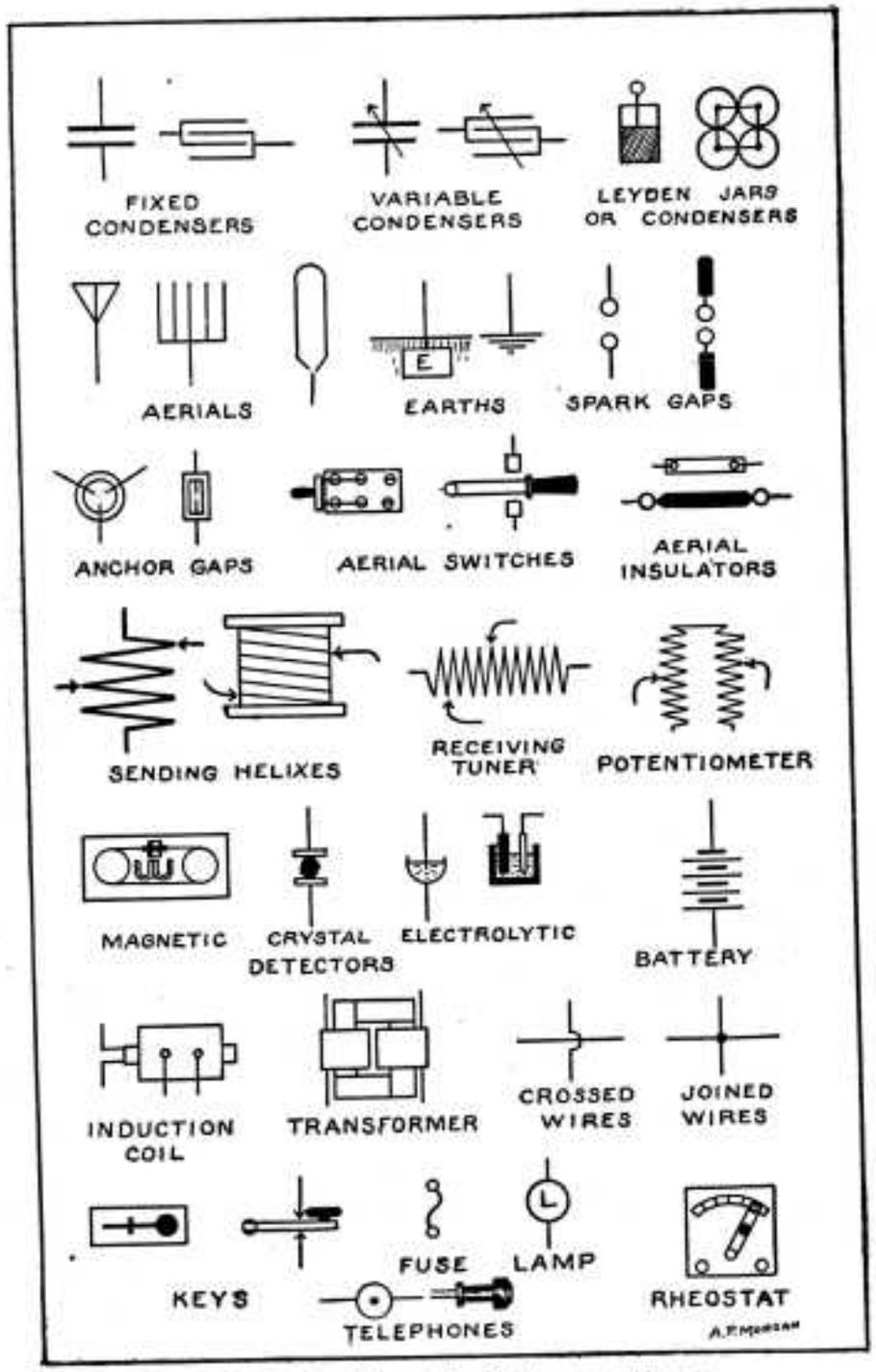

Frontispiece. **Plate I. Electrical Conventions.**

WIRELESS TELEGRAPH CONSTRUCTION FOR AMATEURS

BY

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AUTHOR OF "WIRELESS TELEGRAPHY AND TELEPHONY"

WITH 167 ILLUSTRATIONS

Third Edition, Revised and Enlarged

WITH A COMPLETE DESCRIPTION OF THE NEW WIRELESS LAW

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PREFACE.

