W. G. ABBOTT, Jr.

METHOD OF AND APPARATUS FOR THE TREATMENT OF LAMP FILAMENTS.

APPLICATION FILED OCT. 9, 1908.

1,011,396. Patented Dec. 12, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

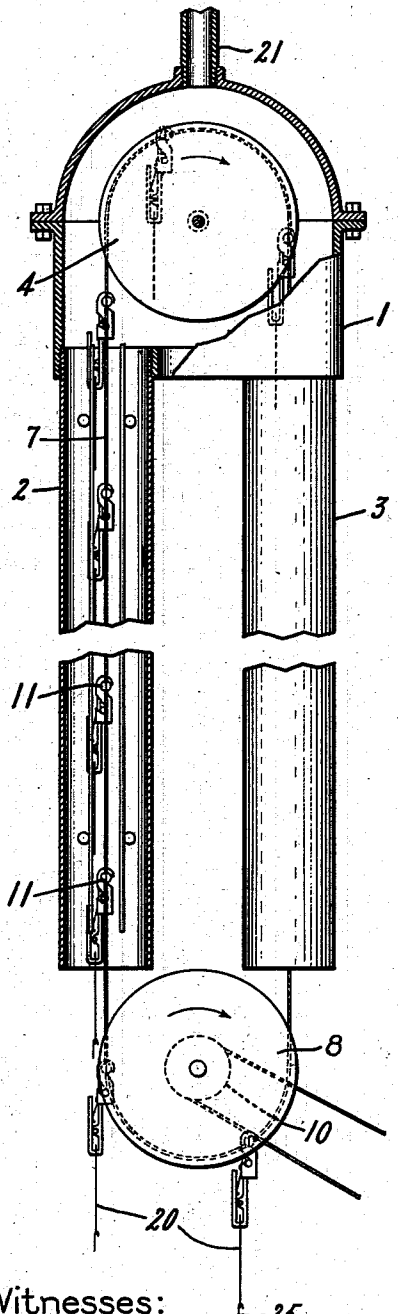


Fig. 2.

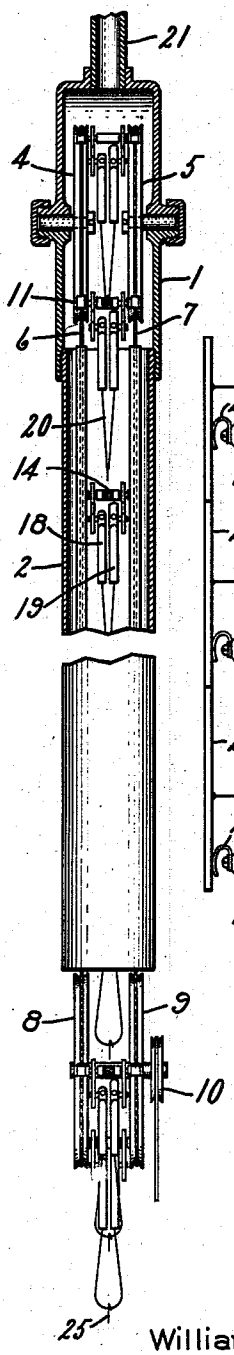
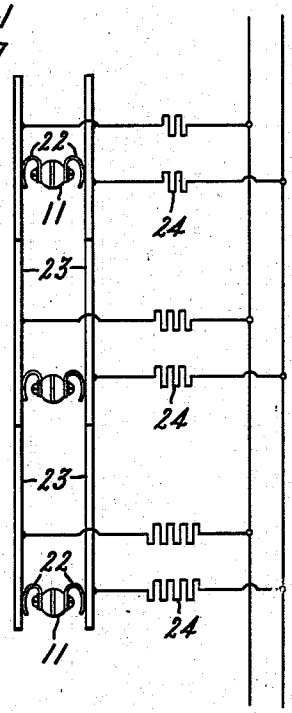


Fig. 3.



