PUBLISHED
JUNE 8, 1943.
BY A. P. C.

# W. DÄLLENBACH ET AL
## DEVICE FOR SUPER-POSITION OF TWO ULTRA-HIGH-FREQUENCY ELECTRO-MAGNETICAL-OSCILLATIONS

Filed Feb. 24, 1941

Serial No.
380,368

2 Sheets-Sheet 1

Fig. 1.

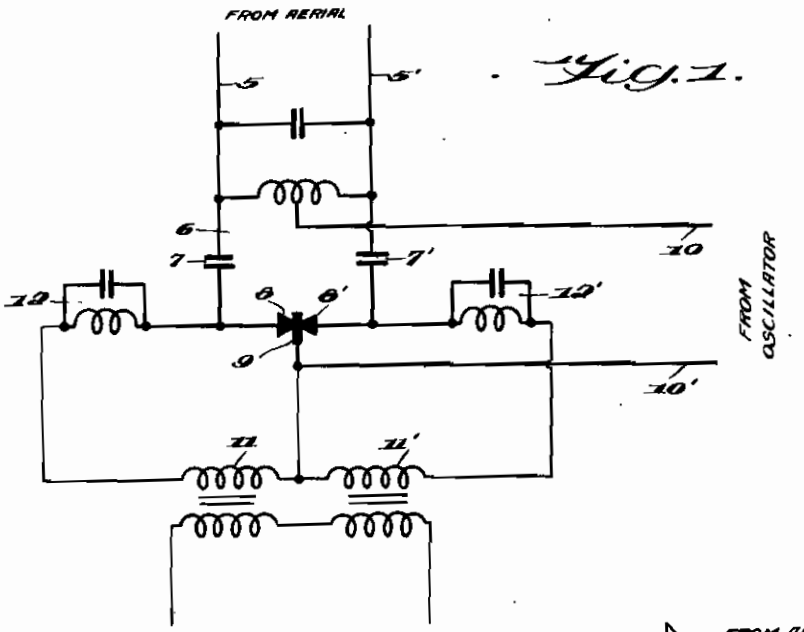
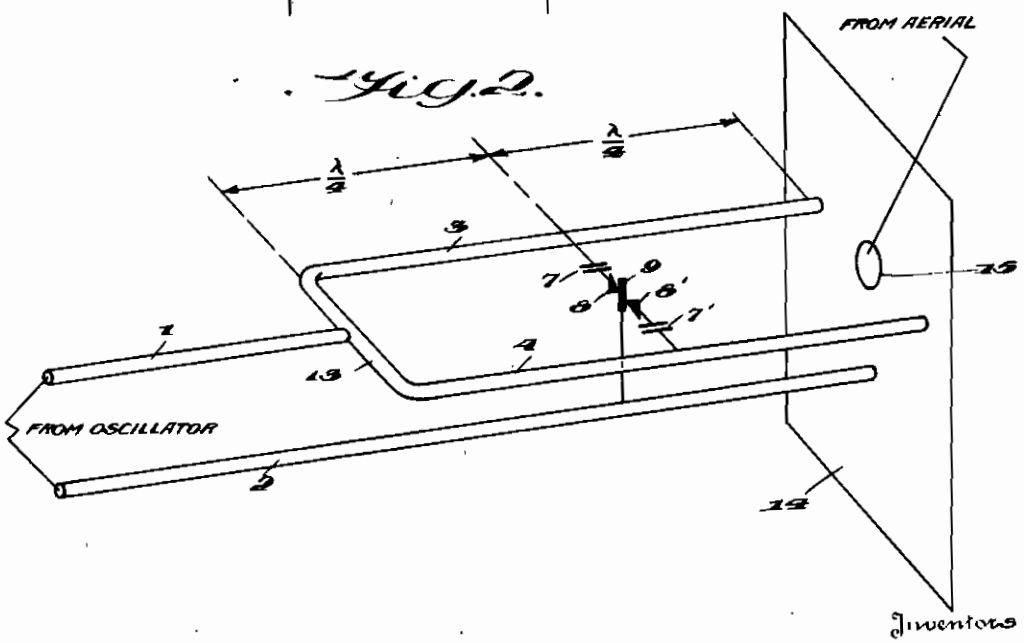



Fig. 2.




