No. 768,778. PATENTED AUG. 30, 1904.

H. C. SNOOK.

WIRELESS TELEGRAPHY.

APPLICATION FILED OCT. 23, 1902.

NO MODEL.

Fig. 1.

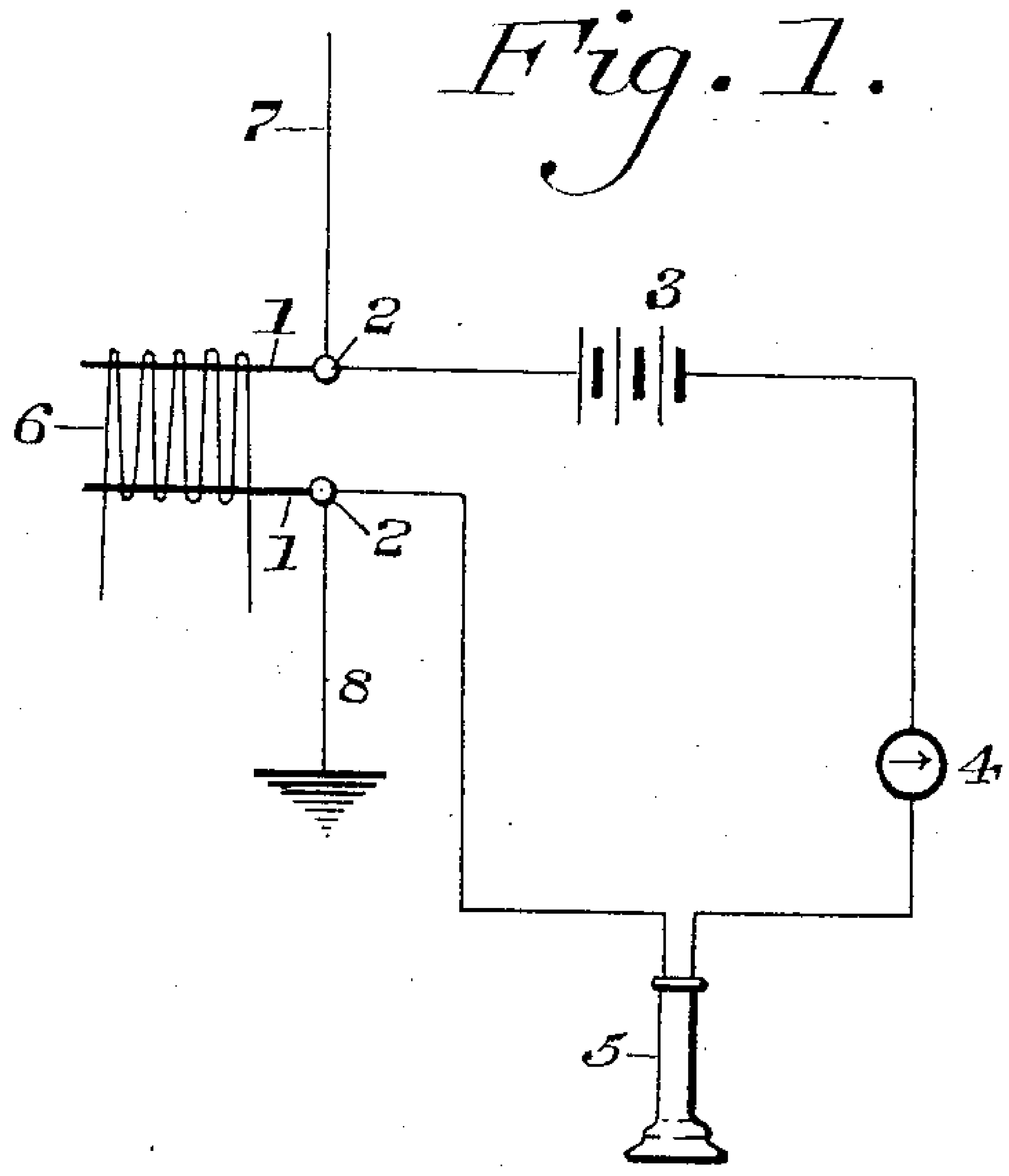


Fig. 2.

