

March 5, 1935.

H. EBERHARD

1,993,436

TRANSMITTER DEVICE

Filed April 19, 1932

2 Sheets-Sheet 1

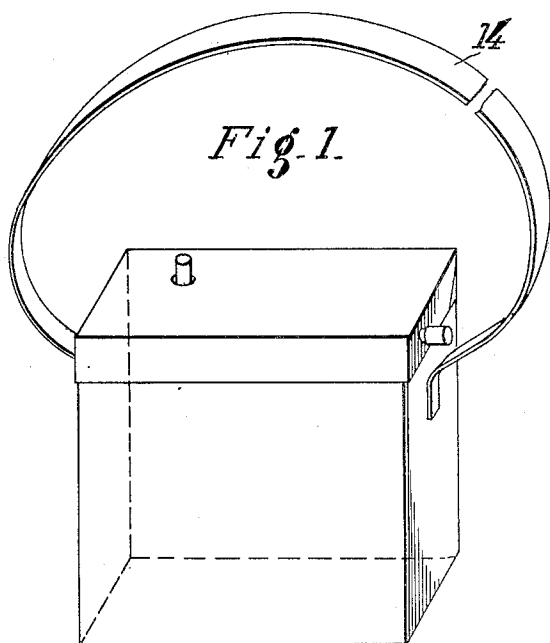


Fig. 1.

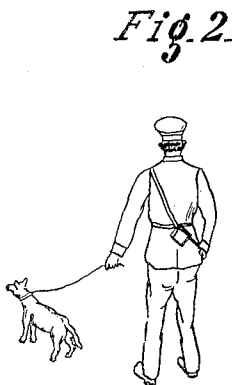


Fig. 2.

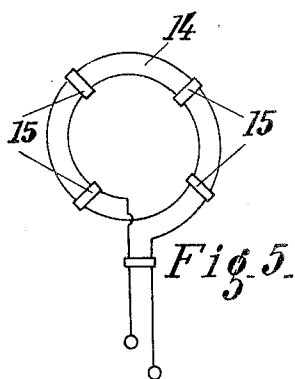


Fig. 5.

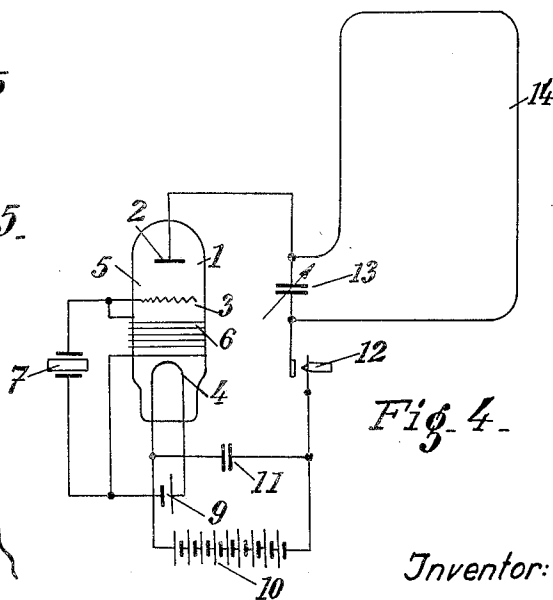


Fig. 4.

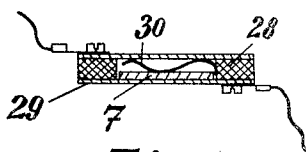


Fig. 10.

