Sept. 7, 1937. H. E. HOLLMANN 2,092,069

ULTRA SHORT WAVE RADIO SYSTEM

Filed Aug. 7, 1936

Fig. 1

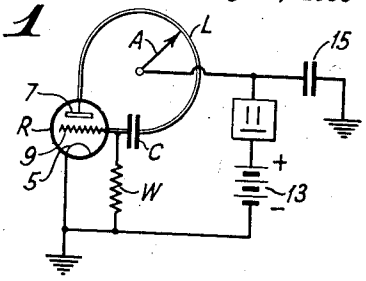


Fig. 2

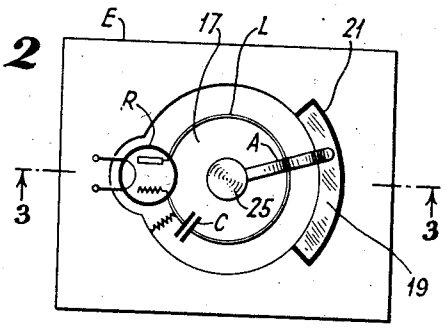


Fig. 3

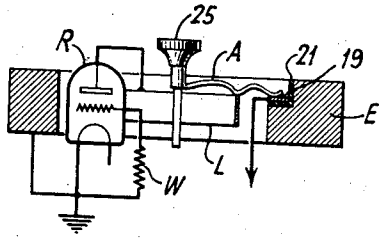
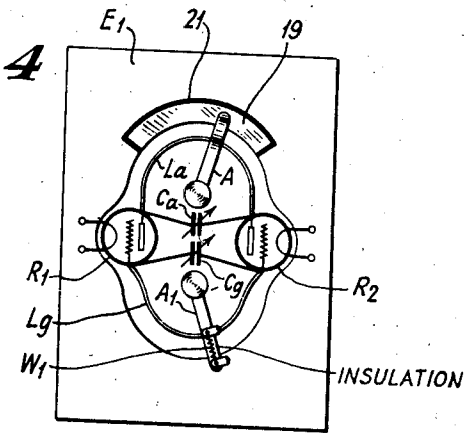


Fig. 4



INVENTOR
HANS ERICH HOLLMANN
BY H. E. Hollmann
ATTORNEY

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ULTRA-SHORT WAVE RADIO SYSTEM

Hans Erich Hollmann, Berlin, Germany

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6 Claims. (Cl. 250—27)

This invention concerns an arrangement for the generation and reception of ultra short waves and has particularly to do with means including a variable feed-back device for avoiding interference from long-wave oscillations.

It is appreciated by those skilled in the art that the circuit arrangements which have proved the most satisfactory for use in ultra-short wave systems are those possessing the greatest simplicity. It is for this reason that the circuit of the triode discharge tube still holds first place either as an ultra-high frequency oscillation generator, or as a detector.

The object of my invention is primarily to provide an ultra-high frequency circuit having means for facilitating the adjustment of the feed-back. Other objects and advantages will become apparent as the invention is further elucidated.

In describing my invention reference will be made to the accompanying drawing in which,

Figure 1 shows diagrammatically the type of circuit to which my invention relates,

Figure 2 shows more in detail the constructional details of one embodiment of my invention,

Figure 3 shows a cross section along the line 3—3 of Fig. 2, and

Figure 4 shows a modification as applied to a push-pull circuit.

Referring to Fig. 1, an electron discharge tube R is provided with the usual cathode 5, anode 7 and control electrode 9. An inductive loop L is connected between the anode 7 and one terminal of a capacitor C. The other terminal of this capacitor is connected to the control electrode 9. A bias resistor W interconnects the control electrode and the cathode.

The anode-to-cathode circuit preferably includes a variable tap A on the inductive loop L, a utilization device 11, and a source of direct current potential 13. The purpose of the variable tap is to adapt the circuit to existing conditions and particularly to control the degree of feed-back. Usually the tap will be set at a point along the oscillatory inductive loop where a high-frequency node occurs, and where, consequently, the circuit may be grounded, if desired, through the blocking condenser 15.

