R. T. ACKLEY.

WAVE DETECTOR.

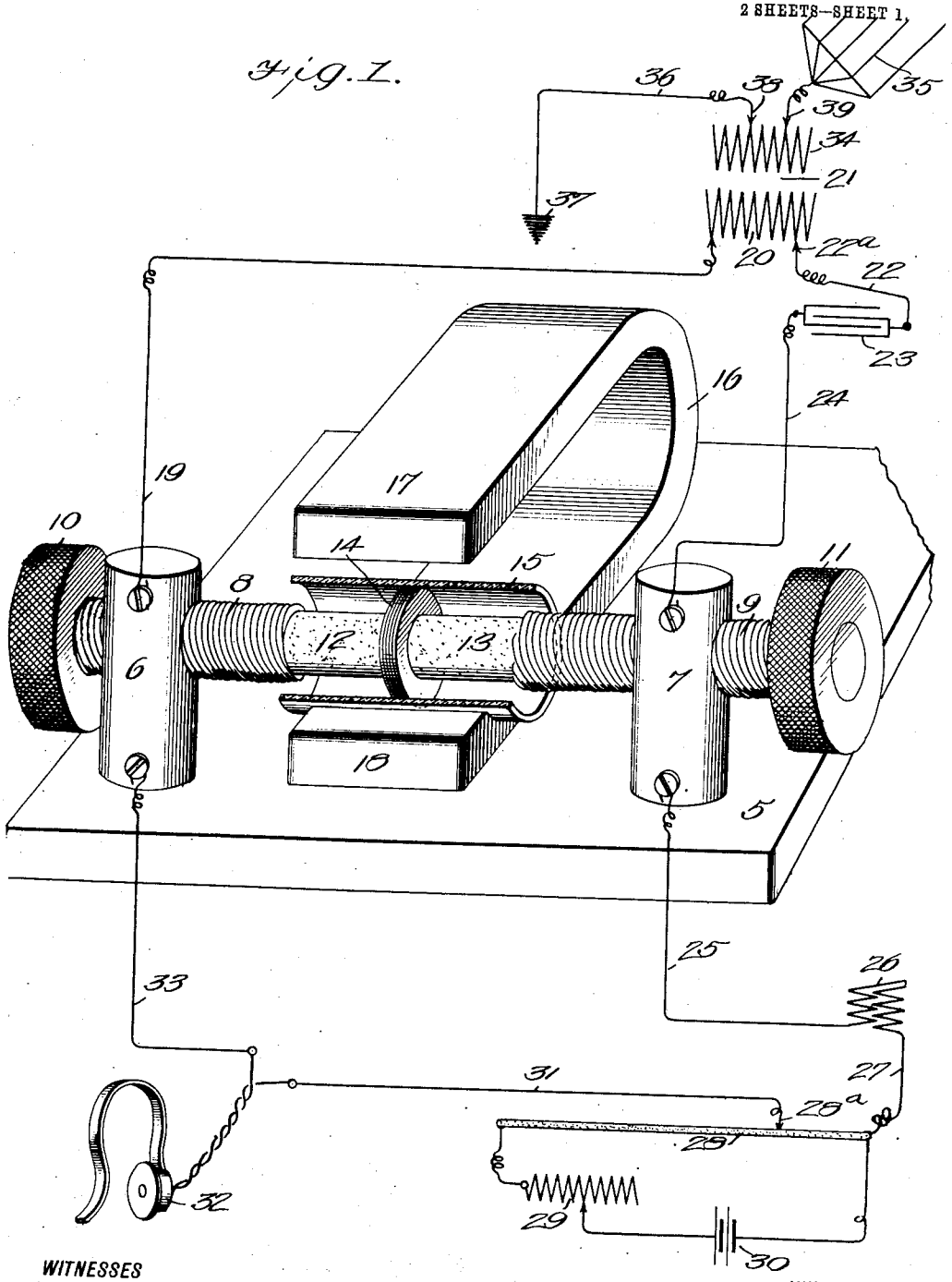
APPLICATION FILED DEC. 17, 1912.

1,112,411.

Patented Sept. 29, 1914.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

F. C. Barry

Walton Harrison

INVENTOR

Robert T. Ackley

BY Munn & Co.

ATTORNEYS

R. T. ACKLEY.

WAVE DETECTOR.

APPLICATION FILED DEC. 17, 1912.

1,112,411.

Patented Sept. 29, 1914.

