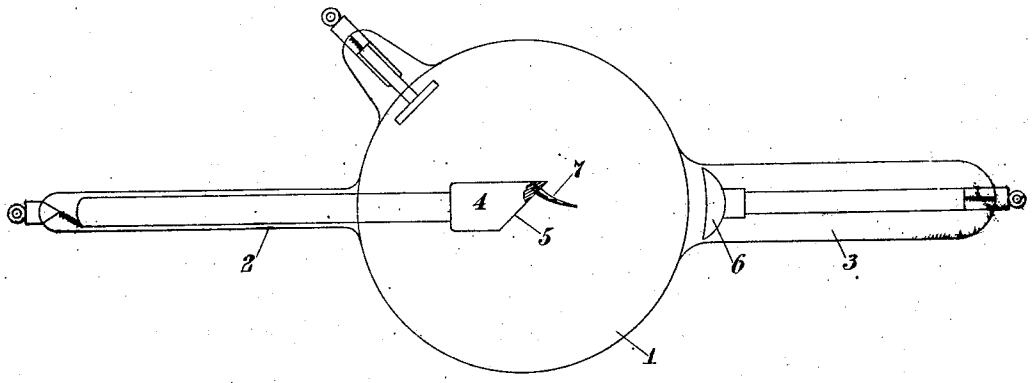
R. H. WAPPLER.

X-RAY TUBE.

APPLICATION FILED DEC. 13, 1912.

1,152,578. Patented Sept. 7, 1915.



Witnesses:
Harry C. Reeves

Inventor
Reinhold H. Wappler
By his Attorney
Henry D. Williams

UNITED STATES PATENT OFFICE.

REINHOLD H. WAPPLER, OF NEW YORK, N. Y., ASSIGNOR TO WAPPLER ELECTRIC MANUFACTURING COMPANY, INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

X-RAY TUBE.

1,152,578. Specification of Letters Patent. Patented Sept. 7, 1915.

Application filed December 13, 1912. Serial No. 736,651.

To all whom it may concern:

Be it known that I, REINHOLD H. WAPPLER, a citizen of the United States, residing at the borough of Manhattan, city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in X-Ray Tubes, of which the following is a specification, reference being had therein to the accompanying drawings, forming part thereof.

My invention relates to X-ray or Röntgen ray tubes. Such tubes are commonly provided with electrode stems of reduced diameter integral with the bulb, and the cathode or negative electrode is commonly disposed within the cathode stem at or near its mouth. As a consequence of the strength of the current commonly used in operating X-ray tubes, and of the proximity of the surrounding glass walls of the mouth of the stem to the cathode, these walls become heated in the X-ray tubes in general use by the current in its passage from the anode to the cathode, and frequent breakages occur at the juncture of the cathode stem with the bulb due to the weakening at this point resulting from the excessive temperature.

An object of my invention is to obviate this difficulty and eliminate the heating of the walls about the cathode.

A more particular object is to so direct the current as to prevent it from passing in heating proximity to these walls.

Another object is to reduce to a minimum the deleterious inverse currents which impair the efficiency of the tube.

Another object is to confine the anode stream or the stream passing from the anode to the cathode and thus confine the cathode stream with a resultant confining of the X-rays within the desired area of operation.

Other objects are simplicity and inexpensiveness of construction, and reliability of operation.

Still other objects and advantages of my invention will appear from the following description.

In carrying out my invention, I provide current-directing means on the reflecting surface of the anode or target, which is arranged to direct the current within a defined area of the cathode. More specifically the current-directing means consists in a pointed conductor arranged to direct the current at substantially the center of the cathode. Still more specifically the pointed conductor is bent or curved and arranged with its base out of the range of the cathode stream and with its pointed end in the line of the stream and directed at the center of the cathode.

My invention also includes other features of construction and arrangements of parts, as will hereinafter more fully appear.

