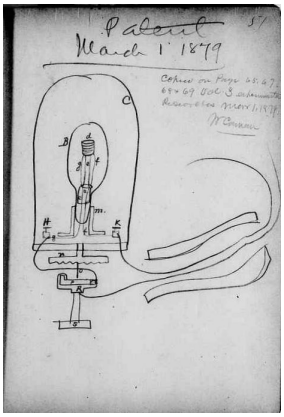
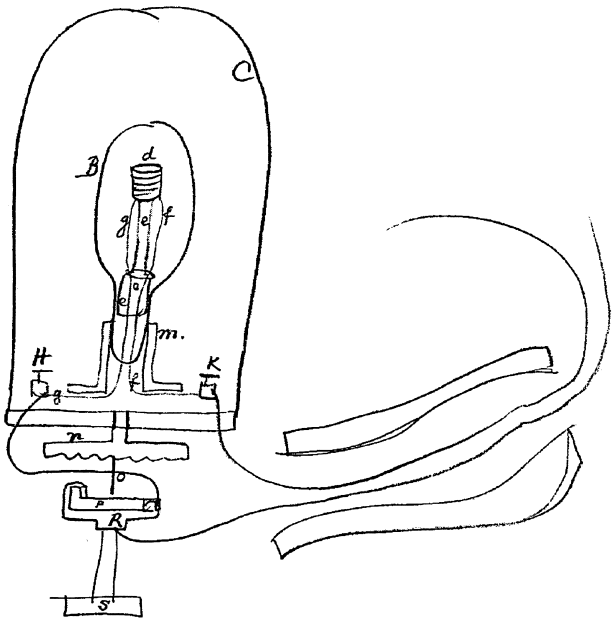
[Menlo Park,] March 1 1879

Draft Patent Application: Electric Lighting



Patent[1]



The object of this invention is devise an ~~practical~~ electric lamp which shall admit of being worked in great numbers on one electric circuit

The invention consists in ~~sea~~ placeding in a recepitable ~~of gl~~ made entirely of glass a bobbin of pyro insulated wire which is to be brought to incandescence by the passage of the current through it

The invention further consists in ~~caus~~ making a vacuum in such receptiable while the conductor is ~~h~~gradually heated.

The invention further consists in the use of salt[a] of lime, magnesia zircon, cerium erbia ~~or other~~ for coating the wire which salt is decomposible by heat. The salts which are easily[a] decomposed are the acetates of these metals[2]

The invention further consists of a vacuum receptable made entirely of glass and sealed by melting the same in combination with an incandescent continuous[b] conductor, pyro insulated

The invention further consists in winding ~~bobb~~ pyroinsulated wire upon a bobbin of ~~an~~a compressed[b] infusible substance such as lime.

The invention further consists in placing the vacuum bulb within another glass receptable also closed from the air and

employing the expansion of the air between the two receptables due to the heat of the incandescent bobbin, to produce[a] a movement which shall disconnect the lamp from the electric circuit when its temperature is too great.

B is the vacuum bulb This bulb is opened at the smaller end and the burner d inserted and placed in connection with a mercury vacuum pump. The platina wires g & f passing through The opening are connected with a battery and variable resistance coil, while the vacuum is being made the heat of the bobbin d is ~~gradually~~ in the course of 1 hour brought ~~from~~ gradually from the temperature of the air upon to ~~brill~~ vivid incandescence when the vacuum is considered practically perfect the ~~tube~~ open end of the tube is melted & sealed the platina wires ~~being at these~~ passing through the glass are also sealed— Thus I am enabled to obtain a nearly perfect vacuum[a] which is permanent and at the same time give the platinum wire a new and unknown property of great value in electric lighting which is that a platina wire which melts in the open air at a point where it emits a light equal to[c] four candles will when operated upon as described emit ~~25~~ a light equal to 25 candles without fusion. The reason why the melting point of the metal is thus raised is that in the act of making the vacuum with the metal under heat all the gases which are contained in its pores is withdrawn, and when the receptable is sealed cannot reenter when cold hence unequal ~~exp~~ & sudden expansions cannot take place and the wire is never cracked but if left uncovered becomes as bright as the most polished silver, an appearance which cannot be given it in any other way— on the other hand ~~pt~~ it is known that the metals of the platinum group have in a surprising degree[d] the peculiar power of absorbing within their pores many volumes of gas, and it is th~~is~~e sudden expansion of this gas upon a sudden accession of heat that disrupts the wire & produces cracks which extend nearly to its centre when the wire is brought to a moderate incandescence in the open air ~~where the gas~~ These cracks ~~pcause~~ set up[e] a great resistance to the passage of the current and at[a] these points become abnormally heated hence the platina wire easily melts, whereas no such cracks are noticed when the wire has been operated upon in the vacuum & all its gases pumped out— e is a cylinder of ~~l~~Lime with a small ~~bob~~ spool ~~on~~ its extremity on which the wire is coiled about 30 feet of platinum iridium wire coated with ~~li~~Magnesia oxide is coiled upon the spool[3] The ~~size of~~[a] wire may be of any size but I prefer to use wire[b] .005 of an inch diameter which will give a resistance when in-

candescence of about 750 ohms— by the use of such high resistant lamps I am enabled to place a great number in multiple arc without bringing the total resistance of all the lamps ~~too lo~~ to such a low point as to require a large main conductor but on the contrary am enabled to use a main conductor of very moderate dimensions— ~~No loss in economy occurs in having~~ another important point is gained by the use of lamps of high resistance as the resistance of the wires leading from the main conductors may be of very moderate dimensions hence can be placed in the pipes already used for gas & at the same time effect a great saving in the cost of wire—