2 SHEETS—SHEET 2.

Fig. 2.

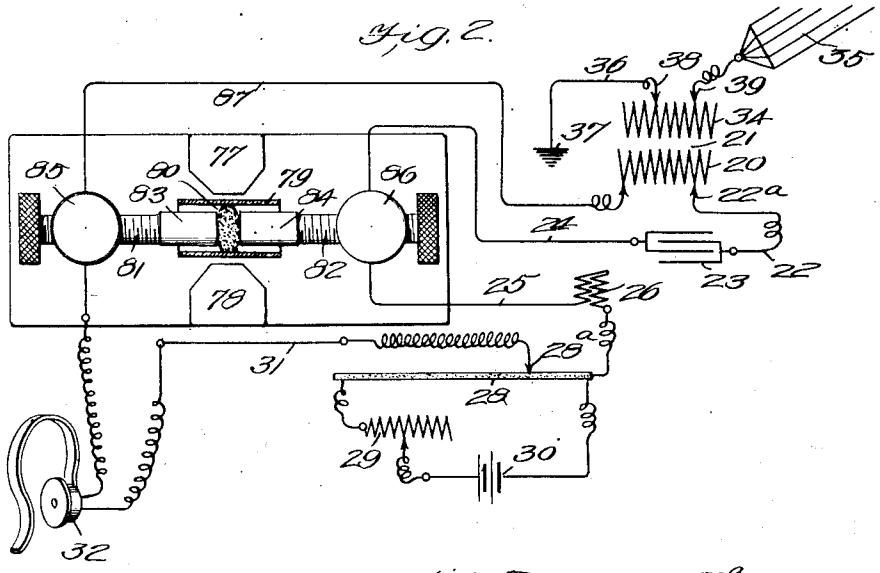


Fig. 3.

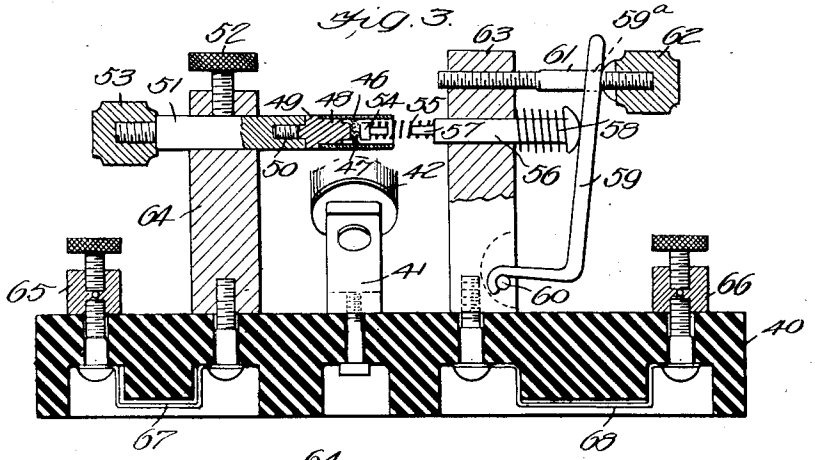
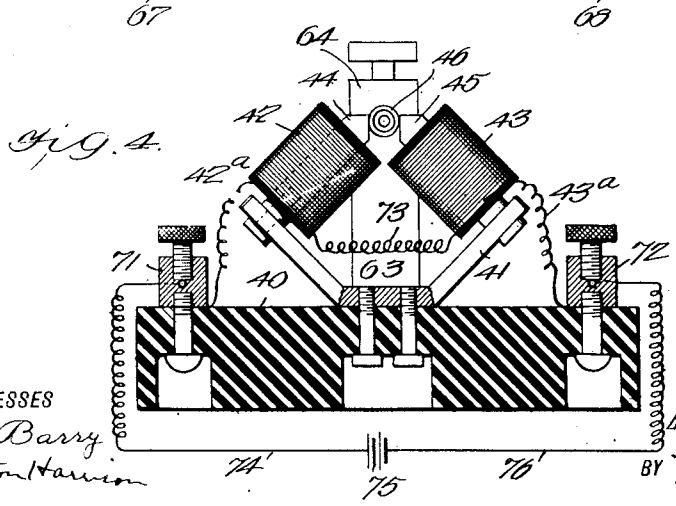


Fig. 4.



WITNESSES

H. C. Barry

Walton Harrison

INVENTOR

Robert T. Ackley

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

ROBERT T. ACKLEY, OF CORTLAND, OHIO.

