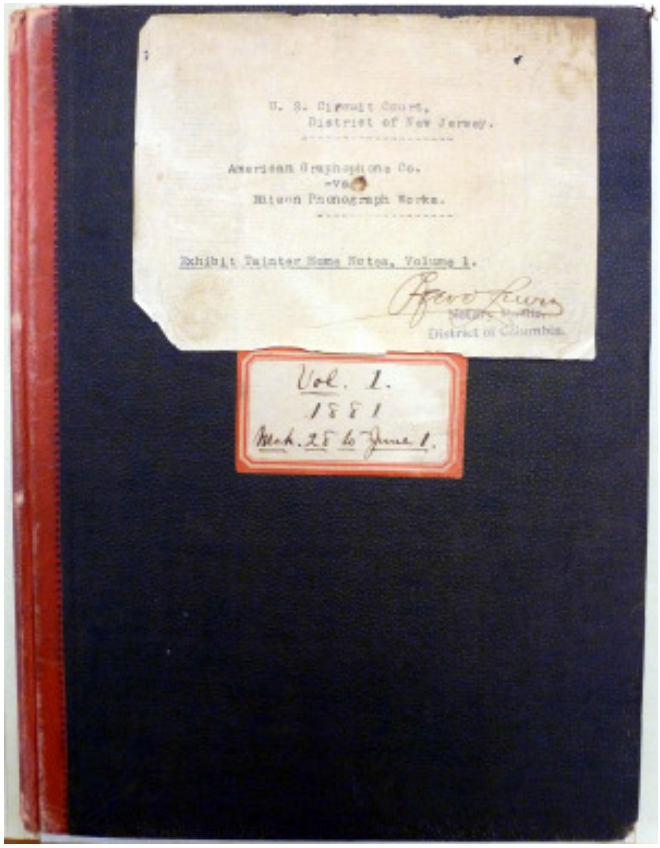
Phonographic Treasures of the Smithsonian: Part 1

by Patrick Feaster

It was the summer of 1914. Fred DeLand—superintendent of the Volta Bureau which Alexander Graham Bell had founded in 1887 to promote knowledge about deafness—was trying to figure out what to do with an assortment of paraphernalia left behind at the Bureau's headquarters relating to old sound media experiments. In a letter to Bell, he recommended that the telephone-related materials ought to go to the Smithsonian, where they would complement existing holdings, and in passing he asked whether the phonograph-related materials might belong there too.[1] Bell replied that the Smithsonian could have whatever it wanted, adding:

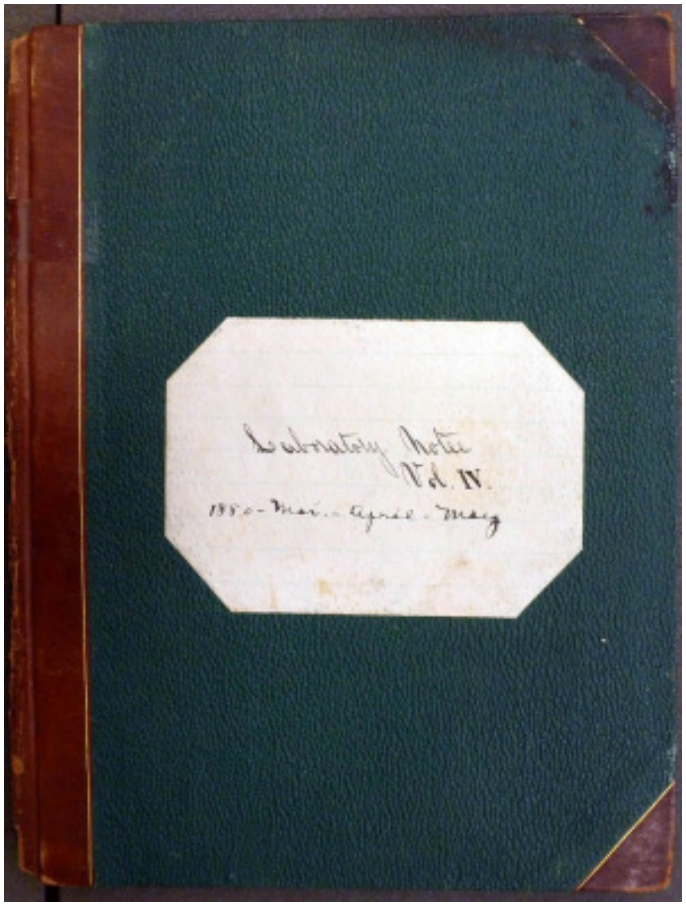
There are quite a number of flat graphophone discs of both small and large diameter that I think should be there, as they antedate the flat discs universally employed at the present time. While the old Volta Bureau Associates are very commonly given credit for the wax cylinders employed in phonographs and graphophones it is not so generally known that they also developed the flat disc.[2]



Cover of Tainter Home Notes, Vol. 1, Archives Center, National Museum of American History, Smithsonian Institution.

Back in the early to mid-1880s, Bell and his associates in the Volta Laboratory Association had stood at the forefront of efforts to develop the principle of Thomas Edison's speaking phonograph into a practically useful technology. It was well known that their work had resulted in the Bell-Tainter cylinder graphophone of 1887, the first phonographic instrument put on the market for such "serious" purposes as business dictation. But many of their other accomplishments were not so widely recognized, having taken place behind closed doors, and Bell supposed that the experimental odds and ends that had been gathering dust in Washington might have value as evidence of these—and particularly of the development of the "flat disc." Getting them into a safe place could thus help to secure the group's place in history.

That winter, DeLand gathered up whatever old machines and recordings he could find and dispatched them to the Smithsonian, where they were received as accession number 57,694 with the understanding "that Doctor Bell will call at the Museum to make some explanations regarding this apparatus, and that he will furnish necessary historical data regarding the various objects."[3] The following summer, during



Cover of Laboratory Notes, Vol. 73, Alexander Graham Bell Family Papers, Library of Congress.

an inspection of the old Georgetown laboratory across the street from the Volta Bureau's headquarters, Bell's representative Arthur Clime found "some additional specimens of Doctor Bell's early talking machine apparatus which, he thinks, should properly be added to the collection of similar apparatus already send [sic] to the Museum."[4] These supplemental objects were received on 23 June 1915 and assigned accession number 58,498. Soon afterwards, Bell wrote from Canada that he would be happy to furnish the Smithsonian with information about what everything was:

But it is very difficult for me to do so, as the apparatus is all old and the experiments were made over thirty years ago. I cannot undertake to do this until after my return to Washington in the Autumn, but I conceive it to be my duty to attempt this task.... I may say that we have at the Volta Bureau a box filled with the notebooks of the members of the Volta Laboratory Association, describing the experiments that were made in detail. This box has not been opened for many years and I would like to ask your advice as to whether it would be a good plan to add these notebooks to the collection.... In which case the future historian of the phonograph and graphophone may be able to find contemporaneous data in the Museum.[5]

In other words, Bell thought his own recollection of the experiments might be hazy after so many years, but he was willing to make some complementary written source material available to help fill the gaps in his memory. It was agreed that the box of notebooks would go to the Smithsonian, and that it would remain sealed there until Bell himself could be present to examine its contents.[6] If things had gone as planned, we might long since have had a clear and thorough account of the Volta Laboratory's pioneering work in recorded sound, and also of the place of each of the donated recordings within it.

