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F. M. F. CAZIN.

APPARATUS FOR THE MANUFACTURE OF GLOWERS FOR ELECTRIC LAMPS.

APPLICATION FILED FEB. 2, 1903.

Fig. 1.

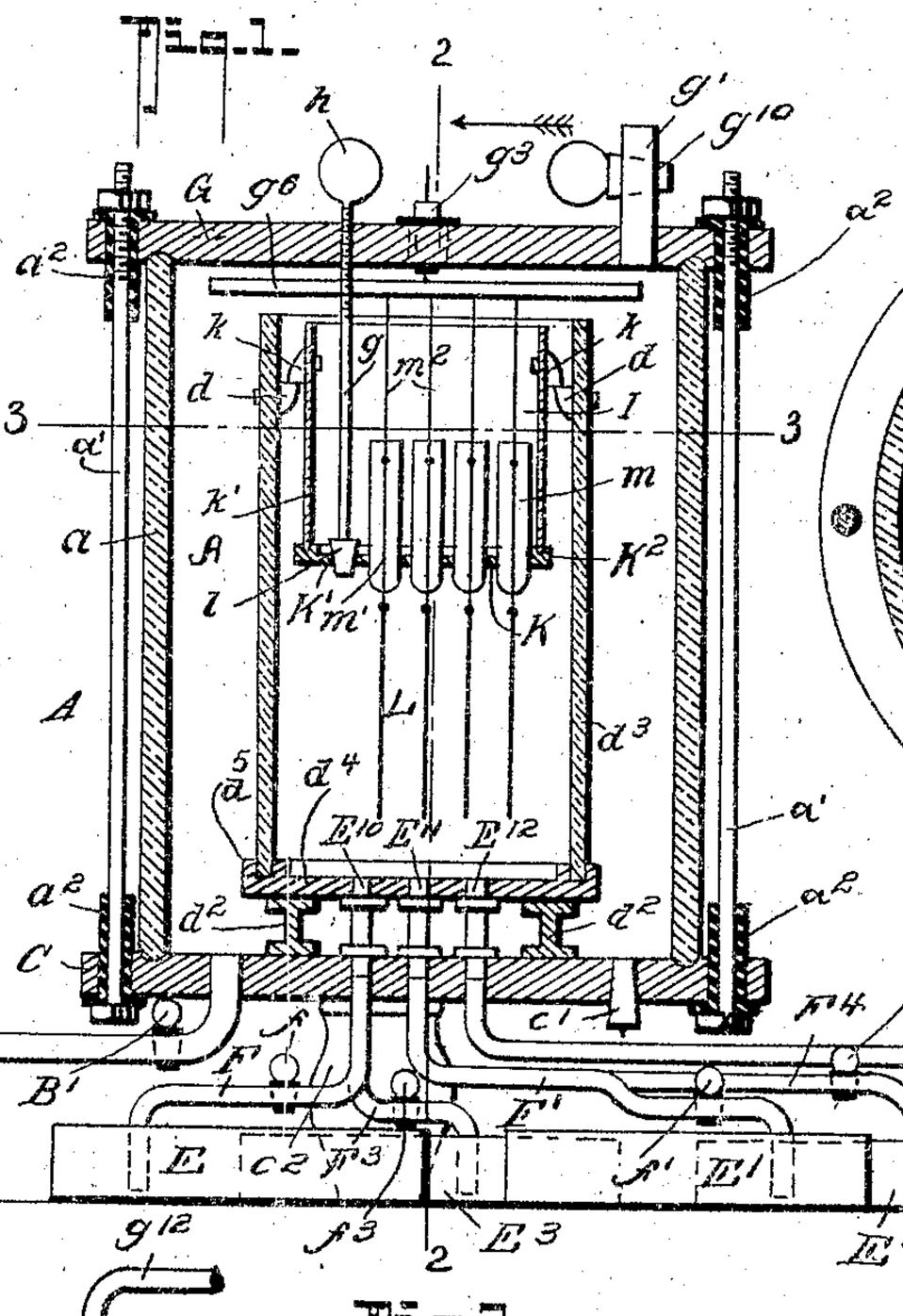


Fig. 3.

