R. A. FESSENDEN.

RECEIVER FOR ELECTRIC SIGNALING.

APPLICATION FILED JAN. 6, 1906.

962,015. Patented June 21, 1910.

FIG. 1.

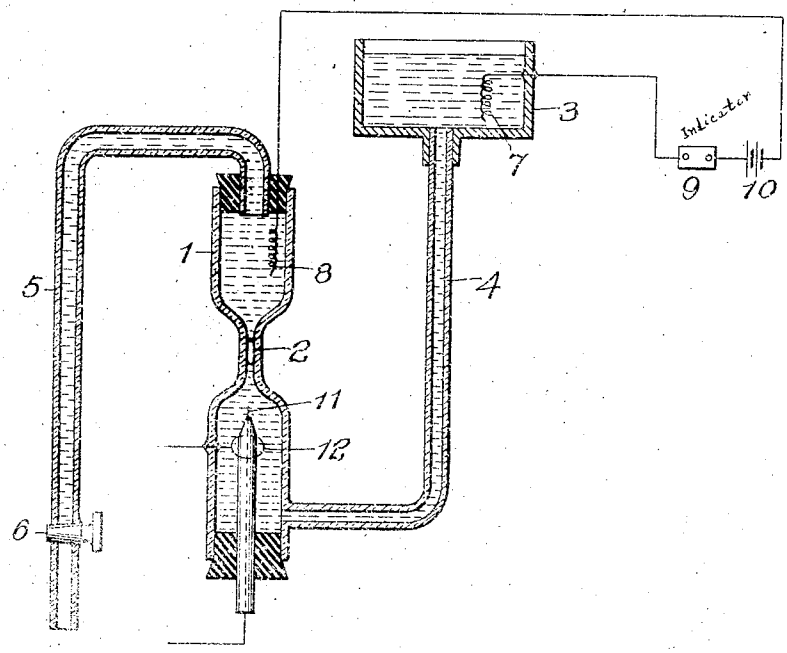


FIG. 2.

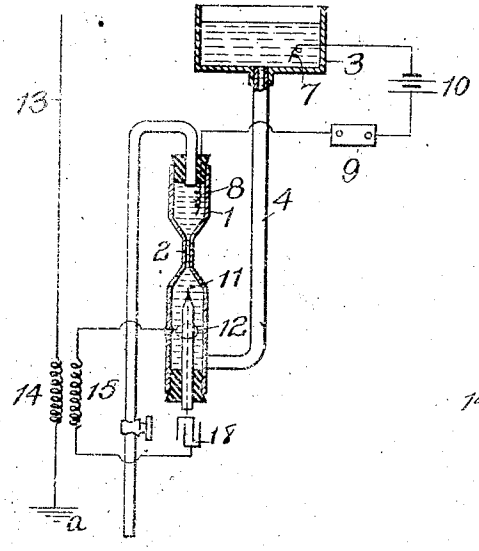
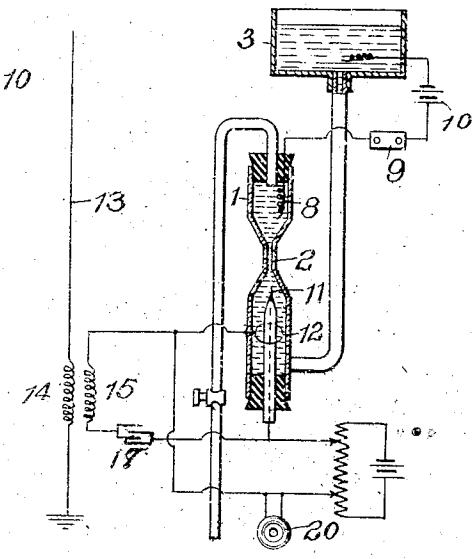


FIG. 3.



WITNESSES:

Herbert Bradley.

J. Morron Johnston.

INVENTOR

Reginald A. Fessenden

by Dennis B. Wolcott Atty

UNITED STATES PATENT OFFICE.

REGINALD A. FESSENDEN, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO THE NATIONAL ELECTRIC SIGNALING COMPANY, A CORPORATION OF NEW JERSEY.

RECEIVER FOR ELECTRIC SIGNALING.

