A Practical Neutrodyne Receiver

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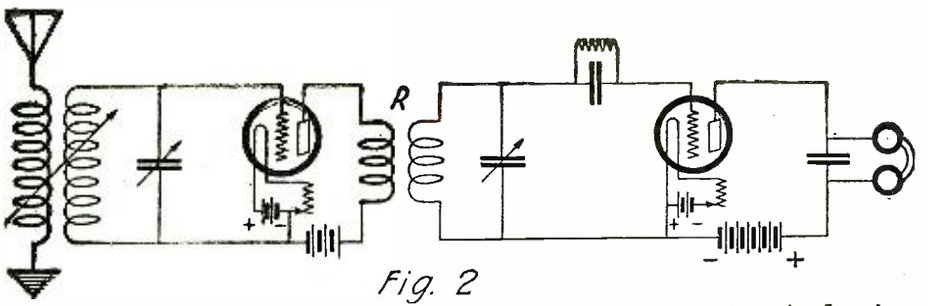
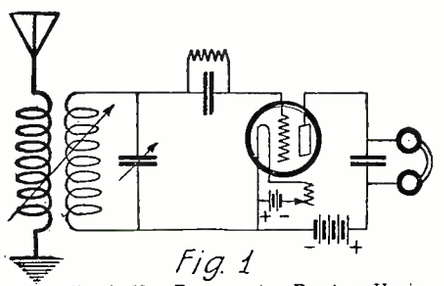
This article explains the action of the neutrodyne circuit in a manner which can be grasped by the novice. Its formation is described stage by stage, followed by complete constructional details for the building of a receiver of this type.



A One-Stage Radio Frequency Amplifier and a Non-Regenerative Detector, the Respective Secondary Circuits of Which Are Tuned by Means of Variable Condensers.

IT is unfortunate that so many good circuits are labeled with such formidable titles. The name "neutrodyne" is usually enough to scare the average radio fan. A neutrodyne circuit, as commercially developed, is, however, a great deal more simple to understand than the regenerative or reflex circuit.



A Two-Circuit Non-Regenerative Receiver Having a Tuned Secondary Circuit.

The average fan is not interested in the higher mathematics of a circuit but he does like to know the size of the parts so that he can put one together to obtain results.

Fig. 1 represents a simple type of non-regenerative hook-up. By varying the condenser the natural wave-length of the set can be altered. This is exactly the diagram of the first stage of the neutrodyne.

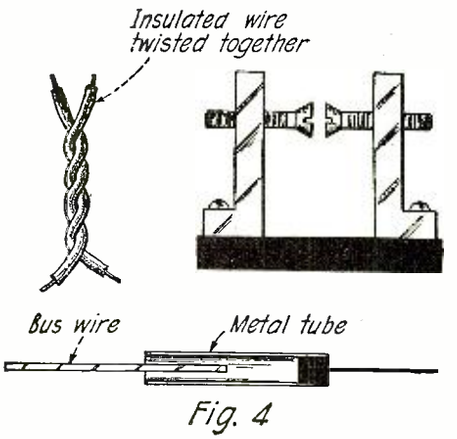
In Fig. 2, another stage exactly like the first has been added. In this case the first tube acts as a radio frequency amplifier and the second tube as a detector.

It will be noticed that the plate circuit of the first tube is not tuned, but that the grid circuit of the second tube, as well as the grid circuit of the first tube, are both tuned and in reality make the two stage filter through which the incoming signal must pass.

