

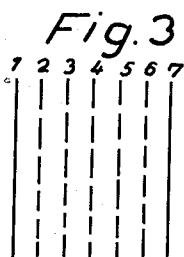
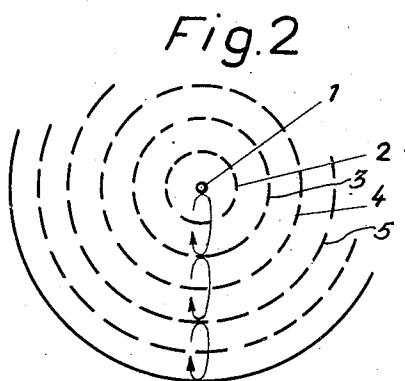
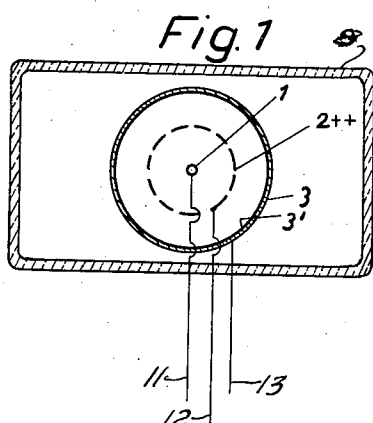
Sept. 14, 1943.

K. KOHL

2,329,540

ULTRA SHORT WAVE TUBE

Filed Nov. 27, 1940



INVENTOR

Karl Kohl

BY *Henry J. Rucke*
HIS ATTORNEY

UNITED STATES PATENT OFFICE

2,329,540

ULTRA SHORT WAVE TUBE

Karl Kohl, Berlin, Germany; vested in the
Alien Property CustodianApplication November 27, 1940, Serial No. 367,423
In Germany October 31, 1939

3 Claims. (Cl. 250—175)

For the transmission or production of ultra short waves, a number of arrangement of connections have been developed of which especially the brake field connections have proved to be suitable for the shortest waves. As is known, the excitation of the oscillations is understood to be effected in such a way that the electrons issued by an emission cathode are attracted with a great force by a highly positive electrode but, owing to their proper velocity attained thereby, they fly past the electrode and on their further way are caused by an electric or magnetic brake field to turn back. The whole process is performed by oscillations and may be influenced by a corresponding control and tuning of systems connected therewith, both according to the amplitude and with respect to the frequency. In spite of all appliances employed, the action of these brake field connections is limited with respect to the effect obtained. This effect will be the smaller, the shorter the generated or transmitted wave is.

The present invention provides means for increasing the output of ultra short wave energy and especially for extending towards ultra short waves the limit of the possibility of generation or excitation.

According to the invention, the cathode or the brake field electrode is capable of emitting secondary electrons at a ratio to primary electrons greater than unity upon impact by such primary electrons. Instead of, or in conjunction with, said electrodes there may be provided additional separate auxiliary electrodes with an emission of secondary electrons. The preferably sensitized brake electrode or auxiliary electrode may be made on its part, due to the emission of secondary electrons, the source of a new oscillation so that there will result a cascade-like series connection of excited oscillation systems. The electrodes may be arranged successively in one direction, as plane electrodes or also in a circularly symmetrical construction as concentric cylinders. The individual electrodes have to be perforated so as to permit the secondary electrons released on one side to pass through to the other side. Of course, the spaces between the electrodes and also the potentials or potential differences applied must be adapted to the durations of a cycle or to the frequencies. The electrodes may also be connected with corresponding resonance systems, or may be constructed as such.

The invention is illustrated by way of constructional examples in the accompanying drawing in which—

Fig. 1 illustrates in central transverse section

and in central longitudinal section a simple embodiment of the invention;

Fig. 2 illustrates in central transverse section and in central longitudinal section another embodiment of the invention, providing a plurality of mutually concentric electron oscillation spaces;

Fig. 3 illustrates in central longitudinal section and in transverse section another embodiment of the invention.

Fig. 1 shows a constructional example in the most simple form. 1 is a cathode capable of emitting electrons, 2 is a perforated grid-like anode to which a high positive potential $++$ is applied, 3 is a brake field electrode. The above referred to cathode, anode, and electrode are enclosed in an evacuated glass vessel 8. Conductors 11, 12 and 13 are sealed in the walls of the evacuated vessel 8 and are connected respectively at their inner ends to the cathode 1, anode 2 and electrode 3, it being understood that such conductors are connected in the usual way when it is desired to connect the same in a proper circuit. The brake field electrode possesses in the usual manner a potential of zero voltage or a small positive or negative potential with respect to the cathode 1. The brake electrode 3 is furnished with a sensitized covering 3', preferably consisting of silver with sprayed on beryllium. In addition, the cathode 1 may be sensitized and, if necessary, also the anode 2, although here the action of the secondary electrons is but small, since, owing to the high potential, the electrons are at once picked up by the electrode itself.

Fig. 2 shows another arrangement in which several electron oscillation spaces are disposed concentrically to one another. The first space is formed by the three electrodes 1, 2, 3, and the second by the electrode system 3, 4, 5. Of course, further systems could follow outside. The electrons oscillate in orbits indicated by the elliptical arrows. In order that the electron oscillations should not develop excessively in the space of the actual cathode 1 with respect to the other spaces, it is advisable to let the electrode potentials of the anodes 2, 4, etc. increase from the centre to the outside, the potentials of the brake electrodes having to be adapted accordingly. In this way, the secondary electrons are prevented from returning in too large numbers to the cathode 1.

Fig. 3 shows a corresponding plane arrangement. The ultra short wave energy may be derived selectively from different electrodes. Thus, for example, the anode 2 may be constructed with an external connecting hoop as a circle of spirals.

Of course, the same applies to the other electrodes.

Instead of sensitizing the actual brake electrode, there may be provided separate auxiliary electrodes in the space between the anode 2 and the brake electrode 3 or else at the side.

The new arrangement is not only adapted for generating oscillations, but in a suitable manner also for amplification, rectification, and modulation. Special means may be provided for stabilizing the oscillations or the releasing of the electrons, in order to prevent the tube from being destroyed. Such means may consist of attenuation members, or also of placing aslope the cathode, which in this respect is particularly sensitive. Furthermore, the shifting of the generation of the oscillations to the outer oscillation spaces, not containing the cathode, acts in a stabilizing manner. Instead of or in conjunction with placing the cathode aslope, there may be employed a magnetic or electric field accordingly inclined with respect to the axis of symmetry.

What is claimed is:

1. An electron tube for ultra-short waves having a heatable cathode adapted for emitting secondary electrons, and a plurality of accelerating

electrodes and brake electrodes adjacent to said cathode and adapted for emitting secondary electrons, the accelerating and brake electrodes being arranged alternately thus forming oscillating spaces, and the electrodes being perforated to allow part of the electrons to pass through.

2. An electron tube for ultra-short waves having a central elongated heatable cathode and a plurality of substantially cylindrical perforated accelerating and brake electrodes of different diameters arranged concentrically and alternately, the cathode and brake electrode being provided with a covering adapted for emitting secondary electrons.

3. An electron tube having a heatable cathode for emitting secondary electrons and a plurality of accelerating and brake electrodes mounted alternately adjacent said cathode in serial relationship with one of said electrodes spaced a predetermined distance from said cathode and the other electrodes spaced progressively farther from said cathode providing a plurality of substantially equal spaces therebetween, whereby alternate ones of said electrodes are effective during operation to act as accelerating and brake electrodes.

KARL KOHL.