962,015. Specification of Letters Patent. Patented June 21, 1910.

Original application filed January 9, 1905, Serial No. 240,268. Divided and this application filed January 6, 1906. Serial No. 294,929.

To all whom it may concern:

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

My invention relates to receivers for signaling by currents or electro-magnetic waves and has for its object a construction wherein a substance is changed as to one or more of its characteristics by the action of currents or electro-magnetic waves and the changed portion is caused to leave the point of change and after leaving such point produces or controls the production of an indication.

It is a further object of the invention to provide for the formation of a constricted conducting fluid path and for the interruption of such path by a change in the fluid, such interruption causing or controlling the production of an indication, all as is hereinafter more fully described and claimed.

In the accompanying drawing forming a part of this specification, Figure 1 is a sectional elevation of a form of receiver embodying my improvement; Figs. 2 and 3 are similar views illustrating modified arrangements of receiving and indicating circuits.

In the practice of my invention, the vessel, 1, which is preferably glass, has its upper and lower portions connected by a constricted portion, 2, through which a movement of the substance employed, as for example a 20% solution of nitric acid, may be established. In the construction shown, this movement of the liquid, which is for the purpose of causing the portion of the liquid acted on by the electro-magnetic waves to pass through the constricted portion, is produced by the flow of liquid from an elevated receptacle, 3, connected by a tube, 4, to the lower portion of the vessel, 1. An outlet from the upper portion of the vessel is formed by the tube, 5, provided with a valve, 6, for regulating the rate of flow of liquid through the constricted portion, 2. Terminals, 7 and 8, of a local circuit which includes an indicating mechanism, 9, and a battery, 10, are so located that the liquid, especially that portion forming the constricted conducting path, will form a part of the local circuit.

Two terminals, 11 and 12, one small and the other preferably larger, are so arranged with reference to the constricted portion, 2, that the movement of the substance in the vessel, 1, will be from the small terminal, 11, to and through the constricted portion, 2. These terminals may be directly or indirectly connected to the receiving conductor.

On the passage of a current between the terminals, 11, and 12, a portion of the substance contained in the vessel, 1, will be changed as to one or more of its characteristics, *e. g.* if the substance be electrolyzable, a bubble will be formed at the fine terminal, 11. The portion of the substance thus changed moves or is caused to move away from the fine terminal and so act upon the constricted conducting path as to produce a change in the current flowing through the local circuit. In the case of the electrolytic action the bubble will float or be carried by the movement of the liquid through the constricted portion, 2, and thereby breaking the local circuit or so reducing the constricted conducting fluid path as to produce a material reduction of current flowing through such path. As will be readily understood, the movement of the portion of the substance acted on, as for example, the movement of bubbles from the fine terminal, may be observed or the movement of the changed portion may control a local circuit containing an indicating mechanism.

Electrolysis, which includes the evolution of gas, is not ordinarily produced by alternating currents because when the electrodes are large the film of oxygen gas produced during the passage of the positive half of the current wave produces only a thin coating on the electrode, and this film does not contain a sufficient quantity of gas to enable it to form bubbles and to float up from the electrode. Consequently, on the negative half of the current wave passing and evolving hydrogen, the hydrogen combines with the oxygen, and as a consequence at the end of each complete wave the original amount of liquid is reproduced. Should, however, either one or both terminals be made so small that there is a large amount of gas per unit of area of the electrode, the gas will not exist in the form of a thin sheet but in the form of a thick layer whose buoyancy will be such that it will break

away from the electrode and float upward. When this is the case, the gas evolved during the positive half of the wave, will not be in contact with the electrode when the negative half passes, and consequently, will not recombine again to form the liquid. During the negative half of the wave consequently the hydrogen gas will be evolved which in turn will float away and the result is that both oxygen and hydrogen will be evolved and the solution will be electrolyzed. Hence, when electrolyzable substances are employed, the terminal, 11, should be made sufficiently fine to permit of electrolysis by the alternating currents produced by electro-magnetic waves.

By making the surface sufficiently small, even the small amount of current flowing at the very beginning of the half wave may be sufficient to crowd all the rest of the gas evolved during the main part of the wave away from the electrode so that practically the whole of the alternating current is effective in producing electrolysis.

