not been very successful in applying r.f. tubes in regenerative receiver circuits. The outstanding reason for this failure has been the lack of proper shielding and filtering, and a contributing cause has been the use of coils of unsuitable design.

Regeneration control is made much more consistent and stable, due to the presence of the r.f. tube which acts as a buffer ahead of the regenerative circuit and thus prevents antenna absorption.

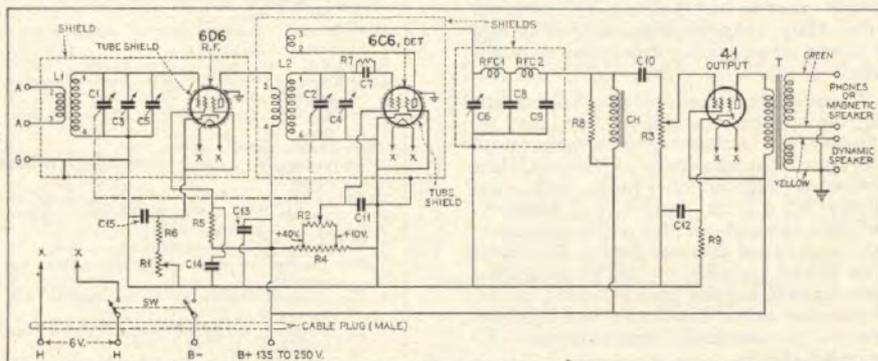


Fig. 1

Thus several distinct advantages are gained through the use of the r.f. stage.

After several weeks of testing on actual reception of short-wave signals the "Skyscraper" worked out remarkably well and in some respects even exceeded expectations. In the matter of r.f. gain, for instance, it was found that many signals which ordinarily would be considered only moderately strong, were brought up to such a level in the r.f. stage (when the sensitivity control was turned on full) as to overload the detector. Other signals which were weak on an ordinary regenerative receiver, were reproduced by the "Skyscraper" with more than adequate loudspeaker volume. The European and South American short-wave broadcast stations, for instance, were many times tuned in with far more than normal room volume. "Ham" stations were good on all bands. Perhaps the most outstanding of all was the reception in the 20-meter "ham" band.

The excellent operating characteristics of the "Skyscraper" are accounted for to a considerable extent by the coils employed. These are the new Hammarlund plug-in coils in which XP-53, a newly developed dielectric, is employed for the forms. This new material rates among the best yet, is sufficiently inexpensive to permit the coils and forms to be marketed at ordinary prices.

The Hammarlund coils are tuned by a band-spreading condenser arrangement. The tuning condensers C1 and C2 are of 20 mmfd. capacity and are ganged together to the drum dial. The band setting condensers, C3 and C4 are of 140 mmfd. each and are controlled by individual dials.

The special "Skyscraper" chassis is 12 1/8" long, 7" wide and 3 1/2" deep.

The small panel on which the drum dial is mounted is 9 3/8 inches high by 3 inches wide. This panel is mounted directly on the front of the chassis.

The two box shields are each 4 1/2 inches long and 6 inches high.

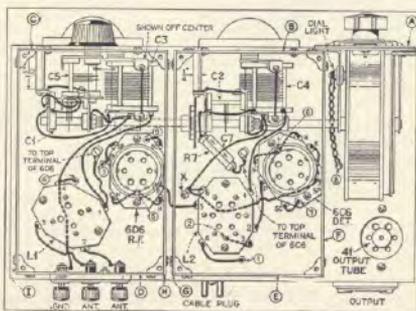
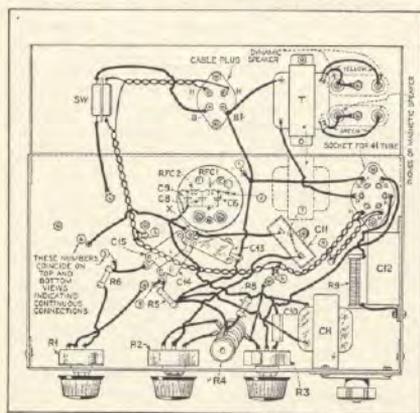
List of Parts

HAMMARLUND PRODUCTS

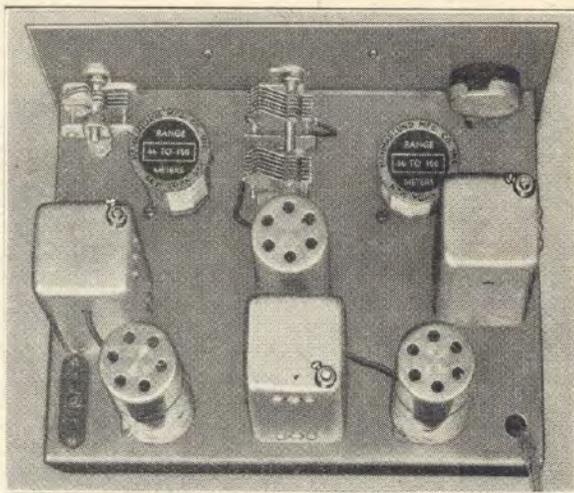
- C1, C2—Midget variable condensers, type MC-20-S
- C3, C4—Midget variable condensers, type MC-140M
- C5—Midget variable condensers, type MC-35-S
- C6—Padding condenser, type MICS-70
- L1—Standard set 4-prong plug-in coils, Type SWK-4
- L2—Standard set 6-prong plug-in coils, type SWK-6
- RFC1—RF choke, type CH-3
- RFC2—RF choke, type CH-X
- 1 Isolantite socket, 4-prong, type S-1
- 3 Isolantite sockets, 6-prong, type S-6
- 2 Tube shields, type TS-50
- 1 Flexible coupling, type FC