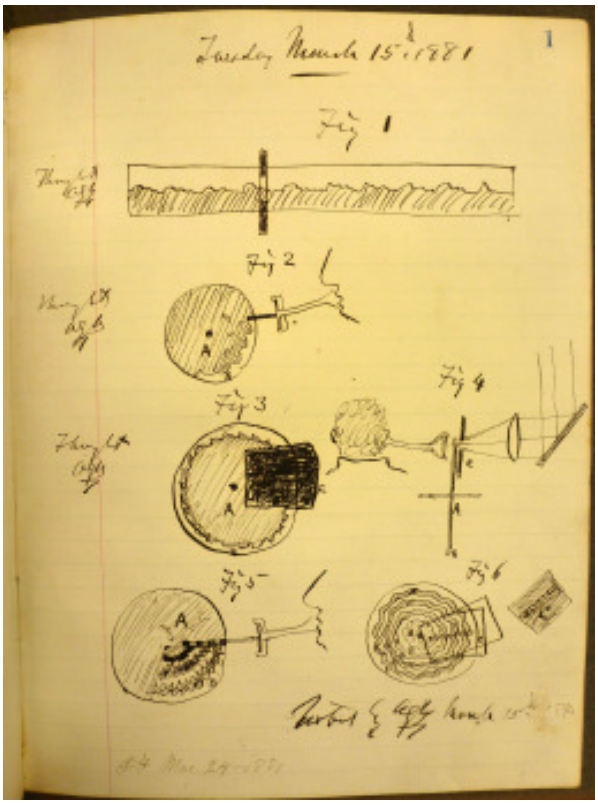
But this was not to be. Bell had DeLand reclaim the unopened box of notebooks for a research project in the spring of 1922,[7] and he died a couple of months later without ever having identified the objects given to the Smithsonian on his behalf. Curatorial staff assigned the cryptic artifacts catalog numbers ranging from the 287,650s through the 287,900s, wrote up rudimentary physical descriptions, and transcribed whatever inscriptions were readily visible and legible—but with neither the notebooks or Bell's memories available for consultation, the recordings yielded up few of their secrets.

In 1947, some relevant documentation finally became available when the Smithsonian acquired the papers of Charles Sumner Tainter, another member of the Volta Laboratory Association. Included in the gift from Tainter's widow were ten volumes of "Home Notes" and multiple drafts of an unpublished

autobiography, which Leslie J. Newville pronounced in 1959 to be the long-awaited "key" to the Volta artifacts deposited four decades earlier.[8] The Tainter Papers remain mostly unpublished, but they're available for researchers to study in the Archives Center at the National Museum of American History, and past efforts to reconstruct a detailed chronology of experimental work at the Volta Laboratory have focused almost exclusively on them.[9] I suspect historians have found them so attractive in part because they're so easy to use: the "Home Notes" are organized in strict chronological order, with just a couple gaps where individual volumes were lost in a fire, and Tainter's autobiography offers an appealing ready-made narrative.

Meanwhile, the notebooks which Alexander Graham Bell had authorized DeLand to reclaim from the Smithsonian in 1922 eventually wound up (together with other relevant documents) in the Alexander Graham Bell Family Papers at the Library of Congress, where anyone with a reader's card may examine them today in the Manuscript Reading Room. Even so, they're not as easy for the phonograph historian to digest as the Tainter Papers are. The Library of Congress has organized Bell's notebooks into two numbered series, the "Laboratory Notes" and the "Home Notes," but the Volta associates themselves distinguished other categories of notebook, such as "Laboratory Rough Notes," and the original numbering is often at odds with the library's own numbering scheme—for example, the original "Laboratory Notes Vol. IV" is now officially designated "Laboratory Notes Vol. 73." Multiple notebooks were kept open concurrently, such that following an experimental thread typically means needing to skip back and forth between two or three different volumes housed in separate boxes. Entries about phonograph-related experiments are intermingled with notes on other subjects ranging from metal detection to animal husbandry. Thus, it's no wonder that past researchers interested in recorded sound have only sampled these notebooks rather than trying to mine them methodically.[10]

But the Tainter Papers alone—for all their richness—don't yield a complete picture of the Volta group's activities. In 1914, Alexander Graham Bell assumed that "the future historian of the phonograph and graphophone" would also want to study the hundreds



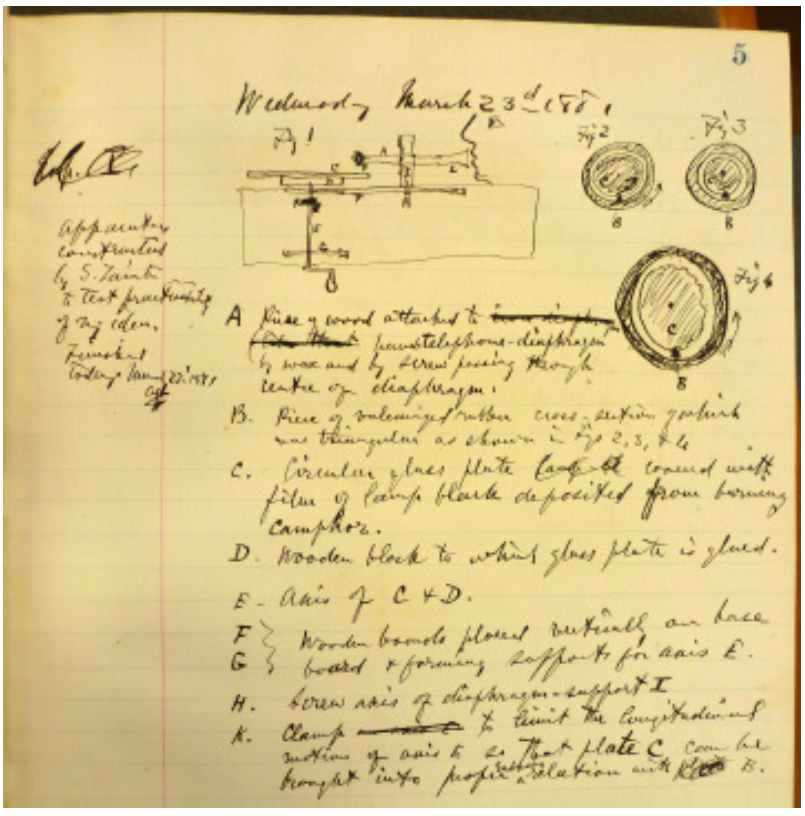
Sketches showing arrangements for using a photophone receiver to reproduce recorded sounds. "Fig 2" shows a rotating disc covered with lampblack; a stylus attached to a phonographic membrane wipes part of the surface clean, leaving a transparent band of varying width. "Fig 3" shows the recorded disc rotating past a narrow slit; "Fig 1" shows a strip version of the same concept. "Fig 4" shows light passing through the slit—its intensity modulated by variations in the width of the clear strip around the circumference of the rotating disc—and then striking a photophone receiver, with someone listening to the reproduced voice. Fig 5" and "Fig 6" show methods of recording and playing back multiple traces at once,"presumably to boost the volume. Laboratory Notes 14:1, Alexander Graham Bell Family Papers, Library of Congress.

of actual recordings preserved at the Smithsonian in conjunction with the "contemporaneous data" of all available notebooks, so that the objects and the writings could complement each other.