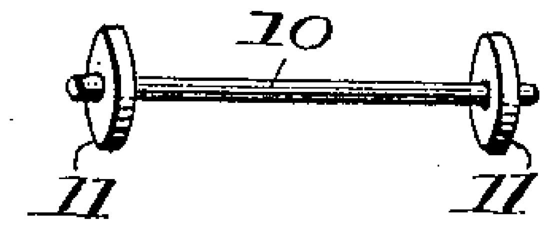


Fig. 3.

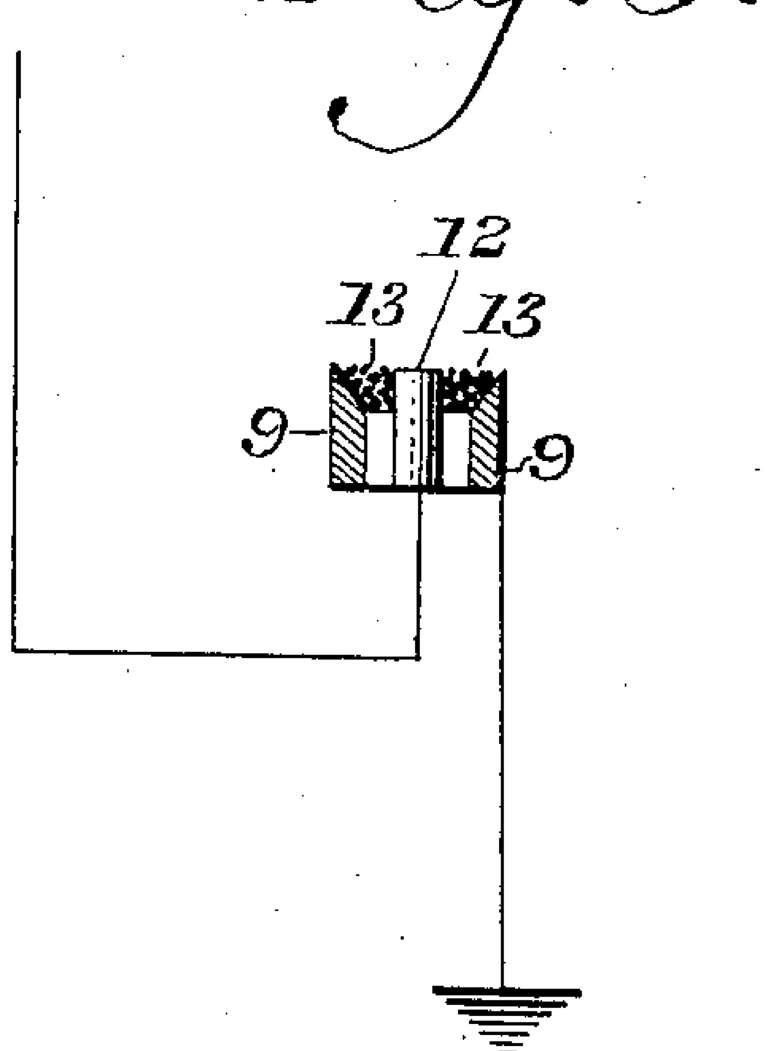
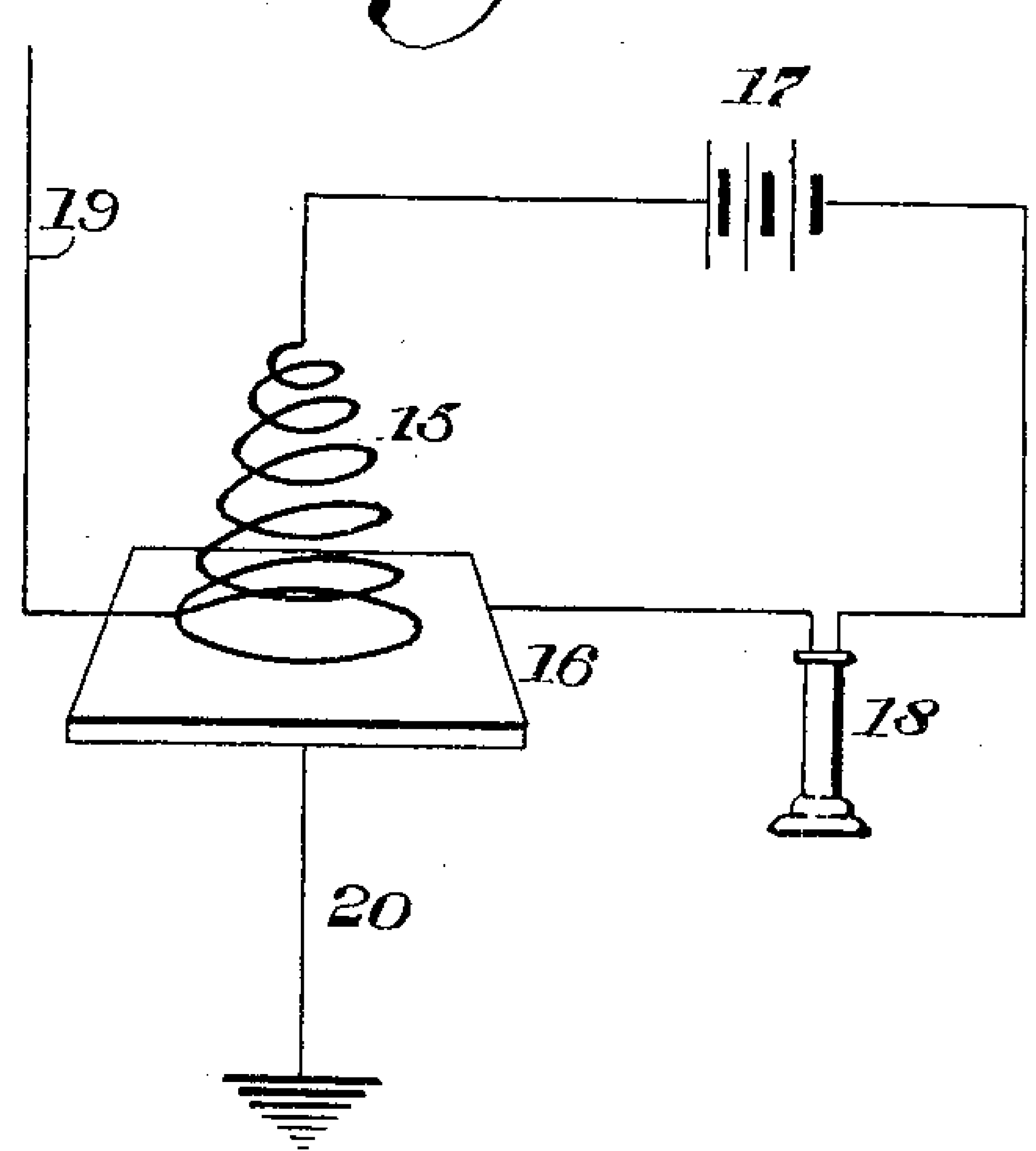


