No. 720,888. PATENTED FEB. 17, 1903.

E. W. CALDWELL.

X-RAY APPARATUS.

APPLICATION FILED NOV. 10, 1902.

NO MODEL.

FIG. 1.

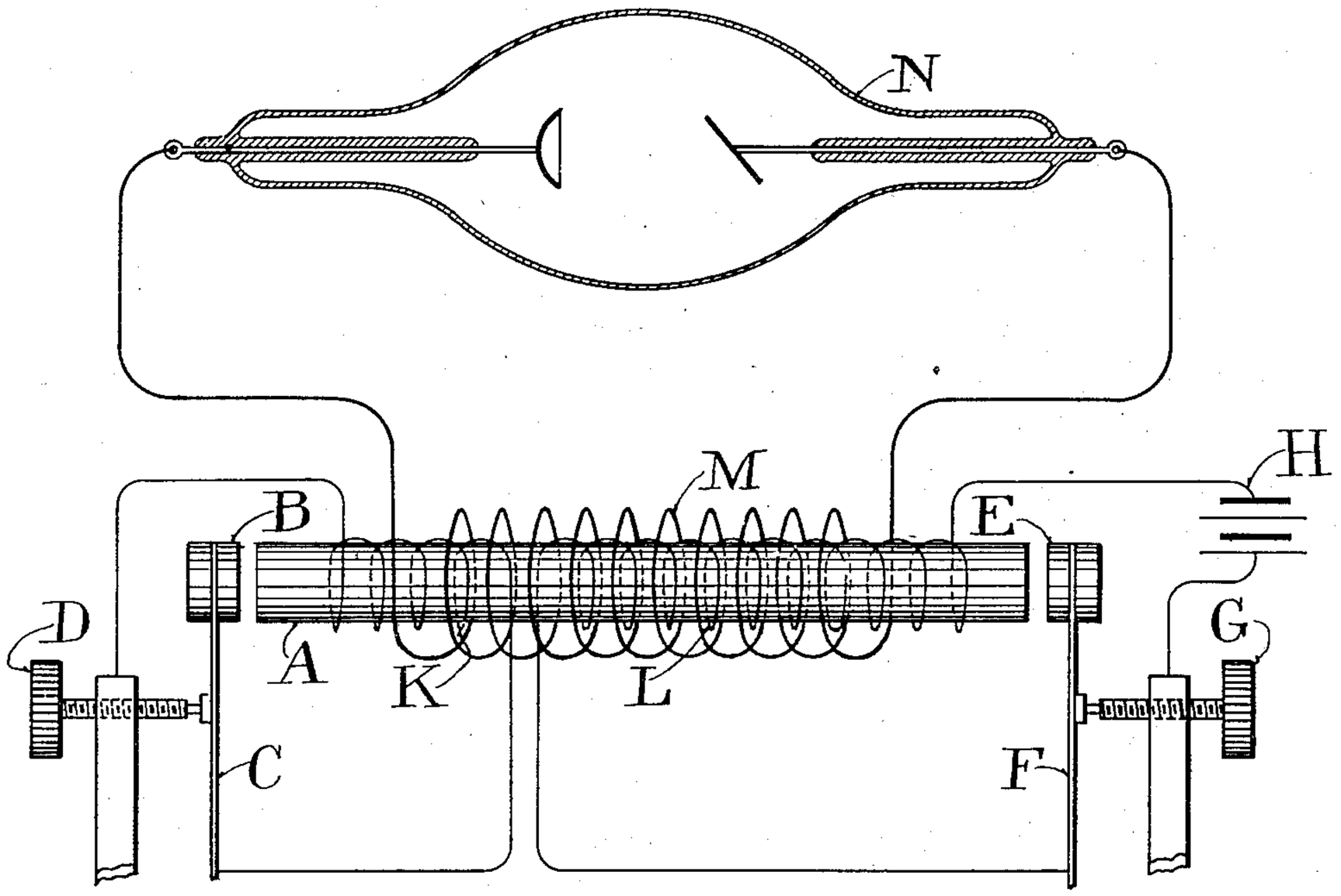
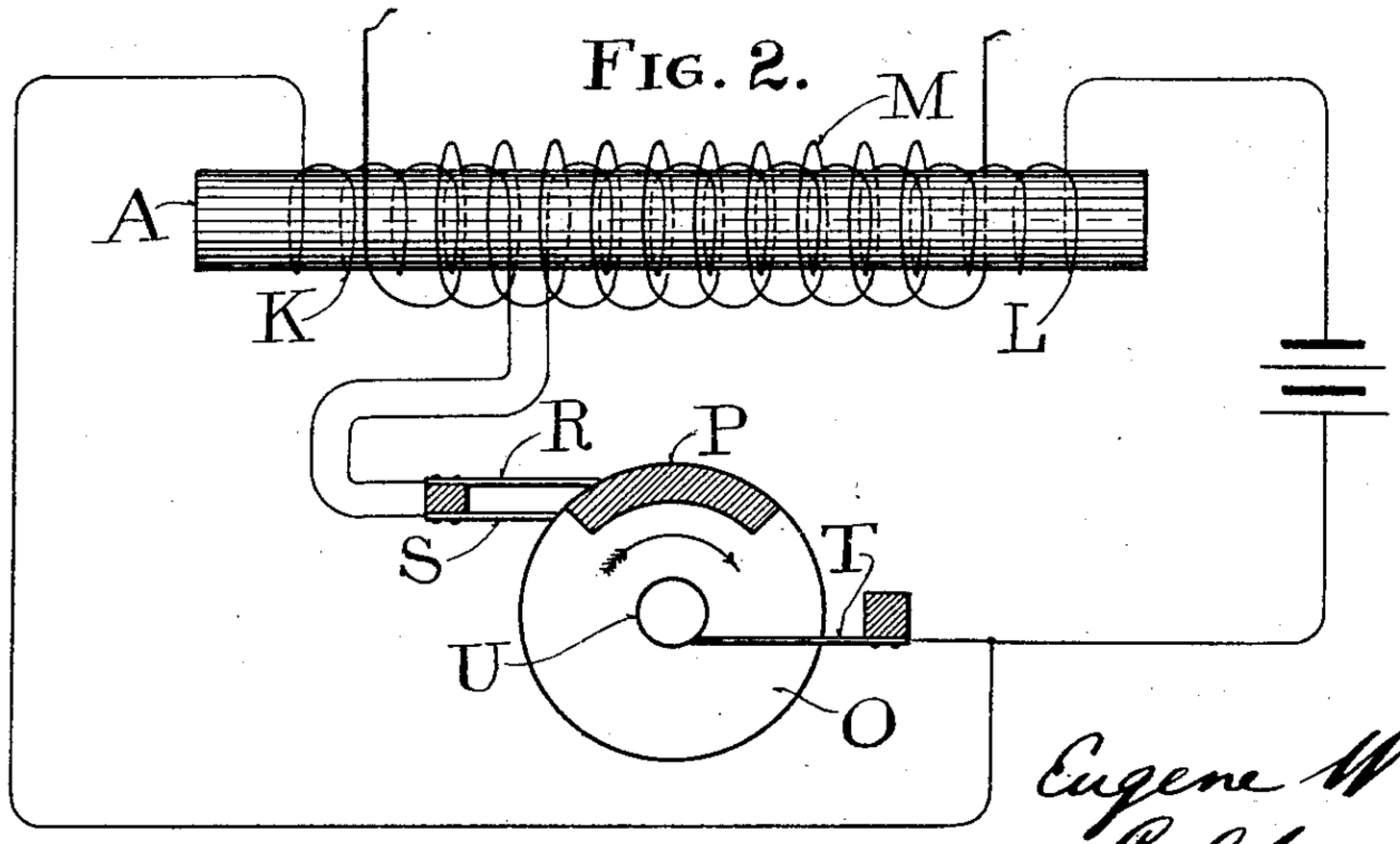


FIG. 2.



Witnesses.

