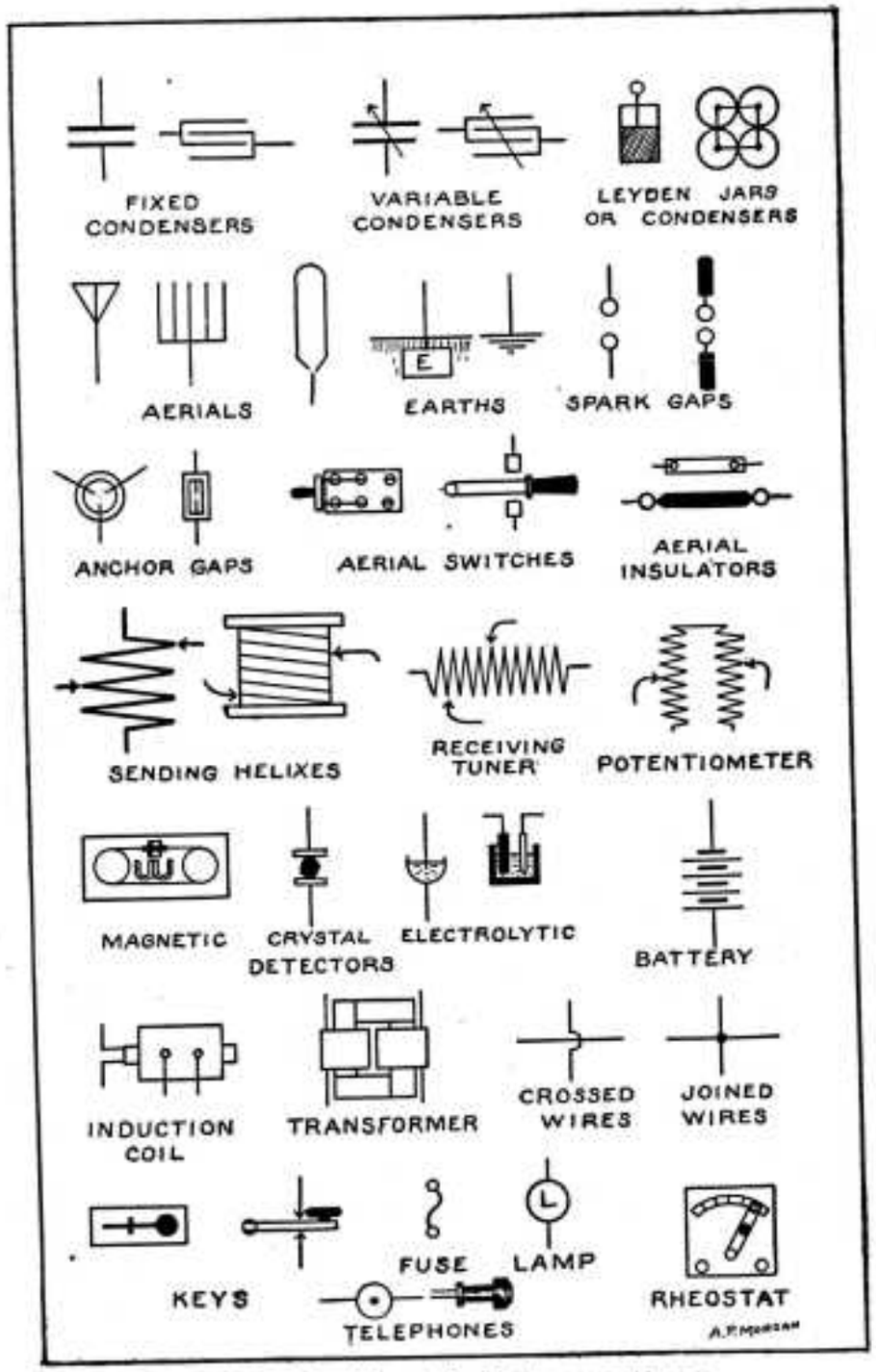

Frontispiece. **Plate I. Electrical Conventions.**

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

Twelve dry cells are connected with a multiple point switch so that an electromotive force of 6–18 volts, varying in steps of one cell at a time, may be secured. The flame is best provided with a mica chimney to protect it from drafts. By keeping plenty of salt in the trough and carefully adjusting the voltage, this detector may be made marvelously sensitive.

