The Papers of Thomas A. Edison

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Edison had firmly established himself in New York by the summer of 1881. From there he oversaw development of a large exhibit for the Exposition Internationale de l’Électricité in Paris; arrangements for electric lighting in Europe and Great Britain; and preparations for his most prized goal, an electric light and power system in Manhattan.

Edison entrusted Charles Batchelor with the day-to-day responsibilities of putting together his Paris exhibit. Many of the planned items represented technologies in which he was no longer actively involved (like the telegraph, telephone, and phonograph) or those such as incandescent lamps and small generators, which he no longer considered experimental. The large dynamo, a prototype of what Edison planned for the New York central station, was a different matter and required his personal attention.

This dynamo, built by the Edison Machine Works, was the largest in the world. It was constructed according to the design of an experimental machine made at Menlo Park early in the year, and Edison believed it would operate about 800 lamps. When he tested it in June and July, however, he found several serious faults. It ran too hot, was prone to arcing in the armature, produced low voltage, and sparked badly at the commutator. The last problem, he later admitted, made him fear he could not take off the heavy current the machine could generate. However, solutions to the sparking and low voltage were relatively straightforward. After a series of experiments on the Paris dynamo and two smaller ones to find the causes of heating and arcing, he ordered the massive armature to be rebuilt entirely. This required more than a week of day-and-night
labor that even Edison called “a terrible job.” When finished, the machine performed to his expectations. He also gained from the experience a more thorough understanding of the electrical characteristics of his dynamos, which enabled him to improve the design of his smaller ones as well.

Edison took a number of significant steps in August and September toward developing the electric lighting business in foreign countries. Contrary to his usual reluctance to take legal action in defense of his patents, he instructed his representatives to seek an injunction in a French court against Hiram Maxim’s incandescent electric lights at the Exposition. This was done successfully, and Edison next wanted to pursue Joseph Swan, but his advisor Grosvenor Lowrey counseled against it. Edison also urged his agents in Paris and London to cultivate friendly relations with prominent technical writers, with the expectation that they would be paid retainer fees. His exhibit attracted considerable favorable attention, and in late September he declined an invitation to visit Paris. Because Batchelor and others warned that the display made widespread patent infringement likely, Edison was anxious to lay the administrative and financial foundations to manufacture equipment and sell lighting plants on the Continent. Financier Egisto Fabbri and Joshua Bailey presented rival proposals from prospective investors. Fabbri withdrew and Edison negotiated with Bailey, pushing for a large investment in factories. Edison suggested making the financing contingent on successful operation of the large dynamo and the New York central station. He and Bailey reached an accord in October that led in early 1882 to the formation of manufacturing and operating companies for the commercial development of his electric light system in Europe. In the meantime, he began planning for a demonstration central station in England. Charles Clarke started designing a 1,000-lamp dynamo for this plant in mid-August. At the end of September, Edison dispatched Edward Johnson to make arrangements in London. He also urged George Gouraud, his business representative there, to market isolated lighting plants in British colonies and other countries outside Europe and Britain.

Having selected the financial district of lower Manhattan for his first commercial electric system, Edison threw himself into the task of building the network to light its brokerages, banks, offices, and newspaper publishers. He selected two adjoining buildings on Pearl Street, below Fulton Street near the unfinished Brooklyn Bridge, for the generating plant. The
Edison Electric Illuminating Company took title to the properties on 3 August and Edison promptly began outfitting them. On the afternoon of 22 September, a crew a few blocks away at the corner of Peck Slip and South Street began excavating for the underground conductors. Exactly what form those cables would take was still the subject of experiment by John Kruesi. Edison also continued to refine the accuracy and reliability of his consumption meter.

Because Edison did not expect the central station to be ready for almost a year, isolated lighting for individual buildings was an immediate concern. He needed a small standardized dynamo to advance this business. Drawing on his July experiments with the large Paris machine, he and Clarke modified the distinctively tall dynamo developed at Menlo Park, designating the new 60-lamp machine the Z model. The first production unit was installed in September, and dozens followed in the next year.

At the lamp factory, output reached nearly 1,000 lamps per day. This was greater than demand, and Francis Upton contemplated a two week layoff. Planning began on rehabilitating the buildings for the new lamp factory in Harrison, where Edison and Upton hoped to reduce labor expenses and eventually expand production. John Branner, a botanist whom Edison sent to South America in late 1880, continued his search for plant materials suitable for lamp filaments. Upton and his staff continually experimented with ways to decrease the cost of lamps and increase their durability and efficiency. They reported results to Edison, who did not participate directly in experiments at this time but clearly had an active role in the factory’s management. The price of lamps (and later those of dynamos and other necessary equipment) started to cause discord among Edison-related interests, especially the new foreign firms.

The expansion of Edison’s manufacturing capabilities continued to strain his personal finances. Some relief came in mid-July, when he received about $55,000 in partial liquidation of his British telephone interests. The amount disappointed him, and he carried on a running dispute with George Gouraud over the balance he believed was owed. He looked forward to remuneration from the merger of his European telephone interests with those of Alexander Graham Bell and Frederic Gower, although progress from a preliminary to final agreement was slow. Formation of the Oriental Telephone Company to control the patents of Edison and Bell in British colonies...
proceeded even more fitfully because of Edison’s prior disposition of his Hong Kong patent rights.

In other activities, Edison discharged all but a handful of workers at his Menlo Park laboratory in July. Charles Hughes remained and continued to experiment on vacuum preservation of perishable foods. Having finished that work, Hughes made a preliminary survey for a new electric railroad in late August. A few weeks later, financier Henry Villard agreed to underwrite construction of an experimental railroad at Menlo Park.

Samuel Insull continued to play a vital role in Edison’s business, particularly his extensive transatlantic cable and postal correspondence. Insull’s ubiquity in these affairs prompted George Gouraud to ask him to “discriminate between your personal letters and letters written specially at Edison’s request.”

Edison and his family remained at a Fifth Avenue boarding house near his offices. In August he was introduced to famed violinist Eduard Reményi, who proclaimed his company “intellectual heaven” and invited him to several concerts. Mary Edison spent an unknown length of time in Michigan, and in late August, Edison went there to bring her home, returning about 7 September. Nothing more is known about this trip except that it may have coincided with a calamitous wildfire on 4–6 September in the region around Port Huron, where Edison’s father, brother, and other family members lived. The fire burned a million acres in five counties and killed almost 300 people. Edison gave one hundred dollars to a relief fund for survivors.

1. Batchelor’s list of equipment for this exhibit is Doc. 2111.
2. Doc. 2122.
3. TAE to George Gouraud, 25 Sept. 1881, Lbk. 9:141 (TAED LB09141; TAEM 81:50).
5. William Hammer memorandum, 22 Sept. 1881, Ser. 2, Box 23, Folder 1, WJH.
6. Upton to TAE, 6 July 1881, DF (TAED D8123ZCV; TAEM 57:924).
7. Gouraud to Insull, 30 July 1881, DF (TAED D8104ZCE; TAEM 57:172).
9. On Edison’s trip see Doc. 2149. “Major Post-Logging Fires in Michigan: the 1880’s,” Michigan State University, Department of Geography course 333 (http://www.geo.msu.edu/geo333/fires.html);
New York July 1st. 1881.

My Dear Colonel:—

I have written you weekly for some time past, but have not received any note from you as to whether you have got my letters. I presume, however, that they have all arrived and that you will see whether you can find time to write me. When you have a little time to spare I should like a line from you giving me some general information as to how matters progress in England.

Fruit Experiments.

Your letter relating your experience with the chops, and steaks and strawberries came duly to hand. Mr. Edison was really amused by it, and he wished me to say to you that he is highly delighted that the first attempt should not prove successful as it would be really too bad to find that he was working on a thing that any man could make go all right, and that one guarantee against infringers when he does get the thing to work in proper order will be that they will have the same difficulty in getting an efficient process, and will in fact have to go through precisely the same experience as he always expects to have to undergo when experimenting on some new invention. But, of course, the fact that because those chops emitted such an abominable smell will not deter him from continuing his experiments which will no doubt turn out all right eventually. From my previous letters you will have understood that your report as to the condition of what you receive does not surprise him in the slightest degree.

Electric Light.

The plant for England is being pushed ahead as quickly as possible. We have the Porter-Allen engine which is to operate the machinery already in our shop and the dynamo is far on the way to completion, and as Johnson is giving the whole of his time to seeing that this equipment is rushed through you may depend that not a moment will be lost. We had the Paris machine running a few days ago for a short time, and a splendid sight it was to see the thing running. The dynamo is, of course, the largest in the world and will put into the shade every thing that opponents can bring both in the way of econ-
omy and efficiency. Yours will be if anything, better than the Paris machine, inasmuch as Edison will profit by his experience in the manufacture of the Paris machine, and if there should happen to be any slight defects in that they will be rectified so far as the London outfit is concerned. Our lamps are showing a wonderful record. The way in which Mr. Edison arrived at the conclusion that the life of the lamp was from three to four hundred hours is as follows. He would set up a number of sixteen candle lamps at about fifty candle power and run them at this state of incandescence until they played out. Now, of course, this was no fair test as the lamps are only made to run at sixteen candle and to run them at fifty would entirely alter the conditions. The first real test as to how long the lamps would last at sixteen candles is now being made. Up to the present moment they average about seven hundred and thirty hours each. One went out after burning seventy hours. Another went out at one hundred and sixty. Another went out somewhere in the neighborhood of three hundred. The fourth one has just died. The remaining six of the original ten lighted have up to the present been burning nine hundred and ninety hours. How long they will last, of course time alone can prove. The longer they do last, of course, the better is the average life of the lamp, and anyway it would appear that the average life will be considerably above one thousand hours. These ten lamps were just taken out from our ordinary stock and therefore the average will be an absolutely fair one. We are watching this test with very great interest indeed. You will appreciate the very great importance of getting the life of our lamps as long as possible as it must considerably affect the economy of the system. The lamps in this building still hold out. As I have already told you, we lit up on the 24th. of March and not a single lamp has yet given way.

Telephone.

They seem a long time settling up that Edison Telephone Company of London liquidation. If you could send Mr. Edison the proceeds of the sale of his shares it would be of very great advantage to him at this time. What with his lamp factory, machine works, tube company and laboratory he requires a very great deal of money, and if he could collect what is due him on English Telephone right away it would save him some considerable anxiety. I will send forward the release which Renshaw sent us to be signed by Edison and Johnson by next mail. I propose sending it to you as there are a number of
blanks that require to be filled in and we prefer that the release should be in your hands until this is done. Very truly yours,

(Insull)

TL (carbon copy), NjWOE, DF (TAED D8104ZBU; TAEM 57:156).

*Mistyped. **"n” interlined above by hand. ˇCanceled. ˇSecond “l” added by hand. *Handwritten.

1. Gouraud had responded to Doc. 2107 but had not acknowledged Doc. 2112 or Insull’s 17 June letter. Gouraud to Insull, 17 June 1881; Insull to Gouraud, 17 June 1881; both DF (TAED D8104ZBP; D8104ZBQ; TAEM 57:143, 148).

2. Gouraud reported that a lamb chop, a porterhouse steak, and a few strawberries, have come safely to hand— I opened the tubes a few days after their arrival, but the result was anything but satisfactory— The stink emitted from the “Chop” and “Steak” was to such a degree noxious, that I was unable to remain in the room & it was some time before I recovered from its bad effects— The strawberries appeared to be on the point of decomposition & the tube contained a good deal of water. I regret to say that the process, as applied to these instances at least, has proved a complete failure.

[Gouraud to TAE, 15 June 1881, DF (TAED D8104ZBO; TAEM 57:142)]

3. See headnote, Doc. 2122.

4. See Doc. 2117.

5. Alfred George Renshaw of the law firm Renshaw & Renshaw was acting as trustee for Edison’s interest in the defunct Edison Telephone Co. of London (see Doc. 1954). In sending the form to Insull, he explained that the number of shares Edison was to receive in the successor company was still subject to the liquidator’s payment of a few outstanding claims. Insull returned the executed release on 8 July. Renshaw to Insull, 16 June 1881; Insull to Gouraud, 8 July 1881; both DF (TAED D8149W, D8104ZBW; TAEM 59:965, 57:162).

2119

[New York,] July 5th. [1881]

To George Gouraud

My Dear Gouraud:

Referring to your favor of the 15th ult., I have no feeling particularly against Mr. Preece excepted that I think he acted “pretty rough.” In I think the whole matter about that microphone controversy arose from my utter inability to conceive that a man of science could see any difference between the principle of the microphone and the principle of my carbon telephone, which are exactly similar as [I] think Mr. Preece will now admit. I therefore think that at the time I had considerable justification in going for him, but I see that a great many men quite as scientific as he, have made the same mistake and

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could not see that the carbon telephone and the microphone were one and the same thing. Give Mr. Preece any lamps that he may want [?] ordered some time [ago?] sufficient to fill your requirements for such purposes. Very truly, yours,

Thos A Edison [nsull]


1. William Preece was the electrician and assistant chief engineer for the British postal telegraph system. He and Edison enjoyed a cordial relationship until a bitter and public falling out in 1878 over Preece’s role in advancing David Hughes’s claims to the invention of the microphone. See Docs. 1331, 1338, 1346–48, 1366–67, 1370, 1375, 1378, and 1398; Baker 1976, 176–77; Israel 1998, 157–60.

2. Gouraud wrote that “Preece manifests great interest in your light, and I understand gives it precedence over all others, and is likely to prove a strong ally. It is highly desirable to cultivate this and so bury an old hatchet. Sir Wm. Thomson advocates this feeling and I shall act upon it unless you advise me to the contrary which I sincerely trust you will not.” Preece had also told Gouraud “that he has in the Post Office all the different kinds of lamps including Swan’s and Maxim’s, and that he would like a couple of yours—and for which I have promised to ask you, not feeling myself at liberty to do so without your approval.” Samuel Insull wrote extensive shorthand notes on the back of Gouraud’s letter which are presumably the basis for Edison’s reply. When Gouraud received the reply, he wrote back that “it would do a great deal of good” to show it to Preece. In the meantime, Gouraud had given two lamps to Preece, whom he reported “seems to be very highly pleased with them. It looks as though he were going to be a useful card to us.” Gouraud to TAE, 15 June and 19 July 1881, DF (TAED D8133W, D8133Y; TAEM 58:621, 626).

EDISON AND PUBLIC RELATIONS AT THE PARIS ELECTRICAL EXPOSITION Doc. 2120

Edison’s exhibit at the Paris Electrical Exposition generated widespread favorable publicity.1 Otto Moses and Charles Batchelor were his main representatives at the Exposition and both strove to create favorable impressions among scientists, the press, and prominent visitors. Moses, fluent in French and German, made connections with European scientists and journalists. The relationship he established with the celebrated French electrician Théodore du Moncel proved crucial. Du Moncel, a senior editor of the influential French journal La Lumière Électrique, was initially lukewarm to Edison’s incandescent light. With help from Theodore Puskas and Joshua

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Bailey, Moses succeeded in obtaining his services as press agent and advocate for the Edison interests for the sum of $1000 francs a month for the three months of the Exposition and $10,000 francs to be paid by the syndicate of Edison investors in France. Du Moncel wrote a flattering account of Edison’s lighting exhibit which appeared in *La Lumière Électrique* and in translation in the *Scientific American Supplement.*

Charles Batchelor, with his detailed knowledge of Edison’s lighting system, managed the exhibit. He maintained and repaired equipment, supervised Edison’s technical team, and gave Edison frequent reports about competitors’ displays. He also answered visitors’ questions about particular elements of the exhibit and solicited applications for lighting plants from impressed viewers. Noteworthy visitors to the Edison rooms included King Kalakaua of Hawaii, French Prime Minister Léon Gambetta, and French economist Léon Say.

1. For a summary of the publicity activities of the Edison interests at the Exposition see Fox 1996 (164–65). Fox attributes a substantial portion of the success of Edison’s exhibit to the publicity efforts on his behalf. Scores of articles about the exhibit and the Exposition in general were kept in two scrapbooks for Edison. Cats. 1068 and 1069, Scraps. *(TAED SM068, SM069; TAEM 89:34, 143).*

2. Du Moncel 1881.

3. See Docs. 2142 and 2147; Moses to TAE, 7 Sept. 1881, DF *(TAED D8135ZBI; TAEM 58:1038).*

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From Otto Moses

Paris, July 12. 81

My dear Sir:

The following is an abstract of Armengaud’s and Du Moncel’s conversations referred to in my last.—Mr. Bailey introduced me to Armengaud for the purpose of giving him an insight into your system, and also to remove certain prepossessions of mind by which it could easily be seen he was affected. I spent two or three hours with him profitably. He knew nothing whatever of the merits of the case, and appeared to be more ignorant of the subject than one would have supposed possible after the many conversations he must have had with Messrs. Bailey and Puskas. I enlightened him without in the slightest wounding his ‘amour propre.’ He was delighted with the systematic appearance of all your electric light inventions, no doubt because his mind, freshly steeped in telephone affairs, was impressed with the necessity for a thoroughness in all such extensive undertakings. With much self-satisfaction
he mentioned that Bell lost his French patents through him; and he also said that Mr. Edison had taken precautions which saved him; to this fact I ascribe the apparent ease with which he accepted my statements about your extreme prudence in patent affairs. He had elaborated a comparative table of the patents granted you and Maxim, and he showed that ‘over-claims’ or rather a mixture of claims on different subjects, had caused the Government to demand a separation of the claims made by Maxim. Before this was done, however, publication had taken place, and so the matter stood. Armengaud said this might give rise to grave questions. I told him that he might rest assured his estimate of your caution was correct; and I cited the case of your not allowing two copper plated carbons to go into Italian hands while any doubt existed about your patents being protected there; also your getting Serrell to cable to Europe to know if the disc dynamo had been protected, before allowing me to describe it.5

I am to meet Armengaud at intervals in order to compare the English and French patents, and to post him on any points upon which he may want general information. A. is very busy, has a half dozen clerks, and affects the hurried air of a man with business too large for his clerical force. He listens attentively and at the same time gives orders about business, bounces around, telephones his clients, and makes memoranda. He is Attorney for several electric light companies, and you know his official connection with the telephones. Altogether he is agreeable, polite, and he makes an honorable impression; still Mr. Bailey speaks of employing counsel with him.

Du Moncel. When I arrived I presented the letter I showed you, to Dr Herz who seems to have a preponderating influence with the “Lumière Electrique.” He has really been of service to me. He sent me ‘La Lumière Electrique’ from the beginning, introduced me to every one of the writers on that paper, and finally took me up to Du Moncel’s house to introduce me. He left me alone immediately with that gentleman, and I talked Edison &c to him for two hours. I will not of course tell you what I said it would simply be disgusting to you. One fact I mentioned however, which I must tell. He was showing me a coil of several hundred feet of copper wire closely wound on a bobbin without insulation, with compressor plates at the ends worked by screws, for purpose of demonstration that pressure longitudinally increased conductivity; when I said “Permit me, Monsieur le Comte, (he is a count, you know) to mention a little incident. I was one day talking to Mr. Edison about the

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wonderful properties of his carbon button, when he said to me he had just been told of your having also spoken in your great work, of the latter varying conductivity of carbon. He then expressed most naively his inability to verify the statement of his informant as he could neither speak nor read French, and asked me to translate passages from your work.” This seemed to touch the man; for he thawed immediately and before I left asked the privilege of describing your lamp and offered to carry on the experimental verifications in the laboratory of the Institute. He can be easily had to read a paper on the subject before the Institute which would be subject to revision and correction; however I do not think there is any more sting in him after what I said during a very long visit. He said he would call on me soon.

By the by, I never got the letters of introduction I was to have brought. In France you know it is necessary to be identified and endorsed. Even Mr. Bailey who is well known here, takes with him your the letter of authorizing him to act for you at the Exposition, whenever he wishes to transact business for your account. By the way I am received however, on the mention of my business I am always sure of a cordial hearing.

I am just in receipt of Maj. Eaton’s letter informing me of the unavoidable delay in shipping the great dynamo. I will reply to him on the subject and to do so must close in order to mail by today’s steamer via “Queenstown.”

Faithfully yours, Otto A Moses


1. The brothers Jacques-Eugène (1810–1891) and Charles (1813–1893) Armengaud were patent agents and consulting engineers. It is unclear to which Moses referred; in Doc. 2071 n. 2 the editors conjectured that Edison was dealing with the elder brother, but Charles was his agent for at least nine French patents obtained in 1882 and 1883. DBF, s.vv. “Armengaud, Jacques-Eugène” and “Armengaud, Charles.”

2. Count Théodose-Achille-Louis du Moncel (1821–1884) was a scientific instrument maker, engineer, administrator for the state-owned French telegraph system, and a senior editor of the influential French electrical journal La Lumière Électrique. Doc. 1248 n. 13; Fox 1996, 164.

3. Moses wrote on 10 July that he had “seen Armengaud and du-Moncel. It is sufficient to say that in the case of both ‘I came, I saw, and will conquer.’” He gave few details of his conversations but reported that Armengaud “talks Maxim to me and I talk system and piracy to him. He wanted me to telegraph for the papers in M[axim]. vs. Edison.” Moses to TAE, 10 July 1881, DF (TAED D8135U; TAEM 58:908).

4. Pride or self-esteem.

5. Lemuel Serrell became Edison’s patent attorney in May 1870. He
continued to act in that capacity until January 1880, when George W. Dyer and Zenas Wilber took charge of his new patents. Serrell continued to act for Edison in regard to prior U.S. applications and interferences and foreign patents. On 29 April, Edison directed him to find out whether disk dynamo patents had been properly filed in Europe before allowing a published description of it to appear. See TAEB 1:196, n. 2 and Doc. 1270 n. 16; TAE to Serrell, 29 Apr. 1881, DF (TAED D8142ZAL; TAEM 59:318).

6. Du Moncel 1878, of which Edison had tried to obtain an English translation in 1879. See Doc. 1738.

7. Sherburne Eaton was an attorney and important Edison business associate. He became vice president and general manager of Edison Electric Light Co. in early 1881 and president in October 1882. He was also a director (1880–1884) and vice president (1881–1884) of the Edison Electric Illuminating Co. of New York and president of the Edison Electric Light Co. of Europe. In the late 1880s he became Edison’s personal attorney. Israel 1998, 210–28; NCAB 7:130.

8. The “C” or “Jumbo” dynamo; see headnote, Doc. 2122.

9. Neither Eaton’s letter to Moses nor Moses’s reply has been found.

--2121--

To Thomas Logan

[New York, 15th July [1881]

Dear Sir,

When you have finished the Lamp Co work that you are actually engaged on & Batchelors work (with the exception of the new non magnetic Dynamo)¹ please discharge every man in the Laboratory and the Machine Shop except Alfred Swanson² who will act as night watchman. Of course Dr Haid Randolph³ & the men working for Mr Claudius⁴ will remain.

I will procure a four horsepower Baxter Engine⁵ and have it sent to Menlo Park. You can disconnect the heavy piece of shafting from the Engine & run the shop with the Baxter Engine. You will remain, as you are, doing whatever work Dr Haid Hughes & Claudius may desire

Please ship to the Edison Machine Works 104 Goerck St New York immediately the large lathe⁶ the large Drill Press & large plainer,⁷ also the various parts of the new non magnetic Dynamo which I propose having finished at Goerck St

Yours truly

T A Edison

LS, NjWOE, DF (TAED D8137ZBW; TAEM 59:105). Written by Samuel Insull. ¹Obscured overwritten text.

1. This was the disk dynamo for the Paris Exposition, on which the shop had been working since at least 6 June. This machine was “non magnetic” in the sense that, as Edison explained in a patent, “the iron core of the armature will not be necessary” to complete the magnetic
circuit across the relatively narrow armature. Logan to TAE, 6 June 1881, DF (TAED D8137ZAY; TAEM 59:90); U.S. Pat. 263,150; see also headnote, Doc. 2074.

2. Alfred Swanson was the night watchman and a general assistant at the Menlo Park laboratory. He had worked for Edison since 1876. Doc. 2069 n. 3, TAEB 5 App. 2.

3. John Randolph had worked for Edison as an office assistant and laboratory factotum since the end of 1878. Among Randolph’s duties at this time was taking care of the library and answering requests for materials in it from Edison and others in New York. TAEB 5 App. 2.

4. Edison hired Hermann Claudius, a former engineer with the Austrian Imperial Telegraph Department, in 1880 to build scale models and made calculations for central station distribution systems. Doc. 2028 n. 2.

5. The Baxter was considered a portable steam engine because it combined the boiler and engine in a single moveable unit that did not require a permanent foundation. Portable engines were increasingly popular, as one contemporary noted, “wherever it is necessary to do work sufficiently great to pay for them, but not for permanent business.” The Baxter was distinctive in being manufactured with interchangeable parts by the Colt’s Fire Arms Manufacturing Co. Several thousand of them, from 2 to 10 horsepower, were in use by this time. Hunter 1985, 494–96.

6. The Edison Machine Works received this equipment by the end of August, when Charles Rocap inquired about its cost. A marginal notation indicates the lathe was $858 and the drill press $525. Rocap to John Randolph, 30 Aug. 1881, DF (TAED D8129ZBG; TAEM 58:275).

