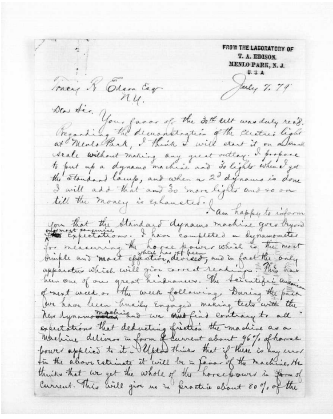
–1770–

Draft to Tracy Edson[1]



MENLO PARK, N.J.[a] July 7, 79

Dear Sir.

Your favor of the 30th ult was duly rec'd.[2] Regarding the demonstration of the electric light at Menlo Park, I think I will start it on a small scale without making any great outlay. I propose to put up a dynamo machine and 30 lights when I get the standard lamp, and when a 2d dynamo is done I will add that and 30 more lights and so on till the money is exhausted.[3]

I am happy to inform you that the standard dynamo machine goes beyond ~~the~~ our most sanguine[b] expectations. I have completed a dynamometer for measuring the horse power which is the most simple and most[c] effective which has yet been[d] devised, and in fact the only apparatus which will give correct readings. This has been one of our great hindrances. The Scientific American of next week or the week following.[4] During the past we have been busily engaged making tests with the new dynamo~~meter~~ machine[e] and we ~~and~~ find contrary to all expectations that deducting friction the machine as a machine delivers in form of current about 96% of horse power applied to it.[5] Upton thinks that if there is any error in the above estimate it will be in favor of the machine. He thinks that we get the whole of the horsepower in form of current. This will give us in practice about 80% of the total horse power applied that will be useful outside in the lamps 20% being lost in friction and in the machine owing to the fact that certain portions of the current must necessarily be lost in wire around the machine

The best machine of this nature heretofore constructed is that of Siemens which is said to translate 90% of power applied deducting friction but the great diff~~iculty~~erence between our machine and this or of any other heretofore constructed is, that of the 90% no more than 55% could be used outside of the machine 35% being lost in wire around it whereas in our machine 75 to 80% of the 90% will be obtained outside of the machine. These results are greatly in favor of greater economy than calculated.

I have now 80 feet of iron piping coated inside with rubber very beautiful and as soon as I get my boxes cast and coated we

will put them down and pass wires through them and show the system in operation. We[c] have received a list of prices from the Rubber Co[6] for coating these pipes and the whole system will be one of remarkable cheapness and efficiency beyond what we had even calculated upon. We have also[c] recd[c] a private price list from Phelps Dodge & Co for pure copper wire very much below that which I had been basing estimates on.[7]

We have sent out 1500 circulars[8] to parties in the mining regions of the Pacific Coast regarding platinum and have rec'd an overwhelming number of replies which go to show that there will not be the slightest difficulty in obtaining all the platinum requisite for the light.

I have also a satisfactory regulator for the standard lamp for the first time.[9] After several months continuous efforts we are now getting out pure oxide of zirconium for the lamps and in 2 weeks will have a sufficient supply to go ahead with the experiments on the burner.[10]

Everything looks bright and as long as there is any hope of obtaining more burners per horsepower than six I shall continue to experiment and produce a lamp equal in efficiency to the standard dynamo machine

We have the forgings for 3 more dynamos which we are now making like the ~~samp~~ model.

The expenses are not over $400 per week and the money on hand will last several weeks.

This is all the information I have at the present time which I think will be of interest. Very Truly

T.A.E.

DfS, NjWOE, DF (*TAEM* 50:264; *TAED* D7920ZAU). Written by Stockton Griffin. [a]Place from Edison's laboratory handstamp. [b]"our most sanguine" interlined above. [c]Obscured overwritten text. [d]"which has yet been" interlined above. [e]Interlined above.

1. Stockton Griffin's docket note indicates that the completed letter was sent to Edson, Calvin Goddard, and Grosvenor Lowrey.

2. Edson had asked for "an Estimate of the cost of the proposed demonstration at Menlo Park, giving an idea also of the extent of the demonstration, as to the number of Lights &c. I should also like to know at what time you expect to make the exhibition— I learn from Mr Banker that you consider the Light and the Generator finished." Edson later explained that he made this request "not because I am getting impatient, but so that I might be able to answer numerous enquiries intelligently, and for the purpose of taking early measures to provide the necessary funds to put the matter through so that there should be no delay after you were ready." Edson to TAE, 30 June and 9 July 1879, DF (*TAEM* 50:263, 268; *TAED* D7920ZAT, D7920ZAV).

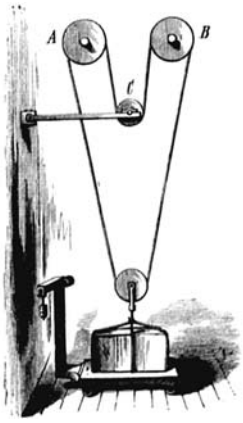
3. In his 9 July reply (see note 2), Edson endorsed this proposal because "I think it quite likely that after you have set up one Dynamo Machine and 30 Lights, you will wish to make some changes before putting up the second 30 Lights, and that could be done more economically than if they had all been set up at once."

