

J. MURGAS.  
MAGNETIC WAVE DETECTOR.  
APPLICATION FILED SEPT. 29, 1908.

917,104.

Patented Apr. 6, 1909.  
3 SHEETS—SHEET 1.

Fig. 1.

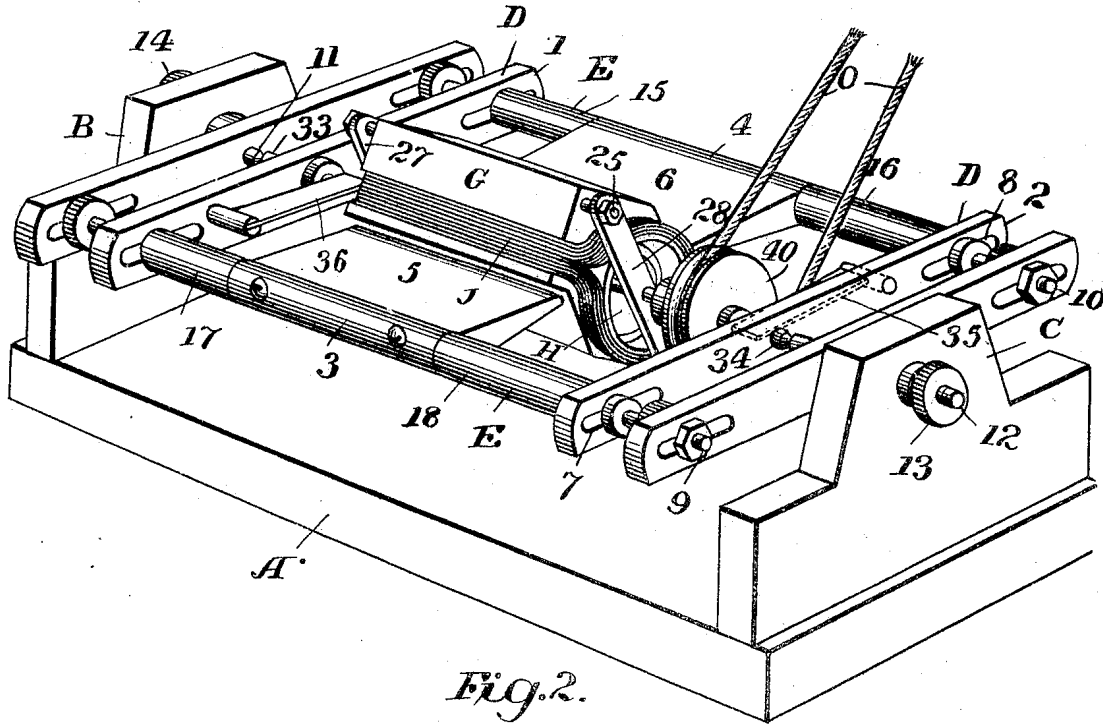
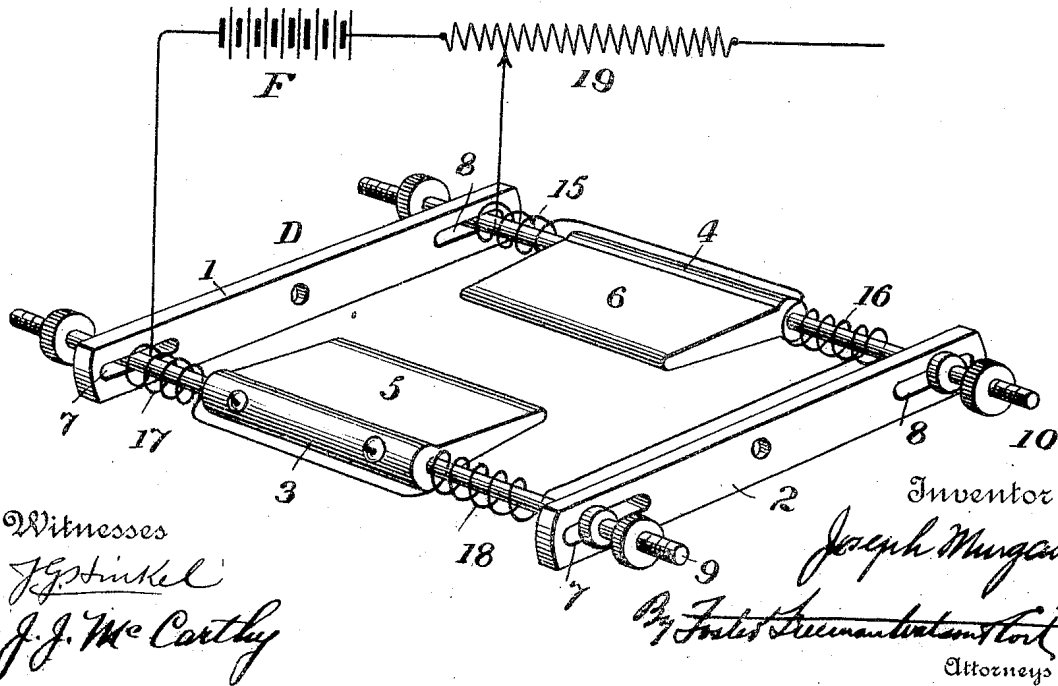