Fig. 4.



Witnesses

P. F. Nagle.

L. Douville.

Inventor

Homer Clyde Snook.

By Wiedersheim & Fairbanks.

Attorneys

UNITED STATES PATENT OFFICE.

HOMER CLYDE SNOOK, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO AMERICAN DE FOREST WIRELESS TELEGRAPH COMPANY, A CORPORATION OF MAINE.

WIRELESS TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 768,778, dated August 30, 1904.

Application filed October 23, 1902. Serial No. 128,435. (No model.)

To all whom it may concern:

Be it known that I, Homer Clyde Snook, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Wireless Telegraphy, of which the following is a specification.

The invention relates to improvements in wireless telegraphy; and it consists of an improvement in the material composing the electrodes.

It further consists of an improvement in the material composing the conductors constituting the circuit in an imperfect-contact receiver.

It further consists of novel details of construction, all as will be hereinafter set forth.

Figure 1 represents a diagrammatic view of a wireless-telegraphy system embodying my invention. Fig. 2 represents a view of an imperfect-contact receiver that may be employed. Fig. 3 represents a view of electrodes and conductors for an imperfect-contact receiver that may be employed. Fig. 4 represents a view of a system for wireless telegraphy that may be employed.

The efficiency of an imperfect-contact receiver when used as a wave-responsive device depends greatly upon the kind or kinds of substances which make the imperfect contact. Of these imperfect-contact receivers there are two (2) general classes: first, those which after responding to the wave or waves they are designed to receive return to their normal condition of high resistance without being mechanically agitated or disturbed; second, those which after responding to the wave or waves they are designed to receive do not return either completely or partially to their normal condition of high resistance without mechanical agitation or disturbance to effect this end.

The invention hereinafter described consists in an imperfect-contact receiver for electromagnetic waves in the use of a kind or kinds of material forming the imperfect contact such that a partial or complete restoration to the normal high resistance of the imperfect contact or contacts occurs upon the cessation of the electromagnetic wave or waves.