MISCELLANEOUS PARTS

- C7, C8, C9—Aerovox or Cornell .0001 mfd.
- C10—Aerovox or Cornell .01 mfd., 400v.
- C11—Aerovox or Cornell can type condenser, 1 mfd., 200v.
- C12—Aerovox or Cornell electrolytic condenser 10 mfd., 25v.
- C13, C14, C15—Aerovox or Cornell condensers, .01 mfd.
- R1—Electrad potentiometer, 25,000 ohms
- R2—Electrad potentiometer, 50,000 ohms
- R3—Electrad potentiometer, 500,000 ohms
- R4—Electrad voltage divider, 50,000 ohms, 25 watts
- R5—I.R.C. resistor, 100,000 ohms, 1/2 watt
- R6—I.R.C. resistor, 250 ohms, 1/2 watt
- R7—I.R.C. resistor, .4 megohm
- R8—I.R.C. resistor, .5 megohm
- R9—Electrad resistor, 700 ohms, 10 watts
- CH—Thordarson AF choke, type T-2927
- T—Thordarson output transformer, type T-6806
- SW—Toggle switch, dpst.
- 1—Eby wafer socket, 6-prong
- 1—Eby 4-hole cable plug, female
- 1—Eby chassis mounting four prong cable, male
- 1—Eby twin jack speaker strip
- 1—Eby 3-gang binding post strip
- 1—Eby twin jack speaker strip
- 1—National Drum Dial, type H
- 1—Panel and Chassis
- 2—Solid shaft couplings
- 1—4-wire, 3' cable
- 2—Kurz-Kasch vernier dials
- 1—3" length, 1/4" diameter bakelite rod
- 1—Shield can 2" diameter



A 3-Tube S. W. Pentode Receiver



THIS 3-tube Super was originally described by M. Harvey Gernsback in Short Wave Craft.

A 6A7 is used as the first detector and oscillator, a 6F7 as the first I.F. amplifier and audio amplifier, and a 6B7 as a second I.F. amplifier, second detector, and delayed AVC tube—three tubes performing seven functions. The 6A7 is a pentagrid grid converter, the 6F7—a combination variable mu RF pentode with a separate triode, both sections of the tube employing a common cathode. The 6B7 consists of a variable mu RF pentode and two separate diodes.

This is not a "freak" receiver requiring delicate manipulation of many controls. There are only three controls—a volume, main tuning, and antenna trimmer.

The first detector and oscillator coils

are the standard Hammarlund XP-53, 4-prong plug-in type.

The new Hammarlund "variable coupling" air tuned I.F. transformers are used, affording a tremendous high gain as well as a high fidelity output. Two of the I.F. transformers used have to have slight changes made in them for use in this receiver. In one case, it is necessary to remove the control grid lead, so that it appears at the bottom, and in the other unit the control grid lead has to be brought out at the opposite end to which it now goes. This is done in the following way. To change the position of the grid lead, first take off the collar from the top of the plunger rod which is held in place by one set screw. Then take out the four screws—there is one on each side of the adjustment screws on top and bottom. Now slowly and carefully remove the coil, being sure to see that

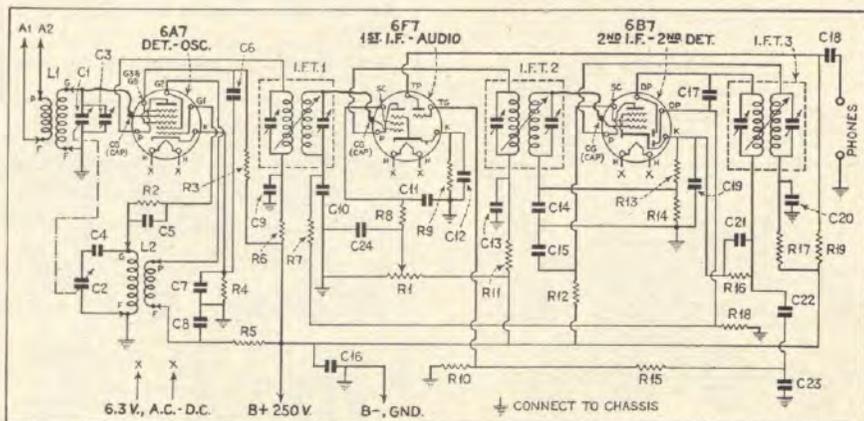


Fig. 1

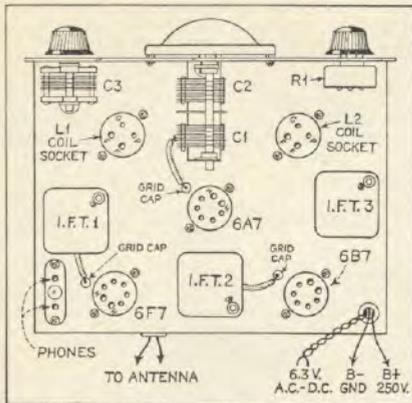
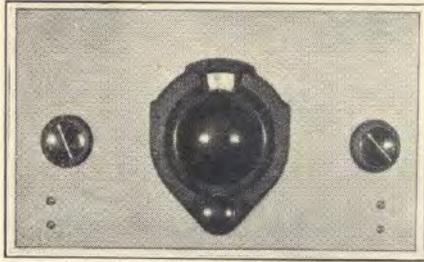


Fig. 2

the spring on the plunger does not pop out. Now take the grid lead off the top coil lug and solder on a lead of the proper length to reach your tube cap. Then drill a hole in the opposite side of the can and insert this new grid lead through this hole, while, of course, placing the coil back again in its original position. Now with the other coil, the same removal procedure is followed except that the grid lead is not taken out from the side of the can. It is left at the bottom. This is done since the second detector is a diode and the diode connection must be made to the base of the tube and not to the cap. Be sure that all control grid leads are covered with metal shielding braid, at least to within $\frac{1}{2}$ " of the point to where the wire is soldered. For complete satisfaction, these I.F. transformers should be lined up very carefully. This is done by using an O-25 millimeter in the following way: Connect the set up and plug in the set of coils covering the 49 meter band. Incidentally, it is a good plan to remove about one and a half turns from the grid winding of the oscillator coil on this particular band to insure proper tracking. Now turn the dial until a signal is picked up, bringing it up to a maximum with the aid of the antenna trimmer. Connect the millimeter in series with the B plus lead to the receiver. With 250 volts applied to the set, the meter should read between 20 and 25 mills. Adjust the set screws on the sides of the can of the first I.F. Do this slowly with a wooden or Bakelite screw driver, and note the meter reading. Adjust the other I.F.'s similarly. Now detune the set slightly with the main tuning control. The meter reading should go up as the set is tuned away from the station. Now tune the station in again and repeat the lining up procedure of the I. F. transformers. Watch the meter reading and adjust the set



Panel View

screws for *minimum* current on the meter. If the station is fading, the meter will fluctuate continually during the operation, and it will be necessary to take an average reading on the meter. Repeat this procedure once more for certainty.