Inventors
WALTER DÄLLENBACH,
ALFRED ALLERDING,
ERICH HÜTTMANN,

By Bailey & Parson
Attorneys

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

# W. DÄLLENBACH ET AL
DEVICE FOR SUPER-POSITION OF TWO ULTRA-HIGH-FREQUENCY ELECTRO-MAGNETICAL-OSCILLATIONS
Filed Feb. 24, 1941

Serial No.
380,368
2 Sheets-Sheet 2

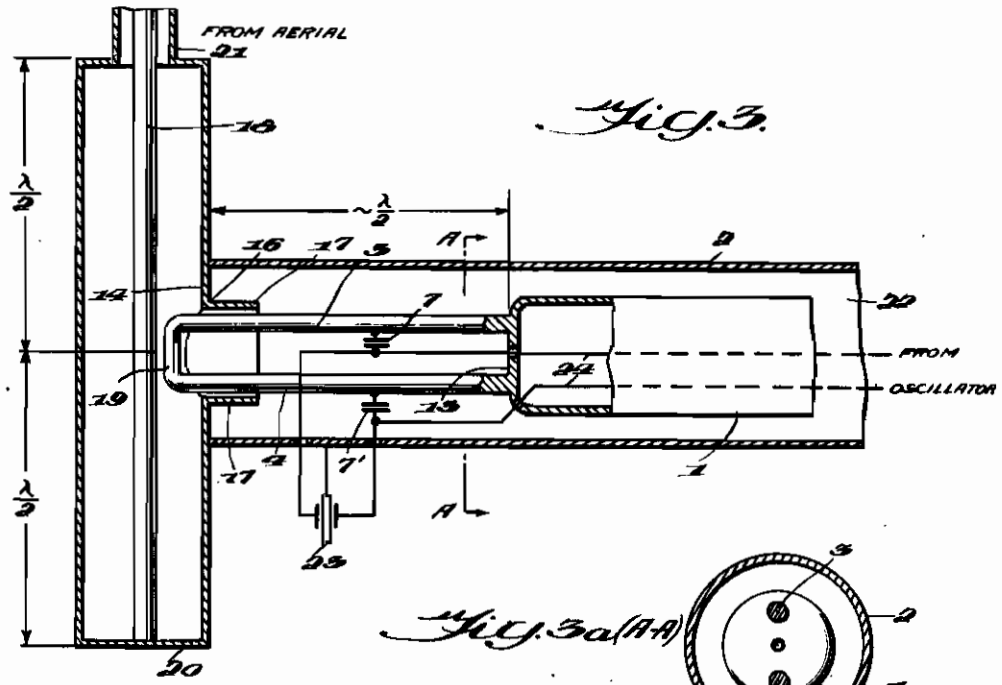



Fig. 3.




Fig. 3a (A-A)

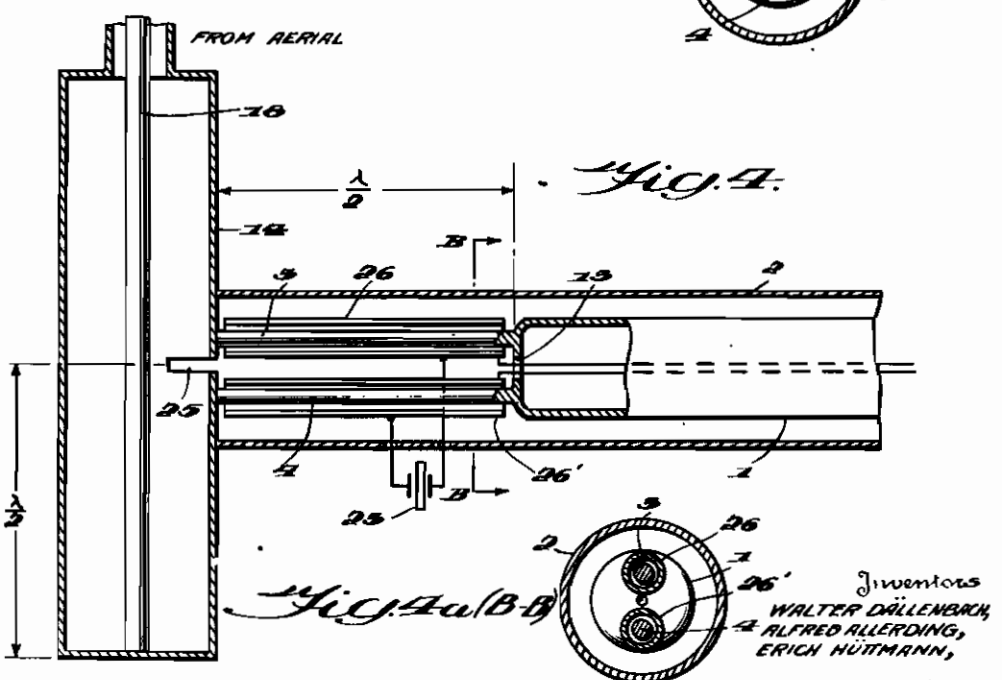



Fig. 4.