And that's what I recently set out to do. For ten weeks between October and December 2011, I carried out an item-by-item study of the early experimental sound recordings at the National Museum of American History, including all those associated with Alexander Graham Bell and the Volta Laboratory Association. At the same time, I gathered together all relevant information I could find in the various series of notebooks and other written documentation at NMAH and the Library of Congress. I gratefully acknowledge the help of curator Carlene Stephens, who spent many hours guiding me through the collections of artifacts; the logistical and financial support of a Lemelson Center Fellowship; and the generous hospitality of David Giovannoni and Kathy Sheram during my stay in Washington.

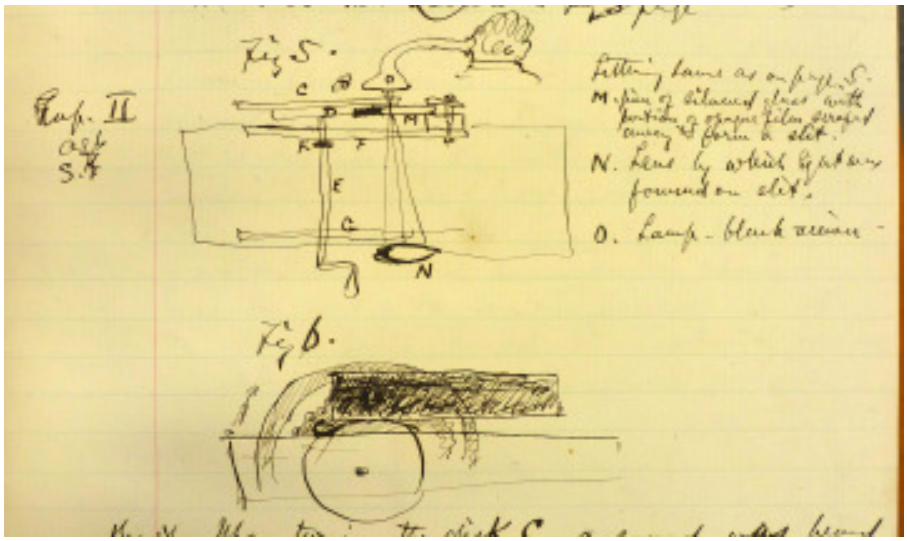
I'd like to report some highlights of the project in these pages over the coming months, but in this first installment, I'll share just one finding about the Volta group's earliest forays into the sound-recording field. "The actual beginnings of the Bell and Tainter work on the improvement of the phonograph is not clear," writes Ray Wile. "The earliest firm date that can be assigned to any significant work is evidenced by the first entry of March 28, 1881, the first of Tainter's *Home Notes*."[11] But if by "significant work" we mean real experiments as opposed to mere brainstorming, the notebooks at the Library of Congress allow us to push that date back by several days.

Before March 1881, Alexander Graham Bell and Sumner Tainter had both entertained various ideas about how to improve the phonograph, but they had devoted their collaborative experimental work pretty much exclusively to the photophone, an invention that transmitted sound wirelessly by modulating the intensity of a beam of light. Photophone receivers were of a couple different types: some placed a substance such as selenium, with an electrical conductivity that varied with exposure to light, into a circuit with a telephone receiver, while others relied on substances such as lampblack that sounded directly when exposed to a modulated light beam. On 15 March 1881, Bell and Tainter sketched out some arrangements by which they thought one of their photophone receivers might also be made to reproduce recorded sounds,[12] and on 23 March they put the idea to the test—the first time I can document them conducting an actual phonographic experiment together. First, a glass disc was coated with lampblack and rotated while a triangular piece of rubber pressed against its surface to clear away a transparent circular band. Next, the piece of rubber was moved forward slightly towards the



Recording arrangement used on 23 March 1881. Laboratory Notes 14:5, Alexander Graham Bell Family Papers, Library of Congress.

center of the disc so that it overlapped the edge of the trace that had just been produced. Tainter then gave the disc a single whirl with a hand-crank while Bell shouted the word "potato" into a mouthpiece, and the diaphragm conveyed its vibrations to the piece of rubber, giving a wavy contour to the trace's inner edge and a variable width to the trace as a whole—alas, there was only enough space for the first two syllables: "po-tay." Finally, they rotated the disc again while causing the variations in the width of the trace to modulate a beam of light, resulting in a "very imperfect reproduction" of the recorded syllables in a lampblack receiver.[13] To the best of my knowledge, this was the first attempt ever made to play back a recorded sound optically,[14] but Tainter didn't mention it in his autobiography years later, probably because he'd forgotten about it and didn't have access to the relevant notebook entries to jog his memory.



Playback arrangement used on 23 March 1881. Laboratory Notes 14:7, Alexander Graham Bell Family Papers, Library of Congress.

Unfortunately, no recording matching this description turned up in the collections of the NMAH—but at least I would have recognized it if I'd seen it! In the next installment, we'll consider the earliest recording made by the Volta group that *does* survive at the Smithsonian today.

NOTES:

[1] [Fred DeLand] to Alexander Graham Bell, 15 July 1914, copy, NMAH accession document 50701.001; this and other accession documents were accessed via photocopies in the Division of Work and Industry.

[2] Alexander Graham Bell to Fred DeLand, 20 July 1914, NMAH accession document 50701.002.

[3] George C. Maynard to Walter Hough, 7 December 1914, NMAH accession document 57694.009.

[4] George C. Maynard to W. H. Holmes, 5 June 1915, NMAH accession document 50701.024.

[5] Alexander Graham Bell to Charles D. Walcott, 8 July 1915, NMAH accession document 50701.034-35.

[6] Alexander Graham Bell to R. Rathbun, 5 August 1915, NMAH accession document 50701.050.

[7] See e.g. Alexander Graham Bell to [Charles D.] Walcott, 10 June 1922, NMAH accession document [162298].005-6.

[8] Leslie J. Newville, "Development of the Phonograph at Alexander Graham Bell's Volta Laboratory," in *Contributions from the Museum of History and Technology, Nos. 1-11* (United States National Museum Bulletin 219, Washington, D.C.: Smithsonian Institution, 1959), 69-79.

[9] Steven E. Schoenherr, "Charles Sumner Tainter and the Graphophone," http://homepage.mac.com/oldtownman/recording/graphophone.html, revised 10 February 2000; Peter Martland, "The Charles Sumner Tainter History and Laboratory Notebooks," *For the Record* 17 (Spring 2006).

[10] Raymond R. Wile, "The Development of Sound Recording at the Volta Laboratory," *ARSC Journal* 21:2 (Fall 1990), 208-225; Jonathan Sterne, *The Audible Past: Cultural Origins of Sound Reproduction* (Durham and London: Duke University Press, 2003), 254ff.

[11] Wile, "Volta," 211-212.