Be sure that the shield separating the variable condenser sections is grounded.

The plungers on the I.F. transformers should all be set in about the same position for selectivity control.

List of Parts

HAMMARLUND PRODUCTS

- C1, C2—Split stator midget variable condenser, type MCD-140-M
- C3—Midget variable condenser, type MC-50-M
- 1FT1, 1FT2, 1FT3—VT-465 transformers
- L1, L2—Standard 4-prong plug-in-coil kits, type SWK-4
- 1 Isolantite small base 7-prong socket, type S-7B
- 2 Isolantite sockets, 5-prong, type S-5
- 3 Tube shields, type TS-50

MISCELLANEOUS PARTS

- R1—Electrad potentiometer, 100,000 ohms
- R2—I.R.C. resistor, 50,000 ohms, $\frac{1}{2}$ watt
- R3, R12, R19—I.R.C. resistors, 100,000 ohms, $\frac{1}{2}$ watt
- R4—I.R.C. resistor, 300 ohms, 1 watt
- R5—I.R.C. resistor, 20,000 ohms, 1 watt
- R6, R11, R17—I.R.C. resistors, 10,000 ohms, $\frac{1}{2}$ watt
- R7, R15, R18—I.R.C. resistors, 1,000,000 ohms, $\frac{1}{2}$ watt
- R8—I.R.C. resistor, 100,000 ohms, 1 watt
- R9—I.R.C. resistor, 500 ohms, 1 watt
- R10, R16—I.R.C. resistor 500,000 ohms, $\frac{1}{2}$ watt
- R13—I.R.C. resistor 400 ohms, 1 watt
- R14—I.R.C. resistor 1500 ohms, 1 watt
- C5—Cornell condenser, .00025 mfd.
- C6, C7, C8, C9, C10, C12, C13, C14, C15, C18, C20—Cornell condensers .1 mfd., 500 v.
- C22—Cornell condenser, .01 mfd., 500 v.
- C11, C24—Cornell condensers, .5 mfd., 500 v.
- C16—Cornell condenser, 1 mfd., 500 v.
- C19—Cornell electrolytic condenser, 5 mfd., 25 v.
- C4, C17, C21—.001 mfd. condenser
- C23—Cornell condenser, .001 mfd.
- 2 Eby 7-prong small wafer sockets
- 1 Eby head phone terminal strip
- 1 Eby antenna-ground terminal strip
- 1 Eby ground binding post
- 1 Vernier tuning dial
- 1 Front panel, $11\frac{1}{2}$ " x 7"
- 1 Chassis $8\frac{1}{2}$ " x $11\frac{3}{4}$ "

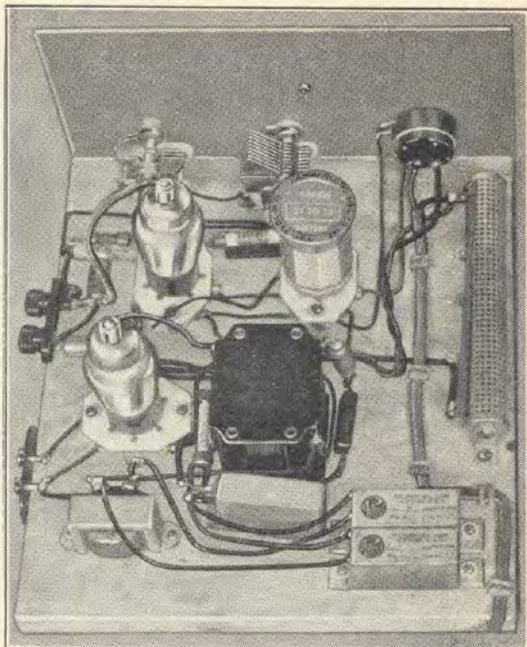
An AC-DC 2-Tube S. W. Receiver

THIS unusual high frequency universally powered receiver was originally described in the "New York Sun" by Louis Martin.

Though but two tubes are used, this little receiver has an untuned R-F stage, a tuned regenerative detector and audio amplifier, and a rectifier. It is perfectly stable, oscillates easily from 200 to 15 meters, and provides foreign reception with surprising ease. In fact, during a test, four foreign stations were tuned in quite easily and heard on a 5 inch dynamic speaker. The amount of hum when used on AC is negligible while the receiver is regenerating.

As you will note from the circuit, Figs. 1 and 2, the first tube is a 6F7 and the second is a 12A5. The 6F7 is really two tubes in a single envelope; a pentode and a triode. The pentode section is connected to the antenna by way of the RF choke CH-1. The output is then connected to the triode section through the use of the RF coils, as shown. The pentode section of the 6F7 is not tuned.

The 12A7 is a combination pentode amplifier and power rectifier of the half wave type. This tube was designed for use in "Cigar Box" receivers, and is suited admirably for our purpose here. The secondary of the audio transformers



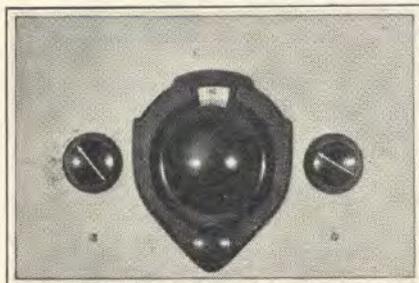
is connected to the grid and C-bias resistor of the pentode amplifier, and the audio output is fed to the phones or magnetic loud speaker.

Rectification of the power voltage is accomplished by the diode section of the 12A7, which is equipped with a separate cathode for this purpose. The base-pin connections of the two tubes used in this receiver are shown in Fig. 3.

