By the beginning of April Edison believed that he had succeeded at what was called subdividing the light, or operating multiple electric lamps simultaneously and independently. His laboratory demonstration in late March convinced him that one mechanical horsepower could sustain six lamps, each equal to a conventional gas jet. From this he calculated the operating expense of his lighting system as one-third that of gas. He wrote his associate Theodore Puskas in Paris that he had only to devise a generator adapted to his system and to refine the lamp to make it suitable for manufacture and everyday use. He began making plans for a large demonstration in Menlo Park which would last for several months, after which he would permit the Edison Electric Light Co. to place his system in commercial use in New York City.

In fact, far more work remained in these and other details than Edison recognized or would acknowledge. The dynamo based on the March design with two-foot field magnets was not completed until 12 April, immediately after which its armature was reconstructed to provide an odd number of commutator connections. On its first trial, the armature windings were torn apart by the strong magnetic forces inside the machine. Edison had to wait for a new armature and it was the end of April or early May before he could try again. The results were gratifying, however, showing it produced more electric current per mechanical horsepower than any other form of generator. Francis Upton designed numerous tests to evaluate the machine more fully but found it difficult to obtain reliable results. At the end of June the machine shop began building a new form of dynamometer for measuring the mechanical...
power transmitted to the dynamo pulley. Even without complete data, however, Edison adopted this form of bipolar generator as the standard and planned to build thirty machines for the anticipated Menlo Park demonstration. Although the long field magnets gave the new generator its distinctive appearance and superior performance, Edison never tried to patent this design in the United States. He did include it in the British patent specification he drafted at the beginning of May. In that draft he began to articulate for the first time the advantages of a low-resistance armature circuit, which he obtained in part by removing the field magnet coils from the circuit and connecting them instead to an outside power source. In the meantime, Edison ordered an extensive series of experiments on bimetallic thermo-electric generators by which he hoped to recover energy from the waste heat of steam engines. Edison evidently provided his first bipolar generator, along with arc lights, telephones, and other equipment, to the New York Herald Arctic expedition in May.

During this period Edison was also trying to perfect his lamp, which consisted of a fine platinum wire “burner” in a high vacuum. One of the remaining difficulties was to control the amount of current to each lamp so the wire would not melt. He tried a number of different regulator designs before settling in early May on a mechanical governor, driven by an electric motor, to momentarily interrupt the circuit to a lamp or household. He also continued to work on formulating a suitable pyroinsulation and thoroughly coating the burner with it. Confident of his lamp, he described its form and method of construction in his draft British patent specification. The greatest obstacles to its commercial use, however, were the relative scarcity of platinum and the difficulty of drawing this refractory metal and its alloys into fine wire. At the end of April Edison received a candid assessment of the situation from Johnson Matthey, & Co., one of the world’s foremost metalworking firms, which had been supplying the laboratory with wire. The company promised that they could meet his need for large quantities of wire but that the costs of doing so would be high. Edison immediately took into his own hands the problem of increasing the supply of ore. He requested published geologic surveys and maps of the United States and its territories and inquired about deposits elsewhere in North America. About the first of May he began sending out 2,000 electric pen copies of a letter to “Postmasters and other public men in mining regions” requesting information about ore deposits in
their locales; later he dispatched Frank McLaughlin to investigate deposits in Quebec. These activities were widely reported in the newspapers, prompting one former acquaintance in Chicago to call him “about the ‘busiest’ man alive.” Edison’s inquiries brought scores, if not hundreds, of replies and ore samples throughout the late spring and summer. At the end of June he began making plans to purchase the platinum-bearing waste sands from hydraulic gold mines in California, which he thought “would undoubtedly give us all the crude metal we desire.”

In anticipation of a large-scale demonstration of his system, Edison began to work on details like water-tight junction boxes and insulating compounds for the underground conductors. He also included the basic design for his meter in the draft British patent specification and the shop began to build one for testing. The device operated by the electro-deposition of copper onto a metal rod which could be removed and weighed to give an indirect measure of the amount of current consumed. It also had a fusible link to protect the household circuit from becoming overloaded. While occupied with these seemingly mundane arrangements, Edison also began to develop for the first time his ideas for electrified freight railroads. During his trip West in 1878 he considered the feasibility of pulling light freight trains with electric locomotives, but it was not until May that he began to examine the requirements of such a system and the form it might take. After making a series of drawings, however, he dropped this project until 1880.

By the middle of April George Gouraud had concluded negotiations to create an Edison telephone company in London and similar ones in provincial cities. However, unexpected contingencies impeded efforts to place the telephone in commercial service. James Adams, Edison’s technical representative, died in early May after a long period of poor health. Edison selected his longtime associate Edward Johnson to replace him but Johnson withdrew under pressure from the Edison phonograph company. Edison had difficulty finding someone else and eventually prevailed on Johnson to go. His nephew Charley, in London since March, did not get along with Gouraud or the manager of the new company. Edison called him home in May but Charley abruptly left for Paris and apparently engaged with one of Edison’s rivals. Despite all this, the nascent company gave successful demonstrations to leaders of the British government and prominent members of the business, press, and scientific establishments. In the United States,
the instrument was exhibited successfully at the Franklin Institute and Edison finally reached agreement with Western Union regarding rights to the receiver in May.5

Gouraud pressed Edison to set up a working telephone exchange before the Bell interests could do so. Edison devised a manual telephone exchange switchboard, and on 23 May Charles Batchelor instructed the machine shop to build a switchboard and sixty-five complete telephones in order to erect a trial exchange in the laboratory before shipping the equipment to London. Although the electromotograph receiver worked well in the laboratory Edison and Batchelor continued experimenting to improve its durability and reduce the effects of induction in the outside line. In June Edison decided to address the latter problem by placing the chalk cylinder in the tertiary circuit of an induction coil, effectively isolating it from transient disturbances.

Edison arranged at the end of April and beginning of May to sell telephone and electric lighting patents to prospective companies on the European Continent, although no money changed hands at that time. In mid-May, however, he received a large advance royalty payment from the London company’s investors. Edison promptly ordered about five hundred journal volumes and books for his library and gave some money to his wife. The payment must have alleviated considerable anxiety, for he reportedly had been “dead broke” and having trouble meeting payroll.6

Edison probably added nearly a dozen names to his payroll between April and June, although a gap in the records makes this difficult to ascertain. Among those for whom records first appear in this time are David Cunningham,7 a machinist; James Seymour,8 a laboratory assistant; and Charles Wurth,9 a machinist who had previously worked for Edison. Another significant addition was Alfred Haid, a Ph.D. analytical chemist (probably hired to replace a departed chemist) who conducted numerous ore assays. During this period Edison contracted for the services of New York glassblower William Baetz. He also agreed to give Francis Upton a 5% share in the profits from the electric light.

1. Doc. 1735.
2. Doc. 1734; “Wanted, A Platinum Mine,” New York Sun, 7 July 1879, Cat. 1241, item 1224, Batchelor (TAEM 04:494; TAED MBSB21224X).
3. Charles Leyenberger to TAE, 6 May 1879, DF (TAEM 49:225; TAED D7903ZDQ).
4. See Doc. 1767.

April–June 1879 161
Dr Sr.

I have made the Western Electric Mfg Co several propositions all of which declined. They have made me none based on what appears to me justice. I am entitled to large credit from them for the delays with which they have filled my orders; also because of the poor quality of goods delivered.¹ Now I don’t want to ruin the business & have worked ceaselessly to build it up. In this they have not cordially co-operated. I am considering whether it will not be better to turn the whole thing over to them, if they are disposed to make any reasonable arrangement, & in some way to entirely separate my interests from them.² If you have any wish in the premises you had better write me fully at an early date³

Respy
Geo. H. Bliss  Gen. Mgr

¹ Bliss’s dispute with the Western Electric Manufacturing Co., which manufactured electric pens under contract with Edison (Doc. 817), dated back to the fall of 1878 (see Docs. 1425 and 1486). By January 1879 Bliss was running out of pen supplies, and on 26 March he reported that “Pen matters are at a stand still just now owing to the fact that the Western Electric refuse to deliver any more goods unless their account is paid in full. I claim damages for the quality of goods furnished and the repeated hindrances in my getting goods which have caused me great loss.” Bliss to TAE, 13 Jan. and 26 Mar. 1879, DF (TAEM 50:383, 432; TAED D7923M, D7923ZAV).

² In his 26 March letter (see note 1), Bliss stated that he wanted to “go ahead and make Electric Pens and any other kinds which will sell regardless of them [Western Electric] if they do not withdraw from their present position.” He told Edison that “If you have that Reed pen in shape I wish you would send me a sample. Or if the Gramme pen, which I saw when there, is better than the old form send one of those.” There are two notebook drawings by Edison from 15 February and another from the following day that show a perforating device operated by a small Gramme dynamo run as an electric motor; Charles Batchelor made two measured drawings of this device on 22 February. The “Reed” pen may be related to a faint sketch that Edison made on 14 February of an “Electric Pen vibrator” designed “To utilize a current by breaking

Bliss reported in another 4 April letter to Edison that he had concluded the purchase on Edison’s behalf of the Griest mechanical duplicating pen patent (see Doc. 1654). Bliss received a license to manufacture the device on which Edison was to receive a five dollar royalty; Bliss asked that Edison waive this royalty on the first 400 outfits. He additionally wanted an unrestricted license to manufacture mechanical pens under the Huffman patent he had acquired in January (see Doc. 1559 esp. n. 3). Edison refused both requests, the latter because he feared it might be used against Western Electric and draw him into Bliss’s troubles with the company. Edison and Bliss had to agree on terms of the licenses before the patents could be assigned to Edison and they negotiated through Lemuel Serrell, who informed Edison on 11 May that agreement had been reached. However, the matter had not been closed up by 17 May, when Bliss wrote that he planned to visit Menlo Park to complete the arrangements, and it is not known when the transfers were executed. Bliss to TAE, 4 Apr. and 26 Mar. 1879; Bliss to Lemuel Serrell, 4 Apr. 1879; Serrell to TAE, 29 Mar., 8, 9, and 25 Apr., 8 and 10 May 1879; Bliss to TAE, 17 May 1879; all DF (TAEM 50:442, 436, 449, 440, 448, 450, 461, 465, 467–68; TAED D7923ZBC, D7923ZAX, D7923ZBH, D7923ZBB, D7923ZBG, D7923ZBJ, D7923ZBT, D7923ZBU, D7923ZBV, D7923ZBW).

3. On the reverse of another letter from Bliss on this date, Edison wrote: “I am thoroughly disgusted with the pen biz and all at sea about it— You had better fix up with the WE Mfg Co somehow” (Bliss to TAE, 4 Apr. 1879, DF [TAEM 50:442; TAED D7923ZBC]). After having been forced by a lack of supplies to close his pen agencies in mid-April, Bliss and his partner, Charles Holland, agreed in May with Western Electric on terms for paying $14,200 they owed the company. Bliss secured his portion of the debt with his entire interest in the 1877 contracts with Edison regarding European telephone and phonograph rights (see TAEB 3:678 n. 5) and reported the settlement to Edison on 17 May. Edison formally assented to this transfer on 13 June 1879, with the stipulations that the first $600 due Bliss from the sale of French telephone patents be applied to the payment of foreign electric pen royalties, and that Bliss accept twenty-five shares in the Edison Telephone Co. of Europe in lieu of cash as payment for his telephone interests on the Continent outside of France (Bliss agreement with Western Electric, 14 May 1879, Box 92, NjWAT; Bliss to TAE, 17 Apr. and 17 May 1879, both DF [TAEM 50:457, 468; TAED D7923ZBQ, D7923ZBW]; Bliss agreement with Western Electric, 22 May 1879 with TAE addendum of 13 June 1879, Miller [TAEM 86:20–21; TAED HM790065]).
1. Edison’s dominant line of work on generator design during 1879 concentrated on machines with drum armatures, but for several months he continued to design machines with ring armatures similar to those found in the Gramme machine used at Menlo Park at the time. These sketches for a patent model show a generator with a ring armature that differed significantly from prior generators of this type in both its spatial and electrical configurations. Edison arranged the armature so each loop of the coil passed through the center of the field magnet pole pieces in contrast to most ring dynamos in which the coils rotated within the space between the poles. Although probably envisioned as a way to increase the effect of the field on the armature, this resulted in the coils moving parallel to rather than cutting across the lines of force and thus induced very little current. The electrical connections specified in the patent application (U.S. Patent 219,393), which was not executed until 7 July, indicate two significant variations from other ring generators. In an effort to reduce the circulation of extraneous currents Edison constructed his ring so that it was not a continuous circuit. This required a special arrangement for the commutator to compensate for the breaks.
The other difference was the use of an intermittently connected shunt around part of the field magnet coils that repeatedly cut and restored the strength of that magnet. It was this latter feature that made the design at all operative. In a standard generator the weakening of the field would make the cutting of the lines of force by the armature less effective in inducing current, but by changing the field in this case Edison was providing an alternative means than motion to induce the current, similar to that employed by Faraday in his seminal experiment on induction.

The first sketches showing a generator with a ring armature passing through the pole pieces date from 16 February. On 7 March measured drawings were prepared and a machine ordered that embodied a version of this arrangement. In this design each magnet pole was composed of a single electromagnet coil with the armature at right angles to the mass of the magnet. It is unclear if this machine was actually built. Although a completion date of 12 April was recorded, the sketch accompanying it shows two coils for each pole of the magnet similar to the design shown in Edison’s 4 April sketches for the patent model. Since Edison had continued to explore alternative designs, it is possible that the 12 April date refers instead to the completion of the patent model, the order and measured drawing for which are both dated 5 April. Cat. 1308:117, 133 (Order Nos. 53, 105), Batchelor (TAEM 90:725, 733; TAED MBN003:32, 40); Machine Shop Drawings (1879–1880); N-79-02-15:1:53–59; N-78-12-04:2:178–81; N-78-12-20:3:47–53; N-79-01-14:49–57, 87; N-79-02-10:57–63, 77, 94; N-79-04-03:3–9; all Lab. (TAEM 45:51–52, 58; 31:684–87; 29:416–17; 30:542–45; 31:285–89, 300; 32:1170–73, 1180, 1189; 31:343–46; TAED NS7986C:10–14; NS7986C:22; N028:27–30; N004:89–90; N015:24–27; N024:26–30, 41; N046:30–33, 40, 49; N025:3–6).

Drawings from Edison’s patent application for a ring dynamo (U.S. Patent 219,393).

Edison’s drawing of his ring dynamo.
Spiral made of 40 inches of Plat Ir .005. Covering and all .013 when wound on the spool this breaks all up so that you can see all the platina—

Think it would be good to mix Nitrate of Magnesia and Acetate of Lime as Acet Lime sticks so fast to the wire and coats so thin that it would hold the nitrate covering together

12 noon Put two platina wires in bottle containing Chloride of Calcium solution and connected them to 2 cell of Daniels battery to see whether it would coat on the metal

12 noon Put piece platinum in boiling Sulphate Magnesia to see if it will coat on

12 noon Put 42 pieces of platina wire in Chloride Magnesium with battery 2 cells on to see if it would deposit on it

Coating Platinum Wires

Try.

Acetate Mag solution Keep wire hot with Gramme mach

Try Coating the $\frac{3}{1000}$ covering of Acetate of Magnesia with rubber dissolved in Benzine to make pliable in winding

Platinum Pyroinsulation

Deposit from Chl Calcium or Chl Magnesia by battery

Chloride Mag. solution on Gramme machine with about 60 ohms resist. deposit very thick on one wire, looks crystalline in form full of cracks—When cold dry it cracks by contraction so that it leaves large spaces in between

Chl Calcium works better apparently finer coating dont crack but when bent & rubbed comes off completely perhaps a coating of rubber would do this good

Platinum Pyroinsulation

Try amalgam of Mg. and Hg volatilizing Hg with Heat

Try rubbing metallic elCa or Mg on wire
Suspend wire in boiling Carbonate of Magnesia or any salt of Mg. and see if it becomes coated in time.  
Make a piece \(\frac{9}{1000}\) thick straight and bring to incandescence and see if it cracks when winding on a \(\frac{1}{2}\) mandril.  
OK. This is the boss yet goes on bringing to incandescence condenses it so that it looks solid and hard and crystalline it bends easily without cracking on \(\frac{1}{2}\) mandril but it seems to [he?] eat platina bad  
I must get something that won’t  
Make a split mould with \(\frac{1}{1000}\) hole put wire put wire through and stretch filter water through keeping mould hot  
Cover wire to \(\frac{1}{1000}\) and serve with silk fibre & wind the heat will eat off the fibre and leave wire and covering on loose  
Mix Magnesia with Rubber dissolved in Benzine in variable proportions  
Mix Magnesia with Gutta Percha dissolved in chloroform & coat  
Try plaster of paris on a wire and note shrinkage  
Coat silk fibre with \(\frac{1}{1000}\) Mg.O. by dipping in alcoholic solution of same and cover wire regular way.  
Mix Carbonate of Baryta with rubber in Benzine and coat wire by great heat it fuses to lead colored slag. nonconductor  
Coat with very fine Woodbridge pipe clay and Fir clay very finely worked and mixed with Mg.O.  
Coat Silk fibre with pipe clay and Mg.O. and wind in usual manner  
Deposit from Sulphate of MgO.  
No good too fluffy & rubs off  
Try Alcoholic sol. of MgO. for coat, bring up in vacuum before bending  
This is good, it is a little difficult to put on and it breaks up by contraction a little however these are not bad faults and can be got over but it still eats into the platina  
Try Alcoholic Solution of Cerium Rutile for coat bring up in vacuum before bending (Titanium)  
Try Cerium Oxide & Oxalate  
Try Zirconium Oxide  

TAE

Chas Batchelor

J[ohn] K[ruesi]


*Date taken from document, form altered. *Paragraph preceded and followed by dividing marks. *Followed by dividing mark. *After this and

April–June 1879
each subsequent entry Batchelor left space for recording results; followed by dividing mark. “2 cells” interlined above. Obscured overwritten text. Interlined above. “Chloride Mag. . . . in between” enclosed by wavy line on left. “Pipe clay” interlined above. “No good” multiply underlined.

1. Charles Batchelor dated the first page of this entry, comprising the first two paragraphs, on 6 April. At noon the next day he began experimenting and drawing up the subsequent list of pyroinsulator coatings and processes to be tried, dating the remaining pages 7 April. Probably at a later time, Edison signed and dated several of these pages 6 April. Batchelor left space after each item coating and process to indicate the results of his experiments; it is not clear when he recorded these results.

2. On 1 April, Batchelor had sketched another device for “covering wire” by heating it with a candle flame pulled by clockwork along a track below the wire. N-79-03-25:11, Lab. (TAEM 32:145; TAED No34:6).

3. A drawing dated 5 April and labeled “No 102 Lime mould E. light” may be the mould in question (Vol. 16:384, Lab. [TAEM 4:821; TAED NV16:343]). Batchelor’s order for No. 102 gives dimensions and describes it as a punch and die for limes “to be made on Edison’s plan”; Kreusi dated this 10 April, which may be the date of completion (Cat. 1308:132 [Order No. 102], Batchelor [TAEM 90:733; TAED MBN003: 40]).

4. That is, to wrap the silk fiber tightly to keep it from unraveling. OED, s.v. “Serve,” 1(54).

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From Theodore Puskas

My dear Edison,

I have sent you to-day the following cable “want motographs very badly.”

The french Compy. here is very anxious to get the instrument which just now would be particularly useful as a great deal of noise is being made about the new loud speaking Gower Telephone. I had a few days ago an excellent opportunity of making a comparative test of the two instruments at an exhibition given by a society of Engineers here and wrote to Col. Gouraud about it asking him to let me have his two electromotographs for the occasion, but could unfortunately not get

April–June 1879 168
them. I have also promised to show it to the Academy of Science here.4

Please let me know which receiver you think the best for a long line with much inductions and also if on such lines you use stronger Batteries and bigger induction coils than under ordinary circumstances.

I am very sorry to hear from you nephew that Adams is so ill now again;5 when I was in London the last time I persuaded him according to a Doctors advice to go to Bournemouth6 and told Col. Gouraud to let him have some rest, but in spite of my admonitions Adams would not stay in Bournemouth but came back to London where he fell ill again. His illness may interfere with us here as we have only a press but no carbon, and in his present state I feel delicate about writing him to send the carbon as I know that if he could only creep he would come over to help us without giving a thought to the consequences to his health. I asked Mr Bailey to inform you of all this begging him to cable me when you would be able to send me carbon directly here to Paris, but he has neither cabled nor written and I do not know if he has spoken to you at all on the subject.

A gentleman of the name of Fleury of Innsbruck in Tyrol7 has written to me and offered his services in Austria, Germany or Italy referring to you; do you know him, or can you give me any information about this person? Very truly yours

Theo. Puskas

Another reason why I am anxious to get the new receiver is because it might influence the decision about your german Patent which is still pending in the courts.8


1. Puskas cabled again four days later, “When shipping motographs urgent Answer” to which Edison replied the same day, “Soon as can manufacture.” On 21 April, after receiving this and another letter from Puskas inquiring about the receiver, Edison wrote that he had “hoped to have it out before this time but find by experimenting that it is susceptible of much improvement. My men are now working at 4 or 5 new styles which will be far superior to those exhibited in England. . . . Now while these refinements are being added it would be poor policy to put out the inferior insts such as I sent Gouraud.” Puskas to TAE, 7, 9, and 11 Apr.; TAE to Puskas, 11 Apr. 1879; all DF (TAEM 52:265, 268–69; TAED D7940L, D7940N, D7940O, D7940P); TAE to Puskas, 21 Apr. 1879, TP (TAED Z400BP).

2. Frederick Allen Gower, New England agent of the Bell Telephone
Co., had adapted the Bell instrument to produce louder speech by employing a large and heavy diaphragm and a stronger electromagnet, which in some demonstrations was reportedly energized by a Gramme dynamo. Its other novel feature was a tube connected to a metallic reed below the diaphragm; blowing air into the tube produced a call signal in the receiving instrument. The telephone was powerful enough to be used at a distance of several feet at both the transmitting and receiving ends and had been successfully exhibited to the Académie des Sciences in Paris in February. John Tyndall lectured on it in London a few days after introducing the electromotograph, prompting George Gouraud to urge Edison to hurry his commercial model. Gouraud cautioned that Gower’s was “apparently an important improvement,” at least temporarily overshadowed by enthusiasm for the Edison receiver. Bruce 1973, 227, 235; “Gower’s Telephone,” Teleg. J. and Elec. Rev., 7 (1879): 75; “A New Telephone,” Times (London), 25 Feb. 1879, 10; “Gower’s Telephone,” English Mechanic 29 (1879): 206; “Recent Improvements in Bell’s Telephone,” ibid, p. 209, Cat. 1241, item 1192, Batchelor (TAEM 94:485; TAED MBSB21192X); Gouraud to TAE, 22 Mar. 1879, DF (TAEM 52:501; TAED D7941R).


4. The Académie des Sciences was officially created in 1816 and remains the most prestigious general scientific society in France and a unit of the national government. Its lecture and meeting rooms are in Paris on the left bank of the Seine. Crosland 1992, 14–19, 50–56, 83.

5. Charley Edison had cabled Puskas four days earlier, “Adams very sick for week past and no improvement in his condition Don’t expect telephone for exhibition Have written.” His letter has not been found. TP (TAED Z400BN).


7. A. L. Fleury was connected with an Innsbruck mining firm. During the previous year he had kept up such a voluminous correspondence of suggestions and queries to Edison that Stockton Griffin “designated him the ‘Terror of the Tyrol’ on account of his being sadly afflicted with the Caeoethes Scribendi,” and Griffin docketed his letters with that nickname. On 18 March, Fleury had written Edison that he was planning to inquire of Puskas “at once” about the electric light. In reply to Puskas, Edison stated that Fleury “is a perfectly competent person to act as agent in the countries named and I strongly advise you to procure his services. He has been recommended to me by strictly first class parties, and I have corresponded with him frequently during the past year.” Griffin to James Redpath, 5 Sept. 1878, ESP Scraps. 7:25; Fleury to TAE, 18 Mar. 1879, DF (TAEM 49:172; TAED D7903ZCH); TAE to Puskas, 21 Apr. 1879, TP (TAED Z400BP); for Fleury’s correspondence with Edison see TAEM–G1, s.v., “Fleury, A. L.”

8. See Doc. 1625. Puskas advised Edison on 19 March that patent attorneys in Germany had informed him “that nothing further has been decided about your Patent for Phonograph and Telephone in that country and the matter is still pending.” Puskas to TAE, DF (TAEM 52:256; TAED D7940F).
Dear Sir

The fact to be accomplished by me is the invention, perfection, and introduction into practice of a complete system of illuminating by electricity which shall effect every object and take the place of the present method of lighting by gas. That the cost of any light, or any number of lights equal in candle power to gas is to be but one third that of the latter.\(^2\) That the cost of the plant shall be no greater than that of gas. That after introduction it shall work as satisfactorily as regards disarrangement as the gas systems of New York. To the present date (April 8, 78) I have sub-divided the light into 20 burners each burner being equal to 16 candles, or one gas jet. There is no obstacle to further sub-division the requirements being, more lamps, generators, and an additional supply of power which is analogous to more retorts furnaces &c in gas making. That any electric lamp may be turned up or down the same as gas. I have demonstrated that for every horse power taken from the engine that six electrical jets are obtained each equal to a gas jet which brings the cost to \(\frac{1}{3}\) that of gas. That there is not as much waste of energy by leakage or otherwise as in gas. that the major portion of plant is salable at a small sacrifice after the lapse of any length of time. That I can measure by means of extreme simplicity the amount of electricity consumed by each customer.

That remaining to be accomplished is,

1st The proper generator both in regard to economy in construction and amount of electricity generated per horse-power applied, its reliability and adaptability to my system.

2d A standard lamp free from all mechanical objections, and of the most extreme simplicity that is attainable.\(^3\)

A test at Menlo Park with 500 lights placed in the surrounding houses and upon posts over the whole of the Park about \(\frac{1}{2}\) mile square of from 3 to 5 months duration 24 hours daily, to ascertain the permanency of the lamps and to bring out under my supervision the inevitable disarrangements which occur in all new systems of industry.

All these defects being eradicated the system will be turned over to the Company in New York. Very Truly

Thomas A Edison

LS, HuBPO, TP (TAED Z400BO). Written by Stockton Griffin. \(^1\) Place from Edison’s laboratory handstamp.

1. An incomplete autograph draft of this letter dated 9 April that was torn from an unidentified laboratory notebook is in WJH (box 25, folder 8).
2. The basis of this estimate is uncertain; see Doc. 1707.

3. Edison presumably meant to differentiate the essential principle of his incandescent burner from the details of its construction, and also from ancillary apparatus such as the regulator. In a newspaper interview published on 23 March he reportedly claimed that the only thing remaining was “to do away with mechanical defects. . . . The burner is no longer affected by chemical action and it acts perfectly well in the sealed globe.” “Edison Altogether Serene,” New York World, 23 March 1879, Cat. 1241, item 1146, Batchelor (TAEM 94:463; TAED MBSB21146).

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Notebook Entry: Telephony

[Menlo Park,] April 8 1879

We find this morning that it is lower probably due to loss of water. I Edison can hear Martin reading 3 feet away but do no understand what is said yet can hear “Mary” etc plain. with induction coil in circuit it reduces it ½ in volume

Zinc pen C[hemically].P[ure]. I hear nothing Batch hears something ie reads it.

Silver nearly as good as platinum with coil out, but ½ as good with

Ruthenium not so good as platinum calling Platinum 100 then Ru 65.

Bismuth C.P.— When 1st put on it is not so good as platina but after turning ½ a minute it gets louder & louder until it equals or nearly equals platinum we now put in Pt and find Bismuth is louder. the latter does not squeak while Pt does Bismuth is worn a little.

Cadmium. Batch does not hear a mortal sound

Cobalt. about same as platinum perhaps better than Pt with the coil in. Squeaks less than Pt. not worm—

Arsenic about 8 to Pt 100—squeaks a little

Antimony. about same as Pt—perhaps slightly less volume. Squeaks about like Pt.