CHAPTER XIV.

TUNING COILS AND TRANSFORMERS.

A TUNING coil is merely a variable inductance wound in single layer on a suitable form.

Fig. 121 illustrates a double slide tuner. The base is a piece of hard wood, 12 inches long, 1 inch thick and $5\frac{1}{2}$ inches wide. Two wooden heads $4 \times 4 \times \frac{3}{4}$ inches support the form upon which the coil is wound.

The form is a piece of wooden curtain pole, 9 inches long and 3 inches in diameter. Some may prefer to use a cardboard tube in place of the curtain pole. A tube can be made by winding a long strip of cardboard 9 inches wide around a suitable form and cementing the layers together with shellac. The liberal use of shellac will stiffen the tube

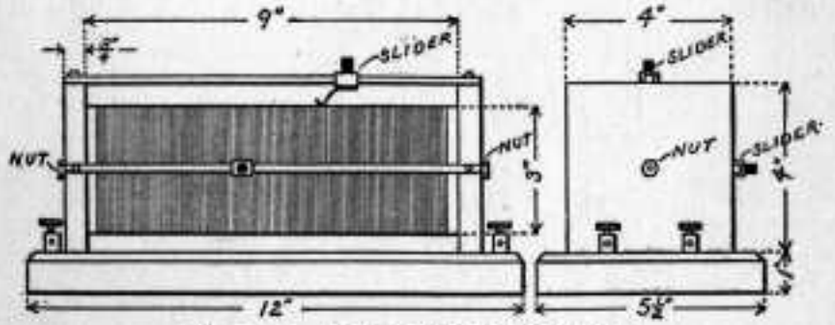

Fig. 121. Double-slide Tuning Coil.

and cause it to better retain its shape. The tube is held tightly between the two heads by means of a brass rod which passes through the center and is clamped by two nuts.

A square brass rod $10\frac{1}{2}$ inches long is fastened to the cen-

ter of the top of the heads and a similar rod to the center of the front face.

Fig. 122 shows two forms of sliders. The first one is the better and to be preferred. A short square brass tube, *S*, fits snugly upon the square brass rod, *R*. It cannot turn around

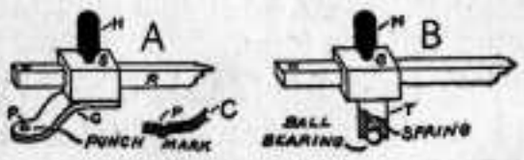

Fig. 122. Sliders.

but is free to slide back and forth. A strip of spring brass, *C*, is soldered to the lower face of the square tube. It is bent in a double turn and a punch mark made near the lower end as shown in the illustration. The indentation is made with a center punch, but should not be deep enough to break through the metal.

The little projection on the under side of *C* caused by the punch mark is the only part of the slider which should make

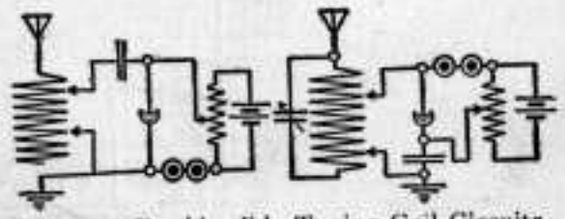

Fig. 123. Double-slide Tuning Coil Circuits.

contact with the wire on the tuning coil. It should slide easily but firmly along the wires and touch only one at a time. Long distance signals will be considerably weakened if the slider touches more than one wire at a time and short-circuits a turn.

The slider, *B*, is similar to *A* except that it has a short length of brass tubing, *T*, soldered to the under side of *S*

