THESIS

DESIGN AND CONSTRUCTION OF A RADIO TRANSMITTING AND RECEIVING SET.

By

Read H. Card.

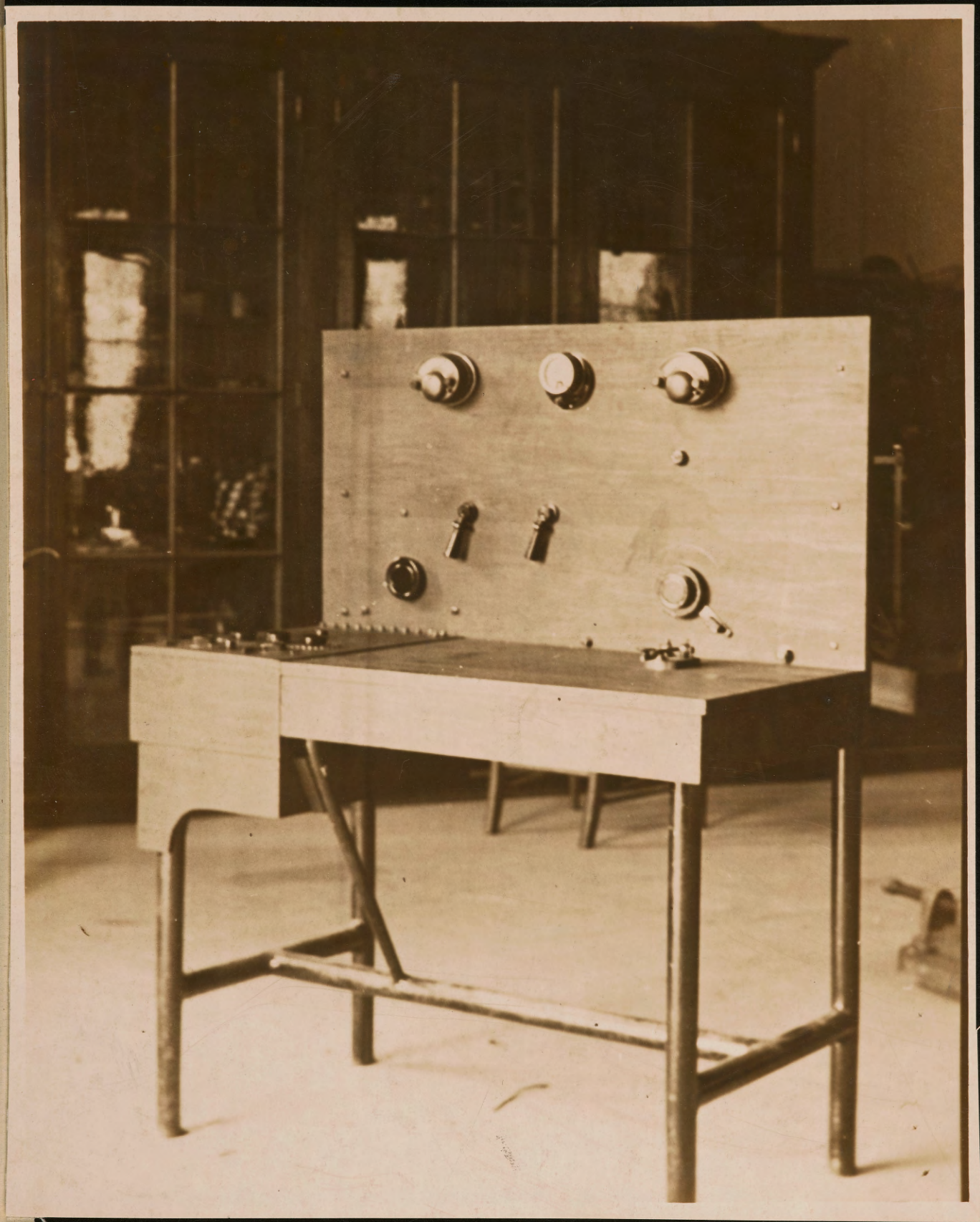
Presented for the Degree of

BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING.