Tellurium about 50 to Pt 100

Aluminum about 20 to Pt 100 Squeaks fearful.

Thallium—Batch hears nothing

Iridium—about same as platina

Nickel. 65 to Pt 100. Squeaks badly

Iron—Chem Pure. 55 to Pt 100

Chromium. Nothing at all

Platinum Iridium alloy not so good as platinum we now put in platinum to ascertain and find that it is as good as platinum

The chalk is getting dry and uneven surface
comes quite low so I can just hear him read but not to under-
stand when the coil is out—

Sulphide of Lead. about 40 pc to Pt 100—
Brass. about same as platinac
Babbitt Metal exceedingly low Batch just hears it. it ap-
ppears to be as loud with coil in as out.
It got so dry that we had to wet it then Pt came out loud.5
Magnesium— Batch hears absolutely nothing. current
passes through ok—
Gold. about 55 to Pt 100c
German Silver. works easier even Dutch with stronger pres-
sure about 75 to pt 100
DiSulphide Tin (mosaicum)3 Very low. Very very very
low low!
We find German Silver to be slightly louder than Platinum
on dryer chalk and a little louder on wetter chalkc
Tin. low—very low I dont hear it 3 feet awayc
Note we find it exceedingly difficult to make comparative
tests owing to drying of chalk between the tests. We now have
put in Tin again but find it exceedingly low
Lead— Batch can scarcely hear it.5
Copper— not so good as Platinae
Sulphide Copper Phenomenal Light pressure loud as
Plat. Try again5
Carbon— Nothing5
We now try without any battery on. no constant—
Platinum not so loud5 as with battery—
Zinc. about 60 to Pt. 100c
Tin— Low—about 20 to Pt. 100c
German Silver— about same as platina—
Lead— Nothingc
No need going further on this—
We now put 2 cells constant in the line—
Lead— nothing—
We put platina back and try 1 2 3 & 4 cells constant = We
find 2 cells weakens but 1 cell is just rightf
We now put in Chalk 2g
3 oz Chalk
5 grs Acet. Hg.
½ fluid oz Caustic Soda

Platina spring— With 2 cells Callaud on primary and 1 cell
in line permanently Talking not just as loud as on
No 1 chalk but very good?5 I see no differencec

April–June 1879
The ordinary width \( \frac{3}{16} \) of spring is best, the \( \frac{3}{8} \) wide being the worst and there is apparently no difference between \( \frac{1}{8} \) and \( \frac{3}{16} \). This I turned off the roller perfectly smooth and started on the \( \frac{3}{8} \) but the result was the same. Think this button is equally as good as No 1 difference of 4 grs Mercury making no difference.

Made No 3 button—

3 oz chalk
\( \frac{1}{2} \) fluid oz Na.O

With no Acet Hg but it is far inferior to 1 & 2. low talking which no wetting will make as good as 1 & 2

Chas Batchelor

X, NjWOE, Lab., N-79-04-08.2:3 (TAEM 31:895; TAED N030:1). Document multiply signed and dated. aCircle. bPage torn. cFollowed by dividing mark. d"Di" added in left margin. eObscured overwritten text. fRemainder of text written by Charles Batchelor. gMultiply underlined. hFormula enclosed by braces. i"just as" interlined above. jCanceled. kInterlined above.

1. This statement may have been added after Edison and Batchelor began to experiment with different numbers of cells.
2. These notes evidently represent the resumption of tests of the electromotorograph receiver. No record of experiments from the previous day(s) have been found but Charles Batchelor had ordered all of these materials except one (sulphide copper) to be prepared as electromotorograph contact springs on 13 March (see Doc. 1700 n. 1).
3. That is, stannic sulfide, also known as artificial gold, mosaic gold, and tin bronze.
4. The next day Charles Batchelor recorded tests with five additional chalks (Nos. 4–8) and also ordered fabrication of “Platina faced springs for new receiver” in five widths. N-79-04-08.2:20–33, Lab. (TAEM 31:905–10; TAED N030:10–16); Cat. 1308:135 (Order No. 119), Batchelor (TAEM 90:734; TAED MBN003:41).

Notebook Entry: Thermo Electricity

Experiments on Thermo electricity

We have cast about 100 alloys and are casting several hundred more, these alloys vary by 10 per cent and besides we are to make alloys of the metals with the arsenides, selenides, phosphides sulphides, Tellurides, and also bars of powdered metals oxides etc moulded under hydraulic pressure. These bars are 1263 mm in length and 12 mm thick with holes in the ends. The bars to be tested are connected together by a cop-
per strap. Thickness $2\frac{3}{4}$ mm length $28\frac{1}{2}$ mm breadth 14 mm copper screws are used to secure the bars together on the strap. The distance between the bars after they are coupled is 3 mm at the other extremities holes are drilled in the sides 10 mm from the end into which the wires are inserted holes drilled in the end have screws which clamp the conducting wire. The sulphides and brittle metallic alloys have clamps instead of screws both to secure them together and to secure the wires this device will be explained further on.

As a source of heat I used a cube of copper with boiling water and the couple was screwed to the side of the cube by a projecting screw which entered a threaded hole in the copper strap connecting the Thermocouple together. A Thompson Mirror Galvanometer with coarse wire was used the resistance of which is ____ ohms—distance between the face of the galvanometer case and the scale 5500 mm. Directing magnet

![Diagram of apparatus]

as shown above. Under these conditions one Daniells cell gave a deflection of 100 degrees through 1820 ohms 150 degrees through 1245 ohms deflection of 200 through 930 ohms deflection of 250 degrees through 757 ohms deflection of 300 degrees through 642 ohms deflection of 350 degrees through 559 degrees deflection to the left=

After taking these readings we find we had a thermo battery in circuit we take the readings again

<table>
<thead>
<tr>
<th>Deflection</th>
<th>100</th>
<th>1870</th>
<th>ohms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>150</td>
<td>—1270</td>
<td>&quot;</td>
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<tr>
<td></td>
<td>200</td>
<td>—965</td>
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<td>250</td>
<td>—780</td>
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<td>300</td>
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<td>350</td>
<td>570</td>
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</tbody>
</table>

*April–June 1879*
We test every metal against copper and allow it to gain a constant temperature before taking the final reading—we have concluded to use the copper clamp both for securing the wires and the bars together.

Boiling water
Copper and Britannia  Reading 1st  292 deg
This had been on over 1 hour— 2nd— 25 "
3rd= 25 "a

We now put them on for 10 minutes & then take the reading, copper on constantly
No 77a Copper & Copper 20 pc Iron 80 per cent put on 9:35 pm. Copper to the right—
Deflection to right 1st reading 90
2nd " 8892a

No 68.— 70 per cent of copper 30 pc of Antimony— 9:45 pm—
Deflection—To the left=a 1st Reading 60
2nd " 65a

No 78. 10 per cent copper 90 pc of iron 10 pm 10:15
Deflection to the right. 1st reading 115
115

I noticed that after 5 minutes it gave deflection of 132
This shews that the bars gradually become heated at the binding post ends.a
No 23 — Sulphide Lead
Copper 10:23 pm

Deflection — 1st Reading

35° through 5100\(^{b}\) ohms
65 " 50
128 " 25 "
300 " 10 "

Keeps same deflection after 10 minutes. The Sulphide Lead is a very poor heat conductor and is scarcely warm even close to the juncture while the copper is hot at the extreme end. The galvanometer is thrown violently off the scale with no resistance in —\(^7\)


Followed by dividing mark.

1. This notebook entry describes procedures and some results of Edison’s experiments on thermo electric batteries which began on or before 8 April. Edison re-numbered four pages of these notes, which he apparently wrote after the “resumption” of these experiments at 7:15 that evening, whose results are on the pages immediately following. No earlier dated records have been found. N-79-04-08.1:29-63, Lab. (TAEM 30:1115-32; TAED N021:11-28).

2. Francis Upton suggested Edison’s rationale for these experiments in undated notes probably made about this time: “In thermo piles, current does not cost directly it is the E.M.F. that costs. The heat that is required for a thermo must be so much in excess of that required that if a fraction only can be used the thermo must be very profitable on low resistance” (N-78-12-20.3:58, Lab. [TAEM 30:548; TAED M015:30]). According to the preliminary specification of the British electric light patent he filed in June 1879 (Brit. Pat. 2,402 [1879], Batchelor [TAEM 92:118; TAED MBP017]), Edison planned to use the heat radiated by the surface condensers of the compound condensing steam engines that would drive the generators at a large central station to produce sufficient current in the thermo electric piles to energize the field magnets. He described the arrangement of surface condensers and thermo electric piles as consisting of “a great number of iron pipes whose surfaces are painted with a thick coating of a non-conducting substance. The pipes after painting are about five inches in diameter. Over these pipes are slipped rings of the double sulphide of lead and copper. These rings are cast in a mould, and both the inner and outer edges are either covered or plated with copper. The inner copper ring of one disk connects with the outer copper ring of the adjoining disk throughout the entire series of disks.” By using these thermo electric piles to control the strength of the field magnets he could combine them with variable resistances to regulate the strength of the outgoing current. Although he claimed that “owing to the exceedingly low resistance of these disks and the considerable electromotive force which they give between the low range of temperature very powerful currents are obtained, and nearly as much energy is thus obtained in the form of an electric current from the waste heat of the en-
gine as can be obtained from the engine itself through the medium of the Faradic machines.” Edison very likely found it impossible to scale the effect sufficiently to power his generators and never employed thermoelectric piles in his system. An undated measured drawing of Edison’s “Electric Thermo Battery” is in Oversize Notes and Drawings (Undated), Lab. (TAEM 45:36; TAED NS7986B:43).

3. Francis Upton made preliminary calculations related to thermopiles and notes on a cadmium-antimony-copper thermopile on 9 March; preparations for systematic experiments evidently began about two weeks later. On 25 March Edison drew a thermopile arrangement and prepared a list (labeled “No 75”) of several dozen metals and alloys to be tried in thermopiles, including many already designated for telephone experiments (see Doc. 1700 n. 1). John Kruesi then entered an order for these in the laboratory order book. In a series of undated notes from about the same time Edison identified approximately a dozen metallic sulfides to be alloyed with metals and other sulfides in proportions varying by 10%, then specified dozens of permutations of triple alloys. He also listed other “special compositions” to be cast in large and small bars, the latter about the size indicated in this document. Laboratory assistant C. E. Munsell spent the second half of March researching metallic sulfide compounds and eventually summarized the opinions of chemical authorities and his own findings in an indexed notebook entry dated 15 March to 12 April. The casting of metal bars began on or before 31 March, when John Lawson prepared alloys of copper and zinc. Lawson listed other metals including lead, iron, zinc, cadmium and antimony to be compounded in 10% gradations. His notes describe his method of fusing the metals and also refer to various authorities regarding their composition and characteristics. Lawson continued this work for an unspecified period, at some time shifting his attention to metallic sulfide compounds. N-78-12-20:356–59, N-79-02-10:47, N-78-11-21:129–33, all Lab. (TAEM 30:547–48, 32:1165, 29:291–93; TAED No15:29–30, No46:25, No03:64–66); N-79-01-12:7–55, N-79-03-10:2:25–55, N-79-03-31:1–67, all Lab. (TAEM 30:858–80, 31:1137–51, 32:607–31; TAED No18:4–28, No32:11–25, No40:2–25).

4. William Thomson developed this type of galvanometer for submarine telegraphy. It consisted of a small mirror, with a magnetized needle on its back, suspended vertically in a thin circular coil of insulated wires. Passage of a current through the wires deflected the needle, causing a beam of light reflected by the mirror to move along a horizontal graduated scale. DSB, s.v. “Thomson, William”; Prescott 1877, 148–54.

5. This arrangement differed from the apparatus employed for the
“resumption” of tests that evening, in which the clamp held a single bar and Edison “use[d] the copper cell itself as the other bar.” N-79-04-08.1:29–31, Lab. (TAEM 30:1115–16; TAED N021:11–12).

6. It is not clear how tests of this and other numbered bars in this document are related to those made with bars of the same composition and identifying number that Edison recorded in his other notes this day. The latter reflect substantially smaller galvanometer deflections, perhaps due to a different experimental arrangement. In most instances Edison tested two bars of each compound. In one case he attributed substantially different results from two ostensibly identical samples to variations in the homogeneity of the bars, a conclusion consistent with John Lawson’s prior remarks on the difficulty of obtaining some of these alloys. N-79-04-08.1:33, Lab. (TAEM 30:1117; TAED N021:13).

7. On 9 April Edison made “Miscellaneous Experiments with rough Masses not very reliable” on dozens of other materials, including electromotograph telephone points and various ores and minerals; he continued this work the next day (N-79-04-8.1:65, Lab. [TAEM 30:1133 TAED N021:29]). There are no further dated records of thermoelectric experiments until John Lawson returned to the subject in October 1879. All of these notes by Edison and Lawson, as well as some undated notes by an unknown experimenter on sulphide and sulphate of copper alloys, take up the remainder of this notebook (N-79-04-8.1:65–285, Lab. [TAEM 30:1133–1208; TAED N021:29–105]).
Friend Prescott

Your favor of this date is just at hand.\(^1\) I agree with you to let Herz\(^2\) sell the Continental patents to the highest bidder.

New Receiver—Your folks do not seem to take much interest in this instrument so I have been working up the English field. Rec’d a cable order yesterday for 2000 complete outfits.\(^3\) They find it works on their worst wires and where no other telephone can be made to work. Just as soon as your people take an interest in the matter I will see what I can do.\(^4\) Very Truly

T. A. Edison  G[ riffin]

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1. Earlier in the day Prescott had written Edison that because they had already “paid so much for our Continental patents I feel unwilling to give the matter up without another effort. I have therefore requested Mr. Serrell to pay the French & Italian annuities, and if you agree will write to Herz to dispose of them upon the best terms he can get and we will give him half. What do you say?” In March Lemuel Serrell had advised Edison that the fifth annuity on his French duplex and quadruplex patents would come due on 28 April; Edison indicated on this letter that “Prescott should be notified.” Prescott to TAE, 10 Apr. 1879; Serrell to TAE, 19 Mar. 1879; both DF (TAEM 49:207, 51:442; TAED D7903ZDE, D7929ZAR).

2. A year earlier Cornelius Herz had tried unsuccessfully to sell the quadruplex in Italy. A promoter and confidence man who was reputedly also a physician and member of the San Francisco Board of Health, Herz and inventor Stephen Field had bought rights to the quadruplex in Austria, Spain, France and Belgium from Edison and Prescott in September 1877. See TAEB 3:526 n. 7, 4:23 n. 16; Docs. 1043 and 1236.

3. See Doc. 1726 n. 3.

4. In his letter of this date (see note 1) Prescott had asked, “What is the reason that we don’t get your new telephone receiver which is spoken so well of in London?” Edison’s response here is substantially the same as his draft reply on Prescott’s letter.
would not have taken the trouble I have to keep him in a good humor. He has been worse ever since yr nephew arrived. He is really dangerously ill and utterly unfit in consequence for the purpose for wh. he is here. You will fully appreciate the of my having here a man whose health will allow of his being able to attend regularly to the business of the Telephone. Hence I have found it indispensable to detain yr nephew. This decision will probably explain Adams sudden departure for Paris yesterday. He did not seem to think it necessary to consult me as to my wishes or convenience in the matter & I only learned of his intention through Charley, whom he had told that he was going. Charley has had much to bear from Adams, & will no doubt do quite as well without him. Adams is really unfit for any kind of business & the Dr says any excitement may easily kill him, his heart is so diseased. If he can get quiet work in connexion with the Paris Co.—to [with?] wh. I presume he has gone he may do well. I have for a long time felt that the expense he has been to me has been justified only on the grounds of charity—& this expense has not been trifling either as you will see. Until last week I gave him money in amts & at times as he requested—& finding him spending more than I do myself I suggested that he shd rec. a regular allowance for his expenses of $5 a day the same I give Charley— I now remember that he seemed not to like this & that may have something to do with his leaving me. I have thought it well to trouble you with these remarks lest in his diseased state of mind & body he shd distort matters any wise. Now that he has chosen to go I hope he will remain away & not do as he has several before done only come here when he was not wanted in Paris or when he was out of money as he has more than once done—getting money from me just before going to Paris & immediately after his return If he repeats that performance he will not find that I will—

You must expect yr nephew to remain till the definite model for yr telephone arrives & long enough thereafter to put into practical operation the Telephone Exchange System—which I presume he is competent to do? Is he? Please answer this question. If he is not then send some one who is as it is important that the first Tel. Ex. in the first city of the world shd be a pronounced success.

I have made a first class combination for a London Compy—upon terms that will greatly gratify you— The contract will be engrossed next week—& a round sum of money will be forthcoming immediately the definitive instruments are rcd

*April–June 1879*
& yr signature is affixed to the document which I may possibly take over to you next week myself & I will at the same time be able to see “the wonderful lamp”

The Presdt. of the Royal Society has asked me to the Grand Soireé of the year 30th inst. with yr telephone.

I hope you approve the name I gave it “The Edison loud-speaking Telephone”—as it is now every where called—very appropriately I think—as at once indicating its essential feature of success wherever the Bell telephone was equally conspicuous as a failure.

The Cable for quotation 2000 telephones was at request of the proposed Company to fix cost & save time, as immediately you decide upon model they want a large number put in hand so as to enable them to occupy the field before the Bell Co do with the Gower improvement  So hurry up!!! Yrs

GEG


1. Gouraud cabled on 18 April that he was sailing for New York. He also urged Edison to hurry a reply to his 9 April message (see note 3). The telephone contract was not completed until mid-May, pending continuing negotiations with the English investors (see Doc. 1743). Gouraud to TAE, 18 Apr. 1879, DF (TAEM 52:529; TAED D7941X).


3. Gouraud had cabled the previous day, “Quote price 2000 Telephones complete and when deliverable.” Gouraud to TAE, 9 Apr. 1879 DF (TAEM 52:516; TAED D7941U).

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[Menlo Park,] Apl 12 [1879]

127 Alter small Edison Faradic so that it will have 49 coils of # wire in layers of turns each.

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April–June 1879 182
Make new commutator with 49 points and wind coil so as to be perfectly symmetrical. Bevil off the edges of the poles so as the wire will not catch in turning.

The new commutator must be independent from the cylinder.

New cylinder must have \( \frac{1}{2} \)\( \frac{1}{2} \) shaft and the wood core must be pinned through besides being driven on tight the iron must go clean down to shaft so:

or down so as I shall direct further on

ADS, NjWOE, Batchelor, Cat. 1308:137 (Order No. 127) (TAEM 90:735; TAED MBNo03:42). Written by Charles Batchelor; double X later written across entry.

1. This is the order number; see Doc. 1687 n. 1.
2. This was order No. 58 (see Doc. 1702), which was completed this day. They apparently decided to incorporate the arrangement of an odd number of coils and commutator blocks that Edison had arrived at in mid-February (see headnote, p. 76) before experimenting with it. A measured drawing of the new generator, dated 15 April, is in Machine Shop Drawings (1879–1880), Lab. (TAEM 45:59; TAED NS7986C:23–24); it was finished at the end of April. This may be the machine designated as “Edison first Faradic machine” that was installed on the Jeanette (see Doc. 1706 n. 2; Vol. 16:430, Lab. [TAEM 4:864; TAED NV16:385–386]).

The New York World reported that during the first test this machine generated so much force that it tore apart the coil of the armature and a new one had to be made (“What Edison Has Done,” New York World, 30 Apr. 1879, Cat. 1241, item 1174, Batchelor [TAEM 94:480; TAED MBSB21174]). There are no dated tests of this machine prior to the second week of May (N-78-12-20.2:154–91, Lab. [TAEM 29:875–93; TAED No08:77–95]), but according to newspaper accounts of a 2 May test reported in the English Mechanic, Wires were connected with five of Wallace’s voltaic lamps, and the moment steam power was applied the lamps were lit. The machine did not become hot, but it gave off a few sparks. The lamps gave a steady light, although currents of air were not excluded, and the five lamps were lit with one machine with one-half of 1-horse power for each lamp. The experiment, although imperfectly made, was entirely satisfactory, and showed that Edison’s generator would allow of nine lamps in a circuit, or would develop more dynamo-electric power per horse-power than any machine yet constructed. . . . These results are obtained by getting a larger magnetic field, and employing a superior method of winding the bobbin with the insu-
lated wires. Edison will now have 30 of these machines constructed for the formation of his model station, which will probably be at Menlo-park. It is estimated that he can get at least 400 lights by means of his 80-horse power steam-engine and 30 of his dynamo-electric machines. He will now devote his time to producing a lamp which will be without flaw. ["The Electric Light," English Mechanic, 16 May 1879, Cat. 1241, item 1203, Batchelor (TAEM 94:488; TAED MBSB21203X)]

The only order at this time was for one new machine “same stile as improved 58 but larger” that had longer field magnets (3 feet long and 6 inches in diameter) and a bigger armature (9 inches long and 9 inches in diameter); the brushes were also altered (Cat. 1308:143 [Order Nos. 149–50], Batchelor [TAEM 90:738; TAED MBN003:45]). Measured drawings of the new machine are in Machine Shop Drawings (1879–1880), Lab. (TAEM 45:62–65; TAED NS7986C:27–35).

New York, 17 April 1879

Dear Sir

At an adjourned meeting of the Board of Directors of the Edison Electric Light Company held today a Committee was appointed, consisting of myself you, Mr Banker and Mr Cutting¹ to consider and report upon the expediency of taking steps to occupy some of the public buildings in New York with the Edison Electric Light.

Will you kindly indicate a day when you will be in New York and have time to meet and confer with the other members of the Committee upon the subject. If convenient I should prefer next Monday at 2 or 2.30 p.m.²

An early reply so that I may consult the convenience of the other members, will greatly oblige. Yours Very Truly

J. O. Green³


1. Robert L. Cutting, Jr., a wealthy New York broker, was among the incorporators of the Edison Electric Light Co. Cutting was also a municipal reformer who had participated in the removal of the Tweed Ring from Tammany Hall. Articles of Incorporation, DF (TAEM 18:38; TAED D7820ZAM); Obituary, New York Times, 14 Jan. 1879, 7.

2. Edison’s response has not been found but Cutting wrote again on 19 April that he would “communicate the substance of your letter to the other members of the Committee who will doubtless be content to await your convenience in the matter.” Green further explained that “it was not proposed to in any way interfere with the proposed practical exhibition of the light at Menlo Park, but to consider the expediency of ob-

April–June 1879 184
taining a foothold in Public Buildings before they are occupied by rivals; which is said to be the case with the Post Office." Beginning on 26 April five Maxim arc lamps were used to light the main room of the New York Post Office in place of gas jets. Green to TAE, 19 Apr. 1879, DF (TAEM 50:253; TAED D7920ZAG); “The Electric Light in the Post Office,” New York Herald, [27 April 1879, p. 8], Cat. 1241, item 1173, Batchelor (TAEM 94:479; TAED MBSB21173b); “Electric Lights in the New York Post Office,” Scientific American 24 (1879): 330.

3. Like his father, Western Union president Norvin Green, James Green was a physician who left that profession to enter the telegraph business. Around this time he superintended the Western Union office responsible for railroad contracts. His stake in the Edison Electric Light Co. is unknown. Obituary, New York Times, 11 Mar. 1924, 19; Reid 1879, 560–61; Green to TAE, 7 Feb. 1880, DF (TAEM 54:460; TAED D8033O).

--1729--

From Johnson Matthey & Co.

London. 19 April 1879

Dear Sir

We are favoured with your letter under date the 31st ulto,¹ and are much interested in your remarks.— The faults you point out as incidental to the platinum and iridio platinum wire hitherto prepared are to be readily overcome.—

It is simply because the necessity of overcoming them has never risen before that it has not been done.— These faults would exist to an exaggerated degree we imagine in the wire prepared on the Continent, especially in the iridio-platinum which as there made is only a mechanical mixture of the prepared iridium and platinum sponge compressed and forged, and yet it has been greatly adopted as available for ordinary commercial employment— Our mode of preparation is by fusion—and by giving a second fusion and great care in the subsequent drawing, we can doubtless arrive at a perfection which we should before have done had the want of such perfect homogeneity existed or occured to us.—

We shall be very happy to undertake any experiments with this view.—

You will readily understand that in obtaining absolute uniformity in size of long lengths of iridio-platinum we have great difficulties to contend with, as no jewels will stand a long draft—the excessive hardness of the wire so quickly cuts the holes that we are obliged to pass each length of [---]² wire backwards through a fresh hole and sometimes backwards and forwards several times to secure a good result, and by this means though with a great sacrifice of jewels and labour we can
we think guarantee to you no greater variation in any part of each $\frac{1}{2}$ lb length (the size of reel we should propose to supply) in a wire of .005 than from .0048 to .0052.—

Our price for these alloys in ordinary sizes is 45/ per per troy oz for 10% alloy, and 62/6 per oz for 20%.— We would be willing to contract for a quantity of 100 lbs of each of the extra fineness required .005 at the rate respectively of 42/6 and 60/ per oz Troy on $\frac{1}{2}$ lb reels—and at the rate of 25 lbs per week after one months notice.—

As platinum must advance considerably in price in consequence of the diminished supplies from the mines and the increasing demand, we cannot too strongly recommend for the consideration of any association that may be formed for this business that it will be to their interest to contract with us for a supply upon present market rates, and we are willing to book for their acceptance a quantity of 1000 lbs to be taken up at the rate of not less than 100 lbs per month, the purchase of which will give them virtual control of this material—for which our price to others will be very considerably advanced.—

If this offer meets with consideration we should ask for a reply within one month and for a deposit of 5%.— We are Dear Sir Yours faithfully

Johnson and Matthey P.T.O.

P.S. Since writing the above we have received your telegram “Send following 20% alloys 6 ozs each—six seven and ten thousandths wire” — This we will put in hand instantly and dispatch with the least possible delay.— JM

L. NjWOE, DF (TAE 50:41; TAED D7919Y). Letterhead of Johnson Matthey & Co. 1 Place taken from letterhead; “18” preprinted. 2 Canceled. 3 “per oz Troy” interlined above. 4 P[lease]. T[urn]. O[ver]. written as page turn.

1. Not found.
2. Johnson Matthey had been experimenting for Edison with high concentrations of iridium in platinum alloys since late 1878 (see TAE 4:762 n. 5) and in early February had written Edison that they were sending “a specimen containing 30% Iridium and we shall hope to work up to 40% if not to 50% but the cost of labour and destruction of tools will be enormous.” Later in the year he asked them to draw wire from an alloy of platinum and osmium, which they had great difficulty in doing, and also asked them to examine a piece of platinum-iridium wire so that they could overcome the defects in its manufacture. Johnson Matthey to TAE, 7 Feb., 7 July, and 13 Sept. 1879, DF (TAE 50:21, 82, 125; TAED D7919O, D7919ZBE, D7919ZCH).

3. At the contemporary exchange rate of somewhat less than five U.S. dollars for one British pound sterling, the offered prices equal approxi-
mately $28 and $15, respectively (*Ency. Brit.*, s.v. “Money”). One troy ounce of ¾% platinum–iridium wire is equivalent to approximately 378 feet of this diameter wire, or about 86 miles per hundred pounds troy (105 miles per hundred pounds avoirdupois).

4. This would constitute a substantial portion of the world’s production of the metal which, as Edison noted in his 1874 paper on platinum for the *Operator* (Doc. 489), “does not exceed two tons per year,” principally from the Ural Mountains.

5. The London firm of Johnson Matthey & Co., refiners of precious metals and manufacturers of platinum apparatus, advertised that its fusion process produced alloys “of the most perfect compactness, strength, and durability, and of increased resistance to the action of acid.” The company continued its experiments for Edison during the summer on platinum alloys with iridium and osmium. Johnson Matthey & Co., Paris Universal Exposition circular, Cat. 30,102, Scraps. (*TAEM* 27: 951–52; *TAED* SB796B:2–3); Johnson Matthey & Co. to TAE, 7 July 1879, DF (*TAEM* 50:82; *TAED* D7919ZBE).