In this work, the author has endeavored to present a book embracing practical information for those who may wish to build for private or experimental use a set of wireless instruments which are more than toys but yet not so expensive as the commercial apparatus.

Many books have been published on the subject of wireless telegraphy, but in them the interests of the novice have been rather neglected and in order to build an outfit he has been forced to rely upon a series of disconnected articles published in the amateur periodicals.

It is the object of this book to show the construction of simple, efficient instruments by means of clear drawings, and to give enough elementary theory and practical hints to enable the experimenter to build a size and type in keeping with his needs and resources.

The tiresome "how to make" style has been avoided as far as possible. History and all unimportant details are omitted to give in their place a concise explanation of the parts played by the different instruments and the influence of developing their various factors.

A small lathe and a set of taps and dies are necessary to produce apparatus having a good appearance, but a little ingenuity displayed in adapting screws and parts of old electrical instruments oftentimes at hand will make these tools unnecessary.

Ordinary precaution and plenty of time should be used in

CHAPTER XV.

RECEIVING CONDENSERS.

CONDENSERS play an important part in tuning and adjusting the receiving circuits of a wireless telegraph station. They are inserted in the circuits for various purposes. In some places a small condenser shunts the detector to somewhat equalize any small changes in capacity which might occur in the detector and throw the circuit out of tune. In other cases where selectivity is desired they provide a path for undesirable oscillations and allow them to flow into the ground without passing through

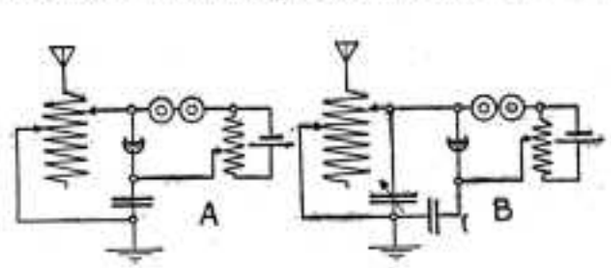

Fig. 137. Tuning Circuit with and without an Adjustable Condenser.

the detector. Wherever the double slide tuner or the Fessenden single slider circuit is used, a condenser must be inserted in the circuit to prevent the wire of the tuning coil from short-circuiting the telephone receivers and battery.

The value of a condenser may be readily appreciated by the following experiment. Connect up a detector according to the diagram shown by *A* of Fig. 137. This circuit will give good results and the signals will be clear. But change it to that shown in *B*, by connecting one side of a variable condenser to the upper contact of the tuning coil and lead-

ing the other side to the ground. Considerable selectivity may now be attained and the signals will be 50 per cent louder.

To be of any value for a receiving circuit the capacity of the condenser must be adjustable, but there are many places where a fixed condenser is of service.

The average capacity of such condensers generally ranges around .003 of a microfarad, but cannot be predetermined, as it depends upon many factors which vary greatly in different stations. Even if specific dimensions were given for the construction of a paper condenser of stated capacity, the experimenter would very seldom succeed in constructing his condenser and have it of this value when finished. The paper used as the dielectric and the pressure applied to the condenser would make the difference.

The best plan is to build one up in the form of a roll as follows. Three thin tin foil strips $3\frac{1}{2}$ inches wide and four feet long are separated by strips of thin paraffined paper 4 inches wide and four and one-half feet long. The two outside strips of tin foil are connected together and form one terminal of the condenser. The middle strip of tin foil is the other. The outside strips of tin foil are covered with paraffined paper and the whole rolled up. If thin paper and tin foil are used the condenser will form a roll 4 inches long and less than an inch in diameter.