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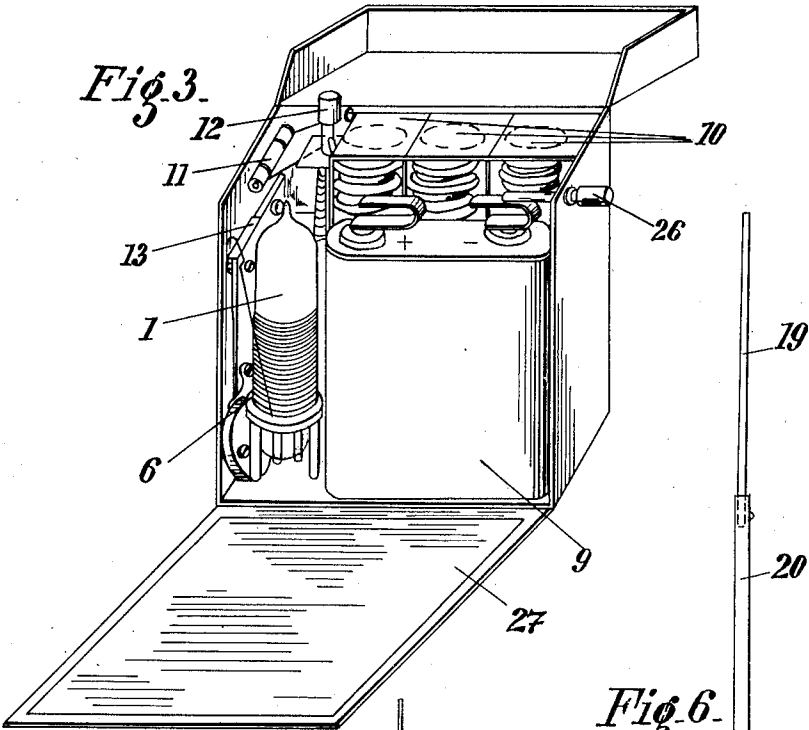
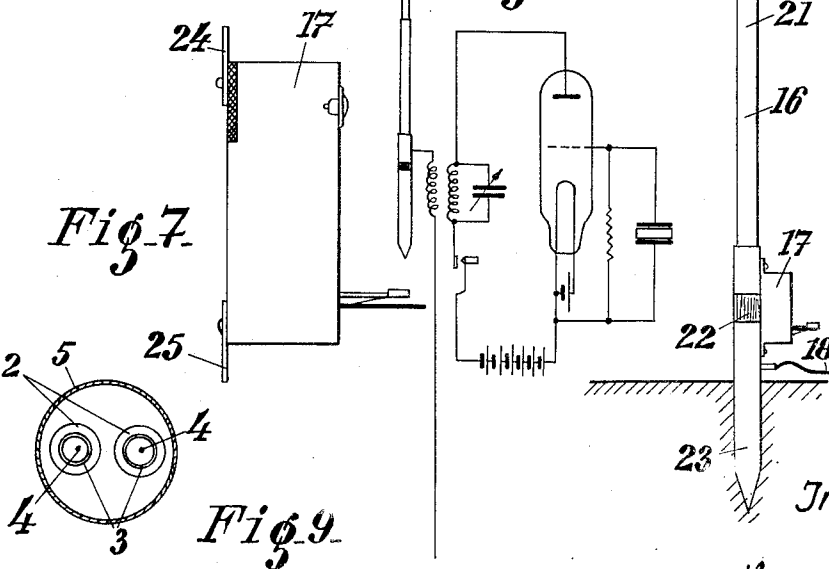


Fig. 6.

Fig. 8.



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UNITED STATES PATENT OFFICE

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TRANSMITTER DEVICE

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7 Claims. (Cl. 250—17)

The subject matter of the present invention concerns a novel type of small portable quartz-controlled transmission apparatus. By reason of its compact construction the same is particularly suitable for police or criminal investigation work, or quite generally in such cases in which it is desired to transmit wireless signals in inconspicuous fashion to not too great distances. The size of the apparatus is roughly that of a cartridge case, i. e., of pocket size. At the same time the apparatus contains a transmission valve of approximately 1 watt.

Specifically, the compact construction is obtained by reason of the fact that as anode battery there is employed a battery having single elements capable of being set together and consisting of circular or rectangular discs with a cross-sectional area amounting to approximately 4 sq. cm. The transmission valve employed also possesses extremely small dimensions. A transmission valve of roughly 1 watt has successfully been designed the bulb of which possesses a diameter of approximately 15 mm. and a length of approximately 60 mm. The valve is fitted without a socket, and requires for its operation a heating potential of 2 volts and an anode potential of approximately 55—60 volts. Anode currents sufficient for short ranges were obtained, however, with even 20 volts. Of particular importance as regards reliable operation of the small transmitter according to the invention is the use of a piezo-electric crystal, for example quartz. The operating waves may have a length amounting to 20—40 metres. Without a control crystal of this nature it would be wholly impossible to transmit signals of a kind capable of being received at a receiving station. The movements of the operator when walking result in capacitative detuning of such nature that the transmission of a constant wave does not enter into the question without the use of a control crystal. If on the other hand quartz is employed in the manner known per se for controlling the transmitter, perfectly satisfactory conditions of operation are obtained. Thus, for example, if police doing street duty are equipped with the small transmitter according to the invention, faultless reception may be obtained by means of a receiving station, which might possibly be fitted in a car in an adjoining street. To enable the transmission apparatus to be carried without creating attention, and more particularly to operate the same inconspicuously, the transmission apparatus according to the invention is, in accordance with the additional subject matter of

