OR 729,166

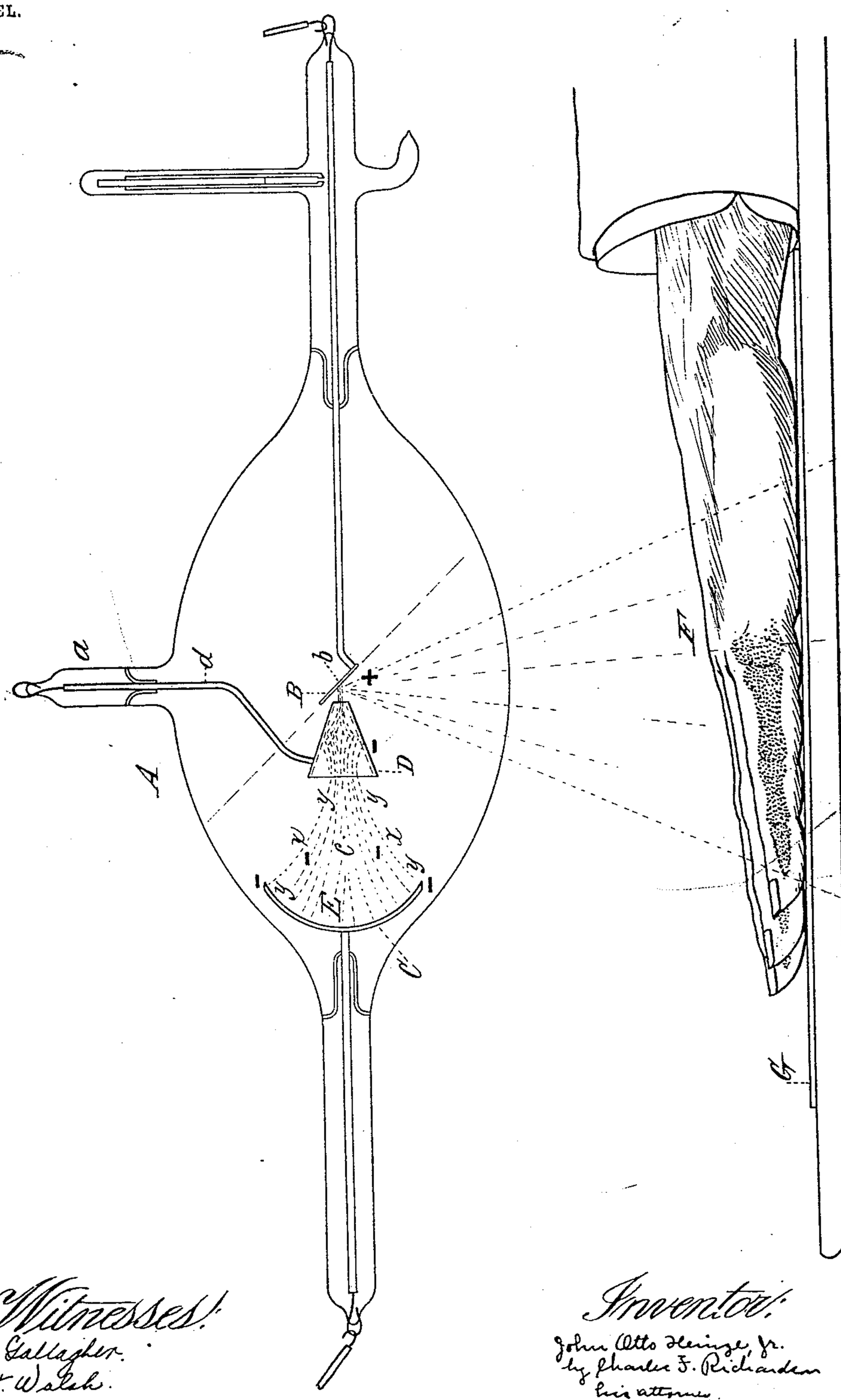
No. 729,166. PATENTED MAY 26, 1903.

J. O. HEINZE, JR.

X-RAY TUBE.

APPLICATION FILED MAR. 19, 1903.

NO MODEL.



Witnesses:
S. O. Gallagher.
F. H. Walsh.

Inventor:
John Otto Heinze, Jr.
by Charles F. Richardson
his attorney

No. 729,166. Patented May 26, 1903.

UNITED STATES PATENT OFFICE.

JOHN OTTO HEINZE, JR., OF CHELSEA, MASSACHUSETTS.

X-RAY TUBE.

SPECIFICATION forming part of Letters Patent No. 729,166, dated May 26, 1903.

Application filed March 19, 1903. Serial No. 148,544. (No model.)

