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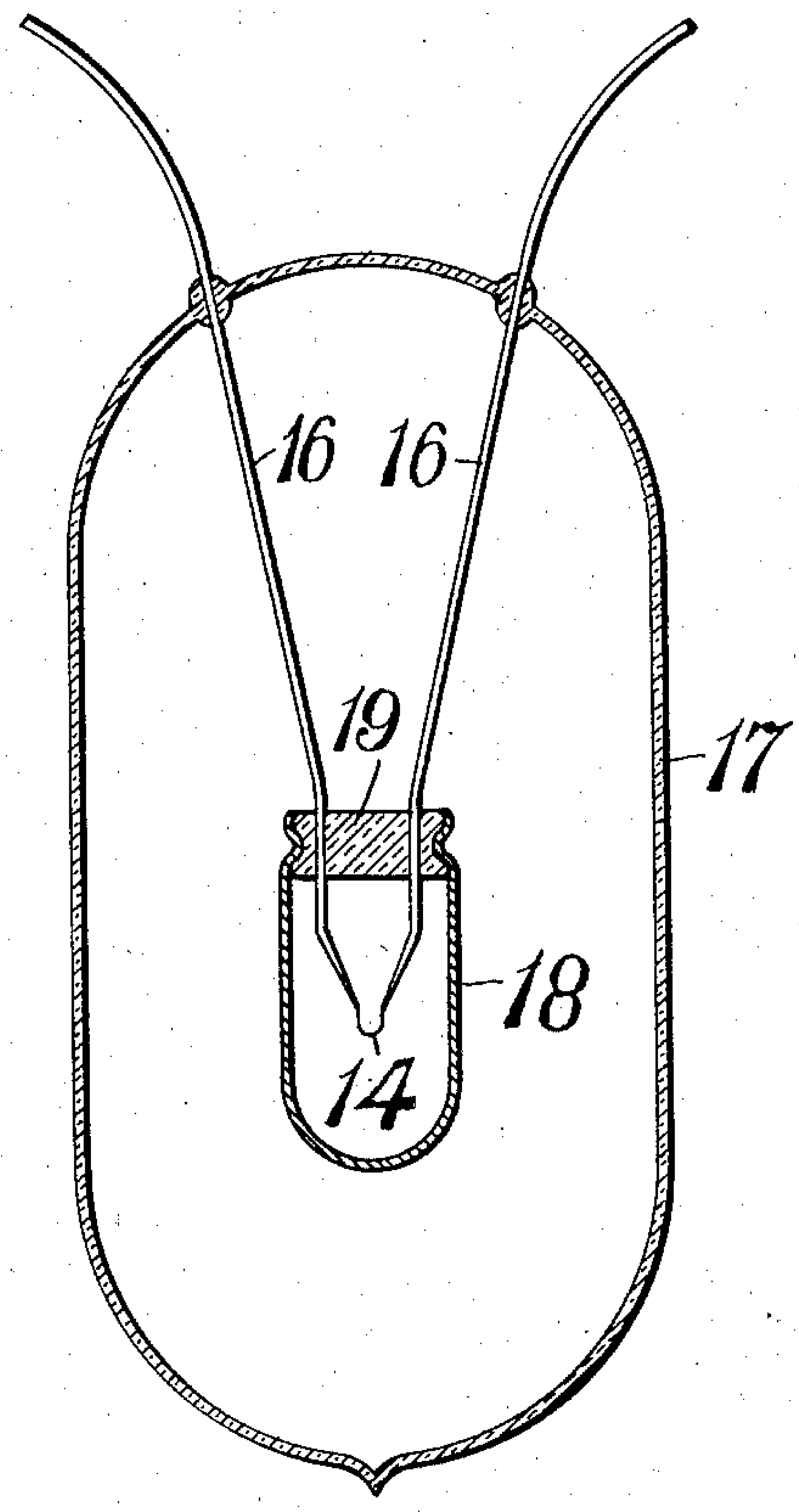
R. A. FESSENDEN.

CURRENT ACTUATED WAVE RESPONSIVE DEVICE.

(Application filed July 1, 1902.)

(No Model.)



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CURRENT-ACTUATED WAVE-RESPONSIVE DEVICE.

SPECIFICATION forming part of Letters Patent No. 706,744, dated August 12, 1902.