Fig. 4a (B-B)

Inventors
WALTER DÄLLENBACH,
ALFRED ALLERDING,
ERICH HÜTTMANN,

By Bailey & Parson
Attorney

Published June 8, 1943

Serial No. 380,368

# ALIEN PROPERTY CUSTODIAN

## DEVICE FOR SUPER-POSITION OF TWO ULTRA-HIGH-FREQUENCY ELECTRO-MAGNETICAL-OSCILLATIONS

Walter Dällenbach, Berlin W 35, Alfred Allerding, Berlin-Friedrichshagen, and Erich Huttmann, Berlin-Kopenick, Germany; vested in the Alien Property Custodian

Application filed February 24, 1941

In regard to super-heterodyne receivers the oscillator as well as the aerial is to be coupled to the miscellaneous tube in such a way that the oscillator-tube will not radiate over the aerial. By miscellaneous tube it is understood a tube in which the super-position and rectifying of two oscillations takes place.

The invention refers to a device for super-position of two ultra-high frequency electro-magnetical systems of oscillations respectively for discoupling of two such systems of oscillations, especially for the purpose of super-heterodyne receiving methods. In such case there can be used a Lecher-system to which the second oscillation is The one conductor of this Lecher-system branches in two conductors which form a second Lecher-system to which the second oscillation is led. The arrangement of these two Lecher-systems is made in such manner that the two conductors of the branching system oscillate in push-pull and both together work in respect to the other conductor of the first Lecher-system in the same rhythm.

For a fuller description of my invention reference is made to the accompanying drawings.

Figure 1 shows a scheme of circuit which embodies the general scope of the invention.

Figure 2 shows an arrangement which corresponds to the general scheme and whioh at the same time shows the transmission of the general scope of the invention to the special case of ultra-short waves. In these case the Lecher-system are shown as concentric pipe-conductors.

According to Figure 3 the coupling of the two Lecher-systems is made by a current-loop, i. e. a wire bent like a hair-pin with which the one system projects into the magnetical field of the other Lecher-system.

Figure 4 shows the coupling being made by means of a slit in the outer conductor of the one Lecher-system.

Fig. 3*a* and 4*a* show cross sectional views of the arrangement of the Lecher-system as shown in Figs. 3 and 4.

In Fig. 1 there is shown schematically a bridge-device. A two wire system 5, 5', coming from the aerial leads to a resonance circuit 6 consisting of capacity and inductance in parallel connection. From the resonance circuit 6 the conductors lead to two blocking condensers 7 and 7' and from there to the miscellaneous tube f. i. to the anodes 8 and 8' of a duo-diode. To the centre of the inductance of the resonance circuit 6 on one hand and to the cathode 9 of the duo-diode on the other hand there are connected the two conductors of a Lecher-system coming from the oscillator-tube. Furthermore the primary windings 11, 11' of a push-pull transformer for the intermediate frequency are connected to the anodes 8 and 8'. The two windings 11 and 11' are counterturned. For preventing the high frequency flowing to the intermediate frequency transformer the two resonance circuits 12 and 12' are inserted in the connection wires between the anodes 8 and 8' and the windings 11 and 11'. The thick lines in Fig. 1 show conductors which lead high frequency whilst the thin lines show conductors which only lead intermediate frequency.

The circuit shown in Fig. 1 acts as follows:

The energy line 10 and 10' is leading a high frequency oscillation from the oscillator to the bridge device. Both anodes 8 and 8' of the duo-diode oscillate in like rhythm in regard to the cathode 9. The high frequency current of the oscillator-tube flows through both halves of the inductance of the resonance circuit 6, through the blocking condensers 7, 7', through the anodes 8 and 8', through the cathode 8 of the duo-diode and from there back to the oscillator. (The inductance of the parallel resonance circuit 6 can be compensated by a capacity in the leading conductors). This flowing causes a directed current from the cathode 9 of the duo-diode to the centre of the primary windings 11, 11' of the intermediate frequency transformer. This directed current will not produce any potential difference at the secondary windings of the intermediate transformer, for both the halves of the windings 11 and 11' are wound in counter-turnings. This causes no effecting from the windings 11, 11' to the secondary windings for equal currents are flowing from the centre to the ends of the primary windings 11 and 11'. If in the contrary there exists a high frequency voltage in the energy line 5, 5' coming from the aerial the anodes 8 and 8' of the duo-diode oscillate in push-pull. The currents which are flowing in the primary windings 11 and 11' of the transformer have the same direction. Currents of this kind will not compensate each other in regard to the secondary windings but produce a directing voltage at the terminals of the secondary windings. The high frequency current coming from the aerial is flowing f. i. through wire 5 and blocking condenser 7 to anode 8 of the duo-diode and from there to cathode 9 and anode 8', and from there to blocking condenser 7' through the wire 5' back to the aerial.