6. Unidentified; presumably a clerk.

7. Edison had sent this telegram at 5:50 P.M. the previous day. Johnson and Matthey did not ship the alloys until 5 May. TAE to Johnson Matthey, 18 Apr. 1879; Johnson Matthey to TAE, 5 May, 1879; both DF (*TAEM* 50:40, 49; *TAED* D7919X, D7919ZAD).

Menlo Park. April 27 1879.

Dear Father:

This month is nearly through and I hardly know where the time has gone, though I have learned and done quite an amount.¹ Mr. was sick during the past week for three days and during that time I had a fine chance to experiment to my satisfaction.

One thing is quite noticeable here that the work is only a few days behind Mr. Edison, for when he was sick the shop was shut evenings as the work was wanting to keep the men busy.² I had a note from Louisa¹ saying that she expected would like to make me a visit. I expected her here yesterday but she did not come.

There still is hope that this summer will see a public exhibition of the electric light. There are thousands of difficulties to be overcome yet before it can be given to the public and Mr. Edison will overcome them if any does. I have not in the least lost my faith in him for I see how wonderful the powers he has, are for invention. He holds himself ready to make anything that he may be asked to make if it is not against any law of nature. He says he will either have what he wants or prove it impossible.
If he does not have a lamp to use electricity he will show that with present knowledge it cannot be had.

I hope to go home for a visit in about three weeks, and hope to find the family health good.

I am with much love Your Son

Francis R. Upton.

ALS, NjWOE, Upton (TAEM 95:527; TAED MU014).

1. Five days previously, Upton had reported to his father that he was “busy now with measuring currents, using two instruments that have just been made after my drawings. You see I have a chance to learn how to make instruments; and see them made. I shall be an expert on dynamo-electrical machines in the course of a short time for I see so many various trials of different devices. Nearly each week there is a new experiment to be tried.” Upton’s experiments were probably related to his effort to determine the voltage of a standard cell for use in dynamometer tests of generators. Upton to Elijah Upton, 22 April 1879, Upton (TAEM 95:525; TAED MU013); Upton 1880b, 180; Cat. 1308:139 (Order Nos. 134–35), Batchelor (TAEM 90:736; TAED MBN003:43); N-70-04:21:50–153, N-78-12:20.2:16–35, both Lab. (TAEM 30:748–96, 29:807–16; TAED No17:23–75, No08:9–18).

2. The New York Herald reported that Edison had been confined to bed by a severe cold. His principal assistants continued to work under Batchelor’s direction but the Herald likened his absence to that “of the star performer from the cast of the play—the performance may go on, but the life of the acting is not there.” “Edison’s Electric Light,” New York Herald, 27 April 1879, p. 8, Cat. 1241, item 1173, Batchelor (TAEM 94:479; TAED MBBSB21173a).

3. Probably Louisa Farley, the twenty-year-old daughter of Upton’s sister, Maria. Vinton 1874, 432–33.

Agreement with Samuel White, Theodore Puskas, Joshua Bailey, and James Banker

This Agreement made this Twenty ninth day of April, 1879, by and between Thomas A. Edison of Menlo Park, in the State of New Jersey; Samuel S. White, of Philadelphia, in the State of Pennsylvania; Theodore Puskas, of 45 Avenue de l’ Opera, Paris, France, and Joshua F. Bailey, of 45 Avenue de l’ Opera, Paris, France, parties of the first part, and James H. Banker of the City of New York, of the second part, witnesseth:

Whereas the parties of the first part, collectively, own or control the use in the following countries of Europe, to wit: Belgium, Austria, Denmark, Germany, Russia, Italy and Spain, of certain inventions of Thomas A. Edison, George M. Phelps, Elisha Gray, and Frederick K. Fitch, in or relating to Speak-
ing Telephones, and of letters patent which have been or may be granted in said several countries, or any of them, for such inventions, or for any other further improvements or additions thereto, or further inventions of the like character, which may be made within five years from the date hereof.

And whereas the parties of the second part desire to acquire an interest in all the rights of said several parties of the first part collectively in such inventions and letters patent aforesaid, and the parties of the first part are willing to sell and convey to them such interest in consideration of the agreements on their part as herein set forth. 7

Now in consideration of the premises and of the mutual agreements of the parties hereto as herein set forth, they agree with each other as follows:

First: The parties of the first part agree to sell, convey and secure to the parties of the second part, by instruments good and sufficient in the law of the several countries above named, for the sum of twelve thousand dollars, one undivided sixth part of all the right, title and interest of all and each of them in each of the countries above named, in all the inventions of said Edison, Phelps, Gray, and Fitch, which they now own or control and in all additions to or improvements of said inventions and in all further inventions of said Edison and others above named of the like character which they may acquire within five years from the date hereof, and in all letters patent for any of such inventions, improvements or additions.

And the parties of the first part agree that all or any part of said sum of twelve thousand dollars which may be paid by the parties of the second part, shall be applied to the procuring of, and bringing into use, as soon as possible, by sale or other most advantageous mode, the inventions and patents aforesaid in the said countries of Europe.

Second: The parties of the second part agree to pay, for application in Belgium and Austria to the uses set forth in the first clause hereof, the sum of six thousand (6000) dollars of the twelve thousand dollars above named; and to pay Two thousand dollars of said Six thousand on the execution of this agreement, and the remaining Four thousand dollars in installments of $1000 each on the expiration of each thirty days from the date of this instrument. 7

Third: It is mutually agreed that if the said parties of the second part, after paying said six thousand dollars shall elect not to pay the residue of said twelve thousand dollars, mentioned in the first clause hereof, on notice after payment of said
six thousand dollars⁸ to so elect (and option to this effect is hereby expressly reserved to the parties⁴ of the second part)—then the parties⁴ of the second part shall be entitled to an un-divided sixth⁴ interest in the inventions and patents aforesaid in and for the countries of Belgium and Austria only—and upon payment of said six thousand dollars⁸ as above provided, the parties of the first part agree to sell, assign and secure to the parties⁴ of the second part, by good and sufficient instruments as aforesaid, one undivided sixth part⁴ of all the right, title and interest of all and each of them in the said inventions and patents in and for Belgium and Austria.⁸

Fourth: The parties to this agreement agree to form together a corporation⁹ under the act of the state of New York, entitled “An Act to provide for the organization of certain business corporations,” being Chapter 611, of the Laws of 1875, and that such corporation shall be such “limited liability company” as is provided by the thirty third section of that Act, with a capital of one hundred thousand dollars, divided into one thousand shares of one hundred dollars each; that shares to the amount of seventy two thousand dollars of the capital shall be issued as full paid stock in payment of the patents of the parties of the first part hereto in the European Countries named in the preamble hereof, and the rest of the capital shall remain in the Treasury of the company, and subject to its control.

Fifth: The seven hundred and twenty shares issued in payment for patents shall be distributed as follows:

To Thomas A. Edison, and to Theodore Puskas, jointly, three hundred and sixty shares; to Samuel S. White, one hundred and twenty shares; to Joshua F. Bailey one hundred and twenty shares;¹⁰ and to the parties of the second part, one hundred and twenty shares¹ but if they shall elect to pay only $6000. under the option in the 3rd clause then they shall receive only 60 of said 720 shares and the rest shall be distributed as follows, viz to said Edison & Puskas jointly¹ 390 shares; to said White 135 shares & to said Bailey 135 shares.¹

Sixth: The agreements of the parties hereto shall bind, and enure to the benefit respectively, of their respective executors, administrators, and assigns.

The words parties of the second part being changed to the words party of the second part and the corresponding pronouns being changed accordingly throughout [entire?]¹⁴ foregoing instrument and the clause beginning but if they shall elect being also added to the fifth article all before execution¹
In witness whereof the parties hereto have hereunto set their hands and seals the day and year first above written.

Thomas A Edisonm
J. F. Baileym
In presence of Wm Carman

ADDITIONUM

Menlo Park NJ Apl 30. 79

It is understood by all the parties to the within instrument and they hereby severally agree that it is part thereof that on the formation of the corporation within provided for they will convey and assign to it their respective interests in all the patents and inventions within referred to including the interest which may be acquired by the party of the second part under the within agreement. The shares allotted by the fifth clause being designed to be given to the parties there named respectfully in exchange for the interests so to be transferred by them to the company

Thomas A Edison
J. F. Bailey
Witness G E Carman

TDS, NJWOE, DF (TAEM 52:270; TAED D7940P1). Notarization omitted. An executed copy of this document is in SSW. "Date taken from text, form altered." 4 "Twentieth ninth" written in unknown hand.

"James H. Banker . . . New York" written in unknown hand. 4 "Written in unknown hand. "Six . . . dollars" written in unknown hand. 4 "and to pay . . . date of this instrument" written in unknown hand. 4 "Six thousand dollars" written in unknown hand. 5 "Sixth part" written in unknown hand. 4 "Six the parties of the second part, one hundred and twenty shares" written in unknown hand. 4 "Obscured overwritten text." 4 "but if they shall . . . 135 shares." written by William Carman. 4 "Paragraph written in left margin by William Carman." 4 "Followed by wax seal." 4 "Addendum is a DS written by William Carman." 4 "Place and date written by Stockton Griffin.

1. This was notarized the same day by Stockton Griffin; agreements notarized in New York used notaries located in the city.

2. Samuel White headed a successful and highly respected Philadelphia firm of the same name that manufactured artificial teeth and other dental appliances. In recent years he had invested heavily in the telegraph and telephone inventions of Elisha Gray and was also a large stockholder in the American Speaking Telephone Co. DAB, s.v. "White, Samuel Stockton"; Davis 1905, v–vi, xxii–xxiii.

3. Joshua Bailey owned rights to the telephone inventions of George Phelps; he also had authority to represent both Puskas and Elisha Gray. Bailey agreement with Edison Telephone Co. of Europe, Ltd., 15 May 1879, SSW (TAED X078AG4).

April–June 1879
4. George Phelps devised several variations on the Gray magneto telephone employing a single mouthpiece with two diaphragms and various arrangements of permanent or electro-magnets. See *TAEB* 4:26 n. 3; Prescott 1878b.

5. Elisha Gray was a noted electrical inventor connected with Western Electric. His claim to the invention of the telephone provided one basis for Western Union’s entry into the telephone business. See *TAEB* 1:402 n. 5 and Hounshell 1975.

6. The electrician Frederick Fitch owned a New York electrical supply shop, successor to the firm of Fitch and Meserole, which Edison had patronized. Fitch devised a telephone transmitter employing carbon plates which he claimed worked with the speaker standing several feet away. At this time he was also at work on a carbon receiver. *TAEM*-G1, s.v. “Fitch, Frederick K.”; Fitch to Samuel White, 21 May 1879, SSW (*TAED* X078AI).

7. This agreement superceded the December 1877 contracts with Puskas regarding telephone rights in Continental Europe (see *TAEB* 3:678 n. 5). Sometime in April Edison had prepared an agreement with Puskas amending those contracts, which stipulated that Puskas receive one half of the proceeds remaining after the payment to Edison of a one-time royalty on the sale of each patent; it was never executed. In May, after completing arrangements for his European electric light patents (Doc. 1736), Edison agreed with Puskas (through Bailey) to annul the 1877 contracts. Draft agreement between TAE and Puskas, April 1879, DF (*TAEM* 52:274; *TAED* D7940Q); TAE agreement with Puskas, 14 May 1879, Legal (*TAEM* 144:1197; *TAED* HK203AAA).

8. Under terms of an unsigned contract dated May 1879, this paragraph also would have required White and Bailey to give Banker a certain share of their British rights to the Gray, Phelps and Fitch telephones. SSW (*TAED* X078AG5).

9. The Edison Telephone Co. of Europe Ltd. was incorporated in New York on 14 May 1879 by Edison, White, Banker, Robert L. Cutting, Jr. and his father, Robert L. Cutting. Certificate of Incorporation, DF (*TAEM* 52:278; *TAED* D7940R1).


11. An executed copy of this addendum written by Edison is with the contract in SSW.

12. Handyman George Carman had worked for Edison since about April 1877, doing odd jobs and some experimental work in the laboratory. See *TAEB* 4:30 n. 6.
144 Take small Dynamo (141) and make an a solid iron armature on a shaft a \( \frac{1}{8} \) less than the hole and perfectly in the middle. The armature must be exactly the same length as the heads I dont any gear wheel on it or commutator

145 Take the armature that Flammer \( ^3 \) made for (141) and take off the wire and fill up with fine iron that George \( ^4 \) will bring today. Wind the wire as full as the magnet head will allow

146 After 145 has been made and tried take the armature and shaft and put on shaft a wooden armature \( ^5 \) the right size for winding on the wire copper so as to make an armature with only copper wire and no iron.\( ^6 \)

C[harles]. B[atchelor]
Electric Lighting

House Meter.

Measuring current by weight of copper deposited

X Depositing Cell

Chas Batchelor

X, NjWOF, Batchelor, Cat. 1304:48 (TAEM 91:47; TAED MBN004:45). Written by Charles Batchelor.

1. Charles Batchelor’s drawing is the first extant 1879 design of a complete meter, though there are some drawings from 2 February of an electrolytic cell for a meter. The design drawn by Batchelor is similar in principle to one Edison had conceived in December 1878 (see Doc. 1622). Edison himself made similar drawings on 4 May and John Kruesi entered an order to make the meter on 8 May; the measured drawings date from the next day. There are no dated records of tests of this meter until the end of July. These tests continued until mid-September and then resumed briefly in mid-November. N-79-03-25:117, 120–21; Cat. 1146; N-79-04-03:101–16, 167–70, 197–205; all Lab. (TAEM 32:197, 199; 5:639–40, 643, 645; 31:392–400, 422–24, 437–42; TAED No34:58, 60; NM014:17–18, 21, 23; No255:61, 84–86, 98–104; Cat. 1308: 143 (Order No. 151), Batchelor (TAEM 90:738; TAED MBN003:45).

Edison had included this basic design in a February 1879 U.S. patent application but the description and claims related to the meter as well as part of a drawing showing the meter were deleted before the patent issued (Pat. App. 227,227). He did include the same description and the full drawing of the meter in a final British specification filed in April 1879 (Brit. Pat. 4,226 [1878], Batchelor [TAEM 92:107; TAED MBP013A]). According to that specification, the apparatus consisted of a box containing a “coil of very large wire, whose resistance is proportional to the number of burners used in the house. This resistance is but the fractional part of the resistance of a single lamp.” The actual measuring device was an electrolytic cell

which contains a solution of copper, [and] has two electrodes of copper, one of which is very thick, while the other is very thin.
The small portion of the current which passes through the cell carries over copper and deposits it upon the thin plate. If one lamp is placed in connection, it draws current from the main, and a proportionate quantity passing through the cell effects a deposit upon the thin plate; if another lamp is connected, double the quantity is deposited, and so on. At the end of any period, say one month, the plate is taken by the inspector to the central office and accurately weighed. As the deposit of copper upon the thin plate will be proportioned to the total amount of current passing into the house, the same becomes a correct measure or standard for the charge for the electricity supplied. [Brit. Pat. 4,226 (1878)]

In a variation Edison described in the U.S. application, one plate could be suspended from a spring balance and its weight read from an external dial “but this requires delicate mechanism in every house, which is rendered unnecessary by weighing the plates” (see Doc. 1622 for this design). The May design includes a feature that was not included in either the U.S. or British applications. This was a circuit breaker (the magnet and lever shown at bottom in Batchelor’s drawing) that would interrupt the circuit in case of an unusually heavy current, such as that caused by a short circuit.

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**Platinum Search Circular**

**Menlo Park, N.J.** [c. May 1, 1879]

Dear Sir:

Would you be so kind as to inform me if the metal platinum occurs in your neighborhood? This metal as a rule, is found in scales associated with free gold, generally in placers.

If there is any in your vicinity, or if you can gain information from experienced miners as to localities where it can be found and will forward such information to my address I will consider it a special favor, as I shall require large quantities in my new system of Electric lighting.²

An early reply to this circular will be greatly appreciated.

Very truly

Thomas. A. Edison.

ALS (electric pen copy), NjWOE, DF (TAEM 50:589; TAED D7028G). ¹Place from laboratory handstamp.
1. Although Edison had received by this date letters from two individuals responding to newspaper stories about his need for platinum, this circular letter marks the beginning of his intensive and highly public search for the mineral. He may have been prompted to write it by Doc. 1729, which he would have received at the end of April. The New York Sun subsequently reported that he sent approximately 2,000 copies to “Postmasters and other public men in mining regions” around 1 May, enclosing with them specimen cards sprinkled with platinum and iridosmine. Edison wrote the circular in his fine telegraphic hand and had it reproduced with the electric pen; the first extant reply to it, dated 7 May from the Dakota Territory, was addressed to Edison on the copy from which the text of this document is taken. William Ross to TAE, 3 Apr. 1879; Fred Gerhard to TAE, 8 Apr. 1879; A. J. Cogan to TAE, 7 May 1879; all DF (TAEM 50:581, 583, 589; TAED D7928A, D7928B, D7928H); “Wanted, A Platinum Mine,” New York Sun, 7 July 1879, Cat. 1241, item 1224, Batchelor (TAEM 94:494; TAED MB0021224X).

2. Edison received scores of letters about platinum throughout the late spring and summer, some replying to this circular and others to specific inquiries. On 14 May he instructed Stockton Griffin to “get a box marked Platina & keep all the correspondence etc in it.” Many of the incoming letters include Edison’s marginal comments, some of them extensive and illustrative of the extent of his search. Marginalia on A. R. C. Selwyn to Edwin Pope, 14 May 1879; DF (TAEM 50:593; TAED D7928L); for a sample of the replies see the folder “Mining–Platinum Search,” DF (TAEM 50:580; TAED D7928).

Edison, who was familiar with existing sources of platinum (see Doc. 489), made numerous personal inquiries regarding as-yet-undeveloped supplies. He solicited help on 30 April from Wexel & De Gress, a munitions firm operating in Central and South America, and the next day from Edison Electric Light Co. secretary Calvin Goddard. He contacted other acquaintances, including A. E. Foote, a Philadelphia mineral dealer, James Dwight Dana, and George Barker. Barker replied that the amount of platinum produced from known sources “is very limited at least for general use,” and cautioned that “An indiscriminate examination for it in all possible rocks, would therefore be a great waste of time.” Wexel & De Gress to TAE, 3 May 1879; Goddard to TAE, 2 May 1879; Dana to TAE, 28 May 1879; Barker to TAE, 30 May 1879; all DF (TAEM 50:587, 586, 605; 49:252; TAED D7928E, D7928D, D7928U, D7902ZEM); TAE to Foote, 26 May 1879, Lbk. 4:358 (TAEM 80:80; TAED LB004358A).

Somewhat later, Edison contacted state officials concerning geological surveys. In July, after having turned his attention to ferrous black sands found in California and coastal Oregon and Washington (see Doc. 1767), he ordered detailed maps of those states as well as Nevada, Mexico, Canada, and other countries. He also wrote to the U.S. Minister to Russia in St. Petersburg that he was “endeavoring to collect statistics regarding the product of platinum from all parts of the world” and desired answers to four specific questions about the production, price, and export of it in Russia, “which at present is the only market in the world.” TAE to G.W. & C.B. Colton & Co., 9 and 15 July 1879, Lbk. 4:456 and 482; TAE to U.S. Minister, Russia, 18 July 1879, Lbk. 5:2 (TAEM 80:93, 104,126; TAED LB004456, LB004482, LB005002); replies from state
officials and publishers concerning survey maps include Howard Chauncey to TAE, 4 June 1879; Joseph Miller to TAE, 5 June; E. H. Gove to TAE, 5 June; William Strong to TAE, 6 June; Frank Putney to TAE, 6 June; J. A. T. Hull to TAE, 6 June; George Martin to TAE, 6 June; W. E. Woodruff to TAE, 6 June; Bowen & Kingsbury to TAE, 7 June; John Collett to TAE, 7 June; James Galloway to TAE, 9 June; George Drew to TAE, 9 June; James Gaines to TAE, 9 June; A. M. Nelson to TAE, 10 June; John Proctor to TAE, 11 June; and F. P. Thompson to TAE, 11 June 1879; all DF (TAEM 50:628, 633–45, 651–52, 656–57, 661, 663–66; TAED D7928ZAJ, D7928ZAM, D7928ZAN, D7928ZAN1, D7928ZAO, D7928ZAP, D7928ZAR, D7928ZAS, D7928ZAT, D7928ZAX, D7928ZAY, D7928ZAZ1, D7928ZBD, D7928ZBF, D7928ZBG).

[Menlo Park, c. May 1, 1879]

Preliminary Specification: Provisional Specification for a *new* English patent—

I have ascertained that† When wires or sheets of‡ platinum, Iridium or other metallic conductors of Electricity which that fuse at a high temperature are exposed for§ to a high temperature near their melting point in air either for several hours by passing a current of electricity through them and then are allowed to cool the metal is found to be ruptured and under the microscope there is revealed myriads of cracks in every direction, many of which are seen to reach nearly to the centre of the wire. hence if ‡ I have also discovered that platinum or platinum alloyed with Iridium or metals of the platinum group

If the heat is long continued these cracks † I have also discovered that contrary to the received notion platinum or platinum & Iridium alloy looses weight when exposed to the heat of a candle that the Even heated air causes it to lose weight, that the loss is so great that it colors tinges a hydrogen flame Green, and under the influence of an Electric current that and at a yellow white heat the loss is very§ great, after a time the metal falls to pieces. hence: wire§ and/or sheets of§ platinum or platinum & Iridium alloy as now known in commerce§ are useless for giving light by incandescence as our 1st because Its§ loss of weight makes it expensive, &§ unreliable and causes the burner to be rapidly destroyed 2st because its electrical resistance changes by loss in weight and its melting point as a whole light giving power for the total surface is greatly reduced by the cracks or ruptures the melting point being determined by the weakest spot where the greatest difference of potential of the electric current is present which abnormally heats t at causes

April–June 1879 197
this point to be brought to a higher heat than the rest of the surface of the wire. Again as it is essential to obtain a steady light the platinum burner must be screened from the air, and when thus screened by being placed in a glass vessel the glass soon becomes coated with a black deposit of platinum.

I have discovered a A platinum spiral brought to incandescence under these conditions may be made to give a light of three sper... standard candles when near its melting point & when the radiating surface is \( \frac{3}{8} \) of an inch, but this amount of light will be gradually reduced as before described.

I now come to that part which constitutes my discovery and invention.

I have found that the cause of the rupturing of the metal when brought to incandescence is due to the expansion of the gases contained both in the physical pores & also in the mass of the later air being probably placed there in the act of drawing the wire or rolling the sheet; now this air when subjected to these high heats greatly expands and ruptures the metal, and it cannot be driven out by slowly heating as it is soon absorbed. I have also discovered that the loss of weight and apparent volatilization of the metal is due entirely to the attrition of the air molecules against the highly heated surface having thus ascertained the cause of fracture & loss of weight I have conducted experiments to obviate these defects and have succeeded by the following method.

If a spiral of platinum wire is placed in a glass bulb and connected to the source of electricity with its either... passing through & sealed in the glass and the air exhausted from the bulb by a Sprengel pump until the spark discharge from a three inch induction coil will not pass between subsidiary wires in the bulb 4 millimetres apart. the wires of the spiral are then connected to magneto electric machine or battery whose current can be controlled by the addition of resistance. A sufficient quantity of current is allowed to pass through the wire to bring it to about 250 150 or 300 deg Fahr when it is allowed to remain at this temperature for 10 or 15 minutes. while thus heated both the air mechanically mixed in the metal by drawing or rolling as well as that in the physical pores is expelled on the one hand by heat & on the other hand tends to pass outwards to equalize the pressures. while this air or gases is passing out of the metal the mercury pump is kept continuously working. After the expiration of the 15 minutes the current passing through the metal is augmented so that its tem-
perature will be about 300 degrees Fahr, and it is allowed to remain at this temperature for another ten or 15 minutes. Thus if the mercury pump be worked continuously and the temperature of the spiral gradually raised at intervals of 10 or 15 minutes until it attains to vivid incandescence and the bulb be then sealed we then have the metallic wire in a state heretofore unknown for it may have its temperature raised to the most dazzling incandescence emitting a light of 25 standard candles whereas before treatment the average melting point of a number of the spirals having of the same length & size of wire and having the same radiating surface was but 3 standard candles.— The wires in the Vacuum subjected to the process of excluding freeing them from air, are found after the process to have a polish exceeding that of silver and obtainable by no other means. No cracks can be seen even after the spiral has been raised suddenly to incandescence many times by the current and no volatilization takes place as there is no deposit upon the glass bulb, nor does the a delicate balance shew any loss of weight after burning for many hours continuously because if the spiral is in high vacuo the attrition of the gasous molecules is reduced to the minimum and were it possible to obtain an absolute vacuum there could be no loss whatsoever. Even with the residual gas the total loss would scarcely be noticed.

I have further discovered that if an alloy of platinum & Iridium or even platinum be coated with the oxide of magnesium in the manner hereinafter stated, and brought subjected to the vacuum process described that a combination takes place between the metal and the oxides giving the all the former remarkable properties. With a spiral of the same size as that of platinum already described having a radiating surface of $\frac{3}{16}$ of an inch, light equal to that given by 40 standard candles may be obtained whereas the same not passed through themy process would melt before giving a light of 4 candles. The effect of the oxide of magnesia is to harden the wire to a suprising extent, to render it more refractory and a spiral spring made of the wire loses is just as elastic & springy when at dazzling incandescence as when cold.

It is ob I have found that chemically pure iron & nickel drawn in wires and subjected to the vacuum process may be made to give a light equaling that of platinum in the open air & not subjected to the vacuum process.
Carbon sticks may be also freed from air in this manner and be brought to a temperature that the carbon becomes pasty and if then allowed to cool is very homogeneous & hard = rods or plates made of a mixture of finely divided conducting & non-conducting materials may thus be freed from air.

It is also obvious that the metal might be heated to its temp by by subjecting the containing bulb to a considerable temperature but this does not produce but partially free the wire.

I will now describe the form of burner or lamp which I propose to use. It to obtain practically unlimited subdivision of the be able to bring to To obtain practically several hundred electric lights each equal to the ordinary gas jet upon one circuit it is essential for many reason both on the score of economy, facility, and reliability, to place them all in multiple arc and to prevent the combined resistance of several hundred lamps from falling to such a low point as to require a main conductor of immense dimensions with low resistance and generating machines of corresponding characters, it is essential to reverse the present universal practice of having lamps which have but one or two ohms resistance and construct lamps which shall have when burning giving their proper light [resistance] of several hundred ohms and I have ascertained by experiment, that no loss that the loss of energy is in proportion to the extent of the radiating surface & independent of the resistance. Hence whether we have 1000 lamps each of 1⁄4 of an inch radiating surface & each of 1 ohm resistance or 1000 lamps having the same radiating surface & 500 1000 ohms resistance each the loss of energy on from each lamp when giving each a light of 15 candles will be the same, but the combined resistance of the 1 ohm lamps will be 1⁄1000 of an ohms requiring an enormous main conductor—whereas the combined resistance of the 1000 ohm lamp will be 1 ohm requiring a conductor of very moderate dimension. In practice the resistance of 200 to 300 ohms in the burner will be sufficient. again with lamps of low resistance the lamp connections & leading wires must be large to prevent great loss of energy by resistance. the leading wires from the main conductors are large and expensive & bulky to handle. the low resistance of the burner requires the larger or incandescent conductor requires large terminals to convey the current and these after offer by their conduction a medium for the rapid dissipation of energy without producing any effect whereas with a lamp of high resistance the leading
wires from the main condr does may be small and the all these objections are obviated. =

My burner consists of a bobbin of composed of an infusible oxide either such as oxide of Calcium Cerium Zirconium, Magnesium, freed from Silica & turned in a lathe from sticks & moulded by hydraulic pressure in a manner hereinafter set forth. This bobbin is shewn in fig 1

It is secured to two platinum wires as in fig 2

These wires serve to hold the bobbin in the centre of the sealed glass vacuum bulb and at the same time serve as conductor of the electric current to the wire coiled upon the bobbin.

Fig. 3 shews the manner of connecting the wire upon the bobbin to the platina supports.