Under the Direction of Dr. Chas. A. Perkins.

UNIVERSITY OF TENNESSEE.

June 25,1919.



This set is designed especially for laboratory and experimental purposes. All parts are arranged conveniently and easily accessible. Means are provided for interchange or addition of other apparatus in order to give the set as wide a range of usefullness as is possible.

TRANSMITTING SET.

The transmitting set is a simple,damped wave,synchronous rotary gap set receiving power from a 900 cycle alternator. The set is designed to give a wave length varying from 140 to 360 meters. It is composed of two separate units, the generator and its driving motor together with the rotary spark gap, and a special mounting carrying the remainder of the apparatus. A place is provided in this mounting also for the receiving set which is made portable but may be combined with the transmitting set when it is so desired.

GENERATOR.-The generator is an Alexanderson type alternator rated as 4500 R.P.M.-115 Volts on open circuit-900 Cycle-200 Watt. It is driven by a round belt from a 1900 R.P.M.-110 Volt-D.C. motor.The generator is mounted in an aluminum casing with ventilating slots provided in one end. The stator of the generator is laminated and carries two windings. The direct current winding for excitation is wound on four poles. Four slots are cut in each of these poles in which are placed the high frequency alternating current windings . The rotor is a soft iron casting made with twelve teeth and acts as an inductor to set up the alternating current in the stator windings.

A rheostat is connected in the D.C. field circuit which is fed from 110 Volt mains, in order to vary the output of the

generator. The relation between the field excitation voltage and the open circuit voltage of the A.C. windings is given by an accompanying curve.

ROTARY SPARK GAP.- On the shaft of the generator is mounted the rotary spark gap. This gap serves to control the tone of the signals sent and to a slight degree quenches the spark, thus reducing the decrement of the transmitted waves. The gap consists of a brass disc mounted on an insulating hub keyed to the shaft of the alternator, forming one electrode, and a second stationary electrode mounted on an insulating block carried by a bracket attached to the generator base. This block also carries a brush bearing on the face of the brass disc. Five interchangeable discs are provided having respectively 6, 8,12,17, and 24 teeth,giving corresponding tones of 450, 600, 900, mixed tone, and 1800 sparks per second.

The stationary electrode is capable of two adjustments, angular and radial. The angular adjustment determines when the spark will occur with reference to the cycle of the generator voltage, while the radial adjustment determines the length of the gap between the stationary electrode and the rotating teeth as they pass. The minumum length of gap should be 1/64 inch.

TRANSMITTING SET PROPER.- The transmitting apparatus with the exception of the generator and rotary gap is mounted on a stand made of iron pipe with welded joints. The accompanying photographs show clearly the construction of this stand. It carries a table surface on which is mounted the sending key. An offset at one end of the stand accomodates the receiving set.

Back of this surface is ah upright panel. On the front of thès panel are mounted the generator field and the input ammeters, the hot wire ammeter in the antenna circuit, and contrdl handles for the different adjustable instruments. In the rear of this panel is the remainder of the apparatus, consisting of the power transformer, condensers, oscillation transformer, generator field rheostatand switch, antanna switch, and a simple adjustable spark gap as a safety measure and for use in placeof the rotary gap when desired.

POWER TRANSFORMER.- A power transformer could not be obtained to take care of the maximum output of the generator, or 200 Watts. Instaad two battery induction coils with vibrators locked down were used. The primaries of the coils were connected in series and the secondaries in parallel. These coils will handle about 50 Watts with a current of 2.5 Amperes. The input to the transformer is indicated by an ammeter and may be controlled by the generator field rheostat.

CONDENSER.- The condenser in the closed circuit has a capacity of about 0.0099 microfarads. Two glass plate condensers connected in series were used.

