J. A. MANNHEIM.

COOLING DEVICE FOR RÖNTGEN TUBES.

APPLICATION FILED DEC. 12, 1911.

1,095,121.

Patented Apr. 28, 1914.

2 SHEETS—SHEET 1.

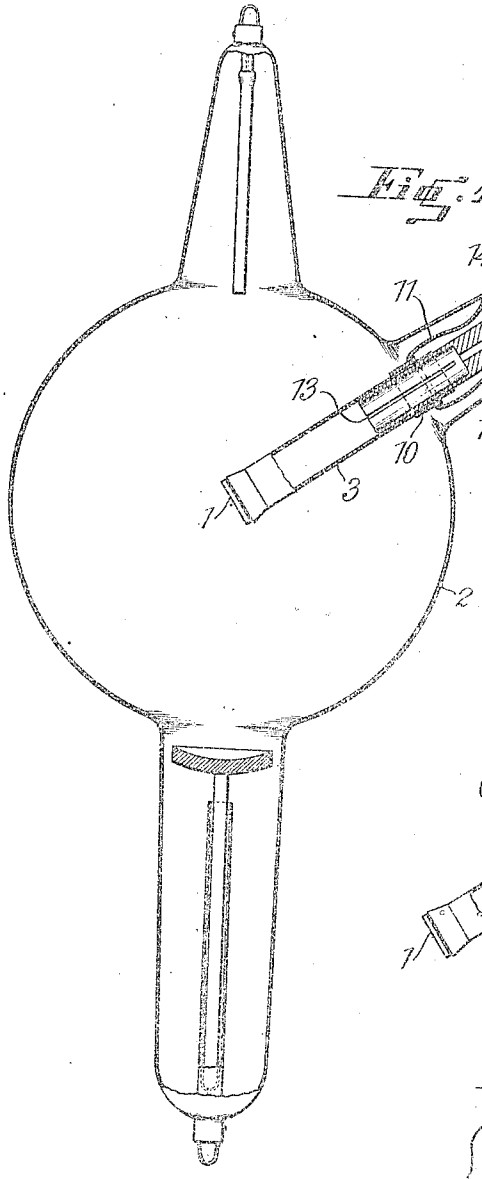


Fig. 1.

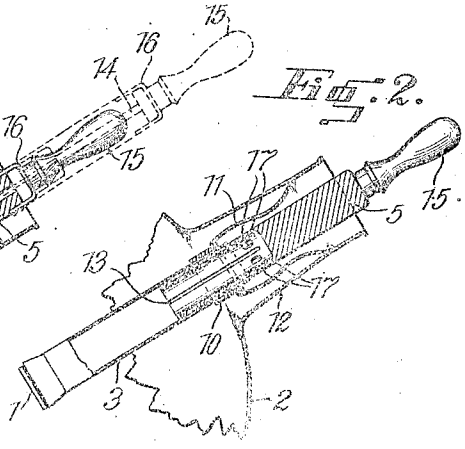


Fig. 2.

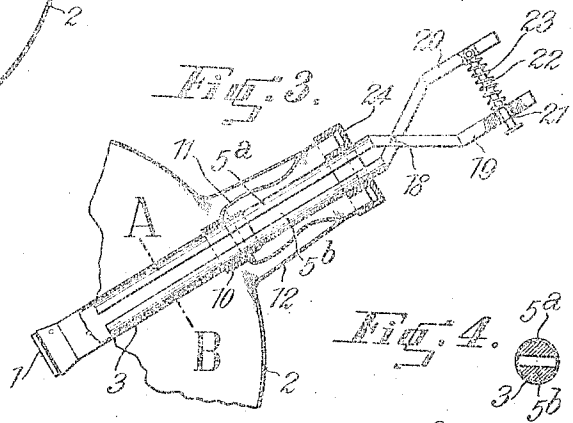


Fig. 3.

Fig. 4.

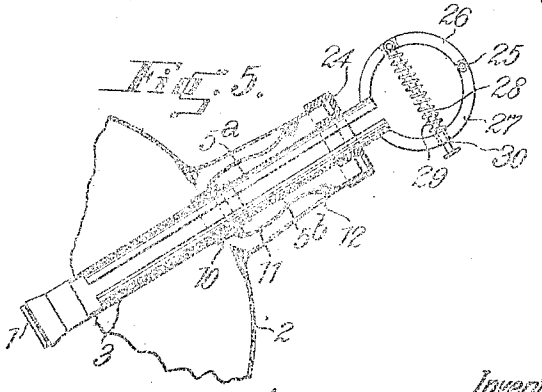


Fig. 5.

Witnesses:

Aprinetta C. Finkiels

Clarke Wyatt.

Inventor

John Alfred Mannheim

by John Lorie

Attorney

J. A. MANNHEIM.

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2 SHEETS—SHEET 2.

Fig. 6.