I shall now describe the embodiment of my invention illustrated in the accompanying drawing, and shall thereafter point out my invention in claims.

In the drawing I have shown a side elevation, partly in section, of an X-ray tube embodying my invention.

The tube, which is composed of glass, is of the familiar shape, having a substantially spherical bulb 1, and projecting from opposite sides thereof an anode stem 2 and a cathode stem 3 in axial alinement. The anode 4, which is composed of copper or other suitable conductive material, is provided with a plane reflecting surface or target 5, preferably of tungsten, arranged opposite the cathode 6 and at an angle of substantially 45° to the axial line of the electrodes, as is usual. The cathode 6 is concave, of the well known construction, and arranged to focus the cathode stream upon the reflecting face or target 5, being disposed substantially at the mouth of the cathode stem 3.

To direct the current from the anode 4 to the center of the cathode 6, and thereby prevent it from passing in heating proximity to the walls about the neck of the stem 3, I employ a current-directing member projecting from the reflecting face of the anode 4. In its illustrated form, this member is a removable curved pointed conductor 7, of copper or other suitable metal, provided with a screw-threaded attaching end of reduced diameter which engages in a screw-threaded hole in the reflecting face of the anode on its upper side out of the focal range of the cathode 6. This pointed conductor is curved to bring its pointed or discharge end into the focal line of the cathode and directed at the center of the cathode, thereby preventing the dissemination of the current about a large area of the cathode and the heating of the walls in proximity thereto. This directing of the current from the anode within a defined area of the cathode

has another important advantage, in that it confines the resultant cathode stream to a well defined, small, round stream, and thereby confines the X-rays to the field of operation and eliminates the stray rays which frequently injure the operator. Also the disadvantages resulting from unevennesses or irregularities on the concave surface of the cathode are thereby obviated or minimized. Inasmuch as the base of the pointed conductor 7 is without the focal range of the cathode 6, it does not interfere with the reflection of the X-rays from the target. Furthermore the reduction in the resistance to the passage of current from the anode to the cathode, which results from the use of the pointed conductor 7, serves to decrease the inverse currents characteristic of X-ray tubes, and to thereby greatly enhance the efficiency of the tube.

It is obvious that various modifications may be made in the construction shown and above particularly described within the principle and scope of my invention.

I claim:

1. In an X-ray tube, a cathode, an anode having a plane reflecting surface, and current-directing means on the reflecting surface arranged to direct the current within a defined area of the cathode.

2. In an X-ray tube, a cathode, and an anode having a plane reflecting surface and having a pointed conductor extending from such surface and directed at the cathode.

3. In an X-ray tube, an anode having a plane reflecting surface, a cathode arranged to focus the cathode rays upon the reflecting surface of the anode, and a pointed conductor extending from the reflecting surface of the anode and arranged to direct the current at substantially the center of the cathode.

4. In an X-ray tube, an anode having a plane reflecting surface, a cathode arranged to focus the cathode rays upon the reflecting surface of the anode, and a pointed conductor extending from the reflecting surface of the anode with its base outside of the cathode stream upon the reflecting surface and arranged to direct the current at substantially the center of the cathode.

5. In an X-ray tube, an anode having a plane reflecting surface arranged at an angle to the axis of the anode, a cathode arranged to focus the cathode rays upon the reflecting surface of the anode, and a pointed conductor extending from the upper portion of the reflecting surface of the anode outside of the range of the cathode stream and bent to bring its pointed end in the line of the cathode stream and directed at substantially the center of the cathode.

6. In an X-ray tube, an anode having a plane reflecting surface, a cathode arranged to focus the cathode rays upon the reflecting surface of the anode, and a removable pointed conductor extending from the reflecting surface of the anode and arranged to direct the current at the cathode.

In testimony whereof I have affixed my signature in presence of two witnesses.

REINHOLD H. WAPPLER.

Witnesses:
ROBERT A. MACHLET,
HUGO F. WOLFF.