The invention consists also in an imperfect-contact receiver for electromagnetic waves, the use of a kind or kinds of material forming the imperfect contact such that after the electromagnetic wave or waves have lowered its resistance complete restoration to its normal high resistance occurs by a very slight agitation, mechanical or otherwise.

By the term "electromagnetic" waves, as used herein, is meant waves of a wave-length long in comparison with the wave-length of the waves found in the infra-red end of the normal spectrum and commonly known as "radiant" heat.

Referring to Fig. 1, there is represented two (2) aluminium wires 1, connected to the binding-posts 2 and in series with the battery 3 and galvanometer 4 and telephone-receiver 5. A coil of carbon 6, such as is used in incandescent-lamp filaments, is in contact with the two aluminium wires 1. This form of apparatus, using the two aluminium wires in contact with the carbon-loop as an imperfect-contact receiver, I found by experiment to be unusually sensitive to the electromagnetic waves such as are used in wireless telegraphy. This form of apparatus is so sensitive to any electromagnetic disturbance that without any aerial capacity, such as is represented at 7, and without any ground connection, as at 8, a small electric-bell buzzer affected it within a radius of eight or ten feet. This form of imperfect contact upon the cessation of the electromagnetic wave restored itself to its normal high resistance, so that it did not require any mechanical agitation or disturbance to effect this end. This form of receiver lowered its resistance upon receiving the waves and was determined by the production of sound in the telephone-receiver and by the deflection of the galvanometer-needle, indicating the presence of an increased current. This form of receiver increased its resistance upon the cessation of the wave and was determined by the restoration of the galvanometer-needle to the

"0" position upon the cessation of the wave. At times the restoration of the galvanometer-needle to the "0" position was not complete upon the cessation of the wave; but the needle either always partially or completely returned to its "0" position.

I employ, if desired, an imperfect-contact receiver of the form indicated in Fig. 2. 10 is a rod, of polished hard carbon, having rings of aluminium 11, in which the carbon rod 10 rests. This receiver responded readily to electromagnetic waves, but did not restore itself to its original high resistance upon the cessation of the waves, as the form in Fig. 1. The carbon 10 in Fig. 2 was not as dense or as hard as the carbon used in Fig. 1. The self-restoration of the initial high resistance of the receiver in Fig. 2 was sufficient, however, to receive messages at a distance of ten (10) miles with the use of limited heights of aerial conductors. The use of a non-porous carbon in an imperfect-contact receiver I have found by experiment is necessary to insure sensitiveness to electromagnetic waves and to secure a self-restoration to the original condition of high resistance upon the cessation of the waves. By "non-porous" carbon is meant carbon not having physical pores such as are readily discerned in carbon manufactured by coking the natural coals or carbon manufactured from ground coke or cokes, but is carbon having a hard, dense, close texture such as is found in the carbon of incandescent-lamp filaments. By "non-porous" carbon is meant flashed or other carbon heated intensely, so as to become non-porous or in a graphitose condition. Non-porous carbon may be obtained by dissolving cotton, paper, or other fiber in some solvent, such as zinc chlorid, ($ZnCl_2$,) squirting the gelatin thus obtained into a filament, subsequently removing the zinc chlorid or the solvent, drying, and, finally, carbonizing the filament in some of the well-known ways. The carbon thus obtained is very hard, dense, and quite non-porous. This non-porous carbon may be obtained by the process of flashing or deposition from a hydrogen-carbon vapor or liquid in the presence of heat. Non-porous carbon may be obtained by other methods besides the above well-known commercial ones. The carbon obtained by either of the above processes is non-porous and well adapted to the purposes of an imperfect-contact receiver.

The shape and form of the electrodes and conductors constituting the imperfect-contact receiver may be varied—as, for instance, in Fig. 3. The electrodes are an aluminium cup 9 and an aluminium cylinder 12, insulated from one another, the imperfect-contact circuit being completed by one or more pieces of non-porous carbon 13. When, as in Fig. 4, the carbon electrode may be a carbon spiral 15 in contact with the aluminium plate 16, the plate being polished or unpolished, a battery 17, and a telephone-receiver 18. In this form of receiver when the waves reduce the resistance of the imperfect contact the resistance of the circuit 15, 17, 18, and 16 is lowered, and increased current flows through 15, causing these spirals to tend by mutual induction to approach each other and retreat from the plate 16, thus decreasing the pressure between 15 and 16 and restoring the imperfect contact to its normal high resistance. I have found that sensitiveness depends greatly upon the pressure exerted by the electrodes constituting the imperfect contact.