The amount of hydrogen gas evolved from the fine terminal will not generally mean more than the amount of oxygen and in the figure shown both gases will be carried upward by the current of liquid and at some period of time will form a bubble as shown in the constricted portion, 2. When this bubble occupies the position shown the circuit of the local battery, 10, will be totally or partially obstructed and an indication will be produced by the indicator, 9.

In addition to the gas evolved directly by electrolysis, gas may be evolved by the heating effect of the alternating current waves on the fluid in case the fluid contains a gas. This will also float upward at the same time and will assist to produce an indication.

A receiver of the type herein described is shown connected so that there will be a constantly flowing current between the electrodes, 7 and 8, and a constant evolution of gas which will produce a constant amount of obstructions in the constricted portion, 2. When the currents produced by the electro-magnetic waves flow between the terminals, 11 and 12, additional gas will be evolved and a change will take place in the amount of obstructions in the portion, 2. This change of obstruction will cause a change of current from the local battery, 10, and this change of current may be made to effect the indicator, 9. Fig. 2 shows a method of connecting the receiver herein shown, 13 being the vertical grounded at *a*, 14 and 15 being primary and secondary of the transformer, the receiver constructed as described is placed in a tuned circuit containing the condenser, 18, 9 being the indicating mechanism and 10 the local battery.

In Fig. 3 is shown an arrangement of circuits whereby the liquid and the terminals, 11 and 12, form a receiver arranged in operative relation to the receiving conductor, 13, and also in a tuned local circuit with the indicator, 20. This circuit is preferably closed as shown. In addition to this local circuit, a second local circuit similar to that shown in Figs. 1 and 2, can be used.

No claim is made herein to the method described with some particularity of receiving electro-magnetic waves as such method forms the subject-matter of an application filed by me January 9th, 1905, Serial No. 240,268, of which this case is a division.

I claim as my invention:

1. A receiver for electro-magnetic waves having in combination a constricted conducting fluid path, means for producing a bubble and means for causing the bubble to move into the constricted fluid path.

2. A receiver for electro-magnetic waves having in combination a flowing liquid and means operative by electro-magnetic waves for producing a signaling or indicating change of conductivity in a portion of said liquid by changing its physical state and moving it.

3. A receiver for electro-magnetic waves having in combination a constricted channel connecting two bodies of liquid, means operative by electro-magnetic waves for producing a change in the physical state of a portion of the liquid and means for causing the changed portion to alter the conductivity by traversing the constricted channel.

4. A receiver for electro-magnetic waves having in combination a constricted channel, a liquid, means for causing the liquid to flow through the constricted channel and means operative by electro-magnetic waves for so producing a change in a portion of the liquid that the changed portion will be moved into the said constricted channel.

5. A receiver for signaling comprising a circuit including a substance alterable by electric current placed between two terminals, means for passing electromagnetic waves through the said substance to change its physical state, means to move the altered portion of said substance and means to effect a signal by alteration of conductivity due to such movement in a new position of the changed portion.

6. A receiver for electro-magnetic waves having in combination an electrolyzable liquid forming a part of a local circuit, means operative by electro-magnetic waves for producing a bubble in said liquid and means moving said bubble to vary the current in the local circuit.

7. A receiver comprising a substance alterable by electromagnetic waves and a local circuit including said substance, means to pass received waves through the substance

and thereby change the state of a portion of it, means to move the changed portion to a new position, and means to effect a signal by the presence of the changed substance in the new position changing the conductivity of the circuit.

8. A wave detector comprising a movable column of liquid forming part of an electric circuit, means to gasify a part of the moving liquid, and an indicating instrument operated by the motion of the gas so formed, substantially as described.

9. A wave detector comprising an electric circuit formed in part by a moving column of liquid, means operated by received waves for gasifying a part of the said column of liquid, and a signaling instrument operated by the motion of the resulting gas, substantially as described.

10. A wave detector comprising a local circuit including a column of liquid in motion, means to produce bubbles in said column by the received waves, and means to alter the conductivity of the local circuit by the resulting motion of said bubbles into a new position.

In testimony whereof, I have hereunto set my hand.

REGINALD A. FESSENDEN.

Witnesses:
DOROTHY O. THURMAN,
JESSIE E. BENT.