A. WASMUS.

MEANS FOR PRODUCING RÖNTGEN RAYS.

APPLICATION FILED MAR. 18, 1912.

1,067,851.

Patented July 22, 1913.

Fig. 1.

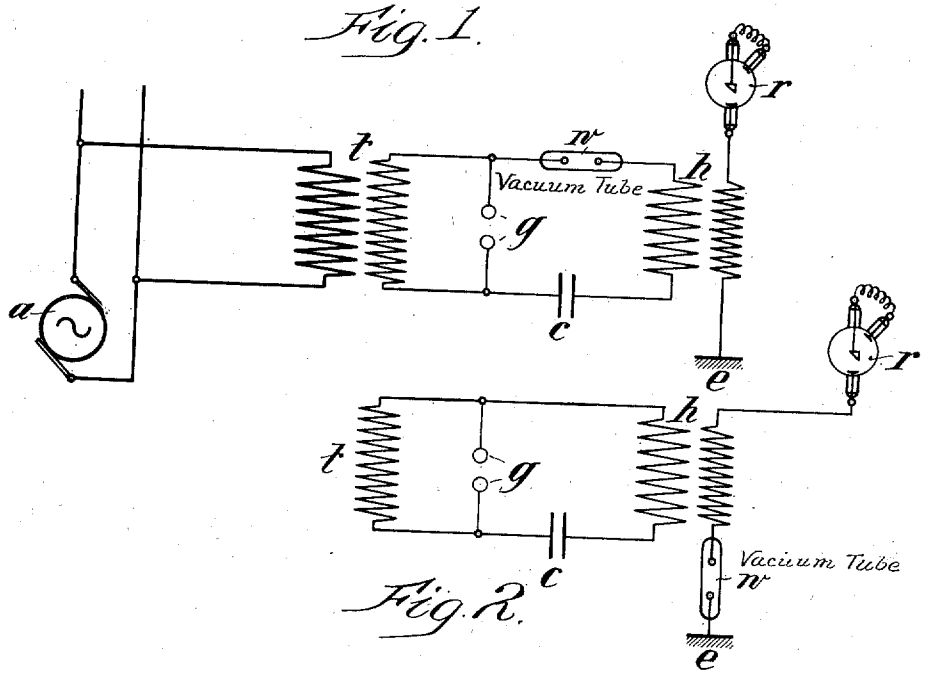


Fig. 2.

Witnesses:
Leo May.
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Inventor:
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By his Attorneys

UNITED STATES PATENT OFFICE.

ADOLF WASMUS, OF HAMBURG, GERMANY, ASSIGNOR TO GESELLSCHAFT FÜR DRAHTLOSE TELEGRAPHIE, M. B. H., OF BERLIN, GERMANY, A CORPORATION OF GERMANY.

MEANS FOR PRODUCING RÖNTGEN RAYS.

1,067,851. Specification of Letters Patent. Patented July 22, 1913.

Application filed March 18, 1912. Serial No. 684,657.

To all whom it may concern:

Be it known that I, ADOLF WASMUS, a subject of the German Emperor, residing at Hamburg, Germany, have invented certain new and useful Improvements in Means for Producing Röntgen Rays, of which the following is a specification.

My invention relates to means for producing Röntgen rays by means of high tension currents of high frequency supplied to the cathode only of the Röntgen tube, and has for its object to provide means whereby a highly unsymmetrical form may be imparted to said currents for the purpose of overcoming certain inherent defects in the production of Röntgen rays by the application of high tension alternating currents of high frequency.

Heretofore, attempts have frequently been made to operate Röntgen tubes with alternating currents of high frequency, the cathode of the tube being connected to the single pole of a Tesla transformer. The results obtained have been unsatisfactory for the reason that both half-waves of the alternating current are symmetrical the valve like action of the Röntgen tubes being under these conditions no longer sufficient for shutting off the wrong half-waves.

As is well known, high frequency currents for working high frequency transformers, may be generated in various ways. Thus an induction coil, or means for producing an interrupted direct current, or an alternating current of any desired periodicity, may be employed with a transformer, the secondary circuit of which is completed through a spark gap which spark gap also completes an oscillatory circuit consisting of the primary circuit of a high frequency transformer. Alternating currents from the secondary winding of the high frequency transformer, have been connected up with the cathode of a Röntgen tube according to the disclosure of my copending application Serial No. 684,651. The present invention contemplates imparting a maximum degree of unsymmetrical form to the curve representing the current supplied to the cathode of the Röntgen tube. For this purpose a quench tube is placed in series with one of the windings of the high frequency transformer. Preferably I use Wien's quench tube, in the oscillatory circuit in the manner exemplified on the accompanying drawings which shows a diagram of the connections for producing Röntgen rays by high tension currents of high frequency and unsymmetrical form supplied to the cathode only of the tube.