Witnesses:

George W. Tilden

J. Ellis Glen

Inventor:

William G. Abbott Jr.,

by Albert G. Davis

Atty.

W. G. ABBOTT, JR.

METHOD OF AND APPARATUS FOR THE TREATMENT OF LAMP FILAMENTS.

APPLICATION FILED OCT. 9, 1908.

1,011,396. Patented Dec. 12, 1911.

2 SHEETS—SHEET 2.

Fig. 4.

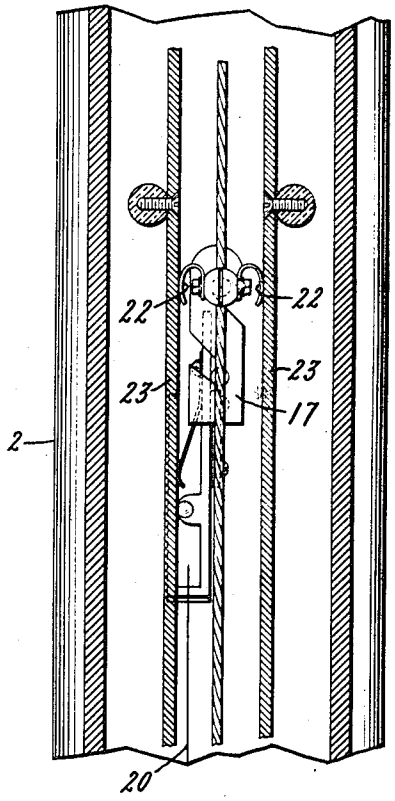


Fig. 5.

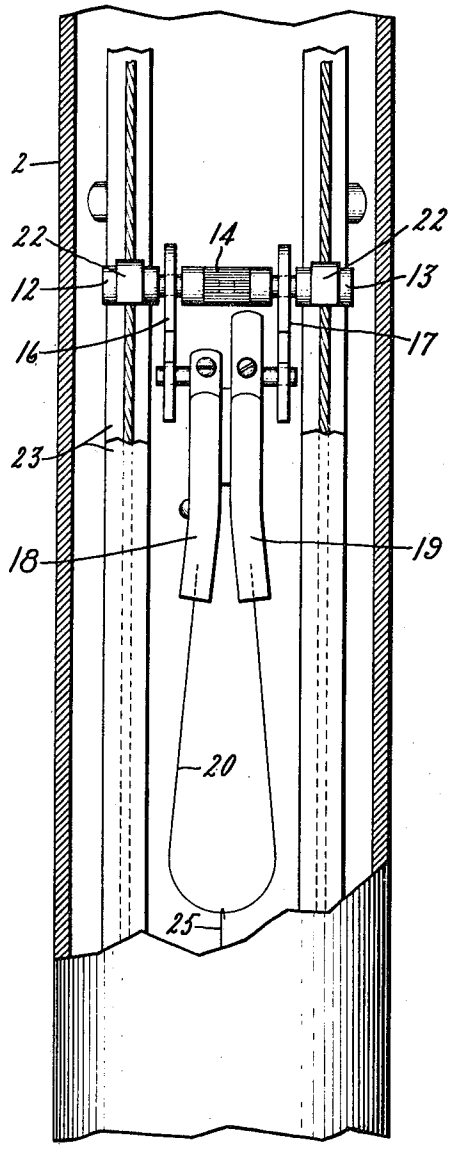
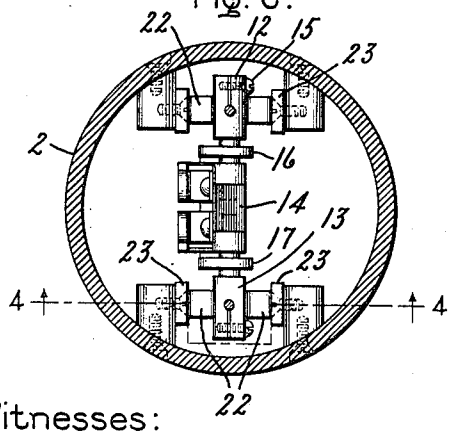


Fig. 6.