[12] *Laboratory Notes* 14:1-2; 19:1; 72:99-103, 115, in the Alexander Graham Bell Family Papers, Library of Congress (cited henceforward as *LN*). Volumes are cited here as numbered by the library, and not as originally numbered.

[13] *LN* 14:5-7; 72:121.

[14] Charles Edgar Fritts applied for a patent on the idea on 22 October 1880 (see U. S. Patents 1,213,613 through 1,213,616), but I've never seen any evidence put forward that he actually tried to put it into practice.

PHONOGRAPHIC TREASURES OF THE SMITHSONIAN - Part Two

by Patrick Feaster

In part one of this series, I described how the Smithsonian Institution's National Museum of American History originally came by the majority of its holdings of experimental sound recordings from the Volta Laboratory through deposits made on Alexander Graham Bell's behalf in 1914 and 1915. It's long been common knowledge that *some* Volta recordings exist at the Smithsonian; particularly famous is NMAH 312,123, a prototype graphophone prepared in September 1881 by filling the groove of a tinfoil phonograph with wax and cutting a record in the wax. But the first hint I had of the sheer *extent* of these holdings came from the following passage on the HistoryWired website, which I stumbled across sometime in 2008:

From the Volta Laboratory, NMAH has approximately 20 pieces of apparatus and approximately 200 records. Bell and his associates made the recordings between 1881 and 1890 in a variety of materials, including glass, rubber, metal, and wax.[1]

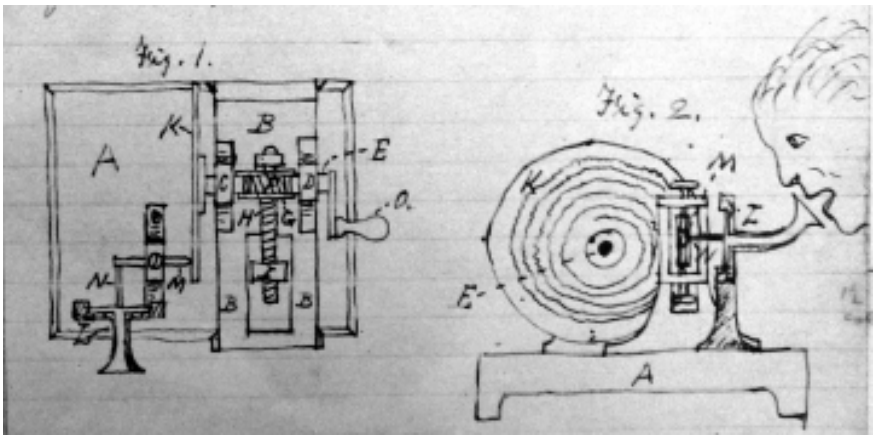
Of course I was eager to learn more, but the museum was then closed for renovations, so it was only in December 2010 that I was able to arrange a preliminary visit to see these collections of experimental sound recordings for myself. They were fully as exciting as I'd hoped, but I also began to get a sense of the depth of the mysteries they presented. Consider the group of three discs pictured at the right, a photograph I took during my initial visit. One of them has some text scratched into its back, which someone has copied onto the adjacent cardboard: "The Phonogram on the opposite side of this plate was transferred from a copper electrotype on the date given above / Sumner Tainter / April 21st 1882." That date points right to a set of notebook entries that explain exactly what the disc is, why it was made, and how it was used—all very straightforward.[2] But what about the other two discs, which don't have any such labels, and which arrived at the Smithsonian without a scrap of accompanying documentation? Take the one at bottom right: a disc with a mottled coppery surface and a wax-filled spiral groove that coils right up to the spindle hole, but which seems at first glance to have no signal cut in it. The only inscription, found on the back , is the museum's own catalog number: 287,674. How do we begin to make sense of an object like this—or of the dozens of other unlabeled discs with catalog numbers in the same range?

Three of the discs Alexander Graham Bell donated to the Smithsonian in 1914-15. *NMAH 287,673, 287,674, and 287,675, National Museum of American History, Smithsonian Institution.*

Fortunately—as I explained in part one of this series—the Volta Laboratory's experiments in sound recording are richly documented in multiple sets of notebooks preserved at the Smithsonian and at the Library of Congress, and one of the main goals of my Lemelson Center Fellowship in late 2011 was to link surviving artifacts with written descriptions of the experiments that had produced them. Even when a recording isn't inscribed or dated, then, there's a *chance* we'll run across a recognizable description of it sooner or later. So let's pick up the story where we left off last time and see where it takes us.

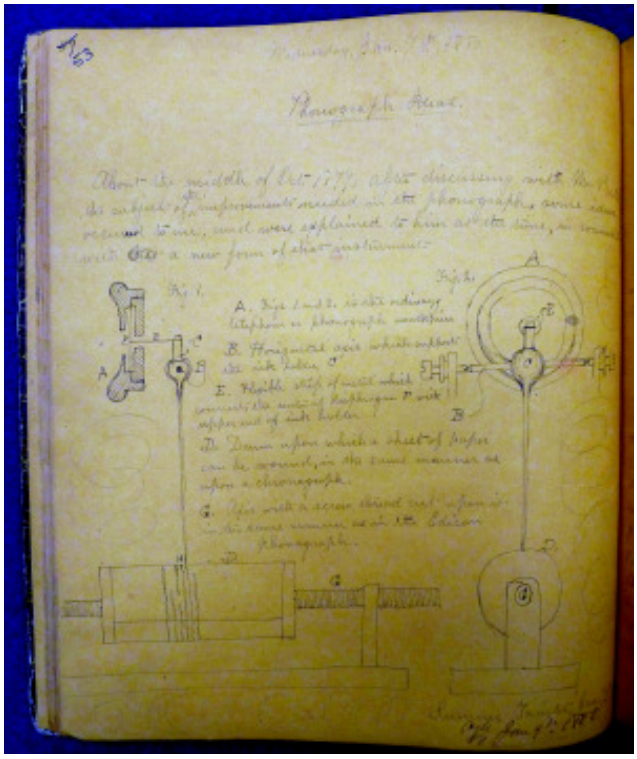
Reverse of NMAH 287,674, showing catalog number. *NMAH 287,674, National Museum of American History, Smithsonian Institution.*

The "po-tay" experiment of 23 March 1881 seems to have been followed by a month-and-a-half lull in phonographic activity. Although the inaugural entry in Charles Sumner Tainter's "Home Notes" is dated 28 March, it doesn't document any actual sound-recording experiments on or around that date. It does, however, describe and illustrate an important idea Tainter was then contemplating: the idea of cutting laterally modulated sound recordings as spirals on rotating discs and then playing them back by substituting a blunt stylus for the cutter.[3] On 30 March, Tainter laid out a further plan combining this idea with another one he'd first jotted down back in January 1880: a laterally modulated phonogram formed in a magnetizable material would be moved rapidly past a magnet that would follow its zigs and zags and thereby cause the recorded vibrations to be reproduced in an attached membrane. The original plan had involved tracing phonograms on paper in ferric ink, but now Tainter proposed to cut a spiral groove into the surface of a disc and then to fill the groove with a magnetizable paste of iron filings as a guide for the reproducing magnet.[4]