4. The 26 July issue of *Scientific American,* which would have been published about the middle of the month, included a diagram and explanation of the new dynamometer, which it reported Edison had devised only after he had "tried every dynamometer within reach, and condemned them all." The magazine published an engraving of the instrument in use with Edison's dynamo in its 18 October issue. "Progress at Menlo Park," *Sci. Am.* (41:52), "Edison's Electric Generator," *Sci. Am.* (41:242), Cat. 1241, items 1232, 1332, Batchelor (*TAEM* 94:503, 513; *TAED* MBSB21232, MBSB21332X).

There is no record of the development of Edison's belt dynamometer before John Kruesi's measured drawing on 1 June and his order for its construction. The machine was completed by 30 June, when Edison demonstrated it for reporters, and may have been the reason for Kruesi's order on 29 June to "Get a 8 inch double belt & cement joint alter counter shaft accordingly." Machine Shop Drawings (1879–1880), Lab. (*TAEM* 45:69; *TAED* NS7986CAU); Cat. 1308:155 (Order No. 199); "Local Miscellany. Edison's New Telephone," *New York Tribune,* 1 July 1879 and "Edison's Work," *New York Herald,* 1 July 1879, Cat. 1241, items 1212, 1214; all Batchelor (*TAEM* 90:744, 94:492; *TAED* MBN003: 51, MBSB21212X, MBSB21214X).

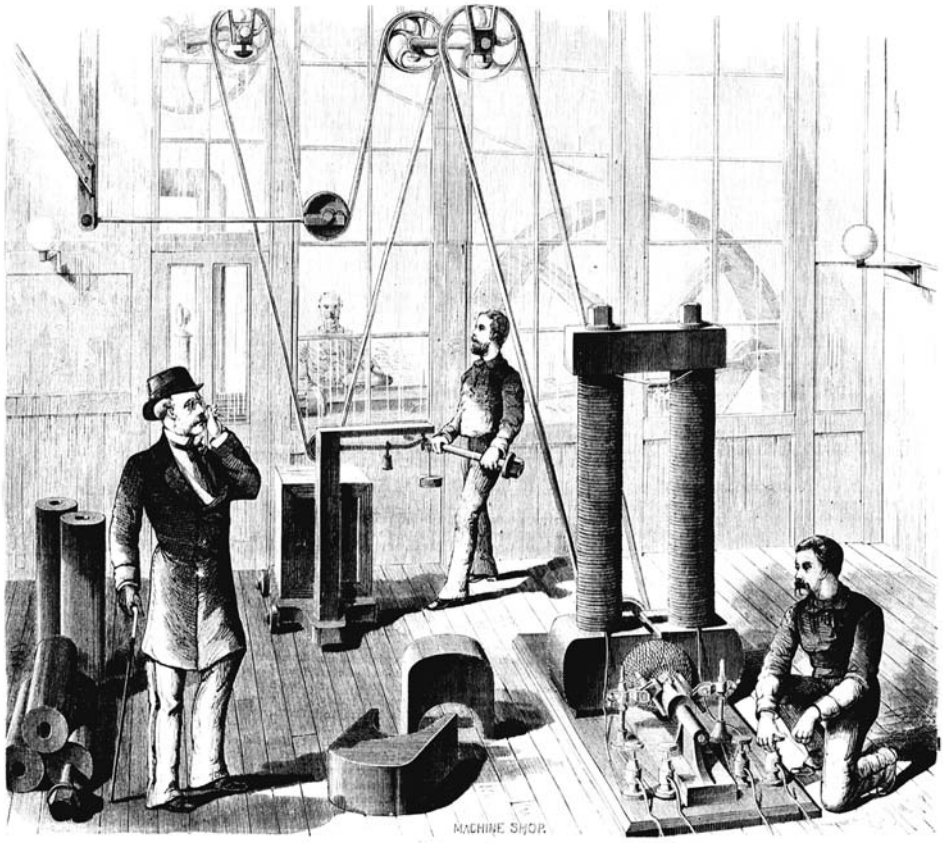
Francis Upton described the operation of the new instrument in his paper on "Methods for Testing Faradic Machines" read at the annual meeting of the American Association for the Advancement in August:

> The driving side of the belt is carried under the pulley attached to a weight, from which is placed so far below the line of the driving and driven pulley, that nearly double the strain on the belt is lifted, as in the case of an ordinary block. To weigh this amount, the weight is placed on a platform scale and the diminution due to the pull from the belt measured. A large load of 900 pounds was used so that the jar due to the movements of the belt is so distributed as to produce very little effect on the scale.
>
> The belt ran about 1000 feet in a minute so that 100 pounds difference represented about a horse and a half power. Since the scale showed half a pound, the results were easily measured within one per cent., making the maximum which could be transmitted 13.5 H.P., though the same weight could be made to answer for transmitting larger amounts of power by increasing the speed. [Upton 1880b, 180]



In this Scientific American *illustration of Edison's dynamometer,* ***A*** *is the driving pulley,* ***B*** *the driven pulley, and* ***C*** *the tension wheel; the weight to be raised and the scale are at bottom.*

