R. A. FESSENDEN.

RECEIVER FOR SIGNALING.

APPLICATION FILED APR. 11, 1904.

1,002,050. Patented Aug. 29, 1911.

Fig. 1.

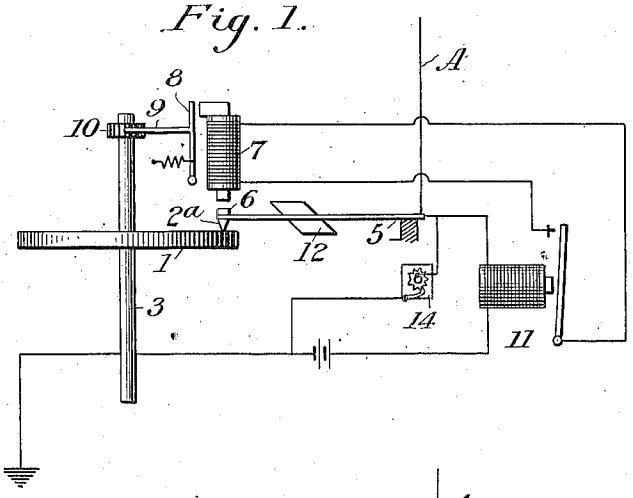


Fig. 2.

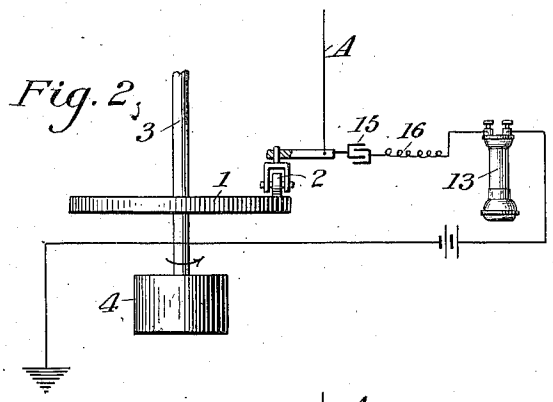


Fig 3.

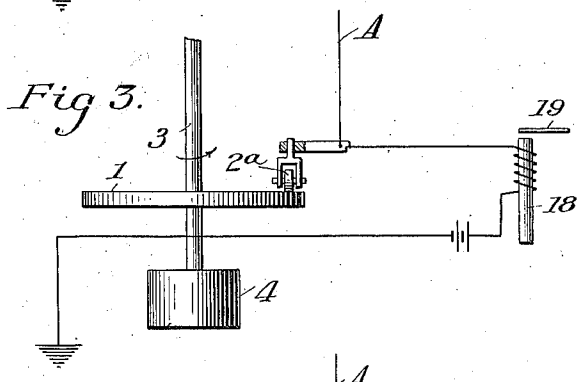
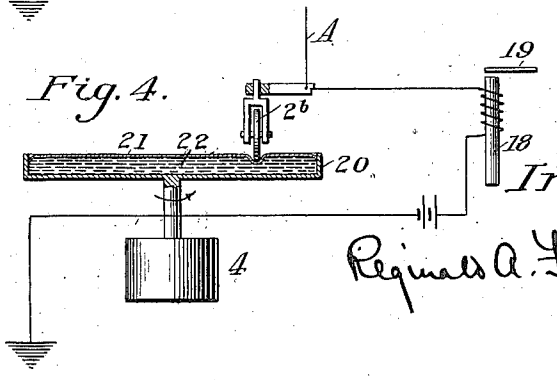


Fig. 4.



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RECEIVER FOR SIGNALING.

1,002,050. Specification of Letters Patent. **Patented Aug. 29, 1911.**

Application filed April 11, 1904. Serial No. 202,666.

To all whom it may concern:

Be it known that I, REGINALD A. FESSENDEN, residing at Washington, in the District of Columbia, a citizen of the United States, have invented or discovered certain new and useful Improvements in Receivers for Signaling, of which improvement the following is a specification.

The invention described herein relates to certain improvements in receivers for signaling.