It is important that the filaments of the tubes and the connections to the rectifier be made exactly as shown. The terminals of the power plug have been labeled plus and minus and these wires must be traced carefully when wiring the receiver. The 6F7 heater must be in that side of the line labeled "negative," else there is a possibility of cathode — heater leakage developing rapidly and ruining the tubes. The resistor should be placed where ventilation is best, for this resistor dissipates considerable heat which can be felt quite a distance away. Do not be alarmed if your hand should get comfortably warmed 12" or 18" away from this resistor.

Condenser C3A is shunted across C3, the main tuning unit, and is a band spread condenser. On 50 meters, half a rotation of this condenser corresponds to 1/20th of a rotation of the main tuning condenser, so that the band spreading is very good on this crowded channel.

The sockets for the tubes and the tuning coil are of the type which are raised above the board. This mode of construc-



Panel View

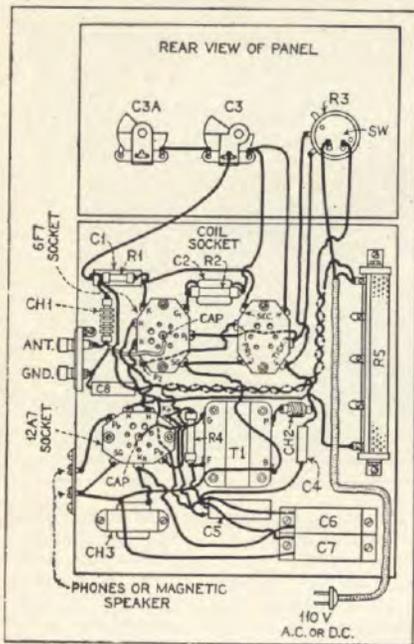


Fig. 1

tion is quite essential in bread-board receivers which utilize complicated wiring to a given socket.

Of course hum may be apparent when used on AC unless care, painstaking care, is taken to keep all AC leads away from the tuning condenser, coil, and grid leak and condenser.

If the receiver is to be constructed from parts lying around the house, then the audio transformer may be replaced with resistance coupling. The plate resistance should have a value of 50,000 ohms, and the grid leak a value of one megohm. The coupling condenser should be about .006 to .1 mfd.

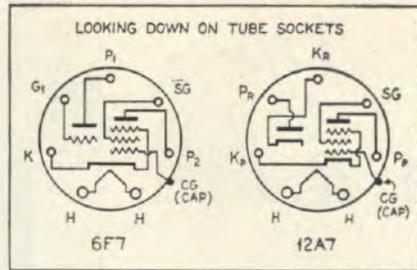


Fig. 3

List of Parts

HAMMARLUND PRODUCTS

- C3—Midget variable condenser, type MC-140-M
- C3A—Midget variable condenser, type MC-35-S
- CH1, CH2—RF Chokes, type CH-X
- 1 Isolantite socket, 6-prong for coil, type S-6
- 2 Isolantite sockets, 7-prong, type S-7B
- 1 Kit of 6-prong plug-in coils, type SWK-6

MISCELLANEOUS PARTS

- C1—Cornell-Dubilier condenser, .1 mfd.
- C2—Cornell-Dubilier condenser, .0001 mfd.
- C4—Cornell-Dubilier condenser, .0005 mfd.
- C5—Cornell-Dubilier electrolytic, 25 mfd., 25 v.
- C6, C7—Cornell-Dubilier electrolytics, 8 mfd., 200 v.
- C8—Cornell-Dubilier condenser, .02 mfd.
- R1—I.R.C. resistor, 300 ohms
- R2—I.R.C. grid leak, 3 megohms
- R3—Electrad tapered potentiometer with line switch, 7500 ohms
- R4—Electrad resistor, 1000 ohms
- R5—Electrad resistor, 300 ohms, 30-50 watts
- T1—Audio transformer
- CH3—Small 400 ohm AC-DC filtered choke
- 1 Eby antenna-ground binding post
- 1 Eby speaker binding post
- 1 7 x 10 aluminum panel
- 1 10 x 11 wooden baseboard

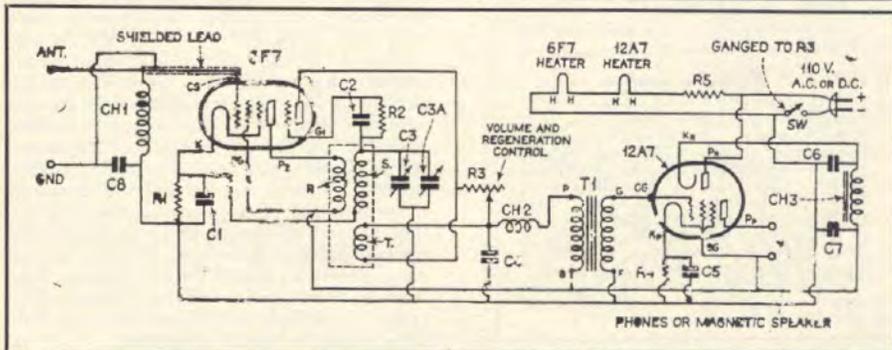
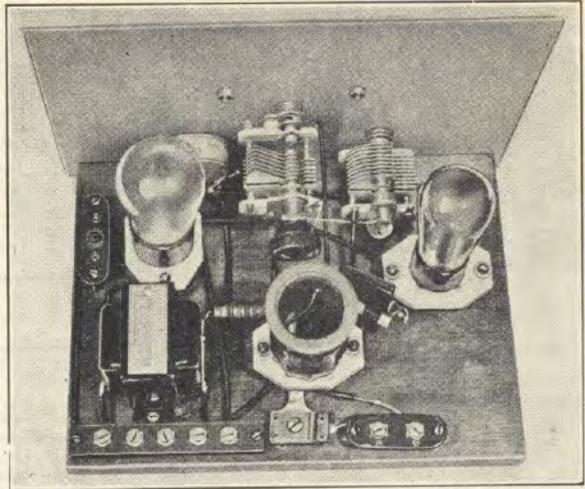


Fig. 2

The A.R.R.L. "Ham" Receiver



THE receiver described here is one which is featured by the American Radio Relay League and the magazine QST as an ideal job for a budding "ham". This receiver was described in detail in the A.R.R.L. booklet "How to Become a Radio Amateur," 3rd edition.

