F. W. MIDGLEY.

WAVE METER.

APPLICATION FILED FEB. 25, 1911.

1,018,769.

Patented Feb. 27, 1912.

2 SHEETS—SHEET 1.

FIG. 1.

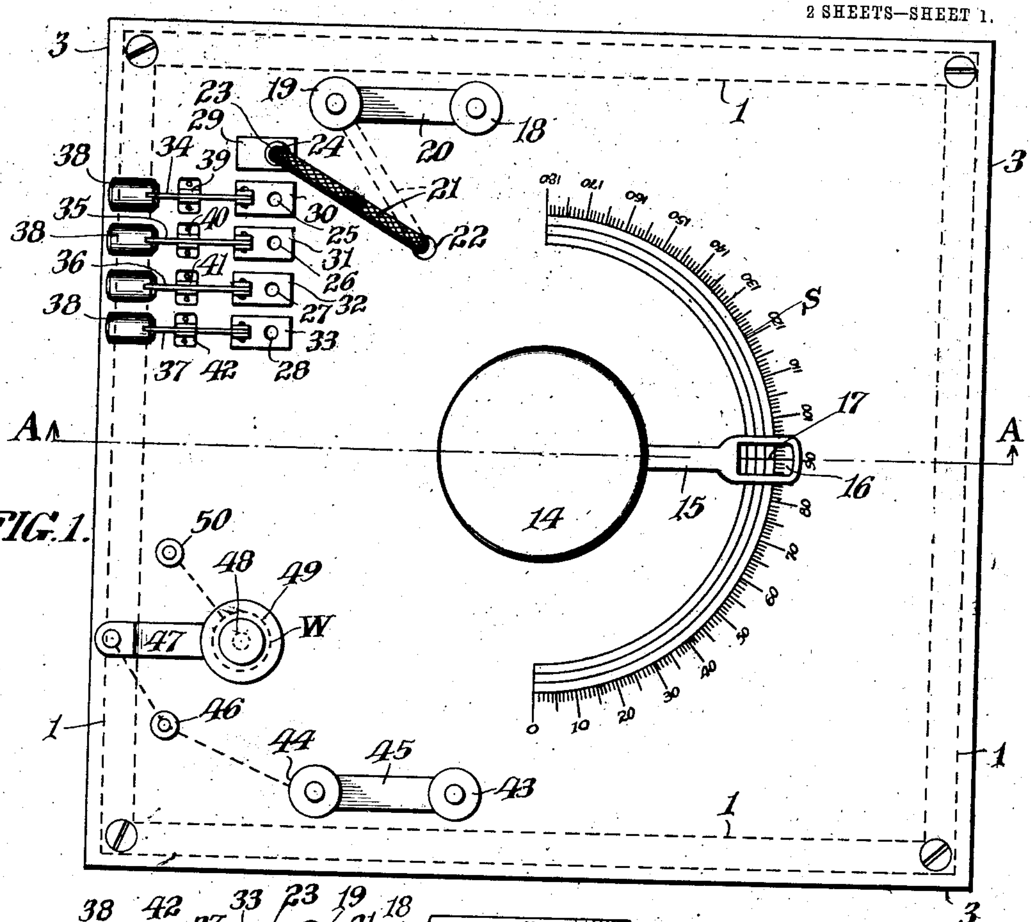
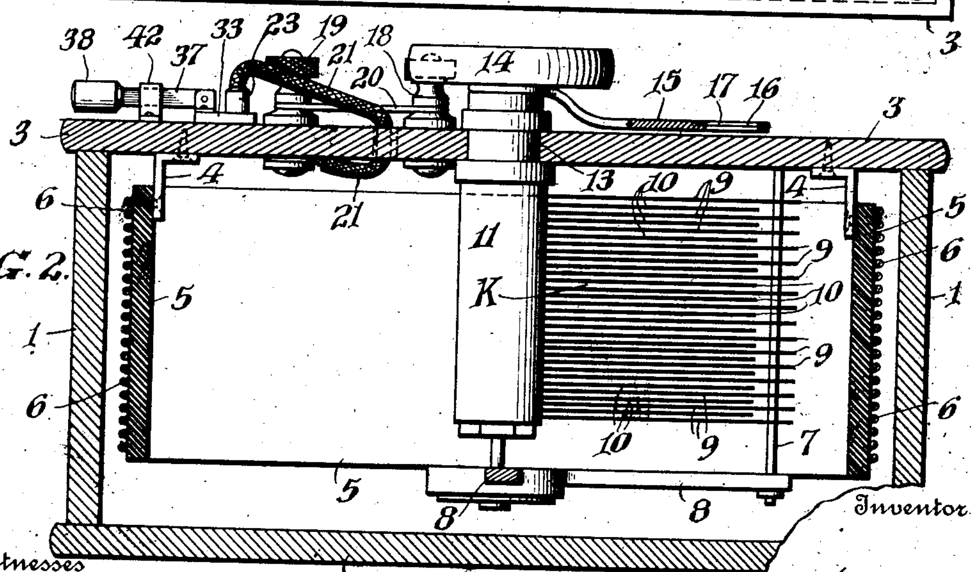