Witnesses:

George H. Tilden

J. Ellis Glen.

Inventor:

William G. Abbott Jr.,

by Albert G. Davis

Att'y.

UNITED STATES PATENT OFFICE.

WILLIAM G. ABBOTT, JR., OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

METHOD OF AND APPARATUS FOR THE TREATMENT OF LAMP-FILAMENTS.

1,011,396. Specification of Letters Patent. Patented Dec. 12, 1911.

Application filed October 9, 1908. Serial No. 456,902.

To all whom it may concern:

Be it known that I, WILLIAM G. ABBOTT, Jr., a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Methods of and Apparatus for the Treatment of Lamp-Filaments, of which the following is a Specification.

Lamp filaments of tungsten and other refractory metals and materials may be made by any one of several different processes wherein filament shaped conductors are first produced and then treated to change their physical or chemical characteristics, and so yield finished highly refractory conductors. For instance, tungsten powder or a reducible or decomposable compound of tungsten or similar metal may be mixed with a suitable binder to form a plastic mass and then extruded through a die to produce filament shaped threads, which can subsequently be heated with current in a suitable atmosphere to remove the binder and to produce the necessary chemical changes, and finally to shrink and sinter the residue of tungsten or similar metal or mixture of metal, into a firm and homogeneous filament of good conductivity. Ordinarily this treating operation is carried out by mounting each filament shaped thread in a treating bottle supplied with the necessary gases and then gradually increasing its temperature until the desired changes are produced. This procedure is troublesome and expensive, for obvious reasons.

According to my present invention unfinished filaments are fed continuously into a receptacle containing the treating gases and are there raised to the proper treating temperature and undergo the necessary chemical and physical changes and finally come out fully treated and finished. The apparatus whereby this effect is produced is shown in the accompanying drawings in which—

Figure 1 is a side elevation partly in section; Fig. 2 is a transverse section; Fig. 3 is a diagram of connections, and Figs. 4, 5 and 6 are sections through one of the tubes of Fig. 1.

The apparatus shown in the drawing is suitable for treating filaments in gas, or mixtures of gases, lighter than air, but obviously the apparatus can be turned bottom up to adapt it to heavier treating mixtures.

The treating envelop consists of a metal box 1 with depending metal tubes 2 and 3 forming a U-shaped receptacle. The box 1 incloses a pair of sprocket wheels or pulleys 4 and 5, over which pass respectively, the steel cables 6 and 7 by means of which the filaments to be treated are carried up one tube and down the other. Outside the envelop these cables pass over a second pair of pulleys 8 and 9 driven through a pulley 10. At regular intervals on the cables 6 and 7 I clamp cross bars 11, each made of two metal parts 12 13 clamped together by an insulating bushing or sleeve 14, and each clamped to its corresponding steel cable by a set screw 15. Each of these cross bars normally serves to carry a filament up into the treating receptacle, and to this end is provided with depending blocks 16 and 17 of metal suitable as supports for a filament carriage consisting of spring clamps 18 and 19 insulated from each other and each engaging with the end of an unfinished lamp filament 20.

When the apparatus is in normal use the operator slips a filament carriage into the depending blocks 16 and 17 of a cross bar and the filament is carried upward into tube 2 where it is immediately enveloped in the treating gas. This gas may be hydrogen or a mixture of hydrogen and nitrogen, in accordance with common practice, or may be other inert or reducing gas capable of effecting the desired changes in the filament. If hydrogen or a mixture of hydrogen and nitrogen is used, it may be supplied at the top of the apparatus through a tube 21, and its lightness as compared with air will serve to keep the treating receptacle full, though the purity of the treating gas will be highest near the top of the receptacle where they are uncontaminated by materials given off by the filament or by diffusion from the outside air. As the filament moves upward into this treating atmosphere, the ends of the filament-supporting bars 11 begin to receive current through brushes or shoes 22 arranged in pairs on either side of the moving cable and rubbing on rails 23 energized by current of the low potential suitable for the first stage of the treatment. The current heats the filament and the treatment begins. As the filament moves up the tube it