PARIS EXPOSITION “C” DYNAMO Docs. 2122, 2123, 2131, and 2134

Edison decided in the spring of 1881 to construct a dynamo for the Paris Exposition even larger than the experimental one completed at Menlo Park in February. The laboratory machine had been a partial success that demonstrated both the practicability of connecting the armature shaft directly to a steam engine and the fundamental utility of the bar armature construction. However, it proved impossible to run safely at its intended speed of 600 revolutions per minute. It also produced too much heat, owing to the relatively high resistance of armature end pieces and their connections with induction bars.¹

The new machine was designed and built at the Edison Machine Works in New York, from which few records are extant.² Charles Clarke, who was largely responsible for designing the Menlo Park dynamo, did most of the planning for what was termed the “C” dynamo.³ The machine was to have six horizontal magnet cores 57 inches long. Its armature measured 33³/₄ inches long and 26⁷/₁₆ outside diameter and consisted of 146 bars connected in pairs through half as many copper disks

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at each end. Edison had contracted for a 125 horsepower Armington & Sims steam engine in early April, and about a month later Clarke was comparing the rotational energy of the engine’s flywheel with that of the projected dynamo’s components, presumably to check the dynamic compatibility of the two machines. Nothing more is known of the dynamo until late June, when it was run on a circuit with resistance coils immersed in casks of cooling water. Samuel Insull called it “a splendid sight” and promised that it would “put into the shade every thing that opponents can bring both in the way of economy and efficiency.” Docs. 2122, 2123, 2131, and 2134 are among the extant records of tests on this machine, which Edison also described and explained in Doc. 2149. Francis Jehl assisted and carried out related experiments on insulation, heat dissipation, and the heat capacity of insulated and uninsulated copper bars. He also measured the heat produced by passing bars through a magnetic field, which may have been to distinguish between magnetic and electrical causes of heating. During the summer Clarke made calculations about the machine’s electrical and physical characteristics, including the mechanical strain and centrifugal force on the armature.

Initial tests showed the armature running too hot; it also sparked between the bars. Edison decided to have it rebuilt as described in Doc. 2122, even though this meant a substantial delay getting the machine to Paris. (Until it arrived near the close of the Exposition, two much smaller dynamos powered Edison’s lighting display.) He used narrower bars which could accommodate japanned paper insulation. However, the new bars increased the resistance and heating so Edison enclosed the armature and shaft in a duct through which a belt-driven blower forced cooling air. Docs. 2131 and 2134 indicate that heavy sparking at the commutator continued to be a serious difficulty. Because output voltage was also lower than expected Edison added two magnets on top. A contemporary engineering account noted that this “unequal distribution of the field magnets . . . could not but tend to produce an unsymmetrical disposition of the lines of force within the field” and this apparently contributed to heavy sparking at the commutator brushes. The completed machine had an armature resistance of only .0092 ohm. Driven by the Armington & Sims engine at 350 rpm, which became the standard speed for Edison’s large dynamos, it could operate about 700 lamps at 16 candlepower. Its construction cost Edison about $6,000 but he asked the Edison Electric Light Co. to cover the cost of related experiments, about that amount again.

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The dynamo required one last-minute repair, of a broken engine shaft, before it was hauled with a police escort to the docks in time to sail on 7 September aboard the *Canada*.\(^{15}\) It began operating on 21 October and continued until the Exposition closed about 15 November.\(^{16}\) After that, Charles Batchelor installed it at his factory near Paris; it later went to a factory in Rotterdam.\(^{17}\) Even before the first “C” began its work at the Exposition, however, Edison had completed a larger dynamo and planned another, both based on the general design of the Paris machine.\(^{18}\)

1. See Docs. 2057 and 2067 n. 3.
2. Charles Clarke’s retrospective account of the machine’s design and construction is Clarke 1904, 35–39. Francis Jehl’s retrospective account is Jehl 1937–41, 970–74. It is illustrated and described generally in Dredge 1882–1885, 1:260–65.
3. Other letter designations were used for isolated plant dynamos. See headnote, Doc. 2126.
7. Doc. 2118.
9. At one point iron bands were wound around the armature for
strength; they quickly broke and were replaced by copper wires. In a patent application completed in August, Edison explained that because the induction bars were “raised off the [armature] core and separated by small blocks or by projections” to increase air circulation, circumferential wires were needed to hold them in place. N-81-02-20:215–23, N-81-04-06:69, both Lab. \((TAED\ N214:91–95,\ N223:32;\ TAEM\ 40:1036–40,\ 41:68)\); U.S. Pat. 263,133.

10. The sparking prompted Edison to adopt an entirely different pattern of arranging the induction coils and connecting them to the commutator blocks in smaller dynamos (see headnote, Doc. 2126). This alteration was not adopted in the large machines, presumably because of mechanical considerations.

11. See Jehl 1937–41, 972–73. Edison executed a patent application for the air blower on 24 August (U.S. Pat. 263,133). In May, Charles Mott had researched for Edison the practices of other inventors in placing commutator brushes with respect to the magnetic lines of force (see Doc. 2100 n. 1).

12. According to a diagram sent to Charles Batchelor, the field magnets were arranged in two groups of four series-wired coils. Dredge 1882–85, 262; Clarke 1904, 50; William Hammer to Batchelor, 1 Sept. 1881, Ser. 1, Box 1, Folder 1, WJH; see also Doc. 2149 n. 4.


14. The experimental costs may have included development of the machine at Menlo Park. TAE to Sherburne Eaton, 13 Sept. 1881, DF \((TAED\ D8126ZAA;\ TAEM\ 58:35)\).


16. See Doc. 2173.

17. Clarke 1904, 36.

18. See headnote, Doc. 2238.

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Notebook Entry: Dynamo

July–September 1881

After working 55 men days and 60 nights for 8 days and 8 nights we have at last made the change in bars and disk tits which the previous test showed was necessary to make the machine more practical.\(^1\) The narrow tit between which the alternate bars could pass was found to be insufficient and heated the plate thus as shewn by the dotted line,

![Diagram of dynamo bars and disk tits]

hence it was necessary to make the tit wide, this would then necessitate passing the bars over the tit instead of between\(^2\) this was done as\(^3\) described in some other book.\(^3\) it was a terrible job. we silver soldered the extra piece on the tit but our big

[New York,] July 15 1881.
press when done will punch out the plate with its simultaneously. The inside piece from the plate kept leading to the commutator kept breaking and we connected the bars to the bobbin thus.  

we japanned the bars—painted them with Zinc white and Linseed oil, then wound tissue paper then repainted. after assembling put mica between all the bars—put the new anti spark device on.  

The new foundation being done placed Engine Dynamo on it. 11 AM. Engine running nicely. taking indicator diagrams, for friction, now taking with field on 108 Volts across field armature open i.e. brushes off—


1. The machine was first tried in the latter part of June (see headnote above) but there is no other record of excessive heating. In an entry dated 14 July on the previous page, Francis Jehl recorded the armature resistance of the C dynamo as .0085 ohms; in an 11 July entry he gave it as .15 ohms. On 4 June, Jehl had conducted a series of simple tests, first measuring the resistance through an undivided armature bar, then a second bar cut into five segments held tightly by screws, and then a third bar with as many joints soldered together. The resistance of the first and third was the same; that of the second slightly higher. N-81-04-06:28, 24; N-81-03-18:86–87, all Lab. (TAED N223:15, 13; N230:42; TAEM 41:51, 49; 41:432).

2. The induction bars were of different lengths so each could connect to one in a series of copper disks at each end, where they were attached with screws to protrusions or lugs (U.S. Pat. 431,018). In August Edison

Figure from Edison’s U.S. Patent 431,018 showing the original method of armature construction. Induction bars E, of different length, are each connected to a disk in the series M or M’ at each end.
filed an application for the method described here of providing a larger contact surface for the joint, which entailed forming an arch at the end of alternate bars to allow them to pass over neighboring connections. To further reduce resistance and inhibit oxidation, Edison prescribed plat- ing the surfaces with gold or silver, or coating them with mercury (U.S. Pat. 264,647).

3. Not found.
4. Text is “comutator.”
5. At the end of June Edison sketched several ways to “do away with the spark on a Dynamo Machine” and a few days later drew one device in more detail (Cat. 1147, Scraps. [TAED NM016:94, 92, 101; TAEM 44:318, 316, 325]). In a patent application executed on 22 July, Edison described this as a “breaking-cylinder” that rotated with and was similar to, but was insulated from, the commutator. Current passed from the main brush, then through a number of brushes in parallel to the breaking cylinder. As the cylinder rotated, it instantaneously interrupted the circuit from the multiple brushes at the moment the main brush passed from one commutator bar to another, preventing the heavy spark there. He stated his observation that the size of spark was reduced as the square of the number of points at which the circuit was broken (U.S. Pat. 263,149). Edison had described the use of multiple commutator brushes to divide the current and thereby reduce commutator sparking in an 1880 British patent; that arrangement is also implicit in an 1880 caveat (Brit. Pat. 3,064 [1880], Cat. 1321, Batchelor [TAED MBP030; TAEM 92:212]; Doc. 2036).

—2123—

Notebook Entry: Dynamo

[New York,] July 20 1881

We run armature little while & then put field on just a as the field was charging up. Spitting commenced with loud sound across from bar to bar with 1/32 of air space.
Two spits took place both starting from edge of paper or right near the paper—but across air space $\frac{1}{32}$ inch. The spit was small only threw up knobs about $\frac{1}{32}$ dia & roughened edges of bar.

The Commutator brushes were not on. Evidently. This spitting is due to E.M.F. accompanied by a Static effect which first starts a static arc and then the other arc commences—and this is the trouble with all dynamos.

One thing is noticeable & that is that the “spit” occurs at the moment the bars pass at X & never at G.

![Crossing of armatures]

Crossing of armatures

![Crossing of armatures]
Test the kick between the insulated armature and the field magnet when the field is put on.

1. See headnote, Doc. 2122.
2. Edison started this test of the Paris C dynamo the previous evening but had to abort it when the iron bands around the armature broke (see headnote n. 9, Doc. 2122). Repairs were made overnight, and the machine was ready at 7 A.M. N-81-04-06:69, Lab. (TAED N223:32; TAEM 41:68).
3. These drawings are unclear. In a series of tests the next day, Edison noticed large flashes on the armature when the machine was run on a resistance circuit; he determined that the armature was crossed in three places (N-81-04-06:82–88, Lab. [TAED N223:39–42; TAEM 41:75–78]). The difficulty of preventing leakage across the high potential difference between bars led Edison to consider new ways of connecting the armature bars (see Docs. 2124 and 2150). In a patent application executed about a month later, he claimed the use of parchment paper or mica (preferably both) to insulate the induction bars. He noted that both materials were also excellent heat conductors (U.S. Pat. 264,647).
4. These sketches are also unclear but may represent attempts to measure induction effects in the stationary armature, possibly resulting from imperfectly continuous current flowing through the field coils. Francis Jehl made several measurements of the “kick” on 19 July. On 21 July, Jehl recorded an unsuccessful effort to bring a current off the front of the armature through a comb-like collector. N-81-04-06:66–68, 82, Lab. (TAED N223:31–32, 39; TAEM 41:67–68, 75).

-2124-

Notebook Entry:
Dynamo

[New York,] July 25 1881

OK winding armature with the alternate Coils over the others mks dif EMF small

OK

OK

July–September 1881 108
OK with odd no of Coils  Wound 1 on top other

1. This notebook entry is interleaved among numerous armature winding diagrams that Edison sketched on 22 and 23 July (N-81-04-06:96–125, 140–49, Lab. [TAED N223:45–59, 67–71; TAEM 41:81–95, 103–109]). His evident satisfaction with a small difference of potential between armature bars suggests that this pattern was intended to eliminate arcing between armature bars, the difficulty noted in Doc. 2123. This drawing suggests two other innovations related to that problem. One is the placement of bars in two layers around the armature to facilitate construction of low-resistance connections at the end plates (see Doc. 2122 n. 2). Edison later explained to Batchelor that this necessitated another change, the use of an even number of commutator connections (see headnote, Doc. 2126 and Doc. 2150). This was a departure from the practice Edison adopted with his first practical dynamos in 1879 (see headnote, Doc. 1682 and Doc. 1694). It entailed an asymmetrical pattern; in addition, the coils in two pairs (5 and 4; 7 and 6) appear to be connected only to their partners.

2. The meaning of the paired and single numbers accompanying this drawing has not been determined, nor is it clear that there is any relationship between the two columns.
Matters necessary to be done, July 29, 1881.

Accurate determination of feeders by Claudius. Clarke. 2
Map complete for Kruesi to lay wires. Kruesi, Claudius, Clarke.
Arrangement with contractors and Kruesi for laying mains. b
Goddard.
Arrangement at Central Station for continuous testing. b
Clarke.
Bids on iron work; on mason work; on carpenter work.
Eaton, Hornig, Clarke.
Supplies of tubing, boxes, mains from tube factory. Eaton.
Getting station and preparing internal structure. Clarke, Hornig.
Arrangement with Babcock & Wilcox relative to boilers, prices etc. b
Eaton.
Meter-room at Central Station. Hornig.
Appliances there. Clarke.
Regular books for doing business at Station. Eaton, Goddard.
Arrangement of staff for operating station. Clarke, Edison.
Water, Croton. 6 Driven wells. Eaton, Hornig, Clarke.
Coal supply, information, data, place of storage. Eaton.
Contract for meters. Eaton.
Moving Greenfield’s room to Central Station. Eaton, Hornig, Clarke.
Motors. — — — — — — — — — — — — — — — d Clarke, Eaton, Edison.
Appliances to utilize the present gas chandeliers and fixtures.
Johnson, Eaton.
Storage room at station for lamps, waste oil, etc.

1. The contents and style of this document suggest Edison as the most likely author, possibly in conjunction with Charles Clarke.
2. Charles Clarke (1853–1941) was a civil engineer and draftsman who joined Edison’s Menlo Park laboratory staff in early 1880. He immediately became deeply involved in designing dynamos and central station systems. At this time Clarke was chief engineer of the Edison Electric Light Co. Doc. 1921 n. 3 and TAEB 5 passim.
3. John Kruesi worked as a machinist for Edison for many years. He
had charge of the Menlo Park machine shop before becoming manager and treasurer of the Electric Tube Co. in early 1881. Docs. 659 n. 6 and 2058 n. 2.

4. Julius Hornig was a German-educated draftsman and mechanical engineer whom Edison hired in January 1881 to help plan central stations. Doc. 1897 n. 3.

5. The New York firm of Babcock & Wilcox was a noted manufacturer of stationary boilers, especially its patented “non-explosive” water-tube design which carried a higher pressure than other types. The company had given Edison estimates for large central station steam plants in 1880. Hunter 1985, 336–39; Docs. 1897 and 2008.

6. Brought into service in 1842, the aqueduct from the Croton River in Westchester County was the principal source of potable water in Manhattan. By this time the roughly thirty-mile pipeline was operating at or above its designed capacity of 75 million gallons per day. In 1881, the region suffered a severe drought that led to fears of a “water famine” in New York. Koeppel 2000, 271–89; “Public Works in New York City,” Sci. Am. 46 (1882): 137.

7. Edwin Greenfield was an electrician, recently with the Holmes Alarm Co. in New York. Whether this move occurred is unclear. In September he was located at 41 Ann St. in lower Manhattan. Greenfield worked with Edison for several years, during which he invented conduit and wiring devices used in isolated lighting installations. Later he became a superintendent for the Bell Telephone Co. but is noted principally for his invention of BX armored cable, which was widely used in the U.S. for decades. “Greenfield, Edwin T.,” Pioneers Bio.; TAE to Charles Walton, 13 Sept. 1881, Lbk. 8:494 (TAED LBoo8494A; TAEM 80:997).

ISOLATED PLANT DYNAMOS Doc. 2126

By mid-July Edison had in hand the design of a standard dynamo intended specifically for isolated lighting plants. He instructed Charles Clarke to give the Edison Machine Works “immediately the size & amount of wire to be put on the new Z machines,” and Clarke began making the calculations on 11 July. The first one was built between then and late September, when it entered service in a mill at Newburgh, N.Y. More than 260 were sold in the next ten months.

The Z type was the first of several standard dynamos for isolated plants fabricated by the Machine Works. Each type was rated for a certain number of lamps and given an arbitrary letter designation (see App. 3). These belt-driven models were variations on the distinctively tall machines made at the Menlo Park laboratory complex in 1879 and 1880. By September 1882 the Edison Company for Isolated Lighting offered four designs. These were the L and K models, larger than the Z, and the smaller E; the Z was by far the most common at that time.
It is difficult to attribute the conceptualization of any specific model to extant notes and drawings. Relatively few records, most of them by Edison or Clarke, remain from the design process. In the case of the Z machine, work cannot always be distinguished from that done simultaneously on the large central station dynamos. The fact that Clarke was also designing electric motors at this time makes interpretation of the records even more problematic. However, it is possible to infer certain fundamental design features of the isolated dynamos from remaining notebooks, specification sheets, and test records.

Each machine was designed to operate either 110 volt A lamps or twice as many 55 volt B lamps by using one of two interchangeable armatures. One gave 110 volts; the other gave half the voltage with a capacity for twice the current. Because both varieties of armature had the same external dimensions, the same size and length of wire, and required the same speed and power, switching from one to the other did not require complex changes to other parts of the machine. According to an 1883 specification chart prepared for the Edison Electric Light Company (probably by John Ott), the B armatures in general were wound in half as many coils (loops) around the core as the A designs. This would reduce the induced voltage by a factor of two. Each coil or loop of the B armature had twice as many individual wires, however, presumably connected in parallel, which would double the induced current. Together, these alterations gave the B configuration a resistance one-fourth that of the A armature. William Hammer’s notes indicate that to operate the B armature, the field coils were to be connected in parallel with each other instead of in series. This was evidently in order to maintain the crucial relationship between the resistance of the armature and that of the field magnets (connected in a shunt circuit with the armature). In the case of the Z machine, with two 30 ohm coils, changing connections to the B configuration reduced the field resistance from 60 to 15 ohms, or the requisite factor of four. Were this not done, it is evident that current through the magnets would be insufficient to maintain full field strength and, consequently, the desired output voltage. The terms “A” and “B” armatures were standard by October 1881, when Edison ordered a number of them made for Z machines going to England. Both forms were also available on the E, L, K, and H models by 1883.

The machines were wired so that a single switch opened or
closed both the main circuit and the field circuit simultaneously. In plants with a single dynamo, the engine and machine would be brought up to speed before the switch was closed, allowing the electrical load to increase gradually as the field gained strength. The same effect could be obtained by starting with the switch closed but all the resistance plugged in the field circuit. A somewhat different arrangement was used for multiple dynamos connected in parallel. In that case, opening the armature connection to the main line did not de-energize the field magnets. Keeping the field magnets energized prevented the armature of one machine from presenting a short circuit to the others.7

In July 1881 Edison and Clarke departed from their established practice of using an odd number of commutator blocks. Edison observed sparking between adjacent insulated induction bars in the armature of the huge C dynamo intended for the Paris Exposition (see Doc. 2123). Evidently concerned that this could also occur in smaller machines like the Z, he experimented with two layers of induction coils in order to reduce the potential difference between successive windings. Edison stated to Charles Batchelor, without further elaboration, that this required an even number of commutator connections.8 He sketched numerous armature winding patterns (much as he and his assistants had done in early 1879),9 attempting to devise a pattern for an even number.10 By 25 July he had devised acceptable arrangements that reduced the difference in potential between successive windings.11 It is unclear how the first Z machines were wound but one with an even number was sent to Paris in September. When William Hammer recorded dynamo specifications in 1882, the Z, H, G and E had an even number of commutator blocks; his records for other models are either incomplete or damaged beyond legibility.12

Clarke suggested one cosmetic change to the Z in November 1881. He advised Edison to have the patterns modified to “round all the edges of the base and field . . . and introduce any features in the way of graceful curves which certainly will add much to the appearance and nothing to the cost.”13

2. Clarke’s notes and calculations indicated the new machine was to have magnets the same size as those in the demonstration dynamos built at Menlo Park in 1879–1880 (see Docs. 1727 n. 2, 1849, 1985, and 2062 n. 3), at this time retrospectively designated the “A” model. He calcu-
lated the resistance needed to produce 115 volts, and the resistance and amount of wire for 125 volts. In early August he made a dimensioned sketch of one coil, showing insulation of japanned parchment paper (N-81-07-11:1–5, Lab. [TAED N220:1–3; TAEM 41:3–5]).

3. Edison Machine Works list, 10 June 1882, DF (TAED D8234B1; TAEM 62:7); see also Edison Co. for Isolated Lighting brochure (p. 6), 1 Sept. 1882, PPC (TAED CA002A; TAEM 96:103).

4. Edison Co. for Isolated Lighting brochure, 1 Sept. 1882, PPC (TAED CA002A; TAEM 96:103); see also Dredge 1882–1885, 2:331–33.

5. See headnote, Doc. 2122.

6. Unbound Notes and Drawings (1883), Lab. (TAED NS83:10; TAEM 44:1144); Hammer notebook 8:22–48, Ser. 1, Box 13, Folder 2, WJH; TAE to Edison Machine Works, 7 Oct. 1881, DF (TAED D8129ZBS; TAEM 58:290).


8. See Doc. 2150.


10. Clarke 1904 (50) later attributed much of the commutator sparking as well to the odd number of commutator blocks. A contemporary

*Edison's K 250-light dynamo for isolated plants.*
standard engineering text explained that the trouble with an odd number was that “when the brushes bear on the collector diametrically opposite to each other, the sectors do not pass simultaneously from under them. While one brush bears on the centre of a sector, the opposite brush bears on two sectors, and so short circuits the two bobbins connected therewith.” Schellen 1884, 353.

11. See Doc. 2124; also Docs. 2122 n. 2, 2149, and 2150. Edison executed a patent application for the overlapping layers of induction bars in November. In the patent he made no reference to the commutator connections but referred only to improved insulation and greater simplicity of construction. U.S. Pat. 263,146.

12. See Doc. 2150 and App. 3; William Hammer notebook 8:22–48, Ser. 1, Box 13, Folder 2, WJH and also Jehl 1937–41, 978. In November, Edison instructed Edward Johnson to apply mercury to commutator blocks of small dynamos to prevent sparking. See Doc. 2190.

13. Clarke to TAE, 11 Nov. 1881, DF (TAED D8126ZCN; TAEM 58:313).
I beg to confirm receipt of £12,000 & $11,000 from you & my telegram to you asking for balance upon the receipt of which you sent me $11,000 which is as near as I can judge £2245 not being able to understand how the total amount for my share of reversion could only be £14,245 I cabled you asking for the total number of shares received for my reversion & you cabled me it & recd from you in reply “Your reversion two thousand eighteen less your share trust charges 186 pounds your Lon London and Joint shares two hundred probable further reversion two hundred making oversold your account five eight two delivered from mine”
My reason for cabling for above information was that from your letters to me & the explanation of your views by Insull I was under the impression that the amount number of shares to be received by me would be certainly 3000. In your letter to me stating that you had in the face of the opposition of the Liquidator obtained the order of the Court for the division of the shares you stated said nothing whatever as to the reduction of the number of shares coming to me & I naturally thought that you had in sending me £12,000 held for some reason the balance which I estimated at between £7,000 & £8,000 whereas according to your second remittance I only had about £2,245 further to come to me on a/c of Reversion this a/c.

I would point out to you that I have been kept totally in the dark as to this matter for some time past that is on the very important point to me of how much I was going to get out of the Reversion & I had naturally made my arrangement as to financing my business under the impression that I should get from you £19,000 or £20,000 as I was led to expect from correspondence with you & this has caused me very great inco & the sale of shares you made and not being posted as to this has caused me considerable inconvenience. I may mention in this connection that although it is now almost a year since the promoters of the Oriental Company first commenced working in my name I have not as yet recd any settlement as per arranged & I have not heard at all from you as to how this stands. Then as to European Telephone although I understand see by the English papers & from conversation with one of Gowers colleagues that a Company has been brought out consolidating my European interests outside France I have no word from you as to the matter & your silence has placed me in a somewhat peculiar position with the Directors of the Edison Telephone Co of Europe as they repeatedly ask for information which they are certainly entitled to & which I feel I ought to be able to give them.

I notice in your cable above quoted that you state my account is I am oversold 580 shares. Now in as much as you sold the shares upon your own judgement I think this is somewhat incorrect. Furthermore you could not by any means construe the letter I wrote you as to the sale of my shares as authorizing you to sell my shares my interest in the “London & Joint shares” at the price you sold the bulk of my shares & I therefore feel that I am entitled to the full value present market value on the 200 shares which you say are coming to me on this account.
(Wrote Gouraud also as to European Light shares explaining lost opportunity")


1. Edison’s letter has not been found; Gouraud replied to it on 12 September after returning from vacation. Gouraud to TAE, 10 and 12 Sept. 1881, both DF (TAED D8104ZCV, D8148ZCA; TAEM 57:202, 59:856).

2. Gouraud wrote on 23 July that eight days previously he had cabled £12,030 through J. S. Morgan & Co. in London. On 30 July he confirmed the text of Edison’s cabled directive that day to “send balance reversionary.” Gouraud responded the same day: “Drexels pay balance.” On the back of one page of his draft, Edison calculated the dollar value at the rate of $4.90 per pound, the approximate exchange rate in 1881. Edison received the $11,000 on 1 August. Gouraud to TAE, 23 and 30 July 1881, both DF (TAED D8149Y, D8149ZAA; TAEM 59:967, 969); Gouraud to TAE, 30 July 1881, LM 1:17 (TAED LM001017A; TAEM 83:880); Private Ledger #2:75, Accts. (TAED AB006:68; TAEM 88:230).

3. The text of Gouraud’s reply is quoted in full. Edison instructed Gouraud on 1 August to “Cable total number shares obtained in settlement” (Gouraud to TAE, 2 Aug. 1881; TAE to Gouraud, 1 Aug. 1881; LM 1:17 [TAED LM001017C, LM001017B; TAEM 83:880]). Edison had consented in July 1880 to have his London telephone interest held in a trust. The “joint shares” were presumably those which, by a separate agreement, he and Gouraud arranged to hold together in the trust, representing a substantial portion of Edison’s total interest (see Doc. 1954 n. 3).

