No. 743,718

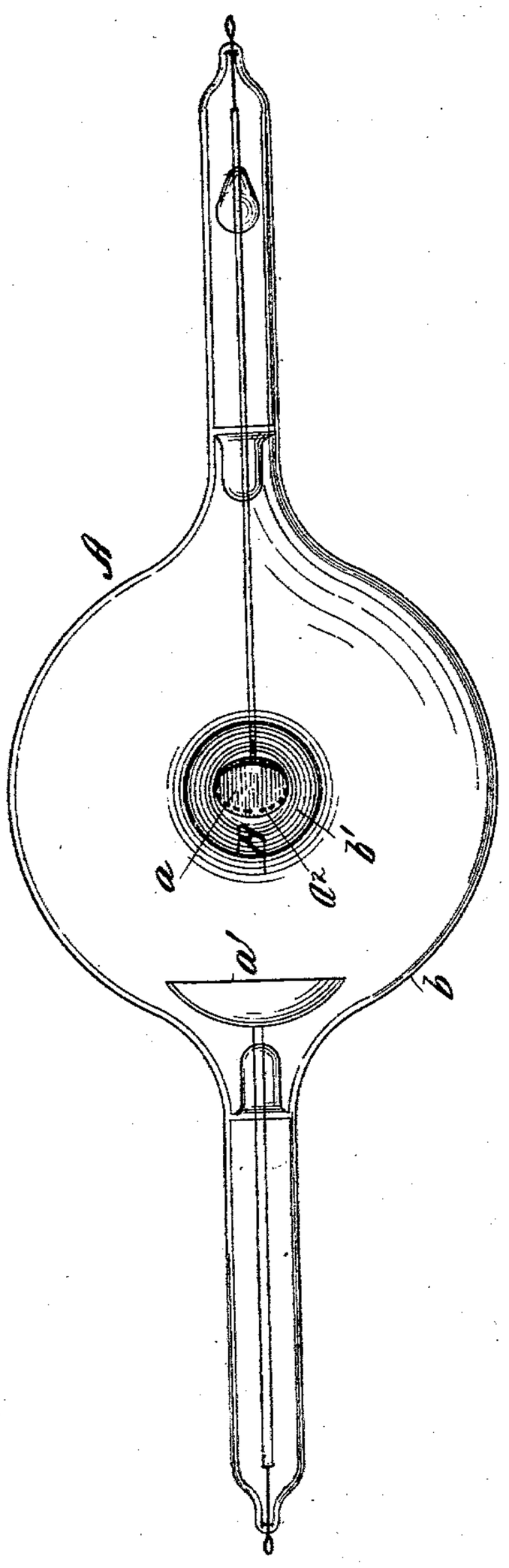
PATENTED NOV. 10, 1903.

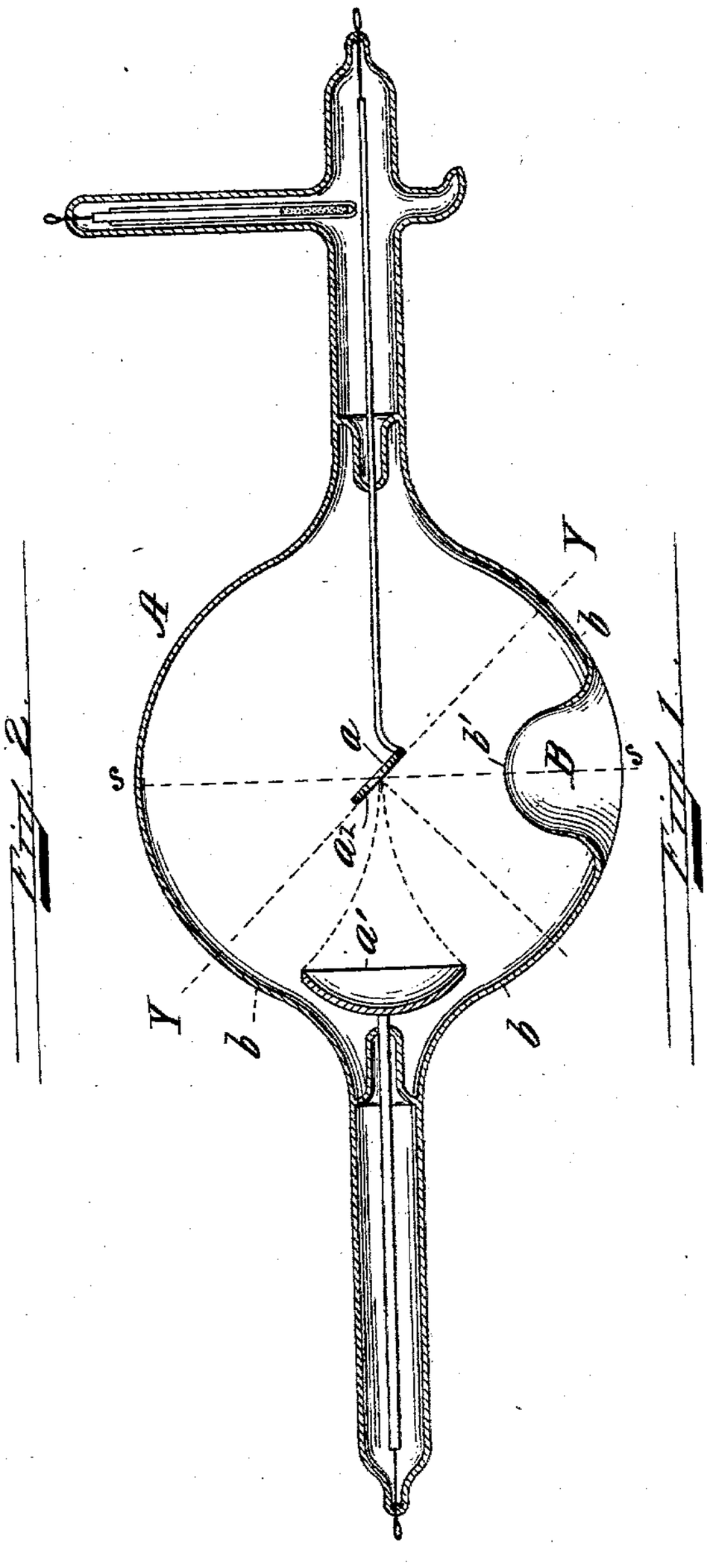
J. O. HEINZE, JR.