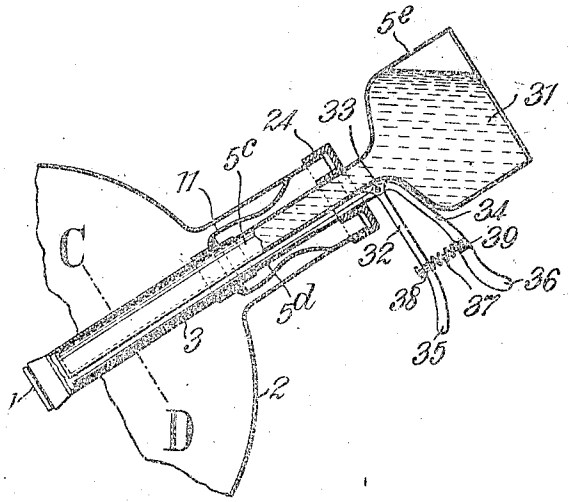
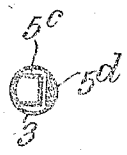


Fig. 7.



Witnesses:

Harriette E. Fitchich

Chas. E. Mattke

Inventor

John Alfred Mannheim

by John Lowe

Attorney

UNITED STATES PATENT OFFICE.

JOHN ALFRED MANNHEIM, OF HAMBURG, GERMANY.

COOLING DEVICE FOR RÖNTGEN TUBES.

1,095,121. Specification of Letters Patent. Patented Apr. 28, 1914.

Application filed December 12, 1911. Serial No. 665,350.

To all whom it may concern:

Be it known that I, JOHN ALFRED MANNHEIM, a subject of the German Emperor, and resident of Hamburg, Germany, have invented certain new and useful Improvements in Cooling Devices for Röntgen Tubes, of which the following is a specification.

My invention relates to Röntgen tubes and particularly to cooling devices therefor. Röntgen tubes with cooling devices are not new broadly.

The purpose of my present invention is to provide a device of this character in which air will be used as the cooling agent; and to accomplish this efficiently, I have devised a special construction by which a direct exchange of heat in insured between the anticathode tube and the cooling rod which serves as a removable heat-absorber.

According to my present invention, I employ a cooling rod arranged, for the greater part of its length, in elastic or pressure contact with the inner surface of the anticathode tube so that a large surface will be available for the efficient exchange of heat between the anticathode tube and the cooling rod. Owing to this arrangement, the heat of the anticathode is transferred very rapidly to the anticathode tube and from the latter to the cooling rod, which acts as a heat absorber and can be replaced readily with another cooling rod after it has absorbed heat to a sufficient extent. The efficient operation of a cooling device of this character depends largely on the close contact between that portion of the cooling rod which is in heat-conducting engagement with the anticathode tube, and the inner surface of said tube. This close contact along the entire circumference may be secured by making the lower or inner end portion of the cooling rod hollow and giving it elasticity by means of one or more longitudinal slits. Another suitable arrangement consists in making the cooling rod of two members, for instance in the shape of scissors, and causing these members to be pressed apart and against the inner wall of the anticathode tube either by an elastic connection or by a separate spring.

Several forms of my invention are illustrated in the accompanying drawings, in which—

Figure 1 is a view, largely in vertical section, of a Röntgen tube provided with my improved cooling device; Figs. 2, 3 and 5 are partial sectional views of three other forms of the invention; and Fig. 4 is a cross section on line A—B of Fig. 3. Fig. 6 is a partial sectional view of a modified form of the invention; Fig. 7 is a cross section on line C—D of Fig. 6.

As illustrated by Fig. 1, the anticathode plate 1 is connected in any suitable manner with the anticathode tube 3, made of copper or the like and secured at its open outer end, by soldering or otherwise, to the metal ring 10. The latter is fused in a cup-shaped glass body 11 set within the nipple 12 connected with the bulb 2 of the Röntgen tube. The nipple 12 and cup 11 cut off the interior of the Röntgen tube from the surrounding air, but the inside of the cup 11 is open to such air, so that the cooling rod 5 may be introduced removably through the cup 11 and ring 10 into the anticathode tube 3. The rod 5 is so constructed that its entire peripheral surface, so far as it is within the tube 3, will be in close contact with the inner surface of the said tube, thus insuring a rapid transfer of heat from the tube 3, which absorbs the heat of the anticathode 1, to the cooling rod 5. This rod is made of copper or other suitable material.

In order to obtain a close contact between the cooling rod 5 and the anticathode tube 3, the inner or lower end of the cooling rod is made hollow in Figs. 1 and 2 and provided with one or more longitudinal slits 13 so as to make it elastic transversely, with a tendency to expand. In Fig. 1 the upper end of the cooling rod has an axial channel 14 by means of which the surrounding air has free access to the interior of the rod 5 and of the anticathode tube 3. The channel 14 and the hollow inner end of the rod 5 together form a longitudinal passage through which the surrounding air is given access to the interior of the anticathode 3. For the sake of easy manipulation, the cooling rod 5 is provided with a handle 15 secured to a bow 16 which clears the upper or outer end of the channel 14.