4. See Docs. 2046 n. 2 and 2079.

5. A month earlier Gouraud had “at last succeeded in getting an equitable division of the Shares of the United Company.” He reported that the liquidator had tried in court “to get a division so as only to return the Shareholders’ money and keep back the balance— This attempt I effectually prevented.” Gouraud to TAE, 2 July 1881, DF (TAED D8149X; TAEM 59:966).

6. Gouraud had written in mid-June that the Oriental Company’s settlement with Edison and the other inventors was delayed by the difficulty of getting Alexander Graham Bell’s legal signature on the documents. The status of Edison’s patents in Hong Kong was also unsettled, as Gouraud reminded him in a 24 June cable. Gouraud to TAE, 17 June 1881, DF (TAED D8104ZBP; TAEM 57:143); Gouraud to TAE, 24 June, LM 1:14 (TAED LM001014B; TAEM 83:879).

7. See Doc. 2112 n. 7. Edison may have been referring to Hilborne Roosevelt, a New York organ manufacturer formerly involved in the phonograph business, who was the brother of Cornelius Roosevelt, one
of Gower’s partners in Paris. Samuel Insull indicated that Roosevelt was one source of Edison’s knowledge of this subject, though Joshua Bailey reported from London at the end of June that plans for the new European company were complete (Insull to Gouraud, 7 Aug. 1881; Bailey to Insull, 30 June 1881; both DF [TAED D8104ZCF, D8148ZBV; TAEM 57:176, 59:846]). These arrangements were substantially altered by the end of the month; Gouraud, in his 12 September reply to Edison (see note 1), explained that “if I had written you the necessary letters to keep you advised of all the infinite variations, the hopes and fears, the ins and outs, the ups and downs, connected with the negotiations I would have utterly exhausted your patience and disgusted you altogether with the whole subject, as was I, and everybody connected with it here.” The Consolidated Telephone Construction and Maintenance Co. was organized in November (Gouraud and Bailey to TAE, 20 Aug. 1881; TAE to Bailey, 23 Aug. 1881; LM 1:24B, 25A [TAED LM001024B, LM001025A; TAEM 83:884]; Gouraud to TAE, 12 Sept. and 5 Nov. 1881 with unidentified clipping of 5 Nov.; TAE and Edison Telephone Co. of Europe agreement with Gouraud, Bailey, and Edison Gower-Bell Telephone Co. of Europe, Ltd., 10 Nov. 1881; Consolidated Telephone Construction and Maintenance Co. agreement with Edison-Gower-Bell Telephone Co. of Europe, 10 Nov. 1881; all DF [TAED D8148ZCA, D8148ZCM, D8148ZCM1, D8148ZCV, D8148ZCW; TAEM 59:856, 878–79, 892, 897]).

8. Gouraud shortly reported two errors in the settlement of this account. In Edison’s favor was the fact that shares had been sold at a higher net price (£7.1.0 after commissions) than originally stated. More than offsetting this was the fact that Edison received only 2,218 shares instead of 3,000 as estimated by the liquidator, with perhaps another 200 still to come. Gouraud proposed to share equally in the loss arising from having sold more than Edison owned but suggested waiting until the price declined to repurchase the shares. Gouraud to TAE, 4 Aug. 1881, DF (TAED D8149ZAC; TAEM 59:978).

9. Edison cabled Gouraud on 29 July: “European Light at seventy you better buy some through Drexels” and again to this effect the next day. Thinking that Edison had meant to suggest telephone stock instead, Gouraud cabled back for clarification; Edison cabled on 1 August that it was “Too late to get European light.” TAE to Gouraud, 29 July 1881; Gouraud to TAE, 30 July 1881, LM 1:16C, 17A (TAED LM001016C, LM001017A; TAEM 83:886); Gouraud to TAE, 30 July and 4 Aug. 1881, DF (TAED D8149ZAA, D8149ZAC; TAEM 59:969, 978).

—2128—

From Otto Moses

Paris, Aug. 2. 81

My dear Sir:

Saturday, Mr. Batchelor arrived with his family and the rest of the staff.1 I had an Agent to meet him and take charge of the shipments; so he came right on reaching here that night.

I am glad to say, he found us further advanced in our preparations than any other exhibitors in the Palais.

July–September 1881
Yesterday while breakfasting with Dr Herz and Mr. Depretz² I was introduced to Mr. Preece, Mr. Hughes,³ and Sir Charles Bright.⁴ A more favorable opportunity than that over the breakfast table could not have happened; and before it was over the two first gentlemen expressed themselves anxious to have all the previous unpleasantness absolutely forgotten.⁵ I made an appointment to introduce Hughes to Batchelor and to have Preece present. I took occasion to tell Batchelor of it a very short while after. Prof. Barker was talking to him and said Preece had ‘gone’ for him on a certain occasion. I suggested he should join us in a visit. He went, and a happy reunion was effected. So the ground is smoothed all around. Night before last ‘La Lumierè Electrique’ sent an Editor here with a message to the effect that as Maxim and Swan both wanted cuts printed of their lights, we should have a show. Maxim’s cut was⁶ a view of a picture gallery, Swan’s a street in Newcastle and his store illuminated. The engravings were very good. I accepted the invitation and told the Editor I would be satisfied with a little sitting room with a three drop chandelier in it and a lady sewing or reading, and a gentleman at a desk like yours with one lamp over it.⁷

I am delighted to hear of the success of the dynamo. Berger desired something done by us⁸ to illuminate the grand escalier, so we had to decide on using some form of arc lamp. He proposed Jablochkoff⁹ but after deliberation I thought that would be advertising him at our expense; particularly, as the Jab. people asked 4000 francs for a months illumination with 16 of their candles, and a proviso that if we did not come to time by 1st Sept they would stay in possession;° so I took an arc lamp belonging to a friend of Puskas (Pilsen patent)¹¹ which we get for nothing during the time we use it, and can take out when we are ready. This lamp is said to be pretty good but we will only take enough of them to light the stair case, not to illuminate it on anything like the scale we are going to employ.

The Exposition is beginning to take shape; but there will not be anything like a full opening. There is so much cutting of concrete soil going on in the Palais that a cloud of dust is always filling the atmosphere. I did not pretend to open the fine instruments while this lasted so fixed everything else first. There was nothing hurt in all our shipments to date but two lamps in the carbon rheostat, two lamps in the barrel that fell from the gang plank and a bent axle in a stock printer.¹²

Du Moncel and his wife called to day at our rooms and examined all that was out. She is a blue stocking and yet very in-

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teresting—took interest in everything and said she would call every day.

Herz responded politely to the request to have the Quadruplex instruments, provided Dr Green telegraphed him to do so. He does everything he can to facilitate my personal communication with scientific people here. He proposes to help me all he can in the Lumiere Electrique. Truly yours,

Otto A Moses.

ALS, NjWOE, DF (TAED D8135ZAF; TAEM 58:953). “Obscured overwritten text.”b Interlined above. “‘they would stay in possession” interlined above.

1. Batchelor and his wife, Rosanna, had two daughters: Emma (b. 1874) and Rosa (b. 1876). In addition to Moses, Batchelor planned to have eight of Edison’s assistants in Paris. These included William Hammond, Edward Acheson, Martin Force, and James Hipple. Philip Seubel had sailed earlier with Moses; Force and at least one other assistant sailed after them, landing in France on 18 July. Doc. 870 n. 1; N-81-05-23:1, Lab. (TAED N212:1; TAEM 40:774); Force to Mrs. Force, 20 July 1881, Force; see Doc. 2148 n. 10.

2. Moses was presumably referring to Marcel Deprez (1843–1918), an early innovator in electrical power generation and transmission. He did pioneering work in the transmission of direct current over long distances and in the design and characterization of direct-current motors. DSB, s.v. “Deprez, Marcel.”

3. David Hughes was a London–born but American–educated electrician and inventor living in London. His 1878 claim to have discovered the principle of the microphone set off a bitter controversy among Edison and Hughes partisans on both sides of the Atlantic. TAEB 4 chaps. 3–5 passim; Oxford DNB, s.v. “Hughes, David Edward.”

4. Sir Charles Tilston Bright (1832–1888) was a British telegraph engineer who was instrumental in the development of submarine cables, particularly the Atlantic cables linking Ireland and Newfoundland. He was a Liberal member of parliament from 1865 to 1868 and a delegate to the Paris electrical congress. Oxford DNB, s.v. “Sir Charles Tilston.”

5. See Doc. 2119. On 9 August Batchelor told Edison that he had “a long talk” with Preece, who “seemed [to] be mighty glad to ‘bury the hatchet.’” Batchelor to TAE, 9 Aug. 1881, DF (TAED D8135ZAF; TAEM 58:961).

6. An illustration of an art gallery illuminated by electric lights, presumably Maxim’s, appeared in the 20 August issue; the two Swan illustrations referred to appeared in the 1 October issue. An engraving of Edison’s lamps illuminating a parlor also appeared in that issue; it was reprinted in Prescott 1884, 189. “La Lumière Électrique,” La Lumière Électrique 4 (1881): 227; “Les Lampes Électriques à Incandescence,” ibid., 5 (1881): 9–11.

7. The form of arc lamp invented by Paul Jablonskoff, a Russian émigré, was installed in a public square in Paris in 1878, to much acclaim. Doc. 1659 n. 1.

8. The Pilsen lamp was an arc light invented by the Austrian engi-
neers Ludwig Piete and Franz Krizik. It employed an iron core inside a solenoid to advance the carbon. Prescott 1884, 324–42.

9. On 10 July Moses wrote Edison that “a fortunate accident occurred in landing. The barrel containing the lamps through gross carelessness of the boatswain was allowed to fall from the gang plank midway, and dropped six feet on the head which was staved in. I immediately examined the contents of the top layers and did not find a carbon broken!” DF (TAED D8135U; TAEM 58:908).

Menlo Park, N.J., Aug 5 1881

Dear Mr. Edison:

When your letter came asking the question how 104 Volts on 125 Ohms can give ten per H.P., I was discussing the same question. Dr. Nichols tested the lamps, and said that they were 125 Ohms resistance, he also stated that they were 10 per H.P. in the calorimeter. His electrical tests showed only nine per H.P. I knew the lamps were tested by copper deposition standards and that we were keeping the marking the same. That is we were marking lamps 105 Volts [-] week in and week out that would test 105 Volts, for I would have old lamps re-tested at frequent intervals.

An engraving of Edison’s incandescent lamp as it might be used in an upper-class parlor.
During the past week Marshall\(^3\) and Howell\(^4\) have been working over all the constants of the instruments and testing the lines by means of instruments borrowed from Princeton\(^5\) and we found that Dr. Nichols has been out in his measurements of the resistances of lamps so that they now test considerably higher than before. I am not yet prepared to give exact results yet, but can say that 140 Ohms is nearer to the resistance of the lamps than 125 Ohms.

I therefore think that you will be satisfied with 95 Volts \(8 \times 13\frac{1}{2}\) A lamps\(^6\) for Paris, of which we can now give you with the range you mentioned all packed of

\[
\begin{align*}
92, 93, 94 \text{ Volts} & \quad 68 \text{ lamps} \\
95 & \quad 44 \\
96 & \quad 108 \\
97 \text{ Volts} & \quad 200 \text{ lamps} \\
98 & \quad 228 \\
\end{align*}
\]

with about 200 lamps in the photometer room.

We can give you all you may want of lamps \(8 \times 17\).

I am sorry that we should have made any error but I knew that which ever way the truth was it would be more favorable to the lamp.

I am going to lay off Monday, Tuesday and Wednesday of next week and during that time I shall have all the connections rerun in the Photo room; we are very sure that the Volts are good and will soon be sure regarding the resistance.

We take copper as our guide and think that we have marked lamps to be relatively right.

I shall be in New York this evening. Yours Truly

Francis R. Upton.


1. Edison’s letter has not been found, but see Doc. 2149. Samples from each lamp lot were routinely tested to determine the voltage required to produce the rated illumination. In addition, the factory often directly measured the resistance of lamps and, as evident in this document, calculated the number that could be operated by 1 horsepower. See headnote, Doc. 2177.

2. That is, using the rate of deposition in an electrolytic cell to measure the flow of current.

3. William Marshall began doing experimental work at the lamp factory in June 1881, three years after graduating from Rutgers College. He was in charge of the photometer room. After he died of typhoid in September, his brother John took his place. Another brother, Bryun, had worked at the Menlo Park laboratory; David Marshall later joined Edi-

4. John Howell (1857–1937) had done research at the lamp factory for his senior thesis at the Stevens Institute of Technology, from which he graduated in the spring of 1881. Upton hired him in early July and assigned him to make drawings of the recently acquired factory buildings in Harrison. About this time Howell took over the testing department duties of Edward Nichols, who had left in June for a teaching job. Howell had a long career in electric lighting and eventually became chief lamp engineer for General Electric. Upton to TAE, 6 July 1881, DF (TAED D8123ZCV; TAEM 57:924); “Howell, John W.,” Pioneers Bio.; Jehl 1937–41, 810–11, 815; Wise 1985, 73, 121–22.

5. Upton borrowed a galvanometer from Princeton on 25 June; it is not known what other instruments he may have obtained. Upton to TAE, 27 June 1881, DF (TAED D8123ZCQ; TAEM 57:917).

6. See Doc. 2085 n. 4.

To John Randolph

[New York,] Aug 7 1881

Johnny—

[----]a Lawson will hire 2 Laborersb at the mine.1 you can putb them on pay roll; also he wants some picks & shovels= also little Carpenter work=

Edison

($)10. Geo Hickman)c

ALS, NjWOE, DF (TAED D8138R; TAEM 59:130). 1.Canceled. 2b-Obscured overwritten text. cMarginalia possibly written by Randolph.

1. On 26 July, Edison obtained the right to extract and reduce copper ore for one year, in exchange for one-sixth of any net profits, at an abandoned mine in a pasture near Menlo Park. From September through November, John Lawson undertook the problem of pumping water out of the old shaft, which had defeated efforts sixty years ago. Edison spent $700 on the work during this time. TAE agreement with Mary Ayers, C. P. Ayers Kelly, and Mary Freeman, 26 July 1881, Miller (TAED HM810154; TAEM 86:413); Lawson to TAE, 15, 17, and 20 Sept., 18, 20, and 25 Oct., 4 Nov. 1881; Samuel Insull to Lawson, 25 Oct. 1881; all DF (TAED D8138T, D8138U, D8138V, D8138Z, D8138ZAA, D8138ZAD, D8138ZAE, D8138ZAB; TAEM 59:132–35, 137, 140, 141, 139); Ledger #5:109, Accts. (TAED AB003:68; TAEM 87:471).

In response to an inquiry from geologist J. Volney Lewis in 1906, Edison recalled that he had “Found native or carbonate Copper in the shists which had sheets of Dolerite interposed in the strata— The ores were too lean to pay—of the streak we worked which was about 4 feet wide the average was about ½ per cent.” Lewis’s historical and technical account of the site concurred with this negative assessment. Lewis to TAE, with TAE marginalia, 28 Nov. 1906, DF (TAED D0606ABE; TAEM 190:527); Lewis 1907, 153–54 and plate XXXII.

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2. A tinsmith by trade, George Hickman had worked at a variety of jobs at the Menlo Park laboratory since 1880. *TAEB* 5 App. 2.

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**Notebook Entry: Dynamo**

**Dynamo**

**Dynamo**

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[New York,] August 8th 1881

Experiments on the resistance of moving contacts especially in regard to commutators and their brushes used on Dynamos—

with South Amn Mac shaft run by gramme at varying speeds brushes sideswise but not end on good pressure. (more than ordinary)

Resistance commutator still. .055.

" [-] shortckted. .043.

" Speed 670 Rev .065

" 812 " .068

915 " .072

930. " .073.

Brushes put slightly more End on—Speed. (copy of Edison’s chart)

Experiments to be tried tonight

1 Sims to make experiments with the string on the indicator— Field off brushes off.

2 Take diagrams with boiler pressure 90 ditto 70

3rd Run 20 minutes with brushes off—indicate try heat, no blower on (Field on)

4 Cool down armature by blower then put brushes on, one brush on block the other on insulation—run 2 minutes indicate—notice heat (open circuit)

5 Put on 3 barrels go to 103 volts then set commutators ahead block at a time in direction of rotation notice spark and drop in volts. use the mercury brushes.

6 Try new brushes (ie) sheets without mercury

7 " " with mercury

8 Try wire on other brush flatwise

9 Set one brush on one side block ahead of the other brush on the same side get drop.

10 Measure resistance while running bet[ween] 2 brushes on the same side.


We took 5 cards numbered from 1 to 5 with field off

Brushes off—9:57 =
We now at 10:02 take cards with field off but brushes on—one brush on insulation one on middle of block=

Now we put field on. 89 volts, separate machine—Brushes on—no current from machine= Brushes on—stopped 10:42—no blower on—worked cards off at diff boiler pressure 90 down to 60—

We start the blower & take Cards to see if there is any more friction—10:46 PM=—stopped 10:53—taking 2 cards one with blower off & 1 with blower on = 60

1 Barrell on 11:13 PM own field.—Hg Brushes—Theres no spark except very very slight.

with one Bbl on 103. It dropped to 94—when Bb another Barrell put on—2 bbls on now—shut down 27 minutes to 12 4 bbls 12:16 AM. Started

12:42 " Shut Down armature not very hot would run that way all day—Thought we saw it spark—shut down started again 1:06 AM. to see if it would cross again. 4 barrells on.

TAE

〈110 B.P.〉


1. See headnote, Doc. 2122. This entry is continued in Doc. 2134.

2. This document was written in several stages. After this brief introductory statement, Edison recorded results from experiments on the resistance of a dynamo commutator. Then Francis Jehl copied into the book Edison’s instructions for additional experiments to be tried (the original has not been found). The last section consists of results given by Edison from related tests.

3. That is, a Gramme dynamo run as a motor.

4. This generator was built for a South American demonstration plant (see Docs. 2048 and 2144). Edison described this test in Doc. 2149.

5. Francis Jehl wrote Edison’s list of experiments to be tried and began to make notes for the first trial, at which point Edison resumed his notes.

6. As evidenced by the resistance barrels and blower for cooling the armature, these experiments were to be made on the completed Jumbo dynamo.

7. Probably Gardiner C. Sims (1845–1910). Sims superintended a locomotive works when he met Pardon Armington, with whom he formed a partnership for the manufacture of high-speed stationary engines. He and Edison developed an electric torpedo, and Sims later served in various engineering capacities in the U.S. Navy and Army. Obituary, ASME
Dear Sir:

Cabled you yesterday to cable date of delivery of the American patents that cover the French patents delivered Paris August ’79, and January February and June ’80. This was because that, in order to get an injunction it is necessary that the American patent, should have issued to the party asking it.

Our counsel in interview two days ago said that it is alleged that the Maxim patents have been issued and yours not. In the absence of copies of your patents here, it was necessary to have your formal assurance on this point. Whether the fact that all the patents invoked by us have not yet been issued, will make a difficulty in getting injunction, remains to be seen.

Also, it is necessary that the original patents should be produced in support of the injunction. The absence of these may cause the injunction to be raised provisionally, i.e. until the production of the original patents. Should the injunction be granted and should you hear of its being raised within a few days, you need not be uneasy. The case seems a very tight one and if we get it on Maxim propose to go at once for Swan and Fox.

1 The Leon syndicate are about to appoint two engineers to make report to them on the economy etc of the Light in your Exhibition. In interview with Mr. Leon this morning the writer proposed to him that another engineer should be added to their two by us, and that the selection on the one side and the other should be mutually acceptable or a change should be made.

Mr Leon accepted this. [----]

12th Aug. As telegraphed last evening injunction was granted yesterday. This morning passed by the Exposition to see if the Maxim people have lamps visible to seize, and finding that they have, telephoned advice to counsel who replied that seizure would be made at Exposition at two P.M. On entering office 33 Ave de l’Opera, found your cable saying “injunction against whom and on what.” It was supposed that you would understand the phrase “principal infringer” used in the

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From Theodore Puskas and Joshua Bailey

Paris Aug 10[–12]/81
first cable sent you regarding the matter. The answer “Against Maxim and will be served at Exposition this afternoon unless you cable contrary” was sent you at ten this morning, and counsel was advised not to make seizure till five this P.M. to give time to receive your reply, should you desire to make one.  

Batchelor and Moses have been present, one or both of them, at the interviews with counsel, at which the points of the respective patents have been discussed, and are clear in the opinion that the injunction should be pushed. Enclosed here-with you will find extracts from Paris journals, which have been kept in as adv. for several days.  

Unless Batchelor and Moses and the Counsel who have examined the points are entirely mistaken, and your patents are valueless because you have invented nothing, the proceeding is a good one. The Exposition raises the questions between you and Maxim and others in such a way that, even if your case were a weak one and it was your interest to dodge and mystify that course is not open. If you have really invented the things claimed for you, the policy of a square attack in reply to the claims made against you is the only one to be thought of. We have no doubt you wish this, and all of us do understand.

Armengaud, who is not a very positive man, and is very timid, said squarely to counsel that he considered Maxim an infringer and that he advised pursuing him. In the article “l’Exposition d’Edison” (p 161,) of the Catalogue Armengaud tells me that he put in to the article the four lines which he thinks sum up your claims on the lamp question, and which he thinks you can hold against everyone, “Edison est le premier qui ait fait [usage], et ces brevets en font foi[,] d’un filament de charbon [incandescent] continu, avec une resistance superieure a dix ohms, dans un vide maintenu par un globe de verre continu dans lequel on scelle les conducteurs metalliques.  

We have paid 3000f retainer to counsel, Falertoz. Yours very truly

Puskas & Bailey

ALS, NjWOE, DF (TAED D8135ZAK; TAEM 58:963). Written by Joshua Bailey.  
1. In reply to the message from Bailey and Puskas, Edison cabled the same day a list of the relevant issued and pending American and French patents. On 10 August Puskas and Bailey asked him to “send quick official copies American patents mentioned your cable both of those issued and those not issued also official copies those of your infringers.”
21 August Edison wired that he had sent official copies of the patents; they arrived on 7 September. Puskas and Bailey to TAE, 9 and 10 Aug. 1881; TAE to Puskas and Bailey, 9 and 21 Aug. 1881; LM 1:20A, 21A, 20B, 25C (TAED LM001020A, LM001021A, LM001020B, LM001025C; TAEM 83:882, 884); Edison Electric Light Co. of Europe memorandum, 20 Aug. 1881; Puskas and Bailey to TAE, 9 Sept. 1881; both DF (TAED D8135ZAW, D8135ZBN; TAEM 58:1003, 1056).

2. Bailey and Puskas recommended in early July that they take legal action on Edison’s behalf against Hiram Maxim and Joseph Swan. After the arrival of Otto Moses, the three consulted with [Charles?] Armengaud about the feasibility of obtaining injunctions. Armengaud was confident of sustaining an injunction against Maxim on the grounds that Edison’s patent claims anticipated Maxim’s by about a year. Puskas and Bailey cautioned that Maxim, in particular, “should not be allowed to get possession of public opinion” and promised that an injunction would “deter capitalists” from investing in his system. Puskas and Bailey to TAE, 22 July, 2 Aug., and c. 10 Aug. 1881; Dorval memorandum, 13 Aug. 1881; Dorval and TAE memorandum, 19 Aug. 1881; all DF (TAED D8135ZAA, D8135ZAG, D8135ZBD, D8135ZAL, D8135ZAL1; TAEM 58:930, 956, 1027, 967–77); Fox 1996, 179–81.

3. St. George Lane-Fox (who later adopted the surname Pitt) filed four British patent applications related to electric lighting in 1878 and 1879. He subsequently organized the Lane-Fox Electrical Co., Ltd., which licensed patents to the Edison interests in Britain. Doc. 1780 n. 15.

On 17 August Puskas and Bailey wrote Edison that they were closely examining Swan’s patents and scientific publications to determine whether they could succeed in getting his exhibit enjoined. However, they were concerned that doing so might alienate prominent British participants at the Exposition, particularly members of the award jury. They also suggested that the action against Maxim made it “unnecessary so far as business reasons are concerned to be in any undue haste regarding Swan.” In early September, after a review of Swan’s patents and publications, they decided “to make an immediate application to the Tribunal for an order of seizure on Swan, taking just the same line of procedure as in the case of Maxim.” In mid-September, however, Puskas, Bailey, and Batchelor decided to delay proceedings until Grosvenor Lowrey arrived in Paris to review the legal situation and there is no evidence of further action. Bailey and Puskas to TAE, 17 Aug., 2 and 9 Sept. 1881, all DF (TAED D8135ZAP, D8135ZBF, D8135ZBN; TAEM 58:885, 1030, 1056); Batchelor to Eaton, 18 Sept. 1881, Cat. 1331:38, Batchelor (TAED MBLB3038; TAEM 93:329).