FIG. 2.



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2 SHEETS—SHEET 2.

FIG. 3.

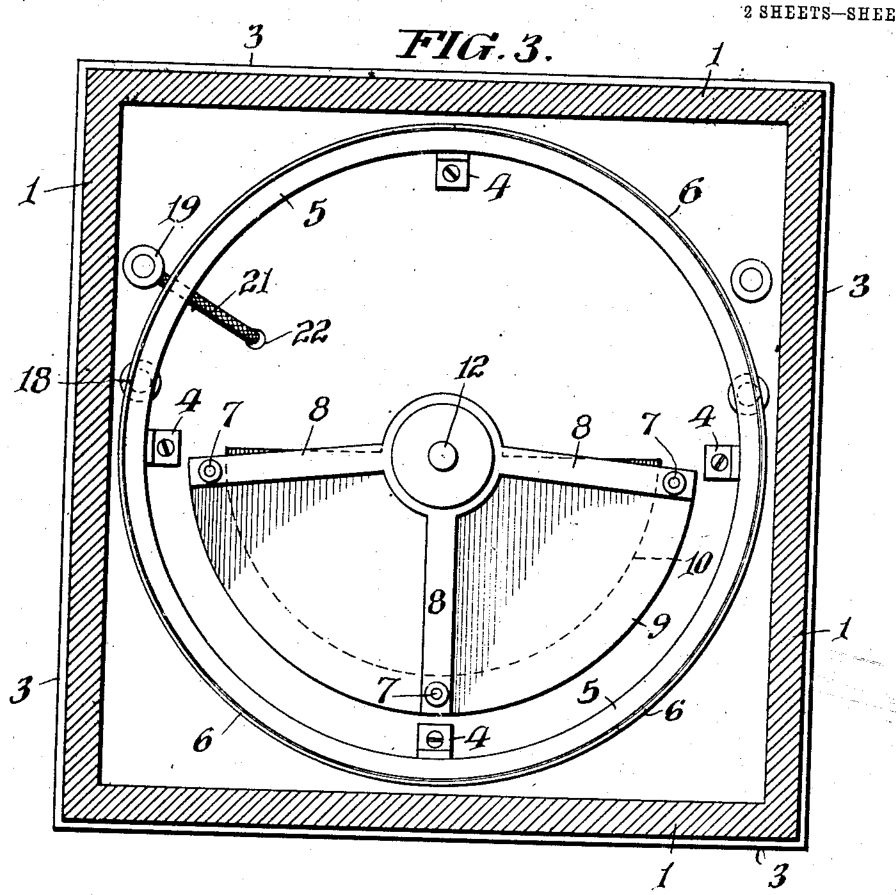
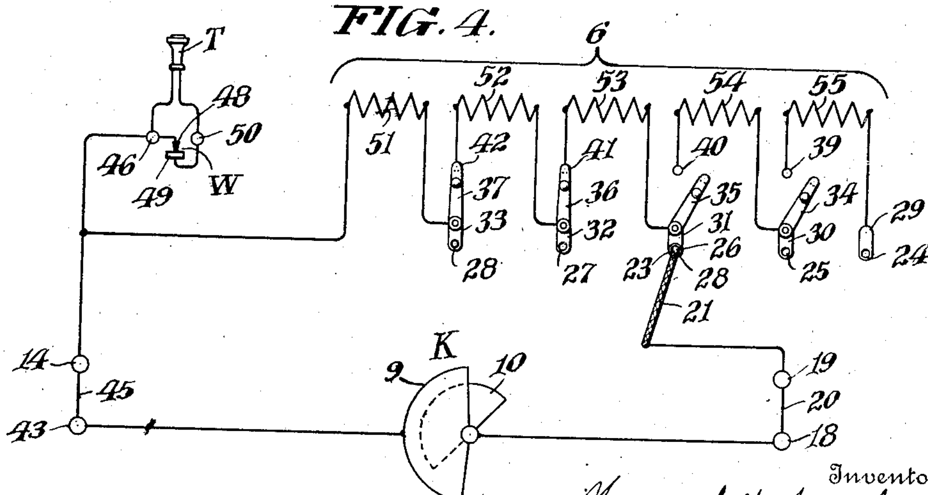