Anne N. Duncan

Abby F. Duncan.

Inventor.

Eugene W Caldwell

By

Duncan & Duncan

Attorneys

UNITED STATES PATENT OFFICE.

EUGENE W. CALDWELL, OF NEW YORK, N. Y.

X-RAY APPARATUS.

SPECIFICATION forming part of Letters Patent No. 720,888, dated February 17, 1903.

Application filed November 10, 1902. Serial No. 130,624. (No model.)

To all whom it may concern:

Be it known that I, EUGENE W. CALDWELL, a citizen of the United States, and a resident of New York city, in the county and State of New York, have invented certain new and useful Improvements in X-Ray Apparatus, of which the following is a specification, taken in connection with the accompanying drawings, which form a part of the same.

This invention relates to X-ray apparatus, and relates more particularly to induction apparatus for use in that connection.

In the accompanying drawings, in which the same reference-letter refers to similar parts in both views, Figure 1 is a diagrammatic view showing this invention. Fig. 2 is a similar view showing a modified construction of interrupter.

In the embodiment of this invention indicated in the drawings the induction apparatus, which of course may have any desired construction, is indicated as having a magnetic circuit in the form of a core or bar A. This magnetic circuit is provided with a primary winding L, which may be disposed upon it in any desired manner, so as to produce the proper variations in the magnetic circuit. This primary winding is indicated as connected with a suitable source of electromotive force H and with the adjustable contact-screw G. This contact-screw coöperates with the break-spring F, upon the upper end of which is mounted the armature E to coöperate with the magnetic circuit of the induction apparatus to be actuated thereby. It will be seen that in the position indicated the primary winding forms a closed circuit, so that current is allowed to flow through it to energize the magnetic circuit of the induction apparatus. This operates upon the armature E and breaks the primary circuit, so as to produce a periodic interruption therein in a well-known manner. The auxiliary winding K is also provided upon the magnetic circuit and is shown as disposed about the core A at one end of the same, although it is understood that it may be arranged in any desired way upon the magnetic circuit. As is indicated in Fig. 1, this auxiliary winding is connected with an adjustable contact-screw D, coöperating with the auxiliary break-spring C and the auxiliary armature B. In the position indicated this auxiliary winding is shown as forming a closed circuit; but it is of course understood that when the magnetic circuit of the apparatus is energized the armature is acted upon so as to periodically interrupt the auxiliary circuit in a well-known manner. The contact-screws D and G are so adjusted and the break-springs and armatures are preferably so proportioned that the auxiliary circuit is broken very slightly before the break occurs in the primary circuit and the auxiliary circuit is closed slightly before the primary circuit is closed, so that the interruptions in the auxiliary circuit occur at a slightly-earlier phase than the interruptions in the primary circuit.

The magnetic circuit of the apparatus is shown as provided with a secondary winding M, which of course may be arranged in any desired way so as to properly coöperate with the core and the other windings, and in Fig. 1 this secondary circuit is shown as including an X-ray tube N of ordinary construction, although it is understood that any other X-ray element may be connected with the secondary winding.

Instead of employing the means just described for interrupting the primary and auxiliary circuits the means illustrated in Fig. 2 may be employed. The primary, auxiliary, and secondary windings are similarly arranged upon the magnetic circuit in that instance, and the primary winding, which, in circuit with a suitable source of electromotive force, is connected with the brush T, which bears upon the axle U of the rotary interrupter O, which is preferably rotated in the direction indicated by the arrow. The periphery of this rotary interrupter is formed with an insulated segment P, and upon this periphery the contact-brushes R and S bear to cause interruptions, as desired, in the primary and auxiliary circuits. The brush R is connected with the primary winding L, and in the position indicated the primary circuit is interrupted. The brush S is connected with one end of the auxiliary circuit K, the other end of this circuit being connected, as indicated, with the brush T. This auxiliary circuit is closed in the position of the interrupter indicated. It will be apparent that as the interrupter rotates the primary and

the auxiliary circuits will be periodically interrupted, and, furthermore, the interruptions in the auxiliary circuit will be out of phase with the interruptions in the primary circuit and slightly in advance of them.