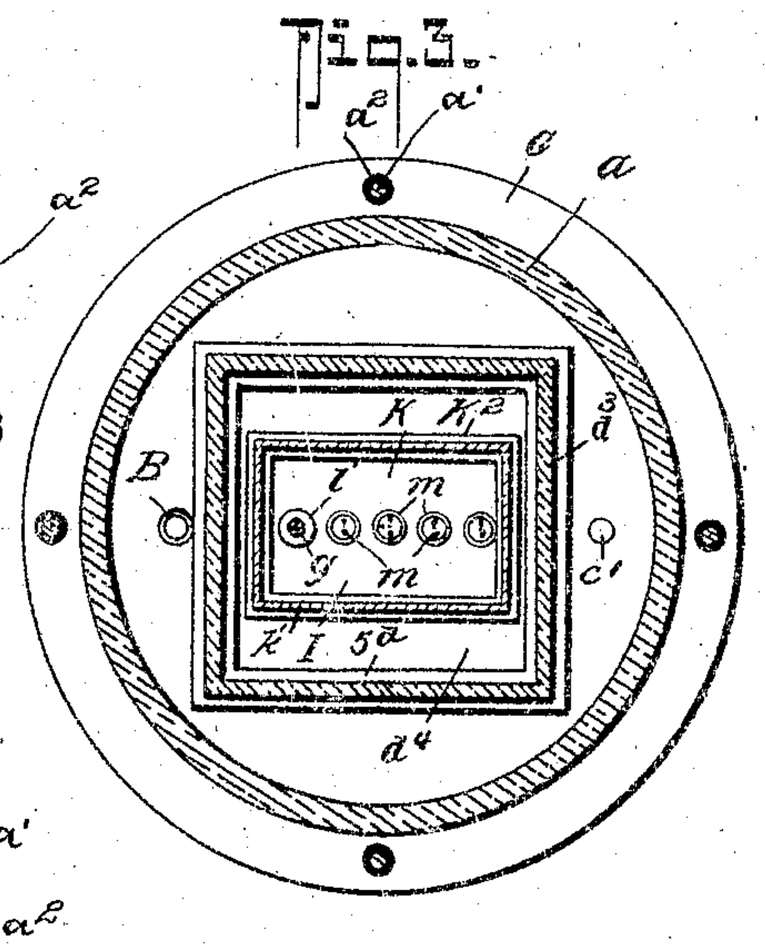


Fig. 2.