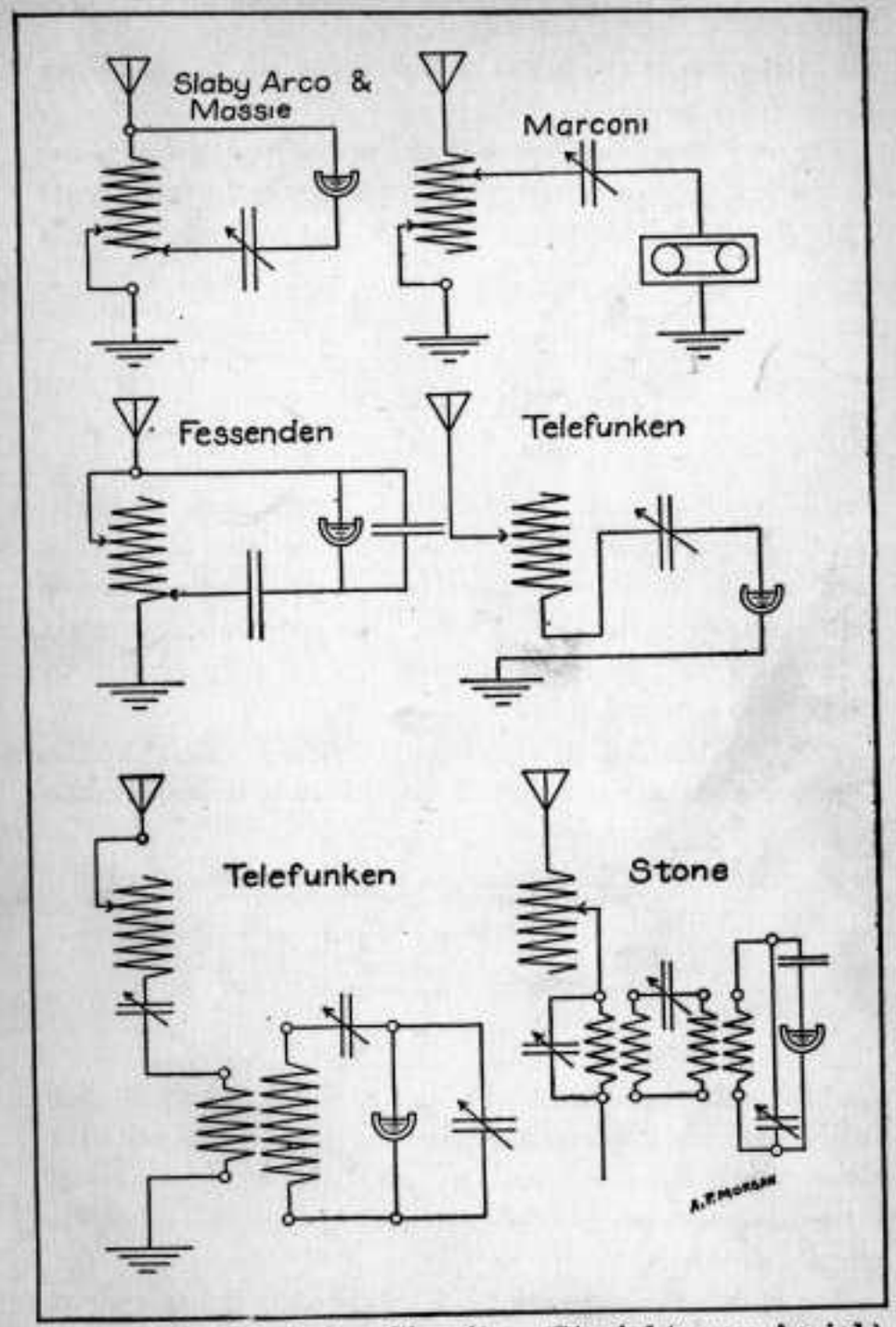

Plate IV. Receiving Circuits. (Straightaway Aerial.)

in place of the brass strip, *C*. A small ball bearing which just fits the bore of the tube is pushed down into contact with the wire by means of a small spiral spring inside of the

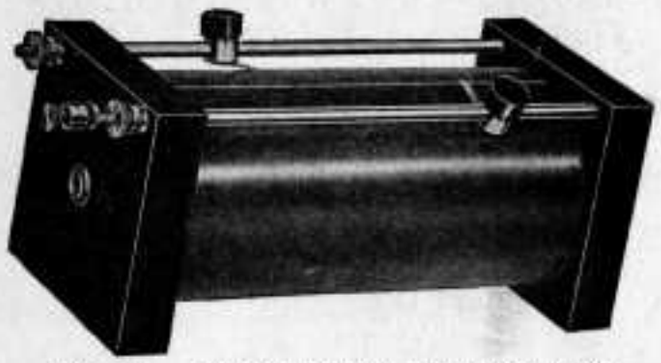

Fig. 124. Murdock Double-slide Tuning Coil.

tube. Both sliders are fitted with a hard rubber handle so that they may be adjusted without the fingers coming into contact with the metal.