Drawing of Sumner Tainter's plan for recording sound laterally on a disc, 28 March 1881. *Tainter Home Notes 1:1, Charles Sumner Tainter Papers, Archives Center, National Museum of American History, Smithsonian Institution.*

On 10 May 1881, Tainter finally began a series of actual experiments along these lines with a membrane and cutter assembly attached to the shop lathe. First he engraved a lateral record on a hard rubber disc, and then another on a disc made of zinc, using variously shaped styli to try to play back the traces, but with disappointing results. He substituted a type-metal disc on 12 May but concluded to his frustration that only a shallow groove would represent sound vibrations accurately, while only a deep groove seemed suit-



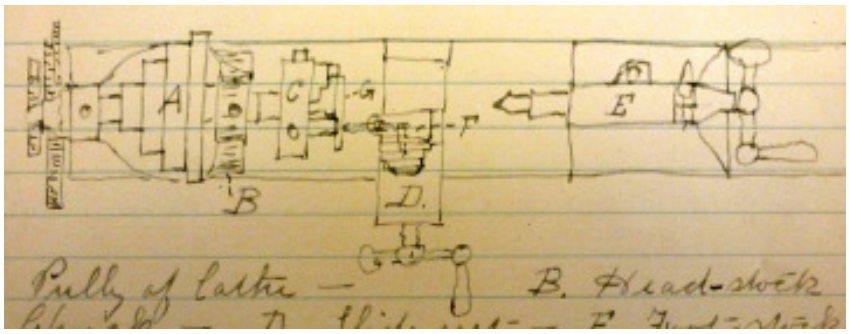
Drawing of Sumner Tainter's initial plan for playing back recorded sounds magnetically, January 1880. *Laboratory Notes 1:59, Alexander Graham Bell Family Papers, Library of Congress.*

able for stylus playback. On 16 May, he tried to resolve this dilemma by cutting a trace in a wax coating on a steel disc and then etching it with nitric acid, but the etched groove proved too irregular to guide a playback stylus. Next, he tried depositing copper followed by iron on a record cut in a wax coating on a type-metal disc to create a raised iron ridge in the exposed groove, hoping the result could be played back with a magnet.[5] He finally got a passable specimen of this kind on 3 June, but his attempt to reproduce speech from it magnetically was a failure. The next day, he tried out another of his ideas. Taking the same type-metal disc, he lathed a deep spiral groove into its surface which he filled with wax, and then he cut a laterally modulated record into the wax spiral—an approach he took because, as he explained, he didn't have enough wax on hand to make a whole disc out of the stuff. Next, he filled in the groove with a mixture of iron filings and wax and then shellacked the whole surface. Once again, however, his attempt to reproduce the recorded speech magnetically was unsuccessful.[6] Finally, on 6 June 1881, he adapted the disc for use in yet another experiment:

This morning the type metal disk used in the experiments last noted was placed in the lathe, and two circular grooves were cut in the edge, so as to leave two sharp ridges as shown in the following diagram [see page 24, top left] . *The engraving apparatus...was then adjusted so as to cut a very small portion off the top of one of the ridges and the lathe revolved while I spoke to the diaphragm of the engraving apparatus. The result was a series of notches cut in the sharp edge of the ridge. The word potato was impressed upon one ridge, and several trilled R's upon the other. The type metal disk was then placed in the iron plating solution and a thin deposit of iron obtained. Upon arranging the magnetic reproducing apparatus as follows* [see page 24, second image] *the sounds of the voice could be heard, and I thought that I could make out the word potato.*[7]

The series of experiments I've just outlined strikingly anticipates key elements of Emile Berliner's gramophone: namely, the laterally modulated disc format and the acid-etching process. But do any

(Continued on Page 25)



Apparatus used for Sumner Tainter's disc-recording experiments of May 1881. *Tainter Home Notes, 1:33, Charles Sumner Tainter Papers, Archives Center, National Museum of American History, Smithsonian Institution.*

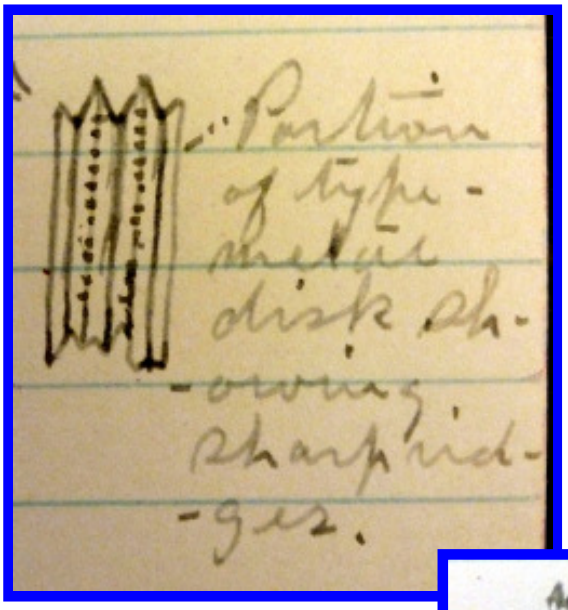
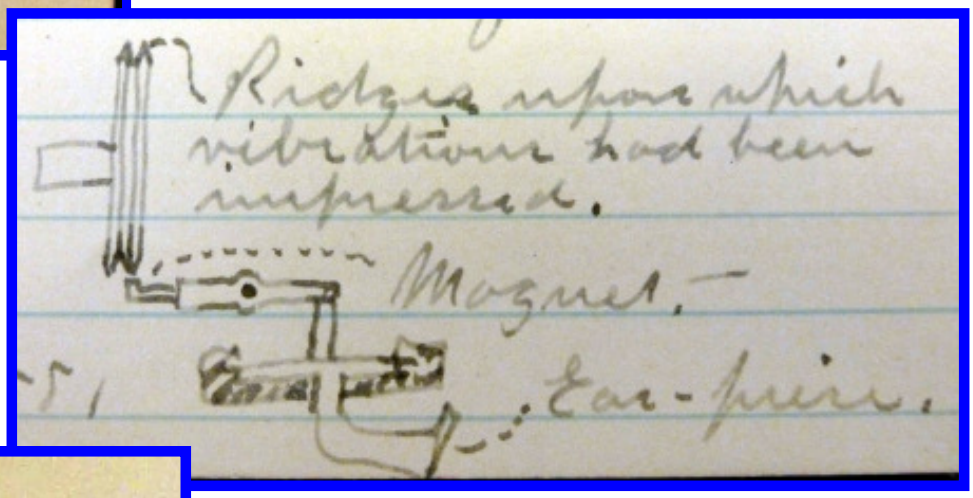


Illustration of the "two sharp ridges" used in Sumner Tainter's experiment of 6 June 1881. *Tainter Home Notes, 2:15, Charles Sumner Tainter Papers, Archives Center, National Museum of American History, Smithsonian Institution.*