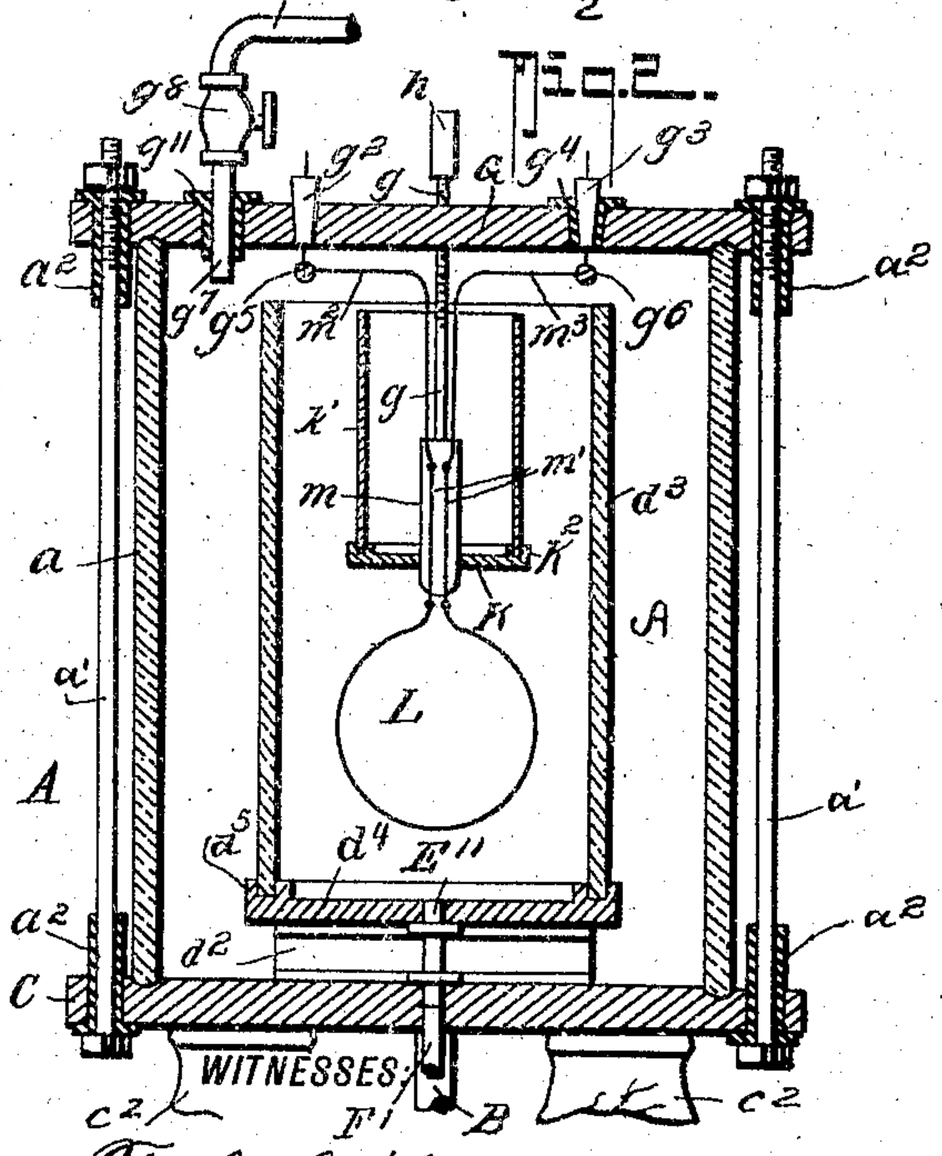
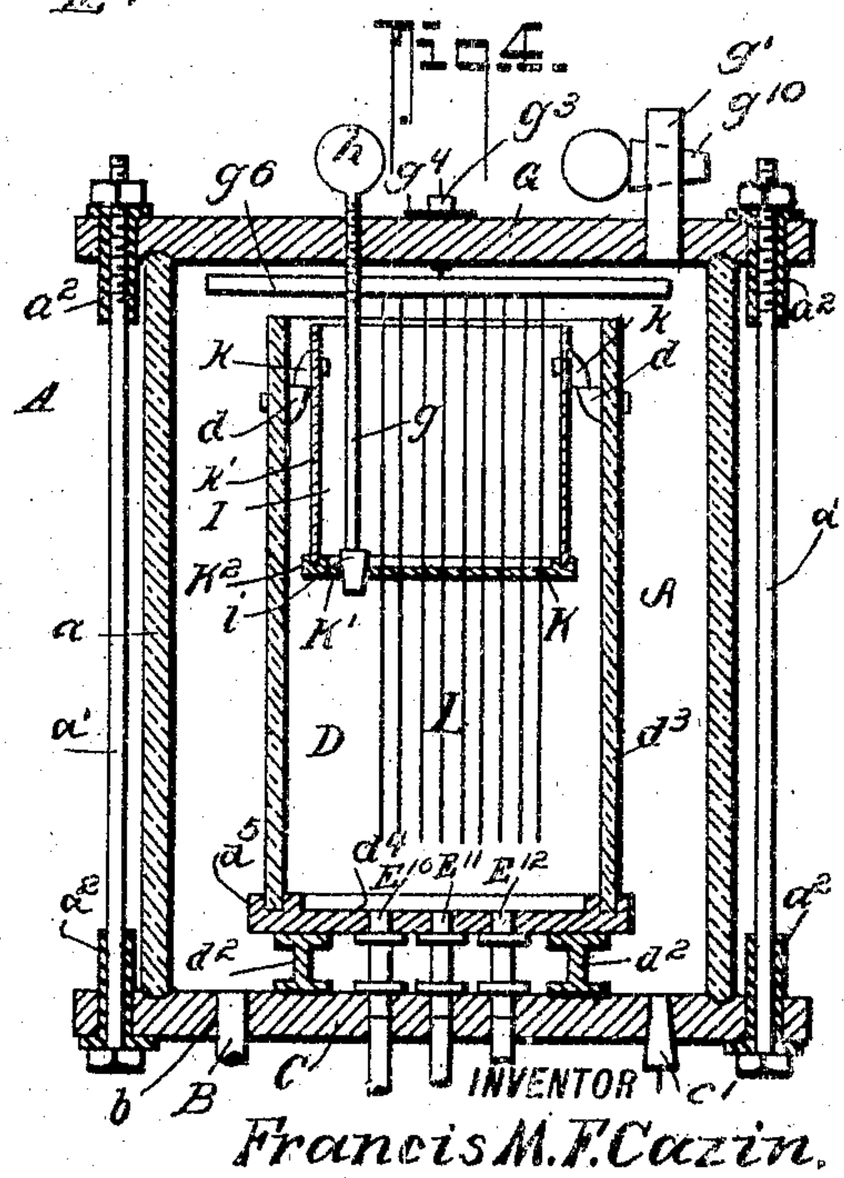


Fig. 4.



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No. 786,727. Patented April 4, 1905.

UNITED STATES PATENT OFFICE.

FRANCIS M. F. CAZIN, OF HOBOKEN, NEW JERSEY.

APPARATUS FOR THE MANUFACTURE OF GLOWERS FOR ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 786,727, dated April 4, 1905.

Application filed February 2, 1903. Serial No. 141,501.