FIG. 4.



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UNITED STATES PATENT OFFICE.

FREDERICK W. MIDGLEY, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO JOHN FIRTH, OF NEW YORK, N. Y.

WAVE-METER.

1,018,769. Specification of Letters Patent. **Patented Feb. 27, 1912.**

Application filed February 25, 1911. Serial No. 610,757.

To all whom it may concern:

Be it known that I, FREDERICK W. MIDGLEY, a citizen of the United States, residing in Jersey City, county of Hudson, and State of New Jersey, have invented certain new and useful Improvements in Wave-Meters, of which the following is a specification.

My invention relates to wave meters for measuring the lengths (or frequencies) of electric waves, particularly of high frequency oscillations, either sustained or in trains, such, for example, as used in the arts of wireless telegraphy and telephony, or wireless transmission generally.

My invention resides in a wave meter which is compact and self-contained, involving an adjustable condenser and an adjustable inductance, the inductance coil surrounding the condenser. The inductance is provided in sections, with means for cutting in or out such sections.

My invention resides also in the mode of connection, in a wave meter, of the detector or wave-responsive device in such manner that a minimum amount of energy is delivered to or consumed in the detector or passed through the detector, whereby the oscillating circuit is very persistent, and, therefore, the resulting tuning is very sharp and accurate.

My invention resides in the features hereinafter described and pointed out in the claims.

For an illustration of one of the forms my invention may take, reference is to be had to the accompanying drawings, in which:

Figure 1 is a top plan view of a wave meter involving my invention. Fig. 2 is a sectional view on the line A—A of Fig. 1, some parts being shown in elevation. Fig. 3 is an interior plan view. Fig. 4 is a diagrammatic view representing the circuit arrangements.

The box 1, preferably of wood or other insulating material and having the bottom 2, is adapted to inclose and contain the inductance and condenser elements, and accessories, of the wave meter. The condenser and inductance elements are supported upon the box cover 3 which is screwed on the top of the box 1. Supported by brackets 4 secured to the under side of the cover 3 is the cylinder or frame 5 of rubber or other suitable insulating material, upon which is wound the wire helix 6, preferably of copper or other low resistance material, the resistance of the wire being made very low, by using wire of relatively great cross section. By rods 7 depending from the cover 3 and supporting at their lower ends the spider 8, are held the stationary conducting plates 9 of the adjustable condenser K. These plates 9 are all electrically connected together and form one armature of the condenser K. The other armature of the condenser K comprises the conducting plates 10 all electrically connected together and insulated from the plates 9, and supported by the member 11 which is rotatable about a vertical axis having a lower bearing in the spider 8 at 12 and a bearing at 13 in the cover 3. Outside the cover 3 and secured to the member 11 is the handle 14 carrying the pointer 15 adapted to sweep over the graduated scale S. The pointer 15 is enlarged at its outer end to form the opening 16 across which extends the radially disposed member 17, which is the indicating portion or member of the pointer 15 and which sweeps over the scale S and facilitates the reading of the scale directly beneath the member 17, the scale being visible through the opening 16. As the handle 14 is turned, the plates 10 are moved in interleaving relation with respect to the plates 9, air intervening between the plates of the two armatures of the condenser, such air forming the condenser dielectric. The plates 9 are substantially semi-circular in extent as are also the plates 10, so that when the plates 10 do not interleave with the plates 9, the condenser has its minimum capacity, and may be varied through all values to maximum capacity which is reached when the plates 10 are wholly disposed between the plates 9.

