April 9, 1929. M. L. HARTMANN ET AL 1,708,573

RECEIVING SYSTEM FOR HIGH FREQUENCY ELECTRICAL OSCILLATIONS

Filed Feb. 21, 1925

Fig. 1.

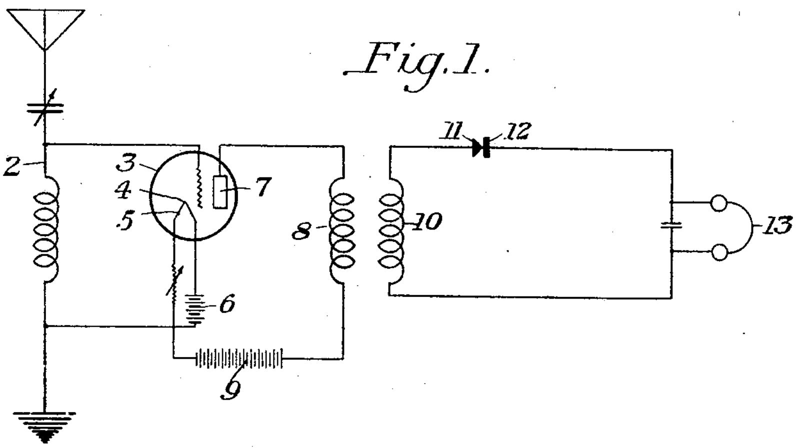


Fig. 2.

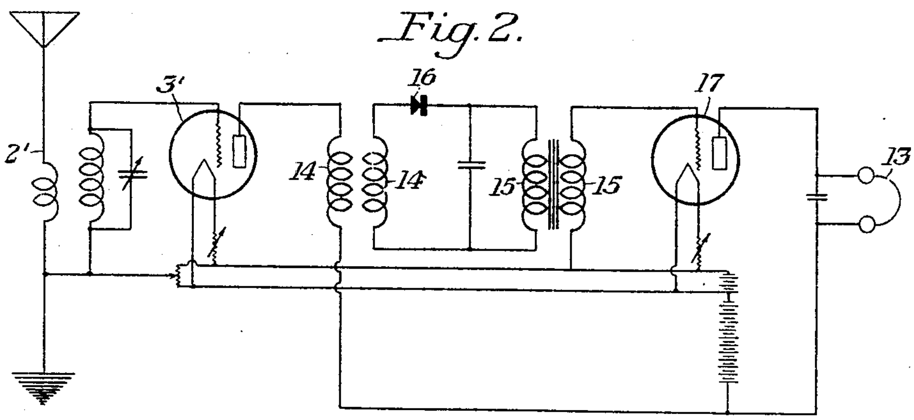
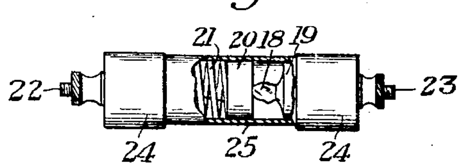


Fig. 3.



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Patented Apr. 9, 1929. 1,708,573

UNITED STATES PATENT OFFICE.

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RECEIVING SYSTEM FOR HIGH-FREQUENCY ELECTRICAL OSCILLATIONS.

Application filed February 21, 1925. Serial No. 10,796.

The present invention relates to an improvement in receiving systems for high frequency electrical oscillations, such as those used in wireless or radio telephony and telegraphy.

It has long been the practice to detect impulses of high frequency electrical oscillations by the use of a crystal rectifier which changes alternating high frequency current to direct pulsating current. Specific minerals, such as galena and pyrite, when placed in proper contact with other materials, such as a fine metal wire, have the property of allowing the current to pass only in one direction, thereby rectifying the current. All "crystal" rectifiers which have heretofore been produced have depended upon a very light touch between the two materials constituting the rectifier, and in either one or both of these there is constantly experienced the trouble of oxidation of the contact points. In practice it has been found that the very best detectors or rectifiers of this type last at best only a few months, particularly if used under conditions in which the voltage of the alternating high frequency current is amplified before it reaches the detector.