The bobbin is sealed in the vacuum bulb as shewn in fig 4

The two platinum wires 1 & 2 are first passed through a small tube of glass X which is softened around the wires. The bobbin wires 1 & 2 pass out through the sides of the narrow tube leading from the bulb and are sealed to prevent leakage by having
smaller glass tube softened upon the wires bent at right angles which tubes are sealed to the glass of the bulb.

Before the burner is permanently sealed at e.g. before being taken from the air pump (the wire upon the bobbin which previous to winding thereon has passed through the vacuum process heretofore described) is brought to incandescence for about one hour to heat the bobbin and thereby expel its air, whereupon the bulb is permanently sealed is & e is ready to be placed in the lamp. This is shewn in fig 5

This is shewn in fig 5

6 is the bulb containing the burner A supported by the platinum conducting wires 1 & 2. The bulb lays in the socket D the extremeties of the conducting wires 1 & 2 are connected by copper wires to the insulated clamping screws E & F. 5 is an
outer glass vessel to prevent injury to the vacuum bulb. This may take any form such as an opal shade, large bulb—

G is an electro magnet having a resistance of but a fraction of that of the lamp, and serves to regulate the amount total energy consumed or given out by the lamp this it does by being adjusted in such a manner that it will serve to disconnect the lamp from the circuit should the current increase materially from any cause beyond what is necessary to produce the normal amount of light. The magnet when is provided with an is in the same circuit as the incandescent conductor of the bobbin A. The lamp being in multiple arc where alone this form of regulation is admissible the current passes from wire No 1 to post F thence via B to the wire 1 to the bobbin A through its wire to wire 2 thence via C to the post E via wire 7 to the contact spring S through R to the spring T thence to the left to the magnet .G. & from the right of magnet .G. via wire 9 to No 2 wire. The circuit admits of being broken by the effect of the attraction of the armature K. which is secured upon the wide spring M, the upper part of which is secured to the base of the lamp fixture. connected to the armature is a rod H which slides in bearings at 20 & at 22 so that the motion of the armature to & from its magnet gives this rod an up and down movement. upon the lower end is secured a cup V. whose periphery serves to come in contact with the springs S & T and seperate them from the metal disc R. which is secured to the disc of insulating or non conducting material N (to which the springs S & T are secured) by a pin P. a pin 28 passing through a hole in a projection 29 from N serves to prevent the latter from turning when it is adjusted upward or downward by the double threaded screws Z & Z. by means of the latter the springs S & T may be brought in so close a proximity to the edge of the cup V. that a very slight current passing through the magnet G will attract its armature sufficiently to cause a downward motion of the rod H & seperate the springs S. T. simultaneously thus opening the circuit in two places simultaneously of the object of which will hereafter be set forth. If thus adjusted the magnet will continue to vibrate automatically with great rapidity but owing to both quite noiselessly when the case is closed. in this condition no increase of the current will allow only a certain amount of energy will pass to the lamp and if the current is increased while thus adjusted the effect will be only to increase the amplitude of the vibrations rendering the closing of the circuit shorter, so that in a given time the total energy will be about the same
whether the current is strong or weak. If now the disc N is adjusted downward more and more current will pass to the lamp as the amplitude of the armature of the magnet is thus decreased until it reaches a point where the power of the current is insufficient to energize the magnet to such an extent as to overcome the constantly increasing power of the circular spring M hence and separate the springs S. T. from R. If the Tensions of the current are properly regulated, the lamp will give its normal amount of light and the springs S & T will be in such proximity to the edge of the cup V. that any abnormal accession of current from accident of otherwise will cause the latter to separate the springs S & T & prevent further rise of temperature in the burner. A band it will continue to vibrate as long as the abnormal flow of current continues & falling back to a quiescent position when the current is at its normal strength. As there is no difficulty in keeping the temperature of a 156 candle power burner within the limits of 12 to 18 candles the regulator will be set at 18 candle so as to vibrate & reduce the total energy when the current reaches a point sufficient to produce a light equal to 18 candles.

The main object is to produce even illumination and not particularly afford a method of increasing & decreasing this amount between from a certain limit to any lesser amount & not particularly to prevent the fusion of the incandescent conductor because The in practice but I shall not have the burner give more than a light equal to 16 Standard Candles whereas it will give forty without fusion.

Heretofore when it is desired to disconnect the light altogether the upward movement of N. in the act of turning out the light as with gas reaches a point which is the normal position of the armature magnet hence the springs S & T are forced against the edge of the cup V and the circuit is permanently opened. Heretofore it has been difficult to obviate the spark due to the break in the circuit when the lamp is disconnected without which is the la.

With lamps worked in series I have regulated the temperature by thermal regulators which served to operate devices which shunted the burner and gave a new route for the passage of the energy.— Regulators worked in this manner have very little troubled with sparks at the contact points, as lamps of low resistance may be used and the difference of potential is very small. And the But when lamps are to be worked in mul-

April–June 1879 204
tiple arc it is essential that the lamp should be disconnected entirely from the circuit at intervals following each other with some degree of rapidity and with dynamo electric machines where the field magnet is secured by the system of reciprocative accumulation, the break in the circuit causes the latter to discharge and or when many lamps are used be reduced in strength for an instant & this gives a very powerful spark sufficient to fuse the platinum contact springs & point by producing a momentary arc. by dispensing with the variable field magnet & making it & con excluding it from the circuit, and energizing it by extraneous energy the spark is so reduced as to be inconsiderable. For but being proportionable to the discharging time of the induction cylinder of the magneto electric generator not withstanding the fact that the spark is small I have found that time brings out a defect not at first perceptible which is that a small point the action of the spark as in the electric arc causes a small point not larger than a needle to shoot out from one of the platina contact points and although the contacts are still as perfect as at first the effect is to change the relative position of the point & thus of contact & thus alter the adjustment I have devised a method of obviating the spark reducing the spark between contact points from a strong current of great electromotive force such as that given by a dynamo machine on short circuit between metallic points, to a point almost inapreciable and without the consumption of energy by the use of resistances & other devices heretofore used for such purposes. This device is applicable to all kinds of electrical apparatus and I shall use it in my lamp

The It is known that the resistance of the spark in the electric arc as well as between metallic points decreases with the increase of energy. hence the spark between a pair of single points will have times the fusing power as when the same circuit is broken simultaneously at two different parts, and in a corresponding ratio for every additional point where the circuit is broken the difference of potential is reduced in the resistance increased. Thus when a spark between platina terminals is 2 inches in length, The same may be reduced so as to be invisible in daylight if the circuit is broken simultaneously at twelve different places in the circuit, and to obtain a simple & cheap device for this purpose I have devised the mechanism shewn in fig.

April–June 1879
X is a ring of insulating material such as Vulcanized rubber. 1, 2, 3, 4, 5, 6, 7, & 8 are contact springs of steel or other elastic metal tipped upon their ends with Iridium platinum or other unoxidizable metal—The ends of 2 & 3 rest upon a metallic sector inlaid or resting upon the insulating disc G which is also of non-conducting material. These sectors are 4 in number 4 & 5 rests upon the 2nd sector 6 & 7 on the 3rd & 7 & 8 on the last. These sectors serve to connect the springs together; hence the circuit for which these devices are ascertained for opening & closing enters say spring 1 passes across the sector to spring 8 via wire 20 to spring .7 thence via sector to spring .6. via wire 21 to spring 5 thence via sector to spring 4 thence via wire 22 to spring 3 thence via sector to the spring .2. to the other end of the circuit wire. When the springs are all in contact with their sectors the circuit is complete. By means of

If the edge of the edge of the ring E the b is brought against the springs all of the springs are separated from their sectors simultaneously and the circuit is broken in 8 different places simultaneously. Fig. 7. shows the arrangement with 4 springs.
Having now described my Lamp I will describe the devices which I propose to employ upon the premises of the consumer for measuring the energy consumed in a given period and to provide against accidental crossing of the conductors leading from the mains.

For measuring the energy consumed I place in a box along with other devices a cell containing two electrodes: one of copper, one of which is the cell itself and the other a hollow rod immersed in the centre of the cell and immersed which I fill with a neutral solution of Cupric Sulphate. And the amount of energy consumed being ascertained by weighing the deposit of copper at any given interval of time, as these rods are of very little weight, and the amount of copper deposit may be due to any fractional part of the total energy passing & still be very accurate it is obvious that for this purpose the device is extremely practical as the rods may be numbered and many hundred carried to the central office by a single inspector to be weighed and returned or others substituted when taken out.

The arrangement of the circuit for passing but a fraction of the energy consumed is shown in fig 8

\[ X \] is the copper cell, \[ D \] the central electrode. \[ R \] a Resistance but the fractional part of an ohm, \[ R^2 \] a resistance of several ohms. \[ R^2 \] & the cell \[ X \] obtains energy by forming a derivation from \[ R^1 \] — the Resistance of \[ R^1 \] will depend upon the Number of lamps whose energy consumption is to be measured. Only an infinitesimal loss of energy occurs by the interpolation of the resistances \[ R^1 R^2 \] & cell as the resistance of \[ R^1 \] may be but \( \frac{1}{100} \) of the total resistance of all the lamps combined & still afford reliable measurements with one lamp—

\[ R^2 \] is for the purpose of causing any change in the resistance of the cell to become a small factor in the calculation. In the same box I place a device, which I call a safety magnet. This device is shown in fig 8.
The object of this magnet is to open the circuit disconnect the lamps from the mains should the leading wires from the lamps be accidentally crossed or get in electrical connection other than through the bobbins of the lamps. The crossing of the wires will tend to draw a powerful current from the mains and if the lever B is so adjusted by the spring retractile spring A by means of the screw C that the current will be insufficient to cause the magnet to attract the lever when all the lamps are on but any great accession of current such as would follow if the leading wires to the lamps become crossed the magnet would then be powerful enough to attract B as the lever B & back contact point EF form part of the circuit the circuit will be opened and the lever is prevented from vibrating by the downward movement of B causing the catches E & D to lock together.

The method of generating the current will now be explained. I have ascertained by means of the Dynamometer for measuring energy applied in foot pounds and by the electrodynamometer for energy obtained in the electric form reduced to foot pounds that the practice of making the leading wires & lamps composing the extraneous resistance equal to the internal resistance of the machine although the most effective for obtaining the maximum current but is by no means so economical as when the extraneous resistances are many times the internal resistance of the machine especially with machines which have a constant field magnet

second that great economy is attained by increasing the electromotive force of the current by the use of powerful field magnets in lieu of high speed of the induction cylinders or rings, such magnets being kept up by extraneous energy

3rd The use of abnormal field magnets having an
abnormal amount of iron for in thei of great mass. The machine which I prefer to use is shewn in fig 10

4th—" + e em

Make good drawing here

Serrell is preparing The Dynamo patent now. Wait for tracing = 15

Shew To follow in this patent figs from Caveat 89—16 1 4. 7. 8 9 10 11 12 13. 14. 16. 15. 17. 19. 20 & close the patent.


"I . . . that" interlined above. "wires or sheets of" interlined above; "or" separately interlined. 'Interlined above. "Obscured overwritten text. "wire . . . of" interlined above. "as . . . commerce" interlined above. Added in margin. "#" appears in margin. 'Starting here, four pages facing the text have vague sketches, possibly for a table lamp, probably unconnected with this draft; the first page also has an unrelated calculation. "with . . . glass" interlined above. "by a Sprengel pump" added later, "Sprengel pump" interlined above. "#" appears in each margin. "or gases" interlined above. "to vivid" interlined above. "after a years use" interlined above. "or even platinum" interlined above. 'Canceled. "made of" interlined above. "& springy" added in margin. "& nickel" interlined above. "rods . . . of" interlined above. "& nonconducting" interlined above. "have in temp" interlined above. "with low resistance" interlined above. 'Interlined below. "& . . . sticks" interlined above. Followed by diagonal line down to the right, filling remainder of page; figure on next page. "Drawing canceled by large "X". "via wire 7" interlined above. "Illegible canceled text interlined above. "of . . . magnet" interlined above. "light equal to" interlined above. "one of" interlined above. "between contact points" interlined above. "Thus when" interlined above. "Interlined above in a different hand. "is . . . springs" interlined above. "many hundred" interlined above.
1. Edison probably authored this draft during the first week of May. It contains a meter design that dates from 1 May (see Doc. 1733) but does not include the 9 May version of the regulator (see note 8), which was included in the final specification. It is unclear what Lemuel Serrell, Edison’s patent attorney, had in hand when he wrote on 8 May, “Shall I enter provisional specification on the new electric light patent in England and then finish up specification, as quick as possible so as to get the seal immediately without waiting for the completion of the specification?” DF (TAEM 51:483; TAED D7929ZBW).

2. Under British patent law, an applicant could obtain a patent by filing either a very general “provisional specification” or a more detailed “complete specification” of an invention. A provisional specification provided patent protection until the submission of the complete specification, which had to be done within six months after the filing of the provisional (Davenport 1979, 30). Edison’s draft is the text for the more detailed complete specification of British Patent 2,402 (1879), Batchelor (TAEM 92:118; TAED MB017). The provisional specification was filed on 17 June and the final specification on 17 December.

3. The preceding discussion is based on lamp experiments that took place between mid-January and mid-February (see Docs. 1665, 1666, 1669, 1670, 1672, and 1675) and the following discussion of improvements in lamp technology are based on Edison’s 9 February draft caveat (Doc. 1676) and his 1 March draft patent (Doc. 1695).

4. An approximate way to gauge the degree of evacuation, extensively used and reported by William Crookes and his assistant Charles Gimingham, is by the strength of spark discharge that a vacuum will inhibit. A three inch induction coil was one that produced a spark powerful enough to extend that far through air at normal pressure and temperature. As Edison wrote in his notes on Crookes’s vacuum technique and designs: “The nearer he gets to a vacuum the more power it requires to drive the spark through the tube.” Spark gauges usually involved not only extra wires as noted here but also a subsidiary chamber on a branch off the main space being evacuated. N-79-04-21:3, Lab. (TAEM 30:727; TAED N017:2).

5. This is Edison’s “electric light law” (see Doc. 1577). Edison’s “law” appears to have been rediscovered by Irving Langmuir during his early twentieth century investigation into the problem of lamp blackening in connection with tungsten lamps. According to Reich 1985 (p. 121), Langmuir showed “that the light radiated from a filament was a direct function of its surface area, but that filament shape significantly affected heat loss. Knowing this, he designed a closely spiraled filament that emitted light from its total surface but lost heat only from the surface of the spiral.”

6. See Doc. 1608.

7. Figure labels, clockwise from left, are “2,” “2,” “1,” “x,” “1,” and “g.”
8. Prior to developing vacuum lamps Edison had focused his efforts on thermal regulators designed to prevent the metal filaments (primarily platinum and platinum-iridium) from reaching their melting point. Beginning in late February he began to develop regulators of the type shown in this patent designed to prevent a sudden increase in current from damaging the lamp. Edison made two sketches on 20 February of an incomplete device, similar in principle to the one described in this document, consisting of a spring-loaded rod moved by an armature responding to two electromagnets. In March he drew several regulators employing a magnetic motor to turn a governor which would interrupt the lamp circuit at a particular speed. In early April Edison briefly considered interposing variable resistances in the circuit; one design of a “Sunflower regulator for Electric Light” consisted of loops of wire that could be switched into the circuit although this drawing does not show any mechanism for doing so automatically. Edison returned to the idea of a solenoid regulator on 4 April and in the next few days he also sketched several designs apparently intended to operate by thermal expansion; he had four of these and one solenoid built. He drew two regulators of the design shown in this document on 7 April and John Kruesi made a measured drawing ten days later. In the completed provisional and final specifications of this patent, however, Edison replaced this regulator with one actuated by a governor driven by a magnetic motor. That design was essentially complete by 9 May and a regulator of that design built two days later. N-79-03-10.1:41–51; N-79-01-14:73–81; N-79-04-03:31–35; N-79-01-21:129–33, 143–49; N-78-12-04.2:201–205; Vol. 16:386; N-79-01-21:159–67; N-79-04-03:75; all Lab. (TAEM 31: April–June 1879)

A lamp with governor regulator based on Edison's 9 May design, from his British Patent 2,402 (1879).

9. Should be “W.”

10. Edison apparently meant by “reciprocal accumulation” that the field magnet was in the same circuit as the lamps.

11. That is, a separately excited field.

12. In the regulator design of 9 May that was included in the final specification, Edison replaced this device for minimizing sparks with a circuit-opening lever. When the collar of the regulator governor moved up, a block on the end of this lever would push against a set of springs causing them to break contact with a metal block and open the circuit. Brit. Pat. 2,402 (1879), Batchelor (TAEM 92:118; TAED MBP017).

13. For the meter, see Doc. 1733.

14. The specifications resulting from this draft are Edison’s first detailed description of his distinctive dynamo design. The armature consisted of a wooden cylinder with an iron head at each end, between which fine iron wire was wound until flush with the edge of the heads. Over this the insulated induction wire was wound longitudinally, “the ends of which are connected to the commutator. The wire of the parallel induction helix is substantially endless, and it is wound with reference to obtaining a continuous current. The number of parallel coils may be more or less in number, but I find the desired object can be obtained by using an even number . . . and an odd number of the commutator plates.” Brit. Pat. 2,402 (1879) (p. 6), Batchelor (TAEM 92:118; TAED MBP017).

Edison’s explanation of the large field magnets depended on an analogy between magnetic and electrical circuits. At this time there was little theoretical understanding of the behavior of the magnetic circuit but there was a growing body of design practices on which he could draw, as did later theoreticians. Based intellectually on Faraday’s analogy between lines of magnetic force and battery current flowing through an electric circuit, this knowledge was developed by what has been called “dynamo theory,” or the semi-empirical tradition of machine design (Jordan 1990, 131–38, 161–69, 172–73). This analogy guided some of Francis Upton’s early dynamo work (see TAEB 4:768 n. 3) and was elaborated upon by Edison in an undated table in which he developed an extended comparison between magnetic and electrical circuits (Oversize Notes and Drawings [1879–1886], Lab. [TAEM 45:32–34; TAED NS7986B:36–41]). It seems to have led Edison to conceptualize the iron parts of the dynamo as the magnetic equivalent of electrical conductors, suggesting that greater mass and good surface contacts would reduce the “resistance.” He explained that by the large magnet cores he was “enabled to reduce the resistance of the magnetic circuit to a very low point, and at the same time by reason of this large mass of iron of great magnetic conductivity the use of a single layer of wire is possible, thus obtaining the maximum economy.” He also noted the iron bar connecting the magnet cores “is greater in mass than in the same length of core. The surface of both the back and the end of each core are ground together,
and are permanently secured by bolts and nuts. By thus employing a large mass of iron for the back, and grinding the faces of contact to a point where air suction becomes powerful, I reduce the resistance of this point to a minimum and prevent the appearance of free magnetic poles” (Brit. Pat. 2,402 [1879] [p. 6], Bachelot [TAEM 92:118, TAED MBP017].

Edison did not attempt to secure a U.S. patent on his field magnet design until 1880 (see Doc. 1890). His September 1879 application for an improved armature (Case 184, which issued as U.S. Pat. 222,881) illustrated but did not describe the complete dynamo with its distinctive magnets, and he was later obliged to make an explicit statement limiting that application to the armature alone (see Doc. 1851). Edison’s reluctance was evidently due to concern that the Patent Office would hold the design to be merely an alteration in the proportions of well-known machines. In October Zenas Wilber reported that he thought first assistant examiner Henry “Townsend and his ass’t Buckingham are inclined to my view about the magneto machine, viz that when change of proportion between the parts is attended by a new result or marked increase of old result, then is involved invention and patentability” (Wilber to TAE, 24 Oct. 1879, DF [TAEM 49:454, TAED D7903ZJR]).

15. It is unclear to which patent application Edison refers. He executed a U.S. application (Case 177) on 21 April but it was not filed until 12 May and covered his earlier, entirely different dynamo design in which the field magnet rotated within the stationary induction windings, the whole surrounded by an iron shell (see Doc. 1694). There are no other known generator patents originating at this time but there is an undated drawing with figure labels, possibly for a patent, showing the three major Edison generators designed up to 1 May—the one shown in Case 177, the first bipolar design with 2 foot field magnets (see Doc. 1702) and the modification of this with 3 foot magnets (see Doc. 1727 n. 2). Oversize Notes and Drawings (1879–1886), Lab. (TAEM 45:29; TAED NS7986:33).

16. This caveat has not been found; it was completed by 15 April, when Serrell sent it (and Caveat 88 and extra copies of the drawings) to Edison for his final signature. Serrell to Edison, 15 April 1879, DF (TAEM 51:469; TAED D7929ZBK).

[New York,¹] May 2, 1879

This agreement made this second day of May in the year 1879, by and between Thomas A. Edison, of Menlo Park in the State of New Jersey; Theodore Puskas, of 45 Avenue de l’Opera, Paris, France; Joshua F. Bailey, of 45 Avenue de l’Opera, Paris, France, of the first part, and James H. Banker, of the City of New York, of the second part,

WITNESSETH:

WHEREAS the parties of the first part, collectively, own or are entitled to acquire and control the exclusive use in the following counties of Europe, to wit: Belgium, Austria, France,
Denmark, Germany, Russia, Italy and Spain, of certain existing and future inventions of Edison in or relating to means for the development of electric currents for and the application of electricity to the uses of lighting, power and heating—and already own certain and may hereafter acquire other letters patent of said countries or some of them for said inventions; the interests of said parties in such inventions and patents being respectively the following, namely—Edison having 30 undivided 60ths, Puskas 27 undivided 60ths, and Bailey 3 undivided 60ths, thereof.—

AND WHEREAS the party of the second part desires to acquire an interest in the said inventions and patents, which the parties of the first part have agreed to sell to him, on the conditions hereinafter set forth:

NOW, in consideration of the premises and of the mutual agreements of the parties hereto, they agree with each other as follows:

FIRST:— The parties of the first part hereby agree to sell, convey and secure to the party of the second part, by instruments good and sufficient in the law of the several countries above named, for the sum of Twenty five thousand dollars, ten undivided sixtieth parts of all the right, title and interest in all the patents of Edison aforesaid, in all or any of the countries above named, which they or either of them now own or may acquire within five years from the date hereof, and the use, benefit and enjoyment of his inventions aforesaid in the said countries which they now have and in all additions to or improvements thereof which they may hereafter acquire: provided however that of said sum of twenty five thousand dollars, five thousand dollars be paid as provided in the second article hereof and the remaining twenty thousand dollars on or before the expiration of seven months from the date of this instrument.

And the parties of the first part agree to apply so much as may be necessary of said sum of twenty five thousand dollars, or of such part thereof as they shall receive, to the expense of Edison in developing said inventions or in making improvements or additions thereto of a like character, and of procuring letters patent in said European countries for the inventions above named and to the bringing into use as soon as possible, by sale or by other most advantageous mode, of the said inventions and patents.

SECOND. The party of the second part agrees to pay to the parties of the first part on the execution of this agreement

April–June 1879 214
three thousand dollars of the twenty-five thousand dollars mentioned in the First clause, and the further sum of two thousand dollars as soon as specifications now being prepared by L. W. Serrell, Edison's solicitor of patents, for further European patents are ready for filing in such European countries.\textsuperscript{b}

\textbf{THIRD.} The parties mutually agree that if the party of the second part, after paying said five thousand dollars, shall, at any time within the seven months provided in the First Clause, elect not to pay the rest of said twenty five thousand dollars—and option to this effect is expressly reserved to the party of the second part—then the party of the second part shall be entitled to receive, instead of the ten undivided sixtieth parts,—only two undivided sixtieth parts of and in the right, title and interest of the parties of the first part in the said inventions and patents for said Countries of Continental Europe,—and after payment of said five thousand dollars and on the declaration of such election by the party of the second part—the parties of the first part will sell, assign and secure to him by instruments good and sufficient in the law of said several countries such two undivided sixtieth parts in such inventions and patents in and for said several countries.\textsuperscript{b}

\textbf{FOURTH:} The parties of the first and second parts agree with each other respectively—that if the party of the second part shall pay the full twenty five thousand dollars as herein provided, they will, immediately upon such payment, form together a corporation under the act of the Legislature of the State of New York entitled “An Act to provide for the organization of certain business corporations,” passed June 21, 1875;\textsuperscript{6} such corporation to be such limited liability company as is provided by the 33rd Section of said Act, with a capital of three hundred thousand dollars, divided into three thousand shares of one hundred dollars each, and that upon formation of such corporation they will severally sell, assign and convey to it their respective rights, titles and interests in all the inventions and patents referred to in this instrument—as they shall stand after such assignment to the party of the second part and as provided by the first clause hereof—to wit, the following undivided interests, namely: Edison $\frac{30}{60}$ths Puskas $\frac{17}{60}$ths, Banker $\frac{10}{60}$ths and Bailey $\frac{3}{60}$ths thereof—and the said parties respectively covenant that they will hold their said several interests meantime for the purpose in this instrument declared, to be assigned to said corporation immediately on the formation thereof as herein agreed—provided however that shares of the stock of said Company shall be issued to them respectively in

\textit{April–June 1879} 215
proportion to their respective interests in the patents and inventions so assigned to it.\textsuperscript{b}

In Witness Whereof the parties hereto have hereunto set their hands and seals the day and year first above written.

Thomas A. Edison (seal) J. F. Bailey. (seal)
James H. Banker. (seal)

In the presence of \textsuperscript{c} As to J. F. Bailey and James H. Banker
Randolph Hurry.\textsuperscript{d} As to Thomas A. Edison Stockton L. Griffin.

**ADDENDUM\textsuperscript{d}**

[New York?] May 10, 1879

The parties to the foregoing agreement hereby severally agree that the words Sweden and Norway were omitted by mistake from the list of countries named in the preamble thereof, and therefore and for the consideration recited in said agreement shall be henceforth read and construed and have the same effect in all respects as if the words “Sweden and Norway” had been written therein next after the word Spain where it first occurs, before execution thereof, and said agreement is hereby amended to the foregoing effect.

In Witness Whereof the parties hereto have hereunto set their hands and seals the day of one thousand eight hundred and seventy nine. In presence of

TD (copy), NJWOE, DF (TAEM 50:308; TAED D7921111). Notarization omitted. \textsuperscript{a}Place taken from oath; date taken from text, form altered. \textsuperscript{b}Followed by horizontal line to right margin. \textsuperscript{c}Written in left margin, probably by Griffin. \textsuperscript{d}Addendum is a TD (copy).

1. Although Edison’s signature to this agreement was later notarized by Stockton Griffin in Menlo Park, on 2 May Edison was in New York where he signed a separate agreement regarding the formation of the Edison Telephone Co. of Europe. Agreement with Robert Cutting, Samuel White, Robert Cutting, Jr., and James Banker, 2 May 1879, CR (TAEM 97:527; TAED CH001AAA).

2. An unsigned copy of an undated addendum to this agreement (p. 6; not transcribed) stipulated that Sweden and Norway had been inadvertently omitted from this list, and that they were to be considered in the same respects as the other countries named.

3. Shortly afterwards, Bailey sold Samuel White one-half of his interest in this agreement. Bailey agreement with White, 14 May 1879, SSW (TAED X078AG1).

4. An ancillary agreement executed eight days later gave Banker the option to purchase in addition, at par value, \(\frac{1}{10}\) of Edison’s interest in the company formed under this contract. This option was to expire in De-
cember but Edison later extended it to 1 January 1880. Banker subsequently paid Edison $15,000 for this interest. Agreement between TAE, Banker, Puskas, and Bailey, 10 May 1879; agreement between TAE and Banker, 29 Nov. 1879; TAE receipt to Banker, 10 Jan. 1880; all DF (TAEM 50:314, 316; TAED D7921222, D7921333, D7921444).

5. This contract superseded Edison’s prior commitments to Puskas regarding the electric light, from which Bailey, acting as Puskas’s attorney, had released Edison on 28 April. Edison subsequently agreed to transfer Banker’s interest to Puskas if Banker failed to fulfill the terms of the contract. TAE agreement with Puskas, 14 May 1879, Miller (TAEM 86:15; TAED HM790062). For the original manuscript copy of this agreement, see Kellow (TAEM 144:1197; TAED HK203AAA).