Two or three such condensers should be constructed, and one of them connected up in the circuit where it is desirable to use it. By unrolling a little of the condenser and cutting one or two inches off at a time the proper size may be determined.

As explained in Chapter VII, two equal condensers connected in series have one-half the capacity of either. By

connecting them in parallel the capacity is the sum of the two. In this manner it is not hard to first find the approximate capacity, which gives the best results before cutting the condenser.

When the proper value is found, place the condenser in a brass tube about 5 inches long and 1 inch in diameter.

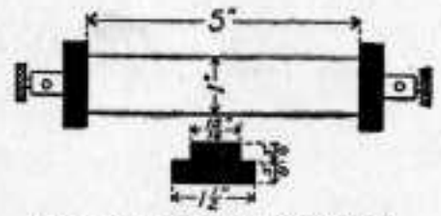

Fig. 138. Tubular Condenser.

The tube is fitted with hard rubber flanges to close the ends. A binding post is mounted on each flange, and connects with the terminal of the condenser to which it is nearest.

Mounting a condenser in this manner gives it a much better appearance and it occupies less space than otherwise. Fixed condensers are used in two cases only, to shunt the condenser and to prevent the tuning coil from short-circuiting the telephone receivers. In any other position they are worthless.

Variable Condensers. — A simple form of adjustable condenser which may be quickly made for a special experiment is constructed in the following manner. A wooden curtain pole 2 inches in diameter and 18 inches long is covered with a layer of tin foil. The tin foil must be laid on smoothly and cemented with shellac. A layer of paraffined paper is then placed over the tin foil. A piece of sheet copper or tin $6\frac{3}{4}$ inches wide and 18 inches long is rolled up in a cylinder to fit over the rod with its tin foil and paper. The rod is fastened at one end to a base board about 20

inches long and 4 inches wide, by means of a bracket, or it may be mounted on a smaller base in a vertical position.

Connections are made to the tin foil and to the outside metal tube. By sliding the tube back and forth on the rod the condenser may be given a variable capacity.

The best variable condensers are constructed so that the dielectric between the two plates is formed by air. There are consequently no losses of energy in the condenser, for this mode of construction eliminates all dielectric hysteresis.

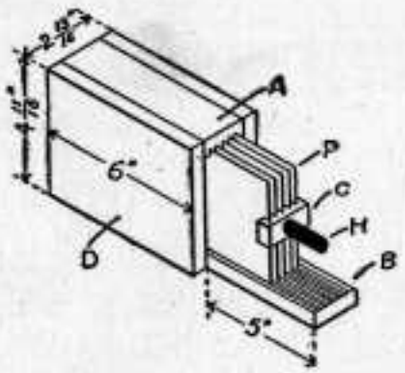

Fig. 139. Variable Condenser.

Fig. 139 shows such a variable condenser and Fig. 140 the details. It is possible to do very close, selective tuning with this instrument. The efficiency of the receiving circuit may be considerably improved if one is used wherever a condenser is required.

A rectangular box is built up in the manner shown in Fig. 135. The sides, *D*, are 6 inches long, 4$\frac{1}{8}$ inches wide and $\frac{1}{2}$ inch thick. The top, *A*, is 6 inches long, 1$\frac{3}{8}$ inches wide and $\frac{1}{2}$ inch thick. The bottom, *B*, has the same width and thickness but is 11 inches long. Eleven grooves are cut in *A* and *B* as shown in the cross section. The grooves are $\frac{1}{16}$ inch wide, $\frac{3}{16}$ inch deep and $\frac{1}{16}$ inch apart. They are

formed by setting the blade of a circular saw so that it projects $\frac{3}{16}$ inch above the table or bed. After cutting one groove, the guide is moved $\frac{1}{8}$ inch and another cut made.