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

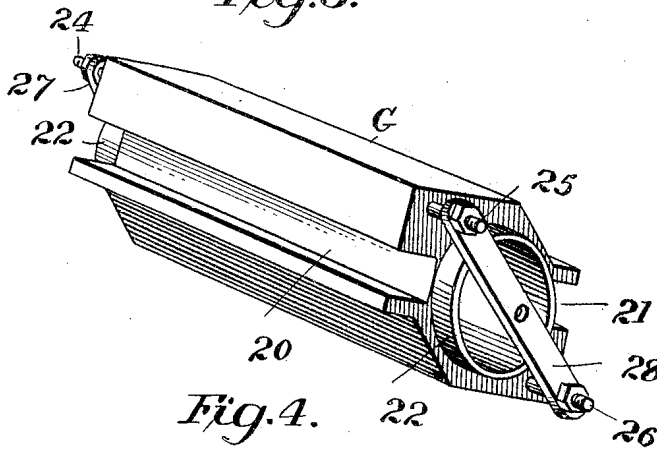


Fig. 4.

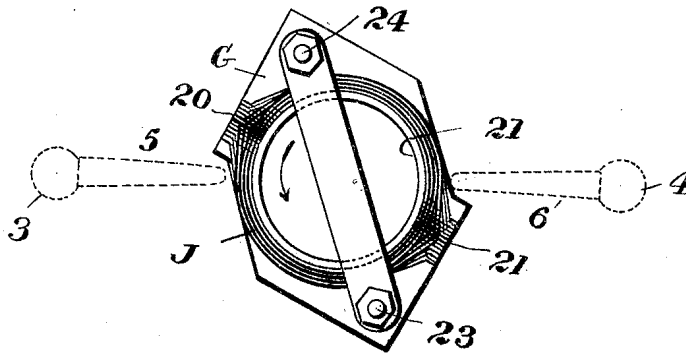


Fig. 5.

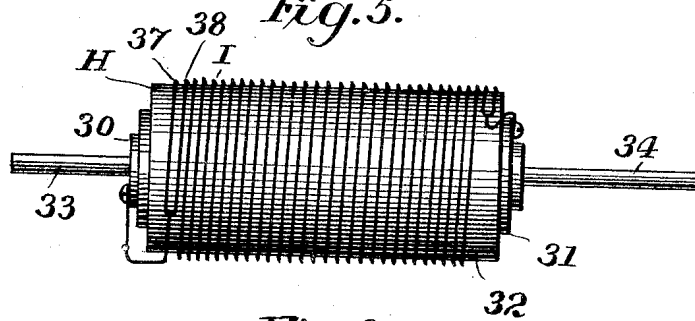
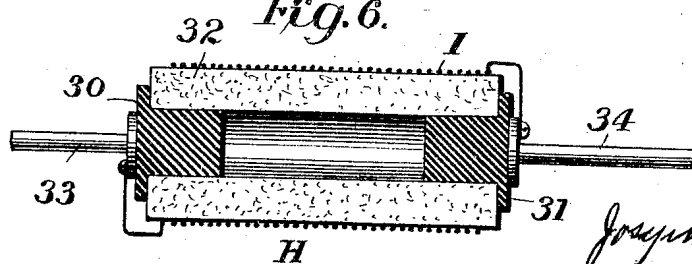


Fig. 6.



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3 SHEETS—SHEET 3.