Original application filed June 6, 1902, Serial No. 110,460. Divided and this application filed July 1, 1902. Serial No. 113,968. (No model.)

To all whom it may concern:

Be it known that I, REGINALD A. FESSENDEN, a citizen of the United States, residing at Manteo, in the county of Dare and State of North Carolina, have invented or discovered certain new and useful Improvements in Current-Actuated Wave-Responsive Receivers, of which improvements the following is a specification.

The invention described herein relates to certain improvements in current-actuated wave-responsive devices for signaling by electromagnetic waves, and has for its object a construction whereby a rate of signaling higher than heretofore possible can be attained and over greater distances with smaller expenditure of power than in any system now in use.

It is a further object of the invention to render the operation of the receiving mechanism so positive and reliable as to make possible transmission of "code-messages" and other desirable classes of work.

The invention is hereinafter more fully described and claimed.

In the accompanying drawing, forming a part of this specification, my improved receiver for signaling by electromagnetic waves is shown in sectional elevation.

In the practice of my invention a silver wire one-tenth (.1) of an inch in diameter and having a platinum core about three one-thousandths (.003) of an inch in diameter is drawn down until the external diameter of the silver wire is about two one-thousandths (.002) of an inch in diameter and the platinum wire is about six one-hundred thousandths (.00006) of an inch in diameter. These dimensions can be varied in accordance with the conditions under which the receiver is to be used, provided the low heat capacity is maintained, as hereinafter described. A short piece of the wire thus prepared is fastened to the leading-in wires 16 and bent to the form of a loop 14. The tip of this loop is immersed in nitric acid to dissolve the silver from the tip and leave a small portion of the loop free from silver without reducing the cross-section or mass at the end or terminals, so that the latter will be capable of facilitating the reduction of temperature of the loop by conduction, especially when receiver is placed in a vacuum. Such a receiver will fulfil the conditions necessary for rapid and distinct signaling—*i. e.*, a capability of changing from and back to normal condition nearly instantaneously, dependent only upon the length of the signal—*i. e.*, whether long or short. As the receipt of signals is here dependent upon currents produced by electromagnetic waves the requirement above stated is fulfilled by the loop 14, as it has small volume, and consequently the loop has small heat capacity—*i. e.*, is capable of being raised quickly an appreciable amount in temperature with a consequent increase in resistance by a small amount of heat and is also capable of cooling rapidly.

It is essential that only a short length of the silver coating be removed, as if the exposed platinum portion be long its heat capacity will be too large and it will have too great radiating-surface and leave too great resistance to permit of its absorbing a sufficient amount of the energy of the electromagnetic waves. In practice I prefer a length of a few hundred thousandths of an inch, and thereby obtain a loop having a resistance of approximately thirty (30) ohms, and hence a low resistance compared with the resistance of the coherer, though good results can be obtained from loops proportioned to have a resistance as high as one hundred and fifty (150) ohms and some results with loops proportioned to have a resistance as high as six hundred (600) ohms.

It is preferred that the loop 14 should be inclosed in a glass bulb 17, the platinum leading-in wires 16 being sealed in the wall of the bulbs, so that a vacuum may be formed and maintained in the bulb. The vacuum is not, however, necessary, as the bulb may contain air or paraffin; but the vacuum is preferred, as less energy will be required to produce a good effect. As a further means of avoiding radiation of heat the loop may be inclosed in a silver shell 18, the shell being slipped over the loop and clamped to a small glass brace 19 on the leading-in wires corrugated for this purpose.

The sensitiveness of the loop may be increased if the loop have a thin coating of silver, forming a composite conductor of half the resistance which the exposed platinum would have. This end can be best attained by dissolving off all the silver at the tip in the manner stated and then recoating the platinum until the composite loop has half the resistance of the uncoated loop. Under these conditions equal currents pass through the platinum core and the renewed silver coating, and as the silver has equal resistance and one-seventh of the volume of the platinum it is heated approximately seven times as hot, and thus a greater total change of resistance is obtained with the composite loop than with the plain one. While preferring platinum and silver, other materials may be employed—as, for example, nickel or iron may be substituted for platinum and gold or aluminium for silver.