To quote from the descriptive article in this book: "The receiving set we describe is of simple design and construction. It is easy and straight-forward to assemble and operate, and yet will readily bring in amateur signals from distant stations with a suitable antenna and ground."

"Some of our readers may notice that the circuit is similar to the old familiar 'three-circuit' tuner so commonly built by broadcast listeners in the early days of broadcasting. Do not think, for this reason, that it is not a particularly good amateur receiver. It may surprise you to know that this tuner, with occasional modifications, is used in the majority of the amateur stations in this country. Much of the international amateur work, expedition communication, etc., is done with receivers using this circuit."

While this little set was designed primarily for the reception of C. W. and 'phone signals from "ham" transmitters, the very features which make it a good "ham" receiver will make it a good receiver for any type of short-wave work.

The tuning condenser really consists of two condensers assembled in a single frame. The 100 mmfd. section is used for coarse tuning or band setting. The smaller sections provides a capacity of 20 mmfd. and it is with this portion that the fine tuning and band spreading is accomplished. Its shaft is brought through the front panel to the main tuning control. The knob for adjusting the larger section is at the rear of the condenser, behind the panel. The band spreading permitted by this arrangement is an invaluable feature of the receiver when operated on the 20, 40, 80 or 160-meter "ham" bands and is a decidedly useful feature on other ranges as well because it spreads the station out on the dial so that instead of two or three stations falling within one degree, as they do on so many receivers which do not include this feature, they are spread out over a dial range of perhaps five or ten degrees and thus tuning is much simplified.

Regeneration in the detector circuit is

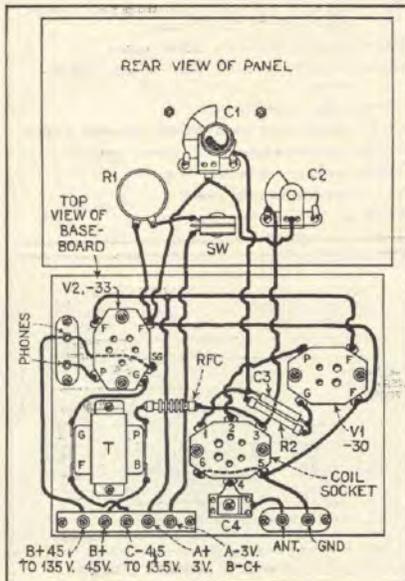


Fig. 1

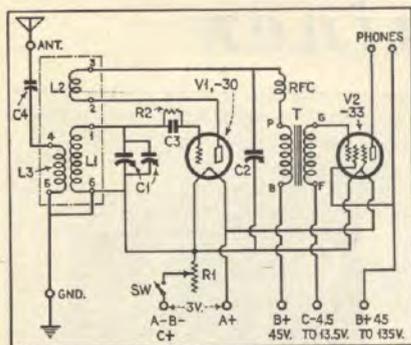


Fig. 2

accomplished by means of the usual tickler and is controlled by means of the variable bypass condenser, C2.

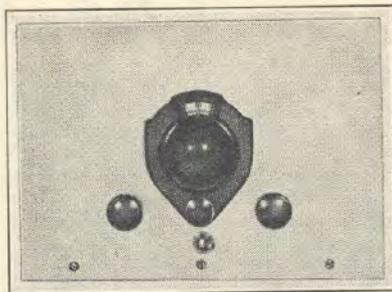
An aluminum front panel is used to minimize body capacity while tuning the receiver. This panel is screwed to the front edge of the wood baseboard. The three Hammarlund Isolantite sockets—this type of socket is recommended because of their low r.f. losses—are elevated approximately $\frac{5}{8}$ inch above the baseboard by means of bushings which are supplied with them. Similar bushings provide a convenient means for mounting the 3 terminal strips.

The receiver as described here provides excellent results when Hammarlund standard 6-prong plug-in coils are used. However, some constructors may prefer to wind their own coils and the necessary data are therefore given here based on the use of Hammarlund Isolantite coil forms.

Coil Data

	L1	L2	L3	Frequency Range
No. 1	70	20	10	1000 to 2200 kc.
No. 2	30	10	10	2250 to 4200 kc.
No. 3	11	7	5	4200 to 9000 kc.
No. 4	5	5	5	9000 to 18000 kc.

All coils are wound in the same direction using No. 30 double silk-covered wire, close wound. Approximately 1/16 inch spacing is provided between coils. In each case the grid coil (L1) is the top winding, the tickler (L2) is in the middle and the antenna coil (L3) at the bottom. The top end of the grid winding corresponds with the coil terminal marked No. 1 on the schematic diagram, the lower end to No. 6; the top end of the tickler to No. 3; the lower end of the tickler to No. 2; the top end of the antenna coil to No. 4 and the bottom end of the antenna coil to No. 5. The numbers marked on the coil socket in the picture wiring diagram, Figure 1 correspond to the coil terminal numbers on the schematic diagram, Figure 2, and the



Panel View

ends of the three windings should connect with the coil form prongs indicated by the numbers on the coil socket.

The tubes used are the popular two volt type. A rheostat of 10 ohms resistance is used to control the three volt supply necessary for these tubes. For this purpose a pair of $1\frac{1}{2}$ volt standard dry cells may be used. The -30 tube is used as the detector and the -33 pentode output tube is in the single audio amplification stage.

A metal chassis may be used. Be sure, though, to see that all leads are properly insulated, and that all grounds are made directly. Follow too the many layout suggestions, provided within the descriptions of the other receivers shown in this manual.