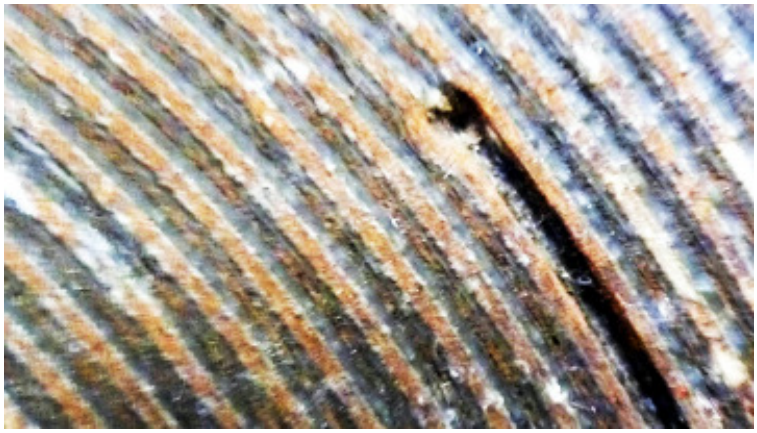
Drawing of the magnetic playback arrangement used in Sumner Tainter's experiment of 6 June 1881. *Tainter Home Notes, 2:15, Charles Sumner Tainter Papers, Archives Center, National Museum of American History, Smithsonian Institution.*

Head-on view of the two ridges. *Detail of NMAH 287,674, National Museum of American History, Smithsonian Institution.*

Side view of the two ridges, showing the "notches." *Detail of NMAH 287,674, National Museum of American History, Smithsonian Institution.*

(Continued from Page 23)

of Tainter's actual recordings from this period survive to corroborate the evidence found in his notebooks? I had no reason to think so—that is, until I took a closer look at that unlabeled disc I mentioned at the start of this piece, NMAH 287,674. It turned out to have two sharp ridges cut into its edge with "notches" in them *[see page 24, bottom two illustrations]*, perfectly matching the description of Tainter's experiment of 6 June 1881. Looking again at the groove on the face of the disc, I saw that the wax-filled spiral had a faint, rust-colored trace at its center—just what we'd expect Tainter's recording of 4 June 1881 to look like. The combination of these two seemingly unique features points inescapably to the conclusion that NMAH 287,674 is the actual disc Tainter used in his experiments of early June 1881. And I believe that makes it the oldest known surviving laterally modulated disc recording in the world.



Close-up of wax-filled spiral groove with rust-colored trace at center. *Detail of NMAH 287,674, National Museum of American History, Smithsonian Institution.*

No attempt has yet been made to play back any of the recordings on NMAH 287,674, so it's too early to judge whether any intelligible speech can be recovered from it. But in the next installment, I'll discuss the oldest Volta Laboratory recording we *can* hear today—and what we can learn from listening to it.

The oldest known surviving laterally modulated disc recording—June 1881. *NMAH 287,674, National Museum of American History, Smithsonian Institution.*

NOTES:

[1] "Early Sound-recording Industry," http://historywired.si.edu/detail.cfm?ID=187, accessed 3 May 2012.
[2] *Tainter Home Notes* 6:34-37, 40-46, in the Charles Sumner Tainter Papers, Archives Center, National Museum of American History (cited henceforward as *THN*).
[3] *THN* 1:1-9.
[4] *Laboratory Notes* 1:59-60, in the Alexander Graham Bell Family Papers, Library of Congress; *THN* 1:10-13.
[5] *THN* 1:32-79.
[6] *THN* 2:9-13.
[7] *THN* 2:15.

Treasures of the Smithsonian: Part 3

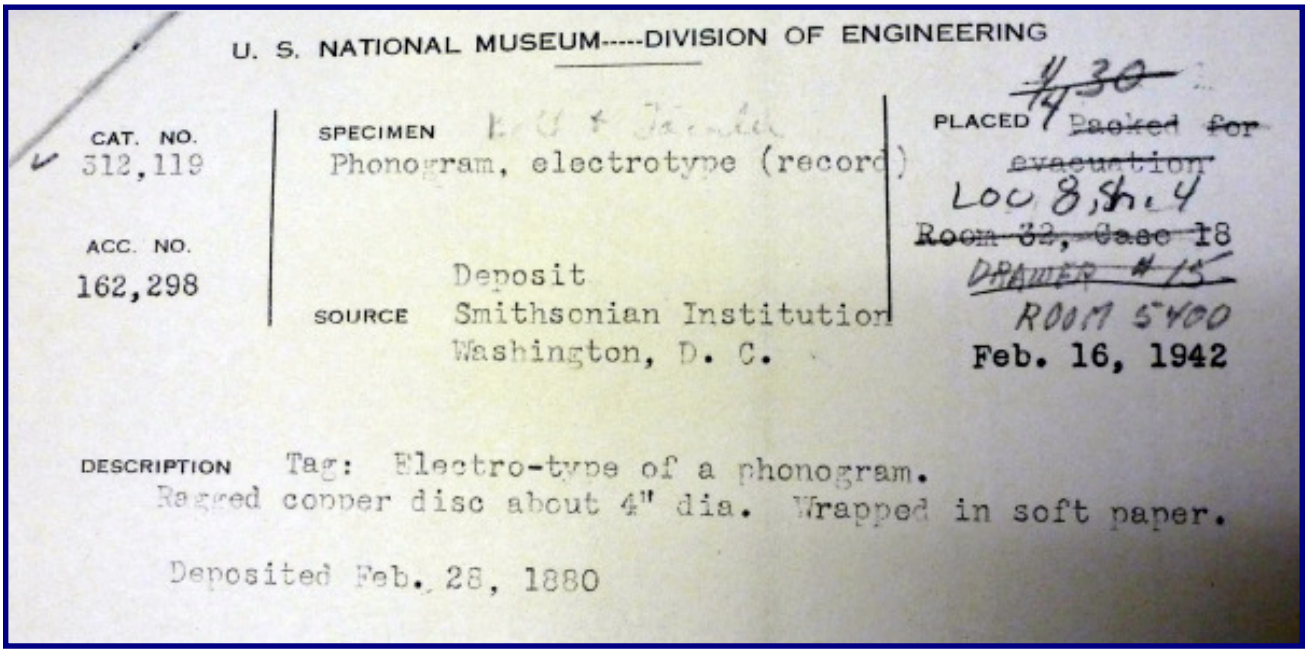
by Patrick Feaster

Continued from Part One (March 2012) and Part Two (June 2012), describing historic sound-recording artifacts at the Smithsonian Institution's National Museum of American History.

A recording technology history website created by Steven E. Schoenherr in the 1990s includes a few photographs of NMAH 287,668, the museum's "earliest identified flat disc," dated 8 November 1881. This object is fairly well-known as Volta artifacts go—for example, it was used as the cover illustration for the second edition of Evan Eisenberg's *The Recording Angel.*[1] However, Schoenherr also mentions another artifact in passing on the same page: "The Smithsonian has one earlier copper electroplated disc deposited Feb. 28, 1880 (NMAH #312,119), but it is unidentified."[2] When I first ran across that statement nine years ago, my curiosity was piqued by the staggeringly early date: if the disc had been *deposited* at the Smithsonian in February 1880, then it had to be at least that old, and possibly even older. What, I wondered, could this "unidentified" recording be?