WAVE-DETECTOR.

1,112,411. Specification of Letters Patent. Patented Sept. 29, 1914.

Application filed December 17, 1912. Serial No. 737,217.

To all whom it may concern:

Be it known that I, ROBERT T. ACKLEY, a citizen of the United States, and a resident of Cortland, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Wave-Detectors, of which the following is a specification.

My invention relates to wave detectors of the kind employed in wireless communication, my more particular purpose being to produce a detector which is particularly sensitive to the action of electro-magnetic waves and which is also self-restoring and possesses quite a number of advantages, among them, simplicity of construction and reliability of action.

It is well known in this art, that light, movable conducting bodies, such as metallic filings, when subjected to the action of currents set up in a wire by aid of electro-magnetic waves, will cohere or cling together, as, for instance, in the well known filings coherer. However, in devices of this character the decoherence of the filings is more or less imperfect and upon that account, mechanical devices such as tappers, have frequently been employed to insure thorough decoherence. Again, wave detectors employing filings have not, in practice, proven sufficiently sensitive to the action of comparatively weak currents made by waves arriving from a long distance or sent by transmitting apparatus of inferior quality. Again, wave detectors employing filings or the like, have not proven satisfactory for purposes of wireless telephonic communication, the reason, apparently, being that the filings are slow to respond to the electro-magnetic wave signals and in all instances where tappers have been employed, it has been impracticable to use the detector for purposes of wireless telephony.

In my invention, I employ no movable, mechanical, electrical or similar means for displacing the cohering bodies.

I have made the discovery that if a number of small bodies such as filings or thin disks of small diameter be subjected directly to the influence of a magnetic field, and particularly if such bodies be of magnetic materials, such as iron, they not only cohere with great rapidity, and vigor, but as soon as the influence due to the waves ceases, they quickly decohere. They are thus rendered extremely sensitive to the action of electro-magnetic waves. The effect of the waves upon the bodies in question is to vary the electrical resistance of the conducting particles as grouped under the influence of the magnetic field and as soon as the electro-magnetic waves cease to affect the group of bodies, it immediately acquires the initial electrical resistance which it possessed before it was disturbed by the waves. I have also made the discovery that if the electro-magnetic field, playing upon the bodies above discussed, be so directed that each body is given two polarities, corresponding as nearly as practicable with diametrically opposite edges of the bodies, the effect of the magnetic field upon the bodies is greatly enhanced. This is due to the fact that if two or more of the bodies be severally given like polarities upon the several edges immediately adjacent each other, these edges are caused to repel each other so that the bodies thus have more or less tendency to spring slightly apart and upon this account, the group of bodies, as a whole, normally offers a very high resistance to the passage of electric currents, yet when, under the action of the waves, the bodies are caused to cohere, the resistance in question is abruptly lowered to a considerable extent, and as soon as the influence of the waves is no longer present, the bodies are decohered by the direct action of the magnetic field which, as above stated, has a tendency to force the bodies apart.

Reference is made to the accompanying drawings, forming a part of this specification, in which like letters indicate like parts.

Figure 1 is a view, partly in perspective and partly diagrammatic, showing one form of my device and wiring associated therewith, this form employing a number of thin metallic disks as the cohering element. Fig. 2 is a view, partly in plan and partly diagrammatic, showing how my invention is employed in connection with a filings coherer. Fig. 3 is a longitudinal section through a wave detector made in accordance with my invention and employing filings together with electro-magnets for subjecting the filings to action of a magnetic field. Fig. 4 is a cross section through the mechanism shown in Fig. 3.

Mounted upon a base 5, are two posts 6, 7. Extending through these posts, are two screws 8, 9, made of metal and provided with annular heads 10, 11, whereby they

may be turned. The screws 8, 9 carry terminal members 12, 13 of conducting material, preferably carbon. Located between the terminals 12, 13, are a number of disks 14 which are made of magnetic material, preferably iron. For convenience of illustration, these disks and various other parts, are shown as of considerable size. In practice, they are preferably made very small and may, with advantage, be made so minute, as to weigh only 1/500 part of a grain. For this purpose, they may be .025 inch in diameter by .0025 inch in thickness.

If desired, some of the disks 14 may be of conducting material of a kind not affected by a magnetic field. A tube 15, of glass, encircles the disks 14 and terminals 12, 13. A permanent magnet is shown at 16 and is provided with two poles 17, 18, these poles being located adjacent to diametrically opposite edges of the several disks 14.