OSCILLATION TRANSFORMER.- The oscillation transformer is made up of two flat spiral inductances wound with copper ribbon. The spirals are carried on a frame on which one of them is free to slide backward and forward, giving varying degrees of coupling. The motion is controlled from a handle on the frontof the panel. The inductance of each of the spirals is made adjustable in twelve steps, giving a wave length varying from 140 to 360 meters in steps of 20 meters.

The spiral in the closed oscillatory circuit is composed of 12-2/3 turns giving an inductance of 36.6 Microhenries. That in the antenna circuit is composed of 9-2/3 turns with an inductance of 23.0 Microhenries.

RECEIVING SET.

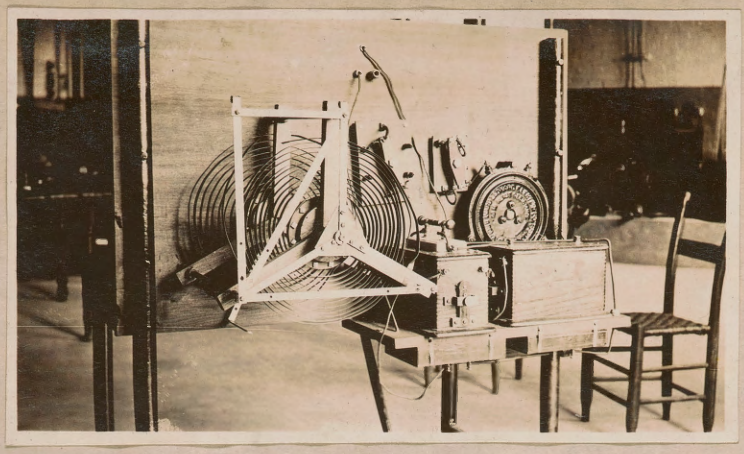
The receiving set is a simple, damped wave receiver using a three electrode vacuum tube detector. The set will receive at all wave lengths up to 2500 meters. All apparatus is mounted on the lower side of a fibre panel 12" by 18" in size. On the top of the panel are all control handles. A series of binding posts are provided at one end of the panel for connection to the antenna and ground, to batteries, and to the telephone head set. Additional binding posts allow for the introduction of other apparatus when desired. A complete wiring diagram, giving the location of the various binding posts is given in an accompanying sketch.

The primary circuit containes, in series, a variable air condenser and variable inductance. The inductance is wound in the form of a multiple layer coil of rectangular cross section. It is variable in thirteen steps of ten turns each, giving a total of 130 turns. The maximum inductance obtainable is 2700 Microhenries. The condenser is of the multiple plate type using air for its dielectric. The movable plates are such shape as to give an approximately geometrical variation of capacity. The capacity of the condenser varies from a minumum of .00002 microfarad to a maximum of 0.00065 microfarad.

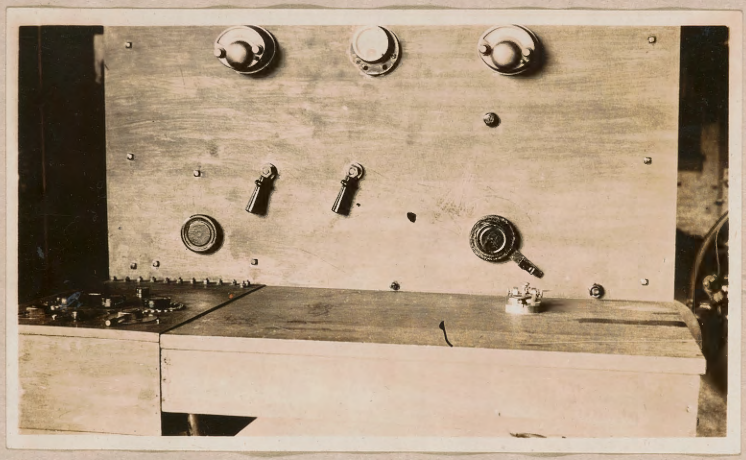
The inductance coil and condenser of the secondary

circuit are similar to thase in the primary circuit. The secondary inductance is placed inside the primary inductance , and its position may be adjusted so that the axes of the two coils coincide or are at right angles to one another. A swith is provided to throw the secondary condenser out of the circuit or to connect it in at will. With this swith "off" the secondary is aperiodic or it will respond to any wave length, allowing the primary to be tuned before the secondary. The grid circuit of the vacuum tube is connected in parallel with the secondary inductance and condenser.

