May 29, 1928. 1,671,953

E. G. GILSON

PROCESS FOR MAKING X-RAY ANODES

Filed June 15, 1927

Fig. 1.

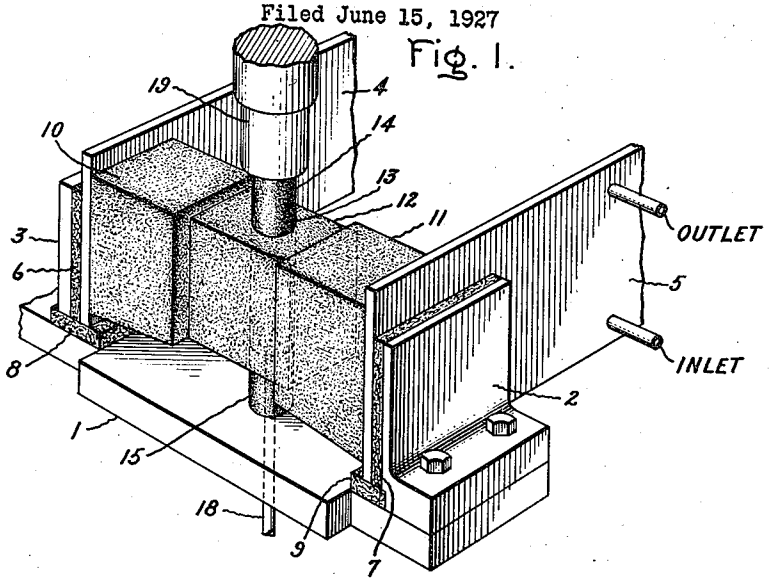


Fig. 2.

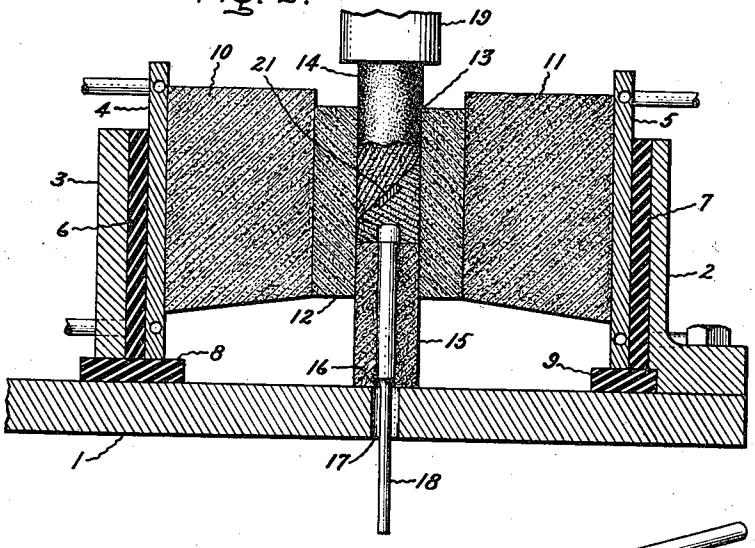
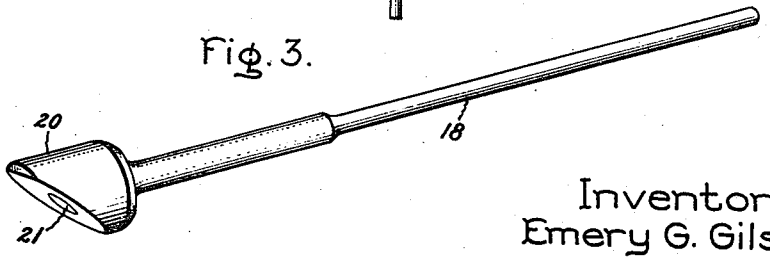


Fig. 3.



Inventor:
Emery G. Gilson,
by Alexander S. Lowe
His Attorney.

Patented May 29, 1928. 1,671,953

UNITED STATES PATENT OFFICE.

EMERY G. GILSON, OF COLONIE, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

PROCESS FOR MAKING X-RAY ANODES.

Application filed July 15, 1927. Serial No. 206,102.

The present invention relates to the manufacture of electrodes and more particularly to the manufacture of tungsten anodes for X-ray tubes. Heretofore, in the manufacture of such anodes a large number of steps have been required to produce the finished product. For example, the tungsten powder, as a rule, is pressed into a bar, sintered and then heated in a hydrogen furnace to a temperature of about 1400° C. The bar is then reheated by an electric current, swaged into the desired shape, ground and swaged to a stem of molybdenum or other suitable material.