Upon the cover 3 are disposed the binding posts 18 and 19, of which 18 is electrically connected with one armature of the condenser K. A wire or plate 20 may electrically connect the binding posts 18 and 19. The binding post 19 is electrically connected with the flexible conducting cord 21 on the under side of the cover 3 which extends up through the hole 22 in the cover 3, and terminates at its outer end in the conducting plug 23, adapted to be inserted in any one of plug holes 24, 25, 26, 27, or 28 in the conducting plates or blocks 29, 30, 31, 32, or 33, respectively.

The blocks or plates 30, 31, 32, or 33 have pivoted thereto, respectively, the switch blades 34, 35, 36, and 37, each provided with a rubber or other handle 38. These switch blades are adapted to contact, respectively, with the terminals 39, 40, 41, and 42 upon the cover 3. On the other side of the cover 3 are provided binding posts 43 and 44, which may be electrically connected by a wire or plate 45. The binding post 43 is electrically connected to the other armature of the condenser K. The binding post 44 is electrically connected to binding post 46 and to the bracket 47 forming one terminal of a wave-responsive device or detector W, comprising the upper element 48 and lower element 49, the lower element 49 being electrically connected to binding post 50. The terminals of a telephone or other signal translating instrument T are connected to the binding posts 46 and 50. All these connections are more readily understood from the diagram of Fig. 4. Here it will be seen that the inductance 6 comprises, for example, five (5) sections 51, 52, 53, 54, and 55.

It will be noted that the detector or wave-responsive device W, which may be a silicon, perikon, carborundum, or any other suitable detector, is not included either in shunt or in series with the oscillating circuit comprising the adjustable condenser K and the inductance; but that only one terminal of the detector W is in electrical communication with the oscillating circuit, the other terminal of the detector being free or unconnected, so far as the oscillating circuit is concerned, and that the telephone or other instrument T is connected to the terminals of the detector W.

As shown in Fig. 4, switches 36 and 37 are closed and the plug 23 is inserted in the hole 26 of the plate or block 31 forming one terminal of the inductance section 53. The result is that there are included in series with the condenser K the three inductance sections 51, 52, and 53. And by having switches 34 and 35 open, the inductance sections 54 and 55 are entirely isolated, so that they in no practical way affect the oscillating circuit. By this arrangement, it is obvious that from one to five sections of inductance may be included in the oscillating circuit at will by suitably placing the plug 23 and by closing suitable switches and opening the others, as circumstances may require, these sections of inductance giving the wave meter a wide range.

In operation, the instrument is placed either within the inductive, conductive, or radiant influence of the high frequency oscillations whose length or frequency is to be measured. Where the oscillations are quite powerful, and the source of them near at hand, the instrument need only be held near the circuit which produces the oscillations, and there will, accordingly, occur in the oscillating circuit of the wave meter oscillations of like frequency. Then, the amount of inductance in the circuit is adjusted by steps, as above described, and the capacity of the condenser K gradually varied by turning the handle 14 until the sound or indication in the instrument T is a maximum. The operator then reads the scale indication immediately below the member 17 of the pointer 15 for that position of adjustment of the condenser K. This scale may be calibrated either in degrees, so that from a curve sheet accompanying the instrument the frequency or wave length may be read, or the scale S may be directly calibrated in frequency or wave length. In such case, the scale S may comprise, in fact, several scales, to accord with the different numbers of inductance sections included in the oscillating circuit. Either the conductor 20 or conductor 45 may be removed from the associated binding posts and conductors led outwardly in a loop from such binding posts to the region of influence of the oscillating circuit whose oscillations are to be measured or in place of either conductor 20 or conductor 45, there may be connected a miliammeter or other measuring instrument or device as occasion may require.