In a receiver, the utilization device 11 may be either a telephone head-set or a transformer feeding to an intermediate frequency amplifier. In an oscillation generator any suitable load may be coupled to the output circuit.

By shifting the position of the tap A, the high-frequency potential components for grid and plate are varied, and the feed-back factor is varied as well. Thus the critical point between a non-oscillating and an oscillating condition can readily be found, and desired adjustments of the circuit can be made accordingly. The variable tap A is conveniently pivoted at the center of the ring-shaped loop L so as to contact therewith throughout a wide arc.

The circuit thus far described is not ideal for ultra high frequency operation since an undesirable inductive reaction takes place between the oscillatory loop and adjacent portions of the anode supply lead, including the movable tap A and the conductive arm on which the tap is mounted. Accordingly, I have found it possible to considerably improve the circuit arrangements by mounting the discharge tube and the oscillatory loop L within an opening or recess cut out from a metallic plate, which may be steel, if desired.

Referring to Fig. 2, the discharge tube A is therein shown within and to one side of an opening 17 in the thick metal plate E. The inductive loop L is mounted concentric with the opening 17. The contact arm A is supported in any suitable manner (not shown) and has its pivot center concentric with the loop L. A contact plate 19 is mounted in a recess in the plate E and is insulated therefrom by an insulator 21. This insulator extends beneath the contact plate 19 and is sufficiently thin to form a suitable dielectric, whereby the contact plate 19 and the portion of the plate E may act as a coupling condenser for grounding the radio frequency currents in the loop L where contact is made therewith by the contact arm A. This contact arm is preferably resilient and engages conductively with the contact plate 19.

By virtue of the constructional features just described it is found possible to maintain an ultra-high frequency potential node on the loop L at or near position of contact with the contact arm A. Furthermore, the feed-back of energy may readily be controlled by moving the arm A to one side or the other of this nodal point. The coupling arrangement between the loop L and the grounding plate E may also be seen to afford a very short path for ultra high frequencies, this being of very great advantage in making suitable adjustments for operating the system on any desired carrier wave in the ultra-short wave spectrum. The output circuit shown in Fig. 1 will be understood to include the contact plate 19 of Figs. 2 and 3. The insulator 21 protects the direct current source 13 from being short-circuited since the positive terminal thereof leads through the utilization device 11 to the contact plate 19 while the negative terminal of the source 13 leads to the cathode 5 which is also grounded at one point through the metal plate E.

The cross sectional view of Fig. 3 when considered with the plan view of Fig. 2 shows further constructional features. For example, the contact arm A may be mounted upon a spindle 23 pivoted in any suitable manner (not shown) and

provided with a manual control knob 25. The grid bias resistor W may be connected between the plate E and that portion of the loop L which interconnects the grid 9 and one terminal of the capacitor C.

Referring to Fig. 4, I show a modification of the invention in which two discharge tubes R_1 and R_2 are provided for push-pull operation. In this case the tubes are inserted in an opening in the plate E_1 in such manner as to accommodate also two inductive loops L_a and L_g. The loop L_a extends between the two anodes while the loop L_g extends between the two grids respectively of the tubes R_1 and R_2.

In this embodiment provision is made for grounding the loop L_a at radio frequency potentials through the contact arm A and the contact plate 19, the same as in Fig. 2. Furthermore, the grid biasing lead through the loop L_g may be connected to the cathodes by means of a contact arm A_1 having the grid bias resistor W_1 mounted thereon for introducing a suitable impedance between the loop L_g and the plate E_1 to which the cathodes are connected at one point.

It will be seen from observation of Fig. 3 that two oscillating circuits L_a C_a and L_g C_g are provided where the capacitor C_a is parallel connected across the loop L_a between the two anodes and where the capacitor C_g is parallel connected across the loop L_g between the two grids. Also in this case provision is made for shifting the grounding points at will according to the adjustment of the contact arms A and A_1.

In the embodiment shown in Fig. 4 as well as that of Fig. 2 the plate supply lead is connected to the contact plate 19 and thus not only the continuous excitation of oscillations can be adjusted at will, but also symmetry of the circuit arrangement can be exactly balanced.