6. Banker paid the balance of the twenty-five thousand dollars on 29 November 1879; the Edison Electric Light Co. of Europe, Ltd. was incorporated in January 1880. Banker to Bailey and Banker to Puskas, both 29 Nov. 1879; Certificate and Articles of Incorporation; all DF (TAEM 52:430, 54:139; TAED D7940ZDJ, D7940ZDK, D8024A).

7. The 10 May agreement with Banker (see note 4) referred to the fact that Puskas had not yet signed. It is not clear why Bailey did not sign this contract on behalf of Puskas, who instead had to await its arrival in Paris.

8. Randolph Hurry was an attorney in New York City. Wilson 1879, 702.

9. The addendum was apparently unsigned at the time this copy was made.

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From William Kirk & Co.

Newark May 6th 1879

Sir

Mr Murry¹ has moved out of No 12 Ward st. and we would like to have a settlement of your acct² Yours Respectfully

W H Kirk & Co³

L., NjWOE, DF (TAEM 49:859; TAED D7912E).

1. Joseph Murray had been Edison’s manufacturing partner between 1872 and 1875, after which he established his own firm in the shop at 10–12 Ward St. in Newark where he continued to make instruments for Edison. See TAEBA 1:282 n. 1, 3:642 n. 1, 4:34 n. 2.

2. Edison retained an undetermined financial interest in Murray’s business and in 1878 had advanced about $1,100 on his behalf to forestall eviction and seizure of his machinery but at this time Murray was selling off his machinery (see Docs. 1204 and 1306). After the landlord again requested a settlement of the account in August 1879, Edison instructed Stockton Griffin to verify that Murray had taken down the shop’s overhead equipment because “Kirk wants me to pay his bill—and I will not until that is removed” (Murray to TAE, 6 Sept. 1879; William Kirk & Co. to TAE, 7 Aug. 1879; both DF [TAEM 49:364, 860; TAED D7903ZHN, D7912E]).

3. This firm was owned by William Kirk, a Newark builder and landlord (see Doc. 157).
Dear Charley

Yours of April 21st just to hand. We are exceedingly sorry to hear of Adam’s death through your telegram and hope you will do all you can to fix matters for his wife. As Gouraud reported he was so sick, Edison had decided to recall him and had already sent the telegram, thinking he would have a better chance to get well here.

Gouraud is here at present and we are making 50 telephones for Central System there, which he will probably take with him. You are right in supposing the width of the spring has considerable to do with the proper working of the motograph the longer the line the narrower the spring and even in Laboratory out of 10 different widths I find $\frac{3}{8}$ to $\frac{3}{16}$ wide by far the best. One of our first ideas on the motogh was that it formed H. gas under the stylus but later we have come to the conclusion that it must be due to capillary action; the passage of the current, altering the capillary force, acting in the pores of the chalk so as to drive the moisture away from the surface.

The new telephone is simply immense. Next Scribner will have a picture of it and I shall send you one. We have no difficulty in working both ends equally loud and in cases like central system we put the line battery on at central station so as to have it in same direction for both receivers. We have also devised for the call a 12 cell battery that goes inside a Leclanche battery jar and is just the best thing you ever saw, it is an open circuit battery and will last I should judge 12 months. This is the connection of the instrument working with central station as far as I know at present

Transmitter will be made with short funnel so that if you talk anywhere within 6 inches it is all OK. We shall put on a bell instead of a sounder and as you see we use a double point key in order to prevent any man from having his battery closed when not working
The permanent line battery is put on at Central Station in this manner; so that \( [\text{it is?}] \) polarity \( [\text{s}] \) always working right for both receivers, the magnet you see is a 500 ohm German silver magnet which gives resistance to the leg and also tells when they have done talking. 9

I sent you a book entitled ‘Edison [and] his inventions’ \( ^{10} \) did you get it? Send me by mail \( [\text{if?}] \) you can Du Moncel’s new book on Tel. Phon etc \( ^{11} \) Sent you Herald with Obituary of Jim \( ^{12} \) what do you thin[k] \( ^{4} \) of it I should like to know the address of his relations in Scotland so I could send some. Will send you [----- ----- --------] \( ^{d} \) in next Yours

Chas Batchelor

ALS (letterpress copy), NjWOE, Batchelor, Cat. 1330:49 (TAEM 93:263; TAED MBLB2049). \( ^{a} \)Copied off edge of page. \( ^{b} \)Canceled. \( ^{c} \)“polarity i” interlined above and copied off edge of page. \( ^{d} \)Illegible.

1. Not found.
2. Charley cabled from London on 5 May “Adams dead Cable transfer me Brown Shipley 100 pounds immediately Unprocurable here.” Edison did so the same day, noting that the sum should be charged to Adams’s account. DF (TAEM 49:220, 52:531; TAED D7903ZDN, D7941ZAA).
4. See Doc. 1742 n. 4.
5. Cf. Doc. 1693. Batchelor recorded a different understanding in a notebook entry on 19 May: “The best theory of the motograph that we can give to account for the action is this:— That the passage of the current has such an effect on its capillary power as to draw the solution to surface and lubricate it.” He remarked that a chalk cylinder, after having dried out, could be restored only by turning it on a lathe, which he attributed “to the fact that the NaO crystallizes on the surface and these crystals must be turned off or dissolved out, in order to get good talking.” This led Edison to consider at the end of May how capillary action might be applied to what he termed a “Motograph Engine ie Capillary Motor.” It is not clear how this device would operate. On 1 June, however, Batchelor reported that “We have accidentally found out that one spring we used (which was much better than any other) was made of Palladium instead of Platina and taking into consideration the fact that Palladium occludes 700 times its own bulk of Hydrogen and the motograph shows itself at the pole where Hydrogen is, we think it is nothing more than a battery action.” Cat. 1304:55, 57, Batchelor (TAEM 91:54–55; April–June 1879 219
In a portion of Batchelor’s 19 May notebook entry that he probably added several weeks after that date, he observed that rubbing a platinum point across the surface of the chalk caused current to flow through a galvanometer. Presumably about this time Francis Upton made several pages of notes on “Chalks Test of E.MF on” (N-79-02-24.2:152–63, Lab. [TAEM 31:1068–73; TAED No31:76–81]). The *Scientific American* reported in its 26 July issue that

Mr. Edison discovered some peculiar freaks in the receiving instrument which at first puzzled him; but on connecting the binding posts of the telephone with a galvanometer, he found to his surprise that the chalk and platinum rubber of the telephone formed a generator of electricity of no mean order, as it equaled in electromotive force a half of a Daniell cell. He therefore arranged four of the chalk cylinders upon a non-conducting shaft, and connected the platinum rubber of one chalk cylinder with the metallic boss of the next, the terminals being a rubber on one end, and a spring touching the metallic boss of the chalk cylinder at the other end. A series of four chalk cylinders thus mounted and connected . . . is equivalent to two Daniell cells, but the power varies somewhat with the speed at which it is rotated . . . . Whether the current is due to the decomposition of the solution with which the chalk is moistened, or whether it is due to capillarity or some other cause, has not been definitely determined. [“Progress at Menlo Park,” *Sci. Am.* 41 (1879): 52]
6. In June, in the first of a series about Edison’s inventions that appeared in *Scribner’s Monthly* (Fox 1879c), Edwin Fox described Edison’s receiver and prospective applications of the electromotograph principle to machine bearings, the Atlantic cable, and stethoscopes. The accompanying engraving of the receiver had been published by *Scientific American* in its 26 April issue (“Edison’s Electro-Chemical Telephone,” *Sci. Am.* 40 [1879]: 260).

7. Figure labels are “LINE,” “Bat.,” “Transmitter,” and “X 12 cell battery.” There is no evidence about the development of this particular battery. On 9 May Batchelor made repeated galvanometer measurements with a “10 couple Leclanche” battery; between then and 5 June, he and George Carman tested almost two dozen different batteries, having some of them ring call bells hundreds of times over many hours. Batchelor instructed the laboratory shop to make “65 10 cell batteries for new receiver order” on 23 May. N-78-11-28:154–214, Lab. (*TAEM* 29: 97–127; *TAED* No01:79–109); Cat. 1304:51–52, 56, Cat. 1308:147 (Order No. 168), Batchelor (*TAEM* 91:50–51, 55; *TAED* MBN04: 48–49, 53; MBN03:47).

8. This arrangement was completed on or before 1 May, when Batchelor made several related drawings, including one of “connections for each station when worked with Central Station.” The same day he also sketched the locations of the connections in each telephone set. Edison’s notation on this latter page indicates that the call bell, induction coil, key, switch and binding post were to be made by Western Electric, and the transmitter itself by Sigmund Bergmann’s shop. N-79-03-25:85, 90–95, 99, Lab. (*TAEM* 32:182, 185–87, 189; *TAED* No34:43, 46–48, 50); Cat. 1304:47, Batchelor (*TAEM* 91:46; *TAED* MBN04:44).

9. On Edison’s rationale for a constant battery current over the line to each receiver, see Doc. 1693. Batchelor made more distinct drawings on 1 May of these connections from “Central Station battery.” N-79-03-25:95, Lab. (*TAEM* 32:187; *TAED* No34:48); Cat. 1304:47, Batchelor (*TAEM* 91:46; *TAED* MBN04:44).

10. See Doc. 1660.

11. English editions of Count Theodose du Moncel’s 1878 book, *Le Telephone, le Microphone, et la Phonographe*, were separately published in 1879 in London and New York; the two versions were not identical (du Moncel 1879b, 1879c).

12. The *New York Herald* reported that Adams had died in Paris on 4 May, at age thirty-three. It stated that he had left his native Scotland
as a youth and principally made his living at sea for fourteen years until beginning his association with Edison. “James Adams,” New York Herald, 6 May 1879, Cat. 1241, item 1186, Batchelor (TAEM 94:483; TAED MBSB21186).

MENLO PARK, N.J.ª May 10, 1877[1879]

Dear Sir

Since my letter of April 8th 1879¹ I have completed the standard generator which exceeds in simplicity and economy all generators previously devised by any one;² The size being less and from 88 to 90 per cent of the horse power applied is thrown into the form of current.

Nothing more remains but the construction of the standard lamp, and the working up of the mechanical details for a large central station. Thirty generators are now being made to start the stations at Menlo Park³ for 500 burners with a radius of $\frac{1}{2}$ mile, 300 lamps being placed in the streets and 200 distributed in the eight houses on the Park,⁴ all provided with metres and the whole system worked as if in actual practice. About 4 to 6 months continuous running will be sufficient time after the system is started to eradicate all defects and prove beyond doubt the economy and practicability of the system for replacing gas as an illuminant. Very Truly

Thomas A Edison

LS, HuBPO, TP (TAED Z400BR). Written by Stockton Griffin. ¹Place from Edison’s laboratory handstamp.

¹. Doc. 1722.
². See Doc. 1727 n. 2.
³. See Docs. 1727 n. 2 and 1749.
⁴. Press accounts from the previous year reported that Menlo Park at that time was “composed wholly of Edison’s laboratory and half a dozen houses where his employees live” (Doc. 1277). Other sources refer to an inn, a tavern, and a store in the village. “The Tally-Ho’s Journey,” New York World, 5 May 1878, Cat. 1240, item 582; “A Night with Edison,” Scribner’s Monthly, Nov. 1878, p. 95, Cat. 1241, item 973; both Batchelor (TAEM 94:194, 390; TAED MBSB10582X, MBSB20973X); Jehl 1937–41, 1:25–28, 285, 3:1121–22.
Dear Sir,

I duly rec'd. & ansd. Mr. W. C. Noyes’ letter as requested—²

I also rec'd. today the Draft of Contract about the New Receiver,² and the same is in Mr. Cary’s³ hands to be written out for signature

I have today seen the Patent issued in April last for the “Fitch Carbon Transmitter,”⁴ and have tried the Instrument—it seems to work well—but I suppose it infringes you does it not?

Yours Truly

Tracy R. Edson

(Yes. Today I send to patent office as a model the so called Blake transmitter⁵ This will be⁶ a fine joke when I get a patent on the instrument exactly as they use it, for I had it that way over a year ago—⁶)


¹Not found.
²Edson had written to Edison on 1 May informing him that he and Hamilton Twombly, possibly accompanied by James Banker, were planning to come to Menlo Park on 3 May and that he would bring the new receiver contract at that time. As Edson requested Edison replied the following day by telegram that they could come out. The agreement between Edison and Western Union assigned the electromotograph receiver to the company in exchange for a royalty of one dollar per year for each receiver put into use up to the amount of $3,000. The contract specified that the receiver would be "at least six times louder than any electro-magnetic receiver now in use.... be as simple and durable and not more expensive to construct than the best magnetic receivers now in use," and would work with Edison’s carbon transmitter. On 21 May, George Walker wrote Edison to ask “when are we to have your wonderful receiver? . . . There are a great many inquiries about it & we want it here as soon as possible.” He also informed Edison that the contract executed by Western Union had been sent him several days previously. The contract was dated 12 May and signed by company president Norvin Green; a copy is in Miller (TAEM 86:11; TAED HM790061).
³Clarence Cary, a Western Union attorney, headed the company’s Claim and Legal Bureau. Reid 1879, 560.
⁴See Doc. 1731 n. 6.
⁵Francis Blake had been for many years an officer in the United States Coast Survey where he had been involved in the electrical determination of longitudes. In the summer of 1878 he devised what became known as the Blake transmitter; he filed a patent application for this design on 3 January 1879. This was a form of inertia transmitter with two
spring-mounted electrodes—a platinum bead and a carbon disk—that remained in contact with each other while being vibrated by the diaphragm. This arrangement eliminated the need for frequent adjustment of the pressure on the carbon button and also reduced the mechanical vibration from the transmitter mounting. After Emile Berliner made several improvements to this design, most notably by substituting a harder carbon disk, it was used extensively by the American Bell Telephone Co. Edward Johnson had tested the Blake instrument in April and reported to Edison that it did not produce “the natural tone of the Edison proper or the Bell magneto” but “only a pure vibration when its low— It’s horrible when loud.” Brief for Francis Blake, 338; Blake’s Patent Specification; both TI (TAEM 11:850, 935; TAED T14:76, T16:340); ANB, s.v. “Blake, Francis”; “The Blake Transmitter,” Sci. Am. 41 (1879): 274; Wile 1974, appendix 2; Fagen 1975, 70–71; King 1962b, 330; Prescott 1972 [1884], 368–70; Johnson to TAE, 19 Apr. 1879, DF (TAEM 49:211; TAED D7903ZDI).

The patent model was probably for Edison’s patent application Case 178, which he filed on 2 June 1879. This application was subsequently placed in interference with Blake’s 3 January 1879 application (see Doc. 1792). When Edison wrote again on 27 May that he thought it “of great importance that you press your application for your Patent on the ‘Blake’ and the ‘Fitch’ Transmitting Models,” Edison noted on the letter that “Blake & Fitch cant come out till thers an interference then I will have pat Blake have none & Fitch annulled.” Two days later Edison, apparently in reference to this application, wired Lemuel Serrell to “Hurry up last telephone case should be in office immediately to stop another application.” During his testimony in the interference proceeding Edison testified that he had made an instrument like that shown in Case 178 in September 1877 and he produced both an instrument and a sketch from October 1877 of a modification of this design. Edison to TAE, 27 May 1879; TAE to Serrell, 29 May 1879; both DF (TAEM 49:246, 51:496; TAED D7903ZEI, D7902ZCI); Edison’s Patent Specification Case 178; Edison’s testimony, 12–13, 16–17; both TI (TAEM 11:985, 1002, 1004; TAED T17:8, 25, 27).

6. Edison is probably referring to the subject of Telephone Interference No. 1 between his Case 141 (filed 20 July 1877, which was later divided and issued as U.S. Patents 474,231 and 474,232) and Francis Blake’s 3 January 1879 application. Edison claimed to have reduced this design to practice by 5 March 1877. Brief in Behalf of Thomas A. Edison, 19, 26–35, Miscellaneous Interferences, TI (TAEM 11:870, 874–78; TAED T15:18, 22–26).

—1741—

From Arnold White

[London,] 13th May 1879

Dear Sir

Telephone I have to report to you that on Saturday the 10th inst, at the House of the President of the Royal Society, the Prince & Princess of Wales, the Crown Prince of Denmark, and many members of both Houses of Parliament, were present at a demonstration of your telephone.

April–June 1879

224
As your nephew, in the face of my protest absented himself in Paris, I placed an instrument in the hands of Mr Conrad Cooke, author of the article in “Engineering.”¹ To his attention and energy we are indebted for the occasion proving an entire success.

The Prince of Wales desires to convey to you his congratulations on your invention. He was greatly pleased and amused at the experiments. I am glad to say that on this occasion I secured the support of Sir John Lubbock² who will put £2000 into the Company, subject to his approval of the other names.

House of Commons I have to-day received from the Speaker copy of my letter to him printed as a Parliamentary paper.³ This coupled with the success of the letter to the Times and the leading article in that journal,⁴ will I am informed, secure the success of the Company.

C. P. Edison. I took yesterday the extremely strong step of requesting Colonel Gouraud to secure your nephews recall.⁵ Any one bearing your name must, in this country, give us great assistance or the reverse. Caprice and stubbornness might easily be surmounted and overcome in one whose name is not Edison. But the Butcher affair⁶—a matter requiring very delicate handling—your nephew’s departure to Paris; his refusal on his return to assist with the instruments, and, I may add, his language, decided me to request that he may be recalled. We can ill-spare one who could, if he liked do so well, but as he will neither do anything himself or consent to other people aiding in the matter, I have come to the conclusion to request his recall, and to lay a plain statement of the matter before you. Copies of telegrams & correspondence passed between us will in due course be sent you.⁷ I am, Dear Sir, Yours faithfully

Arnold White⁸

ALS, NjWOE, DF (TAEM 52:538; TAED D7941ZAM).

1. Conrad Cooke was an engineer known at this time chiefly as the author of an Engineering article describing the first demonstration of the Bell telephone in Britain in 1876. Cooke had also designed an electric light system for the clock tower of the Parliament buildings and later helped introduce incandescent gas lighting in London. A frequent contributor to Engineering, he co-authored the first volume of Dredge 1882–85. Obituary, Teleg. J. and Elec. Rev. 98 (1926): 109; Obituary, Journal of the Institution of Electrical Engineers 66 (1926): 1203.

2. Sir John Lubbock was a member of Parliament and a prominent banker. He was also a noted entomologist and member of the Royal Society. DNB, s.v. “Lubbock, Sir John.”

3. Not found.

4. White’s letter to the editor of the Times described the widespread
adoption of the telephone in American cities and extolled the benefits of
the exchange system for British life and commerce. In a lengthy editorial
comment the same day, the *Times* cautiously endorsed White’s optimis-
mistic outlook and expressed its hope that Parliament would not readily
grant telephone monopolies to private companies. “The Economics of
the Telephone” and untitled editorial, *Times* (London), 10 May 1879, 6
and 11.

5. News of difficulties involving Charley reached Edison on 6 May,
when Gouraud telegraphed from New York that White had cabled him
“implying that Charley is giving trouble Please cable him immediately
to implicitly obey White.” Edison may have done so; Charley wired from
London on 9 May that he had returned from two days in Paris and would
“run things smoothly” in the wake of Adams’s death but that White was
“exasperated.” Edison did cable his nephew on 12 May to “Return here
immediately.” Charley protested that his recall was “premature some
misrepresentation await explanatory letters enroute [Prof. William]
Barrett upholds me” (Gouraud to TAE, 6 May 1879; Charles Edison to
TAE, 9 and 13 May 1879; TAE to Charles Edison, 12 May; all DF
[TAEM 52:533, 535, 537, 536; TAED D7941ZAD, D7941ZAF,
D7941ZAK, D7941ZAI]). Those letters have not been found, but a few
days later Charley sent a detailed defense of his recent actions:

The only reason that I can attribute for your cable is that Mr White,
as I have heard from outside parties also, has conveyed to you the
idea that when I left London for Paris I deserted the telephone in
England. I wish it distinctly understood I did not. Had no such in-
tentions, notified Mr White twice by cable that I would be in Lon-
don the day before the Prince of Wales exhibition he knowing I was
in London & waiting for him at Lombard St nevertheless he took
the instruments and put them in other people’s hands, thereby giv-
ing me no chance whatsoever. now if he persists that in saying that
I deserted the telephone, I will leave it to your good reason to judge
for yourself It is plain for me to understand the course taken by
Mr White as I have seen enough of this man since Gouraud left to
be convinced that he is a perfect failure in his position, and if I
had gone on and done everything he wanted me to do there would
have been reports of some discouraging reports of the telephone.
[Charles Edison to TAE, 15 May 1879, DF (TAEM 52:546; TAED
D7941ZAR)]

6. This refers to a purported September 1878 agreement between
George Gouraud and William Butcher concerning the use of Edison’s
telephone on railroads and in factories. Gouraud and Edison repudiated
the contract over the summer and took steps to indemnify the company
from claims based on it; Butcher was jailed on forgery charges. Gouraud
to Edward Bouverie, 14 July 1879; TAE agreement with Bouverie, 1 Aug.
1879; Renshaw & Renshaw to Gouraud, 20 Sept. 1879; all DF (TAEM
52:616, 648, 800; TAED D7941ZCU, D7941ZDF, D7941ZFU).

7. Not found.

8. Arnold Henry White was a London journalist who contributed to
a number of newspapers and magazines. He was apparently recom-
manded to George Gouraud by William Barrett and became manager of
the Edison Telephone Co. of London. White later stood for Parliamentary elections several times and achieved considerable recognition as an outspoken proponent of eugenic principles. Charles Edison to TAE, 15 May 1879, DF (TAEM 52:546; TAED D7941ZAR); Searle 1976, 118.

Brunswick London

Cable Drexel's authority pay Edisons sixty days draft my order 5,000 signed agreement attached altered as cabled If company want exceeding fifty telephones ordered must order specially the 500 referred to are for provincial exchanges England

Gouraud

L (telegram), NjWOE, DF (TAEM 52:545; TAED D7941ZAQ). Written by Stockton Griffin.

1. Dillwyn Parrish, a London merchant, was the largest investor in the Edison Telephone Co. of London, Ltd. Edison Telephone Co. of London list of stockholders, 28 June 1879, DF (TAEM 52:603; TAED D7941ZCK).

2. Much of the cable correspondence regarding Edison’s telephone in England was addressed or signed in code. This is the only known use of the “Brunswick” cipher; the Edison Telephone Co. of London was designated as “Quephone.” Gouraud’s secretary transcribed the signatures on the reply to this cable as “Parrish White,” which suggests that “Brunswick” was registered in both their names on the company’s behalf. Copy of Dillwyn Parrish and Arnold White to Gouraud, 17 May 1879, appended to Gouraud to TAE, 17 May 1879, DF (TAEM 52:553; TAED D7941ZAU).

3. Earlier in the day Gouraud had telegraphed Edison from New York, “London negotiations closed I am on five fifteen train with contract.” The provisional agreement signed this day provided for the formation of the Edison Telephone Co. of London, Ltd. Neither this version of the agreement nor Gouraud’s cable has been found. Two days later Gouraud wrote Edison that he had received a reply from London advising him to “Consider the matter finally settled.” The agreement was modified after Gouraud’s return to England and finally executed in London on 14 July (see Doc. 1765). The company was capitalized at £200,000 in 2,000 shares. The contract assigned Edison a 20% royalty on each telephone sold or leased by the company, with an advance of £5,000. On 24 May, William Carman recorded the payment from Gouraud of $24,500 (equivalent to £5,000) for Edison’s advance, which was to have been contingent upon assignment of patents to the company and completion of the first 50 of 500 telephones. A copy of the receipt for this advance was written on the cover of an undated printed copy of the contract. Gouraud to TAE, 15 and 17 May 1879; Agreement with Edward Bouvierie, 14 July 1879; Agreement with Edison Telephone Co. of London, Ltd., n.d.; all DF (TAEM 52:544, 553, 617, 1046; TAED D7941ZAU).
Gouraud had reported to Edison the day before that he was pressing Arnold White to complete the negotiations and had “concluded that by cabling them [the London investors] that I had ordered 50 instruments which are soon to be finished & fwd quite independently of any negotiations they are having that it wd give confidence in the belief that the definite instruments are not a myth.” Edison drafted a reply stating that “Its all nonsense to talk about 50 instruments by 21st= it will be about the 28 or 30th= Again these instruments should be all put up or at least a part in a system here & to do that we have to make switchboards indicators batteries etc.” The laboratory shop was instructed on 15 May to make “65 Complete Telephones” but this was probably superseded by Charles Batchelor’s orders on 23 May for the construction of “central station switch complete for 50 fifty subscribers with 12 exchange strips as per sketch” and “65 new Edison Telephones complete for Central Station system.” Edison received fifty telephone boxes from Sigmund Bergmann by 31 May and on 2 June he wired Bergmann to “make up the complete supply for sixty five Telephones.” Several of the instruments were damaged in transit to London. Gouraud to TAE, 14 May 1879; TAE to Gouraud, 15 May 1879; both DF (TAEM 52:541, 543; TAED D7941ZAN, D7941ZAO); Cat. 1308:145–49 (Order Nos. 160, 168–172), Batchelor (TAEM 90:739–41; TAED MBN003:46–48); Bergmann to TAE, 31 May 1879; TAE to Bergmann, 2 June; both DF (TAEM 52:62, 63; TAED D7937ZBB, D7937ZBC).

The contract permitted the formation of independent Edison companies to operate in Parliamentary boroughs or postal districts outside London’s East Central Postal District. These firms were to lease or buy telephones from the London company, to which Edison would give 10% of the royalties he received. Agreement with Edward Bouverie, 14 July 1879, DF (TAEM 52:617; TAED D7941ZCV); see Doc. 1765.

Agreement with George Gouraud

[Menlo Park,] May 15, 1879

This agreement entered into this 15th day of May 1879 by and between Thomas Alva Edison of Menlo Park Middlesex County New Jersey and George E. Gouraud of No 6 Lombard St London England,

Witnesseth. Whereas the said Edison has signed this day a certain Provisional agreement looking to the formation of a Telephone Company in London a copy of which is hereunto annexed and entitled “Heads of Provisional agreement, Edisons Patents Loud Speaking Telephones,” transferring his patents for telephones in the United Kingdom of Great Britain and Ireland and the Channel Islands and the Isle of Mann and Whereas the said Gouraud, in consideration of one dollar in hand the receipt of which is hereby acknowledged and of service already performed and [promises] already made in the
of the said inventions in the said countries and in confirmation of previous understandings is entitled to one half of all moneys or other benefits derived by said Edison from said patents in said countries and improvements thereof. Now I do by these presents assign unto the said Gouraud all my right title and interest in one half of all the benefits derived by me now and hereafter from the said contract and from all subsidiary contracts resulting thereto both directly & indirectly and I agree to execute any further papers which may be necessary by way of authorizing said company or any companies to pay to said Gouraud directly said one half of all monies received or other benefits as may be due to me as above described. It is further agreed and understood that the said Gouraud is to continue to use due diligence and his best endeavors to form the subsidiary companies according to the provisions of the contract here to appended these services being a part of the consideration from the said\textsuperscript{2} Gouraud to the said Edison

Witness  S. L. Griffin\textsuperscript{3} Thomas A Edison

\textbf{ADDENDUM}\textsuperscript{4}

[Menlo Park, May 15, 1879?]

And I do hereby further agree said Gouraud shall during the term of the said patents continue to be my sole agent in the countries aforesaid in regard to said patents.\textsuperscript{4}

\textbf{DS, NjWOE, Miller (TAEM 86:17; TAED HM790063). Written by Stockton Griffin. }\textsuperscript{a}Date taken from text, form altered. \textsuperscript{b}Document damaged. \textsuperscript{c}Written in left margin. \textsuperscript{d}Addendum is a D, written in an unknown hand.