Two good circuits employing the double slide tuner are given in Fig. 123. Plates IV and V illustrate the oscil-

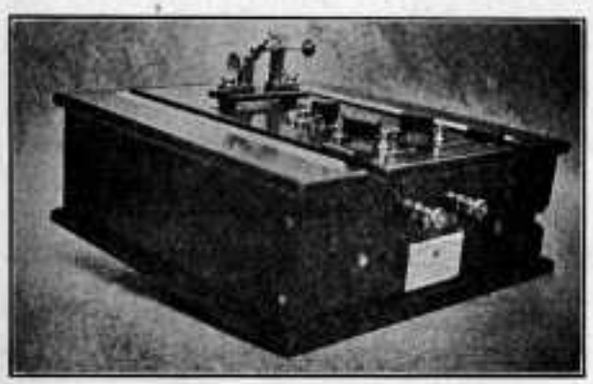

Fig. 125. United Wireless Receiving Set.

lation or tuning circuits of the most prominent receptor systems.

If a loop aerial is used, more than one tuning coil is neces-

sary as shown by the loop aerial oscillation circuits in Plate V.

Figs. 125 and 126 illustrate the instruments employed for receiving by the United Wireless Company.

In Fig. 125 the handles which are attached to the sliders

Fig. 126. United Wireless Portable Receiving Set.

of the tuning coils project through long slots cut in the top and one side of the cabinet.

The tuning coils in the portable outfit are mounted in a vertical position in back of the aerial switch.

Loosely Coupled Tuning Coil. — By the use of a loosely coupled receiving tuner or transformer, the range of a station is considerably increased, as is also the strength of the signals, and much finer tuning and selectivity made possible.

Fig. 127 illustrates the construction of such an oscillation transformer.

The base is wood and measures $14 \times 5\frac{1}{2} \times 1$ inches. The primary winding is wound on a cardboard or fiber tube $4\frac{1}{4}$ inches long, having an internal diameter of $2\frac{3}{4}$ inches and an external diameter of 3 inches. The heads, *L* and *M*, are

the same size as those of the double slide tuning coil. The head, *L*, has a circular hole $2\frac{3}{4}$ inches in diameter cut in the center in order to permit the secondary coil to slide in and out of the primary.

The secondary coil is a piece of round curtain pole $2\frac{1}{2}$ inches in diameter and 3 inches long. A $\frac{5}{16}$-inch hole is

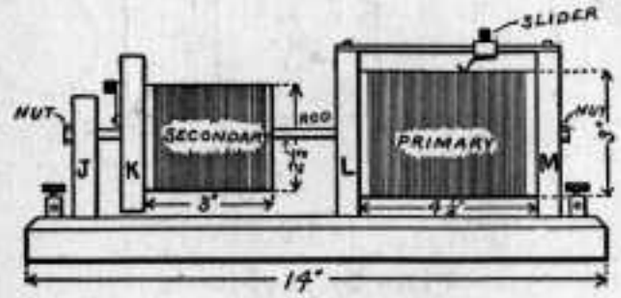

Fig. 127. Oscillation Transformer.

bored through its axis. The head, *K*, of the secondary coil is $3\frac{3}{4} \times 3\frac{3}{4} \times \frac{3}{4}$ inches. A ten-point switch on *K* is so connected that it divides the secondary into ten equal parts

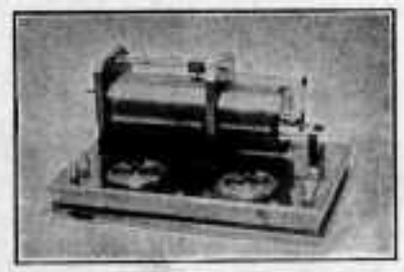

Fig. 128. United Wireless Receiving Transformer.

and permits any number of the divisions to be used as desired.

A wooden post, *J*, $2\frac{1}{2}$ inches high and $1\frac{1}{4}$ inches wide, supports one end of a $\frac{1}{4}$-inch brass rod upon which the secondary slides back and forth.