List of Parts

HAMMARLUND PRODUCTS

- C1—Midget variable condenser, type MC-120B, 2 sections—one 100 mmfd. and one 20 mmfd.
- C2—Midget variable condenser, type MC-140-M
- C4—Equalizer condenser, type EC-35
- L1, L2, L3—Standard 3-circuit, 6-prong, plug-in coil kit, type SWK-6, or four 6-prong coil forms, type CF-6
- RFC—R.F. choke, type CH-X
- 1 4-prong Isolantite socket, type S-4
- 1 5-prong Isolantite socket, type S-5
- 1 6-prong Isolantite socket, type S-6 (for coil)

MISCELLANEOUS

- C3—Cornell-Dubilier condenser, .0001 mfd.
- R1—Electrad type R1-204 rheostat, 10 ohms
- R2—I.R.C. metalized resistor, 2 megohms
- T—Thordarson type R-260 audio transformer
- 1 Eby 2-gang strip (tip jack terminals)
- 1 Eby 2-gang strip (screw terminals)
- 1 Eby 5-gang strip (screw terminals)
- 1 Kurz-Kasch vernier dial (small)
- 1 7 inch by 10 inch aluminum panel, 16-gauge
- 1 Wood baseboard, $9\frac{1}{2}$ inches by 7 inches by $\frac{3}{4}$ in-h thick.
- 1 Toggle switch, s.p.s.t.

The Gainer

THE model of the "Gainer" shown here is an adaptation of the original receiver developed by the technical staff of "Radio" and described in that magazine. The detector is one of the new 6D6 tubes and is the equivalent of the -57 except that it is intended for operation from a 6-volt battery or transformer. The type -76 tube employed in the audio stage is the 6-volt equivalent of the -56. Either a storage battery or a 6-volt a.c. filament supply may be used. For the plate supply either a B eliminator or B batteries may be used. The voltage may be up to 200, although 135 volts will do. Band-spreading tuning is provided, the

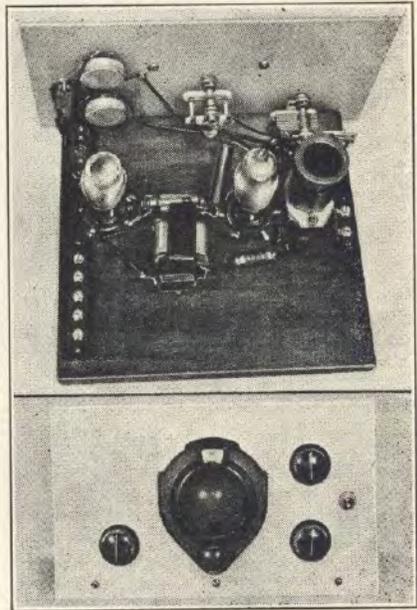
List of Parts

HAMMARLUND PRODUCTS

- C1—Midget variable condenser, type MC-20-S
 C2—Midget variable condenser, type MC-140-M
 C3—Equalizer condenser, type EC-35
 L1, L2—Four-prong plug-in coil set, type SWK-4
 RFC—R.F. choke, type CH-X
 1 Isolantite 4-prong socket, type S-4 (for coil)

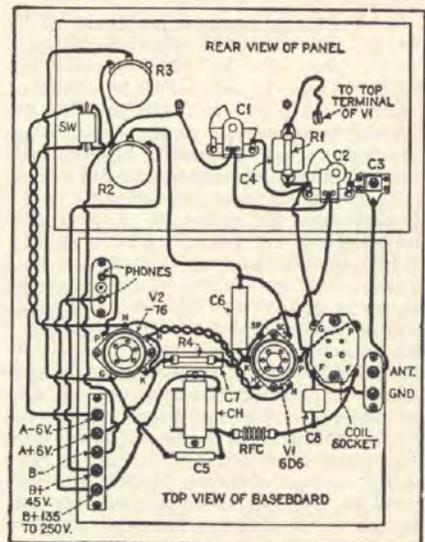
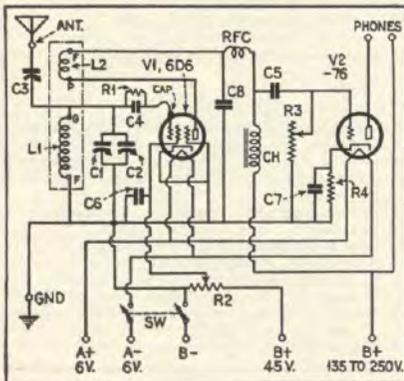
MISCELLANEOUS

- C4—Aerovox mica condenser, .00025 mfd.
 C5—Aerovox mica condenser, .01 mfd.
 C6—Cornell-Dubilier .1 mfd., 200 volts
 C7—Cornell-Dubilier .5 mfd., 200 volts
 C8—Aerovox pigtail mica condenser, .00015 mfd.
 CH—Thorndarson 200 henry audio choke
 R1—I.R.C. resistor, 1 to 5 megohms
 R2—Yaxley potentiometer, 50,000 ohms
 R3—Yaxley potentiometer, 500,000 ohms
 R4—I.R.C. resistor, 10,000 ohms, 2 watts
 1 Eby 5-prong socket, type 12, or Hammarlund Code S-5 Isolantite socket
 1 Eby 6-prong socket, type 12, or Hammarlund Code S-6 Isolantite socket
 1 Eby 5-gang strip (screw terminals)
 1 Eby 2-gang strip (screw terminals)
 1 Eby 2-gang strip (tip jack terminals)
 1 Kurz-Kasch vernier dial (large)
 1 Toggle switch d.p.s.t.
 1 Aluminum panel, 12" x 7"
 1 Baseboard, 10½" long, 9½" deep



140 mmfd. condenser, C2, serving as the coarse tuning or band-setting condenser, while the critical tuning is accomplished with the 20 mmfd. condenser, C1, which is controlled by the main tuning dial.

The coils employed are the standard Hammarlund plug-in coils of the 4-prong type.



The Argonaut

THIS 2-tube, dry-cell operated receiver was described in "Short Wave Craft."