To all whom it may concern:

Be it known that I, FRANCIS M. F. CAZIN, a citizen of the United States, residing at Hoboken, in the county of Hudson and State of New Jersey, have invented a new and Improved Apparatus for Use in the Manufacture of Filaments for Electric Lamps, of which the following is a specification.

My present invention has for its object to provide an improved apparatus for use in the production of electric-lamp filaments in which prospective filaments, pencils, or luminants are treated for sundry purposes; and it more particularly seeks to provide an apparatus for successfully and economically carrying out the process and for producing a filament, pencil, or luminant such as disclosed in my copending application, filed on January 7, 1903, Serial No. 138,084. Again, my invention seeks to provide an apparatus wherein beginning with a core therefor the luminant can be completely manufactured without removing, handling, or moving the same in any way.

With other objects in view which will be hereinafter apparent the invention consists in certain novel construction and arrangement of parts, all of which will be first described in detail and then specifically pointed out in the appended claims, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of my invention. Fig. 2 is a similar view on the line 2 2 of Fig. 1. Fig. 3 is a cross-section on the line 3 3 of Fig. 1. Fig. 4 is a view similar to Fig. 1 and disclosing a slightly-modified form of my invention.

Referring now to the accompanying drawings, in which like characters of reference indicate like parts in all of the figures, A designates a bell-jar for coöperating with the air-exhausting apparatus (not shown) of any approved type by means of the pipe B, and the bell-jar A includes the glass cylinder a, the top plate G, and the bottom plate C, which plates may be constructed of any suitable material, preferaly carbon or graphite. The plates G and C are held in position with respect to the cylinder a by the bolts a', insulated, as at a^2, from the plates. The pipe B enters the jar through an aperture b in the bottom plate C and tightly fits the same.

Mounted on girders d^2 is a vessel D, which comprises a glass envelop or wall d^3 and a bottom plate d^4, having a peripheral enlarged grooved portion d^5 to receive the glass envelop d^3, and the said bottom d^4 is preferably constructed of any suitable conducting material, such as carbon or graphite and the like. Secured to the inner wall of the receptacle D is a series of brackets d, of a non-conducting material, to coöperate with similar brackets or stops k on the outer wall k' of the third or holding vessel I, which vessel I also includes a bottom K, having an aperture K′ and an enlarged annular grooved portion K^2 to receive the wall k', constructed of glass or any other suitable substance.

g designates a conducting-rod having a plug i at one end and a finger-piece h at its other end, and this rod g passes through an aperture in the top plate G of the bell-jar A and is adapted, through its plug i, to close the aperture K′ of the bottom K of the holder I, as well as to make electric connection between the top plate G and the bottom plate K of the holder I. Preferably the rod g has a threaded hermetical connection with the plate G.

The bottom plate K of the holder I in the preferred form of my invention has a series of apertures to receive the tubular glass body m, in which the connecting-wires m' are sealed. To these connecting-wires m' the leading-in wires m^2 m^3 are joined, as are also the ends of the cores L. The leading-in wires m^2 m^3 connect with the bus-bars g^5 g^6, respectively, and these bus-bars are suspended from the plugs g^2 g^3, respectively, which are held in apertures in the top plate G, one of which plugs, g^3, is insulated from the plate G by the bushing g^4, as shown.

g' designates a short pipe-section having a valve g^{10}, whereby air may be admitted to the bell-jar when desired, and g^7 designates an inlet-pipe having a valve g^8, which communicates with the interior of the bell-jar and is insulated therefrom by the insulating-bushing g^{11}.

g^{12} designates a tubular section leading from

any suitable source of steam-supply (not shown) and which tube g^{10} joins with the valve g^8, as shown, and may be rubber hose or any other suitable substance, the valve g^8 preferably being in the nature of a throttle-valve.

In addition to the aperture to which the pipe B, having a valve B′, connects the bottom plate C also has a series of apertures through which the pipes F, F′, and F², having valves f f' f^2, enter the bell-jar and pass through corresponding apertures in the bottom K of the holder I, with which they communicate, and these pipes may be constructed of any suitable material; but I prefer to construct them of glass throughout, or I may construct them partly of glass and partly with metallic ends E^{10} E^{11} E^{12}, as shown. When the metallic ends are used, they also serve to make electrical connection between the bottom plate C of the bell-jar and the bottom plate d^4 of the receptacle D, electrical connection being also made through the girders d^2. The pipes F, F′, and F² lead from the tanks E, E′, and E², respectively, hereinafter again referred to, and they also connect with the branch pipes F³, F⁴, and F⁵, having valves f^3 f^4 f^5, respectively, and the said pipes join with the auxiliary tanks E^3 E^4 E^5, for a purpose presently explained.