Eleven metal plates, *P*, are required, six fixed and five movable. They are made of No. 22 gauge sheet brass and

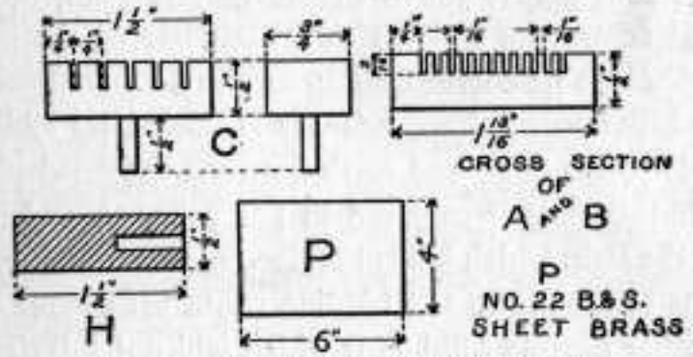

Fig. 140. Details of Variable Condenser.

measure 4 × 6 inches. Six of them are placed in the grooves in the box in such a manner that an empty groove is left between each one. The six plates are then electrically connected together by soldering a strip of brass across their rear ends.

Five slots each $\frac{1}{4}$ inch deep and $\frac{1}{4}$ inch apart are made

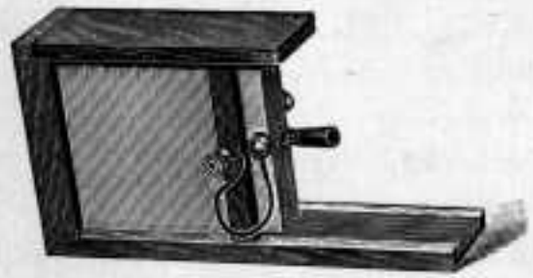

Fig. 141. Sliding Plate Variable Condenser.

with a hack saw in a piece of brass, *C*, 1$\frac{1}{2}$ inches long, $\frac{3}{4}$ inch wide and $\frac{1}{2}$ inch thick. A small pin $\frac{1}{2}$ inch long is

set in the center of *C* on the opposite side from the saw cuts. A fiber handle ½ inch in diameter and 1½ inches long is fastened to the pin.

The five movable brass plates are set in the grooves between the six fixed plates. They are allowed to project three or four inches out of the box. The yoke, *C*, is then soldered across the ends so that each one of the movable plates fits into its corresponding saw cut.

The capacity of the condenser is varied by sliding the movable plates back and forth between the fixed plates.

A binding post is soldered to the yoke, *C*, and another one to the strip which holds the fixed plates together. Connections are made to the binding posts with lamp cord or some other flexible conductor which will not interfere with the movement of the plates.

The instrument is finished by staining the woodwork and giving it a coat of varnish or shellac.

CHAPTER XVI.

TELEPHONE RECEIVERS AND HEADBANDS.

A PAIR of high resistance telephone receivers in nice adjustment constitute one of the most sensitive electrical instruments in existence and will detect an exceedingly weak current.

The only type of receiver of much service in wireless telegraphy is that known as a watch case or pony receiver. It is small and compact so that it may be attached to a headband and clamped against the ear.

The permanent magnets of a watch-case receiver are usually in the form of either a ring or a horseshoe as shown

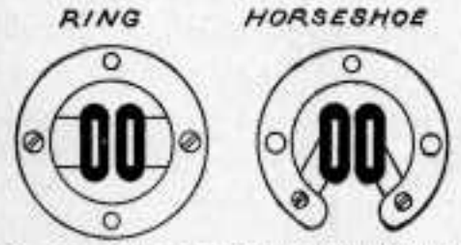

Fig. 142. Types of Permanent Magnets.

by Fig. 142. The first form has "consequent" poles and is considered somewhat superior to the horseshoe, since the lines of force are not so liable to pass across the pole pieces before they pass through the electromagnets and the diaphragm.

The ordinary low resistance telephone receiver is perfectly well suited to the telephone work for which it was designed and adjusted, and will give good service on a wireless receptor for short distances, but can be considerably