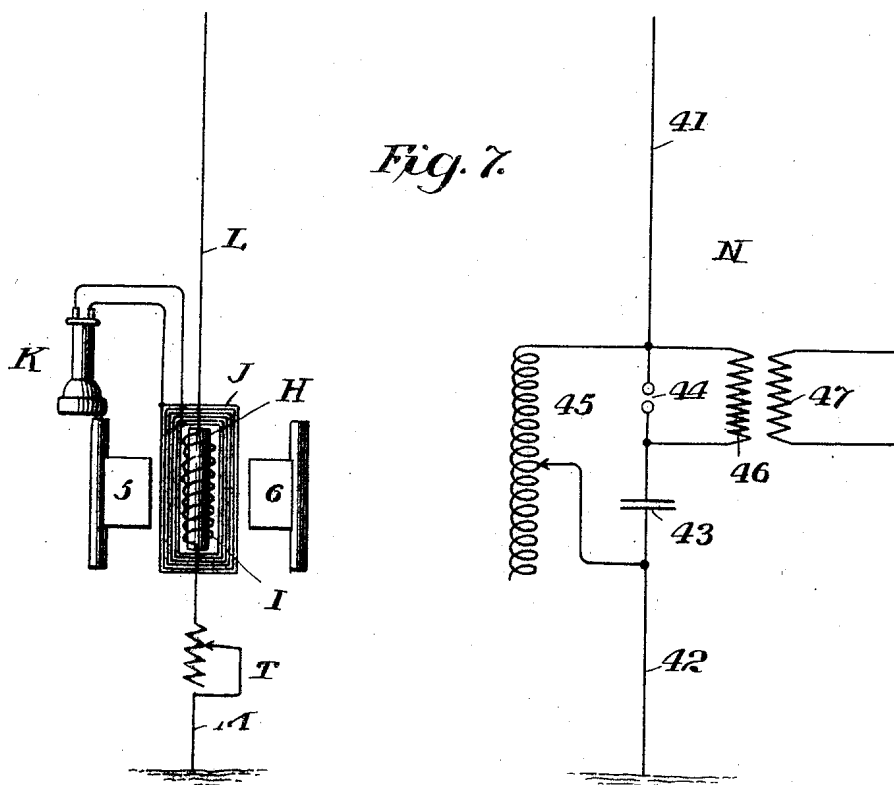


Fig. 7.

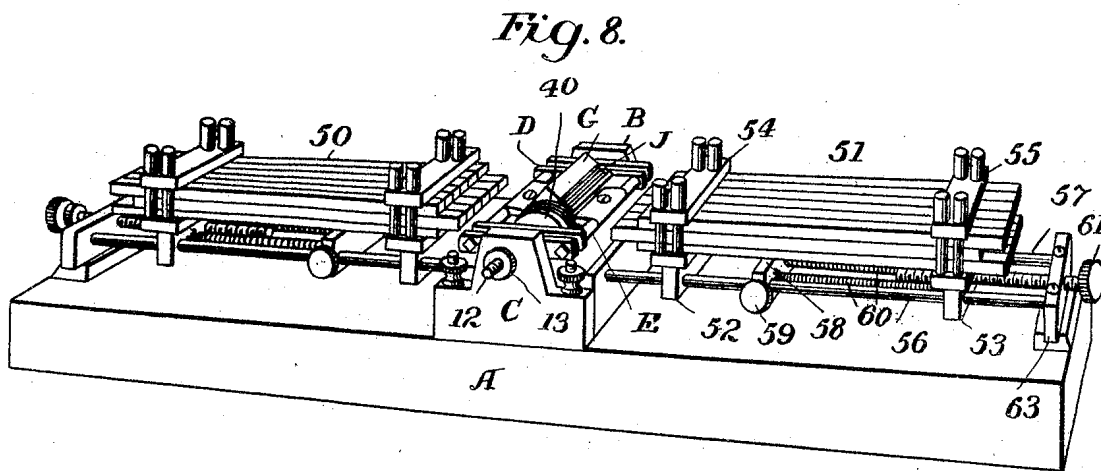


Fig. 8.

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# UNITED STATES PATENT OFFICE.

JOSEPH MURGAS, OF WILKES-BARRE, PENNSYLVANIA.

## MAGNETIC-WAVE DETECTOR.

No. 917,104.

Specification of Letters Patent.

Patented April 6, 1909.

Application filed September 29, 1908. Serial No. 455,335.