The bottom plate C is apertured to receive a conducting-plug c', to which the positive wire from any suitable source of current-supply joins, and the bell-jar A is insulated from earth by the insulating-feet c^2 or by placing the same on any suitable insulating-mat. (Not shown.)

The tanks E, E′, and E² are adapted to contain liquids of different properties, such as volatile liquids, acids, alkaline liquids, and solutions that contain rare metals, rare earths, earth salts, metals of the ruthenium osmium class, such as ruthenium osmium, titanium, uranium, and tungsten or their compounds. Again, one or more of these tanks may contain in solution or suspension suitable nitrates, sulfates, or oxalates or chlorin compounds dissolved in any suitable solvent. In lieu of solutions I may use naphtha or gasolene, &c. I desire it understood that my apparatus permits of the use of gaseous electrolytes as well as solvents and carbonaceous liquids in the same apparatus and either or all to act as electrolytes for electrolytic deposition, under proper provision causing the prospective filament to act as one of two electrodes, (cathode,) hereinafter more fully explained. The composition of the solutions used depends upon the particular function desired to obtain, and I do not desire, therefore, to limit myself to the exact compositions or liquids or gases as herein enumerated, as any other may be used if found to be suitable. One or more of the tanks are adapted to contain water or other washing or cleaning liquid, be it in the nature of pure chemical substance, as water, or in the nature of suitable cleaning material dissolved in any suitable solvent. Again, these vessels are not only containing vessels, but they may be used to regenerate the solutions after the solutions have been used by placing in the tanks or vessels suitable soluble material of the required chemical compositions and other vessels for producing gaseous matter only to be used in connection with my apparatus.

In the modified form of my invention shown in Fig. 4 the prospective glowers are passed hermetically, preferably by means of beeswax, through apertures in the bottom K and may have their ends freshly clipped off after passing through the apertures. When this form of my invention is used, the electrical connection is made between the top plate G and the bottom K of the holder I by the rod g and its plug i.

The auxiliary tanks E^3 E' E^5 may contain fluids corresponding to those in the tanks E′ E², so that when the solution in one of the pair of tanks gives out the said tank may be disconnected and refilled with solution and regenerating material without stopping the operation of the apparatus, or I may use the said auxiliary tanks for containing volatile or gaseous carbonaceous matter, such as naphtha or gasolene, to be used in connection with my process.

Although the position of the supply and regenerating vessels is shown as being below the main apparatus, yet they may be placed on a level with the vessel I or either partly or entirely above or below such level.

I may now describe the operation of my invention as applied to a fillet or core of organic natural origin as an illustration of the entire operation also applicable to other linear bodies of artificial make and of inorganic matter. I take a suitable "working base" L, which may be a fillet of any suitable substance—such as cellulose, bamboo twick, carbon, or other organic or hydrocarbon material, which as such possesses porosity and continuous longitudinal channels, or both—viz., threads or fillets L—and insert directly or indirectly this base in the bottom K of the holder L, as shown. For convenience of description I shall describe my invention as operating to produce an illuminant in which a bamboo twick serves as the "base" to operate upon. After one or more twicks have been placed in the holder the same is placed in the receptacle D and the top G is bolted on, all valves being then closed and the rod g, with its plug i, out of contact with the bottom K, so as to open up communication between the holder I and the receptacle D. I then open the cock in the pipe B and exhaust the bell-jar, after which the cock in pipe B is closed. By thus creating a vacuum in the bell-jar all air is sucked out of the pores or channels of the twick. I next open