It is characteristic of most forms of coherers now in use, that they are formed of small irregular particles of conducting material so that, when brought into contact with each other, a surface of one particle may be in contact with a point of another particle; but, when decohered and again brought into contact with each other, a surface of one may bear upon a surface of the other. By reason of this variation in the areas of contact, the current passing through the coherer will vary, rendering the signals received uncertain. Coherers have also been used in which the contacting surfaces are uniform, but the same surfaces are always brought into contact again after decoherence. Where the same non-conducting film is constantly acted on by the current, its character is so changed as to cause variations in the voltage required to actuate the coherer.

The non-conducting film referred to above and hereinafter as common to all forms of the apparatus described herein may be the oxidized skin of the metal or a thin film of fluid gas, such as air, or other well known non-conducting film such as oil, sulfid, etc., the action of which in coherers, particularly those of carbon, is well understood. With respect to the contact between carbons Heaviside states in his *Electrical Papers*, Vol. 1 page 183 as follows: "There is or seems to be a cushion of badly-conducting air between two pieces of carbon in contact, which air is partially squeezed out by increasing the pressure, and the resistance simultaneously reduced, more points or a larger surface of carbon being brought into real contact, if there be such a thing. At any rate this is in harmony with the difficulty of insuring a really good connection between wires, considerable pressure being required." See also Righi-Dessau, "*Die Telegraphie Ohne Draht*", section 36.

The object of the present invention is to insure uniformity of each contact electrical or physical as may exist or may be established between the parts across a non-conducting film, and also the bringing of new surfaces into contact.

The invention is hereinafter more fully described and claimed.

In the accompanying drawing forming a part of this specification Figure 1 is a diagrammatic view illustrative of my improved receiving apparatus, and Fig. 2 illustrates a modified form of apparatus adapted to prevent disturbing influences from affecting the indicating mechanism, and Fig. 3 illustrates a further modification for that purpose. Fig. 4 shows another modification of the apparatus.

In the practice of my invention parts or members 1 and 2 or 2^a or 2^b of the imperfect-contact receiver are so constructed that one shall have movement relative to the other, so that the contacting surfaces can be changed with sufficient frequency to give operative uniformity. Convenient forms for these parts consist of a disk and a second member stationary relative to the direction of movement of the disk. The disk is mounted upon a spindle 3, which may be rotated by any convenient means, such as the clock work 4. This disk may be formed of carbon, or carbonized structured material, such as carbonized velvet, or metal such as an alloy of gold and bismuth, the latter forming 5% of the alloy, or aluminum or mercury or osmium or iron. The other part or member 2 of the coherer may be formed of carbon or metal. Both parts or members may be formed of similar material. When the part or member 1 is formed of carbon the part or member 2 is made by preference in the form of a roller mounted so as to bear upon the face of the disk and to be rotated by contact therewith, as shown in Fig. 2. When using this construction the disk is preferably constantly rotated by any suitable mechanism. As an indicating mechanism, a telephone 13 in the local circuit, may be used. When the part or member 2 is made in the form of a point 2^a, as shown in Fig. 1, provision should be made for sepa-

rating the parts or members when one of them is shifted to change contacting surfaces, to prevent the point from removing the non-conducting film and thus forming a constantly closed circuit. A desirable construction consists in attaching the point 2^a to a spring arm, 5, whereby the point is held lightly in contact with the disk. A small block of iron, 6, is connected to the spring or point and serves as an armature for the electro-magnet, 7, which when energized will raise the point clear of the disk. The rotation of the disk is effected by the armature, 8, of the magnet through a pawl, 9, connected thereto and engaging a toothed wheel, 10, on the spindle. In order to prevent the point striking hard on the disk when released, a thin light plate, 12, is secured to the spring to retard the action of the latter. A clock work device 14 is connected as shown so as to short circuit the relay circuit about once a second, and so prevent an insensitive position of the contact being maintained.

As shown in Fig. 1, the parts or members 1 and 2^a are arranged in series with the conductor A and also in series with the circuit through the relay 11. This relay controls the circuit including the electro-magnet 7. The signals may be read from the relay or an indicating mechanism or device included in the circuit controlled by the relay or in the secondary circuit.