finally reaches a point in the current supply rails beyond which is a section energized by higher potential. If desired, the successive rail sections may be of decreasing length to prevent the possibility of having two filaments running simultaneously on the same section. Suitable resistances 24 are used to control the treating currents, all as shown diagrammatically in Fig. 3. The filament continues to pass upward through the tube 2 going from one section of current supply rails to the next, through as many stages of heat treatment as are necessary for its complete conversion into a thoroughly sintered and finished filament. The usual "pointing" can be effected by means of a little weight or rider 25 on the filament before it begins its journey up the tube.

When the filament reaches its highest treating temperature it is surrounded entirely by a gaseous atmosphere of substantially the purity of that supplied at the top of the apparatus. Consequently the filament has throughout its progressive treatment been moving steadily against the slow stream of incoming gas and reaches gas of great purity before the final heat treatment, which treatment it will be understood is at very high temperature. When the filaments have been given this final treatment the filament carriage is near the top of the tube and soon thereafter is carried over the top and comes slowly down through the other tube 3.

When the filaments come out into the open air they are cold and entirely finished and may be lifted out together with their carriage. Their places may then be filled by other filaments carried in other carriages which are sent into the treating apparatus on the upward moving cable, as before.

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

1. An apparatus for the treatment of filaments, comprising a receptacle, means for supplying gas thereto, means for successively moving filaments slowly through said gas, and means of heating said filaments with current during said movement.

2. The combination of a receptacle, means for continuously supplying a treating gas thereto, means for progressively moving an individual untreated filament therein, and means for supplying current to said filament in its entirety while so moving.

3. The combination of a receptacle containing a treating gas, and means for regularly and continuously introducing unfinished filaments into said gas and for removing finished filaments therefrom.

4. The combination of a receptacle, a treating gas therein, and means for continuously moving unfinished lamp filaments into said gas and for supplying current thereto to heat the same while moving.

5. The combination of a receptacle supplied continuously with a treating gas, an endless conveyer running into and out of said receptacle, means for securing unfinished filaments to said conveyer, and means for delivering current to the filaments while moving in said receptacle.

6. The method of finishing lamp filaments, which consists in continuously and successively introducing them into a receptacle filled with treating gas, and while in contact with said gas, heating them with current.

7. The method of treating an unfinished lamp filament which consists in progressively moving it against a stream of treating gas and at the same time progressively elevating its temperature, and then moving it out of said gas.

8. The method of treating a filament which consists in progressively moving it against a stream of treating gas and at the same time progressively elevating its temperature, and then moving it with said current of gas and allowing it to be cooled thereby.

9. The combination of a receptacle continuously supplied with treating gas at one end, means for progressively and successively moving unfinished filaments into said receptacle toward the end thereof at which the gas is supplied and removing them from said receptacle, and means for delivering current to said filaments in increasing amounts during their inward movement.

10. In an apparatus for treating filaments, the combination of a receptacle having suitable gas supply means at one end, a pair of wheels mounted in said receptacle, a pair of flexible cables adapted to travel on said wheels, and means carried by said cables for supporting a plurality of filaments between them.

11. The combination of a receptacle, means for supplying a stream of treating gas thereto, and means for moving a filament through said receptacle first in one direction with reference to said stream of gas and then in the reverse direction.

In witness whereof I have hereunto set my hand this 2nd day of October, 1908.

WILLIAM G. ABBOTT, JR.

Witnesses:

BENJAMIN B. HULL,

MARGARET E. WOOLLEY