A wire 19 leads from the post 6 to the secondary winding 20 of a receiving transformer 21. A wire 22, by aid of a sliding contact 22^a, is connected with this secondary winding 20 and leads to a condenser 23, and from the latter, a wire 24 leads to the post 7. Connected with this post, is a wire 25, which leads to a choke coil 26 and from the choke coil, a wire 27 leads to a potentiometer resistance 28, preferably a graphite rod. A variable resistance is shown at 29 and is in metallic communication with a battery 30, the latter being in metallic communication with the wire 27 and with the potentiometer. The potentiometer is provided with a sliding contact 28^a, the latter being connected by a wire 31 with a telephonic receiver 32. A wire 33 leads from this receiver to the post 6. The receiving transformer 21 is provided with a primary winding 34. The antenna is shown at 35 and the ground wire at 36, this ground wire, leading to the earth at 37, and being connected by a sliding contact 38 with the primary winding 34. The antenna 35 is connected with this primary winding by aid of a sliding contact 39.

When electro-magnetic waves strike the antenna 35, oscillations are set up in this antenna. These oscillations flow through the primary winding 34 (or a portion thereof) to the ground, and thence back into the antenna. The primary winding, acting inductively upon the secondary winding, sets up oscillations, which flow through the following circuit: secondary winding 20, wire 19, post 6, screw 8, terminal 12, disks 14, terminal 13, screw 9, post 7, wire 24, condenser 23, wire 22, and sliding contact 22^a, back to the secondary winding 20. These oscillations pass through the condenser 23, but the current from the battery 30 is unable to pass through the condenser. The local or battery circuit is as follows: battery 30, variable resistance 29, potentiometer 28, wire 31, telephonic receiver 32, wire 33, post 6, screw 8, terminal 12, disks 14, terminal 13, screw 9, post 7, wire 25, choke coil 26, wire 27, back to battery 30.

As the magnet poles 17, 18 act inductively upon the adjacent edges of the respective disks 14, these disks are slightly repelled one from another. Under the influence of electro-magnetic waves, however, there is a coherence and as soon as this ceases, owing to cessation of the waves, the disks 14, by virtue of their tendency to move apart, under influence of the magnetic poles, increase the resistance of the local circuit.

Aside from the action above described, the device operates in substantially the same manner as other wave detectors heretofore known.

In the form shown in Figs. 3 and 4, the base appears at 40, and mounted upon the same is a yoke 41, carrying a pair of electromagnets 42, 43, inclined obliquely in relation to each other, and provided with poles 44, 45, of opposite sign, that is, one positive and the other negative. These magnets are connected by a wire 73. A tube 46 made of glass or other insulating material contains a group of metallic filings, shown at 47. These filings are made, preferably, of iron, or a mixture of iron and less magnetic metallic filings may be employed, if desired. In lieu of filings, parallel disks, such as those shown at 14 in Fig. 1, may be used. A plug 48 of conducting material, which may be of metal or carbon, engages the group of filings and carries the tube 46. This plug is provided with a threaded stem 50 which is mounted upon a rod 51. A screw 52 binds upon this rod and holds it in position. By loosening the screw 52, the rod 51 may be adjusted in the general direction of its length. The rod 51 is provided with a knob 53 to facilitate such adjustment. A terminal 54 made of conducting material, preferably carbon, engages the group of filings 47 and is engaged by a spiral spring 55. A sliding bolt is shown at 56 and is provided with a point 57 which extends into the adjacent end of the spring 55. Encircling the sliding bolt 56 is a spiral spring 58. A lever is shown at 59 and engages the sliding bolt 56. This lever is pivoted upon a pin 60 and at its upper end is provided with an eye 59^a. A screw 61 extends through this eye and is provided with a knob 62 so that it can be readily turned. The screw 61, sliding bolt 56 and lever 59 are supported by a post 63, the rod 51 being supported by another post 64. Binding posts are shown at 65, 66, and are connected with the posts 64, 63, by wires 67, 68, located beneath the base. The bindings posts 65, 66 are for the purpose of connecting the instrument with the antenna

and other parts of the receiving system. I employ two other binding posts 71 and 72. The binding post 71 is connected with a wire 74, which leads to a battery. The wire 76 leads to the binding post 72. A wire 42ª leads from the binding post 71 to the electro-magnet 42 and a wire 43ª leads from the binding post 72 to the electro-magnet 43. A circuit through the electro-magnets just mentioned, may be traced as follows: battery 75, wire 74, coil 73, binding post 72, coil 73, wire 76, back to battery 75.