No. 24 B. S. gauge copper wire may be used for winding

both the primary and secondary. It is also the proper size to use on the double slide tuner. The best method is to use bare wire, wound with a thread so that a thread is interposed between adjacent turns of the winding. Give the

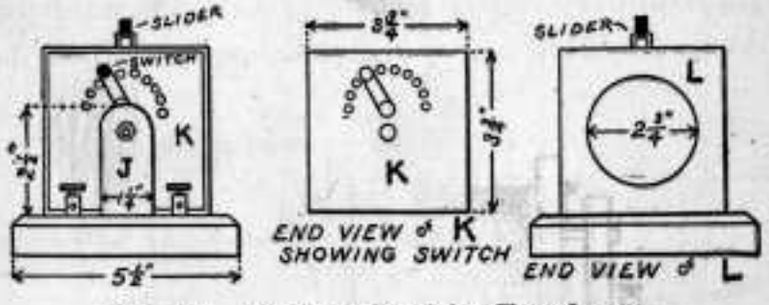

Fig. 129. Details of Receiving Transformer.

whole winding one or two coats of thick shellac and allow it to harden. Then use a strip of sandpaper to remove the shellac in a long narrow path immediately below the sliders so that they may make contact with the wire.

Some may prefer to make a loosely coupled tuner in which the inductance of both coils is adjustable by means of a sliding contact. In such a case the slider on the secondary coil must be constructed as illustrated in Fig. 130. The contact

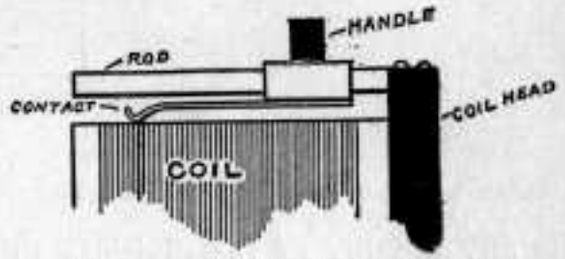

Fig. 130. Slider for Loose Coupler.

is long and narrow so that it can touch the innermost turns, when placed within the primary. By slipping the slider off the end of the rod and reversing it, the contact can be made to touch the turns next to the head. The square brass rod

is set in a notch cut in the coil head so that the rod is flush with the top.

When tuning a receiving transformer, place both variable condensers in a halfway position and adjust the sliding contacts, first on the primary and then on the secondary, until the signals are the loudest. Then adjust the condensers.

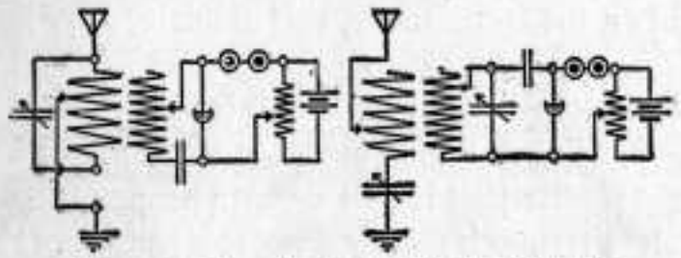

Fig. 131. Loosely Coupled Tuning Circuits.

To cut out an undesirable station, vary the coupling between the two coils by sliding the secondary away from the primary. When several turns on the secondary seem to give the same results also vary the coupling.

Fig. 132 illustrates the wiring diagram of a combination loosely and closely coupled tuner. Two sliding contacts are

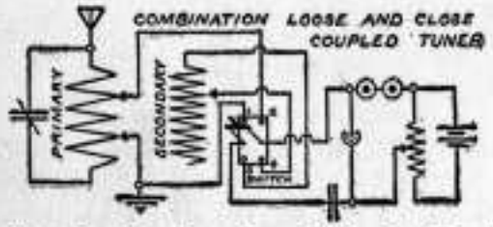

Fig. 132. Combination Loosely and Closely Coupled Tuner.

placed on the primary coil of the receiving transformer and connected with a double pole double throw switch as in the diagram. When the switch is thrown on contacts 1 and 2, the primary is connected to the detector as a double slide tuner, and when on 3 and 4 both the primary and secondary are brought into use as a transformer.

This arrangement may seem cumbersome and is recommended only as a convenience in experimenting. A loosely coupled tuning coil is capable of exact tuning, and unless one understands how to use it, he may not hear a station because the tuner is not properly adjusted. By using the double slide tuner first and then throwing the switch so as to tune in on the transformer, this difficulty may be eliminated.