4. Elie Léon was a French financier who furnished part of the money for Edison’s exhibition at the International Exposition in Paris. In exchange, he received the right to form an Edison company for France. After the success of Edison’s exhibit, Léon and Charles Porges organized a large syndicate of European investors that in turn established the Compagnie Continentale in February 1882 to control Edison’s electric light business in Continental Europe. TAE and Edison Electric Light Co. of Europe agreement with Porges and Léon, 15 Nov. 1881; undated Porges report, 1881; both DF (TAED D8228K, D8132ZCJ; TAEM 61:597, 58:591); Edison Electric Light Co. of Europe report, 7 Mar. 1884 (p. 2), CR (TAED CE001003; TAEM 97:209); Fox 1996, 184–85.
5. On 11 August Bailey cabled Edison: “Injunction granted have your official copies duly certified to produce in court.” Edison replied the same day, “Against whom and on what was injunction issued.” Bailey responded on 12 August: “Against Maxim and will be served at exposition this afternoon unless you cable contrary.” Edison immediately instructed him to “serve injunction now how about Swan.” He also cabled separately the same day: “Important give news regarding injunction agents American Press with request to cable.” Bailey to TAE, and TAE to Bailey, both 11 Aug. 1881; Bailey to TAE, and TAE to Bailey, all 12 Aug. 1881, LM 1:21C–23A (TAED LM001021C, LM001022A, LM001022B, LM001022C, LM001023A; TAEM 83:882–83).

6. These extracts have not been located.

7. This passage in English is, “Edison was the first to use and the patents show a continuous carbon filament with a resistance greater than ten ohms, in a vacuum maintained by a continuous glass globe in which are sealed the metallic conductors.” Text supplied in the quotation is taken from the published version. France. Ministère des Postes et des Télégraphes 1881, 161.

8. Not otherwise identified.

2133

Paris, Aug. 11. 1881

From Otto Moses

My dear Sir:

The Exposition opened on the 10th in order to allow of inspection by the President and his Cabinet. The exhibitors as much as possible had cleaned up the place but all their efforts did not put the machinery in motion. It was a mere formal opening. We are nearly ready however, and I believe more advanced than any of the large exhibitors. We had crowds of visitors; among them several of the Syndicate to whom the working, manufacture &c. were fully explained. They did not appear to know anything about it, and were very much interested. I have been entertained by Mr. Porges at his country seat at St. Cloud and have found him, aside from his wealth and influence (which are very great) a very intelligent and enquiring man. Mr. Léon too has been very kind. He asked me yesterday to enquire about the possibility of obtaining a plant from America for his house near the Bois de Bologne. He will pay $2000 for a 40 light installation. If it could be managed it would be a good plan to let him have it; Mr. May also took great interest in the matter. My relations with all these gentlemen are very pleasant and at anytime I could personally present any views you might desire to express.

Du Moncel is greatly interested in everything we have out on the tables. He and his wife pay us visits at least twice a day.

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Her influence over him is very great as he seems to rely upon her observation entirely as his eyes are now very weak. He has just written an article for La Lumière Electrique on your system which Mr. Batchelor and I revised, and which Mrs Du Moncel corrected as I called her attention to the uncertain points in the descriptive parts. She has a great admiration for you and I believe she is inclined to hero worship. Mr. Bailey has no doubt written you about Du Moncel’s new relations with his paper, so I will not touch on the subject.

Mr. Fabbri called to see the salons the day of his arrival and expressed himself as well pleased. The tapestries on the parlor room walls (as you might call the one from which the coarser instruments have been excluded) so attracted him, that he desired me to make special enquiries about their prices probably with a view to purchasing some of them. An inventory of the valuables loaned in your exhibit shows them to be worth over 350,000 francs. All this is in strong contrast with the empty look of Maxim’s counter in the Salle d’honneur as he advertises the room he proposed to light up. But the blow which he did not expect came this afternoon. Count De[...] Berger’s Secretary, came to our room and said that Mr. Maxim’s agent in Paris, who represents the U.S. Electric L[ighting]. Co., had just come to his office in great consternation about the injunction which had been put upon Maxim’s light. The Count said “he was sorry for him, but it was all right if it was deserved.” The whole matter has caused quite a furor in the Palais. The newspapers have not yet spoken of it, simply because if you wish anything given to the public, (and there’s money in it), you must pay for it. The reporters openly accost you with pen in hand (in place of pistol as brigands would do) and say they will publish such and such a notice at such and such a price. They do it as unblushingly as a bootblack would ask you for his nickle. In fact beggary is a profession here—practiced at times in silk or furs and sometimes in rags; but more generally the first. Paris is in this respect sui generis. The foreigner is the natural prey of the people by common consent. It begins as you enter Paris, or for that matter as your food comes into the city, for it is taxed, in eating it you are taxed and robbed, and as you progress you do it with your hand in your pocket. Pay—pay—pay. That is the war cry here.

The newspapers must be managed, however, so I hope you will arrange some way by which we can ‘go it strong’ with them. Mr. Puskas arrives in N.Y. tonight and I hope things will be focussed time enough for the Congress.
Mr. Batchelor is getting along all right. The instruments are all in good condition with but one or two exceptions. He hopes to have the plant running by Monday; but the official opening at night will not take place before the 27; so you may be sure everything will be working smoothly by that time. Faithfully Yours,

Otto A Moses

ALS, NJWOE, DF (TAED D8135ZAM; TAEM 58:978). \*Interlined above. \*Illegible. \*Repeated at end of one page and beginning of next.

1. François Paul Jules Grévy (1813–1891) was president of the French Republic from 1879 to 1887. Ency. Brit. 1911, s.v. “Grévy, François Paul Jules.”

2. Charles Porges was associated with the Banque Centrale du Commerce & de l’Industrie in Paris. With Elie Léon, he organized a large syndicate of investors for the control of Edison’s electric light business in Continental Europe. See Doc. 2132 n. 4.

3. All that is known of E. May is that he was affiliated with the Banque Franco Egyptienne and he was involved in commercializing Edison’s telephone in France. May to John Harjes, 16 Apr. 1880, DF (TAED HM800101; TAEM 86:123).


5. On 29 July Puskas and Bailey wrote Edison that they had a “long conversation with Du Moncel yesterday morning in which he explained fully his connection with Lumière Électrique, and agreed on certain conditions . . . to sever his connection with L.E. and go with us.” They also told Edison that they were working to establish a journal and to obtain the services of du Moncel and other prominent French scientists as contributors. However, du Moncel retained his post as scientific editor of La Lumière Électrique, and the Edison interests did not start a new electrical magazine. Puskas and Bailey to TAE, 29 July 1881, DF (TAED D8135ZAD; TAEM 58:939); Fox 1996, 164–67.

6. The International Electrical Congress, the first of its kind, was held in conjunction with the Exhibition.

[New York,] Aug 11 1881—

Tests with Indicator and weighing Coal & water on Babcock & Wilcox Boiler, Lump anthracite—Croton water = 

First test simple friction Engine, no field =

Evaporation Commenced, B[oi]ler P[ressure] 120—10:51½ PM.—Engine started at [—]° 11:03 PM with 3 bbls on—on test= Volts. 103= a Besides the 3 bbls there is 9 other lamps on. 103 Volts on armature Average heat 129 deg in barrelles—

Had c to increase speed of blower after 2 hours run after 4 hours had to increase it again= bobbin very hot. d took speed of the blower—(Large size =) 1940 Rev per minute. It will re—

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quire the boreing out of \( \frac{1}{2} \) and air equal to a speed of the big blower 2500 per minute to keep cool—

Mercury wears nearly off Commutator after 4 hours run and brushes especially X

Sparks somewhat freely as it catches stuff at .g. — 4:30 AM. Mercury worn off sparks ratherly badly. 3:35

Shut down at 5:10 AM—stopped Evaporating water at 5:17 AM. Mercury wore off about 3 AM. Sparked badly after that & spotted up Commutator pretty well. Armature when stopped not extra hot though it wouldnt do to let it get any hotter. The joints or contacts were quite hot and the bolts that goes through plates very hot. temperature of the contacts at bars 147. There was 6 ohms outside of field—


1. See headnote, Doc. 2122. This entry is a continuation of Doc. 2131.

My dear Edison,

Recd. your cables etc— The exposition was opened but not a single exhibitor ready. My tressle work was not quite finished but shall be running by the 15th which will be as soon as any and before the great majority. There is a terrible lot of red tape here— I also find great difficulty in getting anything done here; and not all without great expense. The exhibition has made everybody very independent and if you buy or hire anything they will not let it go without pay beforehand— I was not able to get a fast speed engine so had to hire one that only runs 81 revolutions, but of course can make that do; although it looks much larger than it would need to if I could have got a fast speed — I have to pay $200 per mo for the use of it and had to pay $350 to put it in place and raise stack ready for use. When I first came here our men were being boarded at a very high rate nearly $18 per week per man. I have now got them a cheaper place although the best I have been able to get is $12

Paris Aug. 12th 1881

From Charles Batchelor

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per week—Of course I want to keep them as near the exposition as possible—I have got a man looking round for still cheaper rates—

The Electric pen, Stock printers, District, pressure relay expansion relay, Motograph relay, Telephone duplex, Etheric force, 1 Universal private line printer (the other badly damaged but am fixing it) & all telephones; are all up and working well—

(English Light.)b Fabri was here and consulted me about London—I sent Littell the boiler man² over there to see the places that Mr Fabri had picked out as suitable to put the boiler and Dynamo and he will report to me in a few days

I have got hold of Biggs³ of the “Electrician” and Kempe⁴ of the “Telegraphic Journal” and spent yesterday 4 solid hours talking economy of the system—They started in very skeptical but have now become very much interested—Biggs told me he was the scientific head of the Engineer (and between you and I it is a damn poor head) so I am trying to kill two birds with one stone—

DuMoncel is in every day—Dubose the Electric regulator man⁵ said that told the Doctor⁶ yesterday that ours was the only thing he had ever seen that looked like business—There is no other exhibitor here with a complete system such as ours and people are struck with the display of conductors and other plant—The two little machines look so small at one end of this immense building that I am frequently asked the question are you going to light both these large rooms with those little machines down stairs Yours

“Batch”

ALS, NjWOE, DF (TAED D8135ZAO; TAE M 58:083). ¹Multiply underlined. ²Written in left margin and multiply underlined.

1. On 9 August Batchelor cabled Edison that “Moncell wants cuts Street boxes and armature can we publish.” Edison gave his answer in a cable to Puskas on the same day: “Regarding injunction consult Batchelor and use your best judgment Tell Batchelor following second countershaft and quadruplex shipped. do you want whole or half light machines. give Moncel cuts street boxes and armatures. autographic protected can exhibit.” Du Moncel used these illustrations for his article in La Lumière Électrique on Edison’s electric lighting system. Batchelor to TAE and TAE to Puskas, both 9 Aug. 1881, LM 1:19B–19C (TAED L001019B, LM001019C; TAE M 83:881); du Moncel 1881.

2. G. W. Littell was an engineer for Babcock & Wilcox. Batchelor to Theodore Puskas, 14 June 1881, DF (TAED D8135N; TAE M 58:899).

3. C. H. W. Biggs edited the British journal the Electrician. He championed a variety of battery technologies during the 1880s and 1890s, par-
ticularly the “chloride process” which ultimately proved impractical. In July Biggs asked Edison to provide descriptions and drawings of his exhibits for the journal. Biggs to TAE, 16 July 1881, DF (TAED D8135Y; TAEM 58:927); Schallenberg 1982, 216.

4. Harry Robert Kempe (b. 1852) was a British telegraph engineer who helped to found the Telegraphic Journal. He wrote two handbooks on electrical testing and practice. Bright 1974, 186.


My Dear Johnson:

I have just learned that the Maxim Co\(^2\) have by their usual misrepresentation succeeded in obtaining contract for light- ing one of the Penna RR ferry boats as against us.\(^3\) This is pretty rough when one considers that what they put on\(^4\) is one of the most shameful infringements that ever existed that an unimportant decision in\(^a\) the patent of\(^b\) upon an entirely foreign matter is represented to the Penna RR as having affecting our patents & giving them rights,\(^4\) and when when it is a notorious fact known \(\text{[far?!]}\) throughout the world that \& should even have been known to a Penna Official that at Menlo Park in 1879 in that subdivision of that that “scientific impossibility” the subdivision of the Electric Light was accomplished by me, and all the means & methods and it would one would naturally suppose that \(\text{[it?]}\) even a novice would know that the means & methods of doing it would belong to me & not to a pirate Company who appears on the field over a year afterwards= \(\text{[?]}\) have not the slightest concern about any money we could make out of the Penna RR but It seems a little rough that this contract should be given \(\text{[-- ------]}\) \(\text{[------]}\) because we would not stoop to false statements, and Especially when one considers that thise \(\text{[-----]}\) Exhibition of this very light has brought over 70 000 people over the Penna RR to see it in operation at Menlo Park\(^5\) and\(^a\) that long before these pirates started in business—\(\text{[?]}\) I understand you are acquainted with Mr Cassatt,\(^7\) would you not go and place this matter before him, and Explain the lies of these infamous shysters.\(^8\)

Yours

T A Edison

[New York, August 19, 1881?\(^1\)]

Draft to Edward Johnson

ADfS, NjWOE, DF (TAED D8126ZAU; TAEM 57:625). \(^a\)Obscured overwritten text. \(^b\)Canceled.
1. Edward Johnson wrote or copied an amplified version of this letter, dated 19 August, based on Edison’s draft, presumably to transmit to the Pennsylvania Railroad. TAE to Johnson, 19 Aug. 1881, DF (TAED D8120ZAV; TAEM 57:628).

2. The United States Electric Lighting Co., formed in 1878, controlled the lighting patents of its chief engineer, Hiram Maxim. At this time the company was promoting incandescent carbon electric lamps, which Edison considered inferior imitations of his own. Bright 1972, 47–48; Passer 1953, 147–48; see Docs. 2021 and 2022.

3. The Pennsylvania Railroad operated over leased tracks to its terminal at Jersey City, from where it ran ferries to New York. Condit 1980, 50–51.

4. Johnson referred in his version of this letter (see note 1) to “the Thermostatic Regulator—an entirely foreign matter to the present state of the Electric Lighting problem.” In 1879 Edison obtained his first patent for an incandescent electric lamp (U.S. Patent 214,636), a platinum lamp with a thermostatic current regulator to prevent the metal burner from overheating. The patent was placed in interference with an application by Hiram Maxim, however, and in February 1881 the examiner awarded priority to Maxim. Edison appealed twice, but the Commissioner of Patents affirmed the ruling in late July or early August. By that time neither the Edison Electric Light Co. nor the U.S. Electric Lighting Co. foresaw any practical use for the invention. Decision in Maxim v. Edison, 4 Feb. 1881 (TAED W100DCA022); “The Platinum Lamp,” New York Tribune, 3 Aug. 1881; “The Thermostatic Regulator,” New York World, 4 Aug. 1881, both Cat. 1242, items 1629 and 1625, Batchelor (TAED MBSB31629, MBSB31625a; TAEM 94:640).

5. See TAEB 5:539–40.

6. In the longer version (see note 1), a separate paragraph was inserted here. It called the Maxim company’s claim to superior operating economy “a simple fraud—It is notorious that they can get But ½ the No of Lamps of a given candle power—per Horse Power that we obtain.”

7. Alexander Cassatt (1839–1906), brother of noted painter Mary Cassatt, was connected with the Pennsylvania Railroad most of his working life and played crucial roles in its rapid expansion. He was general manager until 1874 and third vice president until 1880, when he was appointed first vice president. Disappointed at not having been named president, Cassatt retired in 1882. He returned to the Pennsylvania in 1899 as president, a position he held until his death. ANB, s.v. “Cassatt, Alexander Johnston.”

8. In the longer version (see note 1) Edison referred to Johnson, who began his telegraphic career as a station agent, as “an old Penna RR man” and asked him to request a hearing: “My relations Past present & to come with the Penna Co—as a resident on their Line & a patron of no inconsiderable moment should also entitle me to this—Please see them on this subject & report to me.” The editors have found no reply from Johnson or the company, but see Doc. 2216. NCAB, 33:475.
Dear Sir and Friend,

Since I was with Victor Hugo and Liszt I never was so much in the intellectual heaven as day before yesterday—I was wide awake, still I was in a dream-land, and I want to remain there, and to nourish myself on that heavenly food—and in the same time I do not wish to be so terribly in debt toward you—otherwise I will be soon bankrupt,—therefore prepare yourself immediately—if not sooner, to a musical assault on your doomed head—and then, only then we will be even—

My most affectionate regards to that sympathetic straightforward luminar Johnson— Your affectionate fidler

Looking at your Photo—I invent also all sorts of melodies—you bet.


1. It is not known how or when Edison met violinist Eduard Reményi. Their correspondence was underway on 2 February when Reményi thanked Edison for accepting a dedication, possibly to a “Liberty Hymn” that he later sent. He also acknowledged Edison’s invitation to meet him. In August and September 1881, while performing at Koster & Bial’s on 23rd St. in New York, Reményi invited Edison to attend on several occasions (Reményi to TAE, 2 Feb. 1880, 19 May, 16 and 29 Aug., 13 Sept. 1881; all DF [TAED D8004ZAK, D8004ZDG, D8104ZCK, D8104ZCS, D8104ZCY; TAEM 53:67, 162; 57:185, 195, 207]). Edison later recalled that the violinist made late-night visits to his Fifth Ave. office and the Edison Machine Works to discuss philosophy and politics and, on at least one occasion, to give an impromptu performance. He offered him an option on shares of Edison Electric Light Co. stock in September 1882; in 1898, he was a pallbearer at Reményi’s funeral (App. 1.B.15; TAE agreement with Reményi, 20 Sept. 1882, Miller [TAED HM820165A; TAEM 86:494]; “The Funeral of Remenyi,” New York Times, 30 May 1898, 7).

2. Hungarian-born of Jewish ancestry, violin virtuoso Eduard Reményi (1828–1898) entered exile in the United States after participating in the unsuccessful 1848 revolution in Hungary. He toured Europe with Brahms in 1853 and became a protege of Liszt. A popular concert artist, he toured extensively through Europe in the 1860s and 1870s before again taking up residence in the U.S. about 1878. He continued to travel widely until he died while performing in San Francisco. NGD, “Reményi [Hoffman], Ede [Eduard].”
Dear Mr. Edison:

Wednesday I had the mercury cleaned 1  Yesterday I started the four workers in one aisle with one hundred pumps. They got off 600 A and 100 B lamps and will do better than this. Next week Friday I am going to start one hundred more pumps and put the two gangs into one and work daytimes only for all the lamps I can get.

Frank Holzer 2 has taken a contract to make 500 pumps at 40 cts. each. I shall do no repairing until this contract is finished and expect to have a number of pumps each day more than he has been giving for contract work brightens up slow men amazingly.

Holzer, Dyer and I have each given Welsh 3 a braceing up 4 and have made him work much better. His breakage has come down to the old figures about 9% once more.

Frank Holzer found it almost impossible to introduce the platinum foil into the fall tube. 5 Will. Holzer 6 will try it again.

Bradley tried last winter 6 every way he knew of to separate fibres from the bamboo without success. He steamed them several hours, twisted them between his fingers rolled them between plates. He will try again. This sticking of the fibres together is what makes the bamboo so good for our use. We could never cut a ribbon $\frac{6}{1000}$ thick if the fibres were not held firmly together.

There is no moisture 7 in the lamps that the eye can see. I shall have certain pumps run with lamps that have been taken from Sulphuric Acid bottles and report. 7

I have sent plumbago forms to Bergmann to plate. 8

When you spoke about our not trying experiments I was rather taken aback. That night I counted 12 experimental pumps on the line and we have tried over 150 forms in the last six months.

The only way with pumps is to keep at it and try the same form again and again to see if there is any change due to mercury or weather. It is the hardest of all experiments to try as a pump works well at one time then badly the[n] good and we cannot tell why.

We have now tested over about 4 200 orders since starting and are putting through lamps as fast as we can not neglecting regular work.

Everything is pulling together now again and I shall show full runs in a few days. 9

I am cutting the price on piece work constantly 10

From Francis Upton

Menlo Park, N.J., Aug 19 1881

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is bringing down the price of fibres. You know that 1000 lamps a day means a good deal and costs. 35 cents a lamp was as low a price as you could see at the start and we are doing that making them at a little less than that. Yours Truly

Francis R. Upton


1. Francis Upton had the vacuum pumps overhauled at the end of July following several days of poor operation. They worked better for a short period but on Wednesday, 17 August, he “stopped the pumps so as to clean the mercury and give them a thorough cleaning.” Alfred Haid suspected the mercury was contaminated with lead and Upton thought it “best to take a decided step and clean the whole with acid.” Upton to TAE, 30 July and 17 Aug. 1881, both DF (*TAED* D8123ZDH, D8123ZDM; *TAEM* 57:937, 944).

2. Frank Holzer (1859–1927) learned glass blowing from his older brother William and joined the payroll at the lamp factory in October 1880. His major duty at this time was making vacuum pumps. He spent his working life at Edison's lamp works and its successors. “Holzer, Frank,” Pioneers Bio.


4. To summon resolution for an effort or prepare for exertion (*OED*, s.v. “Brace,” 5b, c). Upton had recently expressed a desire to fire Welsh, whom he said “has proved very unsatisfactory of late. He is thoroughly lazy and given to untruths.” However, Upton feared “that he will go to the opposition and that he has had his eyes quite wide open since he has been here. I can get good carbons without him and feel better satisfied” (Upton to TAE, 1 Aug. 1881, DF [*TAED* D8123ZDI; *TAEM* 57:938]).

5. The purpose of the foil is not known but may be related to arrangements Edison sketched in June for inserting short lengths of a constricted platinum tube into the supply tube in order to standardize the rate of flow among all pumps. He executed a patent application embodying this idea on 1 July. Cat. 1147, Lab. (*TAED* NM017:82–83; *TAEM* 44:306–7); U.S. Pat. 263,147.

6. William Holzer, brother of Frank, was an experienced commercial glassblower from Philadelphia whom Edison hired in 1880. He married Alice Stilwell, Mary Edison’s sister. About this time he was superintendent of the factory’s glassblowing department. Holzer to TAE, 6 Jan. 1880, DF (*TAED* D8014C; *TAEM* 53:488); *TAEB* 5 App. 2.

7. See Doc. 2139; this was presumably an experiment to remove moisture from the lamps using sulphuric acid instead of phosphorous anhydride, the factory’s usual practice. When Upton reported results of tests on contamination in the mercury a week later, he “thought best to let the experiments with other materials than phosphorous wait. Pumps are now so important that I only want to try such experiments as will in-

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*July–September 1881*
crease their life. The experiments with other driers must have a long run to decide anything.” Upton to TAE, 26 Aug. 1881, DF (TAED D8123ZDP; TAEM 57:951).

8. On the new plumbago carbonizing molds see Doc. 2094. Upton was still trying to determine why the nickel weights in the new forms deteriorated rapidly, but nevertheless asked Sigmund Bergmann to finish 500 more forms. Edison executed a patent application on 19 September for a plumbago carbonizing mold which he stated was durable, cheap to manufacture, and would not damage the filaments. Upton to TAE, 27 June 1881, DF (TAED D8123ZCQ; TAEM 57:917); U.S. Pat. 263,144.

9. In his 1 August letter (see note 4), Upton confessed that he had endured “the worst week nearly I have had since I have been here. Everything was wrong and dragging and I am ashamed. This week will be much better I hope for I think I have pulled things together again.”

10. See headnote, Doc. 2177.

—2139—

From Francis Upton

Menlo Park, N.J., Aug 20 1881

Dear Mr. Edison:

We tried the japanned clamps yesterday. The blue lasted very long on them so that the workers complained a good deal of the delay.\(^1\) The blue seemed to make just at the edge of the carbon and in one instance it broke the carbon itself which happens very seldom with copper clamps.

The drying by sulphuric acid does not show any advantage so far. Those that have run pumps with dried bulbs say they are no better, they can see no difference.

I find I cannot get 1000 A lamps off 200 pumps in one run of 11 or 12 hours sealing off lamps that have been worked high, even if I let tubes I know are not just right pass.

Now about reducing expenses. Considering that we can make lamps faster than the market calls for them would it not be well to cut down to one gang and run about 600 A lamps a day increasing as we can take care of them?

I know we cannot make the lamps as cheaply as we can in larger quantities per lamp but the running expenses will be less.

The great trouble I think is that we shall have to discharge a number of good and well trained men who can carry away points.

As regards the pumps I am sure that the pumpers can tell what we have called good lamps and how they have been made. Yet I know they are somewhat mixed and that I can mix them more by running through experiments.

I shall try and see you Monday. Yours Truly

Francis R. Upton.

\(^1\) Charged

Canceled.

1. A bluish discharge was often visible around the clamps when lamps were brought to high incandescence on the vacuum pumps. It was attributed to an emanation of gas and understood as a sign of insufficient vacuum (headnote, Doc. 1898). On 16 August, John Howell recorded an order (no. 399) for “75 Lamps with clamps japaned.” Two days later he noted a batch (no. 408) of “Lamps that blue hangs in and trouble workers” (Cat. 1301, Batchelor [TAED MBNo07:38–39; TAEM 91:331–32]).

Paris France. August 22nd 1881

My dear Sir,

Yours of the 9th received also numerous papers etc for all of which, thanks. We are progressing well and although backward somewhat we are more forward than the majority of exhibitors. The time for lighting has been set for the 27th but I am lit up every afternoon from 3 till 7. Swan has made one miserable attempt and Maxim not at all— It is the general remark of everybody that we get hold of that we seem to have a complete system whilst any other exhibitor has only a “lamp” or a “machine”— We frequently find Swan’s manager in our place studying our “processes for lamps,” handling sockets, safety catches etc— We shall have to lose no time now or these fellows will steal all we have and use it right under our very nose.2 We find it is impossible to light up the garden spoken of by Messrs. Puskas and Bailey as it is impossible to have it included as part of the exhibit— Very respectfully yours

Chas Batchelor

P.S. I wish also to call your attention to the fact that of all the lamps that have been sent here not one was broken— In Havre one of our barrels dropped about 10 feet in unloading and in that one, we found 2 of the carbons broken. This speaks well for the lamp as far as packing and shipping were concerned. All the barrels were packed a little different from each other and I was asked by the Edison Lamp Co to report on their condition after opening but each seems equally as good as the other— Yours C.B.