the invention, so constructed that the same may be carried about the body by means of a strap. In the strap itself there is then sewn the loop composed of one or more windings acting as aerial.

To obtain the maximum degree of constancy of the operating wave there is not employed, in accordance with the additional subject matter of the invention, a holder of any of the known kinds for the piezo-electric crystal, but specifically for this purpose a space-economizing mounting was designed, which is also suitable for other purposes. The same is particularly characterized by the fact that the heat developed in the vibrating quartz is rapidly discharged, and accordingly during the operation of the quartz there is avoided any change in the natural elastic wave thereof. The mounting for the control quartz consists in detail of two thin metal discs, which act as electrodes and are held at a certain distance apart by means of an insulating ring. The piezo-electric crystal is mounted in the hollow space of the casing thus formed. In order to ensure that the spacing between the quartz and the electrodes does not vary, which is of particular importance when using the same for a portable apparatus, pressure is exerted on the crystal disc by a spring disc.

The invention is described with reference to the drawings, which show a few forms of embodiment.

Fig. 1 represents a complete view of the small transmitter.

Fig. 2 shows a watchman equipped with the apparatus.

Fig. 3 is a view of the interior of a transmitter according to the invention, and shows the structural arrangement of the single parts.

Fig. 4 shows the circuit diagram of the transmitter according to Figs. 1—3.

Fig. 5 illustrates a form of embodiment of the inductance acting as aerial.

In Figs. 6—8 there is shown the manner in which the small transmitter according to the invention may be fitted with an aerial of the rod type.

Fig. 9 is a cross-section through a transmitter valve according to the invention.

Fig. 10 is a section through the oscillator according to the invention.

In the single figures the corresponding parts have been designated by the same reference characters. Thus, for example, 1 is the ionic valve consisting of the anode 2, the grid 3, the cathode 4, which are mounted in the glass bulb 5. About

the glass bulb there is wound the choke 6 which, in the same manner as the piezo-electric crystal 7, is connected between the grid and the cathode of the valve. The heating current for the cathode 4 may be supplied by the battery 9, and the anode current by the anode battery 10. There is, however, no objection to employing in place of an anode battery a vibrator transformer fed by the heating battery, as covered by the patent application Ser. No. 602,865 "Valve connection system" dated April 1932. As will be recognized from Fig. 3, there is arranged behind the heating battery 9 the anode battery 10. For adaptation to the limited conditions of space, the anode battery may be built up of single elements arranged in vertical columns. Thus, for example, the anode battery may consist of single discs of zinc and carbon. The single discs may possess a cross-sectional area amounting to approximately 4 sq. cm. The electrolyte may consist of a filling as known in the case of dry elements. In the present example the electrolyte is made up as follows: 100 c. cm. water, 25 c. cm. sal-ammoniac, 10 c. cm. zinc chloride, and 5 c. cm. calcium chloride and a certain amount of gelatine.

The electronic valve 1, for the purpose of obtaining a considerable slope or large output with minimum requirement for space, is provided with two entirely separate electrode systems constructed on the lines of Fig. 9, wherein the corresponding electrodes may be preferably connected in parallel within the valve. The diameter of the anode of each electrode system shown in cross-section in Fig. 9 may amount to approximately 4 mm., the diameter of the grid to $1\frac{1}{2}$ mm. As cathode there may be employed a $30\ \mu$ tungsten filament. The single windings of each grid may be furnished each with one single transverse bar. Since in employing the valve illustrated in Fig. 9 for the small portable transmitter in Figs. 1-4, it is not a matter of employing valves of considerable durability, but of obtaining within a brief space of time a maximum amount of energy from a valve of small dimensions, the valve is systematically overheated. With an anode potential of approximately 50 volts and a heating potential of approximately 2 volts it is then possible to obtain an emission of roughly m. a. The slope of the valve is then approximately $2\frac{1}{2}$ m. a. per volt, and the reciprocal of the amplification factor roughly 12-15%. The ionic valve illustrated in Fig. 4 or 9 possesses a cathode produced according to the metal vapour process, that is to say—barium in the form of vapour is deposited on the tungsten filament, for example by means of a chemical reaction. The deposition of barium is known per se and is not claimed in this application.

