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METHOD OF AND APPARATUS FOR PRODUCING X RAYS

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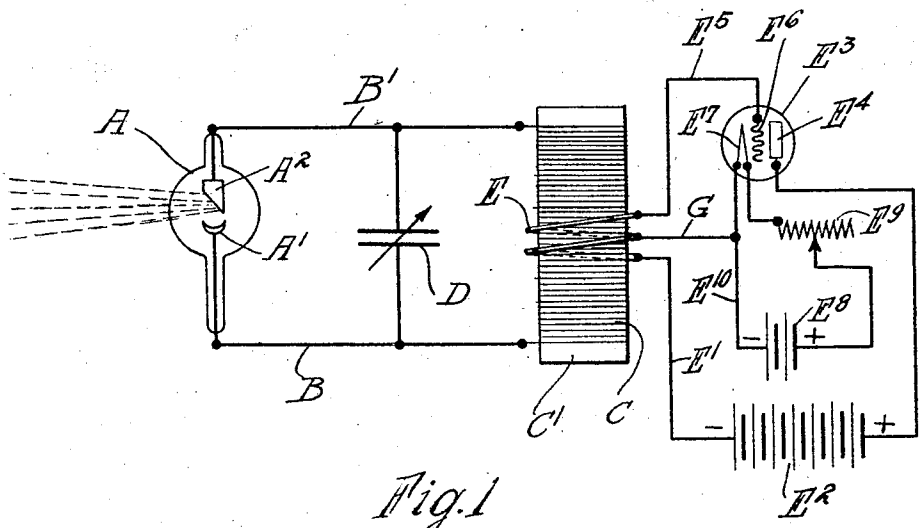


Fig. 1

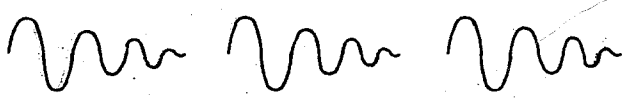


Fig. 2



Fig. 3

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METHOD OF AND APPARATUS FOR PRODUCING X RAYS.

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My invention relates to a process of and an apparatus for producing X-rays. It has for its particular object the production of uniform or undamped rays in which the shorter oscillations are substantially eliminated. Other objects will appear from time to time in the course of the specification and claims.

I illustrate my invention more or less diagrammatically in the accompanying drawings wherein—

Figure 1 is a diagrammatic illustration of my apparatus;

Figure 2 is a diagrammatic illustration of the rays produced by prevailing methods; and

Figure 3 is a diagrammatic illustration of the waves produced by my new method or apparatus.

Like parts are illustrated by like symbols throughout the specification and drawings.

Referring to Figure 1, A is the usual X-ray tube with the cathode A^1 and the anti-cathode or target A^2.

The lines B B^1 extend from the opposite terminals of the tube to the opposite ends of the secondary induction coil C which consists of fine wire wound about the hollow tube C^1. The individual coils are spaced apart and in practice I find that 200 turns of fine wire form a practical coil. D is a variable condenser across the lines B B^1.

Coiled about the coil C is the primary induction coil E which may be formed of from two to four turns of heavy wire. From one end of the primary coil leads the line E^1 through the battery or other power source E^2 to the plate E^4 of the electron tube E^3. The line E^5 leads from the opposite end of the primary coil E to the grid E^6 of the tube. The filament E^7 is in circuit with the battery E^8 and the rheostat or similar variable resistance E^9, by means of the line E^{10}.

G is a connection extending from the line E^{10} of the filament circuit to the primary coil E intermediate its ends.

It will be realized that whereas I have shown a practical and operative circuit which is particularly adapted to carry out my novel process or method, that nevertheless I do not wish to be limited to the specific apparatus or the specific circuit herein shown and that various apparatus or circuits more or less variant from the one illustrated might be employed without departing from the spirit of my invention. The use and operation of my invention are as follows:

One of the problems in X-ray work is the provision of a current of uniform oscillation or wave length. Heretofore has prevailed the use of alternating current stepped up through a transformer, which produced what are generally known as damped oscillations. The nature of these damped waves is diagrammatically illustrated in Figure 2, the wave dying down from a maximum to zero, with a break between the minimum oscillation and the initial oscillation of the succeeding wave. Each such group of diminishing oscillations is practically separated from the succeeding group. It is this nature of the X-rays commonly produced which causes the uneven penetration of the rays, and the burning effects caused by the so-called soft rays, of lower penetration.