1. On 23 May, Edison paid for half of the £1,000 worth of shares in the Edison Telephone Co. of London to which Gouraud was required to subscribe. The same day he signed a power of attorney that nominated Gouraud to the company’s board of directors and gave him voting power for Edison’s shares. Edison also agreed to give Gouraud first option to buy any of his shares. Gouraud’s receipt, 23 May 1879, DF (TAEM 52:560; TAED D7941ZAX); Power of Attorney, 24 May 1879, Miller (TAEM 86:23; TAED HM790067).

2. For the agreement regarding subsidiary companies see Docs. 1742 n. 5 and 1765.

3. Griffin notarized this agreement.

4. On 24 May a similar clause was also added to the 23 May power of attorney (see note 1). Power of Attorney, 24 May 1879, Miller (TAEM 86:23; TAED HM790067).
Telegrams: From/To Charles Edison

May 16, 1879
London 8:25 AM

[Thomas] Edison
Important Exhibition Society Arts¹ White refuses me instruments Cable me order for them immediately²

[Charles] Edison

Menlo Park NJ 9:30 AM

[Charles] Edison
Stop cabling and come home³

[Thomas] Edison

I. (telegrams), NJWOE, DF (TAE&M 52:552; TAED D7941ZAS, D7941ZAT). Written by Stockton Griffin. ¹Date taken from document, form altered.

2. The previous day, Charley protested Edison’s recall order (see Doc. 1741 n. 5) and wrote that Conrad Cooke, with whom White had made arrangements for the upcoming demonstration, had approached him for assistance but “I told him that as it was I was powerless to do anything but if I could get the instruments I would do all I could to make it a success I just wrote a note to Mr White asking him for the use of the instruments for that occasion, but up to closing of Post I have nothing from him and am very anxious.” Charles Edison to TAE, 15 May 1879, DF (TAE&M 52:546; TAED D7941ZAR).

3. In Charley’s stead, Conrad Cooke surveyed the history of various telephonic instruments at the Society on 21 May, giving considerable attention to the explication and demonstration of Edison’s receiver. Cooke sent Edison a copy of his lecture from the Society’s journal; he intended to republish the lecture “as a separate illustrated book” but this has not been located. Arnold White also sent Edison two press accounts of Cooke’s demonstration and excerpts of John Tyndall’s remarks and reported that “considering the worn state of the instrument its performance was remarkably good.” Cooke 1879; “The Telephone,” Téleg. J. and Elec. Rev. 7 (1879): 219; White to TAE, 22 May 1879; Cooke to TAE, 26 May 1879; both DF (TAE&M 52:556, 565; TAED D7941ZAW, D7941ZBD).
Technical Note: Electric Railway

Reversible Electric Commutator

18 in of grade.²
$1.10 \times .80 = 1.90^a$ $1.90^a$

$1250 \ 10 \text{ Miles pr hour.}^4$

J[ohn] K[ruesi]


1. These drawings were presented as exhibits during an 1881 patent interference hearing and then again in an 1892 court case in connection with testimony by Edison and his associates regarding work at Menlo Park on electric railways. Edison testified that while passing through

*April–June 1879* 232
Iowa on his 1878 Western trip (see TAEB 4:375, map) “I conceived the idea that if an electric railroad could be made to operate economically it would be of great value for drawing grain to the main lines of railroad and thus extend the radius of economical grain production.” He proposed to develop a remotely controlled system suitable for “the flat of the Northwest where the winds continually sweep over them, and I thought that I could utilize those winds to run windmills which, in their turn, would give motion to dynamo machines and furnish electricity to operate the small motors and cars which I proposed to deploy.” A sketch dated 21 May shows “a station for an electric railway with a turn-out track . . . the track on trestles and a station with windmill for obtaining power with wires running from the station out to the track.” Edison recalled that he did “a great deal of studying on the subject” after his return to Menlo Park and noted that “the idea that large railroads could be operated by electricity cheaper than by steam was many times speculated upon, and figured upon, and talked over in the laboratory, but at that date the knowledge in the art was not sufficiently advanced to permit us to see our way clear to displace steam on a large railroad.” Edison’s testimony, 74, 99, Edison v. Siemens v. Field; Edison’s Exhibit No. 6, Edison’s testimony, 97–99, Electric Railway Co. of U.S. v. Jamaica and Brooklyn Road Co.; both Lit. (TAEM 46:42, 54; 115:829, 752, 783–84; TAED QD001:38, 50; QE001:93, 47–8).

Edison testified that the first of these drawings represented “a dynamo machine driven by belting, and a motor with a governor connected to it for governing the speed” and that the “words ‘reversible commutator’ refer to reversing the position of the brushes on the commutator, so as to permit the motor running in either direction.” The governor, designed to be placed on top of the motor, functioned by opening the circuit when its speed exceeded a certain limit, necessary in the absence of a train crew; the circuit could be entirely opened with the “open the circuit lever,” C. John Kruesi identified D as “a device for reducing the
sparking at the breaking of the circuit.” It was designed to interrupt the circuit simultaneously at a number of points, each of which would have lower voltage and produce a smaller spark than the circuit as a whole. Edison recalled that sometime prior to making these drawings they had tested a device based on this principle but in which “the levers of several sounders were used in place of the spring contacts”; this worked “satisfactorily.” Edison articulated the principle behind multiple-contact circuit breakers and described another such device for reducing sparking in the British provisional specification he had drafted around the beginning of May (Doc. 1735). In at least some designs of this system, copper conductors parallel to the rails carried current to the locomotive. Edison’s and Kruesi’s testimony, 497, 45, 51, *Electric Railway Co. of U.S. v. Jamaica and Brooklyn Road Co.;* Edison’s testimony, 78, *Edison v. Siemens v. Field;* both Lit. (TAEM 115:783, 758, 761; 46:44; TAED QE001:47, 22, 25; QD001:40).

2. Edison identified these drawings as “a form of governor; a part of a trestle which I proposed to put the track on; also a locomotive drawing a car . . . [and] a section of trestle which I proposed to mount the rails on.” He testified that “we made several models of the trestle work which we proposed to employ on these little wheat railroads. I also remember trying to get money for the erection of an experimental railroad at Menlo Park, but did not succeed.” The trestles were to elevate the tramway so cattle would not interfere with its automatic operation. Edison’s testimony, 497, 499, *Electric Railway Co. of U.S. v. Jamaica and Brooklyn Road Co.,* Lit. (TAEM 115:783–84; TAED QE001:47–48).

On 16 May John Kruesi drew a cross section of a trestle with two braces, carrying an Edison electric locomotive with governor and estimated the cost of materials for an unknown length of this type of trestle, as well as one of a Y-construction (N–79–04–09:70–5, Lab. [TAEM 32:1078–80; TAED No45:32–34]). The former design was rejected as “Too costly,” although a nearly identical structure was drawn on 25 May (Vol. 16:435, Lab. [TAEM 4:870; TAED NV16:391]). Kruesi testified that around 25 May he had made several models of trestles as well as a full-scale trestle at Menlo Park (*Edison v. Siemens v. Field, 42–43, Lit.* [TAEM 46:26; TAED QD001:22]). Related drawings of the trestle and locomotive were submitted as Exhibits 8, 10–11 in *Electric Railway Co. of U.S. v. Jamaica and Brooklyn Road Co.,* Lit. (TAEM 115:831–33; TAED QE001:96–98); an estimate of capital expenses was included in Exhibit No. 9 (Lit. [TAEM 115:831; TAED QE001:96]).

3. This figure may be related to the cost for a section of trestle.
4. The meaning of “1250” is unclear. The following drawing shows “dynamos connected to the track in sections with a reversing switch for reversing the direction of the current on any particular section.” Edison explained separately that “the wires connected to the dynamo system on the left is a circuit reversing switch, whereby the direction of the flow of the current in a certain section of the track near the station may be changed. The system of dynamos on the right was connected to another section of the track, and provided with a circuit reversing lever as implied by the words ‘same here.’” Edison testified that he proposed two methods for reversing the direction of the locomotive: “one reversing the direction of the flow of the current through the bobbin, the other the reversing of the commutator brushes.” Dynamo stations were to be located at seven to ten mile intervals along the line. In some designs of this system copper conductors parallel to the rails carried current to the locomotive while in others the rails themselves were electrified by means of copper strips placed beneath the fish plate connecting the rails; the wheels would have their rims insulated from the hub. The system was designed to operate with a minimal workforce and Edison proposed “the use of a telephone between two stations, a part of the circuit being formed by the electric railway track” to enable “the attendants of the stations to communicate with each other, to run trains, or to govern trains from the stations without having anybody on the trains.” Edison’s and Kruesi’s testimony, 78–81, 85, 37, Edison v. Siemens v. Field; Edison’s and Kruesi’s testimony, 497–98, 49–50; Edison’s Exhibit No. 7, Electric Railway Co. of U.S. v. Jamaica and Brooklyn Road Co.; both Lit. (TAEM 46:44–45, 47, 23; 115:783–84, 760–61, 830; TAED QD001:40–1, 43, 19; QE001:47–48, 24–5, 94).

-1746-

Notebook Entry: Telephony

Edison’s Telephone New receiver.

The remarkable effects produced by the chalk cylinder in the receiver and the extreme loudness and clearness of articulation have led me to try a great number of experiments on it. At a distance from the transmitting instrument of 100 feet, everything can be heard perfectly on the receiver in an ordinary lecture room. If different people are talking and some playing musical instruments or whistling at the transmitting end each one comes out clear and distinct. With the carbon transmitter adjusted lightly on the button the sounds of a small musical box can be reproduced with 3 times their loudness by simply placing it on the table where the transmitter stands. In ordinary talking such is the amplitude of the diaphragm of the receiver that its record on the phonograph is a simple matter and the retransmission over the telephonic circuit by the phonograph receiving it again on another phonograph have frequently been done by me; the reproduction of

April–June 1879 235
the records on the ‘phono’ being almost as loud as the original talking and its articulation exceedingly clear

Chas Batchelor.


1. *Scientific American* noted in a 26 April article about Edison’s receiver that “no one who has heard this new telephone can fail to have been astonished at its clear, articulate, and loud tones; it might appropriately be called ‘The Shouting Telephone,’ for its ‘voice’ is louder than that of any ordinary speaker. . . . Where it is in use it is of course unnecessary to go at all near the instrument, for it may be fixed against the wall of an office, and its messages heard at any part of the room spoken in a loud clear tone.” “Edison’s Electro-Chemical Telephone,” *Sci. Am.* 40 (1879): 260.

—1747—

**Patent Model**

**Specification:**

**Electric Lighting**

[Menlo Park,] May 20 1879

Patent off's model—

Kruzi make the following model to illustrate the system of carrying wires through the Hard rubber lined pipe—

Have a top put on with soft rubber sheet to prevent water coming in & use use bolts. Make the whole of iron 1 & 2 to be with box & all 1 foot long, 3 to be 6 inch long & smaller than 1 & 2. 〈½ in pipe Iron box lined with h[ard]. rubber all over inside packing rubber cascett〉

〈Made by Geo Jackson〉

T.A.E

J Kruesi

1. Edison filed an application covering underground conductors and junction boxes on 7 July (Case 179) that was rejected and subsequently abandoned; only two figures and the claims survive. Edison claimed metallic tubes and junction boxes insulated with a non-conducting substance such as hard rubber, and “the pulleys and cords for passing the conductors through such tubes.” Patent Application Casebook E–2536: 34, PS (*TAEM* 45:701; *TAED* PT020031).
2. Figure labels (written by John Kruesi) are “1 \( \frac{1}{4} \) pipe,” “3 \( \frac{3}{8} \) pipe,” and “2.” Kruesi made the measured drawing for the model the same day. He recorded the order in the laboratory order book on 31 May; it is unclear when George Jackson completed the model. Vol. 16:390 and Machine Shop Drawings (1879–1880), Lab. (TAEM 4:823, 45:67; TAED NV16:345, NS7986CAS); Cat. 1308:149 (Order No. 178), Batchelor (TAEM 90:741; TAED MBN003:48).


4. Machinist George Jackson, who may have worked briefly for Edison and Murray in 1875, had been working at Menlo Park since June 1878. See TAEB 4:414 n. 10.

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New York, May 22 1879.

My Dear Edison

See enclosed—another Bulldozer—¹

I have carefully considered the proposition made me—and am inclined to accept it in spite of all opposition.² I think however that as I am compelled to practically abdicate the certain salary of the Phonograph Co—I should substitute it by a full equivalent as to amount & certainty—$300. is not that when I am abroad & my family here. I am going therefore to ask you to make the terms as follows

$500. per month for 6 months.

5% of advance Royalties for the 6 months with a provision which shall secure me in cases where all the work has been done and my part has been fulfilled but the negotiations have not shall not have⁶ been closed—for instance, for 360 or 690 Days after the expiration of my 6 months—

I presume of course such extraordinary expenses as are entailed by travelling about from Pillar to Post will be borne by the Co.—

If these provisions are satisfactory embody them in one of your characteristic Legal Doc’s Send them to Col Gouraud for his sig. & I will sign³ Yours

E H Johnson

PS. If you will put yourself in my place—and remember the fact that since I went with Palmer in 1868, I have been always seeing the bushy tail of the Fox just around the corner⁴—while another Fox has drawn me off in another direction, only to repeat the story—you will see that I have just reason this time to make myself “Solid”⁷ Yours E.H.

I’ll work for Gouraud & Edison there as here—and never for EHJ I’m doing that now Jo

April–June 1879
1. Not found. To bulldoze was to intimidate or coerce; a bulldozer was a bully or thug. Lighter 1994–97, s.v. “Bulldoze,” “Bulldozer.”

2. Johnson was to be Edison’s chief engineer for the commercialization of telephones in England. He telegraphed Edison on 13 May, presumably referring to his wife, “She consents ergo I go unless the company veto.” Edison wired George Gouraud two days later that he had “got you the best telephone man in country who will go for 2 months for $1000, taking a man with him who he will leave in charge on his return” (Johnson to TAE, 13 May 1879; TAE to Gouraud, 15 May 1879; both DF [TAEM 52:537, 543; TAED D7941ZAL, D7941ZAO]). The “opposition” apparently involved the Edison Speaking Phonograph Co. On 13 May Painter wrote concerning a meeting that he expected Johnson to call of the company’s shareholders, cautioning him that “There is some trap Cheever is setting for you—I oppose either Cheever or [Hilborne] Roosevelt getting any figures or information of any kind from the Co while they are in opposition to us & backing [Oliver] Russell.” Charles Cheever had been the phonograph company’s first treasurer; at this time Painter and Gardiner Hubbard were trying to recover thousands of dollars they alleged he and fellow shareholder Hilborne Roosevelt had misappropriated (Painter to Johnson, 13 May 1879, ESP Scraps. 11:80; Hubbard to Cheever, 28 May 1879; Hubbard to Painter, 28 May 1879; Hubbard to H. Roosevelt, 28 May 1879; Painter to Cheever, 7 and 13 June 1879; all ESP Treasurer’s Lbk. [Nov. 1878–July 1879], 632–35, 667, 671). Hubbard also argued that Johnson had capably filled in when Edison broke his pledge to give his personal attention to perfecting the phonograph, and was now indispensable to the company. He wrote Johnson that “If you now leave us part of the money we have paid you will have been worse than wasted, for we must employ other parties to learn what you have been taught at our expense.” He urged him to “state to Mr Edison my view of the case that you cannot for his benefit honorably leave us at the present time, & that he has no right to ask anything of this kind of you” (Hubbard to Johnson, 28 May 1879, ESP Treasurer’s Lbk. [Nov. 1878–July 1879], 628).

Presumably about this time Edison wired Johnson in New York, “As there is such a row I advise that you stay Have sent for Louderback and will send man from here as assistant.” Edison had asked Henry Bentley in Philadelphia his opinion of De Lancy Louderback, a former operator now the eastern sales agent for Western Electric (see TAEB 4:107 n. 2), who had inquired earlier about the job, and Bentley gave an enthusiastic reply. However, Louderback declined the job on 30 May and Edison wired Gouraud in New York two hours later: “Will not be able to get expert Johnson withdraws” (TAE to Johnson, n.d. May 1879; TAE to Bentley, n.d. May 1879; Bentley to TAE, n.d. May 1879; Louderback to TAE, 17 and 30 May 1879; TAE to Gouraud, 30 May 1879; all DF [TAEM 52:571, 570, 555, 569; TAED D7941ZBM, D7941ZBK, D7941ZBL, D7941ZAV, D7941ZBH, D7941ZBI]). Edison then made an offer to Charles Walton, a Gold and Stock Telegraph Co. employee, but quickly rescinded it after receiving unflattering information, appar-
ently regarding Walton’s sobriety and the nature of his duties (Walton to
TAE, 4 and 9 June 1879, DF [TAEM 52:573, 585; TAED D7941ZBN,
D7941ZBX]; TAE to Walton, 9 June 1879, Lbk. 4:384 [TAEM 80:84;
TAED LB004384]). Francis Upton wrote his father on 1 June that Edi-
son was seeking “a good business man who understands a little about
electricity, and who has a record of having managed something well” but
was finding “very few who will leave this country for England to take
charge of an enterprise which must be of necessity somewhat risky be-
ing entirely new and almost untried” (Upton to Elijah Upton, 1 June
1879, Upton [TAEM 95:532; TAED MU016]).

3. Edison’s original offer to Johnson evidently was for the English
telephone company to pay him $300 per month with a 5% royalty.
Gouraud termed this “a liberal proposition” and feared that the com-
pany “will be subject to criticism” for increasing it. He promised that
Johnson would “have a fair opening for his talents but shd not be over
persuaded to go.” Gouraud nevertheless accepted Johnson’s terms and
Edison drafted and signed a memorandum of agreement embodying
them on 11 June, the day Gouraud departed New York for England.
This agreement was for one year and otherwise incorporated the provi-
sions above. It granted Johnson royalties created by negotiations com-
pleted within sixty days of the end of his employment and also provided
for a $500 advance to provide passage for his family, which Gouraud paid
immediately. Johnson subsequently signed a contract with the tele-
phone company which set his salary at £100 per month (about $500) but
made no mention of royalties. Gouraud to TAE, 24 May and 11 June
1879; Johnson agreement with Telephone Co. of London, Ltd., 24 Sept.
1879; all DF (TAEM 52:562, 591, 742; TAED D7941ZAZ, D7941ZCB,
D7941ZEM); TAE agreement with Gouraud and Johnson, 11 June
1879, Miller (TAEM 86:28; TAED HM790069).

4. Johnson had been chief assistant to William Jackson Palmer in the
survey of a rail line to the Pacific through New Mexico and Arizona in
1867–1868. As an indirect result of this survey Palmer also made plans
for a line from Colorado to Mexico and subsequently organized the
Denver & Rio Grande to develop this route. Johnson assisted in the early
stages of its construction before Palmer dispatched him to the Auto-
matic Telegraph Co. in New York. At this time Palmer was president of
the Denver & Rio Grande, a successful developer of coal and iron mines
in Colorado and Utah, and a founder of Colorado Springs. ANB, s.v.

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From Hamilton
Twombly

New York May 23, 1879

Friend Edison,

What progress on the system for exchange switches and sig-

1b nals? (will have system set up here by May 8th)1b also on

2b the patent to cover the Blake transmitter, (Used Blake Trans as

model its in patent of s)2b also the Electric machine? (we are

making our 30 machines, did not make your six as recd no

3b orders)3b I write these few lines to remind you that I am much in-

April–June 1879 239
interested in all these things, and perhaps a little impatient for
them
Hoping you will have success in all your undertakings I
am Yours truly
H M K Twombly

〈You asked if I could get around the Brooks Cable. I answer
that I have got a system which I am going to use for my E Light
that is infinity better than Brooks〉

ALS, NjWOE, DF (TAEM 49:236; TAED D7903ZEA). Letterhead of
Western Union Telegraph Company Executive Office. “New York”
and “187” preprinted. ¹Marginia interlined above by Edison.

1. See Docs. 1738 n. 8 and 1742 n. 4. Edison’s switchboard system
is described in a British provisional patent specification filed on 20 Sep-
tember 1879 (Brit. Pat. 3,794 [1879], Batchelor [TAEM 92:129; TAED
MBP018]). The system consisted of a grid of horizontal and vertical
metal bars, with the upright members wired to subscribers’ telephones.
When alerted by an annunciator to an incoming call, the attendant could
insert pins at appropriate junctions in the grid to make electrical con-
nections from any upright to the operator’s telephone and, after learn-
ing the caller’s wish, to any other subscriber’s bar.

There is scant evidence for the development of the switchboard prior
to this. John Kruesi’s 25 March measured drawing of vertical and hori-
zontal bars for one to be built for Edison’s new office appears to embody
the essential design. On 13 May Edison drew schematically the switch-
board frame and wiring and also sketched in more detail the wiring in a
representative segment of the switchboard and a detail of the frame’s
construction. Charles Batchelor drew additional details on 19 May, in-
cluding signaling apparatus for identifying incoming calls to the switch-
board attendant. Machine Shop Drawings (1879–1880); N-79-04-09:25–27, 33;

2. See Doc. 1740 n. 5.

3. This apparently refers to the thirty generators that Edison planned
to make for the demonstration central station at Menlo Park. See Docs.
1727 n. 1 and 1739.

4. “Your six” apparently refers to a standing request for telephones
with the electromotograph receiver for Gold and Stock. On 21 May,
George Walker wrote Edison about the “wonderful receiver,” stating
that “there are a great many inquiries about it & we want it here as soon
as possible.” He asked if one could be ready by 1 June for use by a pro-
cessor at Cornell. Edison replied the following day that he would “in all
human probability deliver you six new Telephones complete before the
3d of June.” Walker to TAE, 21 May 1879, DF (TAEM 52:56; TAED
D7937ZAW); TAE to Walker, 22 May 1879, Lbk. 4:342 (TAEM 80:76;
TAED LB004342B).

5. Hamilton McKown Twombly was an investor and manager in
many companies, primarily in the railroad industry. The son-in-law
of William H. Vanderbilt, Twombly served on Western Union’s Executive
Committee and at this time was in charge of its telephone business.

April–June 1879 240
Twombly’s middle name was often abbreviated as “McK.” and he was often referred to as “Hamilton McKay Twombly.” See *TAEB* 4:253 n. 8.

6. Twombly’s prior inquiry has not been found. On 6 May, Edison wired Twombly that the “Brooks patent may not hold” and, at the least, a “broad claim cannot be taken on liquid insulator” by David Brooks. Brooks was a distinguished inventor and engineer who held several patents (the most recent issued in December 1878) for insulating underground lines with oil (see *TAEB* 2:466 n. 8). Tracy Edson wrote Edison on 27 May that although Western Union now indirectly controlled the Brooks patents he thought it “important that you should perfect your new plan as soon as possible.” Edison filed a patent application (Case 179) on 7 July for insulated underground conductors and junction boxes (see Doc. 1747); it was rejected partly on the basis of an 1875 patent held by Brooks (U.S. Pat. 165,535). TAE to Twombly; 6 May 1879; Edson to TAE, 27 May 1879; Lemuel Serrell to TAE, 19 July 1879; all DF (*TAEM* 49:224, 246; 51:534; *TAED* D7903ZDP, D7903ZEI, D7929ZDK); Patent Application Casebook E-2536:34, PS 241

*April–June 1879*
Dear Father:

I went to Lawrence as I expected and found Mr. Fallon\(^1\) ready to give me any information that I might wish.\(^2\) He also said that he would answer any questions that I should ask by letter,\(^3\) which I thought would be the best way of getting information. I could not get to Lowell as I expected on account of the trains, and have sufficient time. Yet as I could find from Mr. Fallon all I wanted it made but little difference whether I went or not.

Mr. Edison seemed pleased to see me back and glad of the information I brought with me. In the afternoon he and I had a long talk about matters pertaining to the light. The telephone system has been progressing since I left, and a large amount of work had been done.

The machine for lighting the North pole had been sent away and a large number of carbons had been prepared for the purpose.\(^3\) Mr. Fallon seemed to think that the electric light might be made in time to take the place of gas in mills. He said that the gas they used cost nearly as much as the water.

I went to lunch with him, and saw his place—he is very deep in gardening.

I judge from certain indications that Edison hauled in some money last week from his telephone contract in England, as he has just ordered about 500 books,\(^4\) and my landlady said given $1000 to his wife.\(^5\) He seemed to be in good spirits which looked as if he had some money in the bank, for he was dead broke when I left, for I heard him say so, and knew he had trouble to pay his pay-roll as he had over drawn his account. There is still a mint of money in telephones yet. I should like very much to have a share of it. Yet if the Electric light succeeds there is far more money in it and I feel sure that I shall have a share in that.

There is the same artist here now painting a picture of Mr. Edison that there was in Brunswick to fill the panels in the chapel. He comes\(^6\) from Scribner’s Monthly to give them a head from which to engrave a portrait.\(^6\)

With much love I am Your Son

Francis R. Upton

Menlo Park, May 24, 1879.
1. Probably John Fallon, employed in an unknown capacity by the Everett Mills in Lawrence. Everett advertised a few years later that it employed more than 1,000 looms and a similar number of workers in producing 200,000 yards of cloth each week. *The Lawrence Directory 1883*, 111, 422.

2. The mills of Lawrence, Mass., had expanded greatly during the Civil War, making the city one of the world’s leading textile centers by this time (Cameron 1993, 1–29). On 19 May, Upton had written Edison from his hometown of Peabody, about 15 miles distant, that “the agent of the largest mill in Lawrence says that his gas bill for one month last winter was $30,000 (thirty thousand dollars) and that he would be glad to have your light tried in his mill.” Upton suggested that on Friday, 23 May, he should “visit Lawrence and Lowell and make such inquiries as may be of value regarding the probable cost of a plant. As we can now at this date beat gas for lighting a mill I think it worth while to glance at the chance.” Upton wrote again the same day that although he had been mistaken and the figure of $30,000 referred to an entire year, “still that is a sum worth asking about.” DF (*TAEM* 50:63, 65; *TAED* D7919ZAP, D7919ZAQ).

3. See Doc. 1706.

4. On 26 May, Edison ordered from Bernard Quaritch, a London book dealer, sets of seventeen periodicals and reports encompassing nearly 500 individual volumes. Most were journals of (chiefly British) scientific and technical societies. This order was evidently prepared from Quaritch’s inventory and price sheet; the legible prices on Edison’s copy of the order total approximately £140, the equivalent of about $700. The same day, Edison requested seven books about mineralogy and mining in the Americas from the Scientific Publishing Co. in New York. Lbk. 4:350, 358 (TAEM 80:79–80; TAED LBoo4350, LBoo4358).

5. Like several other laboratory employees, Upton lived at the boarding house in Menlo Park operated by Sarah Jordan, a stepdaughter of Mary Edison’s father (Jehl 1937–41, 512; *TAEB* 4:538). There is no record of a large sum given to Mary around this time.

6. *Scribner’s Monthly Magazine* tried at the end of March to have Edison sit for a Mr. Chase, a New York artist, but nothing seems to have come of this. On 16 May, the magazine wrote a letter of introduction for Francis Lathrop to Edison, which Lathrop enclosed with his own letter the next day. Lathrop was a noted portraitist and muralist who had painted several panels in the chapel of Bowdoin College, Upton’s alma mater, in Brunswick, Maine. *Scribner’s* published an engraving made from his portrait with Edwin Fox’s article on “Edison’s System of Fast Telegraphy” in its October 1879 issue (18:840). On 25 May Alexander Graham Bell replied to a request from Edison (not found) “for my photograph for the Editor of Scribner’s Monthly.” Bell declined, citing his “very great personal objection to having my photograph published.” Scribner’s to TAE, 27 Mar. and 16 May 1879; Lathrop to TAE, 17 May 1879; Bell to TAE, 25 May 1879; all DF (*TAEM* 49:691, 701, 700, 238; *TAED* D7906ZAB, D7906ZAH, D7906ZAG, D7903ZEC); *ANB*, s.v. “Lathrop, Francis Augustus.”

April–June 1879 243
London. 27 May 1879.

From Joshua Bailey

My dear Sir.

I cabled you to-day:—“You continue Puskas Telephone contract countries not included in assignment to Company”; and a few minutes since received your reply,—“Yes.”