The antenna series condenser, C3, as shown in Figures 1 and 2, is quite novel

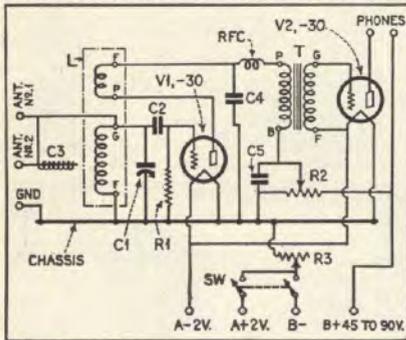
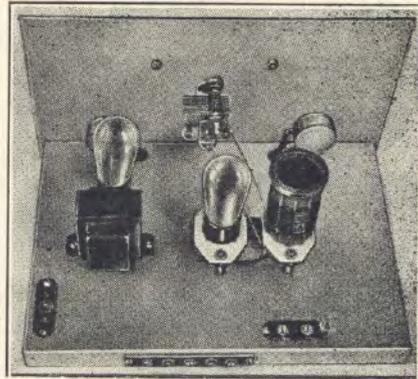


Fig. 1

in its construction. Instead of using the usual equalizer type, adjustable condenser here the designer made his own condenser by winding 14 turns of insulated hook-up wire tightly around a 1 1/4 inch length of bus bar, the hook-up wire and the bus bar each forming one plate of the condenser. The capacity of this condenser is varied either by slipping the coil partly off the bus bar, or by unwinding turns. The sole advantage offered by this kink is the fact that it costs nothing. Actually it is cumbersome to adjust and it is suggested that the constructor will save time and trouble by substituting a Hammarlund type EC-35 equalizer condenser here, its cost being only a few cents and easily justified by the greater convenience and permanency of adjustment.



List of Parts

HAMMARLUND PRODUCTS

- C1—Variable condenser, type MC-140-M
- RFC—R.F. choke, type CH-X
- 2 Isolantite sockets, 4 prong, type S-4
- L—Set of 4-prong 2-circuit plug-in coils, type SWK-4

MISCELLANEOUS

- C2—Cornell-Dubilier condenser, .0001 mfd.
- C3—See text
- C4—Cornell-Dubilier condenser, .00025 mfd.
- C5—Cornell-Dubilier condenser, .1 mfd.
- R1—I.R.C. metalized resistor, 5 megohms
- R2—Electrad potentiometer, 100,000 ohms
- R3—Electrad potentiometer, 20 ohms
- T—Thordarson transformer, type T-5736
- 1 Kurz-Kasch vernier dial (large)
- 1 Aluminum panel, 7" x 12", 16 gauge, and 1 aluminum chassis, 11 5/8" by 3" by 1" high
- 1 Eby 2-gang strip (screw terminals)
- 1 Eby 2-gang strip (tip jack terminals)
- 1 Eby 3-gang strip (screw terminals)
- 1 Eby wafer type 4-prong socket or Hammarlund Code S-4 Isolantite socket
- 1 D.P.S.T. toggle switch

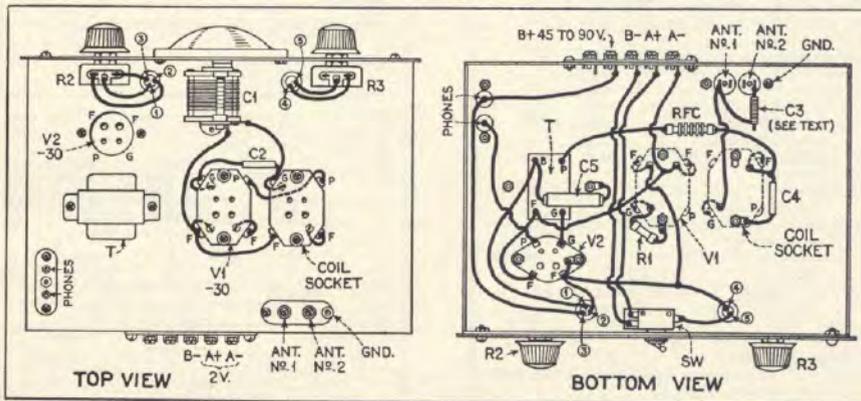


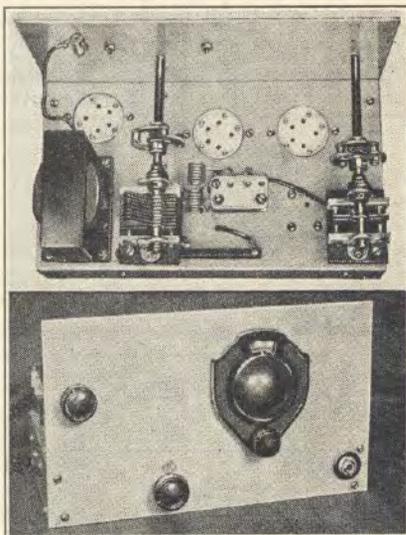
Fig. 2

The Ray Five-Meter Set

THIS three-tube super-regenerative receiver was originally described in detail in "Radio News." It was designed by Garo W. Ray, chief operator of Station WICC, Bridgeport, Connecticut, and owner and operator of an amateur station where he has carried on extensive experimental work in the 5-meter band. This receiver is the outgrowth of his experiments.

The receiver is constructed on an aluminum chassis and panel for the sake of the shielding they provide. These aid in the elimination of hand capacity, and to further reduce this trouble, the variable condensers are mounted at the rear of the chassis with long insulating shafts and flexible couplings.

Coils L1 and L2 consist of 6 or 7 turns each of bare round bus bars shaped on a pencil. After the receiver is completed a little experimentation will determine whether 6 turns or 7 turns are required for each. The spacing between turns also plays an important part in determining the frequency band covered and a considerable amount of variation may be obtained by spreading the turns. This adjustment will be facilitated if one can obtain the assistance of a friend who has a 5-meter receiver in operation, which can be used as an oscillator or monitor, in adjusting the coils to the



proper frequency range.

The oscillator transformer L3-L4 is not particularly critical as to the number of turns required. The specifications are shown below. The choke coil, L5, consists of 25 or 30 turns of No. 36 silk-covered wire, spaced to occupy 3 inches on a piece of 1/4-inch diameter bakelite or hard rubber rod.