up communication with the tank containing sulfuric acid (H_2SO_4)—say tank E—by opening the valve *f*, the vacuum in the bell-jar causing the contents of the tank E to enter the receptacle D and holder I, and when the desired quantity of acid has flown into the receptacles D and I, I again close valve *f* and permit the acid to act upon the twick and be absorbed by the pores and channels thereof until the twick has been carbonized to the desired degree. After the carbonization has gone as far as desired I again open valve *f* and also open valve g^{10} to admit air to the bell-jar, which will then cause the acid to recede into tank E. As soon as the acid has receded I again close both valves *f* and g^{10}. I next again exhaust the bell-jar as before and permit the twick to remain as it now is until it becomes thoroughly dried by reason of such vacuum. As soon as the twick is dried I open the valve *f'* in the pipe connection with the tank (say tank E') containing the washing liquid, (say water,) and thus permit the water to be sucked into the receptacle D and holder I in the same manner as the acid was admitted. This thoroughly washes the tank and twick and removes all excess of acid. The water is withdrawn into its respective tanks by opening the valves *f'* and g^{10} to permit the entry of air into the evacuated bell-jar to force the water to recede. I then close valves *f'* and g^{10} and again exhaust the bell-jar. (The water may be admitted and withdrawn several times, if desired, until twick and receptacle are thoroughly cleansed.) The twick is permitted to remain *in vacuo* until again dried. I then admit the solution containing soluble matter to be deposited on the twick in its pores from the tank (say tank E^2) containing the same in the same manner as the other liquids were admitted. After the twick has absorbed as much of the solution as it will I then cause the solution to recede by admitting air to the bell-jar, after which the bell-jar is again evacuated and the twick permitted to dry *in vacuo*. I repeat the admission and withdrawal of the depositing solution, as well as the vacuo drying, as often as may be required until the desired mechanical deposition is made and then admit the desired solution for the final deposition by electrolysis. When the electrolysis is to take place, I connect the plugs g^2 and g^3 together to the negative terminal of the current source and permit current to pass from the positive terminal to plate C, to plate d^4, to the solution, through the solution to the twicks, and from said twicks to the connected terminal-plugs g^2 g^3 to cause a deposition or metallic skin or shell to form over the mechanically-deposited substance on the twick. After the required deposition has thus taken place I again cause the electrolyte to recede into the tank and once more exhaust the bell-jar to finally dry the now practically complete filament. After the electrolytic deposition has been made I disconnect plugs g^2 g^3 from each other and also disconnect the positive terminal from plug *c'*. I then connect the positive and negative terminals to the plugs g^3 g^2, respectively, to cause the current to pass serially through the filament or pseudo twick to carbonize any of the uncarbonized twick substance as well as to heat the filaments to incandescence. As the filament is first heated up, a reaction takes place within the same by which the deposited material adjacent the carbon is reduced and either partly or entirely carbureted, while the residual carbon is volatilized. The filaments after being thus treated are complete and ready for mounting in the lamp.

From the foregoing it will be seen that by the use of my apparatus when the bell-jar is exhausted the channels of the bamboo twick will be also evacuated, so that when the liquid or solution is admitted thereto the same will readily fill the channels and pores of the twick and by drying the twick, after which operation the solvent evaporates, depositing its soluble material within the channels and pores of the twicks more readily than can otherwise be performed were the twick-channels not exhausted.

While I have described my apparatus as being capable of use in the manner just explained, yet I desire it also understood that the same can be readily used in the process of flashing—viz., precipitating carbon from a carbonaceous fluid or of producing incandescence that may be tested for efficiency, &c.

It will be seen that by the use of my apparatus the successive steps in the production of the filament can be successfully and alternately performed in a continuous process without the necessity of moving or manipulating the prospective filament in any manner whatsoever.

While I have described the carbonization of the twick as the first step to be performed by the apparatus, yet I desire it understood that this step may be eliminated or postponed until the final treatment of the filament by passing current through them serially to heat the same, as this current passing will be sufficient in most cases to carbonize the twick-base, it not having been previously carbonized. Again, the carbonization may be done at any stage of the process in the same apparatus. Again, by the use of my apparatus the prospective filaments are placed in the holder in the shape they are desired to be in the finished lamp, and as I do not need and particularly desire to prevent handling of the prospective filament it will be readily seen that an even and continuous deposit on the twick will be readily made and that there will be no cracks or interruptions in the filament after completion, such as is often the case in

filaments made in the apparatus now commonly in the art.

By constructing the apparatus as shown and described it will be seen that the top plate G, with its accessories, may be readily removed and consequent access to the holder I and its removal for the purpose of mounting and removing the prospective filament and the finished product, as well as an access to the receptacle D, can be readily had. I also desire it understood that all joints should be hermetically closed to prevent escape or entry of air during the evacuation of the bell-jar. It will be also seen from the foregoing that my apparatus, generally speaking, is used to complete four distinct series of manipulations—first, that of cellulose carbonization by means of sulfuric acid; second, impregnating and coating with solid material by means of solutions; third, electrolytical deposition; fourth, causing chemical reactions to take place within the filament while in the apparatus.

While I have described my apparatus for the sake of convenience of description as being applied for use with a bamboo twick, yet I desire it clearly understood that the apparatus is not limited to such use alone, but may be used with any material to serve as a primary substance to build up the prospective filament from. Again, this apparatus may be used in manufacturing metal and rare-metal-oxid threads or pencils of limited flexibility, as well as those of sufficient flexibility to be wound upon positively and negatively connected mandrels.

From the foregoing description, taken in connection with the accompanying drawings, it is thought that the advantages, construction, and complete operation of my invention will be readily understood by those skilled in the art to which it appertains, and I desire it understood that I do not limit myself to exact construction and arrangement of parts herein disclosed, but I may alter or vary the design in its details, if desired, without departing from the spirit of my invention or the scope of the appended claims.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An apparatus of the class described, comprising a bell-jar, a receptacle mounted in said bell-jar, a holder mounted in said receptacle and insulated therefrom and adapted to hold the prospective filaments, means for exhausting said bell-jar, for the purposes specified.