To all whom it may concern:

Be it known that I, JOSEPH MURGAS, a citizen of the United States, residing at Wilkes-Barre, in the county of Luzerne and State of Pennsylvania, have invented certain new and useful Improvements in Magnetic-Wave Detectors, of which the following is a specification.

This invention relates to means for detecting electric oscillations such as are produced in connection with wireless telegraphy and has particular relation to that class of such devices which depend for their operation upon changes produced in the magnetic condition of magnetic material such as iron which are occasioned by the passage of the oscillations.

The object of the present invention is to provide an apparatus of the character described which shall be efficient in operation, compact and simple in construction, and of small cost to manufacture.

The invention is illustrated in the accompanying drawings of which,

Figure 1 is a perspective view of the detector; Fig. 2 is a perspective view of the field magnets showing the electrical connections for the field magnets, the coil of magnetic conducting material and casing being removed; Fig. 3 is a perspective view of the casing; Fig. 4 is an end view of the casing with the cylinder in place, also the coil constituting a part of the means for rendering the signal manifest is shown; Fig. 5 is a side elevation of the cylinder and the coil of conducting magnetic material carried thereby; Fig. 6 is a longitudinal section of the same; Fig. 7 is a diagram showing a receiving station including a magnetic detector embodying the present invention and also a sending station; and, Fig. 8 shows a modified structure in which permanent in place of electro magnets are employed.

Referring to the drawings and first to Figs. 1 to 6, inclusive, the apparatus comprises the bed plate A from which extend the upright standards B and C, to which is pivoted the field magnet frame D, the energizing coils E of which are excited from a suitable source F of current supply. Located within the field frame is a casing G of hard rubber or other suitable material. In this casing is rotatably mounted the cylinder H carrying the coil I of conducting magnetic material. Supported by the casing G in inductive relation to the field produced by the

field magnets is the coil J of conducting material which, with the telephone receiver K, constitutes the means for rendering the passage of oscillations manifest. The usual antenna L and the earth connection M constitute the means for receiving the waves or oscillations and conducting them through the coil I. The sending station is shown at N. The cylinder H and its coil are continuously rotated by any suitable means such as a suitable driving belt O.

Referring now to the apparatus, above generally described, in detail, it will be seen that the field frame D comprises the end members 1 and 2 and the longitudinal members 3 and 4. To the last mentioned members are secured the pole pieces 5 and 6. Radial adjustment of the pole pieces with relation to the coil I is permitted by reason of the slots as 7 and 8 in the end members of the field frame, through which the screws 9 and 10 pass into the ends of the members 3 and 4. It will be apparent that by loosening these screws the members 3 and 4 and with them the magnets or pole pieces 5 and 6 can be moved radially of the coil I. The field frame, as a whole, is rotatable circumferentially about the coil upon the studs 11 and 12, being clamped in adjusted position by means of the nuts 13 and 14.

The field winding E is shown as divided into four sections 15, 16, 17 and 18. The sections 15 and 16 upon the member 4 are wound to oppose each other and produce a consequent pole at 6 in a manner as is well understood, while the sections 17 and 18 upon the member 3 are wound to produce a consequent pole at 5, the sections of both members being so wound as to produce poles of opposite polarity in the pole pieces 5 and 6. The winding E is connected with a source F, in this case shown as a battery, through a resistance 19 whereby the amount of current flowing through the winding and thereby the intensity of the magnets may be varied. The whole pole frame should be constructed of iron to provide good magnetic circuits.

The casing G, which is placed between the poles 5 and 6 as shown, is provided with longitudinally extending slots 20 and 21 for the reception of the coil J. Ledges as 22 being formed on the casing at each end for supporting the ends of the coil J about the shaft of the cylinder. Fixed in the casing are studs 23, 24, 25 and 26 upon which are supported the bars 27 and 28 in which the rotating cyl-

inder is journaled. These bars are preferably of brass or other non-magnetic material.