As above stated, the detector or wave-responsive device W is not connected in the oscillating circuit either in shunt or in series, but has only one unipolar connection with the oscillating circuit. The result is that the detector does not to any appreciable degree affect the persistency of the oscillating circuit of the wave meter, and in the arrangement shown derives from the oscillating circuit a minimum of energy, leaving the oscillating circuit persistent and capable of sharpest and most accurate resonance or tuning, and, therefore, most accurate measurement of wave length or frequency. The links or conductors 20 and 45 may also be removed for quickly disconnecting the condenser and the inductance from each other.

The hereinbefore described construction results in a compact wave meter which, considering its range, is small and light, and does away with exterior interchangeable or removable inductance windings or coils, which in use in prior devices render the same large and unwieldy.

What I claim is:

1. A wave meter comprising a casing, a closing wall therefor, a condenser and an inductance both supported upon said closing wall and removable therewith from said casing, said condenser comprising stationary and movable armatures, each armature comprising separated parallel plates, and a rotatable shaft carrying said movable armature for rotating the plates thereof to position between the plates of said stationary

armature, said inductance comprising a coil having convolutions extending entirely around said condenser, the axis of said inductance coil convolutions and of said rotatable shaft being substantially coincident.

2. In a wave meter, a supporting member, a condenser supported upon said supporting member and comprising stationary and movable armatures, each armature comprising separated parallel plates, a rotatable shaft supporting said movable armature for rotating the plates thereof to position between the plates of said stationary armature, an inductance coil carried by said supporting member and extending entirely around said condenser, the axis of said inductance coil being substantially parallel with the axis of said condenser, said condenser and inductance coil connected in series with each other, said inductance coil divided into sections, terminals for each section upon said supporting member, and switching mechanism comprising a movable plug and switch blades for including in circuit one or more sections of said inductance coil and for isolating the other sections.

3. In a wave meter, a supporting member, a condenser supported upon said supporting member and comprising stationary and movable armatures, each armature comprising separated parallel plates, a rotatable shaft supporting said movable armature for rotating the plates thereof to position between the plates of said stationary armature, an inductance coil carried by said supporting member and extending entirely around said condenser, the axis of said inductance coil being substantially parallel with the axis of said condenser, a flexible conducting cord connected in series with said inductance coil and said condenser, a plug on said flexible cord, said inductance coil divided into sections having terminals on said supporting member, said plug adapted to engage with said terminals, and switch blades coöperating with said terminals, whereby sections of said inductance coil may be connected in circuit and the other sections isolated.

4. A wave meter comprising a condenser and inductance forming an oscillating circuit, and a self-restoring detector having unipolar connection with said oscillating circuit.

5. A wave meter comprising a condenser and inductance forming an oscillating circuit, a self-restoring detector having unipolar connection with said oscillating circuit, and a signal translating instrument having its terminals connected to the terminals of said detector device.

6. A wave meter comprising a condenser having fixed and movable armatures, a plurality of sections of inductance, switching means for including one or more of said inductance sections in circuit with said condenser and for isolating the other sections of inductance, a supporting member, said condenser secured thereon and all said sections of said inductance secured simultaneously on said supporting member, and a scale associated with the movable armature of said condenser.

7. In a wave meter, a casing, a cover therefor, a condenser and inductance supported within said casing upon said cover, said inductance divided into sections, and switches upon said cover for including in circuit with said condenser one or more of said inductance sections.

8. In a wave meter, a casing, a cover therefor, a condenser and inductance supported within said casing upon said cover, said inductance divided into sections, and switches upon said cover for including in circuit with said condenser one or more of said inductance sections and for isolating the other sections of inductance.

9. In a wave meter, a casing, a cover therefor, a condenser supported upon said cover within said casing, a frame or cylinder supported upon said cover within said casing and inclosing and surrounding said condenser, and an inductance wound upon said frame or cylinder.

10. In a wave meter, a casing, a cover therefor, a condenser supported upon said cover within said casing, a frame or cylinder supported upon said cover within said casing and inclosing and surrounding said condenser, and an inductance wound upon said frame or cylinder, said condenser comprising stationary and rotatable armatures, the axis rotation of said rotatable armature being substantially coincident with the axis of said frame or cylinder.

In testimony whereof I have hereunto affixed my signature in the presence of the two subscribing witnesses.

FREDERICK W. MIDGLEY.

Witnesses:
CHARLES G. RENNAR,
ANNA E. STEINBOCK.