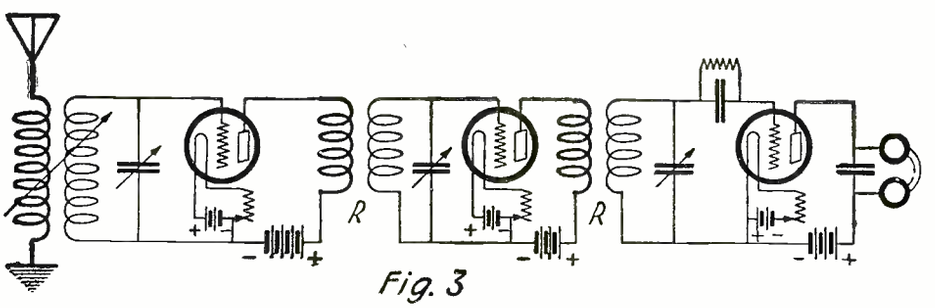
Fig. 3 represents three stages exactly as outlined above and this is the scheme of the neutrodyne after we add the neutralizing condensers which will be considered later.

In Fig. 3, there are two stages of radio frequency amplification and the detector, each stage being tuned by a variable condenser in the grid circuit. This circuit would give wonderful results if it were not for the internal capacity coupling between the plate and the grid circuit of each radio frequency tube. This internal capacity is neutralized by the combination of capacity and inductance; the inductance being the windings of the air core radio frequency transformers R. The capacity necessary for the average vacuum tube is very small and is usually about equal to two circular plates 3/8" in diameter separated by 3/32 of an inch. This is only approximate and the proper value may easily be found. Other types of condensers for this purpose are shown in Fig. 4.

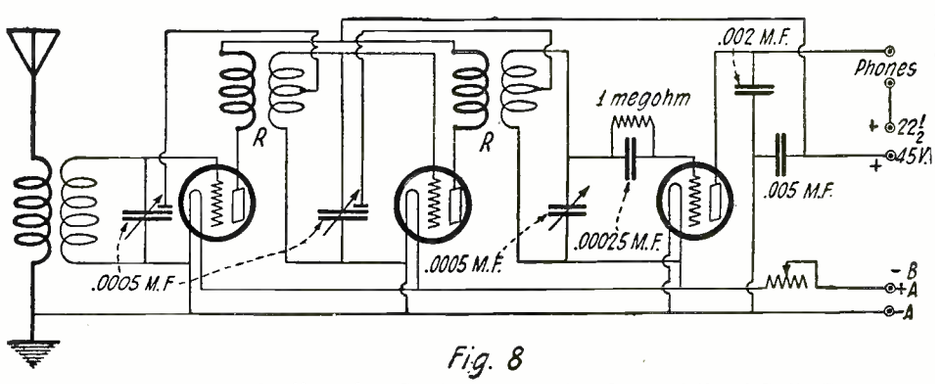
The radio frequency transformers can be made by winding 80 turns of wire on 3" tubes with a tap taken off at the 20th turn. It is preferable to use cardboard because it is an advantage to have a close coupling between this coil and the primary, which is inserted inside. The primary consists of 20 turns of wire on a tube which will just clear the tube on which the secondary coil is wound. It is difficult to buy one tube to fit inside another in this manner, but it can be overcome by sawing a piece of tube ½" wide lengthwise from the same tubing. Then when it is wound, the wire will draw it to a smaller diameter whereupon it may be slid into place inside the full sized tube. It is very important that these transformers be mounted at least 6" apart and at such an angle that a line drawn at right angles to the axis at the end of the winding does not intersect the winding of the adjoining transformer. See Fig. 6. Note the relative position of primary and secondary windings.



Several Ways of Making the Neutralizing Capacities.



Two Stages of Tuned Radio Frequency Amplification and Detector. These Circuits Are Free to Oscillate Due to Feed Back Through the Internal Capacity of the Tubes.



Complete Circuit Diagram of a Neutrodyne Receiver Having Two Stages of Tuned Radio Frequency Amplification and Detector. The Circuit is Kept from Oscillating by Means of Small Condensers Which Neutralize the Capacity of the Tubes.

NEUTRALIZING CONDENSERS

Since the variable condensers used are connected between the grid and the filament, it is possible to connect the grid to the fixed plates and then mount the other small movable plate on the back insulated portion of the condenser. By this means a very small change of capacity can be made in the neutralizing circuit. See Fig. 7.