ALS, NjWOE, Cat. 1331:5, Batchelor (TAED MBLB3005; TAEM 93:303).

1. Eaton’s letter has not been located.

2. Batchelor reiterated this to Eaton about two weeks later. After describing the various installations of Edison lights he had made in and
around the Exposition, he warned that “all we have is open to view; and in Europe the ‘Light’ will have to be exploited very quick or the other people will take all we have; for already Maxim puts a very small copper wire in his circuit in place of our safety catch, and Swan works his lamps in multiple arc, not in series as we suppose.” Batchelor to Eaton, 4 Sept. 1881, Cat. 1331:22, Batchelor (TAED MBLB3022; TAEM 93:313).

2141

To Charles Batchelor

[New York,] Aug [24, 18]81

Knoside’s Paris

Adhere (U.S. [Electric Lighting] Coy) deny seizure even one of their lamps and say not one has been removed by court also that all their lamps still burn what date did Aft (Edison) Maxim Swan and Fox begin lighting and has each continued without break was one Maxim lamp removed by court and where is it now How many days since exhibition opened have above four exhibitors been lighting How many days have Maxims arc lamps burned. Has Maxim lamps burning in Paris outside exhibition and if not would court allow it cable full and exact facts for newspapers answer quickly Cable anything interesting daily

L (telegram, copy), NjWOE, LM 1:29A (TAED LM001029A; TAEM 83:886). Written by John Randolph.

1. This cable was entered into the cable book among other cables dated 24 August 1881.
2. Cable code for Charles Batchelor; see App. 4.

On 21 August Bailey cabled Edison that when Maxim’s exhibitors were served with the injunction they made “so violent resistance that the Police were called in to aid the officer making seizure” and that the court had issued a summons for “Maxim to appear and answer to charge of counterfeiting Edison lamp.” He and Puskas warned Edison to expect a legal battle of at least five months; proceedings continued for three

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My dear Sir:

With the greatest pleasure I chronicle the complete success of our illumination. Last night for the first time we ran the entire capacity and I assure I never saw a more beautiful sight. The two crystal chandeliers in the center of the rooms were resplendent with {} lights each, and 48 lights drooped from 12 chandeliers around them. The two effects did not interfere in the least. I asked everyone whose opinion was valuable as to which would be most acceptable to Parisians and the great majority declared in favor of {} lights, simply however, because 8 candle lights are nearer to the bougie (candle) in appearance. Educate the eye hereafter, for the present, in salons, 8 candle power is enough. Shops will take 16 candle lamps every time.

Berger came in last night while we were illuminated. He was charmed, and paid the light profuse compliments. Capt. Eads and his wife were here when he came. Capt. E. said to me when he left “Oh I would like to give ten years of my life to the study of electricity.” He was enthusiastic over your Exhibit.

Mr Berger told us to-night would be considered the opening night for the government and the press. that MM. Gambetta and Léon Say would attend.

Edmonds, Swan’s partner, (whom you know) also illuminated the Salle du Congress and the adjoining lunch room. Altogether he had more light than we, but the effect was very poor, and every one declared it far inferior to ours; however, it required no impartiality to discover that ours was superior,

4. Batchelor replied on the same day that he would give a fuller account on Friday, 26 August, but cautioned that Maxim and other exhibitors “don’t run yet.” On 26 August he cabled, “Get accurate details tomorrow early received cables whilst showing Gambetta and party round open tonight first time for press grand success.” The following day Batchelor reported that one of Maxim’s lamps was “seized and sealed by Captain police who made Maxims agent responsible produce it in court after making seizure court dont interfere further until decision rendered cant find any small lamps burning outside public not admitted after six till last night lighting before very irregular we have lit fully every day since twentieth.” Batchelor to TAE, 24, 26, and 27 Aug. 1881, LM 1:29B, 30B, 30C (TAED LM001029B, LM001030B, LM001030C; TAEM 83:886–87).

From Otto Moses

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being so much better. Edmonds has a unique style of chandelier which is quite pretty, thin spider-like arms curving out from a center and lamps suspend at intervals. Above each lamp there is a cap of flourescent glass like a drop shade. It is very light and pretty. The Director of the Telephone central station said to me "there is something blinding about the Swan light which you do not see in Edison’s." His loops are smaller and carried to an incandescence equal at least to our 48 candle power.

Maxim’s illumination was the sickliest thing you ever saw. His central light was a ring of lamps with an incandescence running at one side from about 4 up to about 12 candles on the other—and two broken lamps. Such a mess I never did see! His head man is sick and he has fallen into the hands of the Philistines.

You have received news of the accident to Lane-Fox’s lamp by cable. It appears that some of Swan’s men were on the roof of the Palais and saw smoke issuing from one of the partitions in the reading room near our Salle. They shouted to our watchman who called the firemen always on duty in the building. The latter caught the chandelier in their hands and half dozen were sent sprawling one after the other before the cause could be made known. Berger came in great consternation to Batch and said he wanted to know what safeguards should be adopted; and when he was shown the cut off system (as Johnson proposed to call the ‘safety clutch’ as name we gave to Du Moncel) he was perfectly satisfied. To day the whole Palais has been speaking of the fire. Hurrah for our side! The Commission sat to day and apportioned the representation by countries on the juries. France gets 75, Belgium 11, Germany 10, England 10 U.S. 7, Italy 6, Russia 5, Sweden 5, Switzerland 4, Low Countries 3, Spain 3, Austria 5 Japan 1, &c &c. equal 75. France getting ½ Commissioners Freeman & McLean protested at the smallness of the number given to US (This is literally true because besides you there is nothing much to speak of from the United States). We are organizing our campaign. Faithfully Yours

Otto A Moses.
eight candlepower and the other for the forty-eight lamps of 16 candlepower. See Doc. 2147 and Johnson to TAE and Eaton, 22 Oct. 1881 (pp.15–16), DF (TAED D813ZAJ; TAEM 58:642).

3. James Buchanan Eads (1820–1887) was a civil engineer best known for his pioneering bridge-building techniques. He introduced the pneumatic caisson to the United States and in 1874 completed the Eads Bridge across the Mississippi River at St. Louis. More recently he opened the mouth of that river to navigation. *ANB*, s.v. “Eads, James Buchanan.”


6. Henry Edmunds (1853–1927) was a British engineer, entrepreneur, and (since 1877) Edison acquaintance. In the early 1880s he promoted Joseph Swan’s incandescent lamp. He helped secure contracts to install Swan lamps on passenger and military vessels, including the *City of Richmond*, the first passenger ship to make an Atlantic crossing outfitted with incandescent lamps, and the HMS *Inflexible*, the first Royal Navy ship so equipped. Edmunds also managed Swan’s exhibit at the Paris Electrical Exposition. Swan and Edmunds made the lamp the centerpiece of their exhibition and used Brush dynamos and Faure batteries for power. While at Paris Edmunds secured for Swan an important contract to provide incandescent lighting for French naval vessels. Doc. 1205 n. 3; Tritton 1993 chaps. 4, 6–7.

7. Batchelor cabled Edison on 25 August that “one Fox lamp wires caused small fire officials with scientists made strict search into our wiring and expressed great admiration for complete safety system” (Batchelor to TAE, 25 Aug. 1881, LM 1:30A [TAED MBLB3010; TAEM 83:887]). He wrote Sherburne Eaton a fuller description on the same date:

Lane-Fox is lighting up a reading room near ours and about ½ past eleven our watchman saw the fire and immediately called the firemen & had it attended to. Early in morning about 8 oclock I was there; and a deputation of officials and scientific men shortly after came to our rooms to examine our wiring. I went carefully with them right through our mains and branches showing and explaining our safety catch all through and after their expressing admiration at the perfect safety of the system I showed them that independent of this our wires covering would not burn and illustrated it by holding the wire in a flame until it decomposed the covering. [Batchelor to Eaton, 25 Aug. 1881, Cat. 1331:10, Batchelor (TAED MBLB3010; TAEM 93:305)]

8. Frank Freeman was an examiner in the U.S. Patent Office and later a patent attorney; T. C. MacLean was a lieutenant in the U.S. Army. A complete list of jury members and countries of origin is in “Congrès International des Électriciens,” *La Lumière Électrique* 4 (1881): 417–20.
The object of this invention is to produce an electric meter capable of measuring in a convenient and economical manner the quantity of electricity passing in an electric circuit.

The invention consists in various devices, many of which I have tried and others which I am now engaged in experimenting upon to ascertain the best kind to meet all the conditions for practical use in my system of electric lighting.

Fig 1

Expansion of air Meter

In Fig. 1 is shown a meter which records by the expansion of the air in a closed chamber A, such expansion being due to the heating of a coil of wire carbon or other conductor B placed within such chamber. C is a flexible portion of the chamber working like that of an aneroid barometer or an accordion; the movement of this flexible portion of the chamber serves to give motion to a lever \(d\), which actuating a ratchet in the counter \(f\) serves to count every reciprocation or vibration of the lever \(d\). The wire B being in one part of the main circuit M, N, is heated upon the passage of the current, this in its turn expands the air within the chamber; this moves the lever downward when at a certain point it touches the lever K and moves it from the point L to the point G. Now the lever K being connected to one side of the wire in the chamber while the point G is connected to the other side, the contact of the two serves to shunt the current almost entirely from the wire B, thus allowing it to cool, hence the air contracts, the lever is drawn upwards and when it reaches a certain point it disconnects the lever K from G, breaking the shunt, whereupon the coil B again becomes heated and expands the air and the lever makes another vibration, the minimum current with which the lever \(d\) will make a complete vibration being that due to placing a single electric lamp across the circuit, the addition of more lamps will cause the air to expand more quickly, hence the lever \(d\) will make
a greater number of vibrations per minute, the number being proportionate to the number of lamps, each reciprocation counts.

Fig 2

Expansion of wire Meter

Fig. 2 is a modification, the expansion of the wire A, forming part of the circuit serving to replace the air chamber. Preferably this wire is enclosed in a chamber but the expansion of the air contained therein is not utilized.

Fig 3

also in circuit Continuous Meter

Fig. 3 shows a continuously counting meter upon the copper depositing principle. A is a narrow trough in which rotates a disc B of copper upon the pivot C. On its opposite edges are two copper poles or electrodes. Connected to the resistance h in the main line K, L by the wires g, f. These electrodes are marked e, d. When a current passes through the liquid from the electrode d, it passes from it through the thin stratum of liquid to the edge of B nearest to it, thence through the copper disc to the other edge opposite e, thence through the liquid to e, a portion of the current, of course, passes through the liquid in the bottom of the trough but this is very small. The result of the action of the current is to take off copper from d, adding it to the edge of B, thus making B heavier on the side towards d, and at the same time copper is taken off the edge of B opposite e and deposited upon e, thus lightening the edge of the disc B opposite e, hence by the copper deposit one side of B is continually made heavier while the other edge is made lighter, this causes a continuous rotation of the disc which, if its shaft be connected with a counter will give the amount of current passing.
Fig. 4, shows an electro-magnet $N$, which vibrates a lever $K$ pivoted at $m$ and retracted by the moveable weight $L$. On the lower extremity of this lever is a rack $f$ which engages into a pinion $g$ secured to the shaft $e$. Upon the same shaft is a retarding fan $H$, and also a disc $d$, which carries a click or dog $7\ B$, engaging in a ratchet wheel placed on another and independent shaft, the latter shaft being a part of the counter. At every reciprocation or vibration of the lever $K$ the shaft $e$ is rotated a $1/2$ or $1/4$ turn and then brought back to its original position; but this reciprocation of the shaft $e$ causes a rotation of the counter shaft in a constant direction. $R$ is a lever which is moved by $K$. When a current passes through the magnet $N$ the lever $K$ is attracted when it reaches a certain point in its forward movement it separates the lever $R$ from the point $S$ and breaks the circuit of the magnet $N$, the lever $K$ falls back and throws $R$ against $S$, again closing the circuit; when the same action again takes place, the number of vibrations of $K$ being, within certain limits, proportionate to the current passing through the magnet $N$, it follows that the counter $A$ will record the total current passing. $8$

$^{7}$
Fig. 5 shows a continuously vibrating pendulum O, secured at 20 and provided with contact springs 1 and 2, facing contact points Q, P; the point P is connected by wire 4 to the magnet R while Q is connected to the magnet S by the wire 5. The other ends of the magnet are connected together and to the line by the wire N. The pendulum itself is connected to the other portion of the line by the wire M; thus a derived or multiple arc circuit serves to work the pendulum, when the latter in its oscillation has its contact point come in contact with the point P, a current passes through the magnet R for an instant, causing it to attract the pendulum; upon the bob T of the latter there is secured a piece of soft iron on each side; hence the pendulum goes towards R; when the spring Z touches point Q the reverse action takes place and the magnet S attracts the pendulum; this continues as long as there is current on the main line K L. The pendulum itself serves to vibrate a lever V pivoted at W, and playing between contact points; the lever and points serve to open and close the circuit of a magnet A at each vibration of the pendulum; thus the lever e of the magnet A is vibrated regularly; upon the extremity of this lever is a pawl d, engaging in a ratchet wheel B. This ratchet has a click c, which prevents it going backward; this ratchet is on the shaft of the counter. The retractile force on the lever e is a stiff spring f. If a single lamp is put across the circuit at the ends marked L, K a current passes through the magnet A and the lever vibrates, but owing to the stiffness of the spring if it barely catches one tooth in the rachet B, thus advancing the counter shaft very slightly at each vibration. If now another lamp is put across the main circuit the current is doubled in A, and as it has more power the spring f bends to a greater extent and the click d carries the ratchet wheel forward two teeth, and so on until ten lamps are on; when this point is reached a second magnet requiring the current due to ten lamps to give its first vibration can be put in circuit, its counting being of a higher value.

In Fig. 6 a copper depositing cell V is put across the line in multiple arc, but included in circuit with it are a number of re-
sistances, W, X, Y, Z. These resistances are cut in and out of circuit by the movement of the levers of the electro-magnets E, F, G, H, K. The magnets K and E are so adjusted that the placing of the first lamp across the mains will allow enough current to pass to cause the magnets to attract their levers; the lever of K serves to connect the depositing cell and resistance in circuit, while the lever of E cuts out R, W, causing the current passing to be of the proper strength to deposit the amount of copper in V to represent a lamp. If now another lamp is placed across the main circuit it will cause the lever of F to be attracted, cutting out the resistance X and causing double the deposit to take place in V, and so on.

In Fig. 7 is shown an electro-magnet. A whole lever rests upon a large number of springs i, i, i, all separated from each other. When no current energizes the magnet A a resistance R is divided upon into as many coils as there are springs and a spring is connected by a wire and between each coil.

M is a copper depositing cell or electro-motor working a counter; its current is obtained by a derived or multiple arc circuit across the main and through the resistance, R. F is an electro-magnet which, when no lamps are on, open the meter circuit, thus preventing recording, but when a lamp is put in, the circuit causes F to close the meter circuit and the deposit takes place; if now two lamps are put in the lever of A comes down upon the springs with sufficient force to close the top and next spring under together, cutting out of the meter circuit a definite portion of the resistance, R, thus increasing the deposit; if three lamps are put in, then two more springs are pressed together by the action of the increased strength of current acting through A upon the lever B, and so on.
Fig. 8 shows a device which I now use in my regular meter to close the meter circuit only when a lamp is on, and to open it when no lamps are on, so that the counter electro-motive force will not cause a redissolving of the copper deposited by lamps previously on.

Fig. 9 shows an indicating meter where mercury is used. C is the main containing cell of glass; N a carbon electrode, p is another carbon electrode; d is a tube small at the bottom and wide at the top.

The whole of the cell is filled with a mercurial solution. When a current passes metallic mercury appears at P and drops down in the tube d as fast as formed and in proportion to the strength of the current by using an index card, the amount of mercury in the tube can be read off; by reversing the current this mercury may be made to disappear, and thus allowing of reading the total current which has passed in a given time.

Fig. 10 shows a balanced beam cell, B, containing a mercurial solution with the electrodes at the end; the beam is balanced at F, a pointer, f, retracted by a spring, G, serves to in-
dicate the deflection of the beam at H. A A are mercury cups, into which wires dip, which lend to the carbon electrodes in the ends of the beam cell; when the current passes mercury is taken by electrolytic action from one end of the beam and deposited at the other, thus causing it to deflect and indicate. It is obvious that continuous counting could be obtained by applying the devices shown in my beam meter, for which I already have a patent.

fig 11

Fig. 11 shows two dishes; one, F, contains metallic mercury and forms one electrode, while a glass chamber, C, over the open mouth of which is stretched or placed a porous diaphragm; this chamber is also filled with metallic mercury up to the top of the tube, B.

Some mercurial solution is poured over the mercury E to allow of electrolysis; the mercury in C is connected to the main line shunt by a platina wire, X, passing through the chamber, while the mercury E is connected by another wire. When a current passes the total amount of metallic mercury in C is increased, hence it overflows into A, where its amount can be read off.

It is obvious that if instead of allowing it to fall in A, it were to fall in buckets arranged at intervals around the rim of a wheel, it would rotate the wheel and each bucket would, when it came around, deliver the mercury back into E to be again carried upwards into C, the shaft of the bucket wheel being connected to a counter a continuous counting would take place. Good-night,

T. A. EDISON.

ADDENDUM

[New York,] September 9, 1881

Add—In my regular deposit meter I have used plates of amalgamated zinc in a solution of sulphate of zinc, the zinc being electrically deposited and weighed.

Fig. 12 shows an electro magnet A in the main or con-
sumption circuit. It may instead be in a shunt therefrom. The armature lever B is retracted by spring a and carries a counter or a register C, operated by an exposed cog wheel b. Cog wheel b engages with the teeth of a variable gear D, which is driven at a uniform speed by clock work E, or other suitable driving mechanism. The gear D is a cylinder having rows of teeth, which vary in number, the number of teeth being regularly diminished from the bottom to the top of the cylinder. If no lamp is in circuit, the wheel b will be raised by spring a wholly above the teeth of D. If one lamp is turned on, b will be drawn down and will be moved by one tooth on D. If two lamps are used, b will be drawn down to next row which has two teeth, and so on for additional lights until the maximum number of lights for which the meter is arranged has been reached.

Witness S. D. Mott

1. Edison dated the accompanying sketches between 28 August and 10 September. This document is a transcribed version of a caveat manuscript that Edison later testified he prepared in his own hand and gave to his attorneys. It was transcribed in the course of a subsequent patent interference proceeding. The transcribed manuscript is substantially the same as the filed version of the caveat, except as noted. The caveat was executed on 23 September and filed on 4 October 1881; it was also published as part of the interference proceedings. Edison’s testimony, 5–6; Edison’s Exhibit Meter Caveat of October 4, 1881; Edison v. Sprague, Lit. (TAED QD008:5–6, QD008:21–27; TAEM 46:295–96, 311–17); Edison Caveat, 23 Sept. 1881, MdCpNA, RG-241 (TAED W100ABT); see also headnote, Doc. 2163.

2. Figure label at lower right is “counter.”

3. Figure label at lower right is “counter.”

4. In an unnumbered sketch following figure 2, Edison proposed using a “Fan to do work = gramme ring very light but large diameter to obtain leverage say 10 inches, all to weigh one pound — field in multiple arc.” The Gramme motor, placed in a shunt circuit across a resistance, would operate a registering mechanism.

5. Edison executed a patent application for a modified form of this instrument in August 1882; the patent did not issue until 1889. U.S. Patent 406,825.

6. This meter is similar to that drawn by Edison in April in Doc. 2075.

7. General term for a tooth or protrusion, such as that used to engage a ratchet to prevent backward motion. Francis Jehl drew several such devices on 1 September but their purpose is unclear. Knight 1881, s.v. “dog”; N-81-09-03:9–11, Lab. (TAED N235:5–6; TAEM 41:514–15).
8. The electromagnet, faintly marked N, is near the center of the drawing.
9. Label at lower left is “or a motor.”
10. The first evidence of a meter operating on this principle is on 9 September, when Francis Jehl made a “mercury deposition cell” for measuring the rate at which mercury would move from one electrode to the other. He continued these tests on 10 and 11 September. N-81-09-03:22–23, 26–28, Lab. (TAED N235:12, 14–15; TAEM 41:521, 523–24).
11. U.S. Patent 240,678 issued to Edison on 26 April, 1881. It encompassed electro-mechanical mechanisms for registering the movement of a balance with electro-deposition plates at either end. A device for reversing the current when the beam reached its limit of motion was also provided. In August 1882 Edison applied for a patent on an alternative beam meter design having a reversing apparatus similar to that shown in figure 5 (U.S. Pat. 304,082). Edison had begun experimenting with this general form of recording meter in August 1880 (see Doc. 1974 n. 1).
12. In the version of the caveat Edison filed (see note 1), the paragraph pertaining to figure 12 immediately followed this one; the brief paragraph below about zinc plates was the last one in the body of the text.
13. See headnote, Doc. 2163.
14. The drawing referred to has not been found. The device is shown in a drawing by Edison, without lettered figure labels, dated 17 May. It was entered into the interference record. Apparently on the basis of that drawing, Edison stated in his testimony that this was the date of the caveat manuscript. Text at bottom is “clockwork”; text at lower right is “1/200 of ohm in mag[net] for 10 Light meter.” Edison's testimony, 5–6, Edison v. Sprague, Lit. (TAED QD008:5–6; TAEM 46:295–96).

[New York,] 29th Aug [1881]

To Egisto Fabbri

My Dear Sir,

I have yours of 22nd August & note your brothers wishes in the matter of letters from Norway.²

I am sorry that there has been such a delay with the South American machines. The reason is that the machines originally ordered were made outside of my works (they were or-
dered before I started the works) & when I came to test them I found them so unsatisfactory that I decided to make new ones which will be ready shortly.

Yours truly

Thos A Edison [insull]

L (letterpress copy), NjWOE, Lbk. 8:474 (TAED LB008474; TAEM 80:988). Written by Samuel Insull.

1. Egisto Fabbri (d. 1894) was among the original investors in the Edison Electric Light Co. and the Edison Electric Illuminating Co. of New York. He sold out his founding interest in the firm of Fabbri & Chauncey when he became a partner in Drexel, Morgan & Co. in 1876. Docs. 1494 n. 4, 1504 n. 5, and 2037 n. 2; Obituary, New York Times, 27 June 1894, 8.

2. Fabbri’s brother was Ernesto, with whom he helped establish Fabbri & Chauncey, in which Ernesto apparently retained an interest. Fabbri stated that his brother had received a letter from Norway that Samuel Insull had forwarded to George Gouraud, but would prefer to have similar correspondence sent to him directly. Nothing more is known about this matter. Obituary, “Egisto P. Fabbri,” New York Times, 27 June 1894, 8; Fabbri to TAE, 22 Aug. 1881, DF (TAED D8131J; TAEM 58:394).

3. Fabbri & Chauncey, a major New York commercial and shipping firm, controlled Edison’s South American electric lighting patents. The firm had ordered equipment for two 75-light demonstration plants, at least one of which was intended to sustain Edison’s patents in Chile (Docs. 1504 n. 5, 1566, and 2048; Fabbri to TAE, 22 Aug. 1881, DF [TAED D8131J; TAEM 58:394]). Charles Clarke began designing the machines in February 1881. Edward Hampson & Co. built them in New York by early June. It is not clear when the new machines were completed, but the lamps were ready in October or November (N-81-02-20:1–103, Lab. [TAED N214:1–38; TAEM 40:946–83; Hampson & Co. to TAE, 4 June 1881; Philip Dyer to TAE, 1 Nov. 1881; both DF [TAED D8129ZAX, D8124ZAM; TAEM 58:265, 57:1069]).

—2145—

To Egisto Fabbri

[New York,] 29th Aug [188]1

Friend Fabbri,

You may remember the cable correspondence we had with Gouraud some time back with reference to retaining experts in case we should want them on Law suits.

I think that you should see that the Scientific writers on the Electrician, Telegraphic Journal, & especially “Engineering” are retained Conrad Cooke of the last named paper should be retained. The fees to be paid to them should be in accordance with those usually paid for such service in England. I have myself the poorest opinion of the ability of these men but they can nevertheless be of a source of a great deal of petty annoyance to us in the future as they most certainly have been in

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the past so it would be just as well to enlist them on our side as for every dollar of fees it will save us a great many dollars worth of trouble.

Matters are progressing here satisfactorily. We have taken possession of the buildings at Pearl Street where we are now putting the Boilers for the Central Station. The Tube Co has a large stock of street mains on hand and we shall commence laying the mains in the streets very shortly.

Last night we tested the Large Dynamo that is to go to Paris. The test was in every way satisfactory and we shall ship the machine by the [-------] leaving here for Havre on 7th September.

The London machine [will be sent soon I hope on the 14th September] Yours truly?

Thomas A. Edison

LS (letterpress copy), NjWOE, Lbk. 8:480 (TAED LB008480; TAEM 80:990). Written by Samuel Insull. [Faint copy. *Interlined above.]

1. Conrad Cooke (c. 1843–1926) was an engineer who had helped the Edison Telephone Co. of London put on exhibitions in May 1879, later claiming to have been offered the position of consulting electrician. Cooke co-authored the first volume of Dredge 1882–85. Edison wrote Edward Johnson in October that Charles Batchelor reported “he has captured Conrad Cooke (Editor) & Dredge (Proprietor) of Engineering & that they will render us some kind of justice at last. Now I think you should get hold of Cooke have a good square talk with him & tell him you want him to be connected with us in an official capacity. Give him clearly to understand that he will be treated very differently to the way in which Arnold White treated him.” Docs. 1741, n. 1, 1744 nn. 2–3, and 1780; TAE to Johnson, 9 Oct. 1881, Lbk. 9:174 (TAED LB009174; TAEM 81:58).