5. This figure is the last and best of several calculations of the efficiency of Edison's "standard dynamo machine" made by Francis Upton during the first week of July as he and Edison tested and calibrated the new dynamometer. The actual figures given in Upton's 7 July notebook entry were "96.3% excluding friction" and "90% including friction" (N-79-06-16.1:219, Lab. [*TAEM* 35:269; *TAED* N077:109]). During the week of tests Upton compared the mechanical force applied to the



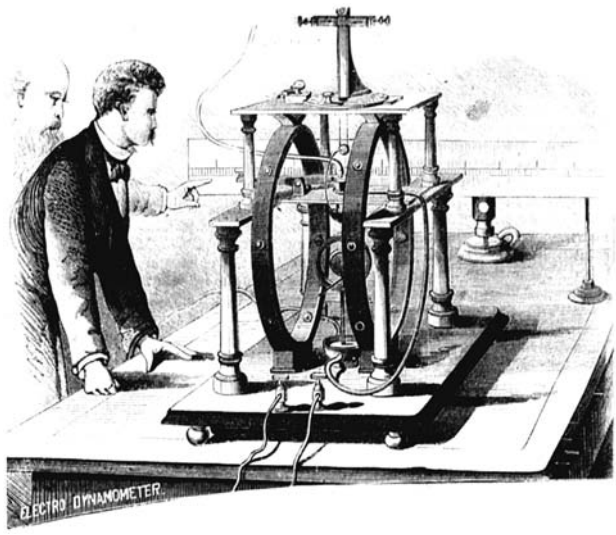
EDISON'S ELECTRIC GENERATOR.—[See page 244.]

This Scientific American *engraving of the dynamometer setup in the Menlo Park machine shop shows George Barker observing a test.*

dynamo, as measured by the dynamometer, with the amount of current generated, as indicated by an electrodynamometer and converted to mechanical units. N-79-02-15.1:163–71, N-79-04-08.2:35–49, N-79-06-16.1:120–223, all Lab. (*TAEM* 31:738–42, 911–18; 35:221–71; *TAED* No28:81–5, No30:17–24, No77:61–111).

The electrodynamometer was essentially a high-resistance galvanometer able to handle heavy current, thereby avoiding the measurement errors caused by shunting only a portion of the current through a conventional galvanometer; its copper construction also made it impervious to magnetic interference. Edison's electrodynamometer, which had been completed on 15 April (Cat. 1308:129 [Order No. 90], Batchelor (*TAEM* 90:731; *TAED* MBN003:38), was a modification of the instrument designed by Harvard professor John Trowbridge; in early July, Upton abstracted an article by Trowbridge (Trowbridge 1879) describing the electrodynamometer and the results of tests with it on various generators (N-79-07–07.1:85–103, Lab. [32:290–99; *TAED* No37:42–51]). Beginning on 21 April, Upton had conducted a series of comparative measurements with a standard galvanometer, presumably to evaluate and calibrate the new instrument. On 22 April he conceded, "I do not understand why these results are so far apart. I think the method with

The Scientific American *illustration of Edison's electrodynamometer.*



galvanometer of high resistance is the best" (N-79-4-21:103, Lab. [*TAEM* 30:773; *TAED* N017:49]). His "Testing E.M.F." and "measurement of the dynamometer" continued until he determined, probably in late April, an algorithm for calculating the amount of current from the instrument's deflection (N-79-4-21:131, 138–51, Lab. [*TAEM* 30:787, 791–96; *TAED* N017:64, 68–74]). At intervals from late April to mid-June, Upton used both the electrodynamometer and galvanometer in extensive tests of the Gramme and Edison dynamos, conducted in part to measure the effects of varying field magnet strength (N-79-04-21:75–153, Lab. [*TAEM* 30:760–97; *TAED* N017:35–75]; Doc. 1760 n. 3).

6. Edison sent two pieces of wrought iron pipe to the Novelty Rubber Co. in New Brunswick on 6 June. The firm replied on 30 June with a price estimate and an offer "to take an order to line fifteen or twenty lengths at these prices, and if we find it can be done for less than our present estimate, will give you whatever advantage there may be. It is impossible to give exact figures without lining several of them, as we can tell in no other way, what proportion of them will turn out perfect." Cat. 1308:232, Batchelor (*TAEM* 90:774; *TAED* MBN003:81); Novelty Rubber Co. to TAE, DF (*TAEM* 50:525; *TAED* D7925ZAG).

7. Not found.

8. Doc. 1734.

9. This device was presumably the same type as the governor regulator designed in the second week of May and included in the provisional British specification that Edison filed in June (see Doc. 1735 n. 8). John Kruesi built one on 11 May and on 30 June he finished "another lamp regulator same as first but only ½ the resistence" (Cat. 1308:145, 155 [Order Nos. 156, 200], Batchelor [*TAEM* 90:739, 744; *TAED* MBN003: 46, 51]). What may be tests of the May regulator, conducted on 23 June, can be found in N-79-06-16.2:5–19, Lab. (*TAEM* 35:370–77; *TAED* N079:3–10).

10. See Docs. 1787 and 1802 n. 3.