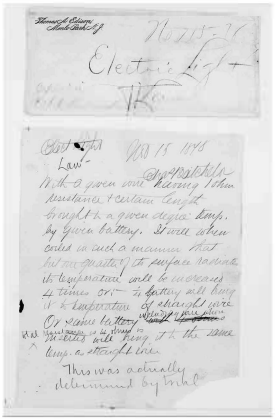
[Menlo Park,] Nov 15—78

Technical Note: Electric Lighting



Elect Light[a] Law—[1]

With a given wire having 1 ohm resistance & certain length brought to a given degree temp. by given battery. It will when coiled in such a manner that but one quarter of its surface radiates its temperature will be increased 4 times or:—¼ gbattery will bring it to temperature of straight wire Or same battery ~~with 4 ohms~~ including wire whose total resistance is 4 ohms is[b] inserted will bring it to the same temp. as straight wire[c]

This was actually determined by trial

The amount of heat lost by a body is in proportion to the radiating surface of that body. If one square inch of platina be heated to 100 deg it will ~~lose its~~ fall to say zero in one second whereas if it was at 200 deg it would require 2 second

Hence in the case of incandescent conductors if the rading surface be 12 inches and the temperature on each inch be 100 or 1200 for all if it is so coiled or arranged that there[d] is but ¼ or 3 inches of radiating surface then the temperature on each inch will be 400. & if reduced to ¾ of an inch it will have on that ¾ 1600 deg fahr notwithstanding the original total[e]

amount was but 12 because the radiation has been reduced to ¾ or 75 units ~~have~~ hence the effect of the lessening of the radiation is to raise the temperature of each remaining inch not radiating to 125 deg=

if the radiating surface was reduced to 3/32 of an inch the temperature would reach 6400 deg fahr ~~since of course~~ to carry out to the best advantage this law in regard to platina etc then with a given length of wire to quadruple the heat ~~and le~~ we must lessen the radiating surface to[c] ¼ & to do this in a spiral ¾ must be within the spiral & ¼ outside for radiating= hence a square wire or other means such as a spiral within a spiral must be used.

These results account for the enormous temperature of the Electric arc with one horse power as for instance if 1 hp will heat a ~~foot~~ 12 inches[f] of wire to 1000 deg fahr.[d] & this concentrated to have ¼ of the radiating surface it would reach a temperature of 4000 deg or sufficient to melt it but supposing it infusible the further concentration to ⅛ its surface ~~or ¾ of an inch~~ it would reach a temperature of 16 000 & to 1/32 its surface which would be about the radiating surface of the Electric arc it would reach 64 000 deg fahr, of course when light it radiated in great quantities [—][g] not quite these temperatures would be reached—

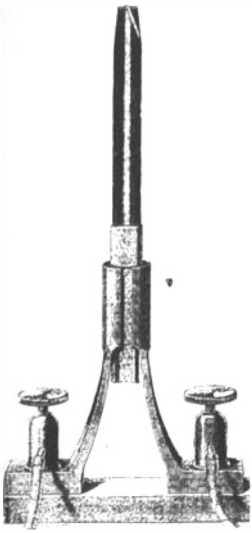
~~from this~~

Another curious law is this ~~in the If~~ it will require a greater initial battery to bring an iron wire of the same size and resistance to a given temperature than it will a platinum wire, in proportion to their specific heats, and in the case of Carbon if a peice of Carbon 3 inches long ⅛[d] diameter with a resistance of 1 ohm, it will require [~~unif an~~?][g] a greater battery power to bring it to a given temperature than it would a cylinder of thin platina foil of the same length diameter & resistance because the specific heat of Carbon is many times greater, besides If I am not mistaken the radiation of a roughened body for heat is greater than a polished one ~~wh~~ like platina which may be polished.

A gas jet equals a Jobhlkoff Candle when concentrated in the same space=

A gas jet has—

10[d] square inches ~~in a gas jet~~ radiating surface—[h]		15 candle p.
if reduced to 52½	"	60
~~662~~ .62	"	240.
~~0.31~~ .15,	"	960.



A Jablochkoff "candle," of two carbon rods with kaolin between, and holder.

The latter radiating surface is about equal to the radiating surface of the arc of a Jobelkoff Candle, hence an ordinary gas jet if concentrated to the size of the Jobelkorf arc would give the same light, or in other words the same power which gives a gas jet of 15 candle power will give 1000 by concentration.[2]

If the radiating power or time of a substance is decreasinged= the gain in light is directly to the decrease for instance if I could with platina coils obtain 4 burners of 15 c.p. each per hpower then by reducing the radiating[e] power 50[d] per cent. I would obtain 8 burners—

Chas Batchelor

X, NjWOE, Lab., NS-78-005 (*TAEM* 7:844). [a]"Elect Light" written by Batchelor. [b]"including . . . ohms is" interlined above. [c]Paragraph written by Batchelor. [d]Obscured overwritten letters. [e]Interlined above. [f]"12 inches" interlined above. [g]Canceled. [h]"radiating surface—" interlined above.

1. Edison copied into this Cat. 994:205–7, Lab. (*TAEM* 3:272–73). Calculations and notes that appear to be related to the development of Edison's "law" are in Vol. 16:223, 225–26, 231, 261–69, Lab. (*TAEM* 4:664, 666–67, 672, 700–8).

2. In a note dated 2 November Edison also treated the Jablochkoff candle as equivalent to sixty-six gas burners and his own electric lamp as equivalent to six gas burners. He claimed that his lamp would cost eight cents per ten hours while the Jablockhoff would cost thirty-two cents per ten hours (NS-78-005, Lab. [*TAEM* 7:842]). Cost calculations are also in Vol. 16:268, Lab. (*TAEM* 4:707).