Potentiometer. — A potentiometer is not properly classed under the heading of tuning coils, but the construction may be made so similar that it well appears here.

The potentiometer is merely a variable resistance shunted across the terminals of the detector battery in the manner illustrated in the numerous detector circuits. It is used to

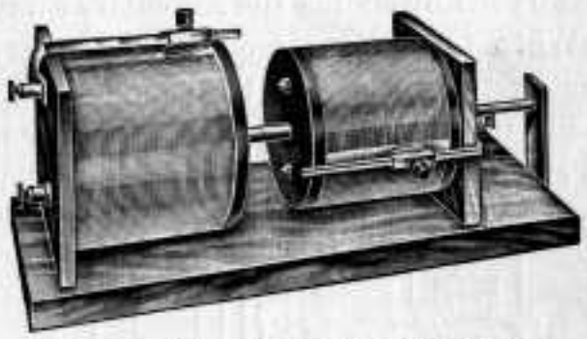

Fig. 133. Clapp-Eastham Loose Coupler.

reduce the voltage of the battery to a value slightly below the critical voltage of the detector. The critical voltage of a detector is the voltage at which its action commences. In the case of an electrolytic detector, it is the voltage required to break down the thin film of gas which collects on the "bare point."

In construction, the potentiometer illustrated in Fig. 135 is in reality a small edition of a double slide tuning coil. It

is wound with No. 28 B. S. gauge German silver wire. Three binding posts are mounted on the base, two of them con-

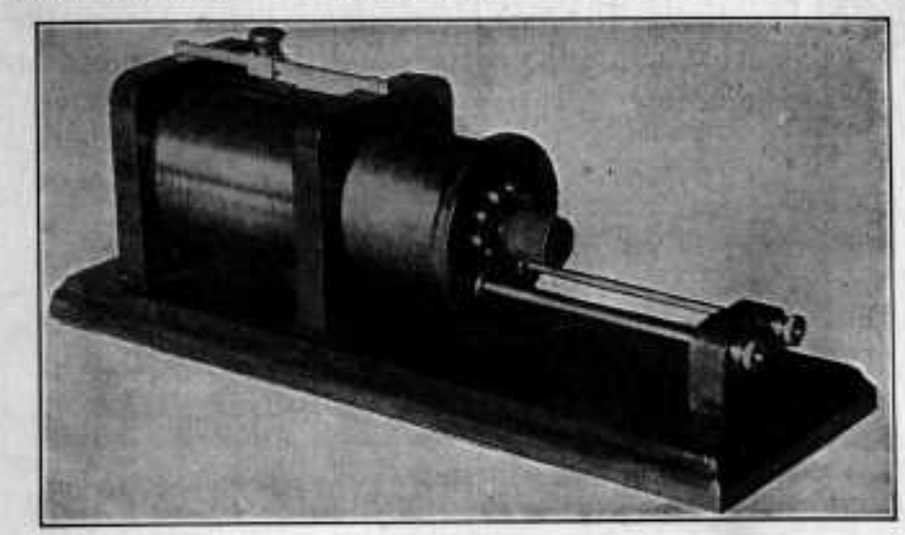

Fig. 134. A Highly Efficient Form of Loose Coupler.

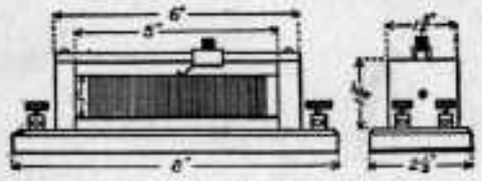

Fig. 135. Potentiometer.

necting with the ends of the coil and one with the sliding contact.

In a finely balanced circuit where long distance work

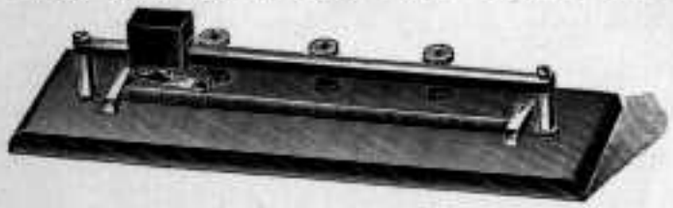

Fig. 136. Amco Potentiometer.

and close tuning are desired, the potentiometer must be non-inductive.