In the drawings, Figure 1 is a wiring diagram showing a Wien tube included in the primary oscillation circuit; Fig. 2 is a fragmentary wiring diagram showing a Wien tube included in the secondary oscillation circuit.

Referring to Fig. 1 of the drawing, the current obtained from an alternating current system a traverses the primary winding of a transformer t. The latter increases the tension of the current to several thousand volts and is connected by its secondary winding with the spark gap g. Connected in parallel to the spark gap g is the primary winding of a high frequency transformer h, a condenser c and a quench tube, such for example as Wien's quench tube w being added in series to the circuit. One end of the secondary high tension coil of the Tesla transformer h is connected to the ground e and the other one to the cathode of the Röntgen tube r.

According to the above described arrangement, the secondary side of the transformer constitutes in effect a radiating coil of which the ends are not closed over a capacity, the action being similar to that of an open transformer, in the secondary coils of which oscillations are produced of the same frequency and damping as in the primary circuit, but at correspondingly higher voltage. Owing to the great resistance of the secondary coil and to the consumption of energy in the Röntgen tube, the damping in the secondary circuit is materially higher than in the primary circuit.

The quench tube designated by w on the drawings is constructed substantially similar to that used by Max Wien as described in *Physikalische Zeitschrift* vol. 11, 1910, pages 76 and 937. This tube is air-tight and preferably provided with electrodes in opposite ends thereof, said electrodes being provided with spherical extremities and suitably disposed so that but a small distance exists between said spherical ends. Applicant employs a tube of this description in circuit with the spark gap g within an oscillation circuit, the spark gap g however being in shunt with the cir-

cuit including the condenser c and the secondary winding of the transformer t. The resistance of the quench tube is of course insufficient to prevent the charging of condenser c but such resistance as it has, in addition to the resistance of spark gap g requires a certain minimum potential in the condenser c to produce the necessary disruptive discharge across the spark gap, g, but immediately the fall in potential occasions a rapid quenching effect in the primary oscillation circuit. The momentary impulse thus delivered to the secondary oscillation circuit will be rapidly diffused by the Röntgen tube for the reason that said Röntgen tube does not have the required capacity to sustain a prolonged vibration in the secondary oscillation circuit. As a consequence, not only is a considerable portion of the energy radiated during the rise and fall of each positive wave which readily traverses the Röntgen tube, but the succeeding negative wave resulting from the reduced pressure, is still further choked by the valve action of the tube. As a result, the desirable waves will largely preponderate over the undesirable waves and the undesirable effects referred to in the foregoing part of this specification are reduced to a minimum. In the embodiment shown in Fig. 2, Wien's tube is connected up in the secondary circuit, its effect being to offer but small resistance to the positive waves which are permitted to traverse the Röntgen tube freely. When however its resistance is opposed to the negative wave, such negative wave has been already considerably damped by the valve-like action of the Röntgen tube so that relatively, the resistance of Wien's tube is much greater upon the negative than upon the positive waves and the dampening effects are thus materially increased.

What I claim is:

1. The combination with a Röntgen tube, of a high frequency transformer, the cathode only of said tube being connected to the secondary winding of said transformer, a primary oscillation circuit including the primary winding of said transformer and a spark gap, a quench tube connected in series with one of the windings of said transformer, and means for supplying alternating current to the primary oscillating circuit, the construction and arrangement of the elements of the above combination being adapted to impart an unsymmetrical form to the alternating current traversing the Röntgen tube.

2. The combination with a Röntgen tube, of a high frequency transformer, the cathode only of said tube being connected to the secondary winding of said transformer, a high frequency oscillation circuit to which the primary winding of said transformer is connected, said oscillation circuit being provided with a spark gap, means for supplying alternating current to the primary oscillating circuit, and a quench tube arranged in series with said primary winding of the transformer.

In testimony whereof, I have signed my name to this specification in the presence of two witnesses.

ADOLF WASMUS.

Witnesses:
WERNER RUSCHEWEYLE,
ERNEST H. L. MUMMENHOFF.

Correction in Letters Patent No. 1,067,851.

It is hereby certified that Letters Patent No. 1,067,851, granted July 22, 1913, upon the application of Adolf Wasmus, of Hamburg, Germany, for an improvement in "Means for Producing Röntgen Rays," was erroneously issued to "Gesellschaft für Drahtlose Telegraphie, m. b. H., of Berlin, Germany, a corporation of Germany," whereas said Letters Patent should have been issued to *Siemens & Halske, A. G., of Berlin, Germany, a corporation of Germany;* 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 19th day of August, A. D., 1913.

[SEAL.]

THOMAS EWING,
Commissioner of Patents.

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2. The combination with a Röntgen tube, of a high frequency transformer, the cathode only of said tube being connected to the secondary winding of said transformer, a high frequency oscillation circuit to which the primary winding of said transformer is connected, said oscillation circuit being provided with a spark gap, means for supplying alternating current to the primary oscillating circuit, and a quench tube arranged in series with said primary winding of the transformer.

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