In using this apparatus at the instant that the circuit is completed through the primary winding K current begins to flow through that winding, and the resulting variation in magnetism in the magnetic circuit tends to set up an electromotive force in the secondary circuit and to produce a make-spark in that secondary circuit, which is very undesirable. The auxiliary circuit is closed preferably slightly before the primary circuit is completed to allow current to flow therein, and therefore it will be apparent that the variation in magnetism in the magnetic circuit will cause a considerable current to flow through this closed auxiliary circuit. This current acting in a well-known manner retards the increase of magnetism in the magnetic circuit and in this way reduces the electromotive force set up in the secondary winding, so as to materially reduce and practically obliterate the make-spark in the secondary. The number of turns and the resistance of the auxiliary winding may be so proportioned that the make-spark will be properly reduced without wasting too much energy in the auxiliary circuit, and for this purpose to further limit the energy consumed in the auxiliary circuit this circuit may be broken very shortly after the primary circuit is completed, and the apparatus can readily be so adjusted as to produce this result. In all cases, however, the auxiliary circuit should be interrupted before the primary circuit is broken. Since the interruptions in the auxiliary circuit occur slightly before those of the primary, and therefore since this circuit is open when the primary circuit is broken, the decrease of magnetism in the magnetic circuit takes place just as if there were no auxiliary winding, and the same electromotive force is generated at this instant in the secondary, and the break-spark is unimpaired in intensity.

It is of course understood that apparatus embodying the principles of this invention may be constructed in many forms, and, furthermore, variations may be made in the exact means for effecting the various results, as previously described. Parts of this apparatus may be used in connection with other devices and parts may be omitted without departing from the spirit of this invention. I do not, therefore, wish to be limited to the disclosure which is made in this case; but

What I claim as new, and what I desire to secure by Letters Patent, is set forth in the appended claims:

1. In X-ray apparatus, a magnetic circuit, a primary winding disposed upon said magnetic circuit, connected with a source of electromotive force, a break-spring operated by an armature coöperating with said magnetic circuit and an adjustable contact-screw, an auxiliary winding disposed upon said magnetic circuit connected with a contact-spring operated by an armature coöperating with said magnetic circuit and an adjustable contact-screw, a secondary winding disposed upon said magnetic circuit and an X-ray tube in series with said secondary winding, the circuit through said auxiliary winding being closed before the circuit through said primary winding is closed and the circuit through said auxiliary winding being open when the circuit through said primary winding is interrupted.

2. In X-ray apparatus, a magnetic circuit, a primary winding disposed upon said magnetic circuit connected with a source of interrupted current, a secondary winding disposed upon said magnetic circuit having an X-ray element connected therewith and an auxiliary winding disposed upon said magnetic circuit connected with means to interrupt the circuit through said auxiliary winding periodically and in slightly-advanced phase from the interruptions in said primary winding.

3. In X-ray apparatus, a magnetic circuit, a primary winding disposed upon said magnetic circuit and having a source of electromotive force and a primary break in series therewith, an auxiliary winding disposed upon said magnetic circuit and having an auxiliary break in series therewith, said auxiliary break operating in slightly-advanced phase from said primary break and a secondary winding disposed upon said magnetic circuit having an X-ray element connected therewith.

4. In induction apparatus, a magnetic circuit, a primary winding connected with a primary break disposed upon said magnetic circuit, a secondary winding disposed upon said magnetic circuit and an auxiliary winding connected with an auxiliary break operating out of phase with said primary break disposed upon said magnetic circuit.

5. In induction apparatus, a magnetic circuit, a primary winding disposed upon said magnetic circuit and connected with a primary break operated by said magnetic circuit, a secondary winding disposed upon said maguetic circuit and an auxiliary winding disposed upon said magnetic circuit connected with an auxiliary break operated by said magnetic circuit in different phase from said primary circuit.

EUGENE W. CALDWELL.

Witnesses:
HARRY L. DUNCAN,
JESSIE B. KAY.