To all whom it may concern:

Be it known that I, JOHN OTTO HEINZE, Jr., a citizen of the United States, residing at Chelsea, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in X-Ray Tubes, of which the following is a specification.

My invention relates to X-ray photography generally, but to X-ray or Crooke's tubes particularly; and its principal object is to provide means whereby the area of bombardment resulting from the play of the cathode-stream on an anode of an X-ray tube is fixed both as to size and position on said anode, the details of the radiograph not being blurred, but sharp and clear, when said area of bombardment occupies a fixed position upon said anode and has the smallest possible diameter.

The drawing shows my invention embodied in an X-ray tube.

When an electric current begins to pass from the anode to the cathode of an X-ray tube, particles of gas in contact with the negative concave cathode become charged with negative electricity, and hence are repelled from said cathode in straight lines at right angles thereto and form said cathode-stream, which tends to approach the focal center of said cathode and becomes concentrated; but as these particles are negative and repel each other each particle is deflected from what would otherwise be a straight course to said focal center and moves in a resulting curve ending at the anode. During the use of said tube the number of particles of gas in the tube that enter into circulation to form the cathode-stream varies and depends upon the relative individual charges of the particles or the amount of electric current sent through the tube, and thus determines the volume and diameter of the cathode-stream. These variations in the cathode-stream cause the variations in the size and position of the area of bombardment on the anode. It is these changes in said area of bombardment that affect the clearness of definition of the body radiographed on a photographic plate, said body and said plate being in fixed positions relatively to the anode.

Now it is the object of my invention to provide means whereby I can so control said cathode-stream that it has an area of bombardment of the smallest possible diameter and having a fixed position on said anode.

In the drawing illustrating the principle of my invention and the best known way now known to me of embodying said principle, A is an X-ray tube; B, its anode; C, its cathode; *c*, the focal center of said cathode, and D a funnel, preferably of metal, such as platinum.

E is a cathode-stream, while *x x* are any two particles of gas in said stream moving in paths *y y* from the cathode to the anode.

The funnel D lies between the cathode C and anode B and is insulated therefrom. It is held in position by a support *d*, mounted in a glass supporting-arm *a*, blown into the tube. The longitudinal axis of said funnel coincides with the axis of the cathode and anode. The inlet-orifice of said funnel is adjacent to the cathode and is of sufficient size to allow the whole of the cathode-stream E to flow into it freely, and its small discharge-orifice is in close proximity to the anode B.

F, the object to be radiographed, is shown as a hand resting upon a photographic negative G.

The operation is as follows: An electric current is caused in the well-known manner to pass from the positive anode B to the cathode C, which immediately becomes negative. The gas particles, as *x x*, in contact with the cathode become negative and are driven toward the focal center *c;* but as they are negative they repel each other, and hence their resultant directions are in curved paths *y y*, leading toward the anode B. These particles, with all that join to form the cathode-stream E, enter the large orifice of the funnel D. The latter being metal, it becomes negatively charged by the bombardment of its walls by some of the moving negative particles and remains so charged during the flow of the cathode-stream.

As the funnel is negatively charged, it tends to drive away from it the negative particles, and with its converging interior surface thus concentrates said cathode-stream more and more, so that when the latter leaves the outlet-orifice and strikes the positive anode at *b* it is of very small diameter. The area of bombardment *b* is therefore very small, and [illegible] funnel D and the anode B are in fixed

positions the area of bombardment is fixed. The area of bombardment being small and constant, and said area, the object F to be radiographed, and the photographic negative G all being in positions fixed relatively to each other, the details of the object F will be sharply defined upon the negative F, and all the objections arising from an area of bombardment that varies either in diameter or in its position upon the anode, or in both, will be obviated and the objects of the invention obtained.

The funnel D may be made of metal. I prefer platinum, however, for the reason that it is hard and is less affected by the bombardment by some of the particles of the cathode-stream, which bombardment raises the temperature of the funnel to a very high degree. Glass cannot be used, for not being charged electrically the particles freely beat against its walls and soon fuse it.

Having described my invention, and desiring to claim the same in the broadest manner legally possible, what I claim is—

1. In an X-ray tube, an anode; a cathode; and a metal, funnel-shaped means, insulated from, and located between, said anode and said cathode, to concentrate the cathode-stream so as to form a small fixed area of bombardment on said anode.

2. In an X-ray tube, an anode; a cathode; and a metal funnel, insulated from, and located between, said anode and said cathode, whereby the cathode-stream may, by passing through said funnel, become concentrated and be delivered to said anode, at a particular area thereof.

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

JOHN OTTO HEINZE, JR.

Witnesses:
JOSEPH GODSOE,
L. S. RUSSELL.