X-RAY TUBE.

APPLICATION FILED JULY 9, 1903.

NO MODEL.





Witnesses:
J. O. Gallagher.
Arthur J. Selfridge.

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

No. 743,718. Patented November 10, 1903.

UNITED STATES PATENT OFFICE.

JOHN O. HEINZE, JR., OF LOWELL, MASSACHUSETTS.

X-RAY TUBE.

SPECIFICATION forming part of Letters Patent No. 743,718, dated November 10, 1903.

Application filed July 9, 1903. Serial No. 164,775. (No model.)

To all whom it may concern:

Be it known that I, JOHN OTTO HEINZE, Jr., a citizen of the United States of America, residing at Lowell, in the county of Middlesex 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 tubes; and the general object of my invention is to provide an X-ray tube strong in construction and efficient in operation.

The glass bulb of an X-ray tube must have a large instead of a small diameter in order that said bulb may have therein a stable working vacuum; but the thickness of the walls of such bulb to withstand the atmospheric pressure is so great that most of the energy of the rays is lost in their passage through said walls by absorption. Further, as the energy of X-rays at any distance from the anode varies inversely as the square of that distance the smaller the diameter of the bulb the greater the ease with which the rays pass through the walls of said bulb, and hence the greater the resulting intensity of the rays radiated. Still further, as the radiating-surface of said bulb is that of a hemisphere in front of the face of the anode the rays, unless controlled, radiate in many directions. In short, the bulb of an X-ray tube should be strong in construction, of large diameter, be thin, and have a small radiating-surface.

Now the particular object of my invention is to provide an X-ray tube that fulfils these requirements, and I accomplish this object by the use of what constitutes the novel feature of my invention—namely, a reëntering portion of the radiating-wall of the bulb.

In the drawings illustrating the principle of my invention and the best mode now known to me of embodying that principle, Figure 1 is a longitudinal vertical section, and Fig. 2 is an elevation at right angles to said section.

The X-ray tube A has an anode a, a cathode a', and other elements well known and usually found in an X-ray tube. B is a reentering portion of the radiating hemispherical wall b of the bulb of said tube, lying in front of the face a^2 of the anode a and cut off by the plane Y Y containing said face. Said reëntering portion B is formed by heating the desired portion of said walls constituting said radiating-surface b, said portion then being "drawn" or "sucked" in by the glass-blower. When so drawn, it becomes dome-shaped, its thickness diminishing from that of the bulb to one of extreme thinness in the portion b' near said anode and across the X-ray paths.

In practice I have made the diameter of the bulb from eleven to twelve inches, the thickness of the main walls one-eighth of an inch, and the thickness of the exposed dome portion b' less than one one-hundredth of an inch. For convenience the axis s s of the dome B is at right angles to that of the anode-stem; but it may be at any other angle, provided said dome lies in the anode's field of bombardment Y b b Y. While the shape of said dome B is easily "blown" and results in the strongest non-collapsible construction, yet I do not wish to limit said reëntering portion B to that shape, for any shape whereby a small portion of the main radiating-walls, thick or thin, can be brought closer than the main walls of the bulb to the anode will embody my invention.

The operation of my invention is as follows: When a current of electricity passes from the anode a to the cathode a', X-rays are generated at the anode a in the well-known manner and radiate in all directions, impinging the hemispherical walls of the bulb b b b in front of the face a^2 of the anode a. The walls b b b being thick and at a considerable distance from the anode a, most of the X-rays are absorbed, said hemispherical-wall portions forming practically a shield against the outward passage of said rays; but these rays, striking the top portion b' of the dome B and having at that distance from the anode, say, four times the energy they would have at twice that distance—say at the main walls of the bulb—readily pass through the top b' of the dome B and have increased intensity—that is, their original intensity is but slightly reduced. This would be true if the dome were even of the same thickness as the main walls of the bulb. Now if in addition to the nearness of the top b' of the dome B to the anode a said top portion is reduced in thickness, so that it is very thin, plainly very little en-

ergy is absorbed in the passage of said rays through said dome and the resulting intensity of the X-rays is still further increased. In fine, by means of my invention I have an X-ray tube in which there is a stable working vacuum and with which there is radiated from a limited area X-rays having greatly increased intensity.

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 bulb, having a reëntering portion of its wall, projecting into the field of bombardment of the anode.

2. In an X-ray tube, an anode; a cathode; a bulb, having a reëntering portion of its radiating-walls, projecting into the field of bombardment; said reëntering portion having that portion near the anode thinner in thickness than the thickness of the radiating-walls of said bulb.

3. In an X-ray tube, an anode; a cathode; and a bulb, having a dome-shaped reëntering portion of its radiating-walls, projecting into the field of bombardment of the anode.

4. In an X-ray tube, an anode; a cathode; and a bulb, having a dome-shaped reëntering portion of its radiating-walls, projecting into the field of bombardment of the anode, and having the thickness of the portion of said dome near the anode, thinner than that of the radiating-walls.

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

JOHN O. HEINZE, JR.

Witnesses:
ALICE MURRAY,
ANNA E. WISE.