It is peculiarly desirable to obtain X-rays without the damping effect of the prevailing waves, in which the so called "soft" rays are eliminated. The ideal is equality and uniformity of oscillation, each oscillation being of the same length and character as the next. I am able by my method to produce such an oscillation and to obtain a far evener penetration than has heretofore been obtained and to eleminate almost entirely the uneven oscillation and the soft rays which cause the burning. The few remaining soft rays are almost entirely due to reflection or "glancing" of rays striking opaque objects.

In my method I employ the usual radio A and B batteries and the usual circuits one of which includes the electron tube filament, the A battery and a variable resistance and the other including the plate, the grid, and the B battery. I insert in the grid plate circuit a primary induction coil of a small number of loops of relatively heavy wire and shunt the coil across to the filament circuit intermediate its ends. Within the heavy primary coil I position a secondary fine wire coil of a larger number of turns, 200 being a fear example. The B battery delivers to the primary coil a current of constant or uniform oscillation which is

stepped up to high frequency and delivered at high frequency to the X-ray tube. The variable condenser permits tuning.

Where I have illustrated as a source of supply for the Tesla coil a battery such as is used in radio circuit, the current of which passes through plate and grid, I might employ other sources of energy.

The current delivered to the X-ray tube by the secondary coil is uniform and the rays projected by the tube are undamped and even. A fair illustrative parallel is the difference between waves sent out by the old wireless circuit transmitters and the present electron tube transmitters.

I claim:

1. In an X-ray projector, and circuit therefor, an electron tube comprising filament, grid and plate, a grid-plate circuit, a primary induction coil in said circuit, a power source in said circuit, a filament circuit, a power source in said filament circuit, a connection between said filament circuit and said coil, intermediate the ends of said coil, a variable resistance in said filament circuit, a high frequency secondary coil within said primary induction coil, an X-ray tube in circuit with said secondary coil, and a variable condenser across said circuit.

2. In an X-ray projector an electron tube, a filament circuit therefor, a grid-plate circuit therefor, a primary induction coil in circuit with said grid-plate circuit a secondary coil associated therewith and an X-ray tube in circuit with said secondary coil.

3. In an X-ray projector, an electron tube comprising filament, grid and plate, a grid-plate circuit, a primary induction coil in said circuit, an electric power source in said circuit, a filament circuit, a secondary coil within said primary induction coil, an X-ray tube in circuit with said secondary coil.

4. In an X-ray projector and circuit therefor, a primary induction coil, a secondary coil, an X-ray tube in circuit with said secondary coil, a tuning means across said X-ray tube circuit, an electron tube in circuit with the primary coil, and a source of electric energy in said circuit.

5. In an X-ray projector and circuit therefor, a primary induction coil, a secondary coil, an X-ray tube in circuit with said secondary coil, a variable condenser across said X-ray tube circuit, an electron tube in circuit with the primary coil, and a source of electric energy in said circuit.

6. In an X-ray projector and circuit therefor, a primary induction coil, a secondary coil, an X-ray tube in circuit with said secondary coil, a tuning means across said X-ray tube circuit, an electron tube in circuit with the primary coil, a source of electric energy interposed in the grid-plate circuit, a filament circuit and a source of energy interposed therein.

7. In an X-ray projector and circuit therefor, a primary induction coil, a secondary coil, an X-ray tube in circuit with said secondary coil, a tuning means across said X-ray tube circuit, an electron tube in circuit with the primary coil, a source of electric energy interposed in the grid-plate circuit, a filament circuit and a source of energy interposed therein, and a shunt connection between the filament circuit and the primary coil.

8. In an X-ray projector and circuit therefor, a primary induction coil, a secondary coil, an X-ray tube in circuit with said secondary coil, means for passing a pulsating current through said primary coil and means for tuning the tube circuit.

9. In an X-ray projector and circuit therefor, a primary induction coil and a secondary coil, an X-ray tube in circuit with said secondary coil, means for passing a pulsating current through said primary coil and tuning means for bringing resonance in the inducing and the induced circuits.

Signed at Chicago, county of Cook and State of Illinois, this 6th day of May, 1925.

DOSSA D. EVINS.