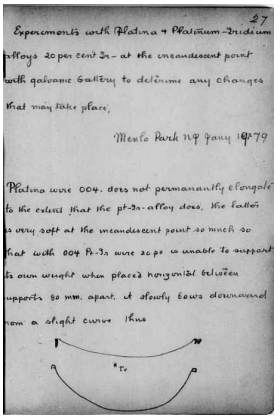
Menlo Park NJ Jany 1~~8~~9=79

Notebook Entry: Electric Lighting[1]


27
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Menlo Park NJ Jany 1879
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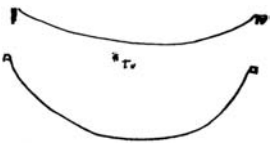
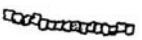


It [--][a] has[b] not anything like the strength of platinum when[c] at the same temperature=

When the Pt-Ir wire is allowed to remain incandescent for 30 minutes a remarkable change is effected It stre~~a~~tches, grows smaller in diameter ie[d] from 004 to 003. & breaks upon examination under the microscope it has this appearance



Platina wire thus

If the platina wire is only brought to incandescence for say 2 minutes it shews these cracks they first are <u>not open</u> but just as if a "mole" had been burrowing around the wire. after a longer time these break & sharp edged cracks make their appearance.[e]

when the platinum wire is fused after being cracked the piece upon the end when it does not break off short has this appearance;[4]

Just before Pt or Pt-Ir wire fuses between the supports it contracts violently and the cause is apparant when we place it under the microscope. it has drawn up into globules if it breaks quickly the globular tendency is just perceptible but if it contract considerable before breaking these globules a[re] plain

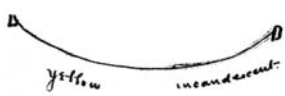
To ascertain loss of weight we placed 005 Pt wire in supports weight 0.0296 ~~m~~. g.ramme in 5 minutes we raised heat so it fused upon weighing the whole it was 0.0293. g showing loss .0003. .gramme.

Another piece weighed 0.0266. after being incandescent for 20 minutes it weighed 0.0265, shewing loss of .0001 .g. at this rate it would all be dissipated in 122 hours, but organic matter may account for some of this loss.

The same piece was then made incandescent for 20 more minutes and weighed 0.0262 gramme shewing a further loss of weight of 0.0003. or a total loss of .0004. gramme after 10 minutes more we again weigh it and find weight to be 0.0260 shewing a further loss of weight of 0.0002^{c} or a total of 0.0006. gramme.

After 20 minutes more we again weigh it and find its weight to be 0.0258 shewing a further loss of 0.0002^{c} or a total of 0.0008. gramme.

Yesterday I noticed a peculiar phenomenon when the platinum of 004 wire was placed between the supports 80 mm apart and brought to incandescence for 1 hour a portion only was incandescent after the lapse of that time thus



with large Eaton spectroscope[5] no lines were visible, but perhaps if larger wire were used lines could be seen— It is barely possible that the platinum is contaminated with Osmium, Ruthinum, Rhodium or other more oxidizable metal of the platinum group= or that there is an immense amount of oxygen condensed in the platinum which is driven out by the heat.

I think that I smell ozone coming from the incandescent wire, at least the smell is peculiar.

Another hypothesis is that chloride of sodium in the air combines with the Pt to form a volitile Pt chloride.

I find that the 001 wire made (Pt) by Johnson Mathay & Co London[6] melts in the ordinary gas jet—under the microscope it shews all broken up in short lengths and clearly fused at these breaks a piece of wire held in the flame bends with a[c] jerk thus

with wire 002 made from Raynors[7] pt. it fuses readily but these short breaks are not so perceptible as in JM & Co wire. all the breaks are smooth thus

whereas JM wire

with Raynors of 010 Pt. after being incandescent 5 minutes on battery, shewed fine cracks just commencing but the sections bounded by the cracks were very much smaller than J.M. & Co small 004 wire.

I now put in 010. 10 p.c. Pt Ir—JM & Co wire.—taken out and experiments resumed with the peice which we have repeatedly weighed—

I notice that these peice does not drop or bow downwards nearly as much as it did when first put in— There is just 70 mm of this wire, after 3 minutes I notice it commences to drop considerable—[e]

With platina wire I notice that the heating always commences exactly in the middle of the wire and reaches towards[c] the two supports simultaneously but the action is not so rapid but that the eye can easily trace it.