It is characteristic of my improvement that new surfaces are constantly brought into contact with each other—the character, *i. e.*, area, and shape of the surfaces in contact, being uniform and similar, so that for each coherence the action is practically the same, and that any insensitive position of the contact does not persist on account of the fact that new surfaces are constantly presented. On account of irregularities in the motion or vibration or surfaces, the contacts will never be entirely uniform. Though I use a roller affording rolling or anti-friction bearing of the moving surfaces whereby new surfaces are brought into contact with the least possible irregular variations in the continuity of a non-conducting film, and though I also contemplate using a dead surface such as carbon velvet or mercury, which tends to minimize or obviate vibration, nevertheless in order to eliminate residual effects when the above mentioned anti-vibratory surfaces are used, and also to enable less strongly anti-vibratory surfaces to be used in some cases, as in the case for example of the rolling contact shown in Fig. 2, irregular noises will be produced in the telephone 13, which will interfere with the signaling. Hence the indicating apparatus is designed so as to respond only to impulses having a frequency equal to the number of electrical discharges per second at the sending station, *i, e.*, if at the sending station there are 100 sparks per second, the indicating apparatus should respond only to impulses of that frequency. This is obtained by tuning the receiving apparatus either electrically, as by putting in the capacity 15 and the inductance 16 in circuit with the telephone 13, as shown in Fig. 2, or mechanically, when the inductances and capacity may be omitted and a telephone having instead of a diaphragm a tongue in tune to the desired frequency as shown in Fig. 3, where 18 is a single telephone magnet and 19 a metallic tongue adapted to vibrate at the desired frequency.

As hereinbefore stated one of the contacting surfaces may be formed of a material such as will give a yielding surface or a surface of a yielding nature, by which is meant a surface capable of deformation by small forces, such for example as the surface of mercury or a thin metal leaf. This form of receiver is especially useful in connection with indicating instruments having a variable zero, by which is meant, an indicating instrument in which the zero is not fixed, as in the case of a relay, but is variable, as in the case of a siphon recorder.

I am aware that imperfect contact devices have been constructed where one or more of the contacts have been made movable for purposes of adjustment, but the motion herein described does not refer to motion of adjustment, which effects a change of sensitiveness by changing the pressure, but of motion for maintaining the sensitiveness practically without changing and for renewing the surfaces of contact.

Fig. 4 is a view of another form of the apparatus in which a conductor and a disk of mercury 22 movable relatively to each other is shown. The disk or flat shaped body of mercury is contained in the shallow metallic dish 20, and dish and mercury disk are rotated preferably by a clockwork 4. The conductor may be a small wheel so arranged that it is normally preserved from making contact with the mercury by the thin film 21 referred to in the preamble which normally and inevitably covers a surface of mercury exposed to air. In lieu of the film of oxid other well known equivalents in the art, such as films of oil, sulfid, etc., may be used, the action being identical in each case. The resistance of the film will depend upon the degree of immersion or pressure. This was shown by Wardsworth who calculated the thickness of films of oil covering metallic surfaces by measuring the ohmic resistance of the films with a sensitive galvanometer and in general when one film is substituted for another the same resistance may be obtained by suitably varying the thickness of the new film, for example the film formed on a coherer of one of the

common types may vary from, say one hundred thousand ohms up to a value undetectable by the most sensitive galvanometer. The metal disk is preferably mounted so as to be revolved as the mercury disk revolves. The arrangement of circuits and indicating mechanism in Fig. 4 may as shown be the same as in Fig. 3.

Where carbon surfaces are used they should not be placed *in vacuo* as Berliner has shown that a vacuum removes the thin fluid and yielding insulating non-conducting film of air on which the microphonic effects depends.

It will be understood that the contact defined herein is a contact across a non-conducting, insulating film, which should not be scraped off or have its continuity destroyed in the operation of the apparatus.

This application is a division or substitution for my co-pending application No. 125,032 filed September 27th, 1902, with an additional figure and some elaboration of the description thereof as indicated in the original specification at page 3, lines 2 to 5 showing the disk as made of mercury as there described.

I claim herein as my invention:

1. A receiver for wireless signaling having in combination two parts or members, one of said members being of a yielding nature, means for continuously changing the point of contacts of said members, and means for selecting signals of a definite group frequency.

2. A receiver for wireless signaling, comprising a revolving disk and an electrode yieldingly held in contact therewith, and means controlled by the action of the electro-magnetic waves for raising said second electrode off the disk.

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