The rotatable cylinder H comprises the blocks 30 and 31, which may be of brass, and upon which is carried a cylinder 32 of a refractory insulating material. A suitable insulating material of this character has been found to be that known commercially as "lavite". Fixed in the blocks 30 and 31 are the trunnions 33 and 34 which are journaled in the bars 27 and 28. Upon the circumference of the cylinder 32 is wound the coil I of magnetic conducting material such as iron. The extremities of this coil are electrically connected with the trunnions 33 and 34 upon which bear the springs 35 and 36 which are respectively connected to the antenna and the earth. It will be observed that the coil I is composed of a plurality of wires 37 and 38 which are wound side by side and electrically connected in parallel. The object of using a plurality of wires instead of a single wire of large size is to increase the efficacy of the apparatus by keeping down the ohmic resistance and increasing the "skin effect". This arrangement facilitates sharp tuning. The tuning may also be facilitated by a variable inductance T in series with the coil I. This winding of a plurality of wires in the same direction and electrically connected in parallel for the purpose specified is not to be confounded with the winding of a coil by a plurality of wires in opposite directions for the purpose of neutralizing self induction. While under some circumstances it may be advantageous to employ a non-inductive coil in apparatus embodying my invention it is usually preferred that it shall be inductive so that tuning will be facilitated and I have so illustrated the coil in the present instance. For the best results the iron wire composing the coil should be soft and preferably the annealing for this purpose is accomplished after the wire is wound upon the cylinder. The heat incident to such annealing would injure substances (as for instance hard rubber) which possess the necessary properties as insulators and except for the results being subjected to the heating in the annealing operation, would be satisfactory. To resist this heat and at the same time furnish the necessary insulating qualities, the refractory material such as lavite is employed.

To rotate the cylinder and coil thereon, one of the trunnions is provided with a pulley 40 from which a belt O extends to a motor.

It will now be apparent that when the parts are assembled as shown, and the field magnets are energized, a magnetic field will pass from the pole piece 5 to the pole piece 6, a large part of the magnetism passing through the magnetic material of the coil upon the cylinder.

While I do not wish to be limited by any theory of operation, it is my belief that the operation of the device is as follows: As the coil of magnetic material is slowly rotated as indicated by the arrow Fig. 4, in the magnetic field, the magnetic conditions in the coil do not change instantaneously in response to the changes in magnetism to which the various parts of the coil are subjected, but on the contrary there is a lag between a magneto-motive force which tends to produce a certain condition in the material of the coil and a production of that condition. The result is that the magnetic field is distorted by the revolving coil of magnetic material. The property resulting in the lag mentioned is known as the hysteresis of the material of which the coil is constructed. The hysteresis is changed by the passage of high frequency electric oscillations through the coil and consequently the distortion in the field will be changed or, in other words, the magnetic field will shift upon the passage of oscillations of the character referred to. It appears then that the magnetic field produced by the stationary magnet (which although adjustable is normally stationary) is distorted by the revolution therein of the rotating coil of magnetic material and is normally stationary in this distorted position. If now electrical oscillations pass through the coil and its hysteresis is thereby changed, the field will shift and magnetic lines of force will cut the coil J and produce an impulse of current therein which may be detected by means of the telephone receiver K connected to the terminals of the coil.

At the sending station, as shown in Fig. 7, is the aerial or antenna 41, the earth connection 42, the condenser 43 and the spark gap 44. Across the spark gap and condenser is connected an adjustable inductance 45 which is made adjustable so that the apparatus may be tuned. Across the spark gap is connected a secondary 46 of a transformer the primary 47 of which is connected with a suitable source of high frequency current.

Referring to Fig. 8 in which permanent instead of electro magnets are employed, it will be seen that the cylinder and its casing are located between the permanent magnets 50 and 51. Each of these magnets is compound, being composed of a plurality of bar magnets. The construction and mounting of each of the magnets is similar to the other and therefore a description of one will apply to the other. The bar magnets composing the compound magnet 51 are clamped together and to the cross heads 52 and 53 by means of brass clamps 54 and 55, these cross heads sliding upon the rods 56 and 57. Adjustably secured upon the rods 56 and 57 is a slider 58 which may be secured in any desired position by a set screw 59. Between

this slider and the cross head 53 are tension springs 60 which tend to press the magnet toward the casing of the cylinder. The screw 61, rotatably mounted in a bracket 63 extending from the base of the apparatus, is in screw threaded engagement with the cross head 53. This screw provides means for withdrawing the magnet from the casing while the adjustable slider 58 affords a means for adjusting the spring 60. In this construction the casing G is carried upon the frame D. As in Fig. 1 this frame is held in adjusted position by nuts as 13 and 14 and may, when these nuts are loosened, be rotated to adjust the coil J to any desired position about the axis of the cylinder.

While the invention has been illustrated in what are considered its best embodiments, it may be embodied in other structures without departing from its spirit and is not limited to the structures shown in the drawing.