2. See Doc. 2125. The Edison Electric Illuminating Co. purchased adjoining buildings at 255–57 Pearl St., in lower Manhattan, on 3 August. It reportedly paid $30,000 for one structure and $1 for the other to the same seller. “Edison’s Company Buys Property,” New York World, 4 Aug. 1881, Cat. 1242, item 1625b, Batchelor (TAED MBSB1625b; TAEM 94:640); see also App. 1.B.54.

3. The Electric Tube Co. was incorporated in March 1881 to manufacture underground electrical conductors for Edison. See Doc. 2058.

4. The dynamo was shipped aboard the Canada on 7 September. See headnote, Doc. 2122.

5. This date has been inferred on the basis of Edison’s 28 August cable to Charles Batchelor that the machine would sail with Edward Johnson on that day. LM 1:31A (TAED LM001031A; TAEM 83:887).
To William Hazen

Dear Sir,

I have your favour of 25th. Its receipt was somewhat delayed in consequence of its being addressed to Menlo Park. I will with pleasure supply you with lamps for the purpose you name but shall have to make you special lamps. I have sent your letter on to Francis R. Upton of the Edison Lamp Co, Menlo Park N.J. to whom I have given instructions as to what I want. Please write him the latest moment at which the Lamps can be received at Washington. He will give you all information as to Battery &c. Yours truly.

Thos. A. Edison

[New York,] 29th Aug [188]1


2. This letter has not been found.

3. On this date Edison instructed Upton to supply Hazen with some lamps of low candlepower with platinum-iridium filaments for use with battery power. Celebrated balloonist Samuel Archer King used these lamps in an ascent he made on 12 September 1881 in his balloon, the Great Northwest. Accompanied by five reporters and a member of the Army Signal Corps, King intended the voyage to perform atmospheric research and to demonstrate the practicality of long-distance aerial navigation. However, the balloon made a forced landing several hours later due to high winds, which destroyed the craft on the ground. King also made several ascents to conduct meteorological research for the Weather Service of the Signal Corps. TAE to Upton, 29 Aug. 1881, Lbk. 8:469 (TAED LB008469; TAEM 80:986); Hazen to TAE, 30 Sept. 1881, DF (TAED D8120ZAY; TAEM 57:636); ANB, s.v. “King, Samuel Archer”; Crouch 1983, 451–63.

From Charles Batchelor

My dear Edison,

Last night we experienced what the parrot said he had with the monkey “a hell of a time.” The half light machine stripped off the brass wires and before we could do anything it tore off the canvas and bent up the bars considerably. This occurred at 10 1/4 o'clock. We immediately cut the belt and ran till 11 with the full light machine on the 16 3 light chandeliers. Our rooms were densely packed as they are every night but the short time we were stopped prevented any disturbance— At Paris— Aug. 30th 1881

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we took out the armature and commenced the fixing of it and at 5 o'clock tonight we began to run and continued till 11 without further trouble. I never let the boys leave it until it was complete having all their meals brought in to them and it was a great disappointment to some of our competitors to see us come up to the scratch 3 hours before time & run all night— These armatures run a little too close to the field and I think it would be a great deal better if you would give them a hundredth of an inch more when boring them out— Both my armatures touch the field when running full power and I am rigging up a boring bar to take a little out of the fields— In rubbing they help to increase the heat. Our exhibit is made by 2 handsome glass chandeliers with 60 lights each, driven by the $\frac{20}{1000}$ machine, and 16 of our 3 light chandeliers placed as in sketch driven by the 110 Volt machine—

Swan lights the next room to ours with 425 lights about 300 of which are festooned round the walls the rest in pendants holding about 20 each near middle of room. His lamps are very irregular and ever since we have been here he has been weeding them out. They are very irregular indeed yet and as we have a door in our room that leads into theirs we never fail to point out this difference to visitors by first taking a good look at Swan’s and then turning round to our chandeliers where we have 60 in a bunch; and although we never picked them out there is not a particle of difference in their intensity— None have busted as yet but of course it is hardly time for that— M. Leon was in for the first time yesterday and congratulated me on the success of the light as compared with others— I went round to Swan’s and Maxim’s with him and pointed out their defects which he appreciated highly. They can plainly see that we have got the system complete whilst others have only got a lamp or a machine, and even their lamp does not begin to compare with ours.

We have lately rubbed against the “Blarsted Royalty” in the shape of King Kalakahua who expressed himself very much
pleased with the light. We showed him also the singing telephone and the Motograph— We could keep these fellows easy enough to see all the apparatus but there is always such a devil of a crowd in the place that they want to get away I have hired two men who speak French and German to do nothing else but explain the things as the boys show them— Gambetta has been here and expressed his intention of coming again in the morning to have it all explained to him I believe he is a very large holder of gas shares— I saw a letter from Eaton to Mr Fabri in which he said you had come to the conclusion to manufacture isolated plants so as to supply those people now who will take your light when you can supply it from a station, for instance “Hines and Ketchum” This I think is a very good idea We have numerous applications here for it and if they could be supplied and terms fixed there are a great many places I am sure that it could be put in in Europe immediately— Bailey has applications from Brussels, Vienna, Lyons etc and if we do not supply them of course Swan and Maxim will. It takes so much time to make the plant and put central stations in operation that we ought to do something to secure the people beforehand I think also that it will be very much easier to form a company in any of these cities if a few people are using it—

I hear Brush has sold his light here for Fcs 2,000,000 to Credit Lyonnaise— The syndicate have appointed their three engineers to go over our plant, one of them is ‘Clerac’ of carbon pressure notoriety however as Bailey says he is a great friend of his and will do anything for him I suppose he is all right We are to appoint two of whom Armengaud the patent agent is one I have had two or three interviews with these engineers and at present we shall have to educate them up to what we have got before we make any tests but I have no doubt we shall be able to convince them that we have something worth Securing— Gas here is sold at $1.80 per 10[00] feet there is an enormous lot of it used in the streets and places of amusement but the public generally do not give it the place it would have if it did not give so much heat and spoil the decorations of the house The whole of Paris is supplied by one company who have a monopoly of the laying of mains etc which lasts 20 years more but the City reserve the right to break this contract if any better method of lighting should come up— Of all places Paris should be the best as every house is about 7 stories high with stores on the ground and private families in every floor each of whom would take the Electric
light where they now use candles in preference to gas because of its high price, deleterious effects, and above all the trouble experienced with the monopolist company. Let me know your views about these isolated plants. Yours

Batchelor

ALS, NjWOE, DF (TAED D8135ZBB; TAEM 58:1020). *Paper damaged.*

1. The phrase “parrot and monkey time,” popularized about this time from an unidentified “droll and salacious tale,” referred to a period of quarreling. Partridge, s.v. “parrot and monkey time.”

2. Kalakaua (1836–1891) was king of the Hawaiian Islands from 1874 until his death. He traveled widely and was keenly interested in public works projects and new technologies like the telephone and electrification. Moses wrote Edison that royalty and prominent political figures daily visited the Edison exhibition. He related that King Kalakaua “was at the notograph telephone with me and Batch was at the transmitter end. He (B.) was asked to sing and gave us ‘Mary had a little lamb,’ which delighted his swarthy Majesty very much. The thought of the narrow escape we had made, flashed upon me, and I blessed my luck—for Batch had intended, as he told me afterwards, to give ‘There was an old nigger,’ which is the other half of his usual répertoire, but didn’t.” On his return from Paris, Kalakaua visited Edison in New York at the end of September and received a full explanation of the electric lighting system. *ANB,* s.v. “Kalakaua, David Laamea”; Moses to TAE, 7 Sept. 1881, DF (TAED D8135ZBI; TAEM 58:1038); “King Kalakaua’s Movements,” *New York Times,* 26 Sept. 1881, 5.

3. This letter has not been found but see Doc. 2156 esp. n. 2.

4. Hinds, Ketcham & Co. was a commercial printer and one of the first businesses to adopt the Edison electric light. Its isolated lighting plant became operational in February 1881. See Doc. 2053.

5. Crédit Lyonnais was a French bank founded in 1863. It expanded dramatically; by 1880 it had become one of the largest French banks, with seventy branches within France and offices in Egypt, Turkey, Switzerland, Britain, Spain, Russia, and Tunisia. Cameron 1961, 172–73.

6. Hippolyte Clerac was an engineer with the French government telegraph service. He claimed to have anticipated Edison in discovering the principle of the microphone in 1865 by showing that a tube made of plumbago changed its resistance under pressure. Docs. 1398 and 1482.

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My dear Major Edison

The great necessity of something being done very quick impresses itself more and more upon my mind every day. If I could make arrangements to supply I could take a couple of orders per day of about a 300 light plant each and I feel terribly galled to think we have such a good thing and we have not even

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From Charles Batchelor

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our manufactories started to supply anything. There is a large dry goods store here called the “Au Bon Marché.” They use 5000 gas lights and they want to replace them with our light, they have been to see it often and yesterday I went and inspected their building to see how it could be adapted to Electric lighting. I find they have tried Jablchekoff lights and Siemens’ lights at an enormous expense and gone back to gas. Their gas bills average about 138,000 francs per year. I told Bailey that I was going to see this place and he communicated with Leon, after which he told me that if this could be put in writing and I would make an estimate of about what saving could be made in this store and put the same into the hands of the Syndicate they would consider this as \( \frac{1}{2} \) of the test that we have got to make. After visiting the store I saw how easily it could be done and proposed to the “Bon Marché” people the following:— They to write me a letter asking me whether I could light up their place and what it would cost; also stating that they would like a preliminary trial of say 300 lights (for which we should have to put a portable engine in similar to what I have at present in the exhibition) for 3 months, and to submit to them an estimate for the expense to them of such preliminary trial, that if they are satisfied with the light at the end of the 3 months they will give us an order for the whole store. To light their whole 5000 lights would take 320 horse power (the paris gas jet is not more than our half light at 9 candles). They have got excellent cellaring large enough for the boilers engines and dynamos etc and are very anxious to get it; their chandeliers are so arranged that I could very easily use them all for our light. Now in such a case as this I should advise the putting in of such a plant, as they would stop their engines and take current from the company’s mains when they are laid; besides Maxim and Swan are open to all such offers and the reason they come to us is because we show the best light, and upon investigation they find we have a complete system—

Now for one more thing:— I have a large manufacturer in Rheims (the champagne district) who has been here for about a week investigating the lights; he has one part of his factory lighted by arc lights driven by 8 gGramme machines and he wanted the rest lighted by our light; altogether about 300 lights. If I could give him a price I am sure I could get the order immediately. He wanted to know whether I could use the Gramme machines he had; so I took him down stairs where I have the American Commission offices, Dolbear’s telephone office, a machine shop and Berger’s office all lighted from one

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little Gramme machine (in all about 42 lights) I showed him our own machines and explained their greater economy. If we were manufacturing here I could secure him immediately at my own price; as it is he may be gobbled by Maxim or Swan although in every case I take great care to point out every defect in the other systems— I have also a man from near Brussels wants 300 lights; one from Vienna 250, one from Strasbourg about 300 and lots more; now to supply these I would make special plants driven by belt as they care not for great economy— I have found that to run the small machines above 1200 makes them spark, but below 1200 with whatever load, they give no spark; so I have slowed down to 1200 and get my electro motive force by taking off a layer of wire on the magnets; you must impress this on the people using the isolated plants as it means that the life of a commutator is years instead of months— You must not think that because I write about isolated plants that I have lost sight of the primary object of this light that is, the lighting of cities in competition with gas; I merely cite cases that are outside of the gas companies (with the exception of the “Bon Marché”) and which the other people will take immediately they get the chance; for your own private information.

The engineers for the Leon party are making calculations and learning the method of Electric lighting on the multiple arc system. I think one of the best evidences of the originality of your methods is that these 3 electrical engineers have to study it out as a new problem that they have never believed possible before. We shall be ready for them to test in a day or two. We have got Berger to get from the “Conservatoire des Arts et Metiers” a dynamometer which we shall put in between the machine and the engine, we expect to get that this week; whatever tests our apparatus goes through I have got two or three influential people in the Congress who will ask that the Maxim, Swan, and others may be tested also in the same manner, and I shall lend my photometer, Calorimeters etc for such tests if they have not any, which I know they have not; and I doubt whether they would know how to use if they had.—

I have always given a great deal of credit for arc-lighting to Brush but now we must be on the warpath for here he runs down our light terribly and tells everybody that the Swan light is the only incandescent light that is reliable and that Edison’s infringes it— When I talk on arc-lights the beauties of the Siemens and the Pillsen stand out in glaring contrast with the July–September 1881
miserable flickering Brush light— I have had a visit from Mr Shillito the manager of Lord Salisbury’s place and his Lordship comes to see me today— Shillito says they have 150 Swan lights burning from a large Brush machine driven by waterfall 1[1/2?] miles away I went all through the thing with him and they will want some of your lights to replace the Swan as I should judge from what he said they were not satisfied sufficiently to put any more in I gathered from him that they never knew what resistance the lamps were hot, that they varied considerably but that by picking them out after putting them in they could make a pretty good showing. I measured a few of our lamps for him hot and they did not vary he was surprised at the completeness of our system but in his case economy is not the primary object as his lordship spends his money on science instead of horse racing— Edmunds of the Swan light had told him that they had not had one break since they came to the Exhibition, I told him that they had some go every night and called Suebel and Force to witness it and Suebel says come with me and we will sit down in his room a little while and see and whilst they were sitting there only a few minutes they saw three go, Shilleto could not understand this as Edmunds had told him that they were put 10 in series so I told him that that was another item he had stole from us— Maxims of course is not lighted and has not been for a week so we can make no comparisons with him—

Now what I want to know from you is=

1 What do you propose for manufacturing for France?
2 Can you supply isolated plants for other countries?
3 Do you propose to work Europe by agency or by separate Co.?
4 Will you entertain the idea of supplying these isolated plants and at what price?
5 Would you entertain the idea of putting our lamps on Gramme machines outside of France and thereby replacing arc-lights that are already running and at what price or royalty?

Also send me any information that you can that will facilitate matters. Suebel heard Mr Leutz that is Siemens’ manager say that he was sorry his firm did not go into the incandescent light 2 years ago but now he [intends?] to do so as he sees what a good thing it is and besides he intends to go for Mr Edison in Germany on the fastening the Carbon by electrolysis so we must look out for him Yours

“Batch”

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ALS, NjWOE, DF (TAED D8132ZAK; TAEM 58:466). *Obscured overwritten text. bMultiply underlined. Illegible.

1. In a letter written to Edison a few days earlier, Joshua Bailey and Theodore Puskas warned: “At the Exposition you have shown out entirely your hand & lots of people are taking note of everything you show, some of them making careful designs and unless you put them in practical operation at once, it will be found in full blast worked by other people and a series of Law Suits will be the result.” They reported having received numerous requests for isolated installations. Charles Batchelor proposed quickly setting up isolated lighting plants or small demonstration stations in a dozen major European cities. Puskas and Bailey promised to arrange funds to do so after the Paris Jumbo dynamo had operated successfully for two weeks. Bailey and Puskas to TAE, 2 Sept. 1881 and 29 Aug. 1881, both DF (TAED D8135ZBG, D8132ZAG; TAEM 58:1033, 455).

2. The Bon Marché, one of the world’s first department stores, was still among the largest and most prestigious. Its building on the Left Bank was in the midst of a long period of renovation and expansion at this time. On 5 September Bailey wrote Edison that “an application was made two days ago for the Bon Marché requiring 5000 Burners” and that Batchelor estimated the annual cost to the store for an incandescent lighting plant, including fuel and interest payments, to be 52,000 francs (approximately $10,000); the director of the Bon Marché claimed that the store consumed 100,000 francs worth of gas a year, a figure Bailey thought was lower than the actual cost. The store was wired for an Edison isolated station and 500 lamps in the middle of 1882. Miller 1981, 41–43; Bailey to TAE, 5 Sept. 1881, DF (TAED D8132ZAH; TAEM 58:459); Edison Electric Light Co. Bulletin 13, 28 Aug. 1882, CR (TAED CB013; TAEM 96:738).

3. Edison’s French investment syndicate required him to achieve two benchmarks, the lighting of the Opera’s foyer and the successful operation of a station powering 2,000 lamps, before they would release more funds. See Doc. 2166.

4. Amos Dolbear (1837–1910) was professor of physics and astronomy at Tufts College. He claimed to have invented a telephone that used permanent magnets, rather than electromagnets, before Bell. He exhibited several of his telephone inventions at the 1881 exhibition. Doc. 1043; France. Ministère des Postes et des Télégraphes 1881, 75–76.

5. Batchelor wrote Edison the next day that six more firms had inquired about Edison lighting plants, and he had promised them that “the policy of the company will be determined inside of a month when they will hear from us.” Batchelor to TAE, 8 Sept. 1881, DF (TAED D8135ZBK; TAEM 58:1044).

6. A committee consisting of George Barker, William Crookes, A. Kundt, E. Hagenbach, and E. Mascart performed these efficiency tests. Batchelor supplied the committee with a ten-cell Daniell battery, resistance coils, Wheatstone bridge, photometer, and a Z dynamo. The committee concluded that Edison’s lamps provided more illumination per horsepower than the lamps of Swan, Maxim, or Lane-Fox. Barker and Crookes published the test as Crookes 1882, a copy of which is in Ser. 3, Box 44, Folder 2, WJH.

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Charles Brush (1849–1929) was an inventor and businessman. Originally trained as a mining engineer, he turned his attention to arc lighting in the 1870s. He developed an improved dynamo and arc light in 1877 and 1878, and he installed the first electric street lighting system in Cleveland, Ohio in 1879. He formed the Brush Electric Company in 1880, which installed street lighting systems in several cities. In 1880 he also invented a lead-acid battery independently of French inventor Camille Fauré. ANB, s.v. “Brush, Charles Francis”; Docs. 1489 n. 4 and 1582 n. 1.

Not otherwise identified.


Philip Seubel may have been associated with Sigmund Bergmann before he sailed with Moses in June to help prepare the Edison exhibits at the Paris Electrical Exposition; he later helped install several isolated plants. Jehl 1937–41, 768, 1023; William Carman to Bergmann, 26 Jan. 1881, Lbk. 6:636 (TAED LBoo6856; TAEM 80:486); Batchelor to Puskas, 14 June 1881, DF (TAED D8135N; TAEM 58:899).

Martin Force had worked as a carpenter constructing Edison’s Menlo Park laboratory and had been employed since late 1877 or early 1878 as a laboratory assistant. Doc. 1039 n. 3; TAEB 5 App. 2.

On 5 September Bailey also urged Edison to decide these issues quickly, noting that “all the arrangements relating to the establishment of the factories & for the purchase of the individual plants can be completed within 30 days from this date.” On 17 September Edison cabled Batchelor to “get bids for making small dynamos can not Turritini make our Dynamos low figure could we use small Siemen’s or Gramme machines for isolated pending establishment our works can ship complete outfits from here including small engines for isolated to all countries where importation does not effect patents” (Bailey to TAE, 5 Sept. 1881, DF [TAED D8132ZAH; TAEM 58:459]; TAE to Batchelor, 17 Sept. 1881, LM 1:37B [TAED LM001037B; TAEM 83:890]).

Not otherwise identified.

On 19 September Edison cabled Batchelor to “make actual sales isolated countries where importation not invalidate patents especially Germany. head off Siemens complete outfits can be shipped from here our capacity getting enormous.” TAE to Batchelor, 19 Sept. 1881, LM 1:41B (TAED LM001041B; TAEM 83:891).
My Dear Batchelor

I had to go to Michigan to get my wife five days before your big machine was ready for shipment and did not return until the machine was shipped.¹ I told Francis to write you a full description as to the magnet we connect the field magnet, but it appears he wrote you a description of the whole machine.² For fear that he might not have put everything in I will give you a description myself.

I must tell you that when you left the first experiment with the big machine brought out the fact that it was a problem of great difficulty to take off from 600 to 800 lights from a commutator with three large brushes on each side when the brushes were put on new and at a proper angle and the ends ground so that all of them would touch the commutator and when six hundred light were put, a few minutes after, the sparking acting bad and increased so that at the end of about half an hour we were always compelled to stop the machine. Sometimes the heat due to the sparking would be so great as to melt the solder and the brushes would come to pieces. The following phenomena occurred which explained why the sparking increased so: The sparks melted the ends of the copper and a film of copper got onto each end and connected to its neighbor so that at the expiration of half an hour the crust at each end was practically solid. It had no elasticity and the commutator would also get badly burnt. I say I was in a bad hole as it looked as if it were impossible to take off such a tremendous current. I then determined to try to investigate the subject thoroughly. I took one of the South American machines having only a spindle in the bearings and a complete commutator with brushes.³ On the spindle was a pulley which was run by an electric motor so that I could vary the speed. I found that with the commutator standing still with new brushes upon which I put very hard pressure and with the commutator highly polished that there was $\frac{1}{1000}$ of an ohm resistance between the brushes and the commutator, or half of $\frac{1}{1000}$ of an ohm per brush. Upon rotating the shaft at different speeds I found that the resistance increased in proportion to the speed whether I started with a light pressure or a heavy pressure, viz. that the resistance was greater when the brushes were on flat than when they were end on. This is of course easy to understand because when they were on flat but a small portion of the brush is in contact. That is to say the total area of brush contact is small, while when they are end on the total.

¹ New Y ork, 8th Sept, 1881

² [New York,] 8th Sept, 1881

³ To Charles Batchelor

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area of contact is many times greater. Besides when end on each wire gets current direct from the commutator, while if on flat the current is taken off through each layer of wires one with the other. But notwithstanding all experiments the resistance with the most terrible pressure was considerable. I think the lowest resistance we could get was \( \frac{5}{1000} \) of an ohm. Now \( \frac{5}{1000} \) of an ohm is not much resistance with a small dynamo with only sixty. That is to say it is a small factor of the total resistance but when you come to a big machine it becomes a very important factor. There seems to be a physical phenomena between moving surfaces composed of the same metal and no amount of pressure or change of form will prevent it. It is fixed and definite and the [missing text] I came to the conclusion that it would be impossible to take off such a tremendous current as we require for the big machine by means of copper brushes, as copper [missing text] without the use of an impractically large commutator. I then thought I would try the effect of more current. I amalgamated the surface of the commutator and the brushes. Presto! There came a change! The thing had no resistance noticeable whether moving or standing still. Upon the next occasion that the big machine was ready to start I amalgamted the commutators and brushes and when 600 lights were put on no sparking could be seen standing a few feet from the machine. Only by looking down between the commutator and the brushes could any sparks be detected and these sparks were blue, and were due to the effect of the machinery while the sparkes of copper would have been yellow and [missing text] I then knew that the problem was solved.\(^4\) We ran the machine for about one hour and a half a few days afterwards we started on a a six hours test with 649 lamps on. The commutators gave no trouble whatever up to the fourth hour, when the mercury got worn off in places and a spark was apparant, but even up to the end of the test the sparks were not great. I afterwards experimented and found that the following was the best way of renewing the mercury. I took the brushes and dipped them for about six seconds in a solution consisting of about fifty parts nitrate acid and about fifty parts of water, dipping about \( 2\frac{1}{2} \) inches of the brushes in the solution. I then put a lot of mercury in a flat dish (perhaps it would be better to use a deep dish) dipped the brushes in the mercury for about five seconds then dipped them again in the nitrate acid solution for another five seconds, then put them under a running stream of water at such an angle that all the acid would be washed out, working the ends of the brushes
so that the mercury would freely flow all over them but being careful not to get them out of position. I then took hold of the brush with both hands, held it over the mercury dish, and gave it eight or ten sharp jerks like the cracking of a whip so as to dislodge the mercury. I then lay them on blotting paper for a few minutes to get rid of the water turning them over from time to time. You will notice that the mercury becomes very black and that the copper when first dipped and then taken out looks very dirty and black much gets over it. This is nothing but oxide of mercury and when steeped in the acid bath the second time is immediately clean. After the brushes are amalgamated several hours they get dull, dry, and the mercury becomes oxidized, therefore the brushes should be amalgamated only fifteen or twenty minutes before they are put into the machine and they should be reamalgamated each time you make a fresh run with the machine. We also amalgamate the commutator. Before I left we had not burned off the commutator which had a great many bad places in it due to its use before amalgamation. I told Dean to turn the commutator off before shipping machine to you. I amalgamate the commutators in the following manner. Disolve mercury in nitrate acid until the acid will soak up no more mercury. Then get a stick and rap around it a linen rag so as to form a kind of sugar tit which should be quite hard. Keep this tit in the solution and then daub it several times on a second rag so as to rid it of any surplus solution as it only requires to be moist. Start the engine slowly, get your commutator clean, then take the rag arranged in the form of a tit and hold it gently on one spot on the commutator during about ten or fifteen turns of the machine. Then take it off and hold a perfectly clean rag on the same spot so as to polish it. The object of this is to get the acid off as quickly as possible as the solution is a acid solution and it is essential that no acid should get down to the mica between the bars; therefore it requires that great care should be taken that the tit should only have a minumum dampness. By performing successive operations as above you will soon get the commutator fully amalgamated and very shiney. Then you better have a superficial amalgamation [missing text] the brushes may be put on and the machine is ready to start. The brushes should be so set that on one side the ends of the brushes are exactly in the centre of the insulation between the blocks and the brushes on the other side should be exactly in the centre of the block so that there will be the same number of blocks on the one side as on the other from [missing text] to brushes and these blocks
should be exactly on the neutral point which you can ascertain by following up the blocks, then the wire up to the bar over the space between the field magnets. Great care should be taken in setting these brushes so that they shall be truly end on. It is quite difficult to get them so, as sometimes the lower part of the brush will bear while the upper wires although they may look as as if they touch while they really do not so that one side of the brush will be right and other not; that is to say not at right angles to the commutator. Care should therefore be taken before starting the machine to get all the ends as far as possible to bear truly on the commutator block.