Inasmuch as the lower end of the cooling rod 5 engages the adjacent portion of the anticathode tube 3 upon its entire circumference, in a heat-conducting relation, an exceedingly rapid exchange or transfer of heat will occur between these two elements. As soon as the cooling rod has absorbed a sufficient amount of heat, it is removed from

the tube, and a cool rod is substituted. The cooling action of the inserted cooling rod 5 is promoted by the fact that the surrounding air has permanent access to the interior of the anticathode tube 3 through the channel 14 and the hollow lower end of the cooling rod.

In the construction illustrated by Fig. 2, the Röntgen tube proper with the parts secured to it permanently, is the same as in Fig. 1. The lower end of the cooling rod 5 is hollow and made elastic by means of longitudinal slits 13 as before, but the channel 11 is omitted and the upper end of the rod is solid and has the handle 15 secured to it directly. Communication between the longitudinal air passage (formed by the hollow lower end of the cooling rod) and the surrounding air is afforded in this case by apertures 17 opening into the space between the cup 11 and the cooling rod.

Figs. 3 and 4 show another construction according to which the cooling rod comprises two members 5^a and 5^b made in the shape of cylinder segments, spaced to form slits between their opposing edges and also forming a longitudinal passage or channel which at its upper end communicates with the surrounding air and at its lower end with the interior of the anticathode tube 3. The upper ends of the members 5^a, 5^b are crossed and connected pivotally at 18 after the fashion of scissors, their extremities 19, 20 constituting handles. To one of these handles, 20, is pivoted a transverse rod 22 extending through an opening 21 in the other handle 19, and a spring 23, coiled around the rod 22, tends to force the handles 19, 20 apart and thus presses the rod members 5^a, 5^b firmly against the inner surface of the anticathode tube 3, thus insuring a good heat-exchange relation between such tube and the cooling rod. An annular cap 24 applied to the outer end of the nipple 12, serves as a guide for the cooling rod 5^a, 5^b.

In Fig. 5, semicircular extensions 26 and 27, pivotally connected at 25, are secured rigidly to the segmental members 5^a and 5^b respectively, and across the loop formed by the said extensions is placed a rod 28 pivoted to one of the extensions, 26, and passing loosely through an opening 30 in the other extension 27. A spring 29, coiled around said rod 28, presses the members 5^a, 5^b apart, to secure the same action as described with reference to Figs. 3 and 4. Of course a spring bow or loop may be substituted for the spring 29, rod 28 and the two-part bow formed by the pivotally connected extensions 26, 27.

In Figs. 6 and 7 the member 5^c is made hollow and provided at its outer end with a cup like receptacle 5^e adapted to receive a cooling medium 31. The other member 5^d of the cooling rod has segmental cross section, as shown in Fig. 7, and is pivotally connected to the lateral arm 32 of the member 5^c at 33. The outer end of the member 5^d terminates in an arm 34, and the ends of the arms 32 and 34 are provided with handles 35 and 36 respectively. A spring 37, being coiled around the rod 38 pivoted to the arm 34 at 39, presses the arms 32 and 34 apart, so as to bring the members 5^c and 5^d in close heat-exchange contact with the interior wall of the anticathode tube, and at the same time to form between said members 5^c, 5^d, a longitudinal air passage communicating with the interior of the anticathode tube 3 and with the outer air. After the cooling medium 31 has absorbed heat to a sufficient degree, the cooling rod 5^c, 5^d may be removed from the anticathode tube in order to replace the heated medium contained in the member 5^c and its receptacle 5^e with fresh cooling medium. In certain cases the member 5^d of the device shown in Figs. 6 and 7, may likewise be made hollow and filled with a cooling medium.

While compression springs have been shown in Figs. 3, 5 and 6 at 23, 29 and 37 respectively, it will be obvious that tension springs or other devices may be used for the same purpose. These modifications and others may be made without departing from the nature of my invention as set forth in the appended claims.

I claim:

1. A Röntgen tube provided with an anticathode, an anticathode tube extending outwardly from the anticathode and open at its outer end, and a cooling rod adapted to be set removably within said anticathode tube, said rod being constructed with a tendency to expand in spring-like fashion so as to secure a close heat-exchange contact between the outer surface of the cooling rod and the inner surface of the anticathode tube.

2. A Röntgen tube provided with an anticathode, an anticathode tube extending outwardly from the anticathode, and a cooling rod adapted to be set removably within said anticathode tube, said rod consisting of a plurality of movably connected members, and means for forcing them apart into close engagement with the anticathode tube.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JOHN ALFRED MANNHEIM.

Witnesses:

ERNEST H. L. MUMMENHOFF,

FRANCIS R. STEWART.