The magnet poles 44, 45, by projecting a magnetic field through the group of filings 47, causes these filings to form into strings or clusters, so arranged that like poles, formed in opposite portions of the respective filings, repel similar poles in adjacent portions of other filings. It will be noted that in this form of device, as well as in the form employing the disks, the direction of the magnetic field crosses the direction of flow of the various electric currents. Upon this account, the effect of the magnetic field is, while diminishing the resistance of the filings along lines or planes crossing the diameter of the group of cohering bodies, to increase the resistance of said bodies in a plane coinciding with the axis of the group of cohering bodies. In other words, if the battery current were passing axially through the coherer, it would meet with less ohmic resistance than would be the case in the absence of the magnetic field playing directly upon the cohering bodies, but as the current follows the axis of the coherer and crosses the general plane of the magnetic field, the ohmic resistance offered by the cohering bodies is correspondingly increased. When, however, under wave action, coherence is established between the cohering bodies, they spring quickly together and in so doing, greatly diminish the ohmic resistance offered, not only to the battery current, but to succeeding oscillations as well.

The mechanism of the coherer or wave detector shown in Fig. 2, is somewhat simpler than that of the form shown in Figs. 3 and 4. The poles of a permanent magnet are shown at 77, 78 and between these poles is a tube 79 of glass or other appropriate insulating material. Filings are shown at 80 and are made wholly or in part of material having great magnetic permeability, such, for instance, as iron. Two screws are shown at 81, 82 and are provided with terminals 83, 84 of conducting material. These screws are revolubly mounted in posts 85, 86. Connected with the post 85 is a wire 87 which extends to the secondary winding 20 of the receiving transformer 21, the various connections of which have already been described with reference to Fig. 1.

The mechanism in Fig. 2 differs from that shown in Figs. 3 and 4 chiefly in the substitution of a permanent magnet for the electro-magnets 42, 43 and from the foregoing description relative to the various other figures, the action of the device shown in Fig. 2 may be readily understood.

I have found that by adjusting the coherer terminals so as to compress the cohering bodies (disks or filings) to a greater or lesser extent, the detector may be caused, under action of the waves, to increase or to diminish the resistance which it normally offers to the battery current.

I do not limit myself to the precise constructions shown, as variations may be made therein without departing from the spirit of my invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is as follows:

1. A wave detector comprising a plurality of disks disposed parallel to and in loose engagement with each other and means for inducing contrary magnetic polarities in oppositely disposed portions in each of said disks.

2. A wave detector comprising a plurality of disks made of magnetically permeable material disposed parallel with each other, means for conferring magnetic polarity of one sign upon contiguous edges of said disks and for conferring magnetic polarity of a different sign upon the opposite continuous edges of adjacent disks.

3. A wave detector comprising a tube of insulating material, cohering bodies mounted therein, terminals located upon opposite sides of said cohering bodies and engaging the same, a spring for pressing one of said terminals toward the other in order to compress said cohering bodies, a sliding bolt connected with said spring, a lever engaging said sliding bolt and means controllable at the will of the operator for adjusting the pressure of said lever upon said sliding bolt.

4. A wave detector comprising a plurality of thin magnetically permeable, movable disks disposed parallel with each other, means for subjecting said disks to the passage of an electric current at right angles to the plane of the disks, and means for maintaining the parallelism of the disks during their movement.

5. A wave detector comprising a plurality of thin magnetically permeable, movable disks disposed parallel with each other, means for subjecting said disks to the passage of an electric current at right angles to the plane of the disks, and means for maintaining the parallelism of the disks during their movement, said last named means comprising a hollow guide member having an interior cross section conforming to the contour of the disks and being disposed in close proximity to the latter.

6. A wave detector comprising a plu-

rality of thin magnetically permeable, movable, cylindrical disks parallel with each other, means for subjecting said disks to the passage of an electric current at right angles to the plane of the disks, means for maintaining the parallelism of the disks during their movement, said last named means comprising a cylindrical tube inclosing the disks, and a magnet having its poles disposed without said tube and on diametrically opposite sides thereof.

ROBERT T. ACKLEY.

Witnesses:
DAVID R. GILBERT,
ETHEL MCBRIDE.