The connection according to Fig. 4 is completed by the bridging condenser 11, the morse key 12, the rotary plate condenser, which is adjustable from the exterior, for example by means of a screw-driver, and by the loop 24 acting as aerial.

The key 12 is so arranged that signals may be transmitted without attracting attention. The key of the apparatus located in the pocket of the operator may accordingly be operated in the pocket in inconspicuous fashion. The key or other interrupting means for the anode circuit operated in morse rhythm may be arranged of course at any other suitable point.

The loop 14 in the arrangement according to Fig. 1 is fitted in the strap of the apparatus, by means of which strap the apparatus may be

carried, as illustrated in Fig. 2. The coil acting as aerial may also be constructed as shown in Fig. 5, or in another suitable manner. As shown in Fig. 5 the coil 14 may consist of two circular wire windings, which are maintained at a constant distance apart, for example amounting to 15 mm., with the assistance of two distance pieces 15. In the arrangement according to Fig. 5 there is employed for the coil an enamelled copper wire of 1 mm. thickness. The inner winding possesses a diameter of approximately 25 cm. The self-supporting coil 14 may in the embodiment according to Fig. 5 be worn under the coat or in the jacket and connected with the condenser 13 or the transmitter connection system by means of special wires.

There is no objection, for improving the radiation, to employing in place of a coil for the aerial an aerial of the open type, for example a rod aerial. Such an aerial is shown in Figs. 6-8. There may be employed a dipole aerial on the lines of a Hertz oscillator, i. e., the transmitter is arranged at the centre between two conductors, the length of each of which may amount to one-quarter of the wave length. It is not absolutely essential that the two conductors are located in the same direction. Thus, for example, the vertically disposed rod aerial 16 (as it is shown in Fig. 6) may be connected with the transmission apparatus 17 at the bottom. At the lower end of the apparatus there is connected the horizontally disposed strand 18 taken towards the right.

According to the additional subject matter of the invention, the rod-shaped aerial is constructed in telescopic fashion on the lines of a tripod. In the form of embodiment shown in Fig. 6 three metal rods, for example aluminium tubes, 19, 20, 21 are arranged one within the other, so as to form a telescope. At the lower end of the tube 21 there is provided an insulating member 22, and beyond the same a point 23, by means of which the aerial may be stuck in the ground. The insulating member 12 serves the purpose of securing the apparatus 17 to the aerial 16, 18. This is preferably performed by furnishing the apparatus 17 with fishplates 24, 25 (Fig. 7). Through the medium of these plates the connections of the oscillatory circuit lead to the aerial, so that when fixing in the apparatus 17 the latter is already connected with the aerial.

It is also of importance that as is shown in Fig. 3 a switch 26 may be provided, which permits of the connection and disconnection of the batteries without opening the box 27.

In Fig. 10 there is shown a cross-section taken through the mounting for the piezo-electric crystal 7. For the electrodes there are employed two thin metal discs 28 and 29, composed for example of nickel. These are held at a certain distance apart by a ring of pertinax or other suitable material. In the hollow space thus formed there is located the quartz disc 7. There is also provided a spring disc 30, which rests with suitable bias on the one hand against the inner surface portion of the electrode 28 and on the other hand against the surface of the crystal plate 7.

I claim:

1. A transmitter comprising an electronic valve, a heating battery connected to the heating filament of said valve, a control-quartz connected on the one hand to the grid of said valve, and on the other hand to said battery, a choke wound about said valve and connected in par-

allel to said control-quartz, and an anode battery connected on the one hand to the filament and on the other hand to the anode of said valve, a morse key interconnected between said anode battery and said anode, a rotary plate condenser interconnected between said morse key and said anode, and a condenser bridging said anode battery, all said parts being arranged in a casing of pocket size.