JM & Cos 005 platina if held in gas flame for 30 seconds shews cracks under microscope; also little round raised drops as if gas were underneath but tension was insufficient to burst the bubble.[e]

heated air can be seen rising from 70 mm of 004 wire 2 feet over it—

The 0.0266 wire after be subjected again to incandescence for 20 minutes weighs—0.0252. shewing a loss since last weighing of 0.0006[c] or a total of ~~0.0014~~ .0014.[c]

It is again made incandescent for 20 minutes & weight found to be 0.0249, shewing loss of 0.0003[c] or total of 0.0017— The wire fused.

we now take ½ of this fused wire which weighs 0.0132 gramme and subject it to incandescence; again for ~~+~~60 minutes continuously—

note— I notice the wire although growing smaller keeps perfectly bright= [f]

the loss in 60 minutes 0.0130 or .0002.[c] This loss is not very great but may be due to the fact that I put a book up on one side of the wire within ¼ inch of it to shield it from air drafts which cooling it in spots raises the temperature of the rests of the wire by reducing resistance & this tends or sometimes causes fusion

we again put the wire to the incandescent point for. 20 minutes. note I did not suceed in fusing the 001 wire in flame from burning paper though it became incandescent.[g] It weighed afterwards .0129, shewing loss of .0001 after 20 more minutes of incandescence it weighs. 0.0129, shewing no loss The scale (Beckers best)[8] does not work as sensitive as it should be. We again put it to the incandescent point, for 20 minutes and I take the book down to allow draughts of air to strike the platinum as it is not highly incandescent, and if the action is due to oxygen this will hasten it. we weigh & find no loss—[h]

we again bring it to the incandescent point, slightly higher than before for 20 minutes— we weigh and find no loss I now at 7 oclock pm bring it to incandescence to be left all night.

X, NjWOE, Lab., N-79-01-19:27 (*TAEM* 31:134; *TAED* No23:13). [a]Canceled. [b]Interlined above. [c]Obscured overwritten text. [d]Circled. [e]Followed by dividing mark. [f]"note . . . bright" inserted between dividing marks. [g]"note . . . incandescent" inserted between dividing marks and enclosed by left bracket. [h]Multiply underlined.

1. This entry is continued in Doc. 1666.

2. On 3 January, Edison had conducted a short series of experiments and recorded the visible changes made by heat in 20 % platinum-iridium wire. He noted that it softened enough when incandescent to sag under its own weight and become permanently elongated. He also saw that if the wire were drawn tight again while incandescent it would, "after a moment of quiet commence to vibrate like a tuned string reaching a vibration of ⅛ of an inch apparent, & then it sags by this effort owing to elongation The effect of this vibration is also to cool the wire producing contraction, a blue light appears in the centre of the neutral point of vibration" (N-78-12-31:45, Lab. [*TAEM* 30:398; *TAED* No14:22]). Immediately preceding Edison's 3 January entry are several pages of notes by Francis Upton, dated the same day, on the number of battery cells required to bring platinum-iridium wire ("stretched between two small

vices") to increasing intensities of light, and the resistance of the wires at each stage. Upton continued these tests for the next two days, and on 14 January Charles Batchelor prepared tables summarizing the changes in resistance and appearance of platinum and 10% and 20% platinum-iridium alloy wires as increasing numbers of Condit & Hanson battery cells were applied. N-78-12-31:30–44, 48–78; N-78-12-20.1:86–106; Unbound Notes and Drawings (1879); all Lab. (*TAEM* 30:391–98, 400–415, 158–68; 44:977–80; *TAED* No14:15–22, 24–39; No12:44–54, NS79:5–8).

3. On 9 January, Batchelor made several drawings of an "Experimental Inst for heating effects in wires," a device for holding and stretching long wire segments; Edison's undated drawing of a similar apparatus is in N-78-12-15.1:111, Lab. (*TAEM* 29:998; *TAED* No09:58). Batchelor also roughly sketched what appears to be a concave reflector intended for "concentration of heat." N-78-12-15.1:121–23, Lab. (*TAEM* 29:1003–4; *TAED* No09:63–64).

4. Text is "smooth."

5. Asahel Eaton was a Brooklyn chemist and manufacturer of spectroscopes and other optical instruments. Edison had acquired a spectroscope in 1875, but it is not known whether this is the Eaton instrument he refers to here. *TAEMG2,* s.v., "Eaton, Asahel K"; *TAEB* 2:427 n. 2.

6. Johnson Matthey & Co. was a London company that refined precious metals and manufactured various platinum devices. Edison had ordered a considerable quantity of platinum and platinum alloy wires and sheets from the firm in November 1878, and some of the material had reached Menlo Park by this time. See *TAEB* 4:762 n. 5.

7. Hiram Raynor was a New York platinum dealer and supplier of wire and other laboratory apparatus. Letterhead, Raynor to TAE, 21 Mar. 1878, DF (*TAEM* 17:394; *TAED* D7811H); Wilson 1879, 1196.

8. Christian Becker, a noted Dutch manufacturer of precision balances at mid-century, established Becker & Sons in New York. Turner 1983, 65, 251; Wilson 1879, 89.