It is one of the objects of the present invention to provide an improved process for manufacturing an electrode, which process, with the exception of the finishing step, may be carried out in a single operation.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, will best be understood from reference to the following specification when considered in connection with the accompanying drawing in which Fig. 1 is a perspective view of an apparatus whereby my process may be carried into effect; Fig. 2 is a cross section of the apparatus shown in Fig. 1; while Fig. 3 is a perspective view of an X-ray anode constructed in accordance with the present process.

Referring to the drawings, I have indicated at 1 the base plate of a press. A stationary angular metal member 2 is bolted to the base plate while a movable metal member 3 is mounted on plate 1 opposite member 2. A pair of flat, water cooled copper conductors 4 and 5 are mounted adjacent plates 2 and 3 respectively, and spaced therefrom by insulators 6 and 7. An insulator 8 is inserted between plate 1 and the lower ends of member 3 and conductor 4, and a similar insulator 9 is inserted between plate 1 and the lower ends of conductor 5 and insulator 7. A pair of carbon blocks 10 and 11, secured in any suitable manner to conductors 4 and 5, are adapted to supply current to a carbon mold 12 and to firmly clamp the mold in position on the press. Mold 12 is substantially rectangular in cross section and is provided with a circular opening 13 extending therethrough in which slidable carbon members 14 and 15 are mounted. The lower member 15 is provided with a central opening 16 adapted to register with an opening 17 in the base plate 1, while the upper member 14 has an inclined face portion of substantially the same form as the face portion of the finished anode. A stem 18, which may be made from molybdenum or tungsten, extends through the openings 16 and 17, and is provided at its upper end with an enlarged portion so that the stem may rest upon the upper end of the carbon member 15 and project a desired distance above that member.

In operation, the carbon member 15 is placed on the press so that its opening 16 registers with the opening 17 in the plate 1. Mold 12 is then placed over the movable member 15 and the block 10 moved into contact with the mold 12 by suitable pressure means applied to the movable plate 3. A refractory powder, such as tungsten, is then placed in the opening 13 in the mold 12 so as to completely surround and extend above the upper end of the rod 18. The movable carbon member 14 is then inserted in mold 12 and a pressure of about 1000 pounds per square inch or more applied thereto by a plunger 19. Simultaneous with the application of pressure, current is supplied to the mold and powdered refractory material through copper conductors 4 and 5 and carbon blocks 10 and 11. The current employed should have a value sufficiently high to heat the tungsten powder at least to its sintering temperature and preferably to a temperature of about 3000° C. The simultaneous application of heat and pressure to the powdered tungsten provides a solid anode substantially integral with the stem portion and substantially free from voids. When removed from the mold, the anode and stem may be polished and is then in condition for use.

If desired, the head portion 20 of the anode may be provided with a tungsten target 21 which is more dense than the remainder of the head portion of the anode. This target may be positioned on the powdered material and pressed and heated with the tungsten powder, the finished product having the appearance substantially as disclosed in Fig. 3. If desired, current may be supplied to the powdered tungsten through the movable carbon members 14 and 15. At a temperature of about 3000° C. however, the carbon plungers have a tendency to buckle and break when pressure is applied to them. This difficulty is avoided by employing th

carbon members 14 and 15 merely to apply pressure to the tungsten powder and by applying current through the sides of the mold, as indicated in Figs. 1 and 2 rather than through members 14 and 15.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. The method of making an electrode of refractory material which comprises surrounding one end of a metal stem with refractory material, and simultaneously applying heat and pressure to the refractory material.

2. The process of making an electrode of refractory material which comprises surrounding one end of a metal stem with refractory material, and simultaneously applying heat and pressure thereto in a confined space.

3. The process of making an electrode of refractory material which comprises surrounding one end of the metal stem with powdered refractory material, and simultaneously applying heat and pressure to the refractory material.

4. The process of making an electrode of refractory material which comprises surrounding one end of a metal stem with refractory material, heating the refractory material to a temperature at least as high as the sintering temperature of the material, and simultaneously applying pressure thereto.

5. The process of making an X-ray electrode which comprises surrounding one end of a refractory metal stem with finely divided material, embedding a target in the finely divided material, heating the finely divided material and target to a temperature at least as high as the sintering temperature of the finely divided material and simultaneously applying pressure thereto.

In witness whereof, I have hereunto set my hand this 14th day of July, 1927.

EMERY G. GILSON.