

Directions for Operation of Standing Wave Apparatus

Cat. No. F4012M

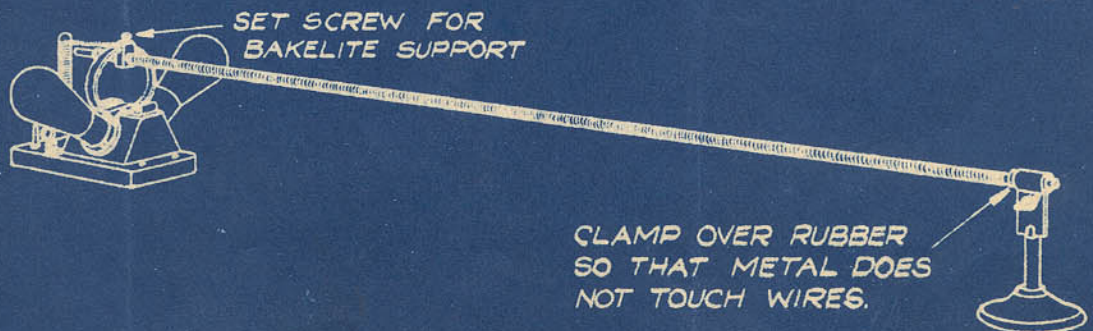
The Standing Wave Apparatus, for the demonstration of standing electromagnetic waves, (Seibt Effect) consists of a long glass tube on which is an evenly spaced winding of fine copper wire, a Bakelite mounting for supporting one end of the tube in the loop of the F4011 Short Wave Apparatus, and a support clamp for holding the other end of the tube.

Setting Up: Place the No. F4011 Oscillator on a long table and connect it up as for ordinary operation. Its antenna arms should not be attached for this experiment. Fasten the Bakelite support to the top of the single turn inductor of the F4011 by means of the set-screw. Slip the bare end of the long tube through the hole in the Bakelite support and secure the rubber-covered end in the clamp support provided for that purpose.

Operation: When the short wave apparatus is set in operation high frequency currents, in the order of 75×10^6 cycles per second are induced in the long coil on the glass tube. These electromagnetic waves are reflected back from the open end of the coil and interfere with the oncoming waves to produce sharply defined voltage nodes and antinodes along the entire length of the winding. These nodes and antinodes may be beautifully demonstrated by holding the "Neon Wand" (Cat. No. F4012N) at right angles to and with one end near to or touching the standing wave coil. As this neon tube is slowly moved along the coil the discharge glow in the tube will slowly creep up the tube towards the hand as a voltage antinode is approached, and will recede down the tube and finally disappear as a voltage node is reached. Eight or ten nodes and antinodes may be counted in this manner.

The electromagnetic field about the standing wave tube is so strong that the Neon Wand will often glow when two or three inches from the winding. Also, small incandescent lamps such as automobile headlights lamps or flashlight bulbs will often produce a bluish glow when the bulb of the lamp is brought against the winding on the tube. Neon lamps such as our Cat. Nos. 8215 or 8216, or a neon spectrum tube such as our Cat. No. F3059 will glow similarly to the Neon Wand when brought near the Standing Wave Tube.

Another striking demonstration of the standing waves may be made by holding in the hand the bulb of a low wattage incandescent lamp such as our Cat. No. F3716 (110 volt 10 watt lamp) and with the brass base of the lamp touching the wire, slowly move the lamp along the coil. The 110 volt lamp will light up brightly as it passes a voltage antinode.



R52531S

RADIO, Short Wave

CENTRAL SCIENTIFIC CO.
CHICAGO, U. S. A.

NO. OF SHEETS 4
SHEET NO. 1

Directions for Operation of Cat. No. F4011
Short Wave Radio Demonstration Apparatus

Description -- The apparatus supplied under Cat. No. F4011 consists of the following parts

- 1 - Oscillator unit less tubes
- 1 - Transformer unit with connecting wires
- 1 - Set of long transmitting antennae (2 pieces)
- 1 - Set of short transmitting antennae (2 pieces)
- 1 - Antenna coupling loop
- 1 - Receiving antenna with flashlight bulb detector

The following accessories are not supplied with Cat. No. F4011 but may be purchased separately if desired:

Cat. No.	F4012A	Radiotron UX210 or CX310 (2 required)
" "	F4012B	Wavemeter 3 to 5 meter range (approx.)
" "	F4012C	Mounting Clips for attaching flashlight bulb to wavemeter
" "	F4012D	Exploring Lamp
" "	F4012E	Neon Test Bulb
" "	F4012F	Extra Receiving Antenna (with flashlight bulb detector)
" "	F4012G	Receiving antenna with number of flashlight bulbs to show current distribution
" "	F4012H	Flashlight bulbs for use with Cat. Nos. F4012C, F4012F, F4012A
" "	F4012K	Roll of No. 36 sheet copper for construction of reflection screen
" "	F4012L	Set of short copper antenna terminals for use with No. 4631 Thermo-galvanometer
" "	14422	Bare copper wire for Lecher Wire experiments
" "	4631	Thermo-galvanometer for indicating resonance and measurement of electromagnetic field intensity

Setting Up Apparatus -- Place the oscillator on a wooden table or support stand as far removed from pipes and other masses of metal as possible. It will be a great convenience to the demonstrator, and is highly desirable electrically to clamp the apparatus on a non-magnetic wooden tripod stand such as our No. F283. Push the tubes in their sockets, plug the 3 wire connector onto the oscillator and plug the transformer primary connector into a 110 volt A.C. 60 cycle lamp socket. The filaments in the tubes should light up immediately. Test the circuit to make sure that it is oscillating by touching the point of a lead pencil to one of the terminals of the inductance. If the circuit is oscillating, small sparks will

be produced at the pencil point. In case the circuit is not oscillating, disconnect the power immediately, as the circuit in a non-oscillating condition will draw an excessive current that will overload both tubes and transformer. The transmitting antenna arms should not be used until after the circuit has been tested for oscillation.

Transmitting Antennae -- Two sets of transmitting antennae are supplied. They consist of four copper-plated brass tubes with a taper plug mounted on one end. The two shorter tubes are intended to be plugged into the tapered receptacles at the ends of oscillator inductance to form the horizontal antenna. The two longer tubes are intended for use with the antenna coupler to form the loose-coupled vertical antenna. Care should be taken to see that these different lengths are used in their proper places only, as to interchange them may cause the circuit to stop oscillating with possible damage to tubes or transformer. The oscillator and the transmitting antennae are not adjustable for wavelength, it being intended that all tuning should be done on the receiver.

Receiving Antenna -- The receiving antenna with flashlight bulb detector consists of an insulated center section containing a flashlight bulb and provided at each end with sockets into which copper-plated brass tubes may be pushed. The tubes for use with this receiver are equipped with smaller rods or tubes which telescope in the main tubes thus providing an adjustment in the length of the antenna which constitutes tuning. In use, the adjustments in length should be made equally on both ends so as to keep the lamp approximately at the center.

Thermo-galvanometer -- When the thermo-galvanometer, Cat. No. 4631, is used for measuring field strength or indicating resonance it should be fitted with the antenna arms from the receiver with the lamp detector. To do this, the two short lengths of copper rod, Cat. No. F4012L, should be fastened under the binding posts of the galvanometer in such a manner that they project in the same straight line from opposite sides of the meter. The adjustable antenna arms from the receiver may then be slipped over these projections from the meter. Take care when this arrangement is in resonance, not to bring it too close to the transmitter as it is much more sensitive than the lamp detector.

Wavemeter -- Before using the wavemeter, Cat. No. F4012B, it should be mounted on an insulating base. A flashlight bulb should be shunted across a few centimeters of the wavemeter inductance, or a neon lamp should be attached to one end of the inductance to indicate when the wavemeter is in resonance with the transmitter.

A mounting clip, Cat. No. F4012C provides a convenient means of attaching the flashlight lamp. Care must be taken not to hold the wavemeter too close to the transmitter when the two are in resonance or the indicating lamp on the wavemeter may be burned out.

Lecher Wire Experiment -- In performing the Lecher Wire experiments, the antenna coupling loop should be plugged into one of the receptacles in the base of the oscillator and the copper wires should be attached to the coupler above and below the loop. The oscillator must, of course, be clamped down to the table or stand when performing this experiment.

The foregoing are general directions and precautions for the setting up and operating of the Short Wave Radio Demonstration Apparatus. For more specific directions as to the various experiments which may be performed, refer to the reprint from the May 1922 issue of "School Science and Mathematics", Vol. xxix, No. 5, on "An Apparatus for Demonstrating the Fundamentals of Radio."

A out-out switch is located on the primary side of the transformer whereby the line voltage may be disconnected without pulling the line cord from its receptacle.

The two binding posts on the base of the oscillator are for connecting to a milliammeter of at least a 100 milliamperere range. The milliammeter indicates the plate current of the tubes. When the milliammeter is not in use the binding posts should be shorted with a short piece of wire.