2. An apparatus of the class described, comprising a bell-jar, a receptacle mounted in said bell-jar, a holder mounted in said receptacle and insulated therefrom and adapted to hold the prospective filaments, means for exhausting said bell-jar, a plurality of tanks having valve-controlled pipe connection with the receptacle for the purposes specified.

3. An apparatus of the class described, comprising a bell-jar, a receptacle mounted in said bell-jar, a holder mounted in said receptacle and insulated therefrom and adapted to hold the prospective filaments, means for exhausting said bell-jar, a plurality of tanks having valve-controlled pipe connection with the receptacle said bell-jar having a conducting top and bottom insulated from each other, and means for electrically connecting said bottom to said receptacle, and said top to said holder, for the purposes specified.

4. In an apparatus for manufacturing filaments from linear or wire-like solids or cores, means for holding said linear bodies or cores, means for alternately admitting liquids to immerse said cores, means for passing electric current from end to end through said bodies, means for passing electric current through such bodies as cathodes, means for air-exhausting from said bell-jar, and means for reducing deposited matter, for the purposes specified.

5. In an apparatus of the class described, comprising in combination with an exhaustible bell-jar, a receptacle mounted within the same, a holder mounted within the receptacle, for the purposes specified.

6. In an apparatus of the class described, comprising in combination with an exhaustible bell-jar, a receptacle mounted within the same, a holder mounted within the receptacle, means for evacuating said bell-jar, and means for admitting liquid to said receptacle and holder, for the purposes specified.

7. In an apparatus of the class described, comprising in combination with an exhaustible bell-jar, a receptacle mounted within the same, a holder mounted within the receptacle, means for evacuating said bell-jar, and means for admitting liquid to said receptacle, and means for again expelling said liquids from said receptacle and holder, for the purposes specified.

8. In an apparatus of the class described, comprising in combination with an exhaustible bell-jar, a receptacle mounted within the same, a prospective filament mounted within the receptacle, means for evacuating said bell-jar, and means for admitting liquid to said receptacle, means for again expelling said liquids from said receptacle and holder, and means for passing electric current through said liquid to cause electrolytic deposition on said prospective filament, for the purposes specified.

9. In an apparatus of the class described, comprising in combination with an exhaustible bell-jar, a receptacle mounted within the same, a prospective filament mounted within the receptacle, means for evacuating said bell-jar, and means for admitting liquid to said

receptacle, means for again expelling said liquids from said receptacle and holder, and means for passing electric current through said liquid to cause electrolytic deposition on said prospective filament, and means for causing a current to pass through said prospective filament serially, for the purposes specified.

10. In an apparatus of the class described, a bell-jar having a non-conducting wall, a conducting top and bottom, means for detachably connecting said top and bottom to said wall, for the purposes specified.

11. In an apparatus of the class described, a bell-jar having a non-conducting wall, a conducting top and bottom, means for detachably connecting said top and bottom to said wall, a receptacle having a non-conducting wall and a conducting-bottom mounted within the bell-jar, and in electrical connection with the bottom thereof, for the purposes specified.

12. In an apparatus of the class described, a bell-jar having non-conducting wall, a conducting top and bottom, means for detachably connecting said top and bottom to said wall, a receptacle having a non-conducting wall and a conducting-bottom mounted within the bell-jar, and in electrical connection with the bottom thereof, a plurality of tanks connected with said receptacle and adapted to contain liquid, means for sucking said liquids alternately into said receptacle, for the purposes specified.

13. In an apparatus of the character described, a bell-jar having a non-conducting wall, a conducting top and bottom, means for detachably connecting said top and bottom to said wall, a receptacle having a non-conducting wall and a conducting-bottom mounted within the bell-jar, and in electrical connection with said receptacle and adapted to contain liquid, means for alternately admitting said liquid into said receptacle and for withdrawing said liquid out of said receptacle, for the purposes specified.

14. In an apparatus of the class described, a bell-jar, having transparent non-conducting wall and conducting top and bottom plates detachably joined therewith, a receptacle having a bottom and a transparent wall mounted within said bell-jar and electrically connected with said bell-jar bottom plate, a plurality of liquid containing and generating tanks, valved pipe connections between said tanks and the interior of the said receptacle, a holder having a transparent wall and a conducting-bottom mounted in and insulated from said receptacle, said holder adapted to receive the prospective filaments, means for electrically connecting said bell-jar top plate to said holder-bottom, means for electrically connecting said top plate with one end of said prospective filament, and a terminal mounted on and insulated from the top plate and in electrical connection with the other end of the filament, for the purposes specified.