I am aware that Hertzian waves have been previously detected by means of a bolometer and that there is a superficial analogy between a bolometer and my improved receiver; but whereas a bolometer is specifically defined in the text-books as a construction arranged so as to have large radiating or absorbing surface in proportion to its mass, and hence consists of metal strips rolled out to a thin sheet, so as to have as large surface as possible (this surface being generally blackened) to assist radiation or absorption, in my case I do exactly the opposite—*i. e.*, arrange that the radiating-surface may be as small as possible, and therefore choose the form of a cylindrical wire as having the least surface per given volume. I also prefer to keep the surface bright as possible and preferably inclose it in a chamber, so as to prevent radiation.

A further distinctive feature is that in the bolometer the strips are made very long, so as to have as little conduction as possible to the terminals and that the radiation will be large compared to the conduction. It is preferred to do the reverse of this—*i. e.*, make the loop very short—so that the conduction losses will exceed the radiation losses. A third and most-strongly marked specific difference and one upon which the success of the invention largely depends is that the heat capacity of my receiver is made extremely small—*i. e.*, so small that practically an infinitesimal amount of energy is required to heat it up. With the bolometer no particular attempt is made to have small heat capacity, as in general the states to be observed are steady, and hence large heat capacity is rather an advantage as checking fluctuations, and though in some cases small heat capacity per unit of length has been attempted, yet such a design would not be available for my purpose, as for my purpose it is necessary that the entire heat capacity should be small. In my device no unnecessary heat is used in raising the temperature of the loop itself; but practically all the heat is spent by induction and radiation. It is by this design differing essentially from any previous design that I am able to detect and observe the practically instantaneous currents generated by electromagnetic waves and am able to attain a high speed of signaling, such as is requisite for practical results and which would be unattainable with a receiver having a large heat capacity.

A still further distinctive feature consists in the combination of low resistance with small heat capacity. It is possible to have low heat capacity and high resistance; but such a combination of qualities would not permit of the best results being attained, as unless the receiver has low resistance as compared with the coherer it will not absorb a sufficiently large amount of the energy of the electromagnetic waves.

While it is preferred to construct the receiver as regards the ratio of conduction to radiation, as hereinbefore described, it is possible to obtain good effects when the radiation is much larger. Hence this invention is not limited as regards the broad claims to a construction having a small ratio of radiation to conductions, as the main fundamental conditions are that the heat capacity should be small and also that conduction and radiation should be absolutely small as distinguished from small relatively to one another.

I claim herein as my invention—

1. A receiver for currents produced by electromagnetic waves consisting of a conductor having small heat capacity, substantially as set forth.

2. A receiver for currents produced by electromagnetic waves consisting of a conductor having small radiating-surface, substantially as set forth.

3. A receiver for currents produced by electromagnetic waves consisting of a conductor having low resistance and small heat capacity, substantially as set forth.

4. A receiver for currents produced by electromagnetic waves consisting of a conductor having a curved portion of small heat capacity, substantially as set forth.

5. A receiver for currents produced by electromagnetic waves consisting of a conductor constructed to lose its heat more rapidly by conduction than by radiation, substantially as set forth.

6. A receiver for currents produced by electromagnetic waves consisting of a conductor rapidly responsive as regards temperature to variations in electrocurrents, substantially as set forth.

7. A receiver for currents produced by electromagnetic waves consisting of a conductor formed of two or more materials and having small heat capacity, substantially as set forth.

8. A receiver for currents produced by electromagnetic waves, consisting of a short conductor having small heat capacity, substantially as set forth.

9. A receiver for currents produced by electromagnetic waves, consisting of a composite conductor, substantially as set forth.

10. A current-actuated wave-responsive device formed by a conducting filament, substantially as set forth.

11. A current-actuated wave-responsive device formed by a metallic filament, substantially as set forth.

12. A current-actuated wave-responsive device formed by a platinum filament, substantially as set forth.

13. A current-actuated wave-responsive device formed of conducting material and coated with another conducting material, substantially as set forth.

14. A current-actuated wave-responsive device formed of a conducting filament having relatively large ends or terminals of high heat conductivity, substantially as set forth.

15. A current-actuated wave-responsive device formed by a platinum filament having a silver coating, substantially as set forth.

16. A current-actuated wave-responsive device consisting of a conductor having a small heat capacity arranged in a vacuum, substantially as set forth.

In testimony whereof I have hereunto set my hand.

REGINALD A. FESSENDEN.

Witnesses:

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