A still further modification of my invention may be made in the one case in reference to the apparatus shown in Fig. 2 and in the other case in respect to the apparatus shown in Fig. 4 if the contact plate 19 and insulator 21 are eliminated and the contact arm A is permitted to establish connection between the loop L (or L_a) and the metal plate E (RE_1). In this case however, the cathode could not be grounded but the entire plate E would be charged at the high plate potential. The necessity for suitably insulating the cathode leads from the plate E introduces practical difficulties which cause the arrangements first described to be preferred.

In the embodiment shown it is assumed that the inductive loops are situated in the plane of the metallic plate E or E_1. The inductive loops may, however, be disposed in front of or in the rear of the metallic plate if so desired but should be maintained essentially in a plane parallel to the plane of the grounding plate E.

I claim:

1. In a radio circuit of the class described, an electron discharge tube having a cathode, an anode and a control grid, an inductive loop and a capacitor constituting a resonant means for intercoupling the anode and control grid, a biasing resistor connected between the cathode and control grid, a source of direct current potential and a utilization device connected between the cathode and anode, a metallic member having an opening therein sufficiently large to accommodate said discharge tube and said inductive loop, a contact plate insulatingly mounted on said metallic member adjacent said opening, a contact arm pivotally mounted at the center of said inductive loop and adapted to slidably contact both with said loop and with said contact plate, said contact arm and said contact plate being in circuit between said anode and said source of direct current potential.

2. Apparatus according to claim 1 and having means including a dielectric element between said metallic member and said contact plate for electrostatically coupling said contact arm to said metallic member at ultra high frequencies.

3. In an ultra short wave system, an electron discharge tube arrangement having a grid-to-cathode input circuit including a bias resistor; a cathode-to-anode circuit including a source of anode potential and a utilization device; shielding means comprising a thick flat metallic plate having an opening therein for accommodating said arrangement, said opening being of circular outline for at least a portion thereof; a capacitor; an inductive loop serially connected from the anode of said discharge tube arrangement through said capacitor to the grid of said discharge tube arrangement and forming a resonant circuit, said loop being concentric with the opening in said shielding means; and feed-back adjusting means in circuit between said utilization device and said loop, the last said means constituting a contact plate and an adjustable contact arm pivoted at the geometric center of said loop and conductively bridging said contact plate and said loop.

4. In an ultra-short wave system, an electron discharge tube arrangement, an orificed thick flat metallic plate surrounding and shielding said arrangement, a contact segment insulatingly mounted in electrostatic association with a recessed portion of said plate, an inductive loop connected to the anode portion of said electron discharge arrangement, and means including a rotatable contact arm for adjustably bridging the inductive loop and the contact segment.

5. A push-pull electron discharge tube arrangement according to claim 4 and having two electron discharge tubes of the triode type, the anodes of said tubes being interconnected by said inductive loop, a second inductive loop disposed within the orifice of said plate and interconnecting the control grids of said tubes, and means including a second rotatable contact arm having a grid leak resistor interconnecting inner and outer contact elements, for providing an adjustable leakage path between the control grids and said metallic plate.

6. In an ultra-high frequency regenerative circuit arrangement, a triode electron discharge tube having an anode, a cathode and a control grid, an inductive loop and a capacitor interconnecting said anode and control grid, a grounded conductive medium shielding and surrounding the zone in which said loop lies, a source of potential for rendering said anode positive with respect to the cathode, said source being connected at a suitable point along the arc of said loop, a rotatable contactor arm through which said potential is applied to said loop, and an arcuately formed plate disposed in a recessed portion of said surrounding conductive medium and in electrostatic association therewith, said plate being in contact with a portion of said rotatable arm.

HANS ERICH HOLLMANN.

CERTIFICATE OF CORRECTION.

Patent No. 2,092,069. September 7, 1937.

HANS ERICH HOLLMANN.

It is hereby certified that the above numbered patent was erroneously issued to the inventor, said "HOLLMANN" whereas said patent should have been issued to Telefunken Gesellschaft für Drahtlose Telegraphie m. b. H., Berlin, Germany, a corporation of Germany, as shown by the record of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 10th day of January, A. D. 1939.

(Seal)

Henry Van Arsdale
Acting Commissioner of Patents.

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