I do not know whether Dean sent you the brushes that I used. I found all brushes are liable to spread out at the edges that is to say that some of the wires at the edge would get spread out. I therefore took a copper wire and wound it around the brush about an inch or an inch and a half, if I remember right, from the edge of the holder so as to keep them together and to prevent this load of wire from gradually working down towards the commutator where it might cause trouble, I connected it to another wire the end of which I fastened round the screw which holds the brush in the holder.

I will now explain to you how to keep up the supply of mercury on the commutator. This is important and requires a little judgement. (After running a few moments the commutator will look a little dull, therefore to prevent this a clean dry rag should be held on the commutator and worked back and forth so as to keep it polished.)

To replenish mercury on the commutator take a couple of thicknesses of extremely fine woven cloth, then pour in some mercury about the size of a pea right in the centre of the cloth. Gather the cloth up like a sugar tit by twisting it. Then while the machine is running and the lamps are on you can as occasion may require, hold this sugar tit so to speak, with the globule of mercury in it on the commutator and by pressing gently the mercury will “spray out” through the cloth onto the commutator. You can see by the shine on the commutator the proper degree of pressure necessary. While holding it on the dry cloth should be held in advance of the tit and worked backwards and forwards so as to spread the mercury. In this way you can reamalgamate the whole surface of the commutator very nicely. About every five or six minutes the dry cloth should be held on the commutator so as to polish it and about every twenty or thirty minutes a slight amount of fresh mercury should be put on the commutator. You will notice when
you are running with lights on a little line of sparks on different parts of the commutator especially after putting fresh mercury on. When these are seen the dry cloth should be held on and it will remove them. It is nothing more than a little film of mercury on the surface of the wires between the bars. Sometimes when you are putting on mercury by means of the tit you may press too hard and too much mercury get out. In this case little snappy arcs will form. Although this does no harm it is best to put it on very gently. The great thing is to keep plenty of mercury on the commutator and keep it very bright. You will find after putting on metallic mercury that a great deal of it is sprayed over on the brush holders by centrifugal forces occasioned by the movement of the armature but this does not matter. After you are through with the nights run the commutator should be wiped very dry and although I have not tried it my impression is that the brushes should be taken out and the ends put in water as if the commutator is allowed to stand for a length of time with any considerable amount of mercury on it it gets very bad as the mercury oxidises to a white solid. I found that when I had eight hundred lights on with two brushes on each side they would carry it with great facility therefore it is possible to lift a brush off if you ever have occasion to do so to fix anything without any danger and it would be even possible (you could?) accurately mark the brushes as to their position on the brush holder, their angle and other things to reamalgamate a break or take it out and put it back while the machine is running, but of course this could not be done without some mark. I should advise you to try this while the machine is standing still to see if the thing can be done with safety.

The bars are wound with four thicknesses of parchment paper each layer being japanned. We found on testing that a half inch spark from the big Ritche with a condenser on it would not penetrate this insulation, but not with standing this insulation and $\frac{1}{12}$ inch air space between each bar a spark occurred between two bars when we have 840 lights on never could not get it to spark when we had 753 lights on, so you see this tendency to spark is a very extraordinary one and I am sure it is just a new (shenanagin) and therefore you should keep it to yourself. It depends entirely on the amount of current passing.

Now I advise that you do not run regularly with more than 500 or 600 lights and as you say a great many half lights can be used this will be quite sufficient. For instance you may use 250
full lights and 700 half lights. This will be equal to 600 full lights. Then you will be perfectly safe. When you make the economical test put on 700 full lights. The machine for this test will be perfectly safe with such a number. But you must look out that there are no crosses in your chandeliers or conductors as a cross would be equal to 200 or 300 extra lights and this added to the 600 you ordinarily burn would surely bring out the above referred to phenomena. This sparking which occurs between the bars does no harm so long as the arc does not stick. Every time that it has occurred so far the arc which was formed has been broken by the attraction of the lines of force at the neutral point and only a few scintillations have been thrown out at the ends of the machine but once the arc was not destroyed by the attraction of the lines of force it got large and a low resistance short circuit of the machine occurred and yanked the bars round in a lovely manner and bent them $\frac{1}{4}$ of an inch out of the true. These arcs which occurred when we had 850 lights on were immediately destroyed in the manner set forth and we continued to run, even after we had seen these arcs, for half an hour without that occurring again the [missing text] probably was covered up by the Japan running into the [missing text] the arcs are of such a nature that one would think that they are due to the wire bands from the armature striking the field magnets. We soon found that this was not so. What led to the discovery of the importance of this phenomena was this. I had concluded that the spotting was due to conduction across the mica between the bars which was the way you remember we first conducted them. Then I concluded that air being the [missing text]8 of the bar from which copper was taken and deposited on the other bar the copper being taken over an air space fully $\frac{1}{64}$ of an inch. I then knew I had to deal with a static current.8 I then went to work and had the bars Japaned finding by investigating with a [missing text] coil that Japan retards static sparks. We assembled the machine the bars being heavily Japaned but she [missing text] every time we had three barrels or 600 lights on and I found this was due to the fact that the Japan was put on unequally. We then took the bars out made them smaller and wound them as I have stated with four thickness of parchment paper. I found that parchment paper is the only kind of paper that offers great resistance to the static spark. You know that all papers are nothing more than a combination of fibers, that the spark goes right through the air spaces between the fibres and the paper offers no resistance at all, in fact it travels through the air, but if the air space is filled

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up with any glutinous substance so that it must pass through matter then it offers high resistance. Now in parchment paper the fibres are all agglutinous the air spaces are (clogged?), hence the spark must pass through solid matter hence the great utility of parchment paper for this purpose. These four layers as the insulation you have on the machine and you are quite safe for 600 lights providing you have no cross in the chandeliers. Perhaps you can get along with even four or five hundred full lights. It would be better to get along with a smaller number until the test for economy takes place. Then you can put on 700 lights. You will notice that we have bored the field out over \( \frac{1}{8} \) of an inch so there is not the slightest danger about the band touching. We were compelled to bore out the field so that we could get sufficient air through the to cool the machine. With the present velocity of the blowers the machine will not over heat itself with 750 lights on. We were compelled to pass the air through one end so that it will go out at the other end as we did not dare to arrange it otherwise. Hence the end of the armature where the air goes in after running many hours would be [missing text] perfectly cold while the end nearest the commutator would be found pretty hot especially the tits. But there is no danger even if the tits get so hot that you cannot scarcely hold your hand over. Of course the end nearest the commutator is at the disadvantage of having hot air thrown against it to cool it.

You will have to be very careful about that “cross belt.” It was the [missing text] and you will have to inspect it well. I do not know whether you will need to run this machine every night or only certain nights in the week. If every night then after closing and the lights are off I should run the machine about half speed with the current altogether off so as to reduce the temperature of the armature. Otherwise it will not be very cool when you start the next night. However do not suppose this matters very much as the speed of the blower is such that the heat never can rise to a dangerous point, without more than 700 lights are put on. I do not know whether Dean written regarding what kind of oil he uses, but my impression is the best lard oil is the thing to use. I think I have heard him say so. I should only run two or three hundred lights at first until you have got your bearings nicely soaking. You will notice that the [missing text] has been changed. It pounded so that Dean put on a regular connecting rod. I want to tell you that just before we were ready to ship this machine the shaft broke off at a point where the disc on the engine connects with it. It
appears Armington & Sims made this shaft of green metal. It was a very lucky accident as you might have had it occur in Paris. The idea of using a green metal shaft on a high speed engine with such a terrible thrust seems to me. In twenty five hours with a big gang of men Dean had a new steel shaft in with the machine running. The dynamo then worked so nicely and satisfactorily that I told Dean that I would not be satisfied if he did not get all the thump out of the engine and I told him to overhaul the engine throughly. In this investigation he found that the disc on the engine with which the rod is connected was cracked. He then had to turn off the wheel and shrink an iron band on. After this was done the engine started and actually the iron band broke it being made of poor iron. He then made another band of the best moor iron and that is what you have on it now. You will notice that we have lagged the governor pulley so as to get the proper speed to the blower.

Now about the electro motive force. There has been some very bad miscalculations in connection with this machine all the way through. I had the cheek (!) to connect up the field magnets so as to put more foot pounds on it and the result was that with even some exterior resistance, two ohms I think, and with a speed of only 320 revolutions we got about 100 or 110 volts which is more than we needed. Your lamps are 103 volts, the loss in your conductors will probably be not more than four volts hence 107 volts is all you require. About 3 horse power is used on the field magnets; the way it was connected when you were here it had but \( \frac{1}{2} \) of a horse power.

Be careful that no water or oil gets round the blower as it might work into it and throw on to the armature.

The English machine which will be shipped on the 17th of this month has 106 bars instead of 146 as in your machine and it has one field magnet longer. It is to be insulated with twelve layers of Japanned parchment paper and the air will be injected in the centre a separation being made between the field magnet; it will give 1000 lights.

I forgot to say that the lamps you have are 140 ohms instead of 125 ohms resistance. This was Dr. Nichol’s mistake. After making about 30,000 of these lamps every body supposing them to be 125 ohms I got to figuring one night and found that if a lamp requires 103 volts with an economy of ten per horse power it would have to have more resistance than 125 ohms or else there must be too many foot pounds on it for a ten per horse power economy. I spoke to Upton about it and upon in-
vestigation he traced it to Dr. Nichols. The Dr. has left us and is now fitting a Professor’s chair in some provincial college, teaching the young idea how to shoot.\textsuperscript{15}

Tell [missing text] to look out for water in his cylinder and always open the drain cocks and get dry steam and heat the cylinder up very slowly when first starting; otherwise he will get in trouble like we did here.

Upon receipt of Bailey’s telegram about making lamps in France\textsuperscript{16} I had Hughes ship you his Barton (?) engine\textsuperscript{17} and archimediar pump burner and blower which he had rigged up for fruit expriments. These I believe have gone forward and I have also instructed Upton to send you fifty thousand [missing text] fibres. He could spare you some cutting moulds but I dare not send them as both the drawings machine and cutting moulds are patented in France. However with the aid of what we have sent you, you can make a very nice little start and I should get a room somewhere in the suburbs 25 ft by 30 ft or 40 ft which will be quite sufficient for the time being and start the thing as economically as possible. I suppose you ought to be able to get such a room as you require for $15. or $20. a month.

You will have to go some glass blowing place and get your globes pot blowers and your tubes drawn from the same pot. Your platina you will of course get at Johnson, Mathey and Co. of Hatton Gardens, London.\textsuperscript{18} You should claim to get it at the same rate at which they supply it to the Lamp Co. (we have special rates with them) stating that you require it for the Lamp Co.’s use in France.

If you have trouble about getting nickel we can send you sheet nickel from here. We use plumbago covers in carbonizing that is to say the large cover which goes over the nickel forms is made of plumbago.

Upton finds that about 2% of his lamps after being put away for two or three months loose their vacuum and finds it due to the fact that the sealing is not long enough. He has therefore added \(1/8\) of an inch to the length of this platinum so that he squeezes \(1/8\) of an inch more glass on it and he also brings the glass in the inside part up to a more “pastey” condition that is to say he gets it very much hotter or better fused before he squeezes it onto the wires.

You will probably have a very healthy time in getting cutting mould made in France. I should only get a half lamp cutting mould made at first.

I will write you further if I should have omitted anything.
Please continue to keep me well posted. Yours very sincerely

Thomas A. Edison

Written by S. Insull.

L. (typed transcript), NjWOE, DF (TAED D8135ZBL; TAEM 58:1046). Typed transcript of illegible document. Several lines left blank.

1. The reason for Mary Edison’s trip to Michigan is not known. The Jumbo dynamo left New York on 7 September but presumably was at the dock before that date (see headnote, Doc. 2122). Edison was away prior to 31 August (Philip Dyer to Samuel Insull, 31 Aug. 1881, DF [TAED D8124ZAB; TAEM 57:1058]).

2. The letter from Francis Jehl to Batchelor has not been found.

3. Edison’s notes from this test are in Doc. 2131.

4. See Docs. 2131 and 2134. Edison executed a patent application on 20 August for this method of reducing sparking in large dynamos (Case 342). The application was rejected and subsequently considered abandoned. Edison had it reinstated, however, and in 1888 amended it to meet the Patent Office’s objection. The new text differentiated his invention from Faraday’s description “of the amalgamation of a contact spring rubbing on a continuous copper wheel. My invention however relates to commutators made up of conducting bars separated by insulation, and here the result attained by amalgamation is different. In my construction sparking occurs as the brushes make and break circuit with the different bars, and the mercury performs the function of carrying off the spark heat by its vapor thus saving the copper of the bars and brushes; for instead of copper vapor being carried off which of course would effect the destruction of the copper, mercury vapor goes off and the mercury is readily renewed from time to time.” The patent issued in 1890. Pat. App. 425,763; Casebook E–2537:12, PS (TAED PT021012; TAEM 45:735); Edison’s undated notes for the U.S. and foreign patents are in Undated Notes and Drawings (c. 1882–1886), Lab. (TAED NSUNo8:136–37; TAEM 45:219–220).

In a retrospective analysis, Charles Clarke blamed the sparking of the early central station dynamos on the odd number of commutator blocks, an insufficient number of blocks, and an unbalanced magnetic field. He noted that mercury compensated somewhat but “the sparking was nevertheless sufficient to fill the air with mercury fumes, which so badly salivated the attendants that the method had to be abandoned, and thereafter a careful adjustment of the brushes and attention to their condition and to the surface of the commutator were relied upon to minimize its harmful effects.” Clarke 1904, 50; see also headnote, Doc. 2122.

5. Charles Dean superintended the Edison Machine Works. He had worked for Edison as a machinist in Newark and Menlo Park. Doc. 1914 n. 8; TAEB 5 App. 2.

6. A sugar teat is “a small portion of moist sugar tied up in a rag of linen of the shape and size of a woman’s nipple, given to quiet an infant when the mother is unable to attend.” OED, s.v. “sugar teat.”

7. Edison referred to a Ritchie coil, a well-known induction coil developed by Edward Ritchie. See Docs. 41 and 434.

8. See Doc. 2123.

July–September 1881 177
9. See Doc. 2148 n. 6.
10. No communication from Charles Dean on this subject has been found.
11. That is, unannealed iron.
12. Francis Jehl later recalled that the shaft broke just as the engine was starting and that it was “an act of providence” that it did not break at full speed, as Charles Clarke and others were standing nearby. Jehl also recalled that “Edison shook his head and expressed his surprise (in language hardly fit to record) that cast iron had been used for a shaft of that importance.” Jehl 1937–41, 973–74.
13. This reference is unclear.
14. This dynamo, intended for the demonstration central station in London, did not ship until early October. See headnote, Doc. 2122.
15. On the miscalculation by Nichols, see Doc. 2129. After leaving Edison’s employ in June 1881, Nichols taught physics at Central University in Richmond, Ky., the University of Kansas, and Cornell University. Doc. 2065 n. 7.
16. On 31 August Bailey cabled Edison: “Maxim making lamps for outside very important we do same Batch says no difficulty about getting some out before factory started says can make few lamps and even small Dynamos if necessary do you authorise.” Bailey to TAE, 31 Aug. 1881, LM 1:32C (TAED LM001032C; TAEM 83:888).
17. A form of piston pump, used on fire engines. Knight 1881, s.v. “fire-engine.”
18. Johnson, Matthey & Co. was a leading refiner of precious metals and manufacturer of platinum devices, with which Edison had dealt since 1878. See Doc. 1604 n. 5; McDonald 1960, chap. 15.

To Charles Batchelor

New York September 13th 1881

My Dear Batch,

I shipped you six meters some days back. You had better do nothing more than show them Fill them with blue viterol¹ and let them stand. Do not attempt to weigh the plates as it is a very delicate job and will cause you considerable trouble. I have got a Cigar Lighter which will be sent you shortly. You may have to change the size of the platinum wires. Bergmann has been about [a] four months making the revolving arc lamp and it is not done yet.² If done in any reasonable time will send them to you.

The Dynamo with radial bars is not done yet. I stopped making a large machine and am making a smaller one & will endeavour to send it to you.³ Try and get it brought prominently out in one of the Scientific papers as a new and novel Dynamo constructed on entirely new principles and have it illustrated as in the Patents where you will find how the connections are made.

My Dear Batch, 

I shipped you six meters some days back. You had better do nothing more than show them Fill them with blue viterol¹ and let them stand. Do not attempt to weigh the plates as it is a very delicate job and will cause you considerable trouble. I have got a Cigar Lighter which will be sent you shortly. You may have to change the size of the platinum wires. Bergmann has been about [a] four months making the revolving arc lamp and it is not done yet.² If done in any reasonable time will send them to you.

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I suppose if you get the Contract for lighting the whole of the Grand Opera House you had better have steam Dynamos sent you of the new type and the best plan will be not to try to use the big Dynamo you have for this purpose but to ship that to England to act as a spare machine for Johnson. I shall be able to give you all the Steam Dynamos you want by the end of December.\(^3\)

Regarding the European Company what I am trying to do is to have a large Syndicate formed in Paris or elsewhere by Fab-bri, Puskas & Bailey, or anyone else which Syndicate is to form a Parent Company for operating the Light on the Continent of Europe and to prevent this new Coy from being a purely speculative one I propose that the Company shall pay up one million of dollars for the purpose of forming a large Manufacturing Coy for making lamps Dynamos, Engines, Tubes, Chandeliers, and all appliances connected with Electric Lighting and the proposition is that the Company shall be formed Capital Twenty million dollars of which one million dollars is to be paid the present European Co in cash and nine million dollars stock. So it would amount to Two million dollars of stock being sold one of which goes as I have said to the European Company and the other million to be subscribed to the Stock of the Construction Company. This is the correct thing to do and Puskas agrees with me in this opinion. It may be that we cannot swing such a large amount but still I believe the longer we hold on the more likely we are to get it. With one million dollars in the Construction Coy run by our men and started by us we having absolute control the first year there would not be any doubt about the technical success of the enterprise and if the technical success is assured the commercial success would naturally follow and the whole thing would be a success while most inventions sent over there have been just the opposite. In my telegram of today I spoke of 5% to be given us.\(^5\) What I mean by that is that we are to supervise and start all the factories and put them in operation and furnish all duplicate drawings and have constructed (at cost of Constn Co) here or on the other side all the special machinery and to give all improvements which we devise in our works here and of which the European Constn Co would equally get the benefit. We should have to start and supervise the manufactory in other Countries than France where under the Patent law we are compelled to manufacture within the Countries themselves. For all this it is but fair that we should receive 5% added calculated on the actual cost of the goods which should be

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paid us from the date when the first goods are turned out, we agreeing to turn over the factories to persons competent to do the work when our connection ceases that is except so far as the 5% are concerned. This sum is to reimburse us for our time our expenses on this side, our drawings and experience and you will easily see that this will be a great bargain for the Constn Co as in finding out what we have learned the cost of experimenting to them would be more than five times what they pay us.

As to the Installation of these various works I shall have to depend on you entirely. You can have what men you want that we can spare and as to the division of the 5% I would make that perfectly satisfactory to you.

The life of the lamps are very much longer than I ever expected. I have not seen the record for the last few days but the last I saw the life of the $8\frac{1}{2}$ per electrical horse power was 1900 hours with an average of 1300 hours while the ten per electrical horse power were 1300 hours with an average life of some what over 700 hours: three lamps of each kind are still running but we are making very much better lamps now as we have curves at 48 candles in which the average life was 94 hours and the longest life of any one lamp was 304 hours at 48 candles. This was a $8\frac{1}{2}$ per horse power set. The average life of the ten per horse power lamps is enormously less at 48 candles. But the lamps on which we are making the 16 candle record only had an average life of 12 hours at 48 candles. Since that time we have curves with the ten per horse power lamps with an average life of 22 candles hours at 48 candles.

I suppose you will have some trouble over on the other side in getting people to believe the statement that the average life our ten per horse power lamps is 800 hours because there is no way to prove it. I suggest that you take the earliest opportunity to put up ten lamps of the lowest volts in a box with glass front having same sealed and start them going at 16 candles. Have a responsible person to seal the box and verify the burning times & he should be a man whom everybody has confidence in. Whether you can get such a chance I do not know but it is possible you might in the Cellar of the Grand Opera House when you make the installation there At any rate I personally will guarantee any contract, with a penalty of twenty thousand dollars ($20,000), to put up twenty five thousand lamps (25 000) in any City in Europe, the said guarantee being that if the lamps do not average a life of seven hundred hours (700) with ten lamps per electrical horse power said lamps giving sixteen candles illumination I will forfeit the sum above named.
Let me know if they are going to make a test as to the efficiency of the Dynamos. If so use the copper Rod Dynamo as you will doubtless get about 95% efficiency out of it. I should take out of it from nine to ten horse power. That will give you the best efficiency. Use plenty of japan around your Dynamo Bobins. It is a splendid thing. Put on a thin coat over night in between the wires or in the case of the small disc Dynamo paint around and over the bars and the discs at the end. It gets very hard and is a splendid Insulator.

I have just thought that the Dynamo I sent you is wound in a different way with a even number of commutators and I have not sent you any description how to wind them. I wrote you previously that I had sent you a lot of wire so that Martin Force can wind the armatures. By next steamer I will have a model sent you showing how to wind them. You know the greatest difference of electro motive force is between any two layers of wire and as it is some what difficult to insulate each layer or section by itself in the old way of winding we have divided the bobin into half the number of spaces making each space twice as wide. Now we wind each space half full going square round the machine; then we insulate the whole of the bobin and wind around again over the top. This keeps the coils which have the greatest difference of potential and tend to cross one above the other instead of side by side. Thus we are enabled to get a good insulation between these coils, but to do this we had to use an even number of coils and commutators. I will send you a wooden bobin in which the first layer is shown in white thread and the second layer with black or red thread (I do not remember which now). I have struck a new way of dealing with men now whom we are sending away say to South America. I make them wind two two complete armatures before they can go and then instead of sending an extra armature I only send wire so that if they break down they can easily rewind the armature.

Please let me know what are the legal results of the examination of my patents in France and also what is my legal status in England if anything has been done there by way of examination.

We cannot find that Swan ever published anything showing that he ever experimented upon a filament of carbon in high vacuo in a chamber made of glass, nor can we find any patents until after our patents were issued on such a device. Do you know anything to the contrary.

Do you believe it would be possible to get the writers of “Engineer” & “Engineering” on our side and what would be
the best way to go about it. Would money in the form of a fee for an opinion on the validity of our patents as against Swan, Lane Fox, & Maxim be the right method

I hope you have got the Roman Letter Automatic working as I am sure it would be very striking. It worked very beautifully here—in fact quite astonished me.

With reference to “Abortion” I offered to pay his way over to Paris & back which he said would amount to $2000. A few days before he sailed he told me he had come to the conclusion that he had better not: he would rather go untrammelled and free to do anything and even if he accepted he would consider himself untrammelled. My impression is that he was bought off and hired by Maxims Coy although I may be mistaken in this. You may be able to tell however by hearing what he says to others where his interests are. It is impossible to tell by talking to him. He is a very deceptive man. Very Sincerely Yours

T A Edison

Since writing above have received following

Test Lamps
Life and Average Sept 13th 7 A.M.

<table>
<thead>
<tr>
<th>Elect. H.P.</th>
<th>Still burning at hours—</th>
<th>Average hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>8½</td>
<td>3</td>
<td>1846 1237</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td>13389 728</td>
</tr>
<tr>
<td>20 (half lamps)</td>
<td>2</td>
<td>1154 590</td>
</tr>
</tbody>
</table>

(½ Lamps were poor set TAE)

LS, NjWOE, Cat. 1244, Batchelor (TAED MBSB7D; TAE 95:271); a letterpress copy is in DF (TAED D81 3ZAO; TAE 58:476). Written by Samuel Insull. 1Paper damaged; text from letterpress copy. 2Interlined above. 3Obscured overwritten text. 4“or section” interlined above.

1. Blue vitriol (copper sulphate, CuSO₄) was used as an electrolyte in many batteries. Pope 1869, 12–14.
2. This was presumably the form of lamp which Edison sketched on 24 May as a design for a “Rotating Carbon arc Lamp.” Three days later Edison completed a patent application covering the use of an electric motor to rotate one of the carbons longitudinally at two or three thousand revolutions per minute so as “to make an absolutely steady arc and secure and even and smooth consumption of the carbon points.” In September Edison also sketched a variation of this with a revolving magnet “so that the arc will revolve instead of the carbon.” N-81-05-21:39, Lab. (TAED N201:16; TAE 40:470); U.S. Pat. 251,538; Cat. 1147, Scraps. (TAED NM016:111; TAE 44:335).
3. Edison referred to the small disk dynamo, which was not completed until early 1882. See Doc. 2228.
4. On the preceding day, Batchelor cabled Edison that the French government had awarded the Edison interests a contract to light the
Grand Hall of the Paris Opera with 800 lamps. The government also stipulated that this would not jeopardize Edison’s prospective patent rights. If the Edison interests successfully lighted this part of the Opera building by 7 October, the government promised to award them a contract to light the whole building with 8,000 lamps. Batchelor added that the “government architect would not consider any other incandescent light. Can you ship small machines to run these also thousand half lamps.” On 17 September Edison cabled that he would soon send seven dynamos for this installation. Batchelor to TAE, 12 Sept. 1881; TAE to Batchelor, 17 Sept. 1881; LM 1:38B, 37B (TAED LM001038B, LM001037B; TAEM 83:891, 890).