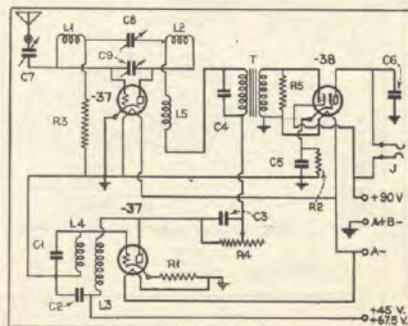
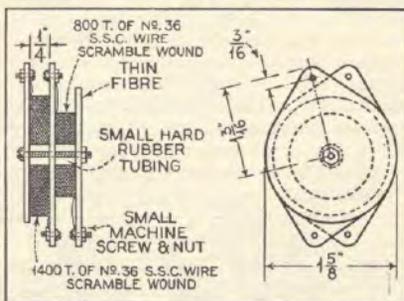
List of Parts

HAMMARLUND PRODUCTS

- C7—Midget variable condenser, type MC-20-S
- C8—Midget variable condenser, type MC-140-M
- C9—Adjustable condenser, Isolantite insulated type MICS-140
- 3 Isolantite sockets, 5-prong, type S-5
- 2 Insulated flexible shaft couplings, type FC

MISCELLANEOUS PARTS

- C1—Cornell condenser, .002 mfd.
- C2, C3, C5—Cornell by-pass condensers, .1 mfd.
- C4—Cornell condenser, .005 mfd.
- C6—Cornell condenser, .001 mfd.
- J—Single circuit (open) phone jack
- L1, L2, L3, L4, L5—(See text)
- R1, R2—I.R.C. metalized 2000 ohms, 1 watt resistors
- R3—I.R.C. metalized 3-megohm, 1-watt resistor
- R4—Electrad type R1-205 potentiometer, 50,000 ohms
- R5—I.R.C. metalized 200,000 ohms, 1 watt resistor
- T—Thordarson audio transformer, type R-260
- 12 inch length, 1/4 inch diameter, bakelite rod (for extension shafts)
- 1 Grid clip
- 2 Type -37 tubes
- 1 Type -38 tube
- Aluminum for chassis and panel, 1/16 inch
- 1 5-wire battery cable
- 1 Kurz-Kasch vernier dial

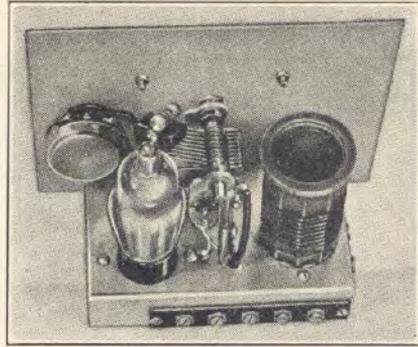


The Pentaflex

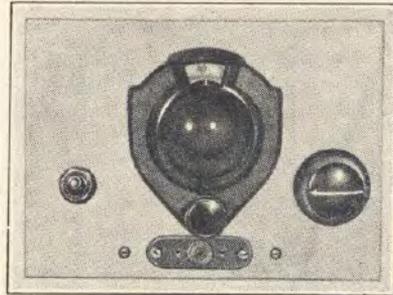
IN spite of its tiny size, this receiver, which was originally described in "Short Wave Craft," provides real 2-tube results.

The method of employing a pentagrid converter tube such as the 6A7 to serve as both a detector and an audio amplifier stage is made clear in Figure 1. Here the screen-grid section of the tube is connected like any other screen-grid tube employed as a regenerative detector. G4 is the control grid, G3 and G5 together constitute the screen, and P the plate. The triode section, used as the audio amplifier, employs G1 as its grid and C2 as its plate. The cathode K is common to both sections. The resistance coupling between the sections consists of R5 as the plate coupling resistor, C4 as the coupling condenser and R4 as the grid leak. The headphones are connected in the circuit of G2 (the triode plate).

This application of the 6A7 tube obviously lends itself to compact receiver design and the Pentaflex takes full advantage of this. The overall size is only 7 inches long, 5 inches high and 3 inches deep. The chassis is formed from a 7 inch by 5 inch sheet of 16-gauge aluminum bent down 1 inch all around. This provides deck space of 3 inches by 5 inches after the chassis has been attached to the back of the 7 inch by 5



Rear View



Panel View

List of Parts

HAMMARLUND PRODUCTS

- C1—Equalizer condenser, type EC-35
- C2—Midget variable condenser, type MC-140-M
- L1, L2—Standard set 4-prong plug-in coils, type SWK-4

- 1 Isolantite coil socket, type S-4, 4 prongs

MISCELLANEOUS

- C3, C5—Cornell-Dubilier by-pass condensers, .1 mfd.
- C4—Cornell-Dubilier by-pass condenser, .01 mfd.
- C6—Aerovox pigtail mica condenser, .0001 mfd.
- C7—Aerovox pigtail mica condenser, .0005 mfd.
- R1—I.R.C. metalized resistor, 3 megohms 1/2 watt
- R2—I.R.C. metalized resistor, 400 ohms, 1/2 watt
- R3—Electrad potentiometer, 50,000 ohms
- R4, R5—I.R.C. metalized resistors, .25 megohm, 1/2 watt
- 1 Kurz-Kasch vernier dial, small size
- 1 Grid clip
- 1 Toggle switch, d.p.s.t.
- 1 Eby 7-prong wafer type tube socket for 6A7 tube, or Hammarlund Code S-7B Isolantite socket
- 1 Pentaflex panel and chassis
- 1 Eby 5-gang strip (screw terminals)
- 1 Eby 2-gang strip (screw terminals)
- 1 Eby 2-gang strip (tip jack terminals)

inch panel by means of 2 screws.

The plug-in coils employed are the standard Hammarlund 4-prong type, four of which are employed to cover the entire short-wave range down to 15 meters.

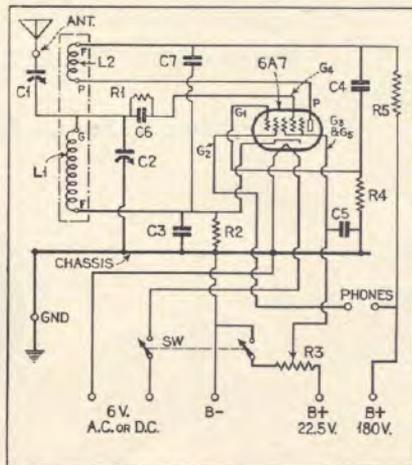


Fig. 1

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