No. 682,337. Patented Sept. 10, 1901.

R. A. NIELSEN.

MANUFACTURE OF INCANDESCING MEDIA FOR INCANDESCENT LIGHTING.

(Application filed July 14, 1900.)

(No Model.)

Fig. 1.

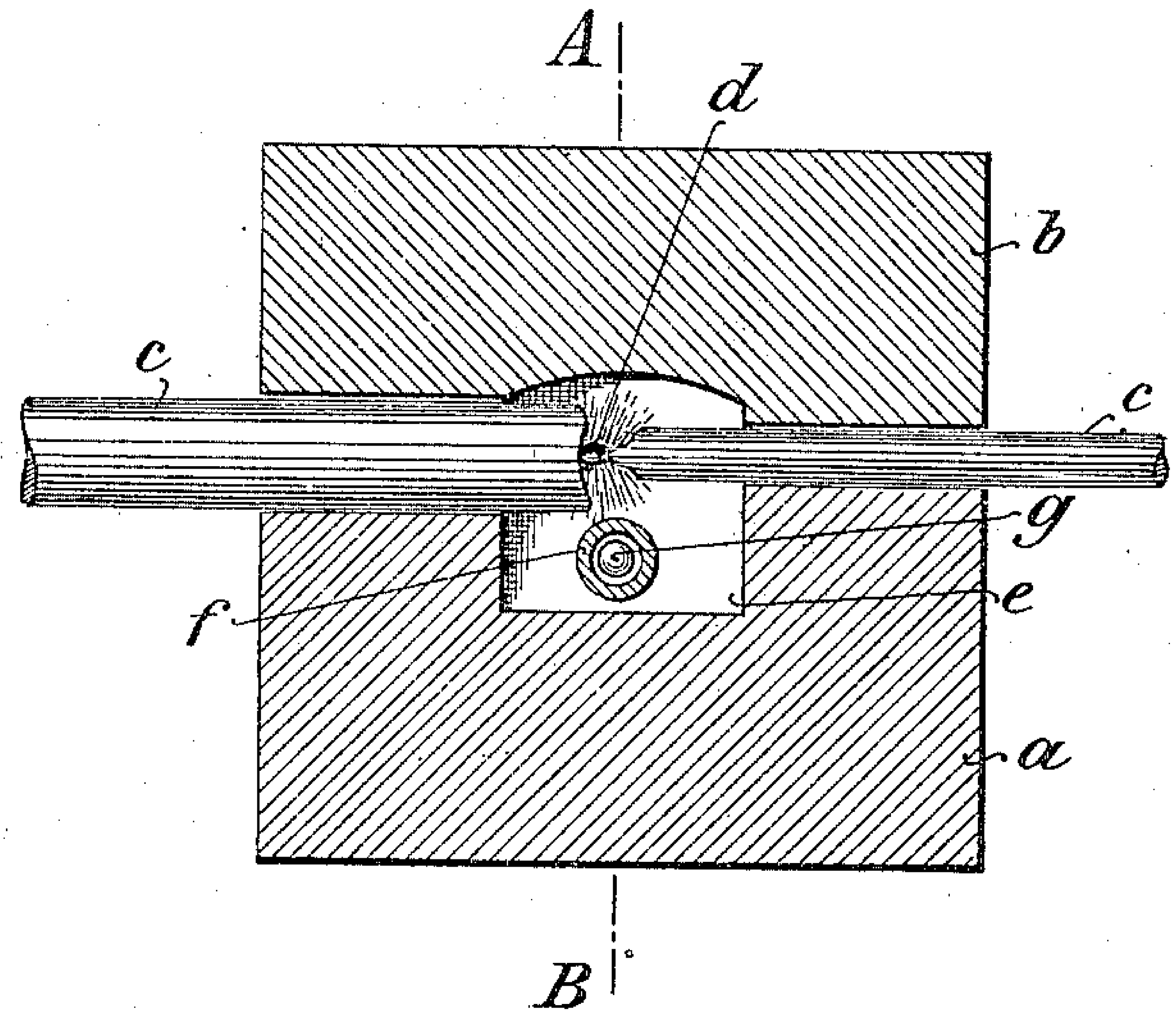
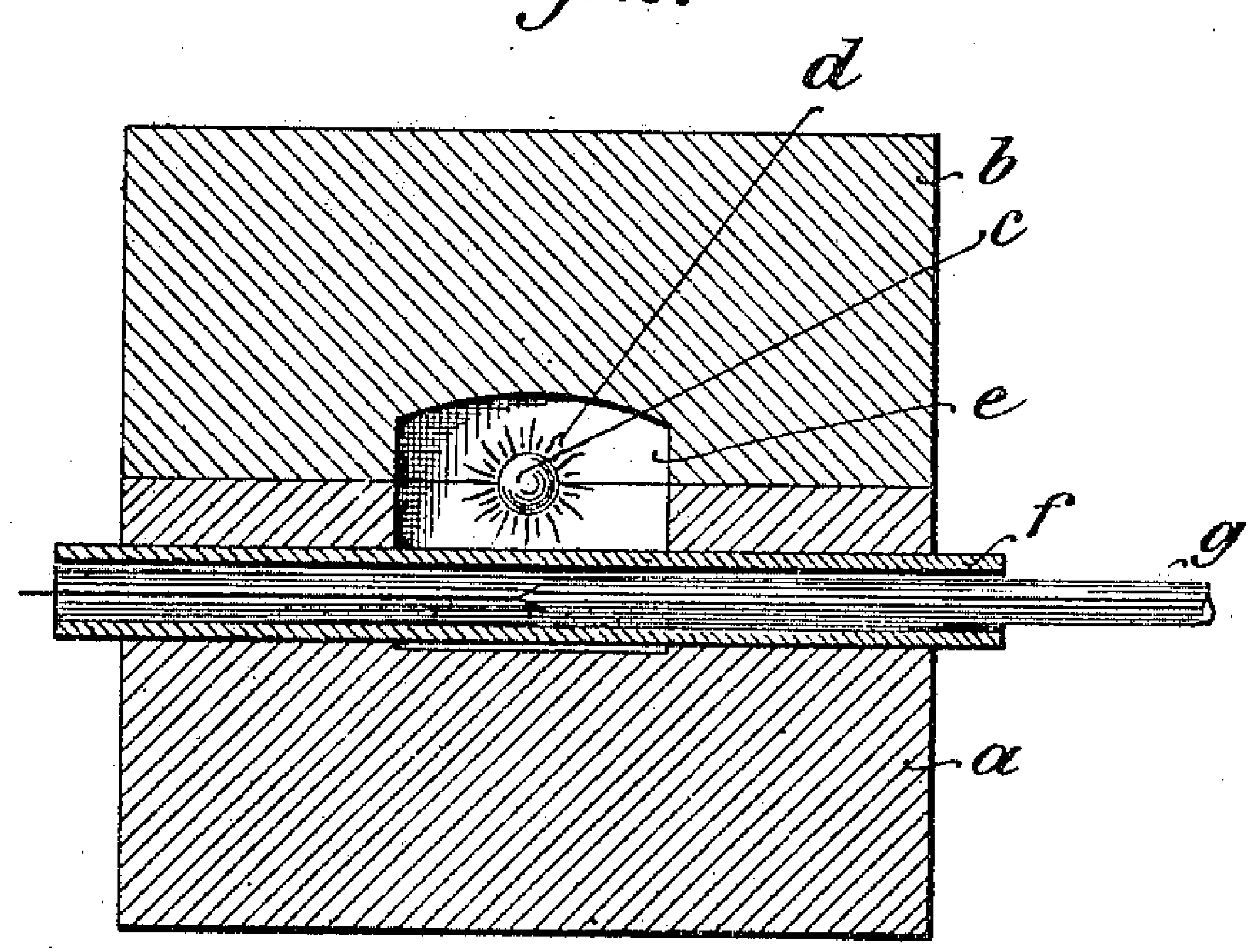


Fig. 2.