Still another point gained is that the high resistance of the lamps allows all to be placed in multiple arc which is the only method where the maximum economy is attainable as the lamp when connected to the circuit draws from the central station just sufficient current to maintain it at the proper temperature and if by accident of want of regularity in the main current the ~~temperature~~ strength of the current should increase abnormally the access of heat sets the thermal regulator in motion & disconnects the lamp entirely from the circuit, thus stopping all further consumption of energy until the temperature of the lamp is reduced to its normal conditions. I will state that these changes are not perceptable to the eye hence the lamp cannot consume ~~only su~~ any more energy than that required to ~~keep it~~ cause it to emit a certain light

No loss in economy occurs by using[a] so large a resistance because the loss of ~~h~~energy is proportionate to the radiating[a] surface exposed to the air & its temperature and is independent of the resistance of the wire forming[f] such surface— m is a lime cup into which the small end of the vacuum burner is held the platina wires pass under it to the binding posts H. K. n is the thermal regulator operated by the expansion of the air ~~and has already be~~ when the temperature of the air between the bulbs becomes too great the diaphragm bulges outwarded & the point .o. seperates the spring p from R & disconnects the lamp from the circuit where it remains until the temperature is reduced to the normal condition. The spark upon the point is very small as I employ ~~contain~~ constant field magnets at the central station hence the powerful sparks due to the secondary circuit set up by the weaking of the powerful field magnet is avoided

I will mention that the second globe C might be made entirely of glass and the aneroid diaphragm provided with a platina tube be sealed in the glass or the aneroid itself[a] be made

of glass ~~of a th~~ I also state that the globe C may be be opened an a light bulb placed between the two other ~~which this bulb~~ the tube from this bulb passing down through the [–][g] base of the instrument has a sealed expanding chamber or coil attached to it—

Claim—[4]

1st In combination with a vacuum chamber made entirely of glass of a~~n~~ continuous incandescent metallic[b] conductor ~~se~~and sealed as set forth.

2nd The method herein described of freeing[a] metallic conductors of their gases in a vacuum & afterwards sealing the same

3rd ~~A coil~~ In combination with a ~~sele~~ sealed vacuum of a bobbin of pyroinsulated wire wound upon an infusible substance.

4 The combination of a vacuum bulb containing a continuous conductor within a second closed chamber for the purpose set forth

5th— The use of a ~~decomposible~~ salt of an~~y~~ metal whose oxide is not readily ~~infus~~ fusible & which salt is decomposed by heat.

6th— The combination of the sealed conductor .d bulb .B. chamber .c. regulator n. o p. r all arranged & operated substantially as set forth

T A Edison

ADfS, NjWOE, Lab., N-79-02-24.2:51 (*TAEM* 31:1018; *TAED* N031:26). Document multiply dated. [a]Obscured overwritten text. [b]Interlined above. [c]"equal to" interlined above. [d]"in a surprising degree" interlined above. [e]"set up" interlined above. [f]"the wire forming" interlined above. [g]Canceled.

1. Edison wrote this draft the same day that the Patent Office model of Edison's "New Electric lamp" was completed (see Doc. 1688 n. 1) and William Carman then copied it onto pages 65–69 of the missing Experimental Researches Volume 3. The beginning of the application was altered before Edison executed it on 12 April 1879 (see note 2) and additional changes were required by the Patent Office before it issued on 4 May 1880 as U.S. Pat. 227,229 (see note 4). The provisional specification for Edison's British Patent 2402 (1879), which was filed on 17 June, also included the basic elements of this patent, with the final specification having similar claims (Cat. 1321, Batchelor, *TAEM* 92:118; *TAED* MBP017).

2. In the filed U.S. application Edison replaced all of the paragraphs to this point with the following two introductory paragraphs:

> When Platina and other metals that fuse at a high temperature are exposed to high heat and then cooled in the atmosphere they are

injured so that they are not well adapted to use in electric lights for a long period of time.

I enclose the conductor that forms the electric candle in a transparent case, and heat the same gradually to expell any gases from the material of the candle. I form a vacuum in the transparent case, and then seal the same hermetically so that all injurious atmospheric influences are avoided. [Pat. App. 227,229]

3. Edison later instructed Lemuel Serrell regarding the "patent & model sent you in lamp with globe within a globe" to add the sentence, "Chemically pure iron cobalt or nickel drawn in wires may take the place of platinum where the light is not required to be intense, as these metals where perfectly pure can be freed from gas as described & be brought to vivid incandescence." However, this sentence was not included in Edison's 12 April application. TAE to Serrell, 10 Mar. 1879, Lbk. 4:207 (*TAEM* 80:57; *TAED* LB004207).

4. The Patent Office examiner objected to the first three claims, which Edison then amended. After further objections to the revised second claim, Edison provided another more acceptable claim. At some point the fifth claim was erased and the sixth renumbered accordingly. He also added three paragraphs at the end of the specification to further distinguish between the invention embodied in this patent and the prior art, including a statement that he did not claim a lamp formed of pyro-insulated metal, which was the subject of a previous application (Case 166) that he subsequently abandoned (see *TAEB* 4:755 n. 1). See application and correspondence in Pat. App. 227,229.