We have discovered that by the use of our improved silicon carbide detector, as described in our co-pending application, Serial No. 10,795 filed of even date herewith, we are able to combine the advantages of amplification or increasing the voltage of the incoming signals with a rectifier which is not deleteriously affected by high voltage, high frequency impulses.

In the drawings—

Figures 1 and 2 illustrate diagrammatically two different types of receiving systems embodying our invention; and

Figure 3 is a view, partly broken out, of our cartridge tube type of detector.

Referring to the embodiment of our invention illustrated in Figure 1, 2 designates a tuned antenna circuit for receiving the incoming signals, which are carried to a radio frequency amplification unit consisting of a 3-element vacuum tube, composed of the grid 4, the filament 5 lighted by a battery 6, and the plate 7 connected through the primary 8 of the transformer to a source of high direct current 9. By means of the action of the audion tube 3 and the transformer primary 8, the voltage of the impulse is increased in the secondary coil 10 of the phone circuit. This higher voltage current is then carried through the rectifier composed of pure silicon carbide fragment 11 and hardened steel plate 12 through the telephone 13, thus completing the secondary or phone circuit.

While we have illustrated our invention in Figure 1 in connection with one stage of radio frequency amplification, it will be understood that two or more stages of amplification may be joined together and used in combination with our improved detector.

Figure 2 illustrates the use of our detector in combination with radio frequency amplification preceding rectification and audio frequency amplification after rectification. In this illustrated embodiment of our invention, 2′ designates the tuned antenna circuit, 3′ a 3-element vacuum tube for amplification of the radio frequency impulses, 14 the radio frequency transformer, 15 the audio transformer, 16 our silicon carbide detector and 17 a 3-element vacuum tube for audio frequency amplification.

We have shown in Figure 3 a preferred form of our silicon carbide detector for use in receiving systems such as described above. This detector and its method of manufacture will be briefly described, the same being also described in more detail in our co-pending application above referred to. It comprises a silicon carbide fragment 18 which has been treated to remove all surface impurities therefrom. It is then coated over approximately one-half of its surface, as by electroplating or spraying, with a thin closely adhering film of conducting metal, such as silver or copper. A second coating is then put on over the first coating consisting of non-oxidizing metal, such as an alloy of lead and tin. The coated fragment is then put in a mold and has a base 19 of metal, such as solder, cast about its coated portion. A hardened steel plate 20 is pressed against the silicon carbine fragment by a coil spring 21 with a pressure in the neighborhood of five pounds. The plate 20 and base 19 are electrically connected to the binding posts 22 and 23 carried by metal caps 24 at the ends of the dielectric tube 25. We have found that a detector of this character has low electrical resistance not only at the rectifying contact but also at the joint be-

tween the metal conductor and the silicon carbide fragment. Actual tests made on a rectifier of this type, develops the fact that it will rectify currents of the order of 75 milliamperes and effectively withstand the destructive action of currents of this value, whereby the rectifier is peculiarly adaptable to use in a radio circuit wherein the relatively large currents of the radio frequency amplifying side of the circuit are impressed on the rectifier.

It is to be understood that our invention is not limited to the embodiments thereof illustrated in Figures 1 and 2, but that it may be otherwise embodied within the scope of the appended claim.

We claim:

In a receiving circuit for high frequency amplification, an amplifying circuit for received oscillations, and a crystal detector comprising a crystal of silicon carbide and a contact element cooperating therewith, characterized by the fact that the crystal is free of those surface impurities that form on silicon carbide in its manufacture and is capable of rectifying efficiently currents of the order of 75 milliamperes and wherein the pressure of the contact element is in excess of one pound whereby it has a low contact resistance value, whereby said circuit secures efficient rectification of the amplified signal impulses while maintaining their maximum effective value due to the low contact resistance in the conducting direction of the crystal.

In testimony whereof we have hereunto set our hands.

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