2. A transmitter comprising an electronic valve, a heating battery connected to the heating filament of said valve, a control-quartz connected on the one hand to the grid of said valve, and on the other hand to said battery, a choke wound about said valve and connected in parallel to said control-quartz, and an anode battery comprising a casing, a great number of single elements set together, and a dry-element filling arranged in said casing, said anode battery connected on the one hand to the filament and on the other hand to the anode of said valve a morse key interconnected between said anode battery and said anode, a rotary plate condenser interconnected between said morse key and said anode, and a condenser bridging said anode battery, all said parts being arranged in a casing of pocket size.

3. A transmitter comprising an electronic valve, a heating battery connected to the heating filament of said valve, a control quartz connected on the one hand to the grid of said valve, and on the other hand to said battery, a choke wound about said valve and connected in parallel to said control-quartz, and an anode battery comprising a casing, a great number of circular or rectangular zinc and carbon discs set together and a dry-element filling arranged in said casing, said anode battery connected on the one hand to the filament and on the other hand to the anode of said valve a morse key interconnected between said anode battery and said anode, a rotary plate condenser interconnected between said morse key and said anode, and a condenser bridging said anode battery, all said parts being arranged in a casing of pocket size.

4. A transmitter comprising an electronic valve, a heating battery connected to the heating filament of said valve, a control-quartz connected on the one hand to the grid of said valve, and on the other hand to said battery, a choke wound about said valve and connected in parallel to said control-quartz, and an anode battery connected on the one hand to the filament and on the other hand to the anode of said valve a morse key interconnected between said anode battery and said anode, a rotary plate condenser interconnected between said morse key and said anode, and a condenser bridging said anode battery, all said parts being arranged in a casing of pocket size, said morse key arranged on a wall of said casing.

5. A transmitter comprising an electronic valve, a heating battery connected to the heating filament of said valve, a control-quartz connect-

ed on the one hand to the grid of said valve, and on the other hand to said battery, a choke wound about said valve and connected in parallel to said control-quartz, and an anode battery comprising a casing, a great number of circular or rectangular zinc and carbon discs set together and a dry-element filling arranged in said casing, said anode battery connected on the one hand to the filament and on the other hand to the anode of said valve a morse key interconnected between said anode battery and said anode, a rotary plate condenser interconnected between said morse key and said anode, and a condenser bridging said anode battery, all said parts being arranged in a casing of pocket size, said morse key arranged at a lid of said casing.

6. A transmitter comprising an electronic valve, a heating battery connected to the heating filament of said valve, a control quartz arrangement comprising two thin metal discs, one insulating ring maintaining said metal discs in a certain distance of one another, a quartz disc arranged between the said metal discs, a thin spring disc arranged between said quartz disc and one of said metal discs to press the quartz disc against the other of the said metal discs, said metal discs connected with the grid of said electronic valve on the one hand and with said heating battery on the other hand, a choke wound about said valve and connected in parallel to said control-quartz, and an anode battery comprising a casing, a great number of circular or rectangular zinc and carbon discs set together and a dry-element filling arranged in said casing, said anode battery connected on the one hand to the filament and on the other hand to the anode of said valve a morse key interconnected between said anode battery and said anode, a rotary plate condenser interconnected between said morse key and said anode, and a condenser bridging said anode battery, all said parts being arranged in a casing of pocket size, said morse key arranged at a lid of said casing.

7. A transmitter comprising an electronic valve, containing two entirely separate systems, each of said systems comprising a grid, plate and filament, each two of the said corresponding electrodes being connected in parallel within the valve, a heating battery connected to the heating filament of said valve, a control-quartz connected on the one hand to the grid of said valve, and on the other hand to said battery, a choke wound about said valve and connected in parallel to said control-quartz, and an anode battery connected on the one hand to the filament and on the other hand to the anode of said valve a morse key interconnected between said anode battery and said anode, a rotary plate condenser interconnected between said morse key and said anode, and a condenser bridging said anode battery, all said parts being arranged in a casing of pocket size, said morse key arranged at a lid of said casing.

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