5. Edison’s cable has not been found, but the same day he wired from Menlo Park to Samuel Insull in New York to “telegraph Batchelor that he & myself should have five per cent on cash price for all goods turned out million dollar works for first ten years.” TAE to Insull, 13 Sept. 1881, DF (TAED D8132ZAN; TAEM 58:475).

6. For details on lamp life tests, see Doc. 2117 and headnote, Doc. 2177.

7. Batchelor apparently marked the beginning and end of this paragraph; these marks are not found in the letterpress copy.

8. Edison referred to the bar armature, rather than one wound with wire.
9. Edison was referring to one of the Z dynamos which he shipped to Batchelor in September, and not to the large C dynamo, which used an odd number of commutator bars. During the summer Edison designed isolated plant dynamos with an even instead of odd number of commutator bars in order to reduce sparking at the brushes. See headnote, Doc. 2126 esp. n. 10.

10. Cable code for George Barker; see App. 4. On Edison’s offer see Doc. 2110.

[New York,] 13th September [188]1

Dear Sir

I beg to enclose you herewith statement of expenditure on account of experiments on the Central Station Dynamo amounting to $61713/100.

As you well know this experimenting has been done on the machine which is now on its way to Paris but in as much as it has been done with a view to perfecting the machines to be used in the Central Station I render the statement to the Electric Light Company and request payment under my agreement with them by which they undertake to pay the cost of my experimenting on Electric Light.

If the Light Company had been obliged to pay for the machine itself as well as the experimenting the cost to them would have been about $12,000, without the machine being of any practical value to them as it would not have been possible to use it in our Central station. By the machine being taken by the European Company the Light Company is saved an expense of about $6000.

This expenditure ($6171.3/100) is cash paid out of my pocket and I shall be glad if you will arrange for me to be reimbursed the amount by Friday as I need the money to meet my engagements this week.

Very truly Yours

Thomas A Edison

LS, NjWOE, DF (TAED D8126ZAA; TAEM 58:35). Written by Samuel Insull.

1. Enclosure not found.

2. Doc. 1576. Weekly statements of expenses related to development of the electric light generally at this time, of which Doc. 1562 is an earlier example, are in Electric Light Co. Statement Book (1880–1884), Accts. (TAED AB032; TAEM 88:512).

3. That is, Friday 16 September. There is no record of a reply but see Doc. 2164.
Agreement with Henry Villard

New York, Sep. 14, 1881

Edison will build 2½ miles of Electric Railway at Menlo Park, equipped with 3 cars, 2 locomotives, 1 for freight and one for passenger, capacity of latter 60 miles per hour.¹ Capacity freight engine 10 tons net freight, cost of handling a ton of freight per mile per horse power to be less than with ordinary locomotives. Experiments in traction and economy and practicability to be made by Edison and supervised by Villard’s Engineer, if experiments successful, Villard² to pay actual outlay in Experiments and to treat with the Light Co. for the installation of at least 50 miles of Electric RR in the wheat regions.³

It is also assumed that the cost of the track will not exceed $2300. per mile, that of the locomotives and cars $800. and $250. respectively each, and the experiments not exceeding $500., unless Villard’s Engineer should require further experiment.⁴

It is understood that Villard shall own the whole of the Electric Railroad, including motive power & rolling stock, if he pays for the same under this agreement.⁵

H. Villard

Thomas A Edison

DS, NjWOE, DF (TAED D8143C; TAEM 59:433). ¹Place and date written by Villard at bottom.

1. Edison had built a one-half mile electric railroad (later extended) in 1880 and continued to experiment on it through that summer. Planning for a new electric railroad at Menlo Park began in late August and September 1881, when Charles Hughes started to acquire rights of way, rails, and other equipment (Hughes to TAE, 26 Aug. and 22 Sept. 1881, both DF [TAED D8143B, D8143E; TAEM 59:431, 435]). For a general view of work on the electric railroad in 1881 and 1882, see Edwin Hammer 1904: Railroad–Electric (D-81-43 and D-82-49, both DF [TAED D8143, D8249; TAEM 59:418, 63:585]; and testimony in the patent infringement case Electric Railway Co. v. Jamaica and Brooklyn Road Co., Lit. (TAED QE001; TAEM 115:736). Related correspondence and technical information are in Cat. 2174, Scraps. (TAED SB012; TAEM 89:251); and N-82-03-12, Lab. (TAED N249; TAEM 41:861).

2. Financier Henry Villard (1835–1900) was a director of the Edison Electric Light Co. In September 1881 he took control of the Northern Pacific Railroad to ensure it would not threaten his coastal transportation system assembled under the Oregon Railway & Navigation Co. (for which Edison installed his first electric light plant on the steamer Columbia in 1880). Villard had worked as a journalist as a young man and about this time he also acquired the New York Evening Post and the Nation. Buss 1978 [1977], 189–90; Doc. 1892; ANB, s.v. “Villard, Henry.”

3. In May 1879 Edison had sketched the rudiments of an electric railroad that would operate automatically, carrying grain to conventional trunk lines throughout the West. See Doc. 1745.

4. On 10 September Charles Hughes told John Randolph that Edison
had given instructions to “open an account with Henry Villard President of the Northern Pacific Railroad and charge everything done on or for the Electric R.R. to him.” Acting through his Oregon & Trans-Continental Co., Villard made a $12,000 loan to Edison, secured by one hundred shares of Edison Electric Light Co. stock. By 1 February 1882 Edison had spent just over $10,000 on this project. Hughes to Randolph, 19 Sept. 1881, DF (TAED D8143D; TAE 59:434); TAE agreement with Oregon & Trans-Continental Co., 2 Mar. 1882, Miller (TAED HM820159; TAE 86:460); Electric Railway Financial Report, 1 Feb. 1882, Cat. 2174, Scraps. (TAED SB012ABW; TAE 89:356).

5. This agreement was read into the record at the 23 September meeting of the Executive and Finance Committee of the Edison Electric Light Co. The company then granted Edison permission to experiment according these terms provided he made no arrangements for patents under its control. Edison Electric Light Co. to TAE, 28 Sept. 1881, Cat. 2174, Scraps. (TAED SB012ABA; TAE 89:306).

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To Joshua Bailey

Heraclite Paris

Object of factory erect square mile plants hence require two to four hundred thousand dollars to carry this out independent investment in factories. Factory is the primal essential after that immense and rapid business possible otherwise long delays loss prestige competition. How can first Paris station be put up without large factory with million dollars assured hundred thousand could be used start small scale furnish isolated plants until large works started. Is European Telephone definitely closed

Edison.

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[New York,] Sept 17. 81


1. Cable code for Joshua Bailey; see App. 4.

2. That is, the investment required for each central station serving a square mile district would be $200,000 to $400,000, in addition to the investment in factories to equip those stations. Cf. Doc. 2148 and see Fox 1996, 184–85.

3. Bailey replied the next day: “First eight words your cable badly transmitted repeat them think can arrange factory if rest programme satisfies you.” In a cable dated 15 September (but evidently not transmitted until the next day), he and Puskas offered terms that included “Manufacturing company five million [francs] to be formed when option declared when first paris station lighted as per previous cable.” They explained further in a 16 September letter to Edison that prospective backers would not make “an absolute engagement to invest so large a sum as five million of francs in a factory and to pay down five million more to the company in advance of the lighting of a station or section in
Paris.” They would be willing to form a company on the strength of reports from the Paris Exposition but were uncertain “whether on mounting a large district complication[s] may not be developed that will put a very different phase from that the business wears at present.” From the point of view of the investor I could find no answer to this.” On 19 September Bailey cabled: “Parties ready meet your views about factory so far as to secure immediate and rapid manufactory.” The prospective investors also requested a “reasonable time during which no other proposition entertained.” Bailey to TAE, 18, 15, and 19 Sept. 1881, LM 1:39B, 35A, 106B (TAED LM001039B, LM001035A, LM00106B; TAEM 83:891, 889, 925); Bailey and Puskas to TAE, 16 Sept. 1881, DF (TAED D8132ZAS; TAEM 58:492).

4. Bailey wrote (and evidently also cabled) Edison on 5 September that he and Theodore Puskas had been able to arrange here for 500,000 francs to put into the purchase and setting up the small [isolated] Plants in the principal Cities of Europe & for the Capital necessary for starting the lamp, Conductor, fixtures & dynamo factories. The suggestion of the purchase of Plants for immediate use as above was made by Mr Batchelor— He says that persons are constantly engaged in handling or in making designs of the various parts of your exhibit relating to the light & that unless the Coy is ready to go into the field immediately it will find itself anticipated either with direct immitations or with contrivances intended to evade your Patents.

He promised that these arrangements could be made in thirty days. Bailey to TAE, 5 Sept. 1881, DF (TAED D8132ZAH; TAEM 58:459).

5. In his cable the next day Bailey answered, “think European Telephone closed will confirm tomorrow.” On 28 September he wired: “Telephone finished tomorrow.” Bailey to TAE, 18 and 28 Sept. 1881, LM 1:36B, 49B (TAED LM001039B, LM001049B; TAEM 83:891, 896); see also Doc. 2127.

Menlo Park, N.J., Sept 17 1881

Dear Mr. Edison:

I enclose a letter to Mr. Goddard regarding his request that we select the lamps for isolated plants.¹

I know a number of the lamps we make are not wholly shapely but as I am trying every way to improve them I think all should count as lamps.

I do not think 50 cts. is too large a price to charge, for we shall not make money at that. I wish you would give Mr. Goddard the letter if you approve of it.

He said that the lamps were crooked in the sockets, this I cannot believe to be the case, I think the trouble must have been in the wooden socket.

¹ See Doc. 2154.
We are trying small and thin tubes on the pumps and we so far think that they are going to work well. They will not be so apt to crack from the cold we hope.

Welsh has taken some high carbons and put them in nickle [-] covers with charcoal powdered and then covered this with plumbago and recarbonized with excellent results.

The putting a second cover over the nickle seems to be a good thing. [-] We will try two runs this way next week for we can save the forms and make the shrinkage smaller for the high heats make the weights stick.² Yours Truly

Francis R. Upton.


1. Calvin Goddard’s request has not been found. In reply, Upton addressed Goddard’s complaints about the lamps for an unidentified isolated lighting plant. He explained that “we test every socket before sending them away to see if they are loose and throw out those that are loose. We are aware that by retrying them some can be loosened though we take every precaution that has been suggested. We think that the man who put the lamps in at Newburg [a woolen mill] must have taken hold of the glass and the plaster and tried them with a firm grip. During the past week we have made an improvement by twisting the glass where it goes into the plaster so that it can make a good contact and be irregular in the body of the plaster.” He reassured Goddard that “crooked or crinkeled carbons are good so far as the lasting qualities and economy are concerned.” He also explained that the factory could not afford to be more selective at the contract price of 35 cents apiece but offered that, for 50 cents, “we will give you selected lamps with straight carbons, well placed in globes and firm sockets tried with a firm twist.” Upton to Goddard, 17 Sept. 1881, DF (TAED D8123ZDT; TAEM 57:960); Edison Co. for Isolated Lighting brochure, 1 Sept. 1882 (p. 6), PPC (TAED CA002A; TAEM 96:103).

2. The standard carbonizing mold devised in 1880 included sliding weights that kept the curved fiber flat and taut, but also allowed it to contract (see Doc. 1961). Alexander Welsh’s experiments may have included experimental lots made two days later (nos. 450–52) of high resistance carbons “treated for resistance” by placing graphite or lamp black in the molds. Lamps made with these carbons had an unusually long average lifetime. On 27 September John Howell noted two batches (nos. 466–67) of fibers treated in charcoal, one placed in nickel forms and the other in plumbago forms. There is no record of test results from these. Cat. 1301, Batchelor (TAED MBN007:45, 47–48; TAEM 91:338, 340–41).
My dear Edison,

As your telegram requested me to try and bring Bailey and Fabri together I may say I have been at that very thing for a week—¹ At first they would not listen to such a thing at all—but now I think I shall succeed— The proposition which Fabri had and was preparing for the company’s consideration I was asked my opinion of by them. What they proposed was entirely inadequate for the working of such a thing as this is; after a couple of hours talk they abandoned it altogether and from what Mr Fabri says I should judge he considers it impossible to raise 5,000,000 francs for manufacturing purposes. I showed them that they can not do it for less. They are now at it again. Bailey is pushing ahead again with the proposition and as I told Fabri the other day if he only had the backing of a house like Drexel Harjes and Co it would be difficult indeed to find his equal here—² They know he is a hard worker but of course they feel that they would not like to be connected with him— However I expect they will eventually come together and I hope work well as this thing ought now to be settled and we started— I have met Dubois Raymond³ and in him you have a friend of course just now almost all my time is taken with these professors as we want them to thoroughly understand our apparatus as many of them will be jurors— Proff Zetsche⁴ has been here and gone to Switzerland— We have plenty of friends and also enemies— We make a lecture every morning on the apparatus and illustrate it by working it—

All the good scientific men are going to test our apparatus for publication—

Have just got the little machine and am putting it up—⁵ Dont fail to send me the actual cost price at our works of the 110 & 62 volt dynamos also send me full price lists of wires (copper) as it seems dear here also costs of lamp manufacture (latest) also from Bergman and Johnson prices of everything——

I have asked the Leon people to put a man in my room at night; also one in Swan’s, and one in Maxim’s, unknown to us, to see what breakages there may be. I expect they have done so

Cable you today:— Getting bids for dynamos, small gramme runs 50 half⁶ large Mulhouse wish put 10,000 our lamps on gramme machines their make now running arc lamps in Germany⁷ fix price lamps & Royalty swan stands ready tried for week bring abatement and abdomen together think
shall succeed send 1500 half, with sockets opera send actual cost small dynamos. Yours

“Batchelor”

ALS, NjWOE, DF (TAED D8132ZAS1; TAEM 58:490). Letterpress copy in NjWOE, Batchelor, Cat. 1331:40 (TAED MBLB3040; TAEM 93:331).

1. Edison’s cable has not been found. For at least several weeks Egisto Fabbri had been competing with Joshua Bailey to finance the commercial development of Edison’s lighting system on the European continent. Fabbri disavowed any personal interest but wrote from Paris that “all I care for is to see the European Co. [Edison Electric Light Co. of Europe] properly represented here and its interests protected more efficiently than they can at present be with nobody with full and special authority to do so— Anybody that can do better than I think I can succeed in doing is welcome to the business.” Bailey to Theodore Puskas, 4 Sept. 1881; Fabbri to TAE, 21 Sept. 1881; both DF (TAED D8132ZAI, D8133ZAB; TAEM 58:464, 629).

2. Drexel, Harjes & Co., the Paris affiliate of Drexel, Morgan & Co., was one of the leading private banks in Europe. Anthony Drexel founded it in 1868 with John Harjes, who was born in Germany of Danish parents but grew up largely in the United States before emigrating to Paris (Carosso 1987, 134–35). Batchelor expressed the same opinion of Bailey in a letter to Sherburne Eaton on this day (Batchelor to Eaton, 18 Sept. 1881, Cat. 1331:38, Batchelor [TAED MBLB3038; TAEM 93:320]).

3. Probably Emil du Bois-Reymond (1818–1896), professor of anatomy at the University of Berlin, who established the modern field of electrophysiology. He was especially noted for his work on animal electricity. His brother, Paul David (1831–1889), was a distinguished mathematician at the University of Tübingen. DSB, s.v. “Du Bois-Reymond, Emil Heinrich”; “Du Bois-Reymond, Paul David Gustav.”

4. Karl Zetzsche (1830–1894) was a mathematician, electrician, and postal telegraph official. Zetzsche taught telegraphy at the polytechnic school in Dresden until about this time, when he took a similar post in Berlin. He was evidently working as a patent expert for Lemuel Serrell on Edison’s behalf. DBE, s.v. “Zetzsche, Karl Eduard”; Serrell to TAE, 27 June 1881, DF (TAED D8142ZBD; TAEM 59:338).

5. Probably the Z dynamo Edison shipped at the end of August. TAE to Batchelor, 28 Aug. 1881, LM 1:31A (TAED LM001031A; TAEM 83:887).

6. That is, 8 candlepower (“B”) lamps.

7. This was probably the Mulhouse engineering and tool making firm whose workshop at the Exposition Batchelor had arranged to light with 15 half lamps. Batchelor to Eaton, 4 Sept. 1881, Cat. 1331:22, Batchelor (TAED MBLB3022; TAEM 93:313).

8. This is the full text of Batchelor’s cable. Upon its receipt the cable code name “abatement” was transcribed as Fabbri, and “abdomen” as Bailey. Batchelor to TAE, 18 Sept. 1881, LM 1:40A (TAED LM001040A; TAEM 83:892); see App. 4.
Noside London

To George Gouraud

At last ready furnish complete outfits and men isolated business from here without interrupting progress general distribution system. Factories completely equipped immense capacity. Take measures at once operate isolated plants our joint countries leaving general system some regular way.

Johnson leaves Gallia machine twenty eighth

L (telegram, copy), NjWOE, I.M 1:42B (TAED LM001042B; TAEM 83:893). Written by Charles Mott.

1. Cable code for George Gouraud; see App. 4.
2. Edison authorized Gouraud in August 1880 to form electric companies for working his patents in numerous countries and territories outside of Britain and the major European nations (see Doc. 1978). In a 10 September 1881 letter that might not yet have reached New York, Gouraud admonished Edison for having decided to postpone “the introduction in any form of your lamp until you can introduce it as an entire system.” He feared this policy would give advantage to Hiram Maxim and St. George Lane-Fox, who were already exhibiting incandescent carbon lamps. However, he was “more than delighted” to learn from Egisto Fabbri’s correspondence with Sherburne Eaton that Edison had “at last determined to go in as extensively as possible for the isolated plants. If this policy is vigorously pursued you will soon recover whatever ground, if any, has been lost. I think it is Johnson’s intention to bring one over here for my country place.” Gouraud to TAE, 10 Sept. 1881, DF (TAED D8104ZCV; TAEM 57:202).

Edison had cabled Charles Batchelor the previous day to make arrangements for selling isolated plants in countries where doing so would not jeopardize his patents, especially in Germany, where he hoped to “head off Siemens.” TAE to Batchelor, 19 Sept. 1881, LM 1:41B (TAED LM001041B; TAEM 83:892).


Falsetto has made proposition which I find is unsatisfactory. Following will beat it. Form syndicate raise three hundred thousand dollars to establish factories immediately upon success large dynamo. then upon success New York station to raise seven hundred thousand dollars more for increasing factories, of first and second sums our company shall receive fifty one hundredths of fully paid shares of manufacturing com-

To Joshua Bailey

Falsetto has made proposition which I find is unsatisfactory. Following will beat it. Form syndicate raise three hundred thousand dollars to establish factories immediately upon success large dynamo. then upon success New York station to raise seven hundred thousand dollars more for increasing factories, of first and second sums our company shall receive fifty one hundredths of fully paid shares of manufacturing com-

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pany out of which they agree pay Edison and Batchelor for un-
patented improvements and cooperation factories here in
cheapening manufacturing. The companies syndicate to aid in
financiering companies throughout Europe. The present
European company giving them one fifth proceeds. Profits of
isolated business to be divided equally between manufacturing
and present European Companies. The syndicate shall from
time to time and until profits come in advance such sums as
shall be mutually agreed for litigation, the press and miscella-
neous expenses which shall be repaid by syndicate out of first
profits with six per cent interest. Consult Batchelor.

Edison

1. Cable code for Joshua Bailey; see App. 4.
2. Cable code for Egisto Fabbri; see App. 4.
3. Charles Batchelor summarized these terms in a memorandum
after Edison instructed him in a cable on 24 September to assist Bailey
“in explaining small risk and handsome profit from isolated to syndicate
if they accept this plan.” Bailey and Puskas replied on 26 September that
the offer was “received favorably” and soon promised that these terms
could be arranged in eight days. Edison cabled back on 4 October that
Fabbri would make no further offers “so you can go ahead with your
eight days option.” Edison authorized Bailey to sign the necessary pa-
pers contingent upon his final ratification and also approval by Charles
Batchelor and Grosvenor Lowrey in Paris. See Doc. 2182 regarding
the final terms. Batchelor Memorandum, n.d.; TAE to Batchelor,
24 Sept. 1881; both Cat. 1244, Batchelor (TAED MBSB7E, MBSB7F;
TAEM 95:282–83); Bailey and Puskas to TAE, 26 and 27 Sept. 1881;
TAE to Bailey and Puskas, 4 Oct. 1881; LM 1:48B, 107A, 52B (TAED
LM001048B, LM001107A, LM001052B; TAEM 83:896, 925, 898);
TAE to Bailey, 10 Oct. 1881, Lbk. 8:191 (TAED LB009191; TAEM
81:68).

2158

[New York,] 25th Sept [188]1

To George Gouraud

Dear Gouraud,

Electric Accumulator

Yours of 10th inst came duly to hand.1

I have a patent in England on the application of the above to
Electric Lighting. It is amongst the devices which I abandoned
for something better.2

If you set down and figure out the matter commercially you
will see that in the present advanced state of the art there is
nothing in it at all that would warrant one in taking up the sub-

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ject. Doubtless eventually the people investing in it will find this out to their cost. 3 Yours very truly

Thos. A. Edison  Insull

L (letterpress copy), NjWOE, Lbk. 9:142 (TAED LBoo9142; TAEM 81:52). Written by Samuel Insull.

1. Gouraud sent two letters to Edison that day in accordance with his practice of restricting each letter to a single topic. In the one concerning electric accumulators, or secondary (storage) batteries, he reported that “a tremendous amount of stir is being made” over the Faure battery. He suspected that there were plans “to make a big thing of it” and thought there was “some degree of merit . . . in the idea per se of an accumulator, for many purposes, and the object of this letter is to ask you to just give a little thought to the subject, and let us have an ‘Edison accumulator’.” Charles Batchelor recently advised Edison from Paris that “the Faure battery people here have been running Swan lights all over the exhibition.” Gouraud to TAE, 10 Sept. 1881; Batchelor to TAE, 8 Sept. 1881; both DF (TAED D8104ZCW, D8135ZBK; TAEM 57:204, 58:1044).

2. One of Edison’s first British patents for electric lighting included “means for storing the electric current or energy so that the same may be used as required. This is done by the use of secondary batteries, and there are devices for shifting the current from one secondary battery to another periodically so that one may be in use while the other is being charged from the main circuit.” Brit. Pat. 5,306 (1878), Cat. 1321, Batchelor (TAED MBP015; TAEM 92:102).

3. See Doc. 2389. Despite this view of the subject, Edison had applied in June for a patent on an arrangement “to maintain constant the electro-motive force of secondary batteries or accumulators—that is, to reinforce their pressure as the same becomes lowered, when such batteries are used as a source of electricity for electric lights or other translating devices.” The application was rejected, then substantially rewritten in 1888; it finally issued in 1890 as U. S. Patent 435,687. Edison returned periodically to storage battery experiments throughout 1882; see Docs. 2276, 2278, 2295, and 2307; also cf. Docs. 2274 and 2334.

---2159---

From Francis Upton

Menlo Park, N.J., Sept 25 1881

Dear Mr. Edison:

Dyer is going into New York today. The money question is growing in importance. For example I looked round New York and found the cheapest place for straw paper. We sent them three orders which they filled immediately and then dunned us for money as the sales were for cash. We have not yet paid them as we took our bills in order. Two weeks ago we sent another order which they have not filled so that yesterday we ran out of paper. 1

The Lehigh Co. 2 have been sending us [-]b very bad coal, we
have written them without effect for we are not prompt in payment.

We are making between 900 and 1000 lamps every working day and the running expenses are between $1700 and $1800 a week, actual money expended.

To keep running this outlay must be met and to run economically it must be met promptly.

We cannot lay off without very serious loss as we have been cutting down wages so that when running constantly we lose now and then hands. Shutting down for two weeks would drive away a number more. Yours Truly

Francis R. Upton


1. Straw paper may have been used merely as packing. According to Jehl 1937–41 (809), finished lamps were “well-wrapped in paper” and shipped in barrels.

2. The Lehigh Valley Coal Co., a subsidiary of the Lehigh Valley Railroad, operated in the anthracite coal fields of northeastern Pennsylvania. The firm had New York offices at 21 Courtlandt St. Davies 1985, 26; Trow’s 1881, 900.

3. Upton planned to close the factory on Monday, 26 September. This was a national day of mourning for the funeral of President Garfield, who died on 19 September. Upton to TAE, 23 Sept. 1881, DF (TAED D8123ZDX; TAEM 57:965); Ackerman 2003, 430.

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To Francis Upton

[New York,] 29th Sept [188]1

Dear Sir

I understand some men were sent out from here to the Lamp Factory without an order from me.

For the future please admit no one whatever to view the Factory without an order from me, and even in such a case make your explanations of working the most superficial character possible. Yours truly

T. A. Edison.

ADDENDUM

[New York, September 29, 1881]

E[dislon]. E[lectric]. L[ight Co.].

Orders from my offices of [---] Co to admit persons not good except countersigned by me

Edison

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LS (letterpress copy), NjWOE, Lbk. 9:159 (TAED L809159; TAEM 81:57). Written by Samuel Insull. “of working” interlined above. bAddendum is an ALS. Canceled.

1. Nothing more is known of this incident.
2. Cf. Docs. 2185 and 2309.