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UNITED STATES PATENT OFFICE.

RASMUS ANTON NIELSEN, OF COPENHAGEN, DENMARK.

MANUFACTURE OF INCANDESCING MEDIA FOR INCANDESCENT LIGHTING.

SPECIFICATION forming part of Letters Patent No. 682,337, dated September 10, 1901.

Application filed July 14, 1900. Serial No. 23,594. (No specimens.)

To all whom it may concern:

Be it known that I, RASMUS ANTON NIELSEN, a subject of the King of Denmark, residing at Copenhagen, in the Kingdom of Denmark, have invented certain new and useful Improvements in the Manufacture of Incandescing Media for Incandescent Lighting, (for which I have applied for patent in England, No. 9,785, dated May 28, 1900; in Denmark, No. 624, dated May 31, 1900; in France, No. 289,099, dated June 1, 1900, and in Germany, dated May 25, 1900,) of which the following is a specification.

In the specification of my application bearing the Serial No. 12,241, filed April 9, 1900, there is described a method of manufacture of incandescing media, according to which the oxids of the rare earths, of the alkaline earth metals, or of the elements zirconium, thorium, molybdenum, tungsten, uranium, titanium, vanadium, niobium, and tantalum are drawn out into threads with the aid of the electric arc, and these threads are woven or otherwise made into incandescing media for incandescent lighting. In carrying out the method described in the said prior specification difficulties are sometimes encountered, these difficulties being consequent upon the direct application of the electric arc.

The object of the present invention is to overcome these difficulties.

The difficulties in question are that an immediate formation of metallic carbids takes place at the exceedingly high temperature of the electric arc by reason of the carbon vapor present, because, as is known, the prevailing conditions are favorable for the formation of such carbids.

The oxids mentioned are, as is well known, conductors of the second class—that is to say, they do not conduct the electric current in a cold condition, but only when heated to at least red heat. It is known that the conductivity of such oxids increases as the temperature is raised. Now the general conditions for the decomposition of any substance by the electric current are as follows: First, the substance must conduct the electric current, and, second, the molecules of the substance must consist of both an electropositive and an electronegative atom or group of atoms. Both of these conditions are fulfilled by the oxids in question, as they conduct the electric current in a molten condition and are composed of one of several electronegative atoms of oxygen and of one electropositive atom of a metal—as, for example, calcium oxids, (CaO.) When a current is passed through these oxids in a molten condition, they are decomposed, inasmuch as the electropositive-metal atoms pass to the negative pole and the electronegative-oxygen atoms to the positive pole. These rules for the electrolytic decomposition of molten substances are universally known. Aluminium, for example, is almost exclusively obtained in this manner from aluminium oxid, (Al_2O_3.)

The process described in my previous application provides that, first, the molten material is subject to the direct passage of the electric current, and, second, is in direct contact with the electric arc and the carbon electrodes. In this process, therefore, the molten mass is, as above mentioned, decomposed by the electric current. In addition to this a considerable quantity of the mass is converted into carbid. It is well known that on melting calcium oxid in the presence of carbon calcium carbid and carbon monoxid are formed, according to the equation:

$$CaO+3C=CaC_2+CO.$$

When thorium oxid is melted in the presence of carbon, a similar reaction takes place, thorium carbid and carbon monoxid being formed, as follows:

$$ThO_2+4C=ThC_2+2CO.$$

It is further universally known that when calcium carbid is molten with water or water-vapor acetylene is developed, leaving a deposit of calcium hydrate, as follows:

$$CaC_2+2H_2O=H_2C_2+Ca(OH)_2.$$

Other metal carbids are also decomposed by water or water-vapor in the same manner, developing various hydrocarbons.

The above will suffice to show that the threads and incandescent mantles produced according to my previous application are not pure, owing to the presence of carbids of metals and of the metals themselves so far as they are not converted into carbids.