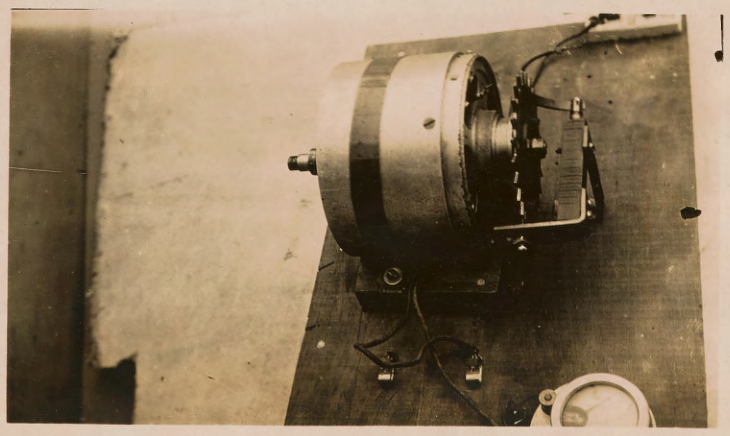
The vavuum tube used is the VT 1 tube used by the U.S. Army, and made by the Western Electric Company. The filament requires a voltage of 4 Volts and the plate of 20 Volts. These voltages are supplied by storage batteries. The telephones are connected in the plate circuit with a small condenser shunted across.



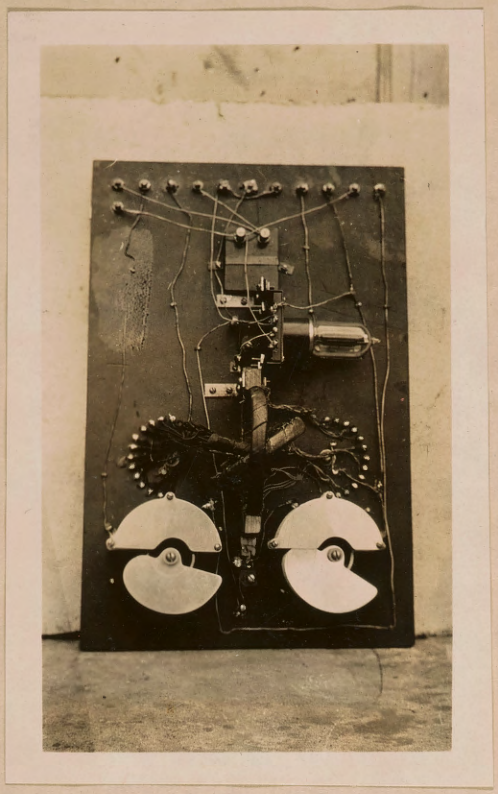
REAR VIEW
TRANSMITTING SET.