After the proper value of this capacity is found, it need never be disturbed unless tubes are changed. It is likewise advantageous to shield the set, although it is absolutely impossible to make this set oscillate if it is properly constructed.

To find the proper value of the neutralizing condensers it is necessary to tune the set to a very powerful signal. The Flewelling "screamer" makes an excellent oscillator for this case. A paper may be inserted in the socket to cover the filament connections but leaving the plate and the grid free. Then the tube is inserted and the signal is still heard.

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This is done for the first stage and second stage separately, adjusting each condenser until the signal is no longer heard. I have found it possible to adjust these condensers without going to this trouble by simply setting them at the greatest capacity which would not cause the set to go into an oscillating condition. The action of these condensers is similar to that of the potentiometer in the original radio frequency circuit with

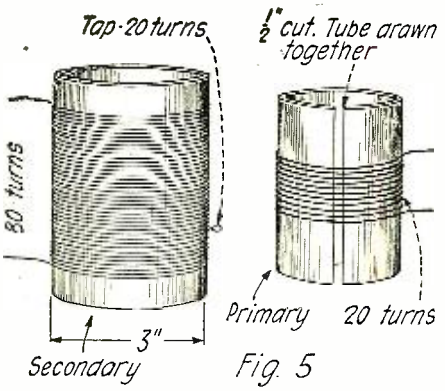

Fig. 5

Constructional Details of the Primary and Secondary Coils of the Neutroformers

the exception of the fact that they need never be changed for different wave-lengths or signal strengths. The complete circuit of the neutrodyne receiver is shown in Fig. 8.

If this set is constructed properly it will give results in clearness and sharpness which are superior to any other type of set which has come to my attention. The volume is not extremely loud but audio frequency can be added in the usual manner.

As seen, there are two stages of radio frequency amplification and a detector. The radio frequency transformers, unlike the iron core type, have untuned primary circuits and tuned secondary circuits. The tuning system likewise has an untuned antenna circuit and a tuned secondary circuit. All adjustments are made by the three variable condensers and maximum volume of any one signal will not be obtained until these three

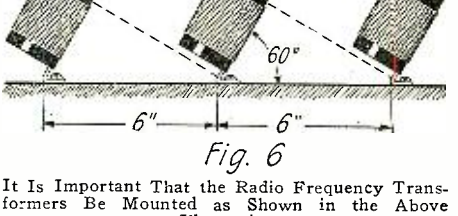

Fig. 6

It Is Important That the Radio Frequency Transformers Be Mounted as Shown in the Above Illustration.

circuits are tuned to the same values. This should be kept in mind when operating a neutrodyne receiver. The simplest way for hunting stations on various wave-lengths is to start at zero on all dials and slowly work towards 180 degrees moving the right hand condenser dial a few degrees first, followed by a corresponding adjustment of the second and first dials. Keep progressing until a station is heard. At this point, a fine adjustment of all three dials will be necessary to obtain maximum volume.

If it is desired to add the regenerative feature to this receiver a variometer should be connected in series with the plate of the detector tube and the head-phones. This variometer will allow as well the placing of the detector circuit in an oscillating condition for the reception of C.W. signals and without a chance of re-radiation.

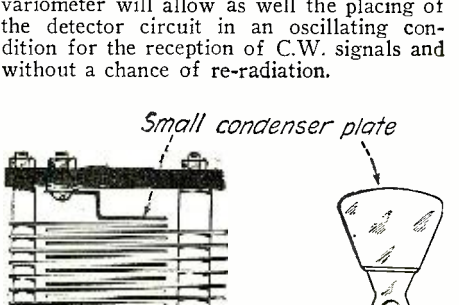

Fig. 7

A Small Metal Plate Mounted as Shown Well Serves the Purpose as the Neutralizing Capacity.