15. In an apparatus of the class described, a bell-jar, having transparent non-conducting wall and conducting top and bottom plates detachably joined therewith, a receptacle having a bottom and a transparent wall mounted within said bell-jar and electrically connected with said bell-jar bottom plate, a plurality of liquid containing and generating tanks, valved pipe connections between said tanks and the interior of the said receptacle, a holder having a transparent wall and a conducting-bottom mounted in and insulated from said receptacle, said holder adapted to receive the prospective filaments, means for electrically connecting said bell-jar top plate to said holder-bottom, means for electrically connecting said top plate with one end of said prospective filaments, and a terminal mounted on and insulated from the top plate and in electrical connection with the other end of the filament, means for evacuating said bell-jar, for the purposes specified.

16. In an apparatus of the class described, a bell-jar, having transparent non-conducting wall and conducting top and bottom plates detachably joined therewith, a receptacle having a bottom and a transparent wall mounted within said bell-jar and electrically connected with said bell-jar bottom plate, a plurality of liquid containing and generating tanks, valved pipe connections between said tanks and the interior of the said receptacle, a holder having a transparent wall and a conducting-bottom mounted in and insulated from said receptacle, said holder adapted to receive the prospective filaments, means for electrically connecting said bell-jar top plate to said holder-bottom, means for electrically connecting said top plate with one end of said prospective filaments, and a terminal mounted on and insulated from the top plate and in electrical connection with the other end of the filament, and means for sucking the liquids from the tanks at will into the receptacle and holder, for the purposes specified.

17. In an apparatus of the class described, a bell-jar, having transparent non-conducting wall and conducting top and bottom plates detachably joined therewith, a receptacle having a bottom and a transparent wall mounted within said bell-jar and electrically connected with said bell-jar bottom plate, a plurality of liquid containing and generating tanks, valved pipe connections between said tanks and the interior of the said receptacle, a holder having a transparent wall and a conducting-bottom mounted in and insulated from said receptacle, said holder adapted to receive the prospective filaments, means for electrically connecting said bell-jar top plate to said holder-bottom, means for electrically connecting said top plate with one end of said prospective filaments, and a terminal mounted on and insulated from the top plate and in electrical connection with the other end of the filament,

and means for sucking the liquids from the tanks at will into the receptacle and holder, means for expelling said liquids from the holder and receptacle into their respective tanks, at will, for the purposes specified.

18. In an apparatus of the class described, a bell-jar, having transparent non-conducting wall and conducting top and bottom plates detachably joined therewith, a receptacle, having a bottom and a transparent wall mounted within said bell-jar and electrically connected with said bell-jar bottom plates, a plurality of liquid containing and generating tanks, valved pipe connections between said tanks and the interior of the said receptacle, a holder having a transparent wall and a conducting-bottom mounted in and insulated from said receptacle, said holder being adapted to receive the prospective filaments, means for electrically connecting said bell-jar top plate to said holder-bottom, means for electrically connecting said top plate with one end of said prospective filaments, and a terminal mounted on and insulated from the top plate and in electrical connection with the other end of the filament, and means for sucking the liquids from the tanks at will into the receptacle and holder, means for expelling said liquids from the holder and receptacle into their respective tanks, at will, and means for drying said prospective filament while within the apparatus, and means for causing said filament to incandesce, for the purposes specified.

19. The combination with an electrolytic-plating apparatus of an air-exhausting apparatus including a bell-jar for inclosing said plating apparatus, means for admitting an electrolyte to and means for withdrawing the electrolyte from, the bell-jar, for the purposes specified.

20. In an apparatus for manufacturing filaments from bamboo twick and the like, means for holding said twick, means for admitting liquids to immerse said twick, means for withdrawing said liquids, means for creating a vacuum around said twick, means for electrolytically depositing matter on said twick, and means for reducing said deposited matter, for the purposes specified.

21. In an apparatus for manufacturing filaments from organic cores and the like, means for holding said cores, means for admitting liquids to immerse said cores, means for withdrawing said liquids, means for creating a vacuum around said cores, means for electrolytically depositing matter on said core, and means for reducing such deposited matter, for the purposes specified.

22. In an apparatus of the class described, a bell-jar having a non-conducting wall, a conducting top and bottom, means for detachably connecting said top and bottom to said wall, a receptacle having a non-conducting wall and a conducting-bottom mounted within the bell-jar, and in electrical connection with said receptacle and adapted to contain liquid, means for sucking said liquids alternately into said receptacle, means for alternately forcing said liquids out of said receptacle back into their respective tanks, for the purposes specified.

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