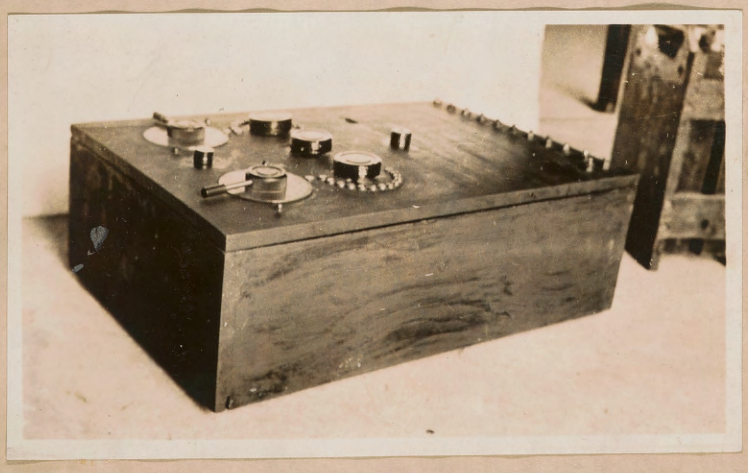
ASSEMBLY
of
RECEIVING AND SENDING SETS



GENERATOR AND ROTARY GAP.



BACK VIEW
RECEIVING SET.



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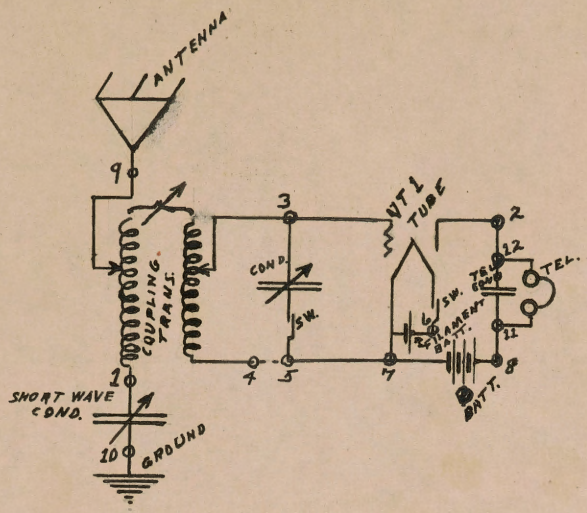

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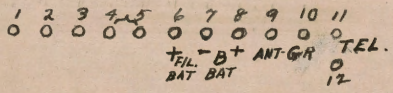
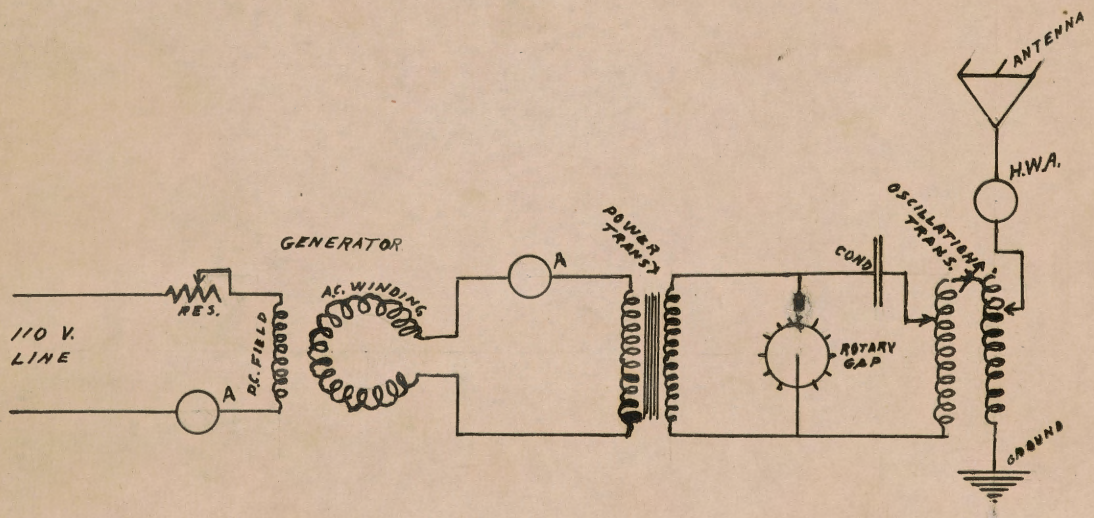


BINDING POST LAYOUT.



SENDING SET