On sitting down with Mr Puskas to go over the contracts made with you and with the Company, we found that we had overlooked Australia, India, & some other minor contract countries in which Mr Puskas had paid for patents. The release which I signed in your favor gave up to you all Mr Puskas’s interest in the contract of 17th December 1877, whereas this release should have applied only to the countries embraced in the assignment made by you to the “Edison Telephone Company of Europe.” In order to make matters straight between you & Mr Puskas, will you kindly send him a memorandum contract continuing to him his rights to the countries in question, as defined in the contract of December 17th.

In regard to the preliminary payments to be made to you in the countries embraced in the assignment to the Company, we would suggest to leave this point open a few days, during which we will have opportunity to consider the manner in which we will carry out the exploitation in Europe, and will make you a proposition which you will accept as equivalent to the original agreement with Mr Puskas. We would also propose that you hold 4,000 dollars of the stock of the Company as collateral security for these advances. I have agreed with Mr Puskas that this deposit shall come in part from our interest, and in part from his; to wit 2,000 dollars of his stock to be held by you, and 2,000 dollars of ours. I have written to Dr White in this mail in reference to this, and have no doubt that he will agree to the proposition. In all events the 2,000 dollars either of his and my stock, or of mine, shall be placed with you as collateral, if this is satisfactory to you. We propose this, because it is agreed between Mr Puskas & myself for considerations lying between us, that the amount of these preliminary payments to you shall be borne equally between his interest and Dr White’s and mine.

Mr Puskas desires me to explain to you that on account of the suits in which he is engaged in Colorado, he wishes to have the stock coming to him, issued in the name of his brother Francis Puskas, residing at Buda-Pesth in Hungary. He desires also that you will explain to the other gentlemen concerned, the reason why his stock is issued not in his name. You know more or less of his affairs in Colorado, & will understand the
reason of this action. Will you please to send to him at once the amount of stock coming to him, withholding from it the one half of either 4,000 or 5,000 dollars, as you may see fit; and I write to Dr White to make up the other half from our interests.4

I shall go to Belgium to commence operations early next week, and Mr Puskas’s Brother, who is a very intelligent Gentleman, will commence operations in Vienna; and probably in the course of a fortnight Mr Puskas will go to Germany.

I have skirmished about considerably yesterday and to-day, picking up opinions about Electric Light, and I find that coming events have decidedly cast their shadow here, and that the Experts are “hedging,” and those who six months ago found all propositions as to the substitution of Electric Light for Gas ridiculous, begin to consider it quite probably that the change will take place. You have doubtless seen the report of the testimony of Sir William Thomson before the Parliamentary Committee; and this represents the general drift of opinion.5

My cable address is always “Bailey, London,” and my post office address care of “Munro & Co, 7 rue Scribe, Paris.”6

I desire to present my kind remembrances to Mr Griffin, Mr Batchelor and Mr Upton, and to remain— Very sincerely yours,

J. F. Bailey by G.H.7

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L, NJWOE, DF (TAEM 52:289; TAED D7940ZAF). a Interlined above. b Obscured overwritten text.

1. Edison wrote his reply on Stockton Griffin’s transcription of Bailey’s cable, which differs slightly from the above text. DF (TAEM 52:288; TAED D7940ZAE).

2. The assignment of patents is Doc. 1731 (see esp. n. 7). The 1877 contract granted Puskas rights in specified European countries and also any foreign country (except Canada and Great Britain) in which he paid patent fees on Edison’s behalf (see TAEB 4:678 n. 5). Edison agreed to correct the error in the release and wrote to Bailey to ask that he or Puskas prepare an appropriate contract “for my signature and for execution” (TAE to Bailey, 11 June 1879, Lbk. 4:390 [TAEM 80:85; TAED LBoo.4390]).

3. It is not clear what “preliminary payments” Edison was to receive. In his 11 June reply to Bailey (see note 2), Edison consented “to all the other propositions as contained in your letter.”

4. Edison promised in his 11 June letter (see note 2) that he would “have the stock issued to Mr Puskas Brother as requested and will explain the reason to the other gentlemen concerned. The stock has not been issued yet, I have just written Mr Banker in regard to it.” Puskas’s business in Colorado was likely related to his earlier involvement in gold mining there and the reported appropriation of his tract by claim-jumpers. Gábor 1993, 43–5.

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April–June 1879 245

6. Unidentified.

7. Unidentified.

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May 27, 1879
New York 10:07 AM

Thomas A Edison

Can you come in town tomorrow Wednesday to talk over foreign matters and perfect agreement.¹ Mr Morgan has just arrived from London answer

G P Lowrey

[Menlo Park]

G. P. Lowrey

Yes will be in tomorrow

Edison

¹. This concerns Edison’s arrangements with both George Gouraud and Drexel, Morgan & Co. for the electric light in Britain (see Docs. 1649, 1714). On the afternoon of 9 May, Gouraud telegraphed Edison from New York to ask if he might visit Menlo Park the next day. A few minutes later, George Soren, a partner in Lowrey’s firm, wired: “Will it not be prudent to delay settling or talking interests with London visitor till Lowrey returns He will be here Tuesday” (13 May). Edison promised in reply the same day, “will do nothing with him on Light until Lowrey returns.” Gouraud wrote on 10 May that he could not keep his
appointment with Edison that day but asked him to “Please wire Lowrey to show me Drexel Morgan agreement Light Pats for England if you see no objection.” Two days later, Edison advised him “Do not come today will be away. Cannot do anything with Contract until Lowrey returns.” DF (TAEM 52:535–36, 50:326, 49:226; TADED D7941ZAG, D7941ZAJ, D7922D, D7903ZDR).

On 2 June Soren inquired if Edison wished him to “draw the agreement between yourself & Col Gouraud which was spoken of at Drexel M & Co. the other day.” He indicated that he had reviewed Edison’s contract with Drexel, Morgan “to see what modification of it is necessary in respect to your arrangement with G.; & also for the purpose of drawing a mem. of the agreement of the D.M. & Co. to repay you half of what you are to give G.” but wanted “more light” before proceeding (DF [TAEM 50:327; TADED D7922H]). In an agreement dated 9 June 1879, Edison granted Gouraud one-tenth of his net income from electric light and power patents held in Britain or obtained within five years, as compensation for prior services on behalf of the light. An unsigned copy of this agreement is in DF (TAEM 50:328; TADED D7922I).

New York May 29 1879

From Edwin Fox

My dear Edison:

I had hoped long before this to be able to return you the $125 you so kindly let me have to meet some pressing engagements some months ago,¹ but I have found it next to impossible to make collections beyond sufficient to meet current expenses. Clients are profuse in promises but rather backwards in furnishing the cash. My books show some $1500. due all of which will come in good time but, Gracious! how slowly!

Thinking that perhaps in your multitudinous expenses a little money might be serviceable at the present time² I send you herein $25 on a/c.

I trust that within a few weeks I can remit the balance.

Accept the assurance of my sincere gratitude for your kindness in the premises

Truly Yours

Edw. Fox

PS. As soon as my “wicked partner”² returns from Kentucky with his big fee for defending Col. Buford³ I’ll be rich and treat. E.M.F.


¹. William Carman recorded a payment of this amount to Curtis & Fox on 6 December 1878, during a period when Fox spent considerable time at Menlo Park writing for the New York Herald (see Docs. 1545 n. 1 and 1613). It is not clear if this is the same transaction to which Fox re-
ferred in late January when he explained to Edison “why our firm note which is over due was not taken up in season.” Fox stated that he had been ill for some time and in his absence “at the office everything seems to go by default.” Ledger #3:71, Accts. (TAEM 87:38; TAED AB001:32); Fox to TAE, 26 Jan. 1879, DF (TAEM 50:237; TAED D7920R).

2. George M. Curtis, a New York City judge until 1874, was tried by the state Senate in 1873 on several counts of judicial corruption, including “grossly improper conduct and scandalous and indecent language upon the bench.” He was acquitted and later served in the state Assembly. Edison had consulted Curtis about an unknown matter in 1878. “The State Legislature,” New York Times, 22 Jan. 1873, 2); Obituary, ibid., 15 May 1915, 13; TAE to Curtis, 6 Dec. 1878, DF (TAEM 16:501; TAED D7802ZZMM).


1754

Charleston, S.C. June 1, 79

My dear Sir:

Your advertisement in the Herald for “an experienced analytical chemist—very expert in qualitative analysis and assaying,”1 has been brought to my notice by a thoughtful friend in New York. This person, having frequently heard me express a longing to be surrounded by such an atmosphere of energy and genius as I had enjoyed in your laboratory( if you remember) about the time of your departure on the Draper expedition, resolved the opportunity should not escape my attention; and indeed I am very glad she did so.2 For there is, I think, nothing in the world could yield me greater pleasure and satisfaction than to know you desired a chemist among your assistants, and that I might fill the place. But to the point: my experiences during seven years in the conduct of a chemical laboratory in this city (during a considerable portion of the time serving as State Inspector of Phosphates) based upon a four years course at the Mining Academy in Freiberg, Saxony, studies in Paris and extensive travel abroad, will justify me in addressing a reply to your advertisement. From the rapid and exhaustive character of your investigations I imagine blowpipe analysis would enter most largely into your method; for my ability in its use I beg to refer you (as most easy of access) to Prof. H. B. Cornwall of Princeton—Editor of Richter on the Blowpipe,3 and to Dr Chandler of the School of Mines,4 to
whom, by the way, I think I showed the first silver assay ever made in Columbia College.

My laboratory is equipped with delicate balances of Becker and of Lingke’s make, apparatus, &c.

As it is of more importance to secure a contact with a fertile suggestor of work, than for me to be paid for it, I will not now propose that question. My income is sufficient for the present, and my philosophy is to know, and to conquer Nature rather than Fortune.

Hoping to hear from you, dear Sir, at an early opportunity I am with kindest regards to Mr Batchelor and your other assistants, Very truly yours,

Otto A Moses

ALS, NjWOE, DF (TAEM 49:914; TAED D7913ZAH). "in your laboratory" interlined above.

1. Edison’s advertisement for this position appeared in the New York Herald on 28 May 1879 (p. 16). He also received responses to an advertisement in the New Yorker Staats-Zeitung, a German-language daily, and corresponded with several applicants about wages. In a draft reply to a 16 July letter concerning an assay of placer mine waste sand, Edison proposed chemical treatments to remove platinum and additional gold from waste sand, noting that he had "some very smart German chemists." Besides Moses the only German chemist that Edison is known to have had on his staff at this time was Alfred Haid, a Ph.D. analytical chemist, who began working in the laboratory by the first week of June 1879, probably replacing Henry McIntire. Two other chemists, John Lawson and C. E. Mumsell, were both American-born. Lawson had no advanced chemical training before joining Edison’s staff while Mumsell had a Ph.D. from the School of Mines at Columbia College. Mumsell may have already left the staff by this time. Otto Kretzchmer to TAE, 28 and 29 May 1879; Mr. Ertmine to TAE, 28 and 29 May 1879; George Smith to TAE, 29 May 1879; W. C. Hendricks & Co. to TAE, 16 July 1879; all DF (TAEM 49:902, 911, 906–9, 909; 50:938; TAED D7913Z, D7913ZAF, D7913ZAC, D7913ZAD, D7913AZAE, D7928ZHB); for Haid, see letterhead of Haid to Insull, 12 Sept. 1884, DF (TAEM 71: 262; TAED D8403ZGK); for Mumsell, see Charles Chandler to TAE, 27 Feb. 1879, DF (TAEM 49:883; TAED D7913P) and N-79-03-10.2: 25, Lab. (TAEM 31:1137; TAED N032:11); for McIntire, see TAEB 4: 749; for Lawson, see “Lawson, John W.,” Pioneers Bio.

2. After seeing the Herald advertisement, Otto Moses’s mother-in-law wrote Edison to recommend him for the job, noting that he “last summer had the pleasure of spending a few days with you” and was now preparing to move from Charleston for New York. Nothing is known of Moses’s presence at Menlo Park in 1878. Mrs. Da Vega to TAE, 28 May 1879, DF (TAEM 49:898; TAED D7913X).

3. Henry Cornwall studied at the Royal Mining Academy in Freiberg and in 1873 became professor of applied chemistry and mineralogy at Princeton (WWW–1, s.v. “Cornwall, Henry Bedinger”). He translated
Plattner 1875, which had been revised by Theodore Richter, from the German.


5. August Lingke & Co. manufactured a variety of instruments in Freiberg, beginning in 1791. de Clercq 1985, 132–33, 136.

6. Otto Moses was a native of Charleston. In addition to the training described above, he was reportedly also a graduate of the University of Leipzig. It is not known when he began to work at Menlo Park; the earliest evidence of his work at the laboratory dates from January 1880. He later served as one of Edison’s representative at the Paris Exhibition of 1881. Obituary, *New York Times*, 6 Jan. 1906, 9; unidentified Obituary, Cat. 1339:10, Batchelor, NjWOE; Time Sheets, NjWOE.

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**MENLO PARK, N.J. June 2d 1879**

*Confidential*

To Theodore Puskas

I was very much surprised today by the receipt of a letter from my nephew dated from Paris,1 as I cabled him some two weeks ago to return to Menlo Park2 as his mission was accomplished and I wish to say that if he remains in3 Europe he does so on his own responsibility and that he is not acting in any capacity for me.

I will also caution you that he has an ungovernable temper which when aroused requires about 2 weeks to become calmed down. This is for your information and I would prefer you would not mention what I have written to him    Very Truly

T. A. Edison   G[iffin]

L., NjWOE, Lbk. 4:374 (TAEM 80:83; TAED LBoo4374). Written by Stockton Griffin; the original is in TP. *Place from Edison’s laboratory handstamp. *Obscured overwritten text.

1. Not found.
2. See Doc. 1744.

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**Menlo Park,] June 6 1879—**

McLaughlin has just returned from the Chaudiere River & the Leloup1 Canada where there are placer-mines2 This alluvial is said to contain a minute trace of Platinum & Iridiosmine McL brings some of the black sand from the sluices before the fine gold is panned from it. By the aid of the microscope I ascertain that the platina is combined with the gold also

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*Notebook Entry: Mining*

April–June 1879 250
in separate pieces. The Pt is not alloyed with Au but is in contact with it. The amount of Platinum is about \( \frac{1}{4} \) that of the gold. Iridosmine is very plentiful. It forms a large bulk of the sand there is probably 6 oz of Iridosmine to every oz of gold. I have found that a Sodium amalgman will take up the Iridosmine \(^a\) & platinum, the Au being previously taken out by pure mercury — There is undoubtedly enough Pt & Iridium in the Canada district to supply the world instead of the black sand containing a trace of the platinoid The mine should be called a platanoid mine with traces of gold —

T.A.E.


\(^a\)Obscured overwritten text.

1. The Chaudière and the Rivière du Loup are tributaries of the St. Lawrence in southeastern Quebec.

2. Frank McLaughlin was a telegrapher acquaintance of Edison’s working in New York as an electric pen agent; he had been Edison’s representative for the phonograph in Australasia in 1878 (see Doc. 1328). Edison dispatched him to Quebec on 26 May after corresponding with Edwin Pope of the Montreal Telegraph Co. about gold deposits there (Edwin Pope to TAE, 6, 13, and 15 May 1879; McLaughlin to TAE, 1 June 1879; all DF [TAEM 50:588, 591–92, 614; TAED D7928F, D7928J, D7928K, D7928ZAC]). A brief description of McLaughlin’s trip and findings is in “Wanted, A Platinum Mine,” New York Sun, 7 July 1879, Cat. 1241, item 1224, Batchelor (TAEM 94:494; TAED MBSB21224X).

—1757—

To Hamilton Twombly

[Menlo Park,] June 11, 79 8:30? AM

Will have system set up soon as get my switch board done\(^1\)

Will notify — Kinney\(^2\) is getting on finely — will have my underground system in\(^*\) few days — \(^3\) Standard Dynamo machine completed.

Edison

ALS (telegram), NjWOE, DF (TAEM 49:262; TAED D7903ZES). \(^a\)Illegible. \(^b\)Time and date written by Stockton Griffin. \(^c\)Obscured overwritten text. \(^d\)“(over)” follows as page turn.

1. Hamilton Twombly had wired the previous day, “Have you the exchange system ready.” Edison wrote this reply on the same paper on which Twombly’s message was transcribed. Twombly to TAE, DF (TAEM 49:262; TAED D7903ZES).

2. Edison meant Patrick Kenny, a former superintendent of the Gold and Stock Telegraph Co.’s manufacturing shops, who had begun collaborating with Edison on facsimile telegraphy in the spring of 1878 and started working at the laboratory that December. See Docs. 1328 and 1638; TAEB 4:406 n. 6.
3. Apart from a patent application covering underground conductors and junction boxes (see Doc. 1747), there is no evidence of work on an underground system for electric lighting at this time.

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New York, June 11—1879

My Dear Edison:—

Now haven’t I exercised a good deal of patience in this matter of staying away from you? Like the fellow who went to sleep in sermon time, it is only because I “have perfect confidence in the minister.”

Johnson tells me you are to have an exhibition of either the electric light or telephone soon. I want to “be thar,” & don’t you fail to notify me. I shall do it up for the Indianapolis paper, besides which W. R. wants it for the Tribune, & Mr. Ford (one of the editors here,) wants it for his letter to the London News. I am to notify him. You will find the Tribune quite inclined to do full justice to all your inventions. If Griffin reads this before you do, or you never see him at all ask him to write me about the experiments & when I can come down. Can’t Ford & I come two or three days before the others, as our papers are so distant? Very Truly Yrs

W. A. Croffut

Do you read “Bourbon Ballads”?5


1. Croffut’s unsigned dispatch appeared as “The Chemical Telephone” in the Indianapolis Journal on 5 July 1879 (p. 7). The article described Johnson’s demonstration of the telephones he took to England and, more briefly, Edison’s dynamo, new dynamometer, and electric light. Croffut had contributed an article on the light to this newspaper in October 1878 (see Doc. 1530).

2. Whitelaw Reid was editor of the New York Tribune, having succeeded Horace Greeley (ANB, s.v. “Reid, Whitelaw”). Croffut apparently had moved to the Tribune from the New York Daily Graphic in recent months.

3. Probably Isaac Ford, identified as an editor at the Tribune’s address. Wilson 1879, 484.

4. On 19 June Croffut wrote Griffin that he had “asked half a dozen correspondents of prominent papers to go down to M.P. to see the new telephone” in the next day or two but had not yet received a definite invitation. Croffut promised that a demonstration for the press would give Edison “a beautiful setting up. W.R. wants me to go down for Tribune.” According to Croffut’s article in the 1 July Tribune, Edward Johnson exhibited fifty receivers, described as “the first we have finished,” which he planned to carry to England on 1 July. Edison also described his gener-

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April–June 1879 252
ator and reportedly claimed of his electric light that “it has come. I have demonstrated, to myself and to my friends, that I have accomplished all I ever expected to in this matter. . . . I claim that this solves the question.” Croffut also sent a dispatch to the London Times aboard Johnson’s ship; it was published on 15 July and reprinted elsewhere in slightly edited form three days later (see Doc. 1780 n. 13). The Daily News, probably the London paper to which Isaac Ford contributed, published a cabled account of the demonstration on 2 July; the event was also covered by the New York Herald. Croffut to Griffin, 19 June 1880; Croffut to TAE, 5 Aug. 1879; both DF (TAEM 49:713, 719; TAED D7906ZAR, D7906ZAV); “Local Miscellany. Edison’s New Telephone,” New York Tribune, 1 July 1879; “Edison’s Work,” New York Herald, 1 July 1879; “Mr. Edison and the Electric Light,” Daily News (London), 2 July 1879; Cat. 1241, items 1212, 1214–15, Batchelor (TAEM 94:492; TAED MBSB21212X, MBSB21214X, MBSB21215X); “The Edison Telephone and Electric Light,” Times (London), 15 July 1879, 8.

5. Croffut wrote “Bourbon Ballads,” a series of mock ballads satirizing the policies of the southern Democrats known derisively as “Bourbons.” They appeared on an irregular but frequent basis in the Tribune and other papers throughout the spring and summer and reportedly were published as a collection in 1880. Obituary, New York Times, 2 Aug. 1915, 9.

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Notebook Entry: 
Telephony

Experiments on Chemical Telephone
Connections Transmitting end

[Menlo Park,] June 12 1879.
When A is in only & X is out it is exceedingly loud. when X is in it reduces it to $\frac{1}{4}$ of the Volume—

When both A & B are in the cutting out of X does not materially alter the volume of sound—

I have just found a bug of large dimensions which is that sometimes when B is cut in scarcely a sound can be heard on A at other times the cutting in makes no difference; This phenomenon must be due to polarization.

I find that with 2 chalks the current that will polarize one will not always sufficiently polarize the other hence one chalk will be loud & the other low. If the battery is increased so as to over polarize then the chalks may have the pressure increased on one & decreased on the other & this will bring them ok so that inserting when one is taken out of ckt the other will go low owing to increase in strength of polarizing current. hen when thus very low the insertion of the other chalks makes it loud again as it weakens the polarization current. On the other hand when one is out & the other is over polarized & low increasing the pressure on the spring so that it will drag as before A loudness will be nearly restored

Just tried experiment of putting induction coil in line ie of its primary coil of $\frac{40}{100}$ of an ohm in line & putting the chalk in a local formed of the secondary of 160 ohms it worked quite loud— I inserted the other chalk right in the line & it didn't
make any difference, but putting in the Induction coil of the regular telephone X lowered it greatly—I now try putting carbon transmitter in line with 4 cells carbon battery, placing primary of induction in Coi line & putting chalk in secondary, I find that you can scarcely hear it with 100 ohms in circuit with 4small carbon cells in line with 12 ohms it is fair.

We not use 1 cell carbon in line & shunt the transmitter around it to see effect. It works loud on short ckt but 12 ohms inserted makes it low—

We now wind 4 layers of 23 wire on the outside of the Induction\(^b\) coil forming a tertiary coil\(^a\) in the circuit of this we put the chalk & a polarizing battery 1 Daniel cell & find that it comes strong & loud in fact as loud as the old way when both induction coils in also that 12 500 ohms may be inserted in the line & it is still readable several feet away = I then wind 6 layers of No 3 wire\(^c\) on a W E Mfg Co Bergman coil for a tertiary & find it as loud. This extra resistance over that which would be given by a 23 wire prevents the chalk ckt shortcktg the induction from the coil when talking = The greater the resistance that can be put in this tertiary & have it work loud the better it will be when transmitting for the other man—

By this means we make each chalk receiver entirely independent of everything\(^b\) else & have a perfectly constant polarization of the chalk we can use a Chloride of Silver battery to polarize the chalk & this will probably last 2 years.

We propose to do away with the switch & ring the bell through the coil by our little multiple battery =

TAE


1. This drawing of an experimental telephone arrangement shows the transmitting circuit at top with an induction coil on the left and the carbon transmitter and a local battery (“Fuller 1 cell”) directly underneath. Edison apparently intended to draw the receiving circuit to the right of the transmitting circuit but, finding a lack of space after drawing in the “magneto” receiver, instead designated that line as the “earth” or ground wire and drew the “line” wire to the receiving circuit at bottom. The receiving circuit includes two electromotograph receivers (“A” and “B”) at right and a “magneto” receiver as part of a standard “W[estern].E[lectric]. Telephone” set marked “X” at left.

2. Edison appears to be analogizing from the polarization of batteries, a phenomenon in which the accumulation of ions on one electrode in an electrolyte increasingly impedes the flow of current. See also Doc. 1738 n. 5.
3. Each receiver is represented by a horizontal line representing the metal stylus of the electromotograph touching a small circle representing the chalk. These are in circuit with the secondary (outer coil) of the induction coil while the transmitters are connected to the small inner primary coil and to the earth. A battery is shown in the line between the induction coils.

4. Charles Batchelor had sketched a receiver in the tertiary circuit of an induction coil on 1 June and Edison made a similar sketch on 15 June. In a portion of a notebook entry dated 10 May but evidently written later (probably about this time), Batchelor commented that “We find it much better to work the button for receiving in a tertiary circuit in telephone as its polarization is always constant and independent of the other end.” Cat. 1304:57, 55, Batchelor (TAEM 91:56, 54; TAED MBN004:54, 52); N-79-01-01:204, Lab. (TAEM 30:356; TAED N013:98).

The tertiary circuit was included in the commercial telephone designed in July (Doc. 1784). In a patent application executed on 17 July, Edison described the rationale for placing the receiver in a tertiary circuit instead of directly upon the line: “the object of placing it in a tertiary circuit is to keep the apparatus free from earth currents, which cause alterations in the volume of sound, owing to the marvellous delicacy of the apparatus.” According to the patent application the primary coil was connected in a local circuit with the transmitter and battery, the secondary with the line wire, and the tertiary with the receiver local circuit and battery. Edison also specified the need for a battery “to keep a constant current in tertiary circuit” but noted that the battery could be omitted when “certain chemicals are used in the porous or chalk cylinder” and the receiver spring was tipped with platina, presumably because of the generative effect described in Doc. 1738 n. 5. This paragraph was later amended to state that the battery was unnecessary when the spring was tipped with palladium but was still needed when platinum was used. Edison included in a later British patent the palladium-tipped spring, “whereby the degree of frictional variation is increased under the action of a given strength of electric current, and a corresponding augmentation in the volume of sound is obtained.” Pat. App. 231,704; Brit. Pat. 5,335 (1879), Batchelor (TAEM 92:141).

5. Edison meant the thinner No. 30 gauge wire, whose resistance is many times greater and which he specified for a tertiary winding of 6 layers in an undated note made around this time. N-79-01-01:201, Lab. (TAEM 30:354; TAED N013:96).

6. The multiple battery referred to is probably a 10 cell battery indicated in a 15 June drawing of a telephone board (N-79-01-01:205, Lab. [TAEM 30:356; TAED N013:98]); see also Doc. 1738 n. 7. Following this document are four pages of notes concerning tests of a variety of chalk button solutions, which include Edison’s notion that “It is probable that every solution will require a different polarizing current, chalk seems to require ¼ or ½ Daniel, salt ½0 of a Daniel roughly speaking” (N-79-06-12:19–25, Lab. [TAEM 35:494–97; TAED N080:11–14]).
James H. Banker

To James Banker

Cant come in today.¹ Have to send Gramme machine away² must conduct some experiments before it goes³ Been up all night.

T. A. Edison

¹ Banker had requested that Edison have Stockton Griffin stop at Robert Cutting, Jr.’s office on 14 June, where he planned to “explain European light Company to him.” On the day of that proposed meeting, Cutting invited Edison to go with him and Banker “some day next week to Coney Island and dine there quietly and have a little spree which we are sure you need.” Shortly before noon on 18 June, Banker wired: “Cannot go today to Menlo If you can come tomorrow to Cuttings at noon can have meeting before going to Coney Island. Better bring Griffin.” Banker to TAE, 12 and 18 June 1879; Cutting to TAE, 14 June 1879; all DF (TAEM 50:317, 49:266, 264; TAED D7921A, D7903ZEW, D7903ZET).

² Edison had arranged in December 1878 to borrow a Gramme dy-
namo through Dr. C. C. Soulages, a partner of Cornelius Herz (see Docs. 1595 and 1647). Soulages wrote in early May that the Gramme was needed in San Francisco and asked for its return, and also remarked on press reports that Edison planned to begin using his own dynamo. Edison wired Calvin Goddard to “ask him the price of it and Telegraph me” but Soulages declined to sell. Goddard reported on 10 May that “Soulages will let us know when he must have Gramme.” In mid to late May, John Kruesi recorded an order to “Take measurements of Gram machine”; the measured drawings of the machine and its parts are in N-79-02-10:158–59 (Lab. [TAEM 32:1218; TAED No46:78]). About the date of this telegram Kruesi noted the order to “have Gramme mach. ready for shipment Friday afternoon,” probably 20 June. It was addressed to Soulages at 30 Lafayette Place in New York. Soulages to TAE, 4 May 1879, Soulages to Goddard, 4 May 1879, TAE to Goddard, 5 May 1879, Goddard to TAE, 10 May 1879; all DF (TAEM 50:255, 257–58; TAED D7920ZAI, D7920ZAL, D7920ZAJ, D7920ZAO); Cat. 1308: 149, 155 (Order Nos. 174, 193), Batchelor (TAEM 90:741, 744; TAED MBN003:48, 51).