The products of combustion of the Bunsen flame used for incandescent gas-light consist of carbonic acid and water-vapor and excess oxygen is present. As now the metal carbids contained in the threads are immediately decomposed by water-vapor, (while it is, moreover, burned in the air,) and because all the metals coming into question on being heated are very liable to be attacked by oxygen (magnesium can indeed be ignited) the threads will be quickly destroyed, and the mantle consequently will become useless.

Now according the present invention in order to overcome the difficulties above referred to I proceed in such manner as to apply only the heating effect of the electric arc, excluding the electrolytically decomposing action of the same and avoiding the carbon-vapors, which are simultaneously evolved. This I effect by placing the substances under treatment in crucibles or the like and introducing them in this condition into the electric furnace. From the molten mass thus obtained the threads which are to be made into incandescing media, as before described, are produced by suitable mechanical means.

In the accompanying drawings, Figures 1 and 2 illustrate a furnace in two sections at right angles to each other. In this furnace substances can be melted to either electrolytic or chemical influences.

a is a block of limestone having a rectangular depression in the middle. *b* is also a block of limestone having a similar depression in the middle, and this second block is placed upon the first one so that the depressions coincide with each other. Through holes situated half in the upper block and half in the lower one the carbon electrodes *c* pass, so that the electric arc *d* is formed in the space *e*. In the lower block *a* a carbon tube *f* is provided underneath but close to the electric arc. This tube, which is of the same material as the electrodes, has an inner diameter of about 1.5 centimeters and is thirty centimeters long. In the interior of this tube the substance from which the threads are drawn is melted. This substance is introduced into the carbon as a rod, having a diameter somewhat less than the internal diameter of the tube, so that it can be advanced into the latter without coming into contact therewith. When the electric circuit is closed and the arc formed, the space *e* becomes filled with carbon-vapor, while the entire heat of the arc is transferred to the carbon tubes. The temperature in the space *e* rapidly increases, and by using a sufficiently-strong current the temperature of the arc can be raised to the point required. The middle part of the carbon tube *f* is raised to the same temperature, so that the part of the rod *g* nearest to the arc is melted.

The thread is formed in the following manner: One end of the rod *g*, which at first is of such a length as to pass from end to end of the tube *f*, is connected with some device, such as a cord passing over a roller, and carrying a weight at the end, so that the rod is subject to a constant pull. As soon as the part of the rod *g* nearest to the electric arc is melted the ends of the rod are pulled farther apart, and a fine thread is thus formed. This thread is guided by a quickly-rotating roller and treated further.

With this construction of furnace very strong currents are used. At one thousand amperes all known substances, with the exception of carbon, are melted inside the tube *f* in a few minutes. In such cases it is preferable to coat the furnace internally with carbon plates of two to four centimeters thickness, so as to prevent the blocks from destruction or melting.

I have further discovered that the applicability of the present method is not limited to the oxids of the rare earths or of the alkaline earth metals or of the elements zirconium, thorium, molybdenum, tungsten, uranium, titanium, vanadium, niobium, tantalum, and beryllium, but that it may be employed with all other earths which are employed for illuminating purposes and with all bodies which can be used for the manufacture of incandescing media. Incandescing media made from the threads thus produced may, if desired, be coated with a pulverulent coating of one or of a mixture of two or more of the oxids above enumerated or of other suitable incandescing substances. This may be conveniently effected, for example, by immersing the incandescing medium—a mantle, for example—in a solution of a suitable salt or salts and raising to incandescence, as described in my said previous specification. This operation may advantageously be carried out several times with a dilute solution, this having the effect of imparting greater resistance and solidity to the coating.

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

The process of manufacturing incandescing media, which consists in subjecting oxids of the rare earths to the heat of the electric arc while said oxids are shielded from the electrolytic decomposing action of the arc, until the said oxids are melted and then drawing the same out into threads for the purpose described.

In testimony whereof I have hereunto set my hand in the presence of two witnesses.

RASMUS ANTON NIELSEN.

Witnesses:

JULIUS HAKELMANN,

PETER LARSON.