What I claim is:—

1. In an electric oscillation detector, the combination with means for producing a normally stationary magnetic field, a conductor of magnetic material movable in said field, means for continuously moving said conductor in said field, means for conducting the oscillations through said conductor, and means in inductive relation to said field for rendering the passage of oscillations manifest.

2. In an electric oscillation detector, the combination with means for producing a normally stationary magnetic field, a coil of conducting magnetic material rotatable in said field, means for continuously rotating said coil, means for conducting the oscillations through said coil and means in inductive relation to said field for rendering the passage of oscillations manifest.

3. In an electric oscillation detector, the combination with a stationary magnet of a coil of conducting magnetic material rotatable in the field of said magnet, means for continuously rotating said coil in said field, means for conducting the oscillations through said coil and means in inductive relation to said field for rendering the passage of oscillations manifest.

4. In an electric oscillation detector, the combination with a normally stationary magnet, of a coil of conducting magnetic material, rotatable in the field of said magnet, means for continuously rotating said coil, means for conducting the oscillations through said coil, and means in inductive relation to said field for rendering the passage of oscillations manifest, said magnet being radially adjustable with relation to said coil.

5. In an electric oscillation detector, the combination with a normally stationary magnet, of a coil of conducting magnetic material, rotatable in the field of said mag-

net, means for continuously rotating said coil, means for conducting the oscillations through said coil, and means in inductive relation to said field for rendering the passage of oscillations manifest, said magnet being circumferentially adjustable with relation to said coil.

6. In an electric oscillation detector, the combination with a normally stationary magnet, of a coil of conducting magnetic material, rotatable in the field of said magnet, means for continuously rotating said coil, means for conducting the oscillations through said coil, and means in inductive relation to said field for rendering the passage of oscillations manifest, said magnet being circumferentially and radially adjustable with relation to said coil.

7. In an electric oscillation detector, the combination with a normally stationary magnet, of a coil of conducting magnetic material, rotatable in the field of said magnet, means for continuously rotating said coil, means for conducting the oscillations through said coil, means in inductive relation to said field for rendering the passage of oscillations manifest, and means for varying the intensity of said magnet.

8. In an electric oscillation detector, the combination with means for producing a magnetic field, of a coil of conducting magnetic material, said coil and field being relatively movable, means for conducting the oscillations through said coil, and means for rendering the passage of oscillations manifest comprising a coil extending longitudinally of the aforesaid coil.

9. In an electric oscillation detector, the combination with means for producing a magnetic field, of a conductor of magnetic material in said field, means for rendering the passage of the oscillations manifest comprising a coil in inductive relation to said field, said coil and field being normally stationary with relation to each other but said coil and field on the one hand and said conductor on the other being relatively movable, and means for conducting the oscillations through said conductor.

10. In an electric oscillation detector, the combination with a support, of magnets mounted thereon, a coil of conducting magnetic material rotatably mounted upon said support within the field of said magnet, a casing about said coil, means for rendering the passage of oscillations manifest comprising a coil supported by said casing and extending longitudinally of the aforesaid coil of magnetic material, means for rotating the said coil of magnetic material and means for conducting the oscillations through said coil of magnetic material.

11. In an electric oscillation detector, the combination with a support, of magnets mounted thereon, a coil of conducting mag-

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netic material rotatably mounted upon said support within the field of said magnet, a casing inclosing said coil circumferentially, means for rendering the passage of oscillations manifest comprising a coil supported by said casing and extending longitudinally of the aforesaid coil of magnetic material, means for rotating the said coil of magnetic material and means for conducting the oscillations through said coil of magnetic material.

12. In an electric oscillation detector, the combination with means for producing a magnetic field, a coil of conducting magnetic material in said field, said coil and field being relatively movable and said coil comprising a plurality of wires wound in the same direction and connected in parallel, means for conducting the oscillations through said coil

and means in inductive relation to said field for rendering the passage of oscillations manifest.

13. In an electric oscillation detector, the combination with means for producing a magnetic field, of a body of conducting magnetic material rotatable in said field, means for conducting the oscillations through said body and means for rendering the passage of the oscillations manifest comprising a coil of conducting material wound longitudinally of the axis of rotation of said body.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH MURGAS.

Witnesses:

JOHN P. POLLOCK,  
CLAIRE JOHNSTON.