3. Beginning on 9 June and continuing until 17 June, Edison and Francis Upton made several tests of Edison’s new generator using the Gramme to excite the field magnet. On 17–18 June they conducted additional tests in which the field of the Gramme was excited by the Edison. One set of the Gramme tests, which Upton reported in his paper to the August 1879 meeting of the American Association for the Advancement of Science, showed that a drop in voltage occurred as the current taken from the Gramme increased. In his paper Upton called this effect “analogous to the case of a battery which becomes polarized as the strength of the currents taken from it are increased. This fall in electromotive force may be called the polarization of the armature and is due to the saturation of the ring of iron wire which forms it.” N-78-12-20.2: 192–281, N-79-06-16.1:1–101, Lab. (TAEM 29:894–938, 35:161–211; TAED No08:96–140, No77:1–51); Upton 1880b, Table 1, 182.

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**From Henry Bentley**

Friend Edison

Franklin Institute packed last night1 aisles passageways and all—hanging on all around the stairs &c Prof Rogers2 said in a brief address after I got through that it was the success of the year just closed. at the Institute. Many big guns there and various curious remarks were made—publicly—and all of the most gratifying character. Everybody was thunderstruck at the perfection with which it went off, and at its loudness. [The?]3 A vote of thanks was presented to Prof Edison “and his able co-adjutor” Henry Bentley for the opportunity afforded of seeing and hearing the the wonderful ins’t.3 It was at its very best and it filled the auditorium with its tones most completely. The cornet on it was simply wonderful to hear.

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*Phila’ 6/19 187[9]*

*April–June 1879* 258
I am glad I stuck to it and brought it over the other night. I send you some papers—no use to send all, you will get the general run of it from these.⁴ You have added another wreath to your brow now sure.

I find when I hold the door of the box open the sound is clearer and louder. Please see if in the arranging of this box it can't be left quite open or full of holes. Yours

Bentley⁵


1. Founded as a Philadelphia mechanics’ institute, the Franklin Institute was by this time a nationally prominent center for science and technology (Sinclair 1974). On 2 May its secretary had asked Edison, for the second time, to demonstrate his electromotograph telephone and electric light at one of the Institute’s monthly meetings. Later that month, George Barker wrote that he had heard Edison planned to show the telephone there but “I could not credit the statement, because in the first place, I could not believe that a society which is controlled scientifically by [Edwin] Houston & [Elihu] Thomson, who have themselves said so many shameful things about you, and a society in whose meetings you have been held up to ridicule & against whom I have had to defend you often, could have the cheek to ask such a thing of you; and in the second, because I did not believe you would accede if they did ask it.” Edison wrote on Barker’s letter, “Lord no I have not promised them any thing nor would not= I am going to send Bently two pair & if possible you a pair.” Franklin Institute to TAE, 2 May 1879; Barker to TAE, 16 May 1879; both DF (TAEM 49:219, 229; TAED D7903ZDL, D7903ZDU).

2. Probably Robert Rogers, a noted chemist and physician and former dean of the medical college of the University of Pennsylvania. Rogers was now professor of medical chemistry and toxicology at Jefferson Medical College in Philadelphia. ANB, s.v. “Rogers, Robert Empie.”

3. Before exhibiting the telephone, Bentley asked Edison to have Stockton Griffin write out “in your own words—any new points on it that you may desire or the general tenor of what you wish printed.” Because Bentley expected his remarks to be published in the Journal of the Franklin Institute he wanted “if possible to give it your own language as nearly as possible,” and arranged to visit Menlo Park on 17 June to “get the bearings” of the instrument so he could “give it the biggest kind of a send-off at the Institute.” The Journal printed only a brief account of Bentley’s demonstration, but a full account was published in the Philadelphia Inquirer. The Institute’s secretary wrote Edison a formal letter of thanks on 19 June. Bentley to TAE, both 14 June 1879; Franklin Institute to TAE, 16 June 1879; all DF (TAEM 52:71, 73; 49:270; TAED D7937ZBL, D7937ZBM, D7903ZFA); “Proceedings, etc.,” Journal of the Franklin Institute 108 (1879): 71; “The Telephone,” Philadelphia Inquirer, 19 June 1879, 3.

4. Not found.

5. Henry Bentley was founder and president of the Philadelphia Local Telegraph Co. See TAEB 2:433 n. 4.
Dear Father:

I have broken my usual rule today, for I have been working nearly all this Sunday. Mr. Edison has been very hard at work on his new telephone receiver during the past week, and has succeeded in getting it into very good order. He has been working night and day and I have been up two nights and parts of four. He sees about $100,000 in cash to come to him from England if he gets it to work satisfactorily. He has ⅜ of this clear after he has paid such shares as he had given away.

I had a talk with him this afternoon and he spoke of five per cent on the electric light, he did not make me a direct offer but hinted that I might have so much. He said that he would give it me the same as he gave to Mr. Batchelor only half the amount he gets. It will be five per cent of the profits, yet I shall have no papers except that my name will be placed on the agreement he has entered into with the electric light Co. I take no risk beyond losing my time for a year or two for it is not a partnership, Mr. Edison runs all risk puts in all the money and gives me five per cent on all his sales clear. There is about $100,000 worth of property here and some twenty to thirty men employed so I think five per cent on the total product is a fair show. I think with some pertinacity I could get him to make is seven and a half, for he is very easy in such matters, yet as it is pure generosity on his part I think it is not becoming in me to try and jiew him. Besides if I grumble perhaps he may say no.

This is what I come in for, fifty shares of Electric light stock, worth today over $100, free from assessment. This comes to me immediately but of course not for me to sell. Then when the Electric light is accepted $5,000 in cash and $1,500 a year for 17 years, so why should I find any fault with my chances. I am going to say yes, I will take five per cent, would not you? The only trouble in the arrangement is that the light is not yet out and far from perfection, yet as I am only getting $600 a year I do not lose much if I go two years without pay. I do not say I can get five per cent, yet things look that way. I am with much love Your Son

Francis R. Upton
was the only element upon which Edison commented, writing “You bet old boy.” N-78-12-28:182, Lab. \(TAEM\) 30:73; \(TAED\) No11:74.

2. For Edison’s obligation to George Gouraud, see Doc. 1743. Nothing certain is known about Edison’s agreements with Batchelor, James Adams, and Charley in regard to the English telephone but see Docs. 1345 and 1652 and \(TAEB\) 4:816 n. 1 regarding his arrangements with them for U.S. and French telephone royalties. Between 20 and 23 May Edison credited \$1631.78\ to Charles Batchelor, \$815.89\ to Mrs. James Adams, and \$500\ to Charley Edison, presumably to apportion his half of the \$24,500 advance received from London about this time (Ledger #3: 112, 205, 178, 335, Accts. \(TAEM\) 87:59, 102, 89, 146; \(TAED\) AB001:53, 96, 83, 140; Doc. 1742).

3. The previous week Upton reported to his father that he had a talk with Mr. Edison today regarding my future. He seems to think favorably of giving me a share in the business instead of wages. The only trouble is that I may have to wait a long time before the profits come... I think it would be quite a fine thing if I could come into partnership, if I only had a little more capital to live on until returns appear. Do you not think I have done well to be able to talk of ten per cent of the total profits at the end of six months [at Menlo Park], and to have any proposition considered as it is now? [Upton to Elijah Upton, 15 June 1879, Upton \(TAEM\) 95:534; \(TAED\) MU017]]

4. Upton wrote his father again the following Sunday, “I do not understand why you should object to my taking the share I thought of taking in the Electric Light. I have not had a good chance to talk alone with Mr. Edison during the past week so have not said anything more about the matter. I only risk my pay if I accept his terms to take a share, for he will only put my name on the agreements he has with the Electric Light Co. and give me some shares of the stock. The market value of the stock will be more than my salary for eight years and the light will be a success or failure long before that time. If I take the share, it is only in the profits which will be very large in case of success, \$30,000 a year guaranteed royalty.” Upton to Elijah Upton, 29 June 1879, Upton \(TAEM\) 95:541; \(TAED\) MU020).

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Paris 25 June 1879.

From Joshua Bailey

Dear Sir,

We cabled you yesterday to telegraph when Motographs will be sent.\(^1\) Mr. Griffin wrote some time ago that they would be shipped from New York June 3rd— We are in great need of the motograph here & cabled in order to know how to shape our operations. Enclosed herewith you will find Memorandum of Contract in accordance with your suggestion—\(^2\) We have engaged your Nephew with the French Company in order to prevent his engaging with Dr Herz.\(^3\) He has an excellent

\(^{1}\) April–June 1879

261
opportunity which we hope he will improve— We advised him strongly to return to you, & offered to advance him money for that purpose, but he did not see fit to accept the advice or the offer. Very truly Yours,

J. F. Bailey

ALS, NjWOE, DF (TAEM 52:297; TAED D7940ZAJ).

1. The previous day Theodore Puskas had wired Edison, “Cable date Motographs sent.” Bailey telegraphed “Date motographs important” on 26 June, the same day Edison cabled Puskas, “Ten days.” After making another inquiry, Puskas instructed Edison on 16 July to “Ship motographs French line Wednesday” (the same day). On 23 July, in reply to another inquiry from Bailey that day, Edison cabled that the instruments had been “Shipped care Johnson Six Lombard” (George Gouraud’s office). Puskas to TAE, 24 June, 15 and 16 July 1879; Bailey to TAE, 26 June and 23 July 1879; TAE to Puskas, 26 June and 15 July 1879; TAE to Bailey, 23 July 1879; all DF (TAEM 52:296, 308–9, 302, 310; TAED D7940ZAI, D7940ZAQ, D7940ZAS, D7940ZAL, D7940ZAT, D7940ZAR, D7940ZAM, D7940ZAR, D7940ZAU).

2. Enclosure not found but see Doc. 1751 n. 2.

3. Charley wrote Edison from Paris on 26 June that “Not having received an answer from my letters after waiting a considerable length of time I anticipated that you were displeased with operarions in England and proceeded as I had intimated in my last letter. I accordingly made arrangements to stay in Paris for Puskas and do the telephone work for the French company.” He acknowledged Edison’s request that he return home but said that “before acting I will give you the situation here and await your reply.” In closing, he asked, “Who is Dr Herz—? when I was hanging around waiting for Bailey he came to me and offered me $300 month to work for him.” Charley Edison to TAE, DF (TAEM 52:298; TAED D7940ZAK).

On 5 June, George Prescott had sent a letter from Cornelius Herz (not found) which he asked Edison to “return to me with your views on the requests about your nephew &c.” Edison wrote on Prescott's letter, “Undoubtedly Herz is a perfect fraud. ... I would be a little careful about being interested] with him. CPE does not understand anything abt quad or Printer. If Herz wld pay in adv for a man for a certn length of time you might send an operato[r] from up st[air]s who unds Quad—that's only proper way do it.” Prescott to TAE with marginalia, DF (TAEM 51:873; TAED D7936W).

Dear Sir.

I learn that Gould is trying to effect an arrangement towards using the Automatic system on the new lines.1 Cannot something be done so the Western Union would take all the Automatic patents?2 I have a large interest in them and of

[Menlo Park,] June 26th [187]9

To Hamilton Twombly

April–June 1879

262
course would like to get paid something for my four years labor in perfecting it. While the value of these patents for use upon the W.U. lines are at present small, owing to unlimited wire capacity the system is of great value to a new company without wire capacity because it gives one wire the capacity [of] 10 ten without an expenditure of capital, hence it can always and will probably always be used as a club to hurt the W.U. The patents contain the base of all that is valuable in automatic telegraphy and cover it for years to come. Very Truly

Thos A Edison

LS (letterpress copy), NjWOE, Lbk. 4:430 (TAEM 88:89; TAED L.B004430). Written by Stockton Griffin; circled “C” written at top of page. “Faint letterpress copy.

1. The lines were those of the American Union Telegraph Co., launched by financier Jay Gould (see ANB, s.v. “Gould, Jay” and TAEB 2:369 n. 12) on 15 May to oppose Western Union (see Doc. 1713 n. 4). Gould, whose dealings made him a public symbol of business corruption, was the principal figure behind an earlier challenge to Western Union that ended in 1877 with the company’s purchase of the Atlantic and Pacific Telegraph Co. (see Doc. 985 n. 1). American Union ultimately did not rely on automatic telegraphy although another new enterprise, the American Rapid Telegraph Co., did so using another system (see Doc. 1790 n. 9). Reid 1886, 577–80, 778–81; Harlow 1936, 409–11; Israel 1992, 146–48.

Edison’s system of automatic telegraphy employed punched-tape automatic transmitters and electrochemical receiving instruments to transmit messages at high speed so that each occupied the line for only a small fraction of the time needed by ordinary manual transmission (see TAEB 1–3 passim). Gould took control of Edison’s automatic patents in 1875 without paying him or most other investors in the Automatic Telegraph Co.; this became the subject of a lawsuit by Edison and investors in the Automatic Telegraph Company. Gould also never assigned the patents to the Atlantic and Pacific Telegraph Co. although the company used the system under a separate agreement, which gave Western Union some claim to the automatic when it subsequently acquired Atlantic and Pacific. See TAEB 2:464 n. 4, 3:10 n. 5; Docs. 522, 561, 676 and 750.

2. Edison was apprised of the prospect of the new company using his automatic system on 14 June by Edwin Fox who had begun to provide legal advice to Edison in his suit with George Harrington against Atlantic and Pacific regarding the automatic. Fox also simultaneously explored a compromise with Gould but these overtures went nowhere and the suit dragged on for decades. Fox to TAE, 10, 12, 14, 16, 24 June, and 16 and 19 July 1879, DF (TAEM 51:874, 884, 890, 892, 896, 907; 49:296; TAED D7936X, D7936ZAA, D7936ZAB, D7936ZAC, D7936ZAE, D7936ZAN, D7903ZFQ); TAEB 2:469 n. 2.

On 24 June, Josiah Reiff also alerted Edison to this situation and sent him a draft letter to Twombly on which Edison loosely based this document. Reiff had hoped that the passage of a bill allowing railroads to
compete for commercial messages would provide a new market for Edison's automatic system, but after the formation of American Union he encouraged Edison to settle with Western Union. Twombly wired on 27 June, “Letter received, how much do you want for your interest.” Edison replied, “For my interest will take sixteen thousand five hundred cash.” Reiff continued his efforts to reach a settlement and in mid-July Edison prompted him to “Hurry up your negotiation I want $16,500. sixteen thousand five hundred dollars For my share= delay is dangerous.” Grosvenor Lowrey and Western Union president Norvin Green also became involved but talks reached an impasse in late July, at least in part over attempts to separate Edison’s interest from Reiff’s. In a draft letter to Twombly from around this time Edison noted that his “offer was not for an indefinite period, and if it was thought to use my interest as a leverage to cut him out all together it was a mistake I can not consent, but will do anything to help you make him come to reasonable terms.” Negotiations continued through September but no settlement was reached. Reiff to TAE, 4, 9, 12, and 23 Feb., 8 Apr., 4 May, 24 June, with Reiff draft to Twombly, and 26 June 1879; Twombly to TAE, 27 June 1879; TAE to Twombly, 27 June and 29 July 1879; Reiff to TAE, 18 July, with TAE marginalia, 22 and 28 July, 5 and 29 Aug., 17 and 19 Sept. 1879; all DF (TAEM 51:847, 849, 851, 855, 865–66, 867, 903–5, 916, 909–10, 912, 917–19, 921; TAED D7936F, D7936G, D7936H, D7936J, D7936K, D7936Q1, D7936R, D7936ZAF, D7936ZAJ, D7936ZAK, D7936ZAL, D7936ZAS, D7936ZAO, D7936ZAP, D7936ZAP, D7936ZAT, D7936ZAU, D7936ZAV, D7936ZAW).

1765

From George Gouraud

Dear Edison

London 27th June 1879

When I got back, I found that steps had already been taken by the London Company to the end of forming Local Boards in both Liverpool, and Manchester, it having been their understanding that they could do this without consulting you or me, and surely there was nothing in the Document as originally drawn which implied anything to the contrary. You will see that it was very important that there should be no ambiguity on this point, as once the London Company had formed Local Boards in the large provincial towns, and established a Central System it would have been very difficult, if not indeed impossible, for us to have successfully formed a separate Company. I have accordingly withheld the original signed Agreement, and substituted for it another one with alterations defining this point as you will observe in Article 8. There were also several other clauses which required further modification in our interests. Opening these questions naturally opened one, or two other points on the other side, but so obviously just and equitable, and on the whole entirely unobjectionable as re-
gards ourselves, that they were therefore assented to in order
to secure the main points of the clause above referred to. You
should therefore receive by this mail the Definitive Agreement
made in the name of the Right Honorable Edward Pleydell
Bouverie\textsuperscript{2} for himself, and the others, who have signed the Pre-
liminary Agreement\textsuperscript{3}

I have received the assignment \textit{and of} the Patents\textsuperscript{4} but
Counsel here prefer that they should be made in a somewhat
different manner to comply\textsuperscript{d} to with\textsuperscript{d} the absolute require-
ments of the English law, so that we are obliged to trouble you
to sign your name once or twice more. This will finish the
whole thing up, and make everything to the liking of every-
body. See that they are duly certified by the Consul as before,
which will give our friend Griffin another chance of airing
himself on Broadway Yours very truly

Geo. E Gouraud

LS, NjWOE, DF (TAEM 52:598; TAED D7941ZCF). Written by
Samuel Insull. “or me” interlined above by Gouraud. Interlined above
by Gouraud. Obscured overwritten text.

1. This article stipulated that the director appointed by Edison
should approve the formation of any local companies. Under an ancil-
lary document Gouraud signed on 2 July, Edison was to receive a one-
time royalty of £5,000 each for Liverpool and Manchester in lieu of
forming independent companies there. The principal contract specified
this sum as Edison’s royalty for each Metropolitan Postal District which
the London company might reserve to itself instead of an independent
company. Edison had already designated Gouraud as his representative
to the board and he subsequently sent this nomination to the company
and drew up a power of attorney specifically authorizing Gouraud to es-
tablish district companies. Details of Edison’s relationship to the district
companies were enumerated in a supplemental agreement dated 1 Au-
gust 1879. Gouraud to TAE, 4 and 20 July 1879; Agreements with Ed-
ward Pleydell Bouverie and the Edison Telephone Co. of London, Ltd.,
2 and 14 July and 1 Aug. 1879; TAE to Gouraud, 20 July 1879; all
DF (TAEM 52:609, 646, 607, 617, 648, 647; TAED D7941ZCO,
D7941ZDC, D7941ZCN, D7941ZCV, D7941ZDF; D7941ZDD); Pow-
ers of Attorney to Gouraud, 24 May and 21 July 1879; TAE to Tele-
phone Co. of London, 21 July 1879; all Miller (TAEM 86:23, 35, 32;
TAED HM790067, HM790073, HM790071).

2. Edward Pleydell Bouverie was a prominent Liberal member of the
House of Commons for thirty years until his defeat in 1874 after break-
ing with the government of William Gladstone. At this time he was in-
volved in financing the debt of Turkey and other countries and was a
director of several British companies. DNB, s.v. “Bouverie, Edward
Pleydell.”

3. Gouraud mailed one copy of the contract on 28 June. He later
asked Edison to cable the name of the steamer returning the signed
agreement, “as upon the receipt of such a cable certain measures may be

April–June 1879 265
proceeded with here without further delay.” Having received no answer by 14 July he cabled again, “Are documents signed rival exchanges forming?” Edison promptly replied, “Telephone contracts signed and go first steamer”; Edward Bouverie executed the contract in London the same day. Gouraud to TAE, 28 June, 1 and 14 July 1879; TAE to Gouraud, 14 July 1879; all DF (TAEM 52:601, 606, 614–15; TAED D7941ZC1, D7941ZCL, D7941ZCS, D7941ZCT).

4. The company’s official registration was contingent on Edison’s assignment of his British Patents 2909 (1877) and 2396 (1878). Just before Gouraud left New York, Edison instructed him to “go to Serrell & have assignments made to Company of two telephone patents subject to Not-tage contract” (see TAEB 4:148 n. 1). Lemuel Serrell sent the documents for Edison’s signature on 14 June. Gouraud to TAE, both 10 June 1879; Serrell to TAE, 14 June 1879; all DF (TAEM 52:588–89, 594; TAED D7941ZBZ, D7941ZCA, D7941ZCD).

Port Huron June 29/79

From Pitt Edison

Dear Bro

I suppose that you got Report for Month of May I would like to have you let me know if they come every month Reguallor the amt that the road owes is as follows

- Bonded debt to Sanborn estate
- Payable 3 years from July 1st 5000.00
- Savings Bank note which we will reduce the first of this month at least one half or more posable pay $750.00 1050.00
- We owe W. Wastell for two hors[es] bot of him $225.00
- The floting dept is not more than $100.00 I think less

but Al this road was in a awwful condition when I took holt of in April last I have had men working on the track ever since I took off the double cars and now running one hors cars which dos all the business for travel is dull out here you know the new compay had a lot and barn near the City Hall I have sold it to a Mr Smith for $750.00 and will make the papers as soon as we can get a meeting of the Directors he makes a cash payment the bal all comes due in time to pay on the bonded dept to Sanborn I will send you Statement for month of June which will look better than the May Report and if we have no bad luck we will get out of Dept before the Sanborn Bond becomes due and have the road and Stock in splen-did condition So have patiance and we will pull through and come out in good shape yet

now Al abot Charley since I got your letter his mother is wild to know what the trouble is is he not acting for you or is he on his own Hook and what trouble did he have in Europe

April–June 1879 266
and who with now do let us know as soon as you get this for we will look for answer every day.

WPE

ALS, NjWOE, DF (TAEM 51:799; TAED D7934E). aObscured overwritten text. b“over” follows as page turn. cFollowed by dividing mark. dInterlined above.

1. There are itemized monthly statements of the receipts and expenses of the Port Huron Railway Co. for 1879 for all months except February, March, and October (DF [TAEM 51:807–24; TAED D7934ZZA]). Edison had become a major stockholder in this horse-drawn street railroad as a result of financing his brother Pitt’s involvement with one of its predecessors; see TAEB 1:306 n. 4, 1:497 n. 3, 4:447 n. 2; Docs. 530, 841, and 1148.

2. Stockton Griffin had written Pitt on 26 May that Edison wanted “a statement of entire debt of the R.R. and the money in the treasury and moneys due on the 1st of June 79.” In his undated response, Pitt supplied approximate figures and promised to send more precise information later. Griffin to Pitt Edison, Lbk. 4:349 (TAEM 80:78; TAED LB004349); Pitt Edison to TAE, n.d., DF (TAEM 51:801; TAED D7934E1).

3. The railroad had borrowed this amount in July 1877 from the estate of J. W. Sanborn, which was administered by company president John Sanborn, to pay construction expenses related to the merger of its predecessors. In return, Sanborn held a mortgage on all of the railroad’s property. Jenks n.d., 14–15; Docs. 841 and 960.

4. Pitt soon reported that this entire note was paid on 3 July, and that he hoped to begin paying down the Sanborn debt. Pitt Edison to TAE, 4 July 1879, DF (TAEM 51:802; TAED D7934F).

5. William Wastell, a Port Huron druggist, was one of the original organizers of the Port Huron and Gratiot Street Railway, a predecessor of the Port Huron Railway. Jenks n.d.; 2, 4, 7; History of St. Clair County, Michigan 1883, 585–86.

6. After having operated a competing livery service for some time Pitt became the Port Huron Railway’s superintendent; the May 1879 statement shows his salary for April as $46.18. TAEB 4:447, n. 2; Jenks n.d., 14; Port Huron Railway Co. statement, May 1879, DF (TAEM 51:810; TAED D7928ZAU).

7. Unidentified.

8. Edison’s letter has not been found. In his letter of 4 July, Pitt asked Edison to “let me know something about Charley.” Edison made a notation on that letter instructing Stockton Griffin to “Write and say Charley is not acting right he is in Paris. If possible I would advise that you get him to come home but do not mention that I said so.” DF (TAEM 51:802; TAED D7934F).
Menlo Park, June 30, 1879

[Memorandum to Stockton Griffin]

Write say letter referred to me for whom information is being obtained.

Say have reced black sand from several sources in California all contain platinum & Iridosmine some more & others less.

Ask him if we found method if he thinks the Hydraulic miners would sell their black sand for nominal sum after gold has been extracted. if they would this would undoubtedly give us all the crude metal we desire. Would he give us an idea of how much gold is extracted from a barrel of black sand in an average hydraulic claim what we desire is to get some idea of the amount of black sand accumulated per 100 dollars in gold.

We find that a large part of the platinoid metals is in the grains of sand themselves & only obtainable by crushing. We send 3 cards the platinum is from Cherokee flat the Iridosmine from Rogue River Oregon.

ADF, NJWOE, DF (TAEM 50:647; TAED D7928ZAU). *Interlined above.* "3" interlined above later.

1. Stockton Griffin’s docket notation indicates that the completed letter was sent on this date to the “Hon. E. T. Hogan” in Quincy, located in the Sierra Nevada mountains. Nothing more is known of Hogan or what position he may have held.

2. Edison prepared this draft in response to Hogan’s 7 June 1879 letter to James Crawford, the superintendent of the U.S. Mint at Carson, Nevada, to whom Edison had written in May for information about platinum in that state. Crawford reported that he knew of none there but promised to make other inquiries; Hogan’s response was apparently among several he forwarded to Edison on 21 June. Hogan wrote that a number of miners told him platinum could be found in the area “in more or less quantities in various mining sections in Plumas [County] but, as they have always regarded it as valueless, they have never saved any of it.” He promised to send Crawford any platinum samples received from local miners. Hogan to Crawford, 7 June 1879; Crawford to TAE, 24 May and 21 June 1879; all DF (TAEM 50:646, 600, 720; TAED D7928ZAU, D7928R, D7928ZCQ).

Edison wrote extensive marginalia and draft replies on a number of other letters concerning platinum around this time, typically inquiring about the quantity and composition of sand in various locales (see Mining—Platinum Search [D-79-28], passim, DF [TAEM 50:580; TAED D7928]). He instructed Stockton Griffin to answer one Oregon correspondent and “ask for sample & say that it is no object to purchase small quantities but if we could be sure of obtaining at least 50 000 oz yearly we would erect works for purifying” (TAE marginalia on A. Pershbaker to TAE, 15 June 1879, DF [TAEM 50:683; TAED D7928ZBS]).

Edison’s platinum circular (Doc. 1734) was printed in the New York Herald on 5 July and again by the New York Sun two days later. The Herald article stated that Edison had received “hundreds” of responses and “samples in large quantities” showing that platinum could be found in

April–June 1879 268
the U.S. “in over abundance” for as little as one dollar per ounce. Despite this apparent plenitude, Edison reportedly personally prospected for platinum sand near Menlo Park in late June and declared himself willing to spend up to $20,000 to develop sufficient supplies. “Edison’s Electric Light,” New York Herald, 5 July 1879; “Wanted, A Platinum Mine,” New York Sun, 7 July 1879, Cat. 1241, items 1219 and 1224, Batchelor (TAEM 94:493–94; TAED MBSB21219X, MBSB21224X).

3. Iridosmine, a native iridium–osmium alloy, usually also contains platinum. The week before Edison drafted a reply to a man who had sent a sample of it from California, in which he stated that he “could not use the ore unless I could get an unlimited supply say 1000 lbs annually as the purification of platinum from its kindred metals Ruthenium—Palladium is the most difficult process in metallurgy & has only been successfully accomplished on a commercial scale by two firms in Europe.” He added that Russian platinum ore sold for $1.84 per ounce, or for $6.85 per ounce in ingots. TAE marginalia on Monroe Thomson to TAE, 14 June 1879, DF (TAEM 50:678; TAED D7928ZBO).

4. Edison routinely sent samples of black platinum-bearing sand for his correspondents to distribute to miners and prospectors. This one may have been from sand sent by Louis Glass on 12 June from the Spring Valley Mining & Irrigation Co. in Cherokee, Calif. (see Doc. 1776 n. 2).