The only person I knew about who had worked on electroplating disc phonograms before February 1880 was William Hollingshead, whose efforts have been described by Ray Wile and Allen Koenigsberg.[3] Further investigation turned up a letter in the Edison papers revealing that, shortly before 11 March 1880, Hollingshead had "suddenly announced that he had stopped work; giving no reason for doing so...other than that it was not paying him enough to continue the experiments longer, and that he did not believe he could do it."[4] Could Hollingshead have deposited one of his disc phonograms at the Smithsonian at the end of February 1880 to document what he'd accomplished for posterity? With this possibility in mind, I emailed Schoenherr to ask whether he knew anything more about NMAH 312,119, but he replied that he'd never actually seen it.[5] A year later, when I tried contacting the museum for information, my query about an "unidentified copper electrotype disc" was routed to the numismatics division,[6] which understandably never got back to me about it. Even so, I mentioned my suspicions in a footnote in my dissertation,[7] and when my First Sounds colleagues and I first began brainstorming about extremely early sound recordings to pursue, the potential "Hollingshead disc" was near the top of our list—but that was in 2007, when the museum was closed for renovations, so we had to wait a few years to learn more.

In early 2010, during my first conversation with Carlene Stephens, curator of sound recordings at NMAH, she told me that NMAH 312,119 had in fact been deposited by Alexander Graham Bell and Charles Sumner Tainter, two members of the team that, with Chichester Bell, would later form the Volta Laboratory Association—for convenience, I'll call them the "Volta group," even though that wasn't yet their official name. Specifically, documentation linked the catalog number to the first of three sealed packages which the Volta group had deposited on 28 February 1880, 6 April 1880, and 20 October 1881 respectively, and which were first opened together during a widely publicized event in 1937. Although the object was otherwise "unidentified," it was evidently a Volta product of some kind, and not the work of Hollingshead after all. But that made its early date all the more puzzling. Virtually every secondary source I could find stated that the Volta group had turned its attention to the recording



U. S. NATIONAL MUSEUM-----DIVISION OF ENGINEERING

CAT. NO. 312,119

ACC. NO. 162,298

SPECIMEN Phonogram, electrotype (record)

SOURCE Deposit
Smithsonian Institution
Washington, D. C.

PLACED ~~1/30~~ ~~Packed for evacuation~~
Loc 8, Sh. 4
~~Room 32, Case 18~~
~~DRAWER # 15~~
ROOM 5400
Feb. 16, 1942

DESCRIPTION Tag: Electro-type of a phonogram.
Ragged copper disc about 4" dia. Wrapped in soft paper.

Deposited Feb. 28, 1880

and reproduction of sound in a serious way only in 1881, and that their work throughout 1880 had instead centered on developing the photophone. There was just one exception. In *From Tin Foil to Stereo,* Read and Welch state:

On February 28, 1880, Alexander Graham Bell and Sumner Tainter deposited a sealed envelope with the Smithsonian Institution containing hand-written copies of notes on their first phonographic experiments and a statement of conclusions, with what appears to be a declaration of intention to invent, similar to a caveat.[8]

Ordinarily, if Read and Welch say one thing and everyone else says something different, I'll go with everyone else. But could they have been right in this instance, and could NMAH 312,119 have been the product of some "first phonographic experiments" by the Volta group in early 1880 or before, centered on the electrotyping of discs—an otherwise forgotten chapter in the history of their experimental work? At first, I thought this might be a possibility. In late 2011, however, I scoured all the Bell and Tainter notebooks from this period, and the first collaborative phonographic experiment they documented didn't take place until 23 March 1881 (see part one of this series). Tainter's experiments with laterally recorded discs didn't begin until 10 May 1881 (see part two of this series). The evidence from the notebooks seemed to rule out any serious phonographic experiments in or before February 1880.

Meanwhile, when I got my first look at NMAH 312,119 in December 2010, there was another surprise in store: instead of just a single copper electrotype disc associated with that number, there were *two*. One, which I'll call NMAH 312,119-[1], contained a laterally modulated spiral phonogram. The other, which I'll call NMAH 312,119-[2], displayed a group of unmodulated concentric rings. As it happens, both discs match experimental results described in Tainter's *Home Notes* closely enough that there's little if any room for doubt about what they are. However, the experiments in question didn't take place until October 1881—more than a year and a half after the date on which the discs had supposedly been deposited!

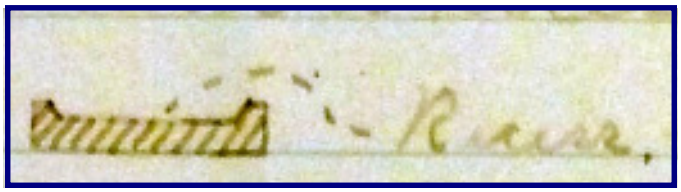
A notebook entry which Tainter wrote on 17 October 1881 sets forth the idea of making electrotype

copies of phonograms and then describes a preliminary experiment he had just carried out with Chichester Bell to test whether a faithful electrotype copy could be made from simple, non-phonographic grooves scratched into the paraffin-wax composition they were then using as a recording medium:

Some of the Paraffin-wax composition was melted in a shallow dish, and when cold was turned off smooth in the lathe, and several concentric rings ~~were~~ cut in the surface.
A quantity of the silvering solution was then poured upon the prepared composition, and very soon a beautiful film of silver was deposited all over the surface.
A sulphate of copper solution was prepared and the silvered composition was immersed in it, and arranged ~~as~~ in the ordinary manner for electro-plating. After remaining in the plating solution over night a good deposit of copper was formed upon the composition.
The sheet of deposited copper upon being removed from the composition, was found to have copied all the irregularities of the composition surface with great accuracy. We are much pleased with the result of this experiment, and feel confident of being able to obtain copies of speech vibrations without much trouble. Our object is to use the copper electro-type for the purpose of forming records or phonograms in other substances by stamping, or printing, and to use these stamped *copies for reproducing the sounds originally recorded in the composition.*
In this way a piece of music, for instance, can be recorded once, and any number of copies made from this original record, and the music reproduced from ~~any~~ each *of the copies.*[9]

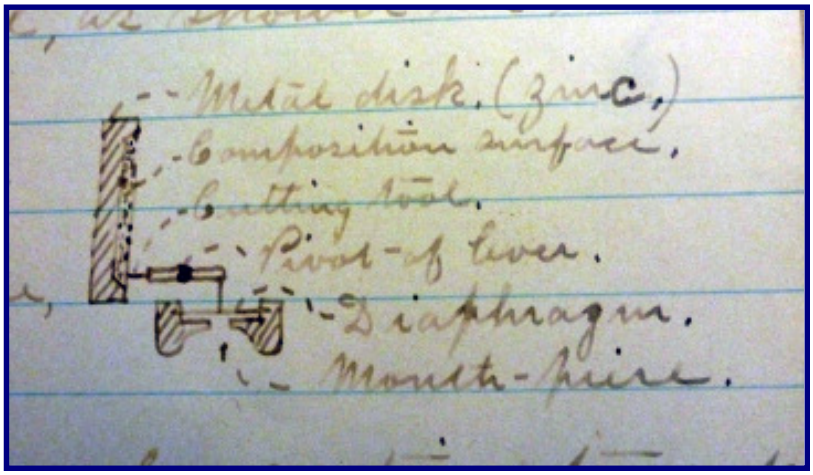
NMAH 312,119-[2] perfectly fits this description. Following up on their success, the experimenters next proceeded to make an electrotype negative from an actual phonogram, as Tainter recounted in a note dated 21 October 1881:
Several days ago we succeeded in getting a fair electro-type of a zig-zag phonogram, in the manner described on the preceeding [sic] *page (49). This electro-type was put into the sealed package which we have been preparing for some time past, together with the phonograph upon which nearly all the experiments have been made* [= NMAH 312,123]*, and yesterday was taken to the Smithsonian Institution and deposited in the confidential archives of the Institution.*[10]
"Several days ago" must have fallen between 17 October, the date of the concentric-circles experiment, and 20 October, the day on which the third sealed package was deposited, and the papers accompanying the third package confirm that it included an object closely resembling NMAH 312,119-[1]:

We...enclose an electro-type copy of a phonogram, which has just been completed. This copy, which is the reverse of the original, ~~and~~ was made in the following manner:—
A thick disk of metal was placed in the lathe and a recess turned in one side, thus:—



This recess was then filled with the paraffin-wax composition, (paraffin 2/3, wax 1/3,) and again placed in the lathe, when the surface was turned off flat and smooth.

A diaphragm and mouth-piece were then fitted to the slide-rest of the lathe, and a lever attached to the center of the diaphragm carried a cutting tool as shown in the next diagram:—



When the lathe revolved the mouth-piece, lever, and cutting tool, received a slow and regular motion towards the center of the disk held in the chuck of the lathe, and the result was a spiral line traced upon the surface of the composition. When no sounds were uttered this line was smooth and regular; but when words and sounds were shouted into the mouth-piece, the vibrations of the diaphragm were communicated to the cutting tool and corresponding irregularities formed in the spiral groove.

The disk with the record or phonogram upon it, was then placed in the well known mixture used for silvering mirrors, and a film of pure silver deposited upon the phonogram.

It was then placed in a solution of sulphate of copper, and connected to a battery of one cell; the second pole of the battery being connected to a plate of copper placed opposite the phonogram, as in the ordinary arrangements for electro-plating.

After remaining in the plating solution about 40 hours the phonogram was taken out and gently heated over a lamp until the copper film separated from the composition.

The irregularities and holes in the copper film are due to the irregularity of the silver film, as the solution acted upon the metal of the disk, (zinc,) and caused a poor deposit of silver upon the phonogram. The phonogram copied in this case is of the zig-zag form but there is nothing to prevent copies of an Edisonian record being made in the same manner.

It is our intention to "back" an electrotype of this kind with a solid plate of metal and then use it as a stamp or die for forming copies in various materials from each of which the original sounds can be reproduced.[11]

Consistent with the above description, NMAH 312,119-[1] doesn't have any extra backing, as some other surviving phonogram electrotypes from 1881-82 do (e.g., NMAH 287,668, 287,671, and 287,881-B), and there are "irregularities" near its outer circumference and one notable "hole" where a section of the phonogram is missing. Because of these imperfections, the electrotype wouldn't have been suitable for use as a stamper in follow-up duplication experiments, but it still had value as a proof of what the experimenters had accomplished in case of future conflicts over priority of invention—so into the box it went.

When the three sealed packages from 1880 and 1881 were finally opened in 1937, their contents seem to have been emptied out onto a table together, and the Smithsonian kept no official record of the proceedings,[12] so it's easy to see how confusion could later have arisen as to which objects came from which boxes. Although someone later inferred that NMAH 312,119 had been "[d]eposited Feb. 28, 1880," the date of the *first* package, the two electrotype discs must actually have come from the *third* package. That solves the mystery of the "1880" date—to my satisfaction, at least.

And the stakes involved in understanding NMAH 312,119-[1] have recently gone up, since it was one of the six experimental Volta recordings played back by a pilot project carried out collaboratively by the Smithsonian Institution, the Lawrence Berkeley National Laboratory, and the Library of Congress and released to the public in December 2011. Based on his first aural analysis, Carl Haber at LBL speculated that the disc might contain mere test tones, but the contemporary reference I'd found to "words and sounds...shouted into the mouth-piece" suggested otherwise, and he was soon able to discern a voice counting from one to six. Even more interesting, at least from my own perspective, is the distinctive sound of a trilled R that comes before and after the counting. Plenty of *written* sources tell us that the Volta group often used trilled Rs as test material for phonographs and photophones, but now at last we're able to *hear* one of them.[13] And even a date of October 1881 still makes NMAH 312,119-[1] the oldest Volta audio yet recovered.

NOTES:

[1] Evan Eisenberg, *The Recording Angel: Music, Records and Culture from Aristotle to Zappa*, 2nd Edition (New Haven: Yale University Press, 2005). The negative electrotype is shown in mirror image, presumably to make the dated inscription more easily legible.
[2] Steven E. Schoenherr, "Tainter electroplated lateral-cut disc 1881," Audio Engineering Society, http://www.aes.org/aeshc/docs/recording.technology.history/electroplate.html, accessed 7 November 2012.
[3] Raymond R. Wile, "'Jack Fell Down and Broke His Crown': The Fate of the Edsion Phonograph Toy Manufacturing Company," *ARSC Journal* 19:2/3 (1987), 6; Allen Koenigsberg, *The Patent History of the Phonograph, 1877-1912,* U. S. Patent Bi-Centennial Edition (Brooklyn, New York: APM Press, 1991), 25; Reese Jenkins, Robert A. Rosenberg, and Paul Israel, eds. *The Papers of Thomas A. Edison* (Baltimore: Johns Hopkins University Press, 1989—), 4:264, n. 2.
[4] Oliver Russell to Edison, 11 March 1880 (TAEM 55:292-3, TAED D8038E).
[5] Steven E. Schoenherr to Patrick Feaster, 14 October 2003, personal email.
[6] Jim Roan to Patrick Feaster, 26 November 2004, personal email.
[7] Patrick Feaster, "'The Following Record': Making Sense of Phonographic Performance, 1877-1908" (Ph.D. dissertation, Indiana University Bloomington, 2007), 221, n. 16.
[8] Oliver Read and Walter L. Welch, *From Tin Foil to Stereo: Evolution of the Phonograph*, Second Edition (Indianapolis: Howard W. Sams & Co., 1976), 28.
[9] *THN* 3:49.
[10] *THN* 3:51.
[11] Papers accompanying deposit of 20 October 1881 (NMAH), 6-8.
[12] See the press photograph of which prints are regularly available from seller khiramaddie on eBay under the name "1937 photo Boxes placed in Smithsonian in 1881 by telephone inventor opened f g2"; Charles G. Abbott to R. T. Barrett, 2 November 1937, NMAH accession document 162298.044.
[13] Patrick Feaster, "Trilled Rs and the Dawn of Recorded Sound in America," *Prototype* (December 2011, http://invention.smithsonian.org/downloads/e-prototype_dec11.pdf): 1-3. Note that the outer, broken portion of the disc doesn't yet appear to have been played.