Other methods than the above can be used for imparting motion to one or more of the electrodes constituting the imperfect contact.

The density of the carbon used being very important in the action of this kind of an imperfect-contact receiver for electromagnetic waves, the following is believed to be an explanation of what occurs: If an imperfect-contact receiver whose electrodes and whose conductors which form the imperfect contact are made of metals receive an electromagnetic wave or waves, the minute arcs which are established upon the breaking down of the resistance of the thin film of dielectric insulating the conductors of the imperfect contact from each other will volatilize a portion of the metal and will also oxidize a portion of it. This volatilization and oxidation will form a permanent bridge of metal or oxid, or both, which decreases the electrical resistance of the imperfect contact suddenly upon the formation of the arc. This conducting-bridge will remain until mechanical motion of one or both of the conductors thus united breaks or ruptures it. If the imperfect contact is made by means of many conductors, it is likely that a correspondingly large number of arcs or bridges are formed upon the reception of an electromagnetic wave or waves and that upon mechanical agitation some or all of the bridges are ruptured. If carbon be used, the volatilization of the carbon by the arc will carry carbon particles along the path of the arc and establish a circuit; but the heat of the arc raises the carbon to its kindling temperature, and in the presence of air as a dielectric the carbon tends to be oxidized. The oxids of carbon, (CO and CO_2,) both being gases, the particles of carbon carried along by the arc are at least partially oxidized into one or both of the above-named gases and do not tend to form a conducting-bridge, as in the case of substances whose oxids are solids and electrically conductive. When carbon is used in an imperfect-contact receiver, the gas, oxygen, nitrogen, &c., occluded by the carbon suffer a miniature explosion at the place where the arc is established. This explosion is due to the sudden local heating of the carbon by the arc. This miniature explosion tends to disintegrate the carbon at this point, shattering and expanding it. If comparatively soft and porous carbon be used, the quantity of gas which explodes is great, and since the mechanical strength of the carbon is low the explosion furs up and bulges out the carbon, making it project with sharp edges across the film of insulating dielectric. If, however, hard non-porous carbon be used, the quantity of occluded gas that explodes is small and the explosion itself correspondingly small. The strength of this carbon is greater and offers greater resistance to the disintegrating effect of the explosion. There is with it thus less tendency to be ruptured and to have formed a conducting-bridge of projecting carbon. This kind of carbon being more dense is enabled the longer to withstand the oxidation by arcing without the formation of pits or other cavities on its surface. It is this absence of the formation of a conducting-bridge when this non-porous carbon is used that renders this form of imperfect-contact receiver self-restoring to its initial high resistance. I have found that hard non-porous carbon exhibits this peculiar property above described when used as one of the contacts of an imperfect-contact receiver for electromagnetic waves in conjunction with various metals.

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

1. In a system of signaling by electromagnetic waves, an imperfect-contact receiver having one of its contacts formed of non-porous carbon.

2. In a system of signaling by electromagnetic waves, an imperfect-contact receiver having one of its contacts formed of non-porous carbon in contact with an oxidizable metal.

3. In a system of signaling by electromagnetic waves, an imperfect-contact receiver having one of its contacts formed of non-porous carbon in contact with aluminium.

4. In a system of signaling by electromagnetic waves, an imperfect-contact receiver, having one of its contacts formed of non-porous carbon in a polished state.

5. In a system of signaling by electromagnetic waves, an imperfect-contact receiver having one of its contacts formed of carbon in a polished state in contact with an oxidizable metal.

6. In a system of signaling by electromagnetic waves, an imperfect-contact receiver having one of its contacts formed of carbon in a polished state in contact with aluminium.

7. In a system of signaling by electromagnetic waves, an imperfect-contact receiver having one of its contacts formed of non-porous carbon maintained under definite pressure.

8. In a system of signaling by electromagnetic waves, an imperfect-contact receiver having one of its contacts formed of non-porous carbon and adapted to be restored to its original condition of high resistance by the mutual interaction of currents flowing in different portions of the conductor in series with the contact.

HOMER CLYDE SNOOK.

Witnesses:

WM. CANER WIEDERSHEIM,

C. D. MCVAY.