This may be accomplished by using two potentiometers wound in opposite directions from one another and connected in series. The two terminals of the windings are then connected across the battery and the sliding contacts led to the detector.

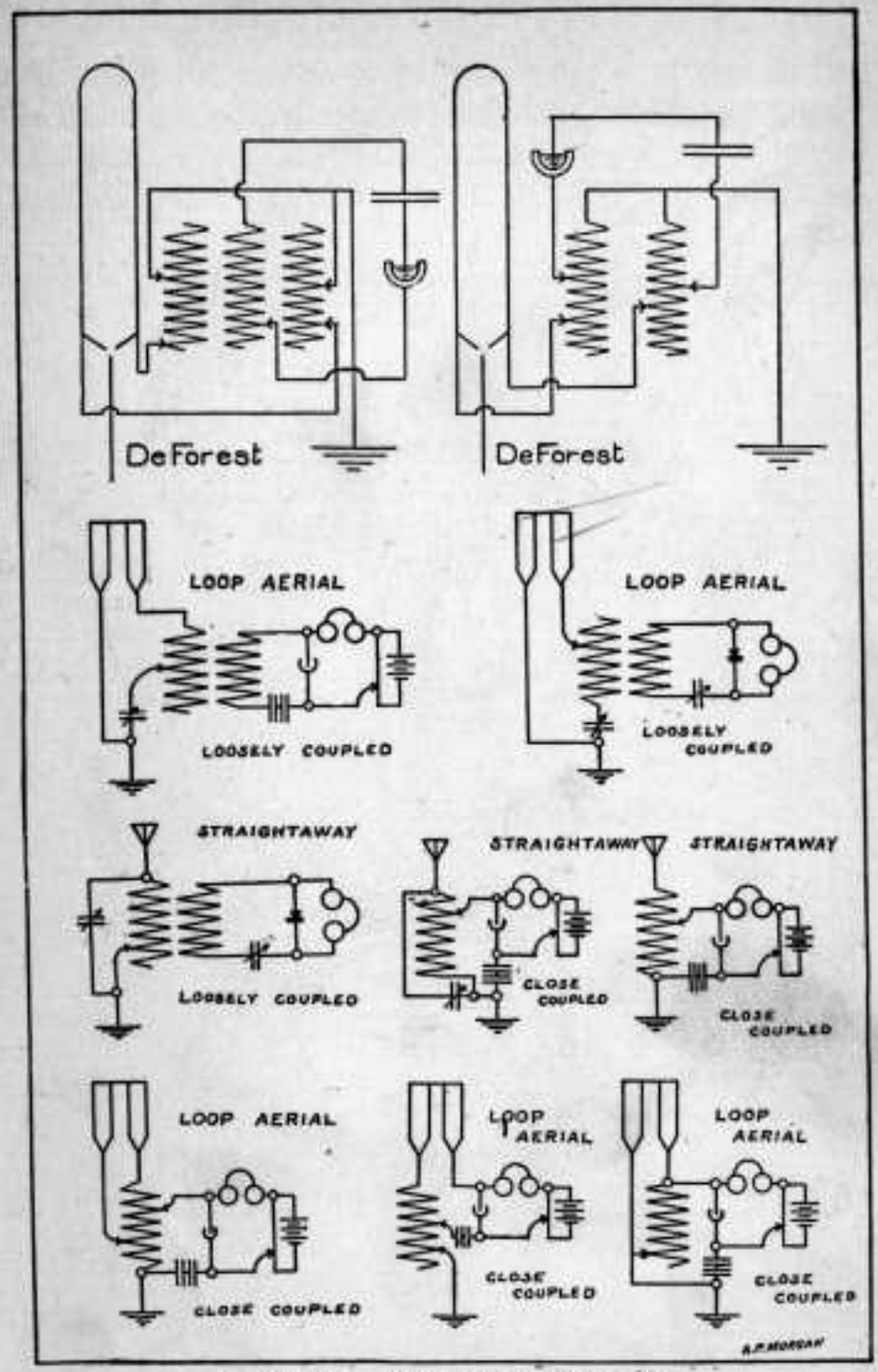

Plate V. Receiving Circuits.