In Figure 2 an arrangement corresponding to

the scheme of Fig. 1 is shown suitable for using ultra-short waves especially waves of a wave length less than 1 m. The first Lecher-system comprising the conductors 1 and 2 is coming from the oscillator-tube. The conductor 1 branches into two conductors 3 and 4 at the point 13. These new conductors form a second Lecher-system consisting from two wires of a length of $\lambda/2$ or a multiple thereof. ($\lambda$=wave length). The system 3 and 4 is short circuited by a plate 14 serving as a bridge. The conductors 3 and 4 are forming a resonator between 13 and 14 which if excited oscillators in push-pull. On the other hand if one connects the conductor 2 to the plate 14 in this manner that there is a potential node at this point also for the Lecher-system 1, 2 there can be led a high frequency oscillation over the system 1, 2 which causes a rhythmical oscillation of the conductors 3 and 4 together in respect of the conductor 2. The push-pull oscillations can be excited f. i. by an opening 15 in the reflecting plate 14 with the aid of current coupling. The miscellaneous tube, f. i. the duo-diode is then connected near to a potential loop between the conductors 3 and 4, i. e. in a distance of $\lambda/4$ from the plate 14 in such manner that the anodes 8 and 8' over-blocking capacities 7, 7' are connected with conductors 3 respectively 4 whilst the cathode 9 is directly connected with conductor 2. The miscellaneous tube presenting at the same time an impedance it will be necessary to make the length of the conductors 3 and 4 not exactly $\lambda/2$ but equivalent to $\lambda/2$ in such manner that the Lecher-system is tuned to the wanted wave length in spite of the valve impedance.

In Figure 3 the arrangement according to Fig. 2 is repeated in case the Lecher-system is formed concentrically. The two conductors 3 and 4 are connected to the branching point 13 in form of a wire bridle in the same manner as in Figure 2. For better understanding in Fig. 3 this arrangement is shown cross sectionally along the line A—A. The wires 3 and 4 are short circuited with the outer conductor 2 at 18 through capacity 17, so that the rhythmical oscillation led from 1, 2 has a potential node at 16. Between the conductors 3 and 4 the outer conductor 14 serving as reflecting plate (of a further) concentric Lecher-system 14, 18 has an opening through which the conductors 3 and 4 project in form of a current loop 19 into the magnetical field of the Lecher-system 14, 18. For getting a perfect symmetric coupling to the system 14, 18 in regard to the conductors 3 and 4 it is advantageous to provide the loop 19 in a potential node of the Lecher-system 14, 19. The centre of the loop 19 has thus a distance of $\lambda/2$ or a multiple thereof of the short-circuited end 20 of the system 14, 18. From this follows that by such arrangement the aerial oscillation introduced at 21 causes no rhythmical oscillation at 22 and vice versa the oscillation of the oscillator-tube introduced at 22 causes no push-pull oscillation at 21. This is a consequence of the symmetry of the arrangement. If in the practical device symmetry is not preserved perfectly it can be restored with the aid of small trimming capacities connected between the conductors 3 and 4 on the one hand and the outer conductor 2 on the other hand.

Near to a potential loop of the system 3, 4 the anodes of the duo-diode 23 are coupled to the conductors 3 and 4 through the blocking condensers 7 and 7' whilst the cathode is connected to the jacket 2. The directed current can be drawn from the wires 24 which are to be led free of inductance and parallel to the conductors 3 and 4. They can run in the inner of the pipe-like conductor 1 to the intermediate transformer.

Figure 4 shows another embodiment of the invention. Instead of a current loop 18 projecting into the magnetical field of the Lecher-system 14, 18 as shown in Figure 3 there is provided a slit 25 in the outer conductor 14 symmetrically to the conductors 3 and 4 effecting a coupling between the Lecher-systems 14, 18 and 3, 4. Besides the blocking condensers 29 and 26' are formed as concentric pipes provided insulated round the conductors 3 and 4 and to themselves the diode 23 is connected. The pipes 26 and 26' form the second Lecher-system for they lead the push-pull oscillation as well as the conductors 3 and 4. The arrangement is shown in Figure 4a in a sectional view along the line B—B. The wires for the directed current are connected in a potential node to the blocking condensers 26 and 26' and are furthermore led insulated in the inner of the conductor 1 to the intermediate frequency transformer.

It is advantageous as shown in all figures to provide the aerial-oscillation as push-pull oscillation and the oscillator-tube oscillation as rhythmical oscillation for the push-pull oscillation needs no high frequency energy in the cathode conductors. These cathode conductors are advantageously made from thin wires for preventing heat losses. For this reason they would be a rather strong damping for the weak aerial-oscillations. On the other hand the oscillator-tube possesses a large energy and therefor the damping will not trouble it.

WALTER DÄLLENBACH.
ALFRED ALLERDING.
ERICH HUTTMANN.